

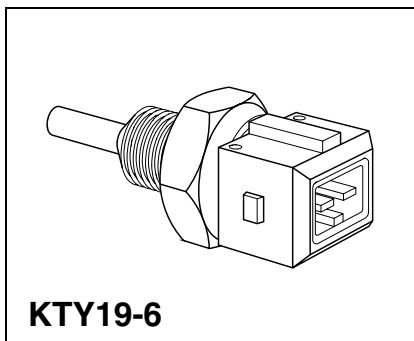
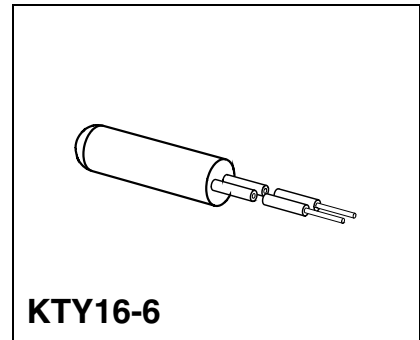
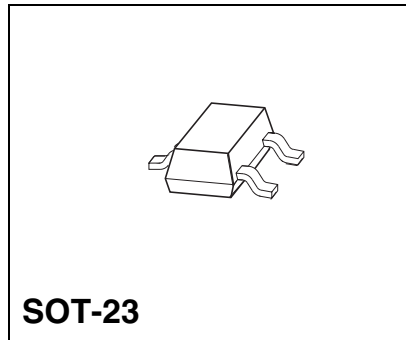
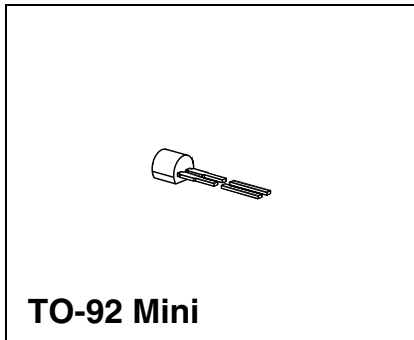
## Silicon Temperature Sensors

KT110	KTY11-x
KT130	KTY13-x
KT210	KTY21-x
KT230	KTY23-x
KTY16-6	KTY19-6

### Data Sheet

### Features

- Temperature dependent resistor with positive temperature coefficient
- Temperature range – 50 °C to + 150 °C (– 60 F to 300 F)
- Available in SMD or leaded or customized packages
- Linear output
- Excellent longterm stability
- Polarity independent due to symmetrical construction
- Fast response time
- Resistance tolerances ( $R_{25}$ ) of  $\pm 3\%$  or  $\pm 1\%$



**Standard Packages**

Type	Marking	Ordering Code	$R_{25 \text{ min}}$	$R_{25 \text{ max}}$	Package
			(in $\Omega$ with $I_{\text{op}} = 1 \text{ mA}$ )		
KT110	T1	Q62705-K332	1940	2060	TO-92 Mini
KT130	T1	Q62705-K333	1940	2060	SOT-23 <sup>1)</sup>
KT210	N1	Q62705-K334	970	1030	TO-92 Mini
KT230	N1	Q62705-K335	970	1030	SOT-23 <sup>1)</sup>
KTY11-5	T5	Q62705-K245	1950	1990	TO-92 Mini
KTY11-6	T6	Q62705-K246	1980	2020	TO-92 Mini
KTY11-7	T7	Q62705-K247	2010	2050	TO-92 Mini
KTY13-5	T5	Q62705-K249	1950	1990	SOT-23 <sup>1)</sup>
KTY13-6	T6	Q62705-K250	1980	2020	SOT-23 <sup>1)</sup>
KTY13-7	T7	Q62705-K251	2010	2050	SOT-23 <sup>1)</sup>
KTY21-5	N5	Q62705-K258	975	995	TO-92 Mini
KTY21-6	N6	Q62705-K259	990	1010	TO-92 Mini
KTY21-7	N7	Q62705-K260	1005	1025	TO-92 Mini
KTY23-5	N5	Q62705-K262	975	995	SOT-23 <sup>1)</sup>
KTY23-6	N6	Q62705-K263	990	1010	SOT-23 <sup>1)</sup>
KTY23-7	N7	Q62705-K264	1005	1025	SOT-23 <sup>1)</sup>

