



Lead-Free Current Sensing Resistors

RLM Series (Halogen-Free)

AEC-Q 200-Ver D qualified

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1. Scope

This specification applied to the products of Lead-Free current sensing resistor of metal foil for Lead-Free RLM series manufactured by TA-I TECHNOLOGY CO., LTD.

2. Type Designation

RLM10

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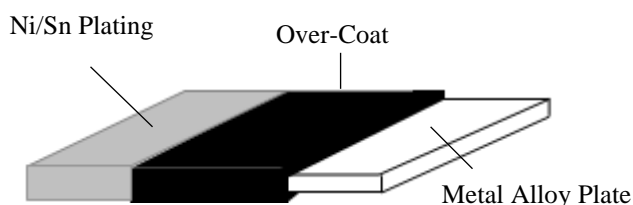
(M)

R003

Series No.	Tolerance	Packaging	Power	Metal	Resistance
10 : 0805(2012)	F= $\pm 1\%$	T=Paper	B= 0.125W	M= MnCu	e.g.
12 : 1206(3216)	G= $\pm 2\%$	E=Embossed	A= 0.25W		R003= 3m Ω
20 : 2010(5025)	J = $\pm 5\%$	Tape	S= 0.5W		R020= 20m Ω
25 : 2512(6432)			I= 0.75W		R50m= 0.5m Ω
			C= 1W		
			D= 1.5W		
			E= 2W		
			G=3W		

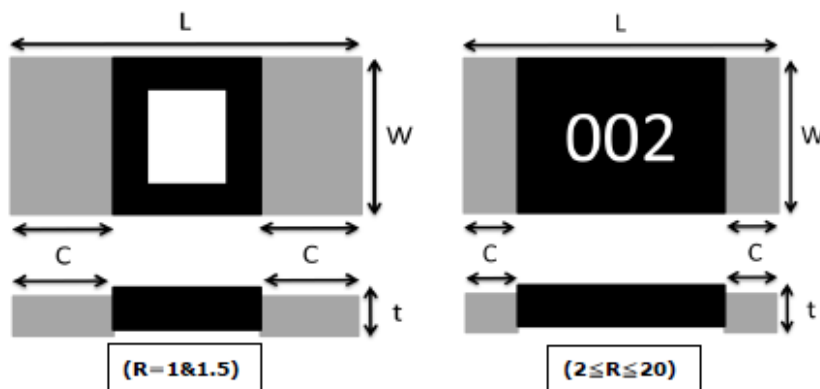
3. Construction and Dimension

3.1 Construction:



3.2 Dimension:

RLM10



Type	L	W	C	t	Material
RLM10	2.0 \pm 0.1	1.25 \pm 0.1	0.65 \pm 0.2(1 \leq R<2)	0.6 \pm 0.20	Strip : Alloy Over Coating : molding Compound UL-94V-0 grade
			0.4 \pm 0.2(2 \leq R \leq 25)		

UNIT: mm



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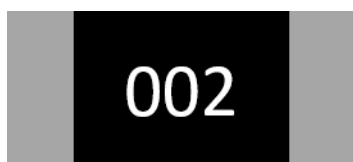
Marking

For RLM10

(1) If $R=1\&1.5$, the marking pattern is a white rectangle.



(2) If $2 \leq R \leq 25$, the marking pattern is as follows.



Resistance value is expressed by 3 digits.

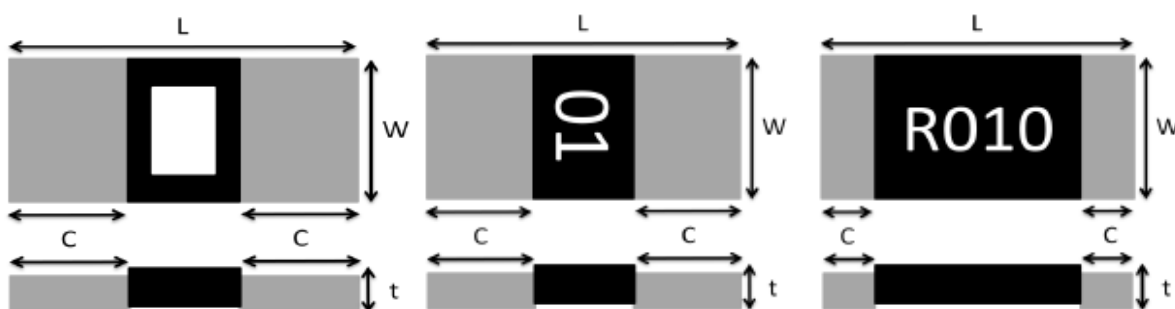
E.G.:

