

## ▶ Measuring resistor with the KTY-sensor

Monitoring of motor winding temperature,  
basic temperature measurement by using KTY-sensors

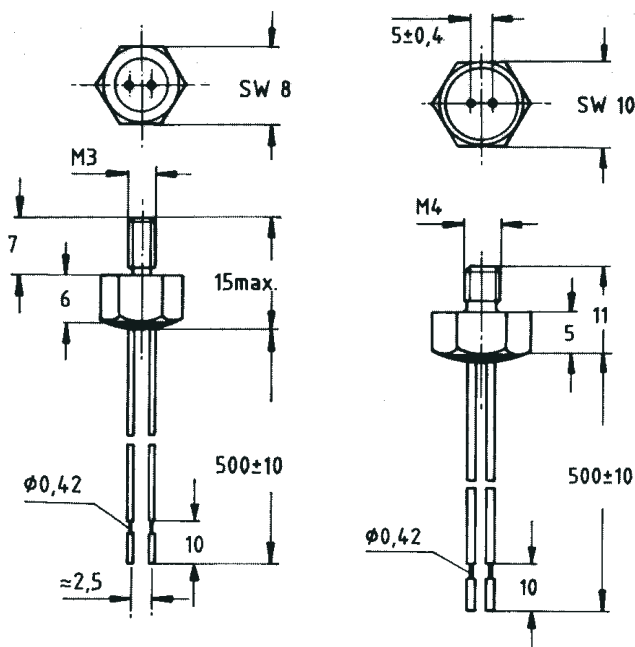
KTY 84-1...

KTY-sensor in windings



Color coding of leads, according to the SIEMENS-standards:  
AWG24, white=minus  
AWG24, brown=plus  
or:  
AWG24, yellow=minus  
AWG24, green=plus

KTY-screw in sensor



### Basic information

The low-cost KTY-sensor is used for precise temperature monitoring, control, and switching in windings, bearings, machines, motors, transformers and many other industrial applications, where errors in measurements have to be excluded.

### Application

With outstanding accuracy and fail-safe operation, they have a wide range of applications in both automotive and industrial markets.

Industrial applications:

- overheating protection
- protection for power supplies
- process temperature control
- exhaust control
- toaster control
- temperature compensation for microprocessors

Automotive applications:

- oil temperature
- oil level
- water temperature
- diesel injection
- transmission
- engine coolant
- engine air
- air condition

### General function

The silicon temperature sensors in the KTY84-1 series have a nearly linear, positive temperature coefficient of resistance over the complete wide temperature range.

### Advantages of these sensors

- Low cost over a temperature range: -40 ... +300°C.
- Larger output signal than Pt100.
- Very long operation life.
- High long term stability.
- Low weight.
- Low thermal time constant.

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### Technical Data

#### Quick reference data:

sensor resistance  $R_{100}$ ,  $T_{amb} = 100^{\circ}\text{C}$ ,  $I_{cont} = 2\text{mA}$

| Parameter  | Min. | Max. | Unit | Marking Code |
|------------|------|------|------|--------------|
| KTY 84-130 | 970  | 1030 | Ohm  | KT84L        |
| KTY 84-150 | 950  | 1050 | Ohm  | KT84M        |
| KTY 84-151 | 950  | 1000 | Ohm  | KT84O        |

#### Limiting values:

In accordance with the absolute maximum rating system (IEC 60134)

| Symbol     | Parameter                     | Conditions  | Min. | Max. | Unit               |
|------------|-------------------------------|---|------|------|--------------------|
| $I_{cont}$ | continuous sensor current     | In free air<br>$T_{amb} = 100^{\circ}\text{C}$ (Note 1) | -    | 10   | mA                 |
|            |                               | In free air<br>$T_{amb} = 300^{\circ}\text{C}$          | -    | 2    | mA                 |
| $T_{amb}$  | ambient operation temperature |   | -40  | 300  | $^{\circ}\text{C}$ |
| $T_{stg}$  | storage temperature           |   | -55  | 300  | $^{\circ}\text{C}$ |

