



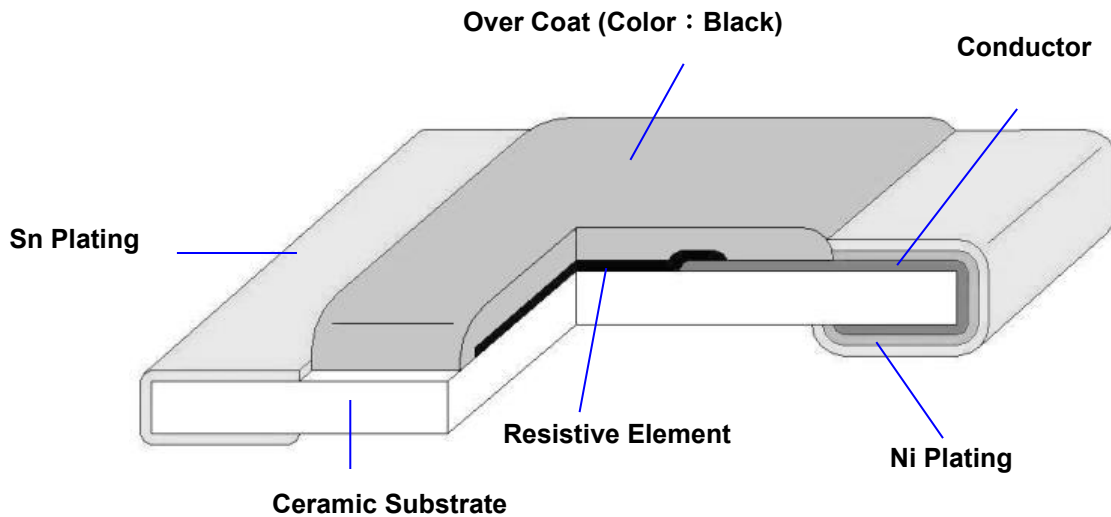
Anti-Surge Chip Resistors
 (RAS series standard)
Halogen-Free
AEC-Q200 qualified

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1. Scope :

This specification applies for the RAS series of Anti-Surge chip resistors made by TA-I.

2. Construction :



3. Type Designation :

<u>RAS</u>	<u>10</u>	<u>J</u>	<u>TN</u>	<u>100</u>
Product Code	Size	Tolerance	Packaging	Nominal Resistance
RAS : Anti-Surge Chip Resistor	Power Rating			

04 - 0402 (1005)	1/5W
06 - 0603 (1608)	1/3W
10 - 0805 (2012)	2/5W
12 - 1206 (3216)	1/2W
13 - 1210 (3226)	1/2W
20 - 2010 (5025)	1W
25 - 2512 (6432)	3/2W

D - ±0.5%
F - ±1%
J - ±5%
K - ±10%

T : Paper Tape
E : Embossed Tape
N : Normal (RoHS exclusion clause)

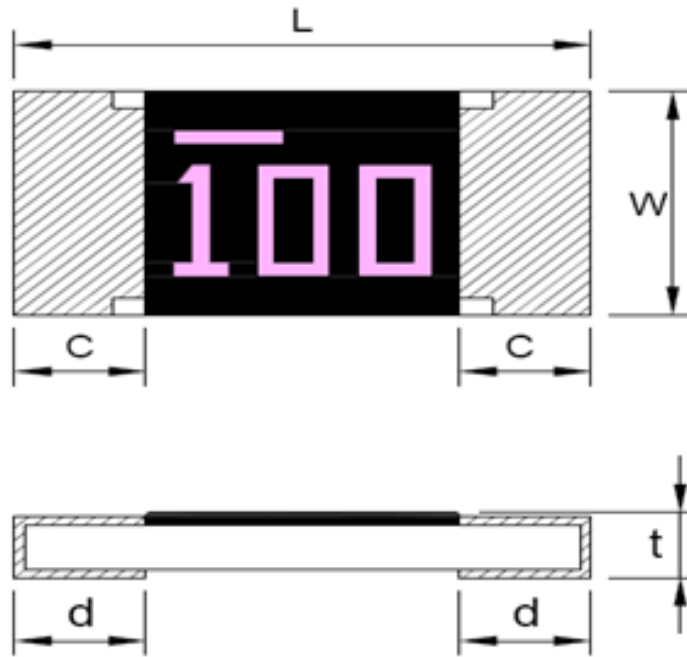
3 digits, e.g., (E-24) 100 = 10Ω
4 digits, e.g., (E-96) 1000 = 100Ω



