

DATA SHEET

Wide Terminal Thick Film Chip Resistor

CR Series

1% TO 5%, TCR ± 100 TO ± 200

SIZE: 46W

RoHs Compliant



WIDE TERMINAL THICK FILM CHIP RESISTOR

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DS-ENG-003

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1. SCOPE

- 1.1 This specification is applicable to lead and halogen free CR46W series wide terminal thick film chip resistors.
- 1.2 Lead free products mean lead free termination meets RoHS requirement. Pb contained in glass material of resistor element is exempted by RoHS directive.
- 1.3 The products are tested and passed based on the test conditions and methods defined in AEC-Q200.

2. PART NUMBERING SYSTEM

Part Numbering is made in accordance with the following system:

CR	46W	-	XXXX	-	F	E
----	-----	---	------	---	---	---

Type	Size (Inch / mm)	Nominal Resistance		Resistance Tolerance	Packaging
Wide Terminal Thick Film Chip Resistors	46W (1218/3146)	Resistors	3-Digit Ex. 10Ω = 100 4.7Ω = 4R7 JUMPER = 0	F = ±1% G = ±2% J = ±5%	E = 4,000 pcs Lead Free
			4-Digit Ex. 10.2Ω = 10R2 10KΩ = 1002 100mΩ = R100		

3. RATING

3.3 Rated Power

3.1.1. Resistor Rated Power: ≥ 1Ω & 0Ω

Type	Rated Power at 70°C	Maximum Working Voltage	Maximum Overload Voltage	T.C.R (ppm / °C)	Resistance Range		JUMPER Rated Current		JUMPER Resistance Value	
					F(±1%) E-24, E-96	G(±2%), J(±5%) E24	J (±5%)	F (±1%)	J (±5%)	F (±1%)
CR46W (1218)	1W	200V	500V	±200	1Ω ≤ R < 10Ω	1Ω ≤ R < 10Ω	2A	7A	50mΩ MAX.	20mΩ MAX.
				±100	10Ω ≤ R < 1MΩ	10Ω ≤ R < 1MΩ				
Operating Temperature Range				-55°C ~ +155°C						



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3.1.2 Resistor Rated Power: < 1Ω

Type	Rated Power at 70°C	Maximum Rated Current	Maximum Overload Current	T.C.R (ppm / °C)	Resistance Tolerance
					F(±1%), G(±2%), J(±5%) E-24 , E-96
CR46W (1218)	1W	10A	25A	±2000	10m Ω ≤ R < 30mΩ
				±1000	30m Ω ≤ R < 56mΩ
				±700	56m Ω ≤ R < 180mΩ
				±250	180m Ω ≤ R < 1Ω
Operating Temperature Range				-55°C ~ +155°C	

3.2 Power Derating Characteristics

Rated Power shall be the load power corresponding to nominal wattage suitable for continuous use at 70°C ambient temperature. In case the ambient temperature exceeds 70°C, reduce the load power in accordance with Derating curve in Fig. 1.

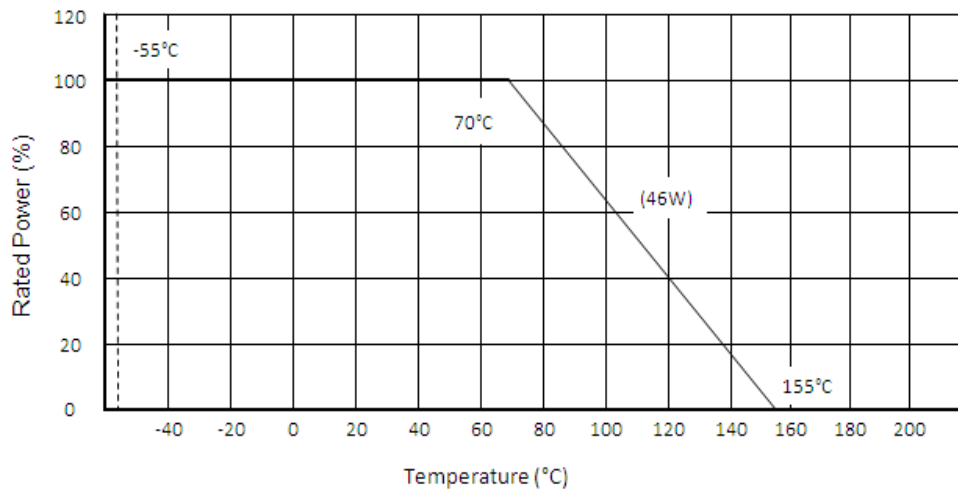


Fig.1 Power Derating Characteristics

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3.3 Standard Atmospheric Condition

