



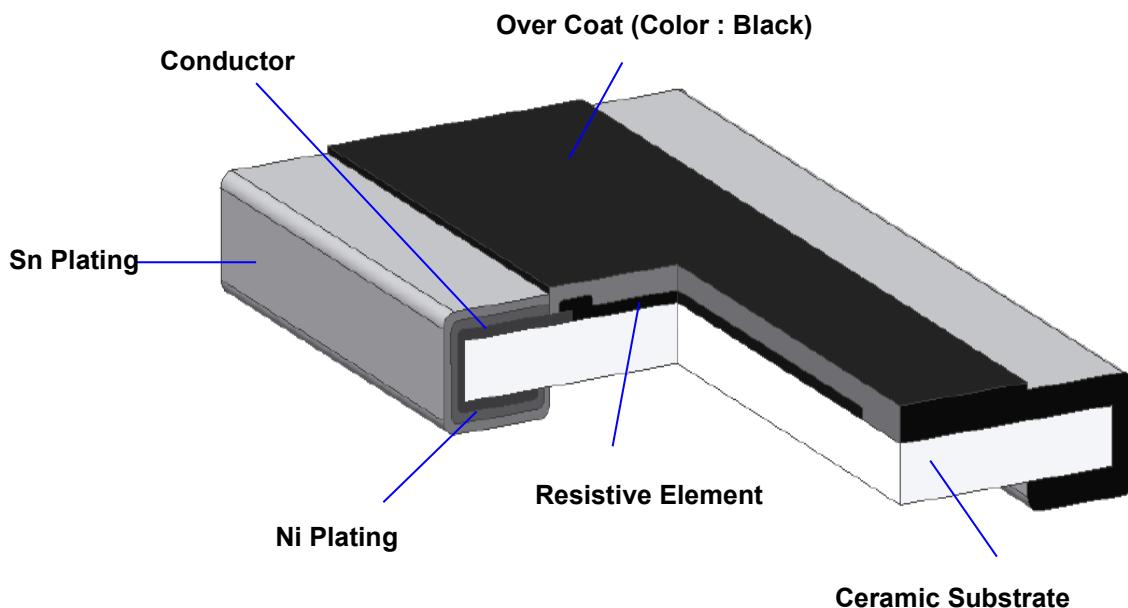
**Thick Film Chip Resistors
(Lead-Free for RML series)
Halogen-Free**

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1. Scope :

This specification applies for the RML series of thick film chip resistors made by TA-I.

2. Construction :



3. Type Designation :

<u>RML</u>	<u>12</u>	<u>J</u>	<u>E</u>	<u>103</u>
Product Code	Size	Tolerance	Packaging	Nominal Resistance
RML : Chip Resistor	Power Rating			

06-0612(1632) 0.75W
10-1020(2550) 1W
12-1225(3264) 2W

K - $\pm 10\%$
J - $\pm 5\%$
G - $\pm 2\%$
F - $\pm 1\%$

T - Paper Tape
E - Embossed Tape

3 digits, e.g.,
(E-24) 103 = 10K Ω

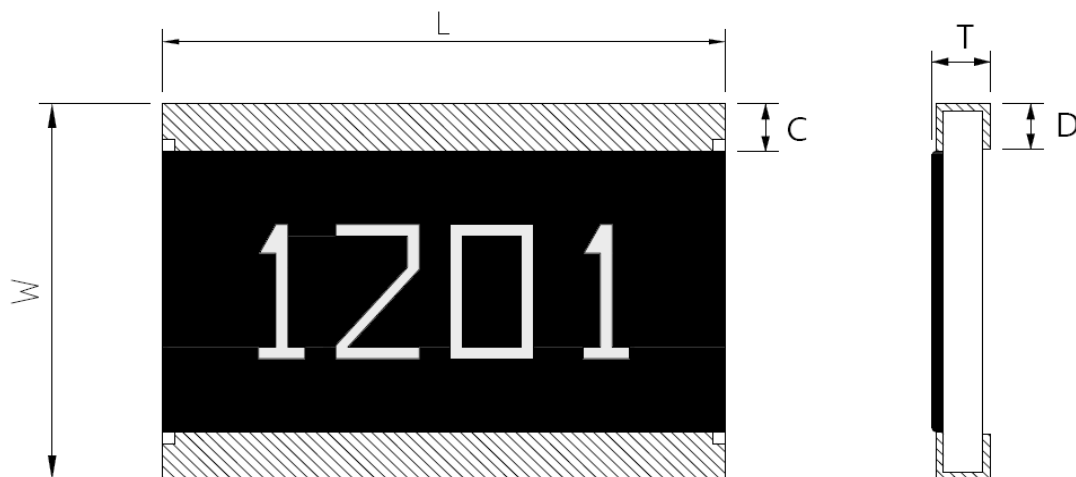
4 digits, e.g.,
(E-96) 1540 = 154 Ω
43R2 = 43.2 Ω



