PTC thermistors

Inrush current limiter

Series/Type:	**C1452-A135-A70**
Ordering code:	**B59452C1135A070**
Date:	2020-08-14
Version:	a

Applications

- Inrush current limiter (charging resistor) for smoothing and DC link capacitors
- To replace high-power fixed resistors for capacitor charging

Features

- Self-protecting in case of malfunction of short-circuit relay or internal short circuit of capacitor
- Inrush current limiters are not damaged when directly connected to V_{max} even without additional current limitation
- Marking: Type, manufacturer's logo, reference temperature in °C and date code YYWW
- Qualification base on AEC-Q200 Rev. D
- RoHS-compatible

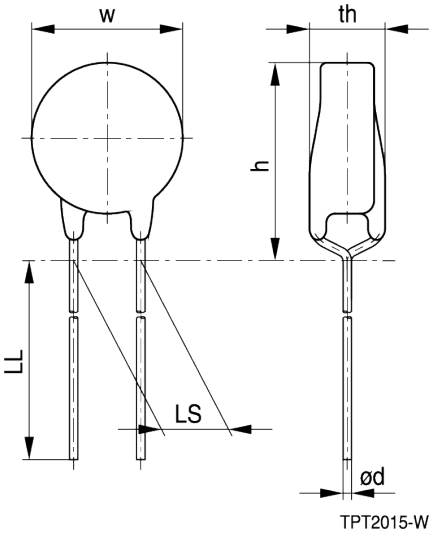
Delivery mode

- Cardboard strips with hot-melt adhesive tape
- 8 pcs per strip

Ordering code

B59452C1135A070

Dimensional drawing



w_{max}	16.0	mm
th_{max}	8.0	mm
h_{max}	20.5	mm
Ød	0.8 ± 0.05	mm
LS	5.0 +0.6/-0.1	mm
LL $_{min}$	25	mm

Dimensions in mm

General technical data

Maximum operating voltage	V_{max}	550	V_{AC}
Max. DC link voltage	$V_{link, max}$	780	V_{DC}
Rated resistance	R_{25}	500	Ω
Resistance tolerance	ΔR_{25}	±30	%
Reference temperature (typical)	T_{ref}	135	°C
Thermal capacity (typical)	C_{th}	2.3	J/K
Thermal time constant (typical)	τ_{th}	150	s
Operating cycles at V_{max} (charging of capacitor)	Nc	> 100,000	cycles
Switching cycles at V_{max} (failure mode)	Nf	> 100	cycles
Operating temperature range (V = 0 V)	T_{op}	-40 / +125	°C
Operating temperature range (V = V_{max})	T_{op}	-20 / +85	°C

Specification for T_{amb} = 25±0.1 °C

Calculation of the number of required PTC elements

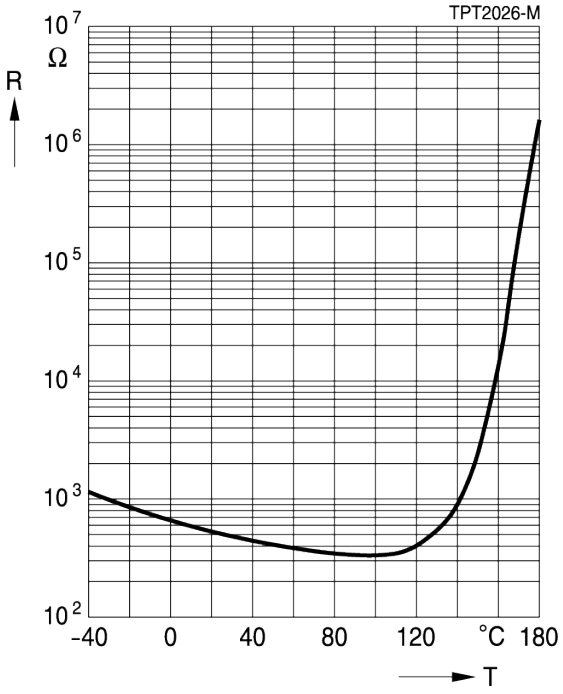
Number of required PTC elements (connected in parallel) as function of capacitance and charging voltage of smoothing or DC link capacitor:

$$N \geq \frac{K \cdot C \cdot V^2}{2 \cdot C_{th} \cdot (T_{ref} - T_{A.max})}$$

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	Charging voltage of capacitor in V
C_{th}	Heat capacity in J/K
T_{ref}	Reference temperature of PTC in °C
$T_{A.max}$	Expected maximum ambient temperature in °C

