

Ceramic PTC Thermistor: PPL Series

Dip Type for Inrush Current Limiter



■ Features

1. RoHS compliant
2. Leaded type
3. Voltage rating: 140~500V_{ac}, 200~1000V_{dc}
4. Resistance range: 3.8 ~2000Ω
5. Stable over a long time
6. Operating temperature range:
-20 ~ +85°C (V=V_{max})
-40 ~ +125°C (V=0)
7. Agency recognition:
UL/cUL: File No. E138827
TUV: File No. R50426392 and R50499186
8. AEC-Q200 compliant products are available



■ Recommended Applications

1. Air conditioner
2. Server
3. LED lamp
4. Switch power supply

■ Part Number Code

P	P	L	1	6	5	0	0	M	A	2	B	7	C	I			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Product Code			Dimensions			Tolerance of R ₂₅			Curie Temperature			Packaging			Internal Control Code		
PP	THINKING Ceramic PTC Thermistor PP Series		06	Φ06mm		M	±20%		P8	80℃		C	Bulk				
			11	Φ11mm		H	±25%		A0	100℃		D	Ammo Box Pitch 12.7mm				
			16	Φ16mm		N	±30%		A2	120℃		H	Ammo Box Pitch 15mm				
			20	Φ20mm		Y	Special		A4	140℃		E	Taping & Reel Pitch 12.7mm				
			25	Φ25mm					B2	220℃		I	Taping & Reel Pitch 15mm				
Series			Resistance (R ₂₅)						Max. Voltage			Application					
L	Leaded Type		3R8	3.8Ω					A4	140V		I	General				
			250	25Ω					B7	270V		C	Automotive				
			500	50Ω					C8	380V							
			101	100Ω					E0	500V							
			102	1000Ω					H5	850V							
			202	2000Ω					J0	1000V							

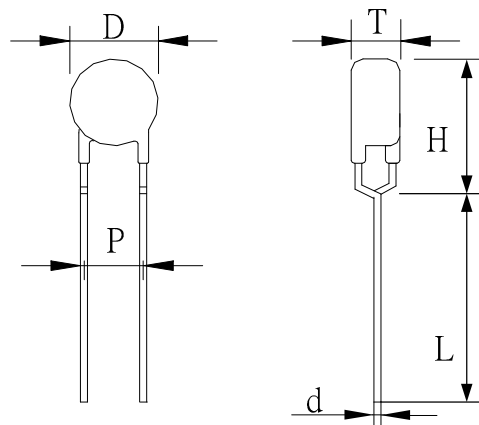
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■ Structure and Dimensions

● Structure



● Dimensions

(Unit: mm)

Part No.	D		T		H	d	P	L
	min	max	min	max	max	±0.02	±1.0	Min.
PPL123R8□A4A1	10.5	13.0	3.0	5.0	17.5	0.6	5	25
PPL09160□A2B2	8.5	11.0	3.0	5.0	14.5	0.6	5	25
PPL19100□A1B7	19.0	21.5	6.5	10.7	25.5	1.0	10	25
PPL16270□A2B7	15.5	18.0	5.0	7.5	21.5	1.0	10	25
PPL16350□A2B7	15.5	18.0	5.0	7.5	21.5	1.0	10	25
PPL16500□A2B7	15.5	18.0	5.0	7.5	21.5	1.0	10	25
PPL16800□A2B7	15.5	18.0	5.0	7.5	21.5	1.0	10	25
PPL19150□A2B7	19.0	21.5	6.5	10.7	25.5	1.0	10	25
PPL20400□A2B7	19.0	22.0	6.0	10.0	25.5	0.8	7.5	25
PPL20600□A2B7	19.0	22.0	6.5	10.7	25.5	1.0	10	25
PPL20330□A3B7	19.5	22.0	6.5	10.7	25.5	1.0	10	25
PPL20470□A3B7	19.5	22.0	6.5	10.7	25.5	0.8	7.5	25
PPL06121□A3B8	5.0	8.0	3.0	6.0	13.8	0.5	5	25
PPL11250□A2C8	10.5	13.0	4.0	6.5	17.0	0.6	5	25
PPL11500□A2C8	10.5	13.0	5.0	7.5	17.0	0.6	5	25
PPL11800□A2C8	10.5	13.0	5.0	7.5	17.0	0.6	5	25
PPL19500□A0C8	19.0	21.5	6.5	10.7	25.5	1.0	10	25
PPL11121□A2C8	10.5	13.0	5.0	7.5	17.0	0.6	5	25
PPL11151□A2C8	10.5	13.0	5.0	7.5	17.0	0.6	5	25
PPL16101□A2C8	15.5	18.0	5.0	7.5	21.5	1.0	10	25
PPL11201□A2D2	10.5	13.0	5.0	7.5	17.0	0.6	5	25
PPL16151□A2D2	15.5	18.0	5.0	7.5	21.5	1.0	10	25
PPL14121□A3D4	12.5	15.0	5.0	7.5	19.5	0.8	5	25
PPL14560□A3D4	12.5	15.0	5.0	7.5	19.5	0.8	5	25
PPL19102□A0D8	19.0	21.5	6.5	10.7	25.5	1.0	10	25
PPL16251□A2E0	15.5	18.0	5.0	7.5	21.5	1.0	10	25
PPL11501□A2E0	10.5	13.0	5.0	7.5	17.0	0.6	5	25

