



PTC thermistors as inrush current limiter

PTC thermistor in housing

Series/Type:	J252
Ordering code:	B59252J0140B020
Date:	2021-07-14
Version:	a

© TDK Electronics AG 2021. Reproduction, publication and dissemination of this publication, enclosures hereto and the information contained therein without TDK Electronics' prior express consent is prohibited.

Applications

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



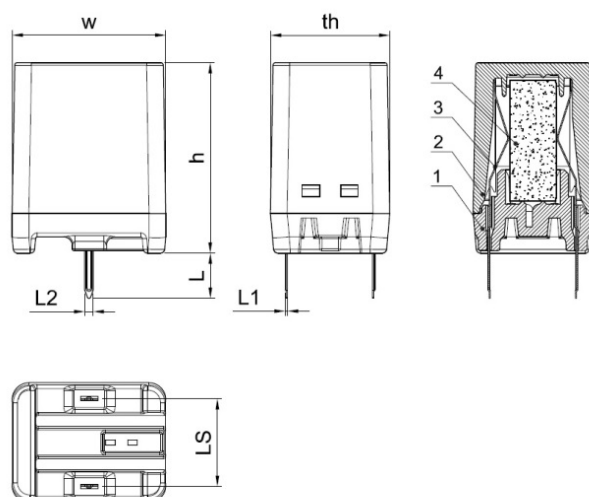
Features

- Self-protecting in case of malfunction of short-circuit relay or internal short circuit of capacitor
- Encased thermistor disk with clamp contacts for high reliability
- For high pulse currents and a high number of operating cycles
- Inrush current limiters are not damaged when directly connected to $V_{\max}$ even without additional current limitation
- Flame-retardant plastic case, case material UL-listed
- Sn-plated lead-free solder pins
- Manufacturer's logo, type designation and date code YYWW on laser-printing
- RoHS-compatible

Delivery mode

- Parts on plastic trays in carton box

Dimensional drawings



	Min.	Nom.	Max.	Unit
w	17.5	18.0	18.5	mm
th	13.5	14.0	14.5	mm
h	21.7	22.2	22.7	mm
LS	9.50	10.0	10.5	mm
L	3.10	3.50	3.90	mm
L1			0.40	mm
L2	0.80	1.00	1.20	mm

	Material
1 Base	PBT+30%GF
2 Cap	PBT+30%GF
3 Spring terminal	Stainless steel 1.4310 (tin area with nickel base layer)
4 PTC thermistor	Barium titanate;

General technical data

Parameter	Symb.	Min.	Nom.	Max.	Unit	Remark
Maximum operating voltage	$V_{\max}$			780	V_{RMS}	$T_A = -40\text{ }^{\circ}\text{C}$ to $85\text{ }^{\circ}\text{C}$
DC link voltage	V_{link}			1100	V_{DC}	$T_A = -40\text{ }^{\circ}\text{C}$ to $85\text{ }^{\circ}\text{C}$
Rated resistance @ $25\text{ }^{\circ}\text{C}$	R_{25}	350	500	650	Ω	$T_A = 25\text{ }^{\circ}\text{C} \pm 0.1\text{ }^{\circ}\text{C}$
Reference temperature (typ.)	T_{ref}		140		$^{\circ}\text{C}$	
Thermal capacity (typ.)	C_{th}		2.3		J/K	
Thermal time constant (typ.)	T_{th}		150		s	
Operating cycles (charging)	N_c	100k				$V = V_{\text{link,max}}$
Operating cycles (malfunction)	N_m	100				$V = V_{\text{link,max}}$
Operating temperature range	T_{op}	-40		125		$V = 0$
Operating temperature range	T_{op}	-40		85		$V = V_{\text{link,max}}$

