







INDEX

◆ Resistors















* AEC-Q200 Compliance

Type	Style	Features	Series	Page
SMD		Thin Film Precision Chip Resistor	*AR	6
		Automotive Grade Thin Film Precision Chip Resistor	*AR..A	176
		Automotive Grade Thin Film Precision Chip Resistor (Wide Terminal)	*ARW..A	181
		Automotive Grade Metal Thin Film Chip Resistor	*ARM..A	184
		Automotive Grade Professional Thin Film Chip Resistor	*ART..A	188
		Automotive Grade High Power Thin Film Chip Resistor	*ARTP..A	192
		Automotive Grade High Voltage Thin Film Flat Chip Resistor	*ARHV..A	195
		Automotive Grade Tantalum Nitride Thin Film Precision Chip Resistor	*TAR	202
		Thin Film Chip Resistor	ARG	11
		Aluminum Nitride Thin Film Precision Chip Resistor	ARN	14
		High Power Thin Film Chip Resistor	*ARP	17
		Anti-Corrosive Thin Film Precision Chip Resistor	PR	20
		Resistor of Advanced Meter Thin Film Chip Resistor	RAM	23
		High Frequency(up to 70GHz)Thin Film Precision Chip Resistor	ARF	27
		   	Thick Film Chip Resistor	*CR..AC
Automotive Grade Chip Resistor	*CR..A..		205	
Automotive Grade Thick Film High Precision Low TCR Chip Resistor	*CRTC..A		211	
Thick Film High Power Chip Resistor (Aluminum Nitride Substrate)	CRP		35	
High Ohmic Chip Resistor	HMR		38	
Pulse Withstanding Chip Resistor	*PWR		41	
Automotive Grade Pulse Withstanding Chip Resistor	*PWR..A		224	
Surge Withstanding Chip Resistor	*SWR		45	
Automotive Grade Surge Withstanding Chip Resistor	*SWR..A		229	
Anti-Sulfurated Thick Film Chip Resistor	AS		49	
Automotive Grade Anti-Sulfurated Chip Resistor	*AS..A		215	
Trimmable Thick Film Chip Resistor	RT		53	
Thick Film Chip Resistor (Wide Terminal)	CRW		56	
Automotive Grade Thick Film Chip Resistor (Wide Terminal)	*CRW..A..		233	
    	Thin Film Current Sensing Chip Resistor		TCS	60
	Current Sensing Chip Resistor	CS	63	
	Automotive Grade Current Sensing Chip Resistor	*CS..A	219	
	Current Sensing Chip Resistor	CSN	68	
	Current Sensing Metal Chip Resistor	*CSM	72	
	Current Sensing Thick Film Chip Resistor	RS	77	
	Current Sensing Chip Resistor (Wide Terminal)	CSW	81	
	Current Sensing Metal Chip Resistor (Wide Terminal)	*CSMW	85	
	Four Terminal High Precision Current Sense Resistors	4T	88	
	Ultra Low Ohm (Metal Strip) Chip Resistor	*LR	91	
	Low Ohm (Metal Strip) Chip Resistor	*LRP	94	
	Automotive Grade Low Ohm (Metal Strip) Chip Resistor	*LRP..A	237	

INDEX

◆ Resistors









* AEC-Q200 Compliance

Type	Style	Features	Series	Page
SMD		Ultra-Low Chip Resistor Jumper	LRJ	97
		Automotive Grade Alloy Chip Shunt Resistor	*LRA..A	244
		Automotive Grade Chip Shunt Resistor	*LRSW..A	248
		Metal Foil Chip Fixed Resistor	MF	100
		Automotive Grade Metal Foil Chip Fixed Resistor	*MF..A	198
		Molding E-Beam Welded Metal Strip Resistor	*WMR	103
		Molding E-Beam Welded Metal Strip Resistor	*WMB	107
		Molding E-Beam Welded Metal Strip Resistor	*WMK	110
		Molding E-Beam Welded Metal Strip Resistor	*WMP	113
	Automotive Grade High Voltage Thick Film Chip Resistor	*HVR..A	240	
UL Demko		High Voltage Thick Film Chip Resistor	HVR	116
		Automotive Grade High Voltage Low VCR Thick Film Chip Resistor	*HVRC	252
Lead-Free		Green Thick Film Chip Resistor	CRG	120
		Automotive Grade Green Chip Resistor	*CRG..A..	256
		Green Anti-Sulfurated Thick Film Chip Resistor	ASG	124
		Automotive Grade Green Anti-Sulfurated Chip Resistor	*ASG..A	260
Network	 	Thin Film Array Chip Resistor	TFAN	128
		Thick Film Flat Array Chip Resistor (Size:0201x2 & 0201x4 Resistors)	CN21&41	131
		Anti-Sulfurated Thick Film Array Chip Resistor	AS Array	134
		Automotive Grade Anti-Sulfurated Thick Film Chip Resistor(Array)	*AS..A(Array)	268
		Thick Film Array Chip Resistor (Flat termination)	*CNF	137
		Automotive Grade Thick Film Flat Array Chip Resistor	*CNF..A	272
		Automotive Grade Thick Film Array Chip Resistor	*CN..A..	264
MELF	      	Automotive Grade Metal Film Precision MELF Resistor	*CSRA	276
		Automotive Grade Metal Film Precision High Voltage MELF Resistor	*CSRP	280
		Metal Film Precision Resistor	*CSRV	141
		Metal Film High Frequency MELF Resistor	CSRF	145
		MELF High Voltage Resistor	CSRH	148
		Wire Wound MELF Resistor	CSRW	151
		Carbon Film Resistor	CFS	154
Leaded	      	High Precision Metal Film Leaded Resistor	MFD	156
		Metal Film Leaded Precision Resistor	MFR	158
		Metal Oxide Film Leaded Resistor	MOF	161
		High Ohmic / High Voltage Metal Glazed Leaded Resistor	MGQ	163
		Carbon Film Leaded Resistor	CFR	165
		Metal Film Flame-Proof Resistor	FMR	167
		Wire Wound Leaded Resistor	KNQ	170
SMD		Foil Initiator chip Resistor	FIR	174

INDEX

◆ Automotive Grade






* AEC-Q200 Compliance

Type	Style	Features	Series	Page	
SMD		Automotive Grade Thin Film Precision Chip Resistor	*AR..A	176	
		Automotive Grade Thin Film Precision Chip Resistor (Wide Terminal)	*ARW..A	181	
		Automotive Grade Metal Thin Film Chip Resistor	*ARM..A	184	
		Automotive Grade Professional Thin Film Chip Resistor	*ART..A	188	
		Automotive Grade High Power Thin Film Chip Resistor	*ARTP..A	192	
		Automotive Grade High Voltage Thin Film Flat Chip Resistor	*ARHV..A	195	
		Automotive Grade Metal Foil Chip Fixed Resistor	*MF..A	198	
		Tantalum Nitride Thin Film Precision Chip Resistor	*TAR	202	
		Automotive Grade Chip Resistor	*CR..A..	205	
		Automotive Grade Thick Film High Precision Low TCR Chip Resistor	*CRTC..A	211	
		Automotive Grade Anti-Sulfurated Chip Resistor	*AS..A	215	
		Automotive Grade Current Sensing Chip Resistor	*CS..A	219	
		Automotive Grade Pulse Withstanding Chip Resistor	*PWR..A	224	
		Automotive Grade Surge Withstanding Chip Resistor	*SWR..A	229	
		Automotive Grade Thick Film Chip Resistor (Wide Terminal)	*CRW..A	233	
		Automotive Grade Low Ohm (Metal Strip) Chip Resistor	*LRP..A	237	
		Automotive Grade High Voltage Thick Film Chip Resistor	*HVR..A	240	
			Automotive Grade Alloy Chip Shunt Resistor	*LRA..A	244
			Automotive Grade Chip Shunt Resistor	*LRSW..A	248
UL Demko		Automotive Grade High Voltage Low VCR Thick Film Chip Resistor	*HVRC	252	
Lead-Free		Automotive Grade Green Chip Resistor	*CRG..A	256	
		Automotive Grade Green Anti-Sulfurated Chip Resistor	*ASG..A	260	
Network		Automotive Grade Thick Film Array Chip Resistor	*CN..A..	264	
		Automotive Grade Anti-Sulfurated Thick Film Chip Resistor(Array)	*AS..A(Array)	268	
		Automotive Grade Thick Film Flat Array Chip Resistor	*CNF..A	272	
MELF		Automotive Grade Metal Film Precision MELF Resistor	*CSRA	276	
		Automotive Grade Metal Film Precision High Voltage MELF Resistor	*CSRP	280	
TO-220		Automotive Grade TO-220 Power Resistor	*TR50-RF..A	283	

INDEX

◆ Power Resistors

* AEC-Q200 Compliance

Type	Style	Features	Series	Page
Wire Wound		SMD Wire Wound Chip Power Resistor	WR	285
TO-220 TO-263	  	TO-220 Power Resistor – 30 Watts	TR30	287
		TO-220 Power Resistor – 35 Watts	TR35	289
		TO-263 Power Resistor – 35 Watts	STR35	291
		TO-220 Power Resistor – 50 Watts	TR50	294
		TO-220 Power Resistor – 50 Watts (Hole)	TR50-H	296
		TO-220 Power Resistor – 50 Watts	TR50-RF	298
		Automotive Grade TO-220 Power Resistor	*TR50-RF..A	283
TO-247		TO-247 Power Resistor – 100 Watts	TR100	300
Wire Wound		Wire Wound Power Resistor	QR	302

INDEX

Series	Page
AR	6
AR..A	176
ARG	11
ARF	27
ARM..A	184
ARHV..A	195
ARN	14
ARP	17
ART..A	188
ARTP..A	192
ARW..A	181
AS	49
AS Array	134
AS..A	215
AS..A(Array)	268
ASG	124
ASG..A	260
CFS	154
CFR	165
CN21&41	131
CN..A..	264
CNF	137
CNF..A	272
CR..AC	30
CR..A..	205
CRG	120
CRG..A..	256
CRP	35
CRTC..A	211
CRW	56

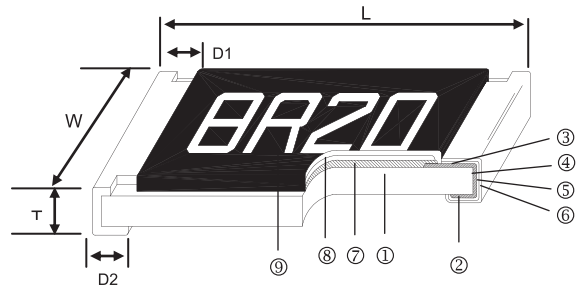
Series	Page
CRW..A..	233
CS	63
CS..A	219
CSM	72
CSMW	85
CSN	68
CSRA	276
CSRF	145
CSRH	148
CSRP	280
CSRV	141
CSRW	151
CSW	81
FIR	174
FMR	167
HMR	38
HVR	116
HVR..A	240
HVRC	252
KNQ	170
LR	91
LRA..A	244
LRJ	97
LRP	94
LRP..A	237
LRSW..A	248
MF	100
MF..A	198
MFD	156
MFR	158

Series	Page
MGQ	163
MOF	161
PR	20
PWR	41
PWR..A	224
QR	302
RAM	23
RS	77
RT	53
STR35	291
SWR	45
SWR..A	229
TAR	202
TCS	60
TFAN	128
TR30	287
TR35	289
TR50	294
TR50-H	296
TR50-RF	298
TR50-RF..A	283
TR100	300
WMB	107
WMK	110
WMP	113
WMR	103
WR	285
4T	88

Thin Film Precision Chip Resistor – AR Series



Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Marking

Features

- Advanced thin film technology
- Very tight tolerance down to $\pm 0.01\%$
- Extremely low TCR down to $\pm 1\text{PPM}/^\circ\text{C}$
- Wide resistance range 1ohm ~ 3Mega ohm
- Miniature size 0201 available
- AEC-Q200 Compliance
- Test proven immunity to biased humidity (85°C/85RH)

Dimensions

Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
AR01	0201	0.58 \pm 0.05	0.29 \pm 0.05	0.23 \pm 0.05	0.12 \pm 0.05	0.15 \pm 0.05	0.14
AR02	0402	1.00 \pm 0.05	0.50 \pm 0.05	0.30 \pm 0.05	0.20 \pm 0.15	0.20 \pm 0.10	0.54
AR03	0603	1.55 \pm 0.10	0.80 \pm 0.10	0.45 \pm 0.10	0.30 \pm 0.25	0.30 \pm 0.20	1.83
AR05	0805	2.00 \pm 0.15	1.25 \pm 0.15	0.55 \pm 0.10	0.30 \pm 0.25	0.40 \pm 0.20	4.71
AR06	1206	3.05 \pm 0.15	1.55 \pm 0.15	0.55 \pm 0.10	0.42 \pm 0.30	0.35 \pm 0.25	9.02
AR13	1210	3.10 \pm 0.15	2.40 \pm 0.15	0.55 \pm 0.10	0.40 \pm 0.30	0.55 \pm 0.25	10.00
AR10	2010	4.90 \pm 0.15	2.40 \pm 0.15	0.55 \pm 0.10	0.60 \pm 0.40	0.50 \pm 0.25	23.61
AR10 (1/2W)	2010	4.90 \pm 0.15	2.40 \pm 0.15	0.55 \pm 0.10	0.60 \pm 0.40	2.20 \pm 0.25	26.68
AR12	2512	6.30 \pm 0.15	3.10 \pm 0.15	0.55 \pm 0.10	0.60 \pm 0.40	0.50 \pm 0.25	38.06
AR12 (1W)	2512 (1-100 Ω)	6.30 \pm 0.15	3.10 \pm 0.15	0.55 \pm 0.10	0.60 \pm 0.40	0.50 \pm 0.25	44.65
AR12 (1W)	2512 (101 Ω above)	6.30 \pm 0.15	3.10 \pm 0.15	0.55 \pm 0.10	0.60 \pm 0.40	2.50 \pm 0.25	44.65

Applications

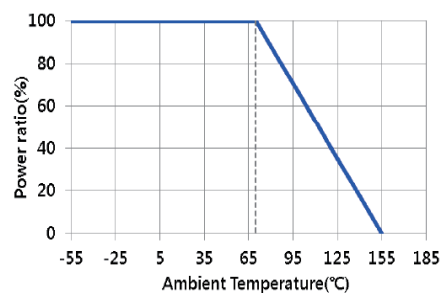
- Medical Equipment
- Testing / Measurement Equipment
- Printer Equipment
- Automatic Equipment Controller
- Converters
- Communication Device, Cell Phone, GPS, PDA

Part Numbering

AR	03	T	T	B	X	1001	
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/ $^\circ\text{C}$)	Power Rating	Resistance	Marking Code
	01: 0201 02: 0402 03: 0603 05: 0805 06: 1206 13: 1210 10: 2010 12: 2512	T: $\pm 0.01\%$ A: $\pm 0.05\%$ B: $\pm 0.1\%$ C: $\pm 0.25\%$ D: $\pm 0.5\%$ F: $\pm 1\%$	T: Taping Reel B: Bulk	5: ± 1 X: ± 2 O: ± 3 S: ± 5 B: ± 10 N: ± 15 C: ± 25 D: ± 50	: Standard* (See Remark) N: 1/20W X: 1/10W W: 1/8W M: 1/6W V: 1/4W O: 1/3W U: 1/2W Q: 3/4W T: 1W	0010: 1 Ω 4R70: 4.7 Ω 1001: 1K Ω 1004: 1M Ω	: Standard Marking for E96 / E24 N: No Marking

*Remark: Standard part no need for power rating code.

Derating Curve



Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range					TCR (PPM/°C)
					±0.05%	±0.1%	±0.25%	±0.5%	±1%	
AR01 (0201)	1/32W	-55 ~ +155°C	15V	30V	—	22Ω - 75KΩ				±25 ±50
AR02 (0402)	1/16W	-55 ~ +155°C	50V	100V	49.9Ω - 12KΩ	4Ω - 511KΩ				±25 ±50
AR03 (0603)	1/16W	-55 ~ +155°C	50V	100V	4.7Ω - 332KΩ	1Ω - 1MΩ				±25 ±50
AR05 (0805)	1/10W	-55 ~ +155°C	100V	200V	4.7Ω - 1MΩ	1Ω - 2MΩ				±25 ±50
AR06 (1206)	1/8W	-55 ~ +155°C	150V	300V	4.7Ω - 1MΩ	1Ω - 3MΩ				±25 ±50
AR13 (1210)	1/4W									
AR10 (2010)	1/4W	-55 ~ +155°C	150V	300V	4.7Ω - 1MΩ	1Ω - 3MΩ				±25 ±50
AR12 (2512)	1/2W									

■ Lower Resistance: 1~10Ω

Special Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range						TCR (PPM/°C)
					±0.01%	±0.05%	±0.1%	±0.25%	±0.5%	±1%	
AR02 (0402)	1/16W	-55 ~ +155°C	50V	100V	49.9Ω - 4.99KΩ		—				±1 ±2 ±3
					49.9Ω - 20KΩ						±5
					49.9Ω - 20KΩ	49.9Ω - 100KΩ				±10 ±15	
AR03 (0603)	1/16W	-55 ~ +155°C	50V	100V	24.9Ω - 15KΩ		—				±1 ±2 ±3
					24.9Ω - 60KΩ						±5
					24.9Ω - 100KΩ	4.7Ω - 332KΩ	4.7Ω - 511KΩ				±10 ±15
AR05 (0805)	1/10W	-55 ~ +155°C	100V	200V	24.9Ω - 30KΩ		—				±1 ±2 ±3
					24.9Ω - 150KΩ						±5
					24.9Ω - 200KΩ	4.7Ω - 1MΩ				±10 ±15	
AR06 (1206)	1/8W	-55 ~ +155°C	150V	300V	24.9Ω - 49.9KΩ		—				±1 ±2 ±3
					24.9Ω - 300KΩ						±5
					24.9Ω - 499KΩ	4.7Ω - 1.5MΩ				±10 ±15	
AR13 (1210)	1/4W	-55 ~ +155°C	150V	300V	24.9Ω - 49.9KΩ		—				±1 ±2 ±3
					24.9Ω - 300KΩ						±5
					24.9Ω - 499KΩ	4.7Ω - 1MΩ				±10 ±15	
AR10 (2010)	1/4W	-55 ~ +155°C	150V	300V	24.9Ω - 100KΩ		—				±1 ±2 ±3
					24.9Ω - 300KΩ						±5
					24.9Ω - 499KΩ	4.7Ω - 1MΩ				±10 ±15	
AR12 (2512)	1/2W	-55 ~ +155°C	150V	300V	24.9Ω - 100KΩ		—				±1 ±2 ±3
					24.9Ω - 300KΩ						±5
					24.9Ω - 499KΩ	4.7Ω - 1MΩ				±10 ±15	

High Power Rating Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range						TCR (PPM/°C)
					±0.01%	±0.05%	±0.1%	±0.25%	±0.5%	±1%	
AR01 (0201)	1/20W	-55 ~ +155°C	25V	50V	—		22Ω - 75KΩ				±25 ±50
AR02 (0402)	1/10W	-55 ~ +155°C	50V	100V	49.9Ω - 4.99KΩ		—				±1 ±2 ±3
					49.9Ω - 20KΩ						±5
					49.9Ω - 12KΩ		49.9Ω - 100KΩ				±10 ±15
					—	49.9Ω - 12KΩ	4.7Ω - 255KΩ				±25 ±50
AR03 (0603)	1/10W	-55 ~ +155°C	75V	150V	24.9Ω - 15KΩ		—				±1 ±2 ±3
					24.9Ω - 60KΩ						±5
					24.9Ω - 100KΩ	4.7Ω - 332KΩ	4.7Ω - 511KΩ				±10 ±15
							1Ω - 1MΩ				±25 ±50
	*1/6W	-55 ~ +155°C	100V	150V	—	10Ω - 332KΩ				±25 ±50	
AR05 (0805)	1/8W	-55 ~ +155°C	150V	300V	24.9Ω - 30KΩ		—				±1 ±2 ±3
					24.9Ω - 150KΩ						±5
					24.9Ω - 200KΩ	4.7Ω - 511KΩ	4.7Ω - 1MΩ				±10 ±15
							1Ω - 2MΩ				±25 ±50
	*1/4W	-55 ~ +155°C	150V	300V	—	10Ω - 499KΩ				±25 ±50	
AR06 (1206)	1/4W	-55 ~ +155°C	200V	400V	24.9Ω - 49.9KΩ		—				±1 ±2 ±3
					24.9Ω - 300KΩ						±5
					24.9Ω - 499KΩ	4.7Ω - 1MΩ				±10 ±15	
						1Ω - 1MΩ	1Ω - 3MΩ				±25 ±50
	*1/3W	-55 ~ +155°C	200V	400V	—	10Ω - 1MΩ				±25 ±50	
AR13 (1210)	1/3W	-55 ~ +155°C	200V	400V	24.9Ω - 49.9KΩ		—				±1 ±2 ±3
					24.9Ω - 300KΩ						±5
					24.9Ω - 499KΩ	4.7Ω - 1MΩ				±10 ±15	
						1Ω - 1MΩ	1Ω - 3MΩ				±25 ±50
AR10 (2010)	1/3W	-55 ~ +155°C	200V	400V	24.9Ω - 49.9KΩ		—				±1 ±2 ±3
					24.9Ω - 300KΩ						±5
					24.9Ω - 499KΩ	4.7Ω - 1MΩ				±10 ±15	
						1Ω - 1MΩ	1Ω - 3MΩ				±25 ±50
	1/2W*1	-55 ~ +155°C	200V	400V	24.9Ω - 2KΩ	4.7Ω - 1MΩ		1Ω - 1MΩ			±10 ±15
						4.7Ω - 1MΩ	4.7Ω - 3MΩ	1Ω - 3MΩ			±25 ±50
AR12 (2512)	3/4W	-55 ~ +155°C	200V	400V	24.9Ω - 2KΩ	4.7Ω - 2KΩ		1Ω - 2KΩ			±10 ±15
						4.7Ω - 2KΩ	4.7Ω - 3MΩ	1Ω - 3MΩ			±25 ±50
	1W*1	-55 ~ +155°C	200V	400V	24.9Ω - 2KΩ	4.7Ω - 1MΩ		1Ω - 1MΩ			±10 ±15
						4.7Ω - 1MΩ	4.7Ω - 3MΩ	1Ω - 3MΩ			±25 ±50

* & *1: Ultra High Power

Operating Voltage= $\sqrt{P \cdot R}$ or Max. operating voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. overload voltage listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement		Test Method
	Tol. $\leq 0.05\%$	Tol. $> 0.05\%$	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.		+25/-55/+25/+125/+25°C
Short Time Overload	$\Delta R \pm 0.05\%$	$\Delta R \pm 0.1\%$	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
	$\Delta R \pm 0.2\%$ for Ultra High power rating		
Insulation Resistance	$> 9999 \text{ M}\Omega$		Apply 100V _{DC} for 1 minute
Endurance	$\Delta R \pm 0.05\%$	$\Delta R \pm 0.1\%$	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
	$\Delta R \pm 0.5\%$ for Ultra High power rating		
	0201: $> 7\text{k}\Omega$ $\Delta R \pm 0.5\%$ $\leq 7\text{k}\Omega$ $\Delta R \pm 0.2\%$		
Damp Heat with Load (for 0201 size)	$\Delta R \pm 0.3\%$		40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Bending Strength	$\Delta R \pm 0.05\%$	$\Delta R \pm 0.1\%$	Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage		245±5°C for 3 seconds
Resistance to Soldering Heat	$\Delta R \pm 0.05\%$	$\Delta R \pm 0.1\%$	260±5°C for 10 seconds
Dielectric Withstand Voltage	By Type		Max. Overload Voltage for 1 minute
Low Temperature Operation	$\Delta R \pm 0.05\%$	$\Delta R \pm 0.2\%$	1 hour, -65°C, followed by 45 minutes of RCWV
	$\Delta R \pm 0.5\%$ for high power & Ultra power high rating		
High Temperature Exposure	$\Delta R \pm 0.5\%$ 0402 $\geq 255.01\text{K}$ 0603 $\geq 402.01\text{K}$ 0805 $\geq 1.01\text{M}$ 1206 $\geq 1.01\text{M}$ 1210 $\geq 1.01\text{M}$ 2010 $\geq 1.01\text{M}$ 2512 $\geq 1.01\text{M}$		at +155°C for 1000 hrs
	$\Delta R \pm 0.2\%$ for the other		
Temperature Cycling	$\Delta R \pm 0.2\%$		-55°C ~125°C, 1000 cycles
ESD	$\Delta R \pm 0.5\%$		Human body model AR02, AR03: 200V AR05, AR06: 1KV AR10, AR12, AR13: 2KV
Sulfur Test	$\Delta R \pm 0.2\%$ (0201 product is excluded)		105±2°C no power rating for 1000 hrs
Biased Humidity	$\Delta R \pm 0.1\%$ (0201 product is excluded)		1000 hrs 85°C/85%RH 10% of operating power

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: MIL-STD-202, JIS-C-5201-1, JESD22, AEC-Q200, ASTM-B-809-95

■ Storage Temperature: 15~28°C; Humidity < 80%RH

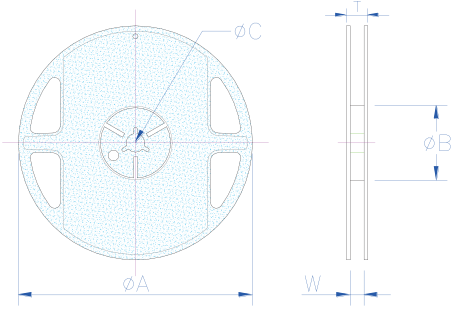
■ Shelf Life: 2 years from production date.

Packaging

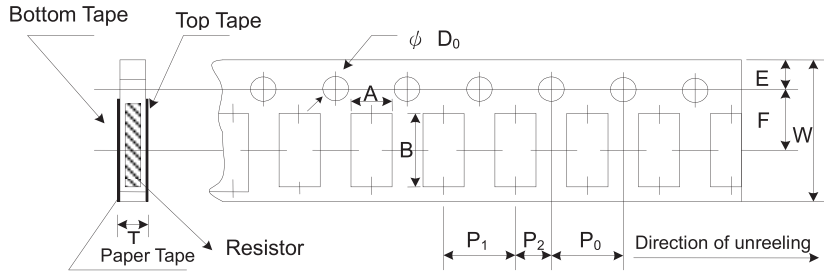
Packaging Quantity & Reel Specifications

Unit: mm

Type	ΦA	ΦB	ΦC	W	T	Paper Tape (EA)	Embossed Plastic Tape (EA)
AR01	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	10,000	-
AR02	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	10,000	-
AR03	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
AR05	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
AR06	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
AR13	178.0±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
AR10	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000
AR12	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000



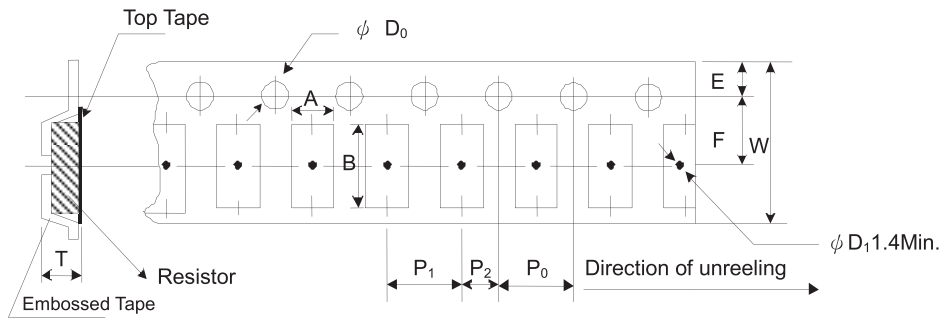
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
AR01	0.40±0.05	0.70±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.03	0.42±0.02
AR02	0.70±0.05	1.16±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.05	0.40±0.03
AR03	1.10±0.05	1.90±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.60±0.03
AR05	1.60±0.05	2.37±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
AR06	2.00±0.05	3.55±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
AR13	2.75±0.05	3.40±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.60±0.10	0.75±0.05

Embossed Plastic Tape Specifications

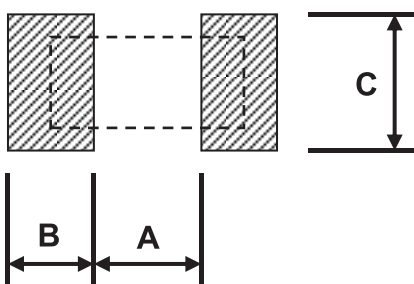


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
AR10	2.85±0.10	5.45±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50±0.10	1.00±0.20
AR12	3.40±0.10	6.65±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50±0.10	1.00±0.20

Recommend Land Pattern

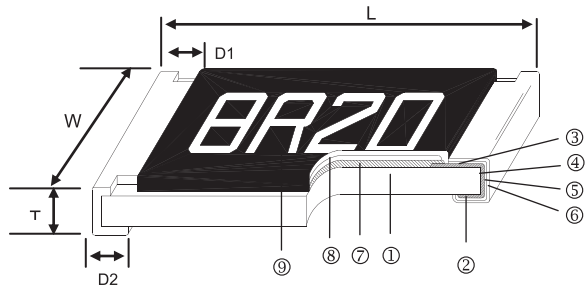
Unit: mm



Type	A	B	C
AR01	0.25	0.30	0.40±0.2
AR02	0.50	0.50	0.60±0.2
AR03	0.80	1.00	0.90±0.2
AR05	1.00	1.00	1.35±0.2
AR06	2.00	1.15	1.70±0.2
AR13	2.00	1.15	2.50±0.2
AR10	3.60	1.40	2.50±0.2
AR10(1/2W)	1.00	2.70	2.50±0.2
AR12	4.90	1.60	3.10±0.2
AR12(1W) _{1-100Ω}	4.90	1.60	3.10±0.2
AR12(1W) _{101Ω above}	1.00	3.55	3.10±0.2

Thin Film Chip Resistor – ARG Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Marking

Features

- Advanced thin film technology
- SMD Type designed for automatic insertion
- Wide resistance range 1ohm ~ 2.49Mega ohm

Applications

- Medical Equipment
- Testing / Measurement Equipment
- Printer Equipment
- Automatic Equipment Controller
- Converters
- Communication Device, Cell Phone, GPS, PDA

Dimensions

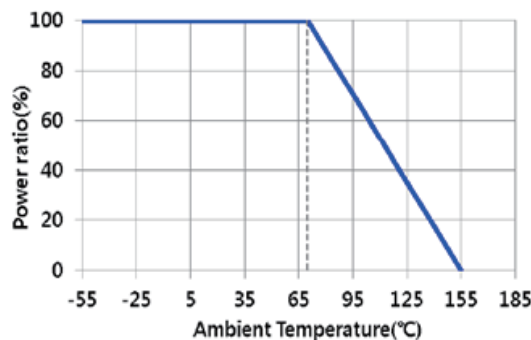
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
ARG02	0402	1.00±0.05	0.50±0.05	0.30±0.10	0.20±0.10	0.20±0.10	0.54
ARG03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	1.83
ARG05	0805	2.00±0.15	1.25±0.15	0.50±0.10	0.30±0.20	0.40±0.20	4.71
ARG06	1206	3.10±0.15	1.55±0.15	0.55±0.10	0.42±0.20	0.35±0.25	9.02

Part Numbering

ARG	03	F	T	C	1001	N
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Resistance	Marking Code
	02: 0402 03: 0603 05: 0805 06: 1206	B: ±0.1% C: ±0.25% D: ±0.5% F: ±1%	T: Taping Reel B: Bulk	C: ±25 D: ±50	0010: 1Ω 4R70: 4.7Ω 1001: 1KΩ 1004: 1MΩ	: Standard Marking for E96 / E24 N: No Marking

Derating Curve



Standard Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range				TCR (PPM/°C)
					±0.1 %	±0.25 %	±0.5%	±1%	
ARG02 (0402)	1/16W	-55 ~ +155°C	50V	100V	4.7Ω - 255KΩ				±25 ±50
ARG03 (0603)	1/10W	-55 ~ +155°C	75V	150V	1Ω - 1MΩ				±25 ±50
ARG05 (0805)	1/8W	-55 ~ +155°C	150V	300V	1Ω - 2MΩ				±25 ±50
ARG06 (1206)	1/4W	-55 ~ +155°C	200V	400V	1Ω - 2.49MΩ				±25 ±50

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

(Lower Resistance: 1~10Ω ; High Power Rating)

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	+25/-55/+25/+125/+25°C
Short Time Overload	$\Delta R \pm 0.2\%$	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	>9999 MΩ	Apply 100V _{DC} for 1 minute
Endurance	$\Delta R \pm 0.5\%$	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat with Load	$\Delta R \pm 0.5\%$	40±2°C, 90~95% R.H. RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Bending Strength	$\Delta R \pm 0.1\%$	Bending amplitude 3 mm for 10 seconds
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	$\Delta R \pm 0.1\%$	260±5°C for 10 seconds
Dielectric Withstand Voltage	By Type	Max. Overload Voltage for 1 minute
Thermal Shock	$\Delta R \pm 0.2\%$	-55°C ~ 150°C, 100 cycles
Low Temperature Operation	$\Delta R \pm 0.5\%$	1 hour, -65°C, followed by 45 minutes of RCWV
High Temperature Exposure	$\Delta R \pm 0.5\%$	at +155°C for 1000 hrs

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower

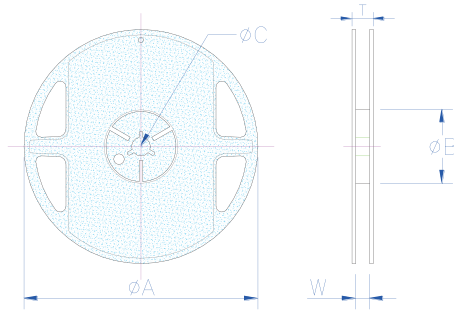
■ **Reference Standards: MIL-STD-202, JIS-C 5201-1**

■ **Storage Temperature: 15~28°C; Humidity < 80%RH**

■ **Shelf Life: 2 years from production date.**

Packaging

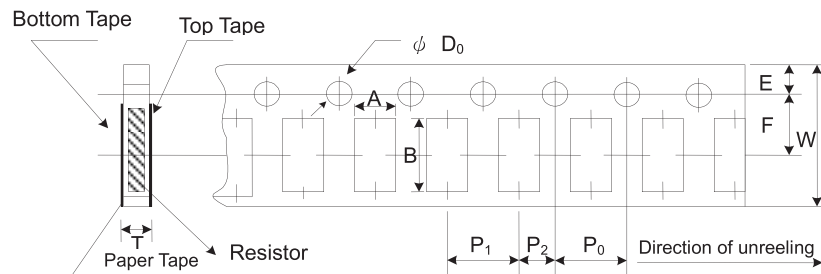
Packaging Quantity & Reel Specifications



Unit: mm

Type	ΦA	ΦB	ΦC	W	T	Paper Tape (EA)
ARG02	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	10,000
ARG03	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000
ARG05	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000
ARG06	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000

Paper Tape Specifications

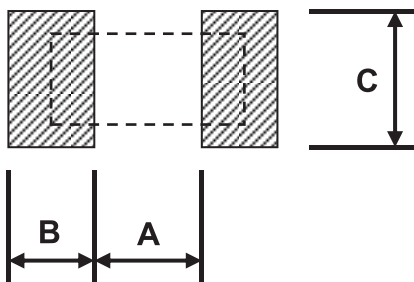


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
ARG02	0.70±0.05	1.16±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.05	0.40±0.03
ARG03	1.10±0.05	1.90±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.60±0.03
ARG05	1.60±0.05	2.37±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
ARG06	2.00±0.05	3.55±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05

Recommend Land Pattern

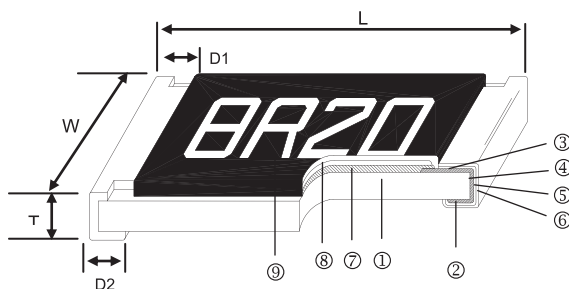
Unit: mm



Type	A	B	C
ARG02	0.50	0.50	0.60±0.2
ARG03	0.80	1.00	0.90±0.2
ARG05	1.00	1.00	1.35±0.2
ARG06	2.00	1.15	1.70±0.2

Aluminum Nitride Thin Film Precision Chip Resistor – ARN Series

Construction



Features

- High thermal conductivity aluminum nitride substrate
- Power rating up to 6.0W
- Resistance 50Ω ~ 30.1KΩ
- Resistor tolerance to ± 0.1%
- TCR to ± 25ppm/°C

① Alumina Nitride Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Marking

Applications

- Power Supplies
- Power Switching
- Braking System

Typical Performance

- TCR 25ppm/°C
- TOL. 0.1%

Dimensions

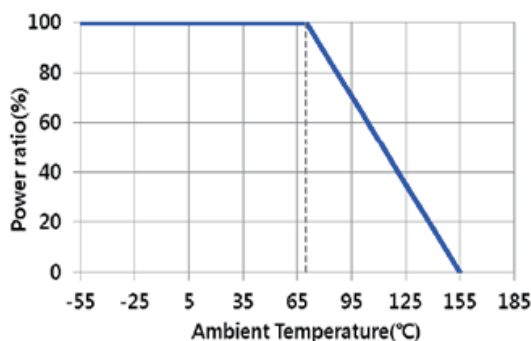
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
ARN03	0603	1.55±0.10	0.80±0.10	0.43±0.15	0.30±0.15	0.50±0.20	1.73
ARN05	0805	2.00±0.15	1.25±0.15	0.43±0.15	0.35±0.15	0.60±0.20	3.95
ARN06	1206	3.05±0.20	1.55±0.20	0.43±0.15	0.50±0.15	1.20±0.20	10.98
ARN12	2512	6.30±0.20	3.10±0.20	0.43±0.15	0.70±0.25	1.60±0.25	42.32

Part Numbering

ARN	06	C	T	C	S	1000	N
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking Code
	03: 0603 05: 0805 06: 1206 12: 2512	B: ±0.1% C: ±0.25% D: ±0.5% F: ±1%	T: Taping Reel B: Bulk	C: ±25 D: ±50	U : 1/2W T : 1W S : 2W I : 6W	0500: 50Ω 1000: 100Ω 5000: 500Ω 1002: 10KΩ	: Standard Marking N: No Marking

Derating Curve



Standard Electrical Specifications

Type	Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range				TCR (PPM/°C)
						±0.1 %	±0.25 %	±0.5%	±1%	
ARN03 (0603)		1/2W ⁽¹⁾	-55 ~ +155°C	75V	150V	50Ω – 30.1KΩ				±25 ±50
ARN05(0805)		1.0W ⁽¹⁾	-55 ~ +155°C	100V	200V	50Ω – 30.1KΩ				±25 ±50
ARN06 (1206)		2.0W ⁽¹⁾	-55 ~ +155°C	100V	200V	50Ω – 30.1KΩ				±25 ±50
ARN12 (2512)		6.0W ⁽¹⁾	-55 ~ +155°C	100V	200V	50Ω – 30.1KΩ				±25 ±50

⁽¹⁾ Dependant on component mounting by user.

Operating Voltage= $\sqrt{P \cdot R}$ or Max. operating voltage listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	+25/-55/+25/+125/+25°C
Short Time Overload ⁽²⁾	$\Delta R \pm 0.5\%$	Actual power handling capability is limited by the end user mounting process. As with any high power chip resistor the ability to remove the heat is critical to the overall performance of the device
Insulation Resistance	>9999 MΩ	Apply 100V _{DC} for 1 minute
Endurance	$\Delta R \pm 1\%$	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat with Load	$\Delta R \pm 0.4\%$	40±2°C, 90~95% R.H. RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	$\Delta R \pm 0.2\%$	260±5°C for 10 seconds
Low Temperature Operation	$\Delta R \pm 0.2\%$	1 hour, -65°C, followed by 45 minutes of RCWV
High Temperature Exposure	$\Delta R \pm 0.2\%$	at +155°C for 1000 hrs
Thermal Shock	$\Delta R \pm 0.2\%$	-55°C ~150°C, 100 cycles

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower

■ Reference Standards: MIL-STD-202, JIS-C 5201-1

■ Storage Temperature: 15~28°C; Humidity < 80%RH

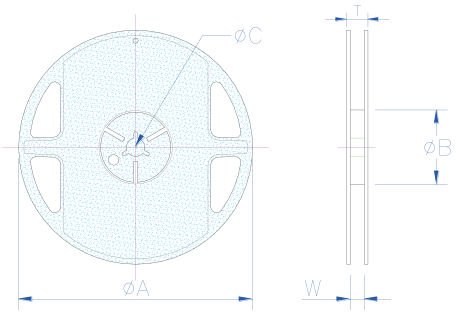
■ Shelf Life: 2 years from production date.

■ Packaging

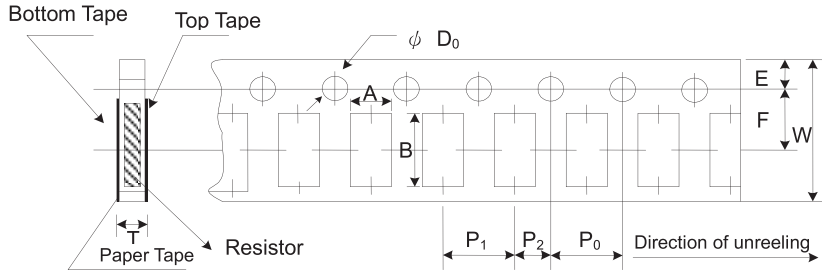
Packaging Quantity & Reel Specifications

Unit: mm

Type	ΦA	ΦB	ΦC	W	T	Paper Tape (EA)	Embossed Plastic Tape (EA)
ARN03	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000	-
ARN05	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000	-
ARN06	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000	-
ARN12	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	13.5 ± 1.0	15.5 ± 1.0	-	4,000



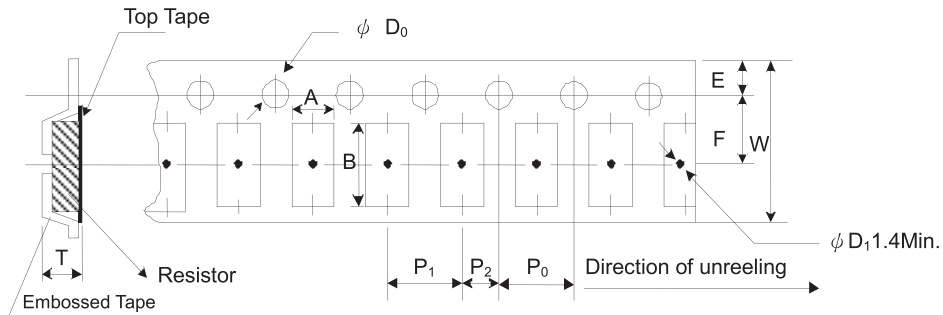
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
ARN03	1.10±0.05	1.90±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.60±0.03
ARN05	1.60±0.05	2.37±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
ARN06	2.00±0.05	3.55±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05

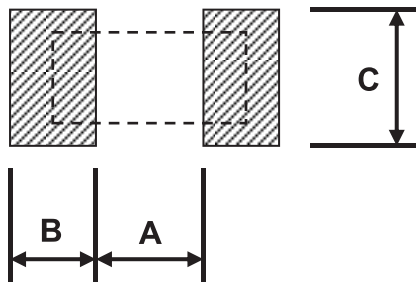
Embossed Plastic Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
ARN12	3.40±0.10	6.65±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	1.00±0.20

■ Recommend Land Pattern



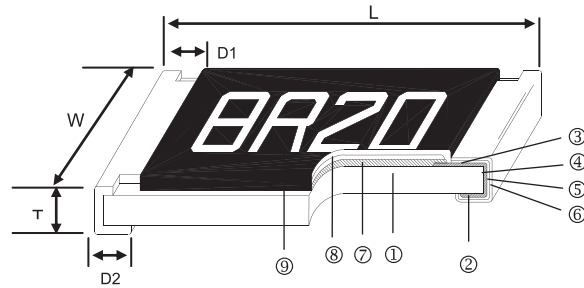
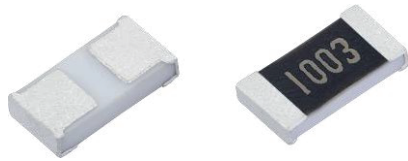
Unit: mm

Type	A	B	C
ARN03	0.37	0.99	0.86±0.1
ARN05	0.50	1.08	1.32±0.1
ARN06	0.60	1.90	1.80±0.1
ARN12	2.77	2.31	3.20±0.2

■ Use a board with a copper thickness of two ounces.

High Power Thin Film Chip Resistor – ARP Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Marking

Features

- Wider bottom terminal enabling higher power capability (short side terminal)
- Significantly larger power handling capability than existing same size resistors
- Size: 1206, Power rating: 1.0W, Resistance range: 10 ~ 100KΩ
- AEC-Q200 Compliance
- Advanced sulfur resistance verified according to ASTM B 809

Dimensions

Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
ARP06	1206	3.05±0.15	1.55±0.15	0.55±0.10	0.42±0.20	1.10±0.20	9.02

Applications

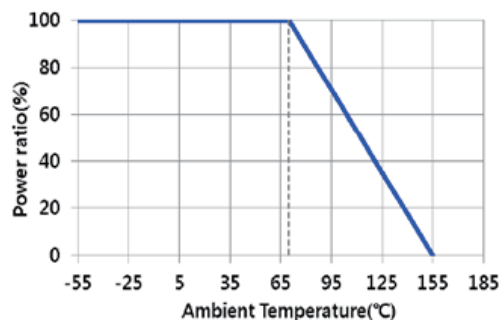
- Power Source Related Devices
- DC Motors, Inverters
- Robotics, Industrial Control System

Part Numbering

ARP	06	B	T	C		1001	N
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking Code
	06: 1206	B: ±0.1% D: ±0.5% F: ±1%	T: Taping Reel B: Bulk	C: ±25 D: ±50	: Standard* (See Remark)	0100: 10Ω 10R2: 10.2Ω 1000: 100Ω 1001: 1KΩ 1003: 100KΩ	: Standard Marking for E96 / E24 N: No Marking

*Remark: Standard part no need for power rating code.

Derating Curve



Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±0.1%	±0.5%	±1%	
ARP06 (1206)	1W	-55 ~ +155°C	200V	400V	47Ω - 100KΩ			±25
					47Ω - 100KΩ	10Ω - 100KΩ	±50	

Operating Voltage= $\sqrt{P \cdot R}$ or Max. operating voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. overload voltage listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	+25/-55/+25/+125/+25°C
Short Time Overload	< 47Ω ΔR±0.4% ≥ 47Ω ΔR±0.2%	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	>1000 MΩ	Apply 100V _{DC} for 1 minute
Endurance	< 47Ω ΔR±0.5% ≥ 47Ω ΔR±0.25%	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
High Temperature Exposure	< 47Ω ΔR±0.25% ≥ 47Ω ΔR±0.1%	at +155°C for 1000 hrs
Biased Humidity	< 47Ω ΔR±0.25% ≥ 47Ω ΔR±0.1%	1000 hrs 85°C /85%RH 10% of operating power
Temperature Cycling	< 47Ω ΔR±0.25% ≥ 47Ω ΔR±0.1%	-55°C to +125°C, 1000 cycles
Bending Strength (Board Flex)	ΔR±0.1%	Bending amplitude 3 mm for 60 seconds
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	< 47Ω ΔR±0.25% ≥ 47Ω ΔR±0.1%	260±5°C for 10 seconds
Terminal Strength	No broken	Force of 1.8kg for 60 seconds
Mechanical Shock	ΔR±0.1%	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	ΔR±0.1%	5 g's for 20 min., 12 cycles each of 3 orientations 10-2000 Hz
ESD	ΔR±0.5%	Human body model 1206 : 1KV
Resistance to solvents	Marking Unsmearred	Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Flammability	No ignition of the tissue paper or scorching or the pinewood board	V-0 or V-1 are acceptable. Electrical test not required
Sulfur Test	ΔR±1%	105±2°C no power rating for 750 hrs.

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower

■ Reference Standards: MIL-STD-202; JIS-C 5201-1; JESD22; IEC-60115-1; AEC-Q200; UL-94;

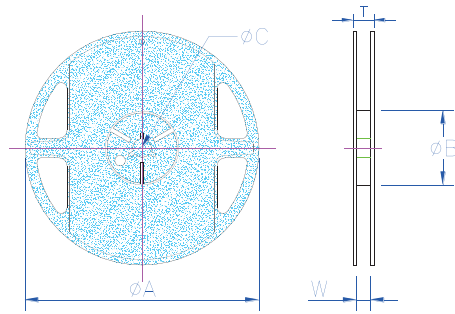
ASTM-B-809-95

■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date

■ Packaging

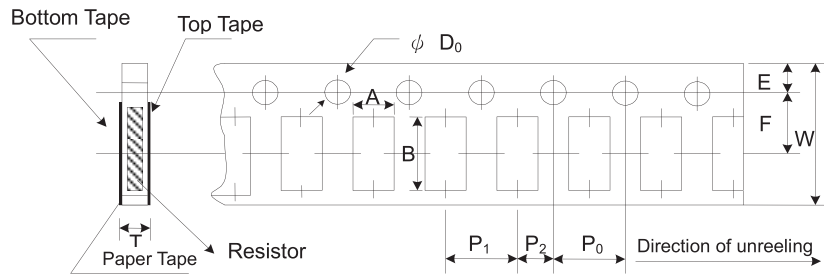
Packaging Quantity & Reel Specifications



Unit: mm

Type	ΦA	ΦB	ΦC	W	T	Paper Tape (EA)	Embossed Plastic Tape (EA)
ARP06	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000	-

Paper Tape Specifications

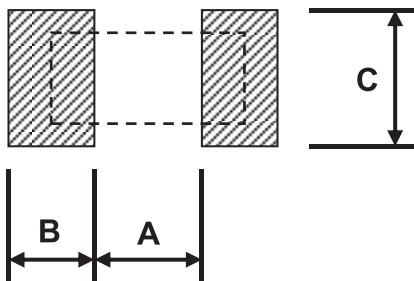


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
ARP06	2.00±0.05	3.55±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05

■ Recommend Land Pattern

Unit: mm

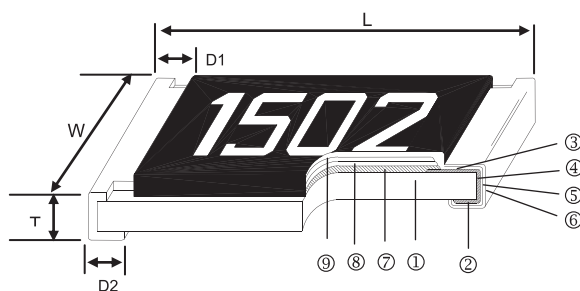


Type	A	B	C
ARP06	0.8	1.9	1.8

■ Please design the land pattern considering heat dissipation to the board so that the terminal temperature will not exceed 155°C

Anti-Corrosive Thin Film Precision Chip Resistor – PR Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Passivation
③ Top Electrode	⑥ External Electrode	⑨ Overcoat

Features

- Long term life stability and demonstrated the Anti-Corrosion claims
- Special passivated NiCr film for Anti-Acid and Anti-Damp
- Tight tolerance down to $\pm 0.1\%$
- Extremely low TCR down to $\pm 15 \text{ PPM}/^\circ\text{C}$
- Wide resistance range 10ohm ~ 1.5Mega ohm

Applications

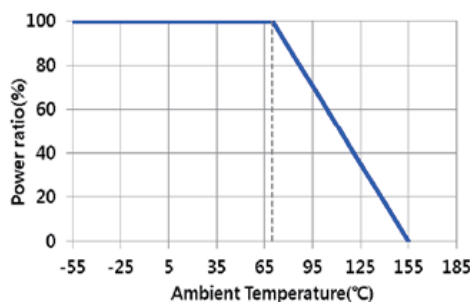
- High-end Computer
- Industrial Equipment
- Automatic Equipment Controller
- Medical Equipment
- Telecommunication Device
- High-end Multimedia Electronics
- Outdoor Electronic Applications

Dimensions

Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
PR02	0402	1.00 \pm 0.05	0.50 \pm 0.05	0.30 \pm 0.05	0.20 \pm 0.10	0.20 \pm 0.10	0.55
PR03	0603	1.55 \pm 0.10	0.80 \pm 0.10	0.45 \pm 0.10	0.30 \pm 0.20	0.30 \pm 0.20	1.85
PR05	0805	2.00 \pm 0.15	1.25 \pm 0.15	0.55 \pm 0.10	0.30 \pm 0.20	0.40 \pm 0.25	4.76
PR06	1206	3.05 \pm 0.15	1.55 \pm 0.15	0.55 \pm 0.10	0.42 \pm 0.20	0.35 \pm 0.25	9.11
PR10	2010	4.90 \pm 0.15	2.40 \pm 0.15	0.55 \pm 0.10	0.60 \pm 0.30	0.50 \pm 0.25	23.82
PR12	2512	6.30 \pm 0.15	3.10 \pm 0.15	0.55 \pm 0.10	0.60 \pm 0.30	0.50 \pm 0.25	38.46

Derating Curve



Part Numbering

PR	03	D	T	D	X	1000	N
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/ $^\circ$ C)	Power Rating	Resistance	Marking Code
	02: 0402 03: 0603 05: 0805 06: 1206 10: 2010 12: 2512	B: $\pm 0.1\%$ C: $\pm 0.25\%$ D: $\pm 0.5\%$	T: Taping Reel B: Bulk	N: ± 15 C: ± 25 D: ± 50	: Standard* (See Remark) Y: 1/16W X: 1/10W W: 1/8W V: 1/4W U: 1/2W	1000: 100 Ω 2201: 2200 Ω 1001: 1K Ω 1004: 1M Ω	: Standard Marking for E96 / E24 N: No Marking

*Remark: Standard part no need for power rating code.

Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±0.1%	±0.25%	±0.5%	
PR02 (0402)	1/16W	-55 ~ +155°C	25V	50V	49.9Ω - 12KΩ			±15
					24.9Ω - 24.9KΩ			±25 ±50
PR03 (0603)	1/16W	-55 ~ +155°C	50V	100V	24.9Ω - 332KΩ			±15 ±25 ±50
PR05 (0805)	1/10W	-55 ~ +155°C	100V	200V	10Ω - 1MΩ			±15 ±25 ±50
PR06 (1206)	1/8W	-55 ~ +155°C	150V	300V	10Ω - 1MΩ			±15 ±25 ±50
PR10 (2010)	1/4W	-55 ~ +155°C	150V	300V	24.9Ω - 1MΩ			±15
					10Ω - 1.5MΩ			±25 ±50
PR12 (2512)	1/2W	-55 ~ +155°C	150V	300V	24.9Ω - 1MΩ			±15
					10Ω - 1.5MΩ			±25 ±50

High Power Rating Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±0.1%	±0.25%	±0.5%	
PR03 (0603)	1/10W	-55 ~ +155°C	75V	150V	24.9Ω - 220KΩ			±15 ±25 ±50
PR05 (0805)	1/8W	-55 ~ +155°C	150V	300V	24.9Ω - 680KΩ			±15 ±25 ±50
PR06 (1206)	1/4W	-55 ~ +155°C	200V	400V	24.9Ω - 1MΩ			±15 ±25 ±50

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement		Test Method
	Size 0603 / 0805 / 1206 / 2010 / 2512	Size 0402	
Short Time Overload	$\leq \pm 0.02\%$	$\leq \pm 0.1\%$	RCWV*2.5 or Max. Overload Voltage whichever is lower for 2 seconds
	$\leq \pm 0.2\%$ for high power rating		
Endurance	$\leq \pm 0.05\%$	$\leq \pm 0.25\%$	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
	$\leq \pm 0.25\%$ for high power rating		
Damp Heat with Load	$\leq \pm 0.05\%$	$\leq \pm 0.5\%$	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
	$\leq \pm 0.25\%$ for high power rating		
Solderability	95% min. coverage		245±5°C for 3 seconds
Resistance to Soldering Heat	$\leq \pm 0.02\%$	$\leq \pm 0.1\%$	260±5°C for 10 seconds
Thermal Shock	$\leq \pm 0.02\%$	$\leq \pm 0.1\%$	-55°C~150°C, 100 cycles

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: MIL-STD-202, JIS-C 5201-1

■ Storage Temperature: 15~28°C; Humidity < 80%RH

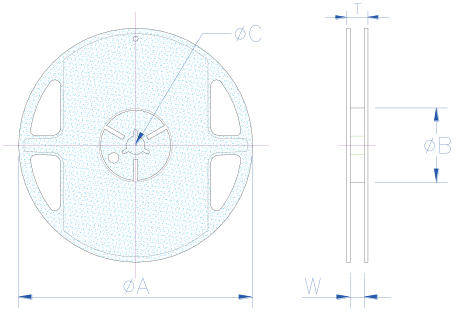
■ Shelf Life: 2 years from production date

Packaging

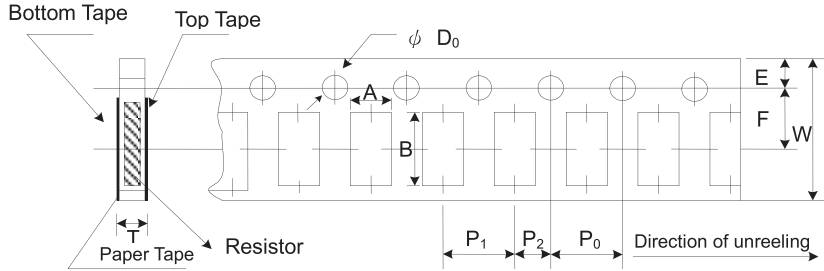
Packaging Quantity & Reel Specifications

Unit: mm

Type	ΦA	ΦB	ΦC	W	T	Paper Tape (EA)	Embossed Plastic Tape (EA)
PR02	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	10,000	-
PR03	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000	-
PR05	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000	-
PR06	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000	-
PR10	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	13.5 ± 1.0	15.5 ± 1.0	-	4,000
PR12	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	13.5 ± 1.0	15.5 ± 1.0	-	4,000



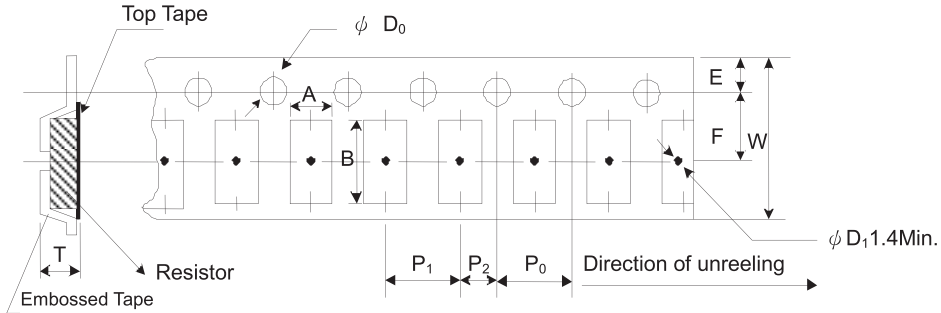
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
PR02	0.70±0.05	1.16±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.05	0.40±0.03
PR03	1.10±0.05	1.90±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.60±0.03
PR05	1.60±0.05	2.37±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
PR06	2.00±0.05	3.55±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05

Embossed Plastic Tape Specifications

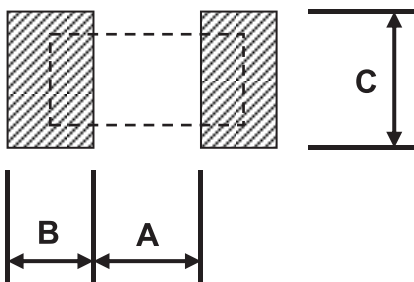


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
PR10	2.85±0.10	5.45±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50±0.10	1.00±0.20
PR12	3.40±0.10	6.65±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50±0.10	1.00±0.20

Recommend Land Pattern

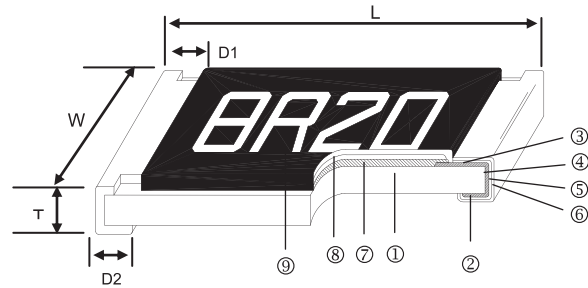
Unit: mm



Type	A	B	C
PR02	0.50	0.50	0.60±0.2
PR03	0.80	1.00	0.90±0.2
PR05	1.00	1.00	1.35±0.2
PR06	2.00	1.15	1.70±0.2
PR10	3.60	1.40	2.50±0.2
PR12	4.90	1.60	3.10±0.2

Resistor of Advanced Meter Thin Film Chip Resistor – RAM Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Marking

Features

- Q/GDW 11179.3 Compliance
- Advanced thin film technology
- RoHS compliant
- Special materials, design, and processing for meter applications

Applications

- Smart Meter
- Testing / Measurement Equipment
- Advanced Metering Infrastructure

Dimensions

Unit: mm

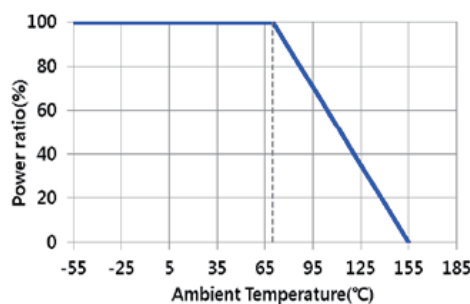
Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
RAM02	0402	1.00±0.05	0.50±0.05	0.30±0.05	0.20±0.10	0.30±0.10	0.54
RAM03	0603	1.55±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.45±0.20	1.83
RAM05	0805	2.00±0.15	1.25±0.15	0.55±0.10	0.30±0.20	0.55±0.20	4.71
RAM06	1206	3.05±0.15	1.55±0.15	0.55±0.10	0.42±0.20	0.50±0.25	9.02
RAM13	1210	3.10±0.15	2.40±0.15	0.55±0.10	0.40±0.20	0.60±0.25	10
RAM10	2010	4.90±0.15	2.40±0.15	0.55±0.10	0.60±0.30	0.65±0.25	23.61
RAM12	2512	6.30±0.15	3.10±0.15	0.55±0.10	0.60±0.30	0.65±0.25	38.06

Part Numbering

RAM	03	B	T	C	X	1001	N
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking Code
	02: 0402 03: 0603 05: 0805 06: 1206 13: 1210 10: 2010 12: 2512	B: ±0.1% C: ±0.25% D: ±0.5% F: ±1%	T: Taping Reel B: Bulk	B: ±10 N: ±15 C: ±25 D: ±50	: Standard* (See Remark) Y: 1/16W X: 1/10W W: 1/8W M: 1/6W V: 1/4W O: 1/3W U: 1/2W	0010: 1Ω 4R70: 4.7Ω 1001: 1KΩ 1004: 1MΩ	: Standard Marking for E96 / E24 N: No Marking

*Remark: Standard part no need for power rating code.

Derating Curve



Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range				TCR (PPM/°C)
					±0.1%	±0.25%	±0.5%	±1%	
RAM02 (0402)	1/16W	-55 ~ +155°C	25V	50V	1Ω - 100KΩ				±25 ±50
RAM03 (0603)	1/16W	-55 ~ +155°C	50V	100V	1Ω - 332KΩ				±25 ±50
RAM05 (0805)	1/10W	-55 ~ +155°C	100V	200V	1Ω - 1MΩ				±25 ±50
RAM06 (1206)	1/8W	-55 ~ +155°C	150V	300V	1Ω - 1MΩ				±25 ±50
RAM13 (1210)	1/4W	-55 ~ +155°C	150V	300V	1Ω - 1MΩ				±25 ±50
RAM10 (2010)	1/4W	-55 ~ +155°C	150V	300V	1Ω - 1MΩ				±25 ±50
RAM12 (2512)	1/2W	-55 ~ +155°C	150V	300V	1Ω - 1MΩ				±25 ±50

Special Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range				TCR (PPM/°C)
					±0.1%	±0.25%	±0.5%	±1%	
RAM05 (0805)	1/10W	-55 ~ +155°C	100V	200V	4.7Ω - 15KΩ				±10 ±15
RAM06 (1206)	1/8W	-55 ~ +155°C	150V	300V	4.7Ω - 20KΩ				±10 ±15
RAM13 (1210)	1/4W	-55 ~ +155°C	150V	300V	4.7Ω - 20KΩ				±10 ±15
RAM10 (2010)	1/4W	-55 ~ +155°C	150V	300V	4.7Ω - 20KΩ				±10 ±15
RAM12 (2512)	1/2W	-55 ~ +155°C	150V	300V	4.7Ω - 20KΩ				±10 ±15

High Power Rating Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range				TCR (PPM/°C)
					±0.1%	±0.25%	±0.5%	±1%	
RAM03 (0603)	1/10W	-55 ~ +155°C	75V	150V	1Ω - 100KΩ				±25 ±50
RAM05 (0805)	1/8W	-55 ~ +155°C	150V	300V	4.7Ω - 15KΩ				±10 ±15
					1Ω - 1MΩ				±25 ±50
RAM06 (1206)	1/4W	-55 ~ +155°C	200V	400V	4.7Ω - 20KΩ				±10 ±15
					1Ω - 1MΩ				±25 ±50

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement		Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.		+25/-55/+25/+125/+25°C
Short Time Overload	$\Delta R \pm 0.2\%$		RCWV*2.5 or Max. overload voltage whichever is lower for 5 seconds Measurement at 0.5 hours after test conclusion.
Endurance	$\Delta R \pm 0.2\%$		70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF" Measurement at 2 hours after test conclusion.
Biased Humidity	96 hrs	$\Delta R \pm 0.2\%$	96 hrs 85°C/85%RH 10% of operating power. 96 hrs 85°C/85%RH No operating power. 1000 hrs 85°C/85%RH 10% of operating power. Measurement at 4 hours after test conclusion.
	1000 hrs	$\Delta R \pm 0.5\%$	
Solderability	95% min. coverage		Solder bath method; 245±3°C for 5 seconds
Resistance to Soldering Heat	$\Delta R \pm 0.1\%$		260±5°C for 5±1 seconds
High Temperature Exposure	96 hrs	$\Delta R \pm 0.1\%$	at +155°C Measurement at 4 hours after test conclusion
	1000 hrs	$\Delta R \pm 0.3\%$	

Item	Requirement	Test Method
Thermal Shock	$\Delta R \pm 0.5\%$	-40°C 30min , 85°C 30min, Temperature Change Time 2~3 min, 1 Cycle, Total 5 Cycles. Measurement at 16 hours after test conclusion
Low Temperature Operation	$\Delta R \pm 0.2\%$	1 hour, -45°C, followed by 45 minutes of RCWV 1 hour, -65°C, followed by 45 minutes of RCWV Measurement at 24 hours after test conclusion
Low Temperature Exposure	$\Delta R \pm 0.5\%$	at -55°C for 96 hrs Measurement at 4 hours after test conclusion
Single Pulse High Voltage Overload	$\Delta R \pm 0.5\%$	Class C:10* RCWV or 5*Max. Operating voltage whichever is lower
Vibration	$\Delta R \pm 0.5\%$	Vibration Frequency Range : 10Hz-150Hz crossover frequency: 60Hz f<60Hz · uniform amplitude: 0.075mm f>60Hz · Constant acceleration: 9.8m/ s ² (1g) Scanning cycles for every axis: 10 Note: 10 Scanning cycles-75min.

RCWV(Rated Continuous Working Voltage)= $\sqrt{(P \cdot R)}$ or Max. Operating Voltage whichever is lower

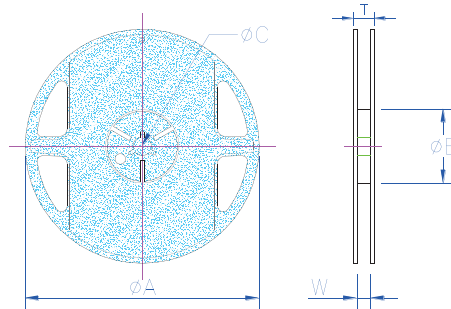
■ Reference Standards: MIL-STD-202, GB/T 5729, Q/GDW 11179.3, GB/T 17215.211

■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date

■ Packaging

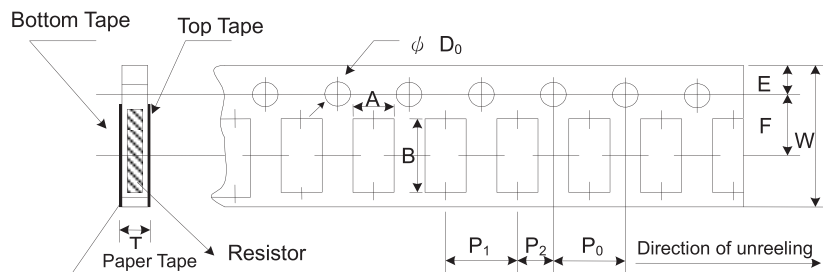
Packaging Quantity & Reel Specifications



Unit: mm

Type	ΦA	ΦB	ΦC	W	T	Paper Tape (EA)	Embossed Plastic Tape (EA)
RAM02	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	10,000	-
RAM03	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000	-
RAM05	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000	-
RAM06	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000	-
RAM13	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000	-
RAM10	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	13.5 ± 1.0	15.5 ± 1.0	-	4,000
RAM12	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	13.5 ± 1.0	15.5 ± 1.0	-	4,000

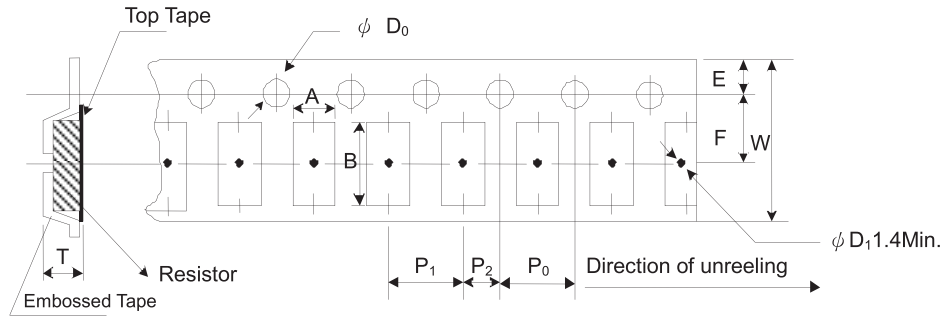
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
RAM02	0.70±0.05	1.16±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.05	0.40±0.03
RAM03	1.10±0.05	1.90±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.60±0.03
RAM05	1.60±0.05	2.37±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
RAM06	2.00±0.05	3.55±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
RAM13	2.75±0.05	3.40±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.60±0.10	0.75±0.05

Embossed Plastic Tape Specifications

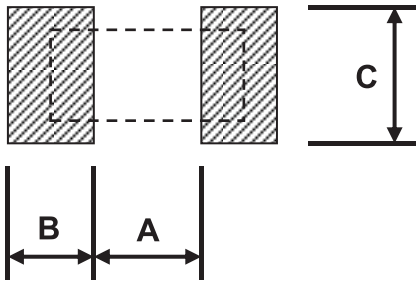


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
RAM10	2.85±0.10	5.45±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20
RAM12	3.40±0.10	6.65±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20

Recommend Land Pattern

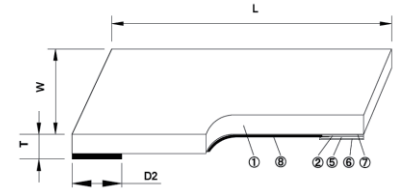
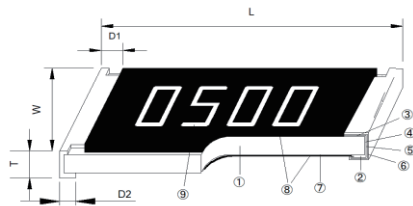
Unit: mm



Type	A	B	C
RAM02	0.50	0.50	0.60±0.2
RAM03	0.80	1.00	0.90±0.2
RAM05	1.00	1.00	1.35±0.2
RAM06	2.00	1.15	1.70±0.2
RAM13	2.00	1.15	2.50±0.2
RAM10	3.60	1.40	2.50±0.2
RAM12	4.90	1.60	3.10±0.2

High Frequency (up to 70GHz) Thin Film Precision Chip Resistor—ARF Series

Construction



0402/0603/0/05/1206

0201

Features

- Small standard size 0201 case size
- High frequency up to 70GHz for 0201
- High frequency up to 50GHz for 0402, 0603
- High purity alumina substrate
- Ohmic range (10Ω~1KΩ)
- Resistor tolerance to ±0.1%
- Low TCR (down to ±25ppm/°C)

① High purity Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Marking

Applications

- Low Noise Amplifiers
- Attenuation
- Line Termination

Typical Performance

- TCR. 25 ppm/°C
- TOL. 0.1%

Dimensions

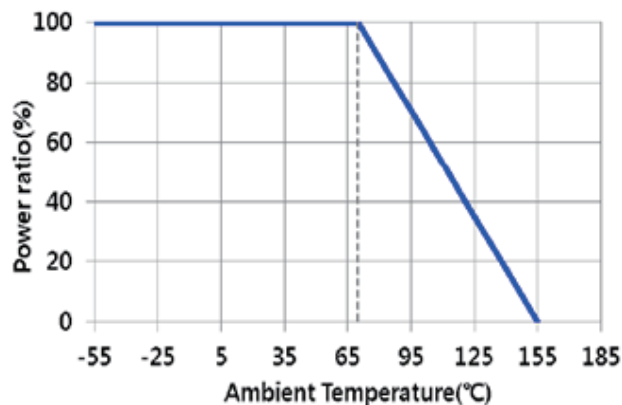
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
ARF01	0201	0.58±0.05	0.30±0.05	0.21±0.07	-	0.15±0.10	0.12
ARF02	0402	1.00±0.07	0.50±0.07	0.38±0.15	0.20±0.15	0.20±0.15	0.73
ARF03	0603	1.55±0.10	0.80±0.10	0.45±0.15	0.30±0.20	0.30±0.20	2.08
ARF05	0805	2.00±0.15	1.25±0.15	0.45±0.15	0.30±0.20	0.35±0.20	4.15
ARF06	1206	3.05±0.20	1.55±0.20	0.45±0.15	0.45±0.20	0.35±0.25	7.59

Part Numbering

ARF	02	B	T	C	N	0500	N
Product Type	Dimensions (L×W)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking Code
	01: 0201 02: 0402 03: 0603 05: 0805 06: 1206	B: ±0.1% C: ±0.25% D: ±0.5% F: ±1%	T: Taping Reel B: Bulk	C: ±25 D: ±50	Z: 1/32W N: 1/20W W: 1/8W P: 1/5W O: 1/3W	0500: 50Ω 1000: 100Ω 1500: 150Ω 1001: 1KΩ	:Standard Marking N: No Marking

Derating Curve



Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max Operating Voltage	Max Overload Voltage	Resistance Range				TCR (PPM/°C)
					±0.1%	±0.25%	±0.5%	±1%	
ARF01 (0201)	1/32W	-55°C ~ +155°C	15V	30V	20Ω~500Ω				±25 ±50
ARF02 (0402)	1/20W	-55°C ~ +155°C	30V	60V	10Ω~1KΩ				±25 ±50
ARF03 (0603)	1/8W	-55°C ~ +155°C	50V	100V	10Ω~1KΩ				±25 ±50
ARF05 (0805)	1/5W	-55°C ~ +155°C	50V	100V	10Ω~1KΩ				±25 ±50
ARF06 (1206)	1/3W	-55°C ~ +155°C	75V	150V	10Ω~1KΩ				±25 ±50

Operating Voltage= $\sqrt{P \cdot R}$ or Max. operating voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. overload voltage listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	+25/-55/+25/+125/+25°C
Short Time Overload	$\Delta R \pm 0.2\%$	RCWV*2.5 or Max. overload voltage whichever is lower for 5 seconds
Insulation Resistance	>9999 MΩ	Apply 100V _{DC} for 1 minute
Endurance	$\Delta R \pm 0.5\%$	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Damp Heat with Load	$\Delta R \pm 0.5\%$	40±2°C, 90~95% R.H. RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Bending Strength	$\Delta R \pm 0.1\%$	Bending once for 60 seconds 2010 2512 sizes: 2 mm Other sizes: 3 mm
Solderability	95% min. coverage 0201: excep	245±5°C for 3 seconds
Resistance to Soldering Heat	$\Delta R \pm 0.1\%$ 0201: excep	260±5°C for 10 seconds
Dielectric Withstand Voltage	By Type	Max. overload voltage for 1 minute
Low Temperature Operation	$\Delta R \pm 0.2\%$	1 hour, -65°C, followed by 45 minutes of RCWV
High Temperature Exposure	$\Delta R \pm 0.5\%$	at +155°C for 1000 hrs

RCWV(Rated continuous working voltage)= $\sqrt{P \cdot R}$ or Max. Operating voltage whichever is lower

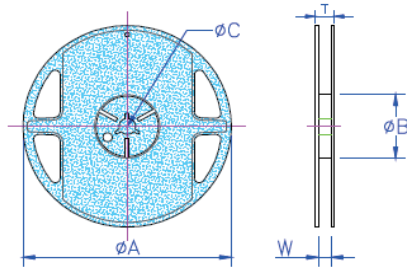
■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Reference Standards: JIS-C 5201-1; MIL-STD-202

■ Shelf Life: 2 years from production date.

Packaging

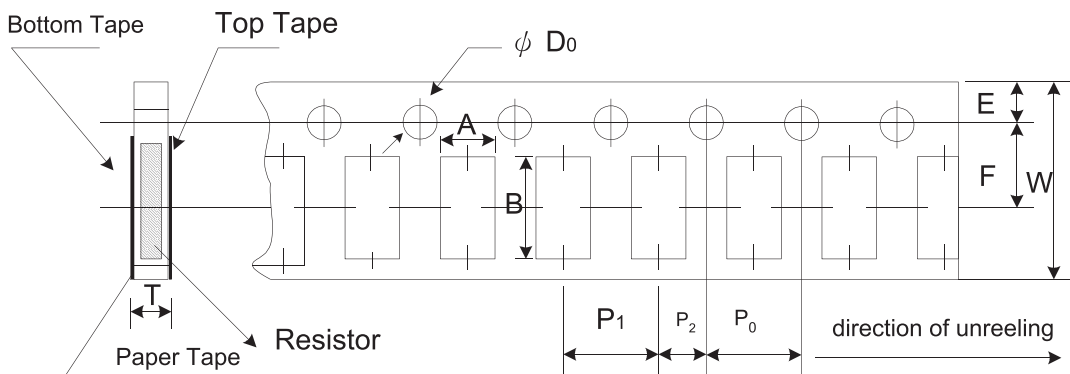
Packing Quantity & Reel Specifications



Unit :mm

Type	ØA	ØB	ØC	W	T	Paper Tape (EA)
ARF01	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	10,000
ARF02	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	10,000
ARF03	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000
ARF05	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000
ARF06	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000

Paper Tape Specifications

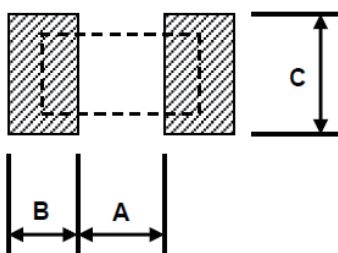


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ØD ₀	T
ARF01	0.40±0.05	0.70±0.05	8.00±0.20	1.75±0.10	3.5±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.03	0.42±0.02
ARF02	0.66±0.06	1.18±0.06	8.00±0.20	1.75±0.10	3.5±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.05	0.60±0.03
ARF03	1.10±0.05	1.90±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.60±0.03
ARF05	1.60±0.05	2.37±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
ARF06	2.00±0.05	3.55±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05

Recommend Land Pattern

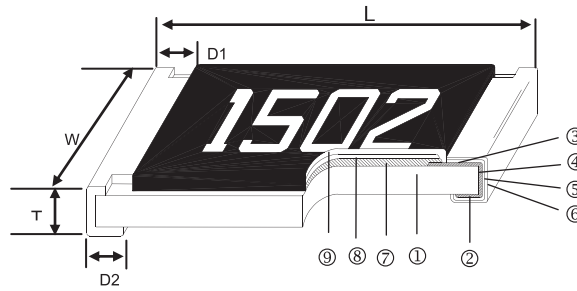
Unit: mm



Type	A	B	C
ARF01	0.25	0.30	0.40±0.2
ARF02	0.50	0.50	0.60±0.2
ARF03	0.80	1.00	0.90±0.2
ARF05	1.00	1.00	1.35±0.2
ARF06	2.00	1.15	1.70±0.2

Thick Film Chip Resistor – CR..AC Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Features

- AEC-Q200 Compliance
- Small size and light weight
- Highly reliable multilayer electrode construction
- Compatible with all soldering process
- 100% CCD inspection

Applications

- Telecommunication Equipment
- Car Media
- Digital Cameras, Watches, Pocket Calculators
- Computers, Instruments
- Medical Equipment

Dimensions

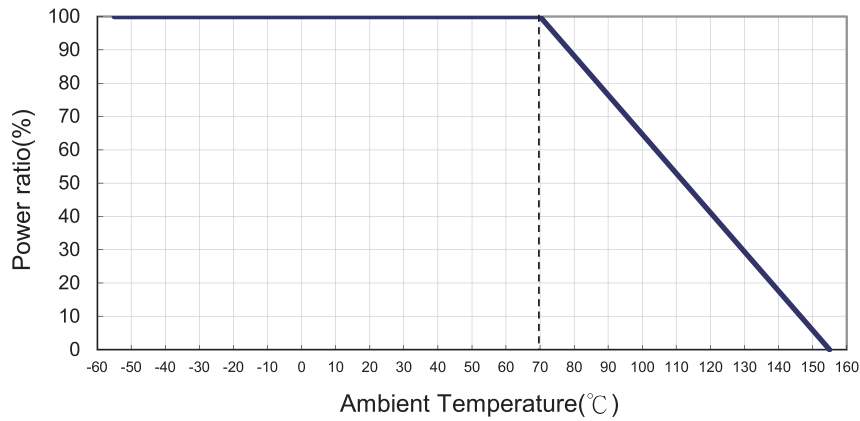
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
CR-01	0201	0.60±0.03	0.30±0.03	0.23±0.03	0.15±0.05	0.15±0.05	0.150
CR-02	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10	0.620
CR-03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	2.042
CR-05	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	4.368
CR-06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	8.947
CR-10	1210	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.25	0.50±0.20	15.959
CR-0A	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20	24.241
CR-12	2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.25	0.50±0.20	39.448

Part Numbering

CR-	03	F	L	7	--10R	AC
Product Type	Dimensions	Resistance Tolerance	Function Code	Packaging Code	Resistance	Packaging Code
	01: 0201 02: 0402 03: 0603 05: 0805 06: 1206 10: 1210 0A: 2010 12: 2512	B: ±0.1% C: ±0.25% D: ±0.5% F: ±1% J: ±5%	L: Standard & High Precision E: TC50 P: High Power H: Ultra High Power M: High Power 1	0: 7" Reel 15Kpcs 2: 7" Reel 2Kpcs 4: 7" Reel 4Kpcs 5: 7" Reel 20Kpcs 6: 7" Reel 10Kpcs 7: 7" Reel 5Kpcs 9: 10" Reel 8Kpcs A: 10" Reel 10Kpcs B: 10" Reel 20Kpcs C: 13" Reel 40Kpcs D: 13" Reel 20Kpcs	--- 1R2: 1.2Ω --- 3K3: 3.3KΩ --- 10K: 10KΩ -- 100K: 100KΩ "-" to fill up 6 spaces	AC:100% CCD inspection

Derating Curve



Standard Electrical Specifications

Type \ Item	Power Rating at 70°C Jumper Rated Current	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range		TCR (PPM/°C)
					±1%(E24、E96)	±5%(E24)	
CR-01 (0201)	1/20W	-55 ~ +155°C	25V	50V	1Ω - 10MΩ		±200
CR-02 (0402)	1/16W	-55 ~ +155°C	50V	100V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 20MΩ 20.5MΩ - 100MΩ		±200 ±100 ±200 ±400
CR-03 (0603)	1/10W	-55 ~ +155°C	75V	150V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 20MΩ 20.5MΩ - 100MΩ		±200 ±100 ±200 ±400
CR-05 (0805)	1/8W	-55 ~ +155°C	150V	300V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 20MΩ 20.5MΩ - 100MΩ		±200 ±100 ±200 ±400
CR-06 (1206)	1/4W	-55 ~ +155°C	200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 20MΩ 20.5MΩ - 100MΩ		±200 ±100 ±200 ±400
CR-10 (1210)	1/3W	-55 ~ +155°C	200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 20MΩ 20.5MΩ - 39MΩ		±200 ±100 ±200 ±400
CR-0A (2010)	3/4W	-55 ~ +155°C	200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 20MΩ 20.5MΩ - 100MΩ		±200 ±100 ±200 ±400
CR-12 (2512)	1W	-55 ~ +155°C	250V	500V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 20MΩ 20.5MΩ - 100MΩ		±200 ±100 ±200 ±400

TC50 Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range (E24、E96)				TCR (PPM/°C)
					±0.1%	±0.25%	±0.5%	±1%	
CR-02 (0402)	1/16W	-55 ~ +155°C	50V	100V	-		100Ω - 1MΩ		±50
CR-03 (0603)	1/10W		75V	150V	10Ω - 1MΩ	10Ω - 10MΩ			
CR-05 (0805)	1/8W		150V	300V					
CR-06 (1206)	1/4W		200V	400V					
CR-10 (1210)	1/3W		200V	400V					
CR-0A (2010)	3/4W		200V	400V					
CR-12 (2512)	1W		250V	500V					

High Precision Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range (E24、E96)			TCR (PPM/°C)
					±0.1%	±0.25%	±0.5%	
CR-02 (0402)	1/16W	-55 ~ +155°C	50V	100V	-		10Ω - 1MΩ	±100
					-		1.02M - 10MΩ	±200
CR-03 (0603)	1/10W		75V	150V	10Ω - 1MΩ			±100
					-	1.02M - 10MΩ		±200
CR-05 (0805)	1/8W		150V	300V	10Ω - 1MΩ			±100
					-	1.02M - 10MΩ		±200
CR-06 (1206)	1/4W		200V	400V	10Ω - 1MΩ			±100
					-	1.02M - 10MΩ		±200
CR-10 (1210)	1/3W		200V	400V	10Ω - 1MΩ			±100
		-			1.02M - 10MΩ		±200	
CR-0A (2010)	3/4W	200V	400V	10Ω - 1MΩ			±100	
				-	1.02M - 10MΩ		±200	
CR-12 (2512)	1W	250V	500V	10Ω - 1MΩ			±100	
				-	1.02M - 10MΩ		±200	

High Power & Ultra High Power Rating Electrical Specifications

Type \ Item	Power Rating at 70°C	Function Code	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
						±0.5% (E24、E96)	±1% (E24、E96)	±5% (E24)	
CR-02 (0402)	1/10W	M	-55 ~ +155°C	50V	100V	10Ω - 1MΩ	1Ω - 9.76Ω 10Ω - 1MΩ	1Ω - 9.76Ω 10Ω - 1MΩ	±200 ±100
	1/8W	P							
CR-03 (0603)	1/4W	P		75V	150V				
CR-05 (0805)	1/3W	P		150V	300V				
CR-06 (1206)	1/3W	P		200V	400V				
	*1/2W	H							
CR-10 (1210)	1/2W	P		200V	400V				
	*3/4W	H							
CR-0A (2010)	1W	P		200V	400V				
CR-12 (2512)	2W	P	250V	500V					

*: Ultra High Power

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Jumper(0Ω)

Type \ Item	Rated Current	Function Code	Resistance	Operating Temp. Range
			5%	
CR-01 (0201)	1A	L	<50mΩ	-55 ~ +155°C
CR-02 (0402)	1A			
CR-03 (0603)	1A			
CR-05 (0805)	2A			
CR-06 (1206)	2A			
CR-10 (1210)	2.5A			
CR-0A (2010)	3.5A			
CR-12 (2512)	4A			

High Current Jumper(0Ω)

Type	Item	Rated Current	Function Code	Resistance	Operating Temp. Range
				5%	
	CR-02 (0402)	1.5A	P	<20mΩ	-55 ~ +155°C
	CR-03 (0603)	2A			
	CR-05 (0805)	2.5A			
	CR-06 (1206)	3.5A			
	CR-10 (1210)	5A			
	CR-0A (2010)	6A			
	CR-12 (2512)	7A			

Environmental Characteristics

Item	Requirement			Test Method
	±1% and Below	±5%	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.			At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	<50mΩ	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds, 2 seconds for high power series Ultra High Power (2512) : RCWV*2 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G			Max. Overload Voltage for 1 minute
Endurance	±(1.0%+0.10Ω)	±(2.0%+0.10Ω)	<100mΩ	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat with Load	±(1.0%+0.10Ω)	±(2.0%+0.10Ω)	<100mΩ	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Dry Heat	±(1.0%+0.05Ω)	±(1.5%+0.10Ω)	<50mΩ	At +155°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage			245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover			1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤ 5% Total leaching area ≤ 10%			260±5°C for 30 seconds
Rapid Change of Temperature	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	-55°C to +155°C, 5 cycles

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1

■ Storage Temperature: 15~28°C; Humidity < 80%RH

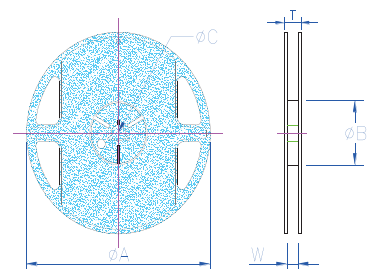
■ Shelf Life: 2 years from production date

Packaging

Reel Specifications & Packaging Quantity

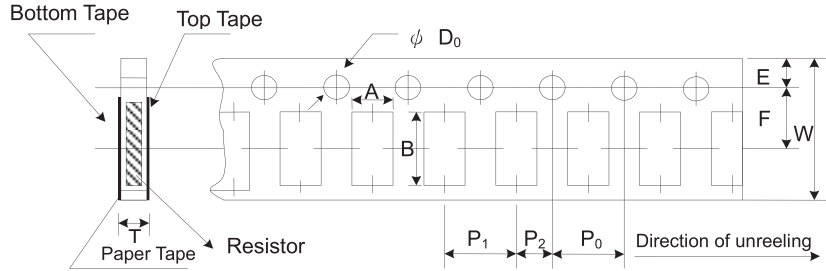
Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T	
CR-01	Paper	15K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
CR-01 CR-02	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		20K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		40K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
CR-03 CR-05 CR-06 CR-10	Paper	5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		10K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		20K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
CR-0A CR-12	Embossed	4K	12mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.5	13.0±0.5	15.5±0.5
		8K	12mm	10 inch	250±1.0	62±0.5	13.0±0.5	12.5±0.5	16.5±0.5



Packaging

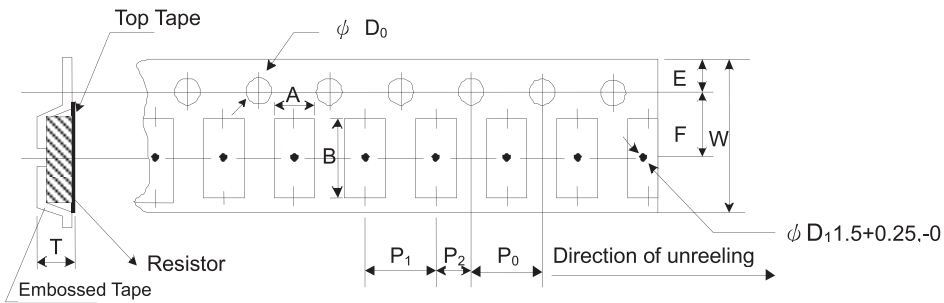
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CR-01	0.38±0.05	0.68±0.05	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.42±0.20
CR-02	0.65±0.10	1.15±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.10
CR-03	1.10±0.10	1.90±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.10
CR-05	1.60±0.10	2.40±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CR-06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CR-10	2.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Embossed Plastic Tape Specifications

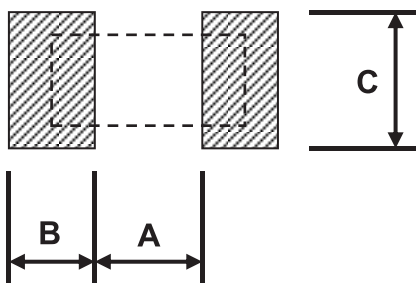


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CR-0A	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰
CR-12	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰

Recommend Land Pattern

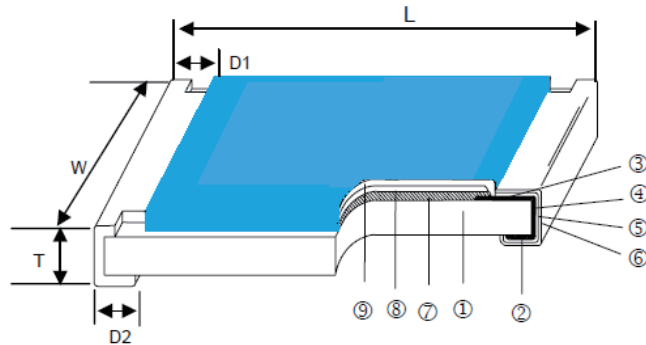
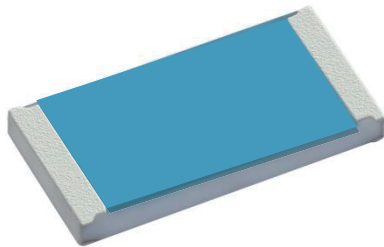
Unit: mm



Type	A	B	C
CR-01	0.30	0.25	0.30
CR-02	0.50	0.45	0.60
CR-03	0.90	0.60	0.90
CR-05	1.20	0.70	1.30
CR-06	2.00	0.90	1.60
CR-10	2.00	0.90	2.80
CR-0A	3.80	0.90	2.80
CR-12	4.90	1.60	3.50

Thick Film High Power Chip Resistor – CRP Series (Aluminum Nitride Substrate)

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Features

- Thick film resistive element on an aluminum nitride (AlN) substrates
- Lead (Pb)-free wraparound termination over nickel barrier

Dimensions

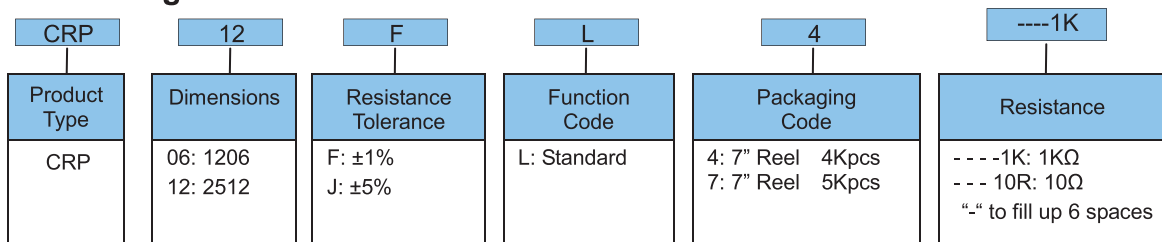
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2
CRP06	1206	3.10±0.13	1.52±0.13	0.51±0.13	0.38±0.13	1.22±0.13
CRP12	2512	6.35±0.13	3.15±0.13	0.51±0.13	0.60±0.25	2.70±0.10

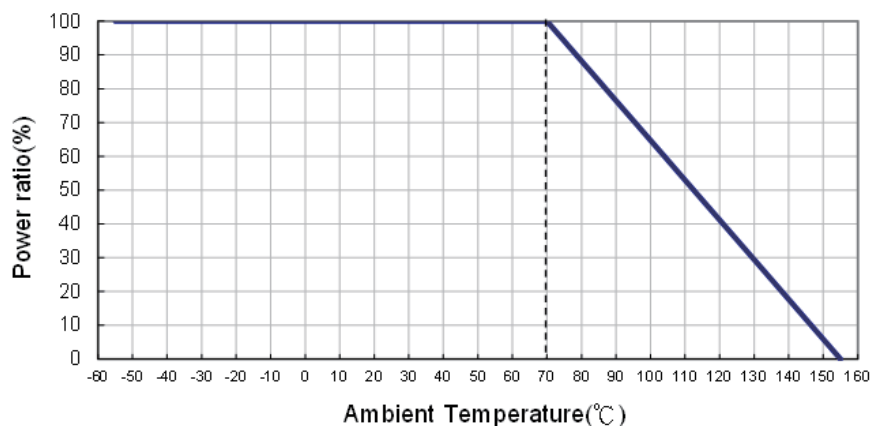
Applications

- Industrial
- Telecom markets

Part Numbering



Derating Curve



Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Resistance Range		TCR (PPM/°C)
				±1%(E24、E96)	±5%(E24)	
CRP06 (1206)	2.4W	-55 ~ +155°C	200V	10Ω – 2KΩ		±150
CRP12 (2512)	3.5W	-55 ~ +155°C	200V	3Ω – 2KΩ		±150

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

The power rating depends on the maximum temperature of the resistive element. The maximum power rating only applies if the temperature of the resistive element is maintained below 155°C.

