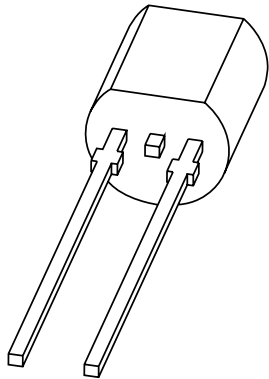


DATA SHEET



KTY81-1 series Silicon temperature sensors

Product specification
Supersedes data of 1998 Mar 26

2000 Aug 25

Silicon temperature sensors

KTY81-1 series

DESCRIPTION

The temperature sensors in the KTY81-1 series have a positive temperature coefficient of resistance and are suitable for use in measurement and control systems. The sensors are encapsulated in the SOD70 leaded plastic package.

Tolerances of 0.5% or other special selections are available on request.

MARKING

| TYPE NUMBER | CODE |
|-------------|------|
| KTY81-110 | 110 |
| KTY81-120 | 120 |
| KTY81-121 | 121 |
| KTY81-122 | 122 |
| KTY81-150 | 150 |
| KTY81-151 | 151 |
| KTY81-152 | 152 |

PINNING

| PIN | DESCRIPTION |
|-----|------------------------------------|
| 1 | electrical contact |
| 2 | electrical contact |
| 3 | not to be connected to a potential |

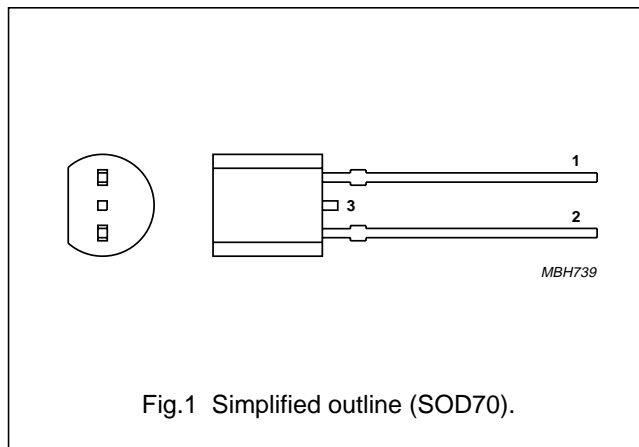


Fig.1 Simplified outline (SOD70).

QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|------------------|-------------------------------|--|------|------|------|
| R ₂₅ | sensor resistance | T _{amb} = 25 °C; I _{cont} = 1 mA | | | |
| | KTY81-110 | | 990 | 1010 | Ω |
| | KTY81-120 | | 980 | 1020 | Ω |
| | KTY81-121 | | 980 | 1000 | Ω |
| | KTY81-122 | | 1000 | 1020 | Ω |
| | KTY81-150 | | 950 | 1050 | Ω |
| | KTY81-151 | | 950 | 1000 | Ω |
| KTY81-152 | 1000 | 1050 | Ω | | |
| T _{amb} | ambient operating temperature | | -55 | +150 | °C |

Silicon temperature sensors

KTY81-1 series

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; $T_{\text{amb}} = 25\text{ °C}$ | – | 10 | mA |
| | | in free air; $T_{\text{amb}} = 150\text{ °C}$ | – | 2 | mA |
| T_{amb} | ambient operating temperature | | –55 | +150 | °C |

CHARACTERISTICS

$T_{\text{amb}} = 25\text{ °C}$, in liquid, unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|------------------|-------------------------------|---|-------|----------|-------|----------|
| R_{25} | sensor resistance | $I_{\text{cont}} = 1\text{ mA}$ | | | | |
| | KTY81-110 | | 990 | – | 1010 | Ω |
| | KTY81-120 | | 980 | – | 1020 | Ω |
| | KTY81-121 | | 980 | – | 1000 | Ω |
| | KTY81-122 | | 1000 | – | 1020 | Ω |
| | KTY81-150 | | 950 | – | 1050 | Ω |
| | KTY81-151 | | 950 | – | 1000 | Ω |
| KTY81-152 | 1000 | – | 1050 | Ω | | |
| TC | temperature coefficient | | – | 0.79 | – | %/K |
| R_{100}/R_{25} | resistance ratio | $T_{\text{amb}} = 100\text{ °C}$ and 25 °C | 1.676 | 1.696 | 1.716 | |
| R_{-55}/R_{25} | resistance ratio | $T_{\text{amb}} = -55\text{ °C}$ and 25 °C | 0.480 | 0.490 | 0.500 | |
| τ | thermal time constant; note 1 | in still air | – | 30 | – | s |
| | | in still liquid; note 2 | – | 5 | – | s |
| | | in flowing liquid; note 2 | – | 3 | – | s |
| | rated temperature range | | –55 | – | +150 | °C |

Notes

- The thermal time constant is the time taken for the sensor to reach 63.2% of the total temperature difference. For example, if a sensor with a temperature of 25 °C is moved to an environment with an ambient temperature of 100 °C , the time for the sensor to reach a temperature of 47.4 °C is the thermal time constant.
- Inert liquid, e.g. FC43 manufactured by the 3M company.