#### Note

1. For temperatures greater than  $+200^{\circ}\text{C}$ , a sensor current of  $I_{cont} = 2\text{mA}$  must be used.

#### Characteristics:

$T_{amb} = 100^{\circ}\text{C}$ , in liquid, unless otherwise specified

| Symbol            | Parameter                      | Conditions  | Min.  | Typ.  | Max.  | Unit |
|-------------------|--------------------------------|---|-------|-------|-------|------|
| $R_{100}$         | sensor resistance              | $I_{cont} = 2\text{mA}$                                   |       |       |       |      |
| TC                | temperature coefficient        |   | -     | 0.62  | -     | %/K  |
| $R_{250}/R_{100}$ | resistance ratio               | $T_{amb} = 250^{\circ}\text{C}$ und $100^{\circ}\text{C}$ | 2.111 | 2.166 | 2.221 |      |
| $R_{25}/R_{100}$  | resistance ratio               | $T_{amb} = 25^{\circ}\text{C}$ und $100^{\circ}\text{C}$  | 0.595 | 0.603 | 0.611 |      |
| $\tau$            | thermal time constant (note 1) | In still air  | -     | 20    | -     | s    |
|                   |                                | In still liquid (Note 2)                                  | -     | 1     | -     | s    |
|                   |                                | In flowing liquid (Note 2)                                | -     | 0.5   | -     | s    |

#### Note

1. The thermal time constant is the time taken for the sensor to reach 62.3% of the total temperature difference.

For example, if a sensor with a temperature of  $25^{\circ}\text{C}$  is moved to an environment with an ambient temperature of  $100^{\circ}\text{C}$ , the time of the sensor to reach a temperature of  $72.4^{\circ}\text{C}$  is the thermal time constant.

$$T_{62,3\%} = 25^{\circ}\text{C} + 0.632 * (100^{\circ}\text{C} - 25^{\circ}\text{C}) = 72.4^{\circ}\text{C}$$

2. Inert liquid, e.g. FC 43 manufactured by the 3M company

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*Ambient temperature, corresponding resistance, temperature coefficient and maximum expected temperature error*

