

FrelTec GmbH

Mathildenstr. 10A
82319 Starnberg
Germany

Ultra Low Ohm - Metal Strip Chip Resistor SMD

SMD

SPECIFICATION

Part
Number

048	06*	R010*	J*	T05**	D
Type	Size	Value	Tolerance	Packing	Power Rating
048 : SMD Ultra Low Ohm Metal Strip Chip Resistor	06 : 1206	The last digit is the multiplier	J : $\pm 5\%$	E04: Embossed tape and reel for 4k pcs (7"reel)	H: 1/2W
	20 : 2010	which denotes the number of zero following	G : $\pm 2\%$	E02 : Embossed tape and reel for 2k pcs (7"reel)	J: 1W
	25 : 2512		F : $\pm 1\%$	E01 : Embossed tape and reel for 1k pcs (7"reel)	K: 1,5W
	27 : 2725	Example:	D : $\pm 0,5\%$	E0A : Embossed tape and reel for 500pcs (7"reel)	L: 2W
	28 : 2728	97R6=			M: 3W
	45 : 4527	R100 = 0,1Ohm		** E04 for 1206 ($\geq 1,0m\Omega$) and 2512 (w/o 0,3m Ω) Embossed Plastic Type, 4mm Pitch	O: 3,5W
	46 : 4527S	R050 = 0,05Ohm		** E02 for 1206 (0,3 to 0,6m Ω) and 2010 Embossed Plastic Type, 4mm Pitch	P: 4W
		R001: 0,001Ohm		** E02 for 2512 (0,3m Ω) Embossed Plastic Type, 8mm Pitch	Q: 5W
		0M50 = 0,0005Ohm		** E01 for 2725 Embossed Plastic Type, 8mm Pitch	
		1M50: 0,0015Ohm		** E01 for 2728 Embossed Plastic Type, 12mm Pitch	
				** E0A for 4527 and 4527S Embossed Plastic Type, 12mm Pitch	

All products according to RoHS (2011/65/EU)
And according to REACH, status June 2015

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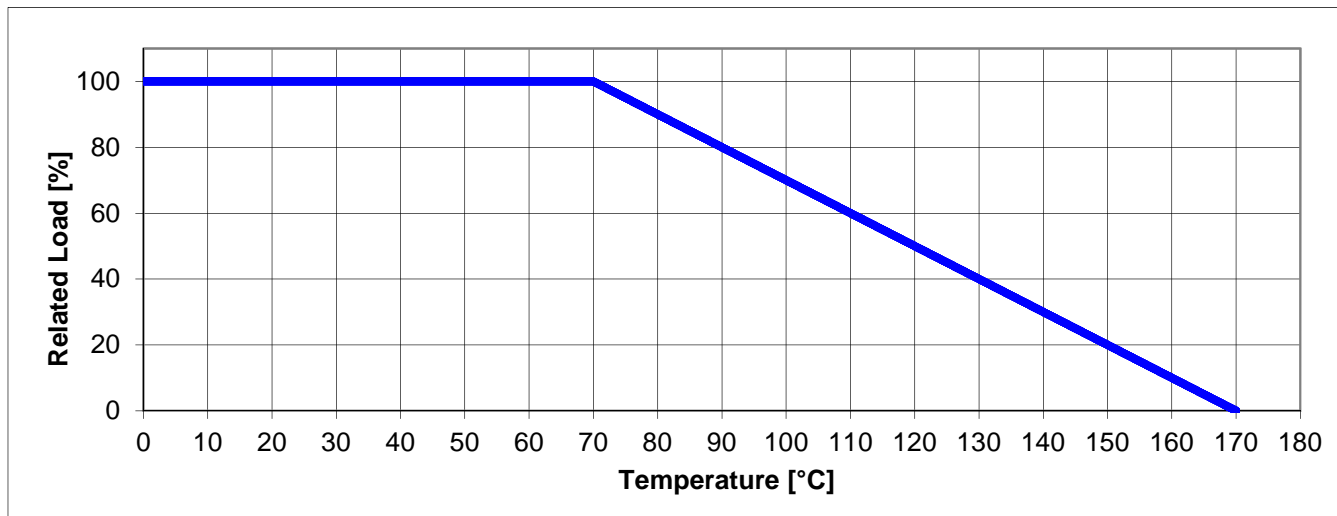
Material of Alloy

Type	Watts	Material	Resistance
1206	0,5	Copper-Manganese Alloy	$\leq 4,0\text{m}\Omega$
	1,0 1,5	Iron-Chromium Aluminium Alloy	$> 4,0\text{m}\Omega$
2010	1,0	Copper-Manganese Alloy	$\leq 4,0\text{m}\Omega$
		Iron-Chromium Aluminium Alloy	$> 4,0\text{m}\Omega$
2512	1,0	Copper-Manganese Alloy	$< 3,5\text{m}\Omega$
	1,5 2,0	Iron-Chromium Aluminium Alloy	$\geq 3,5\text{m}\Omega$
	3,0	Copper-Manganese Alloy	$\leq 2,5\text{m}\Omega$
		Iron-Chromium Aluminium Alloy	$\geq 3,0\text{m}\Omega$
2725	4,0	Copper-Manganese Alloy	$\leq 0,5\text{m}\Omega$
	5,0	Iron-Chromium Aluminium Alloy	$> 0,5\text{m}\Omega$
2728	3,0 3,5 4,0	Iron-Chromium Aluminium Alloy	All
4527	3,0	Copper-Manganese Alloy	$\leq 3,0\text{m}\Omega$
	5,0	Iron-Chromium Aluminium Alloy	$\geq 4,0\text{m}\Omega$

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Power Derating Curve

For resistors operated in ambient temperatures above 70 °C , power rating shall be derated in accordance with figure below, Operating Temperature Range : -55°C 170°C

**Current Rating:**

The following equation may be used to determine the DC (Direct Current) or AC (Alternating Current) currents (RMS, root mean square value) of normal rated power. However, if the result value exceeds the highest current of regulated standards, the highest normal rated power is to be used.

