GRACE

SPECIFICATION

ROHS Compliant Parts

Customer : _____

Part Name : Chip PTC Thermistor

Part Number : KPTC-P Series

Dongguan GRACE electronic Technology Co., LTD

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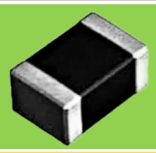
Chip PTC Thermistor — KPTC - P series

For Over Current Protection



Features

- Suitable for miniaturizing circuits due to small size SMD type
- Accurate temperature measurement from -40 °C to 125°C
- Short response time and Excellent long-term aging stability
- 100% Pb free, RoHS

Applications

- Over current protection for electric equipment such as tablet and notebook PCs, Computer periperals and LCD TVs.

Explanation of Part Numbers

KPTC	0603	P	470	M	101	K	X	XXXX	T
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩

①	Series
GRACE Chip CPTC Thermistor	

②	Chip size (EIA)
0603	
0805	
1210	

③	Series code
P	Over Current Protection
S	Overheat Sensing

④	Nominal resistance R_{25}(Ω)
470	47
471	470
152	1500

⑤	Resistance tolerance
M	±20%
H	±25%
S	±35%

⑥	Switch temperature（℃）
101	100

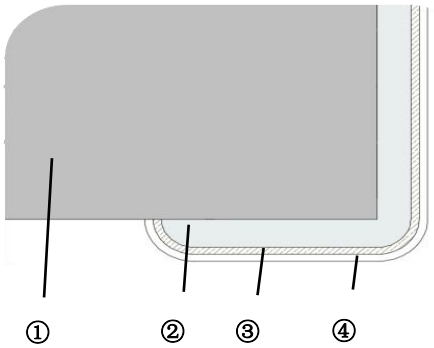
⑦	Temperature tolerance
K	±10%

⑧	internal code
X	

⑨	Customer identification code
XXXX	

⑩	Packaging style
T	Tape
B	Bulk

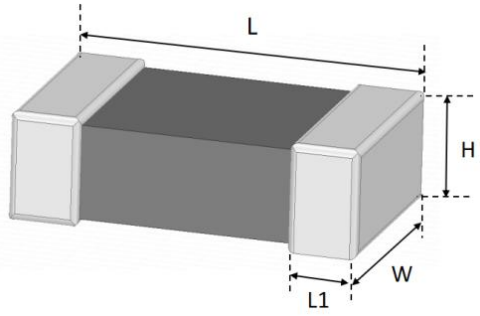
Construction



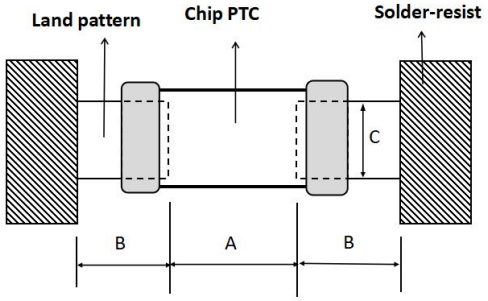
No.	Name	
①	PTC Semiconductive Ceramics	
②	Terminal electrode	Ag
③		Ni
④		Sn

Dimensions

1）Dimensions：



2）Recommended PCB pattern for reflow soldering:



Unit: mm

Size （EIA/JIS)	L	W	H	L1	A	B	C
0603/1608	1.60±0.20	0.80±0.20	0.80±0.20	0.30±0.20	0.60~0.80	0.60~0.80	0.60~0.80
0805/2012	2.00±0.20	1.20±0.20	1.45max	0.40±0.20	0.80~1.20	0.80~1.20	0.90~1.60
1210/3225	3.20±0.30	2.50±0.30	1.80max	0.40±0.30	1.90~2.10	1.20~1.50	2.60~2.80

Electrical Characteristics

0603 Type

Part Number	Switch temperature	Resistance @25℃	Hold Current		Trip Current		Voltage Max	Current Max	Working temperature	
			@ +25℃	@ +60℃	@ -10℃	@+25℃			@ Vmax	@V=0
	Tc (℃)	R25 (Ω)	In (mA)		It (mA)		Vdc (V)	Imax (mA)	TL~TU(℃)	
KPTC0603P330M101K□□T	100±10	33	36	25	85	71	24	900	-10~ +60	-40~ +125
KPTC0603P470M101K□□T		47	29	20	75	61		630		
KPTC0603P600M101K□□T		60	29	20	75	61		500		
KPTC0603P101M101K□□T		100	21	15	55	45		300		
KPTC0603P221M101K□□T		220	14	10	35	29		130		
KPTC0603P471M101K□□T		470	10	7	25	21		60		

0805 Type

Part Number	Switch temperature	Resistance @25℃	Hold Current		Trip Current		Voltage Max	Current Max	Working temperature	
			@ +25℃	@ +60℃	@ -10℃	@+25℃			@ Vmax	@V=0
	Tc (℃)	R25 (Ω)	In (mA)		It (mA)		Vdc (V)	Imax (mA)	TL~TU(℃)	
KPTC0805P150M101K□□T	100±10	15	59	40	140	116	20	1600	-10~ +60	-40~ +125
KPTC0805P220M101K□□T		22	44	30	110	91		1100		
KPTC0805P221M101K□□T		220	14	10	35	29	24	130		

1210 Type

Part Number	Switch temperature	Resistance @25℃	Hold Current		Trip Current		Voltage Max	Current Max	Working temperature	
			@ +25℃	@ +60℃	@ -10℃	@+25℃			@ Vmax	@V=0
	Tc (℃)	R25 (Ω)	In (mA)		It (mA)		Vdc (V)	Imax (mA)	TL~TU(℃)	
KPTC1210P270□111K□□T	110±10	27	90	40	263	180	30	500	-40~ +85	-40~ +125
KPTC1210P550□121K□□T	120±10	55	60	34	190	130	30	400		
KPTC1210P121□121K□□T	120±10	120	40	23	132	90	80	300		
KPTC1210P401□900K□□T	90±10	400	15	6	59	40	265	200		
KPTC1210P152□121K□□T	120±10	1500	12	4	32	22	400	150		

※ The above data were tested in stationary air at 25℃ with unmounted independent units.

Description and definition of terms

No.	Items	Test Methods and Remarks
1	Switch temperature	The temperature when PTC component resistance starts to increase sharply Defined as the temperature corresponding to the zero -power resistance value at 25 ° C.
2	Nominal Zero-Power Resistance (R25)	Ambient temperature: 25±0.2℃. Measuring electric power: 0.1mW Max.
3	Hold Current	In the current voltage characteristics of PTC, the current value that can flow without increasing resistance

4	Trip Current	In the current voltage characteristics of PTC, it refers to the current value of the rising resistance. Further current will be suppressed
5	Voltage Max	Refers to the maximum voltage that can be applied to PCT within the working temperature range
6	Current Max	After starting the power supply of the electronic equipment switch, the large current flowing over the rated current value in a short period of time

