



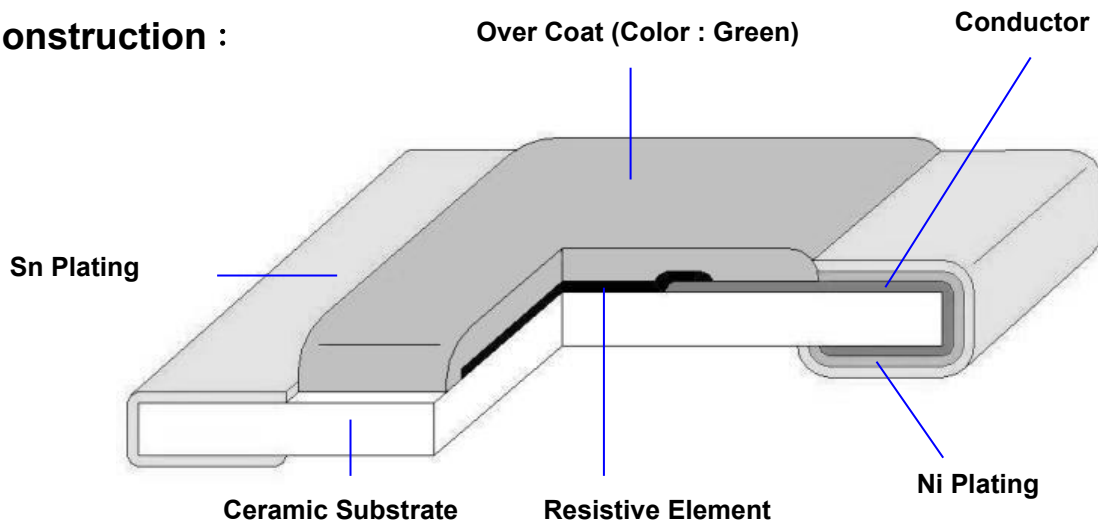
Thick Film High Voltage Chip Resistors (Standard) Halogen-Free

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1. Scope :

This specification applies for thick film high voltage chip resistors made by TA-I.

2. Construction :



3. Type Designation :

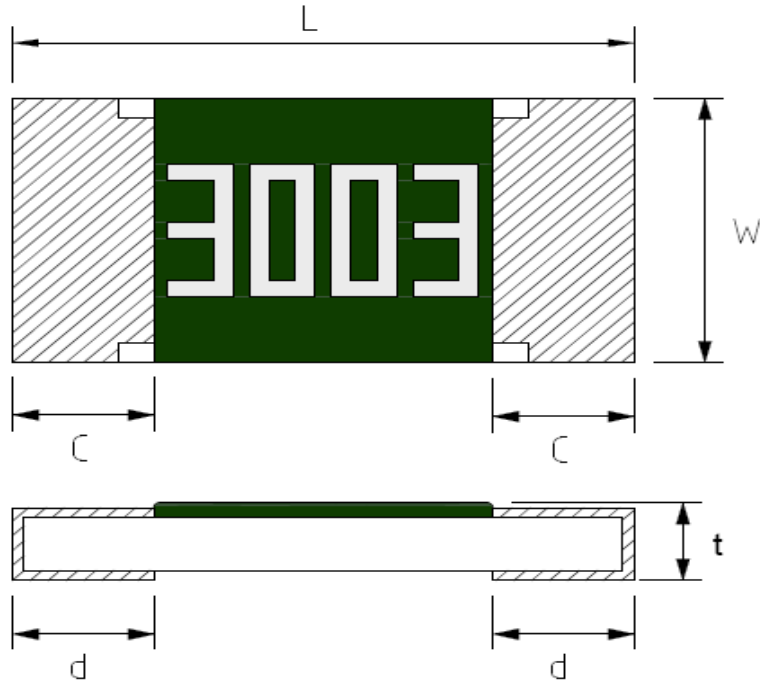
<u>RH</u>	<u>12</u>	<u>F</u>	<u>TN</u>	<u>4993</u>
Product Code	Size	Tolerance	Packaging	Nominal Resistance
RH : High voltage	Power Rating			
06-0603(1608) 10-0805(2012) 12-1206(3216) 13-1210(3226) 20-2010(5025) 25-2512(6432)	1/10W 1/8W 1/4W 1/3W 1/2W 1W	J - $\pm 5\%$ G - $\pm 2\%$ F - $\pm 1\%$ D - $\pm 0.5\%$	T : Paper Tape E : Embossed Tape N : Normal (RoHS exclusion clause)	3 digits, e.g., (E-24) 104 = 100K Ω 4 digits, e.g., (E-96) 4993 = 499K Ω