$$002 = 0.002\Omega = 2\text{m}\Omega$$

$$010 = 0.010\Omega = 10\text{m}\Omega$$

*Note: If the marking pattern has underline, it is indicated as a MnCu material.

RLM 12



Type	L	W	C	t	Material
RLM12	3.2 ± 0.20	1.6 ± 0.20	1.1 ± 0.30 ($0.5\text{m}\Omega \leq R < 2\text{m}\Omega$)	1.1 ± 0.20 ($0.5\text{m}\Omega \leq R < 1\text{m}\Omega$)	Metal : Alloy Over Coating: molding Compound UL-94 grade
			0.5 ± 0.30 ($2\text{m}\Omega \leq R \leq 50\text{m}\Omega$)	0.75 ± 0.20 ($1\text{m}\Omega \leq R < 2\text{m}\Omega$)	
				0.6 ± 0.20 ($2\text{m}\Omega \leq R \leq 50\text{m}\Omega$)	

UNIT: mm



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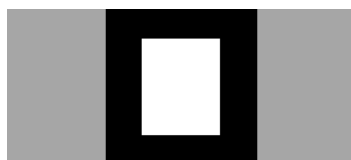
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Marking

For RLM12

(1) If $0.5\text{m}\Omega \leq R < 1\text{m}\Omega$, the marking pattern is a white rectangle.



(2) If $1\text{m}\Omega \leq R < 2\text{m}\Omega$, the marking pattern is as follows



Resistance value is expressed by 2 digits.

E.G.:

$$01 = 0.001\Omega = 1\text{m}\Omega$$

(3) If $2\text{m}\Omega \leq R \leq 50\text{m}\Omega$, the marking pattern is as follows



Resistance value is expressed by 4 digits.

E.G.:

$$R002 = 0.002\Omega = 2\text{m}\Omega$$

$$R010 = 0.010\Omega = 10\text{m}\Omega$$

*Note: If the marking pattern has underline , it is indicated as a MnCu material



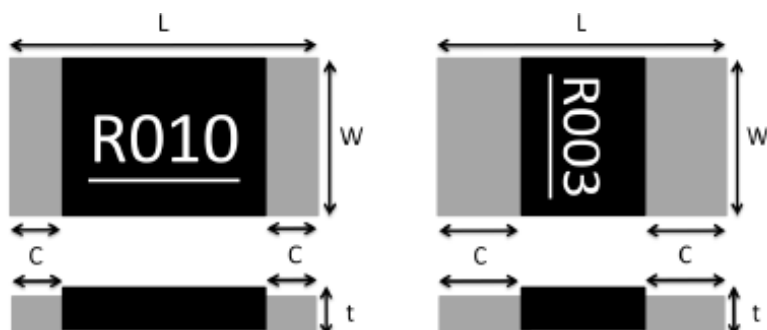
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RLM 20



Type	L	W	C	t	Material
RLM20	5.0±0.2	2.5±0.2	1.5±0.3(≤3mΩ)	0.6±0.20	Strip : Alloy Over Coating : polymer Compound UL-94V-0 grade
			0.6±0.3(R>3mΩ)		

UNIT: mm

Marking

For RLM20

(1) If $R \leq 3\text{m}\Omega$, the marking pattern is as follows



Resistance value is expressed by 4 digits.

E.G.:

$$R003 = 0.003\Omega = 3\text{m}\Omega$$

(2) If $R > 3\text{m}\Omega$, the marking pattern is as follows



Resistance value is expressed by 4 digits.