Reliability Test

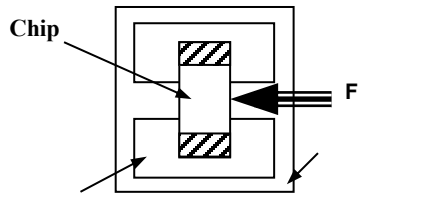
<table>
<tr><th>Items</th><th>Requirements</th><th>Test Methods and Remarks</th></tr>
<tr><td rowspan="2">Terminal Strength</td><td>No removal or split of the termination or other defects shall occur.</td><td rowspan="2">Solder the chip to the testing jig (glass epoxy board shown in the following Fig. 1-1) using eutectic solder. Then apply a force in the direction of the arrow.
<table><tr><th>Size（EIA）</th><th>Force</th><th>Duration</th></tr><tr><td>0603</td><td>5N</td><td rowspan="2">10±1s</td></tr><tr><td>0805、1210</td><td>10N</td></tr></table></td></tr>
<tr><td> 

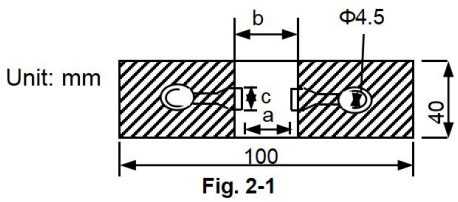
Fig.1-1</td></tr>
<tr><td>Resistance to Flexure</td><td>No visible mechanical damage.
Unit: mm
<table><tr><th>Size（EIA）</th><th>a</th><th>b</th><th>c</th></tr><tr><td>0603</td><td>1.0</td><td>3.0</td><td>1.2</td></tr><tr><td>0805</td><td>1.2</td><td>4.0</td><td>1.65</td></tr><tr><td>1210</td><td>2.1</td><td>4.5</td><td>3.1</td></tr></table> 

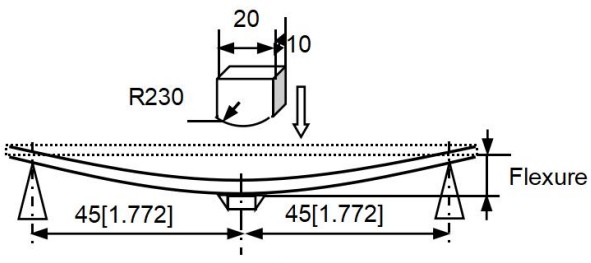
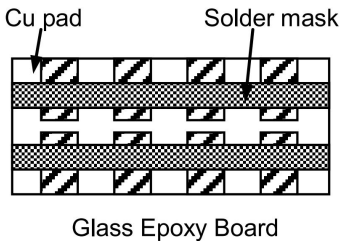
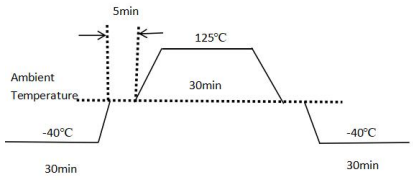
Fig. 2-1</td><td>Solder the chip to the test jig (glass epoxy board shown in Fig.2-1) using a eutectic solder. Then apply a force in the direction shown in Fig. 2-2.
<table><tr><th>Size（EIA）</th><th>Flexure</th><th>Pressurizing Speed</th><th>Duration</th></tr><tr><td>0603、0805、1210</td><td>2mm</td><td>＜0.5mm/s</td><td>10±1s</td></tr></table> 

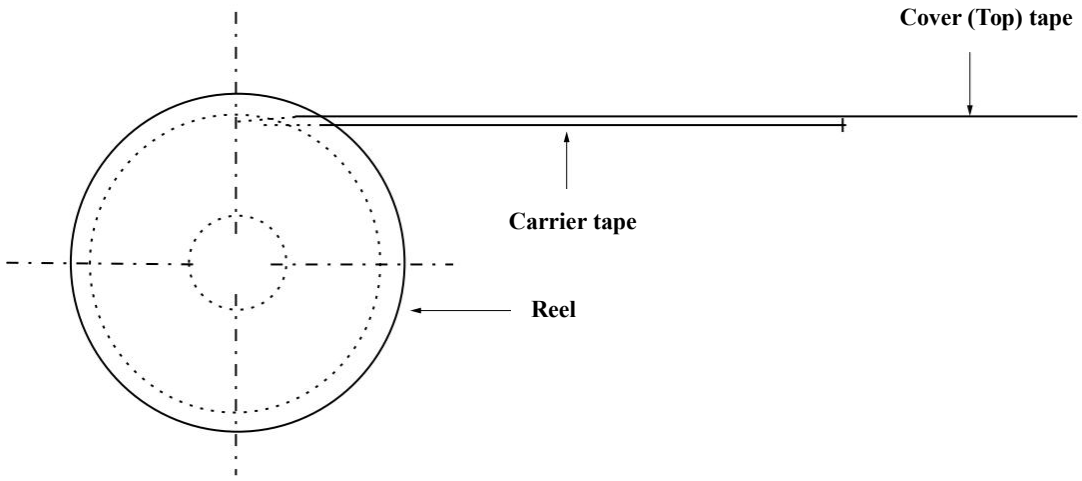
Fig.2-2</td></tr>
</table>

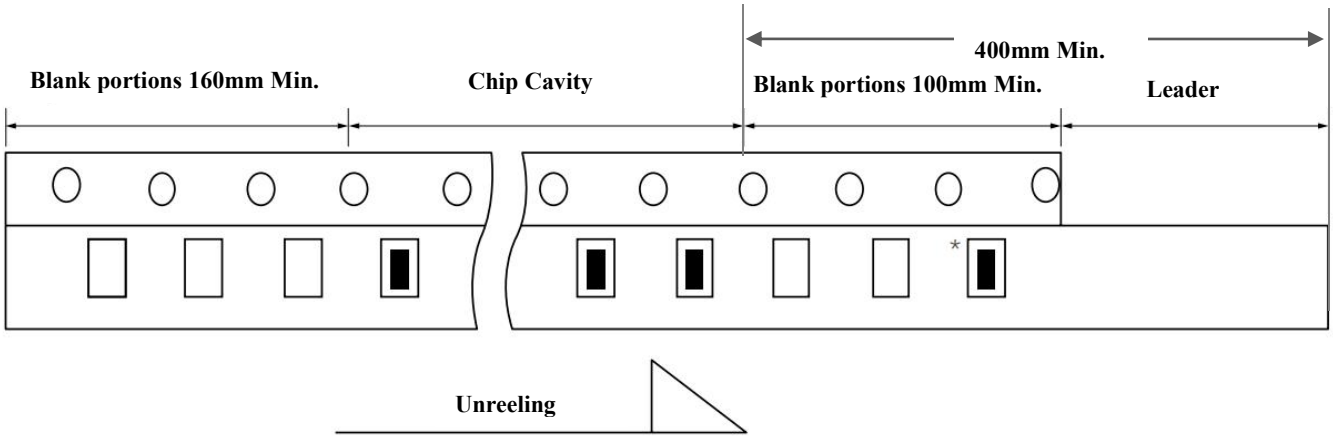
Vibration	**No visible mechanical damage.**  **Fig. 3-1**	❖ **Solder the chip to the testing jig (glass epoxy board shown in Fig.3-1) using eutectic solder.** ❖ **The chip shall be subjected to a simple harmonic motion having total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 55 Hz.** ❖ **The frequency ranging from 10 to 55 Hz and returning to 10 Hz shall be traversed in approximately 1 minute. This motion shall be applied for a period of 2 hours in each 3 mutually perpendicular directions (total of 6 hours).**
Dropping	**No visible mechanical damage.**	**Drop chip inductor 10 times on a concrete floor from a height of 100 cm.**
Solderability	❖ **No visible mechanical damage.** ❖ **Wetting shall exceed 80% coverage.**	❖ **Solder temperature: 245±2℃ .** ❖ **Duration: 3 sec.** ❖ **Solder: Sn/3.0Ag/0.5Cu.** ❖ **Flux: 25% Resin and 75% ethanol in weight.**
Resistance to Soldering Heat	❖ **No visible mechanical damage.** ❖ **R25 change: within ±20%.**	❖ **Solder temperature: 250±5℃** ❖ **Duration: 5 sec.** ❖ **Solder: Sn/3.0Ag/0.5Cu.** ❖ **Flux: 25% Resin and 75% ethanol in weight.** ❖ **The chip shall be stabilized at normal condition for 1~2hours before measuring.**
Thermal Shock	❖ **No visible mechanical damage.** ❖ **R25 change: within ±20%.** 	❖ **Temperature, Time: -40℃ for 30±3 min→ 125℃ for 30±3min.** ❖ **Transforming interval: 5sec. Max.** ❖ **Tested cycle: 5 cycles.** ❖ **The chip shall be stabilized at normal condition for 1~2 hours before measuring.**
Resistance to Low Temperature	❖ **No visible mechanical damage.** ❖ **R25 change: within ±20%.**	❖ **Temperature: -40±3℃** ❖ **Duration: 1000+24 hours.** ❖ **The chip shall be stabilized at normal condition for 1~2 hours before measuring.**
Resistance to High Temperature	❖ **No visible mechanical damage.** ❖ **R25 change: within ±20%.**	❖ **Temperature: 125±3℃** ❖ **Duration: 1000+24 hours.** ❖ **The chip shall be stabilized at normal condition for 1~2 hours before measuring.**