**Custom Packages**

Type	Marking	Ordering Code	$R_{25 \text{ min}}$	$R_{25 \text{ max}}$	Screw Thread
			(in $\Omega$ with $I_{\text{op}} = 1 \text{ mA}$ )		
KTY16-6	none	Q62705-K128	1980	2020	–
KTY19-6M	KTY19M	Q62705-K271	1980	2020	ISO M10x1
KTY19-6Z	KTY19Z	Q62705-K272	1980	2020	NPTF 1/8x27
Connector set for KTY19		Q62901-B80			

1) Electrical contact between Pin1 and Pin2 (refer to package outlines drawing).

**Absolute Maximum Ratings**

Parameter	Symbol	KT1x0 KTY1x-x	KT2x0 KTY2x-x	Unit
Maximum operating voltage <sup>1)</sup> $T_A \leq 25\text{ °C}, t \leq 10\text{ ms}$	$V_{\text{opmax}}$	25		V
Maximum operating current	$I_{\text{opmax}}$	5	7	mA
Peak operating current $T_A \leq 25\text{ °C}, t \leq 10\text{ ms}$	$I_{\text{opp}}$	7	10	mA
Operating temperature range	$T_{\text{op}}$	- 50 ... + 150		°C
Storage temperature range	$T_{\text{stg}}$	- 50 ... + 150		°C

1) When the temperature sensor is operated with long supply leads, it should be protected through the parallel connection of a > 10 nF capacitor to prevent damage to the sensor through induced voltage peaks.

**Electrical Characteristics**

$$I_{\text{op}} = 1\text{ mA}$$

Thermal Time Constant ( $\tau$ ); (63% of $\Delta T$ )	$\tau_{\text{air}}$ (typ.)	$\tau_{\text{oil}}$ (typ.)	Unit
KT110, KT210, KTY11-x, KTY21-x	11	1.5	s
KT130, KT230, KTY13-x, KTY23-x	7	1	
KTY16-6	40	4	
KTY19-6M/Z	40	4	

## General Technical Data: KT- and KTY-Series Temperature Sensors

These temperature sensors are designed for the measurement, control and regulation of air, gases and liquids within the temperature range of  $-50\text{ °C}$  to  $+150\text{ °C}$ . The temperature sensing element is an n-conducting silicon crystal in planar technology. The gentle curvature of the characteristic,  $R_T = f(T_A)$ , is described as a regression parabola in the following expressions.

The resistance of the sensor can be calculated for various temperatures from the following second order equation, valid over the temperature range  $-30\text{ °C}$  to  $+130\text{ °C}$ .

$$R_T = R_{25} \times (1 + \alpha \times \Delta T_A + \beta \times \Delta T_A^2) = f(T_A)$$

$$\text{with: } \alpha = 7.88 \cdot 10^{-3} \text{ K}^{-1}; \beta = 1.937 \cdot 10^{-5} \text{ K}^{-2}$$

The temperature factor  $k_T$  can be derived from this:

$$k_T = \frac{R_T}{R_{25}} = 1 + \alpha \times \Delta T_A + \beta \times \Delta T_A^2 = f(T_A)$$

The temperature at the sensor can be calculated from the change in the sensors resistance from the following equation, which approximates the characteristic curve.

$$T = \left( 25 + \frac{\sqrt{\alpha^2 - 4 \times \beta + 4 \times \beta \times k_T} - \alpha}{2 \times \beta} \right) \text{ °C}$$