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4. Dimensions :



UNIT : mm

Type	L	W	C	d	t
RAS04	1.00 ^{+0.1} _{-0.05}	0.50±0.05	0.20±0.10	0.25±0.10	0.32±0.05
RAS06	1.60±0.10	0.80±0.10	0.30±0.20	0.30±0.20	0.45±0.10
RAS10	2.00±0.10	1.25±0.10	0.40±0.20	0.40±0.20	0.50±0.10
RAS12	3.10±0.10	1.55±0.10	0.50±0.30	0.40±0.20	0.55±0.10
RAS13	3.10±0.10	2.55±0.10	0.50±0.30	0.40±0.20	0.60±0.10
RAS20	5.00±0.15	2.50±0.15	0.60±0.30	0.50±0.25	0.60±0.10
RAS25	6.30±0.20	3.20±0.20	0.60±0.30	0.50±0.25	0.60±0.10



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5. Ratings & Characteristics :

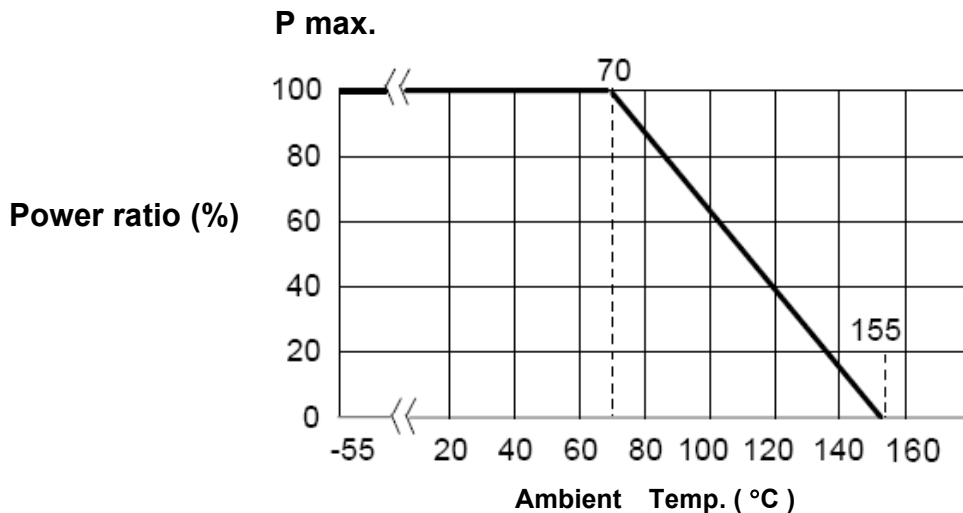
Type	Power Rating at 70°C	Rating Voltage	Max. Working Voltage	Max. Over-Load Voltage	T.C.R (PPM/°C)	Resistance Range(Ω)			
						D(±0.5%) E-96	F(±1%) E-96	J(±5%) E-24	K(±10%) E-24
RAS04	1/5W	Refer 5.2	50V	100V	±100	10Ω-1MΩ	10Ω-1MΩ	10Ω-1MΩ	10Ω-1MΩ
					±200		1Ω ≤ R < 10Ω	1Ω ≤ R < 10Ω	1Ω ≤ R < 10Ω
RAS06	1/3W	Refer 5.2	75V	150V	±100	10Ω-1MΩ	10Ω-1MΩ	10Ω-1MΩ	10Ω-1MΩ
					±200		1Ω ≤ R < 10Ω	1Ω ≤ R < 10Ω	1Ω ≤ R < 10Ω
RAS10	2/5W	Refer 5.2	150V	300V	±100	10Ω-1MΩ	10Ω-1MΩ	10Ω-1MΩ	10Ω-1MΩ
					±200		1Ω ≤ R < 10Ω	1Ω ≤ R < 10Ω	1Ω ≤ R < 10Ω
RAS12	1/2W	Refer 5.2	200V	400V	±100	10Ω-1MΩ	10Ω-1MΩ	10Ω-1MΩ	10Ω-1MΩ
					±200		1Ω ≤ R < 10Ω	1Ω ≤ R < 10Ω	1Ω ≤ R < 10Ω
RAS13	1/2W	Refer 5.2	200V	400V	±100	10Ω-1MΩ	10Ω-1MΩ	10Ω-1MΩ	10Ω-1MΩ
					±200		1Ω ≤ R < 10Ω	1Ω ≤ R < 10Ω	1Ω ≤ R < 10Ω
RAS20	1W	Refer 5.2	200V	400V	±100	10Ω-1MΩ	10Ω-1MΩ	10Ω-1MΩ	10Ω-1MΩ
					±200		1Ω ≤ R < 10Ω	1Ω ≤ R < 10Ω	1Ω ≤ R < 10Ω
RAS25	3/2W	Refer 5.2	200V	400V	±100	10Ω-1MΩ	10Ω-1MΩ	10Ω-1MΩ	10Ω-1MΩ
					±200		1Ω ≤ R < 10Ω	1Ω ≤ R < 10Ω	1Ω ≤ R < 10Ω

