PTC thermistors

Inrush current limiters

Series/Type:	**J252-B 140-A 20**
Ordering code:	**B59252J0140B020**
Date:	2024-03-26
Version:	b

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

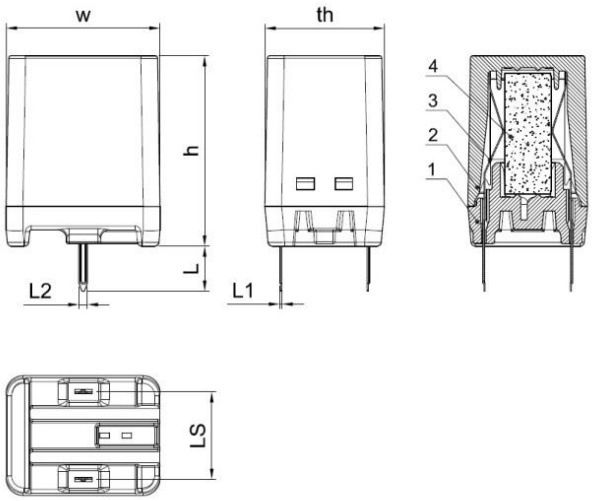
Features

- Self-protecting in case of malfunction of short-circuit relay or internal short circuit of the 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 (laser-printing)
- Qualification based on AEC-Q200 Rev. D
- RoHS-compatible

Delivery mode

- Parts on plastic trays in carton box

Dimensional drawings in mm



	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 tinned with nickel base layer)
4	PTC thermistor	Barium titanate

Electrical specifications

Parameter	Symb.	Min.	Nom.	Max.	Unit	Remark
Maximum operating voltage	V_{max}			780	V_{RMS}	T_{amb} = -40 °C to +85 °C
DC link voltage	V_{link}			1100	V_{DC}	T_{amb} = -40 °C to +85 °C
Rated resistance @ +25 °C	R_{25}	350	500	650	Ω	T_{amb} = +25 °C ±0.1 °C
Reference temperature (typ.)	T_{ref}		140		°C	
Thermal capacity (typ.)	C_{th}		2.3		J/K	
Thermal time constant (typ.)	τ_{th}		150		s	
Operating cycles (charging or discharging of capacitor)	N_c	100 k				V = $V_{linkmax}$
Operating cycles (failure mode)	N_m	100				V = $V_{linkmax}$
Operating temperature range	T_{op}	-40		125	°C	V = 0
Operating temperature range	T_{op}	-40		85	°C	V = $V_{linkmax}$

Specification for T_{amb} = +25 °C

Calculation of the number of required PTC elements

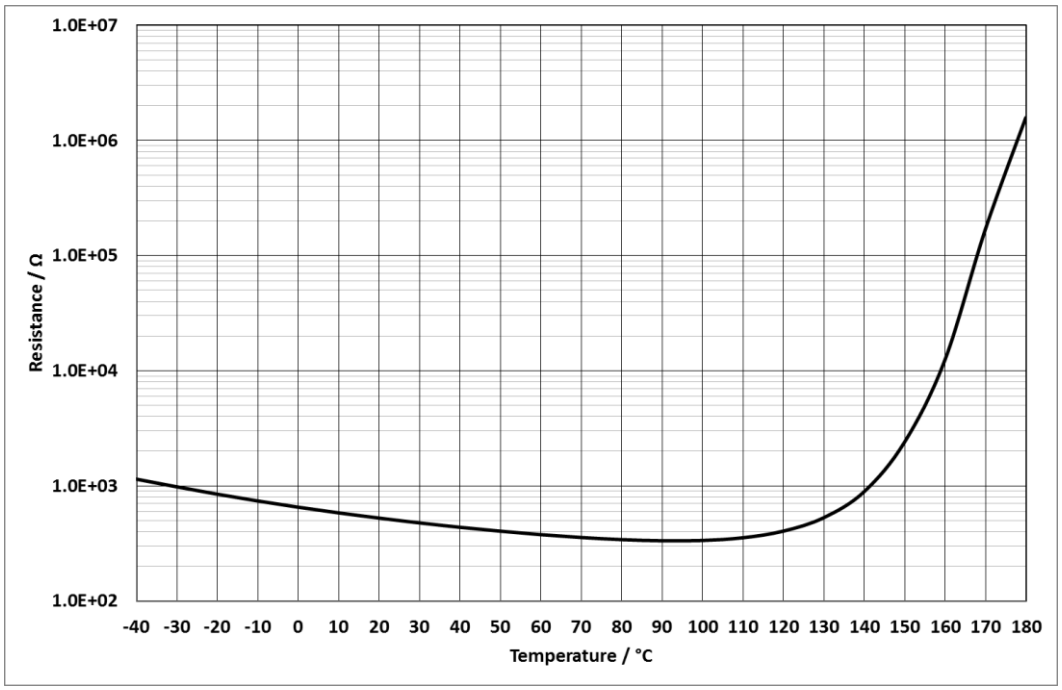
Number of required PTC elements (connected in parallel) as function of capacitance and charging voltage of smoothing or DC link capacitor:

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

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)



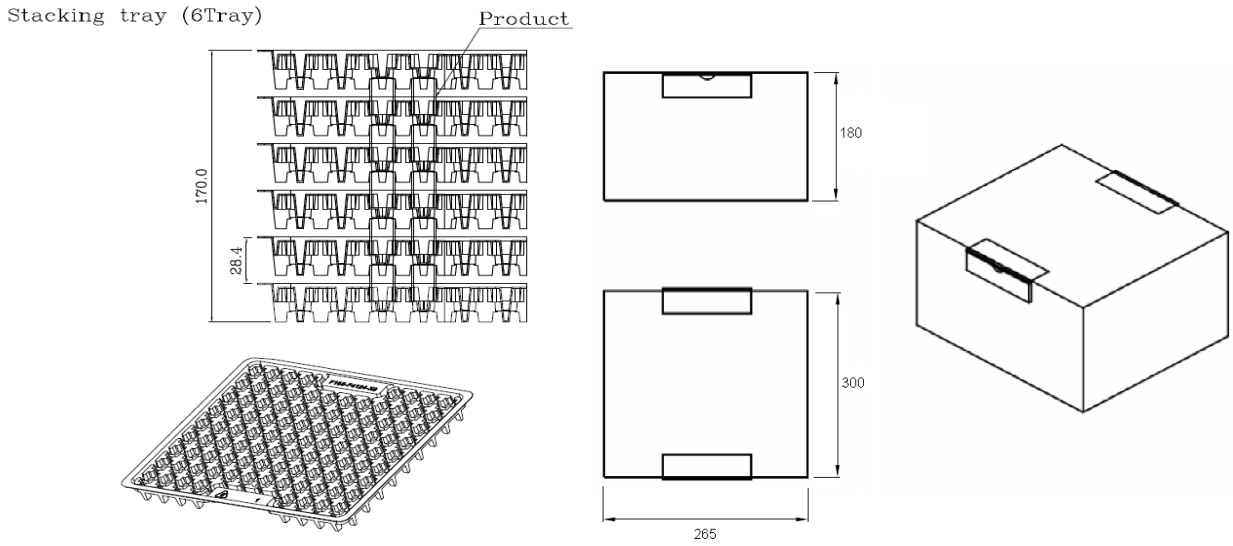
Reliability data

Test item	Standard	Testing method / Description	$I\Delta R_{25}/R_{25}I$
Electrical endurance cycling		Room temperature, V = V_{link}, max, applied energy < Cth·(Tref – TA) Number of cycles: 100000	≤ 25%
Electrical endurance cycling (failure mode)	IEC 60738-1	Room temperature, V = V_{link}, max, RS = 0 Ω, ton = 2 s, toff = 600 s Number of cycles: 100	≤ 25%
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 hours after test conclusion.	≤ 25%
Biased humidity	Mil-STD-202, Method 103	1000 hrs. 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 hrs. 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 = 1000 m/s^2, Duration = 6 ms, 3 pulses per axis (6 directions)	≤ 5%
Vibration	MIL-STD-202 Method 204	f = 10-2000-10 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 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%

