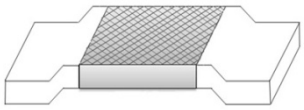
1 Scope:

1.1 This specification is applicable to lead free and halogen free for metal alloy low-resistance shunt resistor.

1.2 Ideal for current detection under high current circuit.

1.3 The lineup of ultra-low resistance values.

1.4 Made from electron-beam-welded composite material.



2 Explanation Of Part Numbers:

LRS 3921 - 2 4 R001 F 3

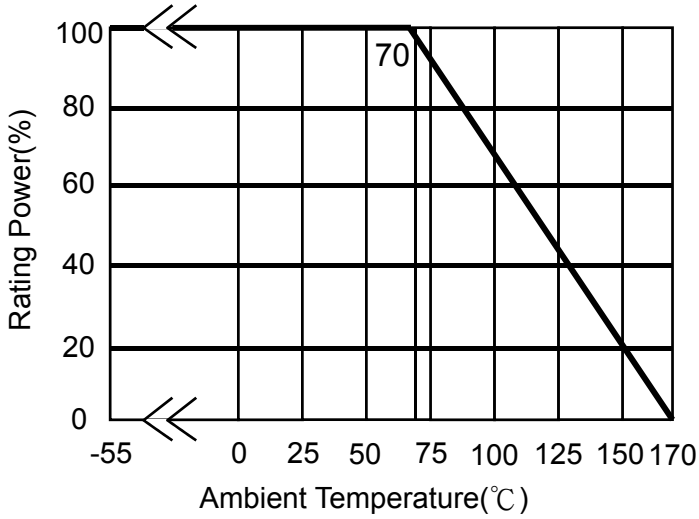
Type	Size (inch)	Number of Terminals	Rated Power	Resistance (4~6 Digits)	Tolerance	Packaging
Metal Alloy Low-Resistance Shunt Resistor	• 3921 • 5931	2: 2 terminals	• 2=2.0W • 3=3.0W • 4=4.0W • N=4.5W • 5=5.0W • 6=6.0W • 7=7.0W • 9=9.0W • 10=10W	EX: R000 =Below0.20mΩ R001 = 1mΩ R003 = 3mΩ R005 = 5mΩ R0002 = 0.2mΩ R0005 = 0.5mΩ	F=± 1.0% G=± 2.0% J=± 5.0%	A=500pcs 1=1,000pcs 2=2,000pcs 3=3,000pcs

3 Product Specifications:

Type	# of Terminals	Max. Rating Power	Max. Rating Current	Max. Overload Current	T.C.R. (ppm/°C)		Resistance Range (mΩ) F (±1%); G (±2%); J (±5%)	Operating Temperature Range
LRS3921	2	9W	212.13A	424.26A	0.2mΩ:	≦±200	0.2	-55~170°C
		5W	158.11A	353.55A	0mΩ: 0.2mΩ: 0.3mΩ: 0.5mΩ:	≦3800 ≦±200 ≦±150 ≦±100	0、0.2、0.3、0.5	
		4.5W	54.77	122.47	1.5mΩ:	≦±75	1.5	
		4W	63.25A	141.42A	1.0mΩ、2.0mΩ:	≦±75	1.0、2.0	
		3W	31.62A	70.71A	3.0mΩ、4.0mΩ:	≦±75	3.0、4.0	
		2W	20.00A	44.72A	5.0mΩ:	≦±50	5.0	
LRS5931	2	10W	223.61A	447.21A	0.2mΩ:	≦±100	0.2	
		7W	187.08A	374.17A	0.2mΩ、0.3mΩ:	≦±100	0.2、0.3	
		6W	109.54A	244.95A	0.5mΩ:	≦±100	0.5	
		5W	70.71A	158.11A	1.0mΩ、 2.0mΩ:	≦±75	1.0、2.0	
		4W	36.51A	81.65A	3.0mΩ:	≦±75	3.0	

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

For resistors operated in ambient temperatures 70°C, power rating shall 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.

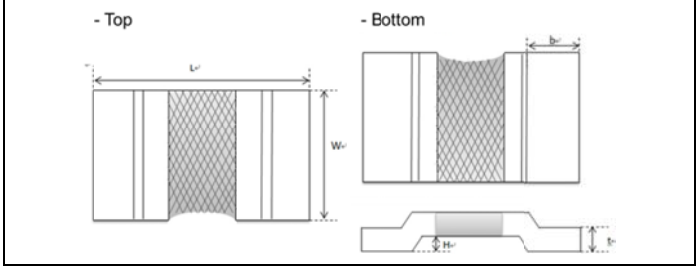
Remark:

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

I=Rating Current(A)
P= Rating Power(W)
R=Resistance(Ω)