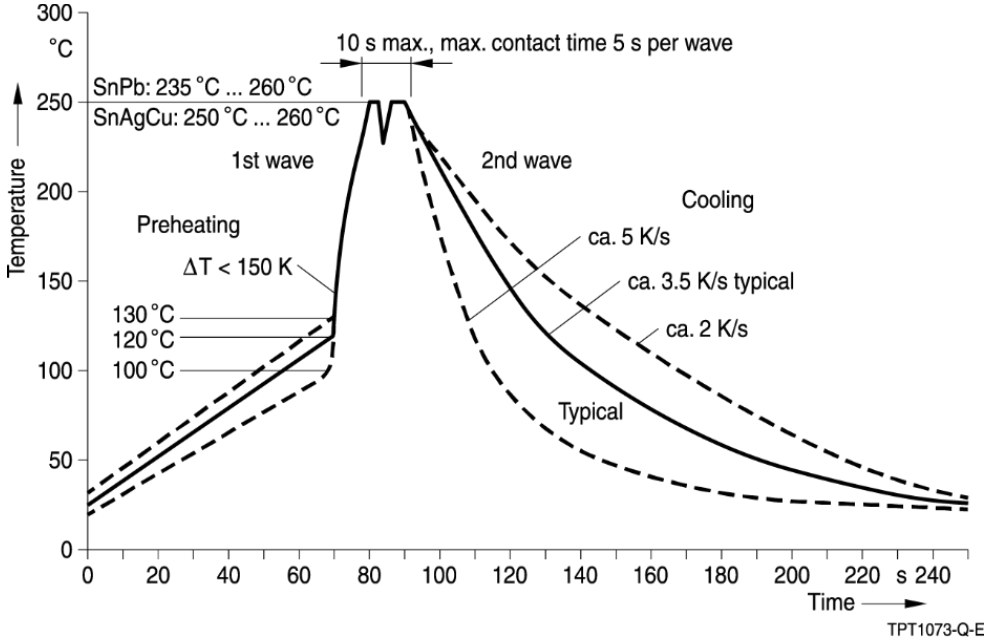
In case of large N values the resulting resistance of the parallel PTC network might be too low for effective limitation of the charging current. In this case a combination of series and parallel connected PTC thermistors can be used.

Characteristics R/T curve (typical)



Soldering instructions

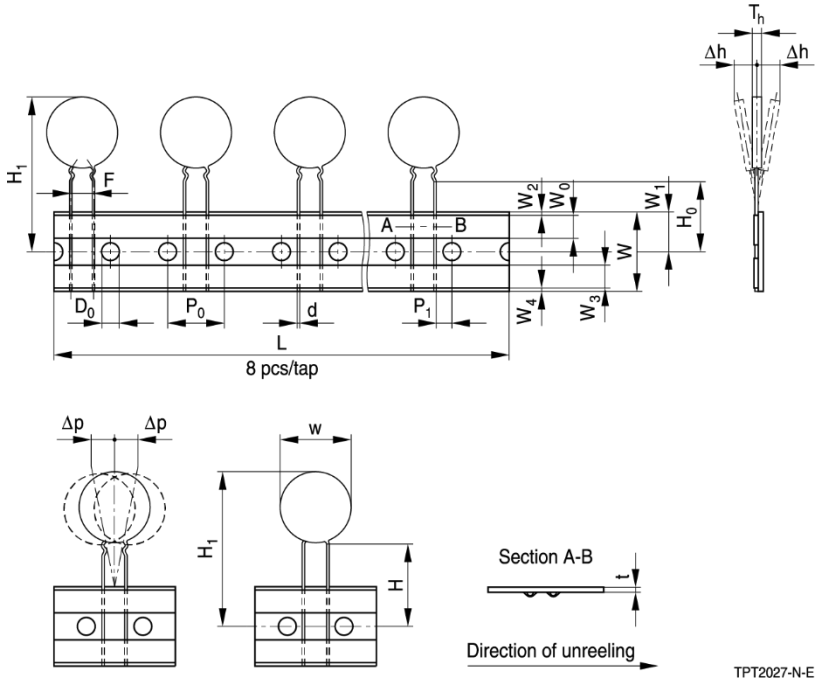
Recommended temperature profile for wave following IEC 61760-1. Applicable for leaded PTCs and selected SMD PTCs (case sizes 3225 and4032).



Reliability data

Test item	Testing method / description	$I\Delta R_{25}/R_{25}I$
High temperature exposure	MIL-STD-202, Method 108 1000 hrs at max. operating temperature +125 °C (V = 0) Measurement at 24 +/- 2 hours after test	≤ 20%
Temperature cycling	JESD22 Method JA-104 1000 Cycles, -55 °C to +125 °C, Dwell time = 30 min at each temperature extreme, 1 min max. transition time. Measurement at 24 +/- 2 hrs after test conclusion.	≤ 25%
Biased humidity	MIL-STD-202, Method 103 1000 hrs. 85°C/85%RH, V = 0.05*Vmax (10% rated power) Measurement at 24+/-2 hrs after test conclusion	≤ 20%
Operational life	MIL-STD-202, Method 108 1000 hrs. at max. operating temperature, + 105 °C, V = V_{max} Measurement at 24+/-2 hrs after test conclusion	≤ 25%
Terminal strength	MIL-STD-202, Method 211 After gradually applying the force 2.27kg and keep the unit fixed for 10 s, the terminal shall be visually examined for any damage	≤ 5%
Resistance to solvents	MIL-STD-202, Method 215 Note: Add Aqueous wash chemical - OKEM Clean or equivalent Do not use banned solvents.	≤ 10%
Mechanical shock	MIL-STD-202-213 Condition C Amplitude = 1,000 m/s2, Duration = 6 ms, 3 pulses per axis (6 directions)	≤ 5%
Vibration	Frequency range: 10 to 55 Hz Displacement amplitude: 0.75 mm Test duration: 3 x 2 h Test according to IEC 60068-2-6, Test Fc	≤ 5%
Resistance to soldering heat	MIL-STD-202 Method 210 Condition B No pre-heat of samples. T = 260 +/- 3 °C, Duration = 10 s	≤ 20%
ESD	AEC-Q200-002 or ISO/DIS10605 150 pF / 330 Ω; 8 kV contact discharge, polarity +/-; 10 pulses in each polarity	≤ 5%
Solderability	J-STD-002 Electrical test not required. Magnification 50 X. Conditions Solder material: Sn96.5Ag3Cu0.5 Solder bath, T = 245 +/- 3 °C, duration 3 s	Continuous solder coating with coverage ≥ 95%