Environmental Characteristics

Item	Requirement	Typical	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	± 120 ppm	At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	± 0.50 %	± 0.10 %	CRP06:4.7W applied for 5s CRP12:7.7W applied for 5s
Endurance	± 0.50 %	± 0.20 %	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
High Temperature Exposure	± 0.50 %	± 0.10 %	+150°C for 100hrs
Solderability	95% min. coverage	95% min. coverage	245±5°C for 3 seconds
Terminal Strength	No evidence of mechanical damage	No evidence of mechanical damage	CRP06:2kg force applied CRP12:3kg force applied
Moisture Resistance	± 0.50 %	± 0.15 %	≥ 80% RH, 240 hrs
Resistance to Soldering Heat	± 0.50 %	± 0.20 %	260±5°C for 10 seconds

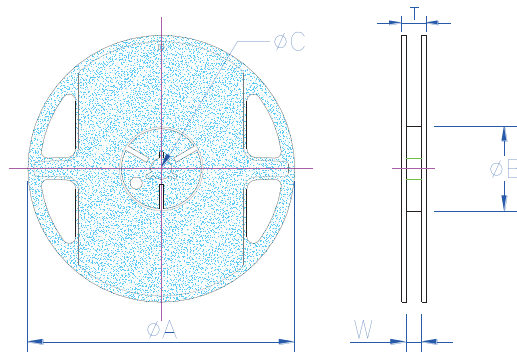
RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1; MIL-STD-202

■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date

Packaging



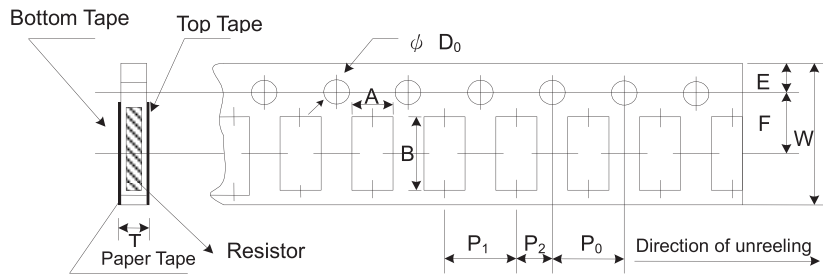
Reel Specifications & Packaging Quantity

Unit: mm

Type	Packaging Quantity		Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T
CRP06	Paper	5K	8mm	7 inch	178.5±1.5	60+1/-0	13.0±0.2	9.0±0.5	12.5±0.5
CRP12	Embossed	4K	12mm	7 inch	178.5±1.5	60+1/-0	13.0±0.5	13.0±0.5	15.5±0.5

Packaging

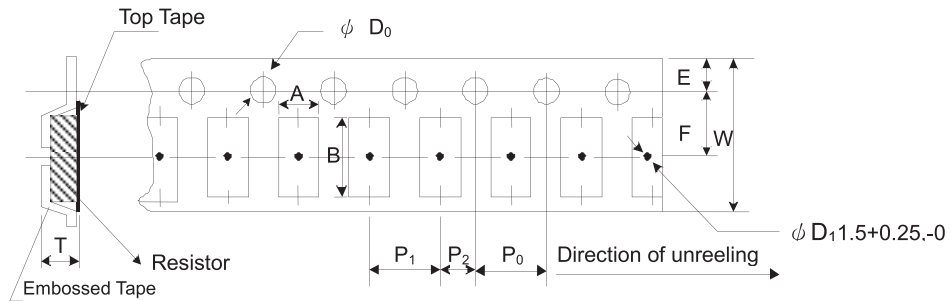
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD_0	T
CRP06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Embossed Plastic Tape Specifications



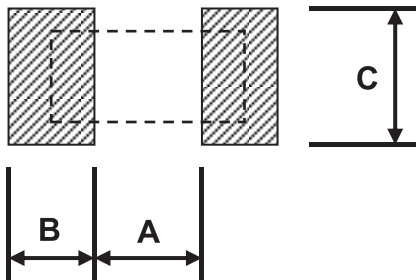
Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD_0	T
CRP12	3.5±0.10	6.7±0.10	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰

Marking

No Marking

Recommend Land Pattern

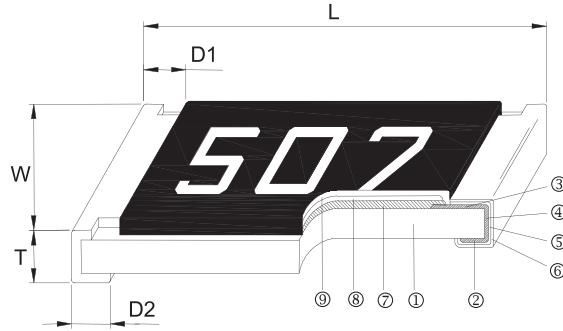


Unit: mm

Type	A	B	C
CRP06	0.46	1.73	1.68
CRP12	0.61	3.40	3.30

High Ohmic Chip Resistor—HMR Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Features

- Extended resistance range(110MΩ~ 1GΩ)
- Surface mount package
- Highly reliable multilayer electrode construction

Applications

- Voltage dividers and hybrids
- X-Ray equipment
- Low signal detection or amplification circuits
- High input impedance quartz amplifiers
- Testing devices

Dimensions

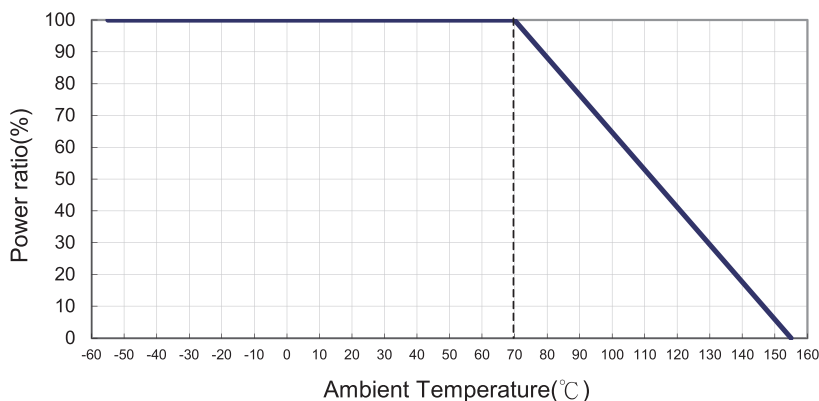
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
HMR05	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	4.368
HMR06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	8.947

Part Numbering

HMR	05	J	L	7	--200M
Product Type	Dimensions	Resistance Tolerance	Function Code	Packaging Code	Resistance
	05: 0805 06: 1206	J: ±5%	L: Standard	7: 7" Reel 5Kpcs A: 10" Reel 10Kpcs D: 13" Reel 20Kpcs	-- 200M: 200MΩ --- 1G: 1GΩ "-" to fill up 6 spaces

Derating Curve



Standard Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range	TCR (PPM/°C)
					±5% (E24)	
HMR05 (0805)	1/8W	-55 ~ +125°C	150V	300V	110MΩ - 500MΩ	±500
					510MΩ - 1GΩ	±1000
HMR06 (1206)	1/4W	-55 ~ +125°C	200V	400V	110MΩ - 500MΩ	±500
					510MΩ - 1GΩ	±1000

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(2.0%+0.05Ω)	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G	Max. Overload Voltage for 1 minute
Endurance	±(3.0%+0.10Ω)	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat with Load	±(3.0%+0.10Ω)	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Dry Heat	±(1.5%+0.10Ω)	at +125°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	Bending once for 60 seconds 0805, 1206 sizes: 3mm
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	±(1.0%+0.05Ω)	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover	1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤ 5% Total leaching area ≤ 10%	260±5°C for 30 seconds
Rapid Change of Temperature	±(1.0%+0.05Ω)	-55°C to +125°C, 5 cycles

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

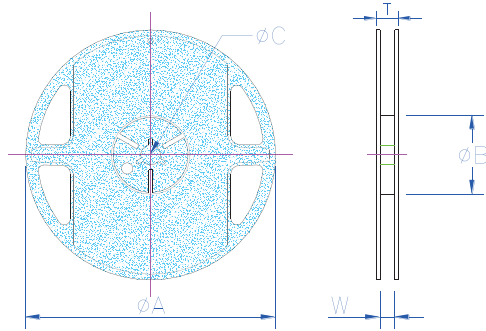
■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1

■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date

■ Packaging

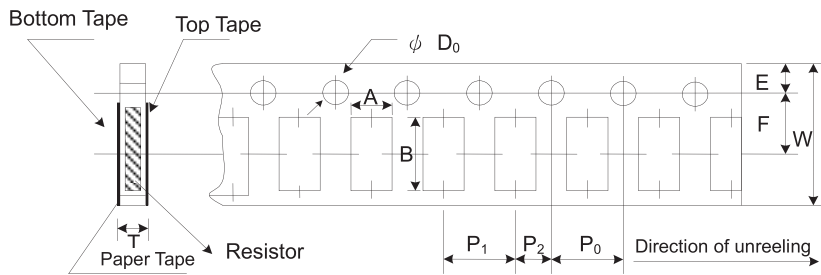
Reel Specifications & Packaging Quantity



Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T
HMR05 HMR06	5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
	10K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
	20K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5

Paper Tape Specifications

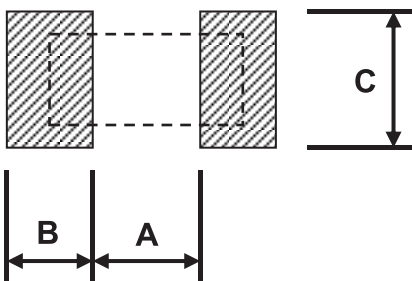


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
HMR05	1.60±0.10	2.40±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
HMR06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

■ Recommend Land Pattern

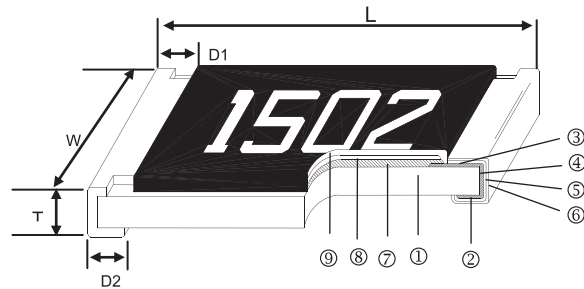
Unit: mm



Type	A	B	C
HMR05	1.20	0.70	1.30
HMR06	2.00	0.90	1.60

Pulse Withstanding Chip Resistor – PWR Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Features

- Tolerance from $\pm 0.5\%$ ~ 5%
- High power rating
- Excellent pulse withstanding performance
- Improved working voltage ratings
- Standard package sizes of 0402~2512
- AEC-Q200 Compliance

Applications

- Metering (Testing/Measurement)
- Diagnostic Equipment
- Medical Devices
- Industrial Controls
- Plasma
- LCD Video Monitors

Dimensions

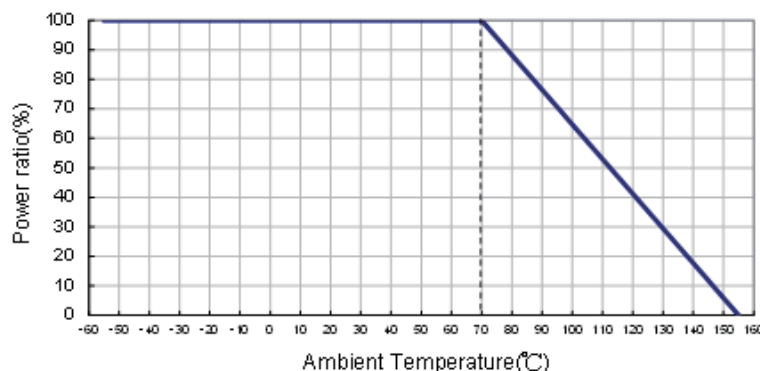
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
PWR02	0402	1.00 \pm 0.05	0.50 \pm 0.05	0.35 \pm 0.05	0.20 \pm 0.10	0.20 \pm 0.10	0.6
PWR03	0603	1.60 \pm 0.10	0.80 \pm 0.10	0.45 \pm 0.10	0.30 \pm 0.20	0.30 \pm 0.20	2.0
PWR05	0805	2.00 \pm 0.10	1.25 \pm 0.10	0.50 \pm 0.10	0.35 \pm 0.20	0.40 \pm 0.20	4.4
PWR05 (1/2W)	0805	2.00 \pm 0.10	1.25 \pm 0.10	0.50 \pm 0.10	0.35 \pm 0.20	0.40 \pm 0.20	5.0
PWR06	1206	3.10 \pm 0.10	1.55 \pm 0.10	0.55 \pm 0.10	0.50 \pm 0.25	0.50 \pm 0.20	8.9
PWR06 (3/4W)	1206	3.10 \pm 0.10	1.55 \pm 0.10	0.55 \pm 0.10	0.50 \pm 0.25	0.50 \pm 0.20	9.5
PWR13	1210	3.10 \pm 0.10	2.60 \pm 0.15	0.55 \pm 0.10	0.50 \pm 0.25	0.50 \pm 0.20	16.0
PWR10	2010	5.00 \pm 0.10	2.50 \pm 0.15	0.55 \pm 0.10	0.60 \pm 0.25	0.50 \pm 0.20	24.2
PWR12	2512	6.35 \pm 0.10	3.10 \pm 0.15	0.55 \pm 0.10	0.60 \pm 0.25	0.50 \pm 0.20	39.4
PWR12 (2W)	2512	6.35 \pm 0.20	3.15 \pm 0.15	0.60 \pm 0.10	0.60 \pm 0.25	0.60 \pm 0.20	42.0

Part Numbering

PWR	12	J	T	E	A	1001	
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/C)	Power Rating	Resistance	Marking
	02: 0402 03: 0603 05: 0805 06: 1206 13: 1210 10: 2010 12: 2512	D: $\pm 0.5\%$ F: $\pm 1\%$ J: $\pm 5\%$ -: No specified	T: 7" Taping Reel V: 10" Taping Reel W: 13" Taping Reel	E: ± 100 F: ± 200 G: ± 300 4: ± 350 -: No specified	A: 1.5W T: 1W Q: 3/4W U: 1/2W G: 2/5W O: 1/3W V: 1/4W W: 1/8W X: 1/10W P: 1/5W S: 2W K: 1.25W	1001: 1K Ω 1004: 1M Ω R0R0: 0 Ω	: Standard Marking N: No Marking

Derating Curve



Standard Electrical Specifications

Type	Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
						±0.5% (E24,E96)	±1% (E24,E96)	±5% (E24)	
PWR02 (0402)	1/5W	-55 ~ +155°C	50V	100V	-	1Ω-20Ω		±300	
					100Ω-1MΩ	20Ω-1MΩ		±100	
PWR03 (0603)	1/10W	-55 ~ +155°C	50V	100V	10Ω - 294Ω	1Ω - 294Ω		±200	
					10Ω - 1MΩ			±100	
PWR05 (0805)	1/8W	-55 ~ +155°C	150V	300V	10Ω - 294Ω	1Ω - 294Ω		±200	
					10Ω - 20MΩ			±100	
PWR06 (1206)	1/3W	-55 ~ +155°C	200V	400V	10Ω - 20Ω	1Ω - 20Ω		±200	
					10Ω - 20MΩ			±100	
PWR13 (1210)	1/2W	-55 ~ +155°C	200V	400V	10Ω - 20Ω	1Ω - 20Ω		±200	
					10Ω - 20MΩ			±100	
PWR10 (2010)	3/4W	-55 ~ +155°C	400V	800V	10Ω - 20Ω	1Ω - 20Ω		±200	
					10Ω - 20MΩ			±100	
PWR12 (2512)	1.5W	-55 ~ +155°C	500V	1000V	10Ω - 20Ω	1Ω - 20Ω		±200	
					10Ω - 20MΩ			±100	

High Power & Ultra High Power Rating Electrical Specifications

Type	Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
						±0.5% (E24,E96)	±1% (E24,E96)	±5% (E24)	
PWR03 (0603)	1/4W	-55 ~ +155°C	75V	150V	10Ω - 294Ω	1Ω - 294Ω		±200	
	1/3W				10Ω - 1MΩ			±100	
	Jumper: *5A				-	0Ω(≤8mΩ)		-	
PWR05 (0805)	2/5W	-55 ~ +155°C	150V	300V	10Ω - 294Ω	1Ω - 294Ω		±200	
					10Ω - 1MΩ			±100	
PWR05 (0805)	*1/2W	-55 ~ +155°C	400V	600V	10Ω - 294Ω	1Ω - 294Ω		±200	
	Jumper: *6A				10Ω - 1MΩ			±100	
					-	0Ω(≤5mΩ)		-	
PWR06 (1206)	1/2W	-55 ~ +155°C	200V	400V	10Ω - 20Ω	1Ω - 20Ω		±200	
					10Ω - 1MΩ			±100	
PWR06 (1206)	*3/4W	-55 ~ +155°C	500V	1000V	10Ω - 20Ω	1Ω - 20Ω		±200	
	Jumper: *10A				10Ω - 1MΩ			±100	
					-	0Ω(≤5mΩ)		-	
PWR13 (1210)	3/4W	-55 ~ +155°C	200V	400V	10Ω - 20Ω	1Ω - 20Ω		±200	
	1W				10Ω - 1MΩ			±100	
	Jumper: *12A				-	0Ω(≤4mΩ)		-	
PWR10 (2010)	1W	-55 ~ +155°C	400V	800V	10Ω - 20Ω	1Ω - 20Ω		±200	
	1.25W				10Ω - 1MΩ			±100	
	Jumper: *12A				-	0Ω(≤5mΩ)		-	
PWR12 (2512)	*2W	-55 ~ +155°C	500V	1000V	10Ω	1Ω - 10Ω		±350	
	Jumper: *16A				10Ω - 200K			±100	
					-	0Ω(≤5mΩ)		-	

*: Ultra High Power: double side printed resistor element

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

The power rating depends on the maximum temperature of the resistive element. Due to the power dissipation of the resistor, the temperature of the resistive element will rise depending on the condition of heat dissipation from PCB. The maximum power rating in application only applies if the temperature of the resistive element is not exceed 155°C.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement		Test Method
	±5% and Below	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.		At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	0603: ≤ 8mΩ 0805: ≤ 5mΩ 1206: ≤ 5mΩ 1210: ≤ 4mΩ 2010: ≤ 5mΩ 2512: ≤ 5mΩ	RCWV*2.5 or Max.Overload Voltage whichever is lower for 5 seconds Jumper:2*I _{max} for 5 seconds
Insulation Resistance	≥10G		Max. Overload Voltage for 1 minute
Endurance	±(1.0%+0.05Ω)	0603: ≤ 8mΩ 0805: ≤ 5mΩ 1206: ≤ 5mΩ 1210: ≤ 4mΩ 2010: ≤ 5mΩ 2512: ≤ 5mΩ	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat with Load	± (0.5%+0.05Ω)	0603: ≤ 8mΩ 0805: ≤ 5mΩ	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
	Ultra High Power * ± (1.0%+0.05Ω)	1206: ≤ 5mΩ 1210: ≤ 4mΩ 2010: ≤ 5mΩ 2512: ≤ 5mΩ	
Dry Heat	± (0.5%+0.05Ω)	0603: ≤ 8mΩ 0805: ≤ 5mΩ 1206: ≤ 5mΩ 1210: ≤ 4mΩ 2010: ≤ 5mΩ 2512: ≤ 5mΩ	at +155°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	0603: ≤ 8mΩ 0805: ≤ 5mΩ 1206: ≤ 5mΩ 1210: ≤ 4mΩ 2010: ≤ 5mΩ 2512: ≤ 5mΩ	Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage		245±5°C for 3 seconds
Resistance to Soldering Heat	± (0.5%+0.05Ω)	0603: ≤ 8mΩ 0805: ≤ 5mΩ 1206: ≤ 5mΩ 1210: ≤ 4mΩ 2010: ≤ 5mΩ 2512: ≤ 5mΩ	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover		1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤ 5% Total leaching area ≤ 10%		260±5°C for 30 seconds
Rapid Change of Temperature	± (0.5%+0.05Ω)	0603: ≤ 8mΩ 0805: ≤ 5mΩ 1206: ≤ 5mΩ 1210: ≤ 4mΩ 2010: ≤ 5mΩ 2512: ≤ 5mΩ	-55°C to +155°C, 5 cycles

RCWV(Rated Continuous Working Voltage)=√(P*R) or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1

■ Storage Temperature: 15~28°C; Humidity < 80%RH

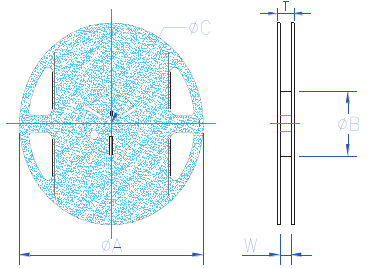
■ Shelf Life: 2 years from production date

■ Packaging

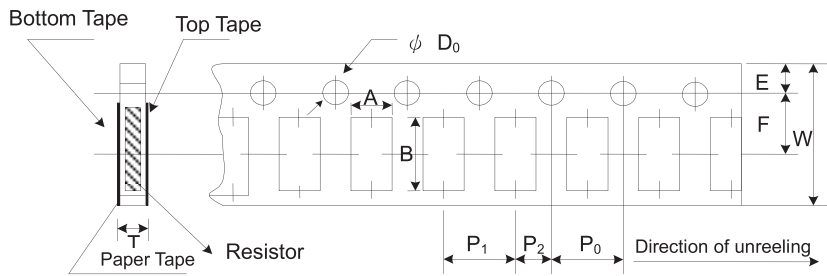
Reel Specifications & Packaging Quantity

Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T	
PWR02	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		20K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		40K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
PWR03 PWR05 PWR06 PWR13	Paper	5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		10K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		20K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
			8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
PWR10 PWR12	Embossed	4K	12mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.5	13.0±0.5	15.5±0.5
		8K	12mm	10 inch	250±1.0	62±0.5	13.0±0.5	12.5±0.5	16.5±0.5



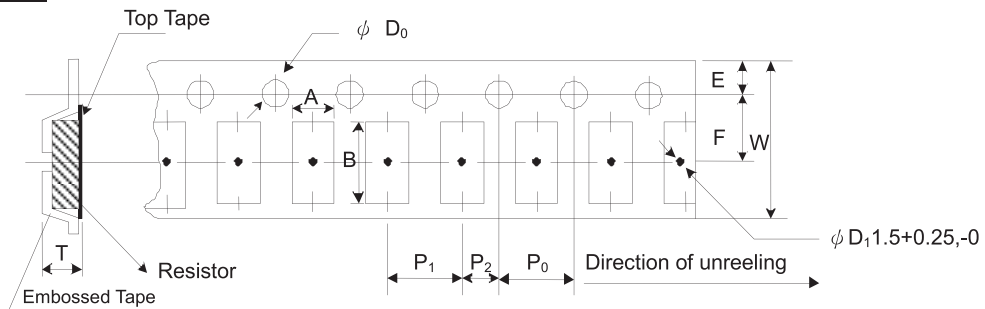
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
PWR02	0.65±0.10	1.15±0.10	8.00±0.2	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.1
PWR03	1.10±0.10	1.90±0.10	8.00±0.2	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.1
PWR05	1.60±0.10	2.40±0.20	8.00±0.2	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.1
PWR06	1.90±0.10	3.50±0.20	8.00±0.2	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.1
PWR13	2.90±0.10	3.50±0.20	8.00±0.2	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.1

Embossed Plastic Tape Specifications

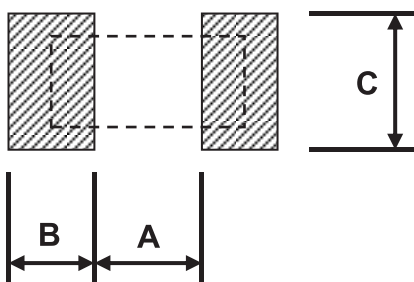


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
PWR10	2.80±0.10	5.40±0.20	12.0±0.3	1.75±0.1	5.50±0.05	4.00±0.10	4.00±0.1	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰
PWR12	3.50±0.10	6.70±0.10	12.0±0.3	1.75±0.1	5.50±0.05	4.00±0.10	4.00±0.1	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰

■ Recommend Land Pattern

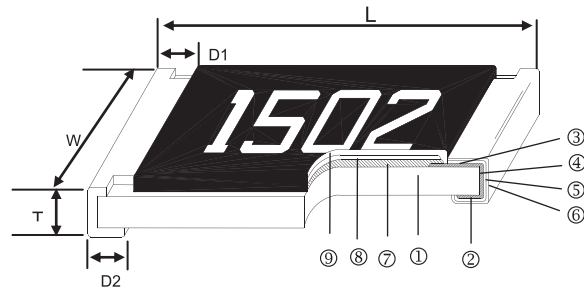
Unit: mm



Type	A	B	C
PWR02	0.50	0.45	0.60
PWR03	0.90	0.60	0.90
PWR05	1.20	0.70	1.30
PWR06	2.00	0.90	1.60
PWR13	2.00	0.90	2.80
PWR10	3.80	0.90	2.80
PWR12	4.90	1.00	3.40

Surge Withstanding Chip Resistor – SWR Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Features

- High power rating
- Excellent surge withstanding & pulse withstanding performance
- Improved working voltage ratings
- Standard package sizes of 0402~2512
- AEC-Q200 Compliance

Applications

- Metering (Testing/Measurement)
- Medical Devices
- Power supply
- Charger
- Inverter
- LCD Video Monitors

Dimensions

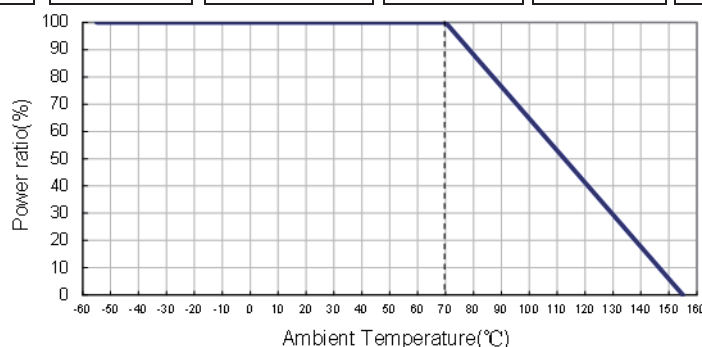
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
SWR02	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10	0.64
SWR03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	2.042
SWR05	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	4.368
SWR05 (1/2W)	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	5.049
SWR06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	8.947
SWR06 (3/4W)	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	9.541
SWR13	1210	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.25	0.50±0.20	15.959
SWR10	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20	24.241
SWR12	2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.25	0.50±0.20	39.448
SWR12 (2W)	2512	6.35±0.20	3.15±0.15	0.60±0.10	0.60±0.25	0.60±0.20	42

Part Numbering

Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking
SWR	12	J	T	E	A	1001	
	02: 0402 03: 0603 05: 0805 06: 1206 13: 1210 10: 2010 12: 2512	J: ±5% K: ±10% M: ±20%	T: 7" Taping Reel V: 10" Taping Reel W: 13" Taping Reel	E: ±100 F: ±200 G: ±300 4: ±350	S: 2W A: 1.5W K: 1.25W T: 1W Q: 3/4W U: 1/2W G: 2/5W O: 1/3W V: 1/4W P: 1/5W W: 1/8W	1001: 1KΩ 1004: 1MΩ 1005: 10MΩ	: Standard Marking N: No Marking

Derating Curve



Standard Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±5% (E24)	±10% (E24)	±20% (E24)	
SWR02 (0402)	1/5W	-55 ~ +155°C	50V	100V	1Ω - 20Ω			±300
					22Ω - 1MΩ			±100
SWR03 (0603)	1/8W	-55 ~ +155°C	50V	100V	1Ω - 270Ω			±200
					300Ω - 1MΩ			±100
SWR05 (0805)	1/4W	-55 ~ +155°C	150V	300V	1Ω - 270Ω			±200
					300Ω - 20MΩ			±100
SWR06 (1206)	1/3W	-55 ~ +155°C	200V	400V	1Ω - 20Ω			±200
					22Ω - 20MΩ			±100
SWR13 (1210)	1/2W	-55 ~ +155°C	200V	400V	1Ω - 20Ω			±200
					22Ω - 20MΩ			±100
SWR10 (2010)	3/4W	-55 ~ +155°C	400V	800V	1Ω - 20Ω			±200
					22Ω - 20MΩ			±100
SWR12 (2512)	1.5W	-55 ~ +155°C	500V	1000V	1Ω - 20Ω			±200
					22Ω - 20MΩ			±100

High Power Rating Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±5% (E24)	±10% (E24)	±20% (E24)	
SWR03 (0603)	1/4W 1/3W	-55 ~ +155°C	75V	150V	1Ω - 270Ω			±200
					300Ω - 1MΩ			±100
SWR05 (0805)	2/5W	-55 ~ +155°C	150V	300V	1Ω - 270Ω			±200
					300Ω - 1MΩ			±100
SWR05 (0805)	*1/2W	-55 ~ +155°C	400V	600V	1Ω - 270Ω			±200
					300Ω - 1MΩ			±100
SWR06 (1206)	1/2W	-55 ~ +155°C	200V	400V	1Ω - 20Ω			±200
					22Ω - 1MΩ			±100
SWR06 (1206)	*3/4W	-55 ~ +155°C	500V	1000V	1Ω - 20Ω			±200
					22Ω - 1MΩ			±100
SWR13 (1210)	3/4W 1W	-55 ~ +155°C	200V	400V	1Ω - 20Ω			±200
					22Ω - 1MΩ			±100
SWR10 (2010)	1W 1.25W	-55 ~ +155°C	400V	800V	1Ω - 20Ω			±200
					22Ω - 1MΩ			±100
SWR12 (2512)	*2W	-55 ~ +155°C	500V	1000V	1Ω - 10Ω			±350
					11Ω - 200KΩ			±100

*: Ultra High Power: double side printed resistor element

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

The power rating depends on the maximum temperature of the resistive element. Due to the power dissipation of the resistor, the temperature of the resistive element will rise depending on the condition of heat dissipation from PCB. The maximum power rating in application only applies if the temperature of the resistive element is not exceed 155 °C.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	RCWV*2.5 or Max.Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G	Max. Overload voltage for 1 minute
Endurance	±(3.0%+0.05Ω)	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat with Load	±(3.0%+0.05Ω)	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Dry Heat	±(3.0%+0.05Ω)	at +155°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	±(1.0%+0.05Ω)	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover	1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤5% Total leaching area ≤ 10%	260±5°C for 30 seconds
Rapid Change of Temperature	±(1.0%+0.05Ω)	-55°C to +155°C, 5 cycles

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

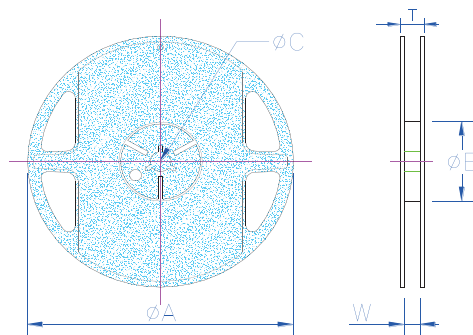
■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1

■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date

Packaging

Reel Specifications & Packaging Quantity

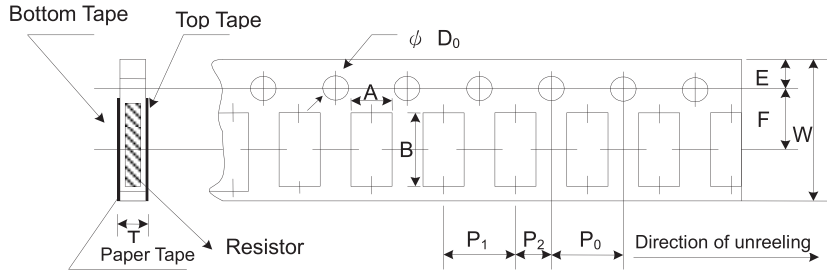


Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T	
SWR02	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		20K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		40K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
SWR03 SWR05 SWR06 SWR13	Paper	5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		10K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		20K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
			8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
SWR10 SWR12	Embossed	4K	12mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.5	13.0±0.5	15.5±0.5
		8K	12mm	10 inch	250±1.0	62±0.5	13.0±0.5	12.5±0.5	16.5±0.5

Packaging

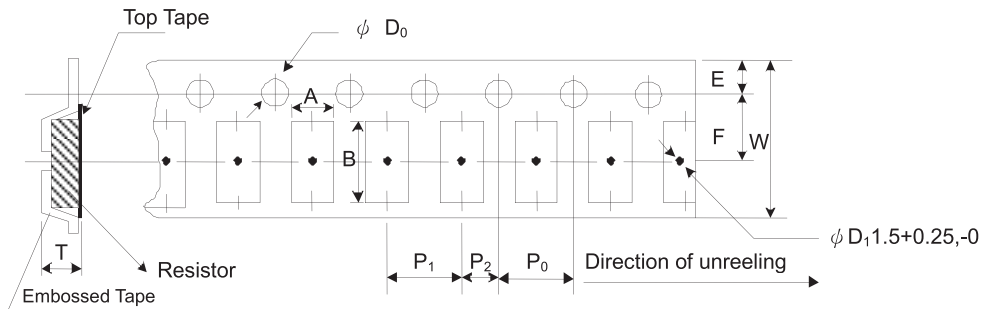
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
SWR02	0.65±0.10	1.15±0.10	8.00±0.2	1.75±0.1	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.1
SWR03	1.10±0.10	1.90±0.1	8.00±0.2	1.75±0.1	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.1
SWR05	1.60±0.10	2.40±0.2	8.00±0.2	1.75±0.1	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.1
SWR06	1.90±0.10	3.50±0.2	8.00±0.2	1.75±0.1	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.1
SWR13	2.90±0.10	3.50±0.2	8.00±0.2	1.75±0.1	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.1

Embossed Plastic Tape Specifications

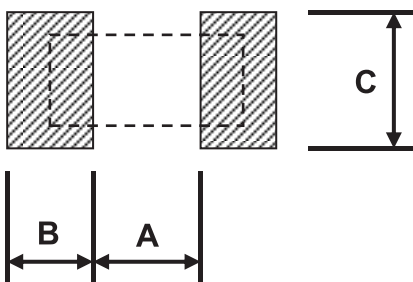


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
SWR10	2.80±0.10	5.40±0.20	12.0±0.3	1.75±0.1	5.5±0.05	4.00±0.10	4.00±0.1	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰
SWR12	3.50±0.10	6.70±0.10	12.0±0.3	1.75±0.1	5.5±0.05	4.00±0.10	4.00±0.1	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰

Recommend Land Pattern

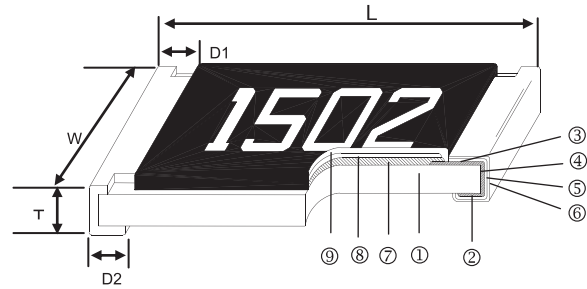
Unit: mm



Type	A	B	C
SWR02	0.50	0.45	0.60
SWR03	0.90	0.60	0.90
SWR05	1.20	0.70	1.30
SWR06	2.00	0.90	1.60
SWR13	2.00	0.90	2.80
SWR10	3.80	0.90	2.80
SWR12	4.90	1.00	3.40

Anti-Sulfurated Thick Film Chip Resistor – AS Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Features

- Special construction to prevent sulfuration in a sulfur containing environment

Applications

- High-end Computer
- Industrial Equipment
- Automatic Equipment Controller
- Medical Equipment
- High-end Multimedia Electronics
- Outdoor Electronic Applications

Dimensions

Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
AS01(STD)	0201	0.60±0.03	0.30±0.03	0.23±0.03	0.17±0.05	0.15±0.05	0.15
AS01(HP)	0201	0.60±0.03	0.30±0.03	0.23±0.03	0.15±0.05	0.15±0.05	0.15
AS02(STD)	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.25±0.10	0.25±0.10	0.55
AS02(HP)	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10	0.55
AS03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	2.04
AS05	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	4.37
AS06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	8.94
AS10	1210	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.25	0.50±0.20	15.96
AS0A	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20	24.24
AS12	2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.25	0.50±0.20	39.44

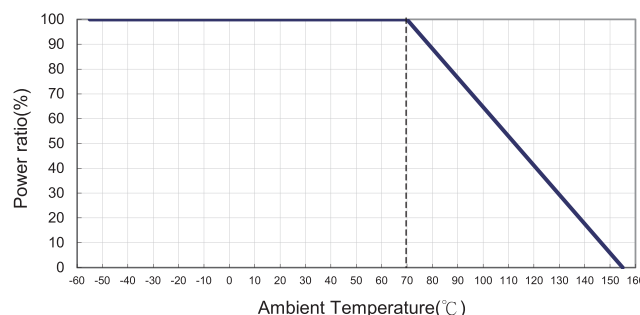
Part Numbering

■ STD : Standard HP : High Power

AS	03	F	T	E		1003
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance
	01: 0201 02: 0402 03: 0603 05: 0805 06: 1206 10: 1210 0A: 2010 12: 2512	D: ±0.5% F: ±1% J: ±5%	T: 7" Taping Reel V: 10" Taping Reel W: 13" Taping Reel K: 7" 15K/Reel	E: ±100 F: ±200 H: ±400 - : No Specified	: Standard* (See Remark) 3: 1/12W X: 1/10W W: 1/8W V: 1/4W O: 1/3W U: 1/2W Q: 3/4W T: 1W	R0R0: 0Ω 0010: 1Ω 1000: 100Ω 1002: 10KΩ 2201: 2.2KΩ 1003: 100KΩ 1004: 1MΩ

*Remark: Standard part no need for power rating code.

Derating Curve



Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±0.5% (E24 - E96)	±1% (E24 - E96)	±5% (E24)	
AS01 (0201)	1/20W	-55 ~ +155°C	25V	50V	-	1Ω - 9.76Ω	±400	
	Jumper: 0.5A					10Ω - 1MΩ	±200	
AS02 (0402)	1/16W		50V	100V	-	1.02MΩ - 10MΩ	±200,±400	
	Jumper: 1A					0Ω(<50mΩ)	-	
AS03 (0603)	1/10W		75V	150V	-	1Ω - 9.76Ω	±200,±400	
	Jumper: 1A					10Ω - 1MΩ	±100,±200	
AS05 (0805)	1/8W		150V	300V	-	1.02MΩ - 10MΩ	±200,±400	
	Jumper: 2A					0Ω(<50mΩ)	-	
AS06 (1206)	1/4W		200V	400V	-	1Ω - 9.76Ω	±200	
	Jumper: 2A					10Ω - 1MΩ	±100	
AS10 (1210)	1/3W		200V	400V	-	1.02MΩ - 10MΩ	±200	
	Jumper: 2.5A					0Ω(<50mΩ)	-	
AS0A (2010)	3/4W	200V	400V	-	1Ω - 9.76Ω	±200		
	Jumper: 3.5A				10Ω - 1MΩ	±100		
AS12 (2512)	1W	250V	500V	-	1.02MΩ - 10MΩ	±200		
	Jumper: 4A				0Ω(<50mΩ)	-		

High Power Rating Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±0.5% (E24 - E96)	±1% (E24 - E96)	±5% (E24)	
AS01 (0201)	1/12W	-55 ~ +155°C	25V	50V	-	10Ω - 1MΩ	±200	
AS02 (0402)	1/10W		50V	100V	-	1Ω - 9.76Ω	±200	
AS03 (0603)	1/4W		75V	150V	-	10Ω - 1MΩ	±100	
					-	1Ω - 9.76Ω	±200	
AS05 (0805)	1/3W		150V	300V	-	10Ω - 1MΩ	±100	
					-	1Ω - 9.76Ω	±200	
AS06 (1206)	1/2W		200V	400V	-	10Ω - 1MΩ	±100	
					-	1Ω - 9.76Ω	±200	
AS10 (1210)	3/4W	200V	400V	-	10Ω - 1MΩ	±100		
				-	1Ω - 9.76Ω	±200		
AS0A (2010)	1W	200V	400V	-	10Ω - 1MΩ	±100		

Operating Voltage= $\sqrt{(P \cdot R)}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{(P \cdot R)}$ or Max. Overload Voltage listed above, whichever is lower.

The power rating depends on the maximum temperature of the resistive element. Due to the power dissipation of the resistor, the temperature of the resistive element will rise depending on the condition of heat dissipation from PCB. The maximum power rating in application only applies if the temperature of the resistive element is not exceed 125 °C.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement			Test Method
	±1% and Below	±5%	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.			At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	<50mΩ	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds, 2 seconds for high power series
Insulation Resistance	0201,0402,0603 (Standard) : ≥1G 0201,0402,0603(High Power) & Other sizes : ≥10G			Max. Overload Voltage for 1 minute
Endurance	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	<100mΩ	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat with Load	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	<100mΩ	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Dry Heat	±(1.0%+0.05Ω)	0201,0402,0603 (Standard) : ±(2.0%+0.05Ω) 0201,0402,0603 (High Power) & Other sizes: ±(1.5%+0.10Ω)	0201,0402,0603:<100mΩ Other sizes:<50mΩ	at +155°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage			245±5°C for 3 seconds
Resistance to Soldering Heat	0201,0402,0603 (Standard): ±(1.0%+0.05Ω) 0201,0402,0603 (High Power) & Other sizes: ±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover			1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤5% Total leaching area ≤ 10%			260±5°C for 30 seconds
Rapid Change of Temperature	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	-55°C to +155°C, 5 cycles
Sulfur Test	±(0.5%+0.05Ω)	±(0.5%+0.05Ω)	<50mΩ	0201,0402,0603(High Power) & Other sizes: H2S, 50±2°C, 91~93% R.H., no power rating for 1000 hrs
	±(5.0%+0.05Ω)	±(5.0%+0.05Ω)	<100mΩ	0201(Standard): Soaked in industrial oil with sulfur substance contained 105°C±3°C, for 500 hours 0402,0603(Standard): Soaked in industrial oil with sulfur substance contained 105°C±3°C, for 1000 hours

RCWV(Rated Continuous Working Voltage)=√(P*R) or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC60115-1, 60068-2-58; JIS-C 5201-1; ASTM-B-809

■ Storage Temperature: 15~28°C; Humidity < 80%RH

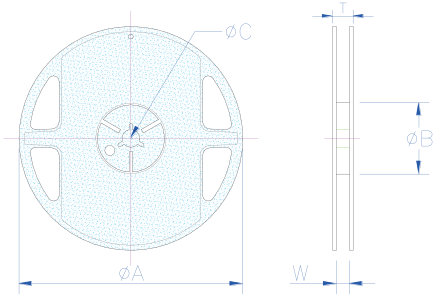
■ Shelf Life: 2 years from production date

Packaging

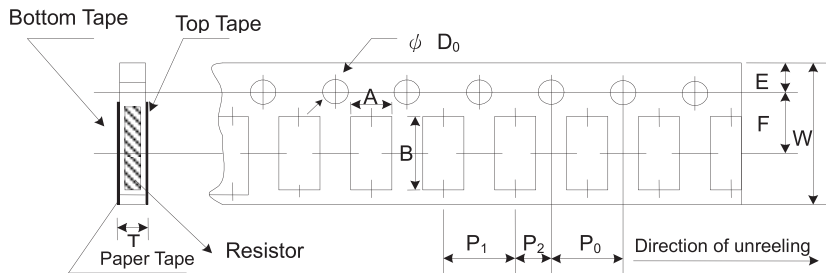
Reel Specifications & Packaging Quantity

Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T	
AS01(STD)	Paper	15K	8mm	7 inch	178±2.0	58.0±2.0	13.0±0.5	9.5±1.0	12.5±1.5
AS02(STD)		10K							
AS03(STD)		5K							
AS01(HP) AS02(HP)	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		20K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		40K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
AS03(HP) AS05 AS06 AS10	Paper	5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		10K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		20K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
AS0A AS12	Embossed	4K	12mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.5	13.0±0.5	15.5±0.5
		8K	12mm	10 inch	250±1.0	62±0.5	13.0±0.5	12.5±0.5	16.5±0.5



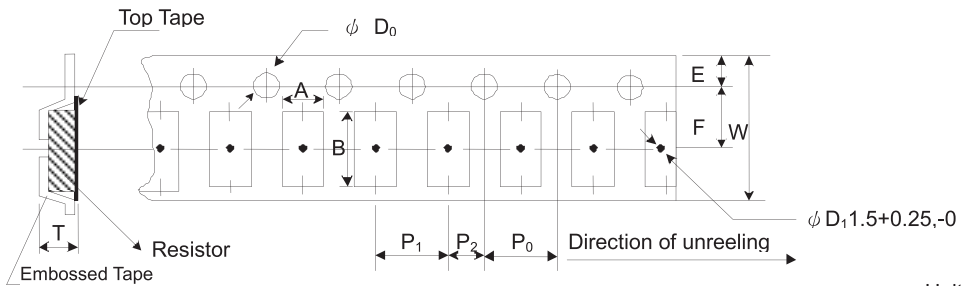
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
AS01(STD)	0.40±0.10	0.70±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50±0.10	0.42±0.20
AS02(STD)	0.70±0.10	1.20±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50±0.10	0.45±0.10
AS03(STD)	1.10±0.10	1.85±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	0.70±0.10
AS01(HP)	0.38±0.05	0.68±0.05	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.42±0.20
AS02(HP)	0.65±0.10	1.15±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.10
AS03(HP)	1.10±0.10	1.90±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.10
AS05	1.60±0.10	2.40±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
AS06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
AS10	2.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Embossed Plastic Tape Specifications

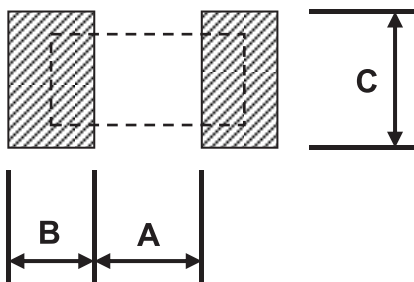


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
AS0A	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰
AS12	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰

Recommend Land Pattern

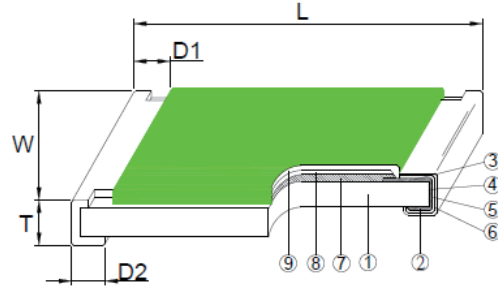
Unit: mm



Type	A	B	C
AS01	0.30	0.25	0.30
AS02	0.50	0.45	0.60
AS03	0.90	0.60	0.90
AS05	1.20	0.70	1.30
AS06	2.00	0.90	1.60
AS10	2.00	0.90	2.80
AS0A	3.80	0.90	2.80
AS12	4.90	1.60	3.50

Trimmable Thick Film Chip Resistor – RT Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Features

- Suitable for laser fine tune
- Small size and light weight
- Highly reliable multilayer electrode construction
- Compatible with all soldering process

Applications

- Tuner
- Sensor Control Circuit
- Camcorder
- Portable Audio
- Photo Sensor
- Portable Measuring Equipment

Dimensions

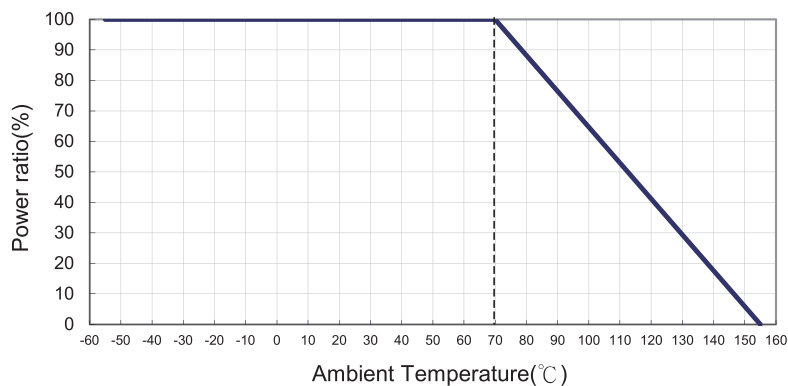
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
RT-02	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10	0.62
RT-03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	2.0
RT-05	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	4.3
RT-06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	8.9
RT-10	1210	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.25	0.50±0.20	15.95
RT-0A	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20	24.0
RT-12	2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.25	0.50±0.20	39.4

Part Numbering

RT-	03	N	L	7	---1R2
Product Type	Dimensions	Resistance Tolerance	Function Code	Packaging Code	Resistance
	02: 0402 03: 0603 05: 0805 06: 1206 10: 1210 0A: 2010 12: 2512	N: 0~-10% P: 0~-20% Q: 0~-30%	L: Standard	4: 7" Reel 4Kpcs 6: 7" Reel 10Kpcs 7: 7" Reel 5Kpcs 9: 10" Reel 8Kpcs A: 10" Reel 10Kpcs B: 10" Reel 20Kpcs C: 13" Reel 40Kpcs D: 13" Reel 20Kpcs	--- 1R2: 1.2Ω --- 3K3: 3.3KΩ -- 10K: 10KΩ -- 100K: 100KΩ "-" to fill up 6 spaces

Derating Curve



Standard Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range(E24)			TCR (PPM/°C)
					0~ -10%	0~ -20%	0~ -30%	
RT-02 (0402)	1/16W	-55 ~ +155°C	50V	100V	1Ω - 10MΩ			±200
RT-03 (0603)	1/10W		50V	100V	1Ω - 9.1Ω 10Ω - 1MΩ 1.1MΩ - 10MΩ			±200 ±100 ±200
RT-05 (0805)	1/8W		150V	300V				
RT-06 (1206)	1/4W		200V	400V				
RT-10 (1210)	1/3W		200V	400V				
RT-0A (2010)	3/4W		200V	400V				
RT-12 (2512)	1W		250V	500V				

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	$\pm(1.0\%+0.05\Omega)$	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	$\geq 10G$	Max. Overload Voltage for 1 minute
Endurance	$\pm(2.0\%+0.10\Omega)$	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat with Load	$\pm(2.0\%+0.10\Omega)$	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Dry Heat	$\pm(1.0\%+0.05\Omega)$	at +155°C for 1000 hrs
Bending Strength	$\pm(1.0\%+0.05\Omega)$	Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	$\pm(0.5\%+0.05\Omega)$	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover	1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area $\leq 5\%$ Total leaching area $\leq 10\%$	260±5°C for 30 seconds
Rapid Change of Temperature	$\pm(0.5\%+0.05\Omega)$	-55°C to +155°C, 5 cycles

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1

■ Storage Temperature: 15~28°C; Humidity < 80%RH

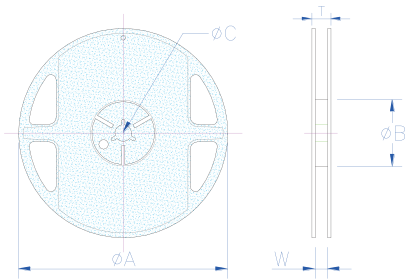
■ Shelf Life: 2 years from production date

Packaging

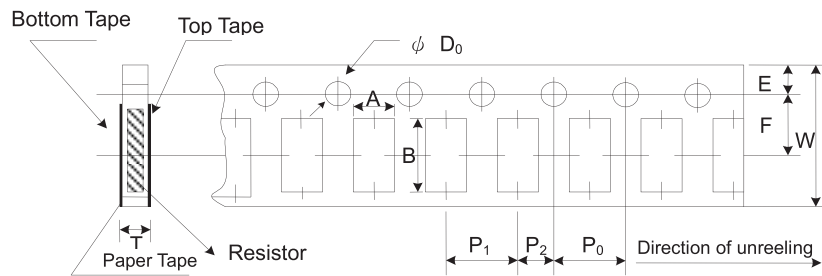
Reel Specifications & Packaging Quantity

Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T	
RT-02	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		20K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		40K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
RT-03 RT-05 RT-06 RT-10	Paper	5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
10K		8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5	
20K		8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5	
RT-0A RT-12		Embossed	4K	12mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.5	13.0±0.5
8K	12mm		10 inch	250±1.0	62±0.5	13.0±0.5	12.5±0.5	16.5±0.5	



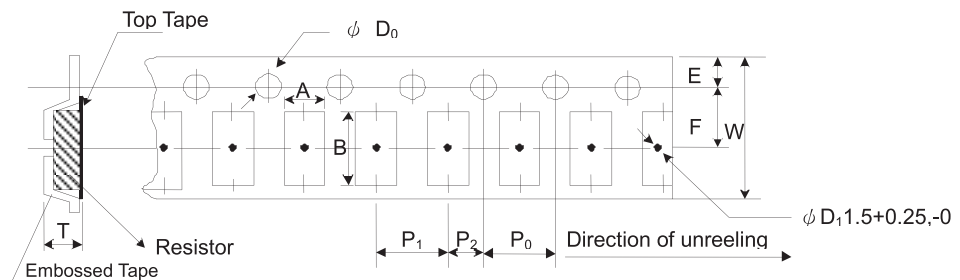
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
RT-02	0.65±0.10	1.15±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.10
RT-03	1.10±0.10	1.90±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.10
RT-05	1.60±0.10	2.40±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
RT-06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
RT-10	2.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Embossed Plastic Tape Specifications

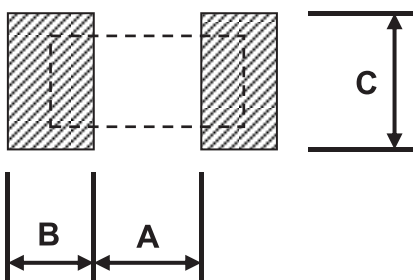


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
RT-0A	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰
RT-12	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰

Recommend Land Pattern

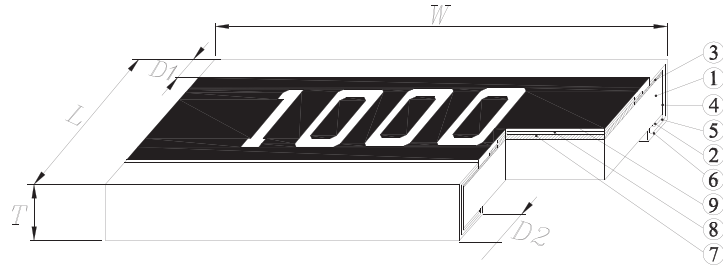
Unit: mm



Type	A	B	C
RT-02	0.50	0.45	0.60
RT-03	0.90	0.60	0.90
RT-05	1.20	0.70	1.30
RT-06	2.00	0.90	1.60
RT-10	2.00	0.90	2.80
RT-0A	3.80	0.90	2.80
RT-12	4.90	1.60	3.50

Thick Film Chip Resistor(Wide Terminal) – CRW Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Features

- Highly reliable multilayer electrode construction
- Compatible with all soldering process

Applications

- Telecommunication Equipments
- Radio and Tape Recorders, TV Tuners
- Digital Cameras, Watches, Pocket Calculators
- Computers, Instruments
- Medical Equipment

Dimensions

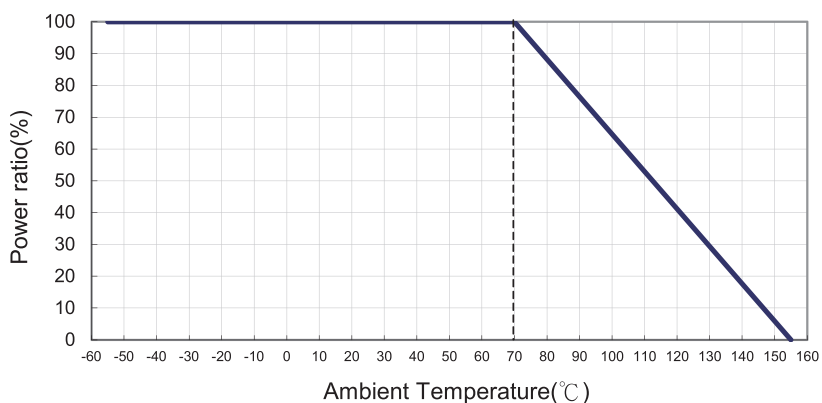
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2
CRW08	0508	1.25±0.10	2.00±0.10	0.55±0.10	0.30±0.15	0.30±0.15
CRW08(Jumper)					0.20±0.15	
CRW62	0612	1.55±0.10	3.00±0.15	0.55±0.10	0.25±0.15	0.40±0.15
CRW62(Jumper)					0.45±0.20	
CRW20	1020	2.45±0.15	5.00±0.10	0.60±0.15	0.35±0.20	0.70±0.20
CRW20(Jumper)					0.45±0.20	
CRW25	1225	3.20±0.20	6.40±0.15	0.65±0.15	0.40±0.20	1.10±0.20
CRW25(Jumper)					0.50±0.20	

Part Numbering

CRW	25	F	L	4	---10R
Product Type	Dimensions	Resistance Tolerance	Function Code	Packaging Code	Resistance
	08: 0508 62: 0612 20: 1020 25: 1225	D: ±0.5% F: ±1% J: ±5%	L: Standard & High Precision P: High Power	4: 7" Reel 4Kpcs 7: 7" Reel 5Kpcs	--- 20R: 20Ω --- 1R2: 1.2Ω --- 0R: 0Ω "-" to fill up 6 spaces

Derating Curve



Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±0.5% (E24 · E96)	±1% (E24 · E96)	±5% (E24)	
CRW08 (0508)	0.75W	-55 ~ +155°C	200V	400V	1Ω~9.76Ω			±150
					10Ω~1MΩ			±100
CRW62 (0612)	1W	-55 ~ +155°C	200V	400V	1Ω~1MΩ			±100
CRW20 (1020)	1.5W	-55 ~ +155°C	200V	400V	1Ω~9.76Ω			±150
					10Ω~1MΩ			±100
CRW25 (1225)	2W	-55 ~ +155°C	200V	400V	1Ω~29.4Ω			±200
					30Ω~1MΩ			±100

High Power Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±0.5% (E24 · E96)	±1% (E24 · E96)	±5% (E24)	
CRW08 (0508)	1W	-55 ~ +155°C	200V	400V	1Ω~9.76Ω			±150
	Jumper:5A				10Ω~1MΩ			±100
					-	0Ω(<10mΩ)	-	
CRW62 (0612)	1.5W	-55 ~ +155°C	200V	400V	1Ω~1MΩ			±100
	Jumper:6A				-	0Ω(<10mΩ)	-	
CRW20 (1020)	2W	-55 ~ +155°C	200V	400V	1Ω~9.76Ω			±150
					10Ω~1MΩ			±100
	Jumper:10A				-	0Ω(<10mΩ)	-	
CRW25 (1225)	3W	-55 ~ +155°C	200V	400V	1Ω~29.4Ω			±200
					30Ω~1MΩ			±100
	Jumper:12A				-	0Ω(<10mΩ)	-	

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G	Max. Overload Voltage for 1 minute
Endurance	±(1.0%+0.10Ω)	70°C±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat with Load	±(1.0%+0.10Ω)	40±2°C, 90~95% R.H., RCWV for 1000hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Dry Heat	±(1.0%+0.05Ω)	at +155°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	Bending once for 60 seconds with 3mm

Item	Requirement	Test Method
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover	1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤ 5% Total leaching area ≤ 10%	260±5°C for 30 seconds
Rapid Change of Temperature	±(0.5%+0.05Ω)	-55°C to +155°C, 5 cycles

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

* Not include 0Ω Jumper

■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1

■ Storage Temperature: 15~28°C; Humidity < 80%RH

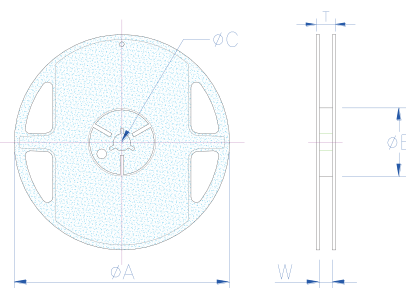
■ Shelf Life: 2 years from production date

■ Packaging

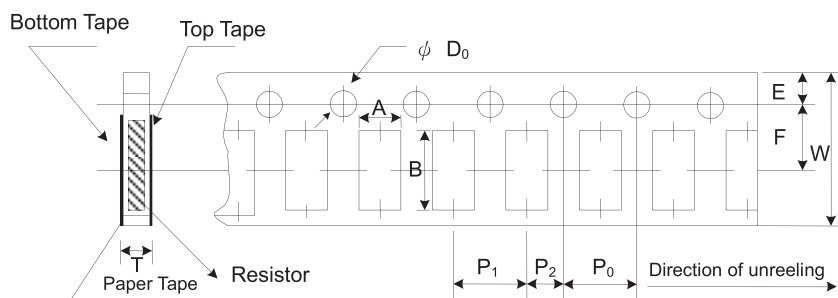
Reel Specifications & Packaging Quantity

Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T	
CRW08 CRW62	Paper	5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
CRW20 CRW25	Embossed	4K	12mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.5	13.0±0.5	15.5±0.5



Paper Tape Specifications

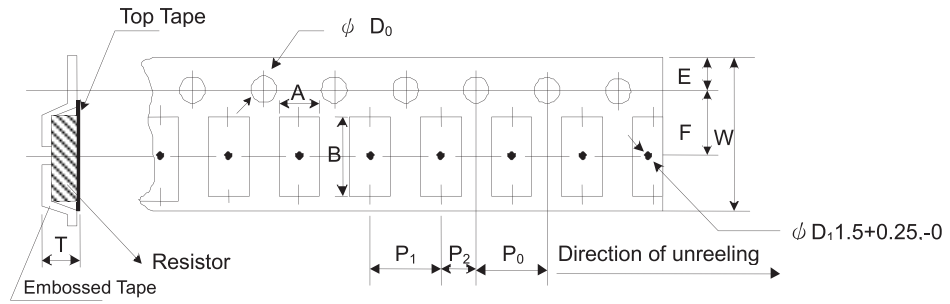


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CRW08	1.60±0.10	2.40±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CRW62	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Packaging

Embossed Plastic Tape Specifications

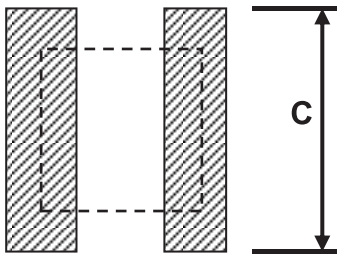


Unit: mm

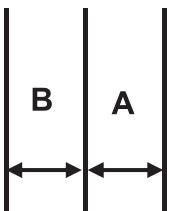
Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD_0	T
CRW20	2.80±0.15	5.40±0.20	12.0±0.10	1.75±0.10	5.50±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.55+0.10	1.00±0.20
CRW25	3.50±0.10	6.70±0.10	12.0±0.10	1.75±0.10	5.50±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.55+0.10	1.00±0.20

Recommend Land Pattern

Unit: mm



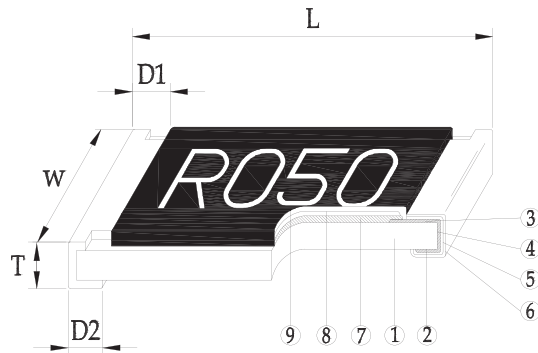
Type	A	B	C
CRW08	0.55	0.90	2.00
CRW62	0.70	0.80	3.20
CRW20	1.00	1.20	5.00
CRW25	1.00	2.00	7.00



Thin Film Current Sensing Chip Resistor – TCS Series



Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Marking

Features

- Thin film process
- High power rating up to 3 Watts in 2512 size
- Tight tolerance down to $\pm 0.5\%$
- Extremely low TCR down to ± 50 PPM/ $^{\circ}\text{C}$
- Resistance values from 50m to 1ohm
- High purity alumina substrate for high power dissipation

Applications

- Power Management Applications
- Switching Power Supply
- Over Current Protection in Audio Applications
- Voltage Regulation Module (VRM)
- DC-DC Converter, Battery Pack, Charger, Adaptor
- Automotive Engine Control
- Disk Driver
- Portable Devices (PDA, Cell Phone)

Dimensions

Unit: mm

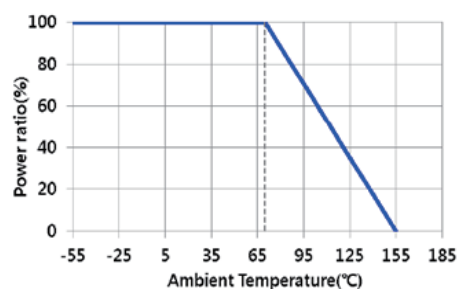
Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
TCS02	0402	1.00 \pm 0.05	0.50 \pm 0.05	0.32 \pm 0.10	0.25 \pm 0.10	0.20 \pm 0.10	0.56
TCS03	0603	1.60 \pm 0.10	0.80 \pm 0.10	0.45 \pm 0.10	0.30 \pm 0.20	0.30 \pm 0.20	3.1
TCS05	0805	2.00 \pm 0.15	1.25 \pm 0.15	0.55 \pm 0.10	0.30 \pm 0.20	0.40 \pm 0.25	5.6
TCS06	1206	3.05 \pm 0.15	1.55 \pm 0.15	0.55 \pm 0.10	0.50 \pm 0.30	0.40 \pm 0.25	12.3
TCS10	2010	5.00 \pm 0.20	2.45 \pm 0.15	0.60 \pm 0.15	0.60 \pm 0.30	0.50 \pm 0.25	26.7
TCS12	2512	6.35 \pm 0.20	3.15 \pm 0.15	0.60 \pm 0.10	0.60 \pm 0.30	0.55 \pm 0.25	49.6
TCS12 (3W)	2512	6.35 \pm 0.20	3.15 \pm 0.15	0.75 \pm 0.10	0.60 \pm 0.30	0.55 \pm 0.25	49.6

Part Numbering

TCS	12	F	T	E		R050	
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/ $^{\circ}\text{C}$)	Power Rating	Resistance	Marking
	02: 0402 03: 0603 05: 0805 06: 1206 10: 2010 12: 2512	D: $\pm 0.5\%$ F: $\pm 1\%$	T: Taping Reel B: Bulk	D: ± 50 E: ± 100 F: ± 200	: Standard* (See Remark) R: 3W	R050: 0.05 Ω R100: 0.1 Ω 1R00: 1 Ω	: Standard N: No Marking

*Remark: Standard part no need for power rating code.

Derating Curve



Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Resistance Range (mΩ)		TCR (PPM/°C)
			±0.5%	±1%	
TCS02 (0402)	1/16W	-55~+155°C	500 - 1000		±100 ±50
TCS03 (0603)	1/10W	-55~+155°C	200 - 300 301 - 1000		±100 ±50
TCS05 (0805)	1/8W		200 - 300 301 - 1000		±100 ±50
TCS06 (1206)	1/4W	-55~+155°C	—	50 - 100	±200 ±100 ±50
			101 - 300 301 - 1000		
TCS10 (2010)	3/4W	-55~+155°C	50 - 100 101 - 300 301 - 1000		±200 ±100 ±50
TCS12 (2512)	1W	-55~+155°C	50 - 100 101 - 300 301 - 1000		±200 ±100 ±50

High Power Rating Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Resistance Range (mΩ)		TCR (PPM/°C)
			±0.5%	±1%	
TCS12 (2512)	3W	-55~+155°C	100 - 1000		±100

Operating Voltage= $\sqrt{P \cdot R}$

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	+25/-55/+25/+125/+25°C
Short Time Overload	±1%	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	>1000MΩ	Apply 100V _{DC} for 1 minute
Endurance	±1%	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat with Load	±0.5%	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Bending Strength	As Spec.	Bending amplitude 3mm for 60 seconds
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	±0.5%	260±5°C for 10 seconds
Dielectric Withstand Voltage	By Type	Apply Max. Overload Voltage for 1 minute
Thermal Shock	±0.5%	-55°C ~150°C, 100 cycles
Low Temperature Operation	±0.5%	1 hour, -65°C followed by 45 minutes of RCWV

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

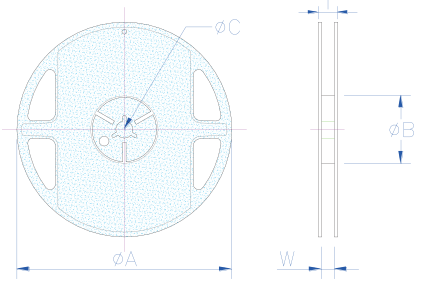
- Reference Standards: MIL-STD-202, JIS-C 5201-1
- Storage Temperature: 15~28°C; Humidity < 80%RH
- Shelf Life: 2 years from production date.

■ Packaging

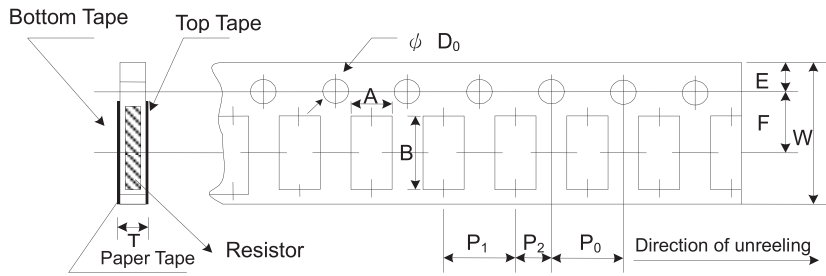
Packaging Quantity & Reel Specifications

Unit: mm

Type	ΦA	ΦB	ΦC	W	T	Paper Tape (EA)	Embossed Plastic Tape (EA)
TCS02	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	10,000	-
TCS03	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000	-
TCS05	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000	-
TCS06	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000	-
TCS10	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	13.5 ± 1.0	15.5 ± 1.0	-	4,000
TCS12	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	13.5 ± 1.0	15.5 ± 1.0	-	4,000



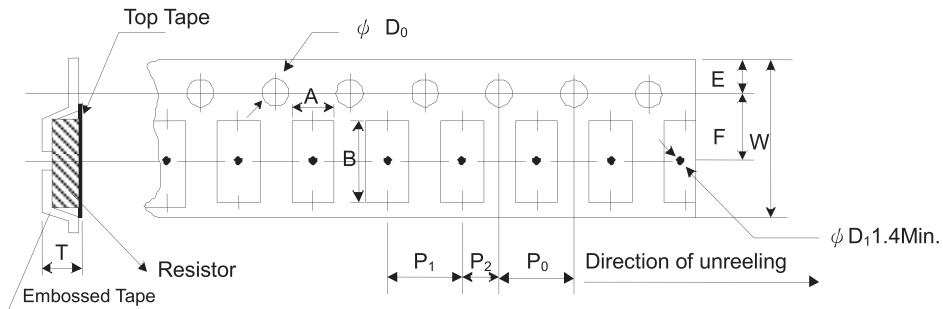
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
TCS02	0.70±0.05	1.16±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.05	0.40±0.03
TCS03	1.10±0.05	1.90±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.60±0.03
TCS05	1.60±0.05	2.37±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
TCS06	2.00±0.05	3.55±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05

Embossed Plastic Tape Specifications

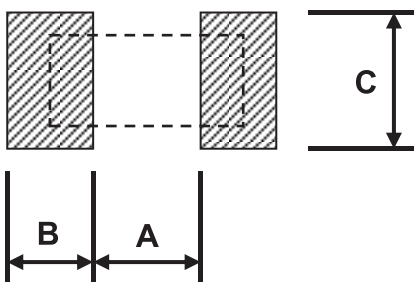


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
TCS10	2.85±0.10	5.45±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20
TCS12	3.40±0.10	6.65±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20

■ Recommend Land Pattern

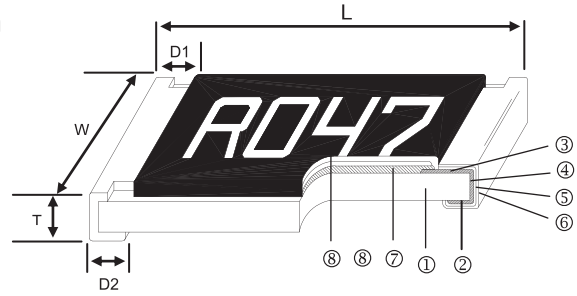
Unit: mm



Type	A	B	C
TCS02	0.50	0.50	0.60±0.20
TCS03	0.80	1.00	0.90±0.20
TCS05	1.00	1.00	1.35±0.20
TCS06	2.00	1.15	1.70±0.20
TCS10	3.60	1.40	2.50±0.20
TCS12	4.90	1.60	3.10±0.20

Current Sensing Chip Resistor – CS Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Features

- 3 Watts power rating in 1 Watt size, 1225 package
- Low TCR of ± 100 PPM/°C
- Resistance values from 1m to 1 ohm
- High purity alumina substrate for high power dissipation
- Long side terminations with higher power rating
- RoHS Compliance

Applications

- Power Management Applications
- Switching Power Supply
- Over Current Protection in Audio Applications
- Voltage Regulation Module (VRM)
- DC-DC Converter, Battery Pack, Charger, Adaptor
- Disk Driver

Dimensions

Unit: mm

Type	Size	L	W	T	D1	D2	Weight (g) (1000pcs)
CS01	0201	0.60±0.03	0.30±0.03	0.23±0.05	0.12±0.05	0.15±0.05	0.18
CS02	0402	1.00±0.05	0.50±0.05	0.32±0.10	0.25±0.10	0.20±0.10	0.7
CS03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	1.99
CS05	0805	2.00±0.10	1.25±0.10	0.55±0.10	0.30±0.20	0.40±0.25	5.3
CS06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.30	0.40±0.25	8.82
CS06 (1W)	1206 (102 - 1000mΩ)	3.15±0.10	1.60±0.15	0.65±0.10	0.80±0.20	0.80±0.20	12.15
CS13	1210	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.30	0.50±0.25	15.5
CS10	2010	5.00±0.10	2.50±0.15	0.60±0.15	0.60±0.30	0.50±0.25	27.03
CS12	2512	6.35±0.10	3.10±0.15	0.60±0.10	0.60±0.30	0.55±0.25	43.08
CS12 (2W)	2512 (10 - 99mΩ)	6.35±0.20	3.15±0.15	0.74±0.10	0.60±0.30	0.55±0.25	53.08
CS12 (2W)	2512 (100 - 1000mΩ)	6.35±0.20	3.15±0.15	0.74±0.10	0.60±0.30	2.10±0.10	53.08
CS25	1225	3.20±0.15	6.45±0.15	0.90±0.15	0.60±0.30	0.80±0.25	64.88
CS37	3720	2.00±0.20	3.75±0.20	0.60±0.10	0.40±0.20	0.40±0.20	19.96
CS75	7520	2.00±0.20	7.50±0.30	0.60±0.10	0.40±0.20	0.40±0.20	35.71
CS62	0612	1.55±0.10	3.10±0.15	0.55±0.10	0.30±0.15	0.45±0.15	10.19

Part Numbering

CS	06	F	T	G	U	R100	
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking
	01: 0201 02: 0402 03: 0603 05: 0805 06: 1206 13: 1210 10: 2010 12: 2512 25: 1225 37: 3720 75: 7520 62: 0612	F: $\pm 1\%$ G: $\pm 2\%$ J: $\pm 5\%$	T: Taping Reel	E: ± 100 F: ± 200 G: ± 300 H: ± 400 J: ± 600 K: ± 150 R: ± 1000	: Standard* (See Remark) A: 1.5W Q: 3/4W S: 2W T: 1W U: 1/2W V: 1/4W P: 1/5W W: 1/8W	R010: 0.01Ω R100: 0.1Ω 1R00: 1Ω	: Standard N: No Marking

*Remark: Standard part no need for power rating code.

※ Part Number : CS06FTFTR100N (CS06 1W No Marking)

Standard Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Current	Resistance Range (mΩ)			TCR (PPM/°C)
				±1%	±2%	±5%	
CS01 (0201)	1/20W	-55 ~ +155°C	0.70A	100 - 147 150 - 500 510 - 1000			±1000 ±600 ±300
CS02 (0402)	1/16W		1.11A	50 - 100 102 - 500 510 - 1000			±400 ±300 ±200
CS03 (0603)	1/10W		2.23A	20 - 50 51 - 100 102 - 300 301 - 1000			±600 ±400 ±300 ±200
CS05 (0805)	1/8W		2.50A	20 - 50 51 - 100 102 - 196 200 - 1000			±600 ±400 ±300 ±200
CS06 (1206)	1/4W		5.00A	10 - 20 21 - 50 51 - 91 100 - 1000			±600 ±400 ±300 ±200
CS13 (1210)	1/2W		7.07A				
CS10 (2010)	3/4W		8.66A				
CS12 (2512)	1W		10.0A				
CS25 (1225)	3W		31.6A	3 - 5 6 - 20 21 - 30 33 - 8000			±300 ±200 ±150 ±100
CS37 (3720)	1W		10.0A	10 - 18 20 - 500			±300 ±150
CS75 (7520)	2W		44.7A	—		1 - 4	±300
				5 - 10 11 - 350			±200 ±150
CS62 (0612)	1W		10.0A	10 - 27 30 - 91 100 - 499 500 - 1000			±600 ±300 ±200 ±100

High Power & Ultra High Power Rating Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Current	Resistance Range (mΩ)			TCR (PPM/°C)
				±1%	±2%	±5%	
CS02 (0402)	1/8W	-55 ~ +155°C	1.56A	51 - 100 102 - 500 510 - 1000			±400 ±300 ±200
CS03 (0603)	1/8W 1/5W		1.98A				
CS05 (0805)	1/4W 1/2W		2.21A				
CS06 (1206)	1/2W	-55 ~ +155°C	7.07A	10 - 20 21 - 50 51 - 91 100 - 1000			±600 ±400 ±300 ±200
CS13 (1210)	3/4W		8.66A				
CS10 (2010)	1W		10.0A				
CS12 (2512)	1.5W		12.2A				
CS12 (2512)	*2W		14.1A				
CS06 (1206)	*1W		-55 ~ +155°C				

*: Ultra High Power

■ CS06 1W: double side printed resistor element without marking

Low TCR Electrical Specifications

Type	Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Current	Resistance Range (mΩ)			TCR (PPM/°C)
					±1%	±2%	±5%	
	CS05 (0805)	1/8W	-55 ~ +155°C	1.11A	100 - 1000			±100
	CS06 (1206)	1/4W		1.58A	100 - 1000			±100
	CS13 (1210)	1/2W		2.58A	75 - 1000			±100
	CS10 (2010)	3/4W		3.87A	50 - 1000			±100
	CS12 (2512)	1W		7.07A	20 - 1000			±100
	CS12 (2512)	*2W		6.32A	50 - 1000			±100
	CS37 (3720)	1W		3.16A	100 - 500			±100
	CS75 (7520)	2W		6.32A	50 - 350			±100

*: Ultra High Power

Operating Voltage= $\sqrt{P \cdot R}$; Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$; Operating Current= $\sqrt{P/R}$

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(0.5%+0.05Ω)	RCWV*2.5 or Max.Overload Voltage whichever is lower for 5 seconds CS06 1W: 5*rated power for 5 seconds
	±(1.0%+0.05Ω) For High power rating	
Insulation Resistance	≥ 10G	Max. Overload Voltage for 1 minute
Endurance	±(1.0%+0.05Ω)	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat with Load	±(0.5%+0.05Ω)	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
	CS06 1W: ±(1.0%+0.05Ω)	
Dry Heat	±(0.5%+0.05Ω)	at +155°C for 1000 hrs
	CS06 1W: ±(1.0%+0.05Ω)	
Bending Strength	±(1.0%+0.05Ω)	Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	260±5°C for 10 seconds
	CS06 1W: ±(1.0%+0.05Ω)	
Voltage Proof	No breakdown or flashover	1.42 times Max. Operating Voltage for 1 minute CS01:50V; CS02:100V; CS03:150V; CS05:300V CS06/13/10/25/37/75/62:400V; CS12:500V
Leaching	Individual leaching area ≤ 5% Total leaching area ≤ 10%	260±5°C for 30 seconds
Rapid Change of Temperature	±(0.5%+0.05Ω)	-55°C to +155°C, 5 cycles
	CS06 1W: ±(1.0%+0.05Ω)	

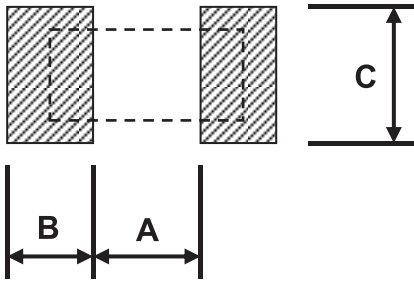
RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1

■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date

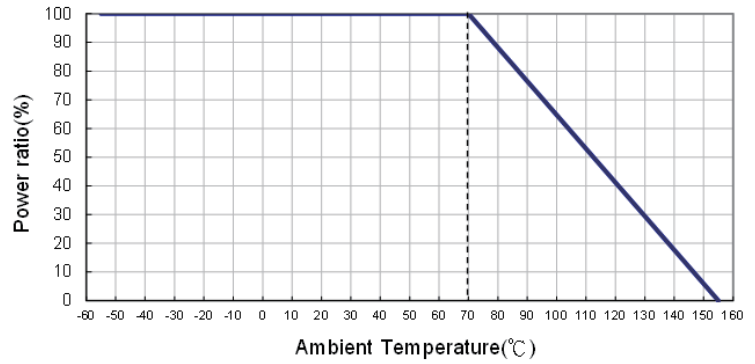
Recommend Land Pattern



Pad Layout (Except For CS12: Ultra High Power Rating Series)

Type	A	B	C
CS01	0.25	0.30	0.40±0.2
CS02	0.50	0.50	0.60±0.2
CS03	0.80	1.00	0.90±0.2
CS05	1.00	1.00	1.35±0.2
CS06	2.00	1.15	1.70±0.2
CS06 (1W)	0.90	1.70	1.70±0.2
CS13	2.00	1.15	2.50±0.2
CS10	3.60	1.40	2.50±0.2
CS12	4.90	1.60	3.20±0.2
CS25	1.20	2.00	7.00±0.2
CS37	1.00	1.80	3.90±0.2
CS75	1.00	1.80	7.60±0.2
CS62	0.60	1.00	3.20±0.2

Derating Curve



Pad Layout (For CS12: Ultra High Power Rating Series) Unit: mm

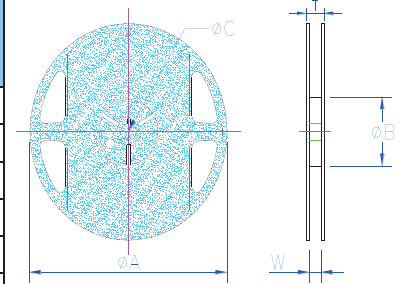
Type	Resistance Range	A	B	C
CS12	10 - 99mΩ	4.90	1.60	3.20±0.2
CS12	100 - 1000mΩ	1.00	3.55	3.20±0.2

Packaging

Packaging Quantity & Reel Specifications

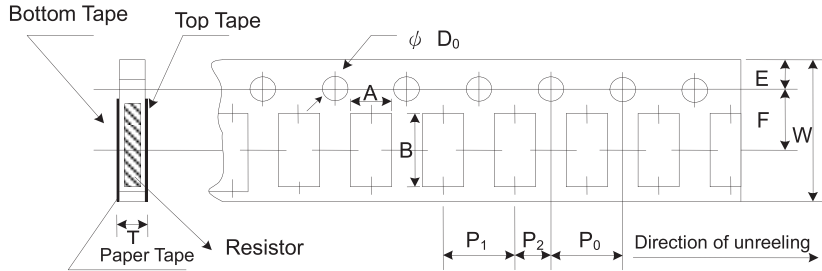
Unit: mm

Type	ΦA	ΦB	ΦC	W	T	Paper Tape (EA)	Embossed Plastic Tape (EA)
CS01	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 0.1	11.5 ± 1.0	10,000	-
CS02	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 0.1	11.5 ± 1.0	10,000	-
CS03	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 0.1	11.5 ± 1.0	5,000	-
CS05	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 0.1	11.5 ± 1.0	5,000	-
CS06	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 0.1	11.5 ± 1.0	5,000	-
CS13	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 0.1	11.5 ± 1.0	5,000	-
CS10	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	13.5 ± 1.0	15.5 ± 1.0	-	4,000
CS12	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	13.5 ± 1.0	15.5 ± 1.0	-	4,000
CS12 (2W)	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	13.5 ± 1.0	15.5 ± 1.0	-	2,000
CS25	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	13.5 ± 1.0	15.5 ± 1.0	-	2,000
CS37	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	13.5 ± 1.0	15.5 ± 1.0	-	2,000
CS75	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	17.5 ± 1.0	19.5 ± 1.0	-	2,000
CS62	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 0.1	11.5 ± 1.0	5,000	-



Packaging

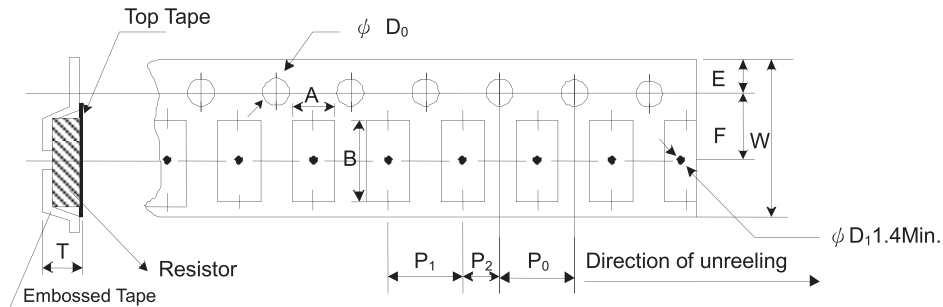
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CS01	0.38±0.05	0.68±0.05	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.42±0.20
CS02	0.65±0.10	1.15±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.10
CS03	1.10±0.10	1.90±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.10
CS05	1.60±0.10	2.40±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CS06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CS13	2.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CS62	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Embossed Plastic Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CS10	2.80±0.10	5.40±0.20	12.0±0.10	1.75±0.10	5.50±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20
CS12	3.50±0.10	6.70±0.10	12.0±0.10	1.75±0.10	5.50±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20
CS12 (2W)	3.38±0.10	6.68±0.10	12.0±0.30	1.75±0.10	5.50±0.10	4.00±0.10	4.00±0.10	2.00±0.05	1.55+0.05	1.45±0.20
CS25	3.38±0.10	6.68±0.10	12.0±0.30	1.75±0.10	5.50±0.10	4.00±0.10	4.00±0.10	2.00±0.05	1.55+0.05	1.45±0.20
CS37	2.50±0.20	4.45±0.20	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.20±0.20
CS75	2.50±0.20	8.30±0.20	16.0±0.30	1.75±0.10	7.80±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.20±0.20

Marking

No Marking for 0201/0402/1206(1W)

1%, 5% for 0805/1206/1210/2010/2512/1225/3720/7520/0612 : 4 digits marking

Example:

Resistance	47mΩ	75mΩ	15mΩ	750mΩ	820mΩ
Marking	R047	R075	R015	R750	R820

5% for 0603: 3 digits marking in E24

1% for 0603: 3 digits marking with under-line in E96 (non-including E24 series)



3 digits marking for E24 or R value suffix is zero in E96: R10=100mΩ; R28=280mΩ

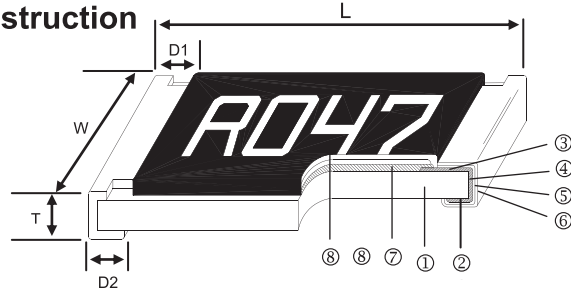


3 digits marking for E96: 243=243mΩ; 511=511mΩ

Current Sensing Chip Resistor – CSN Series



Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	

Features

- Resistance values from 10m to 1ohm
- Low TCR
- High purity alumina substrate for high power dissipation
- RoHS Compliance

Applications

- Power Management Applications
- Switching Power Supply
- Over Current Protection in Audio Applications
- Voltage Regulation Module (VRM)
- DC-DC Converter, Battery Pack, Charger, Adaptor
- Disk Driver

Dimensions

Unit: mm

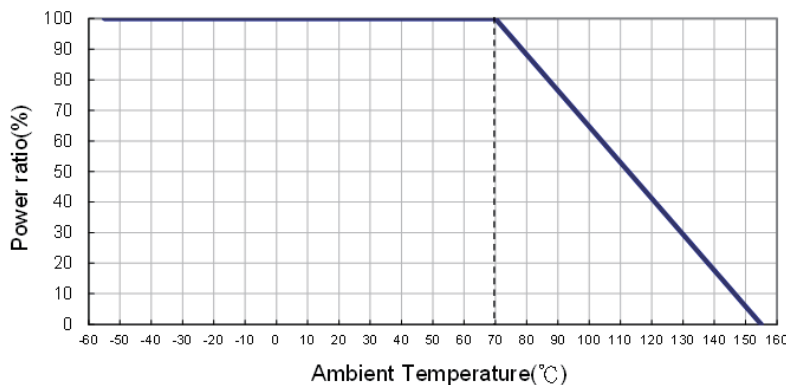
Type	Size	L	W	T	D1	D2	Weight (g) (1000pcs)
CSN05	0805	2.00±0.10	1.25±0.10	0.55±0.10	0.30±0.20	0.40±0.25	4.6
CSN06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.30	0.40±0.25	8.7
CSN13	1210	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.30	0.50±0.25	16.0
CSN10	2010	5.00±0.10	2.50±0.15	0.60±0.15	0.60±0.30	0.50±0.25	23.7
CSN12	2512	6.35±0.10	3.10±0.15	0.60±0.10	0.60±0.30	0.55±0.25	40.0
CSN12 (2W)	2512 (10-1000mΩ)	6.35±0.10	3.10±0.15	0.74±0.10	0.60±0.30	2.10±0.10	53.6
CSN12 (2W)	*2512 (46~49mΩ)	6.35±0.10	3.10±0.15	0.74±0.10	0.60±0.30	2.10±0.10	53.6
CSN12 (2W)	*2512 (20~45mΩ)	6.35±0.10	3.15±0.15	0.90±0.10	0.60±0.30	0.60±0.30	65.3

*: Low TCR

Part Numbering

CSN	06	F	T	F	V	R100
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance
	05: 0805 06: 1206 13: 1210 10: 2010 12: 2512	F: ±1% G: ±2% J: ±5%	T: Taping Reel	D: ±50 W: ±75 E: ±100 F: ±200 G: ±300 H: ±400 J: ±600	A: 1.5W T: 1W S: 2W Q: 3/4W U: 1/2W V: 1/4W W: 1/8W	R051: 0.051Ω R100: 0.1Ω 1R00: 1Ω

Derating Curve



Standard Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Current	Resistance Range (mΩ)			TCR (PPM/°C)
				±1%*1	±2%	±5%	
CSN05 (0805)	1/8W	-55 ~ +155°C	2.5A	20 - 50 51 - 100 102 - 196 200 - 1000	20 - 50 51 - 100 110 - 180 200 - 1000	±600 ±400 ±300 ±200	
CSN06 (1206)	1/4W			-55 ~ +155°C	5.0A	10 - 20 22 - 50 51 - 91 100 - 1000	10 - 20 22 - 50 51 - 91 100 - 1000
CSN13 (1210)	1/2W	7.07A					
CSN10 (2010)	3/4W	8.66A					
CSN12 (2512)	1W	10.0A					

High Power Rating Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Current	Resistance Range (mΩ)			TCR (PPM/°C)
				±1%*1	±2%	±5%	
CSN05 (0805)	1/4W	-55 ~ +155°C	2.21A	20 - 50 51 - 100 102 - 196 200 - 1000	20 - 50 51 - 100 110 - 180 200 - 1000	±600 ±400 ±300 ±200	
CSN06 (1206)	1/2W		7.07A	10 - 20 22 - 50 51 - 91 100 - 1000	10 - 20 22 - 50 51 - 91 100 - 1000	±600 ±400 ±300 ±200	
CSN13 (1210)	3/4W		8.66A				
CSN10 (2010)	1W		10.0A				
CSN12 (2512)	1.5W		12.2A				
CSN12 (2512)	*2W		14.1A				

High Power Rating & Low TCR Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Current	Resistance Range (mΩ)			TCR (PPM/°C)
				±1%*1	±2%	±5%	
CSN05 (0805)	1/4W	-55 ~ +155°C	1.58A	100 - 196 200 - 499 500 - 1000	100 - 180 200 - 470 500 - 1000	±100 ±75 ±50	
CSN06 (1206)	1/2W		2.58A	75 - 100 102 - 147 150 - 1000	75 - 100 110 - 140 150 - 1000	±100 ±75 ±50	
CSN06 (1206)	*1W		3.65A				
CSN13 (1210)	3/4W		3.87A				
CSN10 (2010)	1W		4.47A				
CSN12 (2512)	1.5W		5.47A				
CSN12 (2512)	*2W		10A				20 - 47 50 - 147 150 - 1000

*: Ultra High Power

*1: The nominal resistance value for less than 100mΩ is in E-24 series, other requirement of resistance value please contact our sales office.

Operating Voltage= $\sqrt{P \cdot R}$; Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$; Operating Current= $\sqrt{P/R}$

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature Low TCR: At 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(0.5%+0.05Ω)	RCWV*2.5 or Max.Overload Voltage whichever is lower for 5 seconds
	±(1.0%+0.05Ω) For ≤50mR & all High power · Ultra High Power	
Insulation Resistance	≥ 10G	Max. Overload Voltage for 1 minute
Endurance	±(1.0%+0.05Ω)	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
	±(2.0%+0.05Ω) For ≤50mR & all High power · Ultra High Power	
Damp Heat with Load	±(0.5%+0.05Ω)	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
	±(1.0%+0.05Ω) For ≤50mΩ & all High power · Ultra High Power	
Dry Heat	±(1.0%+0.05Ω)	at +155°C for 1000 hrs
	±(2.0%+0.05Ω) For ≤50mΩ & all High power · Ultra High Power	
Bending Strength	±(1.0%+0.05Ω)	Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover	1.42 times Max. Operating Voltage for 1 minute CSN05:300V CSN06/13/10:400V; CSN12:500V
Leaching	Individual leaching area ≤5% Total leaching area ≤10%	260±5°C for 30 seconds
Rapid Change of Temperature	±(0.5%+0.05Ω)	-55°C to +155°C, 5 cycles

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

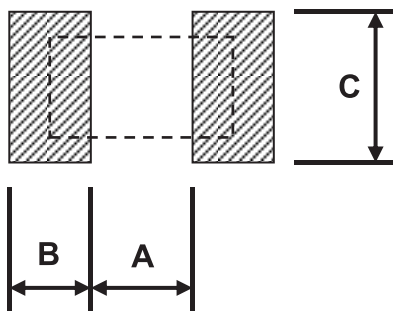
■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1

■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date

Recommend Land Pattern

Unit: mm



Type	Resistance Range	A	B	C
CSN05	20-1000mΩ	1.00	1.00	1.35±0.2
CSN06	10-1000mΩ	2.00	1.15	1.70±0.2
CSN13	10-1000mΩ	2.00	1.15	2.50±0.2
CSN10	10-1000mΩ	3.60	1.40	2.50±0.2
CSN12	10-1000mΩ	4.90	1.60	3.20±0.2
CSN12 (2W)	10-1000mΩ	1.00	3.55	3.20±0.2
*CSN12 (2W)	20-45mΩ	4.90	1.60	3.20±0.2
*CSN12 (2W)	46-1000mΩ	1.00	3.55	3.20±0.2

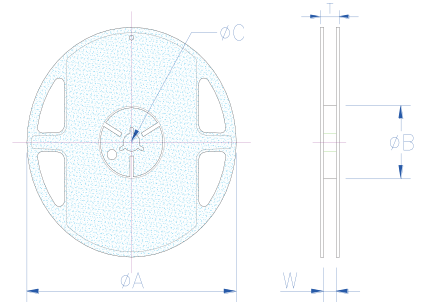
*: Low TCR

Packaging

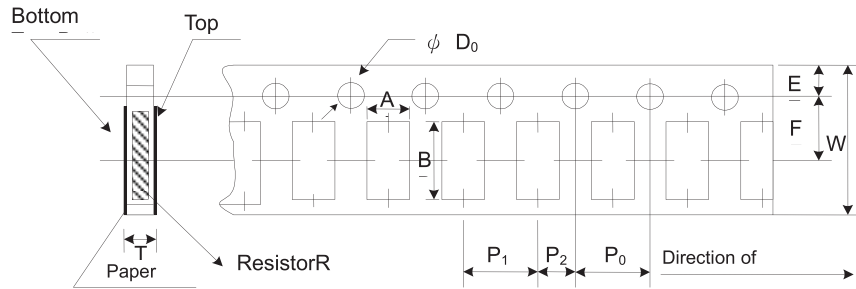
Packaging Quantity & Reel Specifications

Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T
CSN05 CSN06 CSN13	Paper	5K 8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
CSN10 CSN12	Embossed	4K 12mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.5	13.0±0.5	15.5±0.5
CSN12 (2W)	Embossed	2K 12mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.5	13.0±0.5	15.5±0.5



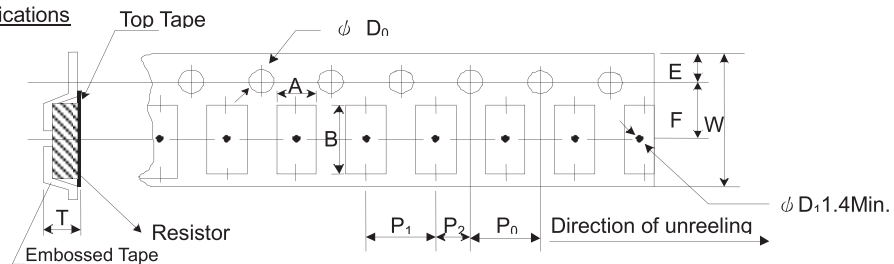
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CSN05	1.60±0.10	2.40±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CSN06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CSN13	2.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Embossed Plastic Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CSN10	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20
CSN12	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20
CSN12 (2W)	3.38±0.10	6.68±0.10	12.0±0.30	1.75±0.10	5.50±0.10	4.00±0.10	4.00±0.10	2.00±0.05	1.55+0.05	1.45±0.20
*CSN12 (2W) (20-45mΩ)	3.55±0.10	6.75±0.10	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.10	1.45±0.20

*: Low TCR

Marking

1%, 5% for 0805/1206/1210/2010/2512 : 4 digits marking

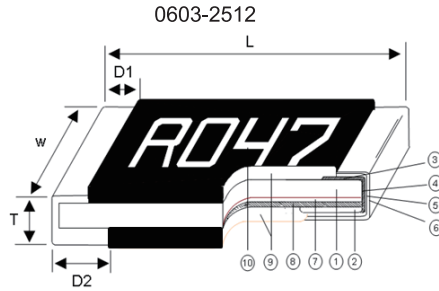
Example:

Resistance	10mΩ	51mΩ	75mΩ	100mΩ	549mΩ
Marking	R010	R051	R075	R100	R549

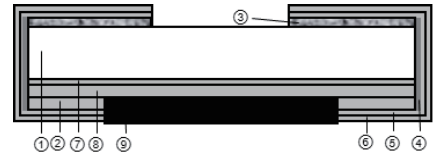
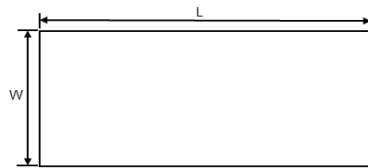
Current Sensing Metal Chip Resistor – CSM Series



Construction



0402



Features

- SMD Type designed for automatic insertion (CSM02 : The soldering side has a black mark on the product surface .)
- High power rating in small size
- Low resistance resistor for current detection
- Metal foil construction ensures high reliability and performance with very low and stable TCR
- Designed for current sense circuits in power electronic systems
- Pb-Free to meet RoHS requirements
- AEC-Q200 Compliance
- Inherently Anti-Sulfur

① Alumina Substrate	⑤ Barrier Layer	⑨ Primary Overcoat
② Bottom Electrode	⑥ External Electrode	⑩ Marking
③ Top Electrode	⑦ Adhesive	
④ Edge Electrode	⑧ Resistor Layer	

Applications

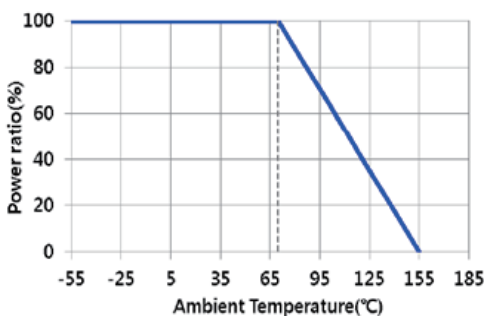
- Power Management Applications
- Switching Power Supply
- Over Current Protection in Audio Applications
- Voltage Regulation Module (VRM)
- DC-DC Converter, Battery Pack, Charger, Adaptor

Part Numbering

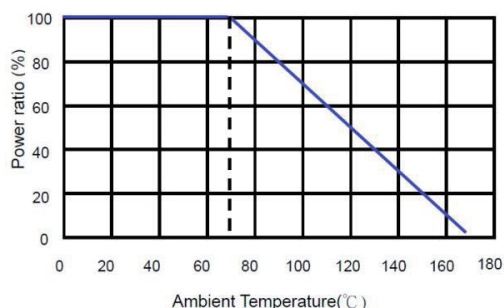
CSM	06	F	T	E	U	R100	
Product Type	Dimensions (L×W)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking
	02: 0402 03: 0603 05: 0805 06: 1206 10: 2010 12: 2512	D: ±0.5% F: ±1% G: ±2% J: ±5%	T: Taping Reel	D: ±50 E: ±100 K: ±150 F: ±200 G: ±300	W : 1/8W V : 1/4W U : 1/2W Q: 3/4W T: 1W A: 1.5W S: 2W	R003: 0.003Ω R010: 0.01Ω R100: 0.1Ω	: Standard (Standard Power / High Power) N: No Marking (Standard Power)

Derating Curve

Standard Power



High Power



Dimensions

Unit: mm

Type	Size (Inch)	Power Rating	Resistance Range (mΩ)	L	W	T	D1	D2	Weight (g) (1000pcs)
CSM02	0402	1/4W	3 - 18	1.05±0.10	0.55±0.10	0.50±0.10	-	0.27±0.10	1.11
			19 - 50	1.05±0.10	0.55±0.10	0.45±0.10	-	0.27±0.10	0.93
CSM03	0603	1/8W	10 - 29	1.55±0.10	0.85±0.10	0.40±0.10	0.30±0.15	0.35±0.25	2.98
			30 - 100	1.55±0.10	0.85±0.10	0.40±0.10	0.30±0.15	0.35±0.25	2.86
		1/2W	3 - 18	1.70±0.15	1.00±0.15	0.55±0.15	0.35±0.25	0.35±0.25	2.98
			19 - 100	1.70±0.15	1.00±0.15	0.50±0.15	0.35±0.25	0.35±0.25	2.86
CSM05	0805	1/4W	10 - 29	2.00±0.15	1.25±0.15	0.55±0.10	0.30±0.20	0.40±0.25	8.14
			30 - 100	2.00±0.15	1.25±0.15	0.52±0.10	0.30±0.20	0.40±0.25	7.06
		3/4W	3 - 18	2.15±0.15	1.40±0.15	0.68±0.15	0.40±0.25	0.40±0.25	8.14
			19 - 100	2.15±0.15	1.40±0.15	0.62±0.15	0.40±0.25	0.40±0.25	7.06
CSM06	1206	1/2W	10 - 29	3.05±0.15	1.55±0.15	0.58±0.15	0.50±0.25	0.50±0.25	15.06
			30 - 100	3.05±0.15	1.55±0.15	0.55±0.15	0.50±0.25	0.50±0.25	13.16
		1W	3 - 18	3.20±0.15	1.70±0.15	0.68±0.15	0.50±0.25	0.50±0.25	15.06
			19 - 100	3.20±0.15	1.70±0.15	0.62±0.15	0.50±0.25	0.50±0.25	13.16
CSM10	2010	3/4W	10 - 29	5.00±0.20	2.50±0.20	0.58±0.15	0.60±0.30	0.60±0.30	31.42
			30 - 100	5.00±0.20	2.50±0.20	0.55±0.15	0.60±0.30	0.60±0.30	28.35
		1.5W	3 - 18	5.00±0.20	2.50±0.20	0.68±0.15	0.60±0.30	0.60±0.30	31.42
			19 - 100	5.00±0.20	2.50±0.20	0.62±0.15	0.60±0.30	0.60±0.30	28.35
CSM12	2512	1W	10 - 29	6.30±0.20	3.15±0.20	0.58±0.15	0.60±0.30	0.70±0.30	45.21
			30 - 100	6.30±0.20	3.15±0.20	0.55±0.15	0.60±0.30	0.70±0.30	43.49
		2W	3 - 18	6.40±0.20	3.20±0.20	0.68±0.15	0.70±0.30	0.70±0.30	45.21
			19 - 100	6.40±0.20	3.20±0.20	0.62±0.15	0.70±0.30	0.70±0.30	43.49

Standard Electrical Specifications

Type	Item	Power Rating at 70°C	Operating Temp. Range	Resistance Range (mΩ)				TCR (PPM/°C)
				±0.5%	±1%	±2%	±5%	
CSM03 (0603)	1/8W		-55 ~ +155°C	-	10 - 19			±100
				-	20 - 100			±50 ±100
CSM05 (0805)	1/4W			-	10 - 19			±100
				30 - 100	20 - 100			±50 ±100
CSM06 (1206)	1/2W			-	10 - 19			±100
				30 - 100	20 - 100			±50 ±100
CSM10 (2010)	3/4W			-	10 - 19			±100
				30 - 100	20 - 100			±50 ±100
CSM12 (2512)	1W			-	10 - 19			±100
				30 - 100	20 - 100			±50 ±100

Operating Voltage= $\sqrt{P \cdot R}$; Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$; Operating Current= $\sqrt{P/R}$

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

High Power Rating Electrical Specifications

Type	Item	Power Rating at 70°C	Operating Temp. Range	Max. Overload Current	Resistance Range (mΩ)				TCR (PPM/°C)
					±0.5%	±1%	±2%	±5%	
CSM02 (0402)	1/4W		-55 ~ +170°C	11.2A	30 - 50	10 - 50		±100	
				13.4A	-	7 - 9		±200	
				20.4A	-	3 - 6		±300	
CSM03 (0603)	1/2W		-55 ~ +170°C	15.8A	30 - 100	10 - 100		±100	
				18.9A	-	7 - 9		±100	
				28.9A	-	3 - 6		±150	
CSM05 (0805)	3/4W		-55 ~ +170°C	19.4A	30 - 100	10 - 100		±50	
				35.4A	-	3 - 9		±100	
CSM06 (1206)	1W		-55 ~ +170°C	22.4A	30 - 100	10 - 100		±50	
				40.8A	-	3 - 9		±100	
CSM10 (2010)	1.5W		-55 ~ +170°C	27.4A	30 - 100	10 - 100		±50	
				50.0A	-	3 - 9		±100	
CSM12 (2512)	2W		-55 ~ +170°C	28.3A	30 - 100	10 - 100		±50	
				51.6A	-	3 - 9		±100	

Operating Voltage= $\sqrt{P \cdot R}$; Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$; Operating Current= $\sqrt{P/R}$

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

For Standard Series

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	-55°C~+125°C, 25°C is the reference temperature
Short Time Overload	±(0.5%+0.05Ω)	5* Rated Power for 5 seconds
Insulation Resistance	≥ 10G	Max. Overload Voltage for 1 minute
Endurance	±(1.0%+0.05Ω)	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat with Load	±(1.0%+0.05Ω)	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Dry Heat	±(0.5%+0.05Ω)	at +155°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover	1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤5% Total leaching area ≤10%	260±5°C for 30 seconds
Rapid Change of Temperature	±(0.5%+0.05Ω)	-55°C to +155°C, 5 cycles

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1

■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date.

Environmental Characteristics

For High Power Rating Series

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	-55°C~+125°C, 25°C is the reference temperature
Short Time Overload	$\Delta R \leq \pm 1\%R$	2512 size: 4* Rated Power for 5 seconds. Other sizes: 5* Rated Power for 5 seconds.
Insulation Resistance	$\geq 1000M\Omega$	Max. Overload Voltage for 1 minute
Operational Life	$\Delta R \leq \pm 1\%R$	Condition D Steady State $T_A=125^\circ C$ at derated power. Measurement at 24±4 hours after test conclusion
Biased Humidity	$\Delta R \leq \pm 1\%R$	85°C/85RH., 1000 hrs, apply 10% of operating power (current) or limiting element current whichever is lower
High Temperature Exposure	$\Delta R \leq \pm 1\%R$	at +155°C for 1000 hrs
Temperature Cycling	$\Delta R \leq \pm 1\%R$	-55°C to +125°C, 1000 cycles
Bending Strength (Board Flex)	$\Delta R \leq \pm 1\%R$	Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	$\Delta R \leq \pm 1\%R$	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover	1.42 times Max. Operating Voltage for 1 minute
Resistance to solvents	Marking Unsmearred	Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Mechanical Shock	$\Delta R \leq \pm 1\%R$	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	$\Delta R \leq \pm 1\%R$	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	$\Delta R \leq \pm 1\%R$	Human body model 0402 size: 1KV Other sizes: 2KV
Flammability	No ignition of the tissue paper or scorching or the pinewood board	V-0 or V-1 are acceptable. Electrical test not required.
Terminal strength	No broken	Force of 1.8kg for 60 seconds

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC 60115-1, JIS-C 5201-1, AEC-Q200, MIL-STD-202, UL-94, JEDS22

■ Storage Temperature: 15~28°C; Humidity < 80%RH

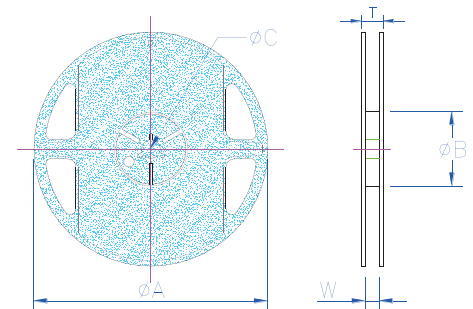
■ Shelf Life: 2 years from production date.