Damp Heat (Steady States)	❖ No visible mechanical damage. ❖ R25 change: within ±10%.	❖ Temperature: 60±2℃ ❖ Humidity: 90% to 95% RH. ❖ Duration: 1000+24 hours. ❖ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
*Loading at High Temperature (Life Test) *Only available for 1210 series	❖ No visible mechanical damage. ❖ R25 change: Within ±20%.	❖ Temperature: 85±2℃ ❖ Duration: 1000+24 hours. ❖ Applied current: Max. Permissive Operating Current. ❖ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
Loading at High Temperature (Life Test)	❖ No visible mechanical damage. ❖ R25 change: within ±20%.	❖ Temperature: 60±2℃ ❖ Applied current: Vmax,for 1.5 hour on, 0.5 hour off. ❖ Duration: 1000+24 hours. ❖ The chip shall be stabilized at normal condition for 1~2 hours before measuring.
Climatic sequence test	❖ No visible mechanical damage. ❖ R25 change: within ±20%.	❖ Temperature, Time: 125℃ for 16 hours ❖ First cycle: 40 ℃ 95%RH x 24 hours ❖ -40℃,2 hours ❖ Five cycles 40℃ 95% RH x 24 hours/time

Packaging

(1) Figure



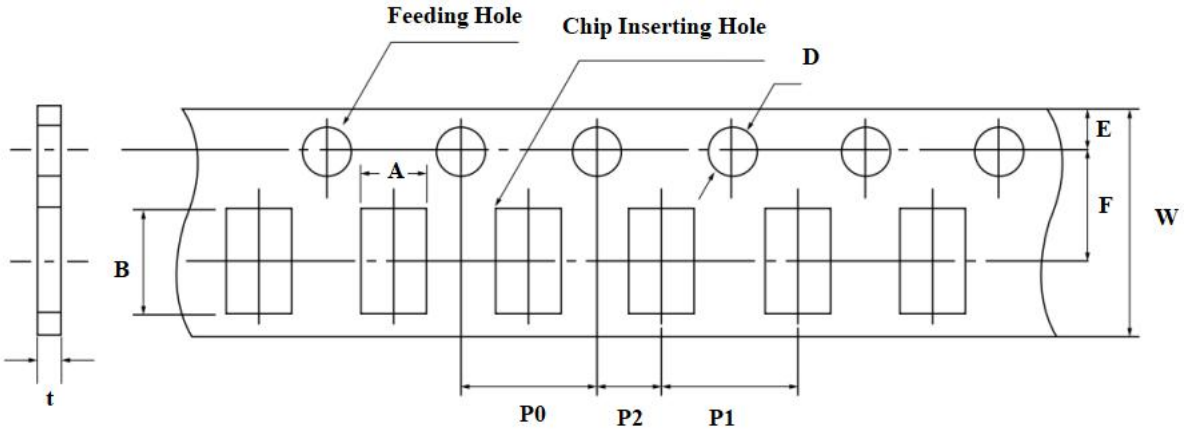


(2) Quantity

Size(EIA)		0603	0805	1210
Taping Type		PAPER	PAPER	plastic
Quantity	Reel	4K	4K	3K
	Inner Box	4K×10=40K	4K×10=40K	3K×10=30K
	Outer Box	4K×10×6=240K	4K×10×6=240K	3K×10×6=180K

(3) Tape Size

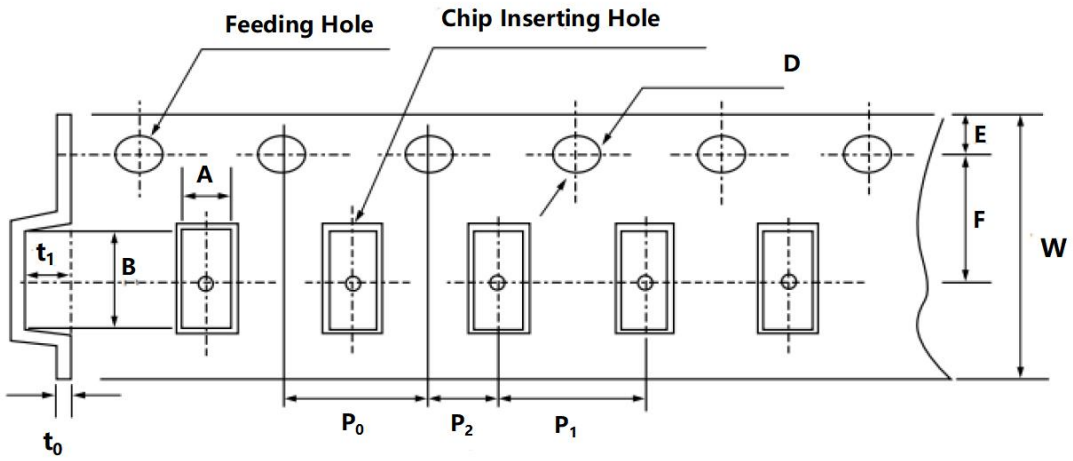
❖ **Cardboard(Paper) tape**



Unit: mm

Size (EIA)	A	B	W	F	E	P1	P2	P0	D	t
0603	1.0±0.2	1.8±0.2	8.00 ±0.30	3.50 ±0.05	1.75 ±0.10	4.00 ±0.10	2.00 ±0.05	4.00 ±0.10	Φ1.50 +0.1/-0.03	≤1.1
0805	1.5±0.2	2.3±0.2				4.00 ±0.10				≤1.1