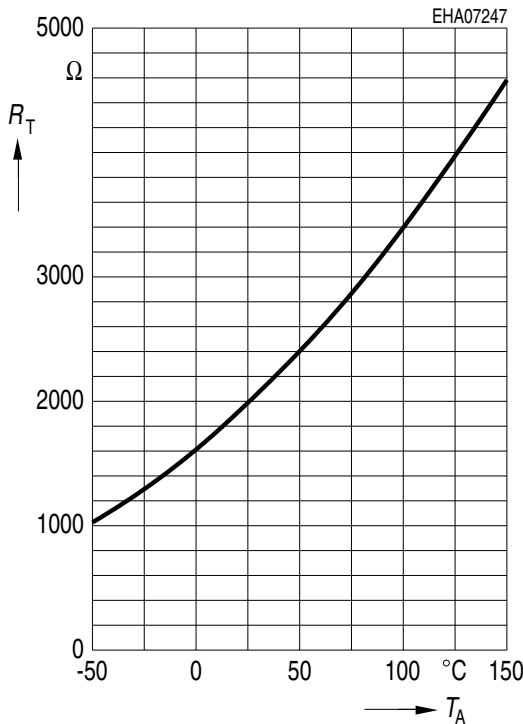
**Table 1**  
**Spread of the Temperature Factor  $k_T$**

$T_A$ °C	$k_T$		
	min.	typ.	max.
- 50	0.506	0.518	0.530
- 40	0.559	0.570	0.581
- 30	0.615	0.625	0.635
- 20	0.676	0.685	0.694
- 10	0.741	0.748	0.755
0	0.810	0.815	0.821
10	0.883	0.886	0.890
20	0.960	0.961	0.962
25	1.0 <sup>1)</sup>		
30	1.039	1.040	1.041
40	1.119	1.123	1.126
50	1.204	1.209	1.215
60	1.291	1.300	1.308
70	1.383	1.394	1.405
80	1.478	1.492	1.506
90	1.577	1.594	1.611
100	1.680	1.700	1.720
110	1.786	1.810	1.833
120	1.896	1.923	1.951
130	2.010	2.041	2.072
140	2.093	2.128	2.163
150	2.196	2.235	2.274

1) Normalising point

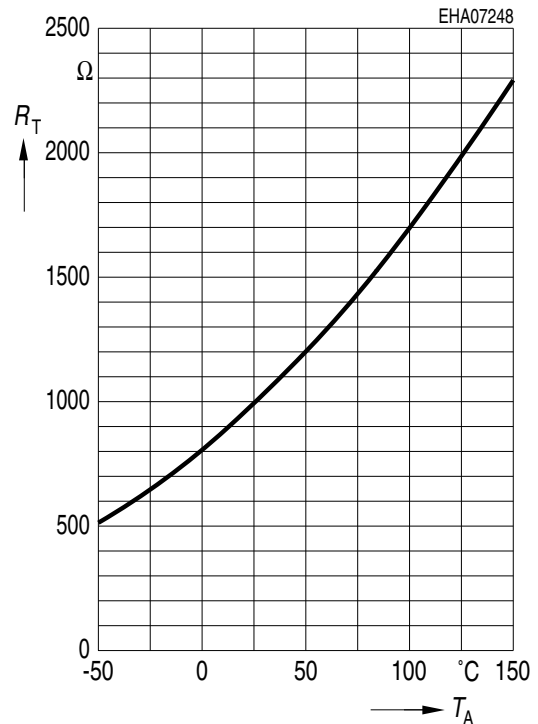
**Sensor Resistance**  $R_T = k_T \times R_{25} = f(T_A)$