E.G.:

$$R005 = 0.005\Omega = 5\text{m}\Omega$$

$$R010 = 0.010\Omega = 10\text{m}\Omega$$

*Note: If the marking pattern has underline , it is indicated as a MnCu material



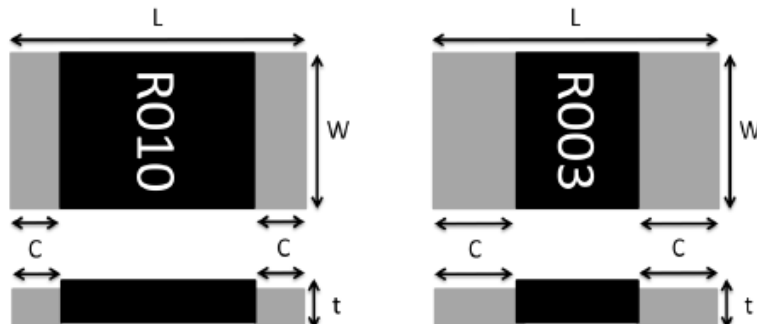
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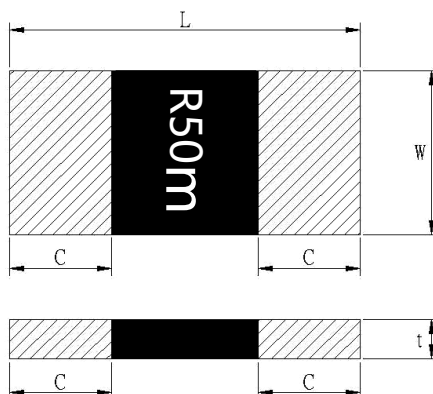
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RLM25



Type	L	W	C	t	Material
RLM25	6.4±0.2	3.2±0.2	2.2±0.2(≤3mΩ)	0.6 ±0.20	Metal : Alloy Over Coating : molding Compound UL-94V-0 grade
			0.9±0.2(R>3mΩ)		

UNIT: mm



Style	L	W	C	t	Material
RLM25	6.4±0.2	3.2±0.2	2.6±0.3	1.1 ± 0.20 (R≤0.30 mΩ)	Metal: Copper-Manganese Alloy Over Coating : molding Compound UL-94V-0 grade
				0.6 ± 0.20 (0.5 mΩ≤R≤0.75 mΩ)	

UNIT: mm



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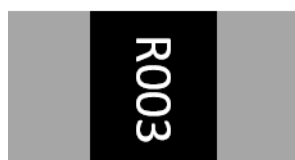
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Marking

For RLM25

(1) IF $R \leq 3\text{m}\Omega$, the marking pattern is as follows



Resistance value is expressed by 4 digits.

E.G.:

$$R003 = 0.003\Omega = 3\text{m}\Omega$$

(2) IF $R > 3\text{m}\Omega$, the marking pattern is as follows



Resistance value is expressed by 4 digits.

E.G.:

$$R005 = 0.005\Omega = 5\text{m}\Omega$$

$$R010 = 0.010\Omega = 10\text{m}\Omega$$

(3) If $0.3\text{m}\Omega \leq R \leq 0.75\text{m}\Omega$, the marking pattern is as follows



Resistance value is expressed by 4 digits.

E.G.:

$$R30\text{m} = 0.0003\Omega = 0.3\text{m}\Omega$$

$$R50\text{m} = 0.0005\Omega = 0.5\text{m}\Omega$$

*Note: If the marking pattern has underline , it is indicated as a MnCu material



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4. Features

Type	RLM10 (MnCu)	*RLM12 (MnCu/NiCu)	RLM20 (NiCu)	RLM20 (MnCu)	RLM25 (MnCu)	RLM25 (MnCu)	RLM25 (NiCu)
Size	0805	1206	2010		2512		
Power Rating	0.125W 0.25W 0.5W	0.5mΩ≤R<1mΩ (0.25W,0.5W,1W,1.5W) 1mΩ≤R≤50mΩ (0.25W,0.5W,1W)	0.5W 0.75W 1W 1.5W		1W (R=0.5mΩ~50mΩ) 1.5W (1mΩ ≤ R ≤ 15mΩ) 2W (0.5mΩ ≤ R ≤ 10mΩ) 3W(0.3mΩ ≤ R ≤ 0.75mΩ)		
Resistance Value	1~25mΩ	0.5~50mΩ	2~50mΩ	1~50mΩ	1~50mΩ	0.3 ~0.75mΩ	1~50mΩ
Operation Temperature Range	-55°C~+170°C						
TCR	±50ppm/°C				±50ppm/°C	±50ppm/°C	±275 ppm/°C (R≤1mΩ)
							±50ppm/°C (1mΩ<R≤50mΩ)
Tolerance	±1%、±2%、±5%						
Insulation Resistance	Over 100MΩ						
Maximum Working Voltage(V)	(P*R) ^{1/2}						

