

## Data Sheet

Customer:

Product: Automotive Grade Anti-Sulfurated Chip Resistor – AS..A Series

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

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## Automotive Grade Anti-Sulfurated Chip Resistor



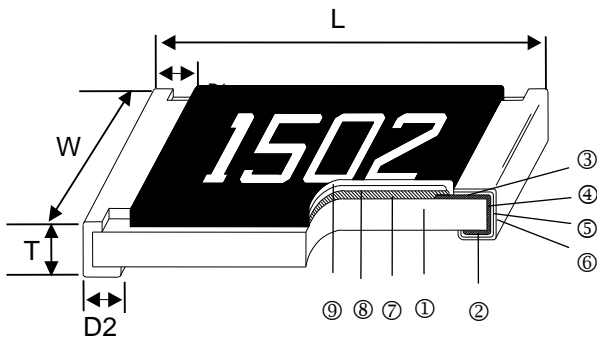
### Scope

- 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
- AEC-Q200 Qualified
- 100% CCD inspection
- MSL: Level 1
- Products with lead-free terminations meet EU RoHS requirements. Pb-glass contained in electrodes, resistors element and glass are exempted by RoHS.

### Construction



### Applications

- Automotive
- 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

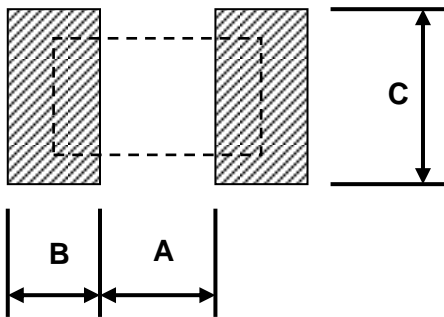
Type	Size (Inch)	L (mm)	W (mm)	T (mm)	D1 (mm)	D2 (mm)	Weight (g) (1000pcs)
AS01	0201	0.60±0.03	0.30±0.03	0.23±0.03	0.15±0.05	0.15±0.05	0.150
AS02	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.25±0.10	0.620
AS03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	2.042
AS05	0805	2.00±0.10	1.25±0.10	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	06	F	T	E	U	1002	A
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	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% or Jumper	T: 7" Taping Reel V: 10" Taping Reel W: 13" Taping Reel	E: ±100 F: ±200 - : No Specified (For Jumper)	: Standard* (See Remark) W: 1/8W V: 1/4W O: 1/3W U: 1/2W Q: 3/4W T: 1W S: 2W	1000: 100Ω 1002: 10KΩ 2201: 2.2KΩ 1003: 100KΩ R0R0: 0Ω	A: Automotive Grade

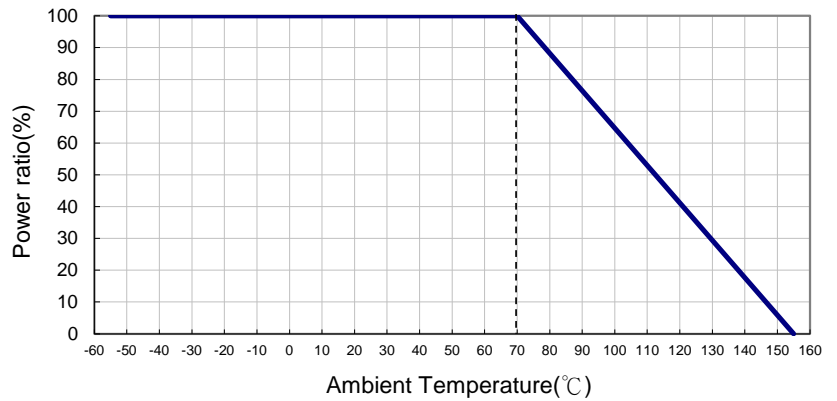
\*Remark: Standard part no need for power rating code.