$I_B = 1 \text{ mA}$ ; Example:  $R_{25} = 2000 \ \Omega$



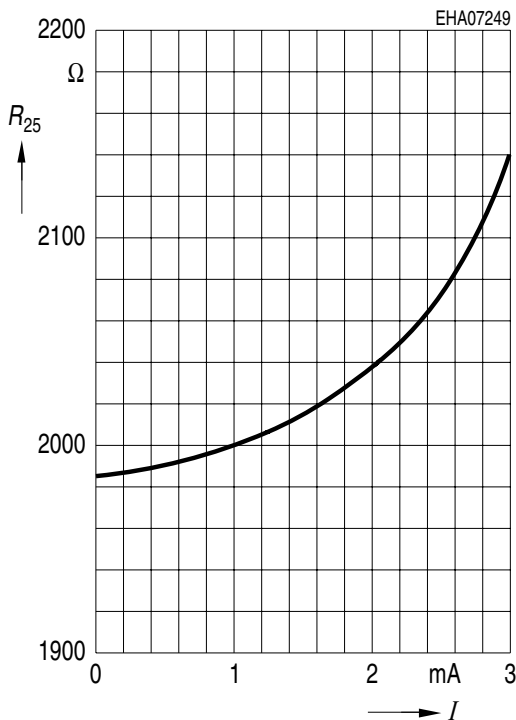
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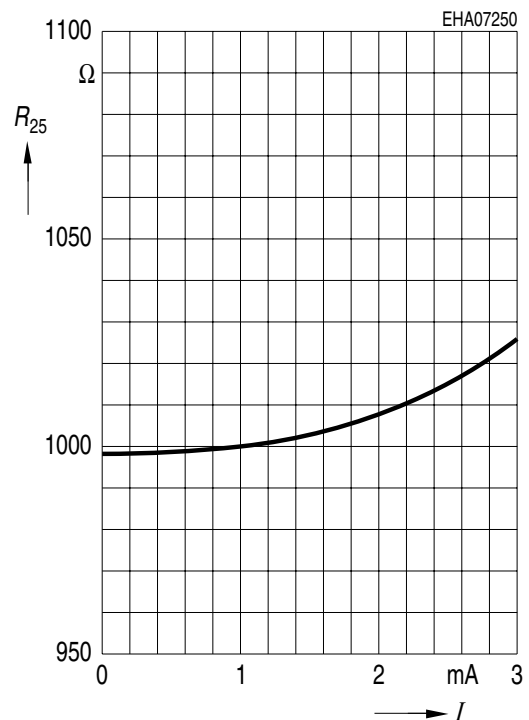
**Typical Dependence of Sensor Resistance on Supply Current**

Example: KTY11-6 in oil at  $T_A = 25 \ ^{\circ}\text{C}$



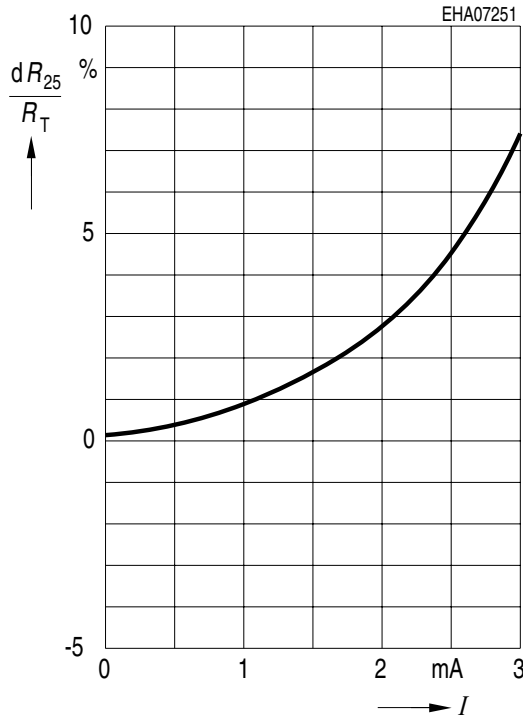
**Typical Dependence of Sensor Resistance on Supply Current**