Operating Temp (°C) : -55°C ~ +155°C

Note : Except for the above standardized products, we also provide the customized products.

5.1. Derating Curve :

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





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5.2. Voltage :

The rated voltage is calculated by the following formula :

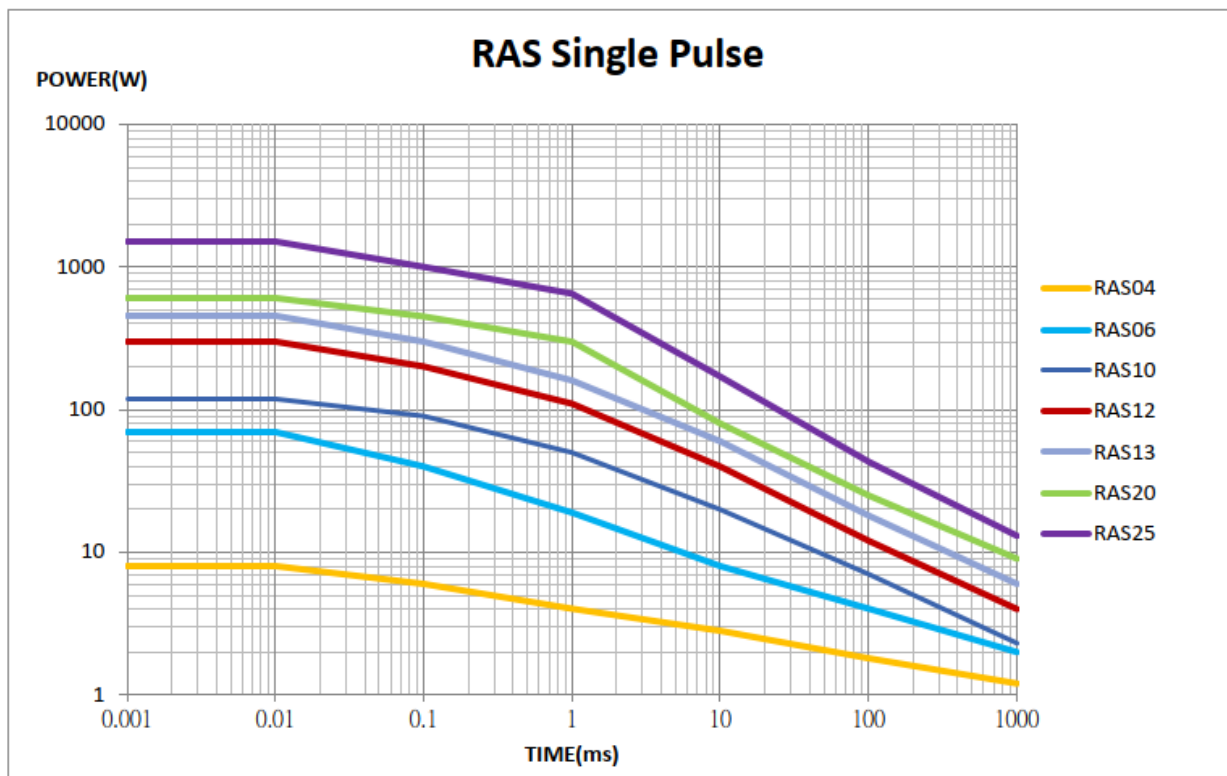
$$E = \sqrt{P * R}$$

E=Rated Voltage(V)
P=Rated Power(W)
R=Resistance Value(Ω)

e.g., What is RAS10JTN101 the rated voltage ?
RAS10JTN101 P : 2/5W ; R : 101 = 100 Ω

