

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 °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 °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.

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

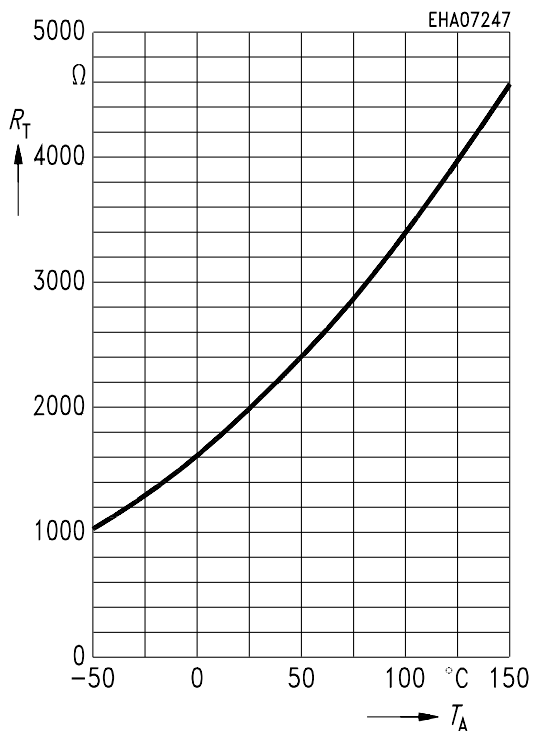
Table 15
Spread of the Temperature Factor k_T

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 ¹⁾		
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

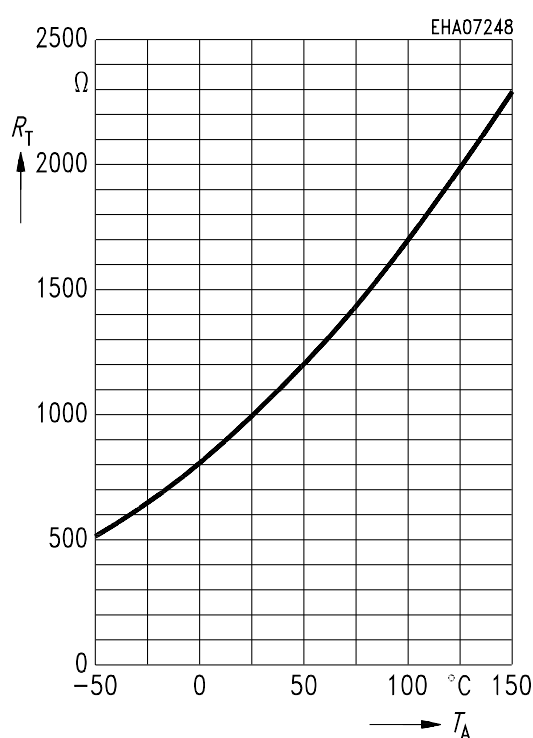
Sensor Resistance $R_T = k_T \times R_{25} = f(T_A)$

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



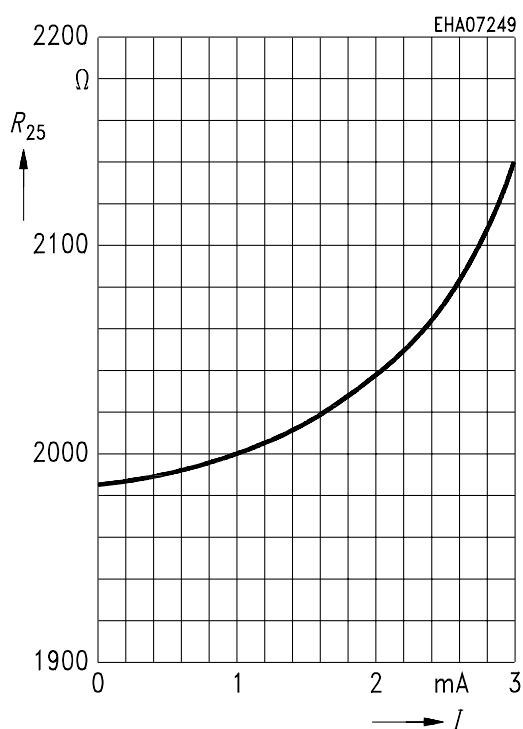
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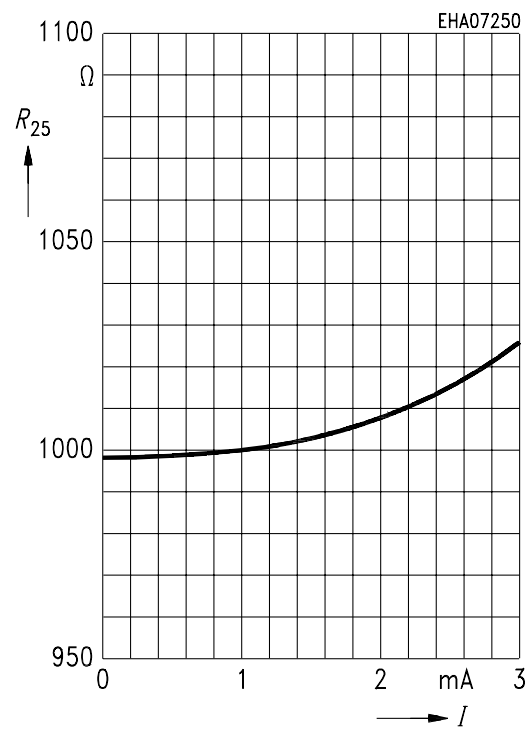
Typical Dependence of Sensor Resistance on Supply Current