Note*:1 Watts with total solder pad and trace size of 300mm²

5. Reliability Tests

Test Items	Reference	Condition of Test	Test Limits
Temperature Coefficient of Resistance	IEC60115-1 4.8	+25 ~ 125°C	Refer 4.0
High Temperature Exposure (Storage)	AEC-Q200-REV D-Test 3 MIL-STD202 Method 108	T=170°C, 1000hrs, Measurement at 24hrs after test conclusion.	< $\pm 1\%$
Temperature Cycling	AEC-Q200-REV D-Test 4 JESD22 Method JA-104	1000Cycle (-55°C to 125°C) Measurement at 24hrs after test conclusion.	< $\pm 0.5\%$
Short time overload	IEC60115-1 4.13	5 X rated power for 5s	< $\pm 0.5\%$
Moisture Resistance	AEC-Q200-REV D-Test 6 MIL-STD-202 Method 106	T=24 hours / Cycle ,10 Cycles. Notes: Steps 7a& 7b not required. Unpowered	< $\pm 1\%$
Biased Humidity	AEC-Q200-REV D-Test 7 MIL-STD-202 Method 103	10% Rated power at 85°C, RH:85%, 1000Hrs, Measurement at 24hrs after test conclusion.	< $\pm 0.5\%$
Operation life	AEC-Q200-REV D-Test 8 MIL-STD-202 Method 108	1000 hours TA=125°C at 45% rated power. Measurement at 24 \pm 4 hours after test conclusion.	< $\pm 1\%$
External Visual	AEC-Q200-REV D-Test 9 MIL-STD-883 Method 2009	Electrical test not required. Inspect device construction, marking and workmanship	

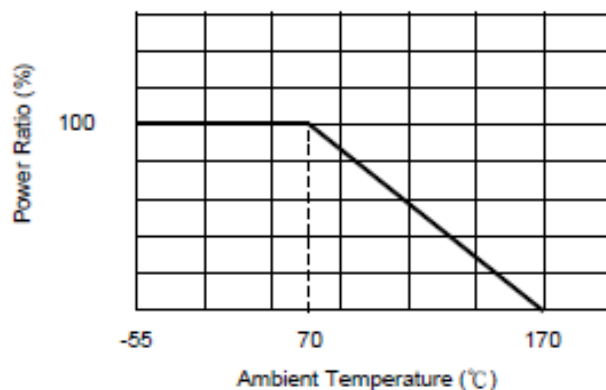


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Physical Dimension	AEC-Q200-REV D-Test 10 JESD22 Method JB-100	Verify physical dimensions to the applicable device detail specification. Note: User(s) and Suppliers spec. Electrical test not required.	
Resistance to Solvents	AEC-Q200-REV D-Test 12 MIL-STD-202 Method 215	a: Isopropyl Alcohol : Mineral Spirits= 1 : 3 b: Terpene Defluxer (Bioact EC-7R) c: Deionized water : Propylene Glycol Monomethyl Ether : monoethanolamine =42 : 1 : 1	Marking and protective layer Cannot be detached
Resistance to Soldering Heat	AEC-Q200-REV D-Test 15 MIL-STD-202 Method 210	T=260+/-5°C solder, 10+/-1 sec dwell	< ±0.5%
Mechanical Shock	AEC-Q200-REV D-Test 13 MIL-STD-202 Method 213	100g's, Normal duration is 6ms, half sine shock pulse	< ±0.5%
Resistance to vibration	AEC-Q200-REV D-Test 14 MIL-STD-202 Method 204	5g's for 20min. 12cycles, 10-2000Hz	<±0.5%
Board Flex	AEC-Q200-REV D-Test 21 AEC-Q200-005	Min 2mm deflection ,60sec.	< ±0.5%
Flammability	AEC-Q200-REV D-Test 20 UL-94	V-0 or V-1 are acceptable, Electrical test not required	V-0
Thermal Shock	AEC-Q200-REV D-Test 16 MIL-STD-202 Method 107	-55°C/+155°C. Note: Number of cycles required-300, Maximum transfer time-20 seconds, Dwell time-15 minutes. Air-Air.	< ±1.0%
ESD	AEC-Q200-REV D-Test 17 AEC-Q200-002 or ISO/DIS 10605	verify the voltage setting at 500V	< ±1.0%
Solderability	AEC-Q200-REV D-Test 18 J-STD-002	Method B, aging 4 hours at 155 °C dry heat Lead-free solder bath at 235±3 °C Dipping time: 3±0.5 seconds	> 95% area covered with tin
Terminal Strength (SMD)	AEC-Q200-REV D-Test 22 AEC-Q200-006	Force of 1.8kg for 60 seconds Remarks: 0201-NA	< ±1.0%

