



## **PTC thermistors for motor starting**

Metallized disks, standard sizes

**Series/Type:**

Date: February 2012

## Motor starting

### Standard sizes

#### Applications

- Time delay in turning off the auxiliary winding of single-phase AC motors (e.g. refrigerator compressors)
- Type A314 suitable for air conditioning systems

#### Features

- Metallization: CrNi (sputtered) + Ag (screen-printed), except A314 (screen-printed Ag)
- Excellent long-term reliability
- Suitable for clamp contacting
- UL approval to UL 1434 (file number E69802)
- VDE approval (license number 87406 E), except A524 and A314
- CSA approval for A506 (certificate No. 1109600)
- RoHS-compatible

#### Options

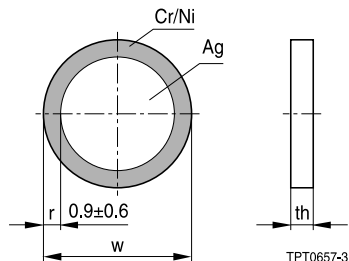
- Other dimensions and ratings on request

#### Delivery mode

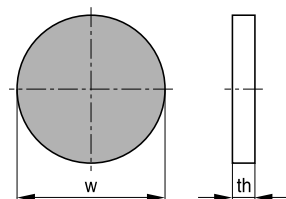
- Bulk

#### Dimensional drawing

A19\*, A5\*\*



A314



TPT0449-Z-E

#### Dimensions (mm)

Type	w	th
$V_R = 120 V_{RMS}$		
A506	17.5 ±0.5	2.5 ±0.2
$V_R = 230 V_{RMS}$		
A192	19.5 ±0.5	2.5 ±0.2
A196	19.5 ±0.5	3.2 ±0.2
A197	19.5 ±0.5	3.2 ±0.2
A314	20.0 +0.2/-0.8	5.0 ±0.25
A501	19.5 ±0.5	2.5 ±0.2
A524	19.5 ±0.5	2.5 ±0.2
A544	17.5 ±0.5	2.5 ±0.2

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#### General technical data

Switching cycles		N	> 100000	
Operating temperature range (V = 0)		T <sub>op</sub>	+5/+80	°C
Operating temperature range (V = V <sub>max</sub> )		T <sub>op</sub>	+5/+80	°C

#### Electrical specifications and ordering codes

Type	I <sub>max</sub> A	V <sub>max</sub> V	T <sub>ref</sub> (typ.) °C	t <sub>s</sub> <sup>1)</sup> s	V <sub>BD</sub> <sup>2)</sup> V	R <sub>R</sub> ±ΔR <sub>R</sub> (V <sub>PTC</sub> ≤ 2.5 V) Ω	Ordering code
<b>V<sub>R</sub> = 120 V<sub>RMS</sub></b>							
A506	12	180	120	0.45	> 360	4.7 ±20%	B59506A0120A020
<b>V<sub>R</sub> = 230 V<sub>RMS</sub></b>							
A501	6	355	135	0.45	> 700	33 ±20%	B59501A0135A020
A524	7	300	135	0.55	> 600	22 ±20%	B59524A0135A020
A544	8	320	120	0.35	> 650	20 ±20%	B59544A0120A020
A192	8	325	120	0.35	> 650	22 ±20%	B59192A0120B020
A196	8	350	120	0.50	> 700	15 ±30%	B59196A0120A020
A197	9	350	120	0.30	> 700	33 ±30%	B59197A0120B020
A314	9	400	120	0.35	> 800	38 ±30%	B59314A0120B010

**Note:** Type A314 suitable for air conditioning systems.

1) Measured at V = V<sub>max</sub> and I = 0.8 · I<sub>max</sub>

2) PTC clamped between points.

**Motor starting**
**Standard sizes**
**Reliability data**

Test <sup>1)</sup>	Standard	Test conditions	$ \Delta R_{25}/R_{25} $
Electrical endurance, cycling	IEC 60738-1	Room temperature, $V_{\max}$ ; $I_{\max}$ Number of cycles: 500 000	< 25%
Electrical endurance, constant	IEC 60738-1	Storage at $V_{\max}/T_{\text{op,max}}$ ( $V_{\max}$ ) Test duration: 1000 h	< 25%
Damp heat	IEC 60738-1	Temperature of air: 40 °C Relative humidity of air: 93% Duration: 56 days Test according to IEC 60068-2-78	< 20%
Rapid change of temperature	IEC 60738-1	$T_1 = T_{\text{op,min}}$ (0 V), $T_2 = T_{\text{op,max}}$ (0 V) Number of cycles: 5 Test duration: 30 min Test according to IEC 60068-2-14, test Na	< 20%
Climatic sequence	IEC 60738-1	Dry heat: $T = T_{\text{op,max}}$ (0 V) Test duration: 16 h Damp heat first cycle Cold: $T = T_{\text{op,min}}$ (0 V) Test duration: 2 h Damp heat 5 cycles Tests performed according to IEC 60068-2-30	< 25%

1) All tests with PTC disk mounted in EPCOS housing.

## Motor starting

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## 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 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 (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.

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#### 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).

## Motor starting

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#### Symbols and terms

A	Area
C	Capacitance
$C_{th}$	Heat capacity
f	Frequency
I	Current
$I_{max}$	Maximum current
$I_R$	Rated current
$I_{res}$	Residual current
$I_{PTC}$	PTC current
$I_r$	Residual current
$I_{r,oil}$	Residual current in oil (for level sensors)
$I_{r,air}$	Residual current in air (for level sensors)
$I_{RMS}$	Root-mean-square value of current
$I_S$	Switching current
$I_{Smax}$	Maximum switching current
LCT	Lower category temperature
N	Number (integer)
$N_c$	Operating cycles at $V_{max}$ , charging of capacitor
$N_f$	Switching cycles at $V_{max}$ , failure mode
P	Power
$P_{25}$	Maximum power at 25 °C
$P_{el}$	Electrical power
$P_{diss}$	Dissipation power
$R_G$	Generator internal resistance
$R_{min}$	Minimum resistance
$R_R$	Rated resistance
$\Delta R_R$	Tolerance of $R_R$
$R_P$	Parallel resistance
$R_{PTC}$	PTC resistance
$R_{ref}$	Reference resistance
$R_S$	Series resistance
$R_{25}$	Resistance at 25 °C
$R_{25,match}$	Resistance matching per reel/ packing unit at 25 °C
$\Delta R_{25}$	Tolerance of $R_{25}$
T	Temperature
t	Time
$T_A$	Ambient temperature
$t_a$	Thermal threshold time

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$T_C$	Ferroelectric Curie temperature
$t_E$	Settling time (for level sensors)
$T_R$	Rated temperature
$T_{sense}$	Sensing temperature
$T_{op}$	Operating temperature
$T_{PTC}$	PTC temperature
$t_R$	Response time
$T_{ref}$	Reference temperature
$T_{Rmin}$	Temperature at minimum resistance
$t_S$	Switching time
$T_{surf}$	Surface temperature
UCT	Upper category temperature
$V$ or $V_{el}$	Voltage (with subscript only for distinction from volume)
$V_{c(max)}$	Maximum DC charge voltage of the surge generator
$V_{F,max}$	Maximum voltage applied at fault conditions in protection mode
$V_{RMS}$	Root-mean-square value of voltage
$V_{BD}$	Breakdown voltage
$V_{ins}$	Insulation test voltage
$V_{link,max}$	Maximum link voltage
$V_{max}$	Maximum operating voltage
$V_{max,dyn}$	Maximum dynamic (short-time) operating voltage
$V_{meas}$	Measuring voltage
$V_{meas,max}$	Maximum measuring voltage
$V_R$	Rated voltage
$V_{PTC}$	Voltage drop across a PTC thermistor
$\alpha$	Temperature coefficient
$\Delta$	Tolerance, change
$\delta_{th}$	Dissipation factor
$\tau_{th}$	Thermal cooling time constant
$\lambda$	Failure rate
$e$	Lead spacing (in mm)

### Abbreviations / Notes

**SMD** Surface-mount devices

\* To be replaced by a number in ordering codes, type designations etc.

+ To be replaced by a letter

All dimensions are given in mm.

The commas used in numerical values denote decimal points.



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#### Как с нами связаться

**Телефон:** 8 (812) 309 58 32 (многоканальный)

**Факс:** 8 (812) 320-02-42

**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.