Unless otherwise specified, the standard range of atmospheric conditions for making measurements and tests is as follows:

Ambient Temperature = + 5°C to +35°C

Relative Humidity = < 85% RH

Air Pressure = 86 kPa to 106kPa

If there may be any doubt about the results, measurement shall be made within the following limits:

Ambient Temperature = 20 ± 2°C

Relative Humidity = 60 to 70% RH

Air Pressure = 86 kPa to 106kPa

3.4 Operating Temperature Range -55°C to +155°C

3.5 Storage Temperature Range -5°C to + 40°C

3.6 Flammability Rating Tested in accordance to UL-94, V-0

3.7 Moisture Sensitivity Level Rating: Level 1

3.8 Product Assurance ASJ resistor shall warranty 24 months from the date of shipment.

3.9 ASJ resistors are RoHS compliance in accordance to RoHS Directive 2011/65/EU.

3.10 Rated Voltage

The rated voltage is calculated from the rated power and nominal resistance by the following formula:

$$E = \sqrt{P \cdot R}$$

Where E : Rated Voltage (V)

P : Rated Power (W)

R : Nominal Resistance (Ω)

In case the value calculated by the formula exceeds the maximum working voltage given in Section 3.1.2, the maximum working voltage in Section 3.1.2 shall be regarded as the rated voltage.

3.11 All product, product specifications and data are subject to change without notice to improve reliability, function or design or otherwise.



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4. MARKING ON PRODUCT

The nominal resistance shall be marked on the surface of each resistor

Part Number	Color	Marking on Product
CR46W (1218)	Light Yellow	1) Tolerance : $\pm 1.0\%$ (F) ° Four Numerals Marking (E96 Series) 2) Tolerance; $\pm 2.0\%$ (G), $\pm 5.0\%$ (J) Three Numerals Marking

4.1 Numeric Numbering

4.1.1 5% Tolerance: *Three Numerals Marking*

First 2 digits are significant figures, third digit is number of zeros. Letter R is decimal point.

Example

Nominal Resistance	Marking	Remarks
1 Ω	1R0	$1 \times 10^0 = 1$
10 Ω	100	$10 \times 10^0 = 10$
100 Ω	101	$10 \times 10^1 = 100$
4.7K Ω	472	$47 \times 10^2 = 4700$
47K Ω	473	$47 \times 10^3 = 47000$
470K Ω	474	$47 \times 10^4 = 470000$
4.7M Ω	475	$47 \times 10^5 = 4700000$

4.1.2 1% Tolerance : *Four Numerals Marking*

First 3 digits are significant figures, fourth digit is number of zeros.

Examples:

Nominal Resistance	Marking	Remarks
1 Ω	1R00	$1 \times 10^0 = 1$
10 Ω	10R0	$10 \times 10^0 = 10$
100 Ω	1000	$100 \times 10^0 = 100$
4.7K Ω	4701	$470 \times 10^1 = 4700$
47K Ω	4702	$470 \times 10^2 = 47000$
470K Ω	4703	$470 \times 10^3 = 470000$
1M Ω	1004	$100 \times 10^4 = 1000000$

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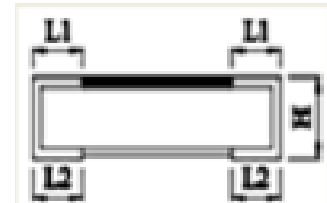
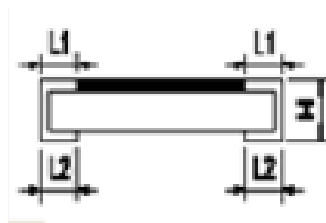
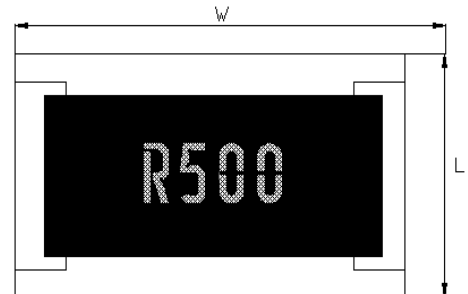
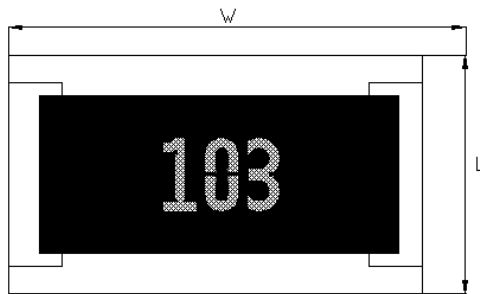
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5. DIMENSIONS, CONSTRUCTIONS AND MATERIALS

