

Data Sheet

Customer:

Product: Automotive Grade Metal Foil Chip Fixed Resistor –MF..A Series

Sizes: 0603/0805/1206/2010/2512

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Automotive Grade Metal Foil Chip Fixed Resistor



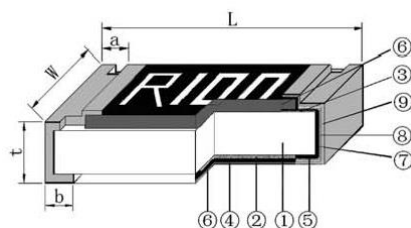
■Features

- AEC-Q200 Compliance
- High power rating up to 2 Watts
- Low TCR down to ± 50 PPM/ $^{\circ}\text{C}$
- Current detecting resistors for power supply, 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.

■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

■Dimensions

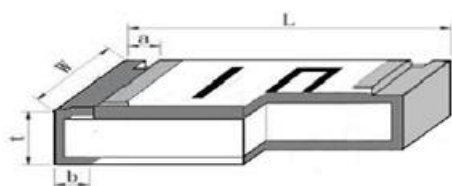


Figure1

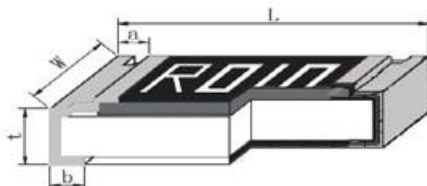


Figure2

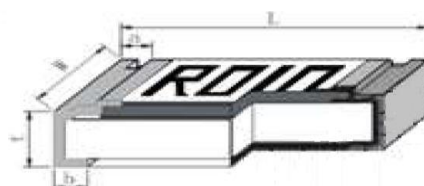


Figure3

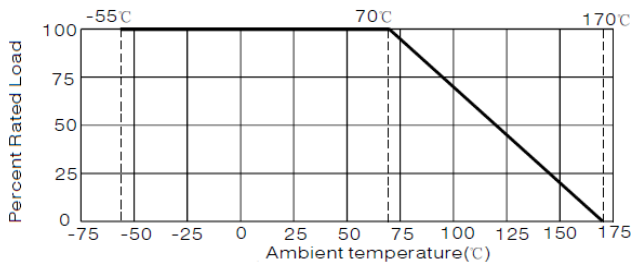
Type	Size (Inch)	Resistance (mΩ)	L mm	W mm	t mm	a mm	b mm
MF03	0603	5-20	1.60 $\pm$ 0.20	0.80 $\pm$ 0.20	0.70 $\pm$ 0.15	0.35 $\pm$ 0.25	0.35 $\pm$ 0.20
MF05	0805	3-4	2.00 $\pm$ 0.20	1.25 $\pm$ 0.20	0.70 $\pm$ 0.15	0.40 $\pm$ 0.25	0.70 $\pm$ 0.30
		5-47					0.40 $\pm$ 0.30
MF06	1206	3-4	3.20 $\pm$ 0.20	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 $\geq$ 10mΩ / MF06 type / MF12 type ; Figure 3 for MF05<10mΩ / 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

Derating Curve



Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Limiting Element Current(A)	Max. Overload Current (A)	Resistance Range(mΩ)			TCR (PPM/°C)
					±1%	±2%	±5%	
MF03	1/4W	-55 ~ +170°C	5.0	11.2	11-20			±100
	1/3W, 1/2W		10.0	22.4	5-9		±200	
					10		±100	
MF05	1/4W	-55 ~ +170°C	3.5	7.9	21-47			±50
	1/3W, 1/2W		12.9	28.9	3-9		±100	
					10-20		±50	
MF06	1/2W	-55 ~ +170°C	5.0	11.2	21-56			±50
	1/2W, 1W		18.3	40.8	3-9		±100	
					10-20		±50	
MF10	1W	-55 ~ +170°C	18.3	40.8	3-9		±100	
					10-100		±50	
MF12	1W	-55 ~ +170°C	3.2	7.1	101-200			±50
	1W, 2W		31.6	63.3	2		±200	
					3-9		±100	
					10-100		±50	

Current of DC or AC RMS value.