Packaging

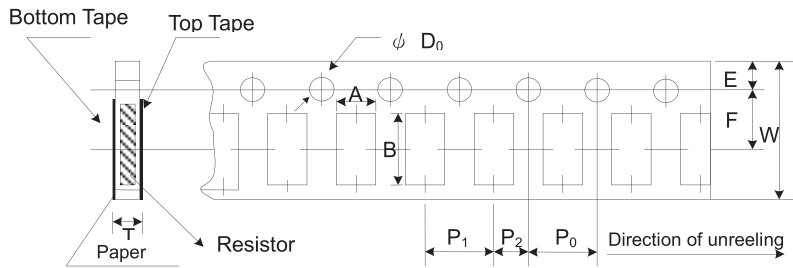
Packaging Quantity & Reel Specifications

Unit: mm

Type	ΦA	ΦB	ΦC	W	T	Paper Tape (EA)	Emboss Plastic Tape (EA)
CSM02	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	10,000	-
CSM03	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-
CSM05	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-
CSM06	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-
CSM10	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000
CSM12	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000



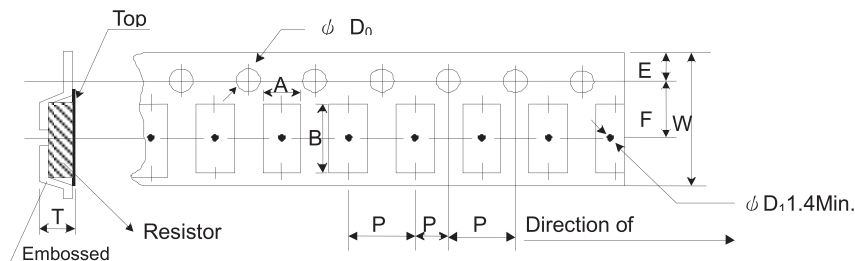
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CSM02 (1/4W)	0.66±0.06	1.18±0.06	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.05	0.60±0.06
CSM03	1.10±0.10	1.90±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.10
CSM03 (1/2W)	1.10±0.10	1.85±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.60±0.05
CSM05	1.60±0.10	2.40±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CSM05 (3/4W)	1.60±0.10	2.35±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.95±0.05
CSM06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CSM06 (1W)	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.95±0.05

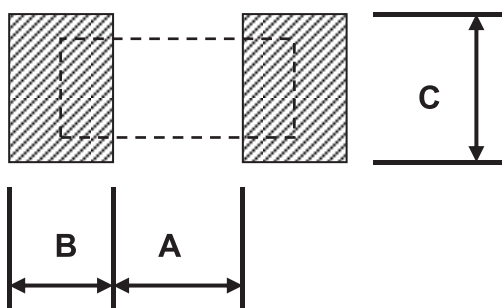
Embossed Plastic Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CSM10	2.80±0.10	5.50±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20
CSM10 (1.5W)	2.85±0.10	5.45±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20
CSM12	3.50±0.10	6.70±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20
CSM12 (2W)	3.40±0.10	6.65±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20

Recommend Land Pattern



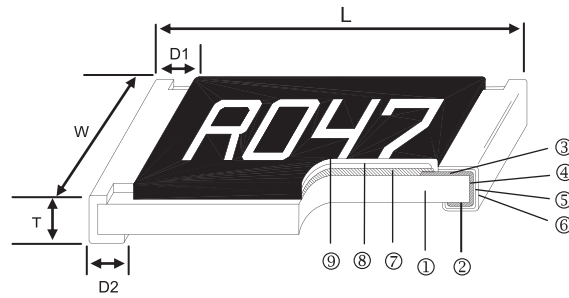
Pad Layout

Type	Resistance Range	A (mm)	B (mm)	C (mm)	t (μm)
CSM02	3-50mΩ	0.50	0.50	0.60	35
CSM03	10-29mΩ	0.40	1.20	0.90	-
	30-100mΩ	0.70	1.05	0.90	-
CSM03(1/2W)	3-100mΩ	0.50	1.00	0.90	35
CSM05	10-29mΩ	0.80	1.10	1.35	-
	30-100mΩ	1.00	1.00	1.35	-
CSM05(3/4W)	3-100mΩ	0.80	1.30	1.30	70
CSM06	10-29mΩ	0.90	1.70	1.70	-
	30-100mΩ	1.50	1.40	1.70	-
CSM06(1W)	3-100mΩ	1.50	1.40	1.70	105
CSM10	10-29mΩ	1.70	2.35	2.50	-
	30-100mΩ	2.80	1.80	2.50	-
CSM10(1.5W)	3-100mΩ	2.70	1.80	2.90	105
CSM12	10-29mΩ	2.30	2.90	3.20	-
	30-100mΩ	3.60	2.25	3.20	-
CSM12(2W)	3-100mΩ	3.80	2.10	3.40	105

t: copper foil minimum thickness of PCB

Current Sensing Thick Film Chip Resistor – RS Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Features

- Low inductance
- Highly reliable multilayer electrode construction
- Higher component and equipment reliability
- Reduced size of final equipment reliability
- RoHS Compliance

Applications

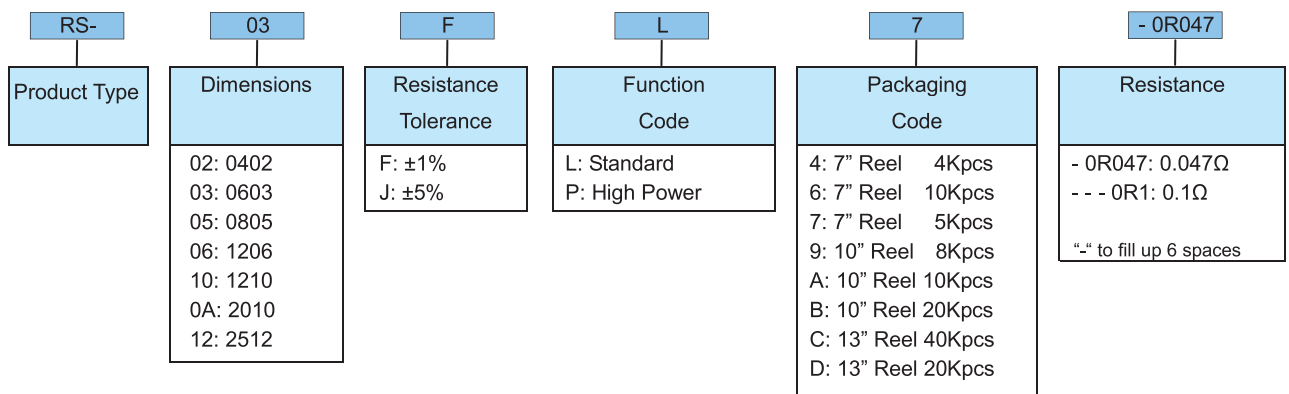
- Power Management Applications
- Switching Power Supply
- Over Current Protection in Audio Application
- Voltage Regulation Module (VRM)
- DC-DC Converter, Battery Pack, Charger, Adaptor
- Disk Driver

Dimensions

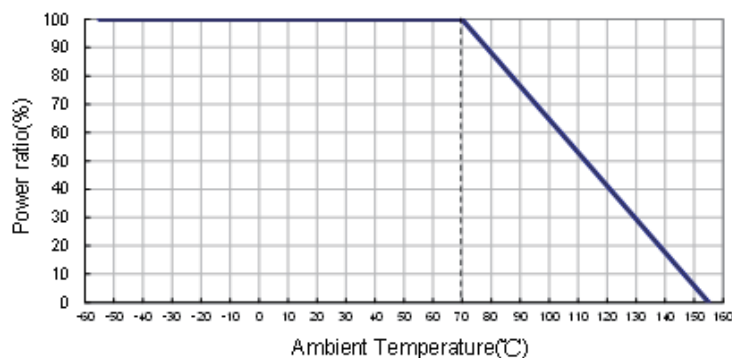
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
RS-02	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10	0.620
RS-03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	2.042
RS-05	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	4.368
RS-06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	8.947
RS-10	1210	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.25	0.50±0.20	15.959
RS-0A	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20	24.241
RS-12	2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.25	0.50±0.20	39.448

Part Numbering



Derating Curve



Standard Electrical Specifications

Type	Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Current	Resistance Range (mΩ)		TCR (PPM/°C)
					±1%	±5%	
RS-02 (0402)		1/16W	-55~+155°C	1.11A	50 - 91 100 - 976		±800 ±500
RS-03 (0603)		1/10W	-55~+155°C	2.23A	20 - 47 50 - 91 100 - 976		±1200 ±800 ±500
RS-05 (0805)		1/8W	-55~+155°C	3.53A	10 - 18 20 - 47 50 - 91 100 - 976		±1500 ±1200 ±800 ±500
RS-06 (1206)		1/4W		5.00A			
RS-10 (1210)		1/3W	-55~+155°C	5.77A	10 - 18 20 - 91 100 - 976		±1500 ±800 ±500
RS-0A (2010)		3/4W		8.66A			
RS-12 (2512)		1W		10.0A			

Operating Voltage= $\sqrt{P \cdot R}$; Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$; Operating Current= $\sqrt{P/R}$

High Power Rating Electrical Specifications

Type	Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Current	Resistance Range (mΩ)		TCR (PPM/°C)
					±1%	±5%	
RS-02 (0402)		1/10W	-55~+155°C	1.40A	50 - 91 100 - 976		±800 ±500
RS-03 (0603)		1/8W	-55~+155°C	2.50A	20 - 47 50 - 91 100 - 976		±1200 ±800 ±500
RS-05 (0805)		1/4W	-55~+155°C	5.00A	10 - 18 20 - 47 50 - 91 100 - 976		±1500 ±1200 ±800 ±500
RS-06 (1206)		1/2W		7.07A			
RS-10 (1210)		1/2W	-55~+155°C	7.07A	10 - 18 20 - 91 100 - 976		±1500 ±800 ±500
RS-0A (2010)		1W		10.0A			
RS-12 (2512)		2W		14.1A			

Operating Voltage= $\sqrt{P \cdot R}$; Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$; Operating Current= $\sqrt{P/R}$

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement		Test Method
	±1%	±5%	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.		At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds, 2 seconds for high power series
Insulation Resistance	≥10G		Max. Overload Voltage for 1 minute
Endurance	±(1.0%+0.10Ω)	±(2.0%+0.10Ω)	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat with Load	±(1.0%+0.10Ω)	±(2.0%+0.10Ω)	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Dry Heat	±(1.0%+0.05Ω)	±(1.5%+0.10Ω)	at +155°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage		245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover		1.42 times Max. Operating Voltage for 1 minute RS-02:100V; RS-03:150V; RS-05:300V RS-06/10/0A:400V; RS-12:500V
Leaching	Individual leaching area ≤5% Total leaching area ≤ 10%		260±5°C for 30 seconds
Rapid Change of Temperature	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	-55°C to +155°C, 5 cycles

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1

■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date

Marking

No Marking for 0402

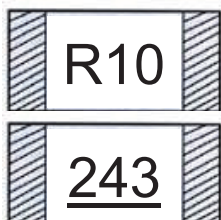
1%, 5% for 0805/1206/1210/2010/2512: 4 digits marking

Example:

Resistance	47mΩ	75mΩ	15mΩ	750mΩ	820mΩ
Marking	R047	R075	R015	R750	R820

5% for 0603: 3 digits marking in E24

1% for 0603: 3 digits marking with under-line in E96 (non-including E24 series)



3 digits marking for E24 or R value suffix is zero in E96: R10=100mΩ; R28=280mΩ

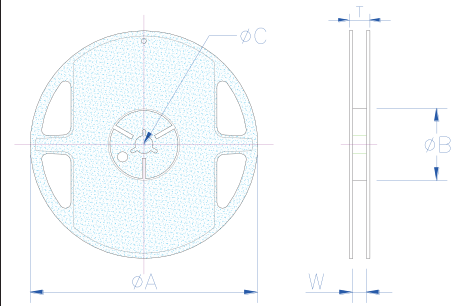
3 digits marking for E96: 243=243mΩ; 511=511mΩ

Packaging

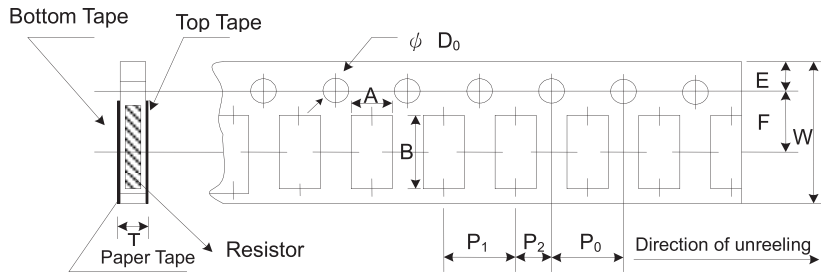
Reel Specifications & Packaging Quantity

Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T	
RS-02	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		20K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		40K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
RS-03 RS-05 RS-06 RS-10	Paper	5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
10K		8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5	
20K		8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5	
RS-0A RS-12	Embossed	4K	12mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.5	13.0±0.5	15.5±0.5
8K		12mm	10 inch	250±1.0	62±0.5	13.0±0.5	12.5±0.5	16.5±0.5	



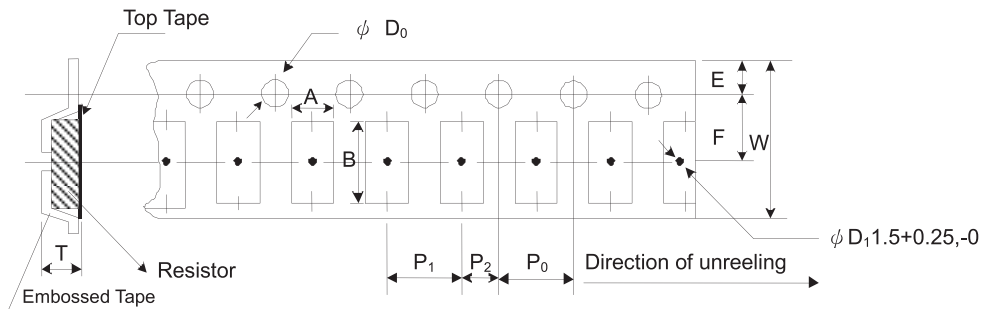
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
RS-02	0.65±0.10	1.15±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.10
RS-03	1.10±0.10	1.90±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.10
RS-05	1.60±0.10	2.40±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
RS-06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
RS-10	2.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Embossed Plastic Tape Specifications

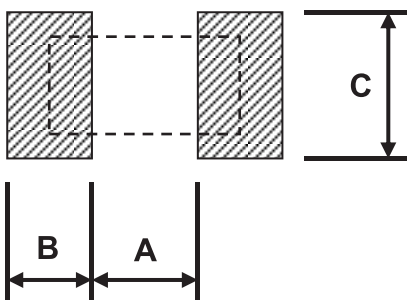


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
RS-0A	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰
RS-12	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰

Recommend Land Pattern

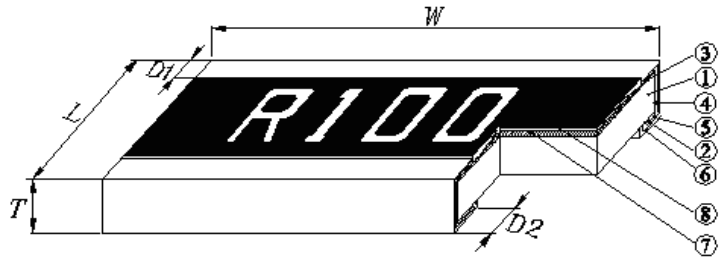
Unit: mm



Type	A	B	C
RS-02	0.50	0.45	0.60
RS-03	0.90	0.60	0.90
RS-05	1.20	0.70	1.30
RS-06	2.00	0.90	1.60
RS-10	2.00	0.90	2.80
RS-0A	3.80	0.90	2.80
RS-12	3.80	1.60	3.50

Current Sensing Chip Resistor (Wide Terminal) – CSW Series

Construction



Features

- Highly reliable multilayer electrode construction
- Reduced size of final equipment reliability
- 3 Watts power rating in 1 Watt size, 1225 package
- Resistance values from 10m to 510m ohm
- High purity alumina substrate for high power dissipation
- Long side terminations with higher power rating
- RoHS Compliance

① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Overcoat
③ Top Electrode	⑥ External Electrode	

Applications

- Power Management Applications
- Switching Power Supply
- Over Current Protection in Audio Applications
- Voltage Regulation Module (VRM)
- DC-DC Converter, Battery Pack, Charger, Adaptor
- Disk Driver
- Medical Equipment

Dimensions

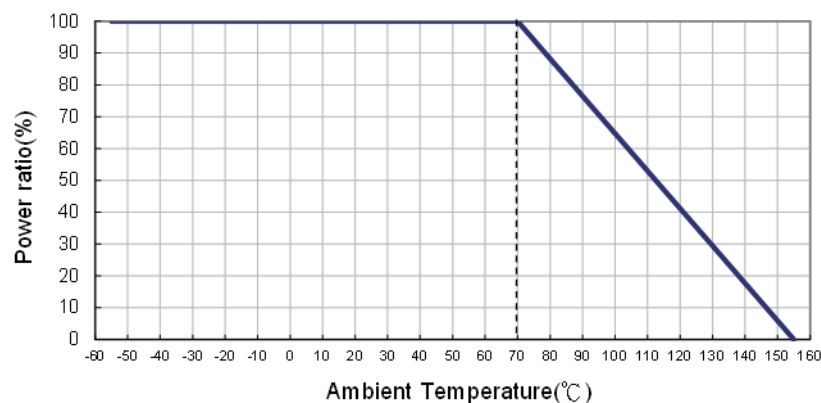
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
CSW08	0508	1.25±0.15	2.00±0.15	0.60±0.10	0.30±0.20	0.35±0.15	6
CSW62	0612	1.60±0.15	3.20±0.15	0.60±0.10	0.30±0.20	0.45±0.15	12
CSW20	1020	2.50±0.15	5.00±0.15	0.60±0.10	0.40±0.20	0.75±0.15	35
CSW25	1225	3.10±0.15	6.30±0.15	0.60±0.10	0.45±0.20	0.75±0.15	48

Part Numbering

CSW	25	F	T	E	U	R100	
Product Type	Dimensions (L×W)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking
	08: 0508 62: 0612 20: 1020 25: 1225	F: ±1% J: ±5%	T: Taping Reel	E: ±100 F: ±200 J: ±600	U: 1/2W Q: 3/4W T: 1W A: 1.5W S: 2W R: 3W	R010: 0.01Ω R100: 0.1Ω	N: No Marking

Derating Curve



Standard Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Current	Resistance Range (mΩ)		TCR (PPM/°C)
				±1% (E24 · E96)	±5% (E24)	
CSW08 (0508)	1/2W	-55 ~ +155°C	7.07A	10-27(E24)		±600
				30-510		±200
CSW62 (0612)	3/4W		8.66A	10-27(E24)		±600
				30-510		±200
CSW20 (1020)	1W		10A	10-27(E24)		±600
				30-750		±200
CSW25 (1225)	1.5W		12.24A	10-27(E24)		±600
				30-750		±200

High Power Rating Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Current	Resistance Range (mΩ)		TCR (PPM/°C)
				±1% (E24 · E96)	±5% (E24)	
CSW08 (0508)	1W	-55~+155°C	10.0A	10 - 27(E24)		±600
				30 - 510		±200
CSW62 (0612)	1.5W		12.2A	10 - 27(E24)		±600
				30 - 510		±200
CSW20 (1020)	2W		14.1A	10 - 27(E24)		±600
				30 - 750		±200
CSW25 (1225)	3W		17.3A	10 - 27(E24)		±600
				30 - 750		±200

High Power Rating Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Current	Resistance Range (mΩ)		TCR (PPM/°C)
				±1% (E24 · E96)	±5% (E24)	
CSW08 (0508)	1W	-55~+155°C	3.16A	100 - 510		±100
CSW62 (0612)	1.5W		7.07A	30 - 510		±100
CSW20 (1020)	2W		8.16A	30 - 750		±100
CSW25 (1225)	3W		10.0A	30 - 750		±100

Operating Voltage= $\sqrt{P \cdot R}$; Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$; Operating Current= $\sqrt{P/R}$

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(2.0%+0.05Ω)	RCWV*2 for 5 seconds
Insulation Resistance	≥ 10G	Max. Overload Voltage for 1 minute
Endurance	±(2.0%+0.05Ω)	70°C±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"

Item	Requirement	Test Method
Damp Heat with Load	$\pm(2.0\%+0.05\Omega)$	40±2°C, 90~95% R.H., RCWV for 1000hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Dry Heat	$\pm(1.0\%+0.05\Omega)$	at +155°C for 1000 hrs
Bending Strength	$\pm(1.0\%+0.05\Omega)$	Bending once for 60 seconds with 3mm
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	$\pm(1.0\%+0.05\Omega)$	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover	1.42 times Max. Operating Voltage for 1 minute CSW08:300V, CSW62/20/25:400V
Leaching	Individual leaching area $\leq 5\%$ Total leaching area $\leq 10\%$	260±5°C for 30 seconds
Rapid Change of Temperature	$\pm(0.5\%+0.05\Omega)$	-55°C (30 minutes) / +125°C (30 minutes), 5 cycles

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

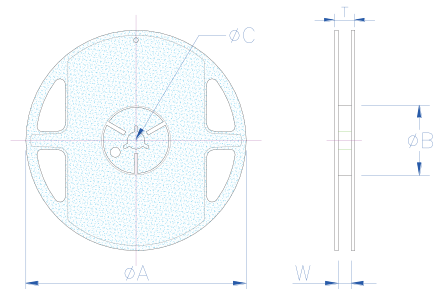
- Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1
- Storage Temperature: 15~28°C; Humidity < 80%RH
- Shelf Life: 2 years from production date

■ Packaging

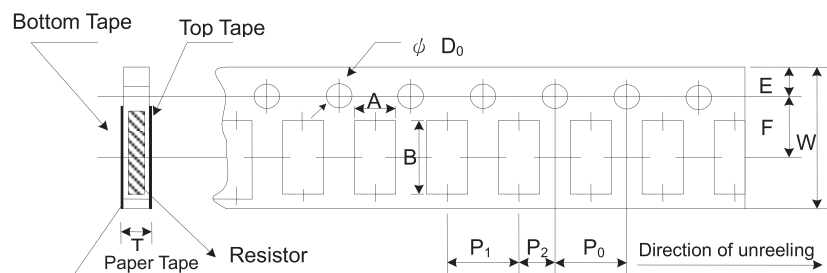
Reel Specifications & Packaging Quantity

Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T
CSW08 CSW62	Paper 5K	8mm	7 inch	178.0±1.0	60 ^{+1/-0}	13.5±0.7	9.5±0.1	11.5±1.0
CSW20 CSW25	Embossed 4K	12mm	7 inch	178.0±1.0	60 ^{+1/-0}	13.5±0.7	13.0±1.0	15.5±1.0



Paper Tape Specifications

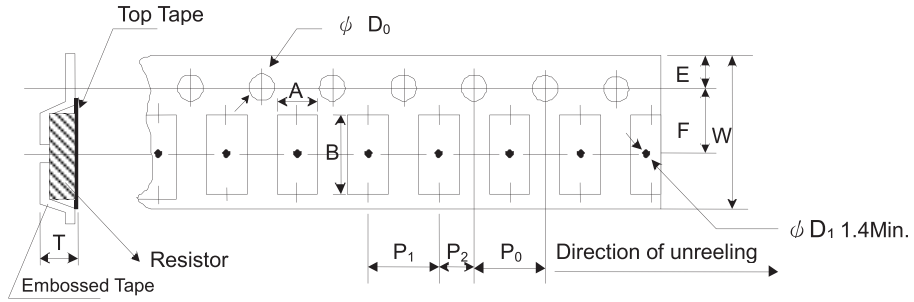


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CSW08	1.60±0.10	2.40±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CSW62	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

■ Packaging_

Embossed Plastic Tape Specifications

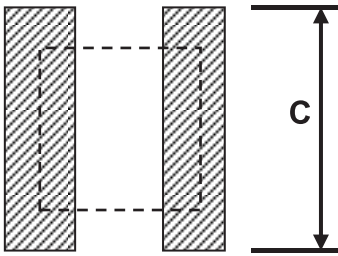


Unit: mm

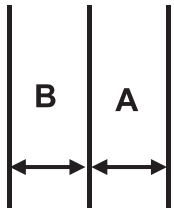
Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD_0	T
CSW20	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50±0.10	1.00±0.20
CSW25	3.38±0.10	6.68±0.10	12.0±0.30	1.75±0.10	5.50±0.10	4.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	1.00±0.20

■ Recommend Land Pattern

Unit: mm

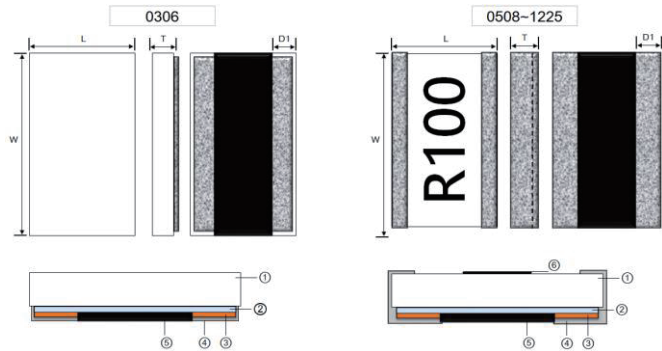


Type	A	B	C
CSW08	0.55	0.90	2.00
CSW62	0.70	0.80	3.20
CSW20	1.00	1.30	5.00
CSW25	1.60	1.20	6.40



Current Sensing Metal Chip Resistor (Wide Terminal) – CSMW Series

Construction



① Alumina Substrate	② Resistor Layer	③ Bottom Electrode
④ External Electrode	⑤ Primary Overcoat	⑥ Marking

Features

- SMD Type designed for automatic insertion on the product surface
- Low resistance resistor for current detection
- Metal foil construction ensures high reliability and performance with very low and stable TCR
- Designed for current sense circuits in power electronic systems
- Pb-Free to meet RoHS requirements
- AEC-Q200 Compliance

Applications

- Power Management Applications
- Switching Power Supply
- Over Current Protection in Audio Applications
- Voltage Regulation Module (VRM)
- DC-DC Converter, Battery Pack, Charger, Adaptor

Dimensions

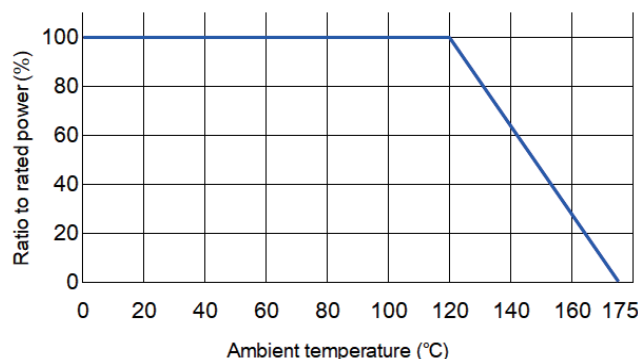
Unit: mm

Type	Size (Inch)	Resistance Range (mΩ)	L	W	T	D1
CSMW36	0306	5 - 100	0.80±0.20	1.60±0.20	0.50±0.20	0.20±0.15
CSMW08	0508	3 - 100	1.25±0.20	2.00±0.20	0.55±0.20	0.30±0.20
CSMW62	0612	3 - 100	1.60±0.20	3.20±0.20	0.55±0.20	0.30±0.20
CSMW20	1020	3 - 100	2.50±0.20	5.00±0.20	0.55±0.20	0.45±0.20
CSMW20	1225	3 - 19	3.10±0.20	6.30±0.20	0.55±0.20	0.55±0.20
		20 - 100	3.10±0.20	6.30±0.20	0.55±0.20	0.50±0.20

Part Numbering

CSMW	36	F	T	D	U	R100	
Product Type	Dimensions (L×W)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking
	36: 0306 08: 0508 62: 0612 20: 1020 25: 1225	F: ±1% G: ±2% J: ±5%	T: Taping Reel	D: ±50 E: ±100 K: ±150 F: ±200	U: 1/2W T: 1W A: 1.5W S: 2W R: 3W	R010: 0.01Ω R100: 0.1Ω	: Standard N: No Marking

Derating Curve



Standard Electrical Specifications

Type \ Item	Power Rating	Operating Temp. Range	Resistance Range (mΩ)			TCR (PPM/°C)
			±1%	±2%	±5%	
CSMW36 (0306)	1/2W	-55 ~ +175°C	5-19			±150
			20-100			±100
CSMW08 (0508)	1W		3-19			±100
			20-100			±50
CSMW62 (0612)	1.5W		3-19			±100
			20-100			±50
CSMW20 (1020)	2W		3-19			±100
			20-100			±50
CSMW25 (1225)	3W		3-19			±100
			20-100			±50

Operating Current= $\sqrt{P/R}$

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	-55°C~+125°C, 25°C is the reference temperature
Short Time Overload	$\Delta R \leq \pm 1\%R$	2.5 x Rated Power for 5 seconds
Insulation Resistance	$\geq 1000M\Omega$	Max. Overload Voltage for 1 minute
Operational Life	$\Delta R \leq \pm 1\%R$	Condition D Steady State $T_A=125^\circ\text{C}$ at derated power. Measurement at 24±4 hours after test conclusion
Biased Humidity	$\Delta R \leq \pm 1\%R$	85°C/85RH., 1000 hrs, apply 10% of operating power (current) or limiting element current whichever is lower
High Temperature Exposure	$\Delta R \leq \pm 1\%R$	at +155°C for 1000 hrs
Temperature Cycling	$\Delta R \leq \pm 1\%R$ $\Delta R \leq \pm 2\%R$	-55°C to +155°C, 100 cycles -55°C to +155°C, 1000 cycles
Bending Strength (Board Flex)	$\Delta R \leq \pm 1\%R$	Bending once for 60 seconds Bending displacement:2mm
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	$\Delta R \leq \pm 1\%R$	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover	1.42 times Max. Operating Voltage for 1 minute
Resistance to solvents	Marking Unsmearred	Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Mechanical Shock	$\Delta R \leq \pm 1\%R$	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	$\Delta R \leq \pm 1\%R$	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	$\Delta R \leq \pm 1\%R$	Human body model 0306 size: 1KV Other sizes: 2KV
Flammability	No ignition of the tissue paper or scorching or the pinewood board	V-0 or V-1 are acceptable. Electrical test not required.
Terminal strength	No broken	Force of 1.8kg for 60 seconds

RCWV(Rated Continuous Working Voltage)= $\sqrt{P^*R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC 60115-1, JIS-C 5201-1, AEC-Q200, MIL-STD-202, UL-94, JEDS22

■ Storage Temperature: 15~28°C; Humidity < 80%RH

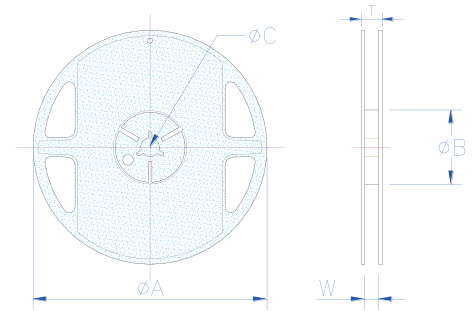
■ Shelf Life: 2 years from production date.

Packaging

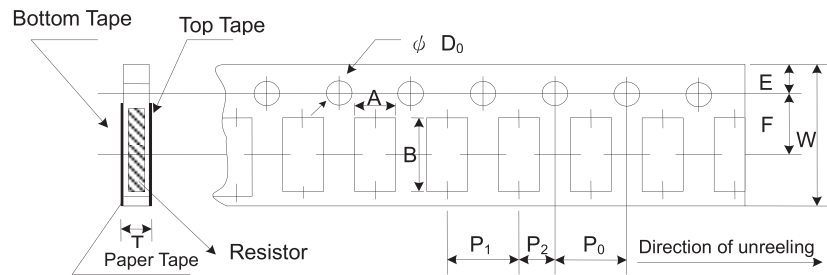
Packaging Quantity & Reel Specifications

Unit: mm

Type	ΦA	ΦB	ΦC	W	T	Paper Tape (EA)	Emboss Plastic Tape (EA)
CSMW36	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-
CSMW08	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-
CSMW62	178.0±1.0	60.0+1.0	13.5±0.7	9.5±0.1	11.5±1.0	5,000	-
CSMW20	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000
CSMW25	178.0±1.0	60.0+1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000



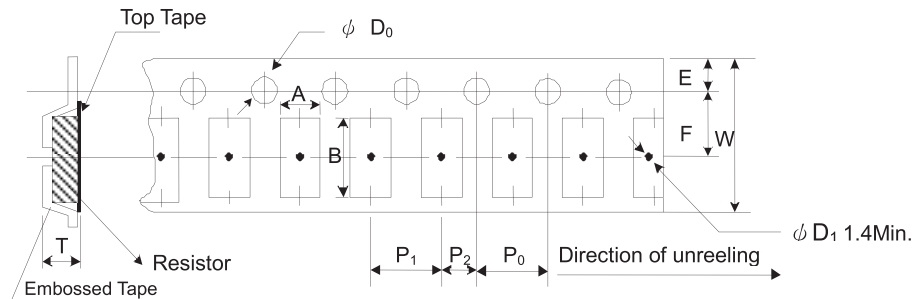
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CSMW36	1.10±0.10	1.85±0.10	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.60±0.05
CSMW08	1.60±0.10	2.37±0.20	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.75±0.05
CSMW62	2.00±0.10	3.55±0.20	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.75±0.05

Embossed Plastic Tape Specifications



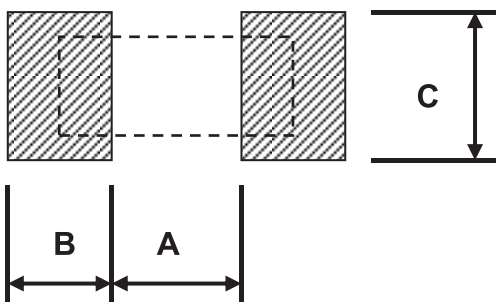
Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CSMW20	2.80±0.10	5.50±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20
CSMW25	3.50±0.10	6.70±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20

Recommend Land Pattern

Pad Layout

Unit: mm

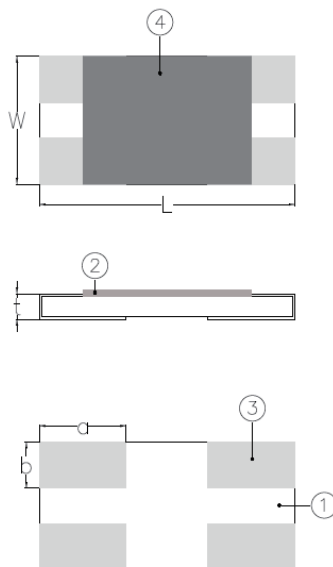


Type	A	B	C	t (μm)
CSMW36	0.25	0.68	1.70	35
CSMW08	0.60	0.70	2.20	35
CSMW62	0.60	0.90	3.40	35
CSMW20	1.20	1.40	5.20	100
CSMW25	2.20	1.00	6.60	100

t: copper foil minimum thickness of PCB

Four Terminal High Precision Current Sense Resistors – 4T Series

Construction



① Alumina Substrate	③ Electrode
② Resistor Layer	④ Protection coat

Features

- SMD Type designed for automatic insertion
- High power rating in small size
- Metal foil construction ensures high reliability and performance with very low and stable TCR
- Design for current sense circuits in power electronic systems
- Industry standard sizes

Applications

- Power Management Applications
- Switching Power Supply
- Over Current Protection in Audio Applications
- Voltage Regulation Module (VRM)
- DC-DC Converter, Battery Pack, Charger, Adaptor
- Automotive Engine Control
- Disk Driver
- Portable Devices (PDA, Cell Phone)

Dimensions

Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
4T06	1206	3.0±0.2	1.6±0.2	0.5±0.15	1.0±0.2	0.55±0.2	10
4T10	2010	5.0±0.2	2.5±0.2	0.5±0.15	1.7±0.2	0.9±0.2	29

Schematic diagram

- V = voltage terminal
- I = current terminal



Part Numbering

4T	10	F	T	F	Q	R010	N
Product Type	Dimensions (L×W)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking Code
	06: 1206 10: 2010	D: ±0.5% F: ±1% G: ±2% J: ±5%	T: Taping Reel B: Bulk	D: ±50 W: ±75 E: ±100	Q: 3/4W U: 1/2W	R010: 0.01Ω	: Standard N: No Marking

Standard Electrical Specifications

Type	Item	Power Rating at 70°C	Operating Temp. Range	Resistance Range				TCR (PPM/°C)
				±0.5%	±1%	±2%	±5%	
4T06 (1206)		1/2W	-55 ~ +155°C	10mΩ– 20mΩ				±50 ±75 ±100
4T10 (2010)		3/4W	-55 ~ +155°C	10mΩ– 20mΩ				±50 ±75 ±100

Operating Voltage= $\sqrt{(P \cdot R)}$ or Max. operating voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{(P \cdot R)}$ or Max. overload voltage listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	+25/-55/+25/+125/+25°C
Short Time Overload	±(0.5%+0.0005Ω)	RCWV*1.5 for 5 seconds
Insulation Resistance	>1000MΩ	Apply 100V _{DC} for 1 minute
Endurance	±(0.5%+0.0005Ω)	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Damp Heat with Load	±(0.5%+0.0005Ω)	40±2°C, 90~95% R.H. RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Bending Strength	±(0.5%+0.0005Ω)	Bending amplitude 3 mm for 10 seconds
Solderability	95% min. coverage	245±5°C for 3 seconds
Dielectric Withstand Voltage	By Type	Apply Max. Overload Voltage for 1 minute
Resistance to Soldering Heat	±(0.5%+0.0005Ω)	260±5°C for 10 seconds
Rapid change of temperature	±(0.5%+0.0005Ω)	-55°C ~155°C, 5 cycles

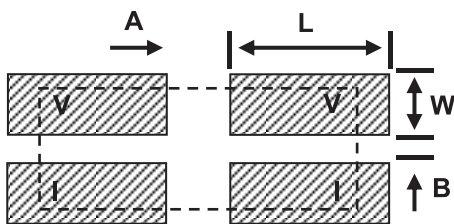
RCWV(Rated continuous working voltage)= $\sqrt{(P \cdot R)}$ or Max. Operating voltage whichever is lower

■ Reference Standards: MIL-STD-202, JIS-C 5201

■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date.

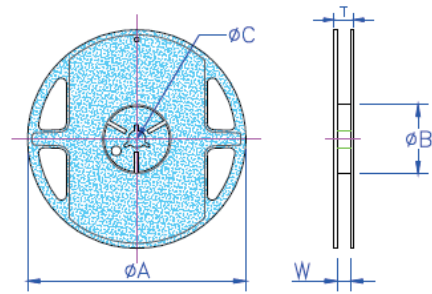
Recommend Land Pattern



Unit: mm

Type	L	W	A	B
4T06	1.75	1.10	1.00	0.30
4T10	2.55	1.55	1.40	0.50

Packaging

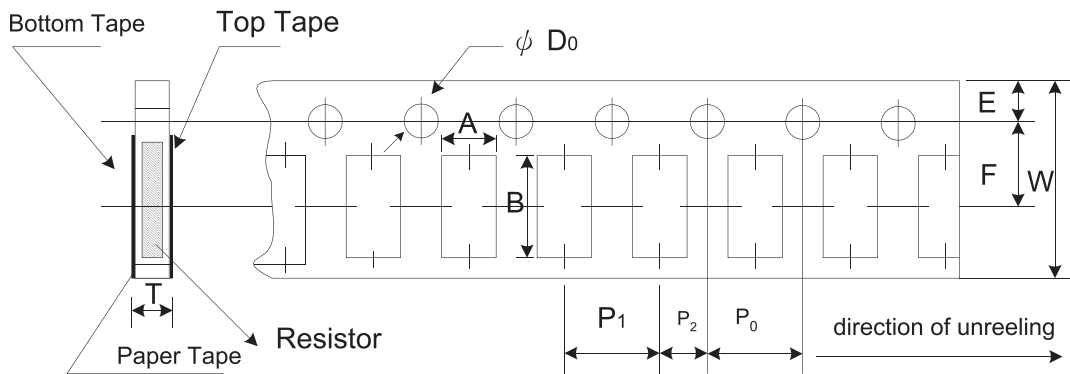


Packing Quantity & Reel Specifications

Unit :mm

Type	ØA	ØB	ØC	W	T	Paper Tape (EA)	Emboss Plastic Tape (EA)
4T06	178.0±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000	-
4T10	178.0±1.0	60.0±1.0	13.5±0.7	13.5±1.0	15.5±1.0	-	4,000

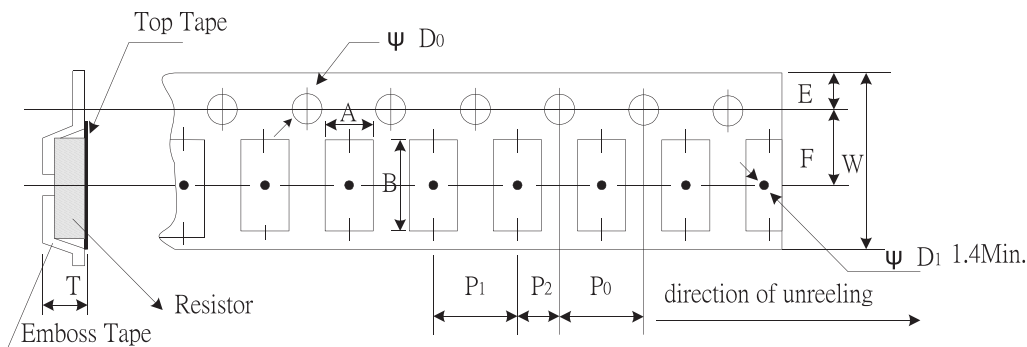
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ØD ₀	T
4T06	2.00±0.05	3.55±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05

Emboss Plastic Tape Specifications

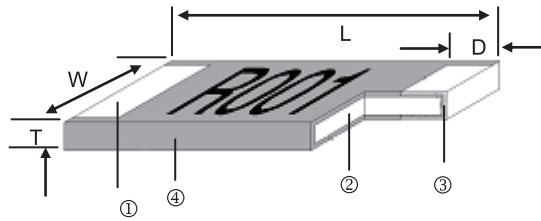


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ØD ₀	T
4T10	2.85±0.10	5.45±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50±0.10	1.00±0.20

Ultra Low Ohm (Metal Strip) Chip Resistor – LR Series

Construction



Black – Wave or IR reflow soldering

① Solder Plating	③ Barrier Layer
② Alloy Plate	④ Overcoat

Features

- High power rating up to 3 Watts
- Low TCR down to ± 50 PPM/ $^{\circ}\text{C}$
- Resistance values from 0.5 to 10m ohm
- Customized resistance available
- Wide range package sizes 2512
- AEC-Q200 Compliance (only LR12 Black)

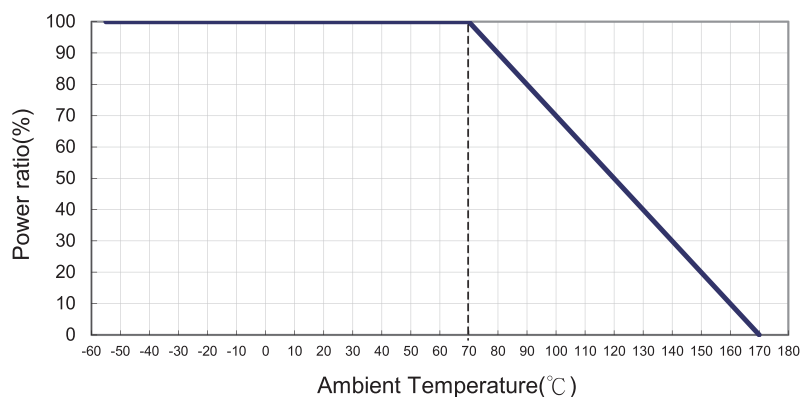
Applications

- NB (for Power Management)
- MB (for Power Management)
- SWPS (DC-DC Converter, Charger, Adaptor)
- Monitor (for Power Management)

Part Numbering

LR	12	J	T	E	S	R002	
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/ $^{\circ}\text{C}$)	Power Rating	Resistance	Marking
	12: 2512	F: $\pm 1\%$ H: $\pm 3\%$ J: $\pm 5\%$	T: Taping Reel	D: ± 50 W: ± 75 E: ± 100 K: ± 150	: Standard A: 1.5W S: 2W R: 3W	R002: 0.002Ω R020: 0.02Ω 0M50: 0.0005Ω 1M50: 0.0015Ω	: Black Coating

Derating Curve



Dimensions

Unit: mm

Part No.	Resistance (mΩ)	L	W	T	D	Weight (g) (1000pcs)
LR12□T□0M50	0.50	6.35±0.254	3.18±0.254	1.25±0.20	1.85±0.38	184.11
LR12□T□0M75	0.75	6.35±0.254	3.18±0.254	0.75±0.20	1.55±0.38	131.11
LR12□T□R001	1.00	6.35±0.254	3.18±0.254	0.65±0.20	1.55±0.38	110.85
LR12□T□1M50	1.50	6.35±0.254	3.18±0.254	0.45±0.20	1.55±0.38	67.16
LR12□T□R002	2.00	6.35±0.254	3.18±0.254	0.35±0.20	1.55±0.38	49.3
LR12□T□2M50	2.50	6.35±0.254	3.18±0.254	0.65±0.20	1.40±0.38	97.95
LR12□T□R003	3.00	6.35±0.254	3.18±0.254	0.55±0.20	1.40±0.38	83.49
LR12□T□R004	4.00	6.35±0.254	3.18±0.254	0.45±0.20	1.40±0.38	62.59
LR12□T□R005	5.00	6.35±0.254	3.18±0.254	0.35±0.20	1.40±0.38	49.84
LR12□T□R006	6.00	6.35±0.254	3.18±0.254	0.32±0.20	1.40±0.38	41.76
LR12□T□6M50	6.50	6.35±0.254	3.18±0.254	0.30±0.20	1.40±0.38	35.85
LR12□T□R007	7.00	6.35±0.254	3.18±0.254	0.27±0.20	1.40±0.38	34.01
LR12□T□R010	10.00	6.35±0.254	3.18±0.254	0.25±0.20	1.40±0.38	25.97

Standard Electrical Specifications

Part No.	Item	Power Rating at 70°C	Operating Temp. Range	Resistance Range (mΩ)			TCR (PPM/°C)
				±1%	±3%	±5%	
LR12□TD□□□□		1W	-55°C ~ +170°C	0.5, 0.75, 1, 1.5, 2			±50
LR12□TW□□□□		1W		6, 6.5, 7			±75
LR12□TE□□□□		1W		4, 5, 10			±100
LR12□TK□□□□		1W		2.5, 3			±150

Operating Current= $\sqrt{P/R}$, Operating Voltage= $\sqrt{P \cdot R}$

High Power Rating Electrical Specifications

Part No.	Item	Power Rating at 70°C	Operating Temp. Range	Resistance Range (mΩ)			TCR (PPM/°C)
				±1%	±3%	±5%	
LR12□TDS□□□□		2W	-55°C ~ +170°C	0.5, 0.75, 1, 1.5, 2			±50
LR12□TWS□□□□		2W		6, 6.5, 7			±75
LR12□TES□□□□		2W		4, 5, 10			±100
LR12□TKS□□□□		2W		2.5, 3			±150
LR12□TDR□□□□		3W		0.5, 0.75, 1, 1.5, 2			±50
LR12□TWR□□□□		3W		6, 6.5, 7			±75
LR12□TER□□□□		3W		4, 5, 10			±100
LR12□TKR□□□□		3W		2.5, 3			±150

Operating Current = $\sqrt{P/R}$, Operating Voltage= $\sqrt{P \cdot R}$

■ Viking has the ability of manufacture following options based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	+25°C ~125°C, 25°C is the reference temperature
Short Time Overload	±0.5%	5*rated power for 5 seconds
Endurance	±1%	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Dry Heat	±1%	at +170°C for 1000 hrs
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	±0.5%	260±5°C for 10 seconds
Thermal Shock	±0.5%	-55°C ~ 150°C, 100 cycles

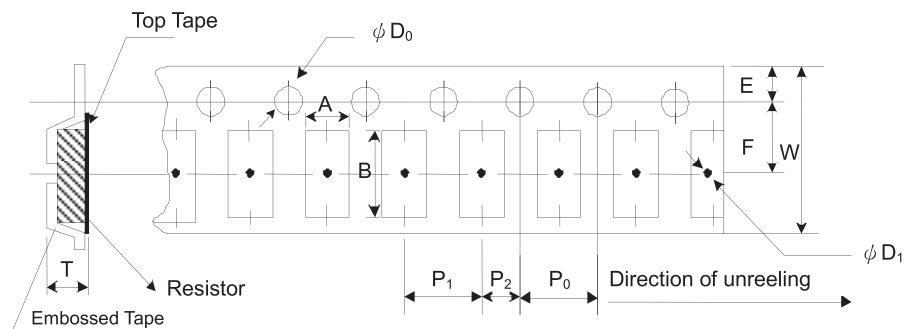
RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

Reference Standards: MIL-STD-202, JIS-C 5201-1

Storage Temperature: 15~28°C; Humidity < 80%RH

Packaging

Embossed Plastic Tape Specifications



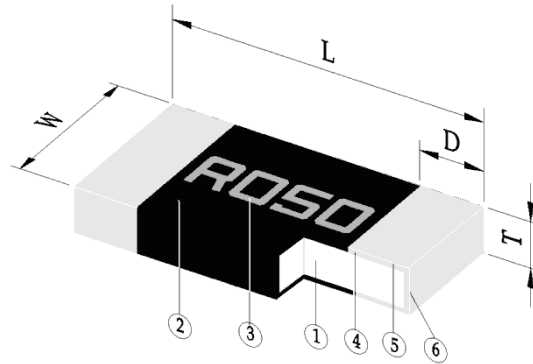
Unit: mm

Type	Resistance (mΩ)	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	ΦD ₁	T	Quantity (EA)
LR12	0.50 - 0.75	3.40±0.1	6.75±0.1	12.0±0.1	1.75±0.1	5.5±0.05	4.0±0.1	4.0±0.1	2.0±0.05	1.55±0.05	1.4min.	1.45±0.2	2,000
	1 - 10	3.40±0.1	6.75±0.1	12.0±0.1	1.75±0.1	5.5±0.05	4.0±0.1	4.0±0.1	2.0±0.05	1.55±0.05	1.4min.	0.81±0.1	2,000

- The cumulative tolerance of 10 sprockets hole pitch is ± 0.2mm.
- Carrier camber shall be not more than 1mm per 100mm through a length of 250mm.
- A & B measured 0.3mm from the bottom of the packet
- T measured at a point on the inside bottom of the packet to the top surface of the carrier.
- Pocket position relative to sprocket hole is measured as the true position of the pocket and not the pocket hole.

Low Ohm (Metal Strip) Chip Resistor – LRP Series

Construction



Features

- Low TCR down to ± 25 PPM/ $^{\circ}$ C
- Customized resistance available
- Low inductance < 5nH
- AEC-Q200 Compliance
- Sulfur resistance unaffected by sulfur environments
- Lead-free and RoHS compliant

① Alloy Plate	④ Internal Electrode
② Overcoat	⑤ Barrier Layer
③ Marking	⑥ Solder Plating

Dimensions

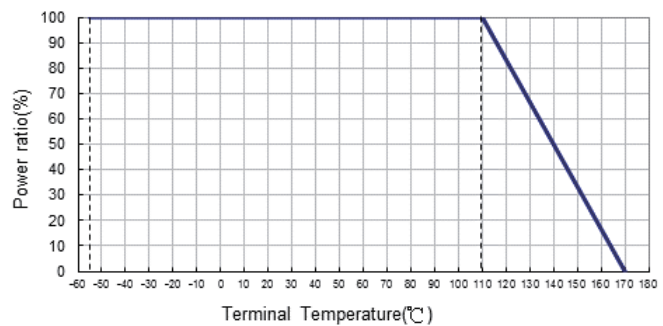
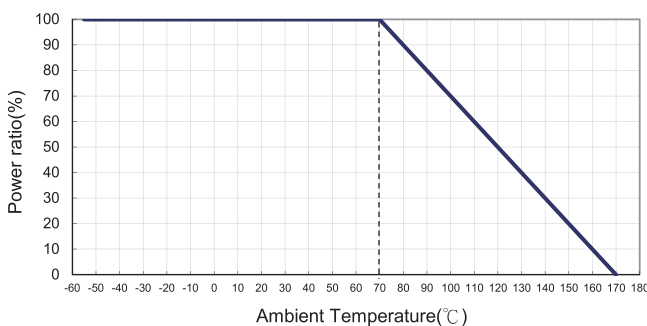
Unit: mm

Type	Size (Inch)	L	W	T	D	Weight (g) (1000pcs)
LRP05	0805	2.05 \pm 0.10	1.25 \pm 0.10	0.40 \pm 0.15	0.55 \pm 0.15	4.5
LRP06	1206	3.15 \pm 0.10	1.45 \pm 0.10	0.55 \pm 0.10	0.55 \pm 0.15	10.5
LRP10	2010	5.00 \pm 0.10	2.40 \pm 0.15	0.60 \pm 0.10	0.80 \pm 0.20	40
LRP12	2512 2-200m Ω	6.40 \pm 0.25	3.20 \pm 0.25	0.70 \pm 0.20	0.90 \pm 0.30	52.6
	2512 1.5m Ω	6.40 \pm 0.25	3.20 \pm 0.25	0.70 \pm 0.20	1.45 \pm 0.30	52.6
	2512 1m Ω	6.40 \pm 0.25	3.20 \pm 0.25	0.70 \pm 0.20	1.85 \pm 0.30	52.6

Applications

- NB (for Power Management)
- MB (for Power Management)
- SWPS (DC-DC Converter, Charger, Adaptor)
- Monitor (for Power Management)

Derating Curve



Part Numbering

LRP	12	F	T	D	S	R015
Product Type	Dimensions (L×W)	Resistance Tolerance	Packaging Code	TCR (PPM/ $^{\circ}$ C)	Power Rating	Resistance
	05:0805 06:1206 10: 2010 12: 2512	D: $\pm 0.5\%$ F: $\pm 1\%$ J: $\pm 5\%$	T: Taping Reel	C: ± 25 D: ± 50 W: ± 75 E: ± 100 K: ± 150	R: 3W S: 2W T: 1W Q: 3/4W	R015: 0.015 Ω R050: 0.05 Ω

Standard Electrical Specifications

Type	Item	Power Rating at 70°C	Rated Terminal Temperature	Operating Temp. Range	Resistance Range (mΩ)			TCR (PPM/°C)
					±0.5%	±1%	±5%	
LRP05 (0805)	0.75W	110°C	-55 ~ +170°C	2, 5			±75	
				10, 15, 20			±50	
	1W	2, 5			±75			
LRP06 (1206)	1W	110°C	-55 ~ +170°C	8, 10, 12, 15, 20, 25, 30, 33, 40			±50	
				3, 4, 5, 7, 8, 10, 12, 15, 20, 25, 30, 33, 40			±75 ±100	
LRP10 (2010)	1W	110°C	-55 ~ +170°C	4, 5, 10, 15, 20, 30, 50, 68, 75, 100			±75	
	2W			4, 5, 10, 15, 20, 30, 50, 68, 75				
LRP12 (2512)	2W, 3W	110°C	-55 ~ +170°C	3, 4, 5, 6, 7, 18, 20, 22, 25, 30, 33, 35, 39, 40, 47, 50, 60, 68, 70, 75, 80, 82, 90, 91, 100, 120, 150, 180, 200			±25	
				1, 1.5, 2, 2.5, 3, 4, 5, 6, 7, 8, 8.5, 9, 10, 12, 15, 18, 20, 22, 25, 30, 33, 35, 39, 40, 47, 50, 60, 68, 70, 75, 80, 82, 90, 91, 100, 120, 150, 180, 200			±50 ±75	

Operating Current = $\sqrt{P/R}$, Operating Voltage = $\sqrt{P \cdot R}$

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	+25°C ~ 125°C, 25°C is the reference temperature
Short Time Overload	±1.0%	5*rated power for 5 seconds
Insulation Resistance	≥10G	100V DC for 1 minute
Endurance	±1.0%	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Biased Humidity	±1.0%	1000 hrs 85°C/85%RH 10% of operating power
Dry Heat	±1.0%	at +170°C for 1000 hrs
Bending Strength	±1.0%	Bending width 2mm once for 60 seconds
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	±0.5%	260±5°C for 10 seconds
Rapid Change of Temperature	±1.0%	-55°C to +155°C, 5 cycles
Low Temperature Storage	±1.0%	at -55°C for 2 hrs

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower. Operating Current = $\sqrt{P/R}$.

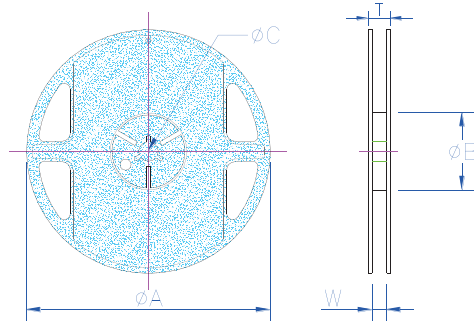
■ Reference Standards: MIL-STD-202, JIS-C 5201-1, IEC-60115

■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date

■ Packaging

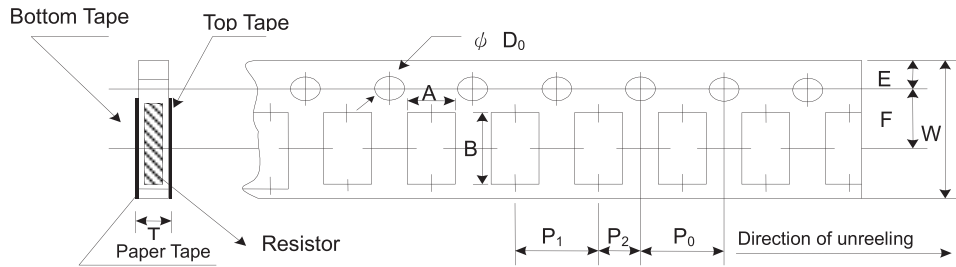
Reel Specifications & Packaging Quantity



Unit: mm

Type	Resistance (mΩ)	Packaging Quantity		Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T
LRP05	2~20	Paper	5K	8mm	7 inch	178.5±1.5	60+1/-0	13.0±0.2	9.0±0.5	12.5±0.5
LRP06	3~40	Paper	5K	8mm	7 inch	178.5±1.5	60+1/-0	13.0±0.2	9.0±0.5	12.5±0.5
LRP10	4~100	Embossed	4K	12mm	7 inch	178.5±1.5	60+1/-0	13.0±0.5	13.0±0.5	15.5±0.5
LRP12	1~200	Embossed	4K	12mm	7 inch	178.5±1.5	60±1.0	13.0±0.5	13.0±1.0	15.5±0.5

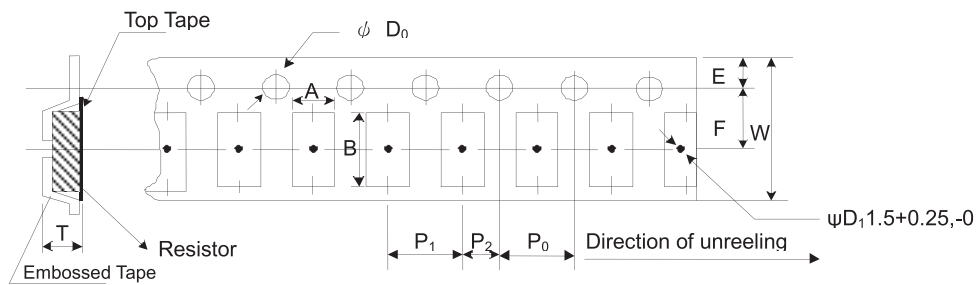
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
LRP05	1.60±0.10	2.40±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
LRP06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Embossed Plastic Tape Specifications

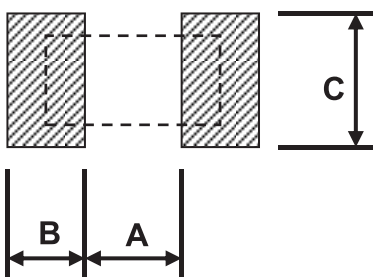


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
LRP10	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.20+0
LRP12	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.20+0

■ Recommend Land Pattern

Unit: mm

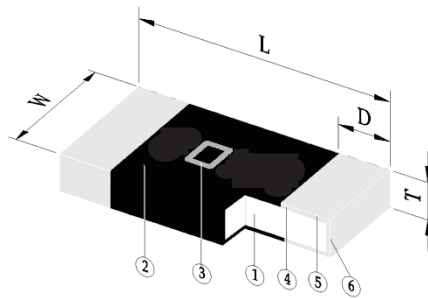


Type	A	B	C
LRP05	0.65	1.10	1.40
LRP06	1.50	1.40	1.70
LRP10	3.60	1.40	2.50
LRP12 (2~200mΩ)	4.00	2.00	3.50
LRP12 (1~1.5mΩ)	2.30	2.65	3.50

* FR4 copper board, 100μm of copper pad thickness

Ultra-Low Chip Resistor Jumper – LRJ Series

Construction



LRJ06 / LRJ10 / LRJ12

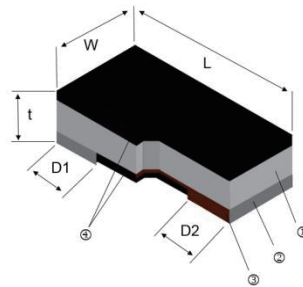
① Alloy Plate	④ Internal Electrode
② Overcoat	⑤ Barrier Layer
③ Marking	⑥ Solder Plating

Features

- Ultra-Low resistance values Max. 0.5 mΩ
- High current application
- Pb Free

Applications

- NB
- Mobil Device
- Server
- Electrical tools
- Power Management



LRJ02 / LRJ03 / LRJ05

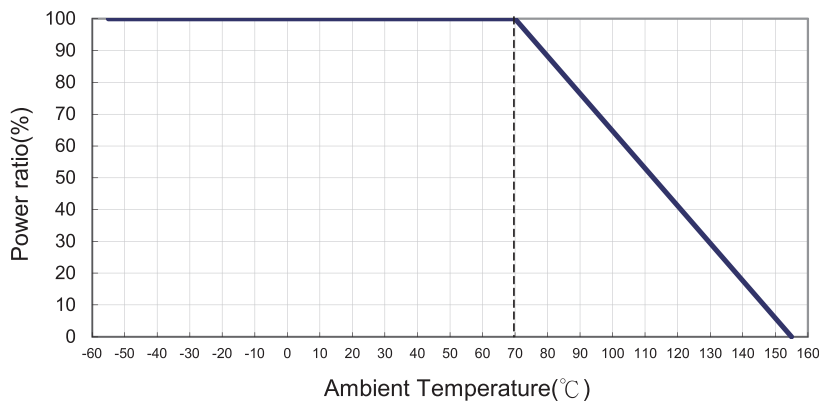
① Alumina Substrate	④ Overcoat
② External Electrode	No Marking
③ Resistor Layer	

Dimensions

Unit: mm

Type	Size (Inch)	L	W	T	D	Weight (g) (1000pcs)
LRJ02	0402	1.00±0.05	0.50±0.05	0.25±0.10	0.30±0.10	0.69
LRJ03	0603	1.50±0.15	0.80±0.15	0.42±0.10	0.40±0.10	1.90
LRJ05	0805	1.95±0.15	1.20±0.15	0.58±0.10	0.55±0.10	5.49
LRJ06	1206	3.10±0.20	1.45±0.20	0.45±0.20	0.55±0.20	9.62
LRJ10	2010	4.85±0.20	2.50±0.20	0.45±0.20	0.75±0.20	31.50
LRJ12	2512	6.20±0.20	3.20±0.20	0.60±0.20	0.90±0.20	55.80

Derating Curve



Part Numbering

LRJ	10	-	T	-		R0R0
Product Type	Dimensions (L×W)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance
	02: 0402 03: 0603 05: 0805 06: 1206 10: 2010 12: 2512	-: No Specified	T: Taping Reel	-: No Specified	: Standard	R0R0: Jumper

Standard Electrical Specifications

Item Type	Operating Temp. Range	Resistance Range (mΩ)	Rated Current (A)
LRJ02 (0402)	-55 ~ +155°C	0.5 mΩ Max.	20.0
LRJ03 (0603)	-55 ~ +155°C	0.5 mΩ Max.	22.4
LRJ05 (0805)	-55 ~ +155°C	0.5 mΩ Max.	31.6
LRJ06 (1206)	-55 ~ +155°C	0.2 mΩ Max.	50.0
LRJ10 (2010)	-55 ~ +155°C	0.2 mΩ Max.	71.0
LRJ12 (2512)	-55 ~ +155°C	0.2 mΩ Max.	100

Operating Current = $\sqrt{P/R}$, Operating Voltage = $\sqrt{P \cdot R}$

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Variation of resistance with temperature	Max. 0.5 mΩ	+25/-55°C, +25/+125°C
Short Time Overload	Max. 0.5 mΩ	Rated current*1.5 for 2 seconds(LRJ02/06/10/12) Rated current*2.5 for 5 seconds(LRJ03/05)
Endurance	Max. 0.5 mΩ	70±2°C, Rated current for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Damp Heat with Load	Max. 0.5 mΩ	40±2°C, 90~95% R.H. Rated current for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Dry Heat	Max. 0.5 mΩ	at +155°C for 1000 hrs
Bending Strength	Max. 0.5 mΩ	Bending once for 60 seconds with 3mm
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	Max. 0.5 mΩ	260±5°C for 10 seconds
Rapid Change of Temperature	Max. 0.5 mΩ	-55°C to +125°C, 5 cycles

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

Operating Current = $\sqrt{P/R}$. Operating Voltage = $\sqrt{P \cdot R}$.

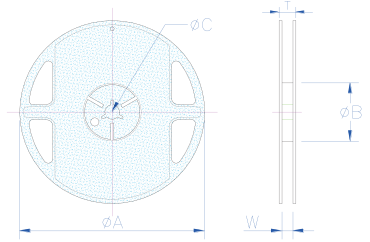
- Reference Standards: JIS-C 5201-1, IEC-60115
- Storage Temperature: 15~28°C; Humidity < 80%RH
- Shelf Life: 2 years from production date

Packaging

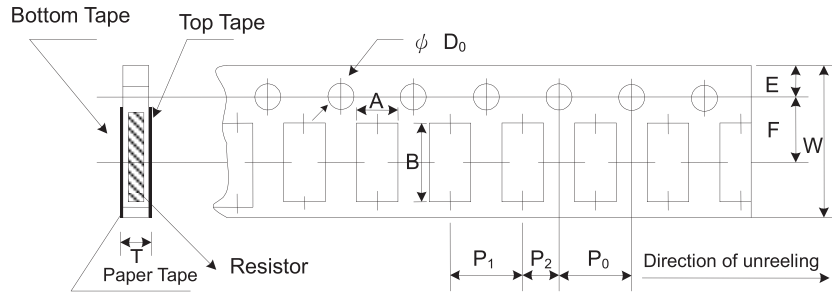
Reel Specifications & Packaging Quantity

Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T	
LRJ02	Paper	10K	8mm	7 inch	178±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5 ± 1.0
LRJ03	Paper	5K	8mm	7inch	178±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5 ± 1.0
LRJ05	Paper	5K	8mm	7inch	178±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5 ± 1.0
LRJ06	Paper	5K	8mm	7 inch	178.5±1.5	60+1/-0	13.0±0.2	9.0±0.5	12.5 ± 0.5
LRJ10	Embossed	4K	12mm	7 inch	178.5±1.5	60+1/-0	13.0±0.5	13.0±0.5	15.5 ± 0.5
LRJ12	Embossed	4K	12mm	7 inch	178.5±1.5	60.0±1.0	13.0±0.5	13.0±1.0	15.5 ± 0.5



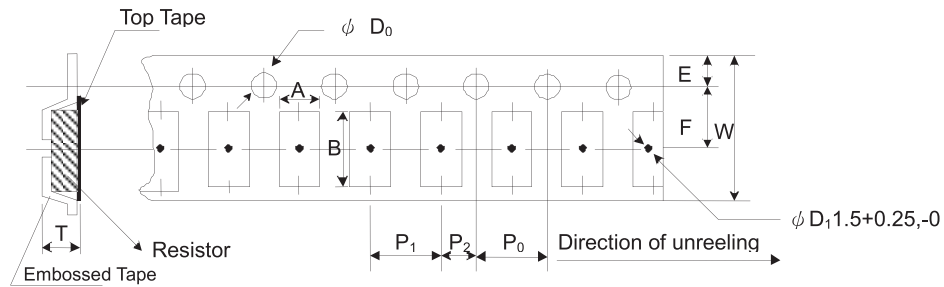
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
LRJ02	0.70±0.05	1.16±0.05	8.00±0.10	1.75±0.05	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.05	0.45±0.10
LRJ03	1.10±0.05	1.90±0.05	8.00±0.10	1.75±0.05	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.60±0.03
LRJ05	1.63±0.05	2.40±0.05	8.00±0.10	1.75±0.05	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
LRJ06	1.90±0.15	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1/-0	0.85±0.10

Embossed Plastic Tape Specifications

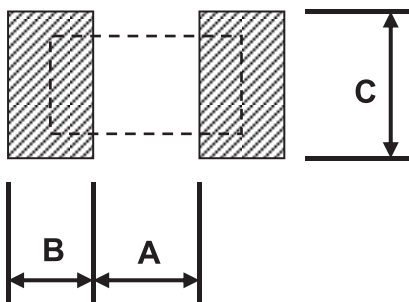


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
LRJ10	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1, -0	1.2 ⁺⁰
LRJ12	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1, -0	1.2 ⁺⁰

Recommend Land Pattern

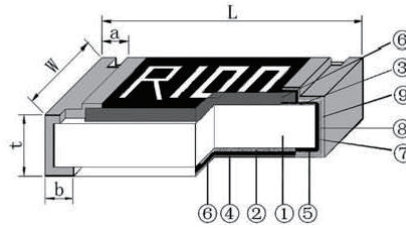
Unit: mm



Type	A	B	C
LRJ02	0.50	0.65	0.50
LRJ03	0.50	1.00	0.90
LRJ05	0.80	1.30	1.30
LRJ06	2.00	0.90	1.60
LRJ10	3.80	0.90	2.80
LRJ12	4.00	2.00	3.50

Metal Foil Chip Fixed Resistor—MF Series

Construction



① Ceramic Substrate	④ Primary Overcoat	⑦ Edge Electrode
② Alloy Plate	⑤ Cu Plating	⑧ Barrier Layer
③ Top Electrode	⑥ Secondary Overcoat	⑨ External Electrode

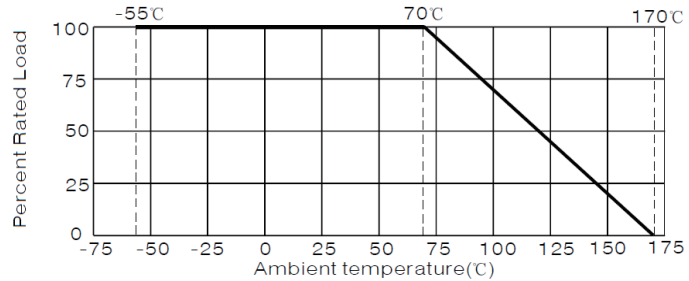
Features

- High power rating up to 2 Watts
- Low TCR down to ± 50 PPM/ $^{\circ}\text{C}$
- Current detecting resistors
- Superior mechanical and frequency characteristics
- Compliant with RoHS directive
- Halgen free requirement

Applications

- Switching Power Supply, Over Current Protection
- Voltage Regulation Module (VRM)
- DC-DC Converter, Charger
- Portable Devices etc

Derating Curve



Dimensions

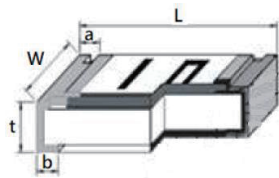


Figure1

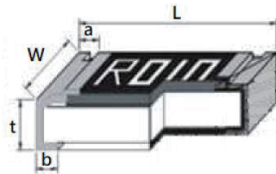


Figure2

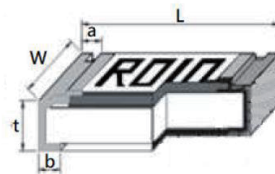


Figure3

Unit: mm

Type	Size (Inch)	Resistance (m Ω)	L	W	t	a	b
MF02	0402	10	1.00 \pm 0.10	0.50 \pm 0.10	0.40 \pm 0.10	\leq 0.35	0.30 \pm 0.15
MF03	0603	\geq 5	1.60 \pm 0.20	0.80 \pm 0.20	0.70 \pm 0.15	\leq 0.60	0.35 \pm 0.20
MF05	0805	3-4	2.00 \pm 0.20	1.25 \pm 0.15	0.70 \pm 0.15	0.40 \pm 0.25	0.70 \pm 0.30
		\geq 5					0.40 \pm 0.30
MF06	1206	3-4	3.20 \pm 0.20	1.60 \pm 0.20	0.75 \pm 0.15	0.50 \pm 0.30	0.90 \pm 0.30
		\geq 5					0.50 \pm 0.30
MF10	2010	2	5.00 \pm 0.20	2.50 \pm 0.20	0.75 \pm 0.20	0.60 \pm 0.30	1.80 \pm 0.30
		3					1.60 \pm 0.30
		4-5					1.30 \pm 0.30
		>5					0.80 \pm 0.30
MF12	2512	2	6.40 \pm 0.20	3.20 \pm 0.20	0.75 \pm 0.20	0.90 \pm 0.30	2.30 \pm 0.30
		3					1.90 \pm 0.30
		4					1.70 \pm 0.30
		5-6					1.20 \pm 0.30
		7					1.10 \pm 0.30
		>7					0.90 \pm 0.30

Figure 1 for MF03 ; Figure 2 for MF05 \geq 10m Ω / MF06 type / MF12 type; Figure 3 for MF05<10m Ω / MF10 type

MF02 chip resistor is without marking.

Part Numbering

MF	06	J	T	E	U	R005
Product Type	Dimensions (L×W)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance
	02: 0402 03: 0603 05: 0805 06: 1206 10: 2010 12: 2512	F: ±1% G: ±2% J: ±5%	T: Taping Reel	D: ±50 E: ±100 F: ±200	P: 1/5W V: 1/4W O: 1/3W U: 1/2W Q: 3/4W T: 1W S: 2W	R005: 0.005Ω R010: 0.01Ω R100: 0.1Ω

Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Limiting Element Current	Max. Overload Current	Resistance Range(mΩ)			TCR (PPM/°C)
					±1%	±2%	±5%	
MF02	1/5W	-55 ~ +170°C	4.5A	10A	10			±100
MF03	1/2W	-55 ~ +170°C	12.9A	28.9A	5 - 9			±200
					10 - 30			±100
MF05	3/4W	-55 ~ +170°C	15.8A	35.4A	3 - 10			±100
	1/4W, 1/3W, 1/2W		12.9A	28.9A	3 - 50			±50
MF06	1/2W, 1W	-55 ~ +170°C	18.3A	40.8A	3 - 9			±100
					5 - 68			±50
MF10	1W	-55 ~ +170°C	22.4A	50A	2			±200
					3 - 9			±100
					10 - 100			±50
MF12	1W	-55 ~ +170°C	3.2A	7.1A	101 - 200			±50
	2W		31.6A	63.3A	2			±200
					3 - 9			±100
					10 - 100			±50

Current of DC or AC RMS value.

Rated current= $\sqrt{P/R}$ or Limiting element voltage whichever is lower.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	+20/+125/+20°C
Short Time Overload	No mechanical damage $\Delta R \leq \pm 1\%$	1/5W~1W: 5xrated power for 5s 2W: 4xrated power for 5s
Endurance		70±2°C, 1000 hrs, rated current or limiting element current whichever is lower for 1.5 hrs "ON" and 0.5 hr "OFF"
Endurance at upper Category Temperature		at 170±2°C for 1000 hrs
Damp Heat Steady State		40±2°C, 93±3% RH, 1000 hrs, rated current or limiting element current whichever is lower for 1.5 hrs "ON" and 0.5 hr "OFF"
Rapid Change of Temperature		-55°C(30min) →normal temperature(5min) →125°C(30min), 100 cycles
Solderability		95% min. coverage
Resistance to Soldering Heat	No mechanical damage $\Delta R \leq \pm 1\%$	270±5°C for 10±1 seconds
Substrate Bending Test		2010, 2512 sizes:2mm Other sizes:3mm Duration: 60±5 seconds
Insulation Resistance	>1000MΩ	Apply DC 100V±15V between substrate and terminations for 1min, then check insulation resistance
Voltage Proof	No breakdown or flashover	Apply max. overload voltage of AC RMS at a rate of approximately 100V/s between substrate and terminations for 60±5 seconds
Component Solvent Resistance	No mechanical damage $\Delta R \leq \pm 1\%$	Iso-propyl alcohol (IPA), 23±5°C, 10hrs

Reference Standards: IEC 60115-1

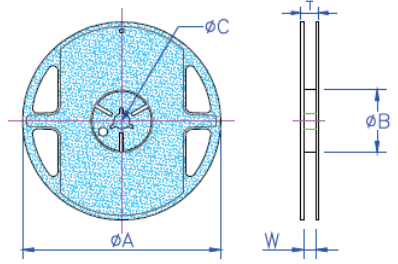
Storage Temperature: 5~30°C; Humidity 30~70%RH

■ Packaging

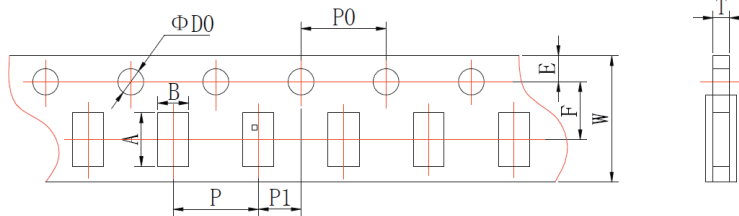
Packing Quantity & Reel Specifications

Unit : mm

Type	∅A	∅B	∅C	W	T	Paper Tape (EA)	Emboss Plastic Tape (EA)
MF02	178.0±2.0	58.0±2.0	13.0±0.5	9.5±1.0	12.5±1.5	10,000	-
MF03	178.0±2.0	58.0±2.0	13.0±0.5	9.5±1.0	12.5±1.5	5,000	-
MF05	178.0±2.0	58.0±2.0	13.0±0.5	9.5±1.0	12.5±1.5	5,000	-
MF06	178.0±2.0	58.0±2.0	13.0±0.5	9.5±1.0	12.5±1.5	5,000	-
MF10	178.0±2.0	57.0±2.0	13.0±0.5	13.0±0.5	15.5±1.5	-	4,000
MF12	178.0±2.0	57.0±2.0	13.0±0.5	13.0±0.5	15.5±1.5	-	4,000



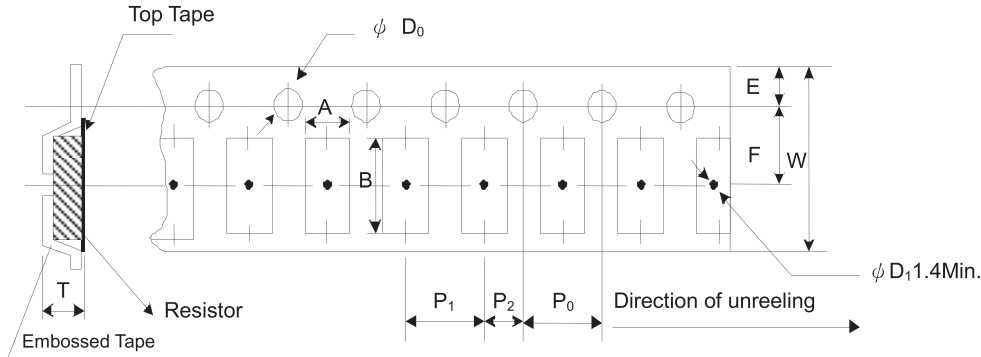
Paper Tape Specifications



Unit: mm

Type	A	B	W	F	E	P	P0	P1	∅D0	T
MF02	1.20±0.10	0.7±0.10	8.00±0.20	3.50±0.05	1.75±0.10	2.00±0.05	4.00±0.10	2.00±0.05	1.50±0.10	0.50±0.10
MF03	1.85±0.10	1.10±0.10	8.00±0.20	3.50±0.05	1.75±0.10	4.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	0.75±0.10
MF05	2.35±0.10	1.65±0.10	8.00±0.20	3.50±0.05	1.75±0.10	4.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	0.95±0.10
MF06	3.50±0.20	1.90±0.20	8.00±0.20	3.50±0.05	1.75±0.10	4.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	0.95±0.10

Emboss Plastic Tape Specifications

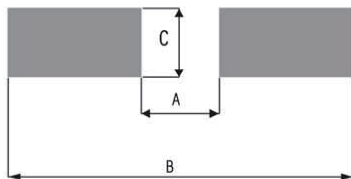


Unit: mm

Type	A	B	W	E	F	P0	P1	P2	∅D0	T
MF10	2.82±0.15	5.50±0.15	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50±0.10	0.84±0.10
MF12	3.45±0.15	6.78±0.15	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50±0.10	0.81±0.10

■ Recommend Land Pattern

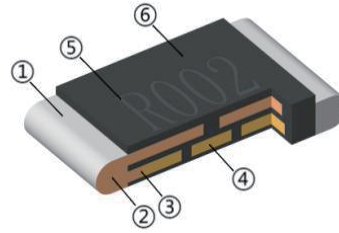
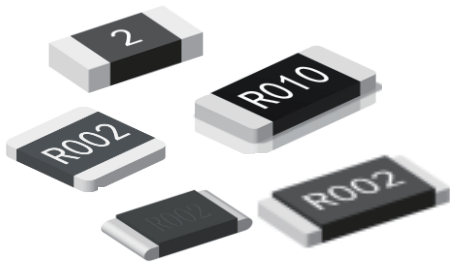
Unit: mm



Type	Resistance	A	B	C
MF02	10mΩ	0.35	1.45	0.6
MF03	5mΩ - 30mΩ	0.6	2.8	1.0
MF05	3mΩ - 4mΩ	0.5	3.2	1.4
	5mΩ - 50mΩ	0.8		
MF06	3mΩ - 4mΩ	0.8	4.4	1.8
	5mΩ - 68mΩ	1.8		
MF10	2mΩ	1.0	6.3	2.9
	3mΩ - 9mΩ	1.6		
	10mΩ - 100mΩ	2.7		
MF12	2mΩ - 4mΩ	1.0	8.0	3.4
	5mΩ - 200mΩ	3.8		

Molding E-Beam Welded Metal Strip Resistor – WMR Series

Construction



① Ni / Sn Plating	④ Alloy Body
② Pure Copper Terminal	⑤ Marking
③ Electron Beam Welding Structure	⑥ Overcoat

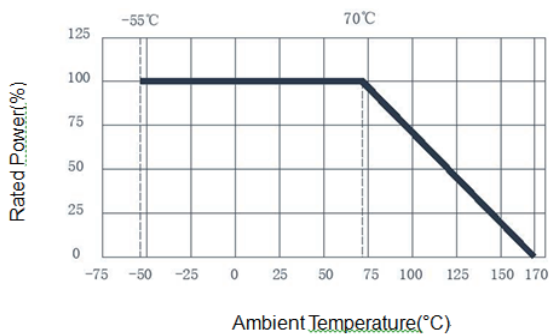
Features

- E-beam welded metal strip resistors, pure copper Electrodes are the ideal solution for current sensing applications
- Excellent reliability, stability, Anti-pulse capability
- Special welding process, all-metal construction, Supports low resistance , High temperature resistant resin molded encapsulation, strong weather resistance
- Low thermal EMF(<math><1 \mu\text{V}/^\circ\text{C}</math>)
- Ultra-low parasitic inductance , fast response, can be used for high frequency AC current detection
- AEC-Q200 Compliance
- RoHS compliant

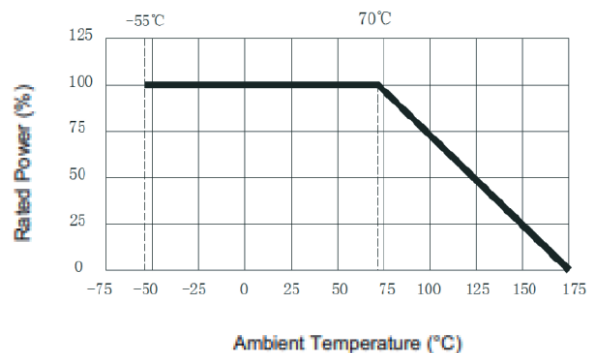
Part Numbering

WMR	12	F	T	D	R	R005	K
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Material Code
	06: 1206 10: 2010 12: 2512 25: 2725 28: 2728 27: 4527	D: $\pm 0.5\%$ F: $\pm 1\%$ J: $\pm 5\%$	T: Taping Reel	C: ± 25 D: ± 50 W: ± 75 E: ± 100 K: ± 150 12: ± 175	S: 2W R: 3W H: 4W D: 5W 9: 9W	0M50: 0.0005 Ω R001: 0.001 Ω R010: 0.01 Ω R100: 0.1 Ω	M: Manganin K: Kamar F: FeCrAl

Derating Curve

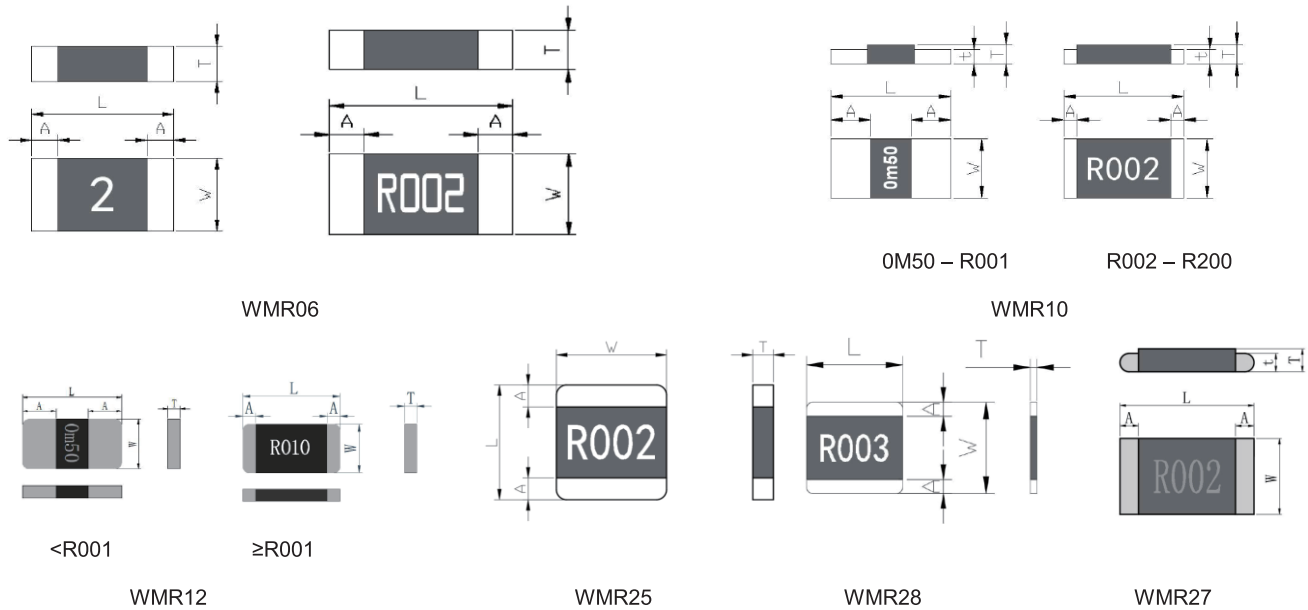


WMR06



WMR10~WMR27

■ Dimensions



Unit: mm

Type	Size (Inch)	Resistance (mΩ)	L	W	T	A	t
WMR06	1206	1	3.20±0.20	1.65±0.20	0.80±0.15	0.70±0.20	-
		2 - 25	3.20±0.20	1.65±0.20	0.80±0.15	0.60±0.20	-
WMR10	2010	0.5 - 1	5.10±0.20	2.50±0.20	0.80±0.15	1.70±0.20	0.60±0.10
		2 - 200	5.10±0.20	2.50±0.20	0.80±0.15	0.55±0.20	0.60±0.10
WMR12	2512	0.5 - 1	6.40±0.20	3.20±0.20	0.80±0.15	2.30±0.20	-
		1 - 4	6.40±0.20	3.20±0.20	0.80±0.15	1.50±0.20	-
		5 - 50	6.40±0.20	3.20±0.20	0.80±0.15	0.85±0.20	-
WMR25	2725	0.2, 0.25	6.80±0.20	6.50±0.20	1.20±0.10	1.70±0.15	-
		0.5, 1, 2, 2.5	6.80±0.20	6.50±0.20	1.20±0.10	1.20±0.15	-
		3	6.80±0.20	6.50±0.20	1.20±0.10	1.00±0.15	-
WMR28	2728	3 - 50	7.20±0.20	6.80±0.20	1.00±0.10	1.10±0.15	-
WMR27	4527	1 - 100	11.6±0.50	6.60±0.50	2.00±0.20	1.60±0.50	1.60±0.10

■ Standard Electrical Specifications

Item Type	Power Rating	Operating Temp. Range	Material	Resistance Range(mΩ)			TCR (PPM/°C)
				±0.5%	±1%	±5%	
WMR06 (1206)	2W	-55 ~ +170°C	Manganin	-	1		±150
			Kamar	-	2 - 8		±100
			FeCrAl	-	9 - 25		±75
			FeCrAl	-	9 - 25		±50
WMR10 (2010)	2W	-55 ~ +175°C	Manganin	-	0.5 - 1		±175
			Kamar	-	2 - 7		±100
			Kamar	-	8 - 200		±75
WMR12 (2512)	3W	-55 ~ +175°C	Manganin	0.5 - 1			±150
			Manganin	1 - 2			±100
			FeCrAl	3 - 4			±50
			FeCrAl	5 - 50			±25
			Kamar	5 - 50			±50
WMR25 (2725)	4W	-55 ~ +175°C	Manganin	-	0.2, 0.25, 0.5		±200
			FeCrAl	-	1, 2, 2.5, 3		±25
WMR28 (2728)	5W	-55 ~ +175°C	FeCrAl	3 - 50			±50
WMR27 (4527)	9W	-55 ~ +175°C	Manganin	-	1 - 5		±75
			Kamar	-	6		±75
			Kamar	-	7 - 100		±50

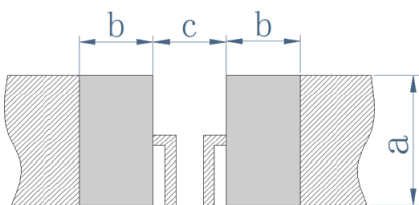
Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	Within the specified value	Measured value -55°C and +125°C, reference value +20°C
Solderability	No visible damage, weldable area 95% minimum	245°C for 3 seconds
Short time overload	No visible damage, $\Delta R \pm 0.5\%$ maximum	2.5 times rated voltage, 5 sec
Resistance to solder heat	No visible damage, $\Delta R \pm 0.5\%$ maximum	270°C for 10 sec
Bending Strength	Within the specified value	Bending amplitude 2 mm for 60 seconds
Flammability	No ignition of the tissue paper or scorching or the pinewood board	V-0 or V-1 are acceptable. Electrical test not required
Insulation Resistance	>1000M Ω	Apply 100VDC for 1 minute
Dielectric Withstand Voltage	No breakdown or arcing	Apply 100VAC for 1 minute
Resistance to solvents	Marking Unsmearred	IPA, 23°C, 10 hrs
High temperature and humidity	No visible damage, $\Delta R \pm 1.0\%$ maximum	temperature 85°C, humidity 85% of the conditions applied 10% of the rated power (current) or component limit current (whichever is less), for 1000 hours
High temperature storage	No visible damage, $\Delta R \pm 1.0\%$ maximum	1000 hrs @ 170°C, without load
Low temperature load	No visible damage, $\Delta R \pm 0.5\%$ maximum	-55°C, No load for one hour, rated voltage load for 45 min, no load for 15 min
Temperature cycling	No visible damage, $\Delta R \pm 0.5\%$ maximum	-55°C @ 30 min ~ room temperature @ <5 min ~ +155°C @ 30 min, 500 cycles
Load life	No visible damage, $\Delta R \pm 1.0\%$ maximum	1000 h @ 70°C, rated current or component limit current (whichever is less), 90 min on, 30 min off

Reference Standards: IEC 60115-1, UL-94; MIL-STD-202

Storage Temperature: 15~28°C; Humidity < 80%RH

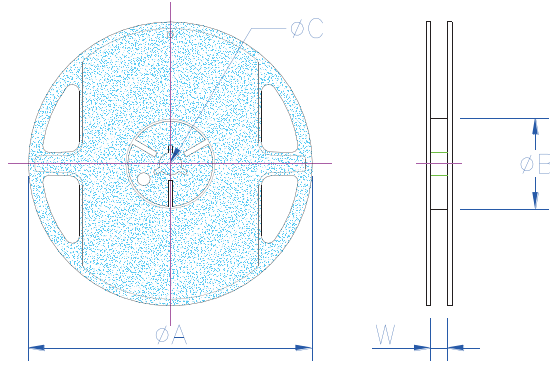
Recommend Land Pattern



Type	Resistance (m Ω)	a (mm)	b (mm)	c (mm)
WMR06	1 – 25	1.78	1.27	1.4
WMR10	0.5 – 1	3.0	2.4	1.4
	2 – 200	3.0	1.6	3.0
WMR12	0.5 – 1	3.7	3.0	1.3
	1 – 4	3.7	2.3	2.8
WMR25	5 – 50	3.7	1.9	3.6
	0.2 – 0.25	6.86	3.18	1.32
	0.5 – 3	6.86	2.28	3.12
WMR28	3 – 50	7.82	2.75	3.51
WMR27	1 – 100	8.7	3.4	8.0

■ Packaging

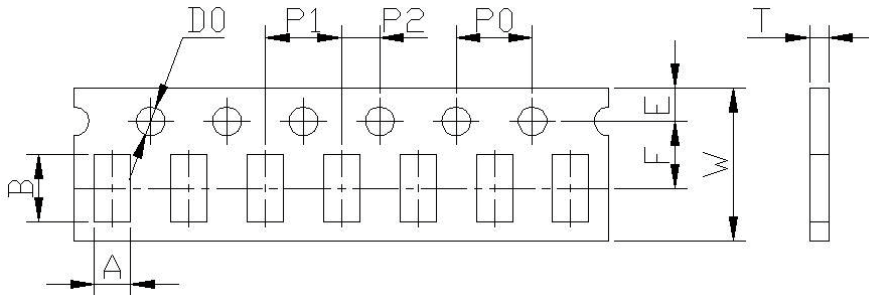
Reel Specifications & Packaging Quantity



Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W
WMR06	Embossed 5K	8mm	7 inch	178.0±2.0	60.0±1.0	13.5±0.5	8.3±0.5
WMR10	Embossed 4K	12mm	7 inch	178.0±2.0	60.0±1.0	13.5±0.5	12.3±0.5
WMR12	Embossed 4K	12mm	7 inch	178.0±2.0	60.0±1.0	13.5±0.5	12.3±0.5
WMR25	Embossed 1K	12mm	7 inch	178.0±2.0	60.0±1.0	13.5±0.5	12.0±0.3
WMR28	Embossed 1K	12mm	7 inch	178.0±2.0	60.0±1.0	13.5±0.5	12.0±0.3
WMR27	Embossed 0.5K	24mm	7 inch	178.0±2.0	60.0±1.0	13.5±0.5	25.0±0.5

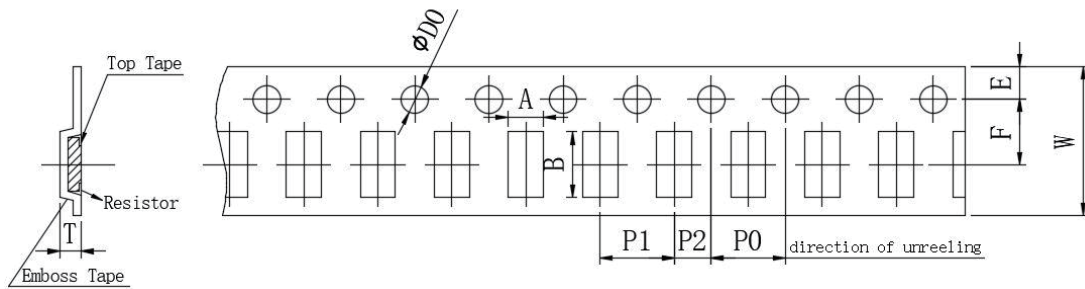
Embossed Plastic Tape Specifications



Unit: mm

Type	A	B	W	E	F	P0	P1	P2	ΦD0	T
WMR06	1.90	3.50	8.00	1.75	3.50	4.00	4.00	2.00	1.50	1.10

Embossed Plastic Tape Specifications

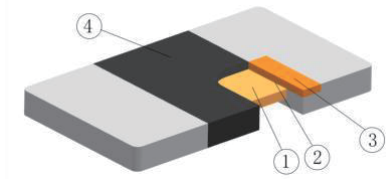
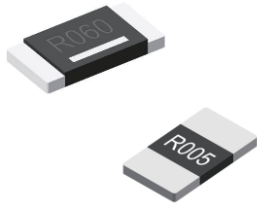


Unit: mm

Type	A	B	W	E	F	P0	P1	P2	ΦD0	T
WMR10	2.80	5.40	12.00	1.75	5.50	4.00	4.00	2.00	1.50	1.20
WMR12	3.50	6.80	12.00	1.75	5.50	4.00	4.00	2.00	1.50	1.20
WMR25	6.80	7.20	12.00	1.75	5.50	4.00	8.00	2.00	1.50	1.50
WMR28	7.70	7.20	12.00	1.75	5.50	4.00	12.00	2.00	1.50	1.45
WMR27	7.40	11.80	24.00	1.75	11.50	4.00	12.00	2.00	1.50	2.30

Molding E-Beam Welded Metal Strip Resistor – WMB Series

Construction

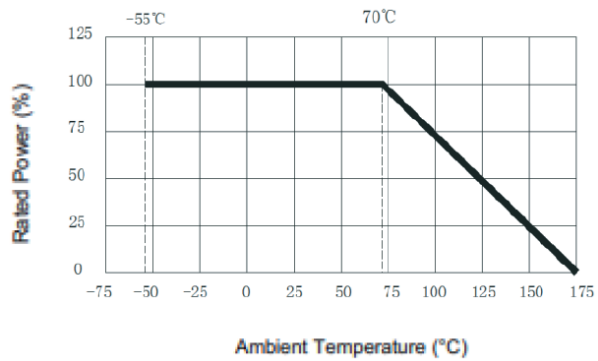


① Alloy Body	③ Alloy Body
② Electron Beam Welding Structure	④ Overcoat

Features

- E-beam welded metal strip resistors, pure copper Electrodes are the ideal solution for current sensing applications
- Excellent reliability, stability, Anti-pulse capability
- Special welding process, all-metal construction, Supports low resistance , High temperature resistant resin molded encapsulation, strong weather resistance
- Low thermal EMF(<1 $\mu\text{V}/^\circ\text{C}$)
- Ultra-low parasitic inductance , fast response, can be used for high frequency AC current detection
- AEC-Q200 Compliance
- RoHS compliant

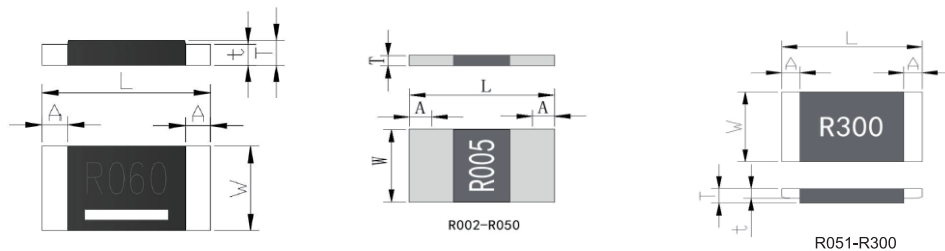
Derating Curve



Part Numbering

WMB	12	F	T	D	S	R050	K
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Material Code
	12: 2512 27: 4527	F: $\pm 1\%$ J: $\pm 5\%$	T: Taping Reel	D: ± 50	S: 2W H: 4W I: 6W	R002: 0.002 Ω R050: 0.05 Ω R100: 0.1 Ω	K: Kamar

Dimensions



2512

4527

Unit: mm

Type	Size (Inch)	Resistance (m Ω)	L	W	A	t	T
WMB12	2512	50 – 300	6.40 \pm 0.20	3.20 \pm 0.20	0.95 \pm 0.20	0.60 \pm 0.20	0.80 \pm 0.15
WMB27	4527	2 – 50	11.50 \pm 0.20	7.20 \pm 0.20	3.50 \pm 0.20	-	1.00 \pm 0.15
		0.5 – 300	11.50 \pm 0.20	7.20 \pm 0.20	1.50 \pm 0.20	1.00 \pm 0.15	1.50 \pm 0.15

Standard Electrical Specifications

Item Type	Power Rating	Operating Temp. Range	Material	Resistance Range(mΩ)		TCR (PPM/°C)
				±1%	±5%	
WMB12 (2512)	2W	-55 ~ +175°C	Kamar	50 – 300		±50
WMB27 (4527)	6W		Kamar	2 - 50		±50
	4W		Kamar	51 - 300		±50

Environmental Characteristics

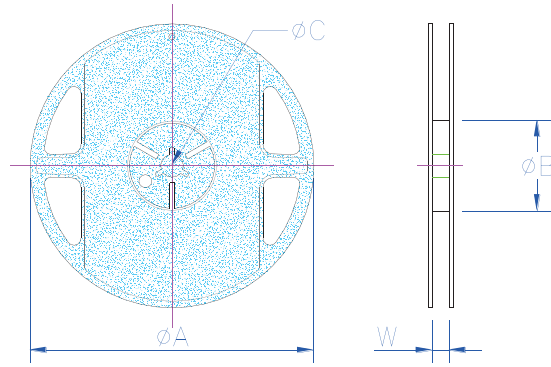
Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	Within the specified value	Measured value -55°C and +130°C, reference value +20°C
Solderability	No visible damage, weldable area 95% minimum	245°C for 3 seconds
Short time overload	No visible damage, ΔR±1.0% maximum	2.5 times rated voltage, 5 sec
Resistance to solder heat	No visible damage, ΔR±1.0% maximum	260°C for 10 sec
Bending Strength	Within the specified value	Bending amplitude 2 mm for 60 seconds
Flammability	No ignition of the tissue paper or scorching or the pinewood board	V-0 or V-1 are acceptable. Electrical test not required
Insulation Resistance	>1000MΩ	Apply a DC voltage of 100V between the electrode and the substrate, keep it for 60 seconds, and then measure the insulation resistance value
Dielectric Withstand Voltage	No breakdown or arcing	Apply an AC voltage with an effective value of the maximum load voltage between the electrode and the substrate at a speed of about 100V/s, and keep it for 60 seconds
Resistance to solvents	Marking Unsmearred	IPA, 23°C , 10 hrs
High temperature storage	No visible damage, ΔR±1.0% maximum	1000 hrs @ 125°C, without load
Low temperature load	No visible damage, ΔR±1.0% maximum	-55°C, No load for one hour, rated voltage load for 45 min, no load for 15 min
Temperature cycling	No visible damage, ΔR1.0% maximum	-55°C @ 30 min ~ room temperature @ <5 min ~ +125°C @ 30 min, 500 cycles
Load life	No visible damage, ΔR±1.0% maximum	1000 h @ 70±2°C, rated current or component limiting current (whichever is smaller), 90 min on, 30 min off

Reference Standards: IEC 60115-1, UL-94; MIL-STD-202

Storage Temperature: 15~28°C; Humidity < 80%RH

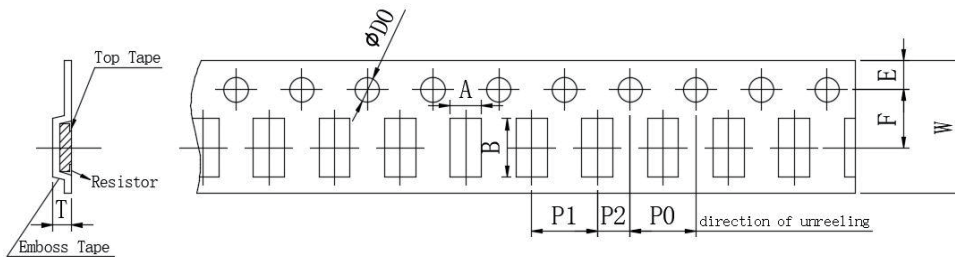
Packaging

Reel Specifications & Packaging Quantity



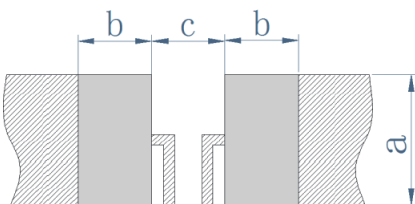
Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA (mm)	ΦB (mm)	ΦC (mm)	W (mm)
WMB12	Embossed 4K	12mm	7 inch	178.0±2.0	60.0±1.0	13.5±0.5	12.3±0.5
WMB27 (R002-R050)	Embossed 1K	25mm	7 inch	178.0±2.0	60.0±1.0	13.5±0.5	25.0±0.5
(R051-R300)	Embossed 0.5K	25mm	7 inch	178.0±2.0	60.0±1.0	13.5±0.5	25.0±0.5

Embossed Plastic Tape Specifications



Type	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P0 (mm)	P1 (mm)	P2 (mm)	ΦD0 (mm)	T (mm)
WMB12	3.50	6.80	12.00	1.75	5.5	4.00	4.00	2.00	1.50	1.20
WMB27 (R002-R050)	7.50	11.80	24.00	1.75	11.5	4.00	12.00	2.00	1.50	1.30
WMB27 (R051-R300)	7.50	11.80	24.00	1.75	11.5	4.00	12.00	2.00	1.50	2.30

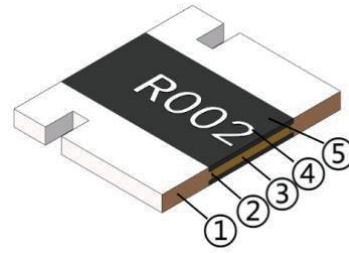
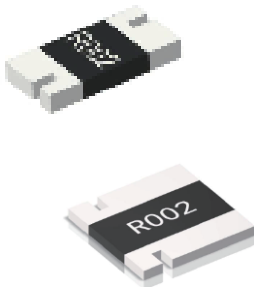
Recommend Land Pattern



Type	a (mm)	b (mm)	c (mm)
WMB12	3.70	1.90	3.60
WMB27 (R002-R050)	8.70	5.00	3.51
WMB27 (R051-R300)	8.70	3.00	7.50

For Terminal Molding E-Beam Welded Metal Strip Resistor – WMK Series

Construction



①	Ni / Sn Plating	④	Marking
②	Electron Beam Welding Structure	⑤	Overcoat
③	Alloy Body		

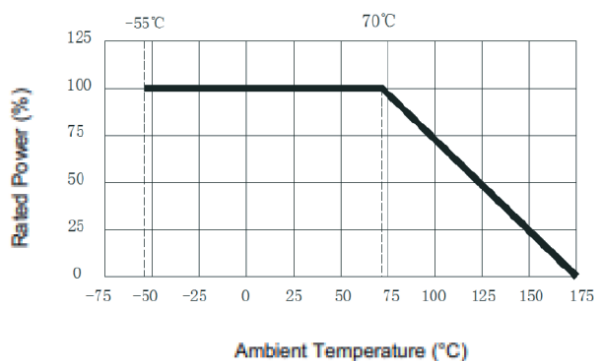
Features

- E-beam welded metal strip resistors, 4-terminal structure, pure copper Electrodes are the ideal solution for current sensing applications
- Excellent reliability, stability, Anti-pulse capability
- Special welding process, all-metal construction, Supports low resistance , High temperature resistant resin molded encapsulation, strong weather resistance
- Low thermal EMF(<math><1 \mu V/^{\circ}C</math>)
- Ultra-low parasitic inductance , fast response, can be used for high frequency AC current detection
- AEC-Q200 Compliance
- RoHS compliant

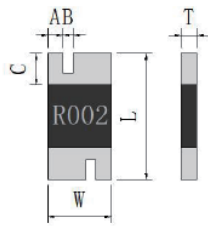
Part Numbering

WMK	12	F	T	E	R	R001	K
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Material Code
	12: 2512 37: 3637	D: $\pm 0.5\%$ F: $\pm 1\%$ J: $\pm 5\%$	T: Taping Reel	C: ± 25 W: ± 75 E: ± 100 K: ± 150	R: 3W	0M50: 0.0005 Ω R001: 0.001 Ω R010: 0.01 Ω	M: Manganin K: Kamar F: FeCrAl

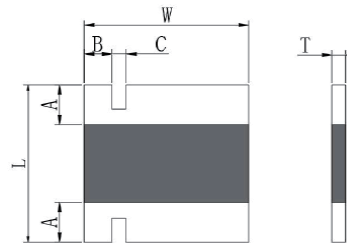
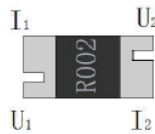
Derating Curve



Dimensions



2512



3637

Unit: mm

Type	Size (Inch)	Resistance (mΩ)	Material	L	W	T	A	B	C
WMK12	2512	0.5	Manganin	6.40±0.20	3.20±0.20	0.80±0.15	0.76±0.25	0.51±0.25	2.30±0.20
		1 – 4	Manganin FeCrAl	6.40±0.20	3.20±0.20	0.80±0.15	0.76±0.25	0.51±0.25	1.50±0.20
		5 – 50	FeCrAl Kamar	6.40±0.20	3.20±0.20	0.80±0.15	0.76±0.25	0.51±0.25	0.85±0.20
WMK37	3637	0.2	Manganin	9.40±0.25	9.10±0.25	1.00±0.15	3.50±0.25	1.60±0.25	0.82±0.25
		0.3	Manganin	9.40±0.25	9.10±0.25	1.00±0.15	3.20±0.25	1.60±0.25	0.82±0.25
		1	Manganin	9.40±0.25	9.10±0.25	1.00±0.15	2.40±0.25	1.60±0.25	0.82±0.25
		2 – 30	Kamar	9.40±0.25	9.10±0.25	1.00±0.15	2.40±0.25	1.60±0.25	0.82±0.25

Standard Electrical Specifications

Item Type	Power Rating	Operating Temp. Range	Material	Resistance Range(mΩ)			TCR (PPM/°C)
				±0.5%	±1%	±5%	
WMK12 (2512)	3W	-55 ~ +175°C	Manganin	0.5			±150
			Manganin FeCrAl	1 - 4			±100
			FeCrAl Kamar	5 - 50			±25
WMK37 (3637)	3W	-55 ~ +175°C	Manganin	0.2, 0.3, 1			±75
			Kamar	2 - 30			±25

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	Within the specified value	Measured value -55°C and +130°C, reference value +20°C
Solderability	No visible damage, weldable area 95% minimum	245°C for 3 seconds
Short time overload	No visible damage, ΔR±1.0% maximum	2.5 times rated voltage, 5 sec
Resistance to solder heat	No visible damage, ΔR±1.0% maximum	270°C for 10 sec
Bending Strength	Within the specified value	Bending amplitude 2 mm for 60 seconds
Flammability	No ignition of the tissue paper or scorching or the pinewood board	V-0 or V-1 are acceptable. Electrical test not required
Insulation Resistance	>1000MΩ	Apply a DC voltage of 100V between the electrode and the substrate, keep it for 60 seconds, and then measure the insulation resistance value
Dielectric Withstand Voltage	No breakdown or arcing	Apply an AC voltage with an effective value of the maximum load voltage between the electrode and the substrate at a speed of about 100V/s, and keep it for 60 seconds
Resistance to solvents	Marking Unsmearred	IPA, 23°C, 10 hrs
High temperature storage	No visible damage, ΔR±1.0% maximum	1000 hrs @ 125°C, without load
Low temperature load	No visible damage, ΔR±0.5% maximum	-55°C, No load for one hour, rated voltage load for 45 min, no load for 15 min
Temperature cycling	No visible damage, ΔR±0.5% maximum	-55°C @ 30 min ~ room temperature @ <5 min ~ +125°C @ 30 min, 500 cycles
Load life	No visible damage, ΔR±1.0% maximum	1000 h @ 70±2°C, rated current or component limiting current (whichever is smaller), 90 min on, 30 min off

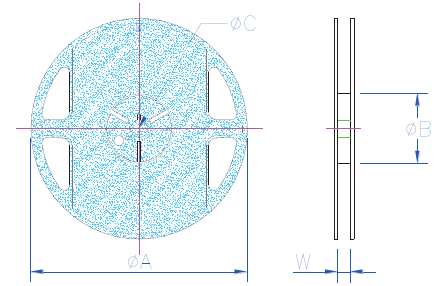
Reference Standards: IEC 60115-1, UL-94; MIL-STD-202

Storage Temperature: 15~28°C; Humidity < 80%RH

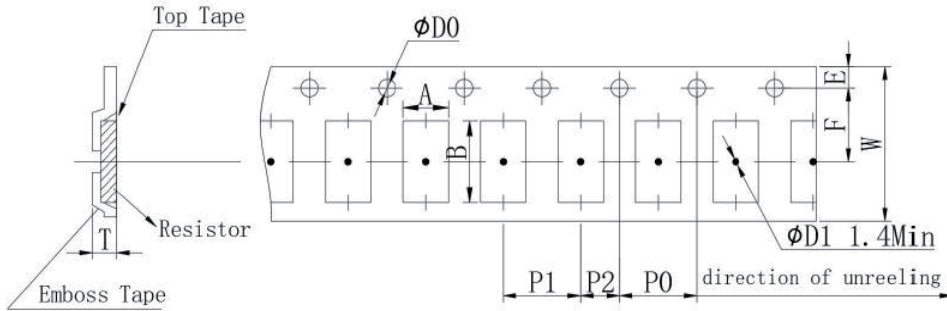
■ Packaging

Reel Specifications & Packaging Quantity

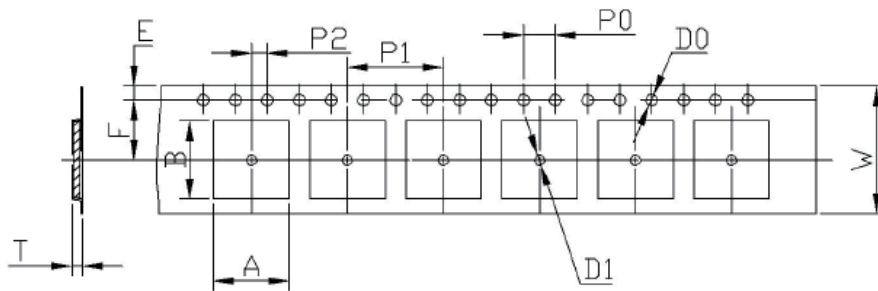
Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA (mm)	ΦB (mm)	ΦC (mm)	W (mm)
WMK12	Embossed 4K	12mm	7 inch	178.0±2.0	60.0±1.0	13.5±0.5	12.3±0.5
WMK37	Embossed 4K	16mm	13 inch	330.0±2.0	60.0±1.0	13.5±0.5	16.3±0.5