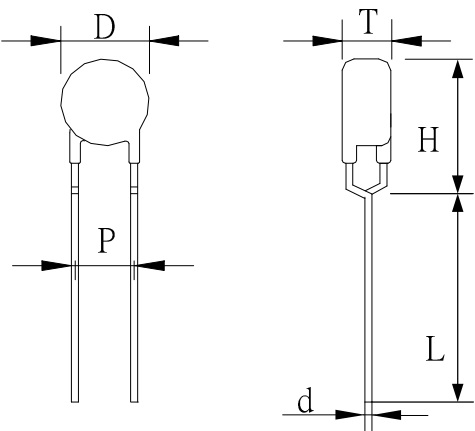
Note: For AEC-Q 200 qualified products, their d is 0.6mm for straight lead, and 0.8mm or 1.0mm for F lead. Please contact THINKING sales representatives and authorized distributors for detailed information.

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■ Structure and Dimensions



● Dimensions

(Unit: mm)

Part No.	D		T		H	d	P	L
	min	max	min	max	max	±0.05	±1.0	Min.
PPL25601□A4G5	25	28	7	9.5	35	1.0	10	25
PPL25251□A2H5	25	28.5	7	9.5	35	1.0	10	25
PPL25102□A2J0	25	28.5	7.5	10.5	35	1.0	10	25
PPL25102□A4J0	25	28	7	9.5	35	1.0	10	25
PPL25301□A8J0	25	28.5	6	9.5	35	1.0	10	25
PPL25501□A8J0	25	28.5	6	9.5	35	1.0	10	25
PPL25801□A8J0	25	28.5	6	9.5	35	1.0	10	25
PPL25102□A8J0	25	28.5	6	9.5	35	1.0	10	25
PPL25132□A8J0	25	28.5	6	9.5	35	1.0	10	25
PPL25152□A8J0	25	28.5	6	9.5	35	1.0	10	25
PPL25182□A8J0	25	28.5	6	9.5	35	1.0	10	25
PPL25202□A8J0	25	28.5	6	9.5	35	1.0	10	25
PPL25301□B2J0	25	28.5	6	9.5	35	1.0	10	25
PPL25501□B2J0	25	28.5	6	9.5	35	1.0	10	25
PPL25801□B2J0	25	28.5	6	9.5	35	1.0	10	25
PPL25102□B2J0	25	28.5	6	9.5	35	1.0	10	25
PPL25132□B2J0	25	28.5	6	9.5	35	1.0	10	25
PPL25152□B2J0	25	28.5	6	9.5	35	1.0	10	25
PPL25182□B2J0	25	28.5	6	9.5	35	1.0	10	25
PPL25202□B2J0	25	28.5	6	9.5	35	1.0	10	25

