

## Data Sheet

Customer:

Product: Anti-Sulfurated Thick Film Chip Resistor - AS Series (Chip)

Size: 0201/0402/0603/0805/1206/1210/2010/2512

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## Anti-Sulfurated Thick Film Chip Resistor



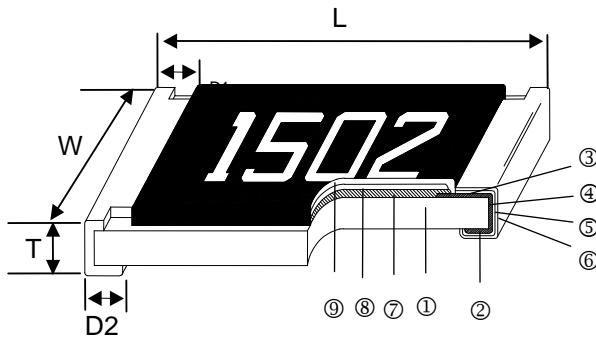
### Scope

- This specification applies to all sizes of rectangular-type fixed chip resistors with Ruthenium-base as material.

### Features

- Special construction to prevent sulfuration in a sulfur containing environment

### Construction



### 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

### Dimensions

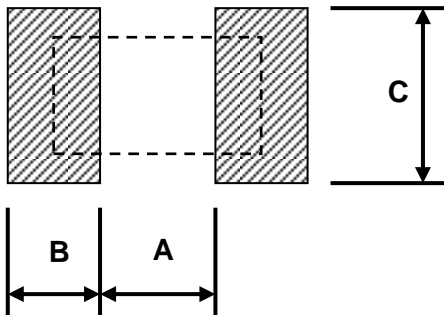
Type	Size (Inch)	L (mm)	W (mm)	T (mm)	D1 (mm)	D2 (mm)	Weight (g) (1000pcs)
AS01	0201	0.60±0.03	0.30±0.03	0.23±0.03	0.15±0.05	0.15±0.05	0.15
AS02	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10	0.62
AS03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	2.04
AS05	0805	2.00±0.10	1.25±0.10	0.50±0.10	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**

AS	06	F	T	E		1002
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	E: ±100 F: ±200 - : 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

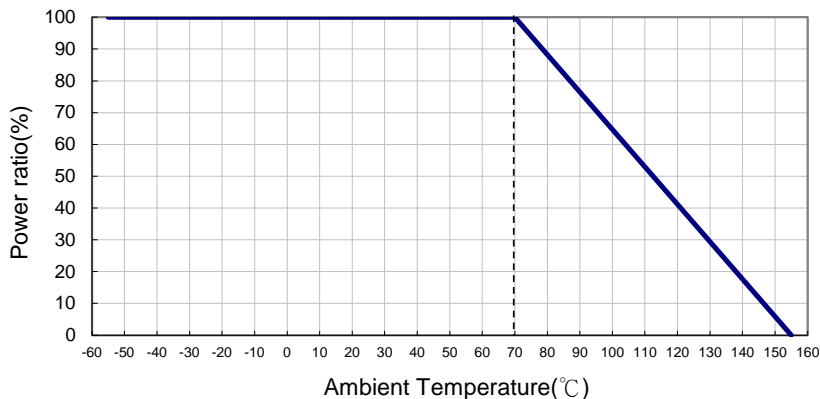
\*Remark: Standard part no need for power rating code.

**Recommend Land Pattern**

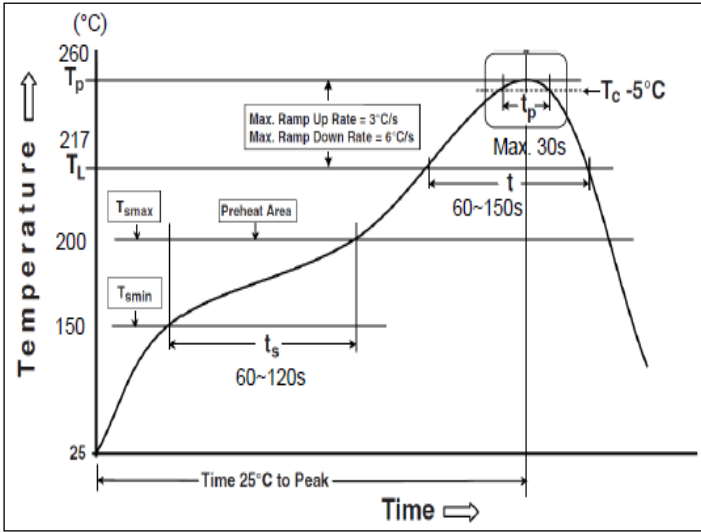


Type	A (mm)	B (mm)	C (mm)
AS01	0.30	0.25	0.30
AS02	0.50	0.45	0.60
AS03	0.90	0.60	0.90
AS05	1.20	0.70	1.30
AS06	2.00	0.90	1.60
AS10	2.00	0.90	2.80
AS0A	3.80	0.90	2.80
AS12	4.90	1.60	3.50