4 Physical Dimensions:

LRS3921/LRS5931



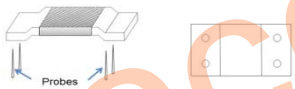
Type	Maximum Power Rating (Watts)	Resistance Range (mΩ)	Dimensions - in inches (millimeters)				
			L	W	H	b	t
LRS3921	5W	0	0.394±0.010 (10.00±0.254)	0.205±0.010 (5.20±0.254)	0.0197±0.004 (0.50±0.1)	0.0709±0.024 (1.80±0.6)	0.039±0.006 (1.00±0.15)
	5W/9W	0.2					0.055±0.006 (1.40±0.15)
	5W	0.3					0.055±0.006 (1.40±0.15)
	5W	0.5					0.035±0.006 (0.88±0.15)
	4W	1.0					0.017±0.006 (0.43±0.15)
	4.5W	1.5					0.33±0.006 (0.84±0.15)
	4W	2.0					0.027±0.006 (0.69±0.15)
	3W	3.0					0.017±0.006 (0.43±0.15)
	3W	4.0					0.014±0.006 (0.35±0.15)
	2W	5.0					0.014±0.006 (0.35±0.15)
LRS5931	7W/10W	0.2	0.591±0.010 (15.00±0.254)	0.305±0.010 (7.75±0.254)	0.0216±0.004 (0.55±0.1)	0.1575±0.024 (4.00.±0.6)	0.055±0.006 (1.40±0.15)
	7W	0.3					0.037±0.006 (0.94±0.15)
	6W	0.5					0.022±0.006 (0.56±0.15)
	5W	1.0					0.033±0.006 (0.85±0.15)
	5W	2.0					0.017±0.006 (0.43±0.15)
	4W	3.0					0.011±0.006 (0.28±0.15)

4.1 Material of Alloy

Type	Watts	Material	Resistance
LRS3921	5.0	Copper	0mΩ
	5.0/9.0	Copper-Manganese Alloy	0.2mΩ
	5.0		0.3mΩ、0.5mΩ
	4.0		1.0mΩ
	4.5	Iron-Chromium Aluminum Alloy	1.5mΩ
	4.0		2.0mΩ
	3.0		3.0mΩ、4.0mΩ
	2.0		5.0mΩ
LRS5931	7.0/10.0	Copper-Manganese Alloy	0.2mΩ
	7.0		0.3mΩ
	6.0		0.5mΩ
	5.0	Iron-Chromium Aluminum Alloy	1.0mΩ
	5.0		2.0mΩ
	4.0		3.0mΩ

5 Reliability Performance:

5.1 Electrical Performance:

<table>
<tr><th>Test Item</th><th>Conditions of Test</th><th>Test Limits</th></tr>
<tr><td>Resistance</td><td>Four-Terminal Measurement: 2 probes per terminal
 
</td><td>F: ±1%
G: ±2%
J: ±5%</td></tr>
<tr><td>Temperature Coefficient of Resistance (TCR)</td><td>• TCR (ppm/℃) = $\frac{(R2-R1)}{R1\ (T2-T1)}$ X 10^6
• R1: resistance of room temperature
• R2: resistance of 150 °C
• T1: Room temperature
• T2: Temperature at 150 °C
• Refer to JIS C 5201-1 4.8</td><td>Refer to Paragraph 3. general specifications</td></tr>
<tr><td>Short Time Overload</td><td>Applied Overload for 5 seconds and release the load for about 30 minutes, then measure its resistance variance rate.
(Overload condition refer to below):
<table>
<tr><th>Type</th><th>Power (W)</th><th># of rated power</th></tr>
<tr><td rowspan="6">LRS3921</td><td>9.0</td><td rowspan="6">5 times</td></tr>
<tr><td>5.0</td></tr>
<tr><td>4.5</td></tr>
<tr><td>4.0</td></tr>
<tr><td>3.0</td></tr>
<tr><td>2.0</td></tr>
<tr><td rowspan="2">LRS5931</td><td>10.0</td><td rowspan="2">4 times</td></tr>
<tr><td>7.0</td></tr>
<tr><td rowspan="3">LRS5931</td><td>6.0</td><td rowspan="3">5 times</td></tr>
<tr><td>5.0</td></tr>
<tr><td>4.0</td></tr>
</table>
Refer to JIS C 5201-1 4.13</td><td>≦±1.0%
No evidence of mechanical damage</td></tr>
</table>