I= Rated Current [A]

P= Power rating [W]

R= Nominal resistance [Ω]

$$I = \sqrt{P/R}$$

048 Series

Standard Electrical Specifications

	Number of Terminals	Max. Rating Power	Max. Rating current	Max. Over-loaded Current	Operating Temp. Range	TCR (ppm/°C)	Resistance Range (mΩ)	
							D(±0,5%)	F(±1%) G(±2%) J(±5%)
04806 1206		0,5W	40,82A	81,64A		0,3 mΩ: ≤ ±450 0,5mΩ to 0,9mΩ: ≤ ±175 1,0mΩ to 15m,0Ω: ≤ ±75 15,1mΩ to 50,0mΩ: ≤ ±50	7,0 to 50,0	0,3 to 50,0
		1W	57,74A	115,47A		0,3 mΩ: ≤ ±450 0,5mΩ to 0,9mΩ: ≤ ±175 1,0mΩ to 15,0mΩ: ≤ ±75 15,1mΩ to 50,0mΩ: ≤ ±50	7,0 to 50,0	0,3 to 50,0
		1,5W	70,71A	141,42A		0,3mΩ: ≤ ±450 0,5mΩ to 0,9mΩ: ≤ ±175 1,0mΩ: ≤ ±75	-	0,3 to 1,0
04820 2010		1W	44,72A	89,44A		0,5mΩ to 0,9mΩ: ≤ ±100 1,0mΩ to 1,9mΩ: ≤ ±75 2,0mΩ to 6,9mΩ: ≤ ±50 7,0mΩ to 100mΩ: ≤ ±25	7,0 to 49	0,5 to 100
04825 2512	2	1W	57,74A	129,10A	-55°C ~ +170°C	0,3mΩ: ≤ ±150 0,5mΩ to 1,0mΩ: ≤ ±75 1,1mΩ to 3,0mΩ: ≤ ±50 3,1mΩ to 100mΩ: ≤ ±25	7,0 to 50,0	0,3 to 100
		1,5W	70,71A	158,11A		0,3mΩ: ≤ ±150 0,5mΩ to 1,0mΩ: ≤ ±75 1,1mΩ to 3,0mΩ: ≤ ±50 3,1mΩ to 75mΩ: ≤ ±25	7,0 to 50,0	0,3 to 75,0
		2W	81,65A	182,57A		0,3mΩ: ≤ ±150 0,5mΩ to 1,0mΩ: ≤ ±75 1,1mΩ to 2,5mΩ: ≤ ±50 2,6mΩ to 10,0mΩ: ≤ ±25	7,0 to 10,0	0,3 to 10,0
		3W	100,00A	173,21A		0,20mΩ: ≤ ±100 0,25mΩ to 3,0mΩ: ≤ ±50	-	0,20 to 3,0
04827 2725		4W	126,49A	252,95A		0,20mΩ: ≤ ±100 0,25mΩ to 0,5mΩ: ≤ ±50	-	0,20 to 0,5
		5W	158,11A	273,86A		4,0mΩ to 100mΩ: ≤ ±25 4,0mΩ to 100mΩ: ≤ ±25 4,0mΩ to 50mΩ: ≤ ±25	4,0 to 19,0 4,0 to 19,0 4,0 to 19,0	4,0 to 100 4,0 to 100 4,0 to 50,0
04828 2728		3W	27,39A	47,43A		0,5mΩ to 1,0mΩ: ≤ ±75 1,1mΩ to 20mΩ: ≤ ±50	7,0 to 20	0,5 to 20
		3,5W	29,58A	51,23A		0,5mΩ to 1,0mΩ: ≤ ±75 1,1mΩ to 200mΩ: ≤ ±50	7,0 to 120	0,5 to 200
		4W	31,62A	63,25A				
04846 4527S (without heat sink)		3W	77,5A	134A				
4845 4527		5W	100A	173A				

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Resistance Marking

All is 4 digit marking

“R” designates the decimal location in ohms, e.g.

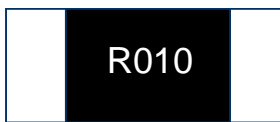
- For 1mΩ the product marking is R001;
- For 25mΩ the product marking is R025;
- For 100mΩ the product marking is R100.

“m” designates the decimal location in milliohms, e.g.

- For 0,25mΩ the product marking is 0m25;
- For 0,5mΩ the product marking is 0m50;
- For 5,5mΩ the product marking is 5m50;
- For 25,5mΩ the product marking is 25m5.

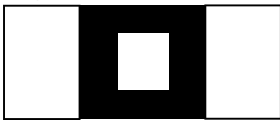
1206 series:

Above 1,0 mΩ & 0,3mΩ:

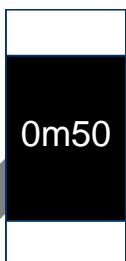


→ Ex. Resistance 10mΩ (for all 1206 products)

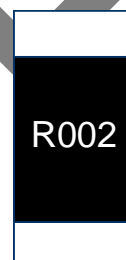
0,5~0,6 mΩ:(Square marking)
Recognize Top/Bottom side.



2010 series:



→ Ex. Resistance 0,5mΩ (when resistance below than 1mΩ)



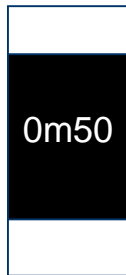
→ Ex. Resistance 2mΩ (when resistance below or equal than 3mΩ)



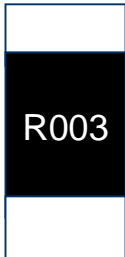
→ Ex. Resistance 5mΩ (when resistance greater than 3mΩ)

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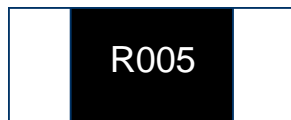
2512 series:



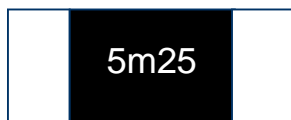
→ Ex. Resistance 0,5mΩ (when resistance below than 1mΩ)



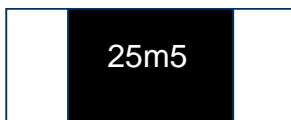
→ Ex. Resistance 3mΩ (when resistance below or equal than 4mΩ)



→ Ex. Resistance 5mΩ (when resistance greater than 4mΩ)

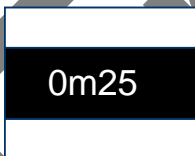


→ Ex. Resistance 5,25mΩ (when resistance greater than 4mΩ)