**Derating Curve**



**■ Soldering Condition (Ref. IPC/JEDEC J-STD-020 & J-STD-002)**



Reflow Profiles	
Profile Feature	Pb-Free Assembly
<b>Preheat</b>	
Min. Temperature (T <sub>min</sub> )	150 °C
Max Temperature (T <sub>max</sub> )	200 °C
Preheating time (t <sub>s</sub> ) from (T <sub>min</sub> to T <sub>max</sub> )	60-120 seconds
Ramp-up rate (T <sub>L</sub> to T <sub>p</sub> )	3 °C/second max.
Liquidous temperature (T <sub>L</sub> )	217 °C
Time (t <sub>L</sub> ) maintained above T <sub>L</sub>	60-150 seconds
Min. Peak temperature (T <sub>p</sub> min)	235°C
Max. Peak temperature (T <sub>p</sub> max)	260°C
Time (t <sub>p</sub> ) within 5 °C of the specified classification temperature (T <sub>c</sub> )	30 seconds max.
Ramp-down rate (T <sub>p</sub> to T <sub>L</sub> )	6 °C/second max.
Time 25 °C to peak temperature	8 minutes max.

**■ Standard Electrical Specifications**

Item Type	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)	
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)
					±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	-	10Ω - 9.76Ω		±200
AS03 (0603)	1/4W		75V	150V	-	10Ω - 1MΩ		±100
AS05 (0805)	1/3W		150V	300V	-	10Ω - 9.76Ω		±200
AS06 (1206)	1/2W		200V	400V	-	10Ω - 1MΩ		±100
AS10 (1210)	3/4W		200V	400V	-	10Ω - 9.76Ω		±200
AS0A (2010)	1W		200V	400V	-	10Ω - 1MΩ		±100
						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.			<b>JIS-C-5201-1 4.8</b> <b>IEC-60115-1 4.8</b> 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	<b>JIS-C-5201-1 4.13</b> <b>IEC-60115-1 4.13</b> RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds, 2 seconds for high power series
Insulation Resistance	≥10G			<b>JIS-C-5201-1 4.6</b> <b>IEC-60115-1 4.6</b> Max. Overload Voltage for 1 minute
Endurance	±(2.0%+0.10Ω)	±(3.0%+0.10Ω)	<100mΩ	<b>JIS-C-5201-1 4.25</b> <b>IEC-60115-1 4.25.1</b> 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	<b>JIS-C-5201-1 4.24</b> <b>IEC-60115-1 4.24</b> 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	<b>JIS-C-5201-1 4.23</b> <b>IEC-60115-1 4.23.2</b> at +155°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	<b>JIS-C-5201-1 4.33</b> <b>IEC-60115-1 4.33</b> Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage			<b>JIS-C-5201-1 4.17</b> <b>IEC-60115-1 4.17</b> 245±5°C for 3 seconds

**Anti-Sulfurated Thick Film Chip Resistor**

Resistance to Soldering Heat	$\pm(0.5\%+0.05\Omega)$	$\pm(1.0\%+0.05\Omega)$	<50m $\Omega$	<b>JIS-C-5201-1 4.18</b> <b>IEC-60115-1 4.18</b> 260 $\pm$ 5°C for 10 seconds
Voltage Proof	No breakdown or flashover			<b>JIS-C-5201-1 4.7</b> <b>IEC-60115-1 4.7</b> 1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area $\leq$ 5% Total leaching area $\leq$ 10%			<b>JIS-C-5201-1 4.18</b> <b>IEC-60068-2-58 8.2.1</b> 260 $\pm$ 5°C for 30 seconds
Rapid Change of Temperature	$\pm(0.5\%+0.05\Omega)$	$\pm(1.0\%+0.05\Omega)$	<50m $\Omega$	<b>JIS-C-5201-1 4.19</b> <b>IEC-60115-1 4.19</b> -55°C to +155°C, 5 cycles
Sulfur Test	$\pm(0.5\%+0.05\Omega)$	$\pm(0.5\%+0.05\Omega)$	<50m $\Omega$	<b>ASTM-B-809-95</b> H <sub>2</sub> S, 50 $\pm$ 2°C, 91~93% R.H., no power rating for 1000 hrs

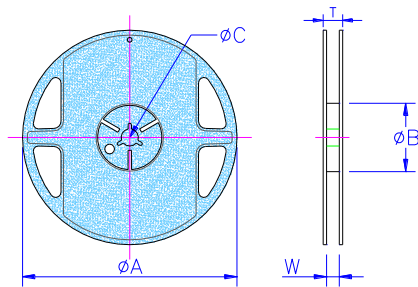
RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$  or Max. Operating Voltage whichever is lower.