Embossed Plastic Tape Specifications

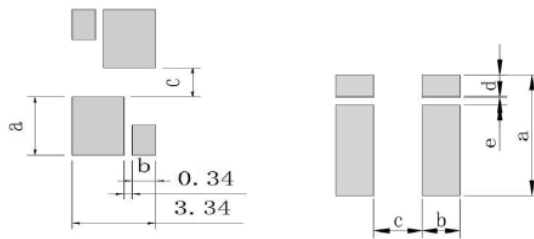


Type	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P0 (mm)	P1 (mm)	P2 (mm)	ΦD0 (mm)	T (mm)
WMK12	3.50	6.80	12.00	1.75	5.5	4.00	4.00	2.00	1.50	1.20



Type	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P0 (mm)	P1 (mm)	P2 (mm)	ΦD0 (mm)	T (mm)
WMK37	9.50	9.80	16.00	1.75	7.50	12.00	12.00	6.00	1.50	1.20

■ Recommend Land Pattern



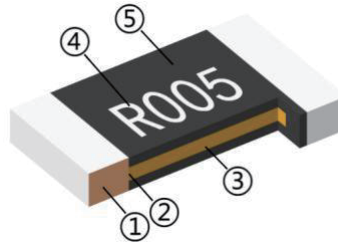
2512

3637

Type	Resistance (mΩ)	a (mm)	b (mm)	c (mm)	d (mm)	e (mm)
WMK12	0.5 – 4	3.30	0.93	1.66	-	-
	5 – 50	2.29	0.93	3.68	-	-
WMK37	0.2 – 0.3	9.90	4.20	1.80	1.80	0.60
	1 – 30	9.90	3.20	4.00	1.80	0.60

Molding E-Beam Welded Metal Strip Resistor – WMP Series

Construction

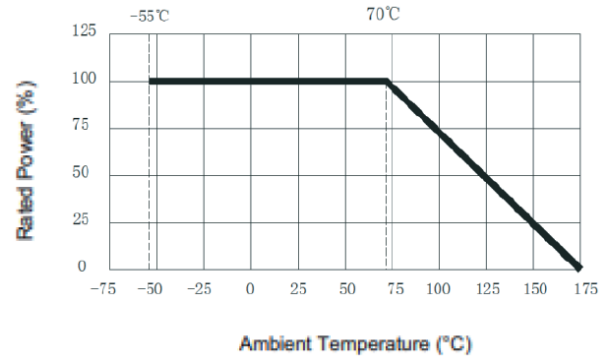


Features

- E-beam welded metal strip resistors, pure copper Electrodes are the ideal solution for current sensing applications
- Excellent reliability, stability, Anti-pulse capability
- Special welding process, all-metal construction, Supports low resistance , High temperature resistant resin molded encapsulation, strong weather resistance
- Low thermal EMF(<1 $\mu\text{V}/^\circ\text{C}$)
- Ultra-low parasitic inductance , fast response, can be used for high frequency AC current detection
- AEC-Q200 Compliance
- RoHS compliant

① Ni / Sn Plating	④ Marking
② Electron Beam Welding Structure	⑤ Overcoat
③ Alloy Body	

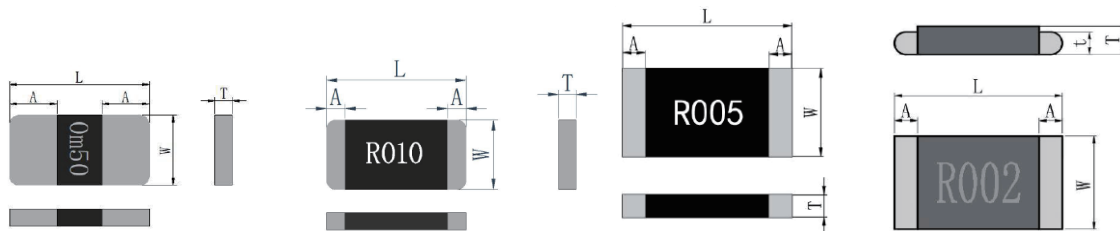
Derating Curve



Part Numbering

WMP	12	F	T	D	R	R003	F
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Material Code
	12: 2512 17: 2817 27: 4527	D: $\pm 0.5\%$ F: $\pm 1\%$ J: $\pm 5\%$	T: Taping Reel	C: ± 25 D: ± 50 W: ± 75 E: ± 100 K: ± 150	R: 3W D: 5W E: 7W 12: 12W	0M50: 0.0005 Ω R001: 0.001 Ω R010: 0.01 Ω	M: Manganin K: Kamar F: FeCrAl

Dimensions



2512

2817

4527

Unit: mm

Type	Size (Inch)	Resistance (m Ω)	Material	L	W	T	A	t
WMP12	2512	0.5	Manganin	6.40 \pm 0.20	3.20 \pm 0.20	0.80 \pm 0.15	2.30 \pm 0.20	-
		1 – 2	Manganin	6.40 \pm 0.20	3.20 \pm 0.20	0.80 \pm 0.15	1.50 \pm 0.20	-
		3 – 4	FeCrAl	6.40 \pm 0.20	3.20 \pm 0.20	0.80 \pm 0.15	1.50 \pm 0.20	-
		5 – 50	FeCrAl Kamar	6.40 \pm 0.20	3.20 \pm 0.20	0.80 \pm 0.15	0.85 \pm 0.20	-
WMP17	2817	1 – 3	Manganin	7.10 \pm 0.20	4.30 \pm 0.20	1.00 \pm 0.15	1.20 \pm 0.20	-
		4 – 100	Kamar	7.10 \pm 0.20	4.30 \pm 0.20	1.00 \pm 0.15	1.20 \pm 0.20	-
WMP27	4527	1 – 6	Manganin	11.60 \pm 0.50	6.60 \pm 0.50	2.00 \pm 0.20	1.60 \pm 0.50	1.60 \pm 0.10
		7 – 100	Kamar	11.60 \pm 0.50	6.60 \pm 0.50	2.00 \pm 0.20	1.60 \pm 0.50	1.60 \pm 0.10

Standard Electrical Specifications

Item Type	Power Rating	Operating Temp. Range	Material	Resistance Range(mΩ)			TCR (PPM/°C)
				±0.5%	±1%	±5%	
WMP12 (2512)	3W	-55 ~ +175°C	Manganin	0.5			±150
			Manganin	1 - 2			±100
			FeCrAl	3 - 4			±50
			FeCrAl	5 - 50			±25
			Kamar	5 - 50			±50
WMP17 (2817)	4W	-55 ~ +175°C	Kamar	-	51 - 100		±50
	7W		Manganin	-	1 - 3		±75
			Kamar	-	4 - 50		±50
WMP27 (4527)	12W	-55 ~ +175°C	Manganin	-	1 - 6		±75
			Kamar	-	7 - 100		±50

Environmental Characteristics

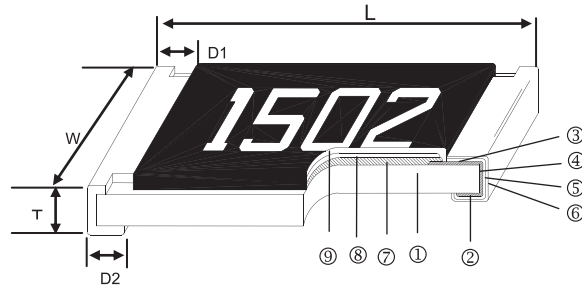
Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	Within the specified value	Measured value -55°C and +125°C, reference value +20°C
Solderability	No visible damage, weldable area 95% minimum	245°C for 3 seconds
Short time overload	No visible damage, ΔR±1.0% maximum	2.5 times rated voltage, 5 sec
Resistance to solder heat	No visible damage, ΔR±1.0% maximum	270°C for 10 sec
Bending Strength	Within the specified value	Bending amplitude 2 mm for 60 seconds
Flammability	No ignition of the tissue paper or scorching or the pinewood board	V-0 or V-1 are acceptable. Electrical test not required
Insulation Resistance	>1000MΩ	Apply a DC voltage of 100V between the electrode and the substrate, keep it for 60 seconds, and then measure the insulation resistance value
Dielectric Withstand Voltage	No breakdown or arcing	Apply an AC voltage with an effective value of the maximum load voltage between the electrode and the substrate at a speed of about 100V/s, and keep it for 60 seconds
Resistance to solvents	Marking Unsmearred	IPA, 23°C , 10 hrs
High temperature storage	No visible damage, ΔR±1.0% maximum	1000 hrs @ 125°C, without load
Low temperature load	No visible damage, ΔR±0.5% maximum	-55°C, No load for one hour, rated voltage load for 45 min, no load for 15 min
Temperature cycling	No visible damage, ΔR±1.0% maximum	-55°C @ 30 min ~ room temperature @ <5 min ~ +125°C @ 30 min, 500 cycles
Load life	No visible damage, ΔR±1.0% maximum	1000 h @ 70°C, rated current or component limiting current (whichever is smaller), 90 min on, 30 min off

Reference Standards: IEC 60115-1, UL-94; MIL-STD-202

Storage Temperature: 15~28°C; Humidity < 80%RH

High Voltage Thick Film Chip Resistor – HVR Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Features

- Highly reliable multilayer electrode construction
- Higher component and equipment reliability
- Excellent performance at high voltage
- Reduced size of final equipment
- IEC 62368-1 & IEC 60950-1 Safety Certificate issued by UL Demko

Applications

- Inverter
- Outdoor Equipments
- Converter
- High Pulse Equipment

Dimensions

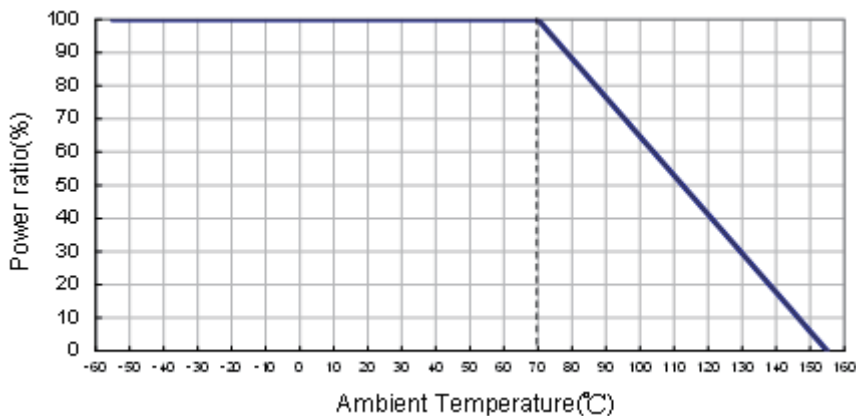
unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
HVR02	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10	0.620
HVR03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	2.042
HVR05	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	4.368
HVR06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	8.947
HVR0A	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20	24.241
HVR12	2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.25	0.50±0.20	39.448

Part Numbering

HVR	03	F	T	E	X	1003
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance
	02: 0402 03: 0603 05: 0805 06: 1206 0A: 2010 12: 2512	F: ±1% J: ±5%	T: 7" Taping Reel V: 10" Taping Reel W: 13" Taping Reel	E: ±100 F: ±200 H: ±400	Y: 1/16W X: 1/10W W: 1/8W V: 1/4W U: 1/2W T: 1W	1003: 100KΩ 1004: 1MΩ 1005: 10MΩ

Derating Curve



Standard Electrical Specifications

Type	Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range		TCR (PPM/°C)
						±1% (E24 - E96)	±5% (E24)	
HVR02 (0402)	1/16W		-55 ~ +155°C	100V	200V	39KΩ - 1MΩ		±100
						1.02MΩ - 10MΩ	1.1MΩ - 20MΩ	±200
						-	22MΩ - 100MΩ	±400
HVR03 (0603)	1/10W		-55 ~ +155°C	200V	400V	56KΩ - 1MΩ		±100
						1.02MΩ - 10MΩ	1.1MΩ - 20MΩ	±200
						-	22MΩ - 100MΩ	±400
HVR05 (0805)	1/8W		-55 ~ +155°C	400V	800V	100KΩ - 1MΩ		±100
						1.02MΩ - 10MΩ	1.1MΩ - 20MΩ	±200
						-	22MΩ - 100MΩ	±400
HVR06 (1206)	1/4W		-55 ~ +155°C	500V	1000V	100KΩ - 1MΩ		±100
						1.02MΩ - 10MΩ	1.1MΩ - 20MΩ	±200
						-	22MΩ - 100MΩ	±400
HVR0A (2010)	1/2W		-55 ~ +155°C	2000V	3000V	51KΩ - 1MΩ		±100
						1.02MΩ - 20MΩ	1.1MΩ - 20MΩ	±200
						-	22MΩ - 100MΩ	±400
HVR12 (2512)	1W		-55 ~ +155°C	3000V	4000V	30KΩ - 1MΩ		±100
						1.02MΩ - 20MΩ	1.1MΩ - 20MΩ	±200
						-	22MΩ - 100MΩ	±400

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

IEC 62368-1 & IEC 60950-1 Safety Certificate Scope

Scope	Size	HVR02	HVR03	HVR05	HVR06	HVR0A	HVR12
G.10.2 (2.5KV impulse test)		10M~100M	10M~100M	100K~100M	470K~100M	51K~100M	30K~100M
G.10.3.2 (10KV surge)				10M~100M			
G.10.3.3 (5KV impulse)				100K~100M			

Environmental Characteristics

Item	Requirement		Test Method
	±1%	±5%	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.		At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G		Max. Overload Voltage for 1 minute
Endurance	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat with Load	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Dry Heat	±(1.0%+0.05Ω)	±(1.5%+0.10Ω)	at +155°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm

Item	Requirement		Test Method
	±1%	±5%	
Solderability	95% min. coverage		245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover		HVR02: 150V for 1 minute HVR03: 300V for 1 minute HVR05/HVR06/HVR0A/HVR12: 500V for 1 minute
Leaching	Individual leaching area ≤ 5% Total leaching area ≤ 10%		260±5°C for 30 seconds
Rapid Change of Temperature	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	-55°C to +155°C, 5 cycles

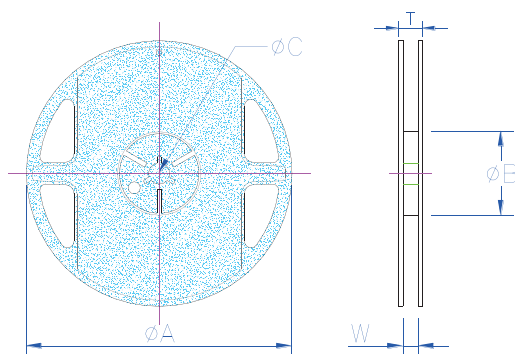
RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1

■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date

■ Packaging



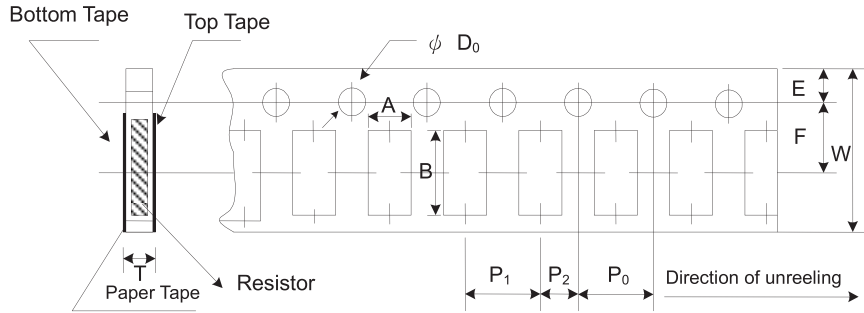
Reel Specifications & Packaging Quantity

Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T	
HVR02	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		20K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		40K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
HVR03 HVR05 HVR06	Paper	5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		10K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		20K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
HVR0A HVR12	Embossed	4K	12mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.5	13.0±0.5	15.5±0.5
		8K	12mm	10 inch	250±1.0	62±0.5	13.0±0.5	12.5±0.5	16.5±0.5

Packaging

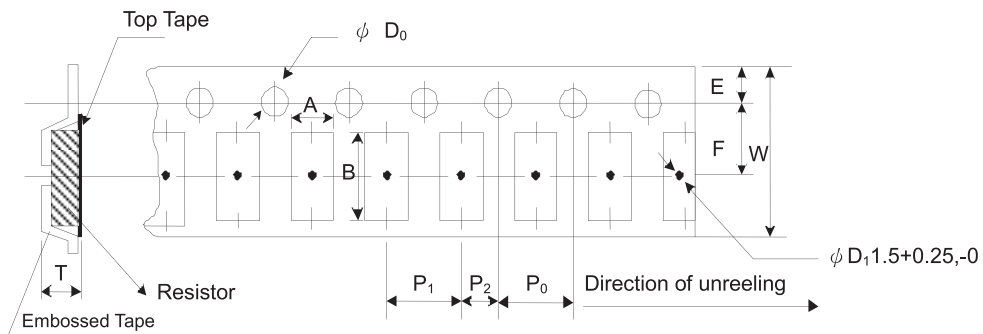
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
HVR02	0.65±0.10	1.15±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.10
HVR03	1.10±0.10	1.90±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.10
HVR05	1.60±0.10	2.40±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
HVR06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Embossed Plastic Tape Specifications

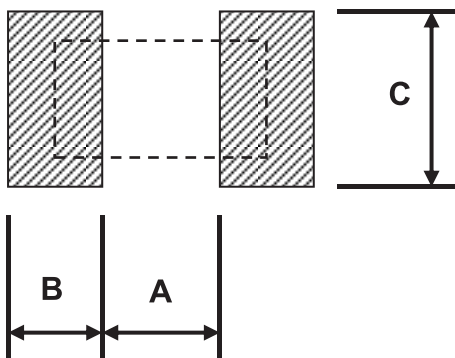


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
HVR0A	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰
HVR12	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰

Recommend Land Pattern

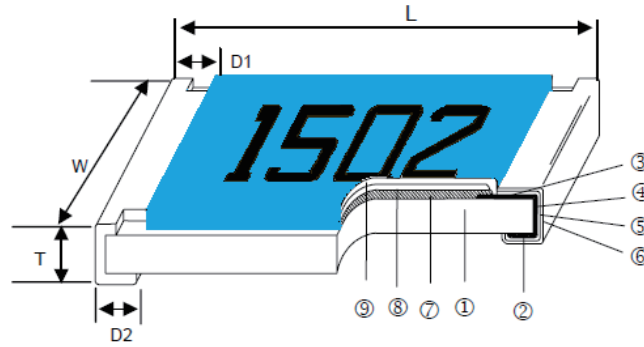
Unit: mm



Type	A	B	C
HVR02	0.50	0.45	0.60
HVR03	0.90	0.60	0.90
HVR05	1.20	0.70	1.30
HVR06	2.00	0.90	1.60
HVR0A	3.80	0.90	2.80
HVR12	4.90	1.60	3.50

Green Thick Film Chip Resistor – CRG Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Features

- Green Resistor without RoHS exemptions
- Highly reliable multilayer electrode construction
- Compatible with all soldering process

Dimensions

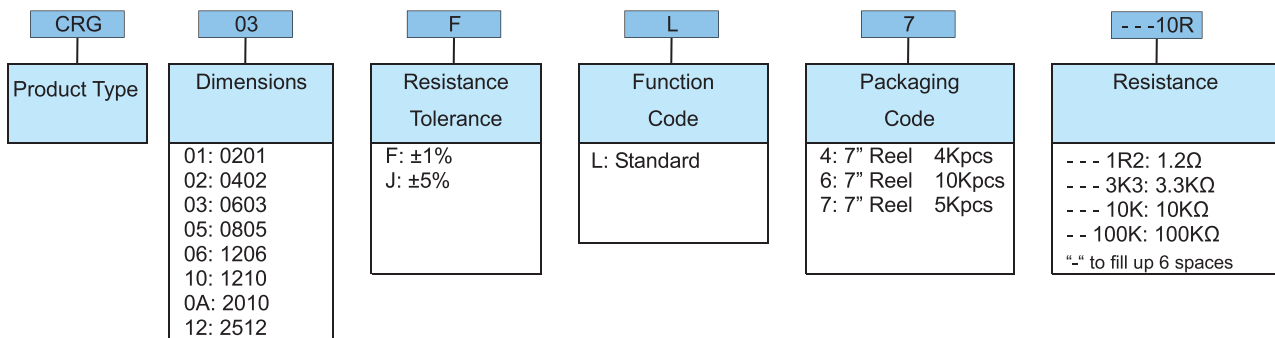
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
CRG01	0201	0.60±0.03	0.30±0.03	0.23±0.03	0.15±0.05	0.15±0.05	0.15
CRG02	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10	0.6
CRG03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	2
CRG05	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	4.3
CRG06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	8.9
CRG10	1210	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.25	0.50±0.20	16
CRG0A	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20	24
CRG12	2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.25	0.50±0.20	39

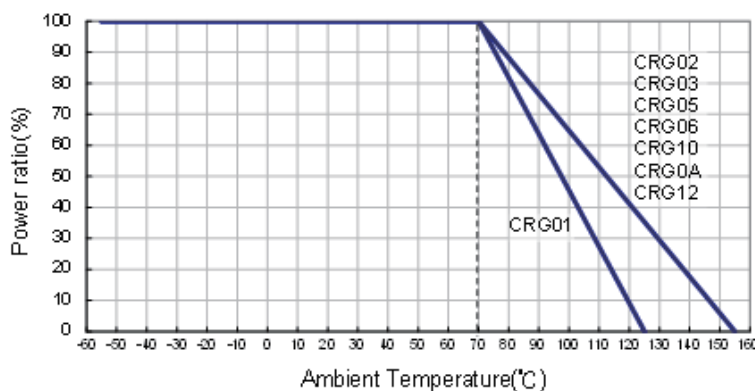
Applications

- Telecommunication Equipments
- Radio and Tape Recorders, TV Tuners
- Digital Cameras, Watches, Pocket Calculators
- Computers, Instruments
- Medical Equipment

Part Numbering



Derating Curve



Standard Electrical Specifications

Type	Item	Power Rating at 70°C Jumper Rated Current	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range		TCR (PPM/°C)
						±1%(E24、E96)	±5%(E24)	
CRG01 (0201)	1/20W	Jumper: 1A	-55 ~ +125°C	25V	50V	1Ω - 4.3MΩ		±200
	-					0Ω (<50mΩ)	-	
CRG02 (0402)	1/16W	Jumper: 1A	-55 ~ +155°C	50V	100V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200
	-					0Ω (<50mΩ)	-	
CRG03 (0603)	1/10W	Jumper: 1A	-55 ~ +155°C	75V	150V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200
	-					0Ω (<50mΩ)	-	
CRG05 (0805)	1/8W	Jumper: 2A	-55 ~ +155°C	150V	300V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200
	-					0Ω (<50mΩ)	-	
CRG06 (1206)	1/4W	Jumper: 2A	-55 ~ +155°C	200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200
	-					0Ω (<50mΩ)	-	
CRG10 (1210)	1/3W	Jumper: 2.5A	-55 ~ +155°C	200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200
	-					0Ω (<50mΩ)	-	
CRG0A (2010)	3/4W	Jumper: 3.5A	-55 ~ +155°C	200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200
	-					0Ω (<50mΩ)	-	
CRG12 (2512)	1W	Jumper: 4A	-55 ~ +155°C	250V	500V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200
	-					0Ω (<50mΩ)	-	

Operating Voltage= $\sqrt{(P \cdot R)}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{(P \cdot R)}$ or Max. Overload Voltage listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement			Test Method
	±1% and Below	±5%	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.			At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	<50mΩ	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds, 2 seconds for high power series
Insulation Resistance	≥10G			Max. Overload Voltage for 1 minute
Endurance	±(1.0%+0.10Ω)	±(2.0%+0.10Ω)	<100mΩ	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat with Load	±(1.0%+0.10Ω)	±(2.0%+0.10Ω)	<100mΩ	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Dry Heat	±(1.0%+0.05Ω)	±(1.5%+0.10Ω)	<50mΩ	at +125°C /+155°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage			245±5°C for 3 seconds

Item	Requirement			Test Method
	±1% and Below	±5%	Jumper	
Resistance to Soldering Heat	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover			1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤5% Total leaching area ≤ 10%			260±5°C for 30 seconds
Rapid Change of Temperature	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	-55°C to +125°C /+155°C, 5 cycles

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

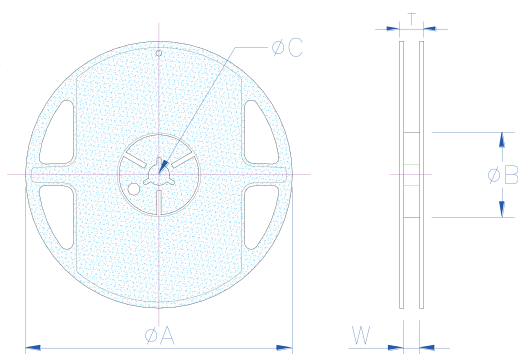
■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1

■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date

■ Packaging

Reel Specifications & Packaging Quantity

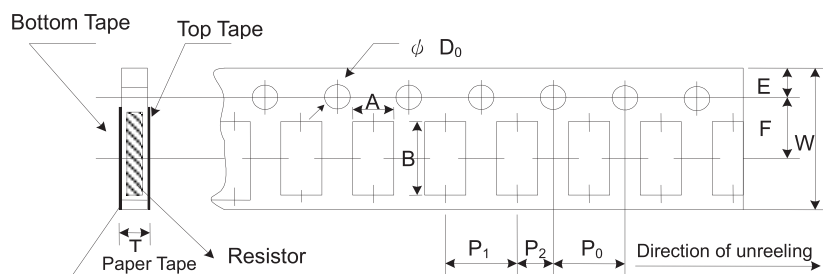


Unit: mm

Type	Packaging Quantity		Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T
CRG01 CRG02	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
CRG03 CRG05 CRG06 CRG10	Paper	5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
CRG0A CRG12	Embossed	4K	12mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.5	13.0±0.5	15.5±0.5

■ Packaging

Paper Tape Specifications

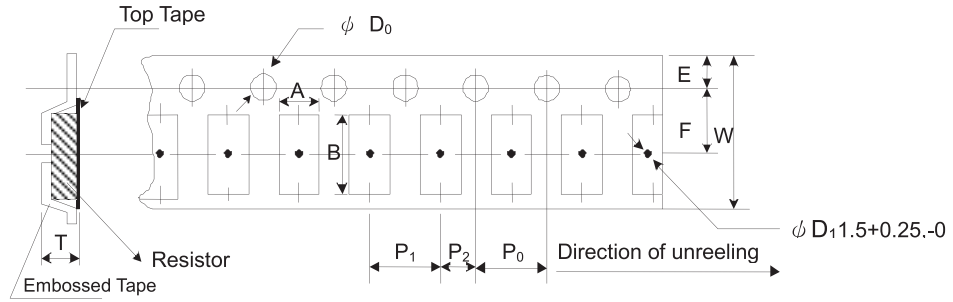


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CRG01	0.38±0.05	0.68±0.05	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.42±0.20
CRG02	0.65±0.10	1.15±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.10
CRG03	1.10±0.10	1.90±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.10
CRG05	1.60±0.10	2.40±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CRG06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CRG10	2.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

■ Packaging

Embossed Plastic Tape Specifications

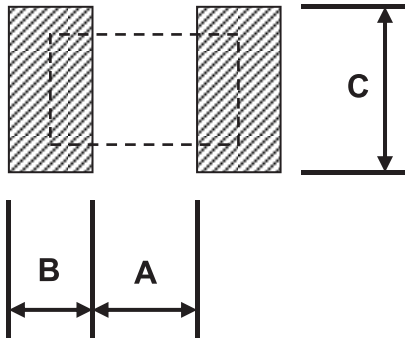


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CRG0A	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1, -0	1.2 ⁺⁰
CRG12	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1, -0	1.2 ⁺⁰

■ Recommend Land Pattern

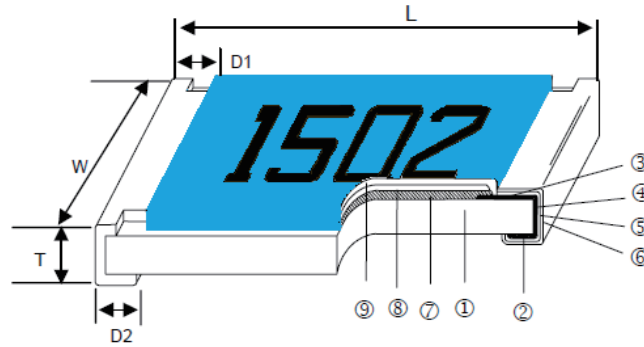
Unit: mm



Type	A	B	C
CRG01	0.30	0.25	0.30
CRG02	0.50	0.45	0.60
CRG03	0.90	0.60	0.90
CRG05	1.20	0.70	1.30
CRG06	2.00	0.90	1.60
CRG10	2.00	0.90	2.80
CRG0A	3.80	0.90	2.80
CRG12	4.90	1.60	3.50

Green Anti-Sulfurated Thick Film Chip Resistor – ASG Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Features

- Special construction to prevent sulfuration in a sulfur containing environment
- Total Lead(Pb)-free without RoHS exemptions

Applications

- High-end Computer
- Industrial Equipment
- Automatic Equipment Controller
- Medical Equipment
- High-end Multimedia Electronics
- Outdoor Electronic Applications

Dimensions

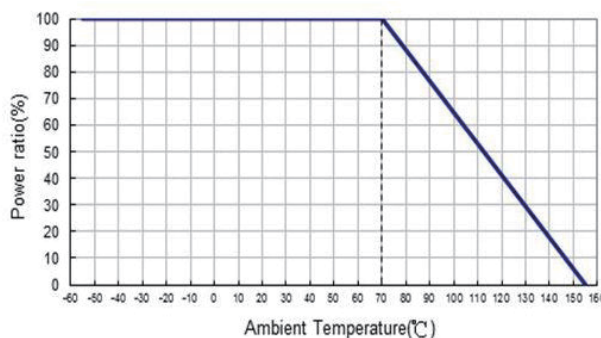
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
ASG02	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10	0.62
ASG03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	2.04
ASG05	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	4.36
ASG06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	8.9
ASG10	1210	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.25	0.50±0.20	15.9
ASG0A	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20	24.2
ASG12	2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.25	0.50±0.20	39.4

Part Numbering

ASG	06	F	T	E	V	1002
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance
	02: 0402 03: 0603 05: 0805 06: 1206 10: 1210 0A: 2010 12: 2512	D: ±0.5% F: ±1% J: ±5%	T: 7" Taping Reel V: 10" Taping Reel W: 13" Taping Reel	E: ±100 F: ±200 - : No Specified	Y: 1/16W X: 1/10W W: 1/8W V: 1/4W O: 1/3W U: 1/2W Q: 3/4W T: 1W A: 1.5W	R0R0: 0Ω 0010: 1Ω 1000: 100Ω 1002: 10KΩ 2201: 2.2KΩ 1003: 100KΩ 1004: 1MΩ

Derating Curve



Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±0.5% (E24 · E96)	±1% (E24 · E96)	±5% (E24)	
ASG02 (0402)	1/16W	-55 ~ +155°C	50V	100V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ			±200 ±100 ±200
	Jumper: 1A				—		0Ω(<50mΩ)	—
ASG03 (0603)	1/10W		75V	150V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ			±200 ±100 ±200
	Jumper: 1A				—		0Ω(<50mΩ)	—
ASG05 (0805)	1/8W		150V	300V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ			±200 ±100 ±200
	Jumper: 2A				—		0Ω(<50mΩ)	—
ASG06 (1206)	1/4W		200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ			±200 ±100 ±200
	Jumper: 2A				—		0Ω(<50mΩ)	—
ASG10 (1210)	1/3W		200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ			±200 ±100 ±200
	Jumper: 2.5A				—		0Ω(<50mΩ)	—
ASG0A (2010)	3/4W		200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ			±200 ±100 ±200
	Jumper: 3.5A				—		0Ω(<50mΩ)	—
ASG12 (2512)	1W	250V	500V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ			±200 ±100 ±200	
	Jumper: 4A			—		0Ω(<50mΩ)	—	

High Power Rating Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±0.5% (E24 · E96)	±1% (E24 · E96)	±5% (E24)	
ASG02 (0402)	1/10W	-55 ~ +155°C	50V	100V	-	1Ω - 9.76Ω		±200
					10Ω - 1MΩ			±100
ASG03 (0603)	1/4W		75V	150V	-	1Ω - 9.76Ω		±200
					10Ω - 1MΩ			±100
ASG05 (0805)	1/3W		150V	300V	-	1Ω - 9.76Ω		±200
					10Ω - 1MΩ			±100
ASG06 (1206)	1/2W		200V	400V	-	1Ω - 9.76Ω		±200
					10Ω - 1MΩ			±100
ASG10 (1210)	3/4W	200V	400V	-	1Ω - 9.76Ω		±200	
				10Ω - 1MΩ			±100	
ASG0A (2010)	1W	200V	400V	-	1Ω - 9.76Ω		±200	
				10Ω - 1MΩ			±100	
ASG12(2512)	1.5W	250V	500V	-	1Ω - 9.76Ω		±200	
				10Ω - 1MΩ			±100	

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

The power rating depends on the maximum temperature of the resistive element. Due to the power dissipation of the resistor, the temperature of the resistive element will rise depending on the condition of heat dissipation from PCB. The maximum power rating in application only applies if the temperature of the resistive element is not exceed 125 °C.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement			Test Method
	±1% and Below	±5%	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.			At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	<50mΩ	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds, 2 seconds for high power series
Insulation Resistance	≥10G			Max. Overload Voltage for 1 minute
Endurance	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	<100mΩ	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat with Load	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	<100mΩ	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Dry Heat	±(1.0%+0.05Ω)	±(1.5%+0.10Ω)	<50mΩ	at +155°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage			245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover			1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤5% Total leaching area ≤ 10%			260±5°C for 30 seconds
Rapid Change of Temperature	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	-55°C to +155°C, 5 cycles
Sulfur Test	±(0.5%+0.05Ω)	±(0.5%+0.05Ω)	<50mΩ	H2S, 50±2°C, 91~93% R.H., no power rating for 1000 hrs

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC60115-1, 60068-2-58; JIS-C 5201-1; ASTM-B-809

■ Storage Temperature: 15~28°C; Humidity < 80%RH

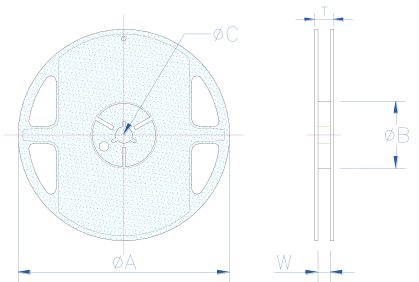
■ Shelf Life: 2 years from production date

Packaging

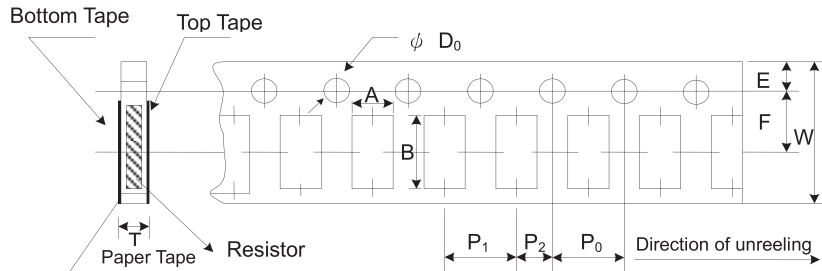
Reel Specifications & Packaging Quantity

Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T
ASG02	Paper	10K	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		20K	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		40K	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
ASG03	Paper	5K	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
ASG05		10K	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
ASG06		20K	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
ASG10	Embossed	4K	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.5	13.0±0.5	15.5±0.5
ASG12		8K	10 inch	250±1.0	62±0.5	13.0±0.5	12.5±0.5	16.5±0.5



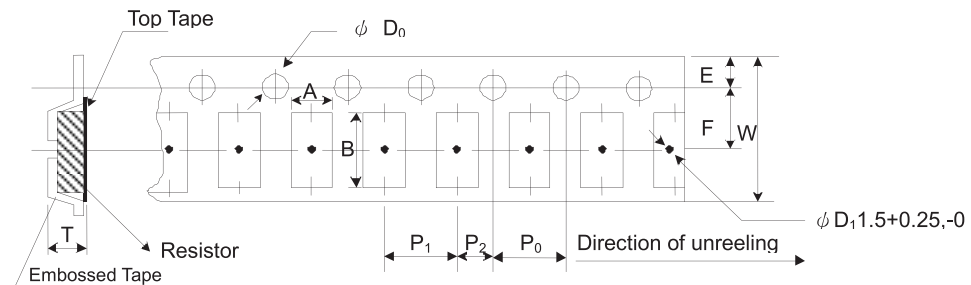
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
ASG02	0.65±0.10	1.15±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.10
ASG03	1.10±0.10	1.90±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.10
ASG05	1.60±0.10	2.40±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
ASG06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
ASG10	2.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Embossed Plastic Tape Specifications

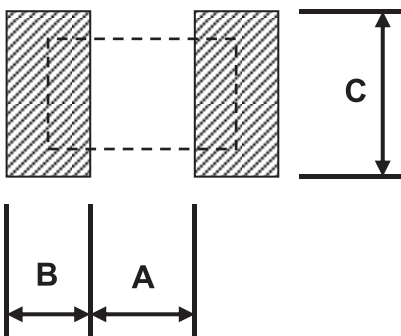


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
ASG0A	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰
ASG12	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰

Recommend Land Pattern

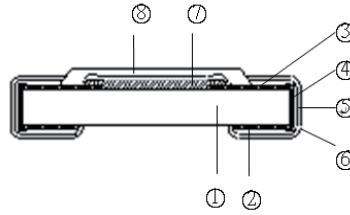
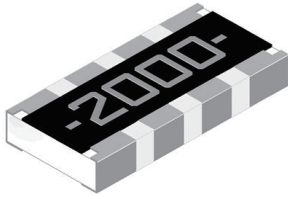
Unit: mm



Type	A	B	C
ASG02	0.50	0.45	0.60
ASG03	0.90	0.60	0.90
ASG05	1.20	0.70	1.30
ASG06	2.00	0.90	1.60
ASG10	2.00	0.90	2.80
ASG0A	3.80	0.90	2.80
ASG12	4.90	1.60	3.50

Thin Film Array Chip Resistor – TFAN Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Overcoat
③ Top Electrode	⑥ External Electrode	

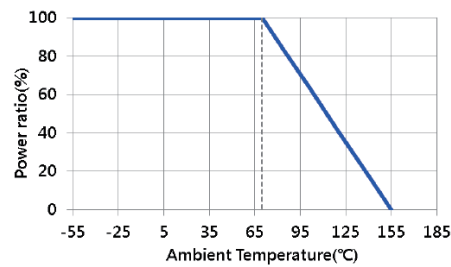
Features

- Advanced thin film technology
- Very tight tolerance down to $\pm 0.05\%$
- Extremely low TCR down to $\pm 5\text{PPM}/^\circ\text{C}$
- TCR tracking down to 5ppm ($\pm 2.5\text{ppm}$) and Tolerance matching down to 0.1% ($\pm 0.05\%$)
- RoHS compliant component, compatible With lead (Pb)-free

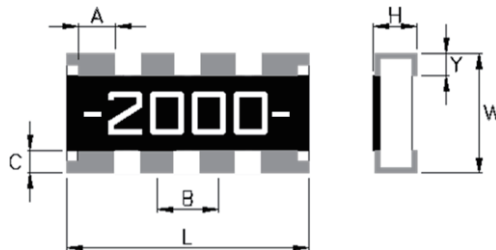
Applications

- Voltage divider
- Feedback circuits
- Signal conditioning

Derating Curve



Dimensions



Unit:mm

Type	Number of Resistors	L	W	H	A	B	C	Y
TFAN43	4	3.20 \pm 0.15	1.60 \pm 0.15	0.55 \pm 0.10	0.50 \pm 0.15	0.80 \pm 0.05	0.25 \pm 0.15	0.30 \pm 0.15

Part Numbering

TFAN	43	B0	T	C0	Y	1001	N
Product Type	Dimensions	Tolerance Grade	Packaging Code	TCR Grade	Power Rating	Resistance	Marking Code
	0603X4	Reference Tolerance Grade Table	T: Taping Reel B: Bulk	Reference TCR Grade Table	Y:1/16W X:1/10W	1000: 100 Ω 1001: 1K Ω 1211: 1.21K Ω 3323:332K Ω	: Standard Marking for E96 N: No Marking

Accuracy Grade Table							
Tolerance Grade				TCR Grade			
Code	Absolute Tolerance	Tolerance Matching	Resistance Value	Code	Absolute TCR	TCR Tracking	Resistance Value
A0	±0.05%	N/A	24.9~332K	S0	±5ppm	N/A	24.9~60K
B0	±0.1%	N/A	24.9~332K	S5	±5ppm	5ppm	24.9~60K
B3	±0.1%	0.1%	24.9~332K	B0	±10ppm	N/A	24.9~332K
C0	±0.25%	N/A	24.9~332K	B4	±10ppm	10ppm	24.9~332K
C2	±0.25%	0.25%	24.9~332K	B5	±10ppm	5ppm	24.9~60K
C3	±0.25%	0.1%	24.9~332K	N0	±15ppm	N/A	24.9~332K
D0	±0.5%	N/A	24.9~332K	N3	±15ppm	15ppm	24.9~332K
D1	±0.5%	0.5%	24.9~332K	N4	±15ppm	10ppm	24.9~332K
D2	±0.5%	0.25%	24.9~332K	N5	±15ppm	5ppm	24.9~60K
F0	±1%	N/A	24.9~332K	C0	±25ppm	N/A	24.9~332K
F1	±1%	0.5%	24.9~332K	C2	±25ppm	25ppm	24.9~332K
F2	±1%	0.25%	24.9~332K	C3	±25ppm	15ppm	24.9~332K
				C4	±25ppm	10ppm	24.9~332K
				D0	±50ppm	N/A	24.9~332K
				D1	±50ppm	50ppm	24.9~332K
				D2	±50ppm	25ppm	24.9~332K

Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range					TCR (PPM/°C)
					±0.05%	±0.1%	±0.25%	±0.5%	±1%	
TFAN 43	1/16W	-55 ~ +155°C	50V	100V	24.9Ω~332KΩ					±10
	1/10W	-55 ~ +155°C	75V	150V						±15
	1/8W	-55 ~ +155°C	75V	150V	24.9Ω~332KΩ					±25
	1/16W	-55 ~ +155°C	50V	100V						±50
	1/10W	-55 ~ +155°C	75V	150V	24.9Ω~60KΩ					±5

Operating Voltage= $\sqrt{P \cdot R}$ or Max. operating voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. overload voltage listed above, whichever is lower.

Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	+25/-55/+25/+125/+25°C
Short Time Overload	$\Delta R \pm 0.1\%$	RCWV*2.5 or Max. overload voltage whichever is lower for 5 seconds
Insulation Resistance	>1000 MΩ	Apply 100V _{DC} for 1 minute
Endurance	1000Hr : $\Delta R \pm 0.15\%$ 8000Hr : $\Delta R \pm 0.3\%$	70±2°C, RCWV with 1.5 hrs "ON" and 0.5 hrs "OFF"
Damp Heat with Load	$\Delta R \pm 0.25\%$	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Damp Heat with Load(85°C/85% R.H)	$\Delta R \pm 0.5\%$	85±2°C, 80~90% R.H. 10% of RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Dry Heat	1000Hr : $\Delta R \pm 0.25\%$ 8000Hr : $\Delta R \pm 0.5\%$	At +125°C
Bending Strength	$\Delta R \pm 0.2\%$	Bending amplitude 3 mm for 10 seconds
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	$\Delta R \pm 0.2\%$	260±5°C for 10 seconds
Dielectric Withstand Voltage	100V	Max. overload voltage for 1 minute
Thermal Shock	$\Delta R \pm 0.25\%$	-55°C ~150°C, 100 cycles
Low Temperature Operation	$\Delta R \pm 0.25\%$	1 hour, -65°C, followed by 45 minutes of RCWV

RCWV(Rated continuous working voltage)= $\sqrt{P \cdot R}$ or Max. Operating voltage whichever is lower

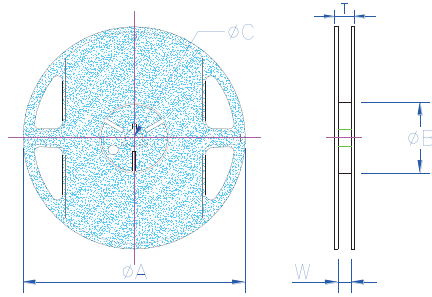
Reference Standards: MIL-STD-202, JIS-C-5201-1

Storage Temperature: 15~28°C; Humidity < 80%RH

Shelf Life: 2 years from production date.

■ Packaging

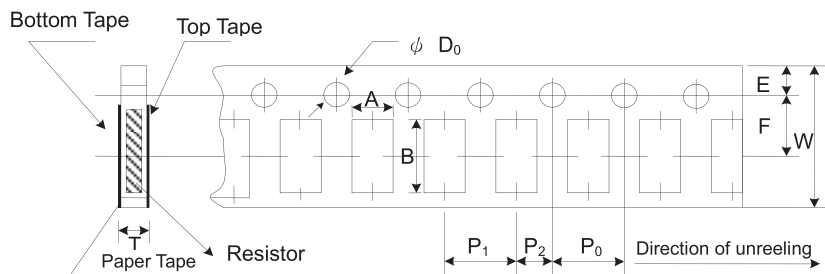
Reel Specifications & Packaging Quantity



Unit: mm

Type	Packaging Quantity	Tape width	Reel Diameter	ϕA	ϕB	ϕC	W	T
TFAN 43	Paper	5K	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5

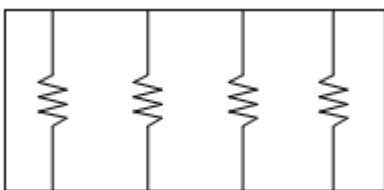
Paper Tape Specifications



Unit: mm

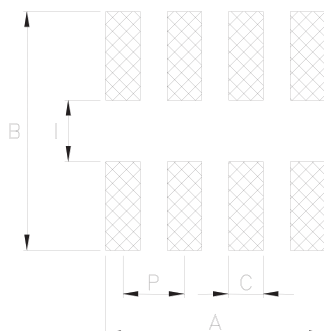
Type	A	B	W	E	F	P ₀	P ₁	P ₂	ϕD_0	T
TFAN43	1.95±0.10	3.50±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1/-0	0.85±0.10

■ Equivalent Circuit Diagram



TFAN43

■ Recommend Land Pattern

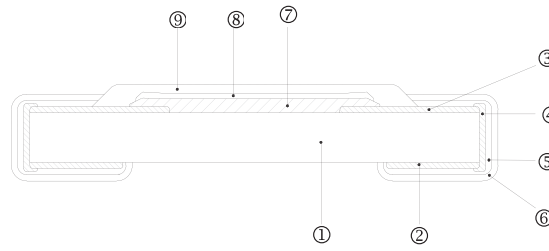


Unit: mm

Type	A	B	C	I	P
TFAN43	3.10	2.85	0.45	0.80	0.80

Thick Film Flat Array Chip Resistor – CN-21 & CN-41

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Features

- Contribute to higher-density mounting and reduction in size of devices by remarkably PCB
- Contribute to the size reduction of small electronic equipment such as Mobile phone, HDD
- Reduced the mounting time by decreasing the number of components
- Suitable for IR reflow soldering

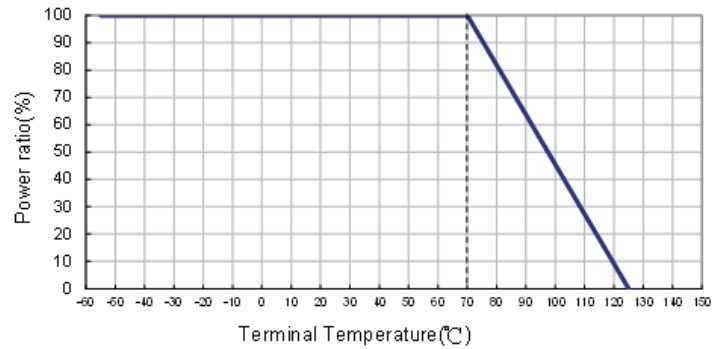
Part Numbering

CN-	41	J	L	6	---1K
Product Type	Dimensions	Resistance Tolerance	Function Code	Packaging Code	Resistance
	21: 0201x2 41: 0201x4	F: ±1% J: ±5%	L: 8P4R / 4P2R	6: 7" Reel 10Kpcs	---1K: 1KΩ ---3K3: 3.3KΩ ---10K: 10KΩ *-* to fill up 6 spaces

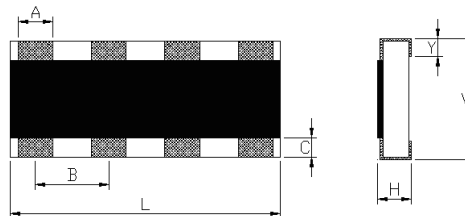
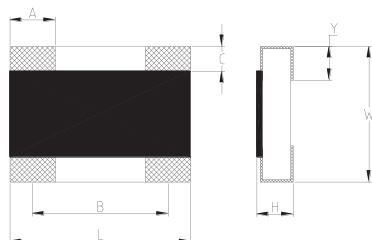
Applications

- Pull-up/pull-down resistors for digital circuits
- Used in interface circuits of LCD displays, memory modules, etc.
- Communication Equipments

Derating Curve



Dimensions



Unit: mm

Type	Number of Resistors	L	W	H	A	B	C	Y	Weight (g) (1000pcs)
CN-21	2	0.80±0.10	0.60±0.10	0.35±0.10	0.30±0.10	0.50±0.10	0.15±0.10	0.15±0.10	0.500
CN-41	4	1.40±0.10	0.60±0.10	0.35±0.10	0.20±0.10	0.40±0.10	0.10±0.07	0.15±0.05	0.833

Standard Electrical Specifications

Type	Item	Power Rating at 70°C Jumper Rated Current	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Number of Resistors	Resistance Range		TCR (PPM/°C)
							±1%	±5%	
CN-21	1/32W	Jumper: 0.5A	-55 ~ +125°C	12.5V	25V	2	-	3Ω - 9.1Ω	±300
							10Ω - 1MΩ		±200
	-	0Ω (<50mΩ)					-		
CN-41	1/32W	Jumper: 0.5A	-55 ~ +125°C	12.5V	25V	4	10Ω - 1MΩ		±200
	-						0Ω (<50mΩ)	-	

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage Listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage Listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement			Test Method
	±1%	±5%	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.			At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	<50mΩ	2.5 times RCWV or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥ 10G			Max. Overload Voltage for 1 minute
Endurance	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	<100mΩ	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat with Load	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	<50mΩ	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Dry Heat	±(1.0%+0.05Ω)	±(3.0%+0.10Ω)	<100mΩ	at +125°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	Bending once for 60 seconds with 3mm
Solderability	95% min. coverage			245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover			1.42 times Max. Operating Voltage for 1 minute
Rapid Change of Temperature	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	-55°C to +125°C, 5 cycles

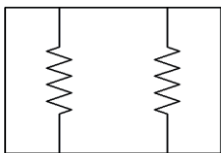
RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1

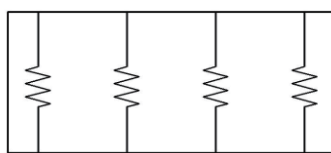
■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date

Equivalent Circuit Diagram



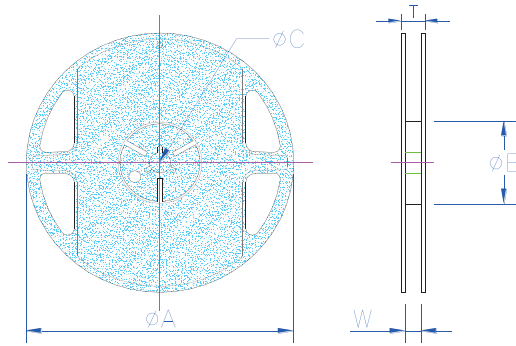
CN-21



CN-41

Packaging

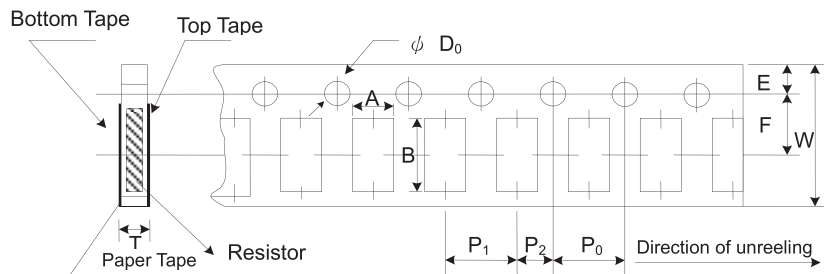
Reel Specifications & Packaging Quantity



Unit: mm

Type	Packaging Quantity		Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T
CN-21	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
CN-41	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5

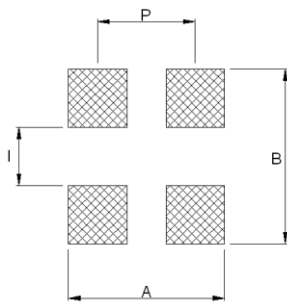
Paper Tape Specifications



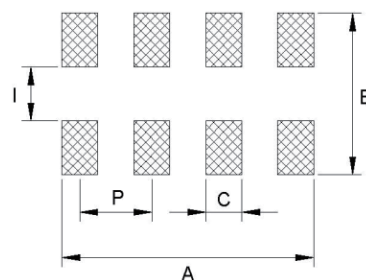
Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CN-21	0.77±0.05	0.97±0.05	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.5 ^{+0.1/-0}	0.50±0.10
CN-41	0.77±0.05	1.57±0.05	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.5 ^{+0.1/-0}	0.50±0.10

Recommend Land Pattern



CN-21



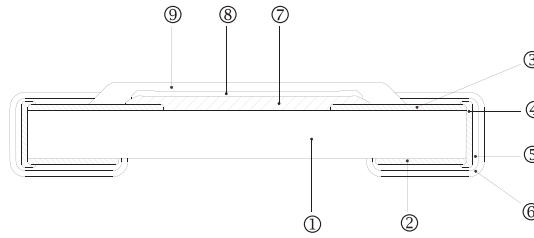
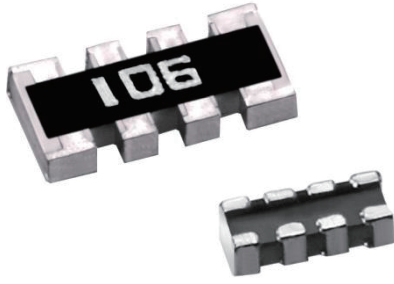
CN-41

Unit : mm

Type	A	B	C	I	P
CN-21	0.80	0.90	--	0.30	0.50
CN-41	1.40	0.90	0.20	0.30	0.40

Anti-Sulfurated Thick Film Array Chip Resistor – AS Array Series

Construction



Features

- Special construction to prevent sulfuration in a sulfur containing environment
- Reduction of assembly costs and matching with placement machines
- Reliability, high quality
- Suitable for IR reflow soldering
- Small size and light weight

Applications

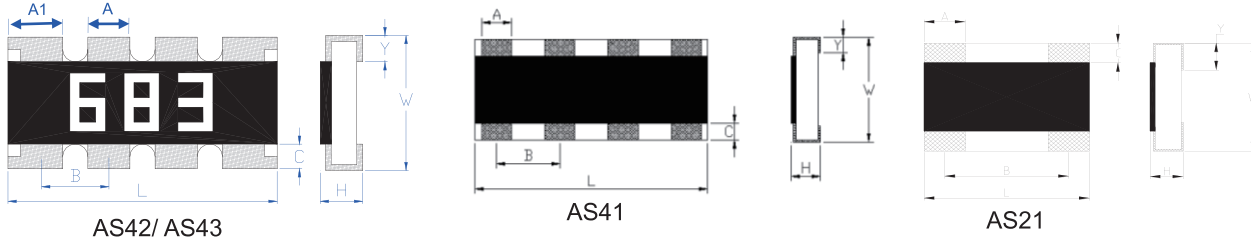
- High-end Computer
- Industrial Equipment
- Automatic Equipment Controller
- Medical Equipment
- High-end Multimedia Electronics
- Outdoor Electronic Applications

① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Part Numbering

AS	43	J	T	F		1002
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance
	21: 0201*2 41: 0201*4 42: 0402*4 43: 0603*4	F: ±1% J: ±5%	T: Taping Reel	F: ±200 G: ±300	: Standard	1000: 100Ω 1002: 10KΩ 1003: 100KΩ

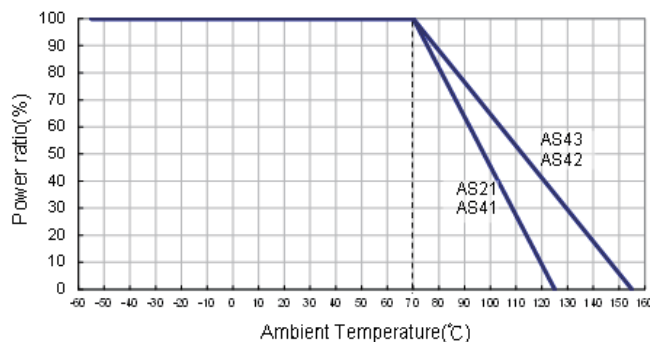
Dimensions



Type	Number of Resistors	L	W	H	A	A1	B	C	Y	Weight (g) (1000pcs)
AS21	2	0.80±0.10	0.60±0.10	0.35±0.10	0.30±0.10	-	0.50±0.10	0.15±0.10	0.15±0.10	0.500
AS41	4	1.40±0.10	0.60±0.10	0.35±0.10	0.20±0.10	-	0.40±0.10	0.10±0.07	0.15±0.05	0.833
AS42	4	2.00±0.10	1.00±0.10	0.45±0.10	0.30±0.10	0.40±0.10	0.50±0.05	0.22±0.15	0.22±0.15	2.817
AS43	4	3.20±0.15	1.60±0.15	0.55±0.10	0.50±0.15	0.65±0.10	0.80±0.05	0.30±0.15	0.30±0.15	8.288

Unit: mm

Derating Curve



Standard Electrical Specifications

Type	Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Number of Resistors	Resistance Range		TCR (PPM/°C)
							±1% (E24, E96)	±5% (E24)	
AS21	1/32W	-55 ~ +125°C	12.5V	25V	2	-	3Ω - 9.1Ω	±300	
						10Ω - 1MΩ		±200	
AS41	1/32W	-55 ~ +125°C	12.5V	25V	4	10Ω - 1MΩ		±200	
AS42	1/16W	-55 ~ +155°C	25V	50V	4	10Ω - 1MΩ	1Ω - 1MΩ	±200	
AS43	1/10W	-55 ~ +155°C	50V	100V	4	10Ω - 1MΩ	1Ω - 1MΩ	±200	

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

The power rating depends on the maximum temperature of the resistive element. Due to the power dissipation of the resistor, the temperature of the resistive element will rise depending on the condition of heat dissipation from PCB. The maximum power rating in application only applies if the temperature of the resistive element is not exceed 125 °C.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement		Test Method
	±1%	±5%	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.		At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G		Max. Overload Voltage for 1 minute
Endurance	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat with Load	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Dry Heat	±(1.0%+0.05Ω)	±(1.5%+0.10Ω)	at +125°C /+155°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	Bending once for 60 seconds with 3mm
Solderability	95% min. coverage		245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover		1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤ 5% Total leaching area ≤ 10%		260±5°C for 30 seconds
Rapid Change of Temperature	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	-55°C to +125°C /+155°C, 5 cycles
Sulfur Test	±(0.5%+0.05Ω)	±(0.5%+0.05Ω)	H2S, 50±2°C, 91~93% R.H., no power rating for 1000 hrs

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1 ; ASTM-B-809-95

■ Storage Temperature: 15~28°C; Humidity < 80%RH

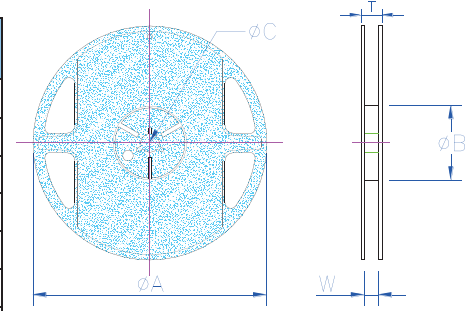
■ Shelf Life: 2 years from production date

Packaging

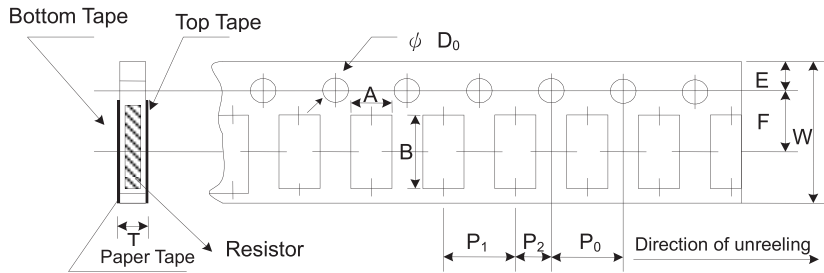
Reel Specifications & Packaging Quantity

Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T	
AS21	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
AS41	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
AS42	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		20K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
AS43	Paper	40K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
AS43	Paper	10K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		20K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5



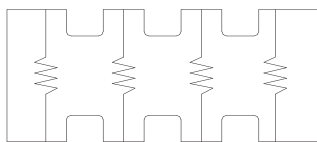
Paper Tape Specifications



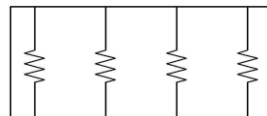
Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
AS21	0.77±0.05	0.97±0.05	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	2.0±0.05	2.0±0.05	1.50+0.1,-0	0.50±0.1
AS41	0.77±0.05	1.57±0.05	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	2.0±0.05	2.0±0.05	1.50+0.1,-0	0.50±0.1
AS42	1.20±0.1	2.20±0.1	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	2.0±0.05	2.0±0.05	1.50+0.1,-0	0.70±0.1
AS43	1.95±0.1	3.50±0.1	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	4.0±0.05	2.0±0.05	1.50+0.1,-0	0.85±0.1

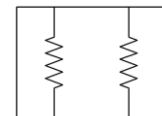
Equivalent Circuit Diagram



AS42/AS43

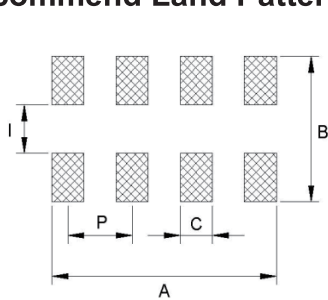


AS41

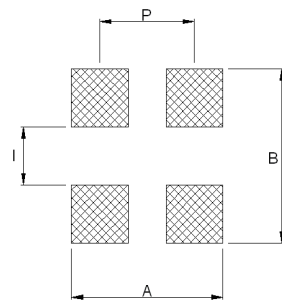


AS21

Recommend Land Pattern



AS41/AS42/AS43



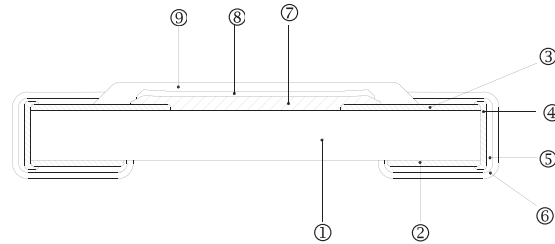
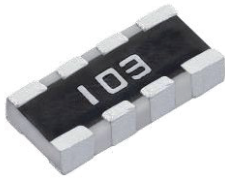
AS21

Unit: mm

Type	A	B	C	I	P
AS21	0.80	0.90	--	0.30	0.50
AS41	1.40	0.90	0.20	0.30	0.40
AS42	2.10	1.80	0.30	0.50	0.50
AS43	3.10	2.85	0.45	0.80	0.80

Thick Film Array Chip Resistor (Flat Termination) – CNF

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

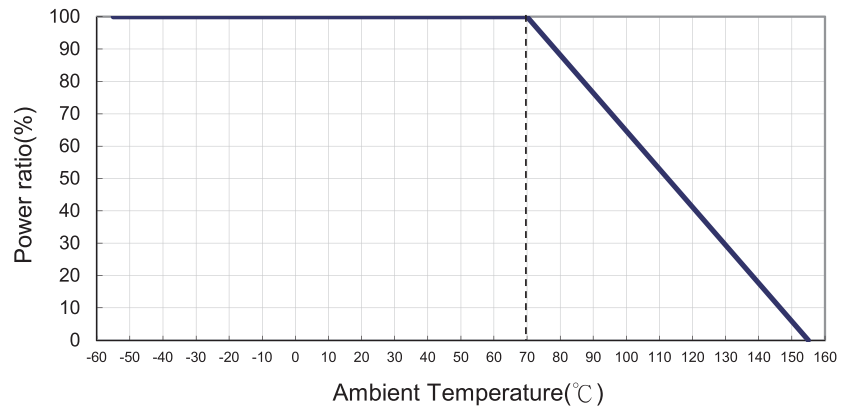
Features

- AEC-Q200 Compliance
- Small size and light weight
- Reduction of assembly costs and matching with placement machines
- Reliability, high quality
- Suitable for IR reflow soldering
- Alternative CN series

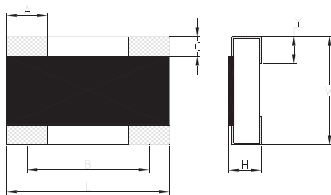
Applications

- Entertainment
- Computer & Related Products
- Communication Equipment
- Power Equipment
- Measuring Instrument

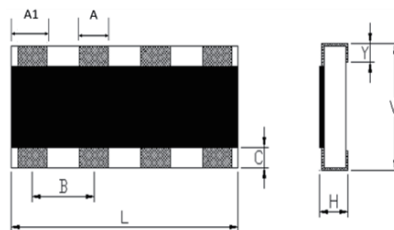
Derating Curve



Dimensions



CNF22



CNF42/43

Type	Number of Resistors	L	W	H	A	A1	B	C	Y	Weight (g) (1000pcs)
CNF22	2	1.20±0.10	1.00±0.10	0.35±0.10	0.43±0.10	-	0.82±0.05	0.22±0.10	0.30±0.15	1.6
CNF42	4	2.00±0.10	1.00±0.10	0.45±0.10	0.35±0.10	0.45±0.10	0.50±0.10	0.20±0.10	0.35±0.15	3.2
CNF43	4	3.20±0.10	1.55±0.10	0.55±0.10	0.45±0.15	0.60±0.10	0.80±0.05	0.20±0.10	0.47±0.15	10.2

Unit: mm

Part Numbering

CNF	22	F	T	F	Y	1002
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance
	22: 0402x2 42: 0402x4 43: 0603x4	F: ±1% J: ±5% or Jumper	T: Taping Reel	F: ±200 - : No Specified (For Jumper)	Y: 1/16W X: 1/10W W: 1/8W	0030: 3Ω 1000: 100Ω 1002: 10KΩ 2201: 2.2KΩ 1003: 100KΩ 1004: 1MΩ R0R0: 0Ω

Standard Electrical Specifications

Type	Item	Power Rating at 70°C Jumper Rated Current	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Number of Resistors	Resistance Range		TCR (PPM/°C)
							±1%	±5%	
CNF22	1/16W	Jumper: 1A	-55 ~ +155°C	25V	50V	2	1Ω - 1MΩ		±200
	-						0Ω (<50mΩ)	-	
CNF42	1/16W	Jumper: 1A	-55 ~ +155°C	50V	100V	4	10Ω - 1MΩ	1Ω - 10MΩ	±200
	-						0Ω (<50mΩ)	-	
CNF43	1/10W 1/8W	Jumper: 1A	-55 ~ +155°C	50V	100V	4	10Ω - 1MΩ	1Ω - 10MΩ	±200
	-						0Ω (<50mΩ)	-	

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage Listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage Listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement			Test Method
	±1%	±5%	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.			At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	<50mΩ	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥ 10G			Max. Overload Voltage for 1 minute
Endurance	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	<50mΩ	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat with Load	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	<50mΩ	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Dry Heat	±(1.0%+0.05Ω)	±(1.5%+0.10Ω)	<50mΩ	at +155°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	Bending once for 60 seconds with 3mm
Solderability	95% min. coverage			245±5°C for 3 seconds

Item	Requirement			Test Method
	±1%	±5%	Jumper	
Resistance to Soldering Heat	$\pm(0.5\%+0.05\Omega)$	$\pm(1.0\%+0.05\Omega)$	<50m Ω	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover			1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area $\leq 5\%$ Total leaching area $\leq 10\%$			260±5°C for 30 seconds
Rapid Change of Temperature	$\pm(0.5\%+0.05\Omega)$	$\pm(1.0\%+0.05\Omega)$	<50m Ω	-55°C to +155°C, 5 cycles

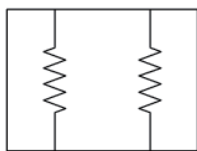
RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1

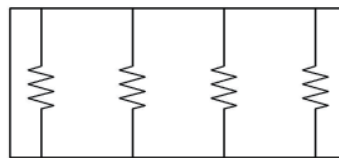
■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date

Equivalent Circuit Diagram



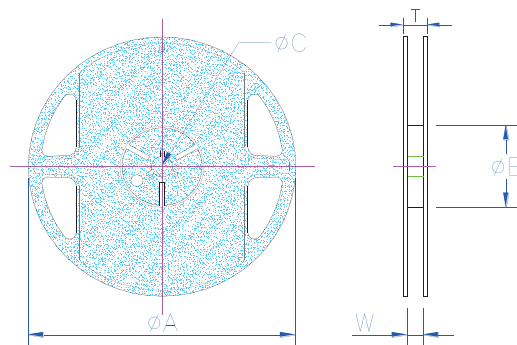
CNF22



CNF42/43

Packaging

Reel Specifications & Packaging Quantity

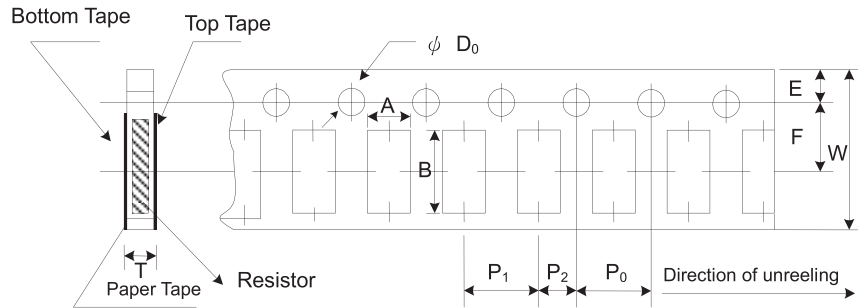


Unit: mm

Type	Packaging Quantity		Tape Width	Reel Diameter	øA	øB	øC	W	T
CNF22	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
CNF42	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
CNF43	Paper	5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5

■ Packaging

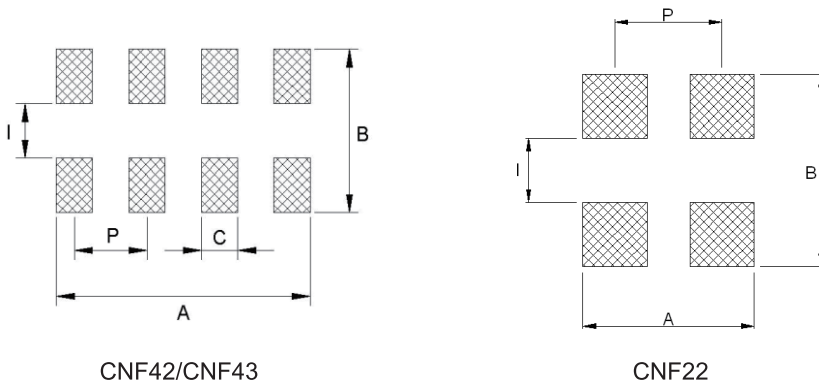
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CNF22	1.20±0.1	1.45±0.1	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	2.0±0.05	2.0±0.05	1.50+0.1,-0	0.43±0.1
CNF42	1.20±0.1	2.20±0.1	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	2.0±0.05	2.0±0.05	1.50+0.1,-0	0.70±0.1
CNF43	1.95±0.1	3.50±0.1	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	4.0±0.05	2.0±0.05	1.50+0.1,-0	0.85±0.1

■ Recommend Land Pattern

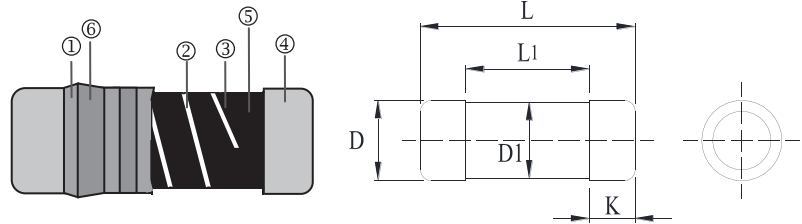


Unit: mm

Type	A	B	C	I	P
CNF22	1.50	1.25	-	0.35	0.80
CNF42	2.10	1.80	0.30	0.50	0.50
CNF43	3.10	2.85	0.45	0.80	0.80

Metal Film Precision MELF Resistor – CSRV Series

Construction



Features

- AEC-Q200 Compliance
- Thin film technology
- Excellent overall stability
- Sn termination on Ni barrier layer
- Tight tolerance down to $\pm 0.1\%$
- Extremely low TCR down to $\pm 5 \text{ PPM}/^\circ\text{C}$
- High power rating up to 1 Watts
- SMD enabled structure
- Lead-free and RoHS compliant

①	Insulation Coating	④	Electrode Cap
②	Trimming Line	⑤	Resistor Layer
③	Ceramic Rod	⑥	Marking

Dimensions

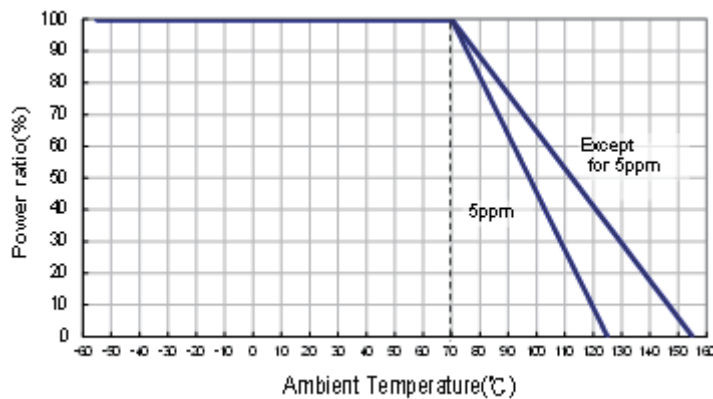
Unit: mm

Type	L	L _{1 min.}	ΦD	ΦD_1	K	Weight (g) (1000pcs)
CSRV0102	2.20 \pm 0.10	1.1	1.10 \pm 0.10	D +0/-0.15	0.45 \pm 0.05	7.7
CSRV0204	3.50 \pm 0.2	1.7	1.40 \pm 0.15	D +0/-0.2	0.8 \pm 0.1	18.7
CSRV0207	5.90 \pm 0.2	2.9	2.20 \pm 0.20	D +0/-0.2	1.3 \pm 0.1	80.9

Applications

- Automotive (non-safety parts)
- Industrial
- Telecommunication
- Medical Equipment
- Measurement/Testing Equipment

Derating Curve



Part Numbering

CSRV	0204	D	T	D	V	1000
Product Type	Dimensions (L \times Φ D)	Resistance Tolerance	Packaging Code	TCR (PPM/ $^\circ$ C)	Power Rating	Resistance
	0102: 2.2x1.1 0204: 3.5x1.4 0207: 5.9x2.2	B: $\pm 0.1\%$ C: $\pm 0.25\%$ D: $\pm 0.5\%$ F: $\pm 1\%$ J: $\pm 5\%$ or Jumper	T: Taping Reel S: 7" Taping Reel, Antistatic Tape [*] W: 13" Taping Reel M: 13" Taping Reel, Antistatic Tape [*]	S: ± 5 B: ± 10 N: ± 15 C: ± 25 D: ± 50 E: ± 100 - : Jumper	T: 1W U: 1/2W V: 1/4W G: 2/5W P: 1/5W W: 1/8W L: 0.3W	0100: 10 Ω 1000: 100 Ω 2201: 2200 Ω 1001: 1K Ω 1004: 1M Ω R0R0: 0 Ω R050: 0.05 Ω R100: 0.1 Ω

^{*} Packaging Code "S" & "M" only for 0102 & 0204 size products, not include 0207 size product.

Standard Electrical Specifications

Item Type	Power Rating at 70 °C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range					TCR (PPM/°C)		
					±0.1% (E24,E96)	±0.25% (E24,E96)	±0.5% (E24,E96)	±1% (E24,E96)	±5% (E24)			
0102	1/8W	-55 ~ +155°C	150V	300V	100Ω-56KΩ					-	±15	
					100Ω-82KΩ		49.9Ω-200KΩ	49.9Ω-390KΩ			-	±25
					-		1Ω-1MΩ					±50
					-		1Ω-1MΩ					±100
0204	1/4W	-55 ~ +125°C	200V	400V	10Ω-332KΩ		-			±5		
		-55 ~ +155°C			200V	400V	10Ω-20KΩ					-
			10Ω-300KΩ					-	±15			
			10Ω-1MΩ				10Ω-3.4MΩ	1Ω-3.4MΩ				±25
			10Ω-1MΩ				1Ω-3.4MΩ	0.2Ω-10MΩ				±50
		-		0.1Ω-10MΩ				±100				
0207	1/2W	-55 ~ +125°C	300V	600V	10Ω-332KΩ		-			±5		
		-55 ~ +155°C			300V	600V	10Ω-20KΩ					-
			10Ω-300KΩ					-	±15			
			10Ω-1MΩ				10Ω-3.4MΩ	1Ω-3.4MΩ				±25
			10Ω-1MΩ				1Ω-3.4MΩ	0.2Ω-10MΩ				±50
		-		0.1Ω-10MΩ				±100				

High Power Rating Electrical Specifications

Item Type	Power Rating at 70 °C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range					TCR (PPM/°C)		
					±0.1% (E24,E96)	±0.25% (E24,E96)	±0.5% (E24,E96)	±1% (E24,E96)	±5% (E24)			
0102	1/5W	-55 ~ +155°C	200V	400V	100Ω-56KΩ					-	±15	
	0.3W				100Ω-82KΩ		49.9Ω-200KΩ	49.9Ω-390KΩ			-	±25
					-		1Ω-1MΩ					±50
					-		1Ω-1MΩ					±100
0204	2/5W	-55 ~ +125°C	200V	400V	10Ω-332KΩ		-			±5		
		-55 ~ +155°C			200V	400V	10Ω-20KΩ					-
			10Ω-300KΩ					-	±15			
			10Ω-1MΩ				10Ω-3.4MΩ	1Ω-3.4MΩ				±25
			10Ω-1MΩ				1Ω-3.4MΩ	0.2Ω-10MΩ				±50
		-		0.1Ω-10MΩ				±100				
0207	1W	-55 ~ +125°C	350V	700V	10Ω-332KΩ		-			±5		
		-55 ~ +155°C			350V	700V	10Ω-20KΩ					-
			10Ω-300KΩ					-	±15			
			10Ω-1MΩ				10Ω-3.4MΩ	1Ω-3.4MΩ				±25
			10Ω-1MΩ				1Ω-3.4MΩ	0.2Ω-10MΩ				±50
		-		0.1Ω-10MΩ				±100				

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage Listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage Listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Jumper Specifications

Item Type	Power Rating	Operating Temp.Range	Resistance	Rated Current
CSR0102	1/8W	-55 ~ +155°C	0Ω(<15mΩ)	2A
	1/5W			
	0.3W			
CSR0204	1/4W	-55 ~ +155°C		3A
	2/5W			
CSR0207	1/2W	-55 ~ +155°C	5A	
	1W			

Environmental Characteristics

Item	Requirement		Test Method
	5% and Below	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec		At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature 5ppm: At 25°C/-10°C and 25°C/+85°C, 25°C is the reference temperature
Short Time Overload	10Ω-270KΩ: ±(0.1%+0.01Ω) <10Ω & >270KΩ: ±(0.15%+0.01Ω) 0102: ±(0.15%+0.01Ω) 5ppm: ±(0.05%+0.01Ω)	<15mΩ	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G		Max. Overload Voltage for 1 minute
Operational Life	10Ω-270KΩ: ±(0.25%+0.01Ω) <10Ω & >270KΩ: ±(0.5%+0.01Ω) 0102: ±(0.5%+0.01Ω)	<15mΩ	Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion. 5ppm: 70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Biased Humidity	<10Ω: ±(1%+0.01Ω) 10Ω-270KΩ: ±(0.5%+0.01Ω) >270KΩ-3.4MΩ: ±(1%+0.01Ω) >3.4MΩ: ±(2%+0.01Ω) 0102: ±(2%+0.01Ω)	<15mΩ	1000 hrs 85°C/85%RH 10% of operating power. (≤100V)
High Temperature Exposure	10Ω-270KΩ: ±(0.25%+0.01Ω) <10Ω & >270KΩ: ±(1%+0.01Ω) 0102: ±(1%+0.01Ω)	<15mΩ	at +125°C/+155°C for 1000 hrs
Board Flex	10Ω-270KΩ: ±(0.1%+0.01Ω) <10Ω & >270KΩ: ±(0.5%+0.01Ω) 0102: ±(0.5%+0.01Ω)	<15mΩ	Bending once for 60 seconds with 2mm
Solderability	95% min. coverage		245±5°C for 3 seconds
Resistance to Soldering Heat	10Ω-270KΩ: ±(0.1%+0.01Ω) <10Ω & >270KΩ: ±(0.25%+0.01Ω) 0102: ±(0.25%+0.01Ω) 5ppm: ±(0.05%+0.01Ω)	<15mΩ	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover		1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤5% Total leaching area ≤10%		260±5°C for 30 seconds
Temperature Cycling	10Ω-270KΩ: ±(0.25%+0.01Ω) <10Ω & >270KΩ: ±(0.5%+0.01Ω) 0102: ±(1%+0.01Ω)	<15mΩ	-55°C to +125°C, 1000 cycles
Mechanical Shock	±(0.25%+0.01Ω)	<15mΩ	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	±(0.5%+0.01Ω)	<15mΩ	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(0.5%+0.01Ω)	<15mΩ	Human body, 0102/0204:2KV; 0207:4KV

Item	Requirement		Test Method
	5% and Below	Jumper	
Resistance to solvents	No visible damage on appearance and marking.		Add aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal strength	No broken		Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board		V-0 or V-1 are acceptable. Electrical test not required.

RCWV(Rated Continuous Working voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1, 6429; AEC-Q200; MIL-STD-202; JESD22; UL94

■ Storage Temperature: 15~28°C; Humidity < 80%RH

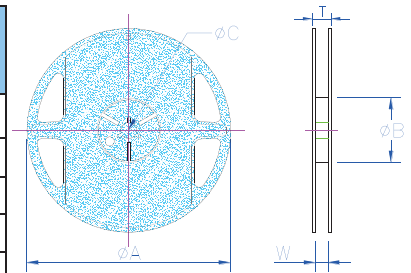
■ Shelf Life: 2 years from production date

■ Packaging

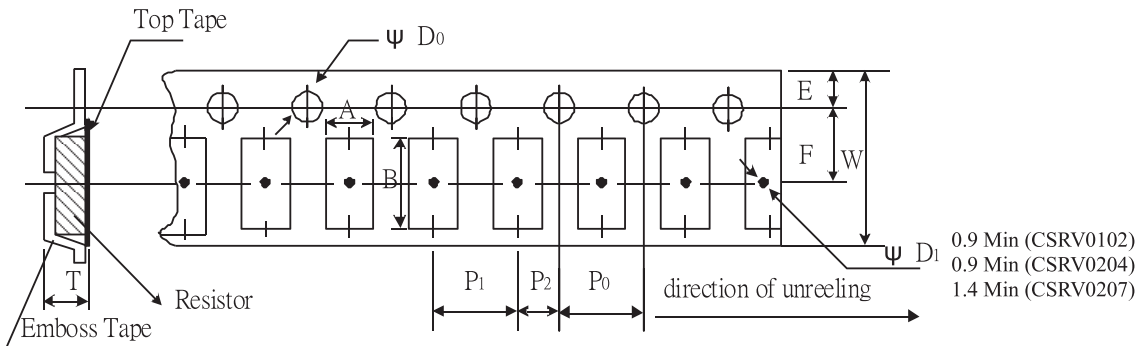
Packaging Quantity & Reel Specifications

Unit :mm

Type	Reel Diameter	ΦA	ΦB	ΦC	W	T	Emboss Plastic Tape (EA)
CSRV0102	7 inch	178.5±1.5	60.0+1.0	13.0±0.2	9.0±0.5	12.5±0.5	3,000
	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5	10,000
CSRV0204	7 inch	178.5±1.5	60.0+1.0	13.0±0.2	9.0±0.5	12.5±0.5	3,000
	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5	10,000
CSRV0207	7 inch	178.5±1.5	60.0+1.0	13.0±0.5	13.0±0.5	15.5±0.5	2,000
	13 inch	330±1.0	99±0.5	13.5±0.5	13.4±1	17.8±1	6,000



Emboss Plastic Tape Specifications

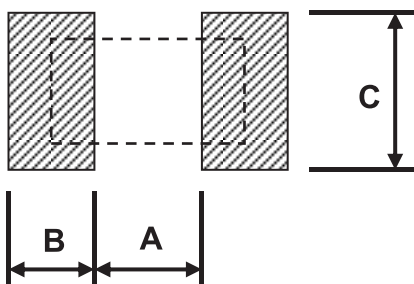


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CSRV0102	1.30±0.20	2.40±0.20	8.0±0.10	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.10	1.50±0.10
CSRV0204	1.55±0.20	3.65±0.20	8.0±0.10	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.10	1.80±0.10
CSRV0207	2.40±0.10	6.15±0.10	12.0±0.10	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.10	2.70±0.10

■ Recommend Land Pattern

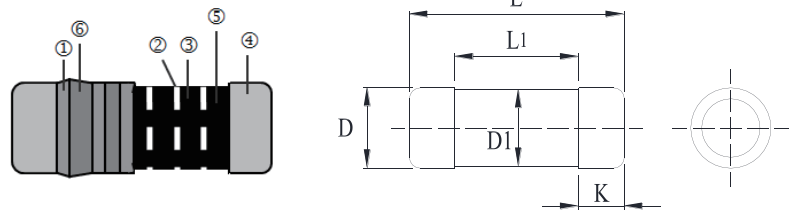
Unit: mm



Type	A	B	C
CSRV0102	1.0	0.8	1.5
CSRV0204	1.6	1.2	1.6
CSRV0207	3.0	1.7	2.4

Metal Film High Frequency MELF Resistor – CSRF Series

Construction



Features

- Thin film technology
- Suitable for RF applications
- Specialty trimmed technology
- Sn termination on Ni barrier layer
- SMD enabled structure
- Lead-free and RoHS compliant

① Insulation Coating	④ Electrode Cap
② Trimming Line	⑤ Resistor Layer
③ Ceramic Rod	⑥ Marking

Applications

- Industrial
- Telecommunication

Dimensions

Unit: mm

Type	L	L _{1 min.}	ΦD	ΦD ₁	K	Weight (g) (1000pcs)
CSRF0102	2.20±0.10	1.1	1.10±0.10	D +0/-0.15	0.45±0.05	7.7
CSRF0204	3.50±0.20	1.7	1.40±0.15	D +0/-0.2	0.80±0.10	18.7
CSRF0207	5.90±0.20	2.9	2.20±0.20	D +0/-0.2	1.30±0.10	80.9

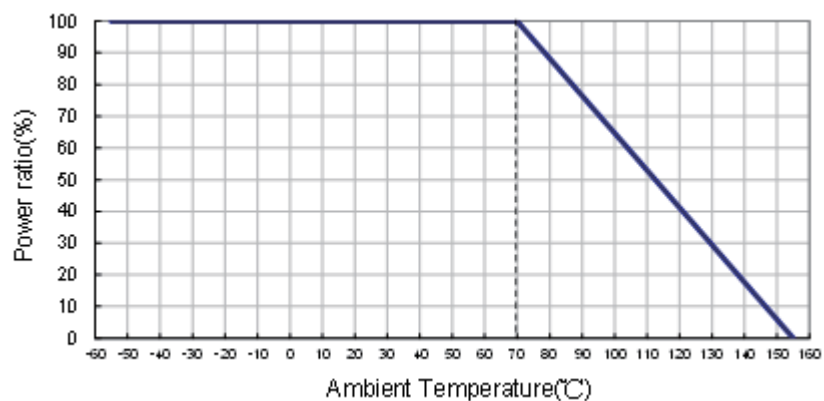
Part Numbering

CSRF	0204	F	T	D	V	1000
Product Type	Dimensions (L×ΦD)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance
	0102: 2.2x1.1 0204: 3.5x1.4 0207: 5.9x2.2	F: ±1%	T: Taping Reel S: 7" Taping Reel, Antistatic Tape* W: 13" Taping Reel M: 13" Taping Reel, Antistatic Tape*	D: ±50	T: 1W U: 1/2W V: 1/4W G: 2/5W P: 1/5W L: 3/10W	1R50: 1.5Ω 0100: 10Ω 1000: 100Ω

** Letter "R" is a decimal point.

※Packaging Code "S" & "M" only for 0102 & 0204 size products, not include 0207 size product.

Derating Curve



Standard Electrical Specifications

Type \ Item	Power Rating at 70° C	Operating Temp. Range	Max. Operating Voltage	Resistance Range	TCR (PPM/° C)
				±1% (E24)	
0102	1/5W	-55 ~ +155°C	150V	50Ω, 6.8Ω-100Ω	±50
0204	1/4W	-55 ~ +155°C	200V	50Ω, 1.5Ω-220Ω	±50
0207	1/2W	-55 ~ +155°C	300V	50Ω, 6.8Ω-220Ω	±50

High Power Rating Electrical Specifications

Type \ Item	Power Rating at 70° C	Operating Temp. Range	Max. Operating Voltage	Resistance Range	TCR (PPM/° C)
				±1% (E24)	
0102	3/10W	-55 ~ +155°C	150V	50Ω, 6.8Ω-100Ω	±50
0204	2/5W	-55 ~ +155°C	200V	50Ω, 1.5Ω-220Ω	±50
0207	1W	-55 ~ +155°C	300V	50Ω, 6.8Ω-220Ω	±50

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage Listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage Listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(0.15%+0.01Ω)	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Endurance	±(0.5%+0.05Ω)	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Damp Heat with Load	±(0.5%+0.05Ω)	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Dry Heat	±(1.0%+0.05Ω)	at +155°C for 1000 hrs
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover	1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤ 5% Total leaching area ≤ 10%	260±5°C for 30 seconds
Rapid Change of Temperature	±(0.25%+0.05Ω)	-55°C to +155°C, 5 cycles
ESD	±(0.5%+0.01Ω)	Human body, 0102:800V; 0204:1000V; 0207:2000V
Resistance to Solvents	No visible damage on appearance and marking.	Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken	Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board	V-0 or V-1 are acceptable. Electrical test not required.

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC 60115-1 ; JIS-C 5201-1 ; MIL-STD-202 ; AEC-Q200 ; JESD22 ; UL94

■ Storage Temperature: 15~28°C; Humidity < 80%RH

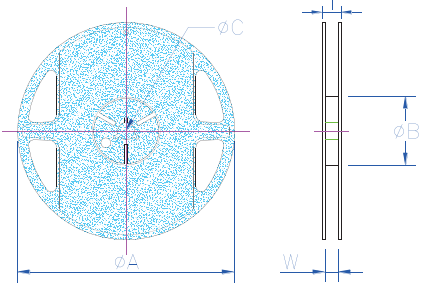
■ Shelf Life: 2 years from production date

Packaging

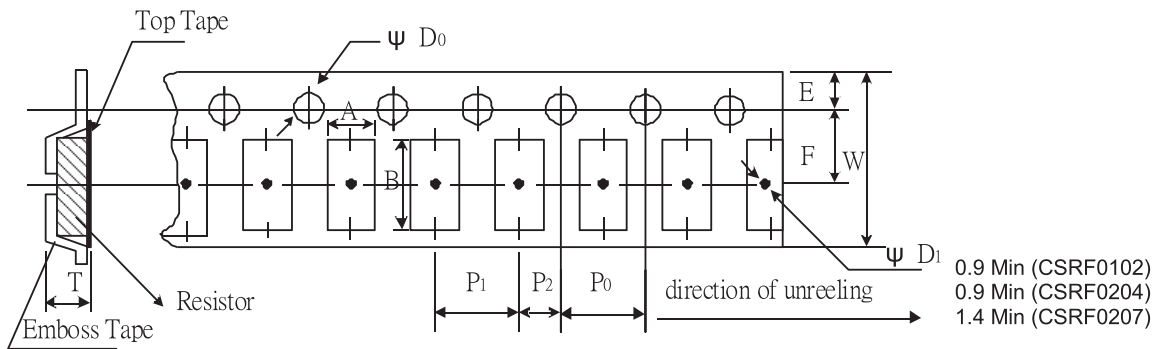
Packaging Quantity & Reel Specifications

Unit: mm

Type	Reel Diameter	ΦA	ΦB	ΦC	W	T	Emboss Plastic Tape (EA)
CSRF0102	7 inch	178.5±1.5	60.0+1.0	13.0±0.2	9.0±0.5	12.5±0.5	3,000
	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5	10,000
CSRF0204	7 inch	178.5±1.5	60.0+1.0	13.0±0.2	9.0±0.5	12.5±0.5	3,000
	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5	10,000
CSRF0207	7 inch	178.5±1.5	60.0+1.0	13.0±0.5	13.0±0.5	15.5±0.5	2,000
	13 inch	330±1.0	99±0.5	13.5±0.5	13.4±1	17.8±1	6,000



Emboss Plastic Tape Specifications

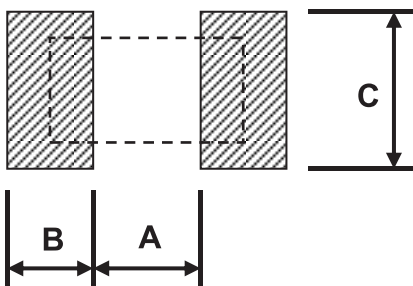


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CSRF0102	1.30±0.20	2.40±0.20	8.0±0.10	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.10	1.50±0.10
CSRF0204	1.55±0.20	3.65±0.20	8.0±0.10	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.10	1.80±0.10
CSRF0207	2.40±0.10	6.15±0.10	12.0±0.10	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.10	2.70±0.10

Recommend Land Pattern

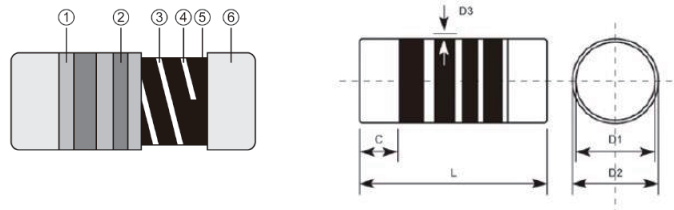
Unit: mm



Type	A	B	C
CSRF0102	1.0	0.8	1.5
CSRF0204	1.6	1.2	1.6
CSRF0207	3.0	1.7	2.4

MELF High Voltage Resistor – CSRH Series

Construction



Features

- For SMD enabled structure
- it is epoxy resin coating material
- high voltage applications for power capacitor, motor start-up protection, car & motorcycle engine ignition, etc. other surge energy request able to design for engineer design request

①	Insulation Coating	④	Ceramic Rod
②	Marking	⑤	Resistor Layer
③	Trimming Line	⑥	Electrode Cap

Applications

- Industrial
- Telecommunication
- Medical Equipment
- Measurement/Testing Equipment

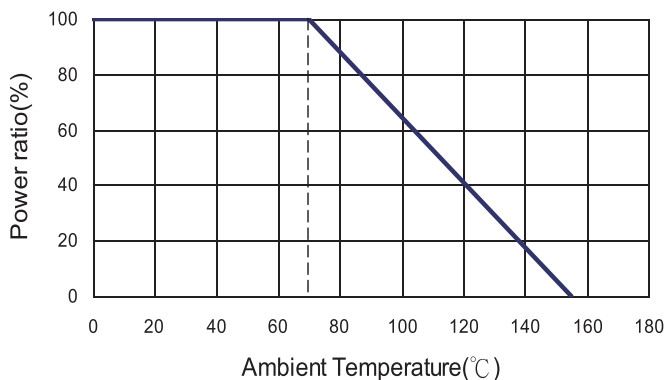
Dimensions

Type	L (mm)	D1 (mm)	D2 max (mm)	D3 max (mm)	C min (mm)
CSRH0207	5.90±0.20	2.20±0.10	2.40	0.15	0.50
CSRH0309	8.50±0.20	3.20±0.20	3.40	0.30	0.50

Part Numbering

CSRH	0207	F	T	E	U	1003
Product Type	Dimensions (L×ΦD2)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance
	0207: 5.9x2.4 0309: 8.5x3.4	G: ±2% J: ±5%	T: Taping Reel	E: ±100 F: ±200	T: 1W U: 1/2W	1003: 100KΩ 1004: 1MΩ

Derating Curve



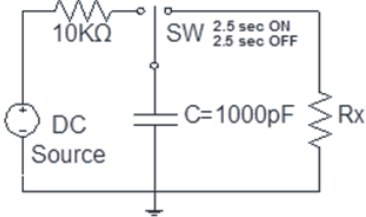
Standard Electrical Specifications

Item Type	Power Rating at 70 °C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range		TCR (PPM/°C)
					±1%	±5%	
0207	1/2W	-55 ~ +155°C	500V	700V	100KΩ-22MΩ		±100 ±200
0309	1W	-55 ~ +155°C	700V	1000V	100KΩ-22MΩ		±100 ±200

Anti Surge Voltage

Type	Power Rating	Voltage
0207	1/2W	100KΩ-10MΩ : 3KV
0309	1W	100KΩ-10MΩ: 4KV

Environmental Characteristics

Item	Requirement	Test Method									
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	+25/-55/+25/+125°C									
Short Time Overload	±(1.0%+0.05Ω)	$V = \sqrt{(P \cdot R) \cdot 2.5}$, 5 seconds <table border="1"> <tr> <td>Type</td> <td>0207</td> <td>0309</td> </tr> <tr> <td>Power rating</td> <td>1/2W</td> <td>1W</td> </tr> <tr> <td>Voltage Max</td> <td>200V</td> <td>250V</td> </tr> </table>	Type	0207	0309	Power rating	1/2W	1W	Voltage Max	200V	250V
Type	0207	0309									
Power rating	1/2W	1W									
Voltage Max	200V	250V									
Resistance to Soldering Heat	±(1.0%+0.05Ω)	260±5°C for 10±1 seconds									
Solderability	95% min. coverage	245±5°C for 3±0.5 seconds									
Thermal Shock Test	±(2.0%+0.05Ω)	5 cycles for -55°C 30minute 155°C 30minute									
Load Life Test	±(5.0%+0.05Ω)	70±2°C, DC 1.5 hrs "ON" and 0.5 hrs "OFF", applied continuously for 1000±48 hrs									
Humidity Resistance	±(5.0%+0.05Ω)	40±2°C, 90~95% R.H., for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"									
Resistance to Solvent	Epoxy insulation coating can not be peeled	3 circles, each circle takes 1 min.									
Anti Surge Characteristics	±(5%+0.05Ω)	Discharge Test: 1/2W=3KV 1W=4KV  1000pF capacitor Discharge Pulse 50 time. (1 pulse / 5 sec. max)									

Reference Standards: JIS-C-5201-1

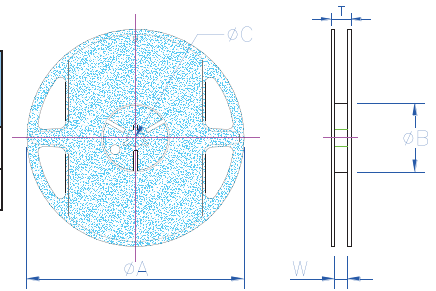
Storage Temperature: 5~40°C; Humidity 55~75%RH

■ Packaging

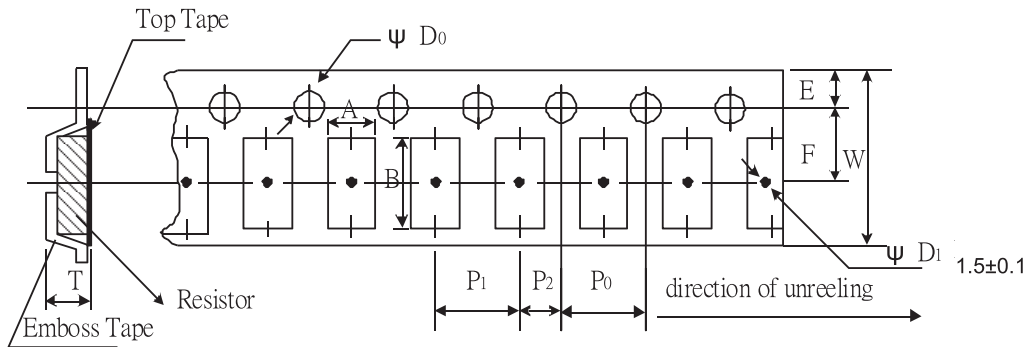
Packaging Quantity & Reel Specifications

Unit: mm

Type	Reel Diameter	ΦA	ΦB	ΦC	W	T	Emboss Plastic Tape (EA)
CSRH0207	7 inch	178.0±1.0	60.0±0.5	13.0±0.5	13.2±0.5	16.0±0.2	2,000
CSRH0309	13 inch	330.0±1.0	100.0±1.0	13.0±0.5	17.0±0.5	21.5±0.2	2,500



Emboss Plastic Tape Specifications

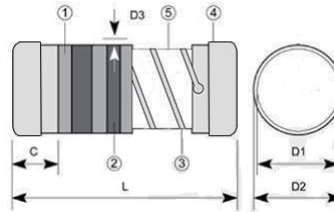


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CSRH0207	2.40±0.10	6.05±0.10	12.0±0.10	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.10	1.50±0.10	2.80±0.10
CSRH0309	3.50±0.10	8.85±0.10	16.0±0.10	1.75±0.10	7.50±0.10	4.00±0.10	8.00±0.10	2.00±0.10	1.50±0.10	3.85±0.10

Wire Wound MELF Resistor—CSRW Series

Construction



① Flame Retardant Paint	④ Tin-coated Cap
② Marking	⑤ Ceramic Rod
③ Alloy Wire	

Features

- Use non-combustible paint, which has the safety characteristics of non-combustible and insulating
- Miniaturization for easy high-density mounting
- Complies with lead (Pb) and lead-containing soldering process requirements
- Can be used in automatic surface mount (SMD) assembly systems, suitable for automatic soldering through wave soldering and reflow soldering

Dimensions

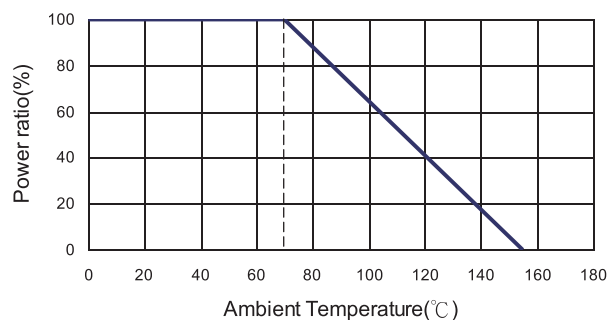
Unit: mm

Type	L	D1	D2	D3 max.	C min.
CSRW0207	6.30±0.20	1.70±0.10	2.50±0.20	0.10	0.60
CSRW0309	8.80±0.20	2.50±0.10	3.40±0.20	0.15	1.00
CSRW0410	10.00±0.20	3.00±0.10	4.00±0.20	0.20	1.50

Applications

- This standard applies to resistors installed instead of plug-ins in electronic equipment such as electric light sources, switching power supplies, chargers, communication equipment, medical electronic equipment, test and measurement equipment, automotive electronics, industrial products and household appliances

Derating Curve



Part Numbering

CSRW	0207	J	T	G	V	0100
Product Type	Dimensions (L×D2)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance
	0207: 6.3x2.5 0309: 8.8x3.4 0410: 10.x4.0	F: ±1% G: ±2% J: ±5%	T: Taping Reel	4: ±350 G: ±300	V: 1/4W U: 1/2W T: 1W S: 2W R: 3W	R100: 0.1Ω 0.10: 10Ω 1000: 100Ω

Standard Electrical Specifications

Item Type	Power Rating at 70 °C	Operating Temp. Range	Insulation Voltage (DC /AC Peak Value)	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±1%	±2%	±5%	
0207	1/4W 1/2W 1W	-55 ~ +155°C	250V	400V	0.1Ω-1Ω 1.1Ω-100Ω			±350 ±300
0309	1/2W 1W 2W	-55 ~ +155°C	300V	500V	0.1Ω-1Ω 1.1Ω-150Ω			±350 ±300
0410	1W 2W 3W	-55 ~ +155°C	350V	600V	0.1Ω-1Ω 1.1Ω-220Ω			±350 ±300

Fusing Characteristic

Definition: When we impose specified overload on fusing resistor, its resistance will increase significantly, thus leads to current dropping to 1/50 time of the resistor original tested current, which is called fusing.

The time, from specified overload to fusing, is fusing time. Those performances are called fusing characteristics.