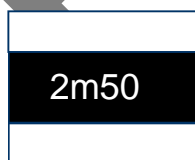


→ Ex. Resistance 25,5mΩ (when resistance greater than 4mΩ)

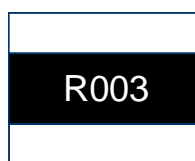
2725 series:



→ Ex. Resistance 0,25mΩ (or 0,25mΩ only)



→ Ex. Resistance 2,5mΩ (for 1,5mΩ and 2,5mΩ only)



→ Ex. Resistance 3mΩ (for 1m, 2m and 3mΩ only)

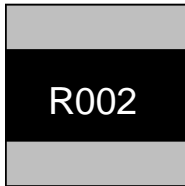
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2728 series:

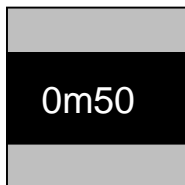


Ex. Resistance 5mΩ (for all 2728 products)

4527 series:

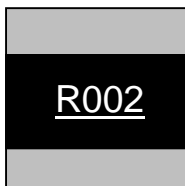


Ex: Resistance 2mΩ.



Ex: Resistance 0,5mΩ.

4527S series:

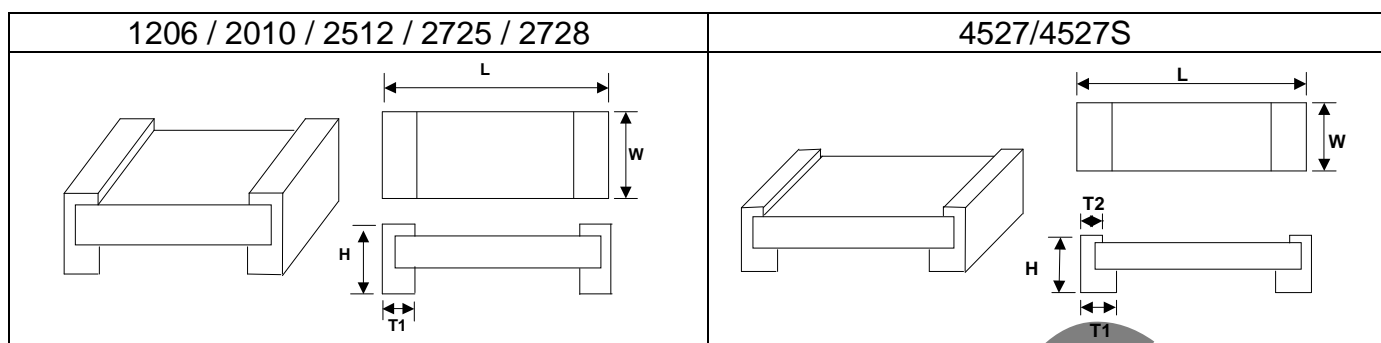


Ex: Resistance 2mΩ.



Ex: Resistance 0,5mΩ.

SMD Dimensions



Type	Maximum Power Rating [W]	Resistance Range [mΩ]	Dimensions - in inches (millimeters)				
			L [mm]	W [mm]	H [mm]	T1 [mm]	T1
1206	0,5 and 1,0	0,3	3,200±0,254	1,600±0,254	1,000±0,254	0,550±0,254	
		0,5 to 0,6			0,725±0,254		
		1,0			0,645±0,254	0,508±0,254	
		2,0 to 4,0			0,545±0,254	0,600±0,254	
		5,0			0,508±0,254		
		6,0 to 50,0			0,550±0,254		
	1,5	0,3			1,000±0,254	0,725±0,254	
		0,5 to 0,6			0,645±0,254	0,508±0,254	
		1,0			0,787±0,254	1,440±0,254	
		0,5 to 0,9			1,295±0,254		
2010	1,0	1,0 to 3,0	5,080±0,254	2,540±0,254	0,645±0,254	0,787±0,254	
		3,1 to 4,0			1,000±0,254	2,02±0,254	
		4,1 to 100,0			0,787±0,254	1,880±0,254	
		0,3			0,645±0,254	1,118±0,254	
2512	1,0 and 1,5	0,5 to 3,0	6,248±0,254	3,202±0,254	1,000±0,254	2,02±0,254	
		3,1 to 4,0			0,787±0,254	1,880±0,254	
		4,1 to 75,0			0,645±0,254	1,118±0,254	
		75,1 to 100,0			0,645±0,254	0,868±0,254	
		0,3			1,000±0,254	2,02±0,254	
	2,0	0,5 to 3,0			0,787±0,254	1,880±0,254	
		3,1 to 4,0			0,787±0,254	1,880±0,254	
		4,1 to 75,0			0,645±0,254	1,118±0,254	
		0,3			1,000±0,254	2,02±0,254	
		0,5			0,787±0,254	1,880±0,254	
	3,0	0,6 to 2,9			0,787±0,254	1,118±0,254	
		3,0 to 4,0			1,676±0,254		
		4,1 to 10,0			0,645±0,254	1,118±0,254	
		0,3			1,000±0,254	2,02±0,254	
0,5		0,787±0,254	1,880±0,254				

FrelTec

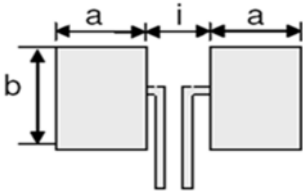
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Ultra Low Ohm Metal Strip

Type	Maximum Power Rating [W]	Resistance Range [mΩ]	Dimensions - in inches (millimeters)				
			L [mm]	W [mm]	H [mm]	T1 [mm]	T1
2725	4,0 and 5,0	0,20 to 0,50	6,807±0,254	6,452±0,254	0,991±0,254	2,159±0,254	
		0,60				1,803±0,254	
		1,0			1,092±0,254	2,159±0,254	
		1,5			0,991±0,254		
		2,0				1,803±0,254	
		2,25 to 2,5			0,889±0,254	1,651±0,254	
		3,0				1,295±0,254	
2728	3,0, 3,5 and 4,0	4,0 to 100,0	6,706±0,254	7,188±0,254	0,991±0,254	1,143±0,254	
4527S (without heat sink)	3,0	0,5	11,430±0,254	6,850±0,254	1,400±0,254	3,215±0,254	0,965±0,254
		0,6 to 3,0					
		4,0 to 5,0					
		5,1 to 20					
4527	5,0	0,5	11,430±0,254	6,850±0,254	1,500±0,254	3,215±0,254	0,965±0,254
		0,6 to 3,0					
		4,0 to 5,0					
		5,1 to 200					