$I_{con} = 2 \text{ mA}$

| Ambient Temperature [°C] | Temp. Coeff. [%K] | KTY84-130        |      |      |                       | KTY84-150        |      |      |                       |
|--------------------------|-------------------|------------------|------|------|-----------------------|------------------|------|------|-----------------------|
|                          |                   | Resistance [Ohm] |      |      | Temperature-Error [K] | Resistance [Ohm] |      |      | Temperature-Error [K] |
|                          |                   | Min.             | Typ. | Max. |                       | Min.             | Typ. | Max. |                       |
| -40                      | 0.84              | 340              | 359  | 379  | ± 6.48                | 332              | 359  | 386  | ± 8.85                |
| -30                      | 0.83              | 370              | 391  | 411  | ± 6.36                | 362              | 391  | 419  | ± 8.76                |
| -20                      | 0.82              | 403              | 424  | 446  | ± 6.26                | 394              | 424  | 455  | ± 8.7                 |
| -10                      | 0.80              | 437              | 460  | 483  | ± 6.16                | 428              | 460  | 492  | ± 8.65                |
| 0                        | 0.79              | 474              | 498  | 522  | ± 6.07                | 464              | 498  | 532  | ± 8.61                |
| 10                       | 0.77              | 514              | 538  | 563  | ± 5.98                | 503              | 538  | 574  | ± 8.58                |
| 20                       | 0.75              | 555              | 581  | 607  | ± 5.89                | 544              | 581  | 618  | ± 8.55                |
| 25                       | 0.74              | 577              | 603  | 629  | ± 5.84                | 565              | 603  | 641  | ± 8.54                |
| 30                       | 0.73              | 599              | 626  | 652  | ± 5.79                | 587              | 626  | 665  | ± 8.53                |
| 40                       | 0.71              | 645              | 672  | 700  | ± 5.69                | 632              | 672  | 713  | ± 8.5                 |
| 50                       | 0.70              | 694              | 722  | 750  | ± 5.59                | 679              | 722  | 764  | ± 8.46                |
| 60                       | 0.68              | 744              | 773  | 801  | ± 5.47                | 729              | 773  | 817  | ± 8.42                |
| 70                       | 0.66              | 797              | 826  | 855  | ± 5.34                | 781              | 826  | 872  | ± 8.37                |
| 80                       | 0.64              | 852              | 882  | 912  | ± 5.21                | 835              | 882  | 929  | ± 8.31                |
| 90                       | 0.63              | 910              | 940  | 970  | ± 5.06                | 891              | 940  | 989  | ± 8.25                |
| 100                      | 0.61              | 970              | 1000 | 1030 | ± 4.9                 | 950              | 1000 | 1050 | ± 8.17                |
| 110                      | 0.60              | 1029             | 1062 | 1096 | ± 5.31                | 1007             | 1062 | 1117 | ± 8.66                |
| 120                      | 0.58              | 1089             | 1127 | 1164 | ± 5.73                | 1067             | 1127 | 1187 | ± 9.17                |
| 130                      | 0.57              | 1152             | 1194 | 1235 | ± 6.17                | 1128             | 1194 | 1259 | ± 9.69                |
| 140                      | 0.55              | 1216             | 1262 | 1309 | ± 6.63                | 1191             | 1262 | 1334 | ± 10.24               |
| 150                      | 0.54              | 1282             | 1334 | 1385 | ± 7.1                 | 1256             | 1334 | 1412 | ± 10.8                |
| 160                      | 0.53              | 1350             | 1407 | 1463 | ± 7.59                | 1322             | 1407 | 1492 | ± 11.37               |
| 170                      | 0.52              | 1420             | 1482 | 1544 | ± 8.1                 | 1391             | 1482 | 1574 | ± 11.96               |
| 180                      | 0.51              | 1492             | 1560 | 1628 | ± 8.62                | 1461             | 1560 | 1659 | ± 12.58               |
| 190                      | 0.49              | 1566             | 1640 | 1714 | ± 9.15                | 1533             | 1640 | 1747 | ± 13.2                |
| 200                      | 0.48              | 1641             | 1722 | 1803 | ± 9.71                | 1607             | 1722 | 1837 | ± 13.85               |
| 210                      | 0.47              | 1719             | 1807 | 1894 | ± 10.28               | 1683             | 1807 | 1931 | ± 14.51               |
| 220                      | 0.46              | 1798             | 1893 | 1988 | ± 10.87               | 1760             | 1893 | 2026 | ± 15.19               |
| 230                      | 0.45              | 1879             | 1982 | 2085 | ± 11.47               | 1839             | 1982 | 2125 | ± 15.88               |
| 240                      | 0.44              | 1962             | 2073 | 2184 | ± 12.09               | 1920             | 2073 | 2226 | ± 16.59               |
| 250                      | 0.43              | 2046             | 2166 | 2286 | ± 12.73               | 2003             | 2166 | 2329 | ± 17.32               |
| 260                      | 0.42              | 2132             | 2261 | 2390 | ± 13.44               | 2087             | 2261 | 2436 | ± 18.15               |
| 270                      | 0.41              | 2219             | 2357 | 2496 | ± 14.44               | 2172             | 2357 | 2543 | ± 19.36               |
| 280                      | 0.38              | 2304             | 2452 | 2600 | ± 15.94               | 2255             | 2452 | 2650 | ± 21.21               |
| 290                      | 0.34              | 2384             | 2542 | 2700 | ± 18.26               | 2333             | 2542 | 2751 | ± 24.14               |
| 300                      | 0.29              | 2456             | 2624 | 2791 | ± 22.12               | 2404             | 2624 | 2844 | ± 29.05               |

