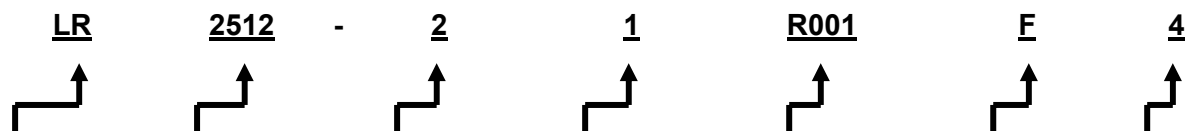


1. Scope:

This specification is applicable to lead free and halogen free for metal alloy low-resistance resistor by following products:

- LR1206 series
- LR2010 series
- LR2512 series
- LR2725 series
- LR2728 series
- LR4527 series

2. Explanation Of Part Numbers:



Type	Size (inch)	Number of Terminals	Power Rating	Resistance (4~6 Digits)	Tolerance	Packing
Metal Alloy Low resistance resistor	<ul style="list-style-type: none"> • 1206 • 2010 • 2512 • 2725 • 2728 • 4527 	2: 2 terminals	<ul style="list-style-type: none"> • C=0.5W • 1=1.0W • A=1.5W • 2=2.0W • 3=3.0W • B=3.5W • 4=4.0W • 5=5.0W 	EX: R001 = 1mΩ R010 = 10mΩ R1000 = 100mΩ R00025 = 0.25mΩ	D=± 0.5% F=± 1.0% G=± 2.0% J=± 5.0%	A=500pcs 1=1,000pcs 2=2,000pcs 4=4,000pcs

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3. Product Specifications:

Type	# of Terminals	Max. Rating Power	Max. Rating Current	Max. Overload Current	T.C.R. (ppm/°C)	Resistance Range (mΩ)		Operating Temperature
						D (±0.5%)	F (±1%); G (±2%); J (±5%)	
LR1206	2	0.5W	22.36A	44.72A	1.0~4.0m: ≤±50 4.1~15.0m: ≤±25 15.1~50.0m: ≤±15	7.0~50.0	1.0~50.0	-55~+170°C
		1W	31.62A	63.25A	1.0~4.0m: ≤±50 4.1~15.0m: ≤±25 15.1~50.0m: ≤±15	7.0~50.0	1.0~50.0	
LR2010		1W	31.62A	63.25A	1.0~3.0m: ≤±50 3.1~6.9m: ≤±25 7.0~100m: ≤±15	7.0~100	1.0~100	
LR2512		1W	44.72A	100.00A	0.5~3.0m: ≤±50 3.1~100m: ≤±25	7.0~100	0.5~100	
		1.5W	54.77A	122.48A				
		2W	63.25A	141.42A	0.5~3.0m: ≤±50 3.1~75m: ≤±25	7.0~75.0	0.5~75.0	
LR2725		3W	77.46A	134.16A	0.5~2.5m: ≤±50 2.6~10.0m: ≤±25	7.0~10.0	0.5~10.0	
		4W	126.49A	252.95A	0.25~3.0m: ≤±50	--	0.25~3.0	
LR2728		3W	27.39A	47.43A	4.0~7.0m: ≤±25 7.1~100m: ≤±15	4.0~100	4.0~100	
		3.5W	29.58A	51.23A	4.0~7.0m: ≤±25 7.1~100m: ≤±15	4.0~100	4.0~100	
	4W	31.62A	63.25A	4.0~7.0m: ≤±25 7.1~50.0m: ≤±15	4.0~50.0	4.0~50.0		
LR4527	3W	77.5A	134A	≤±50	7~120	0.5~120		
	4W	100A	173A					

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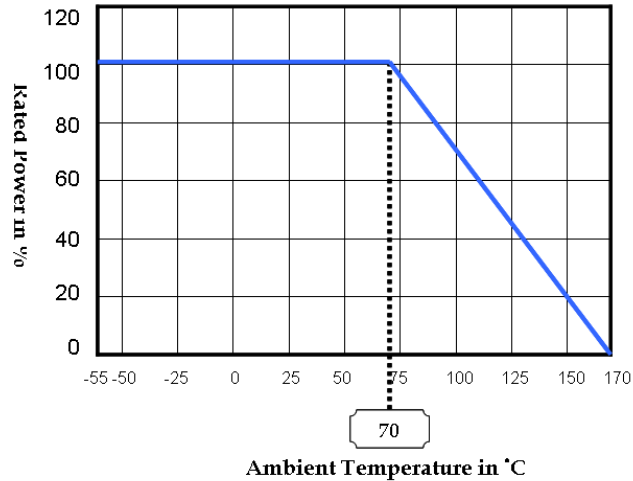
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3.1 Power Derating Curve: Operating Temperature Range : - 55 ~+170 °C