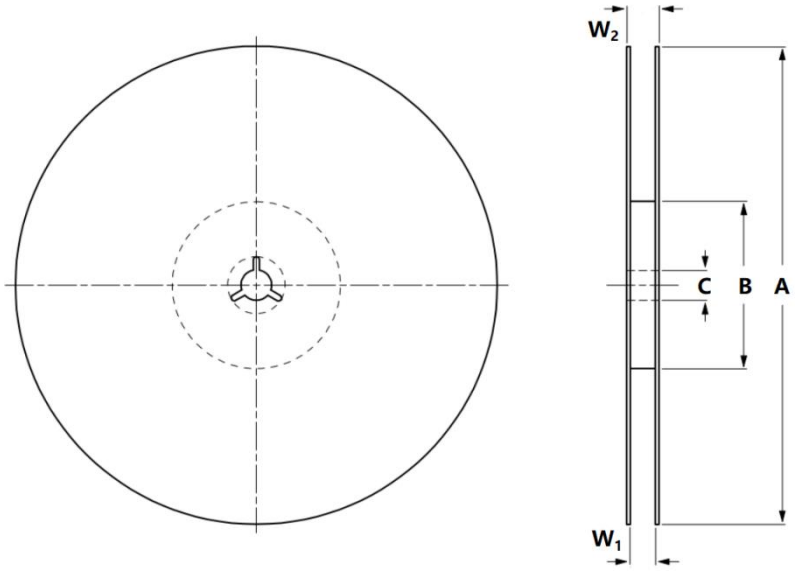
❖ **Embossed (Plastic) tape**



unit: mm

Size (EIA)	A	B	W	F	E	P1	P2	P0	D	t_0	t_1
1210	2.75 ±0.10	3.55 ±0.10	8.00 ±0.30	3.50 ±0.05	1.75 ±0.10	4.00 ±0.10	2.00 ±0.05	4.00 ±0.10	Φ1.50 +0.1/-0.03	≤0.5	≤2.0

(4) Reel Size

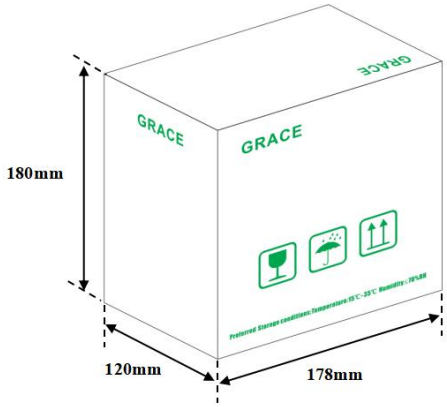


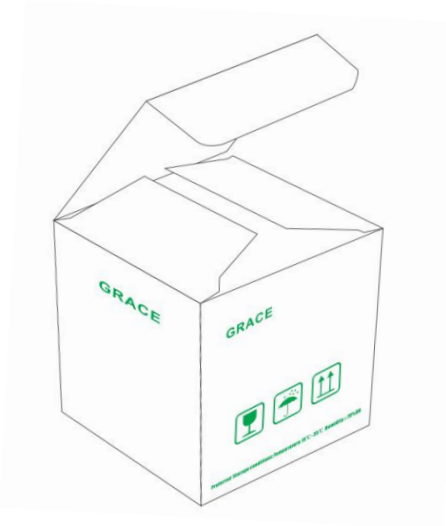
Type	Symbol	Dimensions(mm)
7" Reel	A	178±2
	B	58±2
	C	13.5±0.2
	W1	8.4+1.5/-0.0
	W2	≤14.4

(5) BOX package

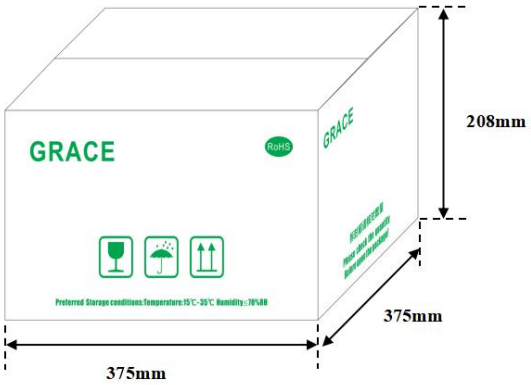
Double packaging with the paper type of inner box and outer box.

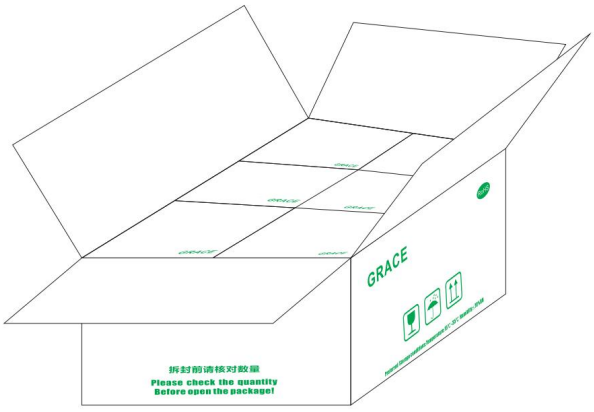
❖ **Inner Box ：**





❖ **Outer Box ：**





※ Box size specifications for reference.

■ Storage environment

(1) Recommendation for temperature/humidity

❖ **Even taping and packaging materials are designed to endure a long-term storage, they should be stored with a temperature of -10~40℃and an RH of 0~70% otherwise, too high temperatures or humidity may deteriorate the quality of the chip rapidly.**

❖ **Packaging material may be deform-ed if package are stored where they are exposed to heat of direct sunlight.**

❖ **As oxidization is accelerated when relative humidity is above 70%RH, the lower the humidity is, the better the solderability is.**

❖ **As the temperature difference may cause dew condensation during the storage of the chip, it is a must to maintain a temperature control environment.**

(2) Shelf Life

- **An allowable storage period should be within 12 months from the outgoing date of delivery in consideration of solderability.**
- **As for chips in storage over 12 months, please check solderability before use.**

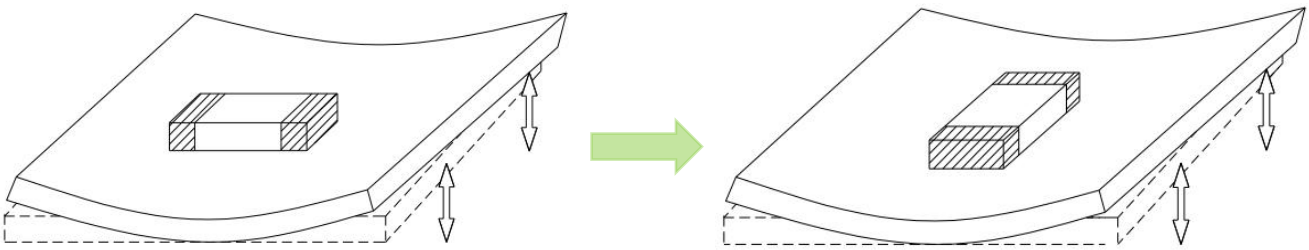
(3) Caution for corrosive environment

As corrosive gases may deteriorate the solderability of chip outer termination, it is a must to store chip in an environment without gases. chip that is exposed to corrosive gases may cause its quality issues due to the corrosion of plating layers and the penetration of moisture.