Example: KTY21-6 in oil at  $T_A = 25 \ ^{\circ}\text{C}$



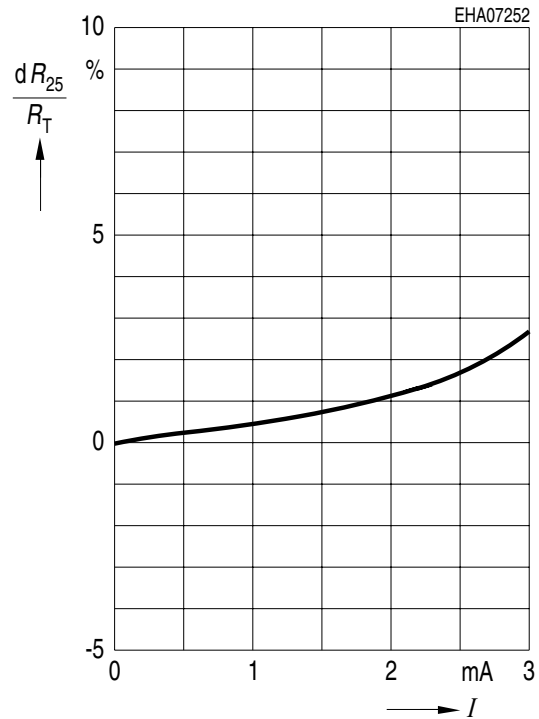
### Typical Deviation of Sensor Resistance from the Basic Resistance $R_{25}$ ( $I_B = 1\text{mA}$ ) Versus Supply Current

Example: KTY11-6 in oil at  $T_A = 25\text{ }^\circ\text{C}$

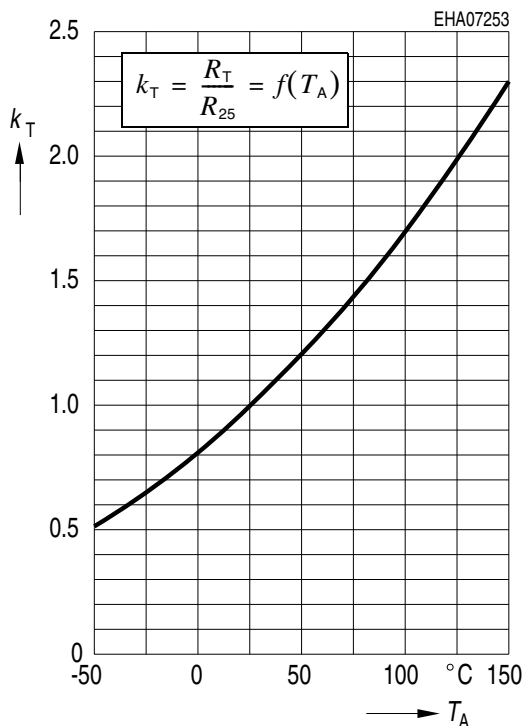


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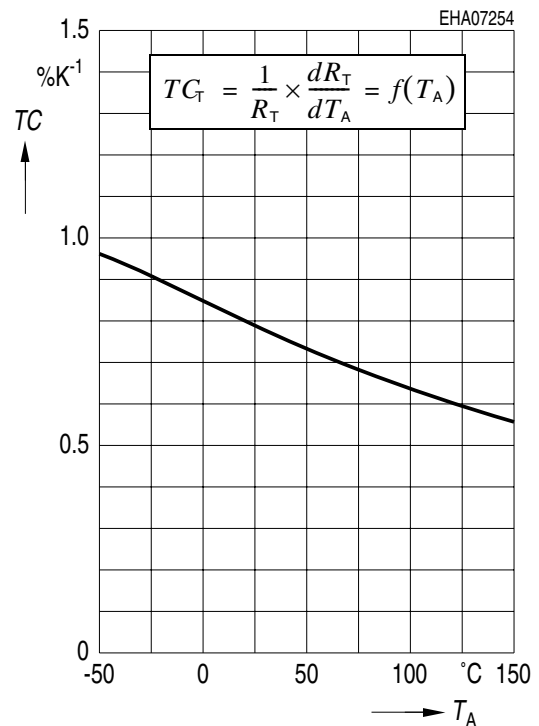
Example: KTY21-6 in oil at  $T_A = 25\text{ }^\circ\text{C}$