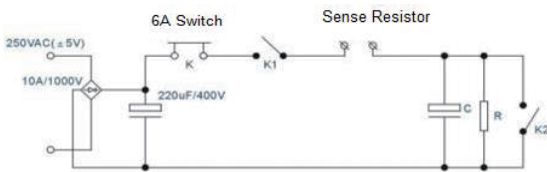
Requirements: Under the condition that resistor is imposed specified multiply rated current, fusing time should comply with following table

Multiplying Power of Rated Current (times)		Fusing Time (S)
1/4W	R < 1Ω: 6 R ≥ 1Ω: 7	≤30
1/2W~3W	R < 1Ω: 6 R ≥ 1Ω: 6	≤30

Note: Fusing characteristic can be made according to customer's requirements.
It is required that the lightning strike products do not undergo fuse assessment

Impact Resistance

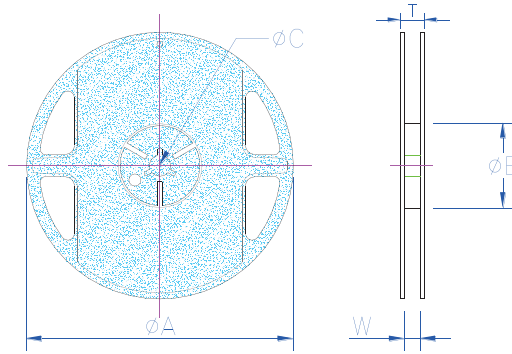
According to the map below, closed switch K, cut K2, repeat K1 on-off 100 times, resistor doesn't meltdown (2 second on and 2 second off)



Environmental Characteristics

Item	Requirement	Test Method
Short Time Overload	$\Delta R \leq \pm (2\%R + 0.05\Omega)$	Resistor is imposed 2.5 times rated voltage and lasts 5 seconds, then the voltage restores to the normal for 1-2h, and calculate the resistance change rate
High voltage	No breakdown, arcing	Put resistor into a metal V-shaped groove, apply specified insulated voltage to the position between pigtails and V-shaped groove for 60 seconds.
Resistance to Soldering Heat	$\Delta R \leq \pm (2\%R + 0.05\Omega)$	260±5°C for 10±0.5 seconds
Solderability	95% min. coverage	260±5°C for 3±0.5 seconds
Endurance	$\Delta R \leq \pm (5\%R + 0.05\Omega)$	70±2°C, DC 1.5 hrs "ON" and 0.5 hrs "OFF", applied continuously for 1000 hrs
Humidity Test	$\pm(5\% + 0.05\Omega)$	40±2°C, 90~95% R.H., 1.5 hrs "ON" and 0.5 hrs "OFF", 500 hrs
Fusing Features	The fusing time should be conform the requirements.	Use DC regulated power supply, follow by the rules of load and nominal value calculated on the subjects resistor test voltage and current value of the first trial in the test circuit access with participants of the same high power resistor value resistor, according to the test voltage to adjust current, make the test current to achieve specified value, disconnect the power, change subjects resistors, connected to the power supply, if the current is not in the specified value, shall be transferred to the specified value in a 2 s, since then no longer to adjust current, observe the ammeter, calculating the melting time
lightning surge	No open circuit in the resistor	Positive and negative polarity 5 times each Interval 20S

Packaging

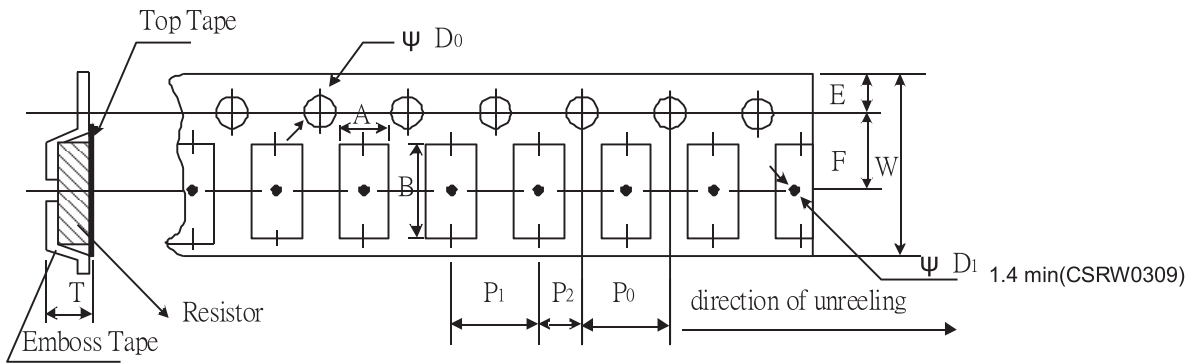


Packaging Quantity & Reel Specifications

Unit: mm

Type	Reel Diameter	ϕA	ϕB	ϕC	W	T	Emboss Plastic Tape (EA)
CSRW0207	13 inch	330.0±2.0	90.0±2.0	13.0±0.5	10.0±1.0	14.5±1.0	6,500
CSRW0309	13 inch	330.0±2.0	90.0±2.0	13.0±0.5	10.0±1.0	14.5±1.0	2,500
CSRW0410	13 inch	330.0±2.0	90.0±2.0	13.0±0.5	10.0±1.0	14.5±1.0	2,000

Emboss Plastic Tape Specifications

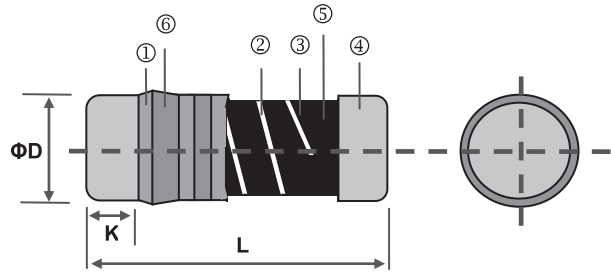


Unit: mm

Type	A	B	W	E	F	P_0	P_1	P_2	ϕD_0	T
CSRW0207	2.80±0.20	6.80±0.20	12.0±0.30	1.75±0.10	5.50±0.10	4.00±0.10	4.00±0.10	2.00±0.10	1.50±0.10	2.95±0.10
CSRW0309	3.70±0.20	9.20±0.20	16.0±0.20	1.75±0.10	7.50±0.10	4.00±0.10	8.00±0.10	2.00±0.10	1.50±0.10	3.85±0.10
CSRW0410	4.40±0.20	10.4±0.20	16.0±0.20	1.75±0.10	7.50±0.10	4.00±0.10	8.00±0.10	2.00±0.10	1.50±0.10	4.45±0.10

Carbon Film Resistor—CFS Series

Construction



① Insulation Coating	④ Electrode Cap
② Trimming Line	⑤ Resistor Layer
③ Ceramic Rod	⑥ Marking

Features

- SMD style carbon resistor
- Free direction for mounting due to cylindrical design
- High solder ability due to specially plated electrodes
- Electrodes strength is higher than flat chip resistors
- Lower current noise than thick film flat chip resistors
- Suitable for reflow, flow and iron soldering

Dimensions

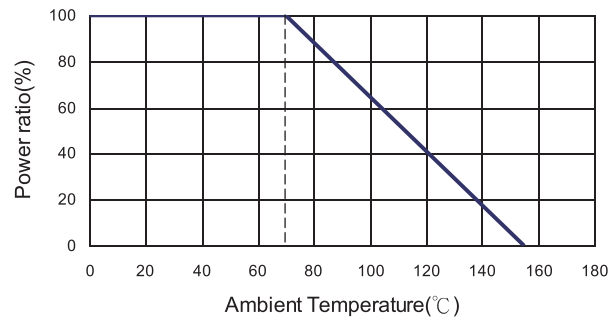
Unit: mm

Type	L	ΦD	K min.	Wight (g) (1000pcs)	Packaging	
					180mm/7"	330mm/13"
CFS0204	3.50±0.20	1.40±0.15	0.5	19	3,000EA	-
CFS0207	5.90±0.20	2.20±0.20	0.5	81	2,000EA	-
CFS0309	8.50±0.20	3.20±0.20	0.5	95	-	2,500EA

Applications

- Telecommunication
- Medical Equipment
- Consumer Product

Derating Curve



Part Numbering

CFS	0204	G	T	-	V	1000
Product Type	Dimensions (L×ΦD)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance
	0204: 3.5x1.4 0207: 5.9x2.2 0309: 8.5x3.2	G: ±2% J: ±5%	T: Taping Reel B: Bulk	-: No specified	S: 2W T: 1W U: 1/2W V: 1/4W	0010: 1Ω 1R20: 1.2Ω 1000: 100Ω 2201: 2200Ω 1001: 1KΩ 1004: 1MΩ

Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range	
					±2%	±5%
0204	1/4W	-55 ~ +155°C	200V	400V	1Ω - 1MΩ	
0207	1/2W		300V	600V	1Ω - 1MΩ	
0309	1W		350V	700V	1Ω - 1MΩ	

High Power Rating Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range	
					±2%	±5%
0207	1W	-55 ~ +155°C	350V	700V	1Ω - 1MΩ	
0309	2W		350V	700V	1Ω - 1MΩ	

Operating Voltage= $\sqrt{P \cdot R}$ or Max. operating voltage Listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. overload voltage Listed above, whichever is lower.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	1Ω – 100KΩ: ±350ppm 101KΩ – 500KΩ: ±700ppm 501KΩ – 1MΩ: ±1000ppm	-55°C~+125°C, 25°C is the reference temperature
Short Time Overload	±(0.5%+0.05Ω)	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Endurance	±(3%+0.05Ω)	Standard: 70±2°C, for 24 hrs High Power: 70±2°C, for 1000 hrs with DC 1.5 hrs "ON" and 0.5 hrs "OFF"
Damp Heat with Load	±(5%+0.05Ω)	Standard: Room temperature + 100°C, 90%~95% RH, Dipping time: 0.5hr High Power: 40±2°C, 90~95% R.H., for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Solderability	95% min. coverage	235±5°C for 3 seconds
Resistance to Soldering Heat	±(1%+0.05Ω)	260±5°C for 10 seconds
Resistance to Solvent	Epoxy Insulation coating can not be peeled	There are 3 cycles, each circle takes 1 min

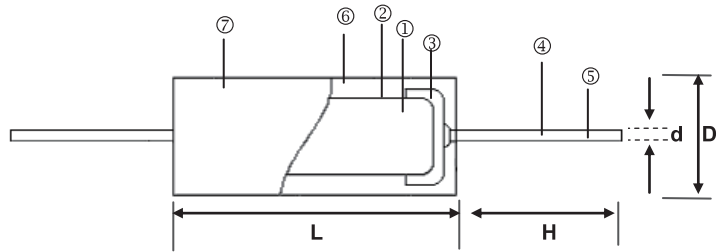
RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: JIS-C 5201-1

■ Storage Temperature: 5~40°C; Humidity 55~75%RH

High Precision Metal Film Led Resistor – MFD Series

Construction



① Ceramic Core	⑤ Lead Wire
② Resistor Element	⑥ Molding
③ Terminal	⑦ Marking
④ Connection	

Features

- Very tight tolerance down to $\pm 0.02\%$
- Extremely low TCR down to $\pm 5\text{PPM}/^\circ\text{C}$
- High precision
- Excellent stability

Dimensions

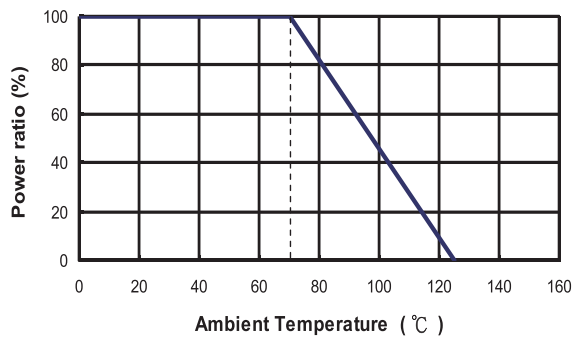
Unit: mm

Type	L	D	H	d	Weight (g) (1000pcs)	Packaging
						Ammo
MFD0727	7.0 \pm 0.3	2.7 \pm 0.4	26 \pm 3	0.6 \pm 0.05	230	1,000
						2,000
MFD1040	10.2 \pm 0.3	4.0 \pm 0.4	25 \pm 3	0.6 \pm 0.05	430	1,000

Applications

- Precision Equipment
- Measurement Equipment

Derating Curve



Part Numbering

MFD	0727	B	B	C	V	1001
Product Type	Dimensions (LxD)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance
	0727: 7.0x2.7 1040: 10.2x4.0	Q: $\pm 0.02\%$ A: $\pm 0.05\%$ B: $\pm 0.1\%$ F: $\pm 1\%$	A: Ammo B: Bulk	S: ± 5 B: ± 10 N: ± 15 C: ± 25	U: 1/2W V: 1/4W	0100: 10 Ω 2201: 2200 Ω 1002: 10000 Ω 1001: 1K Ω 1004: 1M Ω

Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range				TCR (PPM/°C)
					±0.02%	±0.05%	±0.1%	±1%	
0727	1/4W	-55 ~ +125°C	250V	500V	10Ω - 500KΩ				±5
					10Ω - 1MΩ				±10 ±15 ±25
1040	1/2W		300V	600V	10Ω - 500KΩ				±5
					10Ω - 1MΩ				±10 ±15 ±25

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage Listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage Listed above, whichever is lower.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	Resistance value at room temperature and room temperature +60°C
Short Time Overload	±(0.05%+0.05Ω)	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	> 1,000MΩ	Apply 500V _{DC} for 1 minute
Endurance	±(0.2%+0.05Ω)	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat with Load	±(0.2%+0.05Ω)	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Solderability	95% min. coverage	245±5°C for 5 seconds
Resistance to Soldering Heat	±(0.05%+0.01Ω)	350±10°C for 3 seconds or 260±5°C for 10 seconds
Terminal Strength	Tensile: ≥ 2.5kg	Tensile strength: for 10 sec. Torsional strength: Rotated through 360°, 5 rotations
Pulse Overload	±(0.1%+0.01Ω)	4 times RCWV for 10000 cycles with 1second "ON" and 25 seconds "OFF"
Temperature Cycle	±(0.05%+0.05Ω)	-25°C (30min.)/+85°C (30min.), 5 cycles
Resistance to Solvent	No deterioration of coatings and markings	Trichroethane for 3 min. with ultrasonic

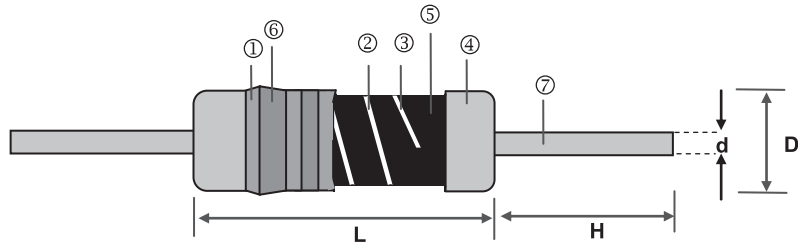
RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: MIL-STD-202, JIS-C 5201-1

■ Storage Temperature: 25°C; Humidity 25~80%RH

Metal Film Leaded Precision Resistor – MFR Series

Construction



①	Insulation Coating	⑤	Resistor Layer
②	Trimming Line	⑥	Marking
③	Ceramic Core	⑦	Lead Wire
④	Electrode Cap		

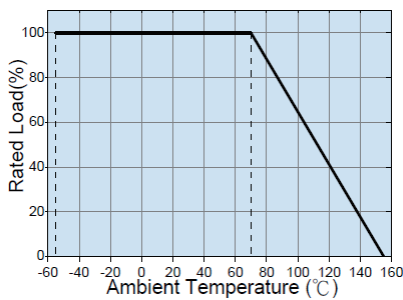
Features

- Excellent overall stability
- Very tight tolerance down to $\pm 0.1\%$
- Extremely low TCR down to ± 10 PPM/ $^{\circ}\text{C}$
- High power rating up to 3 Watts
- Excellent ohmic contact

Applications

- Telecommunication
- Medical Equipment

Derating Curve

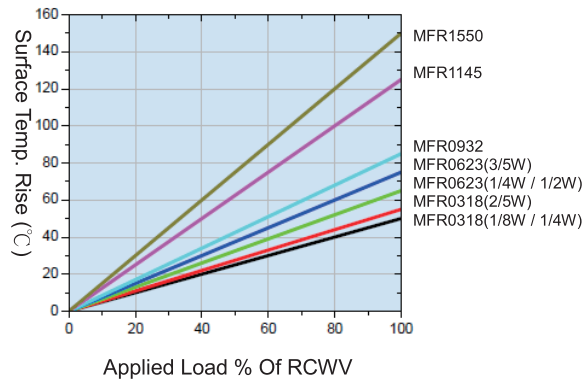


Dimensions

Unit: mm

Type	L	D	H	d	Weight (g) (1000pcs)
MFR0318	3.4 \pm 0.3	1.8 \pm 0.30	29 \pm 3.0	0.45 \pm 0.03	90
MFR0623	6.3 \pm 0.5	2.3 \pm 0.30	28 \pm 3.0	0.55 \pm 0.03	150
MFR0932	9.0 \pm 0.5	3.2 \pm 0.50	26 \pm 3.0	0.65 \pm 0.03	350
MFR1145	11.5 \pm 1.0	4.5 \pm 0.50	35 \pm 3.0	0.78 \pm 0.03	770
MFR1550	15.5 \pm 1.0	5.0 \pm 0.50	32 \pm 3.0	0.78 \pm 0.03	1040

Hot-Spot Temperature



Part Numbering

MFR	0318	B	T	N	W	1001	
Product Type	Dimensions (LxD)	Resistance Tolerance	Packaging Code	TCR (PPM/ $^{\circ}\text{C}$)	Power Rating	Resistance	Special
	0318: 3.4x1.8 0623: 6.3x2.3 0932: 9.0x3.2 1145: 11.5x4.5 1550: 15.5x5.0	A: $\pm 0.05\%$ B: $\pm 0.1\%$ C: $\pm 0.25\%$ D: $\pm 0.5\%$ F: $\pm 1\%$	A: Ammo B: Bulk T: Taping Reel	S: ± 5 B: ± 10 N: ± 15 C: ± 25 D: ± 50 E: ± 100	R: 3W S: 2W T: 1W U: 1/2W V: 1/4W F: 3/5W G: 2/5W W: 1/8W	R100: 0.1 Ω 0010: 1 Ω 1000: 100 Ω 2201: 2200 Ω 1001: 1K Ω 1004: 1M Ω	: Standard MA: MA-type MC: MC-type FA: FA-type FB: FB-type FC: FC-type FD: FD-type

Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Voltage Proof	Resistance Range					TCR (PPM/°C)
						±0.05%	±0.1%	±0.25%	±0.5%	±1%	
0318	1/8W	-55 ~ +155°C	150V	300V	300V	-	10Ω-1MΩ	10Ω-100KΩ		-	±5 ±10
						-	10Ω-1MΩ	-		-	±15
						-	10Ω-1MΩ				±25
						-	10Ω-1MΩ	10Ω-4.99MΩ	10Ω-10MΩ	±50	
						-	10Ω-1MΩ	10Ω-4.99MΩ	0.1Ω-10MΩ	±100	
0623	1/4W	-55 ~ +155°C	250V	500V	500V	10Ω-1MΩ				-	±5
						10Ω-1MΩ				100Ω-22KΩ	±10
						10Ω-1MΩ	10Ω-499KΩ			±15	
						10Ω-1MΩ					±25
						-	10Ω-1MΩ	10Ω-4.99MΩ	10Ω-10MΩ	±50	
0932	1/2W	-55 ~ +155°C	350V	500V	500V	10Ω-1MΩ				-	±5 ±10
						10Ω-1MΩ	-			±15	
						-	10Ω-1MΩ				±25
						-	10Ω-1MΩ	10Ω-4.99MΩ	10Ω-10MΩ	±50	
						-	10Ω-1MΩ	10Ω-4.99MΩ	0.1Ω-10MΩ	±100	
1145	1W	-55 ~ +155°C	500V	700V	700V	10Ω-1MΩ				±25	
						-	10Ω-1MΩ	10Ω-4.99MΩ	10Ω-10MΩ	±50	
						-	10Ω-1MΩ	10Ω-4.99MΩ	0.1Ω-10MΩ	±100	
						-	10Ω-1MΩ				±25
1550	2W	-55 ~ +155°C	500V	1000V	1000V	-	10Ω-1MΩ			±25	
						-	10Ω-1MΩ	10Ω-4.99MΩ	10Ω-10MΩ	±50	
						-	10Ω-1MΩ	10Ω-4.99MΩ	0.1Ω-10MΩ	±100	

High Power & Ultra High Power Rating Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Voltage Proof	Resistance Range					TCR (PPM/°C)
						±0.05%	±0.1%	±0.25%	±0.5%	±1%	
0318	1/4W	-55 ~ +155°C	200V	400V	300V	-	10Ω-1MΩ				±25
						-	10Ω-1MΩ	10Ω-4.99MΩ	10Ω-10MΩ	±50	
						-	10Ω-1MΩ	10Ω-4.99MΩ	0.1Ω-10MΩ	±100	
	2/5W		-	10Ω-1MΩ				±25			
			-	10Ω-1MΩ	10Ω-4.99MΩ	10Ω-10MΩ	±50				
0623	1/2W	-55 ~ +155°C	300V	500V	500V	10Ω-1MΩ				-	±5
						10Ω-1MΩ				100Ω-22KΩ	±10
						10Ω-1MΩ	10Ω-499KΩ			±15	
						10Ω-1MΩ					±25
						-	10Ω-1MΩ	10Ω-4.99MΩ	10Ω-10MΩ	±50	
	-	10Ω-1MΩ	10Ω-4.99MΩ	0.1Ω-10MΩ	±100						
	3/5W	-	100Ω-22KΩ				±10				
		-	10Ω-499KΩ				±15				
		-	10Ω-1MΩ				±25				
-		10Ω-1MΩ	10Ω-4.99MΩ	10Ω-10MΩ	±50						
-	10Ω-1MΩ	10Ω-4.99MΩ	0.1Ω-10MΩ	±100							

High Power & Ultra High Power Rating Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Voltage Proof	Resistance Range					TCR (PPM/°C)
						±0.05%	±0.1%	±0.25%	±0.5%	±1%	
0932	1W	-55 ~ +155°C	400V	600V	500V	10Ω-1MΩ				-	±5 ±10
						10Ω-1MΩ		-			±15
						10Ω-1MΩ					±25
						-	10Ω-1MΩ		10Ω-4.99MΩ	10Ω-10MΩ	±50
						-		10Ω-1MΩ	10Ω-4.99MΩ	0.1Ω-10MΩ	±100
1145	2W	-55 ~ +155°C	500V	700V	700V	-	10Ω-1MΩ			±25	
						-	10Ω-1MΩ		10Ω-4.99MΩ	10Ω-10MΩ	±50
						-		10Ω-1MΩ	10Ω-4.99MΩ	0.1Ω-10MΩ	±100
1550	3W	-55 ~ +155°C	500V	1000V	1000V	-	10Ω-1MΩ			±25	
						-	10Ω-1MΩ		10Ω-4.99MΩ	10Ω-10MΩ	±50
						-		10Ω-1MΩ	10Ω-4.99MΩ	0.1Ω-10MΩ	±100

Operating Voltage= $\sqrt{(P \cdot R)}$ or Max. Operating Voltage Listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{(P \cdot R)}$ or Max. Overload Voltage Listed above, whichever is lower.

Environmental Characteristics

Item	Requirement	Test Method
Resistance Value	1Ω-10MΩ	Measure at a distance of 10mm from the cap end
Short Time Overload	±(0.25%+0.05Ω)	2.5 times RCWV for 5 seconds
Insulation Resistance	> 1000MΩ	The measure was executed by V-Block methods
Endurance	±(1.5%+0.05Ω)	70±2°C, at RCWV (or U _{max.} , whichever less) for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Damp Heat, Steady State	±(1.5%+0.05Ω)	40±2°C, 90~95% R.H. for 56 days, loaded with 0.1 times RCWV (or U _{max.} , whichever less)
Solderability	95% min. Coverag	245±5°C for 3±0.5 seconds
Voltage Proof	By Type	In V-Block for 60 seconds
Temperature Coefficient	By Type	Resistance value at room temperature and room temperature+100°C
Periodic-Pulse Overload Test	±(0.75%+0.05Ω)	4 times RCWV (or U _{max.} , whichever less) for 10000 cycles with 1 second "ON" and 25 seconds "OFF"
Solvent Resistance To Marking	No obvious abnormality in coatings and markings	IPA for 5±0.5 Min. with ultrasonic
Robustness of Terminalations	Tensile: ≥ 2.5kg (24.5N)	Direct Load for 10 sec. In the direction off the terminal leads
Resistance to Soldering Heat	0318: ±(0.75%+0.05Ω) 0623&0932: ±(0.5%+0.05Ω) 1145&1550: ±(0.25%+0.05Ω)	The solder iron heated to 260°C±5°C and applied to the termination for a duration of 10±1 seconds
Temperature Cycling	±(0.75%+0.05Ω)	-55°C/125°C with 5 cycles. the duration at each temperature 30 min

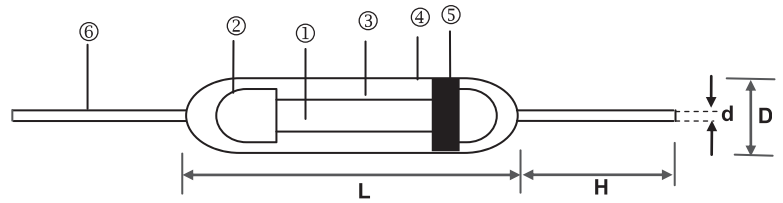
RCWV(Rated Continuous Working Voltage)= $\sqrt{(P \cdot R)}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC 60115-1

■ Storage Temperature: 25±10°C; Humidity <80%RH

Metal Oxide Film Leaded Resistor – MOF Series

Construction



Features

- Excellent Long-Time stability
- Complete Flameproof Construction UL-94V0
- Wide resistance range: 0.1Ω~1MΩ
- Controlled temperature coefficient
- Resistance standard tolerance: ±5%
- Coating and marking resist trichlorethylene, freon, and other cleaing agents

① Ceramic Rod	④ Non-flame Paint With Sol Vent-proof
② Tinned Iron Caps	⑤ Color Code
③ Metal Oxide Film	⑥ Lead Wire

Applications

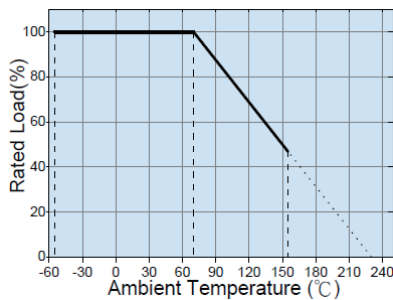
- Telecommunication
- Medical Equipment

Dimensions

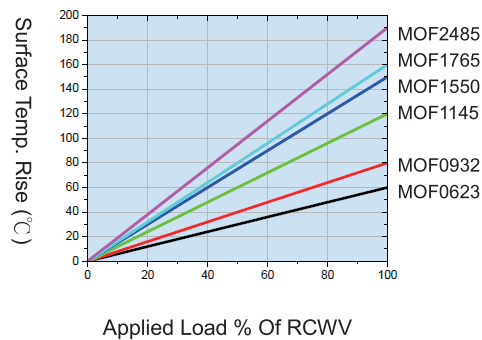
Unit: mm

Type	L	D	H	d	Weight (g) (1000pcs)
MOF0623	6.3±0.5	2.3±0.3	28±3.0	0.55±0.03	156
MOF0932	9.0±0.5	3.2±0.5	26±3.0	0.65±0.03	355
MOF1145	11.5±1.0	4.5±0.5	35±3.0	0.78±0.03	760
MOF1550	15.5±1.0	5.0±0.5	32±3.0	0.78±0.03	1040
MOF1765	17.5±1.0	6.0±0.5	35±3.0	0.78±0.03	1800
MOF2485	24.5±1.0	8.0±0.5	35±3.0	0.78±0.03	4000

Derating Curve



Hot-Spot Temperature



Part Numbering

MOF	0623	F	A	G	U	1001	MA
Product Type	Dimensions (L×D)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Special
	0623: 6.3x2.3 0932: 9.0x3.2 1145: 11.5x4.5 1550: 15.5x5.0 1765: 17.5x6.0 2485: 24.5x8.0	F: ±1% G: ±2% J: ±5%	A: Ammo B: Bulk T: Taping Reel	G: ±300	D: 5W R: 3W S: 2W T: 1W U: 1/2W V: 1/4W	R100: 0.1Ω 0010: 1Ω 1000: 100Ω 2201: 2200Ω 1001: 1KΩ 1004: 1MΩ	: Standard MA: MA-type MC: MC-type FA: FA-type FB: FB-type FC: FC-type

Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Resistance Range			TCR (PPM/°C)
						±1%	±2%	±5%	
0623	1/4W	-55 ~ +235°C	200V	350V	350V	0.1Ω - 1MΩ			±300
0932	1/2W		250V	400V	350V	0.1Ω - 1MΩ			
1145	1W		500V	600V	500V	0.1Ω - 1MΩ			
1550	2W		500V	600V	500V	0.1Ω - 1MΩ			
1765	3W		500V	1000V	750V	0.1Ω - 1MΩ			
2485	5W		750V	1000V	750V	0.1Ω - 1MΩ			

High Power Rating Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Resistance Range			TCR (PPM/°C)
						±1%	±2%	±5%	
0623	1/2W	-55 ~ +235°C	250V	400V	350V	0.1Ω - 1MΩ			±300
0932	1W		300V	500V	400V	0.1Ω - 1MΩ			
1145	2W		500V	600V	500V	0.1Ω - 1MΩ			
1550	3W		500V	800V	600V	0.1Ω - 1MΩ			
1765	5W		700V	1000V	750V	0.1Ω - 1MΩ			

Operating Voltage= $\sqrt{P \cdot R}$ or Max. operating voltage Listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. overload voltage Listed above, whichever is lower.

For resistance value out of above range is by request. Below 10Ω and over 51K(excluded) are using alloy film.

Resistor body color: Standard Power Rating: Grey

High Power Rating: Grey or Pink are available

Environmental Characteristics

Item	Requirement	Test Method
Resistance Value	0.1Ω – 1MΩ	Measure at a distance of 10mm from the cap end
Short Time Overload	±(1%+0.05Ω) for standard power ±(2%+0.05Ω) for high power	2.5 times RCWV for 5 seconds
Insulation Resistance	> 1000MΩ	The measure was executed by V-Block methods
Endurance	±(5%+0.05Ω)	70±2°C, RCWV (or Umax., whichever less) for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat, Steady State	±(5%+0.05Ω)	40±2°C, 90~95% R.H. for 56 days, loaded with 0.1 times RCWV (or Umax., whichever less)
Solderability	95% min. Coverage	245±5°C for 3±0.5 seconds
Voltage Proof	By Type	In V-Block for 60 seconds
Temperature Coefficient	By Type	Resistance value at room temperature and room temperature+100°C
Periodic-Pulse Overload Test	±(2%+0.05Ω)	4 times RCWV (or Umax., whichever less) for 10000 cycles with 1second "ON" and 25 seconds "OFF"
Solvent Resistance of Marking	No obvious deterioration of coatings and markings	IPA for 5±0.5 Min. with ultrasonic
Robustness of Terminations	Tensile: ≥ 2.5kg(24.5N)	Direct Load for 10 seconds In the direction off the terminal leads
Temperature Cycling	±(1%+0.05Ω)	55°C /155°C with 5 cycles the duration at each temperature 30 min
Resistance to Soldering Heat	±(1%+0.05Ω)	The solder iron heated to 260±5°C and applied to the termination for duration of 10±1 seconds

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

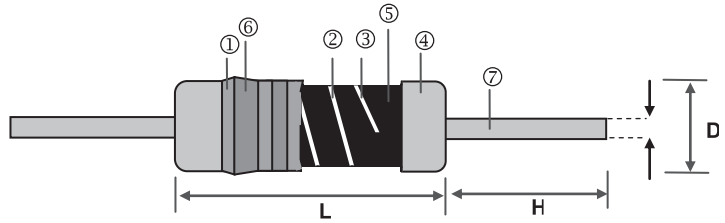
Reference Standards: IEC 60115-1 JIS-C 5201-1

Storage Temperature: 15±10°C; Humidity <80%RH

High Ohmic / High Voltage Metal Glazed Led Resistor—MGQ Series



Construction



Features

- Similar characteristic With metal film but resistance Value can be as high as 1GB
- Metal-glaze elements high stable performance against environmental conditions and overload Resistant to heat, Humidity & solvents
- Tolerance: $\pm 1\%$, $\pm 5\%$
- RoHS compliant / Lead-free available

①	Insulation Coating	⑤	Resistor Layer
②	Trimming Line	⑥	Marking
③	Ceramic Core	⑦	Lead Wire
④	Electrode Cap		

Dimensions

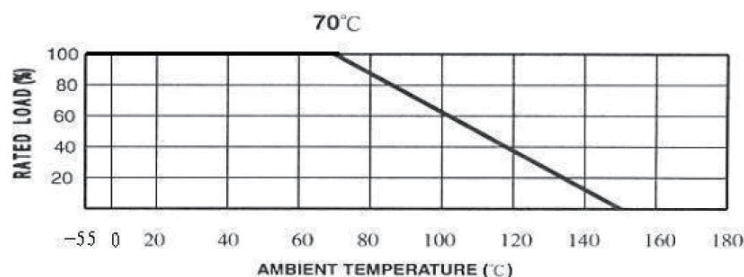
Unit: mm

Type	L	D	H	d	Weight (g) (1000pcs)	Packaging Ammo
MGQ0623	6.3 \pm 0.5	2.3 \pm 0.3	27 \pm 3.0	0.45 \pm 0.05	196.0	5,000
MGQ0932	9.0 \pm 1.0	3.5 \pm 0.5	26 \pm 3.0	0.56 \pm 0.05	389.0	2,500
MGQ1145	11.0 \pm 1.0	4.5 \pm 0.5	25 \pm 3.0	0.65 \pm 0.05	776.0	1,000
MGQ1550	15.0 \pm 1.0	5.0 \pm 0.5	33 \pm 3.0	0.80 \pm 0.05	1108.5	1,000
MGQ1760	17.0 \pm 1.0	6.0 \pm 0.5	32 \pm 3.0	0.80 \pm 0.05	1800.0	500

Part Numbering

MGQ	0623	J	A	4	V	1004
Product Type	Dimensions (LxD)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance
	0623: 6.3x2.3 0932: 9.0x3.5 1145: 11.5x4.5 1550: 15.5x5.0 1760: 17.0x6.0	F: $\pm 1\%$ J: $\pm 5\%$	A: Ammo	4: ± 350	V: 1/4W U: 1/2W T: 1W S: 2W R: 3W	1003: 100K Ω 1004: 1M Ω 1006: 100M Ω

Derating Curve



Standard Electrical Specifications

Item Type	Power Rating at 70°C	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Resistance Range		TCR (PPM/°C)
					±1%	±5%	
0623	1/4W	1600V	3000V	300V	100Ω~100MΩ		±350
0932	1/2W	3500V	7000V	500V	100Ω~100MΩ		±350
1145	1W	5000V	10000V	500V	100Ω~100MΩ		±350
1550	2W	7000V	14000V	600V	100Ω~100MΩ		±350
1760	3W	7000V	14000V	600V	100Ω~100MΩ		±350

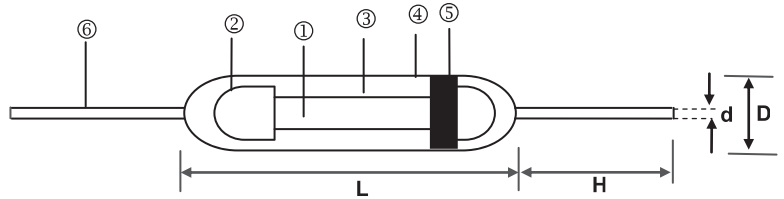
Resistor body color: Pink

Environmental Characteristics

Item	Requirement	Test Method
Short Time Overload	$\leq \pm(1\%R+0.5\Omega)$ Shall be no mechanical breakage	AC or DC voltage 2.5 times the rated voltage for 5 seconds
Endurance	$\leq \pm(5\%R+0.1\Omega)$ Shall be no mechanical breakage	70°C, apply rated voltage for 1000 hrs with 1 hrs "ON" and 0.5 hrs "OFF"
Damp Heat with Load	$\leq \pm(5\%R+0.1\Omega)$ Shall be no mechanical breakage	40±2°C, 90~95% R.H. apply rated voltage for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Solderability	95% min. Coverage	260±5°C for 5±0.5 seconds
Voltage Endurance	No breakdown or flashover	Place the resistor in the "V" slot and hold for one minute, as shown in specifications
Temperature Coefficient of Resistance (T.C.R)	±350PPM	$PPM/°C = \frac{R - R_0}{R_0} \cdot \frac{10^6}{T - T_0}$ R = Measured resistance (Ω) at T R ₀ = Measured resistance (Ω) at T ₀ T = Measured test temperature(°C) T ₀ = Measured base temperature(°C)
Resistance to solvent	No visible damages to protective coating and marking	The resistor shall be completely immersed for 3 min in IPA and rubbed 10 times with the whisk
Resistance To Soldering Heat	$\leq \pm(1\%R+0.5\Omega)$ Shall be no mechanical breakage	Dip the lead in to a solder bath having a temperature of 350±10°C up to 3±0.05mm from the body of the resistor and hold it for 3.5±0.5seconds leave the resistor ,at room temperature 1 hours after ,then Measure
Terminal Strength	Shall be no mechanical breakage	Pull test apply 3.5KG force to the lead in the direction of lead axis for 30±5 seconds
Endurance at upper-limit temperature	$\leq \pm(5\%R+0.1\Omega)$	At 125°C temperature, duration of 1000h
Flammability	No evidence of flaming	The test flame shall be applied and removed for 15 secretary respectively, and repeated cycle for 5times

Carbon Film Led Resistor – CFR Series

Construction



① Ceramic Rod	④ Non-flame Paint With Sol Vent-proof
② Tinned Iron Caps	⑤ Color Code
③ Carbon Film	⑥ Lead Wire

Features

- The characteristics correspond to the IEC 60115-1 standard specification
- General-purpose lead-type resistors
- Automatic insertion is applicable
- Availability of various types and excellent long time stability
- Wide resistance range from 0.1 Ω to 10 MΩ

Applications

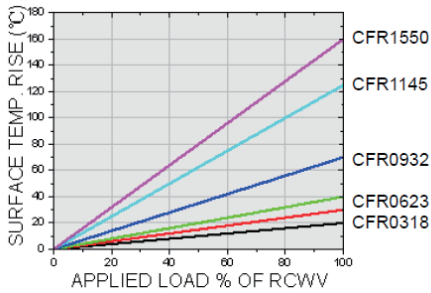
- Telecommunication
- Medical Equipment

Dimensions

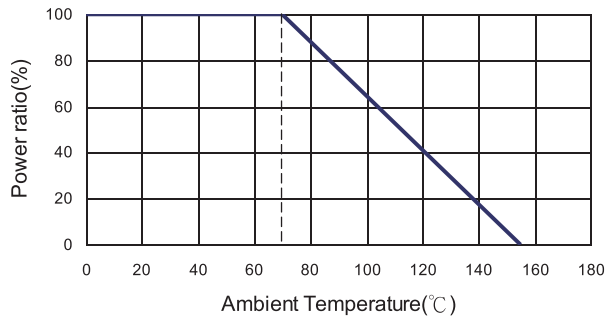
Unit: mm

Type	L	D	H	d	Weight (g) (1000pcs)
CFR0318	3.4±0.5	1.8±0.3	29±3.0	0.41~0.48	92
CFR0623	6.3±0.5	2.3±0.3	28±3.0	0.43~0.58	155
CFR0932	9.0±0.5	3.2±0.5	26±3.0	0.58~0.68	352
CFR1145	11.5±1.0	4.5±0.5	35±3.0	0.68~0.81	775
CFR1550	15.5±1.0	5.0±0.5	32±3.0	0.75~0.81	1042

Hot-Spot Temperature



Derating Curve



Part Numbering

CFR	0318	J	T	-	W	1001	MA
Product Type	Dimensions (L×D)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Special
	0318: 3.4x1.8 0623: 6.3x2.3 0932: 9.0x3.2 1145: 11.5x4.5 1550: 15.5x5.0	J: ±5%	A: Ammo B: Bulk T: Taping Reel	-: No specified	R: 3W S: 2W T: 1W U: 1/2W V: 1/4W W: 1/8W	R500: 0.5Ω 0010: 1Ω 1000: 100Ω 2201: 2200Ω 1001: 1KΩ 1004: 1MΩ	: Standard MA: MA-type MC: MC-type FA: FA-type FB: FB-type FC: FC-type FD: FD-type

Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Resistance Range	
						±5%	
						E6	E24
0318	1/8W	-55 ~ +155°C	150V	300V	300V	0.1Ω – 0.68Ω	1Ω - 10MΩ
0623	1/4W		250V	500V	500V	0.1Ω – 0.68Ω	1Ω - 10MΩ
0932	1/2W		350V	700V	700V	0.1Ω – 0.68Ω	1Ω - 10MΩ
1145	1W		450V	1000V	1000V	0.1Ω – 0.68Ω	1Ω - 10MΩ
1550	2W		500V	1000V	1000V	0.1Ω – 0.68Ω	1Ω - 10MΩ

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage Listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage Listed above, whichever is lower.

High Power Rating Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Resistance Range	
						±5%	
						E6	E24
0318	1/4W	-55 ~ +155°C	200V	400V	400V	0.1Ω – 0.68Ω	1Ω - 10MΩ
0623	1/2W		300V	500V	500V	0.1Ω – 0.68Ω	1Ω - 10MΩ
0932	1W		400V	800V	800V	0.1Ω – 0.68Ω	1Ω - 10MΩ
1145	2W		500V	1000V	1000V	0.1Ω – 0.68Ω	1Ω - 10MΩ
1550	3W		500V	1000V	1000V	0.1Ω – 0.68Ω	1Ω - 10MΩ

Resistor body color:

Standard power rating: Light Brown

High power rating 0318 size: Light Brown is available only other sizes: Light Brown or Pink are available.

Please specify which color is acceptable else the light brown is a top priority.

For resistance value out of above range is by request. Below 10Ω are using alloy film

Environmental Characteristics

Item	Requirement	Test Method
Resistance Value	1Ω ~ 10MΩ	Measure at a distance of 10mm from the cap end
Short Time Overload	±(0.75%+0.05Ω)	2.5 times RCWV for 5 seconds
Insulation Resistance	>1000MΩ	The measure was executed by V-Block methods
Endurance	±(3%+0.05Ω)	70±2°C, RCWV (or U _{max} , whichever less) for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Damp Heat, Steady State	<100KΩ±3% >101KΩ±5%	40±2°C, 90~95% R.H. for 56 days, loaded with 0.1 times RCWV (or U _{max} , whichever less)
Solderability	95% min. coverage	245±5°C for 3±0.5 seconds
Voltage Proof	By Type	In V-Block for 60 seconds
Temperature Coefficient	1145/1550: < 1Ω ±1500ppm 1Ω~100KΩ ±350ppm 100KΩ~1MΩ -0ppm-500ppm 1MΩ~10MΩ -0ppm-1000ppm Other sizes: < 1Ω ±1500ppm 1Ω~100KΩ +350ppm-500 ppm 100KΩ~1MΩ -0ppm-700ppm 1MΩ~10MΩ -0ppm-1500ppm	Resistance value at room temperature and room temperature+100°C
Periodic-Pulse Overload Test	±(1%+0.05Ω)	4 times RCWV (or U _{max} , whichever less) for 10000 cycles with 1 second "ON" and 25 seconds "OFF"
Solvent Resistance of Marking	No obvious deterioration of coatings and markings	IPA for 5±0.5 Min. with ultrasonic
Robustness of Terminations	Tensile: ≥ 2.5 kg (24.5N)	Direct Load for 10 seconds In the direction off the terminal leads
Temperature Cycling	±(1%+0.05Ω)	-55°C /155°C with 5 cycles the duration at each temperature 30 min
Resistance to Soldering Heat	±(1%+0.05Ω)	The solder iron heated to 260±5°C and applied to the termination for duration of 10±1 seconds

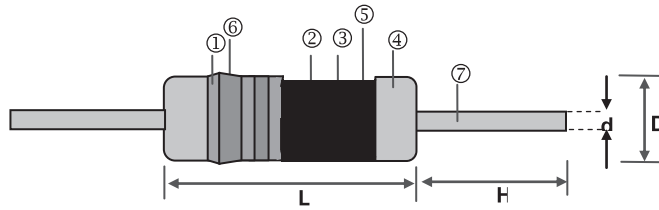
RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

Reference Standards: IEC 60115-1

Storage Temperature: 25±10°C; Humidity <80%RH

Metal Film Flame-Proof Resistor – FMR Series

Construction



Features

- Low Noise
- Low TCR from $\pm 15 \sim 100 \text{PPM}/^\circ\text{C}$
- High Precision from $\pm 0.1\% \sim 1\%$
- Flameproof Coating equivalent to UL94V-0

① Insulation Coating	⑤ Resistor Layer
② Trimming Line	⑥ Marking
③ Ceramic Core	⑦ Lead Wire
④ Electrode Cap	

Applications

- Telecommunication
- Medical Equipment
- Consumer Product

Dimensions

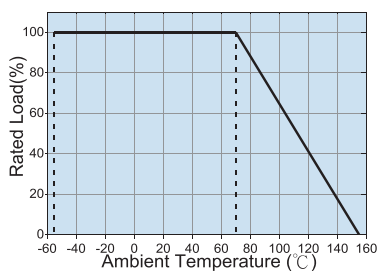
Unit: mm

Type	L	D	H	d	Weight (g) (1000pcs)
FMR0623	6.3 \pm 0.5	2.3 \pm 0.3	28 \pm 3.0	0.55 \pm 0.03	196.0
FMR0932	9.0 \pm 0.5	3.2 \pm 0.5	26 \pm 3.0	0.65 \pm 0.03	389.0
FMR1145	11.5 \pm 1.0	4.5 \pm 0.5	35 \pm 3.0	0.78 \pm 0.03	776.0
FMR1550	15.5 \pm 1.0	5.0 \pm 0.5	32 \pm 3.0	0.78 \pm 0.03	1108.5

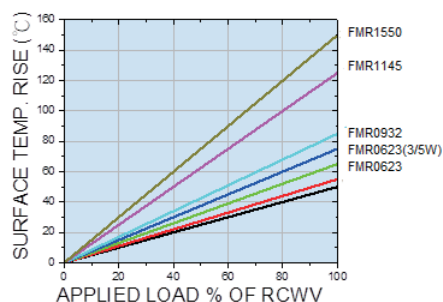
Part Numbering

FMR	0623	B	T	N	V	1001	
Product Type	Dimensions (L×D)	Resistance Tolerance	Packaging Code	TCR (PPM/ $^\circ\text{C}$)	Power Rating	Resistance	Special
	0623: 6.3x2.3 0932: 9.0x3.2 1145: 11.5x4.5 1550: 15.5x5.0	B: $\pm 0.1\%$ C: $\pm 0.25\%$ D: $\pm 0.5\%$ F: $\pm 1\%$	A: Ammo B: Bulk T: Taping Reel	B: ± 10 N: ± 15 C: ± 25 D: ± 50 E: ± 100	R: 3W S: 2W T: 1W F: 3/5W U: 1/2W V: 1/4W	0010: 1 Ω 1000: 100 Ω 2201: 2200 Ω 1001: 1K Ω 1004: 1M Ω	: Standard MA: MA-type MC: MC-type FA: FA-type FB: FB-type FC: FC-type FD: FD-type

Derating Curve



Hot-spot Temperature



Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Working Voltage	Max. Overload Voltage	Voltage Proof	Resistance Range				TCR (±PPM/°C)
						±0.1%	±0.25%	±0.5%	±1%	
0623	1/4W	-55 ~ +155°C	250V	500V	350V	100Ω~22KΩ				±10
						10Ω~499KΩ				±15
						10Ω-1MΩ				±25
						10Ω-1MΩ	10Ω-4.99MΩ	10Ω-10MΩ	±50	
						-	10Ω-1MΩ	10Ω-4.99MΩ	0.1Ω-10MΩ	±100
0932	1/2W		350V	500V	400V	10Ω-1MΩ				±25
						10Ω-1MΩ	10Ω-4.99MΩ	10Ω-10MΩ	±50	
						-	10Ω-1MΩ	10Ω-4.99MΩ	0.1Ω-10MΩ	±100
1145	1W		500V	700V	500V	10Ω-1MΩ				±25
						10Ω-1MΩ	10Ω-4.99MΩ	10Ω-10MΩ	±50	
		-				10Ω-1MΩ	10Ω-4.99MΩ	0.1Ω-10MΩ	±100	
1550	2W	500V	1000V	750V	10Ω-1MΩ				±25	
					10Ω-1MΩ	10Ω-4.99MΩ	10Ω-10MΩ	±50		
					-	10Ω-1MΩ	10Ω-4.99MΩ	0.1Ω-10MΩ	±100	

High Power Rating Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Working Voltage	Max. Overload Voltage	Voltage Proof	Resistance Range				TCR (±PPM/°C)
						±0.1%	±0.25%	±0.5%	±1%	
0623	1/2W	-55 ~ +155°C	300V	500V	350V	100Ω-22KΩ				±10
						10Ω-499KΩ				±15
						10Ω-1MΩ				±25
						10Ω-1MΩ	10Ω-4.99MΩ	10Ω-10MΩ	±50	
						-	10Ω-1MΩ	10Ω-4.99MΩ	0.1Ω-1MΩ	±100
0623	3/5W		300V	500V	350V	100Ω-22KΩ				±10
						10Ω-499KΩ				±15
						10Ω-1MΩ				±25
						10Ω-1MΩ	10Ω-4.99MΩ	10Ω-10MΩ	±50	
						-	10Ω-1MΩ	10Ω-4.99MΩ	0.1Ω-1MΩ	±100
0932	1W	400V	600V	400V	10Ω-1MΩ				±25	
					10Ω-1MΩ	10Ω-4.99MΩ	10Ω-10MΩ	±50		
					-	10Ω-1MΩ	10Ω-4.99MΩ	0.1Ω-1MΩ	±100	
1145	2W	500V	700V	500V	10Ω-1MΩ				±25	
					10Ω-1MΩ	10Ω-4.99MΩ	10Ω-10MΩ	±50		
					-	10Ω-1MΩ	10Ω-4.99MΩ	0.1Ω-1MΩ	±100	
1550	3W	500V	1000V	750V	10Ω-1MΩ				±25	
					10Ω-1MΩ	10Ω-4.99MΩ	10Ω-10MΩ	±50		
					-	10Ω-1MΩ	10Ω-4.99MΩ	0.1Ω-1MΩ	±100	

Operating Voltage= $\sqrt{P \cdot R}$ or Max. operating voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. overload voltage listed above, whichever is lower.

Resistor body color : Grey

■ Environmental Characteristics

Item	Specification	Test Method
Resistance Value	1Ω-10MΩ	Measure at a distance of 10mm from the cap end
Short Time Overload	±(0.25%+0.05Ω)	RCWV*2.5 for 5 seconds
Temperature Coefficient	By Type	Resistance value at room temperature and room temperature+100°C
Voltage Proof	By Type	In V-Block for 60 seconds
Periodic-Pulse Overload	±(0.75%+0.05Ω)	4 times RCWV (or Umax. whichever less) for 10000cycles (1sec.on , 25secs.off)
Insulation Resistance	> 1000MΩ	The measure was executed by V-Block methods
Endurance	±(1.5%+0.05Ω)	70±2°C, at RCWV (or Umax., whichever less) for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Damp Heat (Steady State)	±(1.5%+0.05Ω)	40±2°C, 90~95% R.H., for 56 days , loaded with 0.1 times RCWV (or Umax. whichever less)
Solderability	95% Min. Coverage	245±5°C for 3±0.5 seconds
Resistance to Soldering Heat	0623 / 0932 sizes: ±(0.5%+0.05Ω) 1145 / 1550 sizes: ±(0.25%+0.05Ω)	The solder iron heated to 260±5°C and applied to the termination for a duration of 10±1 seconds
Solvent Resistance of Marking	No obvious deterioration of coatings and markings	IPA for 5±0.5 min. with ultrasonic
Robustness of Terminations	Tensile: ≥ 2.5kg (24.5N)	Direct Load for 10 sec. In the direction off the terminal leads.
Temperature Cycling	±(0.75%+0.05Ω)	-55°C/155°C with 5 cycles. the duration at each temperature 30 min

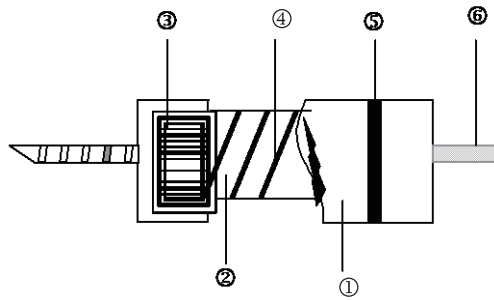
RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower

■ Reference Standards: IEC 60115-1

■ Storage Temperature: 25±10°C; Humidity <80%RH

Wire Wound Led Resistor – KNQ Series

Construction



① Non-flame Paint With Sol Vent-proof	④ Copper-Nickel Alloy Wire Wound Film
② Ceramic Rod	⑤ Marking (Expose)
③ End Cap	⑥ Lead Wire

Features

- Low resistance value
- Flame retardant coating
- Standard tolerance $\pm 5\%$
- RoHS compliant / lead-free available

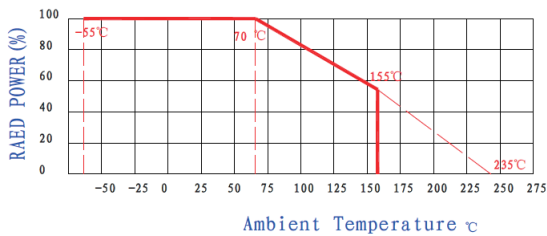
Applications

- Suitable for Use In A Variety of Military Electronics Power, Sampling, Start, Oscillation Circuit, etc.

Dimensions



Derating Curve



Unit: mm

Type	L	D	H	d	Weight (g) (1000pcs)	Packaging
						Ammo
0932	9.0 \pm 0.5	3.5 \pm 0.5	26 \pm 2.0	0.56 \pm 0.05	373.0	2500PCS
1145	11.5 \pm 1.0	4.5 \pm 0.5	35 \pm 2.0	0.65 \pm 0.05	758.0	1000PCS
1550	15.5 \pm 1.0	5.0 \pm 0.5	33 \pm 2.0	0.70 \pm 0.05	1108.5	1000PCS
1760	17.0 \pm 1.0	6.0 \pm 0.5	32 \pm 2.0	0.70 \pm 0.05	1648.0	500PCS
2480	24.0 \pm 1.0	8.0 \pm 0.5	28 \pm 3.0	0.70 \pm 0.05	3832.0	250PCS

Part Numbering

KNQ	0932	J	A	G	U	1000
Product Type	Dimensions (LxD)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance
	0932: 9.0x3.5 1145: 11.5x4.5 1550: 15.0x5.0 1760: 17.0x6.0 2480: 24.0x8.0	J: $\pm 5\%$	A: Ammo B: Bulk	G: ≤ 300	D: 5W R: 3W S: 2W T: 1W U: 1/2W	R100: 0.1 Ω 0010: 1 Ω 0100: 10 Ω 1000: 100 Ω

Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Dielectric Withstanding Voltage	Resistance Range	TCR (PPM/°C)
				±5%	
0932	1/2W	-55 ~ +155°C	300V	0.1Ω~300Ω	≤ 300
1145	1W		350V	0.1Ω~500Ω	
1550	2W		350V	0.1Ω~1KΩ	
1760	3W		500V	0.1Ω~1.5KΩ	
2480	5W		500V	0.1Ω~2.5KΩ	

High Power Rating Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Dielectric Withstanding Voltage	Resistance Range	TCR (±PPM/°C)
				±5%	
0932	1W	-55 ~ +155°C	300V	0.1Ω~500Ω	≤ 300
1145	2W		350V	0.1Ω~500Ω	
1550	3W		350V	0.1Ω~1KΩ	
1760	5W		500V	0.1Ω~1.5KΩ	

Resistor body color : Grey

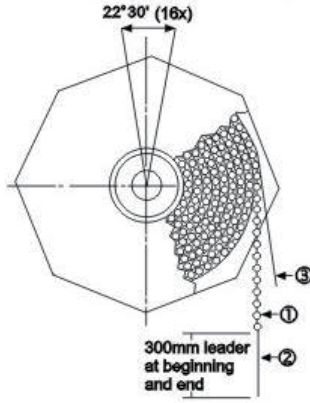
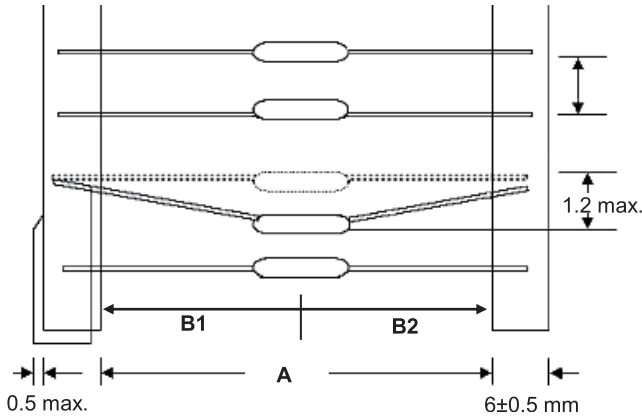
Environmental Characteristics

Item	Requirement	Test Method
Short Time Overload	≤ ±(2%R+0.05Ω) Shall be no mechanical breakage	AC or DC voltage 2.5 times the rated voltage for 5 seconds
Endurance	≤ ±(5%R+0.05Ω) Shall be no mechanical breakage	70°C, apply rated voltage for 1000 hrs with 1 hrs "ON" and 0.5 hrs "OFF"
Damp Heat with Load	≤ ±(5%R+0.1Ω) Shall be no mechanical breakage	40±2°C, 90~95% R.H. apply rated voltage for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Solderability	95% min. Coverage	260±5°C for 5±0.5 seconds
Voltage Endurance	No breakdown or flashover	Place the resistor in the "V" slot and hold for one minute, as shown in specifications
Temperature Coefficient of Resistance (T.C.R)	≤ 300PPM	$PPM/°C = \frac{R - R_0}{R_0} * \frac{10^6}{T - T_0}$ R = Measured resistance (Ω) at T R ₀ = Measured resistance (Ω) at T ₀ T = Measured test temperature(°C) T ₀ = Measured base temperature(°C)
Resistance To Soldering Heat	≤ ±(2%R+0.05Ω) Shall be no mechanical breakage	Dip the lead in to a solder bath having a temperature of 350 ±10°C up to 3±0.05mm from the body of the resistor and hold it for 3.5±0.5seconds leave the resistor ,at room temperature 1 hours after ,then Measure
Terminal Strength	Shall be no mechanical breakage	Pull test apply 3.5KG force to the lead in the direction of lead axis for 30±5 seconds
Vibration	Shall be no mechanical breakage	set a resistor at the vibration table and vibrate 10HZ—55HZ 10HZ/s. with 1.5mm amplitude in 1 min. when the change of frequency shall be completed uniformly. the vibration shall apply to 3 directions, vertical and horizontal to the axis of resistor each for 3h.
Endurance at upper-limit temperature	≤ ±(5%R+0.1Ω)	At 125°C temperature, duration of 1000h

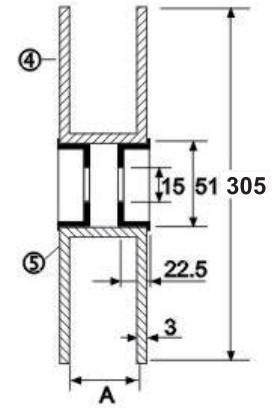
■ Taping/Packing Specifications (For MFR / MOF / CFR / FMR)

1. Standard Type (Reel & Ammo)

Packing Methods



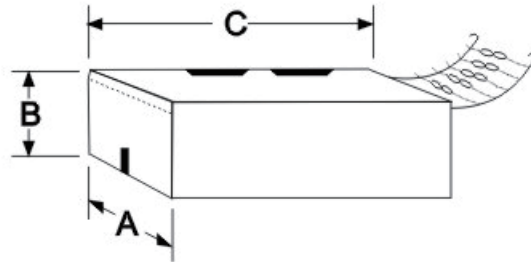
- (1) Resistor
- (2) Bandolier
- (3) Paper
- (4) Flange
- (5) Cylinder



Unit: mm

Type	Packing Methods			Reel Packing				
	A	B1-B2	S	Across Flange (A)	MFR Qty	CFR Qty	MOF Qty	FMR Qty
0318	52+1/-0	1.2	5±0.3	72	5,000	5,000	-	-
	26+0.5/-0	1.0						
0623	52+1/-0	1.2	5±0.3	72	5,000	5,000	5,000	5,000
	26+0.5/-0	1.0						
0932	52+1/-0	1.2	5±0.3	72	2,500	2,500	2,500	2,500
1145	73+1/-0	1.5	5±0.3	95	2,000	2,000	2,000	2,000
	52+1/-0							
1550	73+1/-0	1.5	10±0.8	95	1,000	1,000	1,000	1,000
	52+1/-0							
1760	73+1/-0	1.5	10±0.8	95	-	-	-	-
1765	73+1/-0	1.5	10±0.8	95	-	-	1,000	-
2480	88+1/-0	1.5	10±0.8	110	-	-	-	-
2485	88+1/-0	1.5	10±0.8	110	-	-	500	-

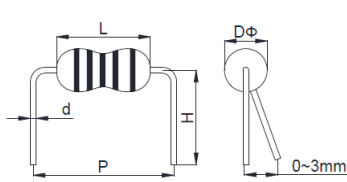
Ammo Packing



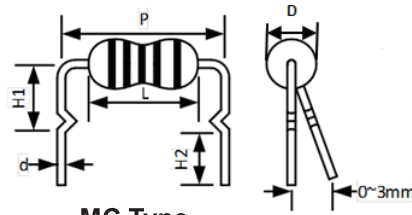
Unit: mm

Type	Packing Methods			Ammo Packing						
	A	B1-B2	S	A	B	C	MFR Qty	CFR Qty	MOF Qty	FMR Qty
0318	52+1/-0	1.2	5±0.3	79±2	73±3	257±5	5,000	5,000	-	-
	26+0.5/-0	1.0		52±2	74±3	252±5				
0623	52+1/-0	1.2	5±0.3	79±2	100±3	257±5	5,000	5,000	5,000	5,000
	26+0.5/-0	1.0		52±2	109±3	252±5				
0932	52+1/-0	1.2	5±0.3	79±2	58±3	257±5	1,000	1,000	1,000	1,000
1145	73+1/-0	1.5	5±0.3	103±2	82±3	262±5	1,000	1,000	1,000	1,000
	52+1/-0			81±2	85±3	256±5				
1550	73+1/-0	1.5	10±0.8	103±2	96±3	265±5	1,000	1,000	1,000	1,000
	52+1/-0			82±2	108±3	258±5				
1760	73+1/-0	1.5	10±0.8	103±2	82±3	262±5	-	-	-	-
1765	73+1/-0	1.5	10±0.8	103±2	82±3	262±5	-	-	500	-
2480	88+1/-0	1.5	10±0.8	115±2	73±3	265±5	-	-	-	-
2485	88+1/-0	1.5	10±0.8	115±2	73±3	265±5	-	-	250	-

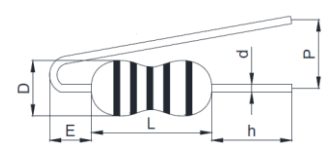
2. Special Type (Bulk)



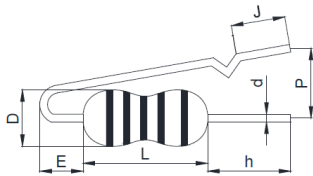
MA Type



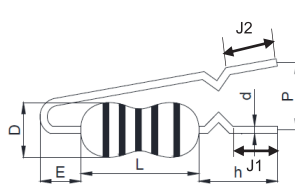
MC Type



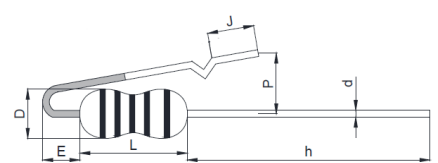
FA Type



FB Type



FC Type

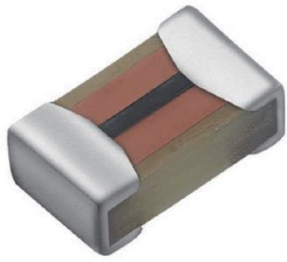


FD Type

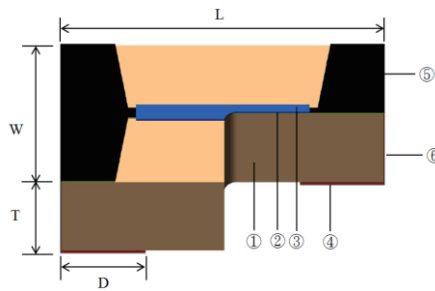
Unit: mm

Product Type	Type	P	H /H1/h	H2/G	J/J1/J2	D	L	d	E
0318	MA	5±1	8.0±1	-	-	1.8±0.3	3.4±0.5	0.45±0.03	-
0623	MA	10±1	10.0±1	-	-	2.3±0.3	6.3±0.5	0.55±0.03	-
	FD	5~15	27.0±2	-	12±2	2.3±0.3	6.3±0.5	0.55±0.03	3±1
0932	MA	12.5±1	10.0±1	-	-	3.2±0.5	9.0±0.5	0.65±0.03	-
	MC	12.5±1	6.5±2	3.5±2	-	3.2±0.5	9.0±0.5	0.65±0.03	-
	FA	5~15	5.0±2	-	-	3.2±0.5	9.0±0.5	0.65±0.03	3±1
	FB	5~15	4.0±2	-	3±2	3.2±0.5	9.0±0.5	0.65±0.03	3±1
	FC	5~15	10.0±3	-	4±2	3.2±0.5	9.0±0.5	0.65±0.03	3±1
1145	MA	15±1	12.5±1	-	-	4.5±0.5	11.5±1.0	0.78±0.03	-
	MC	15±1	9.5±2	4.5±2	-	4.5±0.5	11.5±1.0	0.78±0.03	-
	FA	5~15	5.0±2	-	-	4.5±0.5	11.5±1.0	0.78±0.03	3±1
	FB	5~15	4.0±2	-	3±2	4.5±0.5	11.5±1.0	0.78±0.03	3±1
	FC	5~15	10.0±3	-	4±2	4.5±0.5	11.5±1.0	0.78±0.03	3±1
1550	MA	20±1	15.0±1	-	-	5.0±0.5	15.5±1.0	0.78±0.03	-
	MC	20±1	13.5±2	3.5±2	-	5.0±0.5	15.5±1.0	0.78±0.03	-
	FA	5~15	5.0±2	-	-	5.0±0.5	15.5±1.0	0.78±0.03	3±1
	FB	5~15	4.0±2	-	3±2	5.0±0.5	15.5±1.0	0.78±0.03	3±1
	FC	5~15	10.0±3	-	4±2	5.0±0.5	15.5±1.0	0.78±0.03	3±1
1760 1765	MA	25±1	15.0±1	-	-	6.0±0.5	17.5±1.0	0.78±0.03	-
	MC	24±1	5.0±1	6.0±2	-	6.0±0.5	17.5±1.0	0.78±0.03	-
	FB	5~15	7.0±3	-	3±2	6.0±0.5	17.5±1.0	0.78±0.03	3±1
	FC	5~15	7.0±3	-	4±2	6.0±0.5	17.5±1.0	0.78±0.03	3±1
2480 2485	MA	30±1	15.0±1	-	-	8.0±0.5	24.5±1.0	0.78±0.03	-
	FC	5~15	7.0±3	-	4±2	8.0±0.5	24.5±1.0	0.78±0.03	3±1

Foil Initiator Chip Resistor – FIR Series



Construction



① FR4 Substrate	④ Bottom Electrode
② Foil Layer	⑤ Top Electrode
③ Overcoat	⑥ Edge Electrode

Features

- Size: 0805, Resistance range: 2~8Ω
- Firing energy down to 1.0mJ
- Firing time down to 250us

Applications

- Mining
- Electro-Pyrotechnic
- Electric-Detonator

Dimensions

Unit: mm

Type	Size (Inch)	L	W	T	D	Weight (g) (1000pcs)
FIR05	0805	2.00±0.15	1.20±0.10	0.60±0.15	0.50±0.15	0.53

Part Numbering

FIR	05	K	T	F		0020
Product Type	Dimensions (L×W) 05: 0805	Resistance Tolerance K: ±10% L: ±15% M: ±20% N: ±30%	Packaging Code T: Taping Reel	TCR (PPM/°C) F: ±200	Power Rating :Standard* (See Remark)	Resistance 0020: 2Ω 0030: 3Ω

*Remark: Standard part no need for power rating code.

Electrical Specifications

Type	Item	Power Rating at 70°C	Resistance Range				TCR (PPM/°C)
			±10%	±15%	±20%	±30%	
FIR05		1/20W	2~8Ω				±200

Range of Ignition Performances

Type	Item	NO FIRE Current (A)	NO FIRE Duration (s)	ALL FIRE Current (A)	IGNITION TIME (ms)	ALL FIRE Energy (μJ)
FIR05		0.5 to 1.2	2 to 10	Down to 1	Down to 0.25	Down to 1000

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	-55°C ~+125°C, 25°C is the reference temperature
High Temperature Exposure	$\Delta R \pm 5\%$	at +125°C for 1000 hrs
Temperature Cycling	$\Delta R \pm 5\%$	-55°C to +125°C, 1000 cycles
Operational life	$\Delta R \pm 2\%$	$T_A = 125^\circ\text{C}$ at 0.05mW power for 1000hr
Biased Humidity	$\Delta R \pm 5\%$	1000 hrs 85°C /85%RH 10% of operating power.
Bending Strength (Board Flex)	$\Delta R \pm 2\%$	Bending once for 60 seconds, 2mm
Solderability	95% min. coverage	245±5°C for 3 seconds
Mechanical Shock	$\Delta R \pm 2\%$	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	$\Delta R \pm 2\%$	5 g's for 20 min., 10 cycles each of 3 orientations, 2000 Hz
ESD	$\Delta R \pm 5\%$	Air discharge 25KV/1time

■ Reference Standards: JIS-C 5201-1; IEC-60115-1; MIL-STD-202; JESD22, AEC-Q200

■ Storage Temperature: 15~28°C; Humidity < 80%RH

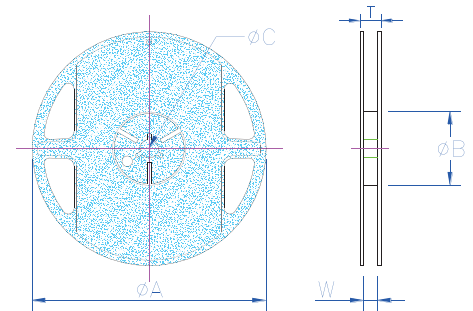
■ Shelf Life: 2 years from production date.

Packaging

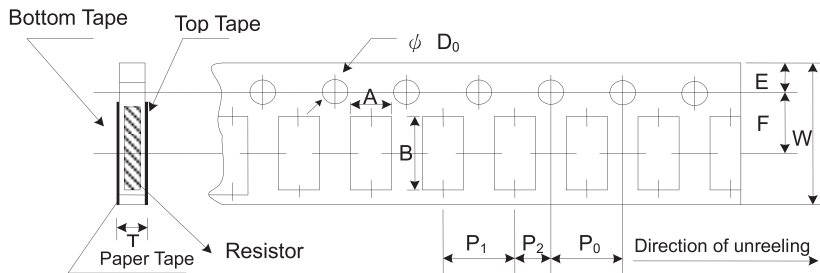
Packaging Quantity & Reel Specifications

Unit: mm

Type	ΦA	ΦB	ΦC	W	T	Paper Tape (EA)
FIR05	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000



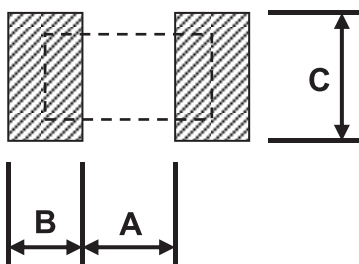
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
FIR05	1.60±0.05	2.37±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05

Recommend Land Pattern

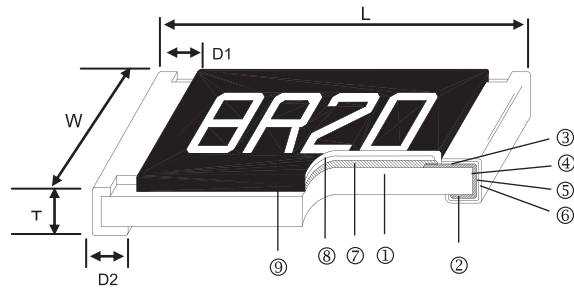


Unit: mm

Type	A	B	C
FIR05	1.00	1.00	1.35±0.2

Automotive Grade Thin Film Precision Chip Resistor – AR..A Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Marking

Features

- AEC-Q200 Compliance
- Advanced thin film technology
- RoHS compliant
- Special materials, design, and processing for high sulfur applications
- Test proven immunity to humidity, moisture, and sulfur

Applications

- Automotive
- Medical Equipment
- Testing / Measurement Equipment
- Printer Equipment
- Automatic Equipment Controller
- Converters
- Communication Device, Cell Phone, GPS, PDA

Dimensions

Unit: mm

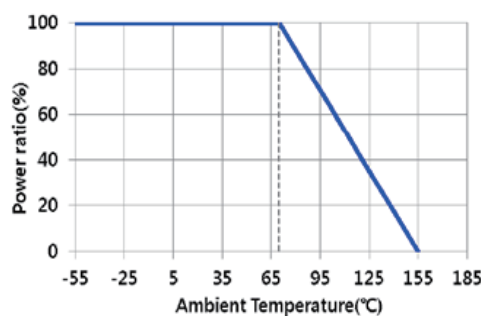
Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
AR02	0402	1.00±0.05	0.50±0.05	0.30±0.05	0.20±0.10	0.20±0.10	0.54
AR03	0603	1.55±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	1.83
AR05	0805	2.00±0.15	1.25±0.15	0.55±0.10	0.30±0.20	0.40±0.20	4.71
AR06	1206	3.05±0.15	1.55±0.15	0.55±0.10	0.42±0.20	0.35±0.25	9.02
AR13	1210	3.10±0.15	2.40±0.15	0.55±0.10	0.40±0.20	0.55±0.25	10.00
AR10	2010	4.90±0.15	2.40±0.15	0.55±0.10	0.60±0.30	0.50±0.25	23.61
AR12	2512	6.30±0.15	3.10±0.15	0.55±0.10	0.60±0.30	0.50±0.25	38.06

Part Numbering

AR	03	A	T	C		1001	A
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking Code
	02: 0402 03: 0603 05: 0805 06: 1206 13: 1210 10: 2010 12: 2512	T: ±0.01% A: ±0.05% B: ±0.1% C: ±0.25% D: ±0.5% F: ±1%	T: Taping Reel B: Bulk	S: ±5 B: ±10 N: ±15 C: ±25 D: ±50	: Standard* (See Remark) X: 1/10W W: 1/8W V: 1/4W G: 2/5W O: 1/3W V: 1/2W	0100: 10Ω 10R2: 10.2Ω 1000: 100Ω 1001: 1KΩ 1004: 1MΩ	A: Automotive Grade

*Remark: Standard part no need for power rating code.

Derating Curve



Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range					TCR (PPM/°C)
					±0.05%	±0.1%	±0.25%	±0.5%	±1%	
AR02 (0402)	1/16W	-55 ~ +155°C	50V	100V	10Ω - 12KΩ	10Ω - 221KΩ				±25 ±50
AR03 (0603)	1/16W	-55 ~ +155°C	50V	100V	10Ω - 49.9KΩ	4.7Ω - 680KΩ				±25 ±50
AR05 (0805)	1/10W	-55 ~ +155°C	100V	200V	10Ω - 100KΩ	4.7Ω - 1MΩ				±25 ±50
AR06 (1206)	1/8W	-55 ~ +155°C	150V	300V	10Ω - 200KΩ	4.7Ω - 1.5MΩ				±25 ±50
AR13 (1210)	1/4W	-55 ~ +155°C	150V	300V	10Ω - 499KΩ	10Ω - 1MΩ				±25 ±50
AR10 (2010)	1/4W	-55 ~ +155°C	150V	300V	10Ω - 499KΩ	10Ω - 1MΩ				±25 ±50
AR12 (2512)	1/2W	-55 ~ +155°C	150V	300V	10Ω - 499KΩ	10Ω - 1MΩ				±25 ±50

Special Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range						TCR (PPM/°C)
					±0.01%	±0.05%	±0.1%	±0.25%	±0.5%	±1%	
AR02 (0402)	1/16W	-55 ~ +155°C	50V	100V	49.9Ω - 12KΩ			-			±5
					49.9Ω - 12KΩ		49.9Ω - 69.8KΩ			±10 ±15	
AR03 (0603)	1/16W	-55 ~ +155°C	50V	100V	24.9Ω - 15KΩ			-			±5
					24.9Ω - 15KΩ	10Ω - 49.9KΩ	10Ω - 332KΩ			±10 ±15	
AR05 (0805)	1/10W	-55 ~ +155°C	100V	200V	24.9Ω - 30KΩ			-			±5
					24.9Ω - 30KΩ	10Ω - 100KΩ	10Ω - 1MΩ			±10 ±15	
AR06 (1206)	1/8W	-55 ~ +155°C	150V	300V	24.9Ω - 50KΩ			-			±5
					24.9Ω - 50KΩ	10Ω - 200KΩ	10Ω - 1MΩ			±10 ±15	
AR13 (1210)	1/4W	-55 ~ +155°C	150V	300V	-	10Ω - 499KΩ	10Ω - 1MΩ			±10 ±15	
AR10 (2010)	1/4W	-55 ~ +155°C	150V	300V	-	10Ω - 499KΩ	10Ω - 1MΩ			±10 ±15	
AR12 (2512)	1/2W	-55 ~ +155°C	150V	300V	-	10Ω - 499KΩ	10Ω - 1MΩ			±10 ±15	

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

High Power Rating Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range						TCR (PPM/°C)
					±0.01%	±0.05%	±0.1%	±0.25%	±0.5%	±1%	
AR02 (0402)	1/10W	-55 ~ +155°C	50V	100V	-	10Ω - 221KΩ					±25 ±50
AR03 (0603)	1/10W	-55 ~ +155°C	75V	150V	24.9Ω - 15KΩ			-			±5
					24.9Ω - 15KΩ	10Ω - 49.9KΩ	10Ω - 332KΩ			±10 ±15	
	1/8W	-	10Ω - 680KΩ			±25 ±50					
AR05 (0805)	1/8W	-55 ~ +155°C	150V	300V	24.9Ω - 30KΩ			-			±5
					24.9Ω - 30KΩ	10Ω - 100KΩ	10Ω - 1MΩ			±10 ±15	
	1/5W	-	4.7Ω - 1MΩ			±25 ±50					
AR06 (1206)	1/4W	-55 ~ +155°C	200V	400V	24.9Ω - 50KΩ			-			±5
					24.9Ω - 50KΩ	10Ω - 200KΩ	10Ω - 1MΩ			±10 ±15	
	2/5W	-	4.7Ω - 1.5MΩ			±25 ±50					
AR13 (1210)	1/3W	-55 ~ +155°C	200V	400V	-	10Ω - 499KΩ	10Ω - 1MΩ			±10 ±15 ±25 ±50	
	1/2W				-	10Ω - 1MΩ			±25 ±50		
AR10 (2010)	1/3W	-55 ~ +155°C	200V	400V	-	10Ω - 499KΩ	10Ω - 1MΩ			±10 ±15 ±25 ±50	

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement		Test Method
	Tol. ≤ 0.05%	Tol. > 0.05%	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.		-55°C~+125°C, 25°C is the reference temperature
Short Time Overload	ΔR±0.05% ΔR±0.1% (0402 1/10W, 0603 1/8W, 0805 1/5W, 1206 2/5W, 1210 1/2W)		RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	>1000 MΩ		Apply 100VDC for 1 minute
Operational Life	ΔR±0.05%	ΔR±0.2%	Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion.
	>7kΩ ΔR±0.2%		
	ΔR±0.2% for high power rating		
Biased Humidity	ΔR±0.1%		1000 hrs 85°C/85%RH 10% of operating power.
High Temperature Exposure	ΔR±0.2%		at +155°C for 1000 hrs
Temperature Cycling	ΔR±0.1%		-55°C to +125°C, 1000 cycles
Bending Strength (Board Flex)	ΔR±0.1%		Bending once for 60 seconds Bending displacement: 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage		245±5°C for 3 seconds
Resistance to Soldering Heat	ΔR±0.05%		260±5°C for 10 seconds
Terminal strength	No broken		Force of 1.8kg for 60 seconds.
Mechanical Shock	ΔR±0.05%	ΔR±0.1%	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	ΔR±0.05%	ΔR±0.1%	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	ΔR±0.5%		Human body model AR02: 0.4KV AR03: 1KV AR05: 1.5KV AR06, AR10, AR12, AR13: 2KV
Resistance to solvents	Marking Unsmearred		Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Sulfur Test	ΔR±1%		105±2°C, no power rating for 1000 hrs
Flammability	No ignition of the tissue paper or scorching or the pinewood board		V-0 or V-1 are acceptable. Electrical test not required.

RCWV(Rated Continuous Working Voltage)=√(P*R) or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1; AEC-Q200; MIL-STD-202; JESD22; UL-94; ASTM-B-809-95

■ Storage Temperature: 15~28°C; Humidity < 80%RH

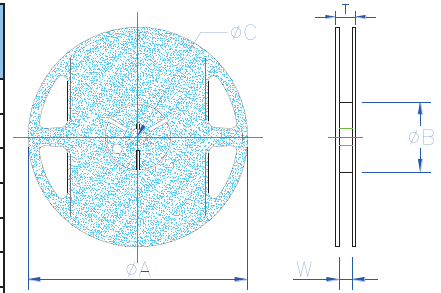
■ Shelf Life: 2 years from production date.

■ Packaging

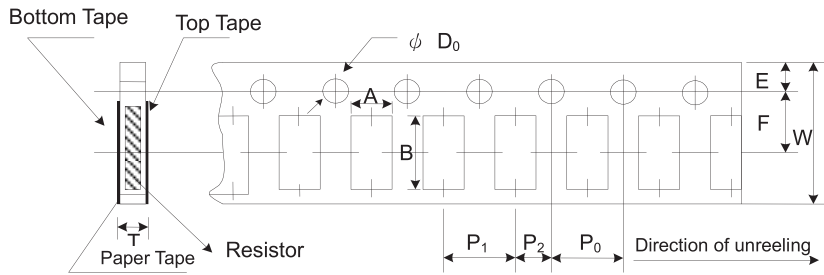
Packaging Quantity & Reel Specifications

Unit: mm

Type	ΦA	ΦB	ΦC	W	T	Paper Tape (EA)	Embossed Plastic Tape (EA)
AR02	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	10,000	-
AR03	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000	-
AR05	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000	-
AR06	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000	-
AR13	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000	-
AR10	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	13.5 ± 1.0	15.5 ± 1.0	-	4,000
AR12	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	13.5 ± 1.0	15.5 ± 1.0	-	4,000



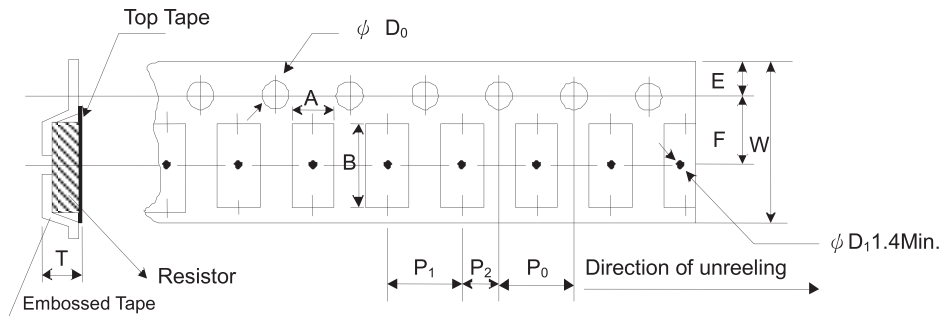
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
AR02	0.70±0.05	1.16±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.05	0.40±0.03
AR03	1.10±0.05	1.90±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.60±0.03
AR05	1.60±0.05	2.37±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
AR06	2.00±0.05	3.55±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
AR13	2.75±0.05	3.40±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.60±0.10	0.75±0.05

Embossed Plastic Tape Specifications

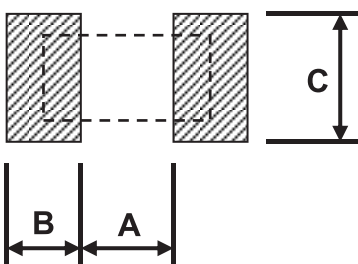


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
AR10	2.85±0.10	5.45±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50±0.10	1.00±0.20
AR12	3.40±0.10	6.65±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50±0.10	1.00±0.20

■ Recommend Land Pattern

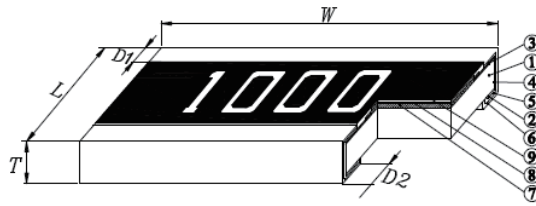
Unit: mm



Type	A	B	C
AR02	0.50	0.50	0.60±0.2
AR03	0.80	1.00	0.90±0.2
AR05	1.00	1.00	1.35±0.2
AR06	2.00	1.15	1.70±0.2
AR13	2.00	1.15	2.50±0.2
AR10	3.60	1.40	2.50±0.2
AR12	4.90	1.60	3.10±0.2

Automotive Grade Thin Film Precision Chip Resistor (Wide Thrminal) – ARW..A Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Marking

Features

- AEC-Q200 Compliance
- Advanced thin film technology
- RoHS compliant
- Special materials, design, and processing for high sulfur applications
- Test proven immunity to humidity, moisture, and sulfur

Dimensions

Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
ARW62	0612	1.55±0.15	3.00±0.15	0.43±0.10	0.25±0.15	0.32±0.15	7.69
ARW20	1020	2.45±0.20	4.90±0.20	0.43±0.10	0.40±0.20	0.52±0.20	20.95
ARW25	1225	3.15±0.20	6.30±0.20	0.45±0.10	0.52±0.20	0.52±0.20	33.24

Applications

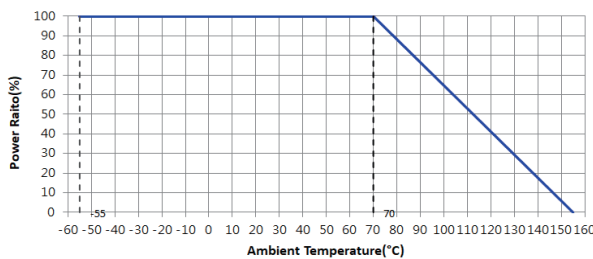
- Automotive
- DC Motor, Inverters
- Testing / Measurement Equipment
- Robotics, Industrial Control System

Part Numbering

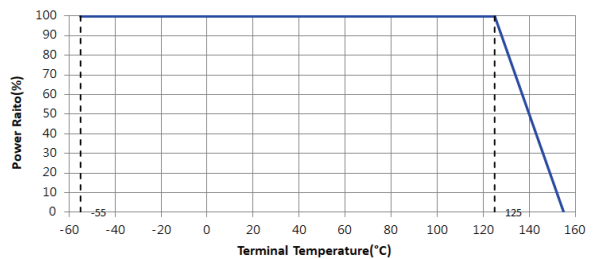
Product Type	Dimensions (LxW)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking Code
ARW	62	B	T	C	T	1001	A
62: 0612 20: 1020 25: 1225	B: ±0.1% C: ±0.25% D: ±0.5% F: ±1%	T: Taping Reel B: Bulk	C: ±25 D: ±50	T: 1W A: 1.5W S: 2W	0100: 10Ω 10R2: 10.2Ω 1000: 100Ω 1001: 1KΩ 1004: 1MΩ	A: Automotive Grade NA: No Marking Automotive Grade	

Derating Curve

ARW Series



ARW Series



Standard Electrical Specifications

Type	Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range				TCR (PPM/°C)
						±0.1%	±0.25%	±0.5%	±1%	
ARW62 (0612)		1W	-55 ~ +155°C	75V	150V	2.5Ω – 80KΩ				±25 ±50
ARW20 (1020)		1.5W	-55 ~ +155°C	100V	200V	2.5Ω – 200KΩ				±25 ±50
ARW25 (1225)		2W	-55 ~ +155°C	200V	400V	2.5Ω – 250KΩ				±25 ±50

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	-55°C~+125°C, 25°C is the reference temperature
Short Time Overload	ΔR±0.1%	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	>1000 MΩ	Apply 100VDC for 1 minute
Operational Life	ΔR±0.2%	Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion.
Biased Humidity	ΔR±0.1%	1000 hrs 85°C/85%RH 10% of operating power.
High Temperature Exposure	ΔR±0.2%	at +155°C for 1000 hrs
Temperature Cycling	ΔR±0.1%	-55°C to +125°C, 1000 cycles
Bending Strength (Board Flex)	ΔR±0.1%	Bending once for 60 seconds Bending displacement: 1020, 1225 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	ΔR±0.05%	260±5°C for 10 seconds
Terminal strength	No broken	Force of 1.8kg for 60 seconds.
Mechanical Shock	ΔR±0.1%	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	ΔR±0.1%	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	ΔR±0.5%	Human body model 0612, 1020, 1225: 2KV
Resistance to solvents	Marking Unsmearred	Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Sulfur Test	ΔR±1%	105±2°C, no power rating for 1000 hrs
Flammability	No ignition of the tissue paper or scorching or the pinewood board	V-0 or V-1 are acceptable. Electrical test not required.

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ **Reference Standards:** IEC 60115-1, 60068-2-58; JIS-C 5201-1; AEC-Q200; MIL-STD-202; JESD22; UL-94; ASTM-B-809-95

■ **Storage Temperature:** 15~28°C; Humidity < 80%RH

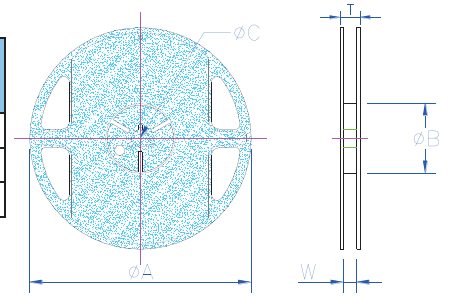
■ **Shelf Life:** 2 years from production date.

Packaging

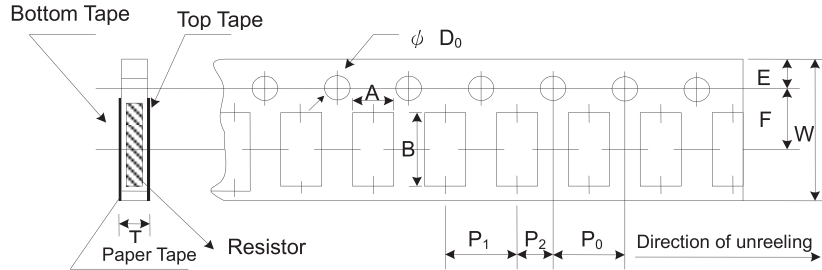
Packaging Quantity & Reel Specifications

Unit: mm

Type	ΦA	ΦB	ΦC	W	T	Paper Tape (EA)	Embossed Plastic Tape (EA)
ARW62	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	9.5 ± 1.0	11.5 ± 1.0	5,000	-
ARW20	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	13.5 ± 1.0	15.5 ± 1.0	-	4,000
ARW25	178.0 ± 1.0	60.0 + 1.0	13.5 ± 0.7	13.5 ± 1.0	15.5 ± 1.0	-	4,000



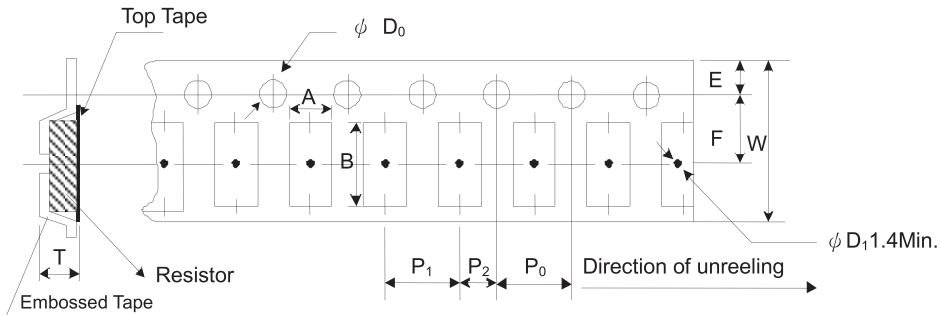
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
ARW62	2.00±0.05	3.55±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05

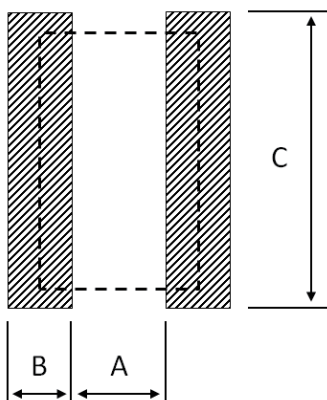
Embossed Plastic Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
ARW20	2.85±0.10	5.45±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20
ARW25	3.40±0.10	6.65±0.10	12.0±0.10	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20

Recommend Land Pattern

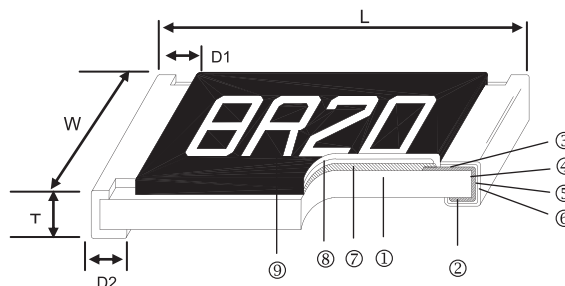


Unit: mm

Type	A	B	C
ARW62	0.70	1.00	3.55±0.2
ARW20	1.20	1.40	5.35±0.2
ARW25	2.10	1.20	6.75±0.2

Automotive Grade Metal Thin Film Chip Resistors – ARM..A Series

Construction



Features

- AEC-Q200 Compliance
- High precision resistance tolerance: $\pm 0.02\%$
- Low TCR down to $\pm 5\text{ppm}/^\circ\text{C}$
- Advanced sulfur resistance verified according to ASTM B 809

① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Marking

Applications

- Automotive
- Telecommunication
- Medical equipment
- Industrial equipment
- Industrial measurement instrumentation, industrial machines, Various sensors, medical electronics

Dimensions

Unit: mm

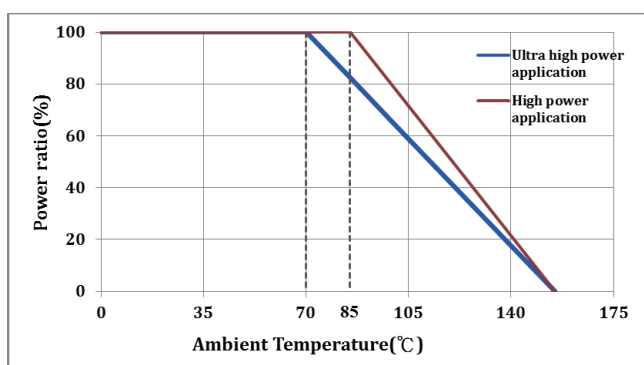
Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
ARM02	0402	1.00 \pm 0.05	0.50 \pm 0.05	0.30 \pm 0.05	0.20 \pm 0.10	0.20 \pm 0.10	0.54
ARM03	0603	1.55 \pm 0.10	0.80 \pm 0.10	0.45 \pm 0.10	0.30 \pm 0.20	0.30 \pm 0.20	1.83
ARM05	0805	2.00 \pm 0.15	1.25 \pm 0.15	0.55 \pm 0.10	0.30 \pm 0.20	0.40 \pm 0.20	4.71
ARM06	1206	3.05 \pm 0.15	1.55 \pm 0.15	0.55 \pm 0.10	0.42 \pm 0.20	0.35 \pm 0.25	9.02

Part Numbering

ARM	06	F	T	C		1001	A
Product Type	Dimensions (L×W)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking Code
	02: 0402 03: 0603 05: 0805 06: 1206	Q: $\pm 0.02\%$ A: $\pm 0.05\%$ B: $\pm 0.1\%$ D: $\pm 0.5\%$	T: Taping Reel B: Bulk	S: ± 5 B: ± 10 C: ± 25 D: ± 50	: Standard* (See Remark) Y: 1/16W X: 1/10W M: 1/6W W: 1/8W V: 1/4W	0100: 10 Ω 10R2: 10.2 Ω 1000: 100 Ω 1001: 1K Ω 1004: 1M Ω	A: Automotive Grade NA: No Making Automotive Grade

*Remark: Standard part no need for power rating code.

Derating Curve



Electrical Specifications

Item Type	Power Rating			Max. Operating Voltage	Max. Overload Voltage	Resistance Range				TCR (PPM/°C)
	Standard	High	Ultra high			±0.02%	±0.05%	±0.1%	±0.5%	
ARM02 (0402)	1/32W	1/16W	1/8W	75V	100V	100Ω – 3KΩ				±5
						100Ω – 3KΩ	47Ω – 100KΩ			±10
						100Ω – 3KΩ	47Ω – 100KΩ		47Ω – 150KΩ	±25
						–	–	47Ω – 100KΩ	10Ω – 150KΩ	±100
ARM03 (0603)	1/16W	1/10W	1/6W	100V	200V	100Ω – 5.1KΩ				±5
						100Ω – 5.1KΩ	47Ω – 270KΩ			±10
						100Ω – 5.1KΩ	47Ω – 270KΩ	47Ω – 332KΩ	47Ω – 1MΩ	±25
						–	–	47Ω – 332KΩ	10Ω – 1MΩ	±50
ARM05 (0805)	1/10W	1/8W	1/4W	150V	300V	100Ω – 10.2KΩ				±5
						100Ω – 10.2KΩ	47Ω – 475KΩ			±10
						100Ω – 10.2KΩ	47Ω – 475KΩ	47Ω – 2.7MΩ		±25
						–	–	47Ω – 2.7MΩ	10Ω – 2.7MΩ	±50
ARM06 (1206)	1/8W	1/4W	–	200V	400V	100Ω – 33.2KΩ				±5
						100Ω – 33.2KΩ	47Ω – 1MΩ			±10
						100Ω – 33.2KΩ	47Ω – 1MΩ	47Ω – 5.1MΩ		±25
						–	–	47Ω – 5.1MΩ	10Ω – 5.1MΩ	±50

Operating Voltage= $\sqrt{P \cdot R}$ or Max. operating voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. overload voltage listed above, whichever is lower.

Operating Temperature Range=-55 ~ +155°C

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	-55°C~+125°C, 25°C is the reference temperature
Short Time Overload	$\leq 47\Omega\Delta R\pm 0.1\%$ $\geq 47\Omega\Delta R\pm 0.05\%$ for Standard and High power rating	RCWV*2.5 or Max. overload voltage whichever is lower for 5 seconds
	$\Delta R\pm 0.1\%$ for Ultra high power rating	
Endurance	Standard power rating at 85°C	$\Delta R\pm 0.1\%$
	High power rating at 85°C	$\Delta R\pm 0.25\%$
	Ultra high power rating at 70°C	$\Delta R\pm 0.5\%$
Biased Humidity	$\Delta R\pm 0.1\%$ for Standard power rating	1000 hrs 85°C/85%RH 10% of operating power.
	$\Delta R\pm 0.25\%$ for high power rating	
	$\Delta R\pm 0.5\%$ for Ultra high power rating	
High Temperature Exposure	$\leq 47\Omega\Delta R\pm 0.25\%$ $\geq 47\Omega\Delta R\pm 0.1\%$ for 0603/0805/1206 size	at +155°C for 1000 hrs
	$\leq 47\Omega\Delta R\pm 0.25\%$ $\geq 47\Omega\Delta R\pm 0.2\%$ for 0402 size	
Temperature Cycling	$\leq 47\Omega\Delta R\pm 0.25\%$ $\geq 47\Omega\Delta R\pm 0.1\%$	-55°C to +125°C, 1000 cycles
Resistance to soldering heat	$\Delta R\pm 0.1\%$	260±5°C for 10 seconds
Insulation Resistance	>1000 MΩ	Apply 100V _{DC} for 1 minute
Bending Strength (Board Flex)	$\Delta R\pm 0.1\%$	Bending once for 60 seconds Bending displacement: 1206 sizes: 3 mm
Solderability	95% min. coverage	245±5°C for 3 seconds
Terminal strength	No broken	Force of 1.8kg for 60 seconds.
Mechanical Shock	$\Delta R\pm 0.1\%$	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	$\Delta R\pm 0.1\%$	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	$\Delta R\pm 0.5\%$	Human body model ARM02 · ARM03 0.2KV ARM05 · ARM06 1KV
Resistance to solvents	Marking Unsmearred	Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Sulfur Test	$\Delta R\pm 1\%$	105±2°C no power rating for 750 hrs.
Flammability	No ignition of the tissue paper or scorching or the pinewood board	V-0 or V-1 are acceptable. Electrical test not required.

RCWV(Rated continuous working voltage)= $\sqrt{P \cdot R}$ or Max. Operating voltage whichever is lower

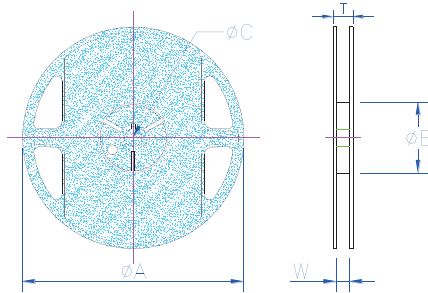
■ Reference Standards: JIS-C-5201-1, IEC-60115-1, MIL-STD-202, JESD22, AEC-Q200, ASTM-B-809-95, UL-94

■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date.

Packaging

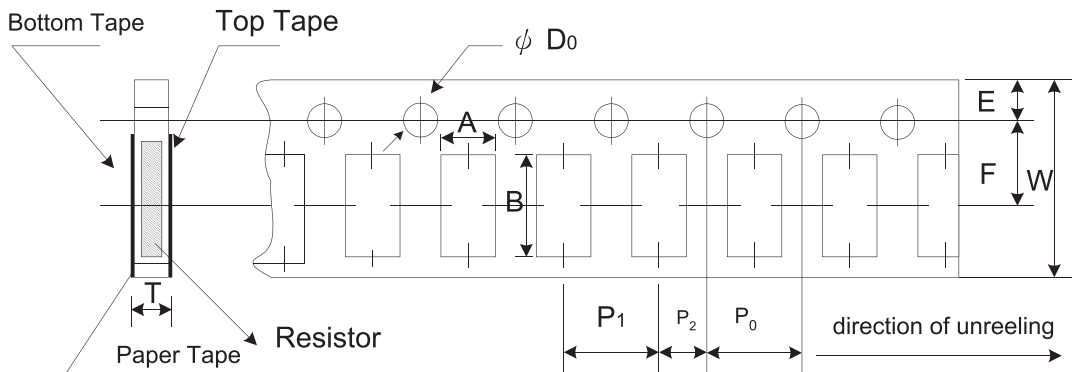
Packing Quantity & Reel Specifications



Unit :mm

Type	ØA	ØB	ØC	W	T	Paper Tape (EA)
ARM02	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	10,000
ARM03	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000
ARM05	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000
ARM06	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000

Paper Tape Specifications

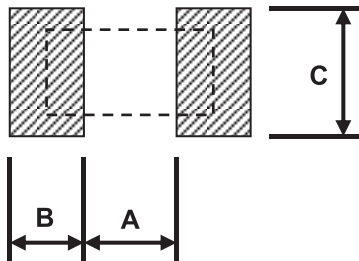


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
ARM02	0.70±0.05	1.16±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.05	0.40±0.03
ARM03	1.10±0.05	1.90±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.60±0.03
ARM05	1.60±0.05	2.37±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
ARM06	2.00±0.05	3.55±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05

Recommend Land Pattern

Unit: mm

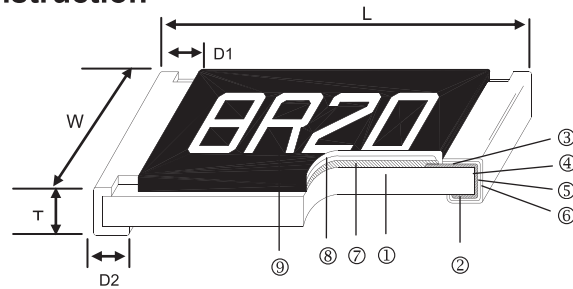


Type	A	B	C
ARM02	0.50	0.50	0.60±0.2
ARM03	1.00	1.00	1.20±0.2
ARM05	1.20	1.40	1.65±0.2
ARM06	2.20	1.40	2.00±0.2

Automotive Grade Professional Thin Film Chip Resistor – ART.A Series



Construction



Features

- Operating temperature up to 175°C for 1000 hrs
- Rated dissipation P_{85} up to 0.4W for size 1206
- AEC-Q200 Compliance
- Superior temperature cycling robustness
- Advanced sulfur resistance verified according to ASTM B 809

Applications

- Automotive
- Telecommunications
- Medical equipment
- Industrial equipment

① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Marking

Dimensions

Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
ART02	0402	1.00±0.05	0.50±0.05	0.30±0.05	0.20±0.10	0.20±0.10	0.54
ART03	0603	1.55±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	1.83
ART05	0805	2.00±0.15	1.25±0.15	0.55±0.10	0.30±0.20	0.40±0.20	4.71
ART06	1206	3.05±0.15	1.55±0.15	0.55±0.10	0.42±0.20	0.35±0.25	9.02

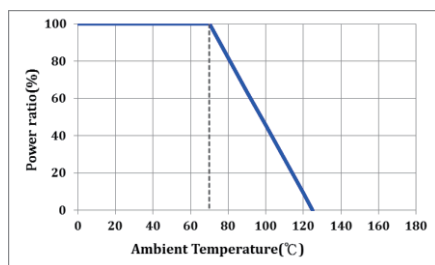
Part Numbering

ART	03	F	T	C		1001	A
Product Type	Dimensions (L×W)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking Code
	02: 0402 03: 0603 05: 0805 06: 1206	B: ±0.1% D: ±0.5% F: ±1%	T: Taping Reel B: Bulk	C: ±25 D: ±50	: Standard* (See Remark)	0100: 10Ω 10R2: 10.2Ω 1000: 100Ω 1001: 1KΩ 1002: 10 KΩ 1003: 100KΩ 1004: 1M Ω	A: Automotive Grade

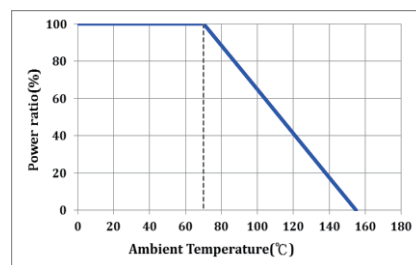
*Remark: Standard part no need for power rating code.

Functional Performance

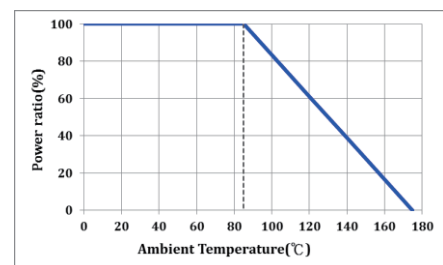
Derating-Standard Operation



Derating- Power Operation



Derating- Advanced Power Operation



Standard Electrical Specifications

Type	Item	Power Rating at 85°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
						±0.1%	±0.5%	±1%	
	ART02 (0402)	1/10W	-55 ~ +175°C	50V	100V	10Ω – 221KΩ			±25,±50
	ART03 (0603)	3/20W	-55 ~ +175°C	75V	150V	4.7Ω – 511KΩ			±25,±50
	ART05 (0805)	1/5W	-55 ~ +175°C	150V	300V	4.7Ω – 1MΩ			±25,±50
	ART06 (1206)	2/5W	-55 ~ +175°C	200V	400V	4.7Ω – 1MΩ			±25,±50

Maximum Resistance Change at Rated Dissipation

Operation Mode		Standard P ₇₀	Power P ₇₀	Advanced Temperature P ₈₅
Rated dissipation	ART02	0.063W	0.100W	0.100W
	ART03	0.100W	0.125W	0.150W
	ART05	0.125W	0.200W	0.200W
	ART06	0.250W	0.400W	0.400W
Operating temperature range		-55 ~ 125°C	-55 ~ 155°C	-55 ~ 175°C
Permissible film temperature		125°C	155°C	175°C
Max. resistance change at rated dissipation for resistance range, ΔR/R after:	ART02	10Ω – 221KΩ	10Ω – 221KΩ	10Ω – 221KΩ
	ART03	4.7Ω – 511KΩ	4.7Ω – 511KΩ	4.7Ω – 511KΩ
	ART05	4.7Ω – 1MΩ	4.7Ω – 1MΩ	4.7Ω – 1MΩ
	ART06	4.7Ω – 1MΩ	4.7Ω – 1MΩ	4.7Ω – 1MΩ
	1000hr	≤ 0.15%	≤ 0.3%	≤ 0.5%
	8000hr	≤ 0.25%	≤ 0.5%	—

Operating Voltage= $\sqrt{P \cdot R}$ or Max. operating voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. overload voltage listed above, whichever is lower.

■Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement		Test Method	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.		+25/-55/+25/+125/+25°C	
Short Time Overload (Standard operation mode)	$\Delta R \pm 0.10\%$		RCWV*2.5 or Max. overload voltage whichever is lower for 5 seconds	
Short Time Overload (Power operation mode)	$\Delta R \pm 0.25\%$			
Insulation Resistance	>1000 M Ω		Apply 100V _{DC} for 1 minute	
Endurance	Standard at 70°C	1000hrs	$\Delta R \pm 0.15\%$	RCWV with 1.5 hrs "ON" and 0.5 hrs "OFF"
		8000hrs	$\Delta R \pm 0.25\%$	
	Power at 70°C	1000hrs	$\Delta R \pm 0.3\%$	
		8000hrs	$\Delta R \pm 0.5\%$	
Advanced temperature at 85°C	1000hrs	$\Delta R \pm 0.5\%$		
High Temperature Exposure	125°C	$\Delta R \pm 0.15\%$		1000 hrs
	155°C	$\Delta R \pm 0.3\%$		
	175°C	$\Delta R \pm 0.5\%$		
Temperature Cycling	$\Delta R \pm 0.25\%$		30 min at -55°C and 30min at 155°C, 1000 cycles	
Biased Humidity	Standard operation mode $\Delta R \pm 0.5\%$		1000hrs 85°C /85%RH 10% of operating power (≤ 100 V)	
Bending Strength (Board Flex)	$\Delta R \pm 0.1\%$		Bending once for 60 seconds Bending displacement: 0402 0603 0805 1206 sizes: 3 mm	
Solderability	95% min. coverage		245 \pm 5°C for 3 seconds	
Resistance to Soldering Heat	$\Delta R \pm 0.1\%$		260 \pm 5°C for 10 seconds	
Terminal strength	No broken		0402 0603: Force of 1kg for 60 seconds. Others: Force of 1.8kg for 60 seconds.	
Mechanical Shock	$\Delta R \pm 0.1\%$		Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.	
Vibration	$\Delta R \pm 0.1\%$		5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz	
ESD	$\Delta R \pm 0.5\%$		Human body model 0402 0.4 KV ; 0603 1 KV ; 0805 1.5 KV ; 1206 2 KV	
Resistance to solvents	Marking Unsmearred		Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.	
Flammability	No ignition of the tissue paper or scorching or the pinewood board		V-0 or V-1 are acceptable. Electrical test not required.	
External Visual	No visible damage.		Electrical test not required. Inspect device construction, marking and workmanship.	
Physical Dimension	As Spec.		Verify physical dimensions to the applicable device detail specification. Note: User(s) and Suppliers Specification. Electrical test not required.	

RCWV(Rated continuous working voltage)= $\sqrt{P \cdot R}$ or Max. Operating voltage whichever is lower

■ **Reference Standards:** MIL-STD-202, JIS-C-5201-1, EN 60115-1, JESD22, IEC-60115-1, AEC-Q200, UL-94, MIL-STD-883

■ **Storage Temperature:** 15~28°C; Humidity < 80%RH

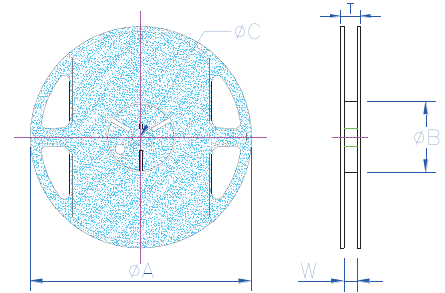
■ **Shelf Life:** 2 years from production date.

Packaging

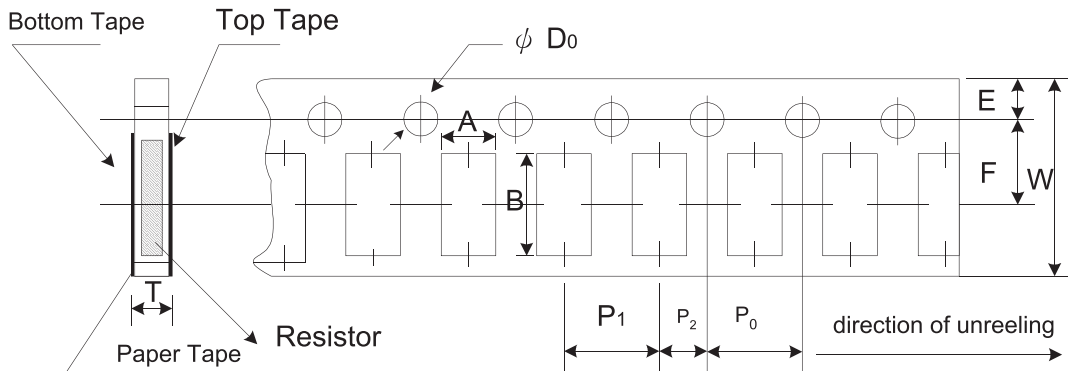
Packing Quantity & Reel Specifications

Unit :mm

Type	ØA	ØB	ØC	W	T	Paper Tape (EA)
ART02	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	10,000
ART03	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000
ART05	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000
ART06	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000



Paper Tape Specifications

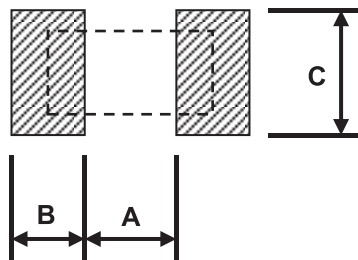


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ØD ₀	T
ART02	0.70±0.05	1.16±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.05	0.40±0.03
ART03	1.10±0.05	1.90±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.60±0.03
ART05	1.60±0.05	2.37±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
ART06	2.00±0.05	3.55±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.10	1.55±0.05	0.75±0.05

Recommend Land Pattern

Unit: mm



Type	A	B	C
ART02	0.50	0.50	0.60±0.2
ART03	0.80	1.00	0.90±0.2
ART05	1.00	1.00	1.35±0.2
ART06	2.00	1.15	1.70±0.2

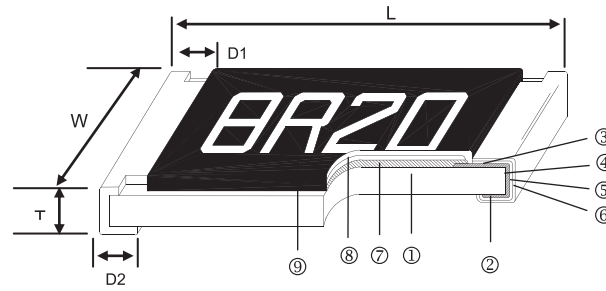
Safety Precautions

- Install the following fail-safe design systems to ensure safety. If these products are used in equipment, the defects of these products may cause casualties or other severe damage, such as damage to vehicles (cars, trains, ships), traffic lights, medical equipment, aviation Aerospace equipment, electric heating equipment, combustion/gas equipment, rotating equipment, and disaster/crime prevention equipment.
 - ★ The system is equipped with protection circuits and protection devices.
 - ★ The system is equipped with redundant circuits or other systems to prevent an unsafe state in the event of a single failure.
 - ★ The system is equipped with a system to prevent the spread of fire or prevent malfunctions.

Automotive Grade High Power Thin Film Chip Resistors – ARTP..A Series



Construction



Features

- Operating temperature up to 175°C for 1000hr
- Rated dissipation up to 0.4W for size 0805
- AEC-Q200 Compliance
- Superior temperature cycling robustness
- Advanced sulfur resistance verified according to ASTM B 809

Applications

- Automotive
- Industrial
- High power and high temperature applications
- Replacement for larger case sizes

① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Marking

Dimensions

Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
ARTP02	0402	1.00±0.05	0.50±0.05	0.30±0.05	0.20±0.10	0.20±0.10	0.54
ARTP03	0603	1.55±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	1.83
ARTP05	0805	2.00±0.15	1.25±0.15	0.55±0.10	0.30±0.20	0.40±0.20	4.71

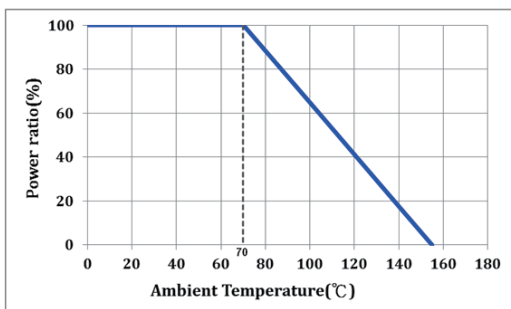
Part Numbering

ARTP	05	F	T	C		1001	A
Product Type	Dimensions (L×W)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking Code
	02: 0402 03: 0603 05: 0805	B: ±0.1% D: ±0.5% F: ±1%	T: Taping Reel B: Bulk	C: ±25 D: ±50	: Standard* (See Remark)	0100: 10Ω 10R2: 10.2Ω 1000: 100Ω 1001: 1KΩ 1002: 10 KΩ 1003: 100KΩ	A: Automotive Grade

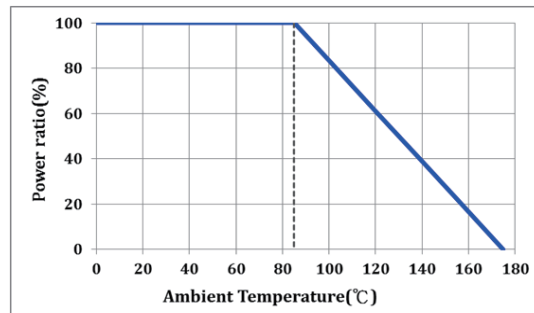
*Remark: Standard part no need for power rating code.

Functional Performance

Derating- Power Operation 70



Derating- Advanced Power Operation



Standard Electrical Specifications

Item Type	Power Rating at 85°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±0.1%	±0.5%	±1%	
ARTP02 (0402)	1/5W	-55 ~ +175°C	50V	100V	47Ω – 100KΩ			±25 ±50
ARTP03 (0603)	1/4W		75V	150V	47Ω – 100KΩ	10Ω – 100KΩ		±25
			—	—	—	10Ω – 100KΩ		±50
ARTP05 (0805)	2/5W	150V	300V	47Ω – 100KΩ	10Ω – 100KΩ		±25	
		—	—	—	10Ω – 100KΩ		±50	

Maximum Resistance Change at Rated Dissipation

Operation Mode		Power P ₇₀	Advanced Temperature P ₈₅
Rated dissipation	ARTP02	0.200W	0.200W
	ARTP03	0.250W	0.250W
	ARTP05	0.400W	0.400W
Operating temperature range		-55 ~ 155°C	-55 ~ 175°C
Permissible film temperature		155°C	175°C
Max. resistance change at rated dissipation for resistance range, ΔR/R after:	ARTP02	47Ω – 100KΩ	47Ω – 100KΩ
	ARTP03	10Ω – 100KΩ	10Ω – 100KΩ
	ARTP05	10Ω – 100KΩ	10Ω – 100KΩ
	1000hr	≤ 0.2%	≤ 0.3%
	8000hr	≤ 0.4%	—

Operating Voltage=√(P*R) or Max. operating voltage listed above, whichever is lower.

Overload Voltage=2.5*√(P*R) or Max. overload voltage listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement		Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.		+25/-55/+25/+125/+25°C
Short Time Overload (Power operation mode)	ΔR±0.25%		RCWV*2.5 or Max. overload voltage whichever is lower for 5 seconds
Insulation Resistance	>1000 MΩ		Apply 100V _{DC} for 1 minute
Endurance	Power at 70°C	1000hrs	RCWV with 1.5 hrs "ON" and 0.5 hrs "OFF" 1000 hrs
		8000hrs	
	Advanced temperature at 85°C	1000hrs	
High Temperature Exposure	ΔR±0.20%	+155°C	1000 hrs
	ΔR±0.30%	+175°C	
Temperature Cycling	ΔR±0.25%		-55°C to +155°C, 1000 cycles
Biased Humidity	Power operation mode ΔR±0.5%		1000 hrs 85°C/85%TH 10% of operating power (≤ 100V)
Bending Strength (Board Flex)	ΔR±0.1%		Bending once for 60 seconds Bending displacement: 0402 0603 0805 sizes: 3 mm
Solderability	95% min. coverage		245±5°C for 3 seconds
Resistance to Soldering Heat	ΔR±0.1%		260±5°C for 10 seconds
Terminal strength	No broken		Force of 1.8kg for 60 seconds.
Mechanical Shock	ΔR±0.1%		Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.

Item	Requirement	Test Method
Vibration	$\Delta R \pm 0.1\%$	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	$\Delta R \pm 0.5\%$	Human body model 0402: 0.4KV ; 0603: 0.5KV ; 0805: 1.5KV
Resistance to solvents	Marking Unsmearred	Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Flammability	No ignition of the tissue paper or scorching or the pinewood board	V-0 or V-1 are acceptable. Electrical test not required.

RCWV(Rated continuous working voltage)= $\sqrt{P \cdot R}$ or Max. Operating voltage whichever is lower

■ **Reference Standards:** MIL-STD-202, JIS-C-5201-1, IEC-60115-1, AEC-Q200, UL-94

■ **Storage Temperature:** 15~28°C; Humidity < 80%RH

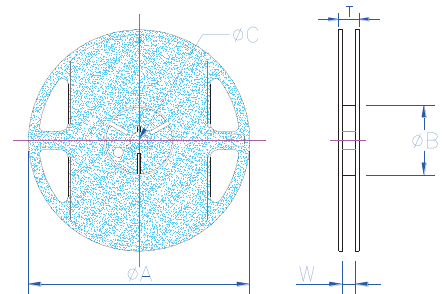
■ **Shelf Life:** 2 years from production date.

■ Packaging

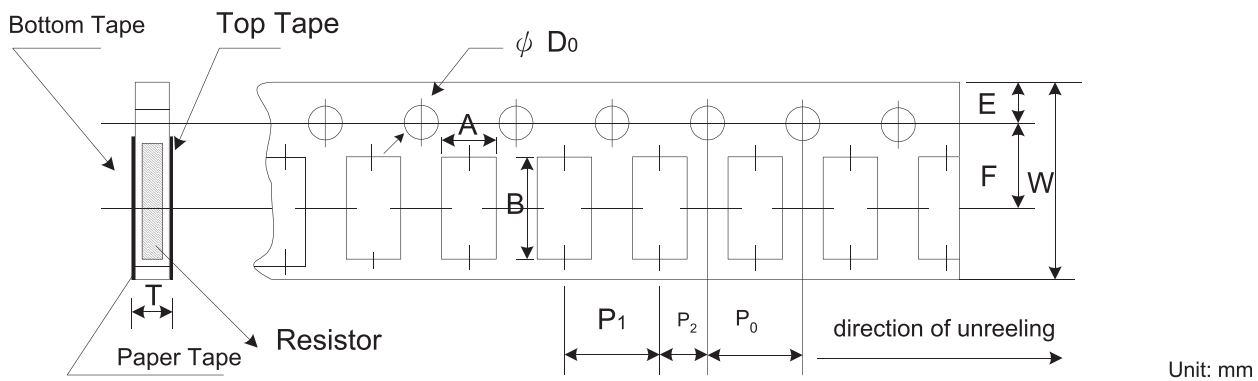
Packing Quantity & Reel Specifications

Unit : mm

Type	ØA	ØB	ØC	W	T	Paper Tape (EA)
ARTP02	178.0±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5±1.0	10,000
ARTP03	178.0±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000
ARTP05	178.0±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000



Paper Tape Specifications

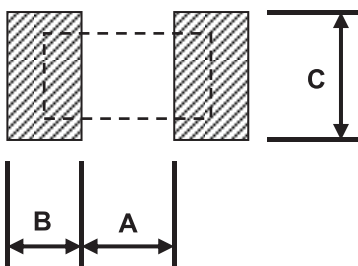


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
ARTP02	0.70±0.05	1.16±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	2.00±0.10	2.00±0.05	1.55±0.05	0.40±0.03
ARTP03	1.10±0.05	1.90±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.60±0.03
ARTP05	1.60±0.05	2.37±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05

■ Recommend Land Pattern

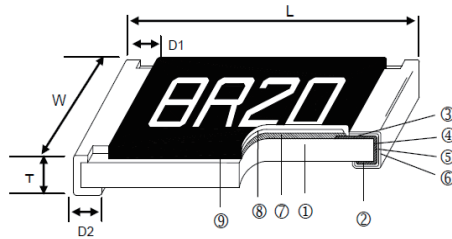
Unit: mm



Type	A	B	C
ARTP02	0.50	0.50	0.60±0.2
ARTP03	0.80	1.00	0.90±0.2
ARTP05	1.00	1.00	1.35±0.2

Automotive Grade High Voltage Thin Film Flat Chip Resistor – ARHV..A Series

Construction



①	Alumina Substrate	④	Edge Electrode	⑦	Resistor Layer
②	Bottom Electrode	⑤	Barrier Layer	⑧	Overcoat
③	Top Electrode	⑥	External Electrode	⑨	Marking

Features

- High operating voltage U_{max} . Up to 1000V
- Low voltage coefficient < 1.5ppm/V
- Superior moisture resistivity (85°C; 85%RH)
- AEC-Q200 Compliance
- Test proven immunity to humidity, moisture, and sulfur

Dimensions

Unit:mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
ARHV05	0805	2.00±0.15	1.25±0.15	0.55±0.10	0.30±0.20	0.40±0.25	5.3
ARHV06	1206	3.05±0.15	1.55±0.15	0.55±0.10	0.42±0.20	0.35±0.25	10.8
ARHV13	1210	3.10±0.15	2.40±0.15	0.55±0.10	0.40±0.20	0.55±0.25	15.7

Applications

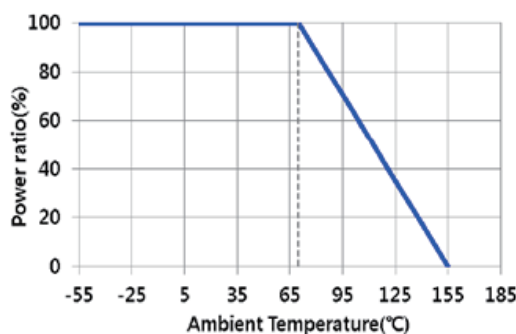
- Industrial and automotive inverters
- Battery management system
- Testing / Measurement Equipment
- Automatic Equipment Controller

Part Numbering

ARHV	13	B	T	C		1213	A
Product Type	Dimensions (L×W)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking Code
	05:0805 06:1206 13:1210	B: ±0.1% C: ±0.25% D: ±0.5% F: ±1%	T: Taping Reel B: Bulk	B: ±10 N: ±15 C: ±25 D: ±50	:Standard* (See Remark)	1213:121KΩ 1004: 1MΩ 2004: 2MΩ	A: Automotive Grade NA: No Making Automotive Grade

*Remark: Standard part no need for power rating code.

Derating Curve



Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range				TCR (PPM/°C)	VCR (PPM/V)
					±0.1%	±0.25%	±0.5%	±1%		
ARHV05 (0805)	1/5W	-55 ~ +155°C	450V	900V	180KΩ~1MΩ				±10 ±15 ±25 ±50	<1.5
ARHV06 (1206)	1/4W	-55 ~ +155°C	700V	1400V	160KΩ~2MΩ				±10 ±15 ±25 ±50	<1.5
ARHV13 (1210)	1/3W	-55 ~ +155°C	1000V	2000V	121KΩ~3.01MΩ				±10 ±15 ±25 ±50	<1.5

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	-55°C~+125°C, 25°C is the reference temperature
Short Time Overload	$\Delta R \pm 0.05\%$	$U = 2 \times \sqrt{P \cdot R}$ or Max. overload voltage whichever is lower for 5 seconds
Endurance	$\Delta R \pm 0.1\%$	$U = \sqrt{P \cdot R}$ 1.5 h on; 0.5 h off; 70 °C; 1000 hrs
Damp Heat with Load	$\Delta R \pm 0.1\%$	$U = 0.1 \times \sqrt{P \cdot R}$ 40±2°C, 90~95% R.H. 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Biased Humidity	$\Delta R \pm 0.25\%$	$U = 0.3 \times \sqrt{P \cdot R}$ 1000 hrs 85°C/85%RH Voltage isn't exceeding 100V
Temperature Cycling	$\Delta R \pm 0.1\%$	-55°C to +125°C, 1000 cycles
High Temperature Exposure	$\Delta R \pm 0.2\%$	at +155°C for 1000 hrs
Single pulse high voltage overload	$\Delta R \pm 0.1\%$	$U = 2 \times \sqrt{P \cdot R}$ 10 pulses 10us / 700us
Periodic electric overload	$\Delta R \pm 0.1\%$	$U = 2 \times \sqrt{P \cdot R}$ 0.1 s on; 2.5 s off; 1000 cycles
Bending Strength (Board Flex)	$\Delta R \pm 0.05\%$	Bending amplitude 3mm for 60 seconds
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	$\Delta R \pm 0.02\%$	260±5°C for 10 seconds
Terminal strength	No broken	Force of 1.8 kg for 60 seconds.
Vibration	$\Delta R \pm 0.05\%$	5g's for 20min, 12 cycles each of 3 orientations, 10-2000Hz
ESD	$\Delta R \pm 0.5\%$	Human body model 0805: 2KV 1206, 1210: 6KV
Resistance to solvents	Marking Unsmearred	Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Flammability	No ignition of the tissue paper or scorching or the pinewood board	V-0 or V-1 are acceptable. Electrical test not required.
Sulfur Test	$\Delta R \pm 1\%$	105±2 °C no power rating for 750 hrs.

RCWV(Rated continuous working voltage)= $\sqrt{P \cdot R}$ or Max. Operating voltage whichever is lower

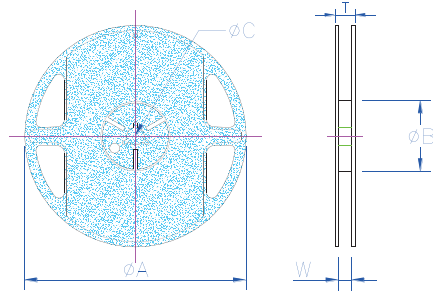
■ Reference Standards: MIL-STD-202, JIS-C-5201-1, IEC-60115-1, AEC-Q200, UL-94, JESD22, IEC61000-4, ASTM-B-809-95

■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date.

Packaging

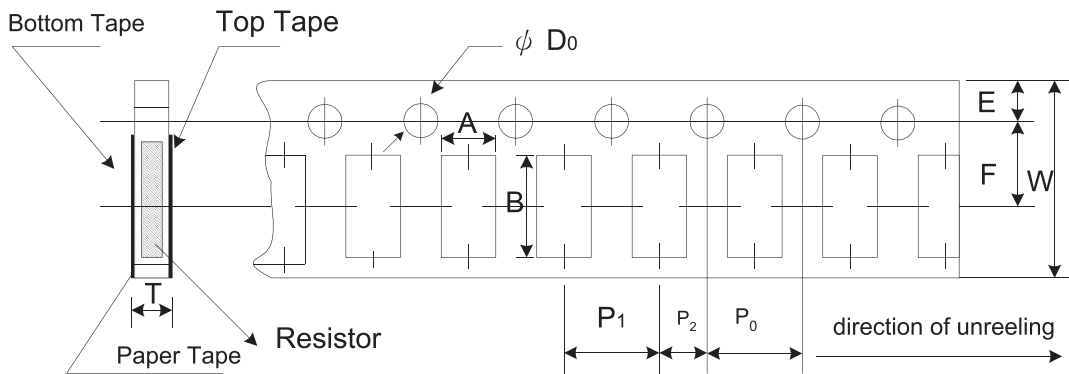
Packing Quantity & Reel Specifications



Unit :mm

Type	ØA	ØB	ØC	W	T	Paper Tape (EA)
ARHV05	178.0±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000
ARHV06	178.0±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000
ARHV13	178.0±1.0	60.0±1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000

Paper Tape Specifications

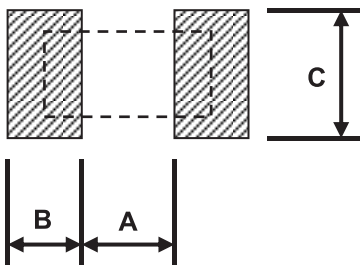


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
ARHV05	1.60±0.05	2.37±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
ARHV06	2.00±0.05	3.55±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
ARHV13	2.75±0.05	3.40±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.60±0.10	0.75±0.05

Recommend Land Pattern

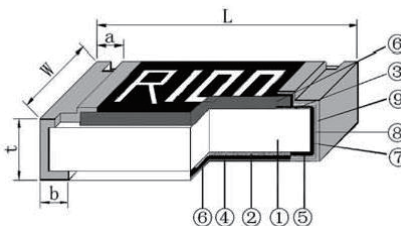
Unit: mm



Type	A	B	C
ARHV05	1.00	1.00	1.35±0.2
ARHV06	2.00	1.15	1.70±0.2
ARHV13	2.00	1.15	2.50±0.2

Automotive Grade Metal Foil Chip Fixed Resistor – MF.A Series

Construction



① Ceramic Substrate	④ Primary Overcoat	⑦ Edge Electrode
② Alloy Plate	⑤ Cu Plating	⑧ Barrier Layer
③ Top Electrode	⑥ Secondary Overcoat	⑨ External Electrode

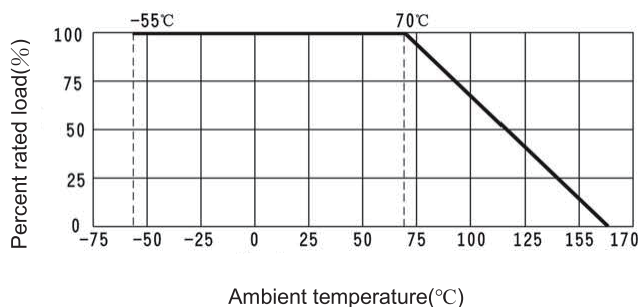
Features

- AEC-Q200 Compliance
- High power rating up to 2 Watts
- Low TCR down to ± 50 PPM/ $^{\circ}$ C
- Current detecting resistors for power supply, Motor circuits, etc
- Superior mechanical and frequency characteristics
- Compliant with RoHS directive
- Halogen free requirement

Applications

- Switching Power Supply, Over Current Protection
- Voltage Regulation Module (VRM)
- DC-DC Converter, Charger
- Automotive Engine Control, Portable Devices etc.

Derating Curve



Dimensions

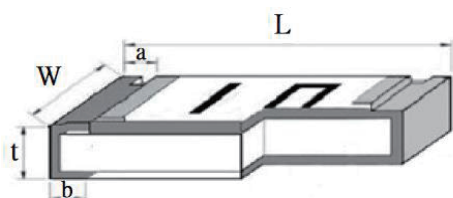


Figure1

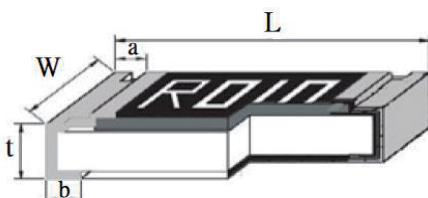


Figure2

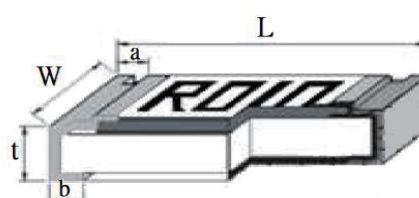


Figure3

Unit: mm

Type	Size (Inch)	Resistance (m Ω)	L	W	t	a	b
MF03	0603	5-20	1.60 \pm 0.20	0.80 \pm 0.20	0.70 \pm 0.15	0.35 \pm 0.25	0.35 \pm 0.20
MF05	0805	3-4	2.00 \pm 0.20	1.25 \pm 0.20	0.70 \pm 0.15	0.40 \pm 0.25	0.70 \pm 0.30
		5-47					0.40 \pm 0.30
MF06	1206	3-4	3.20 \pm 0.20	1.60 \pm 0.20	0.75 \pm 0.15	0.50 \pm 0.30	0.90 \pm 0.30
		5-56					0.50 \pm 0.30
MF10	2010	3	5.00 \pm 0.20	2.50 \pm 0.20	0.75 \pm 0.20	0.60 \pm 0.30	1.60 \pm 0.30
		4-5					1.30 \pm 0.30
		6-100					0.80 \pm 0.30
MF12	2512	2	6.40 \pm 0.20	3.20 \pm 0.20	0.75 \pm 0.20	0.90 \pm 0.30	2.30 \pm 0.30
		3					1.90 \pm 0.30
		4					1.70 \pm 0.30
		5-6					1.20 \pm 0.30
		7					1.10 \pm 0.30
		8-200					0.90 \pm 0.30

Figure 1 for MF03 type ; Figure 2 for MF05 \geq 10m Ω / MF06 type / MF12 type ; Figure 3 for MF05 < 10m Ω / MF10 type

Part Numbering

MF	06	J	T	E	U	R005	A
Product Type	Dimensions (L×W)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Function Code
	03: 0603 05: 0805 06: 1206 10: 2010 12: 2512	F: ±1% G: ±2% J: ±5%	T: Taping Reel	D: ±50 E: ±100 F: ±200	V: 1/4W O: 1/3W U: 1/2W T: 1W S: 2W	R005: 0.005Ω R010: 0.01Ω R100: 0.1Ω	A: Automotive Grade

Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Limiting Element Current	Max. Overload Current	Resistance Range(mΩ)			TCR (PPM/°C)
					±1%	±2%	±5%	
MF03	1/4W	-55 ~ +170°C	5.0A	11.2A	9			±200
	1/3W, 1/2W				10 - 20			±100
MF05	1/4W	-55 ~ +170°C	3.5A	7.9A	5 - 9			±200
	1/3W, 1/2W				10			±100
MF06	1/2W	-55 ~ +170°C	5.0A	11.2A	19 - 47			±50
	1/2W, 1W				3 - 9			±100
MF10	1W	-55 ~ +170°C	18.3A	40.8A	10 -20			±50
					3 - 9			±100
MF12	1W	-55 ~ +170°C	3.2A	7.1A	99 - 200			±50
	1W, 2W				2			±200
			31.6A	63.3A	3 - 9			±100
					10 - 100			±50

Current of DC or AC RMS value.

Rated current= $\sqrt{P/R}$ or Limiting element voltage whichever is lower.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	+20/+125/+20°C
Short Time Overload	No mechanical damage $\Delta R \leq \pm 1\%$	1/2W&1W: 5x rated power for 5s; 2W: 4x rated power for 5s
High Temperature Exposure	No mechanical damage $\Delta R \leq \pm 1\%$	1000 hrs.@T=170±2°C .Unpowered.
Temperature Cycling	No mechanical damage $\Delta R \leq \pm 1\%$	-55°C(30min)~ normal temperature(≤ 1min)~ 155°C (30min), 1000 cycles.
Biased Humidity	No mechanical damage $\Delta R \leq \pm 1\%$	85 C/85%RH. 1000 hours, Apply 10% of operating power or limiting element current whichever is lower
Component Solvent Resistance	Clearly marked No mechanical damage	Immersed in three solvents after 3min immersion, brush wipe 10 times, a total of 3 times, washing with washing and cleaning agent, room temperature on the surface of the ventilation drying
Solderability	95% min. coverage	245±5°C for 3±0.3 seconds
Resistance to Soldering Heat	No mechanical damage $\Delta R \leq \pm 1\%$	270±5°C for 10±1 seconds
Mechanical shock	No mechanical damage $\Delta R \leq \pm 1\%$	Positive half wave, peak acceleration:100g's, pulse duration:6ms, three axis six to each 3 times, a total of 18 times

Item	Requirement	Test Method
Insulation Resistance	>1000MΩ	Apply DC 100V±15V between substrate and terminations for 1min, then check insulation resistance
Voltage Proof	No breakdown or flashover	Apply max. overload voltage of AC RMS at a rate of approximately 100V/s between substrate and terminations for 60±5 seconds
Vibration	No mechanical damage $\Delta R \leq \pm 1\%$	Frequency: 10Hz~2000Hz, acceleration: 5g S, a loop 20 min, X, Y, Z three directions, each direction 12 cycles, 36 cycles
Thermal Shock	No mechanical damage $\Delta R \leq \pm 1\%$	-55°C (15min) ~ normal temperature (≤ 20 sec) ~ 155°C (30min), 300 cycles
Operational Life	No mechanical damage $\Delta R \leq \pm 1\%$	70±2°C, 1000hrs, rated current or limiting element current whichever is lower for 1.5 hrs "ON" and 0.5hrs "OFF"
		125±2°C, 1000hrs, de-rated current for 1.5 hrs "ON" and 0.5hrs "OFF"
Operation at Low Temperature	No mechanical damage $\Delta R \leq \pm 1\%$	-55±5°C, 1h without load rated voltage or limiting element voltage whichever is lower for 45min, 15min without load.
Flammability	No ignition of the tissue paper or scorching or the pinewood board	V-0 or V-1 are acceptable. Electrical test not required.
Substrate Bending Test	No mechanical damage $\Delta R \leq \pm 1\%$	Bending distance: 2mm Duration: 60±5s.
Terminal Strength	No mechanical damage $\Delta R \leq \pm 1\%$	Applying force 17.7N for 60±1s

■ Reference Standards: IEC 60115-1; JIS-C 5201-1; AEC-Q200; MIL-STD-202; JESD22; UL-94

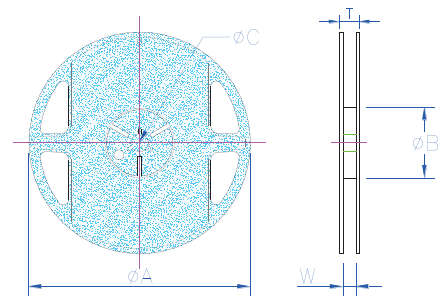
■ Storage Temperature: 5~30°C; Humidity 30~70%RH

■ Packaging

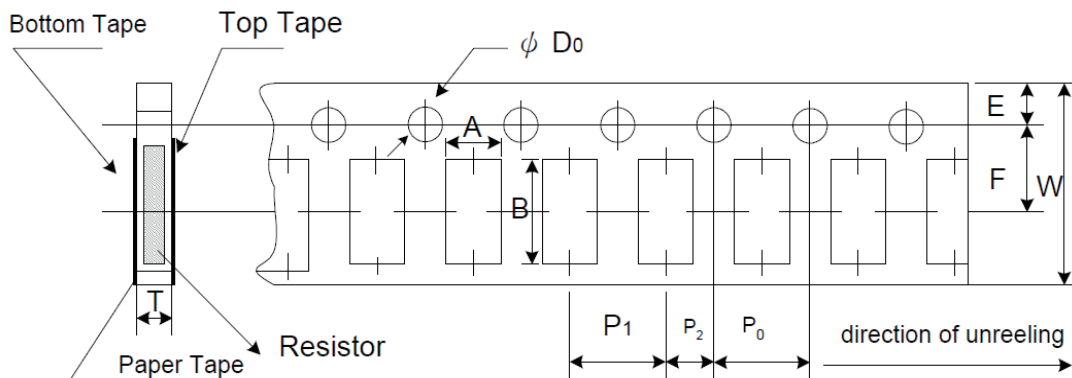
Packing Quantity & Reel Specifications

Unit : mm

Type	ØA	ØB	ØC	W	T	Paper Tape (EA)	Emboss Plastic Tape (EA)
MF03	178.0±2.0	58.0±2.0	13.0±0.5	9.5±1.0	12.5±1.5	5,000	-
MF05	178.0±2.0	58.0±2.0	13.0±0.5	9.5±1.0	12.5±1.5	5,000	-
MF06	178.0±2.0	58.0±2.0	13.0±0.5	9.5±1.0	12.5±1.5	5,000	-
MF10	178.0±2.0	57.0±2.0	13.0±0.5	13.0±0.5	15.5±1.5	-	4,000
MF12	178.0±2.0	57.0±2.0	13.0±0.5	13.0±0.5	15.5±1.5	-	4,000



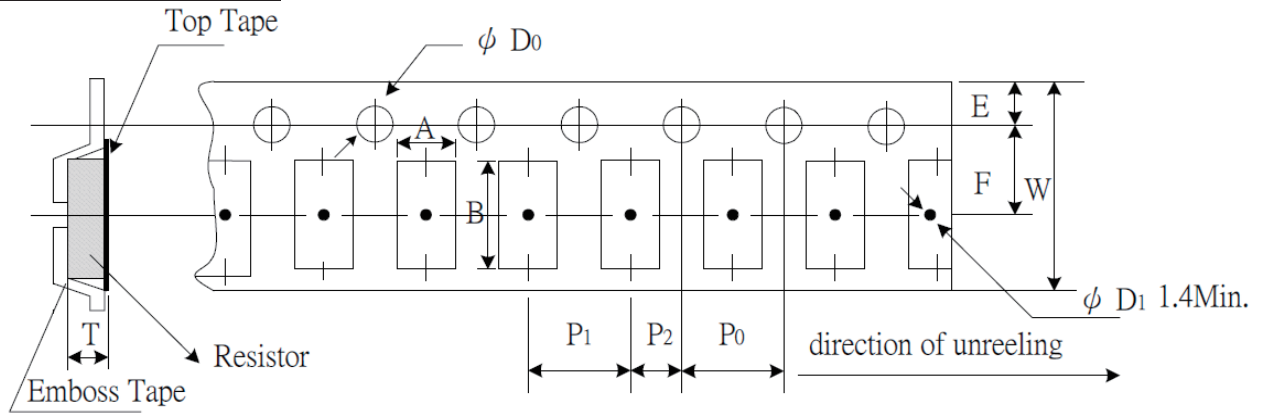
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ØD ₀	T
MF03	1.10±0.10	1.85±0.10	8.00±0.20	1.75±0.10	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	0.75±0.10
MF05	1.65±0.10	2.35±0.10	8.00±0.20	1.75±0.10	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	0.95±0.10
MF06	1.90±0.20	3.50±0.20	8.00±0.20	1.75±0.10	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	0.95±0.10

Emboss Plastic Tape Specifications

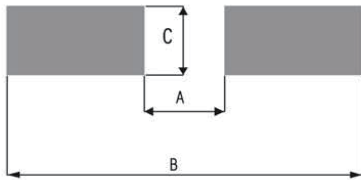


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ØD ₀	T
MF10	2.82±0.15	5.50±0.15	12.0±0.10	1.75±0.10	5.5±0.10	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.10	0.84±0.10
MF12	3.45±0.15	6.78±0.15	12.0±0.10	1.75±0.10	5.5±0.10	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.10

Recommend Land Pattern

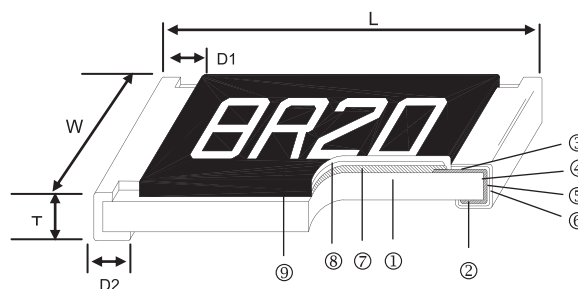
Unit: mm



Type	Resistance	A	B	C
MF03	5mΩ - 20mΩ	0.6	2.8	1.0
MF05	3mΩ - 4mΩ	0.5	3.2	1.4
	5mΩ - 47mΩ	0.8		
MF06	3mΩ - 4mΩ	0.8	4.4	1.8
	5mΩ - 56mΩ	1.8		
MF10	3mΩ - 9mΩ	1.6	6.3	2.9
	10mΩ - 100mΩ	2.7		
MF12	2mΩ - 4mΩ	1.0	8.0	3.4
	5mΩ - 200mΩ	3.8		

Automotive Grade Tantalum Nitride Thin Film Precision Chip Resistor – TAR Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Marking

Features

- Tantalum nitride thin film resistor
- High stability in humid environments
- AEC-Q200 Compliance
- Tight tolerance down to $\pm 0.05\%$
- Extremely low TCR down to $\pm 10\text{PPM}/^\circ\text{C}$
- Resistance values from 10 ohm to 1M ohm
- Special materials, design, and processing for high sulfur applications
- Test proven immunity to humidity, moisture, and sulfur

Dimensions

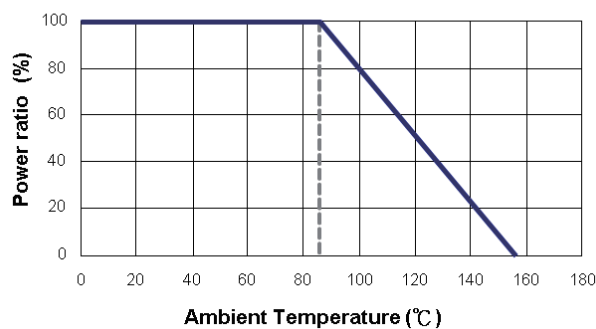
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
TAR02	0402	1.00 \pm 0.05	0.50 \pm 0.05	0.30 \pm 0.05	0.20 \pm 0.10	0.20 \pm 0.10	0.54
TAR03	0603	1.55 \pm 0.10	0.80 \pm 0.10	0.45 \pm 0.10	0.30 \pm 0.20	0.30 \pm 0.20	1.83
TAR05	0805	2.00 \pm 0.15	1.25 \pm 0.15	0.55 \pm 0.10	0.30 \pm 0.20	0.40 \pm 0.20	4.71
TAR06	1206	3.05 \pm 0.15	1.55 \pm 0.15	0.55 \pm 0.10	0.42 \pm 0.20	0.35 \pm 0.25	9.02

Applications

- Automotive
- Medical Equipment
- Testing / Measurement Equipment
- Automatic Equipment Controller
- Converters
- Communication Device

Derating Curve



Part Numbering

TAR	03	A	T	C	M	1001	N
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/ $^\circ\text{C}$)	Power Rating	Resistance	Marking Code
	02: 0402 03: 0603 05: 0805 06: 1206	A: $\pm 0.05\%$ B: $\pm 0.1\%$ C: $\pm 0.25\%$ D: $\pm 0.5\%$ F: $\pm 1\%$	T: Taping Reel B: Bulk	B: ± 10 N: ± 15 C: ± 25 D: ± 50	Y: 1/16W M: 1/6W P: 1/5W U: 1/2W	0100: 10 Ω 1001: 1K Ω 1004: 1M Ω	: Standard Marking for E96 / E24 N: No Marking

Standard Electrical Specifications

Type	Item	Power Rating at 85°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range					TCR (PPM/°C)
						±0.05 %	±0.1 %	±0.25 %	±0.5%	±1%	
TAR02 (0402)	1/16W	-55 ~ +155°C	50V	100V	40Ω - 35KΩ					±10 ±15 ±25 ±50	
TAR03 (0603)	1/6W	-55 ~ +155°C	75V	150V	40Ω - 130KΩ					±10 ±15 ±25 ±50	
TAR05 (0805)	1/5W	-55 ~ +155°C	100V	200V	10Ω - 350KΩ					±10 ±15 ±25 ±50	
TAR06 (1206)	1/2W	-55 ~ +155°C	200V	400V	10Ω - 1MΩ					±10 ±15 ±25 ±50	

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

■Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	-55°C~+125°C, 25°C is the reference temperature
Short Time Overload	$\Delta R \pm 0.1\%$	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	>1000 MΩ	Apply 100V _{DC} for 1 minute
Operational Life	$\Delta R \pm 0.1\%$	Condition D Steady State T _A =125°C at derated power. Measurement at 24±4 hours after test conclusion
Biased Humidity	$\Delta R \pm 0.1\%$	1000 hrs 85°C/85%RH 10% of operating power.
High Temperature Exposure	$\Delta R \pm 0.15\%$	at +155°C for 1000 hrs
Temperature Cycling	$\Delta R \pm 0.1\%$ for 125°C $\Delta R \pm 0.2\%$ for 155°C	-55°C to +125°C, 1000 cycles -55°C to +155°C, 1000 cycles
Bending Strength (Board Flex)	$\Delta R \pm 0.1\%$	Bending 2mm for 60 seconds
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	$\Delta R \pm 0.1\%$	260±5°C for 10 seconds
Terminal strength	No broken	Force of 1kg for 60 seconds
Mechanical Shock	$\Delta R \pm 0.1\%$	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	$\Delta R \pm 0.1\%$	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	$\Delta R \pm 0.1\%$	Human body model TAR02、TAR03 0.2KV TAR05、TAR06 1KV
Resistance to solvents	Marking Unsmearred	Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents

Item	Requirement	Test Method
Sulfur Test	$\Delta R \pm 1\%$	105±2 °C no power rating for 750 hrs
Flammability	No ignition of the tissue paper or scorching of the pinewood board	V-0 or V-1 are acceptable. Electrical test not required
Endurance	$\Delta R \pm 0.1\%$	1000 +48/-0 hours, loaded with RCWV or Vmax in chamber controller 85 ±2°C, 1.5 hours on and 0.5 hours off
Moisture Resistance	$\Delta R \pm 0.1\%$	65±2°C, 80~100% RH, 10 cycles, 24 hours/cycle

RCWV(Rated Continuous Working Voltage)= $\sqrt{(P \cdot R)}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC 60115-1, JIS-C 5201-1; AEC-Q200; MIL-STD-202; JESD22; UL-94; EIA-977

■ Storage Temperature: 15~28°C; Humidity < 80%RH

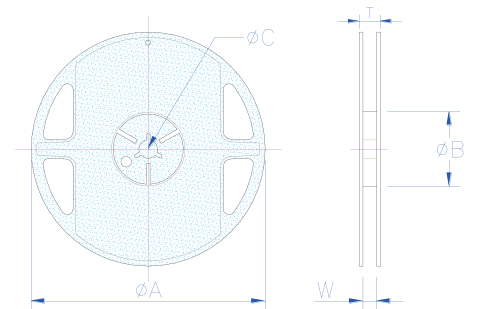
■ Shelf Life: 2 years from production date.

■ Packaging

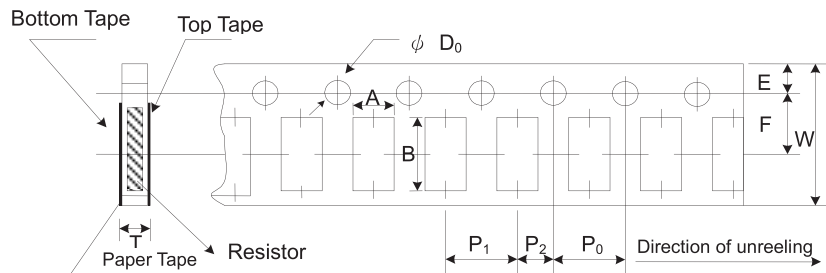
Packaging Quantity & Reel Specifications

Unit: mm

Type	ΦA	ΦB	ΦC	W	T	Paper Tape (EA)
TAR02	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	10,000
TAR03	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000
TAR05	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000
TAR06	178.0±1.0	60.0+1.0	13.5±0.7	9.5±1.0	11.5±1.0	5,000



Paper Tape Specifications

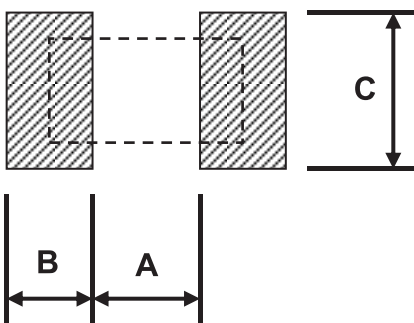


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
TAR02	0.70±0.05	1.16±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.55±0.05	0.40±0.03
TAR03	1.10±0.05	1.90±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.60±0.03
TAR05	1.60±0.05	2.37±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05
TAR06	2.00±0.05	3.55±0.05	8.00±0.10	1.75±0.05	3.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	0.75±0.05

■ Recommend Land Pattern

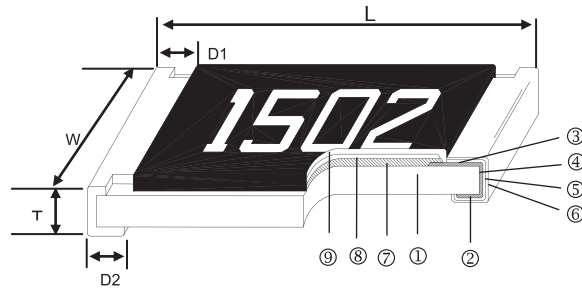
Unit: mm



Type	A	B	C
TAR02	0.50	0.50	0.60±0.2
TAR03	0.80	1.00	0.90±0.2
TAR05	1.00	1.00	1.35±0.2
TAR06	2.00	1.15	1.70±0.2

Automotive Grade Chip Resistor – CR..A Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Features

- AEC-Q200 Compliance
- Highly reliable multilayer electrode construction
- Special construction to prevent sulfuration in a sulfur containing environment
- Compatible with all soldering process
- 100% CCD inspection

Applications

- Automotive Industry
- Telecommunication Equipments
- Radio and Tape Recorders, TV Tuners
- Digital Cameras, Watches, Pocket Calculators
- Computers, Instruments
- Medical Equipment

Dimensions

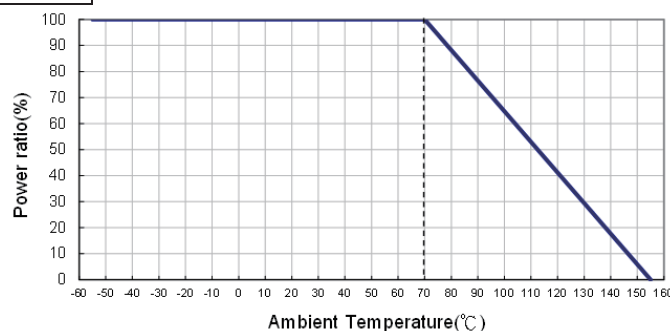
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
CR-01	0201	0.60±0.03	0.30±0.03	0.23±0.03	0.15±0.05	0.15±0.05	0.15
CR-02	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10	0.62
CR-03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	2.04
CR-05	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	4.37
CR-06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	8.95
CR-10	1210	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.25	0.50±0.20	15.96
CR-0A	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20	24.24
CR-0A (2W)	2010	5.00±0.10	2.50±0.15	0.74±0.10	0.60±0.30	1.70±0.20	36.86
CR-12	2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.25	0.50±0.20	39.45
CR-12 (3W)	2512	6.35±0.20	3.15±0.15	0.74±0.10	0.60±0.30	2.10±0.20	53

Part Numbering

CR-	03	F	A	7	---10R
Product Type	Dimensions	Resistance Tolerance	Function Code	Packaging Code	Resistance
	01: 0201 02: 0402 03: 0603 05: 0805 06: 1206 10: 1210 0A: 2010 12: 2512	D: ±0.5% F: ±1% J: ±5%	A: Automotive Grade C: High Power & Automotive Grade D: High Power 1 & Automotive Grade U: Ultra High Power & Automotive Grade Q: Ultra High Power 1 & Automotive Grade	4: 7" Reel 4Kpcs 6: 7" Reel 10Kpcs 7: 7" Reel 5Kpcs 9: 10" Reel 8Kpcs A: 10" Reel 10Kpcs B: 10" Reel 20Kpcs C: 13" Reel 40Kpcs D: 13" Reel 20Kpcs	--- 1R2: 1.2Ω --- 3K3: 3.3KΩ -- 10K: 10KΩ -- 100K: 100KΩ "-" to fill up 6 spaces

Derating Curve



Standard Electrical Specifications

Type \ Item	Power Rating at 70°C Jumper Rated Current	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range		TCR (PPM/°C)
					±1% (E24、E96)	±5% (E24)	
CR-01 (0201)	1/20W	-55 ~ +155°C	30V	50V	1Ω - 10MΩ		±200
CR-02 (0402)	1/16W	-55 ~ +155°C	50V	100V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200
CR-03 (0603)	1/10W	-55 ~ +155°C	75V	150V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200
CR-05 (0805)	1/8W	-55 ~ +155°C	150V	300V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200
CR-06 (1206)	1/4W	-55 ~ +155°C	200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200
CR-10 (1210)	1/2W	-55 ~ +155°C	200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200
CR-0A (2010)	3/4W	-55 ~ +155°C	400V	800V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200
CR-12 (2512)	1W	-55 ~ +155°C	500V	1000V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200

High Precision Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range	TCR (PPM/°C)
					±0.5% (E24、E96)	
CR-02 (0402)	1/16W	-55 ~ +155°C	50V	100V	10Ω - 1MΩ	±100
CR-03 (0603)	1/10W		75V	150V	10Ω - 1MΩ	±100
CR-05 (0805)	1/8W		150V	300V	10Ω - 1MΩ	±100
CR-06 (1206)	1/4W		200V	400V	10Ω - 1MΩ	±100
CR-10 (1210)	1/2W		200V	400V	10Ω - 1MΩ	±100
CR-0A (2010)	3/4W		400V	800V	10Ω - 1MΩ	±100
CR-12 (2512)	1W		500V	1000V	10Ω - 1MΩ	±100

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

High Power & Ultra High Power Rating Electrical Specifications

Type	Item	Power Rating at 70°C	Function Code	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
							±0.5% (E24 - E96)	±1% (E24 - E96)	±5% (E24)	
CR-02 (0402)	1/10W	D	-55 ~ +155°C		50V	100V	-	1Ω - 9.76Ω		±200
	1/8W	C					10Ω - 1MΩ		±100	
CR-03 (0603)	1/4W	C			75V	150V	-	1Ω - 9.76Ω		±200
							10Ω - 1MΩ		±100	
CR-05 (0805)	1/3W	C			150V	300V	-	1Ω - 9.76Ω		±200
							10Ω - 1MΩ		±100	
CR-06 (1206)	1/2W	C			200V	400V	-	1Ω - 9.76Ω		±200
							10Ω - 1MΩ		±100	
CR-10 (1210)	1W	C			200V	400V	-	1Ω - 9.76Ω		±200
							10Ω - 1MΩ		±100	
CR-0A (2010)	1W	C			400V	800V	-	1Ω - 9.76Ω		±200
	*1.25W	U					10Ω - 1MΩ		±100	
	*2W	Q	10Ω - 1MΩ				±100			
CR-12 (2512)	2W	C	500V	1000V	-	1Ω - 9.76Ω		±200		
					10Ω - 1MΩ		±100			
	*3W	U			250V	500V	-	1Ω - 9.76Ω		±200
						10Ω - 1MΩ		±100		

*: Ultra High Power

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

The power rating depends on the maximum temperature of the resistive element. Due to the power dissipation of the resistor, the temperature of the resistive element will rise depending on the condition of heat dissipation from PCB. The maximum power rating in application only applies if the temperature of the resistive element is not exceed 155°C.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Jumper(0Ω)

Type	Item	Rated Current	Function Code	Resistance	Operating Temp. Range
				0Ω 5%	
CR-01 (0201)		1A	A	<50mΩ	-55 ~ +155°C
CR-02 (0402)		1A			
CR-03 (0603)		1A			
CR-05 (0805)		2A			
CR-06 (1206)		2A			
CR-10 (1210)		2.5A			
CR-0A (2010)		3.5A			
CR-12 (2512)		4A			

High Current Jumper(0Ω)

Type	Item	Rated Current	Function Code	Resistance	Operating Temp. Range
				0Ω 5%	
CR-02 (0402)		1.5A	C	<20mΩ	-55 ~ +155°C
CR-03 (0603)		2A			
CR-05 (0805)		2.5A			
CR-06 (1206)		3.5A			
CR-10 (1210)		5A			
CR-0A (2010)		6A			
CR-12 (2512)		7A			

Environmental Characteristics

Item	Requirement			Test Method
	±1%	±5%	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.			At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	<50mΩ	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds, 2 seconds for high power series Ultra High Power: RCWV*2 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G			Max. Overload Voltage for 1 minute
Operational Life	±(1.0%+0.10Ω)	±(2.0%+0.10Ω)	<100mΩ	Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion.
Biased Humidity	±(1.0%+0.10Ω)	±(2.0%+0.10Ω)	<100mΩ	1000 hrs. 85°C/85%RH 10% of operating power (≤100V).
High Temperature Exposure	±(1.0%+0.05Ω)	±(1.5%+0.10Ω)	<50mΩ	at +155°C for 1000 hrs.
Board Flex	±(0.25%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage			245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.25%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover			1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤5% Total leaching area ≤10%			260±5°C for 30 seconds
Temperature Cycling	±(0.5%+0.05Ω)	±(1.5%+0.05Ω)	<50mΩ	-55°C to +125°C, 1000 cycles
Mechanical Shock	±(0.25%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(3%+0.05Ω)			Human body model 0201: 0.5KV 0402/0603: 1KV 0805 and above: 2KV
	±(1%+0.05Ω)			3 positive + 3 negative discharges ESD voltage acc. to size
Resistance to Solvents	No visible damage on appearance and marking.			Add aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken			Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board			V-0 or V-1 are acceptable. Electrical test not required.
Sulfur Test	△R±1%		<50mΩ	60±2°C, no power rating for 500 hrs.

RCWV(Rated continuous working voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

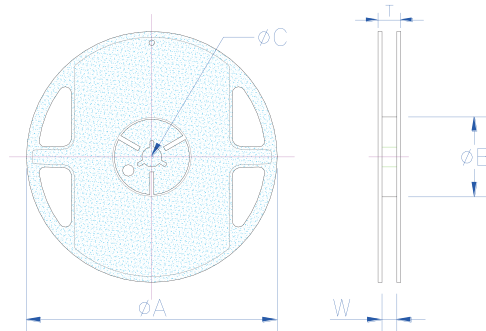
■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1; AEC-Q200; MIL-STD-202; JESD22; UL-94 ; EIA-977

■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date

Packaging

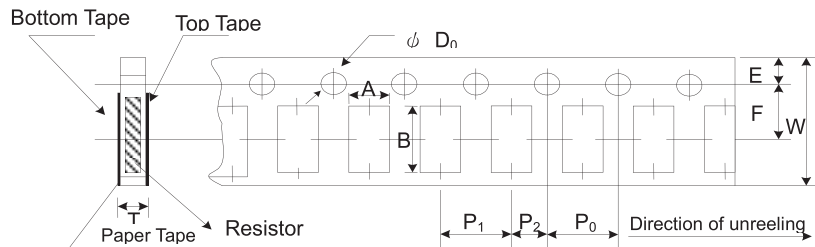
Reel Specifications & Packaging Quantity



Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ØA	ØB	ØC	W	T	
CR-01 CR-02	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		20K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		40K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
CR-03 CR-05 CR-06 CR-10	Paper	5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		10K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		20K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
CR-0A CR-12	Embossed	4K	12mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.5	13.0±0.5	15.5±0.5
		8K	12mm	10 inch	250±1.0	62±0.5	13.0±0.5	12.5±0.5	16.5±0.5
CR-12(3W)	Embossed	2K	12mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.5	13.0±0.5	15.5±0.5

Paper Tape Specifications

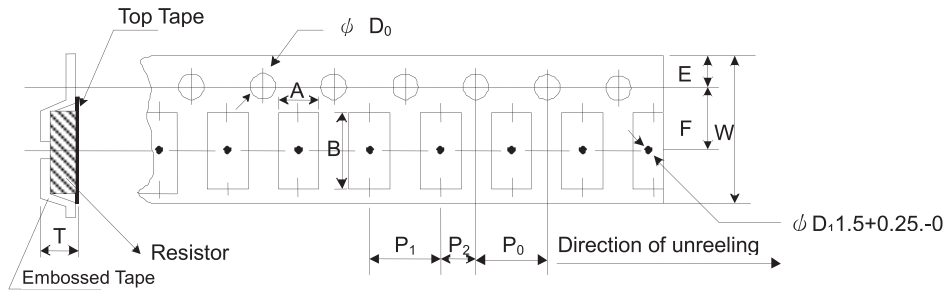


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ØD ₀	T
CR-01	0.38±0.05	0.68±0.05	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.42±0.20
CR-02	0.65±0.10	1.15±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.10
CR-03	1.10±0.10	1.90±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.10
CR-05	1.60±0.10	2.40±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CR-06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CR-10	2.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

■ Packaging

Embossed Plastic Tape Specifications

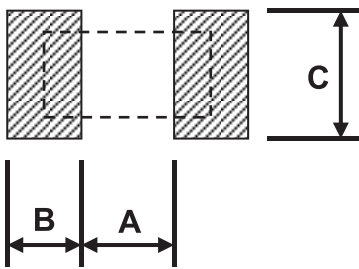


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CR-0A	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1, -0	1.2 ⁺⁰
CR-0A (2W)	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	1.20±0.20
CR-12	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1, -0	1.2 ⁺⁰
CR-12 (3W)	3.40±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.55±0.05	1.45±0.20

■ Recommend Land Pattern

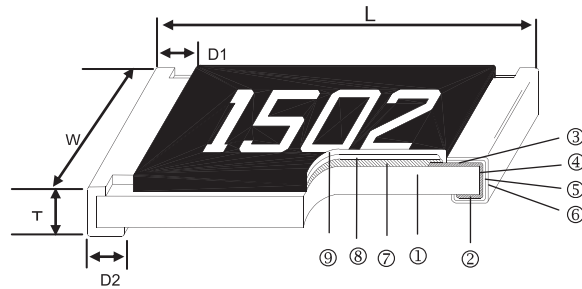
Unit: mm



Type	A	B	C
CR-01	0.30	0.25	0.30
CR-02	0.50	0.45	0.60
CR-03	0.90	0.60	0.90
CR-05	1.20	0.70	1.30
CR-06	2.00	0.90	1.60
CR-10	2.00	0.90	2.80
CR-0A	3.80	0.90	2.80
CR-0A(2W)	1.40	2.40	2.80
CR-12	4.90	1.60	3.50
CR-12(3W)	1.00	3.55	3.50

Automotive Grade Thick Film High Precision Low TCR Chip Resistor – CRTC..A Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Features

- AEC-Q200 Qualified
- Small size and light weight
- Highly reliable multilayer electrode construction
- Compatible with all soldering process
- 100% CCD inspection

Applications

- Telecommunication Equipment
- Car Media
- Digital Cameras, Watches, Pocket Calculators
- Computers, Instruments
- Medical Equipment

Dimensions

Unit: mm

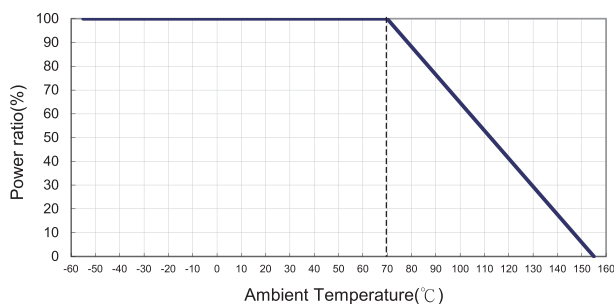
Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
CRTC02	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.18±0.10	0.20±0.10	0.6
CRTC03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	2.0
CRTC05	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	4.4
CRTC06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	8.9

Part Numbering

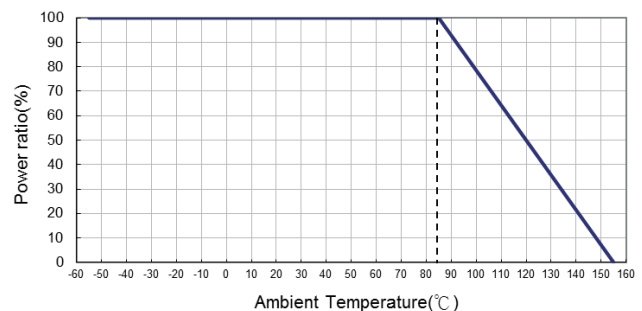
CRTC	06	F	T	C	V	1002	A
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking
	02: 0402 03: 0603 05: 0805 06: 1206	B: ±0.1% C: ±0.25% D: ±0.5% F: ±1%	T: 7" Taping Reel V: 10" Taping Reel W: 13" Taping Reel	C: ±25 D: ±50	Y: 1/16W X: 1/10W W: 1/8W P: 1/5W V: 1/4W O: 1/3W	1000: 100Ω 2201: 2.2KΩ 1002: 10KΩ 1004: 1MΩ	A: Automotive Grade

Derating Curve

For Standard power rating



For High power rating



Standard Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range (E24 · E96)				TCR (PPM/°C)
					±0.1%	±0.25%	±0.5%	±1%	
CRTC02 (0402)	1/16W	-55 ~ +155°C	50V	100V	300Ω~1MΩ				*±25 ±50
CRTC03 (0603)	1/10W		75V	150V	10Ω~1MΩ				
CRTC05 (0805)	1/8W		150V	300V	10Ω~3MΩ	10Ω~6.8MΩ	10Ω~10MΩ		
CRTC06 (1206)	1/4W		200V	400V	10Ω~5.1MΩ		10Ω~10MΩ		

High Power rating Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range (E24 · E96)				TCR (PPM/°C)
					±0.1%	±0.25%	±0.5%	±1%	
CRTC02 (0402)	1/8W	-55 ~ +155°C	75V	100V	300Ω~1MΩ				*±25 ±50
CRTC03 (0603)	1/5W		100V	150V	10Ω~1MΩ				
CRTC05 (0805)	1/4W		150V	300V	10Ω~3MΩ	10Ω~6.8MΩ	10Ω~10MΩ		
CRTC06 (1206)	1/3W		200V	400V	10Ω~5.1MΩ		10Ω~10MΩ		

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

*TCR(25°C/-55°C): -50~+25PPM/°C

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(0.2%+0.05Ω)	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G	Max. Overload Voltage for 1 minute
Endurance	For Standard power rating: 02 (R ≤ 30KΩ) : ±(0.2%+0.05Ω) 02 (R > 30KΩ) : ±(0.4%+0.05Ω) 03,05,06 : ±(0.2%+0.05Ω)	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
	For High power rating: 02 (R ≤ 30KΩ) : ±(0.2%+0.05Ω) 02 (R > 30KΩ) : ±(0.4%+0.05Ω) 03,05,06 : ±(0.2%+0.05Ω)	85±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Biased Humidity	±(1.0%+0.10Ω)	1000hrs 85°C/85%RH 10% of operating power (≤100V).
High Temperature Exposure	02 (R ≤ 30KΩ) /03 (R ≤ 200KΩ) : ±(0.2%+0.05Ω) 02 (R > 30KΩ) /03 (R > 200KΩ) : ±(0.5%+0.05Ω) 05,06 : ±(0.2%+0.05Ω)	At +155°C for 1000 hrs
Board Flex	±(1.0%+0.05Ω)	Bending once for 60 seconds 3mm
Solderability	95% min. coverage	245±5°C for 3 seconds

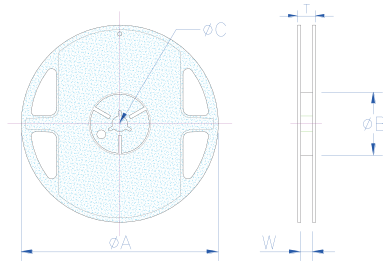
Item	Requirement	Test Method
Resistance to Soldering Heat	$\pm(0.2\%+0.05\Omega)$	260 \pm 5°C for 10 seconds
Voltage Proof	No breakdown or flashover	1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area \leq 5% Total leaching area \leq 10%	260 \pm 5°C for 30 seconds
Temperature Cycling	02 (R \leq 30K Ω) : $\pm(0.2\%+0.05\Omega)$ 02 (R > 30K Ω) : $\pm(0.5\%+0.05\Omega)$ 03,05,06 : $\pm(0.2\%+0.05\Omega)$	-55°C to +125°C, 1000 cycles
Mechanical Shock	$\pm(0.25\%+0.05\Omega)$	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	$\pm(0.5\%+0.05\Omega)$	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	$\pm(3\%+0.05\Omega)$	Human body model 0402/0603: 1KV 0805 and above: 2KV
Resistance to Solvents	No visible damage on appearance and marking.	Add aqueous wash chemical – OKEM Clean or equivalent. DO not use banned solvents.
Terminal Strength	No broken	Force of 1.8kg for 60 seconds
Flammability	No ignition of the tissue paper or scorching or the pinewood board	V-0 or V-1 are acceptable. Electrical test not required
Sulfur Test	$\Delta R \pm 1\%$	60 \pm 2°C, no power rating for 500 hrs.

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

- Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1
- Storage Temperature: 15~28°C; Humidity < 80%RH
- Shelf Life: 2 years from production date

■ Packaging

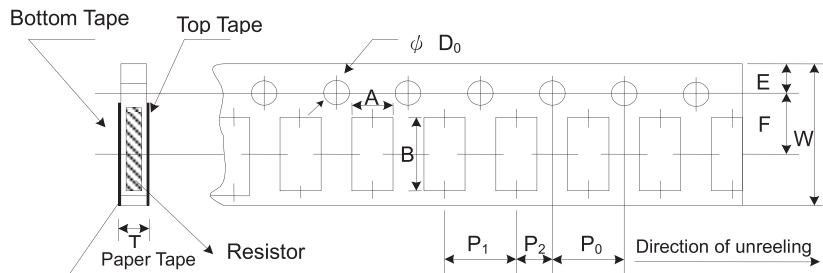
Reel Specifications & Packaging Quantity



Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T	
CRTC02	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		20K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		40K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
CRTC03 CRTC05 CRTC06	Paper	5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		10K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		20K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5

Paper Tape Specifications

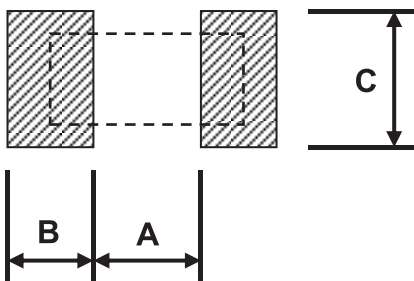


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CRTC02	0.65±0.10	1.15±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.10
CRTC03	1.10±0.10	1.90±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.10
CRTC05	1.60±0.10	2.40±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CRTC06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

■ Recommend Land Pattern

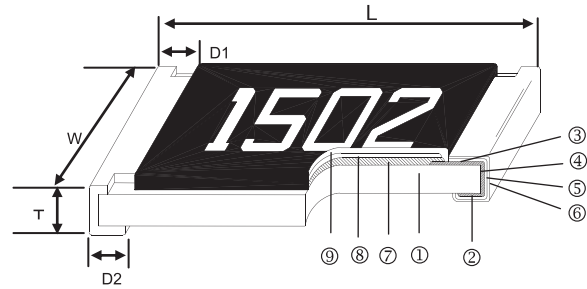
Unit: mm



Type	A	B	C
CRTC02	0.50	0.45	0.60
CRTC03	0.90	0.60	0.90
CRTC05	1.20	0.70	1.30
CRTC06	2.00	0.90	1.60

Automotive Grade Anti-Sulfurated Chip Resistor – AS..A Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Features

- Special construction to prevent sulfuration in a sulfur containing environment
- AEC-Q200 Compliance
- 100% CCD inspection

Applications

- Automotive
- High-end Computer
- Industrial Equipment
- Automatic Equipment Controller
- Medical Equipment
- High-end Multimedia Electronics
- Outdoor Electronic Applications

Dimensions

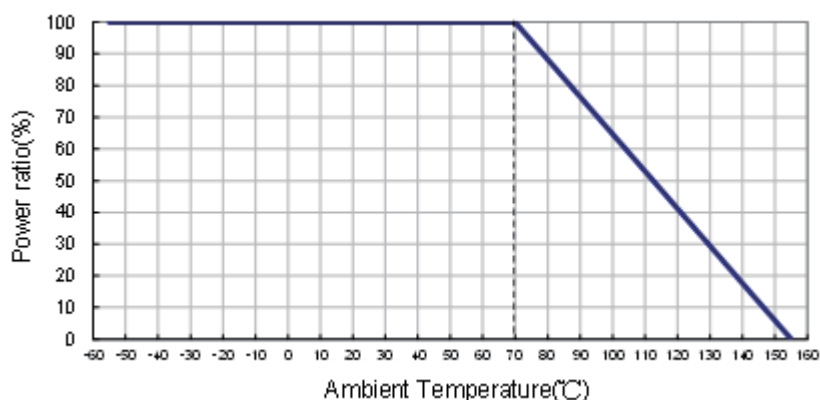
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
AS01	0201	0.60±0.03	0.30±0.03	0.23±0.03	0.15±0.05	0.15±0.05	0.150
AS02	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10	0.620
AS03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	2.042
AS05	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	4.368
AS06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	8.947
AS10	1210	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.25	0.50±0.20	15.959
AS0A	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20	24.241
AS12	2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.25	0.50±0.20	39.448

Part Numbering

AS	03	F	T	E	1002	A
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Resistance	Marking
	01: 0201 02: 0402 03: 0603 05: 0805 06: 1206 10: 1210 0A: 2010 12: 2512	D: ±0.5% F: ±1% J: ±5%	T: Taping Reel V: 10" Taping Reel W: 13" Taping Reel	E: ±100 F: ±200 - : No Specified	1000: 100Ω 1002: 10KΩ 2201: 2.2KΩ 1003: 100KΩ	: Standard A: Automotive Grade

Derating Curve



Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±0.5% (E24,E96)	±1% (E24,E96)	±5% (E24)	
AS01 (0201)	1/20W	-55 ~ +155°C	25V	50V	-	1Ω - 10MΩ		±200
	Jumper: 1A				-	0Ω(<50mΩ)		-
AS02 (0402)	1/16W		50V	100V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ			±200 ±100 ±200
	Jumper: 1A				-	0Ω(<50mΩ)		-
AS03 (0603)	1/10W		75V	150V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ			±200 ±100 ±200
	Jumper: 1A				-	0Ω(<50mΩ)		-
AS05 (0805)	1/8W		150V	300V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ			±200 ±100 ±200
	Jumper: 2A				-	0Ω(<50mΩ)		-
AS06 (1206)	1/4W		200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ			±200 ±100 ±200
	Jumper: 2A				-	0Ω(<50mΩ)		-
AS10 (1210)	1/3W		200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ			±200 ±100 ±200
	Jumper: 2.5A				-	0Ω(<50mΩ)		-
AS0A (2010)	3/4W	200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ			±200 ±100 ±200	
	Jumper: 3.5A			-	0Ω(<50mΩ)		-	
AS12 (2512)	1W	250V	500V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ			±200 ±100 ±200	
	Jumper: 4A			-	0Ω(<50mΩ)		-	

High Power Rating Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range		TCR (PPM/°C)
					±1% (E24,E96)	±5% (E24)	
AS02 (0402)	1/8W	-55 ~ +155°C	50V	100V	1Ω - 9.76Ω		±200
					10Ω - 1MΩ		±100
AS03 (0603)	1/4W		75V	150V	1Ω - 9.76Ω		±200
					10Ω - 1MΩ		±100
AS05 (0805)	1/3W		150V	300V	1Ω - 9.76Ω		±200
					10Ω - 1MΩ		±100
AS06 (1206)	1/2W		200V	400V	1Ω - 9.76Ω		±200
					10Ω - 1MΩ		±100
AS10 (1210)	3/4W	200V	400V	1Ω - 9.76Ω		±200	
				10Ω - 1MΩ		±100	
AS0A (2010)	1W	200V	400V	1Ω - 9.76Ω		±200	
				10Ω - 1MΩ		±100	
AS12 (2512)	2W	250V	500V	1Ω - 9.76Ω		±200	
				10Ω - 1MΩ		±100	

Operating Voltage= $\sqrt{(P \cdot R)}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{(P \cdot R)}$ or Max. Overload Voltage listed above, whichever is lower.

The power rating depends on the maximum temperature of the resistive element. Due to the power dissipation of the resistor, the temperature of the resistive element will rise depending on the condition of heat dissipation from PCB. The maximum power rating in application only applies if the temperature of the resistive element is not exceed 125°C.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement			Test Method
	±1% and Below	±5%	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.			At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	<50mΩ	2.5 times RCWV or Max. Overload Voltage whichever is lower for 5 seconds High Power: 2 times RCWV or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥ 10G			Max. Overload Voltage for 1 minute
Operational Life	±(1.0%+0.10Ω)	±(3.0%+0.10Ω)	<100mΩ	Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion.
Biased Humidity	±(1.0%+0.10Ω)	±(3.0%+0.10Ω)	<100mΩ	1000 hrs 85°C/85%RH 10% of operating power(≤ 100V)
High Temperature Exposure	±(1.0%+0.05Ω)	±(1.5%+0.10Ω)	<50mΩ	at +155°C for 1000 hrs
Board Flex	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	Bending once for 60 seconds 2010, 2512 sizes: 2 mm Other sizes: 3mm
Solderability	95% min. coverage			245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover			1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤5% Total leaching area ≤10%			260±5°C for 30 seconds
Temperature Cycling	±(0.5%+0.05Ω)	±(1.5%+0.05Ω)	<50mΩ	-55°C to +125°C, 1000 cycles
Mechanical Shock	±(0.25%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(3%+0.05Ω)			Human body model 0201: 0.5KV 0402/0603: 1KV 0805 and above: 2KV
Resistance to Solvents	No visible damage on appearance and marking.			Add aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken			Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board			V-0 or V-1 are acceptable. Electrical test not required.
Sulfur Test	△R±1%		<50mΩ	105±2°C, no power rating for 750 hrs.

RCWV(Rated Continuous Working Voltage)=√(P*R) or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC60115-1, 60068-2-58; JIS-C 5201-1; EIA-977; AEC-Q200; MIL-STD-202; JESD22; UL-94

■ Storage Temperature: 15~28°C; Humidity < 80%RH

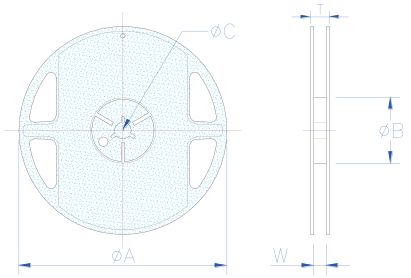
■ Shelf Life: 2 years from production date

■ Packaging

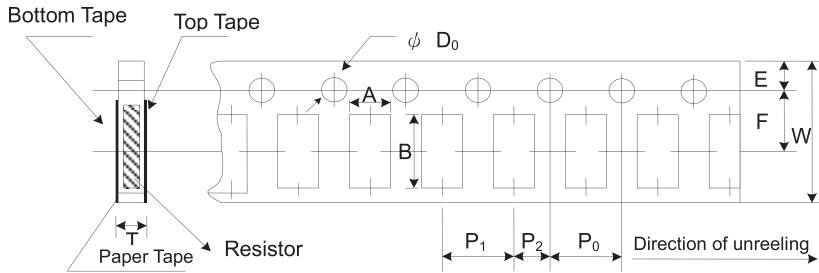
Reel Specifications & Packaging Quantity

Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T	
AS01 AS02	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		20K		10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		40K		13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
AS03 AS05 AS06 AS10	Paper	5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		10K		10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		20K		13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
				AS0A AS12	Embossed	4K	12mm	7 inch	178.5±1.5
8K	10 inch	250±1.0	62±0.5	13.0±0.5		12.5±0.5		16.5±0.5	



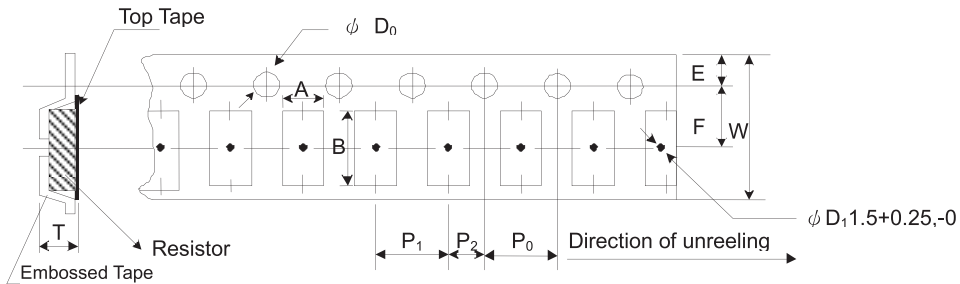
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
AS01	0.38±0.05	0.68±0.05	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.42±0.20
AS02	0.65±0.10	1.15±0.10	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.10
AS03	1.10±0.10	1.90±0.10	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.10
AS05	1.60±0.10	2.40±0.20	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
AS06	1.90±0.10	3.50±0.20	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
AS10	2.90±0.10	3.50±0.20	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Embossed Plastic Tape Specifications

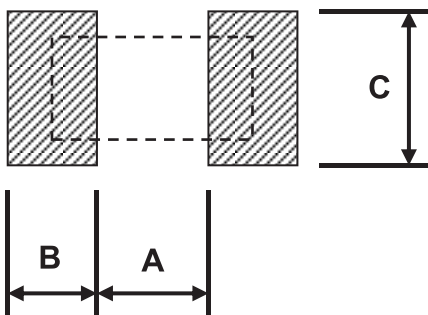


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
AS0A	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰
AS12	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰

■ Recommend Land Pattern

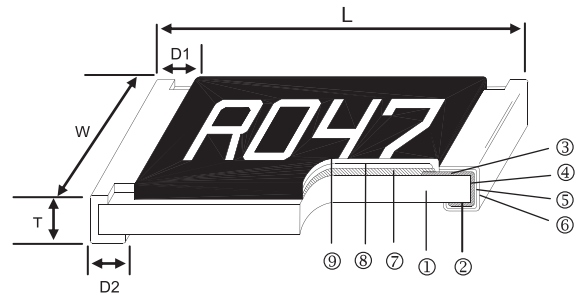
Unit: mm



Type	A	B	C
AS01	0.30	0.25	0.30
AS02	0.50	0.45	0.60
AS03	0.90	0.60	0.90
AS05	1.20	0.70	1.30
AS06	2.00	0.90	1.60
AS10	2.00	0.90	2.80
AS0A	3.80	0.90	2.80
AS12	4.90	1.60	3.50

Automotive Grade Current Sensing Chip Resistor – CS..A Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Features

- AEC-Q200 Compliance
- Highly reliable multilayer electrode construction
- Reduced size of final PCB design
- 3 Watts power rating in 1 Watt size, 1225 package
- Low TCR of ± 100 PPM/°C
- Resistance values from 1m to 1 ohm
- High purity alumina substrate for high power dissipation
- Long side terminations with higher power rating
- Special construction to prevent sulfuration in a sulfur containing environment
- RoHS Compliance
- 100% CCD inspection

Applications

- Automotive Industry
- Power Management Applications
- Switching Power Supply
- Over Current Protection in Audio Applications
- Voltage Regulation Module (VRM)
- DC-DC Converter, Battery Pack, Charger, Adaptor
- Automotive Engine Control
- Disk Driver

Part Numbering

CS	06	F	T	F	U	R100	A
Product Type	Dimensions (LxW)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking
	02: 0402 03: 0603 05: 0805 06: 1206 13: 1210 10: 2010 12: 2512 25: 1225 37: 3720 75: 7520 62: 0612	F: $\pm 1\%$ G: $\pm 2\%$ J: $\pm 5\%$	T: Taping Reel	E: ± 100 F: ± 200 G: ± 300 H: ± 400 J: ± 600 K: ± 150	: Standard* (See Remark) S: 2W A: 1.5W T: 1W Q: 3/4W U: 1/2W V: 1/4W P: 1/5W W: 1/8W	R010: 0.01 Ω R100: 0.1 Ω 1R00: 1 Ω	NA: No Marking A: Automotive Grade

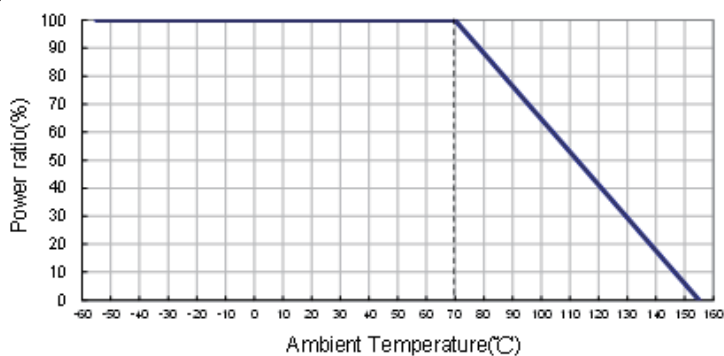
*Remark: Standard part no need for power rating code.

Dimensions

Unit: mm

Type	Size	L	W	T	D1	D2	Weight (g) (1000pcs)
CS02	0402	1.00 \pm 0.05	0.50 \pm 0.05	0.32 \pm 0.10	0.25 \pm 0.10	0.20 \pm 0.10	0.7
CS03	0603	1.60 \pm 0.10	0.80 \pm 0.10	0.45 \pm 0.10	0.30 \pm 0.20	0.30 \pm 0.20	1.99
CS05	0805	2.00 \pm 0.10	1.25 \pm 0.10	0.55 \pm 0.10	0.30 \pm 0.20	0.40 \pm 0.25	5.3
CS06	1206	3.10 \pm 0.10	1.55 \pm 0.10	0.55 \pm 0.10	0.50 \pm 0.30	0.40 \pm 0.25	8.82
CS13	1210	3.10 \pm 0.10	2.60 \pm 0.15	0.55 \pm 0.10	0.50 \pm 0.30	0.50 \pm 0.25	15.5
CS10	2010	5.00 \pm 0.10	2.50 \pm 0.15	0.60 \pm 0.15	0.60 \pm 0.30	0.50 \pm 0.25	27.03
CS12	2512	6.35 \pm 0.10	3.10 \pm 0.15	0.60 \pm 0.10	0.60 \pm 0.30	0.55 \pm 0.25	43.08
CS12 (2W)	2512 (10 - 99m Ω)	6.35 \pm 0.20	3.15 \pm 0.15	0.74 \pm 0.10	0.60 \pm 0.30	0.55 \pm 0.25	53.08
CS12 (2W)	2512 (100 - 1000m Ω)	6.35 \pm 0.20	3.15 \pm 0.15	0.74 \pm 0.10	0.60 \pm 0.30	2.10 \pm 0.10	53.08
CS25	1225	3.20 \pm 0.15	6.45 \pm 0.15	0.90 \pm 0.15	0.60 \pm 0.30	0.80 \pm 0.25	64.88
CS37	3720	2.00 \pm 0.20	3.75 \pm 0.20	0.60 \pm 0.10	0.40 \pm 0.20	0.40 \pm 0.20	19.96
CS75	7520	2.00 \pm 0.20	7.50 \pm 0.30	0.60 \pm 0.10	0.40 \pm 0.20	0.40 \pm 0.20	35.71
CS62	0612	1.55 \pm 0.10	3.10 \pm 0.15	0.55 \pm 0.10	0.30 \pm 0.15	0.45 \pm 0.15	10.19

Derating Curve



Standard Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Current	Resistance Range (mΩ)			TCR (PPM/°C)
				±1%	±2%	±5%	
CS02 (0402)	1/16W	-55 ~ +155°C	1.11A	50 - 100 102 - 500 510 - 1000			±400 ±300 ±200
CS03 (0603)	1/10W		2.23A	20 - 50 51 - 100 102 - 300 301 - 1000			±600 ±400 ±300 ±200
CS05 (0805)	1/8W		2.50A	20 - 50 51 - 100 102 - 196 200 - 1000			±600 ±400 ±300 ±200
CS06 (1206)	1/4W		5.00A	10 - 20 21 - 50 51 - 91 100 - 1000			±600 ±400 ±300 ±200
CS13 (1210)	1/2W		7.07A				
CS10 (2010)	3/4W		8.66A				
CS12 (2512)	1W		10.0A				
CS25 (1225)	3W		31.6A	3 - 5 6 - 20 21 - 30 33- 8000			±300 ±200 ±150 ±100
CS37 (3720)	1W		10.0A	10 - 18 20 - 500			±300 ±150
CS75 (7520)	2W		44.7A	-		1 - 4	±300
				5 - 10 11 - 350		±200 ±150	
CS62 (0612)	1W		10.0A	10 - 27 30 - 91 100 - 499 500 - 1000			±600 ±300 ±200 ±100

High Power & Ultra High Power Rating Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Current	Resistance Range (mΩ)			TCR (PPM/°C)
				±1%	±2%	±5%	
CS02 (0402)	1/8W	-55 ~ +155°C	1.58A	50 - 100 102 - 500 510 - 1000			±400 ±300 ±200
CS03 (0603)	1/8W		1.58A				
	1/5W		1.58A				
CS05 (0805)	1/4W 1/2W		2.23A	50 - 91 100 - 1000			±300 ±200
CS06 (1206)	1/2W		3.16A				
CS13 (1210)	3/4W		3.87A				
CS10 (2010)	1W		4.47A				
CS12 (2512)	1.5W		5.47A				
CS12 (2512)	*2W	6.32A					

Low TCR Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Current	Resistance Range (mΩ)			TCR (PPM/°C)
				±1%	±2%	±5%	
CS05 (0805)	1/8W	-55 ~ +155°C	1.11A	100 - 1000			±100
CS06 (1206)	1/4W		1.58A	100 - 1000			±100
CS13 (1210)	1/2W		2.58A	75 - 1000			±100
CS10 (2010)	3/4W		3.87A	50 - 1000			±100
CS12 (2512)	1W		4.47A	50 - 1000			±100
CS12 (2512)	*2W		6.32A	50 - 1000			±100
CS37 (3720)	1W		3.16A	100 - 500			±100
CS75 (7520)	2W		6.32A	50 - 350			±100

*: Ultra High Power

Operating Voltage= $\sqrt{P \cdot R}$; Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$; Operating Current= $\sqrt{P/R}$

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(0.5%+0.05Ω)	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
	±(1.0%+0.05Ω) For High power rating	
Insulation Resistance	≥ 10G	Max. Overload Voltage for 1 minute
Operational Life	±(1.0%+0.05Ω)	Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion.
Biased Humidity	±(1.0%+0.05Ω)	1000 hrs 85°C/85%RH 10% of operating power.
High Temperature Exposure	±(0.5%+0.05Ω)	at +155°C for 1000 hrs
Board Flex	±(1.0%+0.05Ω)	Bending once for 60 seconds 2010, 2512 sizes: 2 mm Other sizes: 3mm
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover	1.42 times Max. Operating Voltage for 1 minute CS02:100V; CS03:150V; CS05:300V CS06/13/10/25/37/75/62:400V; CS12:500V
Leaching	Individual leaching area ≤ 5% Total leaching area ≤ 10%	260±5°C for 30 seconds
Temperature Cycling	±(0.5%+0.05Ω)	-55°C to +125°C, 1000 cycles

Item	Requirement	Test Method
Mechanical Shock	$\pm(0.25\%+0.05\Omega)$	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	$\pm(0.5\%+0.05\Omega)$	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	$\pm(1\%+0.05\Omega)$	Human body, 2KV
Resistance to Solvents	No visible damage on appearance and marking.	Add aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken	Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board	V-0 or V-1 are acceptable. Electrical test not required.
Sulfur Test	$\pm(0.5\%+0.05\Omega)$	60 \pm 2°C, no power rating for 500 hrs.

RCWV(Rated Continuous Working Voltage)= $\sqrt{(P*R)}$ or Max. Operating Voltage whichever is lower.

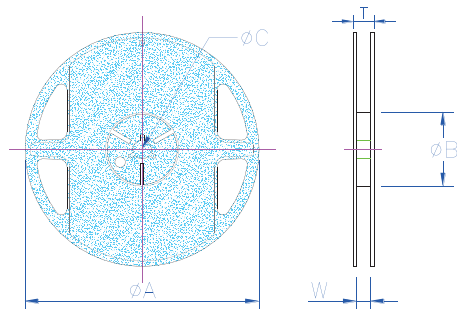
■ **Reference Standards:** IEC 60115-1, 60068-2-58; JIS-C 5201-1; AEC-Q200; MIL-STD-202; JESD22; UL-94; EIA-977

■ **Storage Temperature:** 15~28°C; Humidity < 80%RH

■ **Shelf Life:** 2 years from production date

■ Marking for 0603

Type	Code
1R0	1.000 Ω
R10	0.100 Ω
R01	0.010 Ω
<u>102</u>	0.102 Ω
<u>024</u>	0.024 Ω



■ Packaging

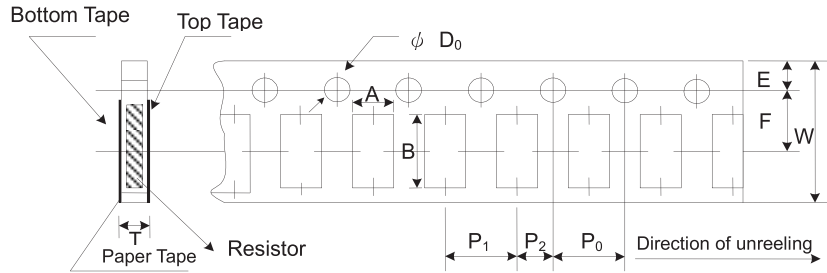
Packaging Quantity & Reel Specifications

Unit: mm

Type	ΦA	ΦB	ΦC	W	T	Paper Tape (EA)	Emboss Plastic Tape (EA)
CS02	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	9.5 \pm 0.1	11.5 \pm 1.0	10,000	-
CS03	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	9.5 \pm 0.1	11.5 \pm 1.0	5,000	-
CS05	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	9.5 \pm 0.1	11.5 \pm 1.0	5,000	-
CS06	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	9.5 \pm 0.1	11.5 \pm 1.0	5,000	-
CS13	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	9.5 \pm 0.1	11.5 \pm 1.0	5,000	-
CS10	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	13.5 \pm 1.0	15.5 \pm 1.0	-	4,000
CS12	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	13.5 \pm 1.0	15.5 \pm 1.0	-	4,000
CS12 (2W)	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	13.5 \pm 1.0	15.5 \pm 1.0	-	2,000
CS25	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	13.5 \pm 1.0	15.5 \pm 1.0	-	2,000
CS37	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	13.5 \pm 1.0	15.5 \pm 1.0	-	2,000
CS75	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	17.5 \pm 1.0	19.5 \pm 1.0	-	2,000
CS62	178.0 \pm 1.0	60.0 \pm 1.0	13.5 \pm 0.7	9.5 \pm 0.1	11.5 \pm 1.0	5,000	-

Packaging

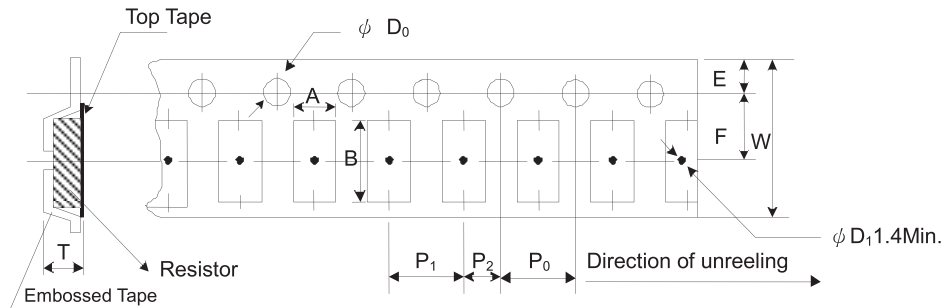
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CS02	0.65±0.10	1.15±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.10
CS03	1.10±0.10	1.90±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.10
CS05	1.60±0.10	2.40±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CS06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CS13	2.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CS62	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

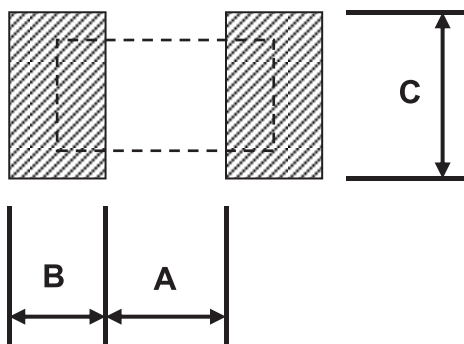
Embossed Plastic Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CS10	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20
CS12	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.00±0.20
CS12 (2W)	3.38±0.10	6.68±0.10	12.0±0.30	1.75±0.10	5.50±0.10	4.00±0.10	4.00±0.10	2.00±0.05	1.55+0.05	1.45±0.20
CS25	3.38±0.10	6.68±0.10	12.0±0.30	1.75±0.10	5.50±0.10	4.00±0.10	4.00±0.10	2.00±0.05	1.55+0.05	1.45±0.20
CS37	2.50±0.20	4.45±0.20	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.20±0.20
CS75	2.50±0.20	8.30±0.20	16.0±0.30	1.75±0.10	7.80±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.10	1.20±0.20

Recommend Land Pattern



Pad Layout (Except For CS12: Ultra High Power Rating Series)

Unit: mm

Type	A	B	C
CS02	0.50	0.50	0.60±0.2
CS03	0.80	1.00	0.90±0.2
CS05	1.00	1.00	1.35±0.2
CS06	2.00	1.15	1.70±0.2
CS13	2.00	1.15	2.50±0.2
CS10	3.60	1.40	2.50±0.2
CS12	4.90	1.60	3.20±0.2
CS25	1.20	2.00	7.00±0.2
CS37	1.00	1.80	3.90±0.2
CS75	1.00	1.80	7.60±0.2
CS62	0.60	1.00	3.20±0.2

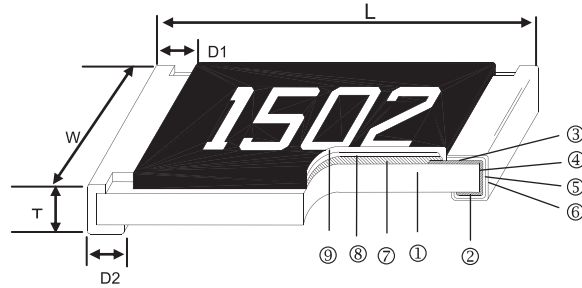
Pad Layout (For CS12: Ultra High Power Rating Series)

Unit: mm

Type	Resistance Range	A	B	C
CS12	10 - 99mΩ	4.9	1.6	3.2±0.2
CS12	100 - 1000mΩ	1.0	3.55	3.2±0.2

Automotive Grade Pulse Withstanding Chip Resistor – PWR..A Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Features

- Tolerance from $\pm 0.5\%$ ~ 5%
- High power rating
- Excellent pulse withstanding performance
- Improved working voltage ratings
- Standard package sizes of 0402~2512
- Special construction to prevent sulfuration in a sulfur containing environment
- AEC-Q200 Compliance
- 100% CCD inspection

Applications

- Metering (Testing/Measurement)
- Diagnostic Equipment
- Medical Devices
- Industrial Controls
- Plasma
- LCD Video Monitors

Dimensions

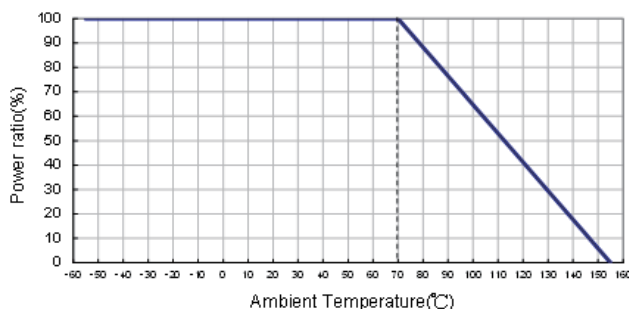
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
PWR02	0402	1.00 \pm 0.05	0.50 \pm 0.05	0.35 \pm 0.05	0.20 \pm 0.10	0.20 \pm 0.10	0.6
PWR03	0603	1.60 \pm 0.10	0.80 \pm 0.10	0.45 \pm 0.10	0.30 \pm 0.20	0.30 \pm 0.20	2.0
PWR05	0805	2.00 \pm 0.10	1.25 \pm 0.10	0.50 \pm 0.10	0.35 \pm 0.20	0.40 \pm 0.20	4.4
PWR05 (1/2W)	0805	2.00 \pm 0.10	1.25 \pm 0.10	0.55 \pm 0.10	0.35 \pm 0.20	0.40 \pm 0.20	5.0
PWR06	1206	3.10 \pm 0.10	1.55 \pm 0.10	0.55 \pm 0.10	0.50 \pm 0.25	0.50 \pm 0.20	8.9
PWR06 (3/4W)	1206	3.10 \pm 0.10	1.55 \pm 0.10	0.55 \pm 0.10	0.60 \pm 0.25	0.55 \pm 0.25	9.5
PWR13	1210	3.10 \pm 0.10	2.60 \pm 0.15	0.55 \pm 0.10	0.50 \pm 0.25	0.50 \pm 0.20	16.0
PWR10	2010	5.00 \pm 0.10	2.50 \pm 0.15	0.55 \pm 0.10	0.60 \pm 0.25	0.50 \pm 0.20	24.2
PWR12	2512	6.35 \pm 0.10	3.10 \pm 0.15	0.55 \pm 0.10	0.60 \pm 0.25	0.50 \pm 0.20	39.4
PWR12 (2W)	2512	6.35 \pm 0.20	3.15 \pm 0.15	0.60 \pm 0.10	0.80 \pm 0.25	0.60 \pm 0.30	42.0

Part Numbering

PWR	12	J	T	E	A	1001	A
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking
	02: 0402 03: 0603 05: 0805 06: 1206 13: 1210 10: 2010 12: 2512	D: $\pm 0.5\%$ F: $\pm 1\%$ J: $\pm 5\%$ -: No specified	T: 7" Taping Reel V: 10" Taping Reel W: 13" Taping Reel	E: ± 100 F: ± 200 G: ± 300 4: ± 350 -: No specified	S: 2W A: 1.5W K: 1.25W T: 1W Q: 3/4W U: 1/2W G: 2/5W O: 1/3W V: 1/4W P: 1/5W W: 1/8W X: 1/10W	1001: 1K Ω 1004: 1M Ω 1005: 10M Ω R0R0: 0 Ω	A: Automotive Grade NA: Automotive Grade & No Marking

Derating Curve



Standard Electrical Specifications

Type	Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
						±0.5% (E24,E96)	±1% (E24,E96)	±5% (E24)	
PWR02 (0402)		1/5W	-55 ~ +155°C	50V	100V	-	1Ω-20Ω		±300
						100Ω-1MΩ	10Ω-1MΩ		±100
PWR03 (0603)		1/10W	-55 ~ +155°C	50V	100V	10Ω - 294Ω	1Ω - 294Ω		±200
						7.15Ω - 1MΩ			±100
PWR05 (0805)		1/8W	-55 ~ +155°C	150V	300V	10Ω - 294Ω	1Ω - 294Ω		±200
						3Ω - 20MΩ			±100
PWR06 (1206)		1/3W	-55 ~ +155°C	200V	400V	10Ω - 20Ω	1Ω - 20Ω		±200
						5.1Ω - 20MΩ			±100
PWR13 (1210)		1/2W	-55 ~ +155°C	200V	400V	10Ω - 20Ω	1Ω - 20Ω		±200
						10Ω - 20MΩ			±100
PWR10 (2010)		3/4W	-55 ~ +155°C	400V	800V	10Ω - 20Ω	1Ω - 20Ω		±200
						10Ω - 20MΩ			±100
PWR12 (2512)		1.5W	-55 ~ +155°C	500V	1000V	10Ω - 20Ω	1Ω - 20Ω		±200
						10Ω - 20MΩ			±100

High Power & Ultra High Power Rating Electrical Specifications

Type	Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
						±0.5% (E24,E96)	±1% (E24,E96)	±5% (E24)	
PWR03 (0603)		1/4W	-55 ~ +155°C	75V	150V	10Ω - 294Ω	1Ω - 294Ω		±200
		1/3W				7.15Ω - 1MΩ			±100
		Jumper: *5A				-	0Ω(≤8mΩ)		-
PWR05 (0805)		2/5W	-55 ~ +155°C	150V	300V	10Ω - 294Ω	1Ω - 294Ω		±200
						3Ω - 1MΩ			±100
PWR05 (0805)		*1/2W	-55 ~ +155°C	400V	600V	10Ω - 294Ω	1Ω - 294Ω		±200
		Jumper: *6A				10Ω - 1MΩ			±100
						-	0Ω(≤5mΩ)		-
PWR06 (1206)		1/2W	-55 ~ +155°C	200V	400V	10Ω - 20Ω	1Ω - 20Ω		±200
						5.1Ω - 1MΩ			±100
PWR06 (1206)		*3/4W	-55 ~ +155°C	500V	1000V	10Ω - 20Ω	1Ω - 20Ω		±200
		Jumper: *10A				10Ω - 1MΩ			±100
						-	0Ω(≤5mΩ)		-
PWR13 (1210)		3/4W	-55 ~ +155°C	200V	400V	10Ω - 20Ω	1Ω - 20Ω		±200
		1W				10Ω - 1MΩ			±100
		Jumper: *12A				-	0Ω(≤4mΩ)		-
PWR10 (2010)		1W	-55 ~ +155°C	400V	800V	10Ω - 20Ω	1Ω - 20Ω		±200
		1.25W				10Ω - 1MΩ			±100
		Jumper: *12A				-	0Ω(≤5mΩ)		-
PWR12 (2512)		*2W	-55 ~ +155°C	500V	1000V	10Ω	1Ω - 10Ω		±350
		Jumper: *16A				10Ω-200K			±100
						-	0Ω(≤5mΩ)		-

*: Ultra High Power: double side printed resistor element

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

The power rating depends on the maximum temperature of the resistive element. Due to the power dissipation of the resistor, the temperature of the resistive element will rise depending on the condition of heat dissipation from PCB. The maximum power rating in application only applies if the temperature of the resistive element is not exceed 155°C.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement		Test Method
	±5% and Below	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.		At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	0603: ≤ 8mΩ 0805: ≤ 5mΩ 1206: ≤ 5mΩ 1210: ≤ 4mΩ 2010: ≤ 5mΩ 2512: ≤ 5mΩ	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds Jumper: 2*I _{max} for 5 seconds
Insulation Resistance	≥10G		Max. Overload Voltage for 1 minute
Operational Life	±(1.0%+0.05Ω)	0603: ≤ 8mΩ 0805: ≤ 5mΩ 1206: ≤ 5mΩ 1210: ≤ 4mΩ 2010: ≤ 5mΩ 2512: ≤ 5mΩ	Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion.
Biased Humidity	±(1.0%+0.05Ω)	0603: ≤ 8mΩ 0805: ≤ 5mΩ 1206: ≤ 5mΩ 1210: ≤ 4mΩ 2010: ≤ 5mΩ 2512: ≤ 5mΩ	1000 hrs 85°C/85%RH 10% of operating power (≤ 100V)
High Temperature Exposure	±(1.0%+0.05Ω)	0603: ≤ 8mΩ 0805: ≤ 5mΩ 1206: ≤ 5mΩ 1210: ≤ 4mΩ 2010: ≤ 5mΩ 2512: ≤ 5mΩ	at +155°C for 1000 hrs
Board Flex	±(1.0%+0.05Ω)	0603: ≤ 8mΩ 0805: ≤ 5mΩ 1206: ≤ 5mΩ 1210: ≤ 4mΩ 2010: ≤ 5mΩ 2512: ≤ 5mΩ	Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage		245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	0603: ≤ 8mΩ 0805: ≤ 5mΩ 1206: ≤ 5mΩ 1210: ≤ 4mΩ 2010: ≤ 5mΩ 2512: ≤ 5mΩ	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover		PWR02: 150V for 1 minute PWR03: 300V for 1 minute PWR05/PWR06/PWR13/PWR10/PWR12: 500V for 1 minute
Leaching	Individual leaching area ≤ 5% Total leaching area ≤ 10%		260±5°C for 30 seconds
Temperature Cycling	±(0.5%+0.05Ω)	0603: ≤ 8mΩ 0805: ≤ 5mΩ 1206: ≤ 5mΩ 1210: ≤ 4mΩ 2010: ≤ 5mΩ 2512: ≤ 5mΩ	-55°C to +125°C, 1000 cycles
Mechanical Shock	±(0.25%+0.05Ω)	0603: ≤ 8mΩ 0805: ≤ 5mΩ 1206: ≤ 5mΩ 1210: ≤ 4mΩ 2010: ≤ 5mΩ 2512: ≤ 5mΩ	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.