Process of Mounting and Soldering

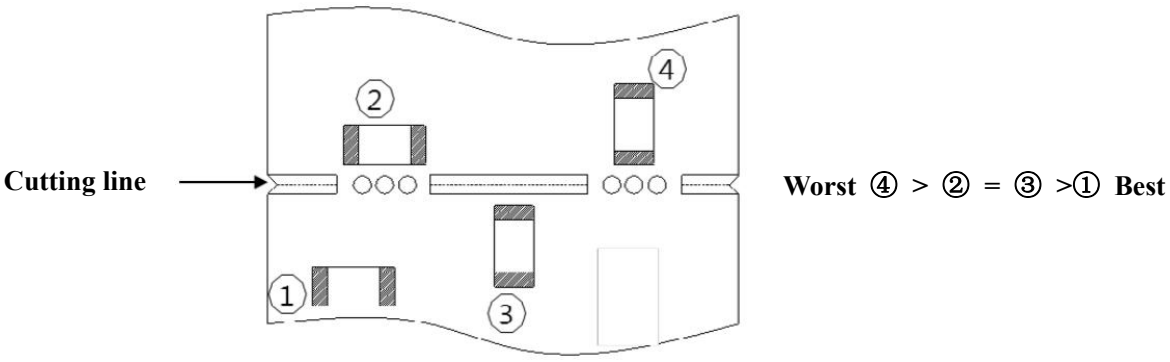
(1) Mounting

- **It is recommended to locate the major axis of chip in parallel to the direction in which the stress is applied.**



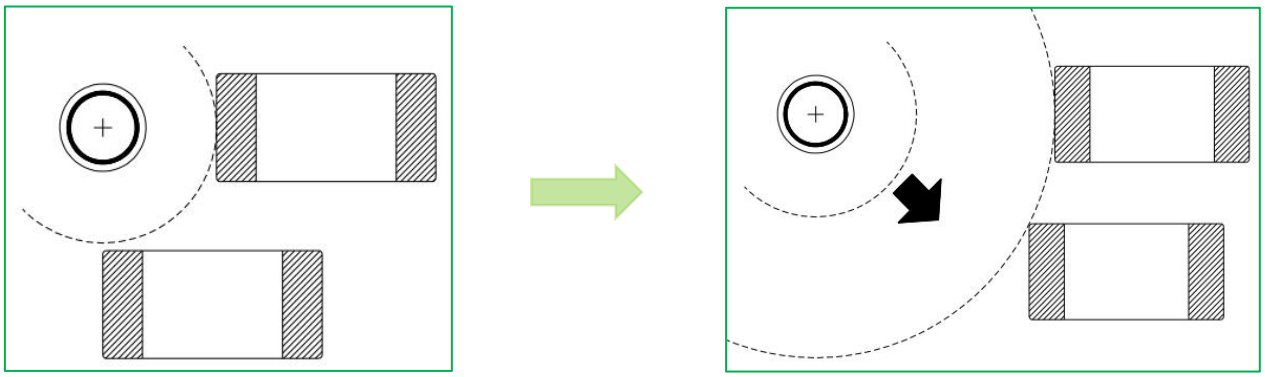
Not recommended **Recommended**

- **Please take the following measures to effectively reduce the stress generated from the cutting of PCB. Select the mounting location shown below, since the mechanical stress is affected by a location and a direction of chip mounted near the cutting line.**



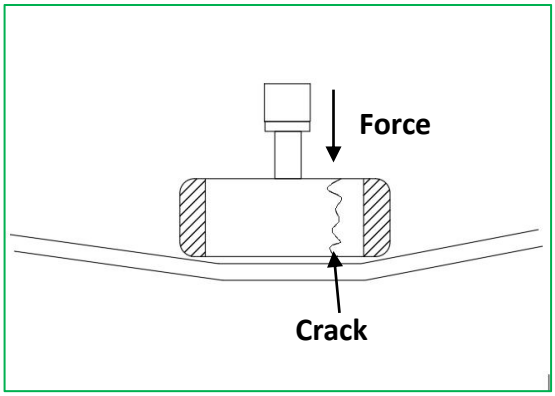
Worst ④ > ② = ③ >① Best

- **If the chip is mounted near a screw hole, the board deflection may be occurred by screw torque. Mount the chip as far from the screw holes as possible.**

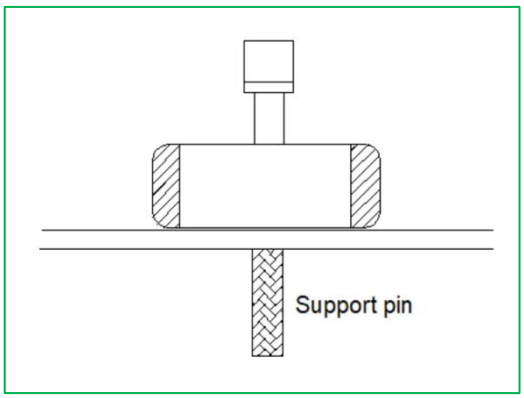


Not recommended Recommended

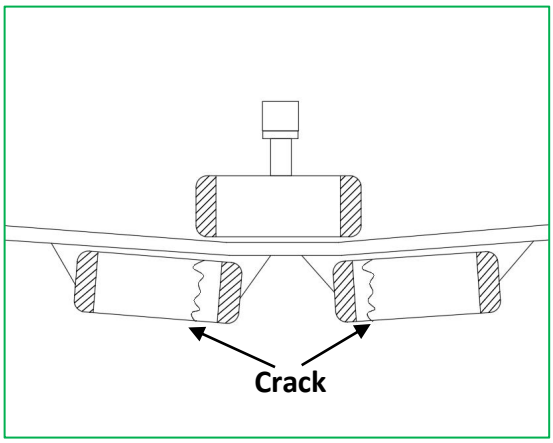
❖ **Substrate fixes up back surface of substrate with support pin in impact of suction nozzle to wely deflection to the utmost, and substrate hold deflection, please. A representative example is shown in the following.**