### Typical Relationship of the Temperature Factor

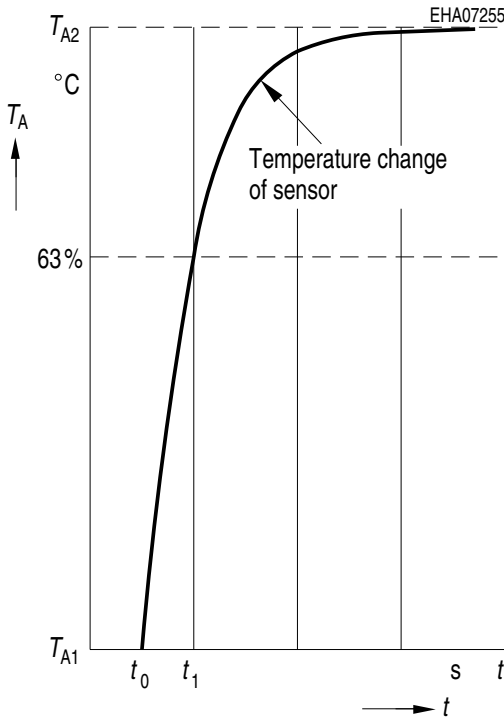


### Typical Relationship of the Temperature Factor



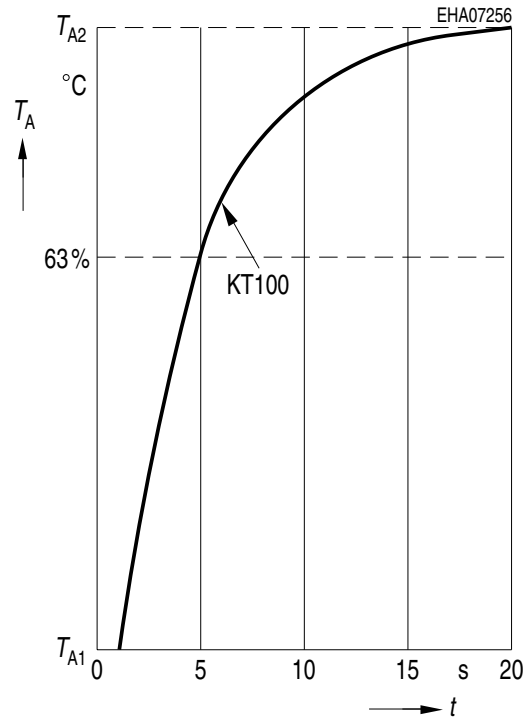
## Definition of the Thermal Time Constant $\tau$

