



# Self-protecting resistor for capacitor charging

PTC thermistors in plastic case

**Series/Type:** B5920\*  
**Date:** December 2006

© EPCOS AG 2006. Reproduction, publication and dissemination of this publication, enclosures hereto and the information contained therein without EPCOS' prior express consent is prohibited.

## Self-protecting resistor for capacitor charging

PTC thermistors in plastic case

J201, J202, J204

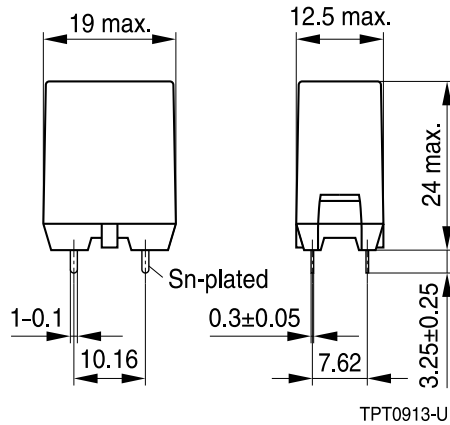
### Applications

- 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
- Encased thermistor disk with clamp contacts
- For high pulse currents and a high number of operating cycles
- Flame-retardant plastic case
- Case material UL-listed
- Sn-plated lead-free solder pins
- Manufacturer's logo and type designation stamped on in white
- RoHS-compatible

### Dimensional drawing



Dimensions in mm

### Delivery mode

- Packed in carton box

### General technical data

Operating cycles at $V_{max}$	(charging of capacitor)	$N_c$	> 100000	cycles
Switching cycles at $V_{max}$	(failure mode)	$N_f$	> 10	cycles
Thermal cooling time constant	(typical)	$\tau_{th}$	150	s
Heat capacity	(typical)	$C_{th}$	2.0	J/K
Operating temperature range	( $V = 0$ )	$T_{op}$	-40/+125	°C
Operating temperature range	( $V = V_{max}$ )	$T_{op}$	0/+85	°C

### Electrical specifications and ordering codes

$V_{max}^{1)}$	$R_R$	$\Delta R_R$	$T_{ref}$	$I_{pulse,max}$	$V_{BD}$	Ordering code
VDC	$\Omega$	%	°C	$A_p$	V	
550	20	30	135	50	> 700	B59201J0140B010
650	56	30	135	25	> 700	B59202J0135B010
800	100	25	130	20	> 900	B59204J0130B010

1)  $V_{max}$ : Maximum permissible DC voltage directly applied to the PTC thermistor.

**Note**

In case the PTC is operated in the AC branch, a max. AC voltage of 440 V<sub>RMS</sub> can be directly applied to the PTC thermistor without series current limiting resistor.

**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:

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

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 <sub>th</sub>	Heat capacity in J/K
T <sub>ref</sub>	Reference temperature of PTC in °C
T <sub>A,max</sub>	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.

## Cautions and warnings

### General

- EPCOS 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 EPCOS 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  $-25\text{ °C} \dots +45\text{ °C}$ , relative humidity  $\leq 75\%$  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 6 months after delivery.

### 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 (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 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 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).

## 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, EPCOS is 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 an EPCOS 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 passive 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 a passive 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 a passive 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.epcos.com/material](http://www.epcos.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.
6. Unless otherwise agreed in individual contracts, **all orders are subject to the current version of the “General Terms of Delivery for Products and Services in the Electrical Industry” published by the German Electrical and Electronics Industry Association (ZVEI)**.
7. The trade names EPCOS, EPCOS-JONES, Alu-X, Baoke, CeraDiode, CSSP, MLSC, Phase-Cap, PhaseMod, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMID, SIOV, SIP5D, SIP5K, Ultra-Cap, WindCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at [www.epcos.com/trademarks](http://www.epcos.com/trademarks).