5.3 Resistance Range: $\geq 1\Omega$ & 0Ω (Picture 1)

5.3 Resistance Range: $< 1\Omega$ (Picture 2)



Unit: Inches (Millimeters)

CODE	L	W	H	I ₁	I ₂
CR46W (1218)	0.122±0.004 (3.10±0.10)	0.181±0.008 (4.60±0.20)	0.022±0.004 (0.55±0.10)	0.018±0.009 (0.45±0.25)	0.016±0.008 (0.40±0.20)

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6. ELECTRICAL CHARACTERISTICS AND TEST CONDITIONS

CHARACTERISTICS		SPECIFICATIONS		TESTING CONDITIONS
		Zero Ohm	Resistance	
1	Resistance Temperature Coefficient	NA	Refer Section 3.5 Table 1	<p>JIS-C5201-1 4.8 Measure R at $t_0=25^{\circ}\text{C}$ and after 45 minutes measure R at $t=125^{\circ}\text{C}$. Calculation : $\text{TCR (ppm}/^{\circ}\text{C)} = \frac{R-R_0}{R_0} * \frac{1}{t-t_0} * 10^6$</p>
2	Short Time Overload	$\leq 50 \text{ m}\Omega$ For 5% and $\leq 20 \text{ m}\Omega$ For 1% tolerance resistor	1. Resistance Range: $\geq 1\Omega$ 1%: $\pm(1.0\%+0.05\Omega)$ 2%, 5%: $\pm(2.0\%+0.10\Omega)$ 2. Resistance Range: $< 1\Omega$ 1%, 2%, 5%: • $\pm(2.0\%+0.001\Omega)$	<p>JIS C 5201-1 4.13 Apply at 2.5 times rated voltage for 5 seconds and release 30s Applied voltage shall not exceed maximum overload voltage or current.</p>
3	Insulation Resistance	$> 10\text{G } \Omega$		<p>JIS C 5201-1 4.6 Apply (100 \pm15) VDC for 1 minute. Measured the insulation resistance between electrodes and insulating enclosure or between electrodes and base.</p>
4	Dielectric Withstanding Voltage	No short or burned on the appearance.		<p>JIS-C5201-1 4.7 Put the resistor in the fixture, add VAC (see SPEC below) in \pm Terminal for. CR46W apply 500 VAC 1minute.</p>