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

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

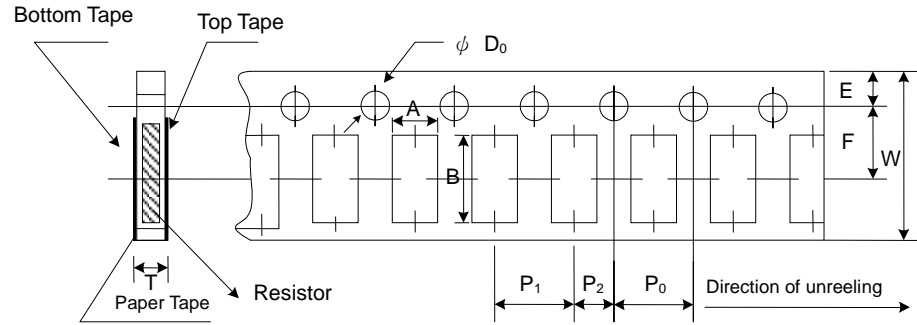
**■ Packaging**

Reel Specifications & Packaging Quantity



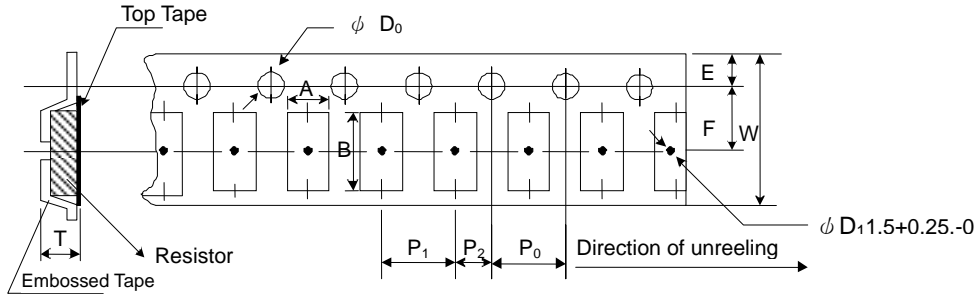
Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA (mm)	ΦB (mm)	ΦC (mm)	W (mm)	T (mm)	
AS01	Paper	10K	8mm	7 inch	178.5 $\pm$ 1.5	60 <sup>+1/-0</sup>	13.0 $\pm$ 0.2	9.0 $\pm$ 0.5	12.5 $\pm$ 0.5
AS02		20K		10 inch	254 $\pm$ 1.0	100 $\pm$ 0.5	13.0 $\pm$ 0.2	9.5 $\pm$ 0.5	13.5 $\pm$ 0.5
		40K		13 inch	330 $\pm$ 1.0	100 $\pm$ 0.5	13.0 $\pm$ 0.2	9.5 $\pm$ 0.5	13.5 $\pm$ 0.5
AS03	Paper	5K	8mm	7 inch	178.5 $\pm$ 1.5	60 <sup>+1/-0</sup>	13.0 $\pm$ 0.2	9.0 $\pm$ 0.5	12.5 $\pm$ 0.5
AS05		10K		10 inch	254 $\pm$ 1.0	100 $\pm$ 0.5	13.0 $\pm$ 0.2	9.5 $\pm$ 0.5	13.5 $\pm$ 0.5
AS06		20K		13 inch	330 $\pm$ 1.0	100 $\pm$ 0.5	13.0 $\pm$ 0.2	9.5 $\pm$ 0.5	13.5 $\pm$ 0.5
AS10									
AS0A	Embossed	4K	12mm	7 inch	178.5 $\pm$ 1.5	60 <sup>+1/-0</sup>	13.0 $\pm$ 0.5	13.0 $\pm$ 0.5	15.5 $\pm$ 0.5
AS12		8K		10 inch	250 $\pm$ 1.0	62 $\pm$ 0.5	13.0 $\pm$ 0.5	12.5 $\pm$ 0.5	16.5 $\pm$ 0.5