Ceramic PTC Thermistor: PPL Series

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■ Characteristics

Part No.	Max. Voltage	Max. DC Link Voltage	Zero-power Resistance at 25°C	Curie Temperature	Max. Non-operating Energy at 60°C	Thermal Capacity	Safety Approvals	
	V _{max} (Vac)	V _{linkmax} (Vdc)	R ₂₅ (Ω)	T _c (°C)	E _{Non60} (J)	C _{th} (J/K)	UL/cUL	TUV
PPL123R8□A4A1	140	160	3.8	140	64	0.8	√	√
PPL09160□A2B2	220	310	16	120	24	0.4	√	√
PPL19100□A1B7	270	380	10	110	175	3.5	√	√
PPL19150□A2B7	270	380	15	120	210	3.5	√	√
PPL16270□A2B7	270	380	27	120	138	2.3	√	√
PPL20330□A3B7	270	380	33	130	266	3.8	√	√
PPL16350□A2B7	270	380	35	120	138	2.3	√	√
PPL20400□A2B7	270	380	40	120	192	3.2	√	√
PPL16500□A2B7	270	380	50	120	138	2.3	√	√
PPL20600□A2B7	270	380	60	120	228	3.8	√	√
PPL16800□A2B7	270	380	80	120	138	2.3	√	√
PPL20470□A3B7	280	400	47	130	266	3.8	√	√
PPL06121□A3B8	280	400	120	130	8	0.1	√	√
PPL11250□A2C8	380	540	25	115	55	1.0	√	√
PPL11500□A2C8	380	540	50	115	77	1.4	√	√
PPL19500□A0C8	380	540	50	100	140	3.5	√	√
PPL11800□A2C8	380	540	80	115	77	1.4	√	√
PPL16101□A2C8	380	540	100	120	138	2.3	√	√
PPL11121□A2C8	380	540	120	115	77	1.4	√	√
PPL11151□A2C8	380	540	150	115	77	1.4	√	√
PPL16151□A2D2	420	600	150	120	138	2.3	√	√
PPL11201□A2D2	420	600	200	120	84	1.4	√	√
PPL14560□A3D4	440	620	56	130	147	2.1	√	√
PPL14121□A3D4	440	620	120	130	147	2.1	√	√
PPL19102□A0D8	480	680	1000	100	152	3.8	√	√
PPL16251□A2E0	500	710	250	120	138	2.3	√	√
PPL11501□A2E0	500	710	500	115	77	1.4	√	√

Note 1: □ is the tolerance of R₂₅

Note 2: AEC-Q 200 qualified products of this series are available.

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■ Characteristics

Part No.	Max. Voltage	Zero-power Resistance at 25°C	Curie Temperature	Thermal Capacity	Max. Non-operating Energy at 60°C	Safety Approvals	
	Vmax (V _{dc})	R ₂₅ (Ω)	T _c (°C)	C _{th} (J/K)	E _{Non60} (J)	UL/cUL	TUV
PPL25601□A4G5	750	600	140	6.2	496	√	√
PPL25251□A2H5	850	250	120	6.2	372	√	√
PPL25102□A2J0	1000	1000	120	6.6	396	√	√
PPL25102□A4J0	1000	1000	140	6.2	496	√	√
PPL25301□A8J0	1000	300	185	6.2	775	—	—
PPL25501□A8J0	1000	500	185	6.2	775	—	—
PPL25801□A8J0	1000	800	185	6.2	775	—	—
PPL25102□A8J0	1000	1000	185	6.2	775	—	—
PPL25132□A8J0	1000	1300	185	6.2	775	—	—
PPL25152□A8J0	1000	1500	185	6.2	775	—	—
PPL25182□A8J0	1000	1800	185	6.2	775	—	—
PPL25202□A8J0	1000	2000	185	6.2	775	—	—
PPL25301□B2J0	1000	300	220	6.2	992	—	—
PPL25501□B2J0	1000	500	220	6.2	992	—	—
PPL25801□B2J0	1000	800	220	6.2	992	—	—
PPL25102□B2J0	1000	1000	220	6.2	992	—	—
PPL25132□B2J0	1000	1300	220	6.2	992	—	—
PPL25152□B2J0	1000	1500	220	6.2	992	—	—
PPL25182□B2J0	1000	1800	220	6.2	992	—	—
PPL25202□B2J0	1000	2000	220	6.2	992	—	—

Note 1: □ is the tolerance of R₂₅

Note 2: AEC-Q 200 qualified products of this series are available.

Note 3: PPL25301□A8J0, PPL25501□A8J0, PPL25801□A8J0, PPL25301□B2J0, PPL25501□B2J0, PPL25801□B2J0 are not applicable for short-circuit protection at 1000Vdc.

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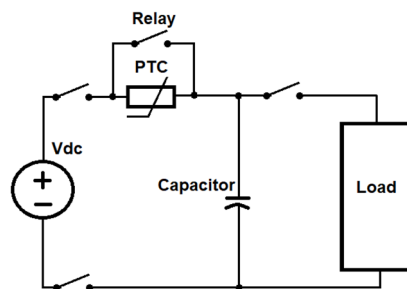
Dip Type for Inrush Current Limiter