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Recommended land pattern

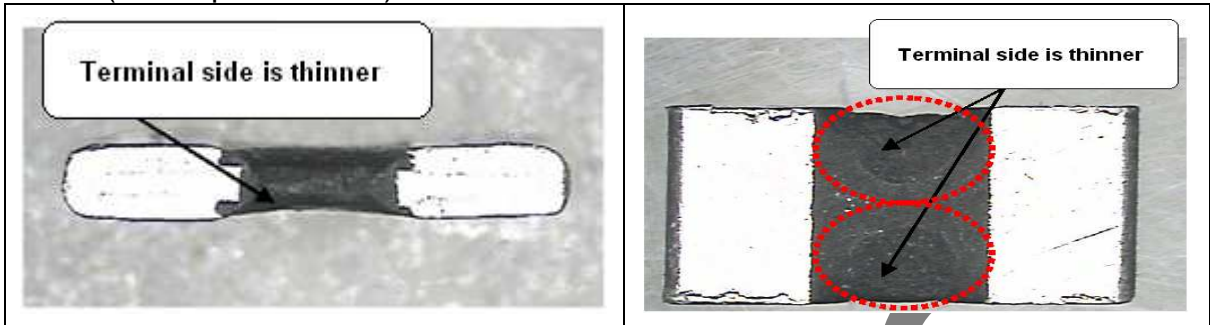


Type	Maximum Power Rating (Watts)	Resistance Range (mΩ)	Dimensions - in millimeters		
			a	b	i
1206	0,5, 1,0, 1,5	0,3to0,6	1,65	2,18	0,90
		1,0 to 50,0	1,60		1,00
2010	1,0	0,5 to 3,0	2,89	2,92	1,22
		3,1 to 100,0	2,29		2,41
2512	1,0, 1,5	0,3 to 4,0	3,05	3,68	1,27
		4,1 to 100,0	2,11		3,18
	2,0	0,3 to 4,0	3,05		1,27
		4,1 to 75,0	2,11		3,18
	3,0	0,3to0,5	3,05		1,27
		0,6to2,9 & 4,1 to 10,0	2,19		3,00
2725	4,0, 5,0	0,20 to 3,0	3,18	6,86	1,32
2728	3,0, 3,5, 4,0	4,0 to 100,0	2,75	7,82	3,51
4527S	3,0	0,5 to 5,0	4,80	8,74	5,51
		5,1 to 20,0	3,40		8,31
4527	5,0	0,5 to 5,0	4,80	8,74	5,51
		5,1 to 200,0	3,40		8,31

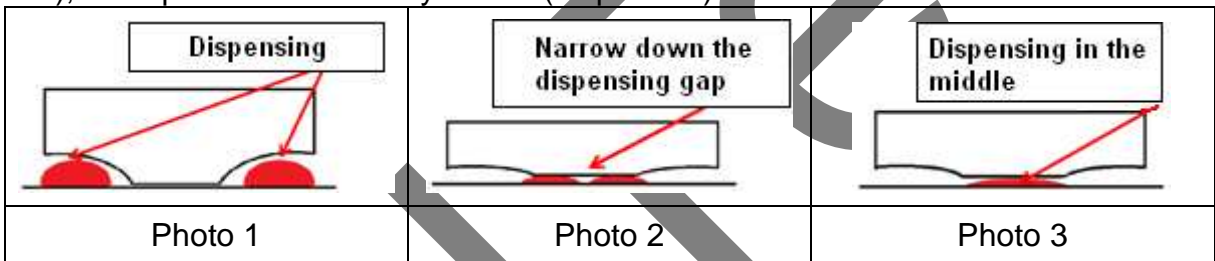
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Recommend dispensing method

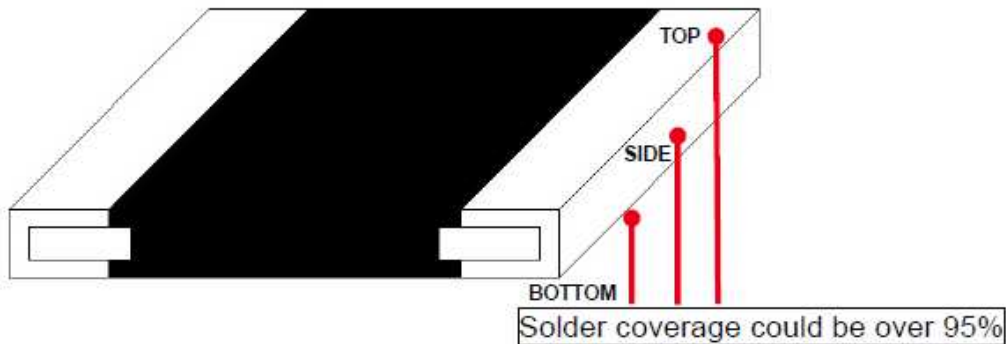
The structure of metal alloy resistor that both side of main body would be thinner due to process factor (as the photo below).



When customer performs wave solder process shall take note on the dispensing gap. If the gap between two dispensing is over, the red-glue will not adhesive the resistor body and be dropped out (as photo 1). Therefore, we suggest customer to narrow down the dispenser gap (as photo 2), or dispenser on the body center (as photo 3)



