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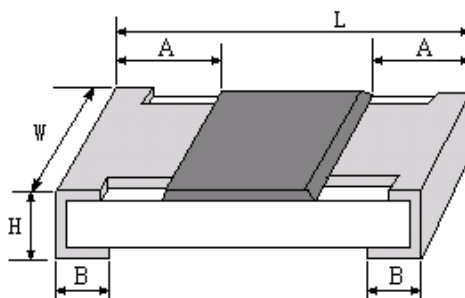
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File Name: AS SERIES $\pm 5\%$, $\pm 10\%$, $\pm 20\%$		Date	2016.08.26	Edition No.	1
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1.0 SCOPE:

This sheet is the statement of the Lead-Free Anti-surge Thick Film Chip Resistors specification that ROYALOHM productions can meet.

2.0 Ratings & Dimension:

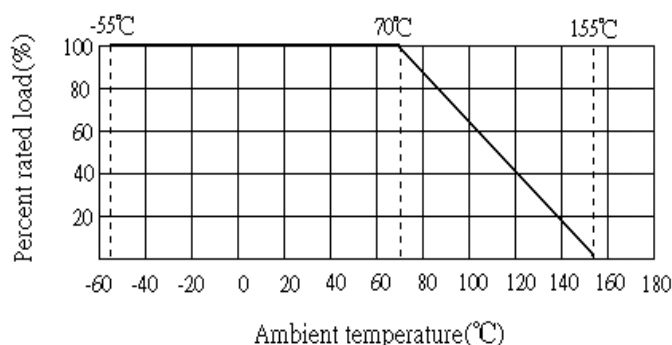


Type		AS03	AS05	AS06	AS07	AS10	AS12
Power Rating at 70°C		1/4W	1/2W	0.6W	3/4W	1.5W	2W
Dimension(mm)	L	1.60±0.10	2.00±0.15	3.10±0.15	3.10±0.10	5.00±0.10	6.35±0.10
	W	0.80±0.10	+0.15 1.25 -0.10	+0.15 1.55 -0.10	2.60±0.20	2.50±0.20	3.20±0.20
	H	0.45±0.10	0.55±0.10	0.55±0.10	0.55±0.10	0.55±0.10	0.55±0.10
	A	0.30±0.20	0.40±0.20	0.45±0.20	0.50±0.25	0.60±0.25	0.60±0.25
	B	0.30±0.20	0.40±0.20	0.45±0.20	0.50±0.20	0.50±0.20	1.80±0.25
Resistance range	±5%	1Ω~10MΩ	1Ω~10MΩ	1Ω~10MΩ	1Ω~10MΩ	1Ω~10MΩ	1Ω~10MΩ
	±10%	1Ω~10MΩ	1Ω~10MΩ	1Ω~10MΩ	1Ω~10MΩ	1Ω~10MΩ	1Ω~10MΩ
	±20%	1Ω~10MΩ	1Ω~10MΩ	1Ω~10MΩ	1Ω~10MΩ	1Ω~10MΩ	1Ω~10MΩ
Max Working Voltage		50V	150V	200V	200V	400V	500V
Max Overload Voltage		100V	300V	400V	500V	800V	1000V
Dielectric Withstanding Voltage		300V	500V	500V	500V	500V	500V
Operating Temperature		-55~+155°C					

3.0 Power Rating:

Resistors shall have a power rating based on continuous load operation at an ambient temperature from -55°C to 70°C. For temperature in excess of 70°C, the load shall be derate as shown in figure 1