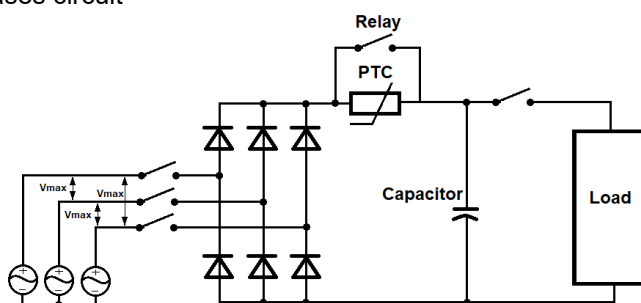
■ Application and Selection

● Typical application circuit

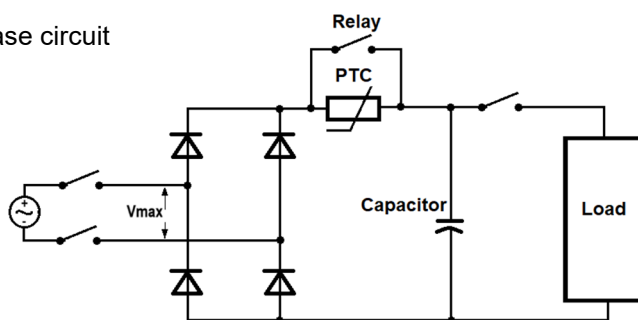
① DC circuit



② Three phases circuit



③ Single phase circuit



● Selection

Calculation of the number of required PTC elements

ENon60: Max Non-operating Energy at 60°C(Ta= 60)