5.2 Mechanical /Constructional Performance:

Test Item	Conditions of Test	Test Limits
Resistance to Solder Heat	The tested resistor be immersed 25 mm/sec into molten solder of 260±5℃ for 10±1secs. Then the resistor is left in the room for 1 hour, and measured its resistance variance rate. Refer to JIS-C5201-1 4.18	≦±0.5% No evidence of mechanical damage
Solderability	Add flux into tested resistors, immersion into solder bath in temperature 245±5℃ for 3±0.5secs. Refer to JIS-C5201-1 4.17	Solder coverage over 95%
Resistance to solvent	The tested resistor be immersed into isopropyl alcohol of 20~25℃ for 60secs, then the resistor is left in the room for 48 hrs. Refer to JIS-C5201-1 4.29	≦±1.0% No evidence of mechanical damage
Vibration	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 : 1.5mm This motion shall be applied for a period of 4 hours in each 3 mutually perpendicular directions (a total of 12hrs) Refer to JIS-C5201-1 4.22	≦±1.0% No evidence of mechanical damage

5.3 Environmental Performance:

Test Item	Conditions of Test	Test Limits
Low Temperature Exposure (Storage)	Put the tested resistor in chamber under temperature -55±2℃ for 1,000 hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate. Refer to JIS-C5201-1 4.23.4	≦±1.0% No evidence of mechanical damage
High Temperature Exposure (Storage)	Put tested resistor in chamber under temperature 170±5℃ for 1,000 hours. Then leaving the tested resistor in room temperature for 60 minutes , and measure its resistance variance rate. Refer to JIS-C5201-1 4.23.2	≦±1.0% No evidence of mechanical damage
Temperature Cycling (Rapid Temperature Change)	Put the tested resistor in the chamber under the temperature cycling which shown in the following table shall be repeated 1,000 times consecutively. Then leaving the tested resistor in the room temperature for 60 minutes, and measure its resistance variance rate. Refer to JIS-C5201-1 4.19	≦±1.0% No evidence of mechanical damage
Moisture Resistance (Climatic Sequence)	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 (Figure 1). Then leaving the tested resistor in room temperature for 24 hr, and measure its resistance variance rate. Refer to MIL-STD 202 Method 106	≦±1.0% No evidence of mechanical damage

	Testing Condition
Lowest Temperature	-55 +0/-10℃
Highest Temperature	150 +10/-0℃

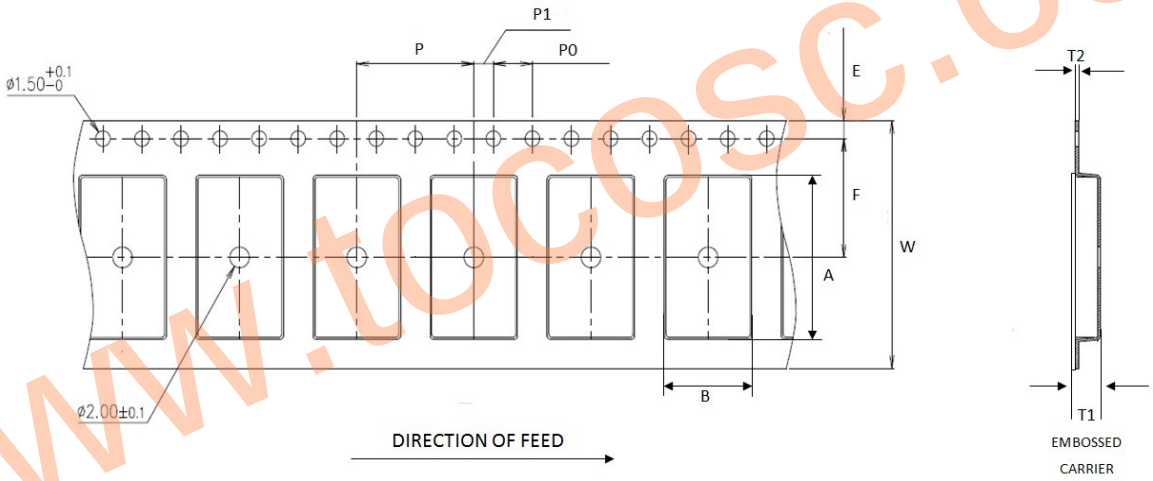
Test Item	Conditions of Test	Test Limits
Bias Humidity	Put the tested resistor in chamber under 85± 5℃and 85± 5%RH with 10% bias and load the rated current for 90 minutes on, 30 minutes off, total 1,000 hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate. Refer to JIS-C5201-1 4.24	≦±1.0% No evidence of mechanical damage

5.4 Operational Life Endurance:

Test Item	Conditions of Test	Test Limits
Load Life	Put the tested resistor in chamber under temperature 70± 2℃ and load the rated current 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. Refer to JIS-C5201-1 4.25	≦±1.0% No evidence of mechanical damage