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4. Dimensions :



UNIT : mm

Type	L	W	C	d	t
RH06	1.60 ±0.10	0.80 ±0.10	0.30 ±0.20	$0.30^{+0.2}_{-0.1}$	0.45 ±0.10
RH10	2.00 ±0.10	1.25 ±0.10	0.35 ±0.20	0.40 ±0.20	0.50 ±0.10
RH12	3.10 ±0.20	1.55 ±0.10	0.40 ±0.25	0.40 ±0.20	0.55 ±0.10
RH13	3.10 ±0.20	2.55 ±0.10	0.40 ±0.25	0.40 ±0.20	0.55 ±0.10
RH20	5.00 ±0.20	2.50 ±0.20	0.50 ±0.25	0.50 ±0.25	0.55 ±0.10
RH25	6.30 ±0.20	3.20 ±0.20	0.60 ±0.30	0.50 ±0.25	0.55 ±0.10



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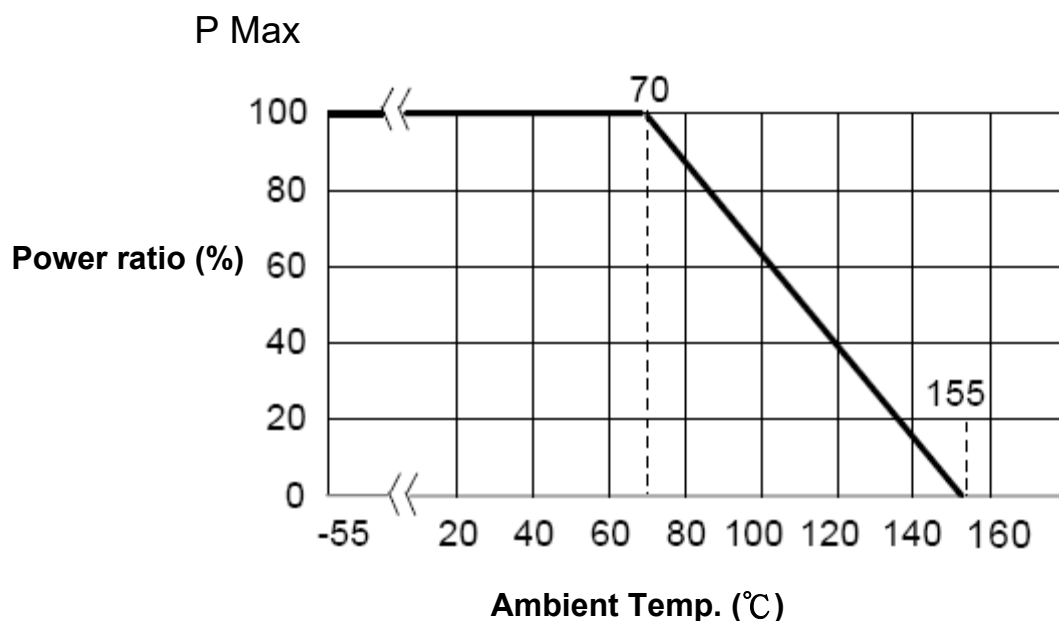
5. Ratings & Characteristics :

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&E-24	F(±1%) E-96&E-24	G(±2%) E-24	J(±5%) E-24
RH06	1/10W	Refer 5.2	350V	500V	±200	47Ω ~ 1M	47Ω ~ 10MΩ	47Ω ~ 10MΩ	47Ω ~ 10MΩ
RH10	1/8W	Refer 5.2	400V	800V	±200	10KΩ ~ 1M	10KΩ ~ 20MΩ	10KΩ ~ 20MΩ	10KΩ ~ 20MΩ
RH12	1/4W	Refer 5.2	500V	1000V	±200	47Ω ~ 1M	47Ω ~ 27MΩ	47Ω ~ 27MΩ	47Ω ~ 27MΩ
RH13	1/3W	Refer 5.2	600V	1200V	±200	47Ω ~ 1M	47Ω ~ 27MΩ	47Ω ~ 27MΩ	47Ω ~ 27MΩ
RH20	1/2W	Refer 5.2	1500V	3000V	±200	10KΩ ~ 1M	10KΩ ~ 20MΩ	10KΩ ~ 20MΩ	10KΩ ~ 20MΩ
RH25	1W	Refer 5.2	2000V	4000V	±200	10KΩ ~ 1M	10KΩ ~ 20MΩ	10KΩ ~ 20MΩ	10KΩ ~ 20MΩ
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 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 RH12FTN3003 the rated voltage ?