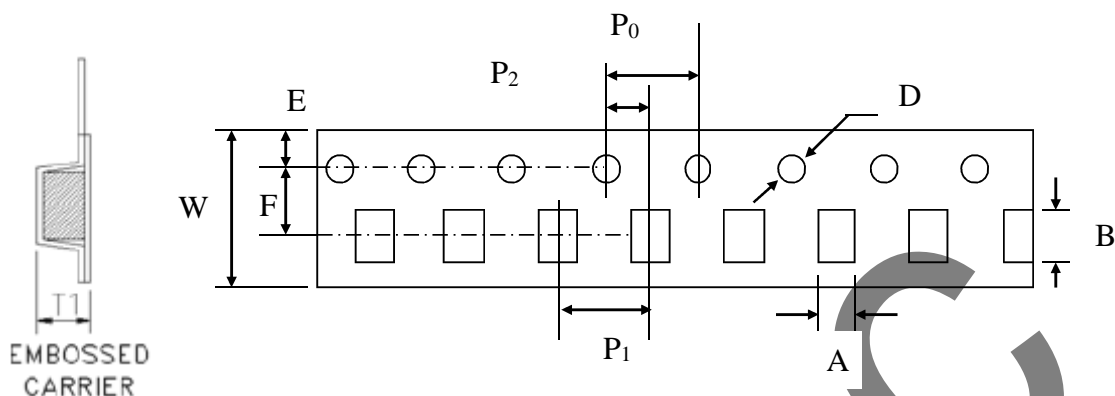
Product warranted solder area



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SPECIFICATION

Tape And Reel Package



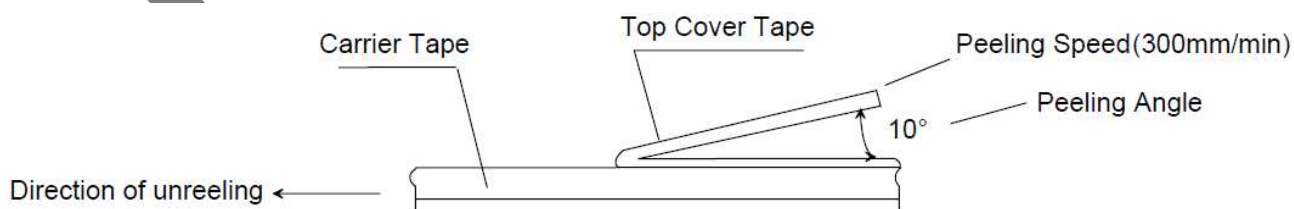
Type	A	B	W	E	F	P ₀	P ₁	P ₂	ΦD	T ₁	T ₂
1206 (0,3 to 0,6mΩ)	1,90±0,10	3,50±0,10	8,0±0,15	1,75±0,10	3,5±0,10	4,0±0,10	4,0±0,10	2,0±0,10	1,50+0,1/-0	1,27±0,10	0,23±01,0
1206 (≥1,0mΩ)	1,83±0,10	3,48±0,10	8,0±0,15	1,75±0,10	3,5±0,10	4,0±0,10	4,0±0,10	2,0±0,10	1,50+0,1/-0	1,10±0,10	0,20±0,05
2010	2,90±0,10	5,45±0,10	12,0±0,15	1,75±0,10	5,5±0,10	4,0±0,10	4,0±0,10	2,0±0,10	1,50+0,1/-0	1,33±0,10	0,23±0,05
2512 (0,3mΩ)	3,50±0,10	6,74±0,10	12,0±0,15	1,75±0,10	5,5±0,10	4,0±0,10	8,0±0,10	2,0±0,10	1,50+0,1/-0	1,60±0,10	0,24±0,05
2512	3,50±0,10	6,75±0,10	12,0±0,15	1,75±0,10	5,5±0,10	4,0±0,10	4,0±0,10	2,0±0,10	1,50+0,1/-0	1,30±0,10	0,20±0,05
2725	6,75±0,10	7,15±0,10	12,0±0,15	1,75±0,10	5,5±0,10	4,0±0,10	8,0±0,10	2,0±0,10	1,50+0,1/-0	1,95±0,10	0,25±0,05
2728	7,70±0,10	7,15±0,10	12,0±0,15	1,75±0,10	5,5±0,10	4,0±0,10	12,0±0,10	2,0±0,10	1,50+0,1/-0	1,45±0,10	0,25±0,05
4527	7,20±0,10	11,80±0,10	24,0±0,15	1,75±0,10	11,5±0,10	4,0±0,10	12,0±0,10	2,0±0,10	1,50+0,1/-0	2,00±0,10	0,30±0,10
4527S	7,20±0,10	11,80±0,10	24,0±0,15	1,75±0,10	11,5±0,10	4,0±0,10	12,0±0,10	2,0±0,10	1,50+0,1/-0	2,00±0,10	0,30±0,10

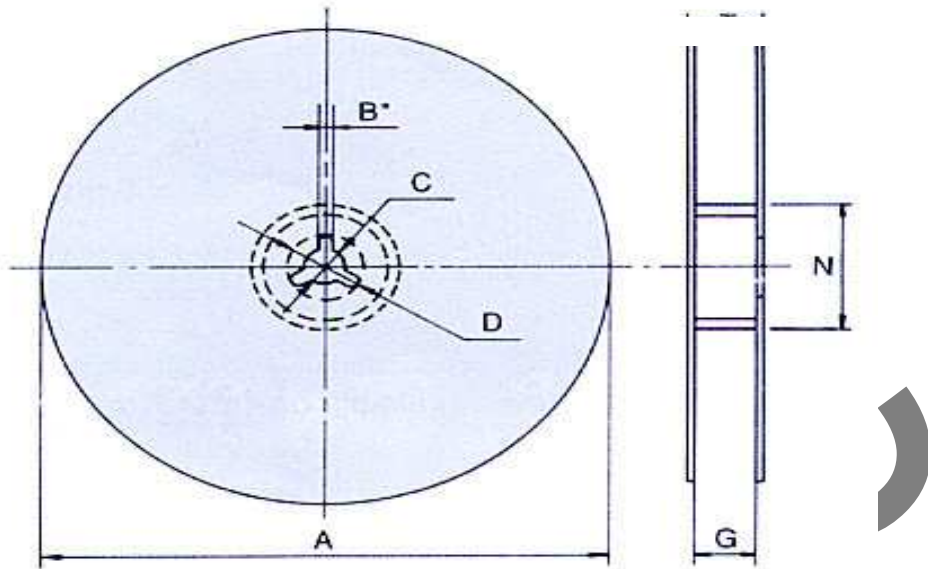
Cover Tape Peel off Strength

Specifications:

For all product— peel force of top cover tape shall be between 30 to 110g.