$$E = \sqrt{0.4(W) * 100(\Omega)} = 6.32(V)$$

5.3. Single Pulse Limiting Power Curve :





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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	$\pm(1.0\% + 0.05\Omega)$
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 (Remarks : 0402 3.0 X RCWV *)	$\pm(5.0\% + 0.1\Omega)$
Moisture Resistance	AEC-Q200-REV D-Test 6 MIL-STD-202 Method 106	T=24 hours / Cycle ,10Cycles. Notes : Steps 7a& 7b not required. Unpowered	0.5%,1%,5% : $\pm(1.0\%+0.05\Omega)$ 10% : $\pm(2.0\%+0.1\Omega)$
Biased Humidity	AEC-Q200-REV D-Test 7 MIL-STD-202 Method 103	1000 hours 85°C/85%RH. Note: Specified conditions: 10% of operating power(not exceeding max working voltage). Measurement at 24±2 hours after test conclusion.	$\pm(3.0\% + 0.1\Omega)$
Operational Life	AEC-Q200-REV D-Test 8 MIL-STD-202 Method 108	1000 hours TA=125°C at 35% rated power. Measurement at 24±4 hours after test conclusion.	$\pm(3.0\% + 0.1\Omega)$
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.	$\pm(1.0\% + 0.05\Omega)$
Solderability	IEC60115-1-4.17 JIS-C5201-1-4.17	245±5°C solder, 2±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	3mm deflection	$\pm(1.0\% + 0.05\Omega)$
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.	$\geq 1G\Omega$
Resistance to Dry Heat	IEC60115-1-4.23.2 JIS-C5201-1-4.23.2	155±5°C for 96±4Hrs	$\pm(2.0\% + 0.1\Omega)$
Resistance to Solder Heat	IEC60115-1-4.18 JIS-C5201-1-4.18	270±5°C solder , 10±1 sec dwell.	$\pm(1.0\% + 0.05\Omega)$

Note* : RCWV : Rated continuous working voltage.

Moisture Sensitivity Level : Level 1



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7. Marking :

7.1 ±5% , ±10% (E24) : RAS06 / 10 / 12 / 13 / 20 / 25

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., $\overline{100} = 10 \times 10^0 = 10\Omega$



RAS06 : R represents the 「 · 」

7.2 ±0.5% , ±1% (E96) : RAS10 / 12 / 13 / 20 / 25

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., $\overline{1000} = 100 \times 10^0 = 100\Omega$



7.3 ±0.5% , ±1% (E96) : RAS06

When the marking space is too small in such small-sized resistors as RAS06, the marking can not made by 4 digits and may be made by two digits combined with one English capital.

Symbol for E96 series nominal resistance value

Symbol	E96	Symbol	E96	Symbol	E96	Symbol	E96
01	100	25	178	49	316	73	562
02	102	26	182	50	324	74	576
03	105	27	187	51	332	75	590
04	107	28	191	52	340	76	604
05	110	29	196	53	348	77	619
06	113	30	200	54	357	78	634
07	115	31	205	55	365	79	649
08	118	32	210	56	374	80	665
09	121	33	215	57	383	81	681
10	124	34	221	58	392	82	698
11	127	35	226	59	402	83	715
12	130	36	232	60	412	84	732
13	133	37	237	61	422	85	750
14	137	38	243	62	432	86	768
15	140	39	249	63	442	87	787
16	143	40	255	64	453	88	806
17	147	41	261	65	464	89	825



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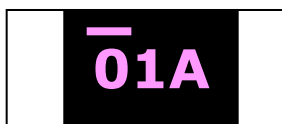
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18	150	42	267	66	475	90	845
19	154	43	274	67	487	91	866
20	158	44	280	68	499	92	887
21	162	45	287	69	511	93	909
22	165	46	294	70	523	94	931
23	169	47	301	71	536	95	953
24	174	48	309	72	549	96	976

Symbol for multipliers

Symbol	A	B	C	D	E	F	G	H	X	Y	Z
multipliers	10 ⁰	10 ¹	10 ²	10 ³	10 ⁴	10 ⁵	10 ⁶	10 ⁷	10 ⁻¹	10 ⁻²	10 ⁻³

e.g., $\bar{0}1A = 100 \times 10^0 = 100\Omega$



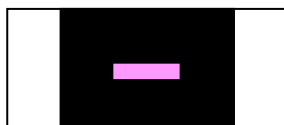
Notes :