For resistors operated in ambient temperatures 70°C, power rating must be derated in accordance with the curve below:



3.2 Rating Current:

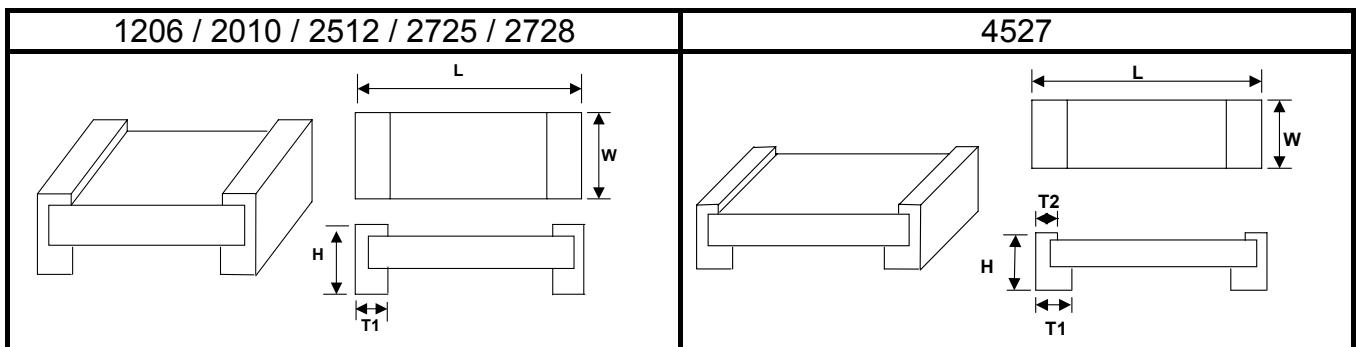
The following equation may be used to determine the DC (Direct Current) or AC (Alternating Current) currents (RMS, root mean square value) of normal rated power. However, if the result value exceeds the highest current of regulated standards, the highest normal rated power is to be used.

Remark:

- a. I: Rating Current.
- b. P: Rating Power.
- c. R: Resistance.

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

4 Physical Dimensions:



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Type	Maximum Power Rating (Watts)	Resistance Range (mΩ)	Dimensions - in inches (millimeters)					
			L	W	H	T1	T2	
LR1206	0.5 & 1.0	1.0 ~ 50.0	0.126±0.010 (3.200±0.254)	0.063±0.010 (1.600±0.254)	0.0254±0.010 (0.645±0.254)	0.020±0.010 (0.508±0.254)		
LR2010	1.0	0.5	0.200±0.010 (5.080±0.254)	0.100±0.010 (2.540±0.254)	0.031±0.010 (0.787±0.254)	0.069±0.010 (1.740±0.254)		
		1.0 ~ 3.0				0.051±0.010 (1.295±0.254)		
		3.1 ~ 100.0				0.031±0.010 (0.787±0.254)		
LR2512	1.0 & 1.5	0.5 ~ 4.0	0.246±0.010 (6.248±0.254)	0.126±0.010 (3.202±0.254)	0.031±0.010 (0.787±0.254)	0.074±0.010 (1.880±0.254)		
		4.1 ~ 75.0				0.044±0.010 (1.118±0.254)		
		75.1 ~ 100.0				0.034±0.010 (0.868±0.254)		
	2.0	0.5 ~ 4.0				0.074±0.010 (1.880±0.254)		
		4.1 ~ 75.0				0.044±0.010 (1.118±0.254)		
	3.0	0.5				0.074±0.010 (1.880±0.254)		
		0.6 ~ 2.9				0.044±0.010 (1.118±0.254)		
		3.0 ~ 4.0				0.066±0.010 (1.676±0.254)		
		4.1 ~ 10.0				0.0254±0.010 (0.645±0.254)		0.044±0.010 (1.118±0.254)
LR2725	4.0	0.25, 0.50	0.268±0.010 (6.807±0.254)	0.254±0.010 (6.452±0.254)	0.039±0.010 (0.991±0.254)	0.085±0.010 (2.159±0.254)		
		1.0			0.043±0.010 (1.092±0.254)			
		1.5			0.039±0.010 (0.991±0.254)			
		2.0			0.035±0.010 (0.889±0.254)	0.071±0.010 (1.803±0.254)		
		2.5				0.065±0.010 (1.651±0.254)		
		3.0				0.051±0.010 (1.295±0.254)		
LR2728	3.0, 3.5 & 4.0	4.0~100.0	0.264±0.010 (6.706±0.254)	0.283±0.010 (7.188±0.254)	0.039±0.010 (0.991±0.254)	0.045±0.010 (1.143±0.254)		
LR4527	3.0 & 5.0	0.5	0.450±0.010 (11.430±0.254)	0.270±0.010 (6.850±0.254)	0.059±0.010 (1.500±0.254)	0.127±0.010 (3.215±0.254)	0.127±0.010 (3.215±0.254)	
		0.6~5.0					0.038±0.010 (0.965±0.254)	
		5.1~120				0.071±0.010 (1.815±0.254)		