5.1 Derating Curve





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5.2 Rated Current

The rated current is calculated by the following formula:

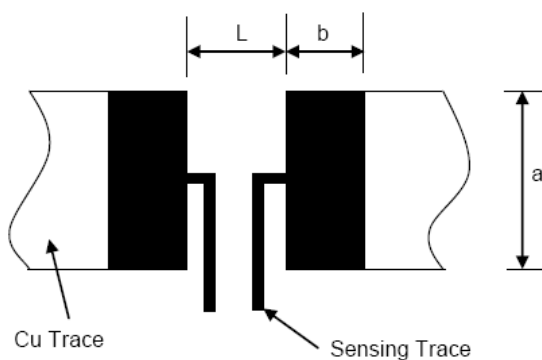
$$I = \sqrt{P \div R}$$

I: Rated Current (A)

P: Rated Power (W)

R: Resistance Value (Ω)

6. Recommended Solder Pad Dimension



Type	Resistance Range(m Ω)	a	b	L
RLM10	$1 \leq R < 2$	1.4 ± 0.1	1.15 ± 0.1	0.7 ± 0.1
	$2 \leq R \leq 25$	1.4 ± 0.1	1.15 ± 0.1	1.2 ± 0.1
RLM12	$R < 2$	1.8 ± 0.1	2.3 ± 0.1	1.0 ± 0.1
	$2 \leq R < 50$	1.8 ± 0.1	1.7 ± 0.1	1.6 ± 0.1
RLM20 (NiCu)	2~3	3.4 ± 0.2	3.5 ± 0.2	2.0 ± 0.2
	4~50	3.4 ± 0.2	1.5 ± 0.2	3.5 ± 0.2
RLM20 (MnCu)	1~3	3.4 ± 0.2	3.5 ± 0.2	2.0 ± 0.2
	4~50	3.4 ± 0.2	1.5 ± 0.2	3.5 ± 0.2
RLM25	1~3	4.0 ± 0.1	3.1 ± 0.1	1.3 ± 0.1
	4~50	4.0 ± 0.1	2.1 ± 0.1	4.1 ± 0.1
	0.3~0.75	4.0 ± 0.1	3.1 ± 0.1	1.3 ± 0.1