$$N \geq \frac{K * C * V^2}{2 * C_{th} * (T_c - T_a)}$$

$$E_{Non60} = (T_c - T_a) * C_{th}$$

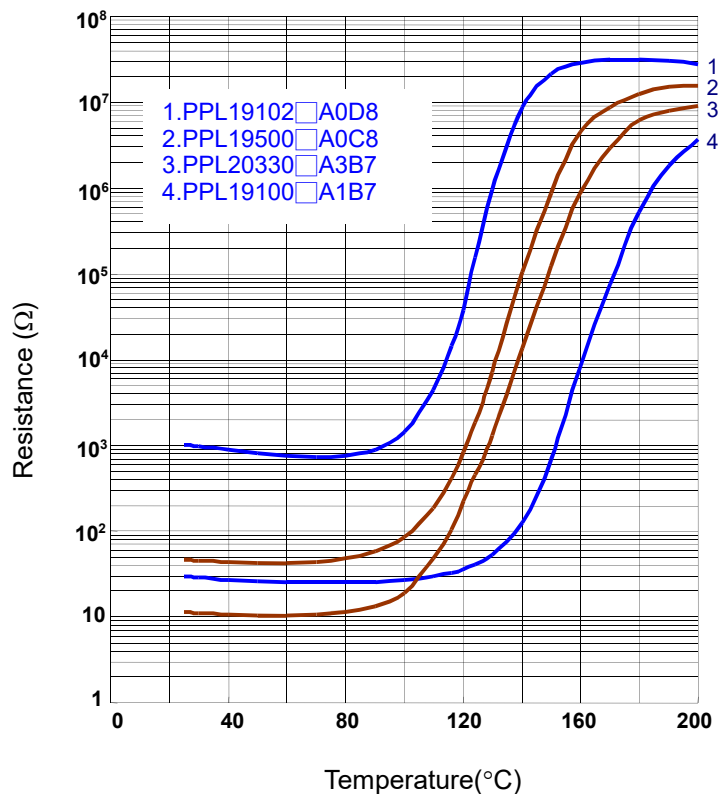
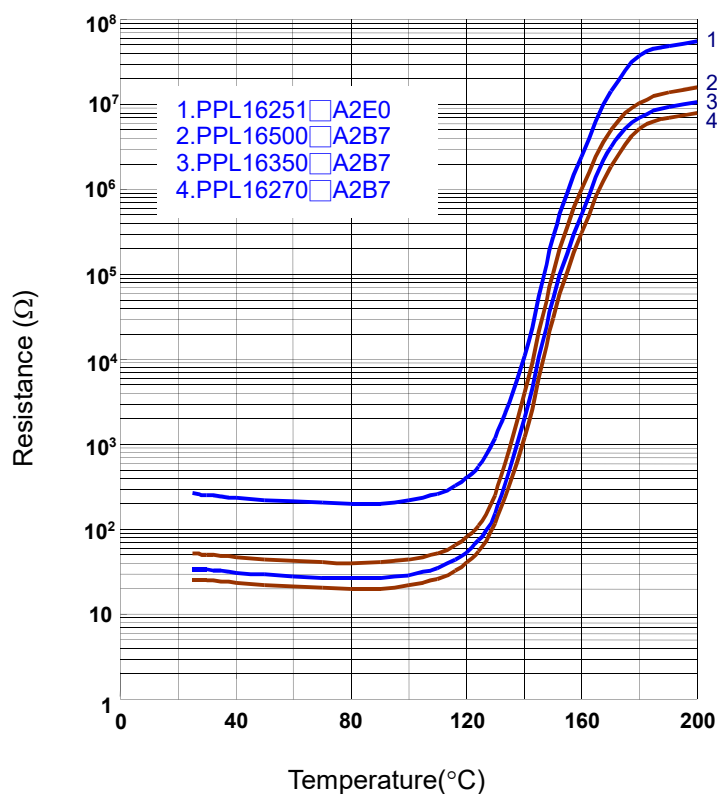
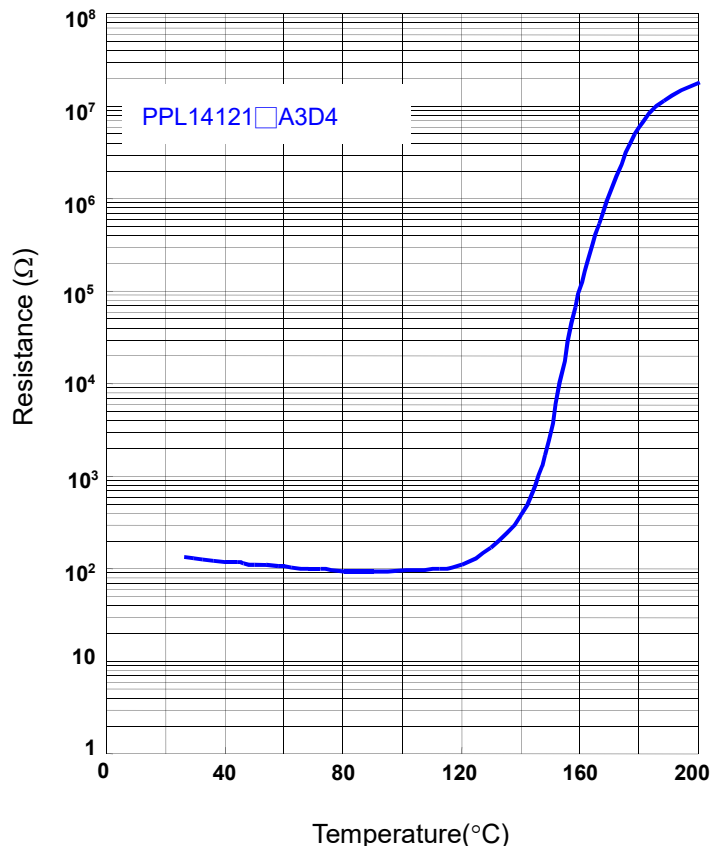
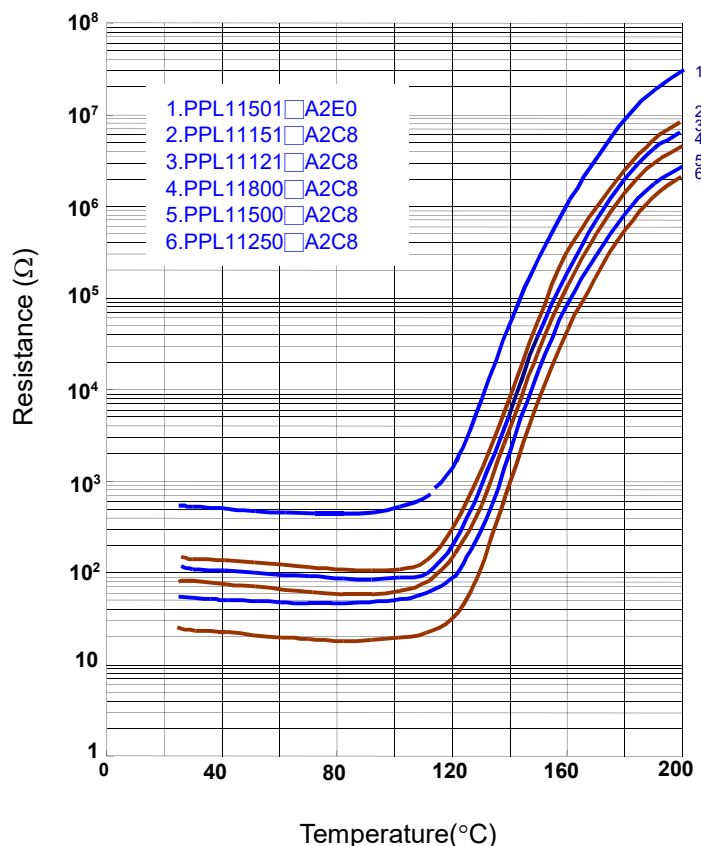
K	K factor
	K = 1 for DC source
	K = 0.96 for 3-phase bridge rectifier
	K = 0.76 for single phase bridge rectifier
N	Number of required PTC thermistors connected in parallel
C	Capacitance of smoothing or DC link capacitor in F
V	Voltage of capacitor charging (V=1.414x Vac)=Vlink,max
Cth	Heat capacity in J/K
Tc	Curie temperature of PTC
Ta	Ambient temperature

