

EPCOS Sample Kit 2016

# SMD NTC Thermistors

Temperature Measurement and Compensation  
for General-Use



# Temperature measurement and compensation

NTC (negative temperature coefficient) thermistors are thermally sensitive semiconductor resistors which show a decrease in resistance as temperature increases. At  $-2\%/K$  to  $-6\%/K$ , the negative temperature coefficients of resistance are about ten times greater than those of metals and about five times greater than those of silicon temperature sensors. NTC thermistors are simple yet very sensitive and accurate sensing elements for measuring and control circuits.

## Features

- Superior performance in high-stability applications
- Accurate temperature sensing up to  $+125\text{ }^{\circ}\text{C}$
- Excellent long-term aging stability in high temperature environment
- Short response time
- All SMD NTC thermistors are listed under UL (file number E69802)
- Alternative ratings available on request, e.g. resistance and B value

## Applications

- Displays
- Smartphones and wearable devices
- Heating and air-conditioning, radiator cooling fan control units, thermostats
- Household electronics, e.g. refrigerators, washing machines, water boilers
- Battery management systems
- Healthcare
- Smart metering
- Electronic control unit
- Industrial automation
- Security and safety
- Lighting, e.g. LED lighting modules, LED retrofit bulbs and tubes

**A short presentation with more details and applications examples can be found under:**  
**[www.epcos.com/smdntc\\_gu](http://www.epcos.com/smdntc_gu)**

**Important information:** 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. We expressly point out that these statements cannot be regarded as binding statements about the suitability of our products for a particular customer application. It is incumbent on the customer to check and decide whether a product is suitable for use in a particular application. This publication is only a brief product survey which may be changed from time to time. Our products are described in detail in our data sheets. The *Important notes* ([www.epcos.com/ImportantNotes](http://www.epcos.com/ImportantNotes)) and the product-specific *Cautions and warnings* must be observed. All relevant information is available through our sales offices.

# Components

|                     |                     |  |                     |  |                     |                     |  |                     |
|---------------------|---------------------|--|---------------------|--|---------------------|---------------------|--|---------------------|
| B57230<br>V2103F260 | B57221<br>V2103J060 |  | B57261<br>V2223J060 |  | B57221<br>V2473J060 | B57250<br>V2473F560 |  | B57250<br>V2104F360 |
|---------------------|---------------------|--|---------------------|--|---------------------|---------------------|--|---------------------|

|                     |                     |                     |                     |                     |                     |                     |                     |  |
|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|--|
| B57330<br>V2103F260 | B57321<br>V2103J060 | B57371<br>V2223J060 | B57371<br>V2473J060 | B57357<br>V2473F560 | B57374<br>V2104J060 | B57350<br>V2104F460 | B57371<br>V2474J060 |  |
|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|--|

|                     |                     |                     |                     |                     |                     |                     |                     |  |
|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|--|
| B57421<br>V2102J062 | B57401<br>V2103J062 | B57421<br>V2103J062 | B57471<br>V2103J062 | B57471<br>V2223J062 | B57471<br>V2473J062 | B57471<br>V2104J062 | B57471<br>V2474J062 |  |
|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|--|