Unit: mm



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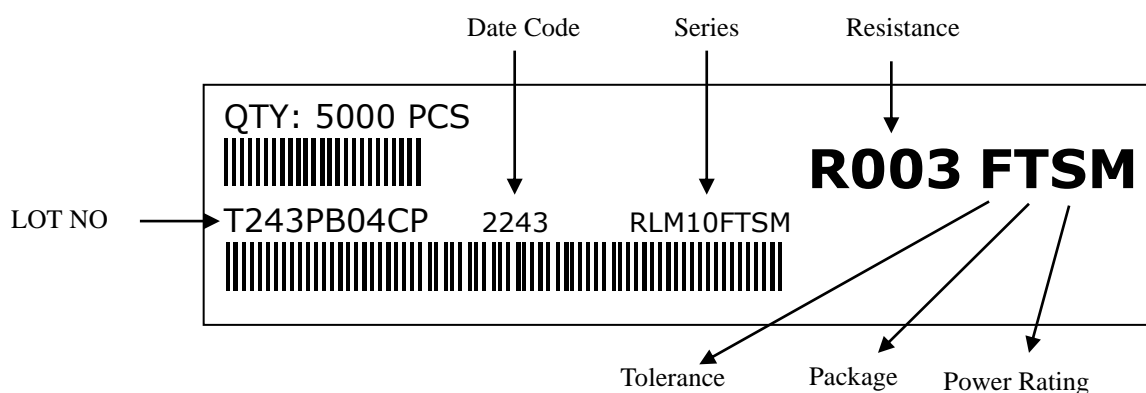
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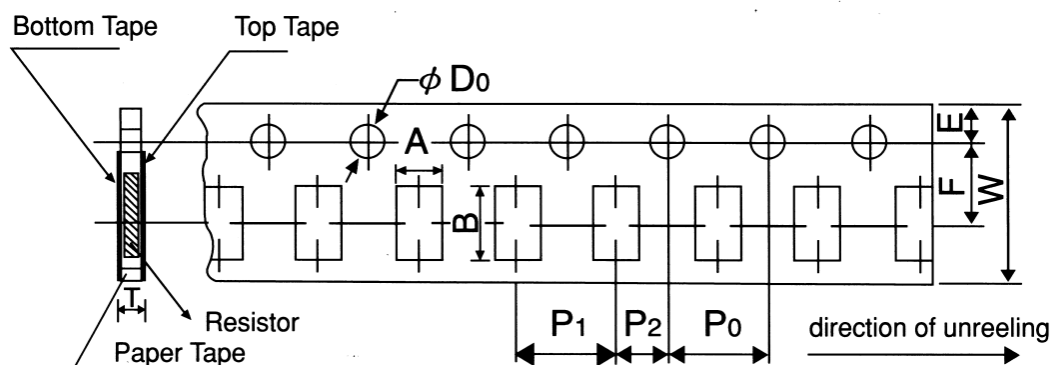
7. Number of Package

Type	RLM 10	RLM 12	RLM 20	RLM 25
Pieces	5000	3000 ($0.5\text{m}\Omega \leq R < 1\text{m}\Omega$)	4000	2000 ($R \leq 0.30\text{ m}\Omega$)
		5000 ($1\text{m}\Omega \leq R \leq 50\text{m}\Omega$)		4000 ($0.5\text{ m}\Omega \leq R \leq 50\text{ m}\Omega$)

8. Label



9. Packaging



Packing	Type	A	B	W	F	E	P ₁	P ₂	P ₀	ϕD_0	T
Paper Tape	RLM10	1.6 ± 0.15	2.4 ± 0.2	8.0 ± 0.2	3.5 ± 0.05	1.75 ± 0.1	4.0 ± 0.1	2.0 ± 0.1	4.0 ± 0.1	$\phi 1.5$ (+0.1/-0)	0.84 ± 0.1
	RLM12	2.0 ± 0.15	3.6 ± 0.2	8.0 ± 0.2	3.5 ± 0.05	1.75 ± 0.1	4.0 ± 0.1	2.0 ± 0.05	4.0 ± 0.1	$\phi 1.5$ (+0.1/-0)	0.84 ± 0.1