When the resistance value is not in the list of E96 , 3 digitals with underline in E-24 series is used as mark.

e.g., 0603 , 120Ω , 1% Marking is $\bar{1}21$



7.4 RAS04 :





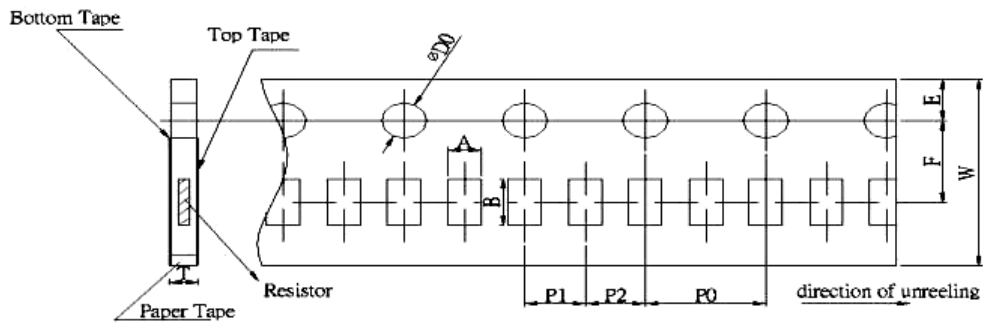
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8. Taping & Reel :

8.1 Taping Dimensions :

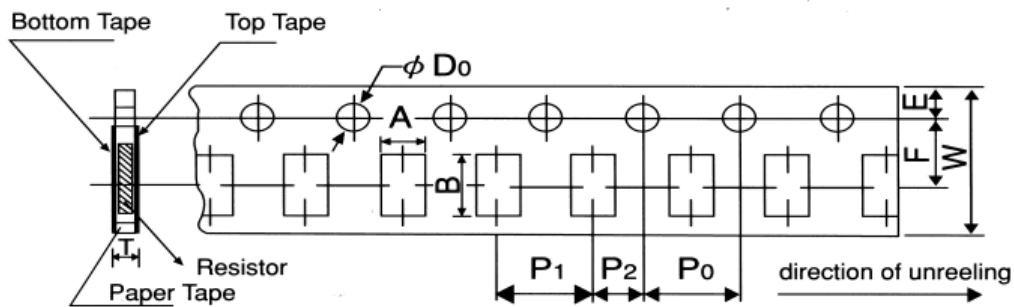
8.1.1 2 mm pitch paper :



UNIT : mm

Packing	Type	A	B	W	F	E	P ₁	P ₂	P ₀	D ₀	T
Paper	RAS04	0.7±0.05	1.2±0.05	8.0±0.2	3.5±0.05	1.75±0.1	2.0±0.1	2.0±0.1	4.0±0.1	φ 1.5 +0.1 -0	0.45±0.1

8.1.2 4 mm pitch paper :



UNIT : mm

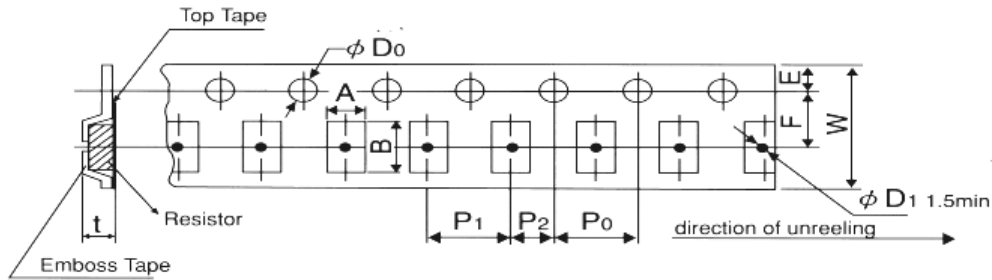
Packing	Type	A	B	W	F	E	P ₁	P ₂	P ₀	D ₀	T
Paper	RAS06	1.1±0.1	1.9±0.1	8.0±0.2	3.5±0.05	1.75±0.1	4.0±0.1	2.0±0.05	4.0±0.1	φ 1.5 +0.1 -0	0.64±0.1
	RAS10	1.6±0.15	2.4±0.2								0.84±0.1
	RAS12	2.0±0.15	3.6±0.2								
	RAS13	2.8±0.2	3.6±0.2								



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8.1.3 4 mm pitch Emboss :