Ceramic PTC Thermistor: PPL Series

Dip Type for Inrush Current Limiter



■ R-T Characteristic Curve (Typical)

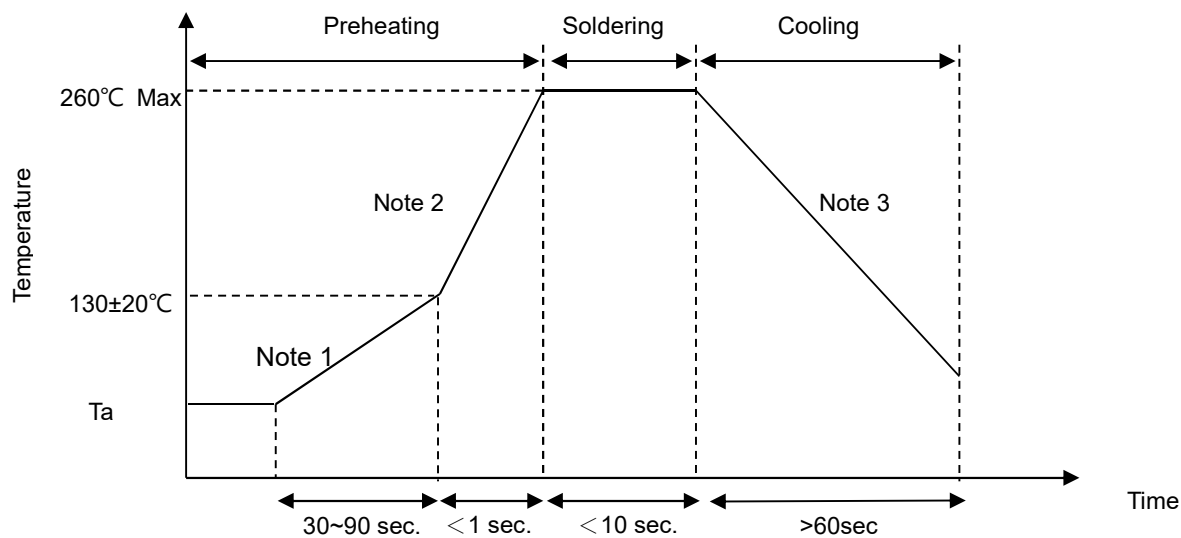


Ceramic PTC Thermistor: PPL Series

Dip Type for Inrush Current Limiter



- Soldering Recommendation
 - Wave Flow Soldering Profile



- Note**
- 1: $(1\sim 3^{\circ}\text{C})/\text{sec}$
 - 2: Approx. $200^{\circ}\text{C}/\text{sec}$
 - 3: $5^{\circ}\text{C}/\text{sec. (Max)}$

- Recommended Reworking Conditions with Soldering Iron

Item	Conditions
Temperature of Soldering Iron-tip	360°C (max.)
Soldering Time	3 sec (max.)
Distance from Coating	2 mm (min.)