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4. Dimensions :



UNIT : mm

Type	L	W	C	d	t
RML06	3.20±0.20	1.60±0.20	0.25±0.15	0.35±0.15	0.55±0.10
RML10	5.0±0.20	2.5±0.20	0.25±0.15	0.4±0.15	0.55±0.10
RML12	6.30±0.20	3.20±0.20	0.40±0.20	0.80±0.20	0.70±0.10

5. Ratings & Characteristics :

Type	Power Rating at 70℃	Rating Voltage	Max. Working Voltage	Max. Over-Load Voltage	T.C.R (PPM/℃)	Resistance Range(Ω)			
						F(±1%) E-96&E-24	G(±2%) E-24	J(±5%) E-24	K(±10%) E-24
RML06	0.75W	Refer 5.2	200V	400V	±100	1Ω-1MΩ			
					±200		1Ω-1MΩ	1Ω-1MΩ	1Ω-1MΩ
RML10	1W	Refer 5.2	200V	400V	±100	1Ω-1MΩ			
					±200		1Ω-1MΩ	1Ω-1MΩ	1Ω-1MΩ
RML12	2W	Refer 5.2	200V	400V	±100	1Ω-1MΩ			
					±200		1Ω-1MΩ	1Ω-1MΩ	1Ω-1MΩ
Operating Temp (℃) : -55℃ ~ +155℃									

Note : Specified power rating requires dedicated mounting conditions to achieve the required thermal resistance



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5.1. Derating Curve :

For resistors operated at ambient temperature over 70°C, power rating shall be derated in accordance with figure 1.

P max.

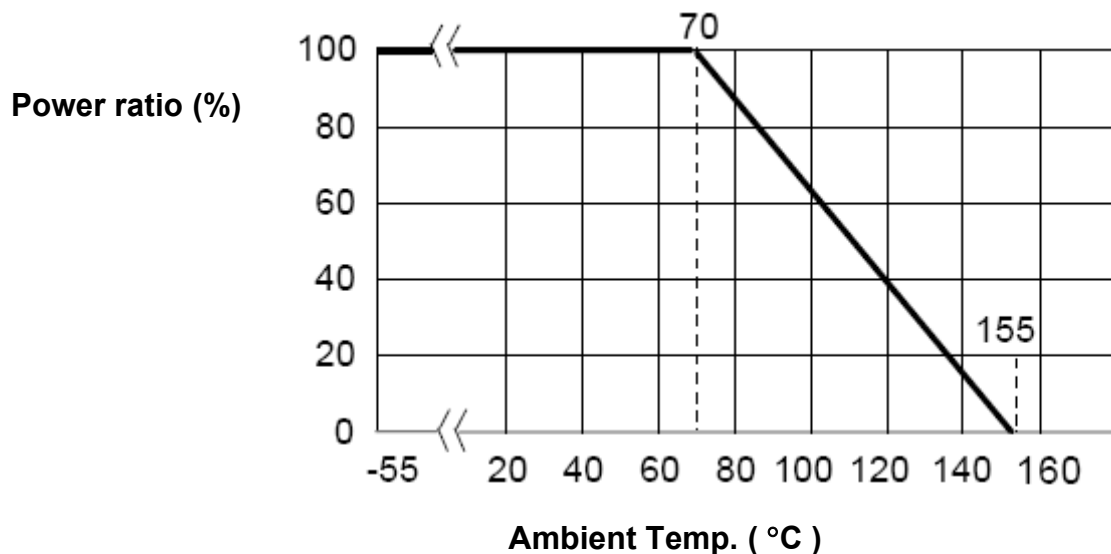


Figure 1

5.2. Rated Voltage :

The rated voltage is calculated by the following formula :

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

E=Rated Voltage(V)

P=Rated Power(W)

R=Resistance Value(Ω)

e.g., What is RML12JE102 the rated voltage ?