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5 Reliability Performance:

5.1 Electrical Performance:

Test Item	Conditions of Test	Test Method	Test Limits																											
Temperature Coefficient of Resistance (TCR)	<ul style="list-style-type: none"> TCR (ppm/°C) = $\frac{(R2-R1)}{R1 (T2-T1)} \times 10^6$ R1: resistance of room temperature (T1) R2: resistance of 150 °C (T2) 	JIS C 5201-1 4.8	Per Spec. (refer to paragraph 3)																											
Short Time Overload	<p>The number of rated power are as follows:</p> <table border="1"> <thead> <tr> <th>Type</th> <th>Power (W)</th> <th># of rated power</th> </tr> </thead> <tbody> <tr> <td rowspan="2">LR1206</td> <td>0.5</td> <td rowspan="2">4 times</td> </tr> <tr> <td>1.0</td> </tr> <tr> <td>LR2010</td> <td>1.0</td> <td rowspan="3">5 times</td> </tr> <tr> <td rowspan="2">LR2512</td> <td>1.0</td> </tr> <tr> <td>1.5</td> </tr> <tr> <td rowspan="2">LR2725</td> <td>2.0</td> <td>3 times</td> </tr> <tr> <td>3.0</td> <td>4 times</td> </tr> <tr> <td rowspan="3">LR2728</td> <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 rowspan="2">LR4527</td> <td>3.0</td> <td rowspan="2">3 times</td> </tr> <tr> <td>5.0</td> </tr> </tbody> </table> <p>Rating power duration: 5secs</p>	Type	Power (W)	# of rated power	LR1206	0.5	4 times	1.0	LR2010	1.0	5 times	LR2512	1.0	1.5	LR2725	2.0	3 times	3.0	4 times	LR2728	3.0	3 times	3.5	4.0	LR4527	3.0	3 times	5.0	JIS C 5201-1 4.13	$\leq \pm 0.5\%$ $\leq \pm 2.0\%$ (LR4527 series)
Type	Power (W)	# of rated power																												
LR1206	0.5	4 times																												
	1.0																													
LR2010	1.0	5 times																												
LR2512	1.0																													
	1.5																													
LR2725	2.0	3 times																												
	3.0	4 times																												
LR2728	3.0	3 times																												
	3.5																													
	4.0																													
LR4527	3.0	3 times																												
	5.0																													
Insulation Resistance	100±15V _{DC} for 1 minute	JIS C 5201-1 4.6	$\geq 10^9\Omega$																											
Dielectric Withstanding Voltage	Applied 500V _{AC} for 1 minute, and Limit surge current 50 mA (max.)	JIS C 5201-1 4.7	Without break down																											

5.2 Mechanical /Constructional Performance:

Test Item	Conditions of Test	Test Method	Test Limits
Resistance to Solder Heat	Solder temp./immersion time: 260±5°C, 10±1secs and 350±10°C, 3.5±0.5secs	JIS C 5201-1 4.18	$\leq \pm 0.5\%$
Solderability test	Specimen prep.: 4 hours ± 15 min. Steam Aging ; Solder Bath/Dip and Look Test, 245±5°C, 3±1secs	JIS C 5201-1 4.17	Over 95% coverage
Vibration	Frequency varied 55Hz in one minute, 3 orientations @ Total duration 12 hours	JIS C 5201-1 4.22	$\leq \pm 0.5\%$
Resistance to solvent	Immersion time: 60±5secs @ 20°C~25°C	JIS C 5201-1 4.29, 4.30	$\leq \pm 0.5\%$
Mechanical Shock	100 grams for 6 milliseconds, 5 pulses	JIS C 5201-1 4.21	$\leq \pm 0.5\%$