Specification for $T_A = 25\text{ }^{\circ}\text{C}$

Calculation of the number of required PTC elements

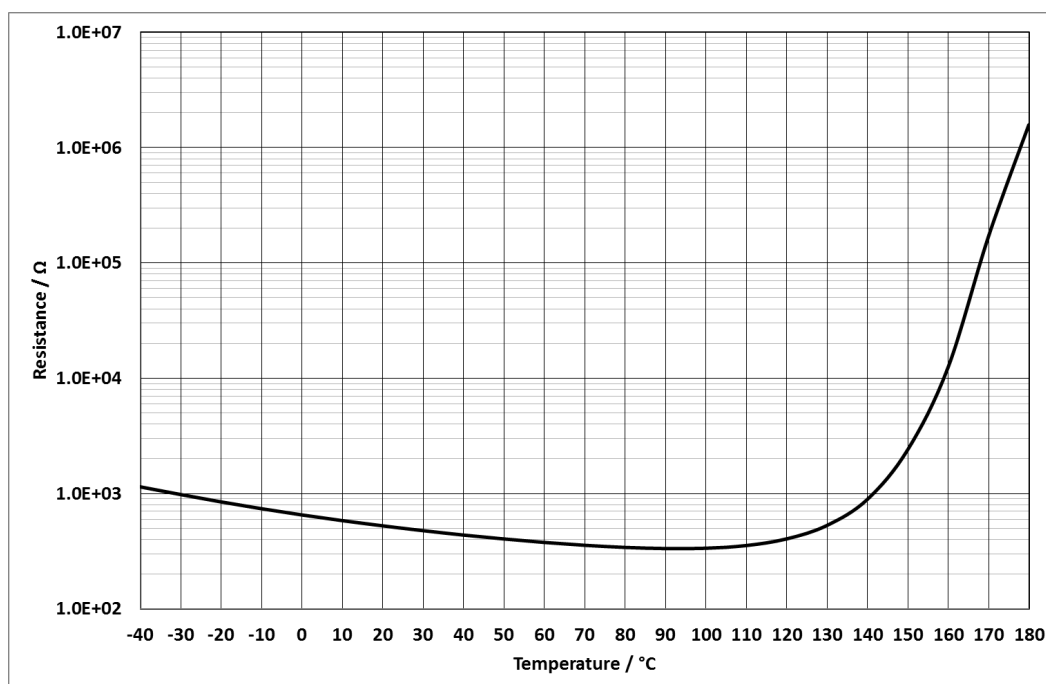
Number of required PTC elements (connected in parallel) as function of capacitance and charging voltage of smoothing or DC link capacitor:

$$N \geq \frac{k * C * V^2}{2 * C_{th} * (T_{ref} - T_{A,max})}$$

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.

Typical R/T-characteristic (low signal measurement)



Reliability data

Test item	Testing method / Description	$ \Delta R_{25}/R_{25} $
High temperature exposure	MIL-STD-202, Method 108 1000 h 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 hours after test conclusion.	≤ 25%
Biased humidity	Mil-STD-202, Method 103 1000 h 85 °C/85%RH, V = 0.05*V _{max} (10% rated power) Measurement at 24+/-2 hours after test conclusion	≤ 20%
Operational life	MIL-STD-202, Method 108 1000 h at max. operating temperature + 85 °C, V = V _{max} Measurement at 24+/-2 hours after test conclusion	≤ 20%
Terminal strength	MIL-STD-202, Method 211 After gradually applying the force 2.27 kg and keep the unit fixed for 10 s, the terminal shall be visually examined for any damage	Terminal no visible damage
Resistance to solvents	MIL-STD-202, Method 215 Note: Add Aqueous wash chemical - OKEM clean or equivalent Do not use banned solvents.	Marking visible
Mechanical shock	MIL-STD-202-213 condition C Amplitude = 1,000 m/s ² , duration = 6 ms, 3 pulses per axis (6 directions)	≤ 5%
Vibration	MIL-STD-202 Method 204 f = from 10 up to 2000 Hz h = 0.75 mm respective a = 50 m/s ² d = 3 * 2 h (3 directions, 2 h/direction)	≤ 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 Ohm; 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%

Packaging

500 pieces per box in tray packaging

Tray

Material: Polystyrol

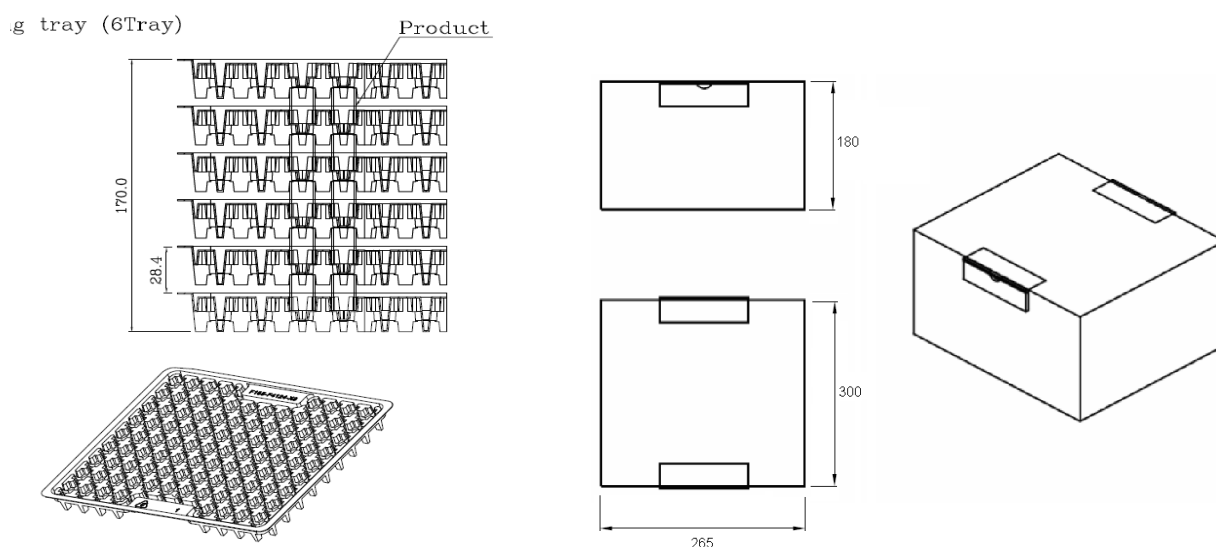
Unit: 100 pieces per tray

Carton

Material: Cardboard

Unit: 5 trays per box, stacked with 1 tray as cover

Dimensional drawing



Dimensions in mm

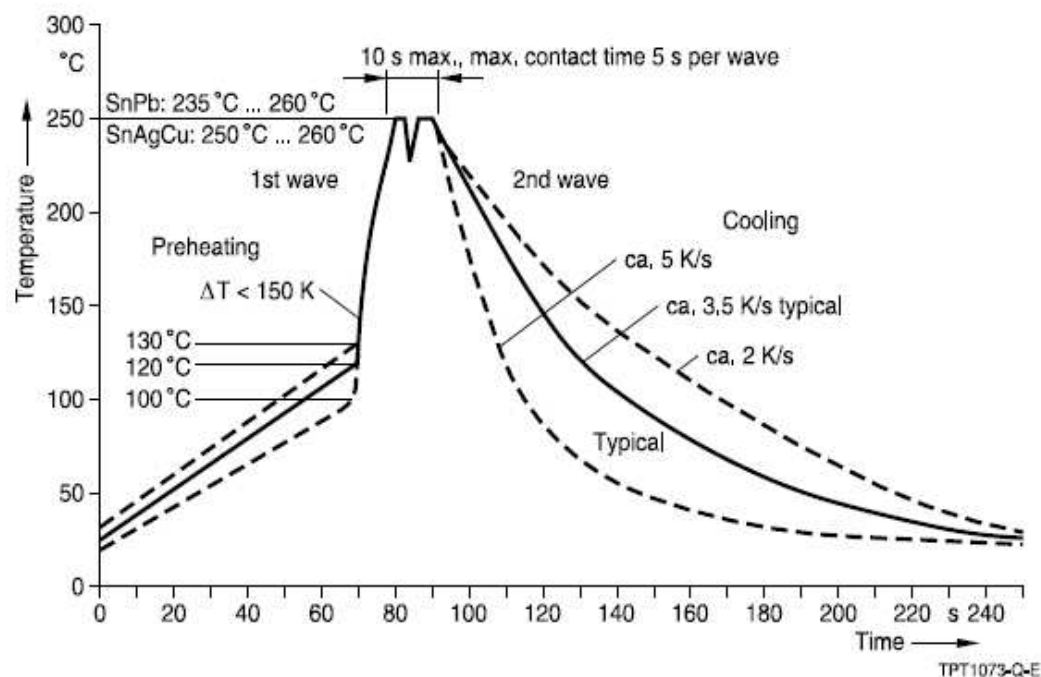
Labelling (example)