Silicon temperature sensors

KTY81-1 series

Table 1 Ambient temperature, corresponding resistance, temperature coefficient and maximum expected temperature error for KTY81-110 and KTY81-120 $I_{\text{cont}} = 1 \text{ mA}$.

| AMBIENT TEMPERATURE | | TEMP. COEFF. (%/K) | KTY81-110 | | | | KTY81-120 | | | |
|---------------------|------|-----------------------|----------------|------|------|-----------------|----------------|------|------|-----------------|
| (°C) | (°F) | | RESISTANCE (Ω) | | | TEMP. ERROR (K) | RESISTANCE (Ω) | | | TEMP. ERROR (K) |
| | | MIN. | TYP. | MAX. | MIN. | | TYP. | MAX. | | |
| -55 | -67 | 0.99 | 475 | 490 | 505 | ±3.02 | 470 | 490 | 510 | ±4.02 |
| -50 | -58 | 0.98 | 500 | 515 | 530 | ±2.92 | 495 | 515 | 535 | ±3.94 |
| -40 | -40 | 0.96 | 552 | 567 | 582 | ±2.74 | 547 | 567 | 588 | ±3.78 |
| -30 | -22 | 0.93 | 609 | 624 | 638 | ±2.55 | 603 | 624 | 645 | ±3.62 |
| -20 | -4 | 0.91 | 669 | 684 | 698 | ±2.35 | 662 | 684 | 705 | ±3.45 |
| -10 | 14 | 0.88 | 733 | 747 | 761 | ±2.14 | 726 | 747 | 769 | ±3.27 |
| 0 | 32 | 0.85 | 802 | 815 | 828 | ±1.91 | 793 | 815 | 836 | ±3.08 |
| 10 | 50 | 0.83 | 874 | 886 | 898 | ±1.67 | 865 | 886 | 907 | ±2.88 |
| 20 | 68 | 0.80 | 950 | 961 | 972 | ±1.41 | 941 | 961 | 982 | ±2.66 |
| 25 | 77 | 0.79 | 990 | 1000 | 1010 | ±1.27 | 980 | 1000 | 1020 | ±2.54 |
| 30 | 86 | 0.78 | 1029 | 1040 | 1051 | ±1.39 | 1018 | 1040 | 1061 | ±2.68 |
| 40 | 104 | 0.75 | 1108 | 1122 | 1136 | ±1.64 | 1097 | 1122 | 1147 | ±2.97 |
| 50 | 122 | 0.73 | 1192 | 1209 | 1225 | ±1.91 | 1180 | 1209 | 1237 | ±3.28 |
| 60 | 140 | 0.71 | 1278 | 1299 | 1319 | ±2.19 | 1265 | 1299 | 1332 | ±3.61 |
| 70 | 158 | 0.69 | 1369 | 1392 | 1416 | ±2.49 | 1355 | 1392 | 1430 | ±3.94 |
| 80 | 176 | 0.67 | 1462 | 1490 | 1518 | ±2.8 | 1447 | 1490 | 1532 | ±4.3 |
| 90 | 194 | 0.65 | 1559 | 1591 | 1623 | ±3.12 | 1543 | 1591 | 1639 | ±4.66 |
| 100 | 212 | 0.63 | 1659 | 1696 | 1733 | ±3.46 | 1642 | 1696 | 1750 | ±5.05 |
| 110 | 230 | 0.61 | 1762 | 1805 | 1847 | ±3.83 | 1744 | 1805 | 1865 | ±5.48 |
| 120 | 248 | 0.58 | 1867 | 1915 | 1963 | ±4.33 | 1848 | 1915 | 1982 | ±6.07 |
| 125 | 257 | 0.55 | 1919 | 1970 | 2020 | ±4.66 | 1899 | 1970 | 2040 | ±6.47 |
| 130 | 266 | 0.52 | 1970 | 2023 | 2077 | ±5.07 | 1950 | 2023 | 2097 | ±6.98 |
| 140 | 284 | 0.45 | 2065 | 2124 | 2184 | ±6.28 | 2043 | 2124 | 2205 | ±8.51 |
| 150 | 302 | 0.35 | 2145 | 2211 | 2277 | ±8.55 | 2123 | 2211 | 2299 | ±11.43 |

Silicon temperature sensors

KTY81-1 series

Table 2 Ambient temperature, corresponding resistance, temperature coefficient and maximum expected temperature error for KTY81-121 and KTY81-122 $I_{\text{cont}} = 1 \text{ mA}$.