UNIT : mm

Packing	Type	A	B	W	F	E	P ₁	P ₂	P ₀	D ₀	T
Emboss	RAS20	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	0.85±0.15
	RAS25	3.6±0.2	6.9±0.2								

UNIT : PCS

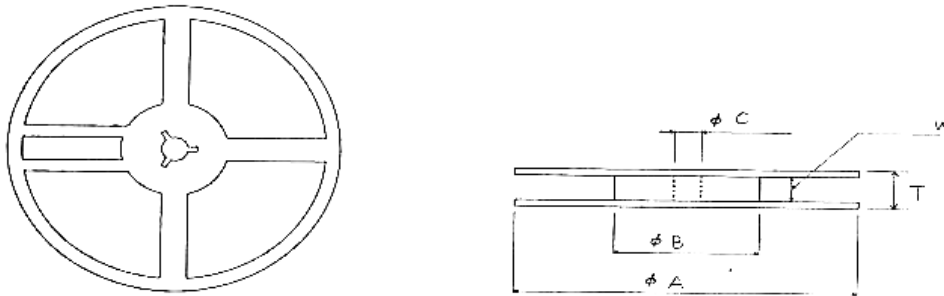
Type	Size	Package		
		Paper Tape	Paper Tape	Emboss Plastic Tape
		2 mm pitch	4 mm pitch	4 mm pitch
		178mm/R	178mm/R	178mm/R
RAS	04	10000		
RAS	06		5000	
RAS	10		5000	
RAS	12		5000	
RAS	13		5000	
RAS	20			4000
RAS	25			4000



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8.2 Reel Specifications :

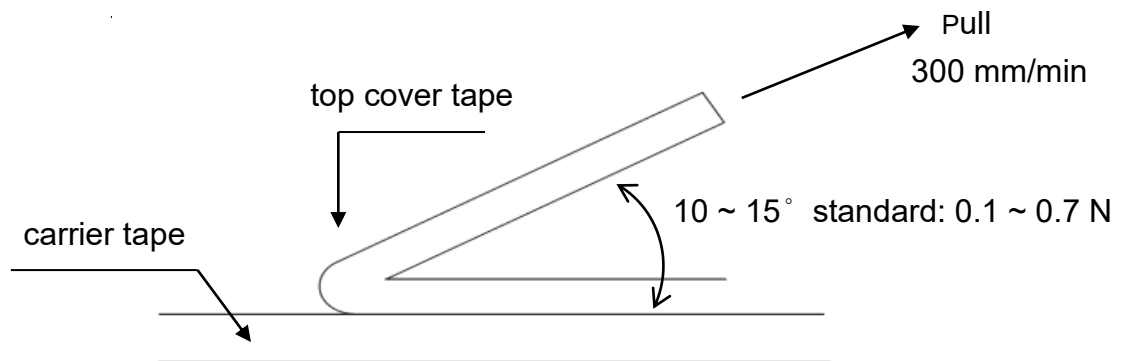


UNIT : mm

Type	ϕA	ϕB	ϕC	W	T
RAS04 / 06 / 10 / 12 / 13	178.0 ± 2.0	60.0 ± 1.0	13.0 ± 1.0	9.0 ± 1.0	11.5 ± 1.0
RAS20 / 25				13.0 ± 1.0	15.5 ± 1.0

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.

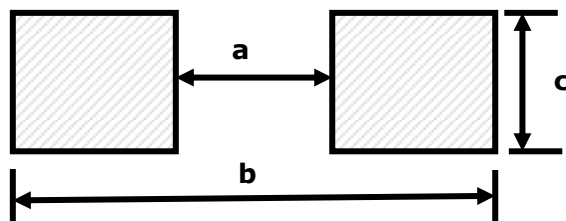




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9. Recommended land patterns :