Soldering Instructions

Wave soldering

Recommended temperature profile for wave soldering following IEC 61760-1. Applicable for leaded PTCs and selected SMD PTCs (case sizes 3225 and 4032).



Cautions and warnings

General

- TDK Electronics thermistors are designed for specific applications and should not be used for purposes not identified in our specifications, application notes and data books unless otherwise agreed with TDK Electronics 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 prior to processing.
- Storage conditions in original packaging: storage temperature -25°C ... +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 1210 and smaller: 12 months

Handling

- PTCs must not be dropped. Chip-offs must not be caused during handling of PTCs.
- The ceramic and metallization of the components must not be touched with bare hands. Gloves are recommended.
- Avoid contamination of thermistor surface during handling.

Soldering (where applicable)

- 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 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 and pressure of the clamping contacts pressing against the PTC must be 10 N and 50 kPa, respectively. In case the assembly is exposed to mechanical shock and/ or vibration this force should be higher in order to avoid movement of the PTC during operation.
- 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 temperatures 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 an appropriate fail-safe function to prevent secondary product damage caused by abnormal function (e.g. use VDR for limitation of overvoltage condition).

This listing does not claim to be complete, but merely reflects the experience of TDK Electronics.

Display of ordering codes for TDK Electronics products

The ordering code for one and the same TDK Electronics product can be represented differently in data sheets, data books, other publications, on the TDK Electronics website, or in order-related documents such as shipping notes, order confirmations and product labels. **The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products.** Detailed information can be found on the Internet under www.tdk-electronics.tdk.com/orderingcodes.

Important notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application**. As a rule we are either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether a product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified**. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
3. **The warnings, cautions and product-specific notes must be observed.**
4. In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as hazardous)**. Useful information on this will be found in our Material Data Sheets on the Internet (www.tdk-electronics.tdk.com/material). Should you have any more detailed questions, please contact our sales offices.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order.

We also **reserve the right to discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available. The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.

6. Unless otherwise agreed in individual contracts, **all orders are subject to our General Terms and Conditions of Supply**.
7. **Our manufacturing sites serving the automotive business apply the IATF 16949 standard**. The IATF certifications confirm our compliance with requirements regarding the quality management system in the automotive industry. Referring to customer requirements and customer specific requirements ("CSR") TDK always has and will continue to have the policy of respecting individual agreements. Even if IATF 16949 may appear to support the acceptance of unilateral requirements, we hereby like to emphasize that **only requirements mutually agreed upon can and will be implemented in our Quality Management System**. For clarification purposes we like to point out that obligations from IATF 16949 shall only become legally binding if individually agreed upon.

Important notes

8. The trade names EPCOS, CarXield, CeraCharge, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CTVS, DeltaCap, DigiSiMic, ExoCore, FilterCap, FormFit, LeaXield, MiniBlue, MiniCell, MKD, MKK, ModCap, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PowerHap, PQSine, PQvar, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, ThermoFuse, WindCap, XieldCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.tdk-electronics.tdk.com/trademarks.

Release 2020-06