Item	Requirement		Test Method
	±5% and Below	Jumper	
Vibration	±(0.5%+0.05Ω)	0603: ≤ 8mΩ 0805: ≤ 5mΩ 1206: ≤ 5mΩ 1210: ≤ 4mΩ 2010: ≤ 5mΩ 2512: ≤ 5mΩ	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(3%+0.05Ω)		Human body model 0402/0603: 1KV 0805 and above: 2KV
Resistance to Solvents	No visible damage on appearance and marking.		Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken		Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board		V-0 or V-1 are acceptable. Electrical test not required.
Sulfur Test	ΔR±1%	0603: ≤ 8mΩ 0805: ≤ 5mΩ 1206: ≤ 5mΩ 1210: ≤ 4mΩ 2010: ≤ 5mΩ 2512: ≤ 5mΩ	60±2°C, no power rating for 500 hrs.

RCWV(Rated Continuous Working Voltage)=√(P*R) or Max. Operating Voltage whichever is lower.

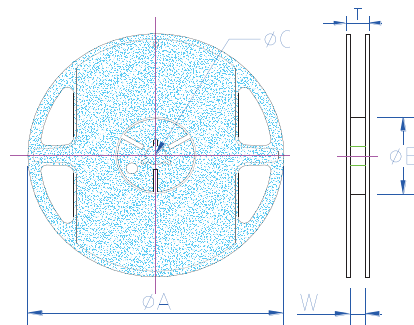
■ Reference Standards: IEC60115-1, 60068-2-58; JIS-C 5201-1; EIA-977; AEC-Q200; MIL-STD-202; JESD22; UL-94

■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date

■ Packaging

Reel Specifications & Packaging Quantity

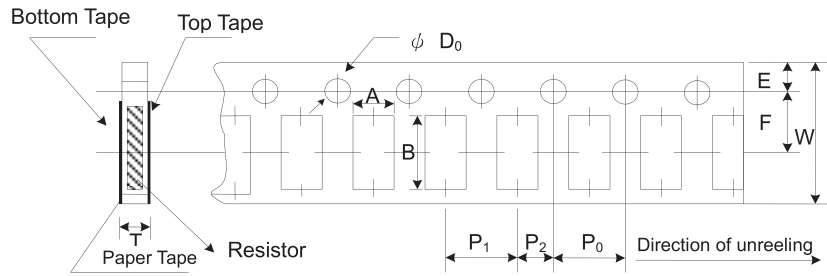


Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T	
PWR02	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		20K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		40K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
PWR03 PWR05 PWR06 PWR13	Paper	5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		10K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		20K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
			8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
PWR10 PWR12	Embossed	4K	12mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.5	13.0±0.5	15.5±0.5
		8K	12mm	10 inch	254±1.0	62±0.5	13.0±0.2	12.5±0.5	16.5±0.5

■ Packaging

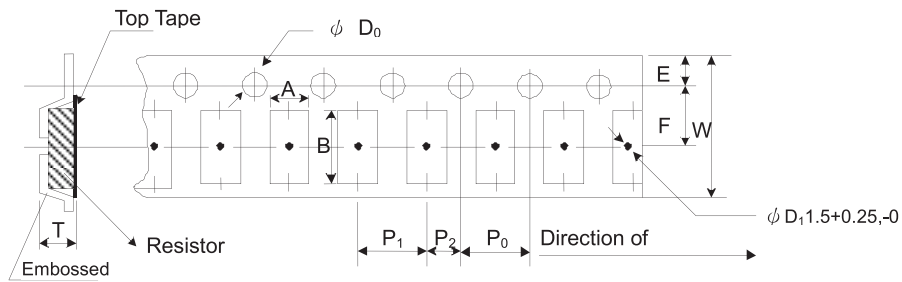
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
PWR02	0.65±0.10	1.15±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.10
PWR03	1.10±0.10	1.90±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.10
PWR05	1.60±0.10	2.40±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
PWR06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
PWR13	2.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Embossed Plastic Tape Specifications

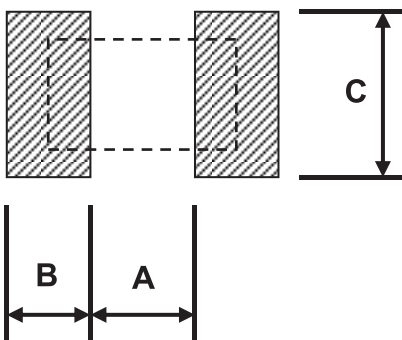


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
PWR10	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰
PWR12	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰

■ Recommend Land Pattern

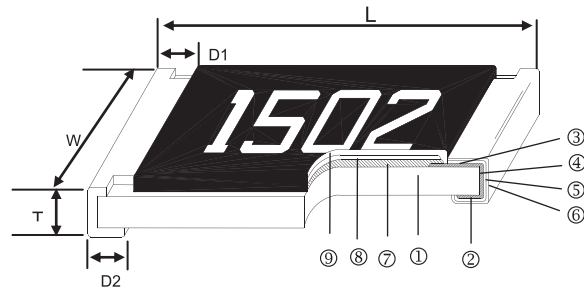
Unit: mm



Type	A	B	C
PWR02	0.50	0.45	0.60
PWR03	0.90	0.60	0.90
PWR05	1.20	0.70	1.30
PWR06	2.00	0.90	1.60
PWR13	2.00	0.90	2.80
PWR10	3.80	0.90	2.80
PWR12	4.90	1.00	3.40

Automotive Grade Surge Withstanding Chip Resistor – SWR..A Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Features

- High power rating
- Excellent surge withstanding & pulse withstanding performance
- Improved working voltage ratings
- Standard package sizes of 0402~2512
- Special construction to prevent sulfuration in a sulfur containing environment
- AEC-Q200 Compliance
- 100% CCD inspection

Applications

- Metering (Testing/Measurement)
- Medical Devices
- Power supply
- Charger
- Inverter
- LCD Video Monitors

Dimensions

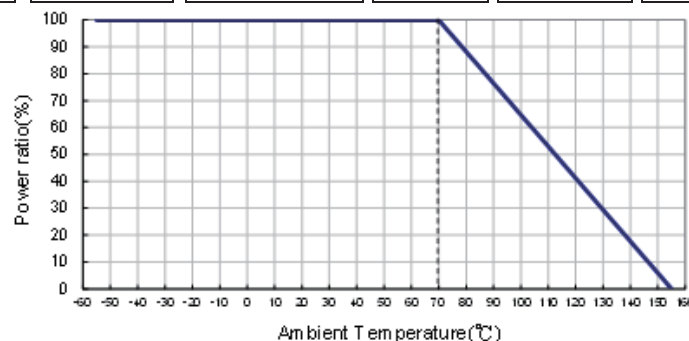
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
SWR02	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10	0.64
SWR03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	2.042
SWR05	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	4.368
SWR05 (1/2W)	0805	2.00±0.10	1.25±0.10	0.55±0.10	0.35±0.20	0.40±0.20	5
SWR06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	8.947
SWR06 (3/4W)	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.60±0.25	0.55±0.25	9.2
SWR13	1210	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.25	0.50±0.20	15.959
SWR10	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20	24.241
SWR12	2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.25	0.50±0.20	39.448
SWR12 (2W)	2512	6.35±0.20	3.15±0.15	0.60±0.10	0.80±0.25	0.60±0.30	42

Part Numbering

Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking
SWR	12	J	T	E	A	1001	A
	02: 0402 03: 0603 05: 0805 06: 1206 13: 1210 10: 2010 12: 2512	J: ±5% K: ±10% M: ±20%	T: Taping Reel V: 10" Taping Reel W: 13" Taping Reel	E: ±100 F: ±200 G: ±300 4: ±350	S: 2W A: 1.5W K: 1.25W T: 1W Q: 3/4W U: 1/2W G: 2/5W O: 1/3W V: 1/4W P: 1/5W W: 1/8W	1001: 1KΩ 1004: 1MΩ 1005: 10MΩ	A: Automotive Grade NA: Automotive Grade & No Marking

Derating Curve



Standard Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±5% (E24)	±10% (E24)	±20% (E24)	
SWR02 (0402)	1/5W	-55 ~ +155°C	50V	100V	1Ω - 20Ω			±300
					22Ω - 1MΩ			±100
SWR03 (0603)	1/8W	-55 ~ +155°C	50V	100V	1Ω - 270Ω			±200
					300Ω - 1MΩ			±100
SWR05 (0805)	1/4W	-55 ~ +155°C	150V	300V	1Ω - 270Ω			±200
					300Ω - 20MΩ			±100
SWR06 (1206)	1/3W	-55 ~ +155°C	200V	400V	1Ω - 20Ω			±200
					22Ω - 20MΩ			±100
SWR13 (1210)	1/2W	-55 ~ +155°C	200V	400V	1Ω - 20Ω			±200
					22Ω - 20MΩ			±100
SWR10 (2010)	3/4W	-55 ~ +155°C	400V	800V	1Ω - 20Ω			±200
					22Ω - 20MΩ			±100
SWR12 (2512)	1.5W	-55 ~ +155°C	500V	1000V	1Ω - 20Ω			±200
					22Ω - 20MΩ			±100

High Power & Ultra High Power Rating Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±5% (E24)	±10% (E24)	±20% (E24)	
SWR03 (0603)	1/4W 1/3W	-55 ~ +155°C	75V	150V	1Ω - 270Ω			±200
					300Ω - 1MΩ			±100
SWR05 (0805)	2/5W	-55 ~ +155°C	150V	300V	1Ω - 270Ω			±200
					300Ω - 1MΩ			±100
SWR05 (0805)	*1/2W	-55 ~ +155°C	400V	600V	1Ω - 270Ω			±200
					300Ω - 1MΩ			±100
SWR06 (1206)	1/2W	-55 ~ +155°C	200V	400V	1Ω - 20Ω			±200
					22Ω - 1MΩ			±100
SWR06 (1206)	*3/4W	-55 ~ +155°C	500V	1000V	1Ω - 20Ω			±200
					22Ω - 1MΩ			±100
SWR13 (1210)	3/4W 1W	-55 ~ +155°C	200V	400V	1Ω - 20Ω			±200
					22Ω - 1MΩ			±100
SWR10 (2010)	1W 1.25W	-55 ~ +155°C	400V	800V	1Ω - 20Ω			±200
					22Ω - 1MΩ			±100
SWR12 (2512)	*2W	-55 ~ +155°C	500V	1000V	1Ω - 10Ω			±350
					11Ω - 200KΩ			±100

*: Ultra High Power: double side printed resistor element

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

The power rating depends on the maximum temperature of the resistive element. Due to the power dissipation of the resistor, the temperature of the resistive element will rise depending on the condition of heat dissipation from PCB. The maximum power rating in application only applies if the temperature of the resistive element is not exceed 155 °C.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	$\pm(1.0\%+0.05\Omega)$	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	$\geq 10G$	Max. Overload Voltage for 1 minute
Operational Life	$\pm(3.0\%+0.05\Omega)$	Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion.
Biased Humidity	$\pm(3.0\%+0.05\Omega)$	1000 hrs 85°C/85%RH 10% of operating power ($\leq 100V$)
High Temperature Exposure	$\pm(1.0\%+0.05\Omega)$	at +155°C for 1000 hrs
Board Flex	$\pm(1.0\%+0.05\Omega)$	Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	$\pm(1.0\%+0.05\Omega)$	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover	SWR02: 150V for 1 minute SWR03: 300V for 1 minute SWR05/SWR06/SWR13/SWR10/SWR12: 500V for 1 minute
Leaching	Individual leaching area $\leq 5\%$ Total leaching area $\leq 10\%$	260±5°C for 30 seconds
Temperature Cycling	$\pm(1\%+0.05\Omega)$	-55°C to +125°C, 1000 cycles
Mechanical Shock	$\pm(1\%+0.05\Omega)$	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	$\pm(1\%+0.05\Omega)$	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	$\pm(3\%+0.05\Omega)$	Human body model 0402/0603: 1KV 0805 and above: 2KV
Resistance to Solvents	No visible damage on appearance and marking.	Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken	Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board	V-0 or V-1 are acceptable. Electrical test not required.
Sulfur Test	$\Delta R \pm 5\%$	60±2°C, no power rating for 500 hrs.

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC60115-1, 60068-2-58; JIS-C 5201-1; EIA-977; AEC-Q200; MIL-STD-202; JESD22; UL-94

■ Storage Temperature: 15~28°C; Humidity < 80%RH

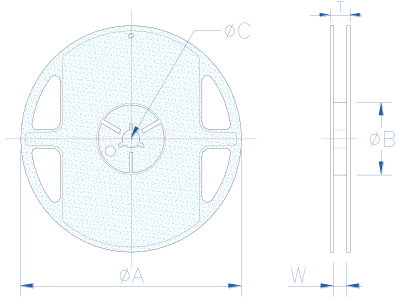
■ Shelf Life: 2 years from production date

Packaging

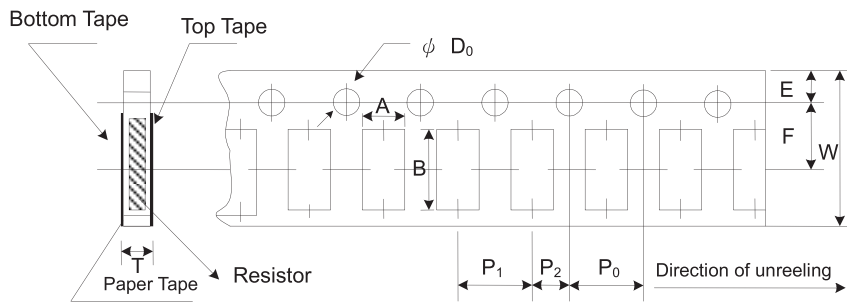
Reel Specifications & Packaging Quantity

Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T	
SWR02	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		20K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		40K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
SWR03	Paper	5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
SWR05		10K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
SWR06		20K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
SWR13			8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
SWR10	Embossed	4K	12mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.5	13.0±0.5	15.5±0.5
SWR12		8K	12mm	10 inch	250±1.0	62±0.5	13.0±0.5	12.5±0.5	16.5±0.5



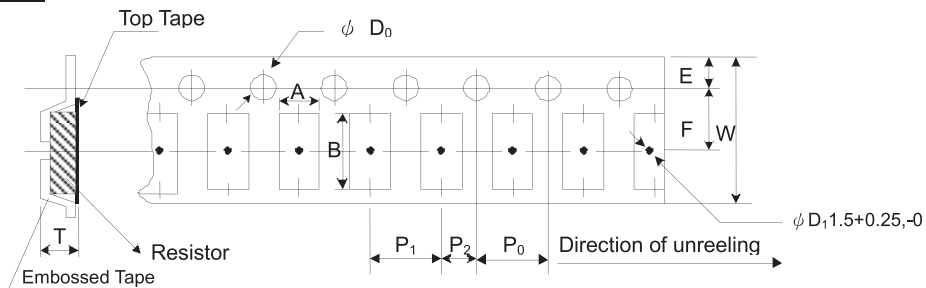
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
SWR02	0.65±0.10	1.15±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.10
SWR03	1.10±0.10	1.90±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.10
SWR05	1.60±0.10	2.40±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
SWR06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
SWR13	2.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Embossed Plastic Tape Specifications

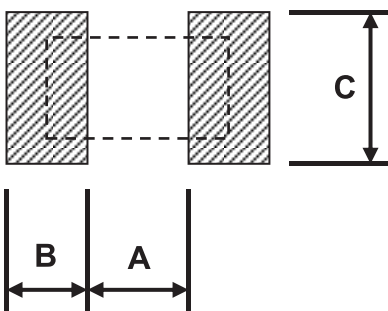


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
SWR10	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰
SWR12	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰

Recommend Land Pattern

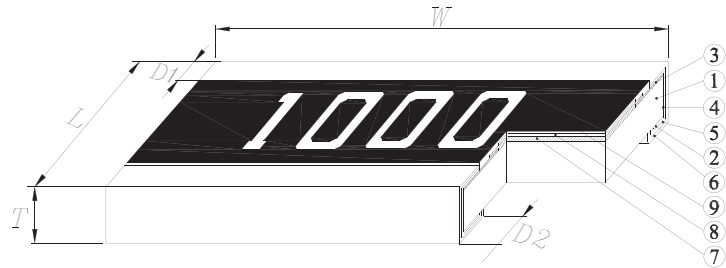
Unit: mm



Type	A	B	C
SWR02	0.50	0.45	0.60
SWR03	0.90	0.60	0.90
SWR05	1.20	0.70	1.30
SWR06	2.00	0.90	1.60
SWR13	2.00	0.90	2.80
SWR10	3.80	0.90	2.80
SWR12	4.90	1.60	3.40

Automotive Grade Thick Film Chip Resistor (Wide Terminal) – CRW..A Series

Construction



Features

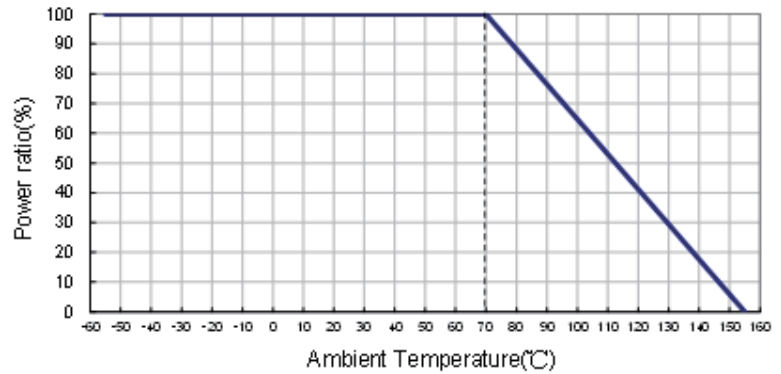
- Highly reliable multilayer electrode construction
- Compatible with all soldering process
- AEC-Q200 Compliance
- 100% CCD inspection

① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Applications

- Automotive Industry
- Telecommunication Equipments
- Radio and Tape Recorders, TV Tuners
- Digital Cameras, Watches, Pocket Calculators
- Computers, Instruments
- Medical Equipment

Derating Curve



Dimensions

Unit: mm

Type	Size (Inch)	L	W	T	D1	D2
CRW08	0508	1.25±0.10	2.00±0.10	0.55±0.10	0.30±0.15	0.30±0.15
CRW08-Jumper					0.20±0.15	
CRW62	0612	1.55±0.10	3.00±0.15	0.55±0.10	0.25±0.15	0.40±0.15
CRW62-Jumper						
CRW20	1020	2.45±0.15	5.00±0.10	0.60±0.15	0.35±0.20	0.70±0.20
CRW20-Jumper					0.45±0.20	
CRW25	1225	3.20±0.20	6.40±0.15	0.65±0.15	0.40±0.20	1.10±0.20
CRW25-Jumper					0.50±0.20	

Part Numbering

CRW	25	F	C	7	---10R
Product Type	Dimensions	Resistance Tolerance	Function Code	Packaging Code	Resistance
	08: 0508 62: 0612 20: 1020 25: 1225	D: ±0.5% F: ±1% J: ±5%	A: Automotive Grade C: High Power & Automotive Grade	4: 7" Reel 4Kpcs 7: 7" Reel 5Kpcs	-- -20R: 20Ω -- --0R: Jumper "-" to fill up 6 spaces

Standard Electrical Specifications

Type \ Item	Power Rating at 70°C Jumper Rated Current	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±0.5% (E24, E96)	±1% (E24, E96)	±5% (E24)	
CRW08 (0508)	0.75W	-55 ~ +155°C	200V	400V	1Ω – 9.76Ω			±150
					10Ω – 1MΩ			±100
CRW62 (0612)	1W	-55 ~ +155°C	200V	400V	1Ω – 1MΩ			±100
CRW20 (1020)	1.5W	-55 ~ +155°C	200V	400V	1Ω – 9.76Ω			±150
					10Ω – 1MΩ			±100
CRW25 (1225)	2W	-55 ~ +155°C	200V	400V	1Ω – 29.4Ω			±200
					30Ω – 1MΩ			±100

High Power Rating Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)	
					±0.5% (E24, E96)	±1% (E24, E96)	±5% (E24)		
CRW08 (0508)	1W	-55 ~ +155°C	200V	400V	1Ω~9.76Ω			±150	
	Jumper:5A				10Ω~1MΩ			±100	
CRW62 (0612)	1.5W	-55 ~ +155°C	200V	400V	-			0Ω(<10mΩ)	-
	Jumper:6A				1Ω~1MΩ			±100	
CRW20 (1020)	2W	-55 ~ +155°C	200V	400V	-			0Ω(<10mΩ)	-
	Jumper:10A				1Ω~9.76Ω			±150	
CRW25 (1225)	3W	-55 ~ +155°C	200V	400V	-			0Ω(<10mΩ)	-
	Jumper:12A				10Ω~1MΩ			±100	
CRW25 (1225)	3W	-55 ~ +155°C	200V	400V	1Ω~29.4Ω			±200	
					30Ω~1MΩ			±100	
CRW25 (1225)	3W	-55 ~ +155°C	200V	400V	-			0Ω(<10mΩ)	-
					1Ω~9.76Ω			±150	

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement*	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G	Max. Overload Voltage for 1 minute
Operational Life	±(1.0%+0.10Ω)	Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion.
Biased Humidity	±(1.0%+0.10Ω)	1000 hrs 85°C/85%RH 10% of operating power. (≤ 100 V)
High Temperature Exposure	±(1.0%+0.05Ω)	at +155°C for 1000 hrs
Board Flex	±(1.0%+0.05Ω)	Bending once for 60 seconds 3mm

Item	Requirement*	Test Method
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover	1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤ 5% Total leaching area ≤ 10%	260±5°C for 30 seconds
Temperature Cycling	±(0.5%+0.05Ω)	-55°C to +125°C, 1000 cycles
Mechanical Shock	±(0.25%+0.05Ω)	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	±(0.5%+0.05Ω)	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(3%+0.05Ω)	Human body model: 2KV
Resistance to Solvents	No visible damage on appearance and marking.	Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken	Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board	V-0 or V-1 are acceptable. Electrical test not required.
Sulfur Test	△R±1%	60±2°C, no power rating for 500 hrs.

RCWV(Rated Continuous Working Voltage)=√(P*R) or Max. Operating Voltage whichever is lower.

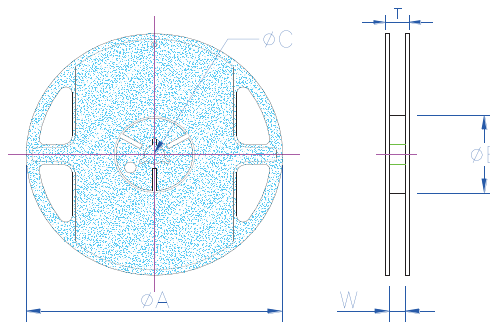
* Not include 0Ω Jumper

■ Reference Standards: IEC60115-1, 60068-2-58; JIS-C 5201-1; EIA-977; AEC-Q200; MIL-STD-202; JESD22; UL-94

■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date

■ Packaging



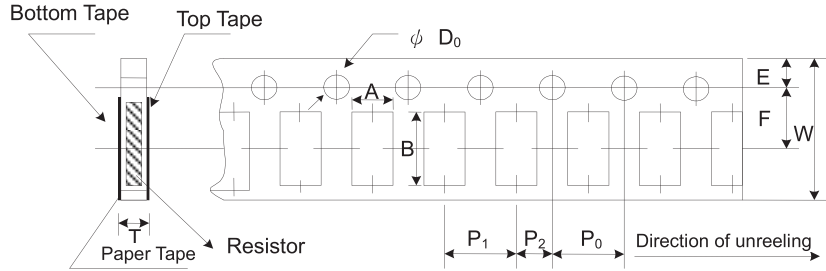
Reel Specifications & Packaging Quantity

Unit: mm

Type	Packaging Quantity		Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T
CRW08 CRW62	Paper	5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
CRW20 CRW25	Embossed	4K	12mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.5	13.0±0.5	15.5±0.5

■ Packaging

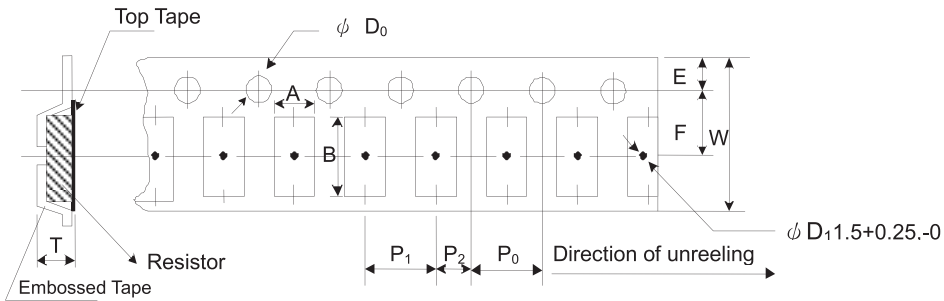
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P_0	P_1	P_2	ΦD_0	T
CRW08	1.60±0.10	2.40±0.20	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CRW62	1.90±0.10	3.50±0.20	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Embossed Plastic Tape Specifications

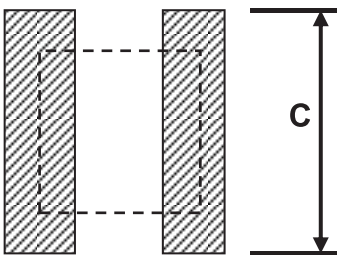


Unit: mm

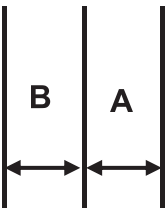
Type	A	B	W	E	F	P_0	P_1	P_2	ΦD_0	T
CRW20	2.80±0.15	5.40±0.20	12.0±0.10	1.75±0.10	5.50±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.55+0.10	1.00±0.20
CRW25	3.50±0.10	6.70±0.10	12.0±0.10	1.75±0.10	5.50±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.55+0.10	1.00±0.20

■ Recommend Land Pattern

Unit: mm

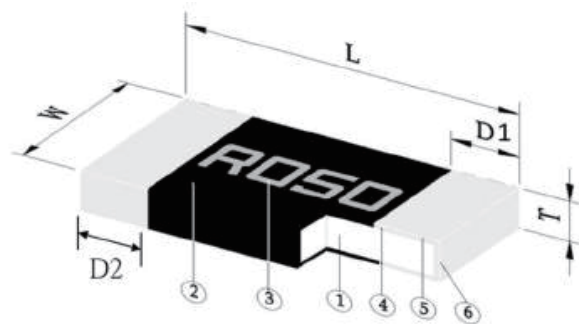


Type	A	B	C
CRW08	0.55	0.90	2.00
CRW62	0.70	0.80	3.20
CRW20	1.00	1.20	5.00
CRW25	1.00	2.00	7.00



Automotive Grade Low Ohm (Metal Strip) Chip Resistor – LRP..A Series

Construction



Features

- Low TCR down to ± 25 PPM/ $^{\circ}$ C
- Customized resistance available
- Low inductance < 5nH
- AEC-Q200 Compliance
- Sulfur resistance unaffected by sulfur environments
- Lead-free and RoHS compliant
- 100% CCD inspection

① Alloy Plate	④ Internal Electrode
② Overcoat	⑤ Barrier Layer
③ Marking	⑥ Solder Plating

Dimensions

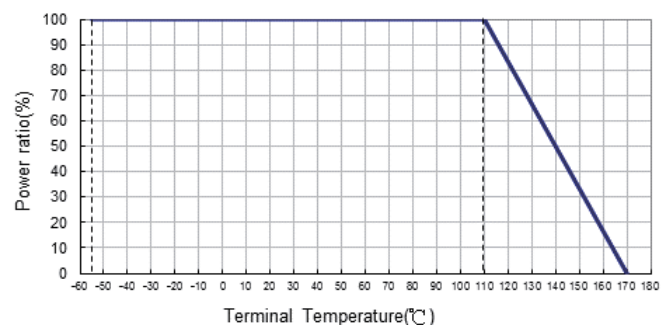
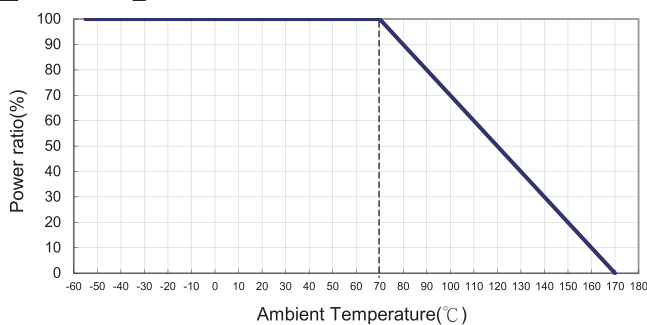
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
LRP05	0805	2.05 \pm 0.10	1.25 \pm 0.10	0.40 \pm 0.15	0.55 \pm 0.15	0.55 \pm 0.15	4.5
LRP06	1206	3.10 \pm 0.10	1.45 \pm 0.10	0.55 \pm 0.10	0.55 \pm 0.15	0.55 \pm 0.15	10.5
LRP10	2010	5.00 \pm 0.15	2.40 \pm 0.15	0.55 \pm 0.15	0.80 \pm 0.20	0.80 \pm 0.20	40.0
LRP12 2~200m Ω	2512	6.40 \pm 0.25	3.20 \pm 0.25	0.70 \pm 0.20	0.90 \pm 0.30	0.90 \pm 0.30	52.6
LRP12 1.5m Ω	2512	6.40 \pm 0.25	3.20 \pm 0.25	0.70 \pm 0.20	0.90 \pm 0.30	1.45 \pm 0.30	52.6
LRP12 1m Ω	2512	6.40 \pm 0.25	3.20 \pm 0.25	0.70 \pm 0.20	0.90 \pm 0.30	1.85 \pm 0.30	52.6

Applications

- NB (for Power Management)
- MB (for Power Management)
- SWPS (DC-DC Converter, Charger, Adaptor)
- Monitor (for Power Management)
- Industrial / Power supply
- Automotive

Derating Curve



Part Numbering

LRP	12	F	T	D	S	R015	A
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/ $^{\circ}$ C)	Power Rating	Resistance	Marking
	05:0805 06:1206 10: 2010 12: 2512	D: \pm 0.5% F: \pm 1% J: \pm 5%	T: Taping Reel	C: \pm 25 D: \pm 50 W: \pm 75 E: \pm 100	R: 3W S: 2W T: 1W Q: 3/4W	R015: 0.015 Ω R050: 0.05 Ω	A: Automotive Grade

Standard Electrical Specifications

Type	Item	Power Rating at 70°C	Rated Terminal Temperature	Operating Temp. Range	Resistance Range (mΩ)			TCR (PPM/°C)
					±0.5%	±1%	±5%	
LRP05 (0805)	0.75W	110°C	-55 ~ +170°C	2, 5			±75	
				10, 15, 20			±50	
	1W	2, 5			±75			
LRP06 (1206)	1W	110°C	-55 ~ +170°C	8, 10, 12, 15, 20, 25, 30, 33, 40			±50	
				3, 4, 5, 7, 8, 10, 12, 15, 20, 25, 30, 33, 40			±75 ±100	
LRP10 (2010)	1W	110°C	-55 ~ +170°C	4, 5, 10, 15, 20, 30, 50, 68, 75, 100			±75	
	2W			4, 5, 10, 15, 20, 30, 50, 68, 75				
LRP12 (2512)	2W, 3W	110°C	-55 ~ +170°C	3, 4, 5, 6, 7, 18, 20, 22, 25, 30, 33, 35, 39, 40, 47, 50, 60, 68, 70, 75, 80, 82, 90, 91, 100, 120, 150, 180, 200			±25	
				1, 1.5, 2, 2.5, 3, 4, 5, 6, 7, 8, 8.5, 9, 10, 12, 15, 18, 20, 22, 25, 30, 33, 35, 39, 40, 47, 50, 60, 68, 70, 75, 80, 82, 90, 91, 100, 120, 150, 180, 200			±50 ±75	

Operating Current = $\sqrt{P/R}$, Operating Voltage = $\sqrt{P \cdot R}$

Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	+25°C ~125°C, 25°C is the reference temperature
Short Time Overload	±1.0%	5*rated power for 5 seconds
Insulation Resistance	≥10G	100V DC for 1 minute
Endurance	±1.0%	70±2°C, rated power for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Biased Humidity	±1.0%	1000 hrs 85°C/85%RH 10% of operating power (≤100 V)
High Temperature Exposure	±1.0%	at +170°C for 1000 hrs
Board Flex	±1.0%	Bending once for 60 seconds 3mm
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	±0.5%	260±5°C for 10 seconds
Temperature Cycling	±1.0%	-55°C to +125°C, 1000 cycles
Low Temperature Storage	±1.0%	at -55°C for 2 hrs
Mechanical Shock	±(0.25%+0.05Ω)	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	±(0.5%+0.05Ω)	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(3%+0.05Ω)	Human body model: 2KV
Resistance to Solvents	No visible damage on appearance and marking.	Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken	Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board	V-0 or V-1 are acceptable. Electrical test not required.

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower. Operating Current = $\sqrt{P/R}$.

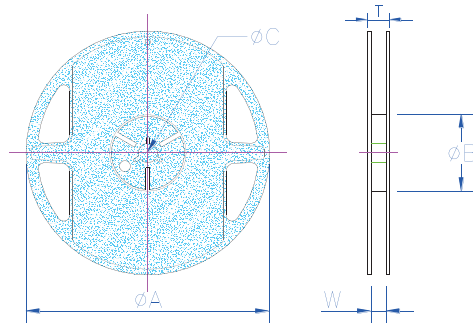
Reference Standards: IEC60115-1, 60068-2-58; JIS-C 5201-1; EIA-977; AEC-Q200; MIL-STD-202; JESD22; UL-94

Storage Temperature: 15~28°C; Humidity < 80%RH

Shelf Life: 2 years from production date

Packaging

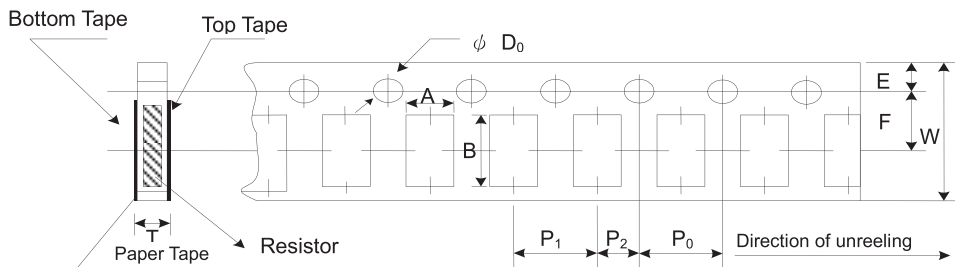
Reel Specifications & Packaging Quantity



Unit: mm

Type	Resistance (mΩ)	Packaging Quantity		Tape Width	Reel Diameter	φA	φB	φC	W	T
LRP05	2~20	Paper	5K	8mm	7 inch	178.5±1.5	60+1/-0	13.0±0.2	9.0±0.5	12.5±0.5
LRP06	3~40	Paper	5K	8mm	7 inch	178.5±1.5	60+1/-0	13.0±0.2	9.0±0.5	12.5±0.5
LRP10	4 - 100	Embossed	4K	12mm	7 inch	178.5±1.5	60±1.0	13.0±0.5	13.0±1.0	15.5±0.5
LRP12	1~200	Embossed	4K	12mm	7 inch	178.5±1.5	60±1.0	13.0±0.5	13.0±1.0	15.5±0.5

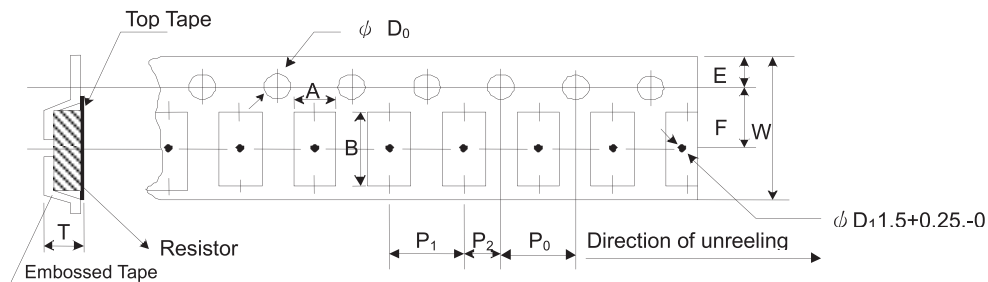
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	φD ₀	T
LRP05	1.60±0.10	2.40±0.20	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
LRP06	1.90±0.10	3.50±0.20	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Embossed Plastic Tape Specifications

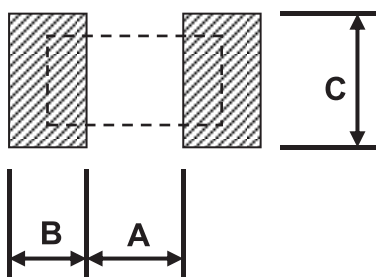


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	φD ₀	T
LRP10	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.20+0
LRP12	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.20+0

Recommend Land Pattern

Unit: mm

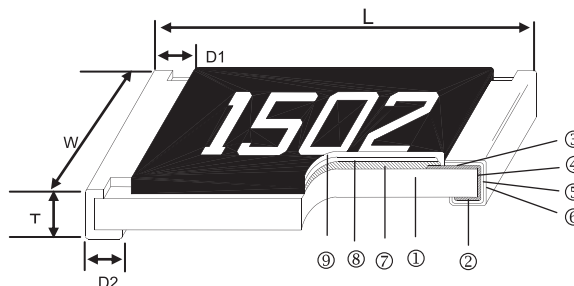


Type	A	B	C
LRP05	0.65	1.10	1.40
LRP06	1.50	1.40	1.70
LRP10	3.60	1.40	2.50
LRP12 (2~200mΩ)	4.00	2.00	3.50
LRP12 (1~1.5mΩ)	2.30	2.65	3.50

* FR4 copper board, 100μm of copper pad thickness

Automotive Grade High Voltage Thick Film Chip Resistor – HVR..A Series

Construction



Features

- Highly reliable multilayer electrode construction
- Higher reliability
- Excellent performance at high voltage
- Reduced size of final PCB design
- Special construction to prevent sulfuration in a sulfur containing environment
- AEC-Q200 Compliance
- 100% CCD inspection

Applications

- Inverter
- Outdoor Equipments
- Converter
- High Pulse Equipment

① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Dimensions

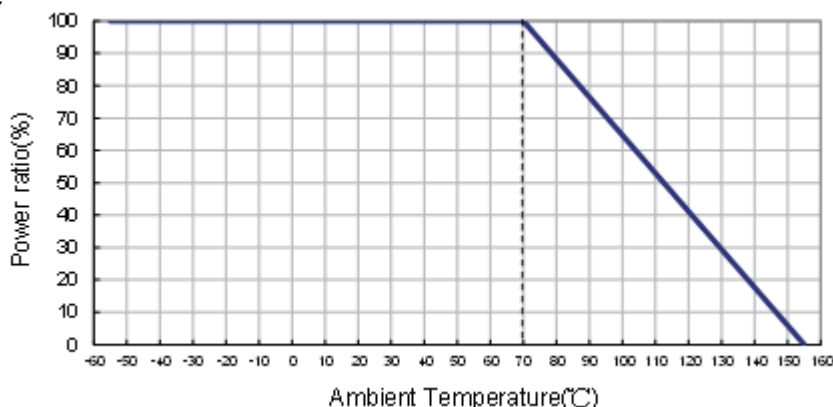
unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
HVR02	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10	0.620
HVR03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	2.042
HVR05	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	4.368
HVR06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	8.947
HVR0A	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20	24.241
HVR12	2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.25	0.50±0.20	39.448

Part Numbering

HVR	03	F	T	E	X	1003	A
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking
	02: 0402 03: 0603 05: 0805 06: 1206 0A: 2010 12: 2512	F: ±1% J: ±5%	T: 7" Taping Reel V: 10" Taping Reel W: 13" Taping Reel	E: ±100 F: ±200 H: ±400	Y: 1/16W X: 1/10W W: 1/8W V: 1/4W U: 1/2W T: 1W	1003: 100KΩ 1004: 1MΩ 1005: 10MΩ	A: Automotive Grade NA: Automotive Grade & No Marking

Derating Curve



Standard Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range		TCR (PPM/°C)
					±1% (E24、E96)	±5% (E24)	
HVR02 (0402)	1/16W	-55 ~ +155°C	100V	200V	39KΩ - 1MΩ		±100
					1.02MΩ - 10MΩ	1.1MΩ - 20MΩ	±200
					-	22MΩ - 100MΩ	±400
HVR03 (0603)	1/10W		200V	400V	56KΩ - 1MΩ		±100
					1.02MΩ - 10MΩ	1.1MΩ - 20MΩ	±200
					-	22MΩ - 100MΩ	±400
HVR05 (0805)	1/8W		400V	800V	100KΩ - 1MΩ		±100
					1.02MΩ - 10MΩ	1.1MΩ - 20MΩ	±200
					-	22MΩ - 100MΩ	±400
HVR06 (1206)	1/4W	500V	1000V	100KΩ - 1MΩ		±100	
				1.02MΩ - 10MΩ	1.1MΩ - 20MΩ	±200	
				-	22MΩ - 100MΩ	±400	
HVR0A (2010)	1/2W	2000V	3000V	51KΩ - 1MΩ		±100	
				1.02MΩ - 20MΩ	1.1MΩ - 20MΩ	±200	
				-	22MΩ - 100MΩ	±400	
HVR12 (2512)	1W	3000V	4000V	30KΩ - 1MΩ		±100	
				1.02MΩ - 20MΩ	1.1MΩ - 20MΩ	±200	
				-	22MΩ - 100MΩ	±400	

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement		Test Method
	±1%	±5%	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.		At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G		Max. Overload Voltage for 1 minute
Operational Life	±(2.0%+0.05Ω)	±(3.0%+0.10Ω)	Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion.
Biased Humidity	±(2.0%+0.05Ω)	±(3.0%+0.10Ω)	1000 hrs 85°C/85%RH 10% of operating power(≤ 100V)
High Temperature Exposure	±(1.0%+0.05Ω)	±(1.5%+0.10Ω)	at +155°C for 1000 hrs
Board Flex	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage		245±5°C for 3 seconds

Item	Requirement		Test Method
	±1%	±5%	
Resistance to Soldering Heat	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover		HVR02: 150V for 1 minute HVR03: 300V for 1 minute HVR05/HVR06/HVR0A/HVR12: 500V for 1 minute
Leaching	Individual leaching area ≤5% Total leaching area ≤ 10%		260±5°C for 30 seconds
Temperature Cycling	±(1.0%+0.05Ω)		-55°C to +125°C, 1000 cycles
Mechanical Shock	±(1.0%+0.05Ω)		Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	±(1.0%+0.05Ω)		5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(3%+0.05Ω)		Human body model 0402/0603: 1KV 0805 and above: 2KV
Resistance to Solvents	No visible damage on appearance and marking.		Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken		Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching on the pinewood board		V-0 or V-1 are acceptable. Electrical test not required.
Sulfur Test	△R±1%	△R±5%	60±2°C, no power rating for 500 hrs.

RCWV(Rated Continuous Working Voltage)= $\sqrt{(P \cdot R)}$ or Max. Operating Voltage whichever is lower.

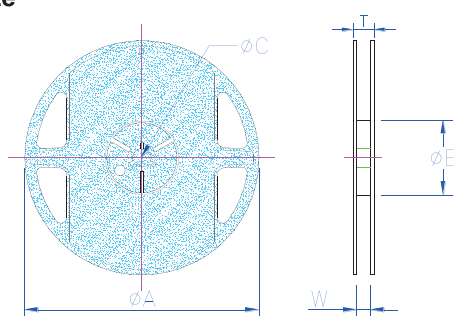
■ **Reference Standards: IEC60115-1, 60068-2-58; JIS-C 5201-1; EIA-977; AEC-Q200; MIL-STD-202; JESD22; UL-94**

■ **Storage Temperature: 15~28°C; Humidity < 80%RH**

■ **Shelf Life: 2 years from production date**

■ Packaging

Reel Specifications & Packaging Quantity

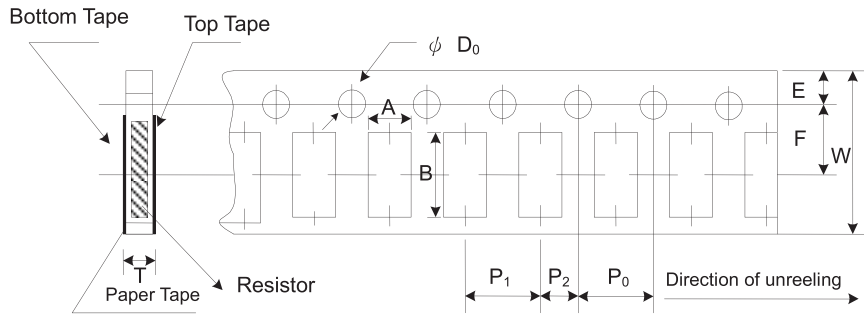


Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T	
HVR02	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		20K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		40K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
HVR03 HVR05 HVR06	Paper	5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		10K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		20K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
HVR0A HVR12	Embossed	4K	12mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.5	13.0±0.5	15.5±0.5
		8K	12mm	10 inch	250±1.0	62±0.5	13.0±0.5	12.5±0.5	16.5±0.5

Packaging

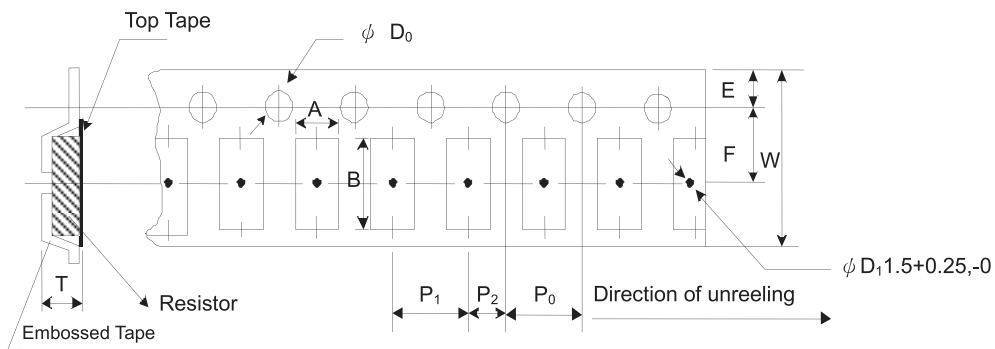
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
HVR02	0.65±0.10	1.15±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.10
HVR03	1.10±0.10	1.90±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.10
HVR05	1.60±0.10	2.40±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
HVR06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Embossed Plastic Tape Specifications

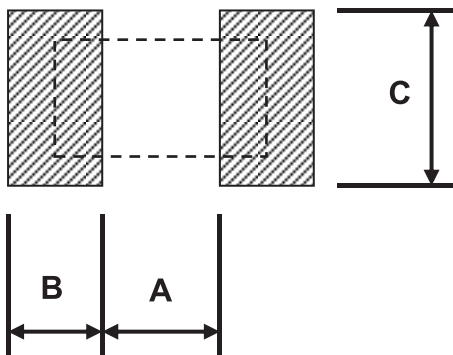


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
HVR0A	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰
HVR12	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰

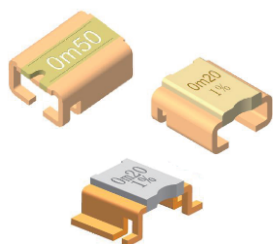
Recommend Land Pattern

Unit: mm



Type	A	B	C
HVR02	0.50	0.45	0.60
HVR03	0.90	0.60	0.90
HVR05	1.20	0.70	1.30
HVR06	2.00	0.90	1.60
HVR0A	3.80	0.90	2.80
HVR12	4.90	1.60	3.50

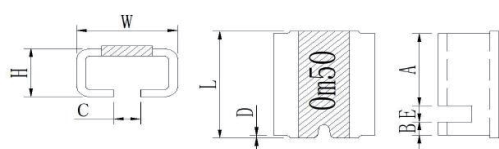
Automotive Grade Alloy Chip Shunt Resistor – LRA..A Series



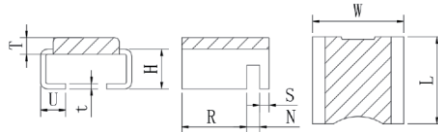
Features

- Nudity E-beam welded metal strip resistors with 4-terminal, Pure copper electrodes are the ideal solution for current sensing applications
- Excellent reliability, stability, Anti-pulse capability, support $\pm 0.5\%$ tolerance of R value
- Special welding process, all-metal construction, supports low Resistance (down to 0.2m Ω), surface pickling passivation Treatment, vulcanization resistance, strong weather resistance
- Very low EMF ($< 1 \mu V/^\circ C$)
- Ultra-low parasitic inductance, Fast response, Can be used for high frequency AC current detection
- AEC-Q200 Compliance
- RoHS compliant

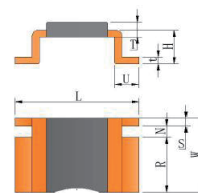
Dimensions



LRA0340



LRA0766



LRA1066

Unit: mm

Type	Size (Inch)	Resistance (m Ω)	Material	L	W	H	A	B	C	D	E	R	N	S	U	T	t
LRA0340	1216	0.3	Manganin	4.1 +0/-0.3	3.1 +0/-0.35	1.9 +0/-0.35	2.7 ± 0.1	0.5 ± 0.1	0.8 +0.35/-0	0.1	0.6 +0.15/-0	-	-	-	-	-	-
		0.5	Manganin														
		1	Manganin														
		2	Kamar														
		2.5	Kamar														
LRA0766	2726	0.2	Manganin	6.6 +0.35/-0.2	6.9 ± 0.3	3.0 ± 0.3	-	-	-	-	-	4.9 ± 0.2	1.0 ± 0.15	0.7 ± 0.1	1.9 ± 0.1	1.3 ± 0.1	0.6 ± 0.1
		0.3	Manganin													1.2 ± 0.1	0.6 ± 0.1
		0.5	Manganin													0.68 ± 0.1	0.68 ± 0.1
		0.7	Manganin													0.48 ± 0.1	0.48 ± 0.1
		1	Manganin													0.35 ± 0.1	0.4 ± 0.1
		2	FeCrAl													0.55 ± 0.1	0.55 ± 0.1
		3	FeCrAl													0.36 ± 0.1	0.4 ± 0.1
		4	FeCrAl													0.28 ± 0.1	0.4 ± 0.1
		5	FeCrAl													0.28 ± 0.1	0.4 ± 0.1
		2	Kamar													0.52 ± 0.1	0.52 ± 0.1
		3	Kamar													0.35 ± 0.1	0.4 ± 0.1
4	Kamar	0.26 ± 0.1	0.4 ± 0.1														
LRA1066	4026	0.2	Manganin	10.1 ± 0.3	6.6 +0.35/-0.2	3.0 ± 0.3	-	-	-	-	-	4.9 ± 0.2	1.0 ± 0.15	0.7 ± 0.1	2.0 ± 0.1	1.3 ± 0.1	0.6 ± 0.1
		0.3	Manganin													1.2 ± 0.1	0.6 ± 0.1
		0.5	Manganin													0.68 ± 0.1	0.68 ± 0.1
		0.7	Manganin													0.48 ± 0.1	0.48 ± 0.1
		1	Manganin													0.35 ± 0.1	0.4 ± 0.1
		2	FeCrAl													0.55 ± 0.1	0.55 ± 0.1
		3	FeCrAl													0.36 ± 0.1	0.4 ± 0.1
		4	FeCrAl													0.28 ± 0.1	0.4 ± 0.1
		5	FeCrAl													0.28 ± 0.1	0.4 ± 0.1
		2	Kamar													0.52 ± 0.1	0.52 ± 0.1
		3	Kamar													0.35 ± 0.1	0.4 ± 0.1
4	Kamar	0.26 ± 0.1	0.4 ± 0.1														

Note: FeCrAl material is magnetic and affects the inverter current, so please be careful in product selection.

Part Numbering

LRA	0340	F	T	E	D	R001	MI	A
Product Type	Dimensions (WxL)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Material & Shape Code	Function Code
	0340: 3.1x4.1 0766: 6.9x6.6 1066: 10.1x6.6	D: ±0.5% F: ±1% J: ±5%	T: Taping Reel	C : ±25 D : ±50 W : ±75 E: ±100	R: 3W H: 4W D: 5W I: 6W E: 7W 9: 9W J: 10W 11: 11W 12: 12W	0M20: 0.2mΩ 0M30: 0.3mΩ 0M50: 0.5mΩ 0M70: 0.7mΩ R001: 1mΩ R002: 2mΩ R003: 3mΩ R004: 4mΩ R005: 5mΩ	FI: FeCrAl & Inward Fold KI: Kamar & Inward Fold MI: Manganin & Inward Fold FO: FeCrAl & Outward Fold KO: Karma & Outward Fold MO: Manganese & Outward Fold	A: Automotive Grade

Standard Electrical Specifications

Type	Power Rating P _{70°C}	Material	Resistance Range(mΩ)			TCR (PPM/°C)
			±0.5%	±1%	±5%	
LRA0340	10W	Manganin	0.3			±100
	9W	Manganin	0.5			±100
	7W	Manganin	1			±100
	5W	Kamar	2, 2.5			±100
LRA0766	12W	Manganin	0.2			±75
	11W	Manganin	0.3			±75
	9W	Manganin	0.5			±75
	7W	Manganin	0.7			±75
	6W	Manganin	1			±50
	6W	FeCrAl	2			±25
	5W	FeCrAl	3			±25
	4W	FeCrAl	4			±25
	3W	FeCrAl	5			±25
	6W	Kamar	2			±50
	5W	Kamar	3			±50
	4W	Kamar	4			±50
LRA1066	12W	Manganin	0.2			±75
	11W	Manganin	0.3			±75
	9W	Manganin	0.5			±75
	7W	Manganin	0.7			±75
	6W	Manganin	1			±50
	6W	FeCrAl	2			±25
	5W	FeCrAl	3			±25
	4W	FeCrAl	4			±25
	3W	FeCrAl	5			±25
	6W	Kamar	2			±50
	5W	Kamar	3			±50
	4W	Kamar	4			±50

Operating Temperature: -55 ~ +175°C

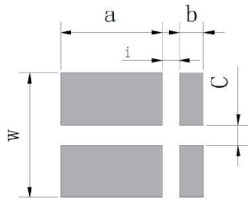
Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance(T.C.R.)	Within the specified value	0340 size: Measured value -55°C and +125°C, reference value +20°C 0766 / 1066 size: Measured value -55°C and +130°C, reference value +20°C
Solderability	No visible damage, weldable area 95% minimum	245°C Tin slot, hold for 3 sec
Short time overload	No visible damage, 0340: $\Delta R \pm 0.5\%$ maximum 0766/1066: $\Delta R \pm 1.0\%$ maximum	2.5 times rated voltage, 5 sec
Resistance to solder heat	No visible damage, 0340: $\Delta R \pm 0.5\%$ maximum 0766/1066: $\Delta R \pm 1.0\%$ maximum	270°C Tin bath, hold for 10 sec
High temperature and humidity	No visible damage, $\Delta R \pm 1.0\%$ maximum	Temperature 85°C, humidity 85% of the conditions applied 10% of the rated power (current) or component limit current (whichever is less), for 1000 hours
High temperature storage	No visible damage, 0340: $\Delta R \pm 0.5\%$ maximum 0766/1066: $\Delta R \pm 1.0\%$ maximum	1000 hrs @ 170°C, without load
Low temperature load	No visible damage, 0340: $\Delta R \pm 0.5\%$ maximum 0766/1066: $\Delta R \pm 1.0\%$ maximum	-55°C, No load for one hour, rated voltage load for 45 min, no load for 15 min
Temperature cycling	No visible damage, 0340: $\Delta R \pm 0.5\%$ maximum 0766/1066: $\Delta R \pm 1.0\%$ maximum	-55°C @ 30 min ~ room temperature @ <5 min ~ +155°C @ 30 min, 500 cycles
Load life	No visible damage, $\Delta R \pm 1.0\%$ maximum	1000 h @ 70±2°C, rated voltage, 90 min on, 30 min off

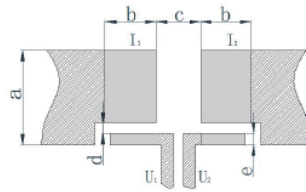
■ Reference Standards: IEC 60115-1, MIL-STD-202

■ Storage Temperature: 15~28°C; Humidity < 80%RH

Recommend Land Pattern



LRA0340

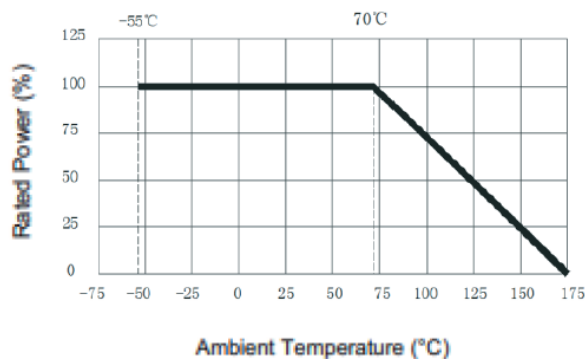


LRA0766 / 1066

Unit: mm

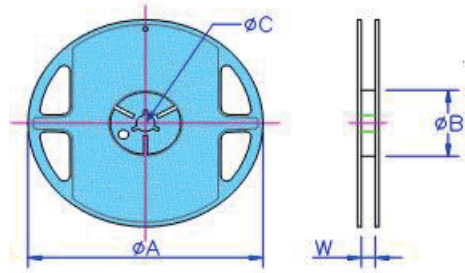
Type	a	b	c	d	e	i	w
LRA0340	2.95	0.70	0.60	-	-	0.50	3.60
LRA0766	7.30	2.90	2.00	0.80	0.90	-	-
LRA1066	7.30	2.45	5.50	0.80	0.90	-	-

Derating Curve



Packaging

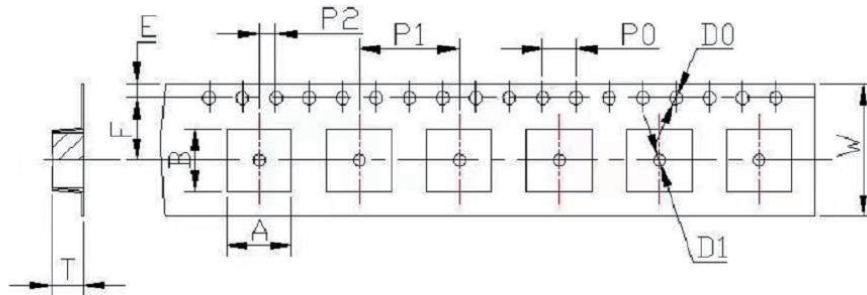
Reel Specifications & Packaging Quantity



Unit: mm

Type	Packaging Quantity		Tape Width	Reel Diameter	ϕA	ϕB	ϕC	W
LRA0340	Embossed	1K	12mm	7 inch	178.0±2.0	60.0±1.0	13.5±0.5	12.3±1.0
LRA0766	Embossed	1K	16mm	13 inch	33.0±2.0	60.0±1.0	13.5±0.5	17.0±0.5
LRA1066	Embossed	1K	24mm	13 inch	33.0±2.0	60.0±1.0	13.5±0.5	25.0±1.0

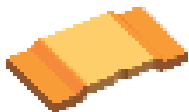
Tape Specifications



Unit: mm

Type	A	B	W	E	F	P0	P1	P2	$\phi D0$	T
LRA0340	3.4	4.2	12	1.75	5.5	4	8	2	1.5	2.3
LRA0766	7.8	7.5	16	1.75	7.5	4	12	2	1.5	3.8
LRA1066	7.3	12.1	24	1.75	12.2	6	12	2	1.5	3.8

Automotive Grade Chip Shunt Resistor – LRSW..A Series



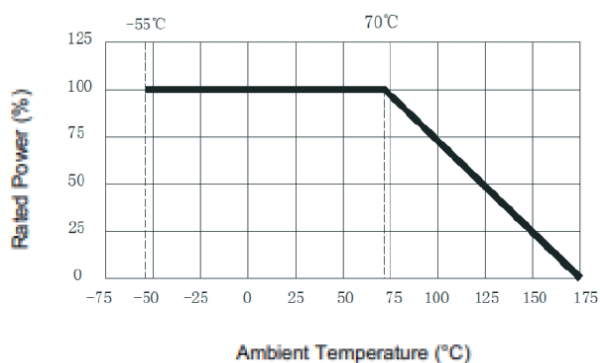
Features

- Nudity E-beam welded metal strip resistors, pure copper Electrodes are the ideal solution for current sensing applications
- Excellent reliability, stability, Anti-pulse capability
- Special welding process, all-metal construction, Supports low resistance, The surface is pickled and passivated for strong weather resistance
- High temperature silicon molded for sever working Environment
- Very low EMF ($<1 \mu V/^{\circ}C$)
- Ultra-low parasitic inductance($< 2nH$), Fast response, Can be used for high frequency AC current detection
- AEC-Q200 Compliance

Part Numbering

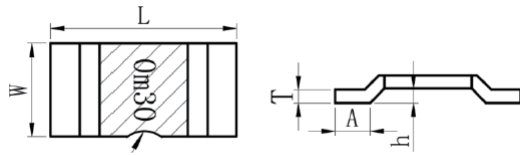
LRSW	1050	F	T	W	R	R005	K	A
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/ $^{\circ}C$)	Power Rating	Resistance	Material Code	Function Code
	0630: 6.4x3.2 1050: 10.0x5.2 1575: 15.0x7.5	F: $\pm 1\%$ J: $\pm 5\%$	T: Taping Reel	D: ± 50 W: ± 75 E: ± 100 K: ± 150	B: 2.5W R: 3W H: 4W D: 5W I: 6W E: 7W 8: 8W 9: 9W J: 10W 12: 12W 15: 15W	0M20: 0.2m Ω 0M30: 0.3m Ω 0M40: 0.4m Ω 0M50: 0.5m Ω 0M70: 0.7m Ω R001: 1m Ω R002: 2m Ω R003: 3m Ω R004: 4m Ω R005: 5m Ω	M: Manganin F: FeCrAl K: Kamar	A: Automotive Grade

Derating Curve



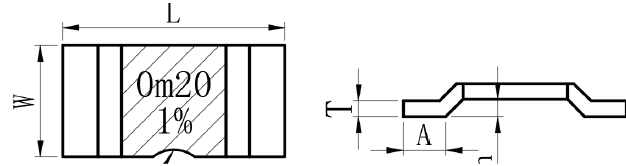
Dimensions

LRSW0630



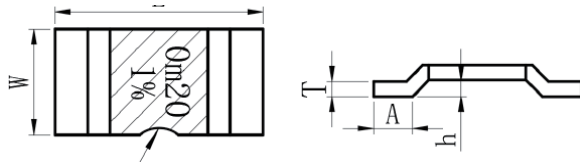
The side arc is a notch for the resistance process

LRSW1050



The side arc is a notch for the resistance process

LRSW1575



The side arc is a notch for the resistance process

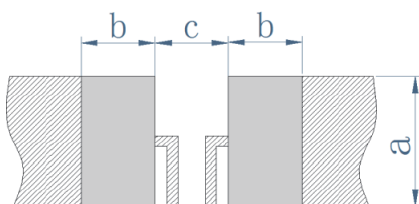
Type	Size (Inch)	Resistance (mΩ)	Material	L (mm)	W (mm)	T (mm)	A (mm)	h (mm)
LRSW0630	2512	0.3	Manganin	6.40±0.30	3.20±0.25	0.95±0.10	1.20±0.20	0.50±0.10
		0.35	Manganin	6.40±0.30	3.20±0.25	0.80±0.10	1.20±0.20	0.50±0.10
		0.4	Manganin	6.40±0.30	3.20±0.25	0.88±0.10	1.20±0.20	0.50±0.10
		0.5	Manganin	6.40±0.30	3.20±0.25	0.85±0.10	1.20±0.20	0.50±0.10
		0.7	Manganin	6.40±0.30	3.20±0.25	0.60±0.10	1.20±0.20	0.50±0.10
		0.75	Manganin	6.40±0.30	3.20±0.25	0.56±0.10	1.20±0.20	0.50±0.10
		1	Manganin	6.40±0.30	3.20±0.25	0.42±0.10	1.20±0.20	0.50±0.10
		2	FeCrAl	6.40±0.30	3.20±0.25	0.67±0.10	1.20±0.20	0.50±0.10
		3	FeCrAl	6.40±0.30	3.20±0.25	0.45±0.10	1.20±0.20	0.50±0.10
		4, 5	FeCrAl	6.40±0.30	3.20±0.25	0.32±0.10	1.20±0.20	0.50±0.10
		2	Kamar	6.40±0.30	3.20±0.25	0.65±0.10	1.20±0.20	0.50±0.10
		2.5	Kamar	6.40±0.30	3.20±0.25	0.50±0.10	1.20±0.20	0.50±0.10
		3	Kamar	6.40±0.30	3.20±0.25	0.43±0.10	1.20±0.20	0.50±0.10
4	Kamar	6.40±0.30	3.20±0.25	0.32±0.10	1.20±0.20	0.50±0.10		
5	Kamar	6.40±0.30	3.20±0.25	0.28±0.10	1.20±0.20	0.50±0.10		
LRSW1050	3920	0.2	Manganin	10.00±0.20	5.20±0.25	1.70±0.10	2.00±0.20	0.50±0.10
		0.3	Manganin	10.00±0.20	5.20±0.25	1.28±0.10	2.00±0.20	0.50±0.10
		0.4	Manganin	10.00±0.20	5.20±0.25	1.00±0.10	2.00±0.20	0.50±0.10
		0.5	Manganin	10.00±0.20	5.20±0.25	0.80±0.10	2.00±0.20	0.50±0.10
		0.7	Manganin	10.00±0.20	5.20±0.25	0.55±0.10	2.00±0.20	0.50±0.10
		0.8	Manganin	10.00±0.20	5.20±0.25	0.48±0.10	2.00±0.20	0.50±0.10
		1	Manganin	10.00±0.20	5.20±0.25	0.40±0.10	2.00±0.20	0.50±0.10
		1	FeCrAl	10.00±0.20	5.20±0.25	1.25±0.10	2.00±0.20	0.50±0.10
		1.5	FeCrAl	10.00±0.20	5.20±0.25	0.94±0.10	2.00±0.20	0.50±0.10
		2	FeCrAl	10.00±0.20	5.20±0.25	0.62±0.10	2.00±0.20	0.50±0.10
		3	FeCrAl	10.00±0.20	5.20±0.25	0.42±0.10	2.00±0.20	0.50±0.10
		4	FeCrAl	10.00±0.20	5.20±0.25	0.35±0.10	2.00±0.20	0.50±0.10
		5	FeCrAl	10.00±0.20	5.20±0.25	0.28±0.10	2.00±0.20	0.50±0.10
		1	Kamar	10.00±0.20	5.20±0.25	1.16±0.10	2.00±0.20	0.50±0.10
		2	Kamar	10.00±0.20	5.20±0.25	0.65±0.10	2.00±0.20	0.50±0.10
3	Kamar	10.00±0.20	5.20±0.25	0.43±0.10	2.00±0.20	0.50±0.10		
4	Kamar	10.00±0.20	5.20±0.25	0.32±0.10	2.00±0.20	0.50±0.10		
5	Kamar	10.00±0.20	5.20±0.25	0.28±0.10	2.00±0.20	0.50±0.10		
LRSW1575	5930	0.2	Manganin	15.00±0.20	7.70±0.30	1.50±0.10	4.20±0.20	0.50±0.15
		0.3	Manganin	15.00±0.20	7.70±0.30	0.96±0.10	4.20±0.20	0.50±0.15
		0.4	Manganin	15.00±0.20	7.70±0.30	0.72±0.10	4.20±0.20	0.50±0.15
		0.5	Manganin	15.00±0.20	7.70±0.30	0.58±0.10	4.20±0.20	0.50±0.15
		0.7	Manganin	15.00±0.20	7.70±0.30	0.42±0.10	4.20±0.20	0.50±0.15
		0.75	Manganin	15.00±0.20	7.70±0.30	0.39±0.10	4.20±0.20	0.50±0.15
		0.8	Manganin	15.00±0.20	7.70±0.30	0.36±0.10	4.20±0.20	0.50±0.15
		1	FeCrAl	15.00±0.20	7.70±0.30	0.94±0.10	4.20±0.20	0.50±0.15
		1.5	FeCrAl	15.00±0.20	7.70±0.30	0.62±0.10	4.20±0.20	0.50±0.15
		2	FeCrAl	15.00±0.20	7.70±0.30	0.48±0.10	4.20±0.20	0.50±0.15
		3	FeCrAl	15.00±0.20	7.70±0.30	0.31±0.10	4.20±0.20	0.50±0.15
		1	Kamar	15.00±0.20	7.70±0.30	0.88±0.10	4.20±0.20	0.50±0.15
		2	Kamar	15.00±0.20	7.70±0.30	0.43±0.10	4.20±0.20	0.50±0.15
3	Kamar	15.00±0.20	7.70±0.30	0.30±0.10	4.20±0.20	0.50±0.15		

Standard Electrical Specifications

Type	Power (P _{70°C})	Material	Resistance Range(mΩ)		TCR (PPM/°C)
			±1%	±5%	
LRSW0630	6W	Manganin	0.3, 0.35, 0.4, 0.5		±150
			0.7, 0.75, 1		±100
	5W	FeCrAl	2		±50
	4W	FeCrAl	3		±50
	3W	FeCrAl	4		±50
	2.5W	FeCrAl	5		±50
	5W	Kamar	2		±75
	4W	Kamar	2.5, 3		±75
	3W	Kamar	4		±75
2.5W	Kamar	5		±75	
LRSW1050	12W	Manganin	0.2		±100
	10W	Manganin	0.3		±100
	9W	Manganin	0.4, 0.5		±100
	8W	Manganin	0.7, 0.8		±100
	7W	Manganin	1		±100
	8W	FeCrAl	1		±50
	7W	FeCrAl	1.5		±50
	6W	FeCrAl	2		±50
	5W	FeCrAl	3		±50
	4W	FeCrAl	4		±50
	3W	FeCrAl	5		±50
	8W	Kamar	1		±75
	6W	Kamar	2		±75
	5W	Kamar	3		±75
	4W	Kamar	4		±75
	3W	Kamar	5		±75
LRSW1575	15W	Manganin	0.2,		±150
	10W	Manganin	0.3		±150
	9W	Manganin	0.4		±150
	8W	Manganin	0.5		±100
	7W	Manganin	0.7, 0.75, 0.8		±100
	9W	FeCrAl	1		±50
	8W	FeCrAl	1.5		±50
	7W	FeCrAl	2, 3		±50
	9W	Kamar	1		±75
	7W	Kamar	2, 3		±75

Note: Iron-chromium aluminum material is magnetic and affects the inverter current, so please be careful in product selection.

Recommend Land Pattern



Unit: mm

Type	a	b	c
LRSW0630	3.60	1.80	3.80
LRSW1050	6.20	2.70	5.60
LRSW1575	8.75	5.20	5.60

Environmental Characteristics

Item	Requirement	Test Method
Thermal shock	Within the specified value	Measured value -55°C and +125°C, reference value +20°C
Solderability	No visible damage, weldable area 95% minimum	245°C Tin slot, hold for 3 sec
Short time overload	No visible damage, $\Delta R \pm 0.5\%$ maximum	2.5 times rated voltage, 5 sec
Resistance to solder heat	No visible damage, $\Delta R \pm 0.5\%$ maximum	270°C Tin bath, hold for 10 sec
High temperature and humidity	No visible damage, $\Delta R \pm 1.0\%$ maximum	Temperature 85°C, humidity 85% of the conditions applied 10% of the rated power (current) or component limit current (whichever is less), for 1000 hours
High temperature storage	No visible damage, $\Delta R \pm 1.0\%$ maximum	1000 hrs @ 170°C, without load
Low temperature load	No visible damage, $\Delta R \pm 0.5\%$ maximum	-55°C, No load for one hour, rated voltage load for 45 min, no load for 15 min
Temperature cycling	No visible damage, $\Delta R \pm 0.5\%$ maximum	-55°C @ 30 min ~ room temperature @ <5 min ~ +155°C @ 30 min, 500 cycles
Load life	No visible damage, $\Delta R \pm 1.0\%$ maximum	1000 h @ 70±2°C, rated voltage, 90 min on, 30 min off

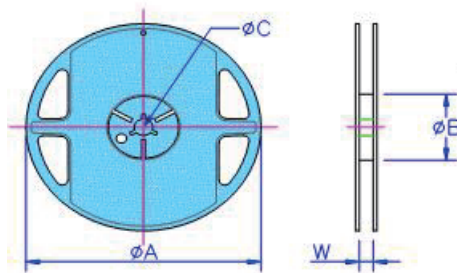
■ Reference Standards: IEC 60115-1; MIL-STD-202;

■ Storage Temperature: 25±5°C; Humidity 40%~70%RH

■ Shelf Life: 1 years from production date

Packaging

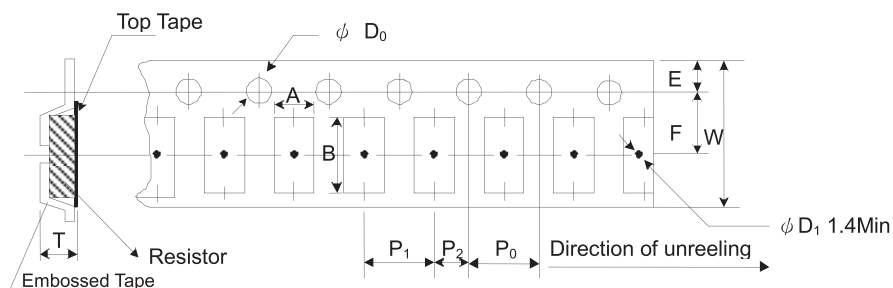
Reel Specifications & Packaging Quantity



Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W
LRSW0630	Embossed 4K	16mm	13 inch	330.0±2.0	60.0±1.0	13.5±0.5	17.5±0.5
LRSW1050	Embossed 2K	24mm	13 inch	330.0±2.0	60.0±1.0	13.5±0.5	25.5±0.5
LRSW1575	Embossed 2K	32mm	13 inch	330.0±2.0	60.0±1.0	13.5±0.5	33.0±0.5

Embossed Plastic Tape Specifications

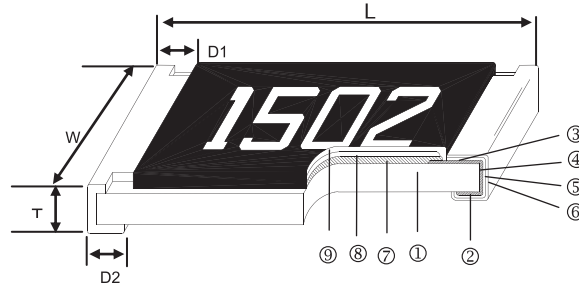
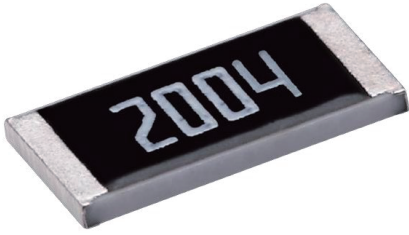


Unit: mm

Type	A	B	W	E	F	P0	P1	P2	ΦD0	T
LRSW0630	3.5	6.8	16	1.75	7.5	4	8	2	1.5	1.8
LRSW1050	5.7	11.2	24	1.75	7.5	4	12	6	1.5	2.5
LRSW1575	8.2	16.1	32	1.75	11.5	4	12	6	1.5	2.5

Automotive Grade High Voltage Low VCR Thick Film Chip Resistor – HVRC Series

Construction



Features

- Highly reliable multilayer electrode construction
- Higher component and equipment reliability
- Excellent performance at high voltage
- Reduced size of final equipment
- Low VCR
- AEC-Q200 Compliance
- IEC 62368-1:2018 Safety Certificate issued by UL Demko
- Excellent sulfur resistance against sulfur containing atmosphere

Applications

- Inverter
- Outdoor Equipments
- Converter
- High Pulse Equipment
- Automotive Industry

① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Dimensions

unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
HVRC06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	8.9
HVRC0A	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20	24.7
HVRC12	2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.25	0.50±0.20	39.8

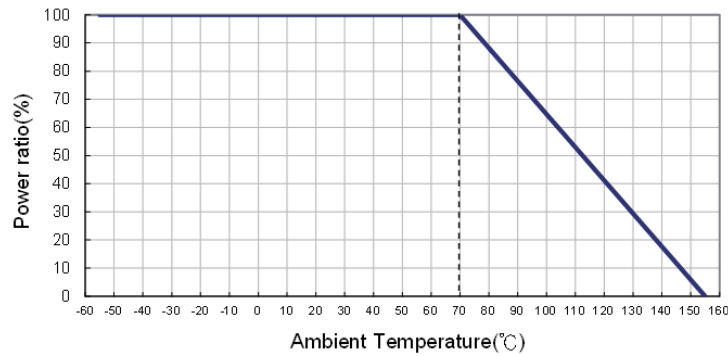
Part Numbering

HVRC	06	F	T	E	O	1004
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance
	06: 1206 0A: 2010 12: 2512	D: ±0.5% F: ±1% J: ±5%	T: 7" Taping Reel V: 10" Taping Reel W: 13" Taping Reel	E: ±100	O: 1/3W U: 1/2W T: 1W	1004: 1MΩ 1005: 10MΩ 1006: 100MΩ

IEC 62368-1:2018

	HVRC06	HVRC0A	HVRC12
G.10.3 (2.5KV impulse test)	100K~470M	51K~470M	30K~470M
G.10.4 (10KV Voltage surge test)			
G.10.5 (5KV Impulse test)			
G.10.6 (396Vac Overload test)	100K~470M	100K~470M	100K~470M

Derating Curve



Standard Electrical Specifications

Type	Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)	VCR (PPM/V)
						±0.5% (E24 - E96)	±1% (E24 - E96)	±5% (E24)		
HVRC06 (1206)		1/3W	-55 ~ +155°C	1000V	1500V	100KΩ - 1MΩ	100KΩ - 10MΩ	100KΩ-500MΩ	±100	<25
HVRC0A (2010)		1/2W		2000V	3000V	51KΩ- 1MΩ	51KΩ- 20MΩ	51KΩ - 500MΩ	±100	
HVRC12 (2512)		1W		3000V	4000V	30KΩ - 1MΩ	30KΩ - 20MΩ	30KΩ - 500MΩ	±100	

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement		Test Method
	±1%	±5%	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.		At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Voltage Coefficient (VCR)	As Spec.		measured at 10 % and at 100 % of either the rated voltage or the limiting element voltage, whichever is the smaller
Short Time Overload	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G		Max. Overload Voltage for 1 minute
Endurance	±(1.0%+0.10Ω)	±(2.0%+0.10Ω)	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Biased Humidity	±(1.0%+0.10Ω)	±(3.0%+0.10Ω)	1000 hrs 85°C/85%RH 10% of operating power
High Temperature Exposure	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	at +155°C for 1000 hrs
Board Flex	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	Bending once for 60 seconds 1206 size: 3mm 2010, 2512 sizes: 2mm
Solderability	95% min. coverage		245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover		HVRC06/HVRC0A/HVRC12: 500V for 1 minute
Leaching	Individual leaching area ≤ 5% Total leaching area ≤ 10%		260±5°C for 30 seconds

Item	Requirement		Test Method
	±1%	±5%	
Temperature Cycling	±(1.0%+0.05Ω)		-55°C to +125°C, 1000 cycles
Mechanical Shock	±(1.0%+0.05Ω)		Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	±(1.0%+0.05Ω)		5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(3%+0.05Ω)		Human body model 2KV
Resistance to Solvents	No visible damage on appearance and marking.		Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken		Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching on the pinewood board		V-0 or V-1 are acceptable. Electrical test not required.
Sulfur Test	△R±1%		60±2°C, no power rating for 500 hrs.

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

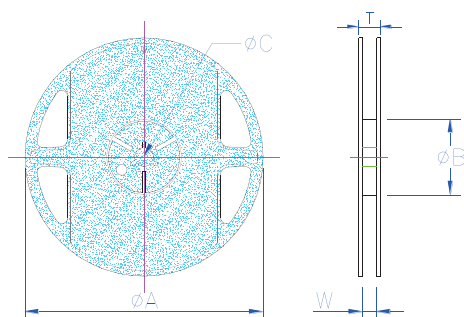
■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1; AEC-Q200; MIL-STD-202; JESD22; UL-94

■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date

■ Packaging

Reel Specifications & Packaging Quantity

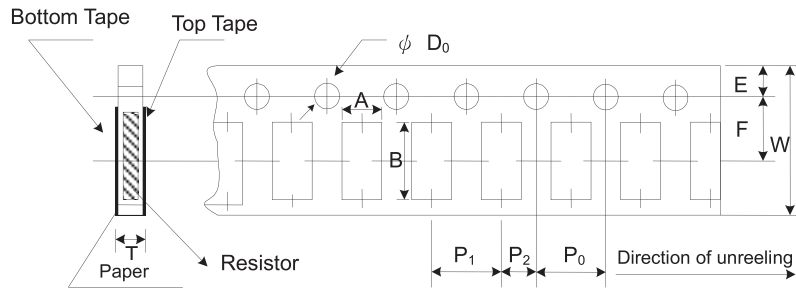


Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T	
HVRC06	Paper	5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		10K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		20K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
HVRC0A HVRC12	Embossed	4K	12mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.5	13.0±0.5	15.5±0.5
		8K	12mm	10 inch	250±1.0	62±0.5	13.0±0.5	12.5±0.5	16.5±0.5

Packaging

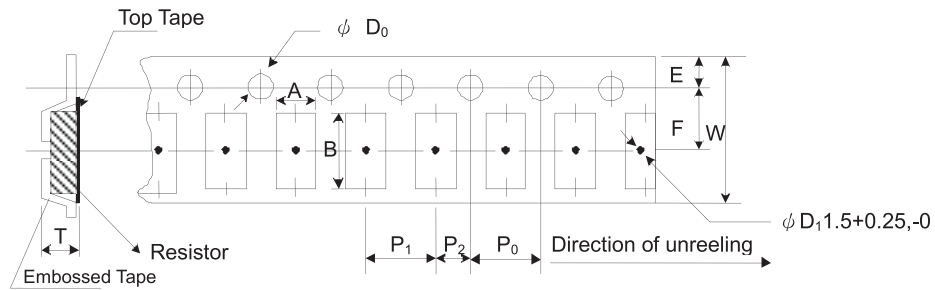
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
HVRC06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Embossed Plastic Tape Specifications

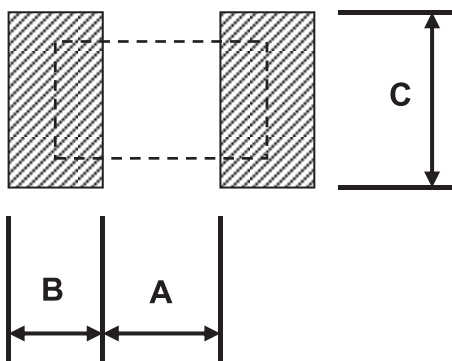


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
HVRC0A	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰
HVRC12	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰

Recommend Land Pattern

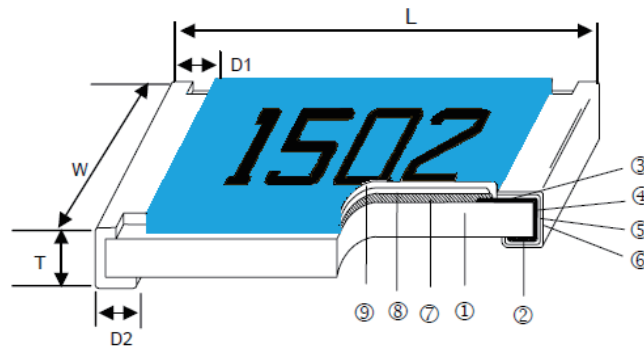
Unit: mm



Type	A	B	C
HVRC06	2.00	0.90	1.60
HVRC0A	3.80	0.90	2.80
HVRC12	4.90	1.60	3.50

Automotive Grade Green Chip Resistor – CRG.A Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Features

- AEC-Q200 Compliance
- Total Lead(Pb)-free without RoHS exemptions
- Highly reliable multilayer electrode construction
- Compatible with all soldering process
- 100% CCD inspection

Applications

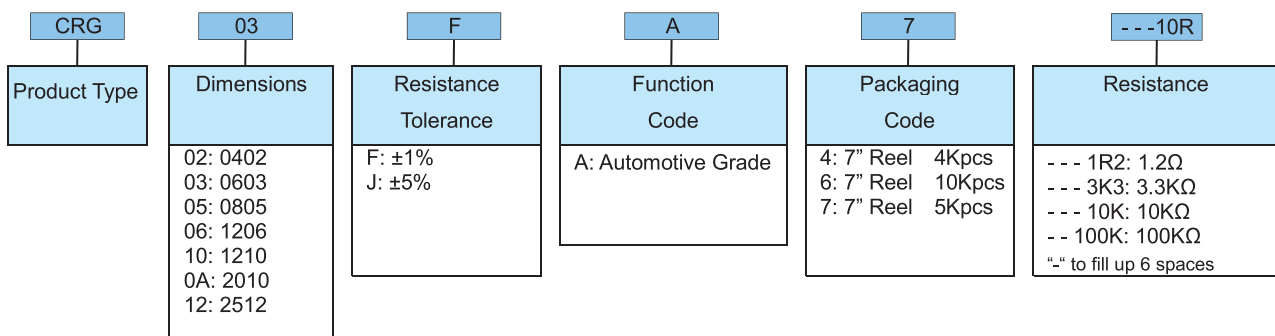
- Automotive Industry
- Telecommunication Equipments
- Radio and Tape Recorders, TV Tuners
- Digital Cameras, Watches, Pocket Calculators
- Computers, Instruments
- Medical Equipment

Dimensions

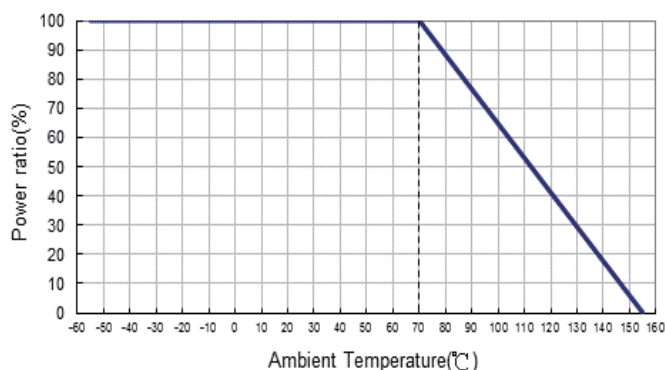
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
CRG02	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10	0.6
CRG03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	2
CRG05	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	4.3
CRG06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	8.9
CRG10	1210	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.25	0.50±0.20	16
CRG0A	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20	24
CRG12	2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.25	0.50±0.20	39

Part Numbering



Derating Curve



Standard Electrical Specifications

Type	Item	Power Rating at 70°C Jumper Rated Current	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range		TCR (PPM/°C)
						±1%(E24、E96)	±5%(E24)	
CRG02 (0402)	1/16W	-55 ~ +155°C	50V	100V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200	
	Jumper: 1A				-	0Ω (<50mΩ)	-	
CRG03 (0603)	1/10W	-55 ~ +155°C	75V	150V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200	
	Jumper: 1A				-	0Ω (<50mΩ)	-	
CRG05 (0805)	1/8W	-55 ~ +155°C	150V	300V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200	
	Jumper: 2A				-	0Ω (<50mΩ)	-	
CRG06 (1206)	1/4W	-55 ~ +155°C	200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200	
	Jumper: 2A				-	0Ω (<50mΩ)	-	
CRG10 (1210)	1/3W	-55 ~ +155°C	200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200	
	Jumper: 2.5A				-	0Ω (<50mΩ)	-	
CRG0A (2010)	3/4W	-55 ~ +155°C	200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200	
	Jumper: 3.5A				-	0Ω (<50mΩ)	-	
CRG12 (2512)	1W	-55 ~ +155°C	250V	500V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200	
	Jumper: 4A				-	0Ω (<50mΩ)	-	

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement		Test Method
	±1%	±5%	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.		At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G		Max. Overload Voltage for 1 minute
Operational Life	±(2.0%+0.05Ω)	±(3.0%+0.10Ω)	Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion.
Biased Humidity	±(2.0%+0.05Ω)	±(3.0%+0.10Ω)	1000 hrs 85°C/85%RH 10% of operating power(≤ 100V)
High Temperature Exposure	±(1.0%+0.05Ω)	±(1.5%+0.10Ω)	at +155°C for 1000 hrs
Board Flex	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage		245±5°C for 3 seconds

Item	Requirement		Test Method
	±1%	±5%	
Resistance to Soldering Heat	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover		1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤ 5% Total leaching area ≤ 10%		260±5°C for 30 seconds
Temperature Cycling	±(1.0%+0.05Ω)		-55°C to +125°C, 1000 cycles
Mechanical Shock	±(1.0%+0.05Ω)		Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	±(1.0%+0.05Ω)		5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(3%+0.05Ω)		Human body model 0402/0603: 0.5KV 0805 and above: 2KV
Resistance to Solvents	No visible damage on appearance and marking.		Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken		Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board		V-0 or V-1 are acceptable. Electrical test not required.
Sulfur Test	△R±1%	△R±5%	60±2°C, no power rating for 500 hrs.

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

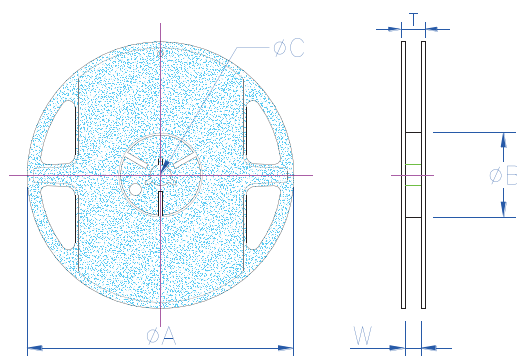
■ Reference Standards: IEC60115-1, 60068-2-58; JIS-C 5201-1; EIA-977; AEC-Q200; MIL-STD-202; JESD22; UL-94

■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date

■ Packaging

Reel Specifications & Packaging Quantity

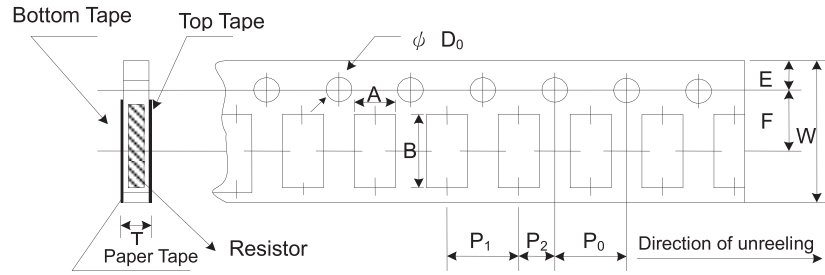


Unit: mm

Type	Packaging Quantity		Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T
CRG02	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
CRG03 CRG05 CRG06 CRG10	Paper	5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
CRG0A CRG12	Embossed	4K	12mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.5	13.0±0.5	15.5±0.5

Packaging

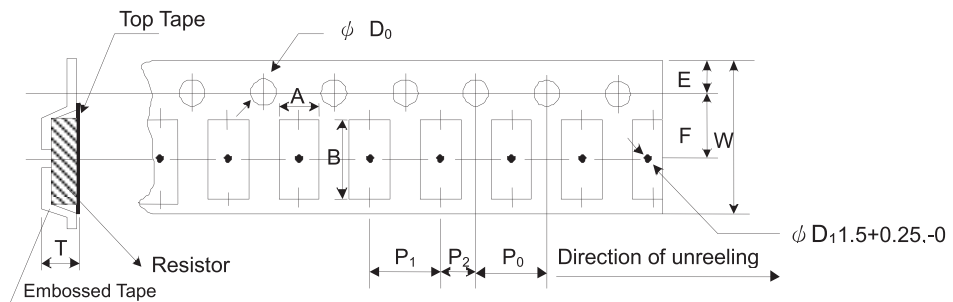
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CRG02	0.65±0.10	1.15±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.10
CRG03	1.10±0.10	1.90±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.10
CRG05	1.60±0.10	2.40±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CRG06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CRG10	2.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Embossed Plastic Tape Specifications

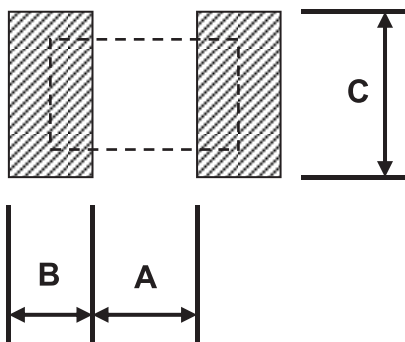


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CRG0A	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰
CRG12	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰

Recommend Land Pattern

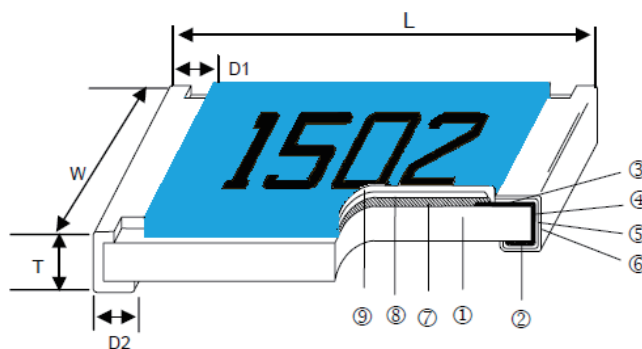
Unit: mm



Type	A	B	C
CRG02	0.50	0.45	0.60
CRG03	0.90	0.60	0.90
CRG05	1.20	0.70	1.30
CRG06	2.00	0.90	1.60
CRG10	2.00	0.90	2.80
CRG0A	3.80	0.90	2.80
CRG12	4.90	1.60	3.50

Automotive Grade Green Anti-Sulfurated Chip Resistor – ASG..A Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

Features

- Special construction to prevent sulfuration in a sulfur containing environment
- Total Lead(Pb)-free without RoHS exemptions
- AEC-Q200 Compliance
- 100% CCD inspection

Applications

- Automotive
- High-end Computer
- Industrial Equipment
- Automatic Equipment Controller
- Medical Equipment
- High-end Multimedia Electronics
- Outdoor Electronic Applications

Dimensions

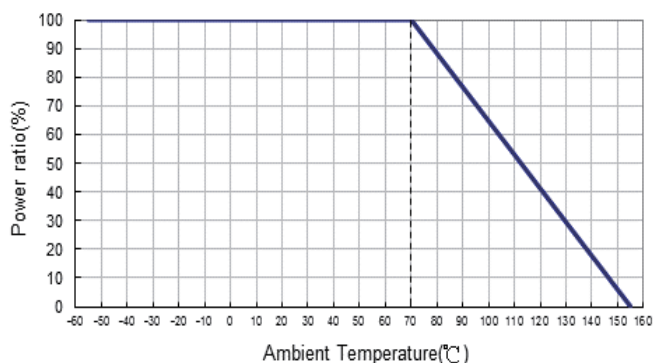
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
ASG02	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10	0.62
ASG03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	2.04
ASG05	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	4.36
ASG06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	8.9
ASG10	1210	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.25	0.50±0.20	15.9
ASG0A	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20	24.2
ASG12	2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.25	0.50±0.20	39.4

Part Numbering

ASG	06	F	T	E	X	1002	A
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking
	02: 0402 03: 0603 05: 0805 06: 1206 10: 1210 0A: 2010 12: 2512	D: ±0.5% F: ±1% J: ±5%	T: 7" Taping Reel V: 10" Taping Reel W: 13" Taping Reel	E: ±100 F: ±200 -: No specified	Y: 1/16W X: 1/10W W: 1/8W V: 1/4W O: 1/3W U: 1/2W Q: 3/4W T: 1W A: 1.5W	R0R0: 0Ω 0010: 1Ω 1000: 100Ω 1002: 10KΩ 2201: 2.2KΩ 1003: 100KΩ 1004: 1MΩ	A: Automotive Grade

Derating Curve



Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±0.5% (E24 · E96)	±1% (E24 · E96)	±5% (E24)	
ASG02 (0402)	1/16W	-55 ~ +155°C	50V	100V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ			±200 ±100 ±200
	Jumper: 1A				—		0Ω(<50mΩ)	—
ASG03 (0603)	1/10W		75V	150V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ			±200 ±100 ±200
	Jumper: 1A				—		0Ω(<50mΩ)	—
ASG05 (0805)	1/8W		150V	300V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ			±200 ±100 ±200
	Jumper: 2A				—		0Ω(<50mΩ)	—
ASG06 (1206)	1/4W		200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ			±200 ±100 ±200
	Jumper: 2A				—		0Ω(<50mΩ)	—
ASG10 (1210)	1/3W		200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ			±200 ±100 ±200
	Jumper: 2.5A				—		0Ω(<50mΩ)	—
ASG0A (2010)	3/4W		200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ			±200 ±100 ±200
	Jumper: 3.5A				—		0Ω(<50mΩ)	—
ASG12 (2512)	1W	250V	500V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ			±200 ±100 ±200	
	Jumper: 4A			—		0Ω(<50mΩ)	—	

High Power Rating Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±0.5% (E24 · E96)	±1% (E24 · E96)	±5% (E24)	
ASG02 (0402)	1/10W	-55 ~ +155°C	50V	100V	-	1Ω - 9.76Ω		±200
					10Ω - 1MΩ			±100
ASG03 (0603)	1/4W		75V	150V	-	1Ω - 9.76Ω		±200
					10Ω - 1MΩ			±100
ASG05 (0805)	1/3W		150V	300V	-	1Ω - 9.76Ω		±200
					10Ω - 1MΩ			±100
ASG06 (1206)	1/2W		200V	400V	-	1Ω - 9.76Ω		±200
					10Ω - 1MΩ			±100
ASG10 (1210)	3/4W	200V	400V	-	1Ω - 9.76Ω		±200	
				10Ω - 1MΩ			±100	
ASG0A (2010)	1W	200V	400V	-	1Ω - 9.76Ω		±200	
				10Ω - 1MΩ			±100	
ASG12 (2010)	1.5W	250V	500V	-	1Ω - 9.76Ω		±200	
				10Ω - 1MΩ			±100	

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage listed above, whichever is lower.

The power rating depends on the maximum temperature of the resistive element. Due to the power dissipation of the resistor, the temperature of the resistive element will rise depending on the condition of heat dissipation from PCB. The maximum power rating in application only applies if the temperature of the resistive element is not exceed 125 °C.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement			Test Method
	±1% and Below	±5%	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.			At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	<50mΩ	2.5 times RCWV or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥ 10G			Max. Overload Voltage for 1 minute
Operational Life	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	<100mΩ	Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion.
Biased Humidity	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	<100mΩ	1000 hrs 85°C/85%RH 10% of operating power (≤ 100V)
High Temperature Exposure	±(1.0%+0.05Ω)	±(1.5%+0.10Ω)	<50mΩ	at +155°C for 1000 hrs
Board Flex	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	Bending once for 60 seconds 2010, 2512 sizes: 2 mm Other sizes: 3mm
Solderability	95% min. coverage			245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover			1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤ 5% Total leaching area ≤ 10%			260±5°C for 30 seconds
Temperature Cycling	±(0.5%+0.05Ω)	±(1.5%+0.05Ω)	<50mΩ	-55°C to +125°C, 1000 cycles
Mechanical Shock	±(0.25%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(3%+0.05Ω)			Human body model 0402/0603: 0.5KV 0805 and above: 2KV
Resistance to Solvents	No visible damage on appearance and marking.			Add aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken			Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board			V-0 or V-1 are acceptable. Electrical test not required.
Sulfur Test	△R±1%		<50mΩ	105±2°C, no power rating for 750 hrs.

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC60115-1, 60068-2-58; JIS-C 5201-1; EIA-977; AEC-Q200; MIL-STD-202; JESD22; UL-94

■ Storage Temperature: 15~28°C; Humidity < 80%RH

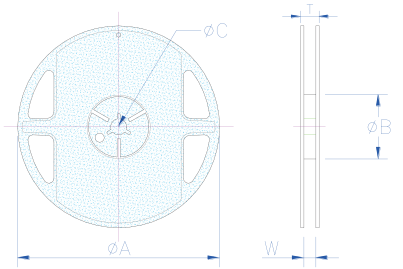
■ Shelf Life: 2 years from production date

Packaging

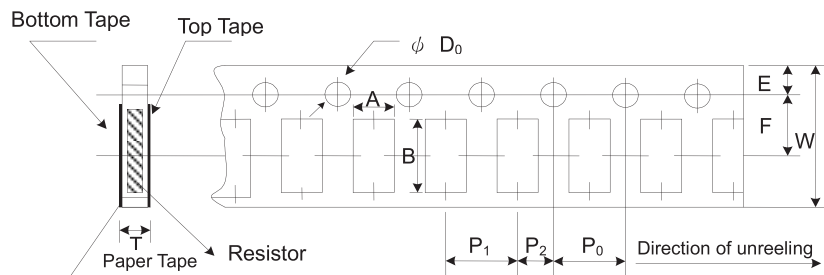
Reel Specifications & Packaging Quantity

Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T
ASG02	Paper	10K	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		20K	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		40K	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
ASG03	Paper	5K	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
ASG05		10K	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
ASG06		20K	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
ASG10								
ASG0A	Embossed	4K	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.5	13.0±0.5	15.5±0.5
ASG12		8K	10 inch	250±1.0	62±0.5	13.0±0.5	12.5±0.5	16.5±0.5



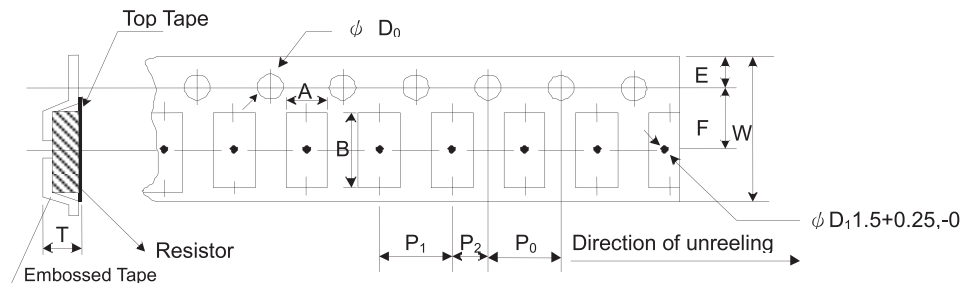
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
ASG02	0.65±0.10	1.15±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.10
ASG03	1.10±0.10	1.90±0.10	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.10
ASG05	1.60±0.10	2.40±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
ASG06	1.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
ASG10	2.90±0.10	3.50±0.20	8.00±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Embossed Plastic Tape Specifications

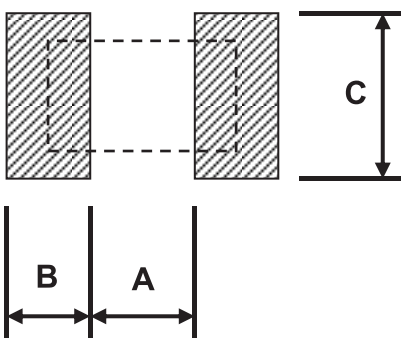


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
ASG0A	2.80±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰
ASG12	3.50±0.10	6.70±0.10	12.0±0.30	1.75±0.10	5.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ⁺⁰

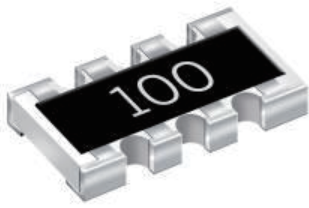
Recommend Land Pattern

Unit: mm

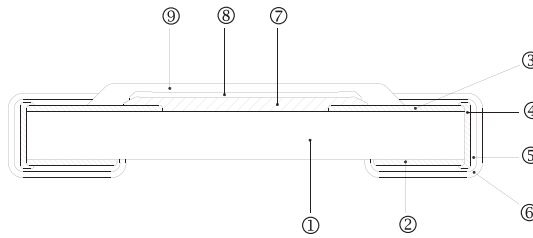


Type	A	B	C
ASG02	0.50	0.45	0.60
ASG03	0.90	0.60	0.90
ASG05	1.20	0.70	1.30
ASG06	2.00	0.90	1.60
ASG10	2.00	0.90	2.80
ASG0A	3.80	0.90	2.80
ASG12	4.90	1.60	3.50

Automotive Grade Thick Film Array Chip Resistor – CN..A Series



Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

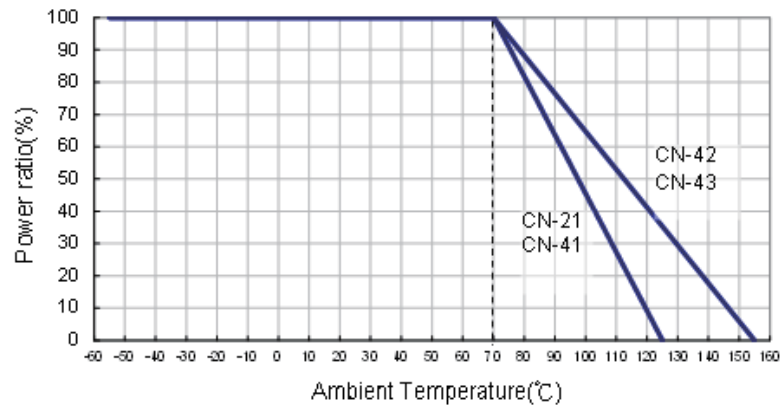
Features

- AEC-Q200 Compliance
- Small size and light weight
- Reduction of assembly costs and matching with placement machines
- Reliability, high quality
- Special construction to prevent sulfuration in a sulfur containing environment
- Suitable for IR reflow soldering
- 100% CCD inspection

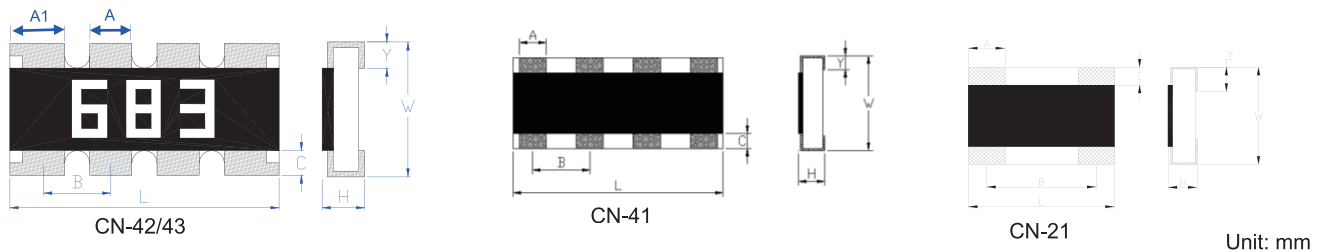
Applications

- Entertainment
- Computer & Related Products
- Communication Equipment
- Power Equipment
- Measuring Instrument

Derating Curve



Dimensions



Type	Number of Resistors	L	W	H	A	A1	B	C	Y	Weight (g) (1000pcs)
CN-21	2	0.80±0.10	0.60±0.10	0.35±0.10	0.30±0.10	-	0.50±0.10	0.15±0.10	0.15±0.10	0.500
CN-41	4	1.40±0.10	0.60±0.10	0.35±0.10	0.20±0.10	-	0.40±0.10	0.10±0.07	0.15±0.05	0.833
CN-42	4	2.00±0.10	1.00±0.10	0.45±0.10	0.30±0.10	0.40±0.10	0.50±0.05	0.22±0.15	0.22±0.15	2.817
CN-43	4	3.20±0.15	1.60±0.15	0.55±0.10	0.50±0.15	0.65±0.10	0.80±0.05	0.30±0.15	0.30±0.15	8.288

Part Numbering

CN-	43	J	A	7	---10R
Product Type	Dimensions 21: 0201x2 41: 0201x4 42: 0402x4 43: 0603x4	Resistance Tolerance F: ±1% J: ±5%	Function Code A: Automotive Grade	Packaging Code 6: 7" Reel 10Kpcs 7: 7" Reel 5Kpcs A: 10" Reel 10Kpcs B: 10" Reel 20Kpcs C: 13" Reel 40Kpcs D: 13" Reel 20Kpcs	Resistance --- 1R2: 1.2Ω --- 3K3: 3.3KΩ --- 10K: 10KΩ -- 100K: 100KΩ "- to fill up 6 spaces

Standard Electrical Specifications

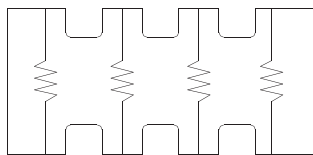
Type	Item	Power Rating / Rated Current	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Number of Resistors	Resistance Range		TCR (PPM/°C)
							±1% (E24,E96)	±5% (E24)	
CN-21	1/32W	Jumper: 0.5A	-55 ~ +125°C	12.5V	25V	2	-	3Ω - 9.1Ω	±300
	10Ω - 1MΩ						±200		
	-						0Ω (<50mΩ)	-	
CN-41	1/32W	Jumper: 0.5A	-55 ~ +125°C	12.5V	25V	4	10Ω - 1MΩ		±200
	-						0Ω (<50mΩ)	-	
	10Ω - 1MΩ						1Ω - 1MΩ	±200	
CN-42	1/16W	Jumper: 1A	-55 ~ +155°C	25V	50V	4	-	0Ω (<50mΩ)	-
	10Ω - 1MΩ						1Ω - 1MΩ	±200	
	-						0Ω (<50mΩ)	-	
CN-43	1/10W	Jumper: 1A	-55 ~ +155°C	50V	100V	4	-	0Ω (<50mΩ)	-
	10Ω - 1MΩ						1Ω - 1MΩ	±200	
	-						0Ω (<50mΩ)	-	

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage Listed above, whichever is lower.