Packing specification



Designation	Symbol	Nominal size mm	Tolerance mm	Remarks
Hole diameter	D_0	4.0	± 0.5	
Pitch of holes	P_0	12.7	± 0.5	
Hot adhesive tape width	W0	5.0	± 0.5	peel-off force ≤10 N
Position of holes	W1	9.0	+0.75/-0.5	
Position of adhesive tape	W2	3.0	max.	
Hot adhesive tape width	W_3	5.0	± 0.5	peel-off force ≤10 N
Position of adhesive tape	W4	3.0	max.	
Spacing hole center / bottom edge of component	H	16	min.	non- kinked lead version only
Spacing hole center / kink level	H_0	16	min.	kinked lead version only
Spacing hole center / upper edge of component	H_1	38	max.	
Length of cardboard strip	L	203	± 2	
Cardboard strip width	W	18	± 0.5	
Spacing hole center /Leads	P1	3.85	± 0.7	

Cautions and warnings

General

- EPCOS thermistors are designed for specific applications and should not be used purposes not identified in our specifications, application notes and data books unless otherwise agreed with us during the design-in-phase.
- Ensure suitability of thermistor through reliability testing during the design-in phase. The thermistors should be evaluated taking into consideration worst-case conditions.

Storage

- Store thermistors only in original packaging. Do not open the package before storage.
- Storage conditions in original packaging: storage temperature -25 °C to +45 °C, relative humidity ≤75% annual mean, maximum 95%, dew precipitation is inadmissible.
- Avoid contamination of thermistors surface during storage, handling and processing.
- Avoid storage of thermistor in harmful environment with effect on function on long-term operation (examples given under operation precautions).
- Use thermistor within the following period after delivery:
  - Through-hole devices (housed and leaded PTCs): 24 months
  - Motor protection sensors, glass-encapsulated sensors and probe assemblies: 24 months
  - Telecom pair and quattro protectors (TPP, TQP): 24 months
  - Leadless PTC thermistors for pressure contacting: 12 months
  - Leadless PTC thermistors for soldering: 6 months
  - SMDs in EIA sizes 3225 and 4032, and for PTCs with metal tags: 24 months
  - SMDs in EIA sizes 0402, 0603, 0805 and 1210: 12 months

Handling

- PTCs must not be dropped. Chip-offs must not be caused during handling of PTCs.
- Components must not be touched with bare hands. Gloves are recommended.
- Avoid contamination of thermistor surface during handling.

Soldering

- Use rosin-type flux or non-activated flux.
- Insufficient preheating may cause ceramic cracks.
- Rapid cooling by dipping in solvent is not recommended.
- Complete removal of flux is recommended.
- Standard PTC heaters are not suitable for soldering.

Mounting

- Electrode must not be scratched before/during/after in the mounting process.
- Contacts and housing used for assembly with thermistor have to be clean before mounting. Especially grease or oil must be removed.
- When PTC thermistors are encapsulated with sealing material, the precautions given in chapter “Mounting instructions”, “Sealing and potting” must be observed.
- When the thermistor is mounted, there must not be any foreign body between the electrode of the thermistor and the clamping contact.
- The minimum force of the clamping contacts pressing against the PTC must be 10 N.

- During operation, the thermistor's surface temperature can be very high. Ensure that adjacent components are placed at a sufficient distance from the thermistor to allow for proper cooling at the thermistors.
- Ensure that adjacent materials are designed for operation at temperature comparable to the surface temperature of thermistor. Be sure that surrounding parts and materials can withstand this temperature.
- Avoid contamination of thermistor surface during processing.

Operation

- Use thermistors only within the specified temperature operating range.
- Use thermistors only within the specified voltage and current ranges.
- Environmental conditions must not harm the thermistors. Use thermistors only in normal atmospheric conditions. Avoid use in deoxidizing gases (chlorine gas, hydrogen sulfide gas, ammonia gas, sulfuric acid gas etc), corrosive agents, humid or salty conditions. Contact with any liquids and solvents should be prevented.
- Be sure to provide and appropriate fail-safe function to prevent secondary product damage caused by abnormal function (e.g. use VDR for limitation of over voltage condition).

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Important notes

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