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5.3 Environmental Performance:

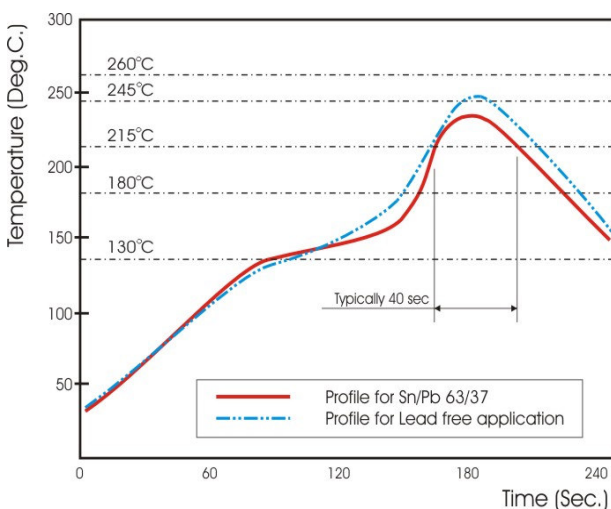
Test Item	Conditions of Test	Test Method	Test Limits
Low Temperature Exposure (Storage)	1,000 hours @ -55°C	JIS C 5201-1 4.23.4	≤±0.5%
High Temperature Exposure (Storage)	1,000 hours @ + 155°C	JIS C 5201-1 4.23.2	≤±1.0%
Temperature Cycling (Rapid Temperature Change)	Air to air, - 55°C to + 150°C, 1,000 cycles, 15 minutes at each extreme, transition time 2 to 3 minutes	JIS C 5201-1 4.19	≤±0.5%
Moisture Resistance (Climatic Sequence)	Mil-STD-202, Method 106, 0% power, 7a and 7b not required, t = 24 h/cycle, 10 cycles, Unpowered,	JIS C 5201-1 4.23	≤±0.5%
Bias Humidity	+ 85 °C, 85% RH, 10% Bias, Extended Life Test: 1,000 hours, 1.5 hours On, 0.5 hours Off	JIS C 5201-1 4.24	≤±0.5%

5.4 Operational Life Endurance:

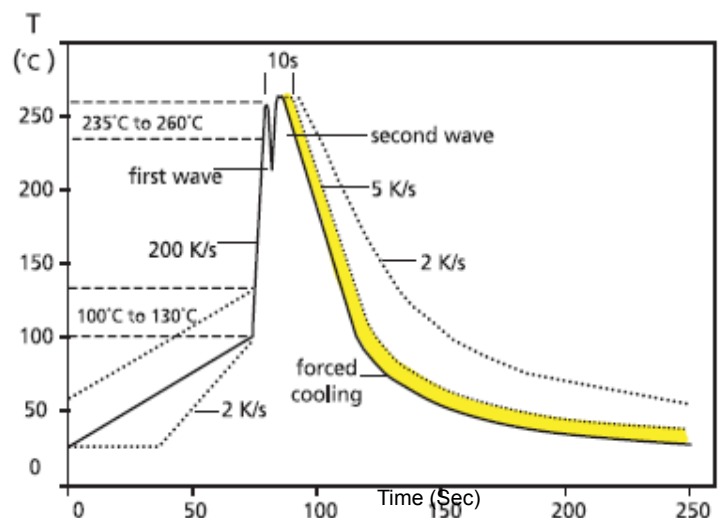
Test Item	Conditions of Test	Test Method	Test Limits
Load Life	Test temperature 70 °C Rated continuous working voltage, Extended Life Test: 1,000 hours, 1.5 hours On , 0.5 hours Off	JIS C 5201-1 4.25.1	≤±1.0% ≤±2.0%(LR4527 series)

6. Recommend Soldering Conditions:

6.1 Surface-mount components are tested for solderability at a temperature of 245 °C for 3 seconds. Typical examples of soldering processes that provide reliable joints without any damage are given in below:



Recommended IR Reflow Soldering Profile



Recommended double-wave Soldering Profile

Typical values (solid line)