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| Ambient<br>Temperature<br>[°C] | Temp.<br>Coeff.<br>[%K] | KTY84-151        |      |      | Temperature-<br>Error [K] |
|--------------------------------|-------------------------|------------------|------|------|---------------------------|
|                                |                         | Resistance [Ohm] |      |      |                           |
|                                |                         | Min.             | Typ. | Max. |                           |
| -40                            | 0.84                    | 332              | 350  | 368  | ± 5.79                    |
| -30                            | 0.83                    | 362              | 381  | 399  | ± 5.48                    |
| -20                            | 0.82                    | 394              | 414  | 433  | ± 5.72                    |
| -10                            | 0.80                    | 428              | 449  | 469  | ± 5.62                    |
| 0                              | 0.79                    | 464              | 486  | 507  | ± 5.51                    |
| 10                             | 0.77                    | 503              | 525  | 547  | ± 5.41                    |
| 20                             | 0.75                    | 544              | 566  | 589  | ± 5.31                    |
| 25                             | 0.74                    | 565              | 588  | 611  | ± 5.25                    |
| 30                             | 0.73                    | 587              | 610  | 633  | ± 5.2                     |
| 40                             | 0.71                    | 632              | 656  | 679  | ± 5.08                    |
| 50                             | 0.70                    | 379              | 704  | 728  | ± 4.96                    |
| 60                             | 0.68                    | 729              | 754  | 778  | ± 4.83                    |
| 70                             | 0.66                    | 781              | 806  | 831  | ± 4.68                    |
| 80                             | 0.64                    | 835              | 860  | 885  | ± 4.53                    |
| 90                             | 0.63                    | 891              | 916  | 942  | ± 4.37                    |
| 100                            | 0.61                    | 950              | 975  | 1000 | ± 4.19                    |
| 110                            | 0.60                    | 1007             | 1036 | 1064 | ± 4.58                    |
| 120                            | 0.58                    | 1067             | 1099 | 1131 | ± 4.99                    |
| 130                            | 0.57                    | 1128             | 1164 | 1199 | ± 5.41                    |
| 140                            | 0.55                    | 1191             | 1231 | 1271 | ± 5.84                    |
| 150                            | 0.54                    | 1256             | 1300 | 1345 | ± 6.3                     |
| 160                            | 0.53                    | 1322             | 1372 | 1421 | ± 6.77                    |
| 170                            | 0.52                    | 1391             | 1445 | 1500 | ± 7.25                    |
| 180                            | 0.51                    | 1461             | 1521 | 1581 | ± 7.75                    |
| 190                            | 0.49                    | 1533             | 1599 | 1664 | ± 8.27                    |
| 200                            | 0.48                    | 1607             | 1679 | 1751 | ± 8.81                    |
| 210                            | 0.47                    | 1683             | 1761 | 1839 | ± 9.36                    |
| 220                            | 0.46                    | 1760             | 1846 | 1931 | ± 9.93                    |
| 230                            | 0.45                    | 1839             | 1932 | 2024 | ± 10.51                   |
| 240                            | 0.44                    | 1920             | 2021 | 2121 | ± 11.11                   |
| 250                            | 0.43                    | 2003             | 2112 | 2220 | ± 11.73                   |
| 260                            | 0.42                    | 2087             | 2205 | 2321 | ± 12.42                   |
| 270                            | 0.41                    | 2172             | 2298 | 2424 | ± 13.37                   |
| 280                            | 0.38                    | 2257             | 2391 | 2525 | ± 14.79                   |
| 290                            | 0.34                    | 2335             | 2479 | 2622 | ± 16.98                   |
| 300                            | 0.29                    | 2406             | 2558 | 2710 | ± 20.61                   |

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**Mechanical data:**

**DIMENSIONS (mm are the original dimensions)**

| UNIT | b<br>max. | D<br>max. | G <sub>1</sub><br>max. | L<br>min. |
|------|-----------|-----------|------------------------|-----------|
| mm   | 0.55      | 1.6       | 3.04                   | 25.4      |