6 Taping specifications:

6.1 Tape Dimensions:



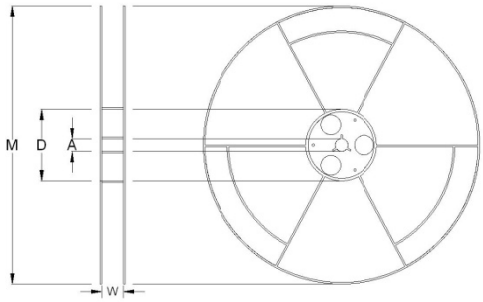
Unit: mm

DIM / Item	A	B	W	E	F	T1	T2	P	P0	10*P0	P1
LRS3921	10.5±0.2	5.7±0.2	16.0±0.2	1.75±0.1	7.5±0.1	2.3±0.1	0.28±0.05	8.0±0.1	4.0±0.1	40.0±0.2	2.0±0.1
LRS5931	15.6.±0.2	8.3±0.2	24.0±0.2	1.75±0.1	11.5±0.1	2.3±0.1	0.28±0.05	12.0±0.1	4.0±0.1	40.0±0.2	2.0±0.1

6.2 Packaging model:

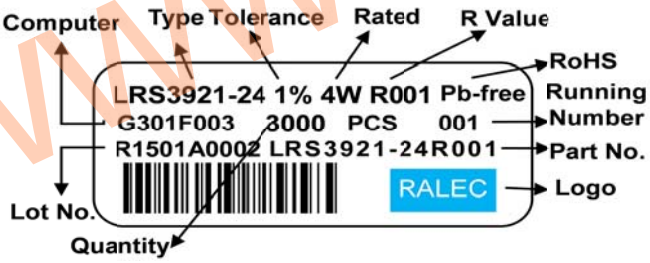
Type	Tape width	Max. Packaging Quantity (pcs/reel)
		Embossed Plastic Type
		4mm pitch
LRS3921	16mm	1000
		3000
LRS5931	24mm	500
		2000

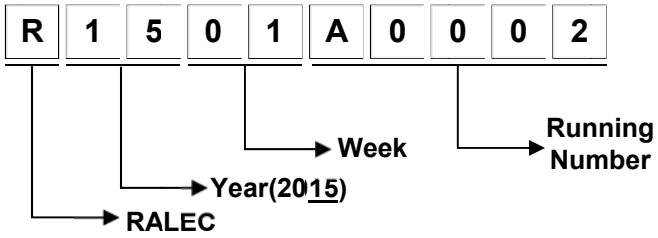
6.3 Reel Dimensions:



Reel Type / Tape	W	M	A	D
7" reel for 16 mm tape	17.4 ± 1.0	178 ± 2.0	13.20 ± 0.5	60.0 ± 1.0
7" reel for 24 mm tape	25.0 ± 1.0			
13" reel for 16 mm tape	17.4 ± 1.0	330 ± 2.0	13.00 ± 0.5	100.0 ± 1.0
13" reel for 24 mm tape	25.4 ± 1.0			

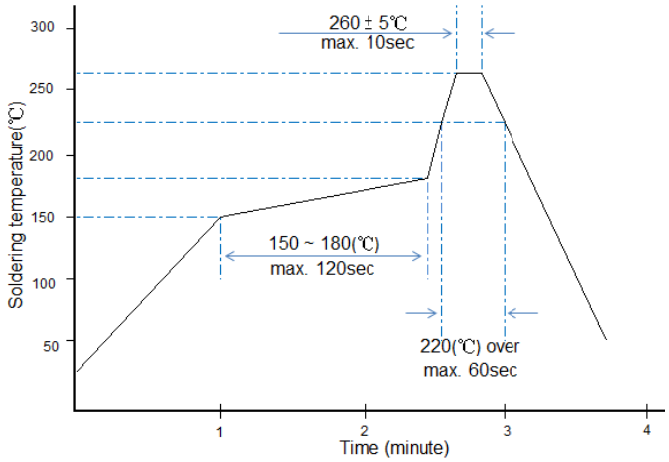
6.4 Label:





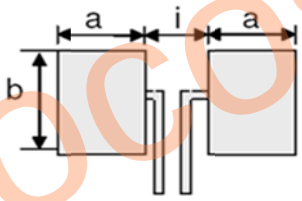
7 Technical note (This is for recommendation, please customer perform adjustment according to actual application)

7.1 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

7.2 Recommend Land Pattern:



Type	Maximum Power Rating (Watts)	Resistance Range (mΩ)	Dimensions - in millimeters		
			a	b	i
LRS3921	5/9	0.2	2.70	6.20	5.60
	5	0.3、0.5			
	4.5	1.5			
	4	1.0、2.0			
	3	3.0、4.0			
	2	5.0			
LRS5931	7/10	0.2	5.20	8.75	5.60
	7	0.3			
	6	0.5			
	5	1.0、2.0			
	4	3.0			

8 Attachments

8.1 Document Revise Record (QA-QR-027)