RML12JE102 P : 2W ; R : 102 = 1KΩ = 1000Ω

$$E = \sqrt{2(W) * 1000(\Omega)} = 44.72 (V)$$



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6. Reliability Tests :

Test Items	Reference standard	Condition of Test	Test Limits ΔR
Temperature Coefficient of Resistance	IEC60115-1-4.8 JIS-C5201-1-4.8	-55~ +125 °C	Refer 5.0
Short Time Overload	IEC60115-1-4.13 JIS-C5201-1-4.13	2.5 X rated voltage for 5 sec	$\pm(2.0\% + 0.1\Omega)$
Intermittent Overload	IEC60115-1-4.39 JIS-C5201-1-4.39	2.5X rated voltage or Max Overloading voltage ,1sec "ON" , 25sec "OFF" ,10000 cycles	$\pm(5.0\% + 0.1\Omega)$
Endurance (Load Life)	IEC60115-1-4.25.1 JIS-C5201-1-4.25.1	1000 hours at rated voltage, 70°C , 1.5hours "ON " , 0.5hour "OFF"	1% : $\pm(1.0\% + 0.05\Omega)$ 2%,5%,10% : $\pm(2.0\% + 0.1\Omega)$
Load Life with Humidity	IEC60115-1-4.24 JIS-C5201-1-4.24	(85 $\pm$ 2) °C; (85 $\pm$ 5) % RH $U = 0.1 \times \sqrt{\frac{P_{70}}{R}} \leq 100 \text{ V}; 1000 \text{ h}$	1% : $\pm(1.0\% + 0.05\Omega)$ 2%,5%,10% : $\pm(2.0\% + 0.1\Omega)$
Rapid Change of Temperature	IEC60115-1-4.19 JIS-C5201-1-4.19	-55°C (30 min.) / +125 °C(30 min.) 1000 cycles	$\pm(1.0\% + 0.05\Omega)$
Solderability	IEC60115-1-4.17 JIS-C5201-1-4.17	245 $\pm$ 5°C solder, 2 $\pm$ 0.5 sec dwell. Solder : Sn96.5 / Ag3.0 / Cu0.5	At least 95% of surface area of electrode shall be covered with new solder.
Robustness of Termination (Bending)	IEC60115-1-4.33 JIS-C5201-1-4.33	2mm deflection	$\pm(0.5\% + 0.05\Omega)$
Dielectric Withstanding Voltage (Voltage Proof)	IEC60115-1-4.7 JIS-C5201-1-4.7	Applying voltage : The 500V for a minute.	No abnormalities such as flashover, burning dielectric breakdown shall appear.
Insulation Resistance	IEC60115-1-4.6 JIS-C5201-1-4.6	Applying voltage 100V for 1 minute.	$\geq 1\text{G}\Omega$
Resistance to Dry Heat	IEC60115-1-4.23.2 JIS-C5201-1-4.23.2	155 $\pm$ 5°C for 1000Hrs	1% : $\pm(1.0\% + 0.05\Omega)$ 2%,5%,10% : $\pm(2.0\% + 0.1\Omega)$
Resistance to Solder Heat	IEC60115-1-4.18 JIS-C5201-1-4.18	260 $\pm$ 5°C solder , 10 $\pm$ 1 sec dwell .	$\pm(0.5\% + 0.05\Omega)$
Vibration	AEC-Q200-REV D-Test 14 MIL-STD-202 Method 204	5 g's for 20 min., 12 cycles each of 3 orientations. Note: Test from 10-2000 Hz.	$\pm(1.0\% + 0.05\Omega)$
ESD	AEC-Q200-REV D-Test 17	verify the voltage setting at 500V	$\pm(1.0\% + 0.05\Omega)$

Note* : RCWV : Rated continuous working voltage.

Moisture Sensitivity Level : Level 1



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7. Marking :

7.1 $\pm 2\%$ & $\pm 5\%$ & $\pm 10\%$ (E24) :

Resistance value is expressed by 3 digits, the first two digits represent the significant figures of nominal resistance value in Ω , and the third digit represents exponent for base of 10.

e.g., $103 = 10 \times 10^3 = 10000 \Omega = 10K \Omega$



7.2 $\pm 1\%$ (E96) :

Resistance value is expressed by 4 digits, the first three digits represent the significant figures of nominal resistance value in Ω , and the fourth digit represents exponent for base of 10.