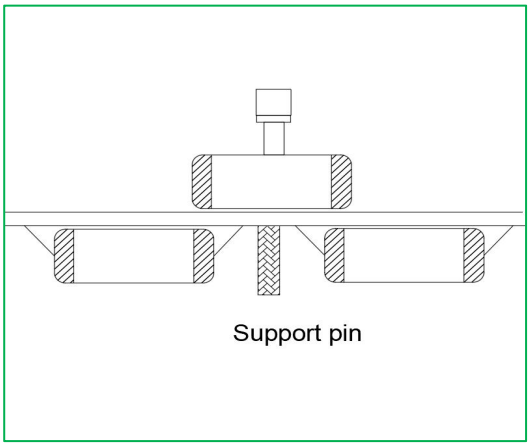
Cases to avoid



Recommended Case



Cases to avoid

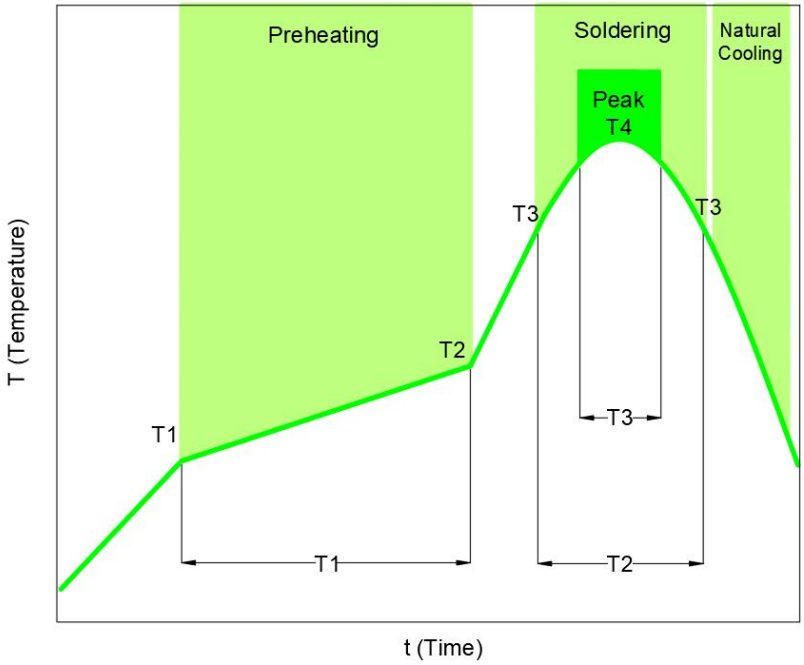


Recommended Case

※ **Dust accumulated in a suction nozzle and suction mechanism can impede a smooth movement of the nozzle. This may cause cracks in the chip due to the excessive force during mounting.If the mounting claw is worn out, it may cause cracks in the chip due to the uneven force during positioning.A regular inspection such as maintenance, monitor and replacement for the suction nozzle and mounting claw should be conducted.**

(2) Reflow soldering

The reflow soldering temperature conditions are composed of temperature curves of Preheating, Temp. rise, Heating, Peak and Gradual cooling. Large temperature difference inside the chip caused by rapid heat application to the chip may lead to excessive thermal stresses, contributing to the thermal cracks. The Preheating temperature requires controlling with great care so that tombstone phenomenon may be prevented. Follow the recommended soldering conditions to avoid degradation of performance .



Item	Specification	
	For eutectic mixture solder	For lead-free solder
Preheating temperature	160 ～ 180 ℃	150 ～ 180 ℃
Solder melting temperature	200 ℃	230 ℃
Maximum temperature	240° C max.	260 ℃ max.
Preheating time	100s max.	120s max.
Time to reach higher than the solder melting temperature	30s max.	40s max.
number of possible reflow cycles	2 max.	2 max.

※ **Pre-heating is necessary for all constituents including the PCB to prevent the mechanical damages on the chip . The temperature difference between the PCB and the component surface must be kept to the minimum.**

a. **Allowable temperature difference △T≦ 150 °C**

b. **Use non-activated flux. (Max. Cl content less than 0.1%)**

(3) Soldering Iron

Manual soldering can pose a great risk on creating thermal cracks in the chip. The high temperature soldering iron tip may come into a direct contact with the ceramic body of the chip due to the carelessness of an operator. Therefore, the soldering iron must be handled carefully, and close attention must be paid to the selection of the soldering iron tip and to temperature control of the tip.

Iron soldering power	Soldering time	Soldering Temp.	Number of times	Pre-heating
20W max.	3s max.	300±10℃ max.	Within each terminal once(Within total of twice)	① ΔT≤130 ② ⩾60S

※ Keep the contact time between the outer termination of the chip and the soldering iron as short as possible. Long soldering time may cause problems such as adhesion deterioration by the leaching phenomenon of the outer termination.

a. Control Δ T in the solder iron and preheating temperature;

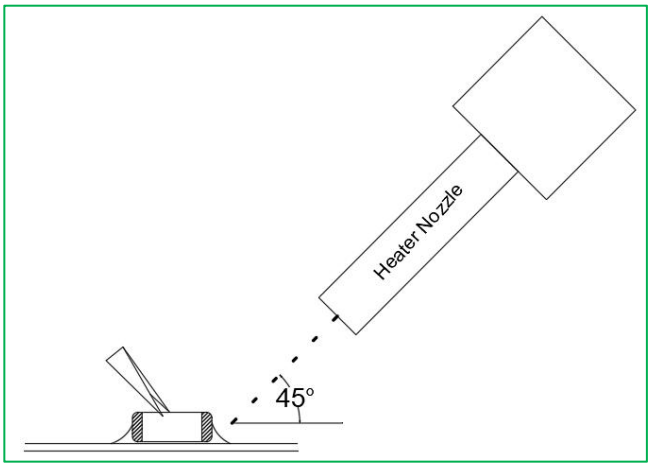
b. Caution - Iron tip should not contact with ceramic body directly;

c. Do not cool down the chip and PCB rapidly after soldering;

d. Lead-free solder: Sn-3.0Ag-0.5CU.

(4) Spot heater

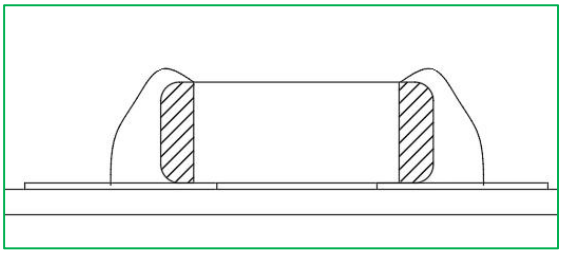
Compared to local heating with a soldering iron, hot air heating by a spot heater heats the overall component and board, therefore, it tends to lessen the thermal shock. In the case of a high density mounted board, a spot heater can also prevent concerns of the soldering iron making direct contact with the component.



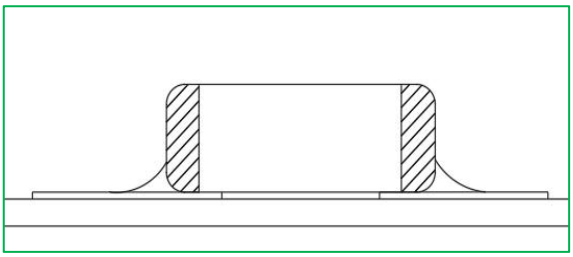
Distance	Hot Air Application angle	Hot Air Temperature Nozzle Outlet	Application Time
≥ 5mm	45℃	≤ 400℃	≤ 10s

※ If the distance from the air nozzle outlet to the chip is too close, the chip may be cracked due to the thermal stress.

(5) Recommended Amount of Solder



Excessive amount



Insufficient amount

※ Notes:

a. Too much solder amount will increase the risk of PCB bending or cause other damages.

b. Too little solder amount will result in the chip breaking loose from the PCB due to the inadequate adhesive strength.

c. Check if the solder has been applied properly and ensure the solder fillet has a proper shape.

(6) Cleaning

❖ **In general, cleaning is unnecessary if rosin flux is used.**

When acidic flux is used strongly, chlorine in the flux may dissolve into some types of cleaning fluids, thereby affecting the performance of the chip.

This means that the cleansing solution must be carefully selected and should always be new.

❖ **Cautions for cleaning**

The chip or solder joint may be cracked with the vibration of PCB, if ultrasonic vibration is too strong during cleaning. Therefore，test should be done for the cleaning equipment and its process before the cleaning in order to avoid damages on the chip，you can refer to the following conditions for cleaning.