RH12FTN3003 P = 1/4W ; R : 3003 = 300K Ω = 300,000 Ω

$$E = \sqrt{1/4(W) * 300000 (\Omega)} = 273.86 V$$

Remark : However , it shall not exceed the maximum rated voltage .

6. Reliability Tests :

Test Items	Reference standard	Condition of Test	Test Limits
Visual examination		Checked by visual examination.	The marking shall be legible , as checked by visual examination
Temperature Coefficient of Resistance	IEC60115-1-4.8 JIS-C5201-1-4.8	-55 ~ +125 °C	Refer to paragraph 5
Dielectric Withstanding Voltage (Voltage Proof)	IEC60115-1-4.7 JIS-C5201-1-4.7	500Va. c., voltage, 1 min. Remarks : RH06 -300V	No abnormalities such as flashover , burning dielectric breakdown shall appear .
Insulation Resistance	IEC60115-1-4.6 JIS-C5201-1-4.6	100V voltage, 1 min.	$\geq 1G\Omega$
Solderability	IEC60115-1-4.17 JIS-C5201-1-4.17	245 $\pm 5^{\circ}C$ solder, 2 ± 0.5 sec dwell. Solder : Sn96.5/Ag3/Cu0.5	At least 95% of surface area of electrode shall be covered with new solder.
Short Time Overload	IEC60115-1-4.13 JIS-C5201-1-4.13	2.5 X rated voltage, 5s 2010 / 2512 : 2.0 X rated voltage, 2s	0.5%, 1% : $\pm(1.0\% + 0.05\Omega)$ 5% : $\pm(2.0\% + 0.1\Omega)$ Remark : RH06 : $\pm(2.0\% + 0.1\Omega)$
Resistance to Soldering Heat	IEC60115-1-4.18 JIS-C5201-1-4.18	270 $\pm 5^{\circ}C$ solder , 10 ± 1 sec dwell .	$\pm(1.0\% + 0.05\Omega)$



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Rapid Change of Temperature	IEC60115-1-4.19 JIS-C5201-1-4.19	-55℃ (30 min.) / +155 ℃(30 min.) 5 cycles	±(1.0% + 0.05Ω)
Load Life	IEC60115-1-4.25.1 JIS-C5201-1-4.25.1	1000 hours at rated power , 70℃ , 1.5hours "ON " , 0.5hour "OFF"	0.5%, 1% : ±(1.0% + 0.05Ω) 5% : ±(3.0% + 0.1Ω) Remark : RH06 : ±(3% + 0.1Ω)
Load Life with Humidity	IEC60115-1-4.24 JIS-C5201-1-4.24	1000 hours at rated voltage , 40±2℃ , 90~95% RH 1.5hours "ON " , 0.5hour "OFF"	0.5%, 1% : ±(1.0% + 0.05Ω) 5% : ±(3.0% + 0.1Ω) Remark : RH06 : ±(3% + 0.1Ω)
Robustness of Termination (Bending)	IEC60115-1-4.33 JIS-C5201-1-4.33	3mm deflection (RH06~13) 2mm deflection (RH20~25)	0.5%, 1% : ±(0.5% + 0.05Ω) 5% : ±(1.0% + 0.05Ω) Remark : RH06~13 : ±(1.0% + 0.05Ω)

Moisture Sensitivity Level : Level 1

7. Marking

7.1 ±2% , ±5% (E24) : RH06 / RH10 / RH12 / RH13 / RH20 / RH25

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.

Ex. 106 = $10 \times 10^6 = 10000000\Omega = 10M\Omega$

7.2 0.5% , ±1% (E96) : RH10 / RH12 / RH13 / RH20 / RH25

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

Ex. 4993 = $499 \times 10^3 = 499000\Omega = 499K\Omega$



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7.3 0.5% , $\pm 1\%$ (E96) : RH06

When the marking space is too small in such small-sized resistors as RH06, 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
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}

Ex. 01A = $100 \times 10^0 = 100\Omega$



Notes :