# Product range



| Electrical specifications and ordering codes |                       |             |             |                  |                            |
|----------------------------------------------|-----------------------|-------------|-------------|------------------|----------------------------|
| $R_{25}$                                     | $\Delta R_R/R_R$      | $B_{25/50}$ | $B_{25/85}$ | $B_{25/100}$     | Ordering code              |
| [k $\Omega$ ]                                | %                     | [K]         | [K]         | [K]              |                            |
| EIA case size 0402                           |                       |             |             |                  |                            |
| 10                                           | $\pm 1, \pm 5$        | 3380        | 3435        | 3455 $\pm 1\%$   | B57230V2103+260            |
| 10                                           | $\pm 5$               | 3940        | 3980        | 4000 $\pm 3\%$   | B57221V2103J060            |
| 22                                           | $\pm 5$               | 4473        | 4548        | 4575 $\pm 3\%$   | B57261V2223J060            |
| 47                                           | $\pm 5$               | 3940        | 3980        | 4000 $\pm 3\%$   | B57221V2473J060            |
| 47                                           | $\pm 1, \pm 3, \pm 5$ | 4050        | 4108        | 4131 $\pm 1\%$   | B57250V2473+560 <b>NEW</b> |
| 100                                          | $\pm 1, \pm 3, \pm 5$ | 4250        | 4311        | 4334 $\pm 1\%$   | B57250V2104+360 <b>NEW</b> |
| EIA case size 0603                           |                       |             |             |                  |                            |
| 10                                           | $\pm 1, \pm 5$        | 3380        | 3435        | 3455 $\pm 1\%$   | B57330V2103+260            |
| 10                                           | $\pm 3, \pm 5$        | 3940        | 3980        | 4000 $\pm 3\%$   | B57321V2103+060            |
| 22                                           | $\pm 3, \pm 5$        | 4386        | 4455        | 4480 $\pm 3\%$   | B57371V2223+060            |
| 47                                           | $\pm 3, \pm 5$        | 4386        | 4455        | 4480 $\pm 3\%$   | B57371V2473+060            |
| 47                                           | $\pm 1, \pm 3, \pm 5$ | 4050        | 4108        | 4131 $\pm 1.5\%$ | B57357V2473+560 <b>NEW</b> |
| 47                                           | $\pm 3, \pm 5$        | 4050        | 4108        | 4131 $\pm 2\%$   | B57358V2473+560 <b>NEW</b> |
| 100                                          | $\pm 3, \pm 5$        | 4386        | 4455        | 4480 $\pm 1\%$   | B57374V2104+060            |
| 100                                          | $\pm 1, \pm 3, \pm 5$ | 4200        | 4260        | 4282 $\pm 1\%$   | B57350V2104+460 <b>NEW</b> |
| 100                                          | $\pm 3, \pm 5$        | 4250        | 4311        | 4334 $\pm 2\%$   | B57358V2104+360 <b>NEW</b> |
| 470                                          | $\pm 3, \pm 5$        | 4386        | 4455        | 4480 $\pm 3\%$   | B57371V2474+060            |
| EIA case size 0805                           |                       |             |             |                  |                            |
| 1                                            | $\pm 3, \pm 5$        | 3940        | 3980        | 4000 $\pm 3\%$   | B57421V2102+062            |
| 10                                           | $\pm 3, \pm 5$        | 3590        | 3635        | 3650 $\pm 3\%$   | B57401V2103+062            |
| 10                                           | $\pm 3, \pm 5$        | 3940        | 3980        | 4000 $\pm 3\%$   | B57421V2103+062            |
| 10                                           | $\pm 3, \pm 5$        | 4386        | 4455        | 4480 $\pm 3\%$   | B57471V2103+062            |
| 22                                           | $\pm 3, \pm 5$        | 4386        | 4455        | 4480 $\pm 3\%$   | B57471V2223+062            |
| 47                                           | $\pm 3, \pm 5$        | 4386        | 4455        | 4480 $\pm 3\%$   | B57471V2473+062            |
| 100                                          | $\pm 3, \pm 5$        | 4386        | 4455        | 4480 $\pm 3\%$   | B57471V2104+062            |
| 470                                          | $\pm 3, \pm 5$        | 4386        | 4455        | 4480 $\pm 3\%$   | B57471V2474+062            |

+ = Resistance tolerance:

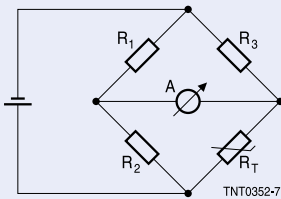
F =  $\pm 1\%$

H =  $\pm 3\%$

J =  $\pm 5\%$

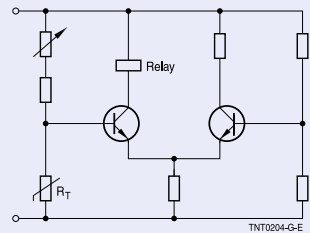
# Application examples for SMD NTC thermistors

## Industrial and medical thermometers

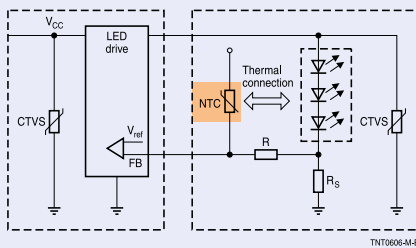


Wheatstone bridge circuit

## Thermostats



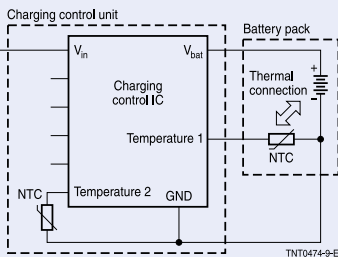
## LEDs



Thermal connection with a NTC on LED

- No discoloration
- No reduction in lumens
- Extension of life time
- Performance efficiency optimization
- Optimum design (reduction in number of LEDs)

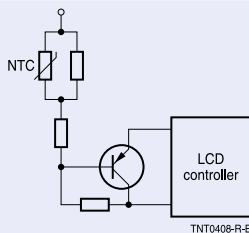
## Battery packs



Charging control unit of a battery pack using NTC thermistors as temperature sensor

- Detects temperature rises of the battery cell during charging
- Detects the ambient temperature for optimized charging
- Detects heat generation of a battery cell caused by abnormal current
- Performs temperature compensation for voltage measurement for display of the remaining amount of energy

## LCD displays



LCD using a NTC thermistor as temperature sensor

- LCDs are sensitive to temperature and have a limited operating temperature range
- LCD contrast increases with temperature, wasting power at high temperatures
- Low temperatures lead to low contrast
- LCD modules often use temperature compensation circuits with NTC thermistors and resistors