| AMBIENT TEMPERATURE | | TEMP. COEFF. (%/K) | KTY81-121 | | | | KTY81-122 | | | |
|---------------------|------|--------------------|----------------|------|------|-----------------|----------------|------|------|-----------------|
| (°C) | (°F) | | RESISTANCE (Ω) | | | TEMP. ERROR (K) | RESISTANCE (Ω) | | | TEMP. ERROR (K) |
| | | MIN. | TYP. | MAX. | MIN. | | TYP. | MAX. | | |
| -55 | -67 | 0.99 | 471 | 485 | 500 | ±3.02 | 480 | 495 | 510 | ±3.02 |
| -50 | -58 | 0.98 | 495 | 510 | 524 | ±2.92 | 505 | 520 | 535 | ±2.92 |
| -40 | -40 | 0.96 | 547 | 562 | 576 | ±2.74 | 558 | 573 | 588 | ±2.74 |
| -30 | -22 | 0.93 | 603 | 617 | 632 | ±2.55 | 615 | 630 | 645 | ±2.55 |
| -20 | -4 | 0.91 | 662 | 677 | 691 | ±2.35 | 676 | 690 | 705 | ±2.35 |
| -10 | 14 | 0.88 | 726 | 740 | 754 | ±2.14 | 741 | 755 | 769 | ±2.14 |
| 0 | 32 | 0.85 | 794 | 807 | 820 | ±1.91 | 810 | 823 | 836 | ±1.91 |
| 10 | 50 | 0.83 | 865 | 877 | 889 | ±1.67 | 883 | 895 | 907 | ±1.67 |
| 20 | 68 | 0.80 | 941 | 951 | 962 | ±1.41 | 960 | 971 | 982 | ±1.41 |
| 25 | 77 | 0.79 | 980 | 990 | 1000 | ±1.27 | 1000 | 1010 | 1020 | ±1.27 |
| 30 | 86 | 0.78 | 1018 | 1029 | 1041 | ±1.39 | 1039 | 1050 | 1062 | ±1.39 |
| 40 | 104 | 0.75 | 1097 | 1111 | 1125 | ±1.64 | 1120 | 1134 | 1148 | ±1.64 |
| 50 | 122 | 0.73 | 1180 | 1196 | 1213 | ±1.91 | 1204 | 1221 | 1238 | ±1.91 |
| 60 | 140 | 0.71 | 1266 | 1286 | 1305 | ±2.19 | 1291 | 1312 | 1332 | ±2.19 |
| 70 | 158 | 0.69 | 1355 | 1378 | 1402 | ±2.49 | 1382 | 1406 | 1430 | ±2.49 |
| 80 | 176 | 0.67 | 1447 | 1475 | 1502 | ±2.8 | 1477 | 1505 | 1533 | ±2.8 |
| 90 | 194 | 0.65 | 1543 | 1575 | 1607 | ±3.12 | 1574 | 1607 | 1639 | ±3.12 |
| 100 | 212 | 0.63 | 1642 | 1679 | 1716 | ±3.46 | 1676 | 1713 | 1750 | ±3.46 |
| 110 | 230 | 0.61 | 1745 | 1786 | 1828 | ±3.83 | 1780 | 1823 | 1865 | ±3.83 |
| 120 | 248 | 0.58 | 1849 | 1896 | 1943 | ±4.33 | 1886 | 1934 | 1982 | ±4.33 |
| 125 | 257 | 0.55 | 1900 | 1950 | 2000 | ±4.66 | 1938 | 1989 | 2041 | ±4.66 |
| 130 | 266 | 0.52 | 1950 | 2003 | 2056 | ±5.07 | 1989 | 2044 | 2098 | ±5.07 |
| 140 | 284 | 0.45 | 2044 | 2103 | 2162 | ±6.28 | 2085 | 2146 | 2206 | ±6.28 |
| 150 | 302 | 0.35 | 2124 | 2189 | 2254 | ±8.55 | 2167 | 2233 | 2299 | ±8.55 |

Silicon temperature sensors

KTY81-1 series

Table 3 Ambient temperature, corresponding resistance, temperature coefficient and maximum expected temperature error for KTY81-150 and KTY81-151 $I_{\text{cont}} = 1 \text{ mA}$.

| AMBIENT TEMPERATURE | | TEMP. COEFF. (%/K) | KTY81-150 | | | | KTY81-151 | | | |
|---------------------|-----|--------------------|-------------------------|------|------|-----------------|-------------------------|------|------|-----------------|
| °C | °F | | RESISTANCE (Ω) | | | TEMP. ERROR (K) | RESISTANCE (Ω) | | | TEMP. ERROR (K) |
| | | | MIN. | TYP. | MAX. | | MIN. | TYP. | MAX. | |
| -55 | -67 | 0.99 | 456 | 490 | 524 | ± 7.04 | 456 | 478 | 499 | ± 4.52 |
| -50 | -58 | 0.98 | 479 | 515 | 550 | ± 6.99 | 480 | 502 | 524 | ± 4.45 |
| -40 | -40 | 0.96 | 530 | 567 | 605 | ± 6.91 | 530 | 553 | 576 | ± 4.3 |
| -30 | -22 | 0.93 | 584 | 624 | 663 | ± 6.84 | 584 | 608 | 632 | ± 4.16 |
| -20 | -4 | 0.91 | 642 | 684 | 725 | ± 6.77 | 642 | 667 | 691 | ± 4.01 |
| -10 | 14 | 0.88 | 703 | 747 | 791 | ± 6.69 | 704 | 729 | 753 | ± 3.84 |
| 0 | 32 | 0.85 | 769 | 815 | 861 | ± 6.61 | 770 | 794 | 819 | ± 3.67 |
| 10 | 50 | 0.83 | 838 | 886 | 934 | ± 6.51 | 839 | 864 | 889 | ± 3.48 |
| 20 | 68 | 0.80 | 912 | 961 | 1010 | ± 6.41 | 912 | 937 | 962 | ± 3.28 |
| 25 | 77 | 0.79 | 950 | 1000 | 1050 | ± 6.35 | 950 | 975 | 1000 | ± 3.18 |
| 30 | 86 | 0.78 | 987 | 1040 | 1093 | ± 6.55 | 988 | 1014 | 1040 | ± 3.33 |
| 40 | 104 | 0.75 | 1064 | 1122 | 1181 | ± 6.97 | 1064 | 1094 | 1124 | ± 3.64 |
| 50 | 122 | 0.73 | 1143 | 1209 | 1274 | ± 7.4 | 1144 | 1178 | 1212 | ± 3.97 |
| 60 | 140 | 0.71 | 1226 | 1299 | 1371 | ± 7.85 | 1227 | 1266 | 1305 | ± 4.31 |
| 70 | 158 | 0.69 | 1313 | 1392 | 1472 | ± 8.31 | 1314 | 1357 | 1401 | ± 4.67 |
| 80 | 176 | 0.67 | 1402 | 1490 | 1577 | ± 8.79 | 1404 | 1453 | 1501 | ± 5.05 |
| 90 | 194 | 0.65 | 1495 | 1591 | 1687 | ± 9.29 | 1497 | 1551 | 1606 | ± 5.43 |
| 100 | 212 | 0.63 | 1591 | 1696 | 1801 | ± 9.81 | 1593 | 1654 | 1714 | ± 5.84 |
| 110 | 230 | 0.61 | 1690 | 1805 | 1919 | ± 10.4 | 1692 | 1759 | 1827 | ± 6.3 |
| 120 | 248 | 0.58 | 1791 | 1915 | 2039 | ± 11.28 | 1792 | 1867 | 1942 | ± 6.94 |
| 125 | 257 | 0.55 | 1840 | 1970 | 2099 | ± 11.91 | 1842 | 1920 | 1999 | ± 7.38 |
| 130 | 266 | 0.52 | 1889 | 2023 | 2158 | ± 12.72 | 1891 | 1973 | 2055 | ± 7.94 |
| 140 | 284 | 0.45 | 1980 | 2124 | 2269 | ± 15.21 | 1982 | 2071 | 2161 | ± 9.63 |
| 150 | 302 | 0.35 | 2057 | 2211 | 2365 | ± 20.09 | 2059 | 2156 | 2252 | ± 12.88 |