$$\Delta T_A = T_{A2} - T_{A1}; \tau = t_1 - t_0$$



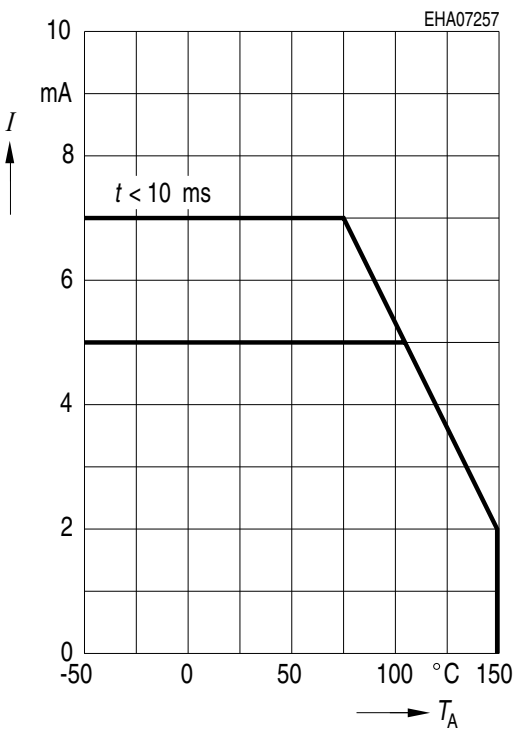
## Thermal Time constant

$$\tau = 5 \text{ s}$$



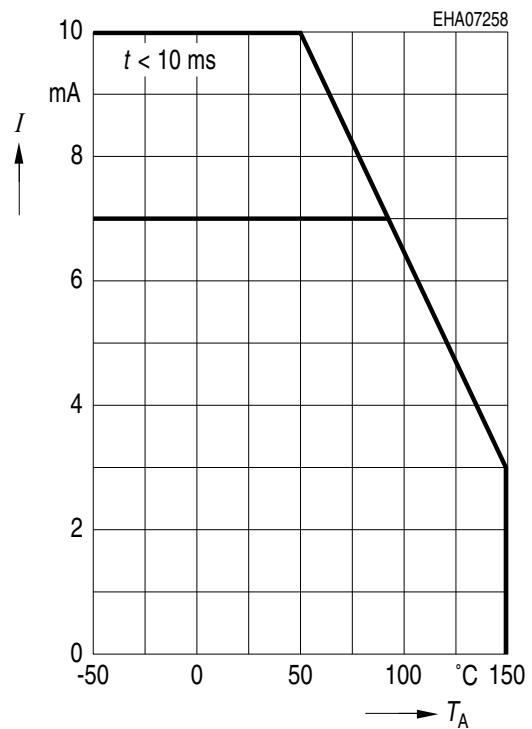
## Peak Current in Air

$$R_{25} = 2000 \Omega; \dot{P} = f(T_A)$$



## Peak Current in Air

$$R_{25} = 1000 \Omega; \dot{P} = f(T_A)$$

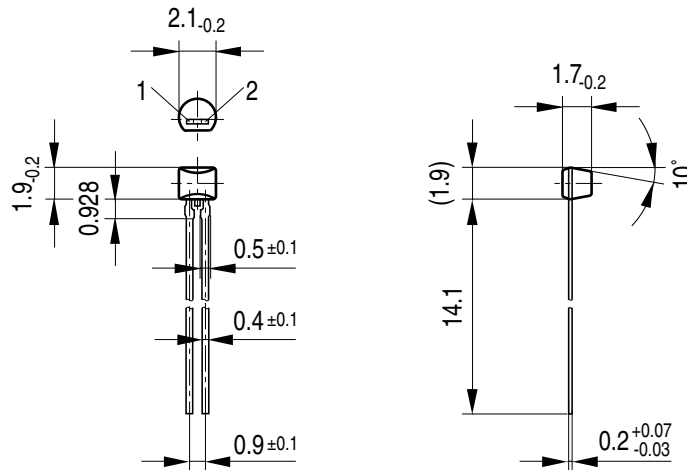




## Package Outlines

### TO-92 Mini

KT110, KT210  
KTY11-x, KTY2x-x

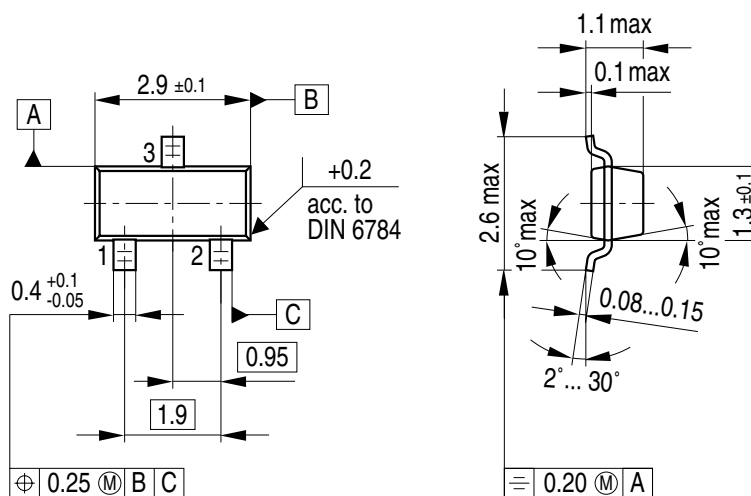


Weight approx. 0.02 g

GPD05637

### SOT-23 (Small Outline Transistor)

KT130, KT230  