Ceramic PTC Thermistor: PPL Series

Dip Type for Inrush Current Limiter



■ Reliability Test

Item	Standard	Test Conditions and Methods	Specifications															
Robustness of Terminations	IEC 60738-1	Gradually apply the specified force and keep the unit fixed for 10±1 sec. <table><tr><td>Terminal diameter (mm)</td><td>Force T(N)</td></tr><tr><td>0.35<d≤0.5</td><td>5.0</td></tr><tr><td>0.5<d≤0.8</td><td>10.0</td></tr><tr><td>0.8<d≤1.25</td><td>20.0</td></tr></table>	Terminal diameter (mm)	Force T(N)	0.35<d≤0.5	5.0	0.5<d≤0.8	10.0	0.8<d≤1.25	20.0	ΔR₂₅/R₂₅ ≤ 20% No visible damage							
Terminal diameter (mm)	Force T(N)																	
0.35<d≤0.5	5.0																	
0.5<d≤0.8	10.0																	
0.8<d≤1.25	20.0																	
Solderability	IEC 60738-1	245±3°C, 2±0.5 sec	At least 95% of terminal electrode is covered by new solder															
Resistance to Soldering Heat	IEC 60738-1	260±3°C, 10±1 sec	ΔR₂₅/R₂₅ ≤ 20% No visible damage															
Vibration	IEC 60738-1	Frequency range:10~55Hz Amplitude: 0.75mm or acceleration: 98m/s ² Direction: 3 mutually perpendicular directions Duration: 6hrs (3x2 hrs)	ΔR₂₅/R₂₅ ≤ 20% No visible damage															
Shock	IEC 60738-1	Wave: half-sine ΔV: 1.0m/s Acceleration: 50 m/s ² Pulse time: 30ms	ΔR₂₅/R₂₅ ≤ 20% No visible damage															
Rapid Change of Temperature	IEC 60738-1	The thermal shock conditions shown below shall be repeated 5 cycles. <table><tr><td>Step</td><td>Temperature (°C)</td><td>Period (minutes)</td></tr><tr><td>1</td><td>-40 ± 3</td><td>30 ± 3</td></tr><tr><td>2</td><td>Room temperature</td><td>≤ 3</td></tr><tr><td>3</td><td>85 ± 2</td><td>30 ± 3</td></tr><tr><td>4</td><td>Room temperature</td><td>≤ 3</td></tr></table>	Step	Temperature (°C)	Period (minutes)	1	-40 ± 3	30 ± 3	2	Room temperature	≤ 3	3	85 ± 2	30 ± 3	4	Room temperature	≤ 3	ΔR₂₅/R₂₅ ≤ 20% No visible damage
Step	Temperature (°C)	Period (minutes)																
1	-40 ± 3	30 ± 3																
2	Room temperature	≤ 3																
3	85 ± 2	30 ± 3																
4	Room temperature	≤ 3																
Climatic Sequence	IEC 60738-1	Dry heat: 125°C for 16 hrs Damp heat first cycle: 40°C, 95% RH ,cycle time: 24 hrs Cold: -40°C for 2 hrs Damp heat (cyclic), remaining cycles: 5 cycles Test according to IEC60068-2-30	ΔR₂₅/R₂₅ ≤ 20% No visible damage															
Damp Heat, Steady State	IEC 60738-1	40±2°C, 90~95% RH, 1000±2hrs	ΔR₂₅/R₂₅ ≤ 20% No visible damage															
Endurance at Maximum Operating Temperature and Maximum Voltage*1	IEC 60738-1	85± 2°C, V _{max} , 1000±2hrs	ΔR₂₅/R₂₅ ≤ 20% No visible damage															
Endurance Test for Charging of Capacitor	Specification Standard	Operating cycles at Vmax, 100,000 cycles (charging of capacitor)	ΔR₂₅/R₂₅ < 25% No visible damage															

Note: *1 Items are not applicable for PPL25□A8J0, PPL25□B2J0

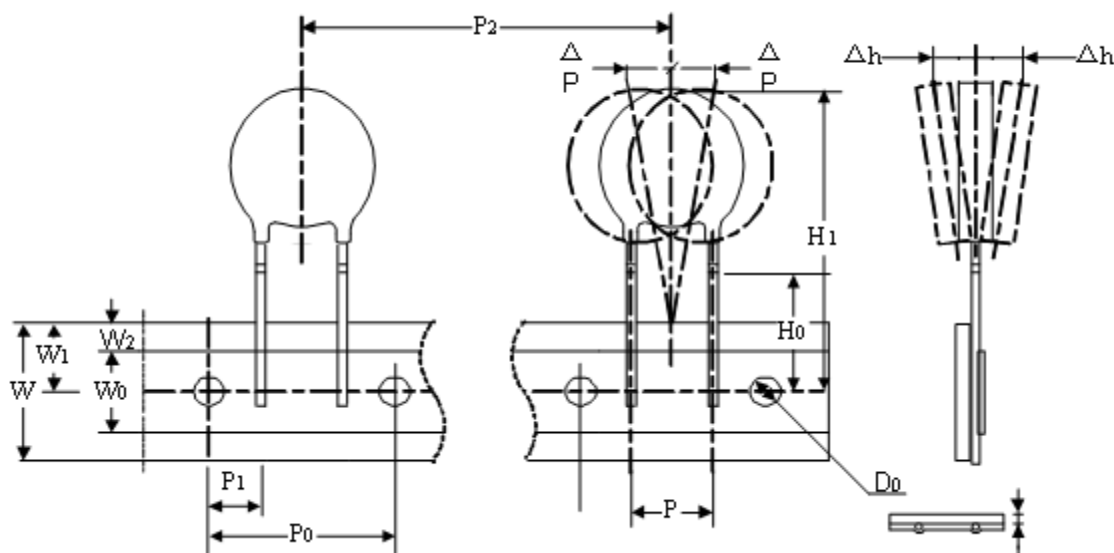
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Dip Type for Inrush Current Limiter