Silicon temperature sensors

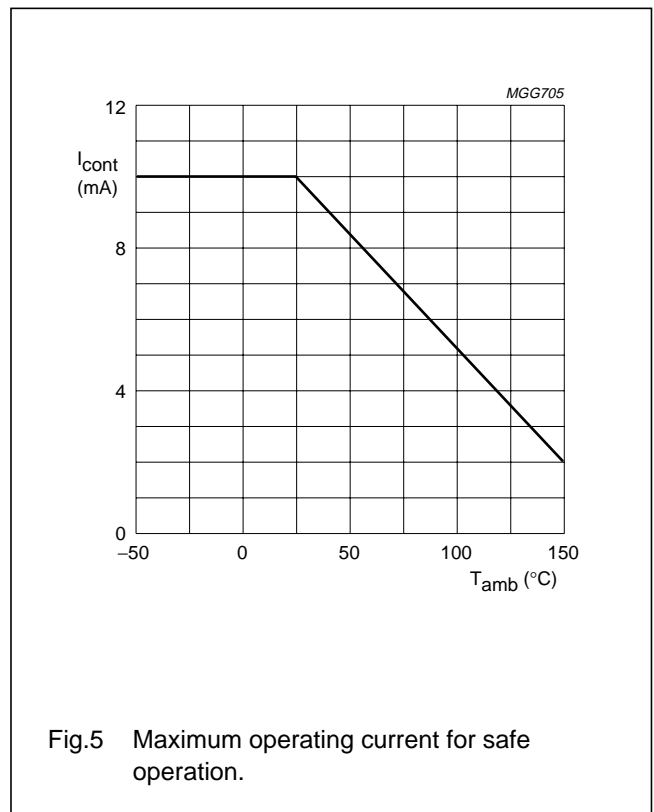
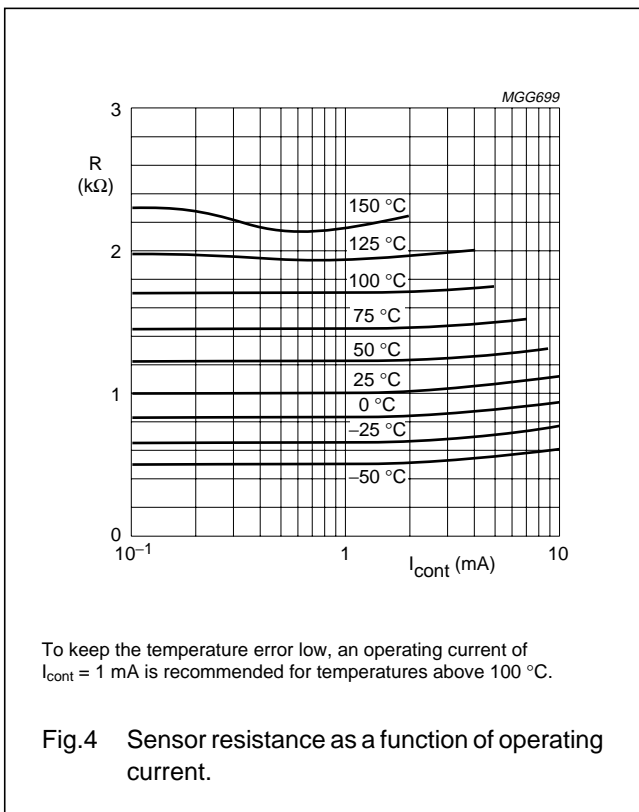
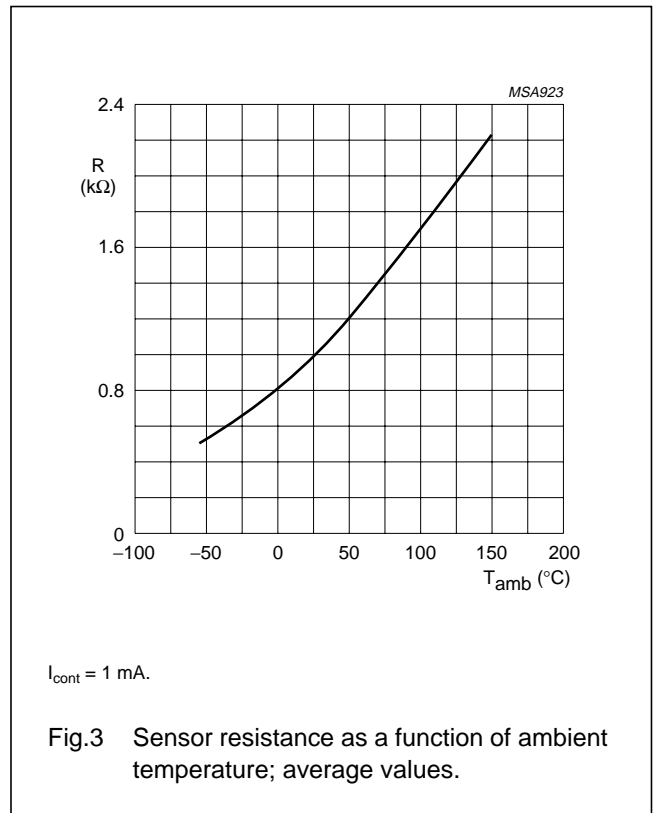
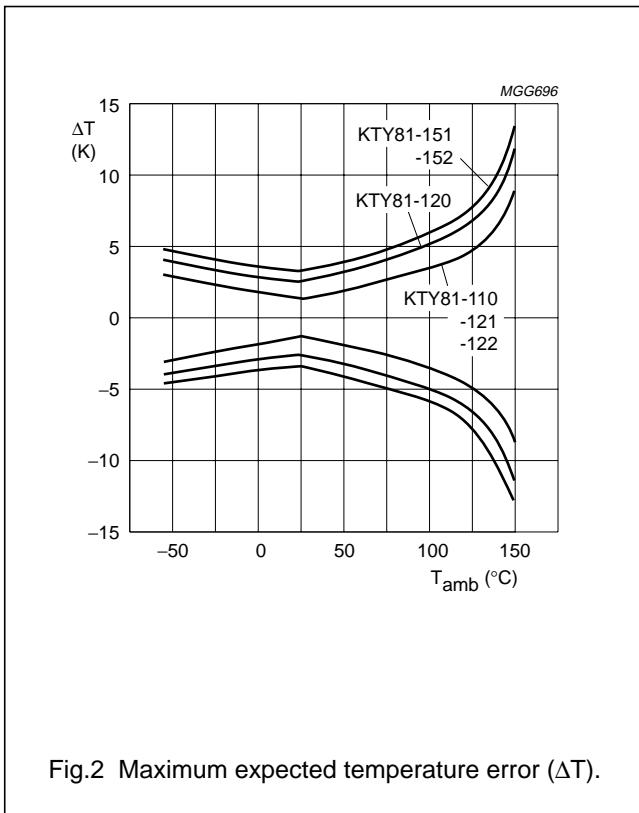
KTY81-1 series