Paper Tape Specifications



Type	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P <sub>0</sub> (mm)	P <sub>1</sub> (mm)	P <sub>2</sub> (mm)	ΦD <sub>0</sub> (mm)	T (mm)
AS01	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	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	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



Type	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P <sub>0</sub> (mm)	P <sub>1</sub> (mm)	P <sub>2</sub> (mm)	ΦD <sub>0</sub> (mm)	T (mm)
AS0A	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 <sup>+0</sup>
AS12	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 <sup>+0</sup>

**■ Marking**

No Marking for 0201 and 0402

Jumper for all: Letter "0"

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

Example:

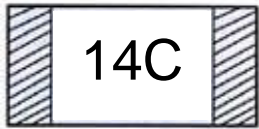
Resistance	5.6Ω	97.6Ω	100Ω	2.2KΩ	10KΩ	49.9KΩ	100KΩ
Marking	5R60	97R6	1000	2201	1002	4992	1003

5% for 0603/0805/1206/1210/2010/2512: 3 digits marking in E24

Example: 101=100Ω 102=1KΩ (1<sup>st</sup> and 2<sup>nd</sup> are E24 code and 3<sup>rd</sup> code is multiplier)

E24 code	10	11	12	13	15	16	18	20	22	24	27	30	33	36	39	43	47	51	56	62	68	75	82	91
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1% for 0603: 3 digits marking in E96



3 digits marking for Example: 14C=13K7Ω 13C=13K3Ω  
68B=4K99Ω 68X=49.9Ω

**Marking Table**

Code	E96	Code	E96	Code	E96	Code	E96		
01	100	25	178	49	316	73	562		
02	102	26	182	50	324	74	576		
03	105	27	187	51	332	75	590		
04	107	28	191	52	340	76	604		
05	110	29	196	53	348	77	619		
06	113	30	200	54	357	78	634		
07	115	31	205	55	365	79	649		
08	118	32	210	56	374	80	665		
09	121	33	215	57	383	81	681		
10	124	34	221	58	392	82	698		
11	127	35	226	59	402	83	715		
12	130	36	232	60	412	84	732		
13	133	37	237	61	422	85	750		
14	137	38	243	62	432	86	768		
15	140	39	249	63	442	87	787		
16	143	40	255	64	453	88	806		
17	147	41	261	65	464	89	825		
18	150	42	267	66	475	90	845		
19	154	43	274	67	487	91	866		
20	158	44	280	68	499	92	887		
21	162	45	287	69	511	93	909		
22	165	46	294	70	523	94	931		
23	169	47	301	71	536	95	953		
24	174	48	309	72	549	96	976		
Code	A	B	C	D	E	F	G	X	Y
Multiplier	10 <sup>0</sup>	10 <sup>1</sup>	10 <sup>2</sup>	10 <sup>3</sup>	10 <sup>4</sup>	10 <sup>5</sup>	10 <sup>6</sup>	10 <sup>-1</sup>	10 <sup>-2</sup>



**REVISION HISTORY**

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version B3	Jun 03, 2014	-	- Environmental Characteristics updated
Version B4	Jul 15, 2016	-	- Remove Material Description - Modify Storage Temperature
Version B5	Oct 31, 2016	-	- Increase High Power Rating Electrical Specifications
Version B6	Jan 12, 2018	-	- Modify Electrical Specifications
Version B7	May 20, 2019	-	- Modify TCR Test description
Version B8	Nov 15, 2019	-	- Upgrade AS06 / AS10 High power rating
Version B9	Jun 22, 2020	-	- Increase AS21/AS41/AS42/AS43 Specifications
Version C	Sep 4, 2020	-	- The separate array into another datasheet - Increase High Power Rating Electrical 0.5% Specification
Version C1	Feb 26, 2021	-	- Modify Bending Test description - Increase large reel packaging code - modify AS0A Embossed Plastic Tape B Specification - modify Soldering Condition (IPC/JEDEC J-STD-020)
Version C2	Nov 15, 2021	-	- Increase the shelf life description
Version C3	Feb 15, 2022	-	- Derating Curve changes the temperature range -0201 Operating temperature rises to 155°C
Version C4	Jun 15, 2022	-	- Modify Soldering Condition - AS03 Max. overload voltage updated
Version C5	Oct 30, 2024	-	- Modify AS01/AS02/AS03 Specifications (Production Site Change)
Version C6	Jan 01, 2025	-	- Modify AS01/AS02/AS03 Specifications (Production Site Change)