KTY13-x, KTY23-x



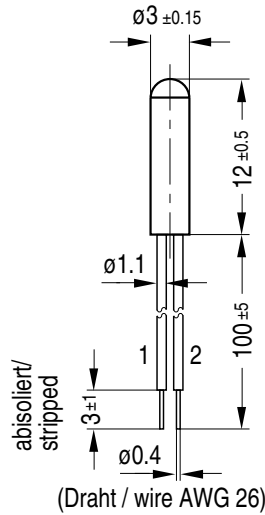
Weight approx. 0.01 g

Pins 1 - 2:  $R_{25}$

GPS05557

## Ni-plated Brass Tube Housing with Tefzel Isolated Leadwires

**KTY16-6**

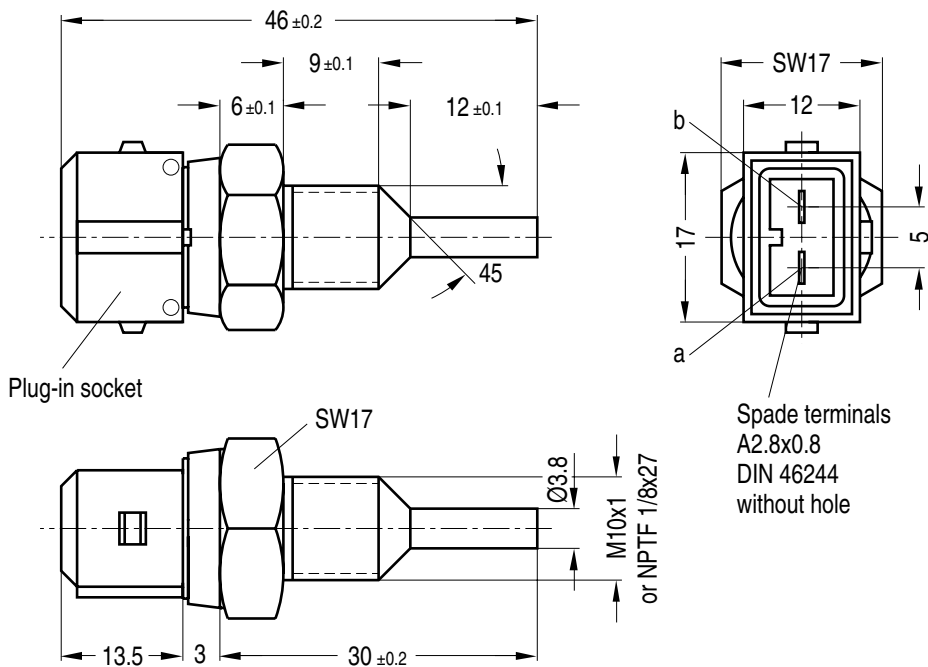


Weight approx. 0.07 g

GPD05638

## Stainless Steel Housing, BSS303 (equiv. DIN 1.4305)

**KTY19-6M/Z**



Weight approx. 20 g

GMX05639

You can find all of our packages, sorts of packing and others in our Infineon Internet Page "Products": <http://www.infineon.com/products>.

Dimensions in mm