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

Ex. 0603 , 120Ω , 1% Marking is 121





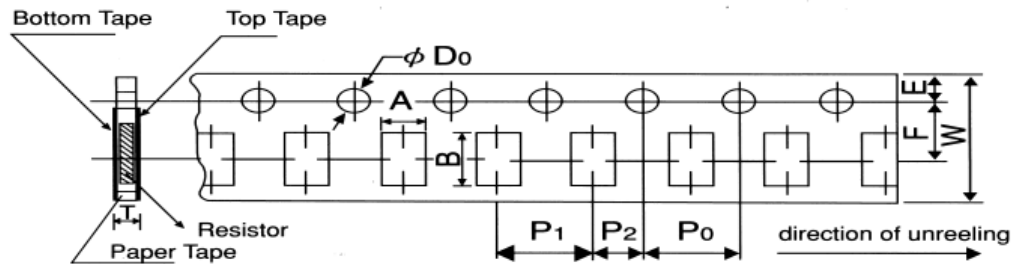
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8. Taping & Reel :

8.1 Taping Dimensions :

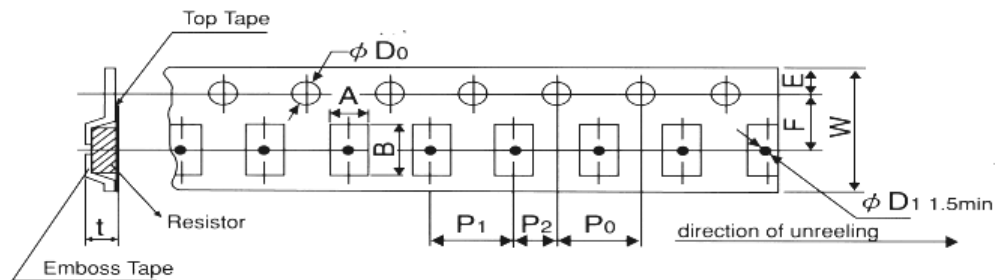
8.1.1 4 mm pitch paper :



UNIT : mm

Packing	Type	A	B	W	F	E	P ₁	P ₂	P ₀	D ₀	T
Paper Tape	RH06	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
	RH10	1.6±0.15	2.4±0.2								0.84±0.1
	RH12	2.0±0.15	3.6±0.2								
	RH13	2.8±0.2	3.6±0.2								

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	RH20	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
	RH25	3.6±0.2	6.9±0.2								



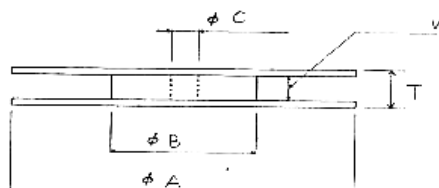
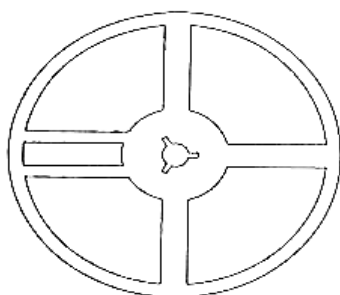
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UNIT : PCS

Type series		Paper Tape	Emboss Plastic Tape 4 mm pitch
		4 mm pitch	
		178mm/R	
RH	06	5000	
RH	10	5000	
RH	12	5000	
RH	13	5000	
RH	20		4000
RH	25		4000

8.2 Reel Specifications :



UNIT : mm

Type	ϕA	ϕB	ϕC	W	T
RH06 / 10 / 12 / 13	178 $\pm$ 2.0	60.0 $\pm$ 1.0	13.0 $\pm$ 1.0	9.0 $\pm$ 1.0	11.5 $\pm$ 1.0
RH20 / 25				13.0 $\pm$ 1.0	15.5 $\pm$ 1.0