Table 4 Ambient temperature, corresponding resistance, temperature coefficient and maximum expected temperature error for KTY81-152 $I_{\text{cont}} = 1 \text{ mA}$.

| AMBIENT TEMPERATURE | | (%/K) | KTY81-152 | | | |
|---------------------|------|-------|----------------|------|------|-----------------|
| (°C) | (°F) | | RESISTANCE (Ω) | | | TEMP. ERROR (K) |
| | | | MIN. | TYP. | MAX. | |
| -55 | -67 | 0.99 | 480 | 502 | 525 | ±4.52 |
| -50 | -58 | 0.98 | 505 | 528 | 551 | ±4.45 |
| -40 | -40 | 0.96 | 558 | 582 | 606 | ±4.3 |
| -30 | -22 | 0.93 | 614 | 639 | 664 | ±4.16 |
| -20 | -4 | 0.91 | 675 | 701 | 726 | ±4.01 |
| -10 | 14 | 0.88 | 740 | 766 | 792 | ±3.84 |
| 0 | 32 | 0.85 | 809 | 835 | 861 | ±3.67 |
| 10 | 50 | 0.83 | 882 | 908 | 934 | ±3.48 |
| 20 | 68 | 0.80 | 959 | 985 | 1011 | ±3.28 |
| 25 | 77 | 0.79 | 1000 | 1025 | 1050 | ±3.18 |
| 30 | 86 | 0.78 | 1038 | 1066 | 1093 | ±3.33 |
| 40 | 104 | 0.75 | 1119 | 1150 | 1182 | ±3.64 |
| 50 | 122 | 0.73 | 1203 | 1239 | 1275 | ±3.97 |
| 60 | 140 | 0.71 | 1290 | 1331 | 1372 | ±4.31 |
| 70 | 158 | 0.69 | 1381 | 1427 | 1473 | ±4.67 |
| 80 | 176 | 0.67 | 1476 | 1527 | 1578 | ±5.05 |
| 90 | 194 | 0.65 | 1573 | 1631 | 1688 | ±5.43 |
| 100 | 212 | 0.63 | 1674 | 1738 | 1802 | ±5.84 |
| 110 | 230 | 0.61 | 1779 | 1850 | 1921 | ±6.3 |
| 120 | 248 | 0.58 | 1884 | 1963 | 2041 | ±6.94 |
| 125 | 257 | 0.55 | 1937 | 2019 | 2101 | ±7.38 |
| 130 | 266 | 0.52 | 1988 | 2074 | 2160 | ±7.94 |
| 140 | 284 | 0.45 | 2084 | 2178 | 2271 | ±9.63 |
| 150 | 302 | 0.35 | 2165 | 2266 | 2367 | ±12.88 |