■ Packaging

● Taping Specification



● Parameter List

(Unit: mm)

Index	Parameter	Nominal dimensions		Tolerance
P	Lead spacing	5		± 1
P_0	Sprocket hole pitch	12.7	15	± 0.3
P_1	Ordinate to adjacent component lead	3.85	5	± 1
P_2	Device pitch	12.7 ($D \leq 10$) 25.4 ($D > 10$)	15.0 ($D \leq 10$) 30.0 ($D > 10$)	± 1
H_0	Abscissa to plane (kinked lead)	16	16	± 0.5
H_1	Abscissa to top	33.5 ($D=11$) 36.0 ($D=14$)		Max.
W	Carrier tape width	18	18	± 1
W_0	Hold-down tape width	12	12	± 1.5
W_1	Sprocket hole position	9	9	± 1
W_2	Top distance between tape edges	3	3	Max.
ΔP	Body tape plane deviation	1	1	Max.
Δh	Body lateral deviation	2	2	Max.
D_0	Sprocket hole diameter	4	4	± 0.2
t	Tape thickness	0.6	0.6	± 0.2

Note: D is the PTC disc diameter.

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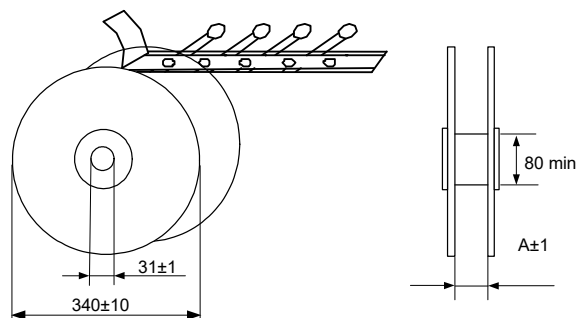
Dip Type for Inrush Current Limiter



■ Quantity

● Bulk Packing

Disc Size (mm)	Quantity (pcs/bag)
$06 \leq \Phi \leq 10$	200
$11 \leq \Phi \leq 16$	100
$19 \leq \Phi \leq 20$	50
$\Phi = 25$	30



● Reel Packing

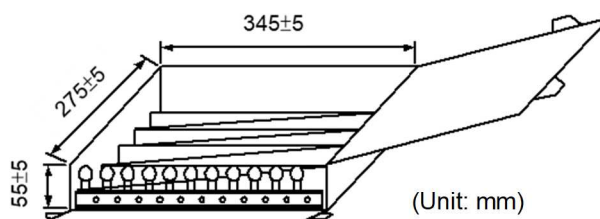
Disc Size (mm)	Quantity (pcs/reel)
$\Phi = 06$	1,500
$\Phi = 11$	500
$\Phi = 12$	750
$\Phi = 14$	500
$\Phi \geq 16$	500 ($V_r \leq 270V$) 250 ($V_r > 270V$)

Disc Size	$\Phi < 16$	$\Phi \geq 16$
A	46	55

(Unit: mm)

● Ammo Packing

Disc Size (mm)	Quantity (pcs/box)
$\Phi = 06$	1,500
$\Phi = 11$	750
$\Phi = 12$	1,000
$\Phi = 14$	500
$\Phi \geq 16$	500



■ Warehouse Storage Conditions of Products

● Storage Conditions

1. Storage Temperature: $-10^{\circ}\text{C} \sim +40^{\circ}\text{C}$
2. Relative Humidity: $\leq 75\% \text{RH}$
3. Keep away from corrosive atmosphere and sunlight.

● Period of Storage 1 year

■ Usage

Please keep products away from the conditions mentioned below to avoid their characteristic deterioration and failure.

1. Corrosive gas or deoxidizing gas (Cl_2 , H_2S , NH_3 , SO_x , NO_x etc.)
2. Place in a vacuum or put pressure
3. Salt water, oil, solvent and chemical liquid
4. Flammable gas
5. Place in splashed water, or high humidity and dewing place
6. Other places similar to any conditions mentioned above