Figure 1



3.1 Voltage rating:

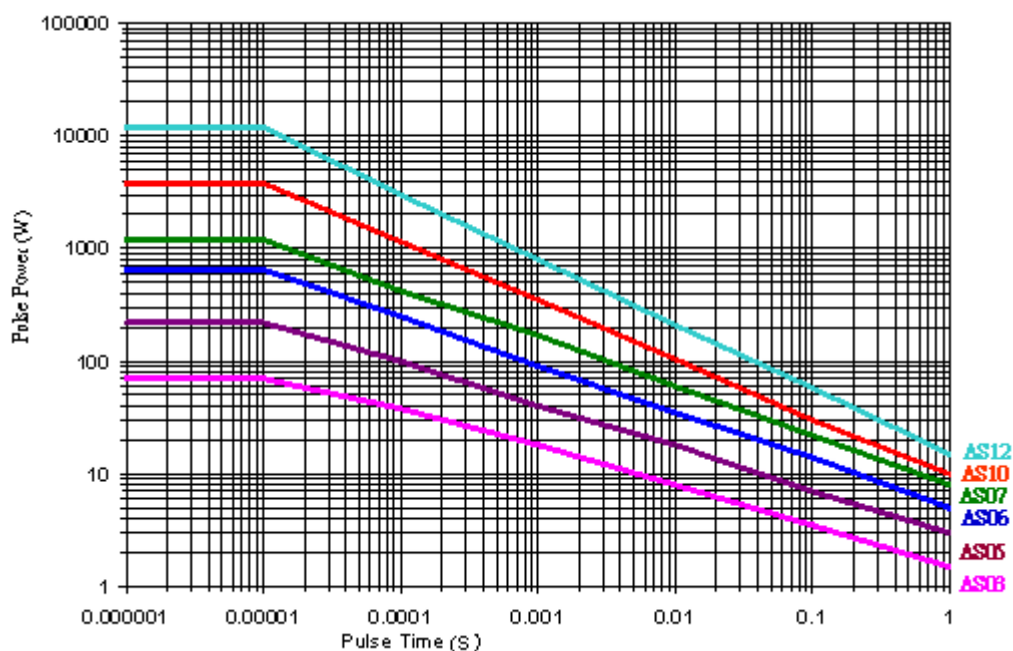
Resistors shall have a rated direct-current (DC) continuous working voltage or an approximate sine-wave root-mean-square (RMS) alternating-current (AC) continuous working voltage at commercial-line frequency and waveform corresponding to the power rating, as determined from the following formula:

$$RCWV = \sqrt{P * R}$$

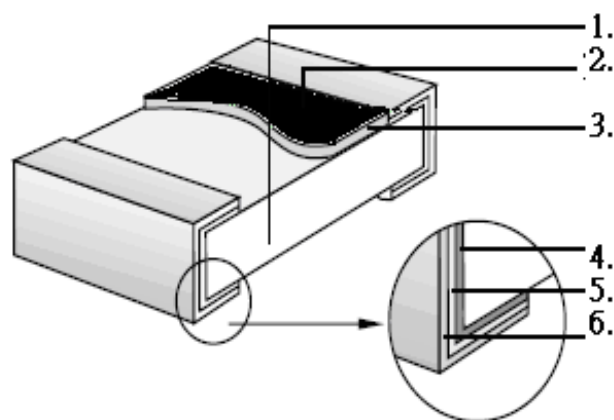
Where: RCWV= Rated dc or RMS ac continuous working voltage at commercial-line frequency and waveform (VOLT.)
P=Power Rating (WATT.)
R=Nominal Resistance (OHM)

In no case shall the rated dc or RMS ac continuous working voltage be greater than the applicable maximum value.

4.0 One-pulse Limiting Electric Power:



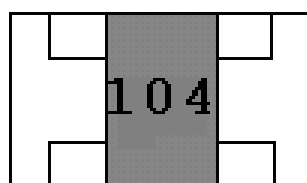
5.0 Structure:



- 1) High purity alumina substrate
- 2) Protective covering
- 3) Resistive covering
- 4) Termination inner (Ag)
- 5) Termination (between) Ni Barrier
- 6) Termination (outer) Sn

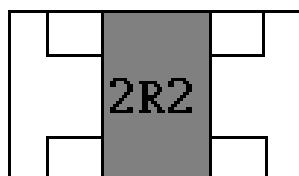
6.0 Marking:

(1) $\pm 5\%$ $\pm 10\%$ $\pm 20\%$ Tolerance: the first two digits are significant figures of resistance and the third denotes number of zeros following.



$$104 = 10 \times 10^4 \rightarrow 100\text{K}\Omega$$

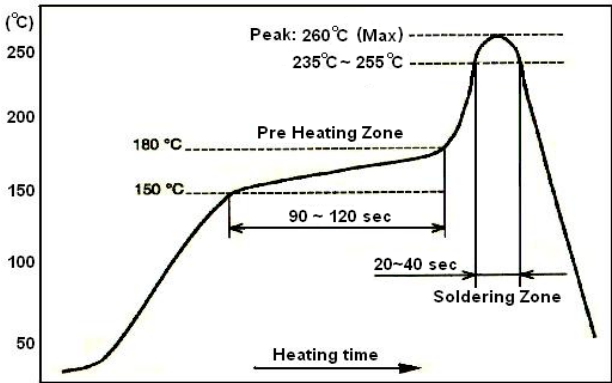
(2) $\pm 5\%$ $\pm 10\%$ $\pm 20\%$ Tolerance: below 10Ω Show as following, read alphabet "R" as decimal point.



$$2R2 \rightarrow 2.2\Omega$$

7.0 Performance Specification:

Characteristic	Limits	Test Method (JIS-C-5201&JIS-C-5202)
Temperature Coefficient	$\leq 10\Omega$: $\pm 400\text{PPM}/^\circ\text{C}$ $> 10\Omega$: $\pm 100\text{PPM}/^\circ\text{C}$	4.8 natural resistance changes per temp. Degree centigrade $\frac{R_2 - R_1}{R_1(T_2 - T_1)} \times 10^6 \text{ (PPM}/^\circ\text{C)}$ R ₁ : resistance value at room temp. (T ₁) R ₂ : resistance value at room temp. +100°C (T ₂) Test pattern: room temp. (T ₁), room temp. +100°C (T ₂)
Short-time overload	$\pm(1\% + 0.1\Omega)$	4.13 Permanent resistance change after the application of 2.5 times RCWV for 5 seconds.
Terminal bending	$\pm(1\% + 0.05\Omega)$	4.33 Twist of test board: Y/x = 3/90 mm for 60Seconds
Solderability	95% coverage Min.	4.17 Test temperature of solder: 245°C $\pm 3^\circ\text{C}$ dipping time in solder: 2-3 seconds.

Soldering temp reference	Electrical characteristics shall be satisfied. Without distinct deformation in appearance. (95 % coverage Min.)	<p><u>Wave soldering condition:</u> (2 cycles Max.)</p> <p>Pre-heat: 100~120°C, 30±5 sec.</p> <p>Suggestion solder temp.: 235~255°C, 10sec. (Max.)</p> <p>Peak temp.: 260°C</p> <p><u>Reflow soldering condition:</u> (2 cycles Max.)</p> <p>Pre-heat: 150~180°C, 90~120sec.</p> <p>Suggestion solder temp.: 235~255°C, 20~40sec.</p> <p>Peak temp.: 260°C</p>  <p>Temperature profile for avaluation</p> <p><u>Hand soldering condition:</u></p> <p>The soldering iron tip temperature should be less than 300°C and maximum contract time should be 5 sec.</p>															
Dielectric withstanding voltage	No evidence of flashover mechanical damage, arcing or insulation breaks done.	4.7 Clamped in the trough of a 90° metallic V-block and shall be tested at ac potential respectively specified in the type for 60-70 seconds															
Soldering heat	Resistance change rate is $\pm(1\%+0.05\Omega)$	4.18 Dipping the resistor into a solder bath having a temperature of $260^{\circ}\text{C}\pm 5^{\circ}\text{C}$ and hold it for 10 ± 1 seconds															
Temperature cycling	$\pm(1.0\%+0.05\Omega)$	<p>4.19 Resistance change after continuous five cycles for duty cycle specified below:</p> <table border="1"> <thead> <tr> <th>STEP</th><th>TEMPERATURE</th><th>TIME</th></tr> </thead> <tbody> <tr> <td>1</td><td>$-55^{\circ}\text{C}\pm 3^{\circ}\text{C}$</td><td>30 MINS</td></tr> <tr> <td>2</td><td>ROOM TEMP.</td><td>10 --- 15 MINS</td></tr> <tr> <td>3</td><td>$+155^{\circ}\text{C}\pm 2^{\circ}\text{C}$</td><td>30 MINS</td></tr> <tr> <td>4</td><td>ROOM TEMP.</td><td>10 --- 15 MINS</td></tr> </tbody> </table>	STEP	TEMPERATURE	TIME	1	$-55^{\circ}\text{C}\pm 3^{\circ}\text{C}$	30 MINS	2	ROOM TEMP.	10 --- 15 MINS	3	$+155^{\circ}\text{C}\pm 2^{\circ}\text{C}$	30 MINS	4	ROOM TEMP.	10 --- 15 MINS
STEP	TEMPERATURE	TIME															
1	$-55^{\circ}\text{C}\pm 3^{\circ}\text{C}$	30 MINS															
2	ROOM TEMP.	10 --- 15 MINS															
3	$+155^{\circ}\text{C}\pm 2^{\circ}\text{C}$	30 MINS															
4	ROOM TEMP.	10 --- 15 MINS															
Load life in humidity	$\pm(3.0\%+0.1\Omega)$	7.9 Resistance change after 1,000 hours (1.5 hours "ON", 0.5 hour "OFF") at RCWV in a humidity chamber controlled at $40^{\circ}\text{C}\pm 2^{\circ}\text{C}$ and 90 to 95% relative humidity.															
Load life	$\pm(3.0\%+0.1\Omega)$	4.25.1 Permanent resistance change after 1,000 hours operating at RCWV with duty cycle 1.5 hours "ON", 0.5 hour "OFF" at $70^{\circ}\text{C}\pm 2^{\circ}\text{C}$ ambient.															
Humidity (steady state)	$\pm(3.0\%+0.1\Omega)$	4.24 Temporary resistance change after 240 hours exposure in a humidity test chamber controlled at $40\pm 2^{\circ}\text{C}$ and 90-95% relative humidity,															