Ultrasound output	Ultrasound frequency	Cleaning time
20W/liter or less	40kHz or less	5minutes or less

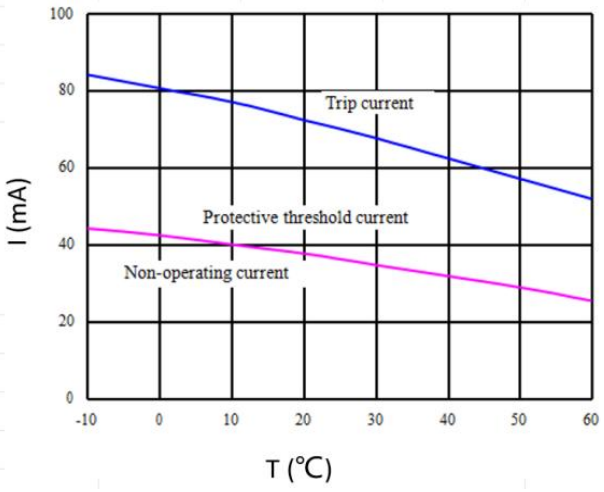
⚠ Limitation

Please contact us with usage environment information such as voltage, current, temperature, or other special conditions before using our products for the applications listed below. The products are not designed or warranted to meet the requirements of the applications listed below, whose performance and/or quality require especially high reliability, or whose failure, malfunction or trouble might directly cause damage to society, person, or property. Please understand that we are not responsible for any damage or liability caused by use of the products in any of the applications below.

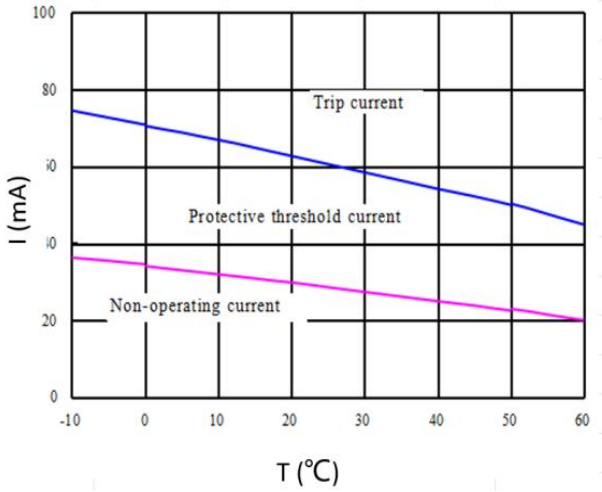
If you have any questions regarding this 'Limitation'，you should first contact our sales personnel or application engineers.

- **Aerospace/Aviation equipment1wheeler, 2wheeler and 3wheeler vehicle**
- **Automotive of Transportation equipment**
- **Military equipment**
- **Atomic energy-related equipment**
- **Undersea equipment**
- **Medical equipment**
- **Disaster prevention/crime prevention equipment**
- **Power plant control equipment**
- **Traffic signal equipment**
- **Data-processing equipment**
- **Electric heating apparatus，burning equipment**
- **Safety equipment**
- **Any other applications with the same as or similar complexity or reliability to the applications**

Current protection range



KPTC0603P330M101K□□T



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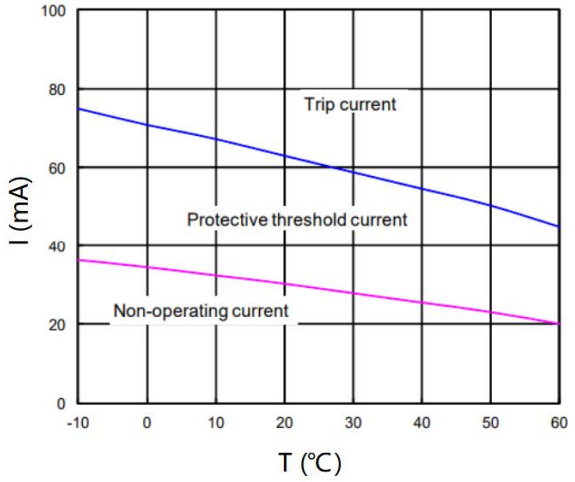

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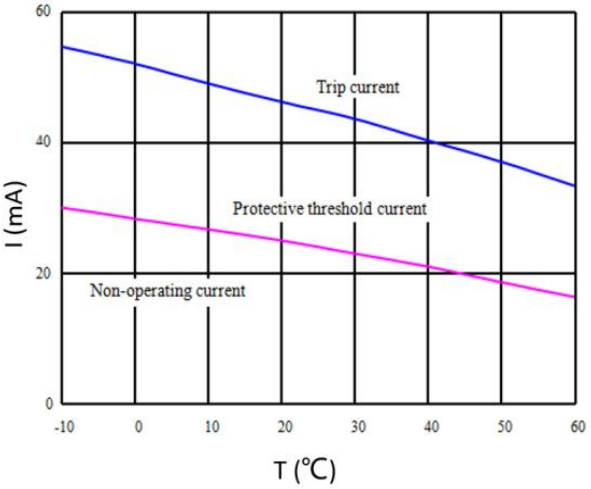

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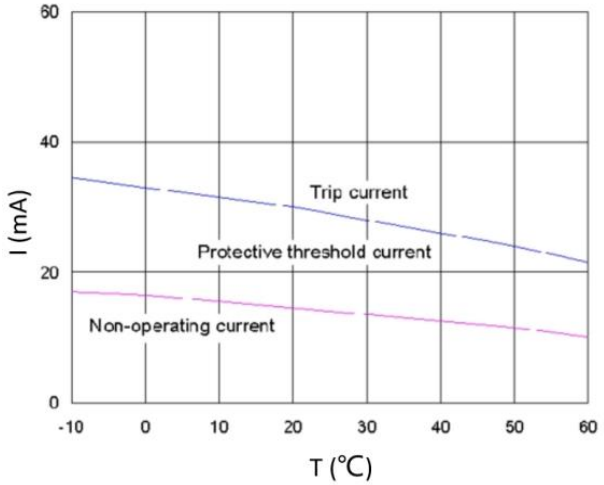

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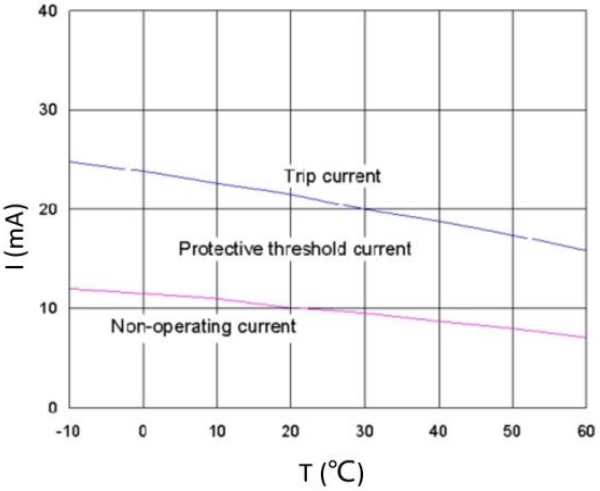

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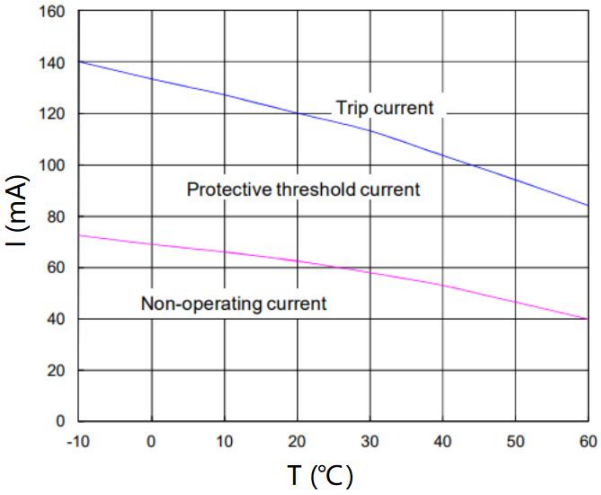