The peel speed shall be about 300mm/min±5%





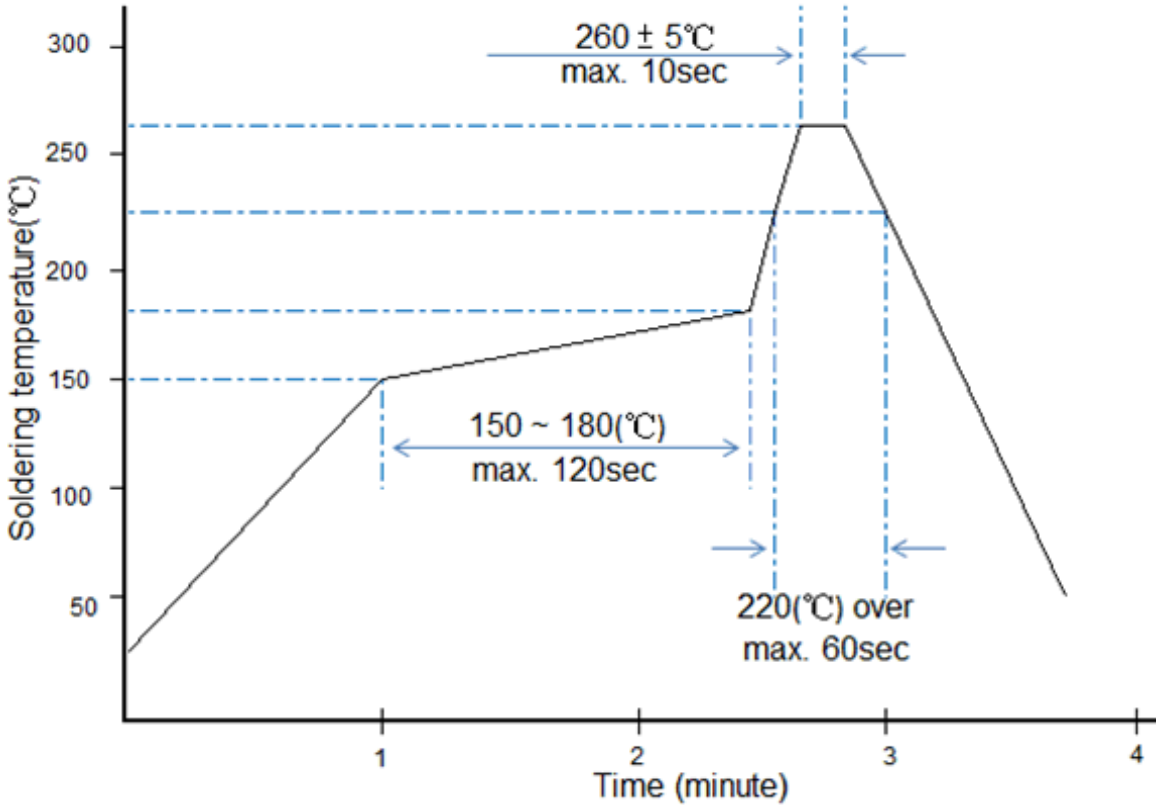
Symbol	Reel Type / Tape	A	N	C	D	B	G
Dimension	7" reel for 8 mm Tape	178±2,0	60,0±1,0	13,5±0,5	21,0±0,5	2,0±0,5	9,0±0,5
	7" reel for 12 mm Tape		80,0±1,0				13,8±0,5
	7" reel for 24 mm Tape		60,0±1,0	13,2±0,5	17,7±0,5		25,0±1,0

in mm

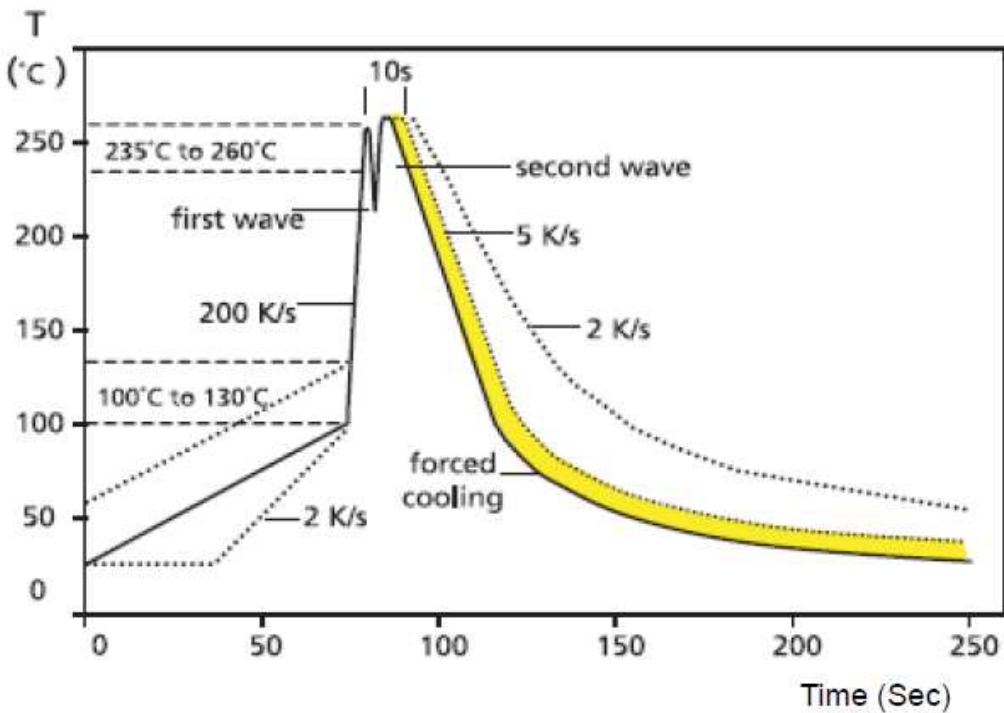
Stock period

The Temperature condition must be controlled at 25± 5 °C, the R.H. must be controlled at 60±15%. The stock can maintain quality level in two years.