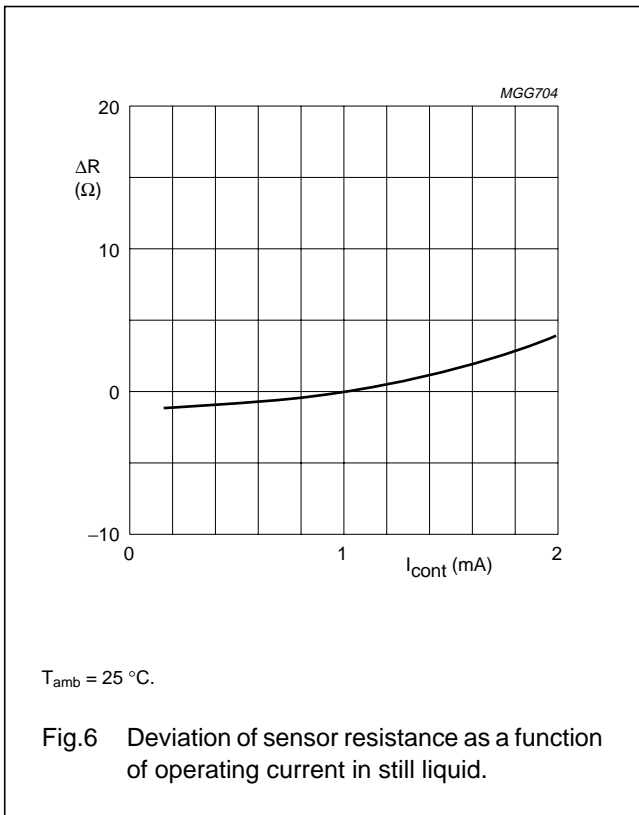
Silicon temperature sensors

KTY81-1 series



Silicon temperature sensors

KTY81-1 series



APPLICATION INFORMATION

| SYMBOL | PARAMETER | CONDITIONS | TYP. | UNIT |
|-----------------|-------------------------------------|--|------|----------|
| ΔR_{25} | drift of sensor resistance at 25 °C | 10000 hours continuous operation; $T_{amb} = 150\text{ }^\circ\text{C}$ | 1.6 | Ω |

Silicon temperature sensors

KTY81-1 series

PACKAGING

Sensors in SOD70 encapsulation are delivered in bulk packaging and also in reel packaging for automatic placement on hybrid circuits and printed-circuit boards (see Figs 7 and 8).

Note: Types in bulk packaging have a lead-to-lead distance of 2.54 millimetres. The lead-to-lead distance of types packaged on reel is 5.08 millimetres for spread lead types and 2.54 millimetres for straight lead types.

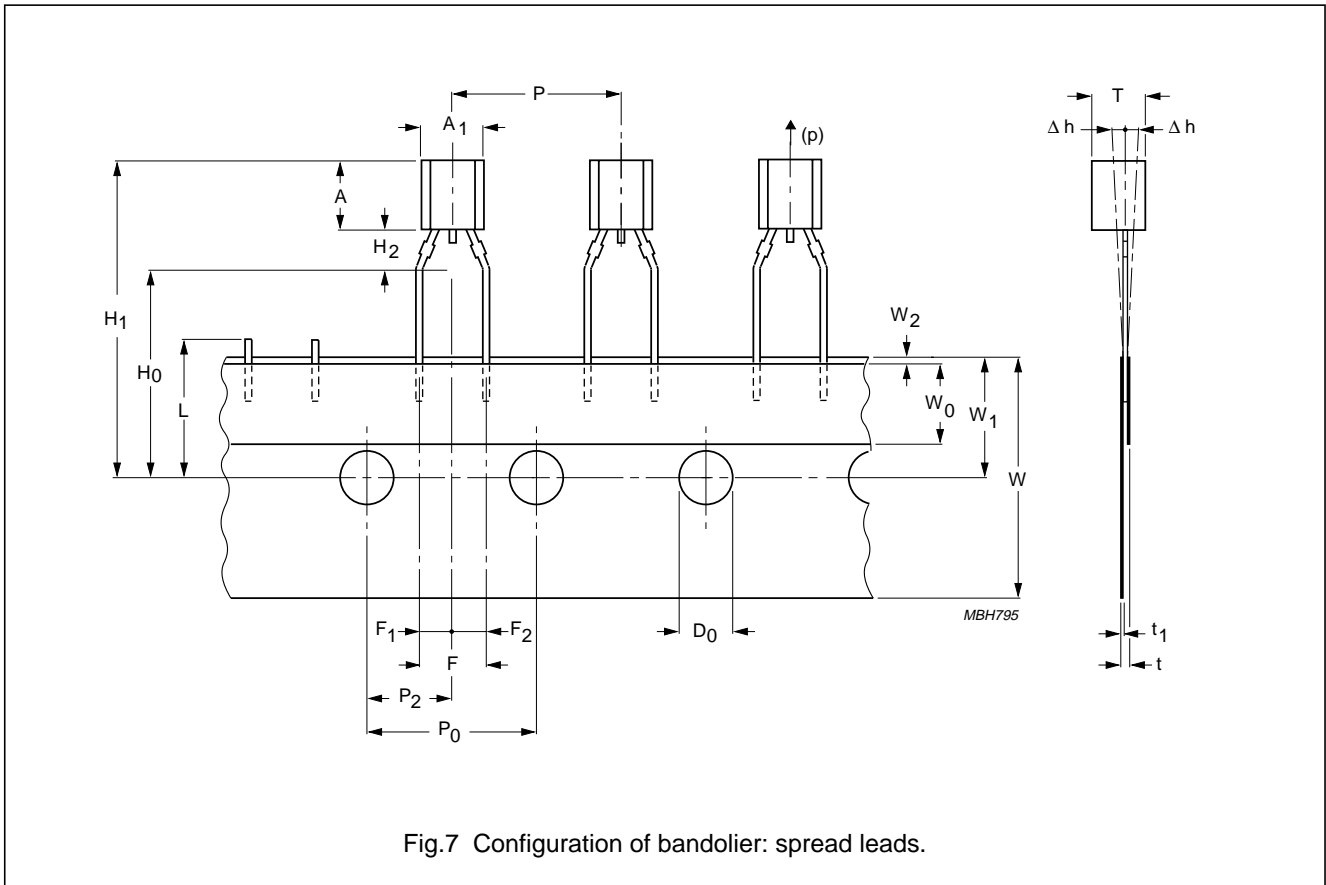


Fig.7 Configuration of bandolier: spread leads.