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5	Intermittent Overload	$\leq 50 \text{ m}\Omega$ For 5% and $\leq 20 \text{ m}\Omega$ For 1% tolerance resistor	1. Resistance Range: $\geq 1\Omega$ • $\pm(5.0\%+0.10\Omega)$ 2 Resistance Range: $< 1\Omega$ • $\pm(5.0\%+0.001\Omega)$	JIS C 5201-1 4.13 Apply 4 times rated voltage for 1 secs ON and 25 secs OFF. Total 10 000 ⁺⁴⁰⁰ ₋₀ cycles. Applied voltage/current shall not exceed maximum intermittent overload voltage/ current.													
		No evidence of mechanical damage. No short or burned on the appearance.															
		<table border="1"> <tr> <td>Type</td> <td>CR46W</td> </tr> <tr> <td>Jumper</td> <td></td> </tr> <tr> <td>5%</td> <td>6A</td> </tr> <tr> <td>1%</td> <td>10A</td> </tr> </table>		Type	CR46W	Jumper		5%	6A	1%	10A						
Type	CR46W																
Jumper																	
5%	6A																
1%	10A																
6	Noise level	NA	<table border="0"> <tr> <td>R<100Ω</td> <td>-10Db(0.32μv/v)</td> </tr> <tr> <td>100Ω≤R<1KΩ</td> <td>0 Db(1.0μv/v)</td> </tr> <tr> <td>1KΩ≤R<10KΩ</td> <td>10 Db(3.2μv/v)</td> </tr> <tr> <td>10KΩ≤R<100KΩ</td> <td>15 Db(5.6μv/v)</td> </tr> <tr> <td>100KΩ≤R<1M</td> <td>20 Db(10μv/v)</td> </tr> <tr> <td>1M≤R</td> <td>30 Db(32μv/v)</td> </tr> </table>	R<100Ω	-10Db(0.32μv/v)	100Ω≤R<1KΩ	0 Db(1.0μv/v)	1KΩ≤R<10KΩ	10 Db(3.2μv/v)	10KΩ≤R<100KΩ	15 Db(5.6μv/v)	100KΩ≤R<1M	20 Db(10μv/v)	1M≤R	30 Db(32μv/v)	JIS C 5201-1 4.12 $V_0(\text{Db}) = T-f(T-S)-D$	
R<100Ω	-10Db(0.32μv/v)																
100Ω≤R<1KΩ	0 Db(1.0μv/v)																
1KΩ≤R<10KΩ	10 Db(3.2μv/v)																
10KΩ≤R<100KΩ	15 Db(5.6μv/v)																
100KΩ≤R<1M	20 Db(10μv/v)																
1M≤R	30 Db(32μv/v)																
7	Core Body Strength	$\leq 50 \text{ m}\Omega$ For 5% and $\leq 20 \text{ m}\Omega$ For 1% tolerance resistor	1. Resistance Range: $\geq 1\Omega$ • $\pm(1.0\%+0.05\Omega)$ 2. Resistance Range: $< 1\Omega$ • $\pm(1.0\%+0.001\Omega)$	JIS-C5201-1 4.15 Applied R0.5 test probe at its central part then pushing 10N (1.02 Kgf) force on the sample for 10 sec.													
		No evidence of mechanical damage. No side conductive peeling off															
8	Terminal Strength	Test 1: No evidence of mechanical damage. Test 2: Type $\geq 5\text{N}$	JIS-C5201-1 4.16/ AEC Q200-005 Test 1: The resistor mounted on the board applied 5N pushing force on the sample rear for 10sec Test 2: The resistor mounted on the board, slowly add force on the sample rear until the sample termination is breakdown.														



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9	Resistance to Solvent	$\leq 50 \text{ m}\Omega$ For 5% and $\leq 20 \text{ m}\Omega$ For 1% tolerance resistor	1. Resistance Range: $\geq 1\Omega$ • $\pm(0.5\%+0.05\Omega)$ 2. Resistance Range: $< 1\Omega$ • $\pm(1.0\%+0.001\Omega)$	JIS-C5201-1 4.29 The tested resistor be immersed into isopropyl alcohol of 20~25 °C for 5 minutes, then the resistor is left in the room for 48 hrs, and measured its resistance variance rate.
		No evidence of mechanical damage. No G2 over coating and Sn layer by leaching.		
10	Resistance to soldering heat	$\leq 50 \text{ m}\Omega$ For 5% and $\leq 20 \text{ m}\Omega$ For 1% tolerance resistor	Test item 1: (1).Variance rate on resistance 1.Resistance Range: $\geq 1\Omega$ $\Delta R\% = \pm(1.0\%+0.05\Omega)$ 2.Resistance Range: $< 1\Omega$ $\Delta R\% = \pm(1.0\%+0.001\Omega)$ (2).No evidence of electrode damage. No side conductive peeling off. Test item 2: (1).Solder coverage over 95%. (2).The underlying material (such as ceramic) shall not be visible at the crest corner area of the electrode. Test item 3: (1).Variance rate on resistance 1.Resistance Range: $\geq 1\Omega$ $\Delta R\% = \pm(1.0\%+0.05\Omega)$ 2.Resistance Range: $< 1\Omega$ $\Delta R\% = \pm(1.0\%+0.001\Omega)$ (2).No evidence of electrode damage. No side conductive peeling off.	JIS-C5201-1 4.18 - Test method 1 (Solder pot test): The tested resistor be immersed into molten solder of 260+5/-0°C for 10 seconds. Then the resistor is left in the room for 1 hour. - Test method 2 (Solder pot test): The tested resistor is immersed into molten solder of 260+5/-0°C for 30 seconds. Then the resistor is left as placed under microscope to observe its solder area. - Test method 3 (Electric iron test): Preheating temperature : 350±10°C Electric iron preheating time : 3+1/-0 sec Preheating the electric iron on electrode termination, as after that step placed the iron over 60 min. and measured its resistance variance rate.