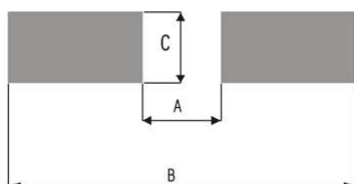
Rated current= $\sqrt{P/R}$ or Limiting element voltage whichever is lower.

Environmental Characteristics

Automotive Grade Metal Foil Chip Fixed Resistor

Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As Spec.	IEC 60115-1 4.8 +20/+125/+20°C
Short Time Overload	No mechanical damage $\Delta R \leq \pm 1\%$	IEC 60115-1 4.13 1/4W&1/3W&1/2W&1W: 5x rated power for 5s; 2W: 4x rated power for 5s
High Temperature Exposure	No mechanical damage $\Delta R \leq \pm 1\%$	MIL-STD-202 Method 108 1000 hrs. @T=170±2°C .Unpowered.
Temperature Cycling	No mechanical damage $\Delta R \leq \pm 1\%$	JESD22 Method JA-104 -55°C(30min)~ normal temperature(≤ 1min)~ 155°C (30min), 1000 cycles.
Biased Humidity	No mechanical damage $\Delta R \leq \pm 1\%$	MIL-STD-202 Method 103 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	MIL-STD-202 Method 215 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	IEC 60115-1 4.17 245±5°C for 3±0.3 seconds
Resistance to Soldering Heat	No mechanical damage $\Delta R \leq \pm 1\%$	MIL-STD-202 Method 210 270±5°C for 10±1 seconds
Mechanical shock	No mechanical damage $\Delta R \leq \pm 1\%$	MIL-STD-202 Method 213 Positive half wave, peak acceleration:100g's, pulse duration:6ms, three axis six to each 3 times, a total of 18 times
Insulation Resistance	>1000MΩ	IEC 60115-1 4.6 Apply DC 100V±15V between substrate and terminations for 1min, then check insulation resistance
Voltage Proof	No breakdown or flashover	IEC 60115-1 4.7 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 $\Delta R \leq \pm 1\%$	MIL-STD-202 Method 204 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 $\Delta R \leq \pm 1\%$	MIL-STD-202 Method 107 -55°C(15min)~ normal temperature(≤20sec)~ 155°C (30min), 300 cycles
Operational Life	No mechanical damage $\Delta R \leq \pm 1\%$	MIL-STD-202 Method 108 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 $\Delta R \leq \pm 1\%$	IEC 60115-1 4.36 -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	UL-94 V-0 or V-1 are acceptable. Electrical test not required.
Substrate Bending Test	No mechanical damage $\Delta R \leq \pm 1\%$	AEC-Q200-005 Bending distance: 2mm Duration: 60±5s.
Terminal Strength	No mechanical damage $\Delta R \leq \pm 1\%$	AEC-Q200-006 Applying force 17.7N for 60±1s

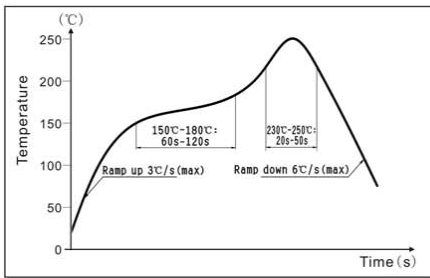
Recommend Land Pattern



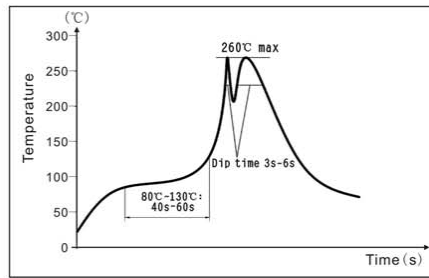
Type	Resistance	A mm	B mm	C mm
MF03	5mΩ - 20mΩ	0.6	2.8	1.0
MF05	3mΩ - 4mΩ	0.5	3.2	1.4
	5mΩ - 47mΩ	0.8		
MF06	3mΩ - 4mΩ	0.8	4.4	1.8
	5mΩ - 56mΩ	1.8		
MF10	3mΩ - 9mΩ	1.6	6.3	2.9
	10mΩ - 100mΩ	2.7		
MF12	2mΩ - 4mΩ	1.0	8.0	3.4
	5mΩ - 200mΩ	3.8		