Recommended IR Reflow Soldering Profile



Recommended double-wave Soldering Profile



Typical values (solid line)
 Process limits (dotted line)

SMD Strip

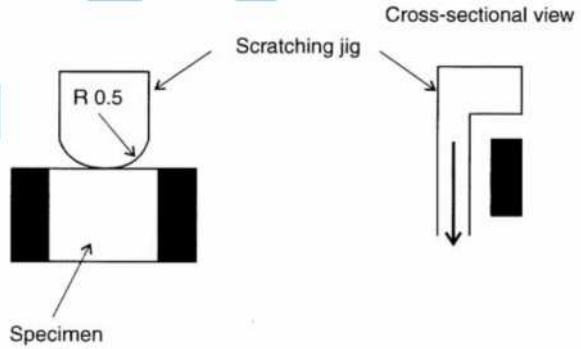
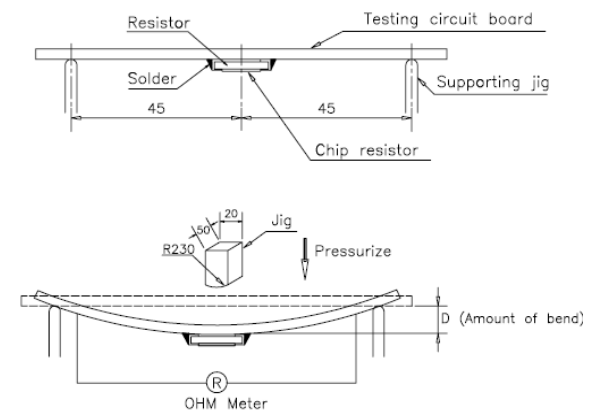
Reliability Test

Electrical Performance Test

ITEM	SPECIFICATION	TEST METHOD																																
	Resistor																																	
Short time Overload	$\leq \pm 0,5\%$ $\leq \pm 02,0\%$ (4527 and 4527S)	<p align="center">JIS C 5201-1 4.13</p> <p>Applied Overload for 5 seconds and release the load for about 30 minutes, then measure its resistance variance rate. (Overload condition refer to below):</p> <table border="1"> <thead> <tr> <th>Type</th> <th>Power (W)</th> <th>Nr. of rated power</th> </tr> </thead> <tbody> <tr> <td rowspan="3">1206</td> <td>0,5</td> <td rowspan="3">4 times</td> </tr> <tr> <td>1,0</td> </tr> <tr> <td>1,5</td> </tr> <tr> <td>2010</td> <td>1,0</td> <td rowspan="3">5 times</td> </tr> <tr> <td rowspan="3">2512</td> <td>1,0</td> </tr> <tr> <td>1,5</td> </tr> <tr> <td>2,0</td> </tr> <tr> <td rowspan="2">2725</td> <td>3,0</td> <td>3 times</td> </tr> <tr> <td>4,0</td> <td>4 times</td> </tr> <tr> <td rowspan="2">2728</td> <td>5,0</td> <td>3 times</td> </tr> <tr> <td>3,0</td> <td rowspan="3">3 times</td> </tr> <tr> <td>3,5</td> </tr> <tr> <td>4,0</td> </tr> <tr> <td>4527S</td> <td>3,0</td> <td rowspan="2">3 times</td> </tr> <tr> <td>4527</td> <td>5,0</td> </tr> </tbody> </table>	Type	Power (W)	Nr. of rated power	1206	0,5	4 times	1,0	1,5	2010	1,0	5 times	2512	1,0	1,5	2,0	2725	3,0	3 times	4,0	4 times	2728	5,0	3 times	3,0	3 times	3,5	4,0	4527S	3,0	3 times	4527	5,0
	Type		Power (W)	Nr. of rated power																														
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4,0																																		
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4527	5,0																																	
Temperatu re Coefficient of Resistance (TCR)	Refer to general specification above	<p align="center">JIS C 5201-1 4.8</p> <p>R1: Resistance at room temperature R2: Resistance at -5°C or +125°C T1: Room temperature T2: Temperature -55°C or +125°C</p> $TCR(ppm/^{\circ}C) = \frac{R2 - R1}{R1} \cdot \frac{1}{T2 - T1} \cdot 10^6$																																
Insulation Resistance	$\geq 1000M\Omega$	<p align="center">JIS C 5201-1 4.6</p> <p>Put the resistor in the fixture, add 100 VDC in +, - terminal for 60 s then measured the insulation resistance between electrodes and insulating enclosure or between electrodes and base material.</p>																																
Dielectric Withstand Voltage	No short or burned on the appearance.	<p align="center">JIS C 5201-1 4.7</p> <p>Applied 500VAC for 1 minute, and Limit surge current 50 mA (max.)</p>																																

SMD Strip

Mechanical Performance Test

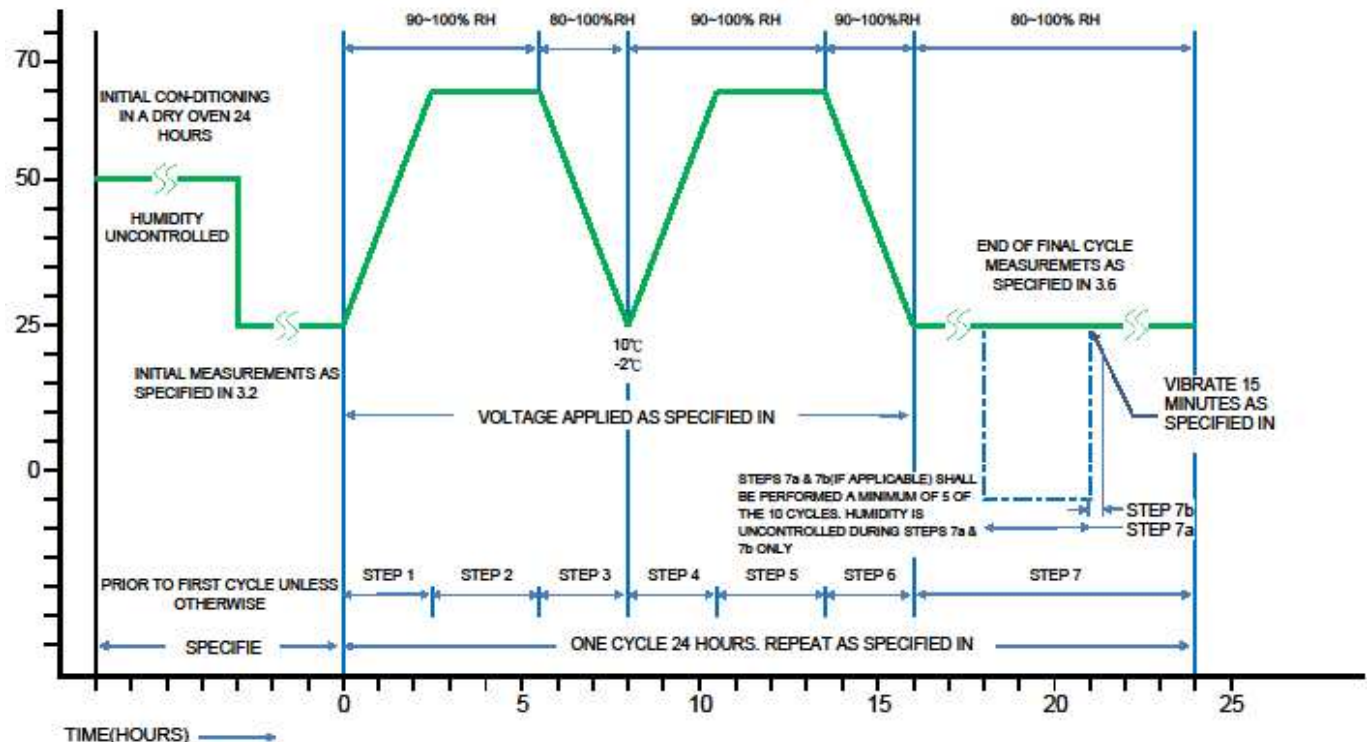
ITEM	SPECIFICATION	TEST METHOD
Core Body Strength	$\leq \pm 0,5\%$ No evidence of mechanical damage.	JIS-C5201-1 4.15 Applied R0,5 test probe at its central part then pushing 5N force on the sample for 10 s.
Joint strength of solder	Test item 1: (1). $\pm 0,5\%$ (2). No evidence of mechanical damage. No terminal peeling off. Test item 2: (1). $\pm 0,5\%$ (2). No evidence of mechanical damage. No terminal peeling off and core body cracked.	JIS-C5201-1 4.33 Preconditioning Put tested resistor in the apparatus of PCT, at a temperature of 105°C humidity of 100% RH, and pressure of $1,22 \times 10^5$ Pa for a duration of 4 h. Then after left the specimen in a temperature for 2 h or more. Test method: Test item 1 (Adhesion): A static load using a R 0,5 scratch tool shall be applied on the core of the component and in the direction of the arrow and held for 10 s and under load measured its resistance variance rate. 17,7N load  JIS-C5201-1 4.32 Test item 2 (Bending Strength): Solder tested resistor on to PC board. add force in the middle down, and under load measured its resistance variance rate. D: 2mm 

SMD Strip

Vibration	$\leq \pm 0,5\%$	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 10Hz to 55Hz and return to 10Hz, shall be transferred in 1 min. Amplitude :1,5mm This motion shall be applied for a period of 4 h in each 3 mutually perpendicular directions (a total of 12 h)
	No evidence of mechanical damage.	
Resistance to solvent	$\leq \pm 0,5\%$	JIS-C520-1 4.29 The tested resistor be immersed into isopropyl alcohol of 20~25°C for 60s, then the resistor is left in the room for 48 hrs.
	No evidence of mechanical damage.	
Solderability	Solder coverage over 95%	JIS-C5201-1 4.17 Add flux into tested resistors, immersion into solder bath in temperature 245±5°C for 3±0,5s

Operational Life Endurance:

ITEM	SPECIFICATION	TEST METHOD
	Resistor	
Load Life	$\leq \pm 1,0\%$ $\leq \pm 2,0\%$ (4527 and 4527S)	JIS-C5201-1 4.25 Put the tested resistor in chamber under temperature 70± 2°C and load the rated current for 90 min on 30 min off, total 1000 hours. Then leaving the tested resistor in room temperature for 60 min, and measure its resistance variance rate.
	No evidence of mechanical damage.	



SMD Strip

Environmental Test

ITEM	SPECIFICATION	TEST METHOD						
	Resistor							
Low Temperature Exposure (Storage)	$\leq \pm 0,5\%$	JIS-C5201-1 4.23.4 Put the tested resistor in chamber under temperature $-55\pm 2^\circ\text{C}$ for 1000 h. Then leaving the tested resistor in room temperature for 60 min, and measure its resistance variance rate.						
	No evidence of mechanical damage.							
High Temperature Exposure (Storage)	$\leq \pm 1,0\%$	JIS-C5201-1 4.23.2 Put tested resistor in chamber under temperature $170\pm 5^\circ\text{C}$ for 1000 h. Then leaving the tested resistor in room temperature for 60 min, and measure its resistance variance rate.						
	No evidence of mechanical damage.							
Moisture Resistance (Climatic Sequence)	$\leq \pm 0,5\%$	MIL-STD 202 Method 106 Put the tested resistor in chamber and subject to 10 cycles of damp heat and without power. Each one of which consists of the steps 1 to 7. Then leaving the tested resistor in room temperature for 24 h, and measure its resistance variance rate.						
	No evidence of mechanical damage.							
Bias Humidity	$\leq \pm 0,5\%$	JIS-C5201-1 4.24 Put the tested resistor in chamber under $85\pm 5^\circ\text{C}$ and $85\pm 5\%\text{RH}$ with 10% bias and load the rated current for 90 min on, 30 min off, total 1000 h. Then leaving the tested resistor in room temperature for 60 min, and measure its resistance variance rate.						
	No evidence of mechanical damage.							
Temperature Cycling (Rapid Temperature Change)	$\leq \pm 0,5\%$	JIS-C5201-1 4.19 Put the tested resistor in the chamber under the temperature cycling which shown in the following table shall be repeated 1000 times consecutively. Then leaving the tested resistor in the room temperature for 60 min, and measure its resistance variance rate.						
	No evidence of mechanical damage.							
Whisker Test	Max 50 μm	JESD Standard No 22A121 class 2 Test item 1 (Thermal Shock test):						
		<table border="1"> <tbody> <tr> <td>Minimum storage temperature</td> <td>$-55\pm 10^\circ\text{C}$</td> </tr> <tr> <td>Maximum storage temperature</td> <td>$85\pm 10/0^\circ\text{C}$</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> Inspection: Inspect for whisker formation on specimens that underwent the acceleration test specified in subclasses 4.2, with a magnifier (stereomicroscope) 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.	Minimum storage temperature	$-55\pm 10^\circ\text{C}$	Maximum storage temperature	$85\pm 10/0^\circ\text{C}$	Temperature-retaining time	10 min.
Minimum storage temperature	$-55\pm 10^\circ\text{C}$							
Maximum storage temperature	$85\pm 10/0^\circ\text{C}$							
Temperature-retaining time	10 min.							
Number of temperature cycles	1.500							

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