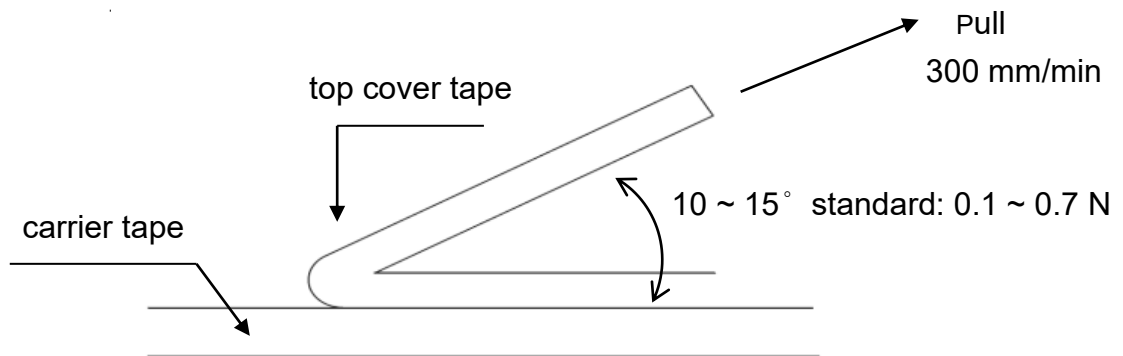


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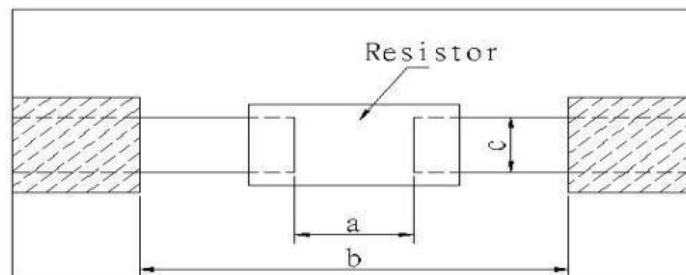
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8.3 Peel –off force :

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
RH	06 (0603)		0.7~0.9	2.0~2.2	0.8~1.0
RH	10 (0805)		1.0~1.4	3.2~3.8	0.9~1.4
RH	12 (1206)		2.0~2.4	4.4~5.0	1.2~1.8
RH	13 (1210)		2.0~2.4	4.4~5.0	2.3~3.5
RH	20 (2010)		3.3~3.7	5.7~6.5	2.3~3.5
RH	25 (2512)		3.6~4.0	7.6~8.6	2.3~3.5



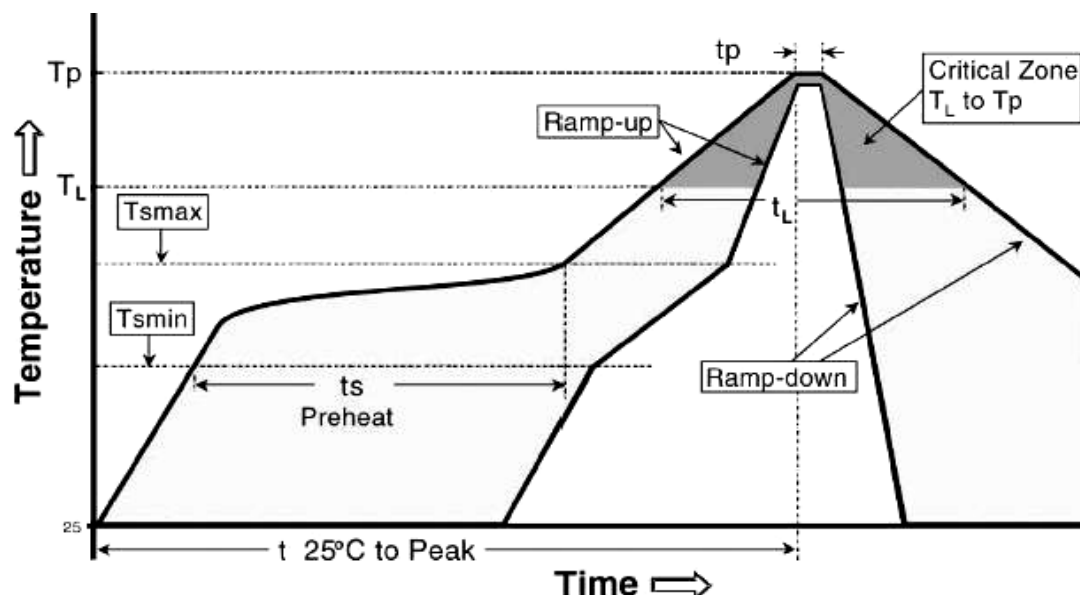
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10. Recommend IR – Reflow profile : (solder : Sn96.5 / Ag3 / Cu0.5)



Profile Feature	Lead (Pb)-Free Assembly
Average ramp-up rate (Tsmax to Tp)	3°C / second max.
Preheat - Temperature Min (Tsmin) - Temperature Max (Tsmax) - Time (Tsmin to Tsmax) (ts)	150°C 200°C 60 -120 seconds
Time maintained above : - Temperature (Tl) - Time (Tl)	217°C 60-150 seconds
Peak Temperature (Tp)	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°C~35°C, 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.