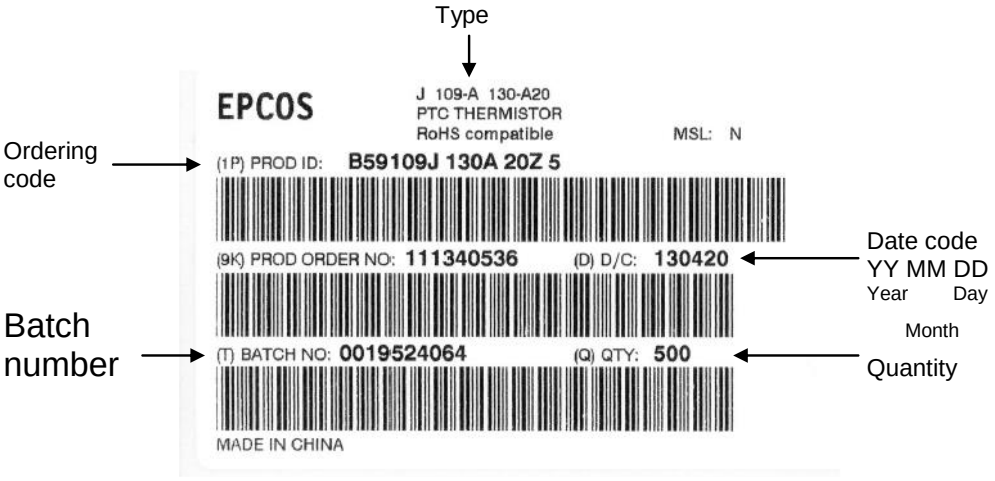
Packaging

- 500 pcs per box in tray packaging
- Tray
  Material: Polystyrol
  Unit: 100 pcs per tray
- Carton
  Material: Cardboard
  Unit: 5 trays per box, stacked with 1 tray as cover

Dimensional drawings in mm



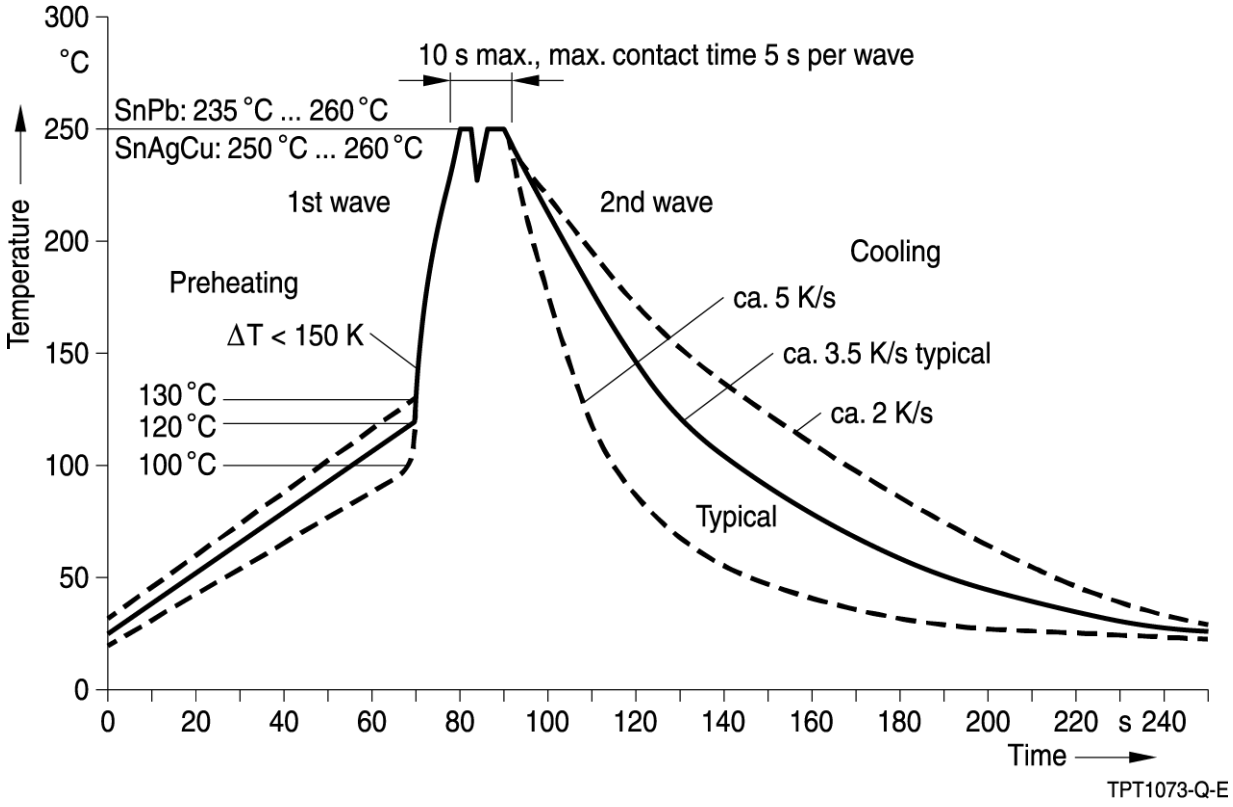
Labelling (example)



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 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 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

- The 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 AG.

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Important notes

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