8.0 Explanation of Part No. System:

The standard Part No. includes 14 digits with the following explanation:

8.1 This is to indicate the Lead Free Anti-Surge Chip Resistor size.

Example: AS03 、AS05 、AS06 、AS07、 AS10、 AS12

8.2 5th~6th digits:

8.2.1 This is to indicate the wattage or power rating .To distinguish the size and the number, the following codes are used; and please refer to the following chart for details:

W=Normal Size; S=Small Size; And “1”~“16”as Hexadecimal:

1/16W~1W:

Wattage	3/4	1/2	1/3	1/4	1/5	1/8	1/10	1/16	1/20W
Normal Size	07	W2	W3	W4	W5	W8	WA	WG	WM

8.2.2 For power rating less than 1 watt, the 5th digit will be the letters W or S to represent the size required & the 6th digit will be a number or a letter code.

Example: WA=1/10W; S4=1/4W-S

8.3 The 7th digit is to denote the Resistance Tolerance. The following letter code is to be used for indicating the standard Resistance Tolerance.

F=±1%

G=±2%

J=±5%

K= ±10%

8.4 The 8th to 11th digits is to denote the Resistance Value.

8.4.1 For the standard resistance values of 5%、 10%&20% series tolerance, the 8th digit is “0”,the 9th & 10th digits are to denote the significant figures of the resistance and the 11th digit is the number of zeros following;

8.4.2 The following number s and the letter codes are to be used to indicate the number of zeros in the 11th digit:

0=10⁰

1=10¹

2=10²

3=10³

4=10⁴

5=10⁵

6=10⁶

J=10⁻¹

K=10⁻²

L=10⁻³

M=10⁻⁴

8.4.3 The 12th, 13th & 14th digits.

The 12th digit is to denote the Packaging Type with the following codes:

C=Bulk in (Chip Product)

T=Tape/Reel

8.4.4 The 13th digit is normally to indicate the Packing Quantity of Tape/Box & Tape/Reel packaging types. The following letter code is to be used for some packing quantities:

1=1000pcs

2=2000pcs

3=3000pcs

4=4000pcs

5=5000pcs

C=10000pcs

D=20000pcs

E=15000pcs

Chip Product:

BD=B/B-20000pcs

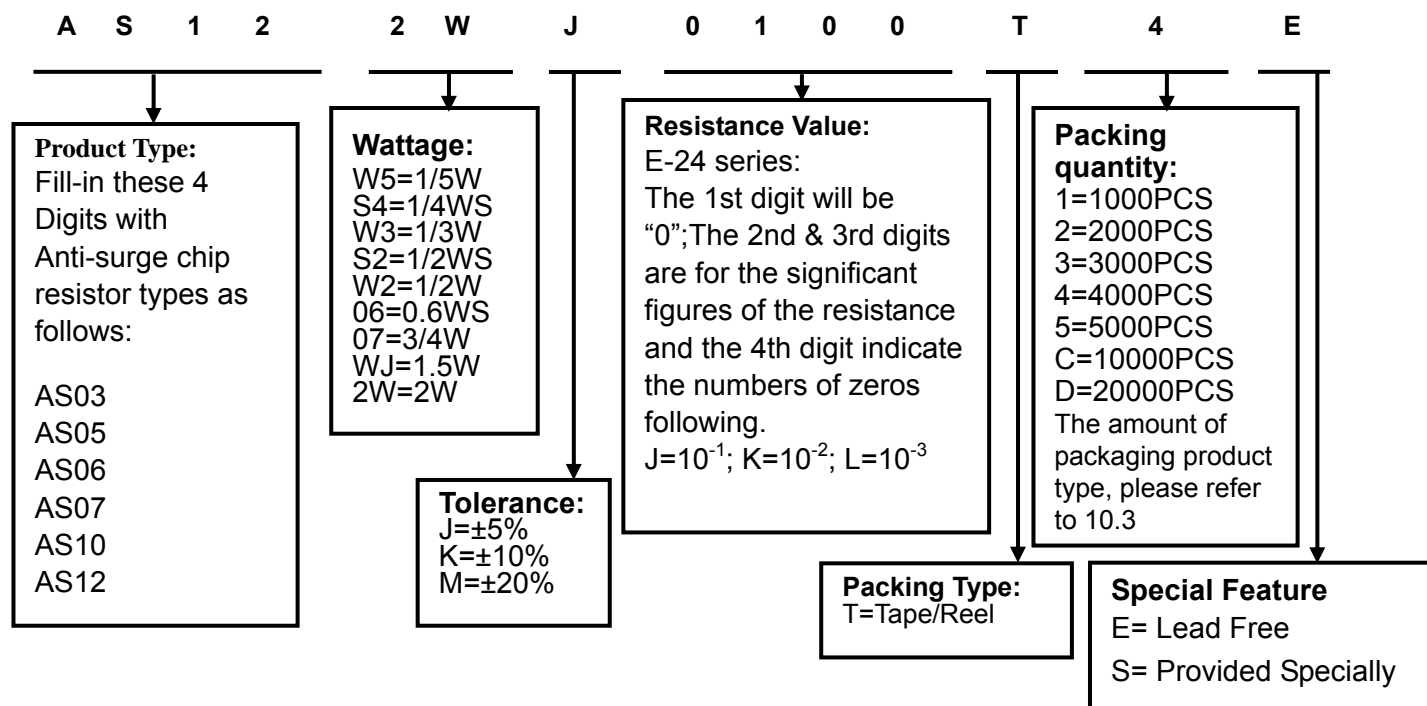
TC=T/R-10000pcs

8.4.5 For some items, the 14th digit alone can use to denote special features of additional information with the following codes:

E= For “Environmental Protection, Lead Free type” .

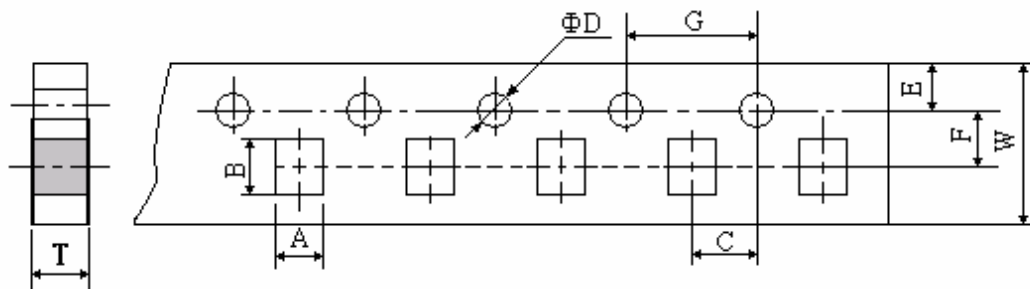
S= Provided Specially.

9.0 Ordering Procedure (Example: AS12 2W ±5% 10Ω T/R-4000)



10.0 Packaging:

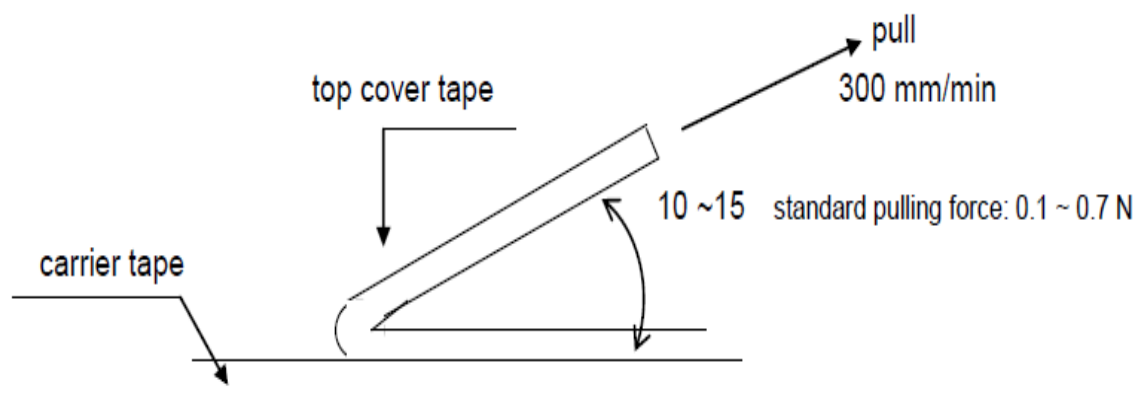
10.1 Tapping Dimension:



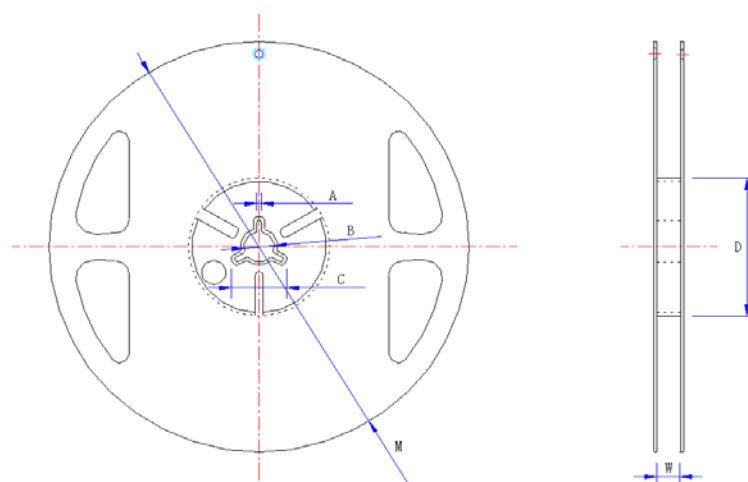
Unit: mm

TYPE	A ± 0.2	B ± 0.2	C ± 0.05	ϕD + 0.1 - 0	E ± 0.1	F ± 0.05	G ± 0.1	W ± 0.2	T ± 0.10
AS03	1.10	1.90	2.00	1.50	1.75	3.50	4.00	8.00	0.67
AS05	1.65	2.40	2.00	1.50	1.75	3.50	4.00	8.00	0.81
AS06	2.00	3.60	2.00	1.50	1.75	3.50	4.00	8.00	0.81
AS07	2.80	3.50	2.00	1.50	1.75	3.50	4.00	8.00	0.75
AS10	2.80	5.40	2.00	1.50	1.75	5.50	4.00	12.00	0.75
AS12	3.50	6.70	2.00	1.50	1.75	5.50	4.00	12.00	1.00

10.2 Peeling Strength of Top Cover Tape:



10.3 Dimension:



Unit: mm

Type	Taping	Size	A \pm 0.5	B \pm 0.5	C \pm 0.5	D \pm 1	M \pm 2	W \pm 1
AS03	Paper	5000pcs reel	2.0	13.0	21.0	60.0	178.0	10.0
AS05			2.0	13.0	21.0	60.0	178.0	10.0
AS06			2.0	13.0	21.0	60.0	178.0	10.0
AS07			2.0	13.0	21.0	60.0	178.0	10.0
AS10	Embossed	4000pcs reel	2.0	13.0	21.0	60.0	178.0	13.8
AS12		4000pcs reel	2.0	13.0	21.0	60.0	178.0	13.8

11.0 Precaution for storage/Transportation:

11.1 Environment Related Substance.

This product complies to EU RoHS directive, EU PAHs directive, EU PFOS directive and Halogen free.

11.2 Ozone layer depleting substances.

Ozone depleting substances are not used in our manufacturing process of this product.

This product is not manufactured using Chloro fluorocarbons (CFCs), Hydrochlorofluorocarbons (HCFCs), Hydrobromofluorocarbons (HBFCs) or other ozone depleting substances in any phase of the manufacturing process.

11.3 Storage Condition

The performance of these products, including the solderability, is guaranteed for a year from the date of arrival at your company, provided that they remain packed as they were when delivered and stored at a temperature of 5°C~35°C and a relative humidity of 25%~75%RH.

Even within the above guarantee periods, do not store these products in the following conditions. Otherwise, their electrical performance and/or solderability may be deteriorated, and the packaging materials (e.g. taping materials) may be deformed or deteriorated, resulting in mounting failures.

1. In salty air or in air with a high concentration of corrosive gas, such as Cl₂, H₂S, NH₃, SO₂, or NO₂.
2. In direct sunlight.