Process limits (dotted line)

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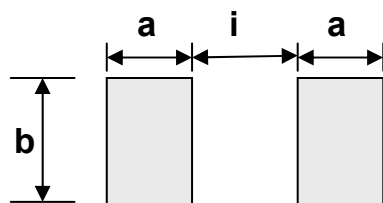
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7. Recommend Land Pattern:



Type	Maximum Power Rating (Watts)	Resistance Range (mΩ)	Dimensions - in inches (millimeters)		
			a	b	i
LR1206	0.5 & 1.0	1.0 ~ 50.0	0.063 (1.60)	0.086 (2.18)	0.026 (0.66)
LR2010	1.0	1.0 ~ 3.0	0.071 (1.80)	0.115 (2.92)	0.048 (1.22)
		3.1 ~ 100.0	0.090 (2.29)		0.095 (2.41)
LR2512	1.0 & 1.5	0.5 ~ 4.0	0.120 (3.05)	0.145 (3.68)	0.050 (1.27)
		4.1 ~ 100.0	0.083 (2.11)		0.125 (3.18)
	2.0	0.5 ~ 4.0	0.120 (3.05)		0.050 (1.27)
		4.1 ~ 75.0	0.083 (2.11)		0.125 (3.18)
	3.0	0.5 ~ 1.5	0.120 (3.05)		0.050 (1.27)
		1.6 ~ 10.0	0.083 (2.11)		0.125 (3.18)
LR2725	4.0	0.25 ~ 3.0	0.125 (3.18)	0.270 (6.86)	0.052 (1.32)
LR2728	3.0、3.5 & 4.0	4.0 ~ 100.0	0.108 (2.75)	0.308 (7.82)	0.138 (3.51)
LR4527	3 & 5	0.5 ~ 5.0	0.189 (4.80)	0.344 (8.74)	0.217 (5.51)
		5.1 ~ 120.0	0.134 (3.40)		0.327 (8.31)

8. Marking Format:

8.1 Product resistance is indicated by using two marking notation styles:

- a. "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.
- b. "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.

Remark: all the products marking are 4 digits.

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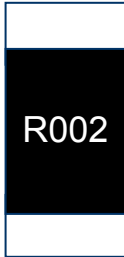
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8.2 LR1206 series:

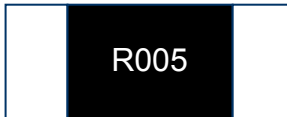


→ Ex. Resistance 10mΩ (for all LR1206 products)

8.3 LR2010 series:

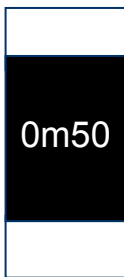


→ Ex. Resistance 2mΩ (when resistance below or equal than 3mΩ)

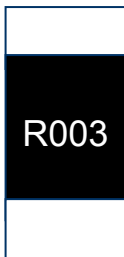


→ Ex. Resistance 5mΩ (when resistance greater than 3mΩ)

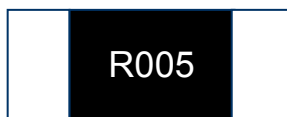
8.4 LR2512 series:



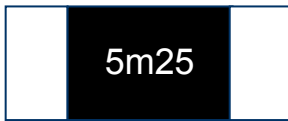
→ Ex. Resistance 0.5mΩ (when resistance below than 1mΩ)



→ 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)

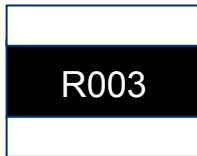
8.5 LR2725 series:



→ Ex. Resistance 0.25mΩ (or 0.25mΩ only)



→ Ex. Resistance 2.5mΩ (for 1.5mΩ and 2.5mΩ only)



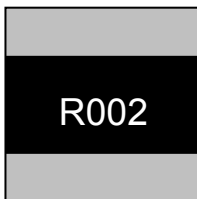
→ Ex. Resistance 3mΩ (for 1m、2m and 3mΩ only)

8.6 LR2728 series:

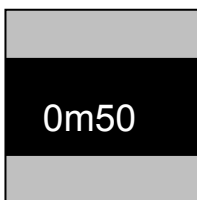


→ Ex. Resistance 5mΩ (for all LR2728 products)

8.7 LR4527 series:



→ Ex: Resistance 2mΩ.



→ Ex: Resistance 0.5mΩ.