Soldering Condition

Recommended reflow profile



Recommended wave solder profile

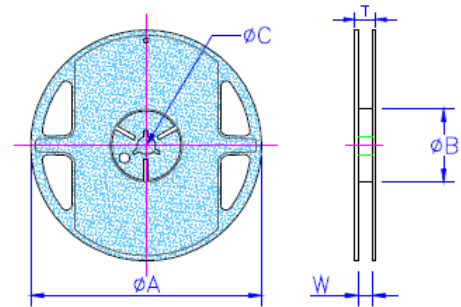


■ Packaging

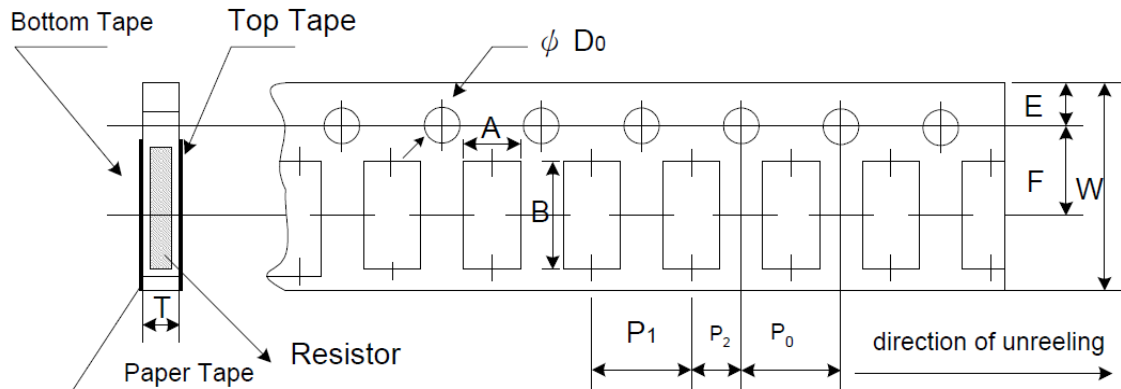
Packing Quantity & Reel Specifications

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

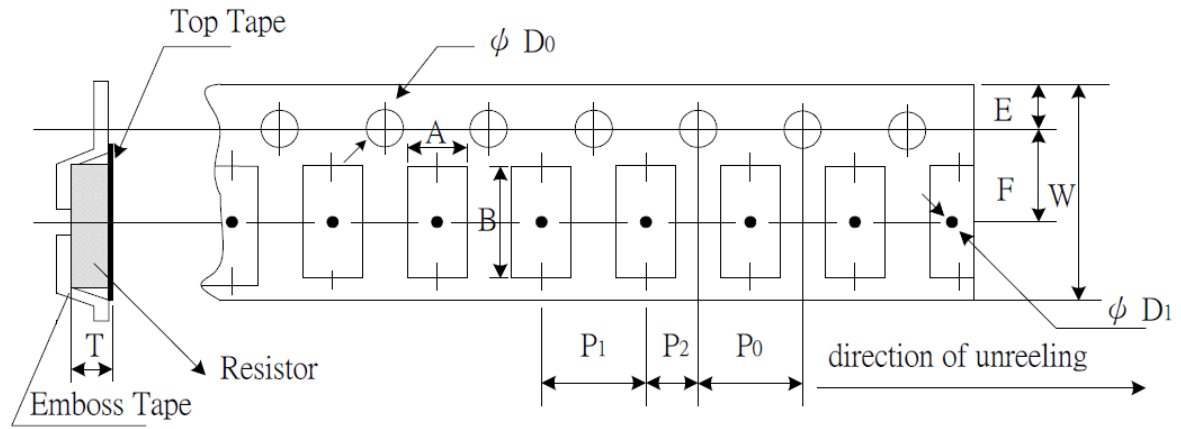


Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ØD ₀	T
MF03	1.05±0.10	1.80±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	1.50±0.10	2.30±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

Automotive Grade Metal Foil Chip Fixed Resistor



Unit: mm

Type	A	B	W	E	F	P ₀	P ₁	P ₂	ØD ₀	ØD ₁	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	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/-0	1.50±0.10	1.00±0.10