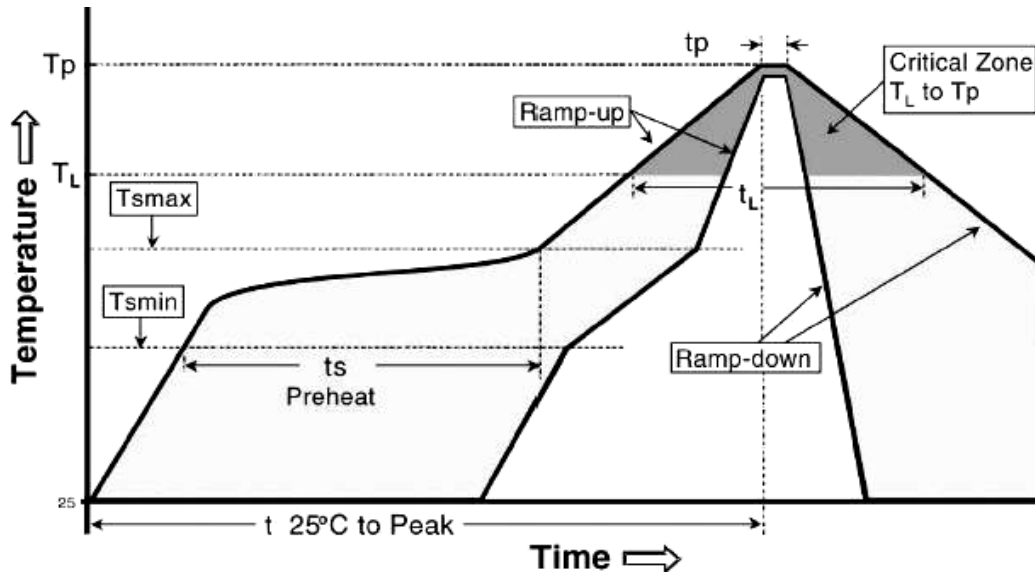
Type	Size	Land pattern		
		Dimension (mm)		
		a	b	c
RAS	04 (0402)	0.5~0.6	1.4~1.6	0.4~0.6
RAS	06 (0603)	0.7~0.9	2.0~2.2	0.8~1.0
RAS	10 (0805)	1.0~1.4	3.2~3.8	0.9~1.4
RAS	12 (1206)	2.0~2.4	4.4~5.0	1.2~1.8
RAS	13 (1210)	2.0~2.4	4.4~5.0	2.3~3.5
RAS	20 (2010)	3.3~3.7	5.7~6.5	2.3~3.5
RAS	25 (2512)	3.6~4.0	7.6~8.6	2.3~3.5



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

Allowed Re-flow times : 3 times

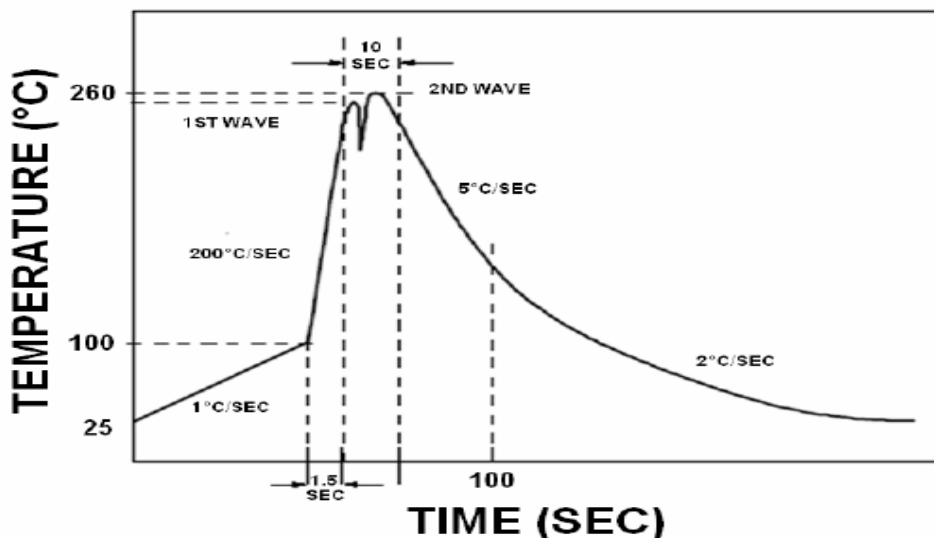
Remark : To avoid discoloration phenomena of chip on terminal electrodes, please use N2 Re-flow furnace.



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11. Recommend Wave-Solder profile : (solder : Sn96.5 / Ag3 / Cu0.5)



12. Solder iron conditions :

Iron temperature : $350 \pm 10^\circ\text{C}$

Application time of soldering iron : 3 sec

The number of times of work : 1 time

13. Storage Conditions :

Temperature : $5^\circ\text{C} \sim 35^\circ\text{C}$, Humidity : 40%~75%.

14. Shelf Life :

2 years from manufacturing date.

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.