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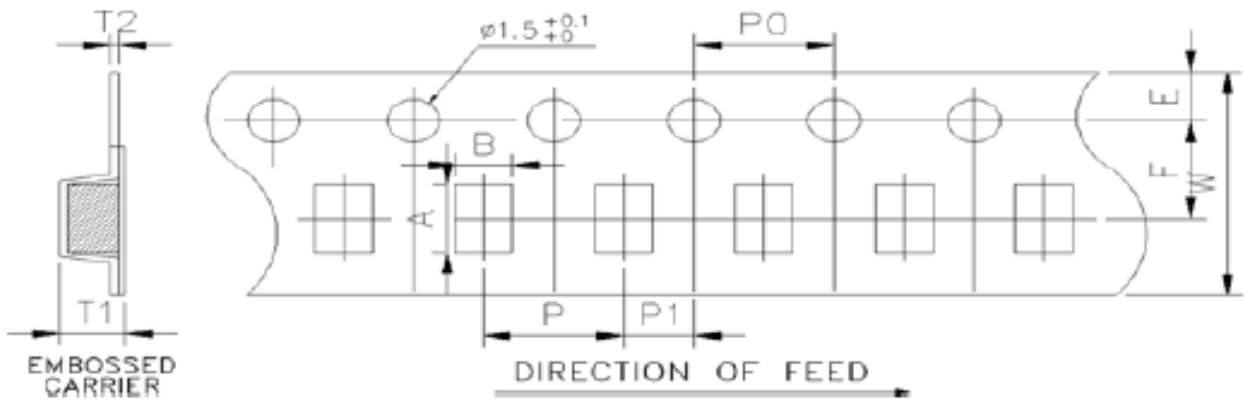
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8.8 Marking Style:

Marking Type	R	m	1	2	3	4	5	6	7	8	9	0
LR1206 LR2010 LR2512 LR2725 LR2728 LR4527	R	m	1	2	3	4	5	6	7	8	9	0

9. Taping specifications:

9.1 Tape Dimensions:



Unit: mm

Item	A	B	W	E	F	T1	T2	P	P0	10*P0	P1
LR1206	3.48	1.83	8.00	1.75	3.50	0.90	0.20	4.00	4.00	40.00	2.00
LR2010	5.45	2.90	12.00	1.75	5.50	1.10	0.23	4.00	4.00	40.00	2.00
LR2512	6.75	3.50	12.00	1.75	5.50	1.10	0.20	4.00	4.00	40.00	2.00
LR2725	7.15	6.75	12.00	1.75	5.50	1.70	0.25	8.00	4.00	40.00	2.00
LR2728	7.15	7.70	12.00	1.75	5.50	1.20	0.25	12.00	4.00	40.00	2.00
LR4527	11.80	7.20	12.00	1.75	5.50	1.70	0.30	12.00	4.00	40.00	2.00
Tolerance	±0.10	±0.10	±0.15	±0.10	±0.10	±0.10	±0.05	±0.10	±0.10	±0.20	±0.10

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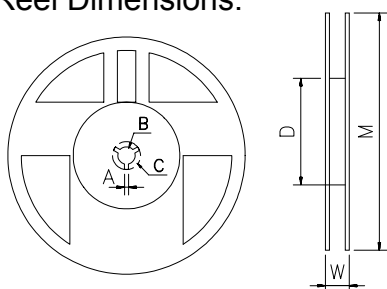
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9.2 Packaging model:

Type	Tape width	Packaging Quantity (pcs/reel)		
		Embossed Plastic Type		
		4mm pitch	8mm pitch	12mm pitch
LR1206	8mm	4,000pcs	--	--
LR2010	12mm	2,000pcs	--	--
LR2512		4,000pcs	--	--
LR2725		--	1,000pcs	--
LR2728		--	--	1,000pcs
LR4527	24mm	--	--	500pcs

9.3 Reel Dimensions:



Unit: mm

Reel Type / Tape	W	M	A	B	C	D
7" reel for 8 mm tape	12.00± 0.5	178 ± 1.0	2.0 ± 0.5	13.2 ± 0.5	17.7 ± 0.5	60.0 ± 0.5
7" reel for 12 mm tape	16.20 ± 0.5		2.5 ± 0.5	13.5 ± 0.5		
7" reel for 24 mm tape	24.00+2/-0		2.0 ± 0.5	13.2 ± 0.5		

10. Attachments

10.1 Document Revise Record (QA-QR-027)

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文件修訂記錄表

文件名稱	Metal Alloy Low-Resistance Resistor Product Specifications		編號	IE-SP-022	
版本日期	修訂 頁次	修訂內容	修訂者	備註	
2005.08.12		新制訂			
2006.01.01	8	依據 ECN NO.059-009 修訂 9.4 項 Label:批號表示由 8 碼變更為 9 碼。	陳田鵬		
2007.01.01	全	將 RD-SP-022 編號改為 IE-SP-022。	謝清帆		
2007.04.04	9	依據 ECN NO.079-001 增加第 9.7 項外銷中國大陸外箱尺寸。	謝清帆		
2007.06.28	全	Release SRD-SP-0023 (版本日期:2007.06.23)	邱石伸		
2007.11.16	2 8	1.修訂項次4尺寸:外觀尺寸的數值。 2.修訂標籤 Pb-free 格式。	姜亮兆		
2008.10.13	全	全修訂 新增 LR20	王萬平		
2008.11.26	全	全修訂 新增 LR06、28	王萬平		
2009.02.04	全	全修訂(巨馳版本:2009.01.15)	王萬平		
2009.04.24	1 4	1.名稱"Metal Strip"改為"Metal Plate" 2.修改項目3 最高過負荷電流 3.修改項目5.1 短時間過負荷條件 (依據巨馳規格書:GCT-SPEC-011-03 版本:2009.04.17)	王萬平		
2009.06.08	全	1.全修訂(巨馳GCT-SPEC-011-06 版本:2009.05.20) 2.增加"無鉛、無鹵素"說明 3.規格表增加±2%規格 4. 修改LR25 3W外觀尺寸 5.修改LR25/LR28 Solder Pad Trace Size 6. 修改 Marking 表示方法	王萬平		
2009.08.12	1 12	1. 依據巨馳GCT-SPEC-011-08 版本:2009.08.10) 增加包裝型式 E1、E6 說明 2.Packaging QTY 增加 E1:4000 pcs / reel、E6:2000 pcs / reel	王萬平		
2009.10.14	全	(依據巨馳GCT-SPEC-011-10 版本:2009.10.08) 1.新增LR06 0.5W規格 2. 修改項目3. LR25 2W最高過負荷電流 3. 修改項目4. LR06 / 20 / 25 外觀尺寸 4. 修改項目 5.1 LR25 2W 短時間過負荷條件	王萬平		

文件修訂記錄表

文件名稱	Metal Alloy Low-Resistance Resistor Product Specifications		編號	IE-SP-022	
版本日期	修訂 頁次	修訂內容	修訂者	備註	
2010.02.03	1	1. 修改項目2(型別名稱)的包裝型式： E1:4000pcs->TE:4000pcs	王萬平		
2010.11.01	全	(依據巨馳GCT-SPEC-011-13 版本:2010.10.01) 1.修改第3項規格表溫度係數規格及修改溫度係數誤差 值,使用溫度範圍改為-55~+170°C 2.修改第4項. LR06外觀尺寸 3.修改第7項LR25 / LR28 2-wire Solder Trace Size尺 寸 4.修改第 8 項 Marking 表示方法	王萬平		
2011.02.20	13	修改 9.4 Label 內容(依據昆山 ECN NO.2011-004)	王萬平		
2011.05.18	1 2 3	(依據巨馳GCT-SPEC-011-14 版本:2010.11.12) 1.修改第3項規格表,額定電流、T.C.R、阻值範圍規格。 2.修改第4項尺寸, LR27之W尺寸 (依據巨馳GCT-SPEC-028-02 版本:2010.03.31) 3.增加 LR4527 規格。	謝清帆		
2011.10.19	全	依據巨馳GCT-SPEC-011-15 版本:2011.04.21 GCT-SPEC-028-01 版本:2010.12.02 GCT-SPEC-029-00 版本:2010.12.15 GCT-SPEC-033-01 版本:2011.03.31 全修訂。	謝清帆		
2012.02.16	4	修改 LR2512 3W (4.1~10mΩ)之尺寸。	謝清帆		
2012.04.06	2&4& 8	新增 LR2010 0.5 mΩ之尺寸。	謝清帆		
2013.01.01	4 11	1.修訂第 4 項, LR2512(W)尺寸。 2.修訂 9.2 項, LR2512 包型式	謝清帆		