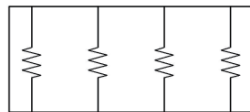
Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage Listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

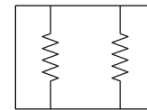
Equivalent Circuit Diagram



CN-42 / 43

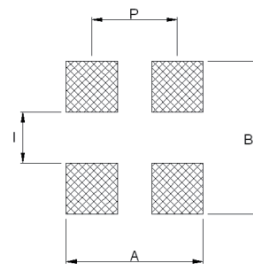
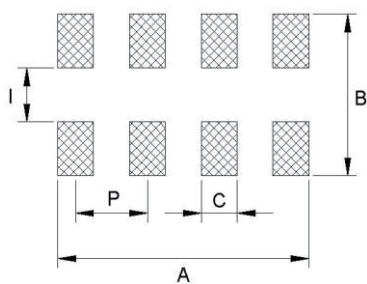


CN-41



CN-21

Recommend Land Pattern



Unit:mm

Type	A	B	C	I	P
CN-21	0.80	0.90	--	0.30	0.50
CN-41	1.40	0.90	0.20	0.30	0.40
CN-42	2.10	1.80	0.30	0.50	0.50
CN-43	3.10	2.85	0.45	0.80	0.80

Environmental Characteristics

Item	Requirement			Test Method
	±1%	±5%	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.			At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	<50mΩ	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G			Max. Overload Voltage for 1 minute
Operational Life	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	<100mΩ	Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion.
Biased Humidity	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	<100mΩ	1000 hrs 85°C/85%RH 10% of operating power. (≤100 V)
High Temperature Exposure	±(1.0%+0.05Ω)	±(1.5%+0.10Ω) CN-21/41: ±(3.0%+0.10Ω)	<50mΩ CN-21/41: <100mΩ	at +125/+155°C for 1000 hrs
Board Flex	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	Bending once for 60 seconds with 3mm
Solderability	95% min. coverage			245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover			1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤ 5% Total leaching area ≤ 10%			260±5°C for 30 seconds
Temperature Cycling	±(0.5%+0.05Ω)	±(1.5%+0.05Ω)	<50mΩ	-55°C to +125°C, 1000 cycles
Mechanical Shock	±(0.25%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(1%+0.05Ω)			Human body, 2KV
Resistance to Solvents	No visible damage on appearance and marking.			Add aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken			Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board			V-0 or V-1 are acceptable. Electrical test not required.
Sulfur Test	△R±1%	△R±5%	<100mΩ	60±2°C, no power rating for 500 hrs.

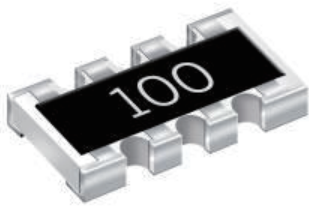
RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1; AEC-Q200; MIL-STD-202; JESD22; UL-94; EIA-977

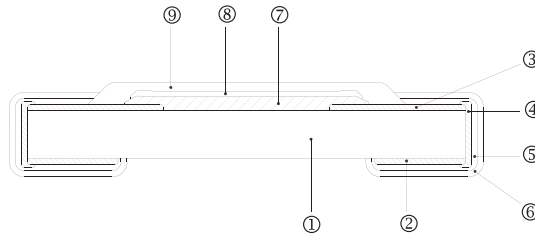
■ Storage Temperature: 15~28°C; Humidity < 80%RH

■ Shelf Life: 2 years from production date

Automotive Grade Anti-Sulfurated Thick Film Array Chip Resistor – AS..A Series



Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

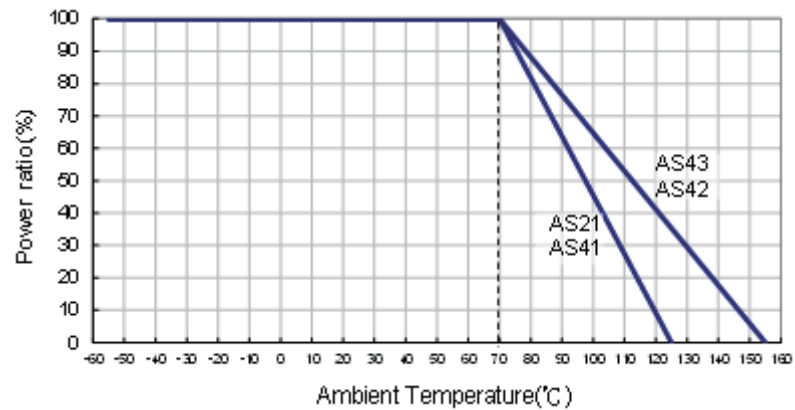
Features

- AEC-Q200 Compliance
- Small size and light weight
- Reduction of assembly costs and matching with placement machines
- Reliability, high quality
- Special construction to prevent sulfuration in a sulfur containing environment
- Suitable for IR reflow soldering
- 100% CCD inspection

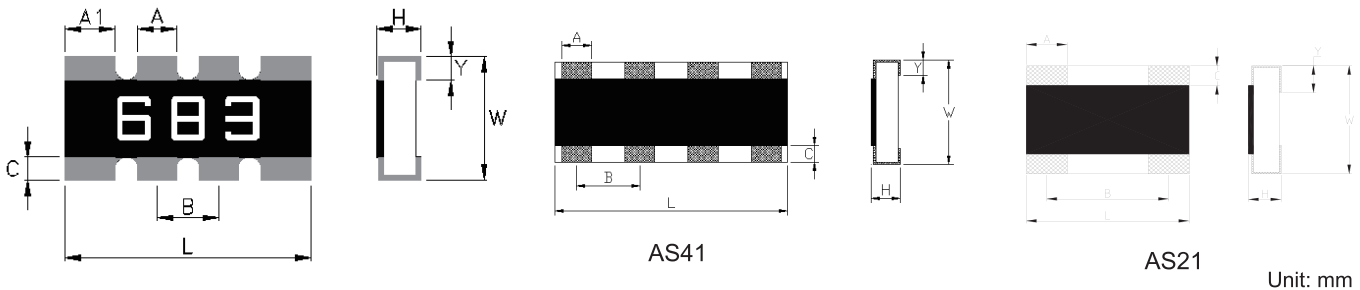
Applications

- High-end Computer
- Industrial Equipment
- Automatic Equipment Controller
- Medical Equipment
- High-end Multimedia Electronics
- Outdoor Electronic Applications

Derating Curve



Dimensions



Type	Number of Resistors	L	W	H	A1	A	B	C	Y	Weight (g) (1000pcs)
AS21	2	0.80±0.10	0.60±0.10	0.35±0.10	0.30±0.10	-	0.50±0.10	0.15±0.10	0.15±0.10	0.5
AS41	4	1.40±0.10	0.60±0.10	0.35±0.10	0.20±0.10	-	0.40±0.10	0.10±0.07	0.15±0.05	0.8
AS42	4	2.00±0.10	1.00±0.10	0.45±0.10	0.40±0.10	0.30±0.10	0.50±0.05	0.22±0.15	0.22±0.15	3.1
AS43	4	3.20±0.15	1.60±0.15	0.55±0.10	0.60±0.10	0.50±0.15	0.80±0.05	0.30±0.15	0.30±0.15	8.6

Part Numbering

AS	43	J	T	F	1000	A
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Resistance	Marking
	21: 0201x2 41: 0201x4 42: 0402x4 43: 0603x4	F: ±1% J: ±5%	T: 7" Taping Reel V: 10" Taping Reel W: 13" Taping Reel	F: ±200 G: ±300	1000: 100Ω 1002: 10KΩ 2201: 2.2KΩ 1003: 100KΩ	A: Automotive Grade

Standard Electrical Specifications

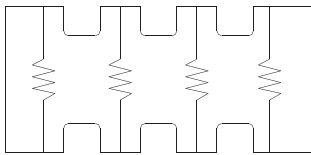
Type	Item	Power Rating / Rated Current	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Number of Resistors	Resistance Range		TCR (PPM/°C)
							±1% (E24,E96)	±5% (E24)	
AS21	1/32W		-55 ~ +125°C	12.5V	25V	2	-	3Ω - 9.1Ω	±300
							10Ω - 1MΩ		±200
AS41	1/32W		-55 ~ +125°C	12.5V	25V	4	10Ω - 1MΩ		±200
AS42	1/16W		-55 ~ +155°C	25V	50V	4	10Ω - 1MΩ	1Ω - 1MΩ	±200
AS43	1/10W		-55 ~ +155°C	50V	100V	4	10Ω - 1MΩ	1Ω - 1MΩ	±200

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage Listed above, whichever is lower.

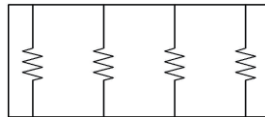
Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage Listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

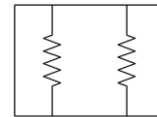
Equivalent Circuit Diagram



AS42 / AS43

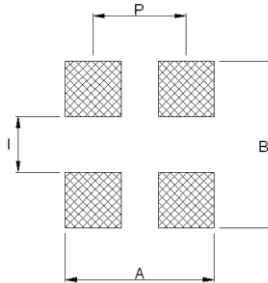
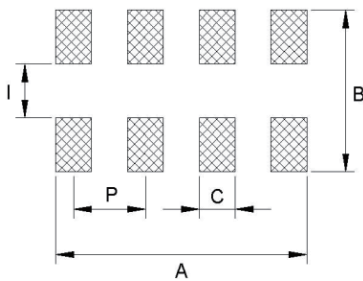


AS41



AS21

Recommend Land Pattern



Unit:mm

Type	A	B	C	I	P
AS21	0.80	0.90	--	0.30	0.50
AS41	1.40	0.90	0.20	0.30	0.40
AS42	2.10	1.80	0.30	0.50	0.50
AS43	3.10	2.85	0.45	0.80	0.80

■ Environmental Characteristics

Item	Requirement		Test Method
	±1%	±5%	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.		At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G		Max. Overload Voltage for 1 minute
Operational Life	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion.
Biased Humidity	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	1000 hrs 85°C/85%RH 10% of operating power (≤100 V)
High Temperature Exposure	±(1.0%+0.05Ω)	±(1.5%+0.10Ω)	at +125°C /+155°C for 1000 hrs
Board Flex	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	Bending once for 60 seconds with 3mm
Solderability	95% min. coverage		245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover		1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤5% Total leaching area ≤ 10%		260±5°C for 30 seconds
Temperature Cycling	±(0.5%+0.05Ω)	±(1.5%+0.05Ω)	-55°C to +125°C, 1000 cycles
Mechanical Shock	±(0.25%+0.05Ω)	±(1.0%+0.05Ω)	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(1%+0.05Ω)		Human body, 0.5KV
Resistance to Solvents	No visible damage on appearance and marking.		Add aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken		Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board		V-0 or V-1 are acceptable. Electrical test not required.
Sulfur Test	△R±1%	△R±5%	105±2°C, no power rating for 750 hrs.

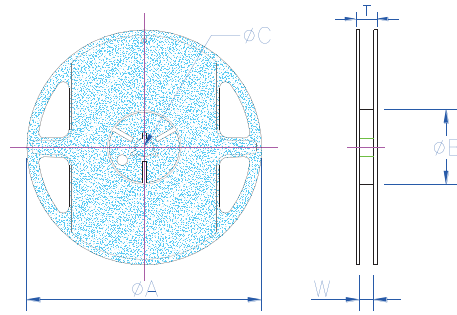
RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1; AEC-Q200; MIL-STD-202; JESD22; UL-94; EIA-977

■ Storage Temperature: 15~28°C; Humidity < 80%RH

Packaging

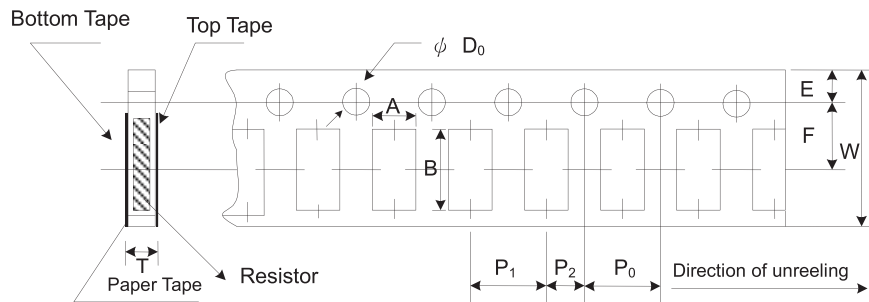
Reel Specifications & Packaging Quantity



Unit: mm

Type	Packaging Quantity		Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T
AS21	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
AS41	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
AS42	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		20K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		40K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
AS43	Paper	5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		10K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		20K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5

Paper Tape Specifications

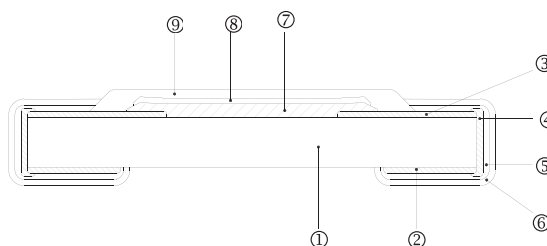
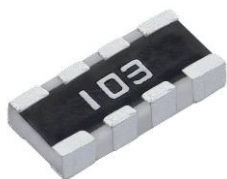


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
AS21	0.77±0.05	0.97±0.05	8.0±0.20	1.75±0.10	3.5±0.05	4.0±0.10	2.0±0.05	2.0±0.05	1.50+0.1,-0	0.50±0.10
AS41	0.77±0.05	1.57±0.05	8.0±0.20	1.75±0.10	3.5±0.05	4.0±0.10	2.0±0.05	2.0±0.05	1.50+0.1,-0	0.50±0.10
AS42	1.20±0.10	2.20±0.10	8.0±0.20	1.75±0.10	3.5±0.05	4.0±0.10	2.0±0.05	2.0±0.05	1.50+0.1,-0	0.70±0.10
AS43	1.95±0.10	3.50±0.10	8.0±0.20	1.75±0.10	3.5±0.05	4.0±0.10	4.0±0.05	2.0±0.05	1.50+0.1,-0	0.85±0.10

Automotive Grade Thick Film Flat Array Chip Resistor – CNF.A Series

Construction



① Alumina Substrate	④ Edge Electrode	⑦ Resistor Layer
② Bottom Electrode	⑤ Barrier Layer	⑧ Primary Overcoat
③ Top Electrode	⑥ External Electrode	⑨ Secondary Overcoat

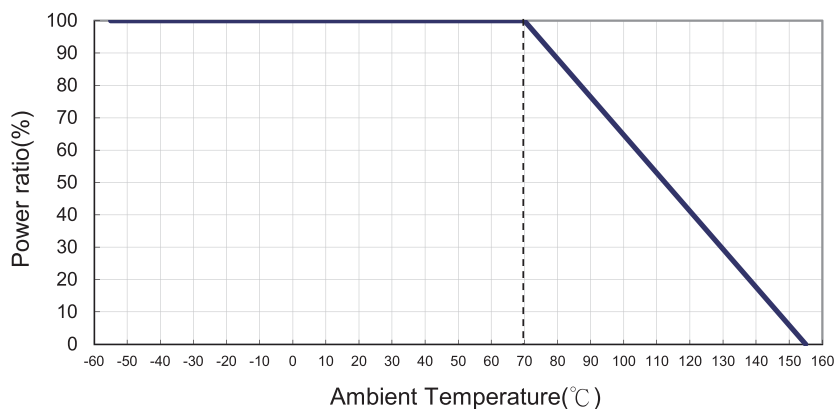
Features

- AEC-Q200 Compliance
- Small size and light weight
- Reduction of assembly costs and matching with placement machines
- Reliability, high quality
- Suitable for IR reflow soldering
- 100% CCD inspection

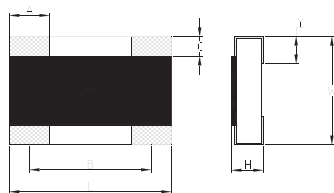
Applications

- Automotive Industry
- Entertainment
- Computer & Related Products
- Communication Equipment
- Power Equipment
- Measuring Instrument

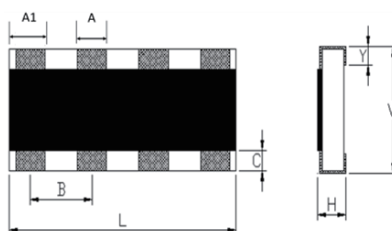
Derating Curve



Dimensions



CNF22



CNF42/43

Unit: mm

Type	Number of Resistors	L	W	H	A	A1	B	C	Y	Weight (g) (1000pcs)
CNF22	2	1.25±0.10	1.00±0.10	0.35±0.10	0.43±0.10	-	0.82±0.05	0.18±0.15	0.26±0.15	1.6
CNF42	4	2.00±0.10	1.00±0.10	0.45±0.10	0.30±0.10	0.40±0.10	0.50±0.10	0.20±0.10	0.35±0.15	3.3
CNF43	4	3.20±0.10	1.60±0.10	0.55±0.10	0.50±0.15	0.65±0.10	0.80±0.05	0.23±0.15	0.47±0.15	9.0

Part Numbering

CNF	22	F	T	F	Y	1000	A
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking
	22: 0402x2 42: 0402x4 43: 0603x4	F: ±1% J: ±5% or Jumper	T: Taping Reel	F: ±200 -: No specified (For Jumper)	Y: 1/16W X: 1/10W W: 1/8W	0030: 3Ω 1000: 100Ω 1002: 10KΩ 2201: 2.2KΩ 1003: 100KΩ 1004: 1MΩ R0R0: 0Ω	A: Automotive Grade

Standard Electrical Specifications

Type	Item	Power Rating at 70°C Jumper Rated Current	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Number of Resistors	Resistance Range		TCR (PPM/°C)
							±1%	±5%	
CNF22	1/16W	Jumper: 1A	-55 ~ +155°C	25V	50V	2	1Ω - 1MΩ		±200
	-						0Ω (<50mΩ)	-	
CNF42	1/16W	Jumper: 1A	-55 ~ +155°C	50V	100V	4	10Ω - 1MΩ	1Ω - 10MΩ	±200
	-						0Ω (<50mΩ)	-	
CNF43	1/10W 1/8W	Jumper: 1A	-55 ~ +155°C	50V	100V	4	10Ω - 1MΩ	1Ω - 10MΩ	±200
	-						0Ω (<50mΩ)	-	

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage Listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage Listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement			Test Method
	±1%	±5%	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.			At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	<50mΩ	2.5 times RCWV or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥ 10G			Max. Overload Voltage for 1 minute
Operational Life	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	<100mΩ	Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion.
Biased Humidity	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	<100mΩ	1000 hrs 85°C/85%RH 10% of operating power(≤ 100V)
High Temperature Exposure	±(1.0%+0.05Ω)	±(1.5%+0.10Ω)	<50mΩ	at +155°C for 1000 hrs
Board Flex	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	Bending once for 60 seconds with 3mm

Item	Requirement			Test Method
	±1%	±5%	Jumper	
Solderability	95% min. coverage			245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover			1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤5% Total leaching area ≤10%			260±5°C for 30 seconds
Temperature Cycling	±(0.5%+0.05Ω)	±(1.5%+0.05Ω)	<50mΩ	-55°C to +125°C, 1000 cycles
Mechanical Shock	±(0.25%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(3%+0.05Ω)			Human body model CNF22/CNF42: 0.5KV CNF43: 1KV
Resistance to Solvents	No visible damage on appearance and marking.			Add aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken			Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board			V-0 or V-1 are acceptable. Electrical test not required.
Sulfur Test	△R±1%	△R±5%	<50mΩ	60±2°C, no power rating for 500 hrs.

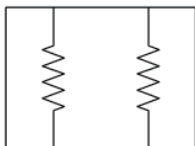
RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ **Reference Standards:** IEC60115-1, 60068-2-58; JIS-C 5201-1; EIA-977; AEC-Q200; MIL-STD-202; JESD22; UL-94

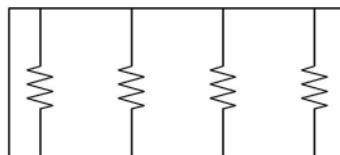
■ **Storage Temperature:** 15~28°C; Humidity < 80%RH

■ **Shelf Life:** 2 years from production date

■ Equivalent Circuit Diagram



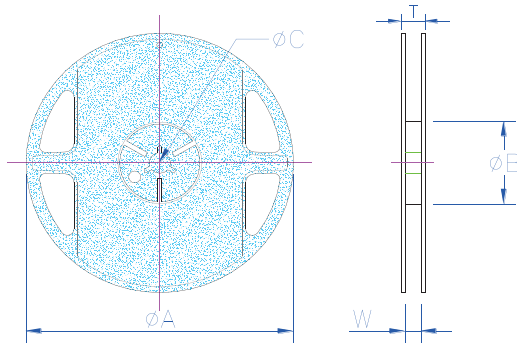
CNF22



CNF42/43

Packaging

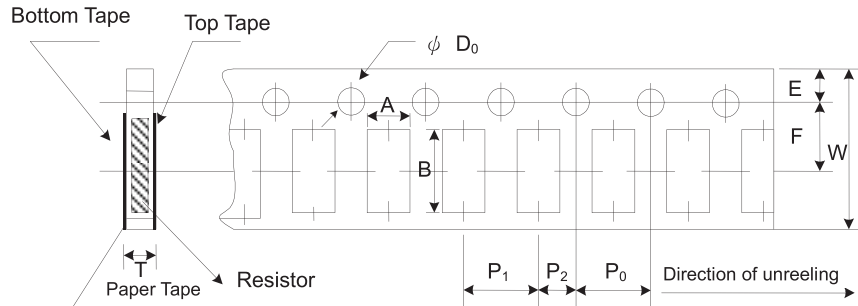
Reel Specifications & Packaging Quantity



Unit: mm

Type	Packaging Quantity		Tape Width	Reel Diameter	ΦA	ΦB	ΦC	W	T
CNF22	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
CNF42	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
CNF43	Paper	5K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5

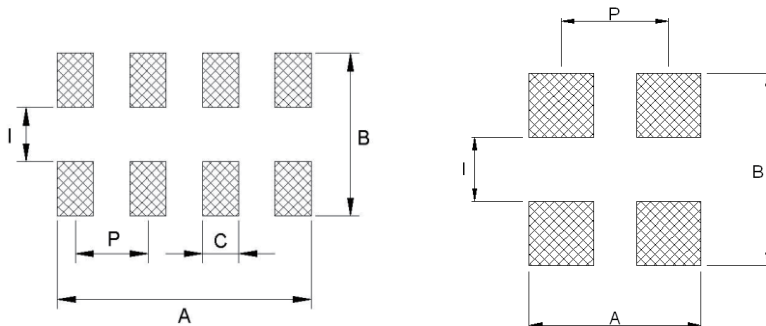
Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CNF22	1.20±0.1	1.45±0.1	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	2.0±0.05	2.0±0.05	1.50+0.1,-0	0.43±0.1
CNF42	1.20±0.1	2.20±0.1	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	2.0±0.05	2.0±0.05	1.50+0.1,-0	0.70±0.1
CNF43	1.95±0.1	3.50±0.1	8.0±0.2	1.75±0.1	3.5±0.05	4.0±0.1	4.0±0.05	2.0±0.05	1.50+0.1,-0	0.85±0.1

Recommend Land Pattern



CNF42/CNF43

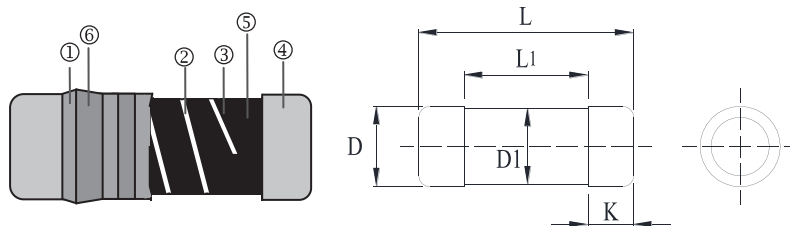
CNF22

Unit: mm

Type	A	B	C	I	P
CNF22	1.50	1.25	-	0.35	0.80
CNF42	2.10	1.80	0.30	0.50	0.50
CNF43	3.10	2.85	0.45	0.80	0.80

Automotive Grade Metal Film Precision MELF Resistor – CSRA Series

Construction



Features

- AEC-Q200 Compliance
- Thin film technology
- Excellent overall stability
- Sn termination on Ni barrier layer
- Tight tolerance down to $\pm 0.1\%$
- Extremely low TCR down to $\pm 5 \text{ PPM}/^\circ\text{C}$
- High power rating up to 1 Watts
- SMD enabled structure
- Lead-free and RoHS compliant

①	Insulation Coating	④	Electrode Cap
②	Trimming Line	⑤	Resistor Layer
③	Ceramic Rod	⑥	Marking

Dimensions

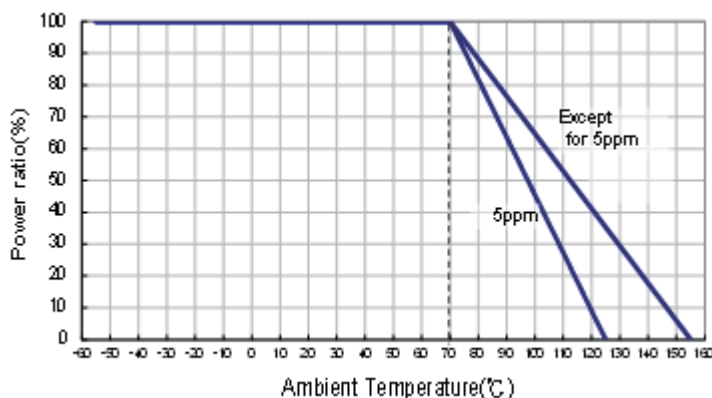
Unit: mm

Type	L	L _{1 min.}	ΦD	ΦD_1	K	Weight (g) (1000pcs)
CSRA0102	2.20 \pm 0.10	1.1	1.10 \pm 0.10	D +0/-0.15	0.45 \pm 0.05	7.7
CSRA0204	3.50 \pm 0.20	1.7	1.40 \pm 0.15	D +0/-0.2	0.8 \pm 0.1	18.7
CSRA0207	5.90 \pm 0.20	2.9	2.20 \pm 0.20	D +0/-0.2	1.3 \pm 0.1	80.9

Applications

- Automotive (non-safety parts)
- Industrial
- Telecommunication
- Medical Equipment
- Measurement/Testing Equipment

Derating Curve



Part Numbering

CSRA	0204	D	T	D	V	1000
Product Type	Dimensions (L \times Φ D)	Resistance Tolerance	Packaging Code	TCR (PPM/ $^\circ$ C)	Power Rating	Resistance
	0102: 2.2 \times 1.1 0204: 3.5 \times 1.4 0207: 5.9 \times 2.2	B: $\pm 0.1\%$ C: $\pm 0.25\%$ D: $\pm 0.5\%$ F: $\pm 1\%$ J: $\pm 5\%$ or Jumper	T: 7" Taping Reel S: 7" Taping Reel, Antistatic Tape W: 13" Taping Reel M: 13" Taping Reel, Antistatic Tape	S: ± 5 B: ± 10 N: ± 15 C: ± 25 D: ± 50 E: ± 100 - : Jumper	T: 1W U: 1/2W V: 1/4W G: 2/5W P: 1/5W L: 3/10W	0100: 10 Ω 1000: 100 Ω 2201: 2200 Ω 1001: 1K Ω 1004: 1M Ω R0R0: 0 Ω R050: 0.05 Ω R100: 0.1 Ω

※Packaging Code "S" & "M" only for 0102 & 0204 size products, not include 0207 size product.

Standard Electrical Specifications

Item Type	Power Rating at 70 °C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range					TCR (PPM/°C)		
					±0.1% (E24,E96)	±0.25% (E24,E96)	±0.5% (E24,E96)	±1% (E24,E96)	±5% (E24)			
0102	1/5W	-55 ~ +155°C	200V	400V	100Ω-56KΩ					-	±15	
					100Ω-82KΩ		49.9Ω-200KΩ	49.9Ω-390KΩ			-	±25
							1Ω-1MΩ					±50
							1Ω-1MΩ					±100
0204	1/4W	-55 ~ +125°C	200V	400V	10Ω-332KΩ					±5		
		-55 ~ +155°C	200V	400V	10Ω-332KΩ					-	±10	
					10Ω-332KΩ					-	±15	
					10Ω-1MΩ		10Ω-3.4MΩ	1Ω-3.4MΩ				±25
					10Ω-1MΩ		1Ω-3.4MΩ	0.2Ω-10MΩ				±50
									0.1Ω-10MΩ			
0207	1/2W	-55 ~ +125°C	300V	600V	10Ω-332KΩ					±5		
		-55 ~ +155°C	300V	600V	10Ω-332KΩ					-	±10	
					10Ω-332KΩ					-	±15	
					10Ω-1MΩ		10Ω-3.4MΩ	1Ω-3.4MΩ				±25
					10Ω-1MΩ		1Ω-3.4MΩ	0.2Ω-10MΩ				±50
									0.1Ω-10MΩ			

High Power Rating Electrical Specifications

Item Type	Power Rating at 70 °C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range					TCR (PPM/°C)		
					±0.1% (E24,E96)	±0.25% (E24,E96)	±0.5% (E24,E96)	±1% (E24,E96)	±5% (E24)			
0102	3/10W	-55 ~ +155°C	200V	400V	100Ω-56KΩ					-	±15	
					100Ω-82KΩ		49.9Ω-200KΩ	49.9Ω-390KΩ			-	±25
							1Ω-1MΩ					±50
							1Ω-1MΩ					±100
0204	2/5W	-55 ~ +125°C	200V	400V	10Ω-332KΩ					±5		
		-55 ~ +155°C	200V	400V	10Ω-332KΩ					-	±10	
					10Ω-332KΩ					-	±15	
					10Ω-1MΩ		10Ω-3.4MΩ	1Ω-3.4MΩ				±25
					10Ω-1MΩ		1Ω-3.4MΩ	0.2Ω-10MΩ				±50
									0.1Ω-10MΩ			
0207	1W	-55 ~ +125°C	350V	700V	10Ω-332KΩ					±5		
		-55 ~ +155°C	350V	700V	10Ω-332KΩ					-	±10	
					10Ω-332KΩ					-	±15	
					10Ω-1MΩ		10Ω-3.4MΩ	1Ω-3.4MΩ				±25
					10Ω-1MΩ		1Ω-3.4MΩ	0.2Ω-10MΩ				±50
									0.1Ω-10MΩ			

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage Listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage Listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Jumper Specifications

Item Type	Power Rating	Operating Temp. Range	Resistance	Rated Current	
CSRA0102	1/5W	-55 ~ +155°C	0Ω(<15mΩ)	2A	
	3/10W				
CSRA0204	1/4W	-55 ~ +155°C		0Ω(<15mΩ)	3A
	2/5W				
CSRA0207	1/2W	-55 ~ +155°C			5A
	1W				

Environmental Characteristics

Item	Requirement		Test Method
	5% and Below	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec		At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature 5ppm: At 25°C/-10°C and 25°C/+85°C, 25°C is the reference temperature
Short Time Overload	10Ω-332KΩ: ±(0.1%+0.01Ω) <10Ω & >332KΩ: ±(0.15%+0.01Ω) 0102: ±(0.15%+0.01Ω) 5ppm: ±(0.05%+0.01Ω)	<15mΩ	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G		Max. Overload Voltage for 1 minute
Operational Life	10Ω-332KΩ: ±(0.25%+0.01Ω) <10Ω & >332KΩ: ±(0.5%+0.01Ω) 0102: ±(0.5%+0.01Ω)	<15mΩ	Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion. 5ppm: 70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Biased Humidity	<10Ω: ±(0.5%+0.01Ω) 10Ω-332KΩ: ±(0.25%+0.01Ω) >332KΩ-3.4MΩ: ±(1%+0.01Ω) >3.4MΩ: ±(2%+0.01Ω) 0102: ±(1%+0.01Ω)	<15mΩ	1344 hrs 85°C/85%RH 10% of operating power. (≤100V)
High Temperature Exposure	10Ω-332KΩ: ±(0.25%+0.01Ω) <10Ω & >332KΩ: ±(0.5%+0.01Ω) 0102: ±(1%+0.01Ω)	<15mΩ	at +125°C/+155°C for 1000 hrs
Board Flex	10Ω-332KΩ: ±(0.1%+0.01Ω) <10Ω & >332KΩ: ±(0.2%+0.01Ω) 0102: ±(0.5%+0.01Ω)	<15mΩ	Bending once for 60 seconds with 2mm
Solderability	95% min. coverage		245±5°C for 3 seconds
Resistance to Soldering Heat	10Ω-332KΩ: ±(0.1%+0.01Ω) <10Ω & >332KΩ: ±(0.25%+0.01Ω) 0102: ±(0.25%+0.01Ω) 5ppm: ±(0.05%+0.01Ω)	<15mΩ	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover		1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤5% Total leaching area ≤10%		260±5°C for 30 seconds
Temperature Cycling	10Ω-332KΩ: ±(0.15%+0.01Ω) <10Ω & >332KΩ: ±(0.5%+0.01Ω) 0102: ±(1%+0.01Ω)	<15mΩ	-55°C to +125°C, 1000 cycles
Mechanical Shock	±(0.25%+0.01Ω)	<15mΩ	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	±(0.5%+0.01Ω)	<15mΩ	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(0.5%+0.01Ω)	<15mΩ	Human body, 0102/0204:2KV; 0207:4KV

Item	Requirement		Test Method
	5% and Below	Jumper	
Resistance to solvents	No visible damage on appearance and marking.		Add aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal strength	No broken		Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board		V-0 or V-1 are acceptable. Electrical test not required.

RCWV(Rated Continuous Working voltage)= $\sqrt{(P \cdot R)}$ or Max. Operating Voltage whichever is lower.

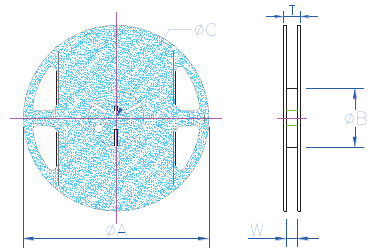
- Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1; AEC-Q200; MIL-STD-202; JESD22; UL94
- Storage Temperature: 15~28°C; Humidity < 80%RH
- Shelf Life: 2 years from production date

■ Packaging

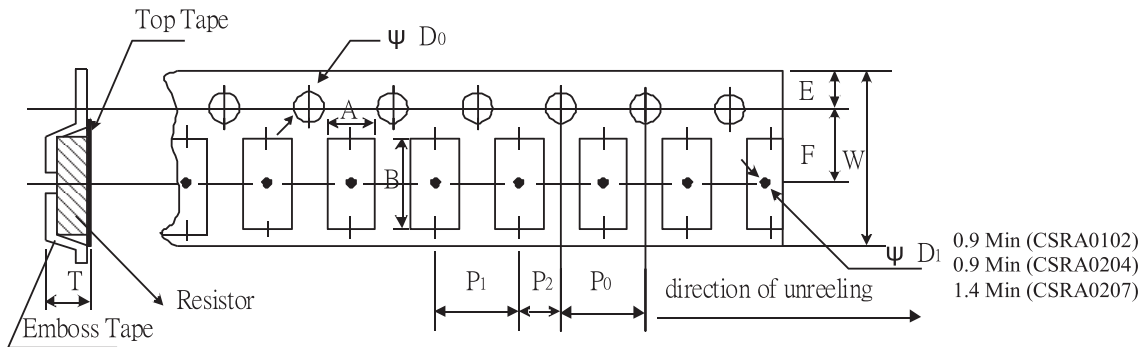
Packaging Quantity & Reel Specifications

Unit :mm

Type	Reel Diameter	ΦA	ΦB	ΦC	W	T	Emboss Plastic Tape (EA)
CSRA0102	7 inch	178.5±1.5	60.0+1.0	13.0±0.2	9.0±0.5	12.5±0.5	3,000
	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5	10,000
CSRA0204	7 inch	178.5±1.5	60.0+1.0	13.0±0.2	9.0±0.5	12.5±0.5	3,000
	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5	10,000
CSRA0207	7 inch	178.5±1.5	60.0+1.0	13.0±0.5	13.0±0.5	15.5±0.5	2,000
	13 inch	330±1.0	99±0.5	13.0±0.5	13.4±1	17.8±1	6,000



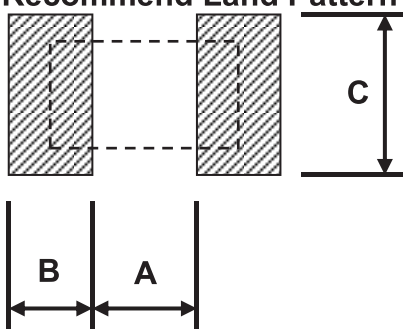
Emboss Plastic Tape Specifications



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CSRA0102	1.30±0.20	2.40±0.20	8.0±0.10	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.10	1.50±0.10
CSRA0204	1.55±0.20	3.65±0.20	8.0±0.10	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.10	1.80±0.10
CSRA0207	2.40±0.10	6.15±0.10	12.0±0.10	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.10	2.70±0.10

■ Recommend Land Pattern

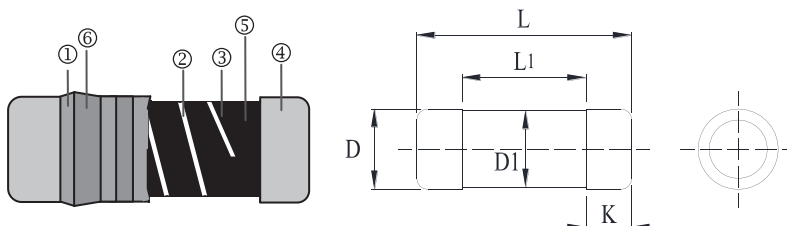


Unit: mm

Type	A	B	C
CSRA0102	1.0	0.8	1.5
CSRA0204	1.6	1.2	1.6
CSRA0207	3.0	1.7	2.4

Automotive Grade Metal Film Precision High Voltage MELF Resistor – CSRP Series

Construction



① Insulation Coating	④ Electrode Cap
② Trimming Line	⑤ Resistor Layer
③ Ceramic Rod	⑥ Marking

Features

- AEC-Q200 Compliance
- Thin film technology
- High voltage application
- Sn termination on Ni barrier layer
- Tight tolerance down to $\pm 0.1\%$
- High power rating up to 1 Watts
- SMD enabled structure
- Lead-free and RoHS compliant

Dimensions

Unit: mm

Type	L	L _{1 min.}	ΦD	ΦD ₁	K	Weight (g) (1000pcs)
CSRP0204	3.50 \pm 0.20	1.7	1.40 \pm 0.15	D +0/-0.2	0.80 \pm 0.10	18.7
CSRP0207	5.90 \pm 0.20	2.9	2.20 \pm 0.20	D +0/-0.2	1.30 \pm 0.10	80.9

Applications

- Industrial
- Telecommunication
- Medical Equipment
- Measurement/Testing Equipment

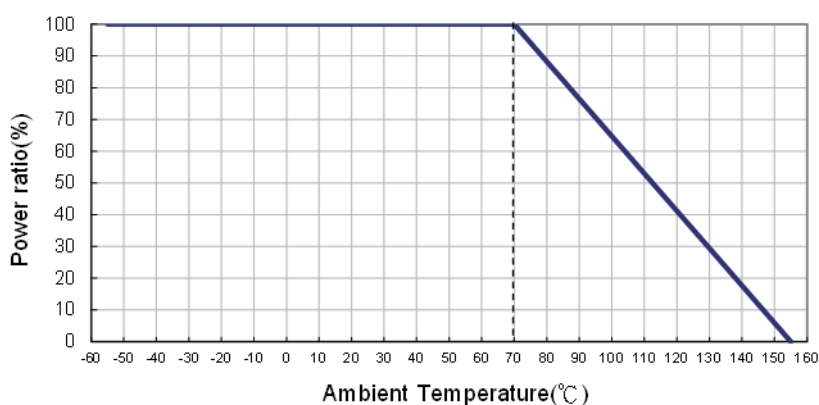
Part Numbering

CSRP	0204	D	T	D	V	1004
Product Type	Dimensions (L \times ΦD)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance
	0204: 3.5x1.4 0207: 5.9x2.2	B: $\pm 0.1\%$ C: $\pm 0.25\%$ D: $\pm 0.5\%$ F: $\pm 1\%$	T: Taping Reel S: 7" Taping Reel, Antistatic Tape W: 13" Taping Reel M: 13" Taping Reel, Antistatic Tape	C: ± 25 D: ± 50	T: 1W G: 2/5W	3403: 340KΩ 1004: 1MΩ

** Letter "R" is a decimal point.

※Packaging Code "S" & "M" only for 0102 & 0204 size products, not include 0207 size product.

Derating Curve



Standard Electrical Specifications

Item Type	Power Rating at 70 °C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range				TCR (PPM/°C)
					±0.1% (E24,E96)	±0.25% (E24,E96)	±0.5% (E24,E96)	±1% (E24,E96)	
0204	2/5W	-55 ~ +155°C	500V	1000V	340KΩ-1MΩ		340KΩ-3.4MΩ		±25
					340KΩ-1MΩ	340KΩ-3.4MΩ	340KΩ-10MΩ	±50	
0207	1W	-55 ~ +155°C	1000V	2000V	340KΩ-1MΩ		340KΩ-3.4MΩ		±25
					340KΩ-1MΩ	340KΩ-3.4MΩ	340KΩ-10MΩ	±50	

Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage Listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ or Max. Overload Voltage Listed above, whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(0.15%+0.01Ω)	RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥ 10G	Max. Overload Voltage for 1 minute
Endurance	±(0.5%+0.01Ω)	70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Biased Humidity	≤ 3.4MΩ: ±(1%+0.01Ω) >3.4MΩ: ±(2%+0.01Ω)	1344 hrs 85°C/85%RH 10% of operating power. (≤ 100 V)
High Temperature Exposure	±(0.5%+0.01Ω)	at +155°C for 1000 hrs
Board Flex	±(0.2%+0.01Ω)	Bending once for 60 seconds with 2mm
Solderability	95% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.25%+0.01Ω)	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover	1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤ 5% Total leaching area ≤ 10%	260±5°C for 30 seconds
Temperature Cycling	±(0.5%+0.01Ω)	-55°C to +125°C, 1000 cycles
Resistance to Solvents	No visible damage on appearance and marking.	Add aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Mechanical Shock	±(0.25%+0.01Ω)	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.

Item	Requirement	Test Method
Vibration	$\pm(0.5\%+0.01\Omega)$	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	$\pm(0.5\%+0.01\Omega)$	Human body, 0204:2KV; 0207:4KV
Terminal Strength	No broken	Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board	V-0 or V-1 are acceptable. Electrical test not required.

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

■ Reference Standards: IEC 60115-1, 60068-2-58; JIS-C 5201-1; AEC-Q200; MIL-STD-202; JESD22; UL-94

■ Storage Temperature: 15~28°C; Humidity < 80%RH

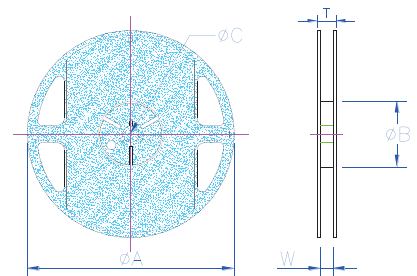
■ Shelf Life: 2 years from production date

■ Packaging

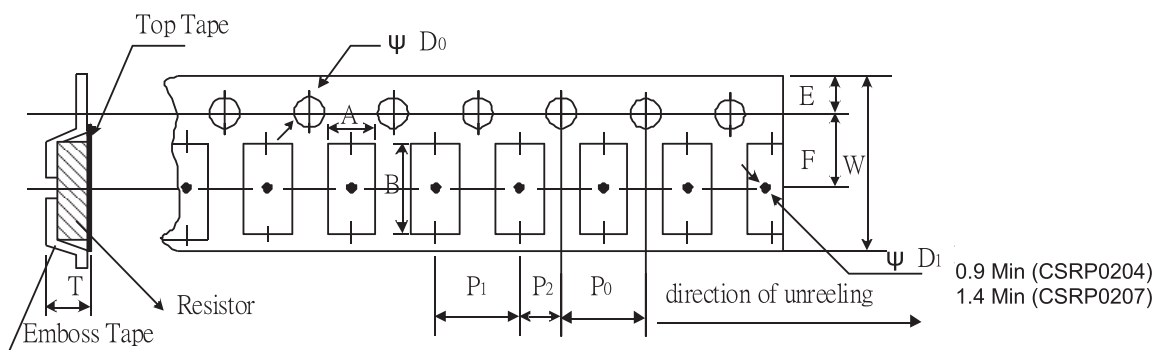
Packaging Quantity & Reel Specifications

Unit: mm

Type	Reel Diameter	ΦA	ΦB	ΦC	W	T	Emboss Plastic Tape (EA)
CSRP0204	7 inch	178.5±1.5	60.0+1.0	13.0±0.2	9.0±0.5	12.5±0.5	3,000
	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5	10,000
CSRP0207	7 inch	178.5±1.5	60.0+1.0	13.0±0.5	13.0±0.5	15.5±0.5	2,000
	13 inch	330±1.0	99±0.5	13.5±0.5	13.4±1	17.8±1	6,000



Emboss Plastic Tape Specifications

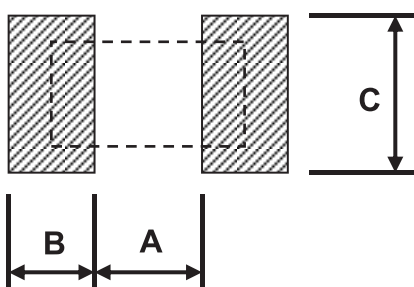


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
CSRP0204	1.55±0.10	3.65±0.20	8.0±0.10	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.10	1.80±0.10
CSRP0207	2.40±0.10	6.15±0.10	12.0±0.10	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.10	2.70±0.10

■ Recommend Land Pattern

Unit: mm

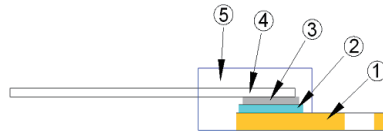


Type	A	B	C
CSRP0204	1.6	1.2	1.6
CSRP0207	3.0	1.7	2.4

Automotive Grade TO-220 Power Resistor – TR50-RF..A Series



Construction



① Flange	④ Lead
② Alumina Substrate	⑤ Molding
③ Resistor Layer	

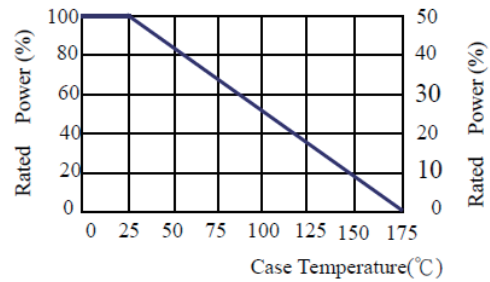
Features

- 50 watts at 25°C case temperature heat sink mounted
- TO-220 style power package
- Single screw mounting to heat sink
- Molded case for protection and easy to mount
- Electrically isolated case
- AEC-Q200 compliant

Applications

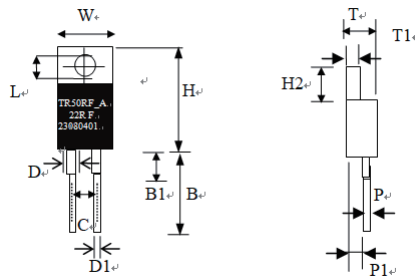
- Switching Power Supplies
- Snubbers Circuits
- Automated Machine Controller
- RF Power Amplifiers
- Low Energy Pulse Loading
- UPS
- Voltage Regulation

Derating Curve



Derating Curve Slope: 0.333W/°K
 (thermal resistance) : 3.00°K/W

Dimensions



Unit:mm

Type	W	H	H1	B	B1	D	D1	L	C	T	T1	H2	P	P1	Packaging
															Tube
TR50-RF	10.16 ±0.30	15.00 ±0.30	2.90 ±0.25	13.50 ±0.80	4 max	1.27 ±0.10	0.78 ±0.08	3.85 ±0.30	5.08 ±0.25	4.60 ±0.20	1.20 ±0.10	6.25 ±0.35	0.60 ±0.15	2.30 ±0.25	50 pcs

Part Numbering

TR	50	J	D	D	1001	-RF	A
Product Type	Power	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Resistance	Code	Function Code
	50: 50 Watts	D: ±0.5% F: ±1% J: ±5%	D: Tube	D: ±50 E: ±100 F: ±200 G: ±300 - : No Specified	R100: 0.1Ω 0100: 10Ω 4700: 470Ω 1001: 1000Ω 1002: 10000Ω	RF: Radiator Fin	A: Automotive Grade

Electrical Characteristics Specifications

Item Type	Resistance Range				TCR (PPM/°C)
	±0.5%	±1%	±5%	±10%	
TR50-RF	-	-	0.05Ω - 0.1Ω		No Specified
	-	≥ 0.1Ω - 1Ω			No Specified
	-	≥ 1Ω - 5Ω			±100 ±200 ±300
	≥ 5Ω - 10Ω				±100 ±200 ±300
	≥ 10Ω - 100KΩ				±50 ±100 ±200

- Operating Voltage: 350V Max.
- Dielectric Strength: 1800VAC
- Insulation Resistance: 10GΩ min.
- Operating Temperature Range: -55°C to +175°C

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	ΔR±0.3%	2 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds
Operational Life	ΔR±1.0%	Condition D Steady State TA=125°C at rated power. Measurement at 24±4 hours after test conclusion.
Biased Humidity	ΔR±0.5%	1000 hrs 85°C/85% RH of operating power
High Temperature Exposure	ΔR±0.3%	at 125°C for 1000 hrs
Solderability	90% min. coverage	245±5°C for 3 seconds
Resistance to Soldering Heat	ΔR±0.5%	260±5°C for 10 seconds (Delta R)
Temperature Cycling	ΔR±0.5%	-55°C~+125°C, 1000 cycles
Mechanical Shock	ΔR±0.25%	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	ΔR±0.25%	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	ΔR±3.0%	Human body model : 2KV
Flammability	No ignition of the tissue paper or scorching or the pinewood board	V-0 are acceptable. Electrical test not required.

- Lead Material: Tinned Copper
- Maximum Torque: 0.9 N-m
- Without a Heat Sink, When in Free Air at 25°C, the TR50-RF..A is Rated for 2.50W
- The Case Temperature is to be used for the Definition of the Applied Power Limit
- The Case Temperature Measurement must be made with a Thermocouple Contacting the Center of the Component mounted on the Designed Heat Sink.
- Thermal Grease should be Applied Properly.
- Storage Temperature: 25±5°C; Humidity <75%RH
- Reference Standards: IEC 60115-1; JIS-C 5201-1; AEC-Q200; MIL-STD-202; JESD22; UL-94

SMD Wire Wound Chip Power Resistor – WR

Features

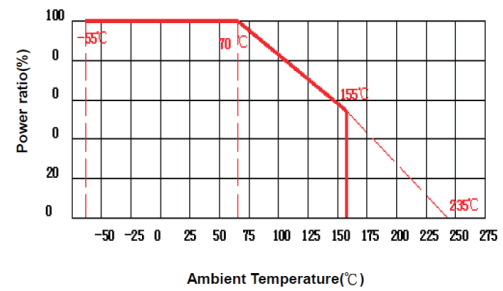
- Resistance range: 0.1 to 1.2KΩ
- High loading power.
- Nonflammable epoxy resin hot-pressing encapsulated, firm in structure
- Low noise, low T.R.C, perfect stability and high reliability
- Good moisture-proof and environmental suitability
- Various size are available.
- Non-inductive wire wound resistors is available.



Applications

- Power supply models of communication
- High power supply
- Protection circuits of signal
- Power supply of STB or other terminal devices

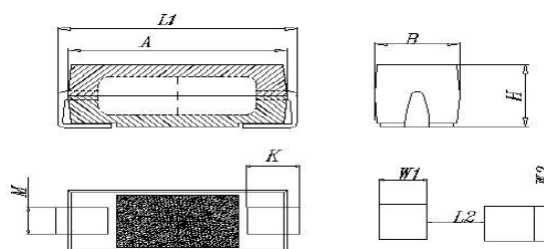
Derating Curve



Part Numbering

WR	27	J	T	E	R	1001
Product Type	Dimensions (L1×B)	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance
	15: 2615 16: 3816 25: 4525 27: 6327	D: ±0.5% F: ±1% G: ±2% J: ±5%	T: Taping Reel B: Bulk	E: ±100 K: ±150 F: ±200 G: ±300	U: 1/2W T: 1W S: 2W R: 3W D: 5W	0010: 1Ω 4R70: 4.7Ω 1001: 1KΩ

Dimensions



Unit: mm

Type	Size (Inch)	L1	A	B max.	H	K min.	M	W1	W2	L2	Packaging
15	2615	6.6±0.5	5.6±0.5	4.0	3.2±0.25	1.2	1.0±0.4	2.0	2.0	4.0	2000pcs
16	3816	9.6±0.5	8.6±0.5	4.2	3.5±0.25	1.8	1.2±0.4	3.0	2.2	5.2	2000pcs
25	4525	11.4±0.5	10.2±0.5	6.5	4.6±0.25	2.2	2.0±0.4	3.2	2.5	7.0	1000pcs
27	6327	15.9±0.5	14.7±0.5	7.0	6.4±0.25	3.0	2.0±0.4	4.5	3.0	8.8	800pcs

Standard Electrical Specifications

Type	Item	Power Rating	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Dielectric Withstand Voltage	Resistance Range				TCR (PPM/°C)
							±0.5%	±1%	±2%	±5%	
15 (2615)	1/2W 1W	-55 ~ +155°C	200V	350V	500V	0.22Ω – 0.49Ω				±300	
						0.5Ω – 0.99Ω				±200	
						1Ω – 9.9Ω				±150	
						10Ω – 50Ω				±100	
16 (3816)	1W 2W	-55 ~ +155°C	250V	500V	500V	0.1Ω – 0.49Ω				±300	
						0.5Ω – 0.99Ω				±200	
						1Ω – 9.9Ω				±150	
						10Ω – 200Ω				±100	
25 (4525)	2W 3W	-55 ~ +155°C	350V	700V	500V	0.1Ω – 0.49Ω				±300	
						0.5Ω – 0.99Ω				±200	
						1Ω – 9.9Ω				±150	
						10Ω – 1KΩ				±100	
27 (6327)	3W 5W	-55 ~ +155°C	500V	800V	500V	0.1Ω – 0.49Ω				±300	
						0.5Ω – 0.99Ω				±200	
						1Ω – 9.9Ω				±150	
						10Ω – 1.2KΩ				±100	

For special TCR which is not shown in the above table, please check us.

Environmental Characteristics

Item	Requirement	Test Method
Temperature Shock Test	±(5% +0.05Ω)	-25°C for 30min, 25°C for 10min and 70°C for 30min as a cycle, 5cycles
Short Time Overload	±(2% +0.05Ω)	RCWV*2.5 or Max. overload voltage whichever is lower for 5 seconds
Endurance	±(5% +0.05Ω)	70±3°C, RCWV for 1000±48 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Damp Heat with Load	±(5% +0.05Ω)	40±2°C, 90~95% R.H. RCWV for 1000±48 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Solderability	95% min. coverage	245±5°C for 3 seconds
Dielectric Withstand Voltage	1000MΩ	Apply 500V~1000V for 1 minute

Storage Temperature: 30±5°C; Humidity < 65%RH

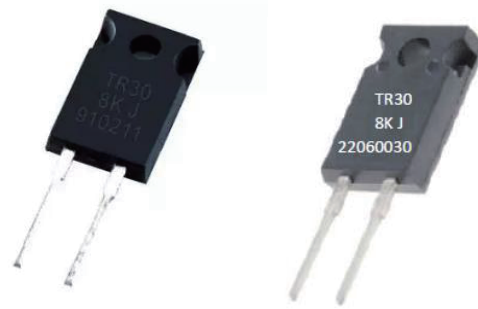
TO-220 Power Resistor – TR30

Features

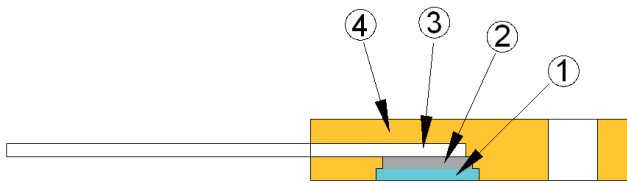
- 30 watts at 25°C case temperature heat sink mounted
- TO-220 style power package
- Single screw mounting to heat sink
- Molded case for protection and easy to mount
- Electrically isolated case
- Non-Inductive design

Applications

- Gate Resistors in Power Supplies
- Snubbers
- Load and Dumping Resistors in CRT Monitors
- Automated Machine Controller
- Terminal Resistance in RF Power Amplifiers
- Voltage Regulation
- Low Energy Pulse Loading
- UPS

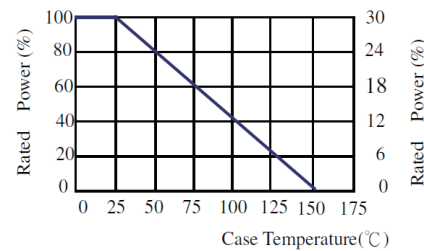


Construction



Alumina Substrate	③	Lead
Resistor Layer	④	Molding

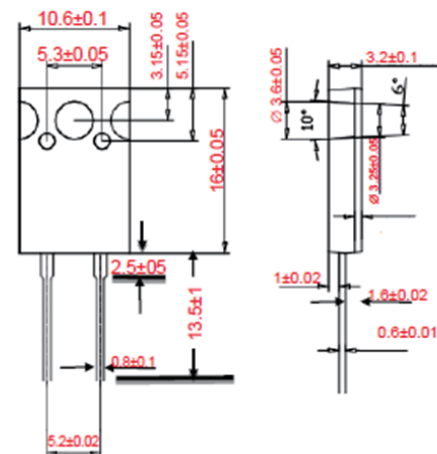
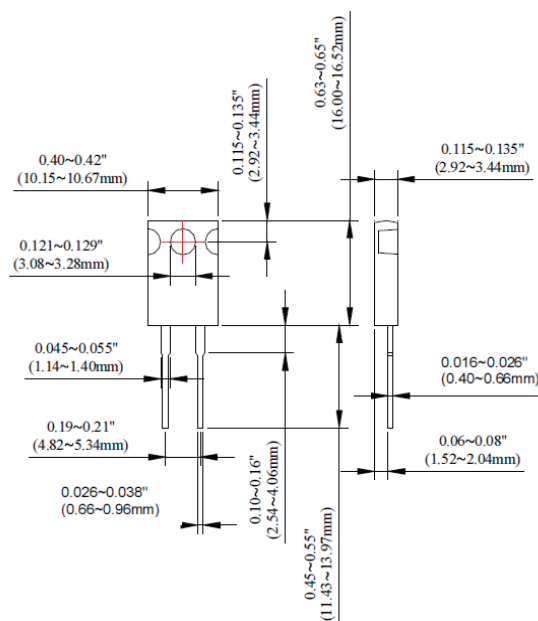
Derating Curve



Dimensions

Unit:mm

Type	Weight (g) (1000pcs)	Packaging
		Tube
TR30	1155	50pcs



Two styles (no round holes and 2 small round holes) side by side.

Part Numbering

TR	30	J	D	D	1001
Product Type	Power	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Resistance
	30: 30 Watts	D: ±0.5% F: ±1% J: ±5% K: ±10%	D: Tube	D: ±50 E: ±100 F: ±200 G: ±300 - : No Specified	R100: 0.1Ω 0100: 10Ω 4700: 470Ω 1001: 1000Ω 1002: 10000Ω

Electrical Characteristics Specifications

Item Type	Resistance Range				TCR (PPM/°C)
	±0.5%	±1%	±5%	±10%	
TR30	-	-	0.05Ω - 0.1Ω		No Specified
	-	≥ 0.1Ω - 1Ω			No Specified
	-	≥ 1Ω - 5Ω			±100 ±200 ±300
	≥ 5Ω - 10Ω				±100 ±200 ±300
	≥ 10Ω - 100KΩ				±50 ±100 ±200

- Operating Voltage: 420V max.
- Dielectric Strength: 1800VAC
- Insulation Resistance: 10GΩ min.
- Operating Temperature Range: -65°C to +150°C

Environmental Characteristics

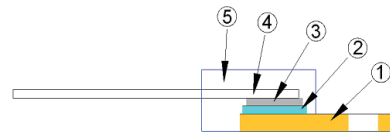
Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	Referenced to 25°C, ΔR taken at +105°C
Short Time Overload	ΔR±0.3%	2 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds
Load Life	ΔR±1.0%	2,000 hours at rated power
Damp Heat with Load	ΔR±0.5%	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Solderability	90% min. coverage	245±5°C for 3 seconds
Thermal Shock	ΔR±0.3%	-65°C~150°C, 100 cycles
Terminal Strength	ΔR±0.2%	(Pull Test) 2.4N
Vibration, High Frequency	ΔR±0.2%	20g peak

- Lead Material: Tinned Copper
- Maximum Torque: 0.9 N-m
- When in Free Air at 25°C, the TR30 is Rated for 2.25W
- The Case Temperature is to be used for the Definition of the Applied Power Limit
- The Case Temperature Measurement must be made with a Thermocouple Contacting the Center of the Component mounted on the Designed Heat Sink.
- Thermal Grease should be Applied Properly.
- Storage Temperature: 25±5°C; Humidity < 75%RH

TO-220 Power Resistor – TR35



Construction



①	Flange	④	Lead
②	Alumina Substrate	⑤	Molding
③	Resistor Layer		

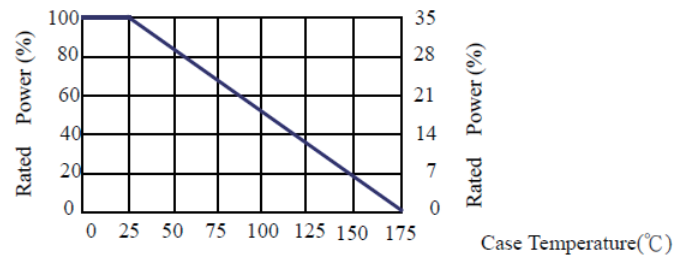
Features

- 35 watts at 25°C case temperature heat sink mounted
- TO-220 style power package
- Single screw mounting to heat sink
- Molded case for protection and easy to mount
- Electrically isolated case
- Non-Inductive design

Applications

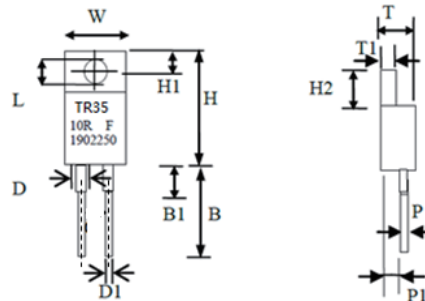
- Switching Power Supplies
- Snubbers Circuits
- Automated Machine Controller
- RF Power Amplifiers
- Low Energy Pulse Loading
- UPS
- Voltage Regulation

Derating Curve



Derating Curve Slope: 0.23W/°K
 Thermal Resistance: 4.28 °K/W

Dimensions



Unit:mm

Type	W	H	H1	B	B1	D	D1	L	C	T	T1	H2	P	P1	Packaging
															Tube
TR35	10.16 ±0.30	15.00 ±0.30	2.90 ±0.25	13.50 ±0.80	4 max	1.27 ±0.10	0.78 ±0.08	3.85 ±0.30	5.08 ±0.25	4.60 ±0.20	1.20 ±0.10	6.25 ±0.35	0.60 ±0.15	2.30 ±0.25	50 pcs

Part Numbering

TR	35	J	D	D	1001
Product Type	Power	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Resistance
	35: 35 Watts	D: ±0.5% F: ±1% J: ±5% K: ±10%	D: Tube	D: ±50 E: ±100 F: ±200 G: ±300 - : No Specified	R100: 0.1Ω 0100: 10Ω 4700: 470Ω 1001: 1KΩ 1002: 10KΩ

Electrical Characteristics Specifications

Item Type	Resistance Range				TCR (PPM/°C)
	±0.5%	±1%	±5%	±10%	
TR35	-	-	0.05Ω - 0.1Ω		No Specified
			≥ 0.1Ω - 1Ω		No Specified
	-		≥ 1Ω - 5Ω		±100 ±200 ±300
			≥ 5Ω - 10Ω		±100 ±200 ±300
			≥ 10Ω - 100KΩ		±50 ±100 ±200

- Operating Voltage: 350V Max.
- Dielectric Strength: 1800VAC
- Insulation Resistance: 10GΩ min.
- Operating Temperature Range: -65°C to +175°C

Environmental Characteristics

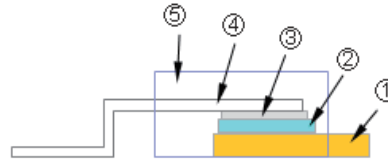
Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	Referenced to 25°C, ΔR taken at +105°C
Short Time Overload	ΔR±0.3%	2 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds
Load Life	ΔR±1.0%	2,000 hours at rated power
Damp Heat with Load	ΔR±0.5%	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Solderability	90% min. coverage	245±5°C for 3 seconds
Thermal Shock	ΔR±0.3%	-65°C~150°C, 100 cycles
Terminal Strength	ΔR±0.2%	(Pull Test) 2.4N
Vibration, High Frequency	ΔR±0.2%	20g peak

- Lead Material: Tinned Copper
- Maximum Torque: 0.9 N-m
- Without a Heat Sink, When in Free Air at 25°C, the TR35 is Rated for 2.50W
- The Case Temperature is to be used for the Definition of the Applied Power Limit
- The Case Temperature Measurement must be made with a Thermocouple Contacting the Center of the Component mounted on the Designed Heat Sink.
- Thermal Grease should be Applied Properly.
- Storage Temperature: 25±5°C; Humidity <75%RH

TO-263 Power Resistor – STR35



Construction



① Flange	④ Lead
② Alumina Substrate	⑤ Molding
③ Resistor Layer	

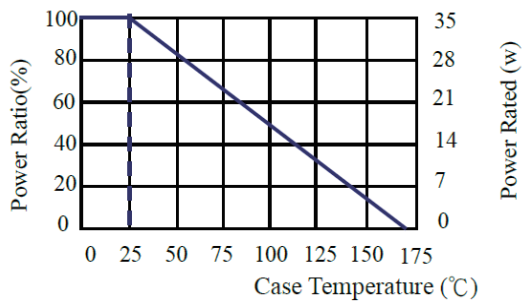
Features

- 35 watts at 25°C case temperature heat sink mounted
- Molded case for protection and easy to mount
- Resistor is electrically isolated from metal tab

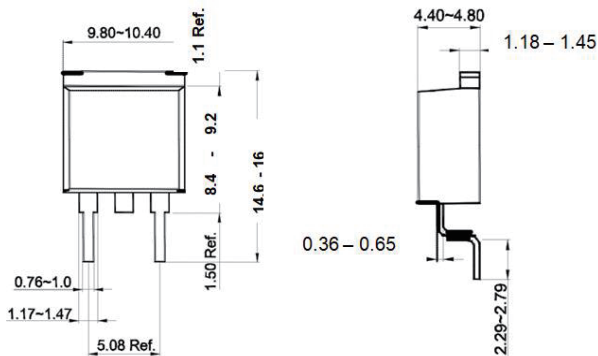
Applications

- Switching Power Supplies
- Snubbers Circuits
- Automated Machine Controller
- RF Power Amplifiers
- Low Energy Pulse Loading
- UPS
- Voltage Regulation

Derating Curve



Dimensions



Unit:mm

Part Numbering

STR	35	J	D	D	1001
Product Type	Power	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Resistance
	35: 35 Watts	D: ±0.5% F: ±1% J: ±5% K: ±10%	T:Taping Reel D:Tube	D: ±50 E: ±100 F: ±200 G: ±300 - : No Specified	R100: 0.1Ω 0100: 10Ω 4700: 470Ω 1001: 1KΩ 1002: 10KΩ

Electrical Characteristics Specifications

Type	Item	Resistance Range				TCR (PPM/°C)
		±0.5%	±1%	±5%	±10%	
STR35	-	-	0.05Ω - 0.1Ω		No Specified	
	-	≥ 0.1Ω - 1Ω			No Specified	
	-	≥ 1Ω - 5Ω			±100 ±200 ±300	
	≥ 10Ω - 100KΩ				±50 ±100 ±200	
	≥ 5Ω - 10Ω				±100 ±200 ±300	

- Operating Voltage: 350V Max.
- Dielectric Strength: 1800VAC
- Insulation Resistance: 10GΩ min.
- Operating Temperature Range: -65°C to +150°C

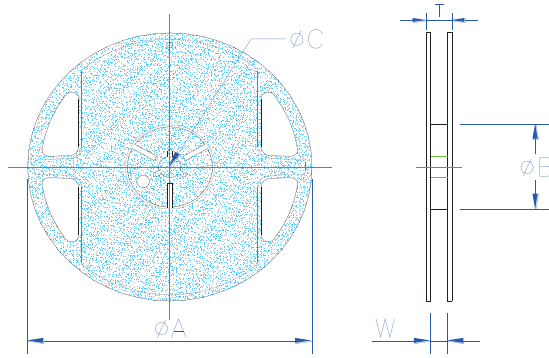
Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	Referenced to 25°C, ΔR taken at +105°C
Short Time Overload	ΔR±0.3%	2 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds
Load Life	ΔR±1.0%	2,000 hours at rated power
Damp Heat with Load	ΔR±0.5%	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Solderability	90% min. Coverage	245±5°C for 3 seconds
Temperature Cycling	ΔR±0.3%	-65°C~+150°C, 1000 cycles
Terminal Strength	ΔR±0.2%	(Pull Test)2.4N
Vibration, High Frequency	ΔR±0.2%	20g peak

- Lead Material: Tinned Copper
- Maximum Torque: 0.9 Nm
- Without a Heat Sink, When in Free Air at 25°C, the STR35 is Rated for 2.5W
- The Case Temperature is to be used for the Definition of the Applied Power Limit
- The Case Temperature Measurement must be made with a Thermocouple Contacting the Center of the Component mounted on the Designed Heat Sink.
- Thermal Grease should be Applied Properly.
- Storage Temperature: 25±5°C; Humidity: <75%RH

■ Packaging

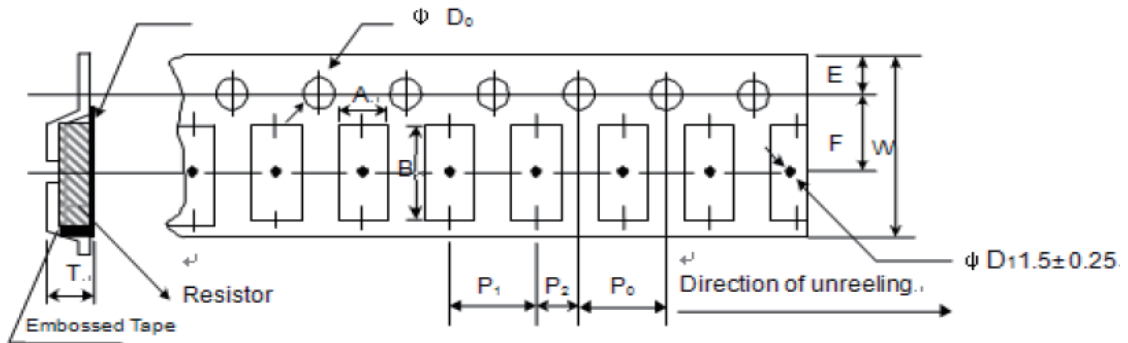
Reel Specifications & Packaging Quantity



Unit:mm

Type	Packaging Quantity	Reel Diameter	ΦA	ΦB	ΦC	W	T
STR35	500 pcs	13 inch	330±1.0	100±0.5	13.5±0.3	25.4±0.5	30.0±0.5

Embossed Plastic Tape Specifications



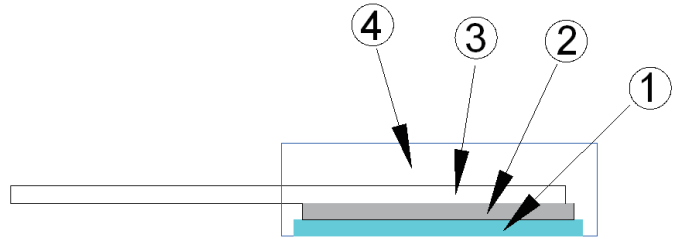
Unit:mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD ₀	T
STR35	10.80±0.10	16.13±0.10	24.0±0.30	1.75±0.1	11.5±0.1	4.0±0.1	16.0±0.1	2.0±0.1	1.55±0.05	5.25±0.20

TO-220 Power Resistor – TR50



Construction



① Alumina Substrate	③ Lead
② Resistor Layer	④ Molding

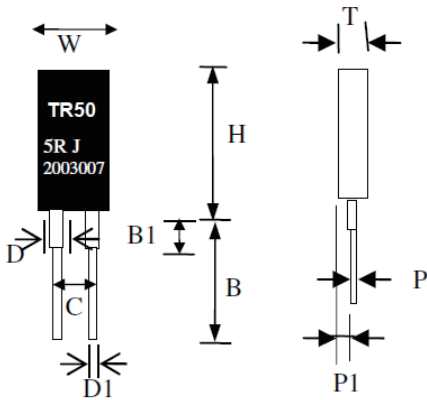
Features

- 50 Watts at 25°C case temperature heat sink mounted
- TO-220 style power package
- Molded case for protection and easy to mount
- Electrically isolated case
- Non-Inductive design

Applications

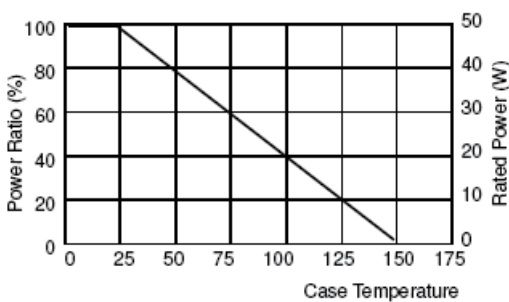
- Switching Power Supplies
- Non-inductive Design for High Frequency
- Pulsing Applications
- UPS
- Voltage Regulation

Dimensions



Type	W (mm)	H (mm)	B (mm)	B1 (mm)	C (mm)	D (mm)	D1 (mm)	T (mm)	P (mm)	P1 (mm)	Weight (g) (1000pcs)	Packaging
												Tube
TR50	10.41 ±0.26	16.26 ±0.26	12.70 ±1.27	3.3 ±0.76	5.08 ±0.26	1.27 ±0.13	0.8 ±0.15	3.18 ±0.26	0.50 ±0.10	1.78 ±0.26	1290	50pcs

Derating Curve



Part Numbering

TR	50	J	D	D	1001
Product Type	Power	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Resistance
	50: 50 Watts	D: ±0.5% F: ±1% J: ±5% K: ±10%	D: Tube	D: ±50 E: ±100 F: ±200 G: ±300 -: No Specified	R100: 0.1Ω 0100: 10Ω 4700: 470Ω 1001: 1000Ω 1002: 10000Ω

Electrical Characteristics Specifications

Type \ Item	Resistance Range				TCR (PPM/°C)
	±0.5%	±1%	±5%	±10%	
TR50	-	-	0.05Ω - 0.1Ω		No Specified
	-	≥ 0.1Ω - 1Ω			No Specified
	-	≥ 1Ω - 5Ω			±100 ±200 ±300
	≥ 5Ω - 10Ω				±100 ±200 ±300
	≥ 10Ω - 100KΩ				±50 ±100 ±200

- Operating Voltage: 350V Max.
- Dielectric Strength: 1800VAC
- Insulation Resistance: 10GΩ min.
- Operating Temperature Range: -65°C to +150°C

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	Referenced to 25°C, ΔR taken at +105°C
Short Time Overload	ΔR±0.3%	2 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds
Load Life	ΔR±1.0%	2,000 hours at rated power
Damp Heat with Load	ΔR±0.5%	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Solderability	90% min. coverage	245±5°C for 3 seconds
Thermal Shock	ΔR±0.3%	-65°C~150°C, 100 cycles
Terminal Strength	ΔR±0.2%	(Pull Test) 2.4N
Vibration, High Frequency	ΔR±0.2%	20g peak

- Lead Material: Tinned Copper
- Without a Heat Sink, When in Free Air at 25°C, the TR50 is Rated for 3W.
- The Case Temperature is to be used for the Definition of the Applied Power Limit.
- The Case Temperature Measurement must be made with a Thermocouple Contacting the Center of the Component mounted on the Designed Heat Sink.
- Thermal Grease should be Applied Properly.
- RCWV(Rated Continuous Working Voltage)=√(P*R) or Max. Operating Voltage whichever is lower.
- Storage Temperature: 25±5°C; Humidity <75%RH

TO-220 Power Resistor – TR50-H

Features

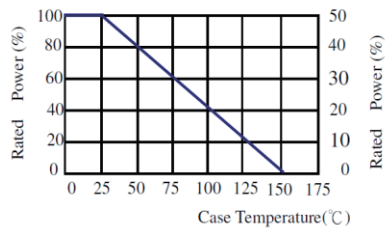
- 50 watts at 25°C case temperature heat sink mounted
- TO-220 style power package
- Single screw mounting to heat sink
- Molded case for protection and easy to mount
- Electrically isolated case
- Non-Inductive design



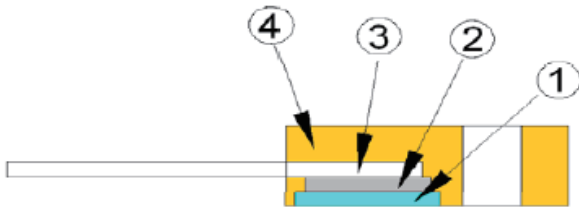
Applications

- Gate Resistors in Power Supplies
- Snubbers
- Load and Dumping in Resistors in CRT Monitors
- Automated Machine Controller
- Terminal Resistance in RF Power Amplifiers
- Low Energy Pulse Loading
- UPS
- Voltage Regulation

Derating Curve



Construction

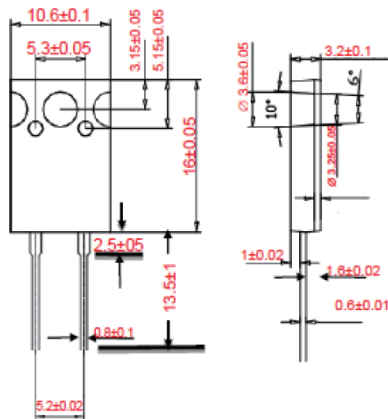
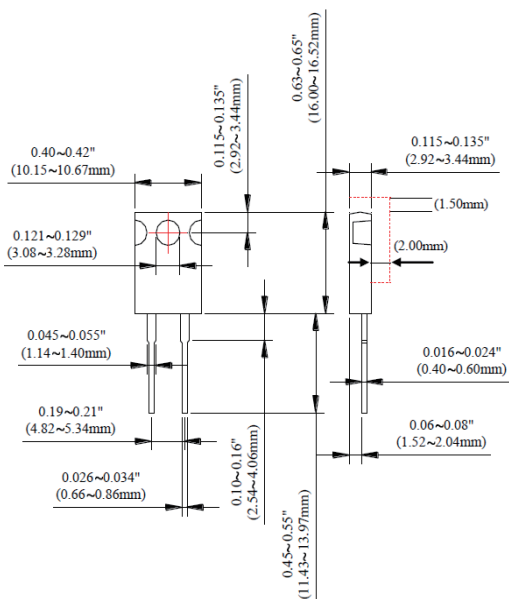


① Alumina Substrate	③ Lead
② Resistor Layer	④ Molding

Dimensions

Unit : mm

Type	Weight (g) (1000pcs)	Packaging
		Tube
TR50	1290	50pcs



Two styles (no round holes and 2 small round holes) side by side.

Part Numbering

TR	50	J	D	D	1001	-H
Product Type	Power	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Resistance	Code
	50: 50 Watts	D: ±0.5% F: ±1% J: ±5% K: ±10%	D: Tube	D: ±50 E: ±100 F: ±200 G: ±300 - : No Specified	R100: 0.1Ω 0100: 10Ω 4700: 470Ω 1001: 1000Ω 1002: 10000Ω	H: Hole

Electrical Characteristics Specifications

Type	Item	Resistance Range				TCR (PPM/°C)
		±0.5%	±1%	±5%	±10%	
TR50	-	-	0.05Ω - 0.1Ω		No Specified	
	-	≥ 0.1Ω - 1Ω			No Specified	
	-	≥ 1Ω - 5Ω			±50 ±100 ±200 ±300	
	-	≥ 5Ω - 10Ω			±50 ±100 ±200 ±300	
	-	≥ 10Ω - 100KΩ			±50 ±100 ±200	

- Operating Voltage: 350V Max.
- Dielectric Strength: 1800VAC
- Insulation Resistance: 10GΩ min.
- Operating Temperature Range: -65°C to +150°C

Environmental Characteristics

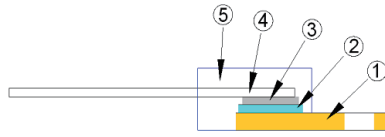
Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	Referenced to 25°C, ΔR taken at +105°C
Short Time Overload	ΔR±0.3%	2 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds
Load Life	ΔR±1.0%	2,000 hours at rated power
Damp Heat with Load	ΔR±0.5%	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Solderability	90% min. coverage	245±5°C for 3 seconds
Thermal Shock	ΔR±0.3%	-65°C ~150°C, 100 cycles
Terminal Strength	ΔR±0.2%	(Pull Test) 2.4N
Vibration, High Frequency	ΔR±0.2%	20g peak

- Lead Material: Tinned Copper
- Maximum Torque: 0.9N-m
- When in Free Air at 25°C, the TR50-H is Rated for 2.25W.
- The Case Temperature is to be used for the Definition of the Applied Power Limit.
- The Case Temperature Measurement Must be Made with a Thermocouple Contacting the Center of the Component Mounted on the Designed Heat Sink.
- Thermal Grease Should be Applied Properly.
- Storage Temperature: 25±5°C; Humidity <75%RH

TO-220 Power Resistor – TR50-RF



Construction



① Flange	④ Lead
② Alumina Substrate	⑤ Molding
③ Resistor Layer	

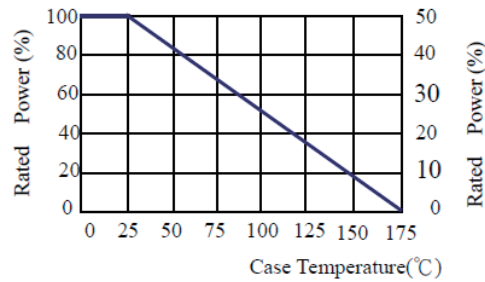
Features

- 50 watts at 25°C case temperature heat sink mounted
- TO-220 style power package
- Single screw mounting to heat sink
- Molded case for protection and easy to mount
- Electrically isolated case
- Non-Inductive design

Applications

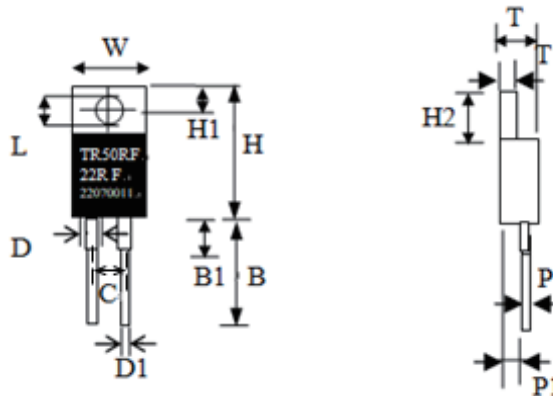
- Switching Power Supplies
- Snubbers Circuits
- Automated Machine Controller
- RF Power Amplifiers
- Low Energy Pulse Loading
- UPS
- Voltage Regulation

Derating Curve



Derating Curve Slope: 0.333W/°K
(thermal resistance) : 3.00°K/W

Dimensions



Unit:mm

Type	W	H	H1	B	B1	D	D1	L	C	T	T1	H2	P	P1	Packaging
															Tube
TR50-RF	10.16 ±0.30	15.00 ±0.30	2.90 ±0.25	13.50 ±0.80	4 max	1.27 ±0.10	0.78 ±0.08	3.85 ±0.30	5.08 ±0.25	4.60 ±0.20	1.20 ±0.10	6.25 ±0.35	0.60 ±0.15	2.30 ±0.25	50 pcs

Part Numbering

TR	50	J	D	D	1001	-RF
Product Type	Power	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Resistance	Code
	50: 50 Watts	D: ±0.5% F: ±1% J: ±5%	D: Tube	D: ±50 E: ±100 F: ±200 G: ±300 - : No Specified	R100: 0.1Ω 0100: 10Ω 4700: 470Ω 1001: 1000Ω 1002: 10000Ω	RF: Radiator Fin

Electrical Characteristics Specifications

Item Type	Resistance Range				TCR (PPM/°C)
	±0.5%	±1%	±5%	±10%	
TR50-RF	-	-	0.05Ω - 0.1Ω		No Specified
	-	≥ 0.1Ω - 1Ω			No Specified
	-	≥ 1Ω - 5Ω			±100 ±200 ±300
	≥ 5Ω - 10Ω				±100 ±200 ±300
	≥ 10Ω - 100KΩ				±50 ±100 ±200

- Operating Voltage: 350V Max.
- Dielectric Strength: 1800VAC
- Insulation Resistance: 10GΩ min.
- Operating Temperature Range: -65°C to +175°C

Environmental Characteristics

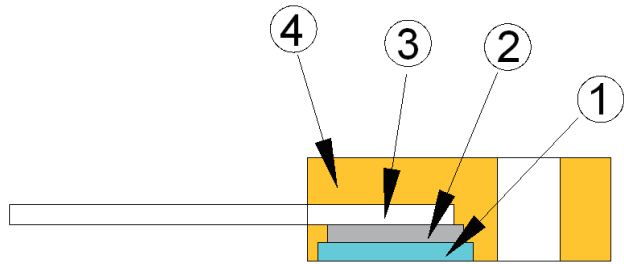
Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	Referenced to 25°C, ΔR taken at +105°C
Short Time Overload	ΔR±0.3%	2 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds
Load Life	ΔR±1.0%	2,000 hours at rated power
Damp Heat with Load	ΔR±0.5%	40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Solderability	90% min. coverage	245±5°C for 3 seconds
Thermal Shock	ΔR±0.3%	-65°C~150°C, 100 cycles
Terminal Strength	ΔR±0.2%	(Pull Test) 2.4N
Vibration, High Frequency	ΔR±0.2%	20g peak

- Lead Material: Tinned Copper
- Maximum Torque: 0.9 N-m
- Without a Heat Sink, When in Free Air at 25°C, the TR50-RF is Rated for 2.50W
- The Case Temperature is to be used for the Definition of the Applied Power Limit
- The Case Temperature Measurement must be made with a Thermocouple Contacting the Center of the Component mounted on the Designed Heat Sink
- Thermal Grease should be Applied Properly.
- Storage Temperature: 25±5°C; Humidity <75%RH

TO-247 Power Resistor—TR100



Construction



① Alumina Substrate	③ Lead
② Resistor Layer	④ Molding

Features

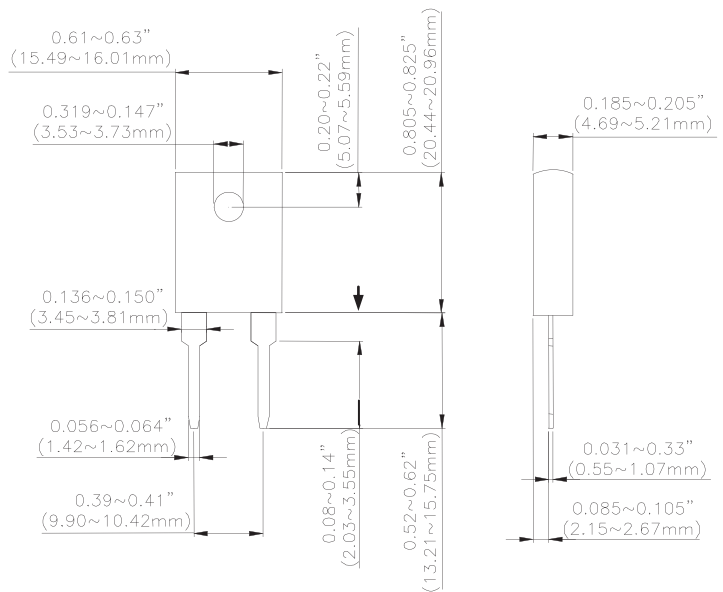
- 100 Watts at 25°C case temperature heat sink mounted
- TO-247 style power package
- Single M3 screw mounting to heat sink
- Molded case for protection and easy to mount
- Electrically isolated case
- Non-Inductive design

Applications

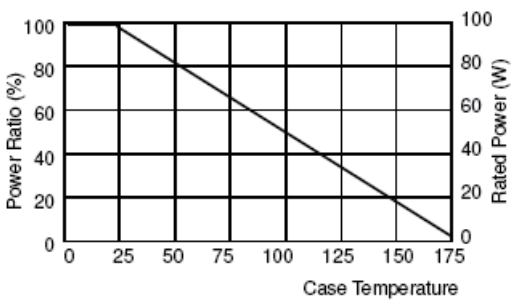
- Gate Resistors in Power Supplies
- Snubbers
- Load and Dumping Resistors in CRT Monitors
- Terminal Resistance in RF Power Amplifier
- Voltage Regulation
- Low Energy Pulse Loading
- UPS

Dimensions

Type	Weight (g) (1000pcs)	Packaging Tube
TR100	3381	35pcs



Derating Curve



Part Numbering

TR	100	J	D	D	1001
Product Type	Power	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Resistance
	100: 100 Watts	F: ±1% J: ±5% K: ±10%	D: Tube	D: ±50 E: ±100 F: ±200 G: ±300 - : No Specified	R100: 0.1Ω 0100: 10Ω 4700: 470Ω 1001: 1000Ω 1002: 10000Ω

Electrical Characteristics Specifications

Type	Item	Resistance Range				TCR (PPM/°C)
		±0.5%	±1%	±5%	±10%	
TR100	-	-	0.05Ω - 0.1Ω		No Specified	
	-	≥ 0.1Ω - 1Ω			No Specified	
	-	≥ 1Ω - 5Ω			±100 ±200 ±300	
	≥ 5Ω - 10Ω				±100 ±200 ±300	
	≥ 10Ω - 100KΩ				±50 ±100 ±200	

- Operating Voltage: 700V Max.
- Dielectric Strength: 1800V AC
- Insulation Resistance: 10GΩ min.
- Operating Temperature Range: -65°C to +175°C

Environmental Characteristics

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	Referenced to 25°C, ΔR taken at +105°C
Load Life	ΔR±1.0%	Rated power, 2,000 hours
Solderability	90% min. coverage	245±5°C for 3 seconds
Momentary Overload	ΔR±0.5%	1.5 times rated power and V (dc) ≤ 1.5V Max. for 5 seconds
Dielectric strength	ΔR±0.15%	1800v AC, 60 seconds
Moisture resistance	ΔR±0.5%	-10°C~+65°C, RH>90%, cycle 240 hours
Thermal Shock	ΔR±0.5%	-65°C~150°C, 100 cycles
Terminal Strength	ΔR±0.2%	(Pull Test) 2.4N
Vibration, High Frequency	ΔR±0.4%	20g peak

- Lead Material: Tinned Copper
- Maximum Torque: 0.9 Nm
- When in Free Air at 25°C, the TR100 is Rated for 3.5W
- The Case Temperature is to be used for the Definition of the Applied Power Limit
- The Case Temperature Measurement must be made with a Thermocouple Contacting the Center of the Component mounted on the Designed Heat Sink
- Thermal Grease should be Applied Properly.
- Storage Temperature: 25±5°C; Humidity <75%RH

Wire Wound Power Resistor—QR



■ Features

- Power 75W~20000W
- Tolerance $\pm 5\%$
- High temperature resistant cerami
- High heat dissipation
- High stability
- Customization for special specification and requirement is available

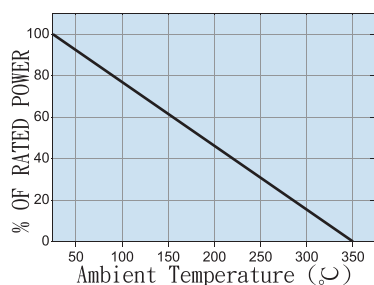
■ Applications

- Load For Power Burn- in
- Brake Load Of Elevator
- Brake Load Of The Motor
- Load Of Injection Molding Machine
- Current Limit
- Buck
- Current Divide
- Fitness Equipment
- Navigation System

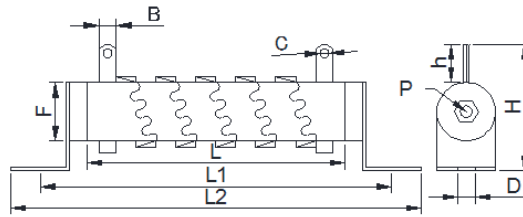
■ Part Numbering

QR	300W	R500	J	B
Product Type	Power Rating	Resistance	Resistance Tolerance	Mounting
QR: Q Type	75W: 75W 90W: 90W 100W: 100W 120W: 120W 150W: 150W 180W: 180W 200W: 200W 225W: 225W 240W: 240W 300W: 300W 350W: 350W 375W: 375W 450W: 450W 600W: 600W 750W: 750W 900W: 900W 1000W: 1000W 1200W: 1200W 1500W: 1500W 2000W: 2000W	R500: 0.5 Ω 0010: 1 Ω 0100: 10 Ω 1000: 100 Ω	J: $\pm 5\%$	B: With Bracket

■ Derating



Dimensions



Unit: mm

Power Rating	Dimensions										Resistance Range
	L	F	B	L1	C	h	D	L2	H	P	±5%
75W	90±5	25±1	8±1	120±5	5±1	18±2	6±1	144±5	58±3	Single M5x115	0.5Ω - 10Ω
95W	110±5	25±1	8±1	125±5	5±1	18±2	6±1	164±5	60±3	Single M5x135	0.5Ω - 11Ω
100W	90±5	28±1	8±1	120±5	5±1	18±2	6±1	144±5	60±3	Single M5x115	0.5Ω - 12Ω
120W	110±5	28±1	8±1	145±5	5±1	18±2	6±1	164±5	60±3	Single M5x135	0.5Ω - 13Ω
150W	140±5	28±1	8±1	175±5	5±1	18±2	6±1	195±5	60±3	Single M5x165	0.5Ω - 15Ω
180W	160±5	28±1	8±1	190±5	5±1	18±2	6±1	215±5	60±3	Single M5x185	0.5Ω - 18Ω
200W	185±5	28±1	8±1	215±5	5±1	18±2	6±1	239±5	60±3	Dual M5x215	0.25Ω - 20Ω
225W	195±5	28±1	8±1	225±5	5±1	18±2	6±1	249±5	60±3	Dual M5x220	0.5Ω - 22Ω
240W	185±5	35±1	8±1	221±5	5±1	18±2	9±1	250±5	75±3	Dual M5x210	0.5Ω - 24Ω
300W	210±5	35±1	8±1	245±5	5±1	18±2	9±1	268±5	75±3	Dual M5x245	0.5Ω - 27Ω
350W	300±5	28±1	8±1	330±5	5±1	18±2	5±1	355±5	60±3	Dual M5x325	0.5Ω - 27Ω
375W	210±5	40±1	10±1	250±5	5±1	22±2	9±1	277±5	77±3	Dual M5x245	0.5Ω - 30Ω
450W	260±5	40±1	10±1	300±5	5±1	22±2	9±1	327±5	77±3	Dual M5x295	0.5Ω - 35Ω
600W	330±5	40±1	10±1	370±5	5±1	22±2	9±1	400±5	77±3	Dual M5x365	0.5Ω - 40Ω
750W	330±5	50±1	12±1	370±5	6±1	24±2	10±1	400±5	105±3	Dual M5x365	0.5Ω - 100Ω
900W	400±5	50±1	12±1	444±5	6±1	24±2	10±1	469±5	105±3	Dual M5x435	0.5Ω - 100Ω
1000W	460±5	50±1	12±1	505±5	6±1	24±2	10±1	532±5	105±3	Dual M5x495	0.5Ω - 120Ω
1200W	460±5	60±1	15±1	508±5	6±1	30±2	10±1	535±5	112±3	Dual M5x495	0.5Ω - 120Ω
1500W	540±5	60±1	15±1	587±5	6±1	30±2	10±1	615±5	112±3	Dual M5x600	1Ω - 160Ω
2000W	650±5	65±1	15±1	690±5	6±1	30±2	10±1	720±5	115±3	Dual M5x695	1Ω - 160Ω

Resistor Body Color: Green

Electrical Characteristics

Characteristics	Limits
Resistance and Resistance Tolerance	Range Resistance tolerance ±5%(J)
Temperature Coefficient	FCHR-2 0.14X1.2m/m 1000~1200ppm/°C max (according to the material)
Power Rating Load	$\Delta R/R \leq \pm(1\% + 0.05\Omega)$ temperature 350°C max
Short-time Overload	$\Delta R/R \leq \pm(2\% + 0.05\Omega)$
Insulation Resistance	DC500V 100MΩ min
Dielectric Withstanding Voltage	AC2500V 1.5MA 1 minute

- These resistors are made by winding resistance ribbon around a ceramic tube in wave shape, externally coated with non flame paint.
- They are extremely good in dissipation of heat, small in size, able to take large load.
- Fit for use on heavy electric machines and production machines.

Power Rating Table

Thin Film						
size	Power Rating	Standards	General	Auto-grade	High stability/ higher ohm	High Frequency
0201	1/32W		AR			ARF
	1/20W		AR			
0402	1/32W				ARM..A	
	1/20W					ARF
	1/16W	ARG	AR	AR..A	ARM..A	
	1/10W		AR			
	1/8W				ARM..A	
	1/5W					
0603	1/16W		AR	AR..A	ARM..A	
	1/10W	ARG	AR	AR..A	ARM..A	
	1/8W					ARF
	3/20W					
	1/6W		AR		ARM..A	
	1/4W					
	1/2W					
0805	1/10W		AR	AR..A	ARM..A	
	1/8W	ARG	AR	AR..A	ARM..A	
	1/5W					ARF
	1/4W		AR		ARM..A	
	2/5W					
	1W					
1206	1/8W		AR	AR..A	ARM..A	
	1/4W	ARG	AR	AR..A	ARM..A	
	1/3W		AR			ARF
	2/5W					
	1/2W					
	1W					
	2W					
1210	1/4W		AR	AR..A		
	1/3W		AR	AR..A		
2010	1/4W		AR	AR..A		
	1/3W		AR	AR..A		
	1/2W		AR			
2512	1/2W		AR	AR..A		
	3/4W		AR			
	1W		AR			
	6W					

High Voltage	AIN	High power	High Temperature	High Temperature with high power	meter	Anti-Corrosive	TaN
					RAM	PR	TAR
			ART..A				
				ARTP..A			
					RAM	PR	
					RAM	PR	
			ART..A				
							TAR
				ARTP..A			
	ARN						
					RAM	PR	
					RAM	PR	
ARHV..A			ART..A				TAR
			ART..A	ARTP..A			
	ARN						
					RAM	PR	
ARHV..A					RAM	PR	
							TAR
		ARP					
	ARN						
					RAM		
ARHV..A							
					RAM	PR	
					RAM	PR	
	ARN						

Power Rating Table

Thick Film						
size	Power Rating	General	Auto-grade	Tight Tolerance & Low TCR	AIN	High ohm
0201	1/20W	CR..AC	CR..A			
	1/12W					
0402	1/16W	CR..AC	CR..A	CRTC..A		
	1/10W	CR..AC	CR..A			
	1/8W	CR..AC	CR..A	CRTC..A		
	1/5W					
0603	1/10W	CR..AC	CR..A	CRTC..A		
	1/8W					
	1/5W			CRTC..A		
	1/4W	CR..AC	CR..A			
	1/3W					
0805	1/8W	CR..AC	CR..A	CRTC..A		HMR
	1/4W			CRTC..A		
	1/3W	CR..AC	CR..A			
	2/5W					
	1/2W					
	3/4W					
	1W					
1206	1/4W	CR..AC	CR..A	CRTC..A		HMR
	1/3W	CR..AC		CRTC..A		
	1/2W	CR..AC	CR..A			
	3/4W					
	1W					
	1.5W					
	2.4W					CRP

Power Rating Table

Thick Film							
size	Power Rating	General	Auto-grade	Tight Tolerance & Low TCR	AIN	High ohm	Pulse Withstanding
1210	1/3W	CR..AC					
	1/2W	CR..AC	CR..A				PWR PWR..A
	3/4W	CR..AC					PWR PWR..A
	1W		CR..A				PWR PWR..A
	1.5W						
	2W						
2010	1/2W						
	3/4W	CR..AC	CR..A				PWR PWR..A
	1W	CR..AC	CR..A				PWR PWR..A
	1.25W		CR..A				PWR PWR..A
	2W		CR..A				
2512	1W	CR..AC	CR..A				
	1.5W						PWR PWR..A
	2W	CR..AC	CR..A				PWR PWR..A
	3W		CR..A				
	3.5W					CRP	

Surge Withstanding	wide terminal	High voltage	High voltage with low VCR	Green	Anti-sulfur	Anti-sulfur with Green
				CRG CRG..A	AS AS..A	ASG ASG..A
SWR SWR..A						
SWR SWR..A					AS AS..A	ASG ASG..A
SWR SWR..A						
	CRW(1020) CRW..A (1020)					
	CRW(1020) CRW..A (1020)					
		HVR HVR..A	HVRC			
SWR SWR..A				CRG CRG..A	AS AS..A	ASG ASG..A
SWR SWR..A					AS AS..A	ASG ASG..A
SWR SWR..A						
		HVR HVR..A	HVRC	CRG CRG..A	AS AS..A	ASG ASG..A
SWR SWR..A						ASG ASG..A
SWR SWR..A	CRW(1225) CRW..A (1225)					
	CRW(1225) CRW..A (1225)					

Power Rating Table

Jumper					
Size		CR..AC	CR..A	AS	AS..A
0201	<50mΩ	1A	1A	0.5A	1A
	<20mΩ				
0402	<50mΩ	1A	1A	1A	
	<20mΩ	1.5A	1.5A		
	≤ 10mΩ				
	≤ 0.5mΩ				
0603	<50mΩ	1A	1A	1A	
	<20mΩ	2A	2A		
	≤ 8mΩ				
	≤ 0.5mΩ				
0805	<50mΩ	2A	2A	2A	
	<20mΩ	2.5A	2.5A		
	<10mΩ				
	≤ 5mΩ				
	≤ 0.5mΩ				
1206	<50mΩ	2A	2A	2A	
	<20mΩ	3.5A	3.5A		
	<10mΩ				
	≤ 5mΩ				
	≤ 0.2mΩ				
1210	<50mΩ	2.5A	2.5A	2.5A	
	<20mΩ	5A	5A		
	≤ 4mΩ				
2010	<50mΩ	3.5A	3.5A	3.5A	
	<20mΩ	6A	6A		
	<10mΩ				
	≤ 5mΩ				
	≤ 0.2mΩ				
2512	<50mΩ	4A	4A	4A	
	<20mΩ	7A	7A		
	<10mΩ				
	≤ 5mΩ				
	≤ 0.2mΩ				

PWR/ PWR..A	LRJ	CN/ CN..A	CNF/ CNF..A	CRW/ CRW..A
		0.5A (0201*2/0201*4)		
		1A (0402*4)	1A (0402*2/0402*4)	
3A				
	20A			
		1A (0603*4)	1A (0603*4)	
5A				
	22.4A			
				5A (0508)
6A				
	31.6A			
				6A (0612)
10A				
	50A			
12A				
				10A (1020)
12A				
	71A			
				12A (1225)
16A				
	100A			

Nominal Resistance / Capacitance

E1	E3	E6	E12	E24	E96			E192					
100	100	100	100	100	100	215	464	100	147	215	316	464	681
	220	150	120	110	102	221	475	101	149	218	320	470	690
	470	220	150	120	105	226	487	102	150	221	324	475	698
		330	180	130	107	232	499	104	152	223	328	481	706
		470	220	150	110	237	511	105	154	226	332	487	715
		680	270	160	113	243	523	106	156	229	336	493	723
			330	180	115	249	536	107	158	232	340	499	732
			390	200	118	255	549	109	160	234	344	505	741
			470	220	121	261	562	110	162	237	348	511	750
			560	240	124	267	576	111	164	240	352	517	759
			680	270	127	274	590	113	165	243	357	523	768
			820	300	130	280	604	114	167	246	361	530	777
				330	133	287	619	115	169	249	365	536	787
				360	137	294	634	117	172	252	370	542	796
				390	140	301	649	118	174	255	374	549	806
				430	143	309	665	120	176	258	379	556	816
				470	147	316	681	121	178	261	383	562	825
				510	150	324	698	123	180	264	388	569	835
				560	154	332	715	124	182	267	392	576	845
				620	158	340	732	126	184	271	397	583	856
				680	162	348	750	127	187	274	402	590	866
				750	165	357	768	129	189	277	407	597	876
				820	169	365	787	130	191	280	412	604	887
				910	174	374	806	132	193	284	417	612	898
					178	383	825	133	196	287	422	619	909
					182	392	845	135	198	291	427	626	920
					187	402	866	137	200	294	432	634	931
					191	412	887	138	203	298	437	642	942
					196	422	909	140	205	301	442	649	953
					200	432	931	142	208	305	448	657	965
					205	442	953	143	210	309	453	665	976
					210	453	976	145	213	312	459	673	988