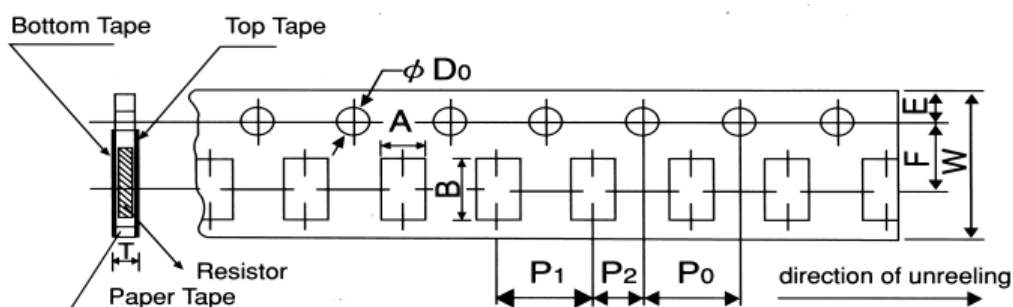
e.g., $1002 = 100 \times 10^2 = 10000 \Omega = 10K \Omega$



8. Taping & Reel :

8.1 Taping Dimensions

8.1.1 4 mm pitch paper :



UNIT : mm

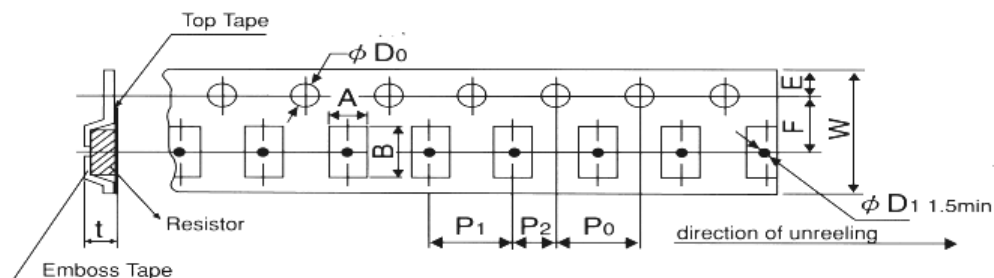
Packing	Type	A	B	W	F	E	P ₁	P ₂	P ₀	D ₀	T
Paper	RML06	2.0 $\pm$ 0.15	3.6 $\pm$ 0.2	8.0 $\pm$ 0.2	3.5 $\pm$ 0.05	1.75 $\pm$ 0.1	4.0 $\pm$ 0.1	2.0 $\pm$ 0.05	4.0 $\pm$ 0.1	ϕ 1.5 ^{+0.1} ₋₀	0.84 $\pm$ 0.1



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8.1.2 4 mm pitch Emboss :



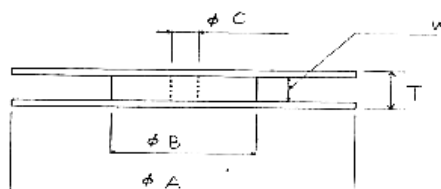
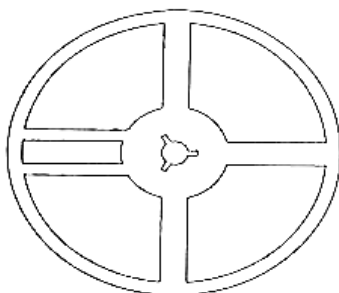
UNIT : mm

Packing	Type	A	B	W	F	E	P ₁	P ₂	P ₀	D ₀	T
Emboss	RML10	2.8±0.2	5.3±0.2	12.0±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
	RML12	3.6±0.2	6.9±0.2								

UNIT : PCS

Type	Size	Package	
		Paper Tape	
		Emboss Plastic Tape	
		4 mm pitch	4 mm pitch
		178mm/R	
RML	06	5000	
RML	10		4000
RML	12		4000

8.2 Reel Specifications:



UNIT : mm

Type	φ A	φ B	φ C	W	T
RML06	178.0 ± 2.0	60.0 ± 1.0	13.0 ± 1.0	9.0 ± 1.0	11.5 ± 1.0
RML10 / 12				13.0 ± 1.0	15.5 ± 1.0