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11	Resistance to Solvent	$\leq 50 \text{ m}\Omega$ For 5% and $\leq 20 \text{ m}\Omega$ For 1% tolerance resistor	1. Resistance Range: $\geq 1\Omega$ • $\pm(0.5\%+0.05\Omega)$ 2. Resistance Range: $<1\Omega$ • $\pm(1.0\%+0.001\Omega)$	JIS-C5201-1 4.29 The tested resistor be immersed into isopropyl alcohol of 20~25 °C for 5 minutes, then the resistor is left in the room for 48 hrs, and measured its resistance variance rate.
12	Solderability	Solder coverage over 95%		JIS-C5201-1 4.17 Preconditioning Put the tested resistor in the apparatus of PCT, at a temperature of 105 °C, humidity of 100% RH, and pressure of $1.22 \times 10^5 \text{ Pa}$ for a duration of 4 hours. Then after left the tested resistor in room temperature for 2 hours or more. Test method: The resistor be immersed into solder pot in temperature $235 \pm 5^\circ\text{C}$ for 2sec, then the resistor is left as placed under microscope to observed its solder area.
13	Vibration	$\leq 50 \text{ m}\Omega$ For 5% and $\leq 20 \text{ m}\Omega$ For 1% tolerance resistor	1. Resistance Range: $\geq 1 \Omega$ 1%: $\pm(0.5\%+0.05\Omega)$ 2%, 5%: $\pm(1.0\%+0.05\Omega)$ 2. Resistance Range: $<1 \Omega$ 1%, 2%, 5%: $\pm(1.0\%+0.001\Omega)$ No evidence of mechanical damage.	JIS-C5201-1 4.22 The resistor shall be mounted by its terminal leads to the supporting terminals on the solid table. The entire frequency range: from 10 Hz to 55 Hz and return to 10 Hz, shall be transferred in 1 min. Amplitude :1.5 mm This motion shall be applied for a period of 2 hours in each 3 mutually perpendicular directions (a total of 6 hrs)
14	Resistance to dry Heat	$\leq 50 \text{ m}\Omega$ For 5% and $\leq 20 \text{ m}\Omega$ For 1% tolerance resistor	1. Resistance Range: $\geq 1\Omega$ 1%: $\pm(1.0\%+0.05\Omega)$ 2%, 5%: $\pm(2.0\%+0.10\Omega)$ 2. Resistance Range: $<1\Omega$ 1%, 2%, 5%: $\pm(1.0\%+0.001\Omega)$	JIS-C5201-1 4.25 Put tested resistor in chamber under temperature $155 \pm 5^\circ\text{C}$ for 1000 +48/-0 hours. Leaving the tested resistor in room temp. for 60 minutes, and measure its resistance variance rate.