Silicon temperature sensors

KTY81-1 series

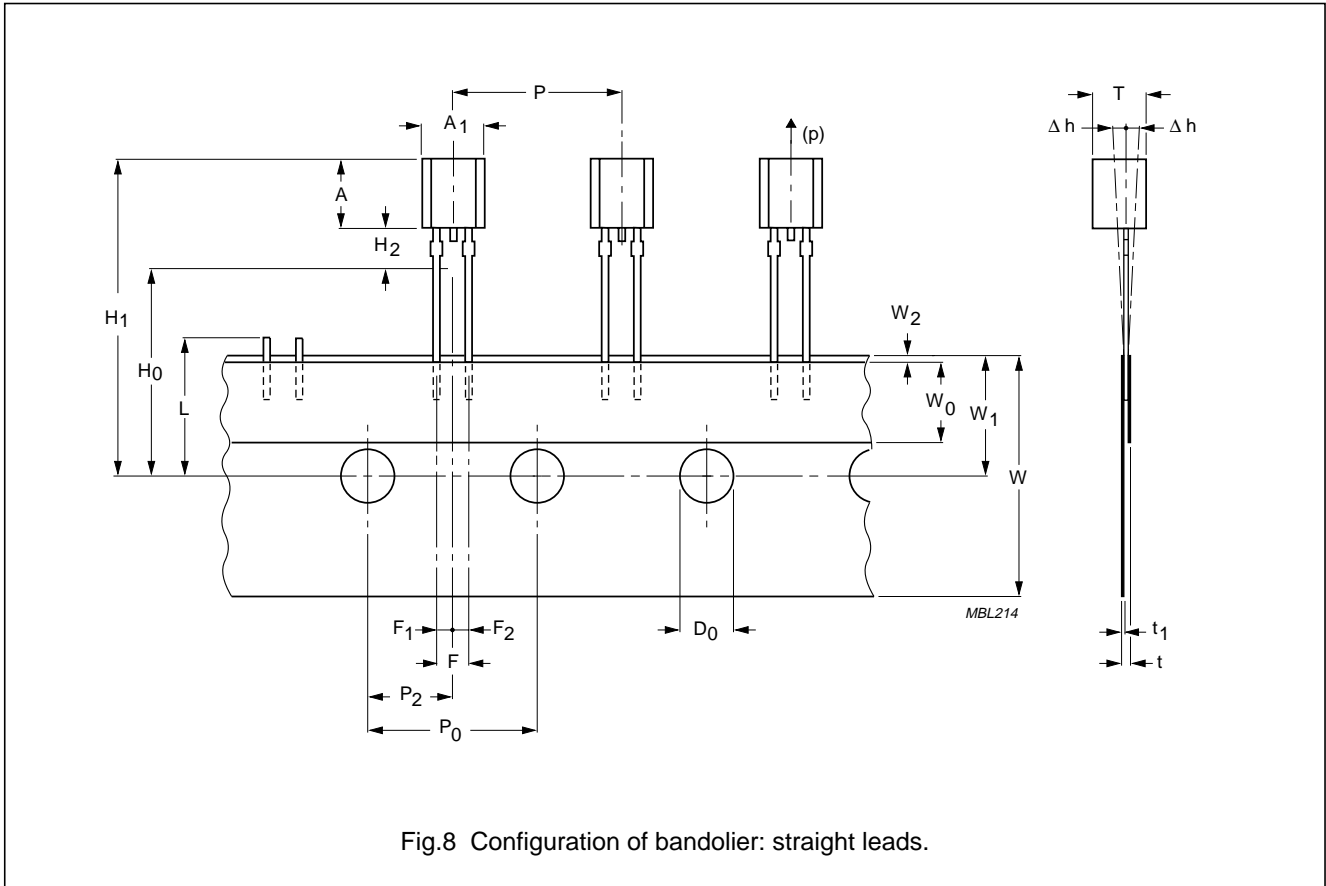


Fig.8 Configuration of bandolier: straight leads.

Silicon temperature sensors

KTY81-1 series

Table 5 Tape specification

| SYMBOL | DIMENSION | SPECIFICATIONS | | | | | REMARKS |
|---------------------------------|--------------------------------------|----------------|------|-------|-----------|------|------------------------------------|
| | | MIN. | NOM. | MAX. | TOL. | UNIT | |
| A ₁ | body width | 4.4 | – | 4.8 | – | mm | |
| A | body height | 5 | – | 5.2 | – | mm | |
| T | body thickness | 3.6 | – | 4.2 | – | mm | |
| P | pitch of component | – | 12.7 | – | ±1 | mm | |
| P ₀ | feed hole pitch | – | 12.7 | – | ±0.3 | mm | |
| | cumulative pitch error | – | – | – | ±0.1 | | note 1 |
| P ₂ | feed hole centre to component centre | – | 6.35 | – | ±0.4 | mm | to be measured at bottom of clinch |
| F | lead-to-lead distance | | | | | | |
| | spread leads | – | 5.08 | – | +0.6/–0.2 | mm | |
| | straight leads | – | 2.54 | – | +0.6/–0.2 | mm | |
| Δh | component alignment | – | 0 | 1 | – | mm | at top of body |
| W | tape width | – | 18 | – | ±0.5 | mm | |
| W ₀ | hold-down tape width | – | 6 | – | ±0.2 | mm | |
| W ₁ | hole position | – | 9 | – | +0.7/–0.5 | mm | |
| W ₂ | hold-down tape position | – | 0.5 | – | ±0.2 | mm | |
| H ₀ | lead wire clinch height | – | 16.5 | – | ±0.5 | mm | |
| H ₁ | component height | – | – | 23.25 | – | mm | |
| L | length of snapped leads | – | – | 11 | – | mm | |
| D ₀ | feed hole diameter | – | 4 | – | ±0.2 | mm | |
| t | total tape thickness | – | – | 1.2 | – | mm | t ₁ = 0.3 to 0.6 |
| F ₁ , F ₂ | lead to snapped lead distance | | | | | | |
| | spread leads | – | 2.54 | – | +0.4/–0.2 | mm | |
| | straight leads | – | 1.27 | – | +0.4/–0.2 | mm | |
| H ₂ | clinch height | – | 2.5 | – | +0.5/0 | mm | |
| (p) | pull-out force | 6 | – | – | – | N | |