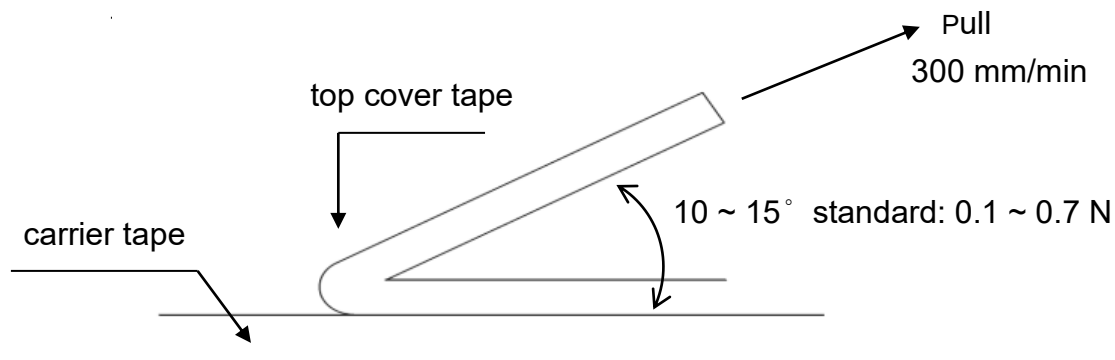


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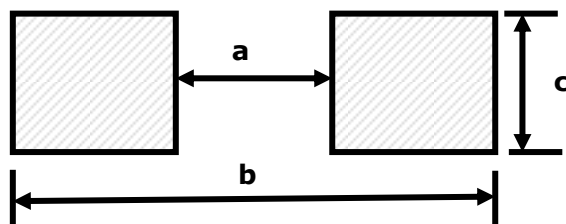
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8.3. Peel –off force :

Peel –off force of paper and blister tape is in accordance with “JIS-C5202 ”
that is , 0.1 to 0.7 N at a peel-off speed of 300 mm / minute.



9. Recommended land patterns :



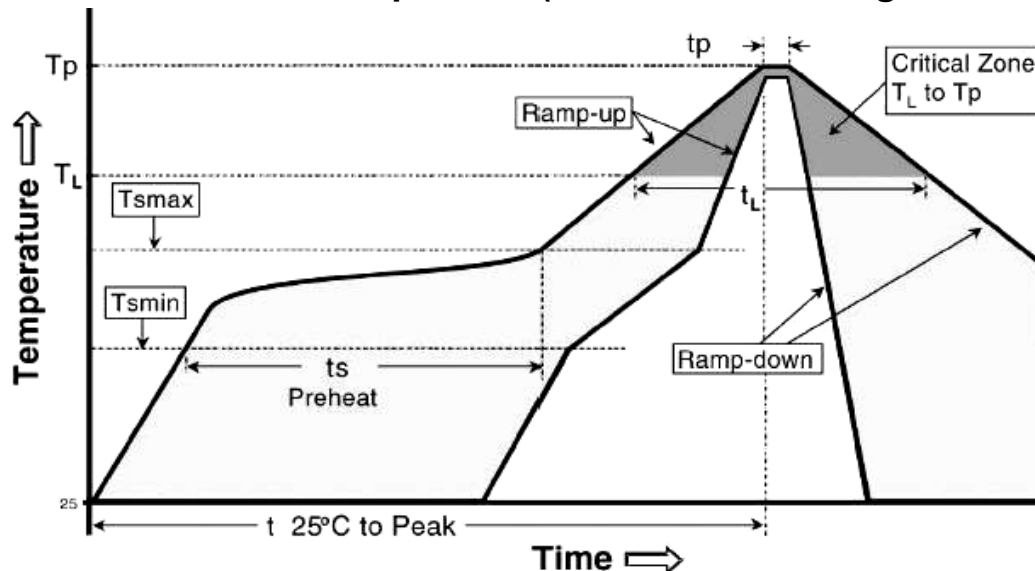
Type	Size	Land pattern	Dimension (mm)		
			a	b	c
RML	06(0612)		0.6~0.8	2.0~2.6	3.4~4.0
RML	10(1020)		1.0~1.3	3.5~4.0	5.5~6.0
RML	12(1225)		1.0~1.2	4.4~5.0	6.4~7.0



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



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 $\begin{smallmatrix} +0 \\ -5 \end{smallmatrix}$ °C of actual Peak Temperature (tp) ²	10 seconds
Ramp-down Rate	6°C/second max.
Time 25°C to Peak Temperature	8minutes max.

Allowed Re-flow times : 3 times

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



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11. Storage Conditions :

Temperature : 5℃~35℃, Humidity : 40%~75%.

12. Shelf Life :

2 years from manufacturing date.

13. 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.