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15	Loadlife	$\leq 50 \text{ m}\Omega$ For 5% and $\leq 20 \text{ m}\Omega$ For 1% tolerance resistor	1. Resistance Range: $\geq 1\Omega$ 1%: $\pm(0.5\%+0.05\Omega)$ 2%, 5%: $\pm(2.0\%+0.10\Omega)$ 2. Resistance Range: $<1\Omega$ 1%, 2%, 5% : $\pm(2.0\% + 0.001\Omega)$	<i>JIS-C5201-1 4.25</i> Put the tested resistor in chamber under temperature $70\pm 2^\circ\text{C}$ and load the rated voltage for 90 minutes on, 30 minutes off, total 1000 hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate.
16	Thermal Shock	$\leq 50 \text{ m}\Omega$ For 5% and $\leq 20 \text{ m}\Omega$ For 1% tolerance resistor	1. Resistance Range: $\geq 1\Omega$ 1%: $\pm(0.5\%+0.05\Omega)$ 2%, 5%: $\pm(1.0\%+0.05\Omega)$ 2. Resistance Range: $<1\Omega$ 1%, 2%, 5% : $\pm(1.0\%+0.001\Omega)$	<i>MIL-STD 202 Method 107</i> Put the tested resistor in the chamber under the Thermal Shock which shown in the following table shall be repeated 300 times consecutively. Then leaving the tested resistor in the room temperature for 1 hours, and measure its resistance variance rate.
17	Loading Life in Moisture	$\leq 50 \text{ m}\Omega$ For 5% and $\leq 20 \text{ m}\Omega$ For 1% tolerance resistor	1. Resistance Range: $\geq 1\Omega$ 1%: $\pm(0.5\%+0.05\Omega)$ 2%, 5%: $\pm(2.0\%+0.10\Omega)$ 2. Resistance Range: $<1\Omega$ 1%, 2%, 5% : $\pm(2.0\% + 0.001\Omega)$	<i>JIS-C5201-1 4.24</i> Put the tested resistor in the chamber under temperature $40\pm 2^\circ\text{C}$, relative humidity 90~95% and load the rated voltage for 90 minutes on, 30 minutes off, total 1000 hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate.
18	Low Temperature Operation	$\leq 50 \text{ m}\Omega$ For 5% and $\leq 20 \text{ m}\Omega$ For 1% tolerance resistor	1. Resistance Range: $\geq 1\Omega$ 1%: $\pm(0.5\%+0.05\Omega)$ 2%, 5%: $\pm(1.0\%+0.05\Omega)$ 2. Resistance Range: $<1\Omega$ 1%, 2%, 5% : $\pm(1.0\%+0.001\Omega)$	<i>MIL-R-55342D 4.7.4</i> put the tested resistor in the chamber at room temperature 25°C . Decreasing the temperature to -55°C and keep the temperature at -55°C for 1 hour. Then load the rated voltage for 45 minutes on, and 15 minutes off. Then leaving the tested resistor in room temperature for 8 ± 1 hours, and measure its resistance variance rate.



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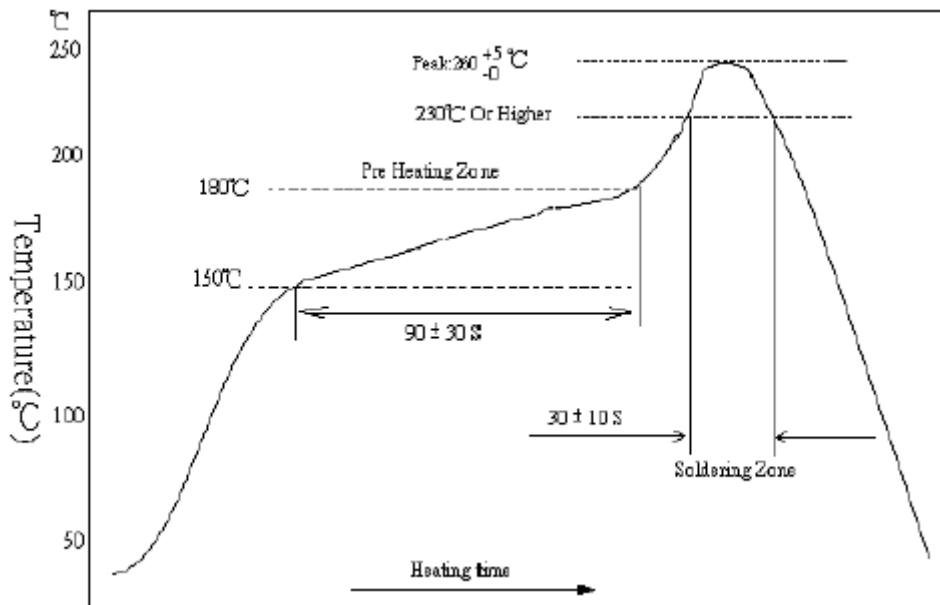
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19	Whisker	Max. 50µm	<p>JESD Standard NO.22A121 class 2.</p> <p>- Test item (Thermal Shock test):</p> <table border="1" data-bbox="991 349 1369 495"> <thead> <tr> <th colspan="2">Testing Condition</th> </tr> </thead> <tbody> <tr> <td>Minimum storage temperature</td> <td>-55+0/-10°C</td> </tr> <tr> <td>Maximum storage temperature</td> <td>85+10/-0°C</td> </tr> <tr> <td>Temperature-retaining time</td> <td>10 min.</td> </tr> <tr> <td>Number of temperature cycles</td> <td>1,500</td> </tr> </tbody> </table> <p>- Inspection: Inspect for whisker formation on specimens that underwent the acceleration test specified in sub clause 4.2, with a magnifier (stereo microscope) of about 40 or higher magnification. If judgment is hard in this method, use a scanning electron microscope (SEM) of about 1,000 or higher magnification.</p>	Testing Condition		Minimum storage temperature	-55+0/-10°C	Maximum storage temperature	85+10/-0°C	Temperature-retaining time	10 min.	Number of temperature cycles	1,500
Testing Condition													
Minimum storage temperature	-55+0/-10°C												
Maximum storage temperature	85+10/-0°C												
Temperature-retaining time	10 min.												
Number of temperature cycles	1,500												