Unit: mm

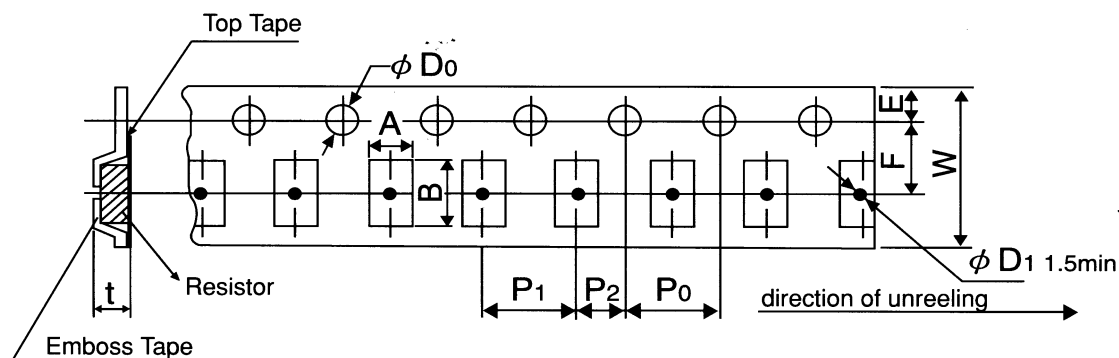


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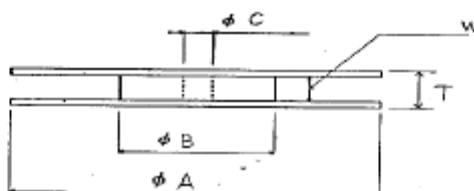
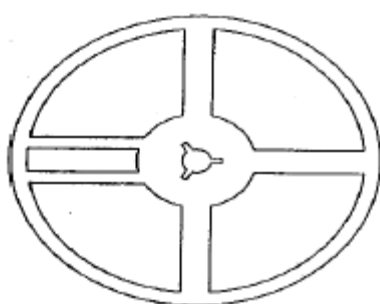
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Packing	Type	A ₀	B ₀	W	F	E	P	P ₂	P ₀	ϕ D ₀	t
Embossed Tape	RLM12	1.78 ±0.1	3.5 ±0.1	8.0 ±0.2	3.5 ±0.05	1.75 ±0.1	4.0 ±0.1	2.0 ±0.05	4.0 ±0.1	ϕ 1.5 (+0.1/-0)	1.27 ±0.1
	RLM20	2.8 ±0.2	5.3 ±0.2	12 ±0.2	5.5 ±0.05	1.75 ±0.1	4.0 ±0.1	2.0 ±0.05	4.0 ±0.05	ϕ 1.5 (+0.1/-0)	0.85 ±0.15
	RLM25 (R ≤ 0.30 mΩ)	3.6 (+0.2/-0.18)	6.9 ±0.2	12 ±0.2	5.5 ±0.05	1.75 ±0.1	4.0 ±0.1	2.0 ±0.05	4.0 ±0.05	ϕ 1.5 (+0.1/-0)	1.5 ±0.15
	RLM25 (0.5 mΩ ≤ R ≤ 50mΩ)	3.6 (+0.2/-0.18)	6.9 ±0.2	12 ±0.2	5.5 ±0.05	1.75 ±0.1	4.0 ±0.1	2.0 ±0.05	4.0 ±0.05	ϕ 1.5 (+0.1/-0)	0.85 ±0.15

Unit: mm

10. Reel Specification



Series	ϕ A	ϕ B	ϕ C	W	T
RLM 10	178.0 ±2.0	60.0 ±1.0	13.0 ±1.0	9.0 ±1.0	11.4 ±1.0
RLM 12	178.0 ±2.0	60.0 ±1.0	13.0 ±1.0	9.0 ±1.0	11.5 ±1.0
RLM 20	178.0 ±2.0	60.0 ±1.0	13.0 ±1.0	13.0 ±1.0	15.5 ±1.0
RLM 25	180(+0/-3)	60.0 ±1.0	13.0 ±1.0	13.0 ±1.0	15.4 ±2.0

Unit: mm



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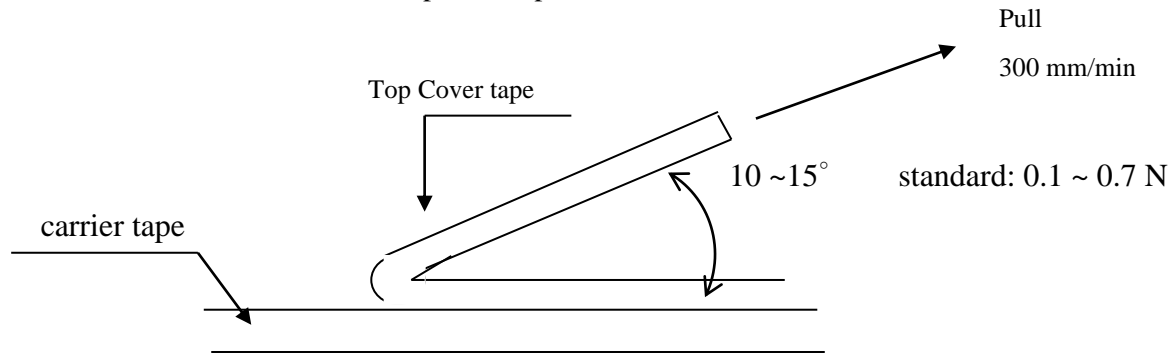
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11. Peeling Strength of Top Cover Tape

Peel – off force of paper and blister tape is in accordance with “JIS”

Test Condition: 0.1 to 0.7 N at a peel-off speed of 300 mm / min.