Note

1. Measured over 20 devices.

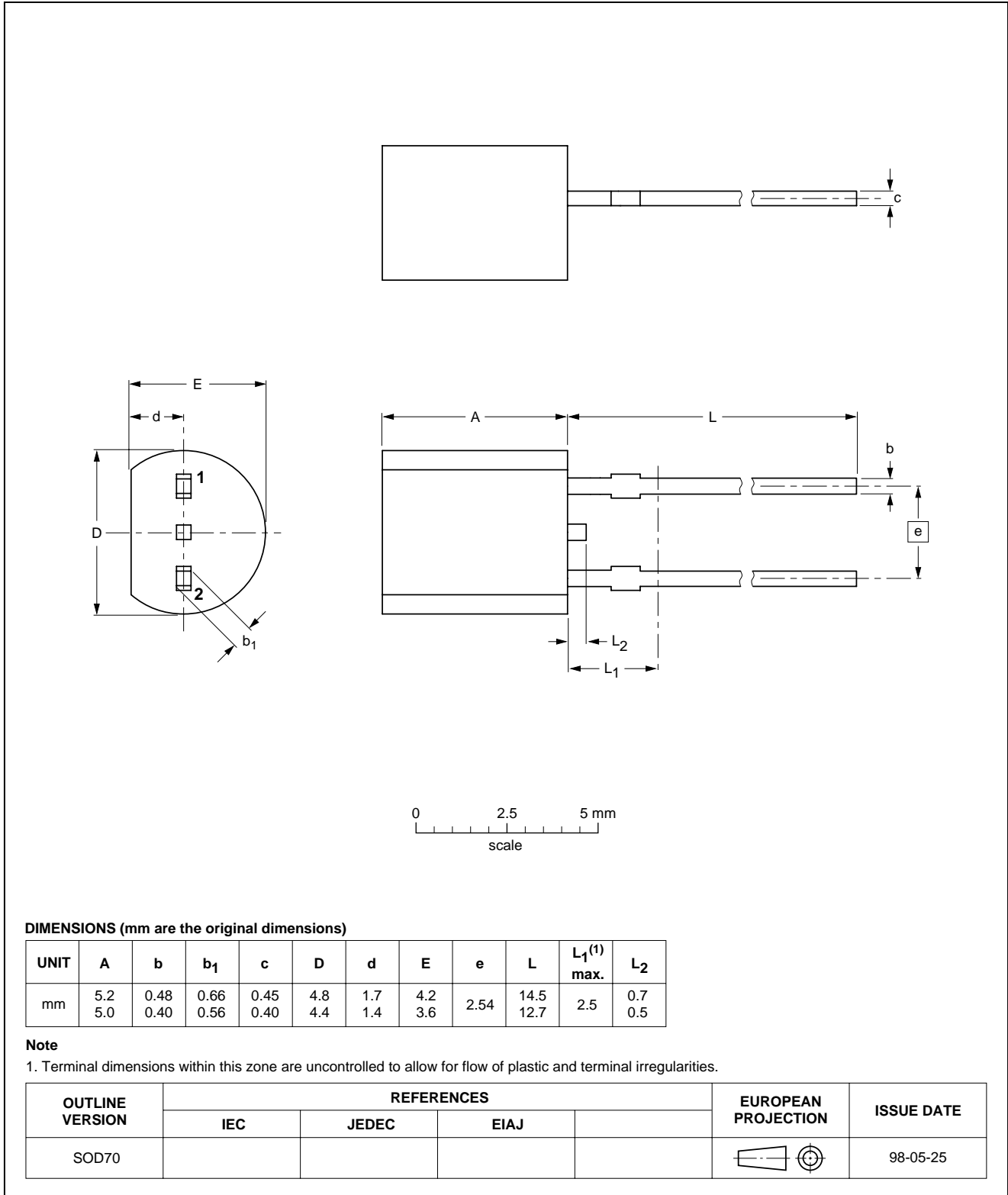
Silicon temperature sensors

KTY81-1 series

PACKAGE OUTLINE

Plastic near cylindrical single-ended package; 2 in-line leads

SOD70



Silicon temperature sensors

KTY81-1 series

DATA SHEET STATUS

| DATA SHEET STATUS | PRODUCT STATUS | DEFINITIONS ⁽¹⁾ |
|---------------------------|----------------|--|
| Objective specification | Development | This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice. |
| Preliminary specification | Qualification | This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product. |
| Product specification | Production | This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product. |

Note

1. Please consult the most recently issued data sheet before initiating or completing a design.

DEFINITIONS

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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Silicon temperature sensors

KTY81-1 series

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