0      2      4 mm  
scale

**Note**  
1. The marking band indicates the cathode.

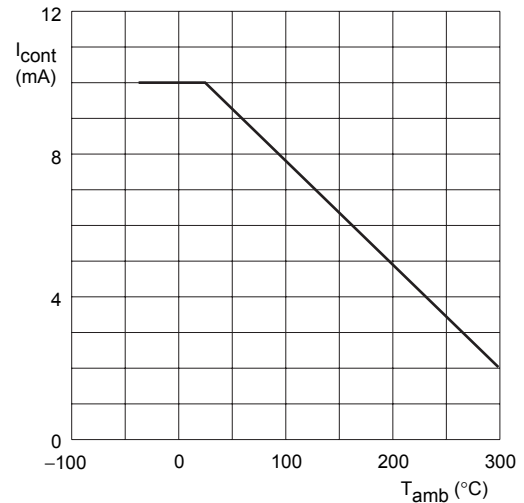
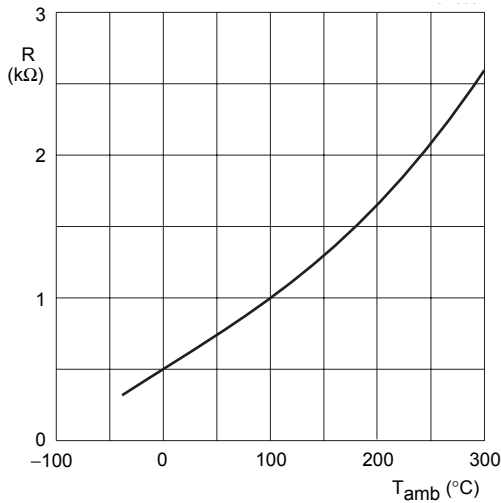
| OUTLINE<br>VERSION | REFERENCES |       |      |  | EUROPEAN<br>PROJECTION | ISSUE DATE |
|--------------------|------------|-------|------|--|------------------------|------------|
|                    | IEC        | JEDEC | EIAJ |  |                        |            |
| SOD68              |            | DO-34 |      |  |                        | 97-06-09   |

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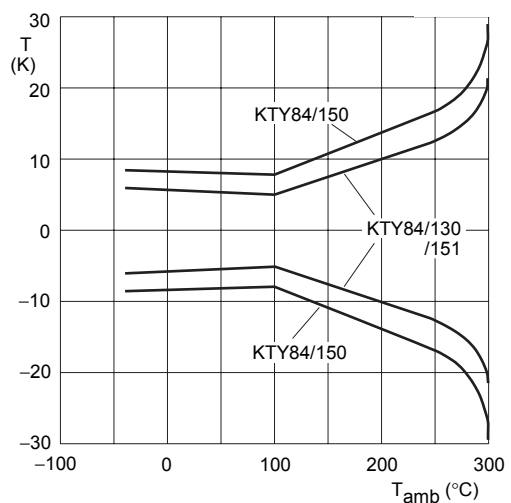
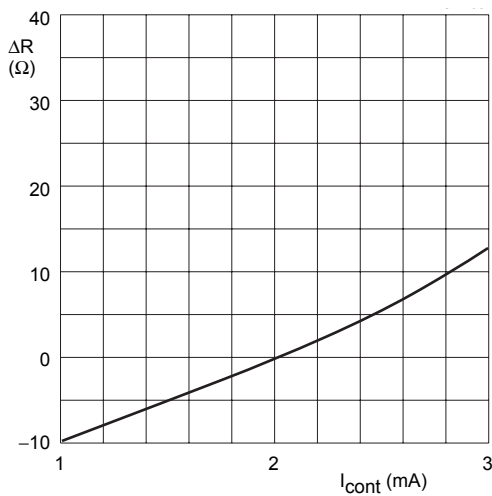
### Characteristic curves of KTY 84-...



$I_{cont} = 2 \text{ mA}$

Sensor resistance as a function of ambient temperature; average values.

Maximum operating current for safe operation



$T_{amb} = 100^\circ\text{C}$

Deviation of sensor resistance as a function of operating current in still liquid.

Maximum expected temperature error ( $\Delta T$ ).