**Recommend Land Pattern**

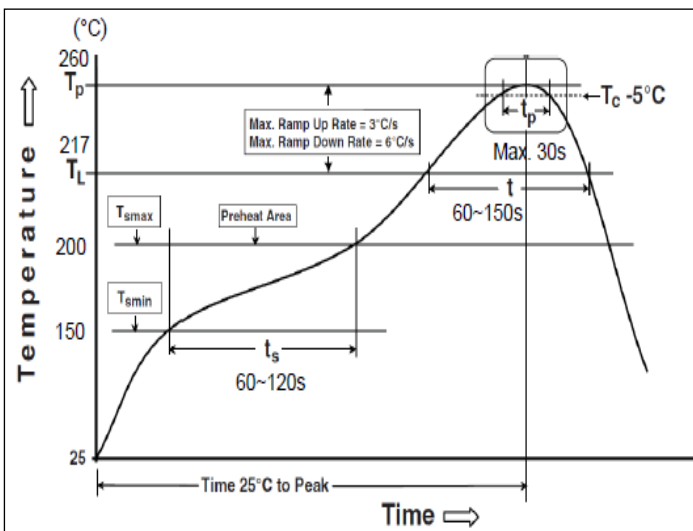


Type	A (mm)	B (mm)	C (mm)
AS01	0.30	0.25	0.30
AS02	0.50	0.45	0.60
AS03	0.90	0.60	0.90
AS05	1.20	0.70	1.30
AS06	2.00	0.90	1.60
AS10	2.00	0.90	2.80
AS0A	3.80	0.90	2.80
AS12	4.90	1.60	3.50

**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		75V	150V	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	75V	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
	1/2W				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
	1W				10Ω - 1MΩ		±100
AS0A (2010)	1W	200V	400V	1Ω - 9.76Ω		±200	
	1.25W			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.			<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> 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			<b>JIS C 5201-1 4.6</b> <b>IEC 60115-1 4.6</b> Max. Overload Voltage for 1 minute
Operational Life	±(1.0%+0.10Ω)	±(3.0%+0.10Ω)	<100mΩ	<b>MIL-STD-202 Method 108</b> 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	<b>MIL-STD-202 Method 103</b> 1000 hrs 85°C/85%RH 10% of operating power. (≤ 100V)

Item	Requirement			Test Method
	±1% and Below	±5%	Jumper	
High Temperature Exposure	±(1.0%+0.05Ω)	±(1.5%+0.10Ω)	<50mΩ	<b>MIL-STD-202 Method 108</b> at +155°C for 1000 hrs
Board Flex	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	<b>AEC-Q200-005</b> Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	>95% coverage			<b>JIS C 5201-1 4.17</b> <b>IEC 60115-1 4.17</b> <b>J-STD-002</b> 245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	<b>MIL-STD-202 Method 210</b> 260±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
Temperature Cycling	±(0.5%+0.05Ω)	±(1.5%+0.05Ω)	<50mΩ	<b>JESD22 Method JA-104</b> -55°C to +125°C, 1000 cycles
Mechanical Shock	±(0.25%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	<b>MIL-STD-202 Method 213</b> 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	<b>MIL-STD-202 Method 204</b> 5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(3%+0.05Ω)			<b>AEC-Q200-002</b> Human body model 0201: 0.5KV 0402/0603: 1KV 0805 and above: 2KV
Resistance to Solvents	No visible damage on appearance and marking.			<b>MIL-STD-202 Method 215</b> Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken			<b>AEC-Q200-006</b> Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board			<b>UL-94</b> V-0 or V-1 are acceptable. Electrical test not required.
Sulfur Test	△R±1%		<50mΩ	<b>EIA-977 (Condition B)</b> 105±2°C, no power rating for 750 hrs.

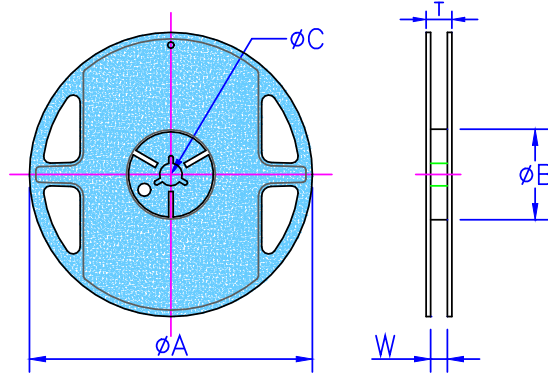
RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$  or Max. Operating Voltage whichever is lower.

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

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

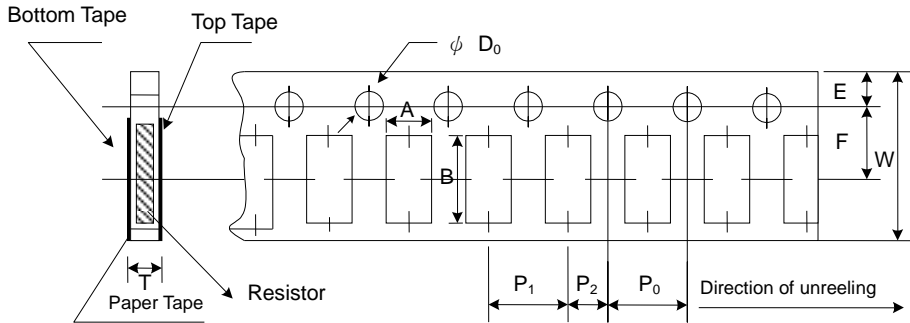
**■Packaging**

Reel Specifications & Packaging Quantity



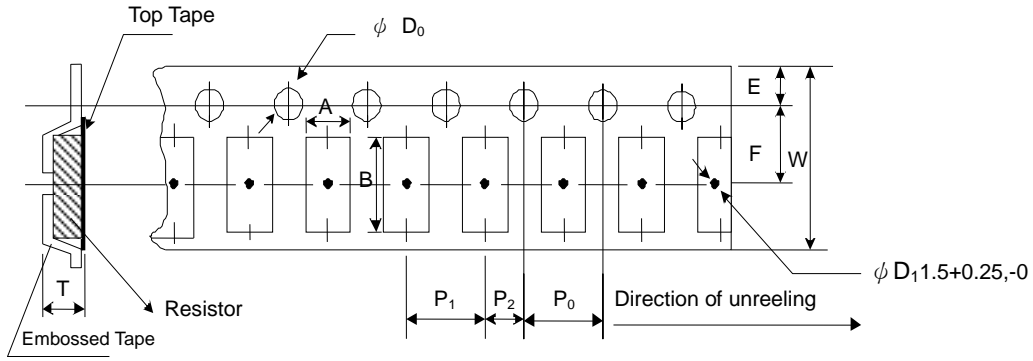
Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA (mm)	ΦB (mm)	ΦC (mm)	W (mm)	T (mm)
AS01 AS02	Paper	10K	7 inch	178.5±1.5	60 <sup>+1/-0</sup>	13.0±0.2	9.0±0.5	12.5±0.5
		20K	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		40K	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
AS03 AS05 AS06 AS10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

Paper Tape Specifications



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	8.0±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



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	2.8±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	3.5±0.10	6.7±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/ 0402

Jumper for all: Letter “0”

0.5%,1% for 0805/1206/1210/2010/2512: 4 digits marking

Example:

Resistance	100Ω	2.2KΩ	10KΩ	49.9KΩ	100KΩ
Marking	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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0.5%,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 A3	Jun 03, 2014	-	- Environmental Characteristics updated
Version A4	Apr 30, 2015	-	- Environmental Characteristics updated
Version A5	Jul 15, 2016	-	- Remove Material Description - Modify Storage Temperature - Increase Product Size 0201
Version A6	Jan 12, 2018	-	- Modify Sulfur Test for EIA-977 - Electrical Specifications updated
Version A7	May 20, 2019	-	- Modify TCR Test description - Features added 100% CCD inspection
Version A8	Jun 1, 2019	-	- Modify ESD Test description & Spec.
Version A9	Mar 10, 2021	-	- Modify Soldering Condition
Version B	Nov 15, 2021	-	- Increase the shelf life description
Version B1	Feb 15, 2022	-	- Derating Curve changes the temperature range -0201 Operating temperature rises to 155°C
Version B2	Jun 15, 2022	-	- Modify Soldering Condition - 0603 Max. Operating & Max. overload voltage updated
Version B3	Sep 22, 2022	-	- Modify Operational Life and Biased Humidity Spec.
Version B4	Jul 08, 2024	-	- Modify the descriptions in the Features - Add high power production range
Version B5	Aug 22, 2025	-	- Modify the descriptions in the Features - Modify 0402 Dimensions
Version B6	Jun 15, 2026	-	- Modify the descriptions in the Features - Environmental Characteristics updated - Upgrade 0402 Specifications - Add high power production range