12. Storage Conditions:

Temperature: 5°C~35°C, Humidity:40%~75%

Humidity storage level: Level 1

13. Shelf Life:

2 years from manufacturing date.



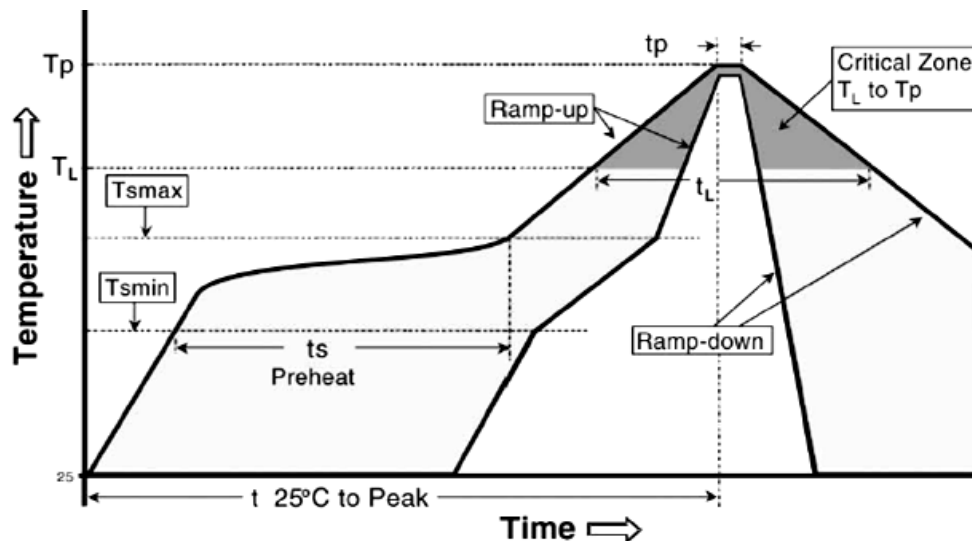
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14. Recommend IR – Reflow profile: (solder: Sn96.5 / Ag3 / Cu0.5)



Alloyed Re-flow times: 3 times

Remark: To avoid discoloration phenomena of chip on terminal electrodes,
please use N2 Re-flow furnace.

Iron Solder:350±10°C, 3+1/-0 sec,1 time

Profile Feature	Lead (Pb)-Free Assembly
Average ramp-up rate (T _{smax} to T _p)	3°C / second max
Preheat - Temperature Min (T _{smin}) - Temperature Max (T _{smax}) - Time (T _{smin} to T _{smax}) (ts)	150°C 200°C 60 -120 seconds
Time maintained above: - Temperature (T _L) - Time (T _L)	217°C 60-150 seconds
Peak Temperature (T _p)	260°C
Time within +0/-5°C of actual Peak Temperature (tp) ²	10 seconds
Ramp-down Rate	6°C/second max.
Time 25°C to Peak Temperature	8minutes max.



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15. ECN

Engineering Change Notice: The customer will be informed with ECN if there is significant modification on the characteristics and materials described in Approval Sheet.

16. Manufacturing Country & City:

TA-I TECHNOLOGY CO., LTD. (Taiwan– Tao Yuan)

Tel: (+886) 3-3246169 Fax: (+886) 3-3246167

Associated companies:

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(2) TA-I TECHNOLOGY ELECTRONIC (DONGGUAN) CO., LTD. (China –Dongguan)

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(3) FORTUNE TASK RESISTOR FACTORY (China – Dongguan)

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(5) P.T.TAI ELECTRONIC Indonesia (Indonesia – Jakarta)

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