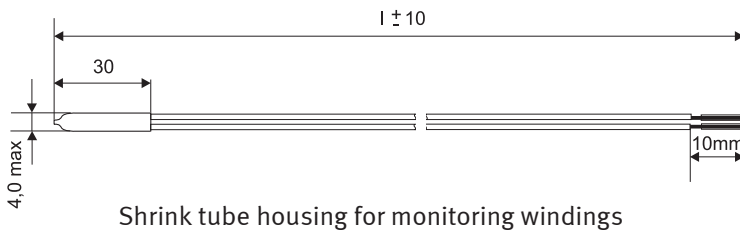
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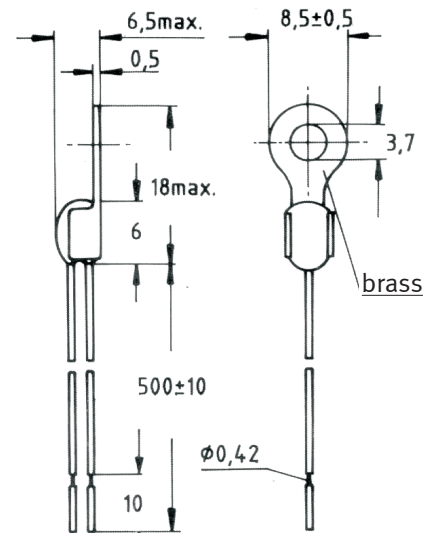
KTY 84-1...

### KTY-sensors:

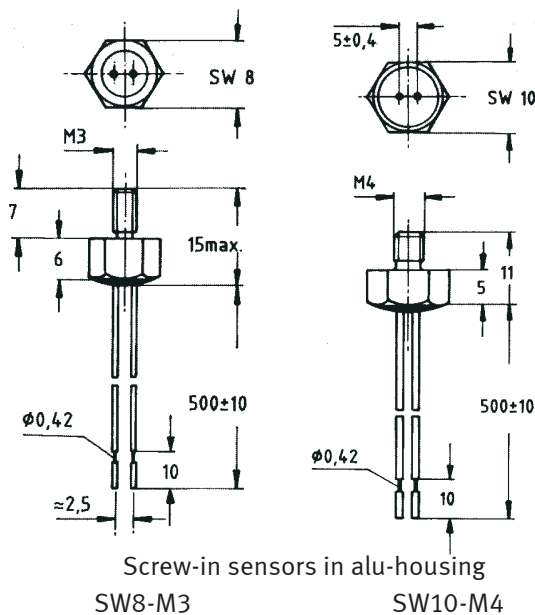
examples of KTY-thermistor-housings



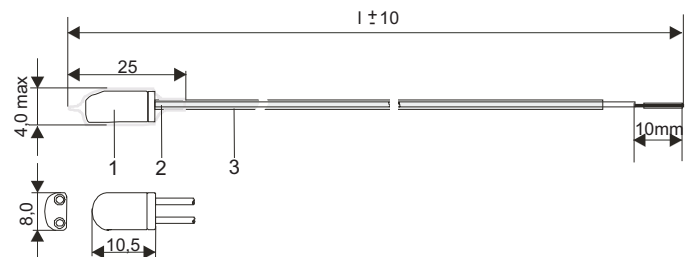
Shrink tube housing for monitoring windings



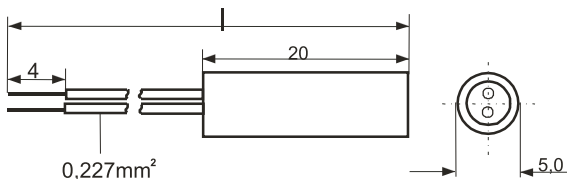
KTY-sensor in cable shoe -  
surface sensor



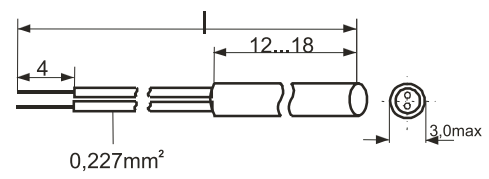
Screw-in sensors in alu-housing  
SW8-M3 SW10-M4



- 1 = KTY-sensor, insulated twice, in stainless steel or PPS-housing
- 2 = Terminal: stranded silver copper wire insulated with Teflon (PTFE), AWG 24 or AWG 26 according to the manufacturers choice; optional: AWG 20
- 3 = additional shrink tube (optional)



KTY-thermistor in stainless steel



KTY-Thermistor in ceramics-  
or brass-housing

For further advice and information contact: