



# KTY83 series

## Silicon temperature sensors

Rev. 06 — 4 April 2008

Product data sheet

## 1. Product profile

### 1.1 General description

The temperature sensors in the KTY83 series have a positive temperature coefficient of resistance and are suitable for use in measurement and control systems. The sensors are encapsulated in the SOD68 (DO-34) package.

Other special selections are available on request.

### 1.2 Features

- High accuracy and reliability
- Positive temperature coefficient; fail-safe behavior
- Long-term stability
- Virtually linear characteristics

### 1.3 Quick reference data

Table 1. Quick reference data

$T_{amb} = 25\text{ }^{\circ}\text{C}$ ; in liquid; unless otherwise specified.

| Symbol   | Parameter         | Conditions                    | Min  | Typ | Max  | Unit     |
|----------|-------------------|-------------------------------|------|-----|------|----------|
| $R_{25}$ | sensor resistance | $I_{sen(cont)} = 1\text{ mA}$ |      |     |      |          |
|          |                   | KTY83/110                     | 990  | -   | 1010 | $\Omega$ |
|          |                   | KTY83/120                     | 980  | -   | 1020 | $\Omega$ |
|          |                   | KTY83/121                     | 980  | -   | 1000 | $\Omega$ |
|          |                   | KTY83/122                     | 1000 | -   | 1020 | $\Omega$ |
|          |                   | KTY83/150                     | 950  | -   | 1050 | $\Omega$ |
|          |                   | KTY83/151                     | 950  | -   | 1000 | $\Omega$ |

## 2. Pinning information

Table 2. Pinning

| Pin | Description | Simplified outline | Graphic symbol |
|-----|-------------|--------------------|----------------|
| 1   | cathode (k) |                    |                |
| 2   | anode (a)   |                    |                |

### 3. Ordering information

Table 3. Ordering information

| Type number | Package |                                                          |         |
|-------------|---------|----------------------------------------------------------|---------|
|             | Name    | Description                                              | Version |
| KTY83/110   | -       | hermetically sealed glass package; axial leaded; 2 leads | SOD68   |
| KTY83/120   |         |                                                          |         |
| KTY83/121   |         |                                                          |         |
| KTY83/122   |         |                                                          |         |
| KTY83/150   |         |                                                          |         |
| KTY83/151   |         |                                                          |         |

### 4. Marking

Table 4. Marking codes

| Type number | Marking code |
|-------------|--------------|
| KTY83/110   | KT83A        |
| KTY83/120   | KT83C        |
| KTY83/121   | KT83D        |
| KTY83/122   | KT83E        |
| KTY83/150   | KT83H        |
| KTY83/151   | KT83K        |

### 5. Limiting values

Table 5. Limiting values

*In accordance with the Absolute Maximum Rating System (IEC 60134).*

| Symbol                 | Parameter                 | Conditions                                    | Min | Max  | Unit |
|------------------------|---------------------------|-----------------------------------------------|-----|------|------|
| $I_{\text{sen(cont)}}$ | continuous sensor current | in free air; $T_{\text{amb}} = 25\text{ °C}$  | -   | 10   | mA   |
|                        |                           | in free air; $T_{\text{amb}} = 175\text{ °C}$ | -   | 2    | mA   |
| $T_{\text{amb}}$       | ambient temperature       |                                               | -55 | +175 | °C   |

## 6. Characteristics

**Table 6. Characteristics**

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

| Symbol                            | Parameter                           | Conditions                                              | Min   | Typ  | Max  | Unit |
|-----------------------------------|-------------------------------------|---------------------------------------------------------|-------|------|------|------|
| R <sub>25</sub>                   | sensor resistance                   | I <sub>sen(cont)</sub> = 1 mA                           |       |      |      |      |
|                                   |                                     | KTY83/110                                               | 990   | -    | 1010 | Ω    |
|                                   |                                     | KTY83/120                                               | 980   | -    | 1020 | Ω    |
|                                   |                                     | KTY83/121                                               | 980   | -    | 1000 | Ω    |
|                                   |                                     | KTY83/122                                               | 1000  | -    | 1020 | Ω    |
|                                   |                                     | KTY83/150                                               | 950   | -    | 1050 | Ω    |
|                                   |                                     | KTY83/151                                               | 950   | -    | 1000 | Ω    |
| TC                                | temperature coefficient             |                                                         | -     | 0.76 | -    | %/K  |
| R <sub>100</sub> /R <sub>25</sub> | resistance ratio                    | T <sub>amb</sub> = 100 °C and 25 °C                     | 1.65  | 1.67 | 1.69 |      |
| R <sub>-55</sub> /R <sub>25</sub> | resistance ratio                    | T <sub>amb</sub> = -55 °C and 25 °C                     | 0.49  | 0.50 | 0.51 |      |
| ΔR <sub>25</sub>                  | drift of sensor resistance at 25 °C | 10000 h continuous operation; T <sub>amb</sub> = 175 °C | -     | 1    | -    | Ω    |
| τ <sub>th</sub>                   | thermal time constant               | in still air                                            | [1] - | 20   | -    | s    |
|                                   |                                     | in still liquid                                         | [1] - | 1    | -    | s    |
|                                   |                                     | in flowing liquid                                       | [1] - | 0.5  | -    | s    |

- [1] 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 72.4 °C is the thermal time constant.

**Table 7. Ambient temperature, corresponding resistance, temperature coefficient and maximum expected temperature error for KTY83/110 and KTY83/120** $I_{sen(cont)} = 1\text{ mA}$ .

| Ambient temperature |      | Temperature coefficient<br>(%/K) | KTY83/110      |      |      |                       | KTY83/120      |      |      |                       |
|---------------------|------|----------------------------------|----------------|------|------|-----------------------|----------------|------|------|-----------------------|
| (°C)                | (°F) |                                  | Resistance (Ω) |      |      | Temperature error (K) | Resistance (Ω) |      |      | Temperature error (K) |
|                     |      |                                  | Min            | Typ  | Max  |                       | Min            | Typ  | Max  |                       |
| −55                 | −67  | 0.97                             | 485            | 500  | 515  | ±3.08                 | 480            | 500  | 520  | ±4.11                 |
| −50                 | −58  | 0.96                             | 510            | 525  | 540  | ±2.99                 | 504            | 525  | 545  | ±4.04                 |
| −40                 | −40  | 0.93                             | 562            | 577  | 592  | ±2.81                 | 556            | 577  | 598  | ±3.88                 |
| −30                 | −22  | 0.91                             | 617            | 632  | 647  | ±2.62                 | 611            | 632  | 654  | ±3.72                 |
| −20                 | −4   | 0.88                             | 677            | 691  | 706  | ±2.42                 | 670            | 691  | 713  | ±3.56                 |
| −10                 | 14   | 0.85                             | 740            | 754  | 768  | ±2.2                  | 732            | 754  | 776  | ±3.37                 |
| 0                   | 32   | 0.83                             | 807            | 820  | 833  | ±1.97                 | 798            | 820  | 841  | ±3.18                 |
| 10                  | 50   | 0.80                             | 877            | 889  | 902  | ±1.72                 | 868            | 889  | 910  | ±2.97                 |
| 20                  | 68   | 0.78                             | 951            | 962  | 973  | ±1.45                 | 942            | 962  | 983  | ±2.74                 |
| 25                  | 77   | 0.76                             | 990            | 1000 | 1010 | ±1.31                 | 980            | 1000 | 1020 | ±2.62                 |
| 30                  | 86   | 0.75                             | 1027           | 1039 | 1050 | ±1.44                 | 1017           | 1039 | 1060 | ±2.77                 |
| 40                  | 104  | 0.73                             | 1105           | 1118 | 1132 | ±1.7                  | 1093           | 1118 | 1143 | ±3.07                 |
| 50                  | 122  | 0.71                             | 1185           | 1202 | 1219 | ±1.98                 | 1173           | 1202 | 1231 | ±3.39                 |
| 60                  | 140  | 0.69                             | 1268           | 1288 | 1309 | ±2.27                 | 1255           | 1288 | 1321 | ±3.73                 |
| 70                  | 158  | 0.67                             | 1355           | 1379 | 1402 | ±2.58                 | 1341           | 1379 | 1416 | ±4.08                 |
| 80                  | 176  | 0.65                             | 1445           | 1472 | 1500 | ±2.9                  | 1430           | 1472 | 1515 | ±4.44                 |
| 90                  | 194  | 0.63                             | 1537           | 1569 | 1601 | ±3.24                 | 1522           | 1569 | 1617 | ±4.82                 |
| 100                 | 212  | 0.61                             | 1633           | 1670 | 1707 | ±3.59                 | 1617           | 1670 | 1723 | ±5.22                 |
| 110                 | 230  | 0.60                             | 1732           | 1774 | 1816 | ±3.95                 | 1714           | 1774 | 1834 | ±5.63                 |
| 120                 | 248  | 0.58                             | 1834           | 1882 | 1929 | ±4.34                 | 1815           | 1882 | 1948 | ±6.06                 |
| 125                 | 257  | 0.57                             | 1886           | 1937 | 1987 | ±4.53                 | 1867           | 1937 | 2006 | ±6.28                 |
| 130                 | 266  | 0.57                             | 1939           | 1993 | 2046 | ±4.73                 | 1919           | 1993 | 2066 | ±6.5                  |
| 140                 | 284  | 0.55                             | 2047           | 2107 | 2167 | ±5.14                 | 2026           | 2107 | 2188 | ±6.96                 |
| 150                 | 302  | 0.54                             | 2158           | 2225 | 2292 | ±5.57                 | 2136           | 2225 | 2314 | ±7.43                 |
| 160                 | 320  | 0.52                             | 2272           | 2346 | 2420 | ±6.02                 | 2249           | 2346 | 2444 | ±7.92                 |
| 170                 | 338  | 0.51                             | 2389           | 2471 | 2553 | ±6.47                 | 2364           | 2471 | 2578 | ±8.43                 |
| 175                 | 347  | 0.51                             | 2449           | 2535 | 2621 | ±6.71                 | 2423           | 2535 | 2646 | ±8.68                 |

**Table 8. Ambient temperature, corresponding resistance, temperature coefficient and maximum expected temperature error for KTY83/121 and KTY83/122** $I_{sen(cont)} = 1\text{ mA}$ .

| Ambient temperature |      | Temperature coefficient<br>(%/K) | KTY83/121      |      |      |                       | KTY83/122      |      |      |                       |
|---------------------|------|----------------------------------|----------------|------|------|-----------------------|----------------|------|------|-----------------------|
| (°C)                | (°F) |                                  | Resistance (Ω) |      |      | Temperature error (K) | Resistance (Ω) |      |      | Temperature error (K) |
|                     |      |                                  | Min            | Typ  | Max  |                       | Min            | Typ  | Max  |                       |
| −55                 | −67  | 0.97                             | 480            | 495  | 510  | ±3.08                 | 490            | 505  | 520  | ±3.08                 |
| −50                 | −58  | 0.96                             | 505            | 519  | 534  | ±2.99                 | 515            | 530  | 545  | ±2.99                 |
| −40                 | −40  | 0.93                             | 556            | 571  | 586  | ±2.81                 | 567            | 583  | 598  | ±2.81                 |
| −30                 | −22  | 0.91                             | 611            | 626  | 641  | ±2.62                 | 624            | 639  | 654  | ±2.62                 |
| −20                 | −4   | 0.88                             | 670            | 685  | 699  | ±2.42                 | 684            | 698  | 713  | ±2.42                 |
| −10                 | 14   | 0.85                             | 732            | 746  | 760  | ±2.2                  | 747            | 762  | 776  | ±2.2                  |
| 0                   | 32   | 0.83                             | 799            | 812  | 825  | ±1.97                 | 815            | 828  | 842  | ±1.97                 |
| 10                  | 50   | 0.80                             | 868            | 880  | 893  | ±1.72                 | 886            | 898  | 911  | ±1.72                 |
| 20                  | 68   | 0.78                             | 942            | 953  | 963  | ±1.45                 | 961            | 972  | 983  | ±1.45                 |
| 25                  | 77   | 0.76                             | 980            | 990  | 1000 | ±1.31                 | 1000           | 1010 | 1020 | ±1.31                 |
| 30                  | 86   | 0.75                             | 1017           | 1028 | 1039 | ±1.44                 | 1038           | 1049 | 1060 | ±1.44                 |
| 40                  | 104  | 0.73                             | 1094           | 1107 | 1121 | ±1.7                  | 1116           | 1130 | 1144 | ±1.7                  |
| 50                  | 122  | 0.71                             | 1173           | 1190 | 1206 | ±1.98                 | 1197           | 1214 | 1231 | ±1.98                 |
| 60                  | 140  | 0.69                             | 1256           | 1276 | 1295 | ±2.27                 | 1281           | 1301 | 1322 | ±2.27                 |
| 70                  | 158  | 0.67                             | 1341           | 1365 | 1388 | ±2.58                 | 1368           | 1392 | 1416 | ±2.58                 |
| 80                  | 176  | 0.65                             | 1430           | 1458 | 1485 | ±2.9                  | 1459           | 1487 | 1515 | ±2.9                  |
| 90                  | 194  | 0.63                             | 1522           | 1554 | 1585 | ±3.24                 | 1553           | 1585 | 1617 | ±3.24                 |
| 100                 | 212  | 0.61                             | 1617           | 1653 | 1690 | ±3.59                 | 1650           | 1687 | 1724 | ±3.59                 |
| 110                 | 230  | 0.60                             | 1715           | 1756 | 1798 | ±3.95                 | 1750           | 1792 | 1834 | ±3.95                 |
| 120                 | 248  | 0.58                             | 1816           | 1863 | 1910 | ±4.34                 | 1853           | 1900 | 1948 | ±4.34                 |
| 125                 | 257  | 0.57                             | 1867           | 1917 | 1967 | ±4.53                 | 1905           | 1956 | 2007 | ±4.53                 |
| 130                 | 266  | 0.57                             | 1920           | 1973 | 2025 | ±4.73                 | 1959           | 2012 | 2066 | ±4.73                 |
| 140                 | 284  | 0.55                             | 2027           | 2086 | 2145 | ±5.14                 | 2068           | 2128 | 2188 | ±5.14                 |
| 150                 | 302  | 0.54                             | 2137           | 2203 | 2269 | ±5.57                 | 2180           | 2247 | 2314 | ±5.57                 |
| 160                 | 320  | 0.52                             | 2249           | 2323 | 2396 | ±6.02                 | 2295           | 2370 | 2444 | ±6.02                 |
| 170                 | 338  | 0.51                             | 2365           | 2446 | 2527 | ±6.47                 | 2413           | 2496 | 2578 | ±6.47                 |
| 175                 | 347  | 0.51                             | 2424           | 2509 | 2595 | ±6.71                 | 2473           | 2560 | 2647 | ±6.71                 |

**Table 9. Ambient temperature, corresponding resistance, temperature coefficient and maximum expected temperature error for KTY83/150 and KTY83/151** $I_{sen(cont)} = 1\text{ mA}$ .

| Ambient temperature |      | Temperature coefficient<br>(%/K) | KTY83/150      |      |      |                       | KTY83/151      |      |      |                       |
|---------------------|------|----------------------------------|----------------|------|------|-----------------------|----------------|------|------|-----------------------|
| (°C)                | (°F) |                                  | Resistance (Ω) |      |      | Temperature error (K) | Resistance (Ω) |      |      | Temperature error (K) |
|                     |      |                                  | Min            | Typ  | Max  |                       | Min            | Typ  | Max  |                       |
| −55                 | −67  | 0.97                             | 465            | 500  | 535  | ±7.19                 | 466            | 487  | 509  | ±4.92                 |
| −50                 | −58  | 0.96                             | 489            | 525  | 561  | ±7.16                 | 489            | 512  | 534  | ±4.56                 |
| −40                 | −40  | 0.93                             | 539            | 577  | 615  | ±7.1                  | 539            | 562  | 586  | ±4.42                 |
| −30                 | −22  | 0.91                             | 592            | 632  | 673  | ±7.04                 | 593            | 617  | 641  | ±4.28                 |
| −20                 | −4   | 0.88                             | 649            | 691  | 734  | ±6.97                 | 650            | 674  | 699  | ±4.12                 |
| −10                 | 14   | 0.85                             | 710            | 754  | 798  | ±6.9                  | 710            | 735  | 760  | ±3.96                 |
| 0                   | 32   | 0.83                             | 774            | 820  | 866  | ±6.81                 | 774            | 799  | 824  | ±3.79                 |
| 10                  | 50   | 0.80                             | 842            | 889  | 937  | ±6.72                 | 842            | 867  | 892  | ±3.59                 |
| 20                  | 68   | 0.78                             | 913            | 962  | 1012 | ±6.61                 | 914            | 938  | 963  | ±3.39                 |
| 25                  | 77   | 0.76                             | 950            | 1000 | 1050 | ±6.55                 | 950            | 975  | 1000 | ±3.27                 |
| 30                  | 86   | 0.75                             | 986            | 1039 | 1091 | ±6.76                 | 987            | 1013 | 1039 | ±3.43                 |
| 40                  | 104  | 0.73                             | 1060           | 1118 | 1177 | ±7.19                 | 1061           | 1090 | 1120 | ±3.76                 |
| 50                  | 122  | 0.71                             | 1137           | 1202 | 1267 | ±7.63                 | 1138           | 1172 | 1206 | ±4.1                  |
| 60                  | 140  | 0.69                             | 1217           | 1288 | 1360 | ±8.1                  | 1218           | 1256 | 1295 | ±4.45                 |
| 70                  | 158  | 0.67                             | 1300           | 1379 | 1457 | ±8.58                 | 1301           | 1344 | 1387 | ±4.83                 |
| 80                  | 176  | 0.65                             | 1386           | 1472 | 1559 | ±9.07                 | 1387           | 1435 | 1484 | ±5.21                 |
| 90                  | 194  | 0.63                             | 1475           | 1569 | 1664 | ±9.59                 | 1476           | 1530 | 1584 | ±5.623                |
| 100                 | 212  | 0.61                             | 1566           | 1670 | 1773 | ±10.12                | 1568           | 1628 | 1688 | ±6.04                 |
| 110                 | 230  | 0.60                             | 1661           | 1774 | 1887 | ±10.66                | 1663           | 1730 | 1796 | ±6.47                 |
| 120                 | 248  | 0.58                             | 1759           | 1882 | 2004 | ±11.28                | 1761           | 1835 | 1908 | ±6.92                 |
| 125                 | 257  | 0.57                             | 1809           | 1937 | 2064 | ±11.51                | 1811           | 1888 | 1966 | ±7.15                 |
| 130                 | 266  | 0.57                             | 1859           | 1993 | 2126 | ±11.8                 | 1862           | 1943 | 2024 | ±7.38                 |
| 140                 | 284  | 0.55                             | 1963           | 2107 | 2251 | ±12.4                 | 1965           | 2054 | 2143 | ±7.87                 |
| 150                 | 302  | 0.54                             | 2069           | 2225 | 2380 | ±13.01                | 2072           | 2169 | 2267 | ±8.36                 |
| 160                 | 320  | 0.52                             | 2178           | 2346 | 2514 | ±13.64                | 2181           | 2288 | 2394 | ±8.87                 |
| 170                 | 338  | 0.51                             | 2290           | 2471 | 2652 | ±14.28                | 2293           | 2409 | 2525 | ±9.4                  |
| 175                 | 347  | 0.51                             | 2347           | 2535 | 2722 | ±14.61                | 2350           | 2471 | 2592 | ±9.67                 |

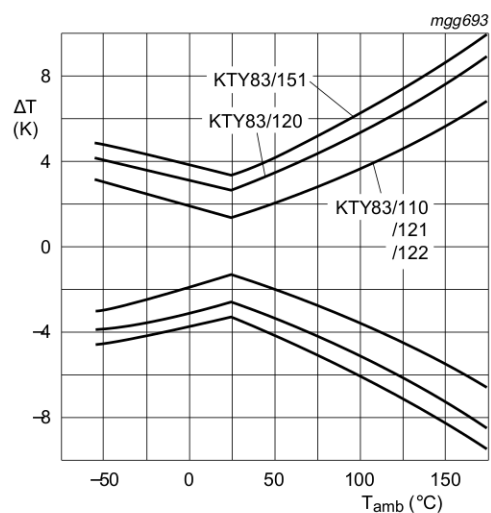


Fig 1. Maximum expected temperature error ( $\Delta T$ )

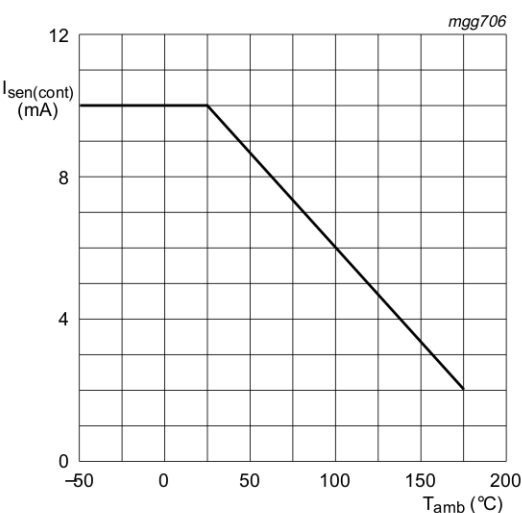
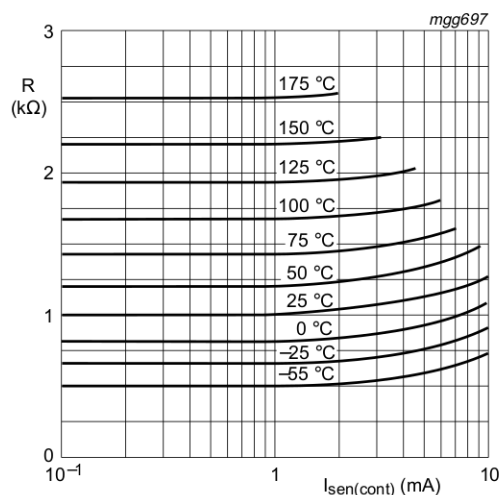


Fig 2. Maximum operating current for safe operation



To keep the temperature error low, an operating current of  $I_{sen(cont)} = 1$  mA is recommended for temperatures above 100  $^{\circ}C$

Fig 3. Sensor resistance as a function of operating current

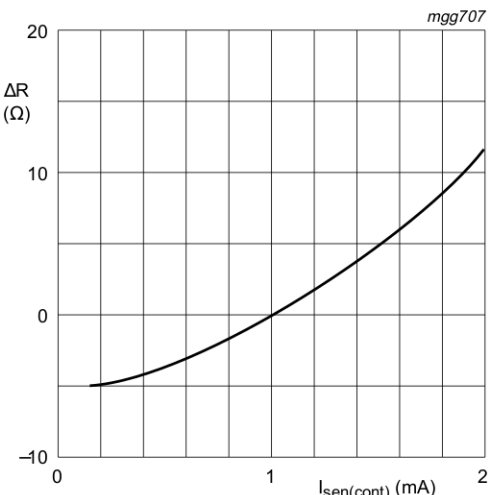


Fig 4. Deviation of sensor resistance as a function of operating current in still liquid