6.1 Soldering Profile

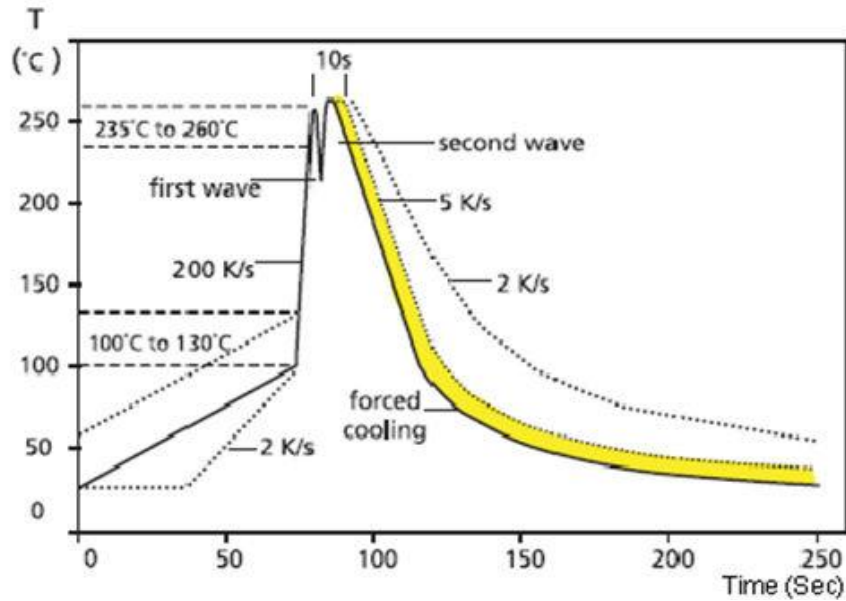
6.1.1 IR Reflow



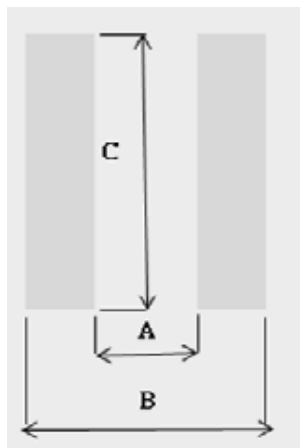
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6.1.2 Wave Soldering



7. LAND PATTERN DESIGN (For Reflow Soldering)



Units: Inches (millimeter)

TYPE	A	B	C
CR46W (1218)	0.0063 (1.6)	0.154 (3.9)	0.187 (4.75)

7.1 Plating Thickness:

Ni: $\geq 2\mu\text{m}$

Sn(Tin): $\geq 3\mu\text{m}$

Sn(Tin): Matte Sn

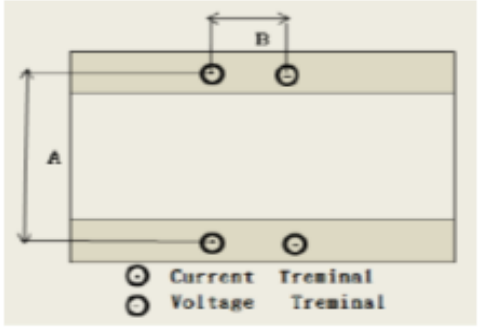
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8. MEASUREMENT POINT

Bottom Electrode	Unit: Inches(mm)		
 <p>○ Current Terminal ○ Voltage Terminal</p>	TYPE / DIM	A	B
	CR46W (1218)	0.112±0.002 (2.85±0.05)	0.065±0.002 (1.65±0.05)

9. STOCK PERIOD

10.1 The temperature condition must be controlled at $25\pm 5^{\circ}\text{C}$; the R.H. must be controlled at $60\pm 15\%$. The stock can maintain quality level in two years.

10. REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version. 1	February 13,2015		Initial Release



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