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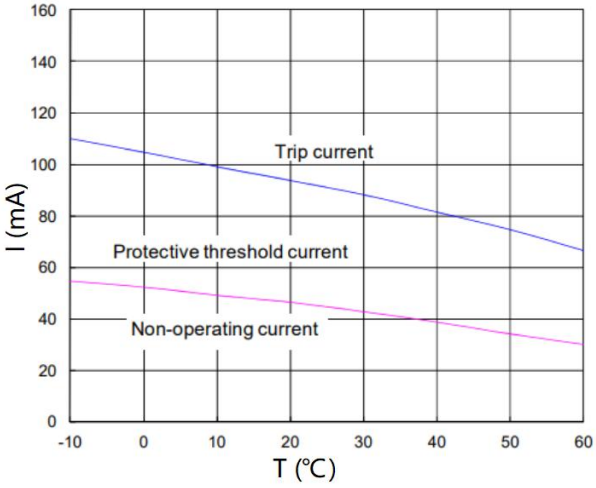

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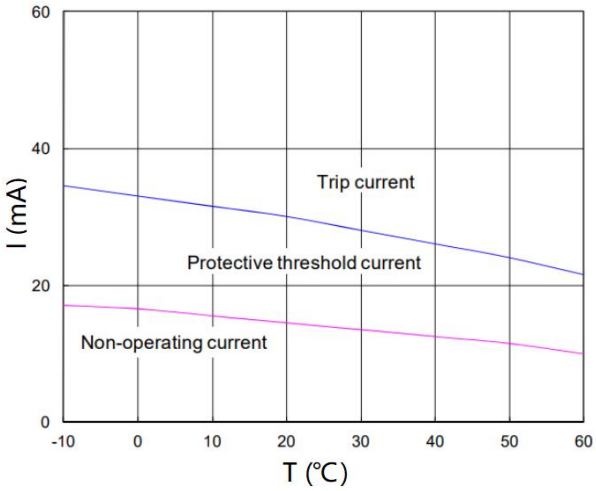

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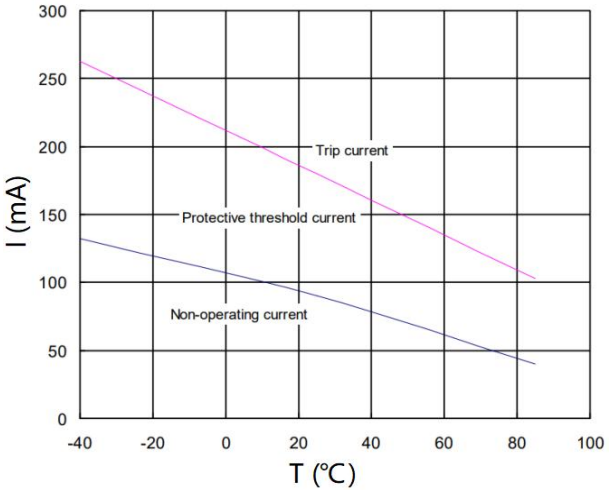

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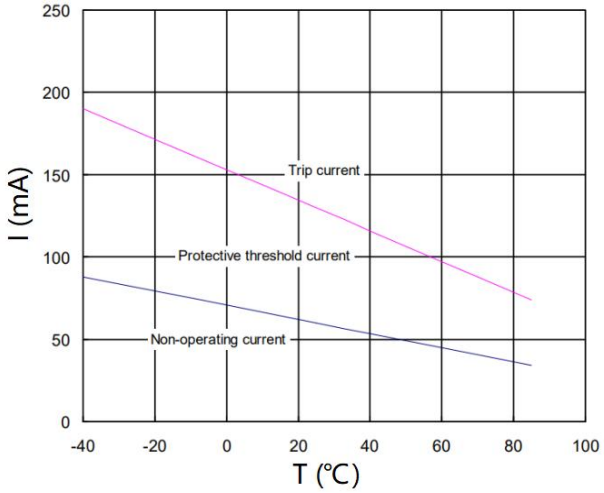

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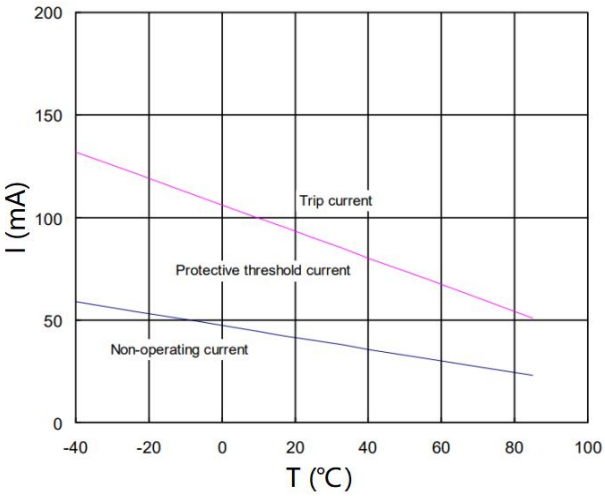

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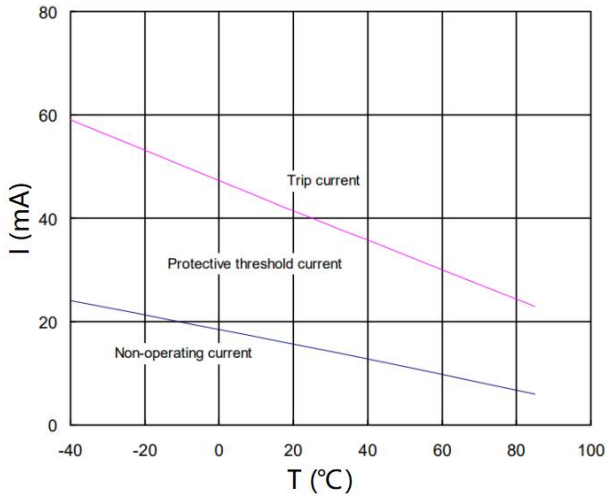

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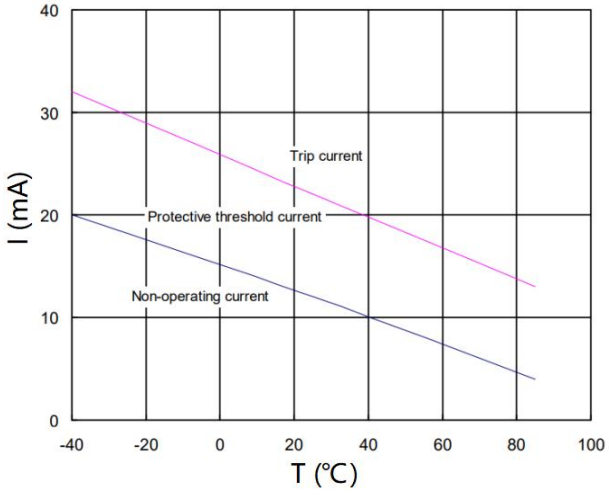

KPTC1210P152□121K□□T