7. Package outline

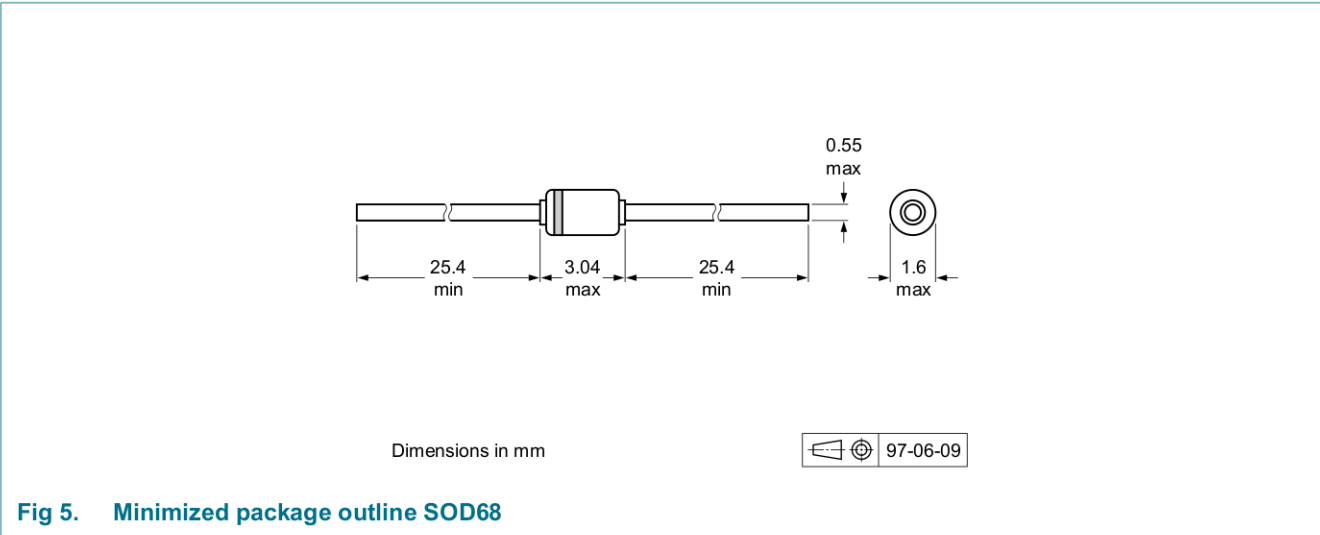


Fig 5. Minimized package outline SOD68

8. Revision history

Table 10. Revision history

| Document ID                                                                                                           | Release date | Data sheet status     | Change notice | Supersedes      |
|-----------------------------------------------------------------------------------------------------------------------|--------------|-----------------------|---------------|-----------------|
| KTY83_SER_6                                                                                                           | 20080404     | Product data sheet    | -             | KTY83_SERIES_5  |
| Modifications:                                                                                                        |              |                       |               |                 |
| • The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. |              |                       |               |                 |
| • Legal texts have been adapted to the new company name where appropriate.                                            |              |                       |               |                 |
| KTY83_SERIES_5                                                                                                        | 20030915     | Product specification | -             | KTY83-1SERIES_4 |
| KTY83-1SERIES_4                                                                                                       | 20000825     | Product specification | -             | KTY83-1SERIES_3 |
| KTY83-1SERIES_3                                                                                                       | 19980409     | Product specification | -             | KTY83-1SERIES_2 |
| KTY83-1SERIES_2                                                                                                       | 19961206     | Product specification | -             | KTY83-1 series  |
| KTY83-1 series                                                                                                        | October 1988 | -                     | -             | -               |



## 9. Legal information

### 9.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | Definition                                                                            |
|-----------------------------------|-------------------------------|---------------------------------------------------------------------------------------|
| Objective [short] data sheet      | Development                   | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet    | Qualification                 | This document contains data from the preliminary specification.                       |
| Product [short] data sheet        | Production                    | This document contains the product specification.                                     |

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

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## 11. Contents

|           |                                       |           |
|-----------|---------------------------------------|-----------|
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