Example: KTY 10-6 in oil at $T_A = 25^{\circ}\text{C}$



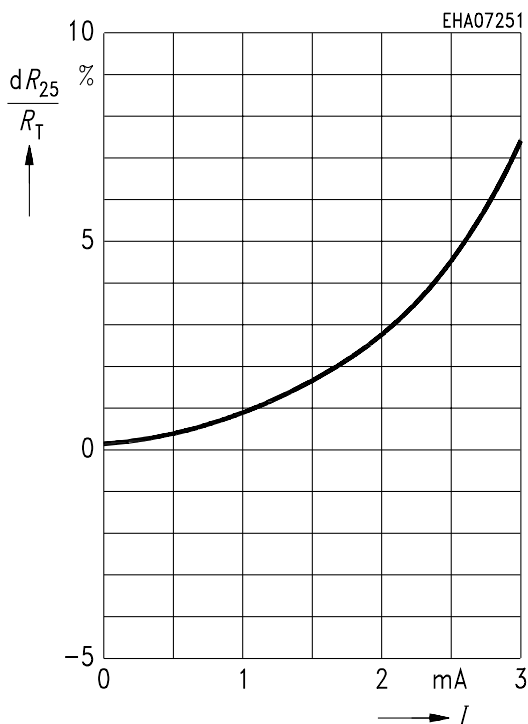
Typical Dependence of Sensor Resistance on Supply Current

Example: KTY 21-6 in oil at $T_A = 25^{\circ}\text{C}$



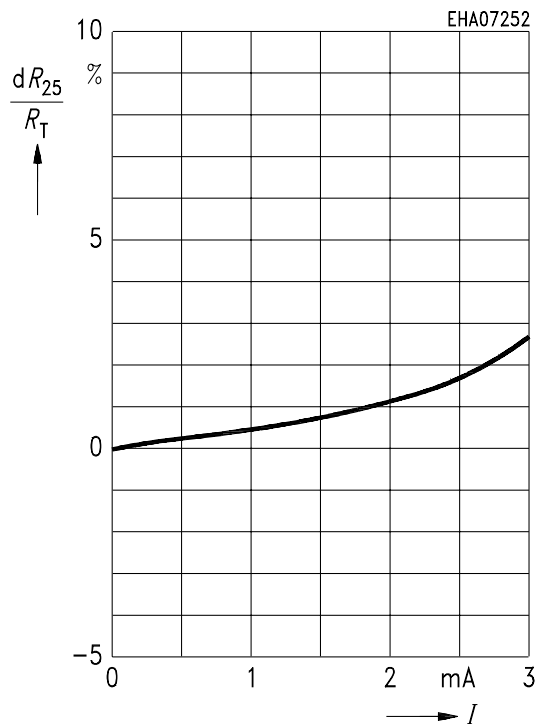
Typical Deviation of Sensor Resistance from the Basic Resistance R_{25} ($I_B = 1\text{mA}$) Versus Supply Current

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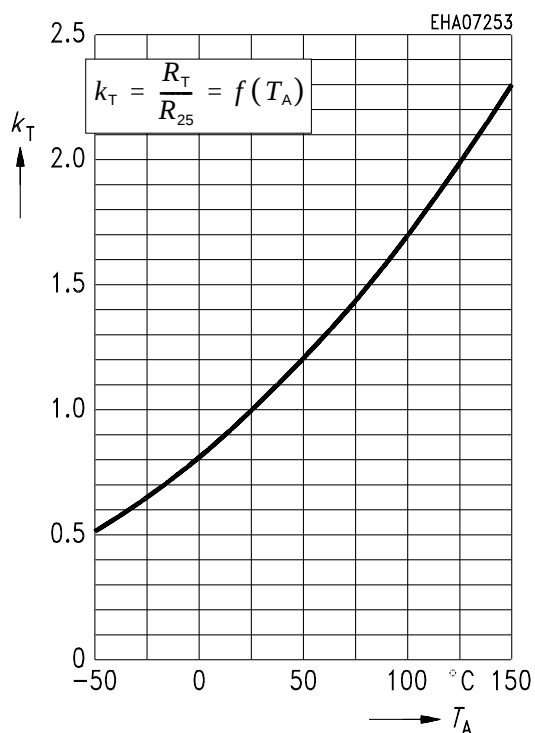


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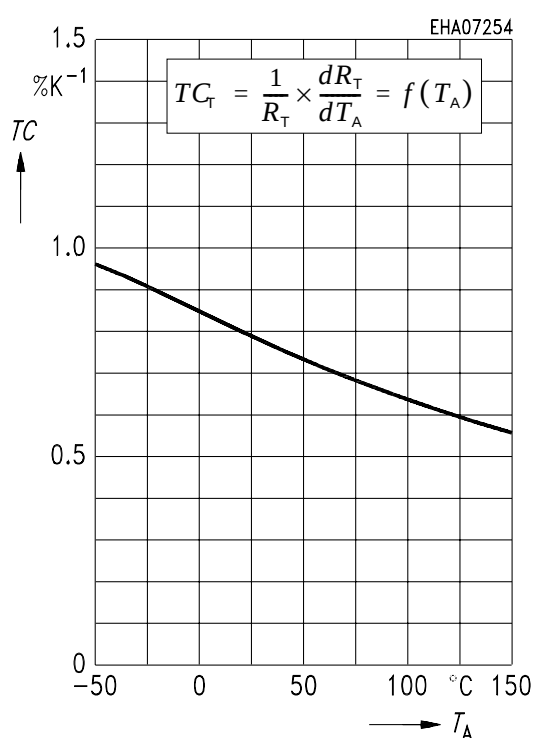
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Typical Relationship of the Temperature Factor

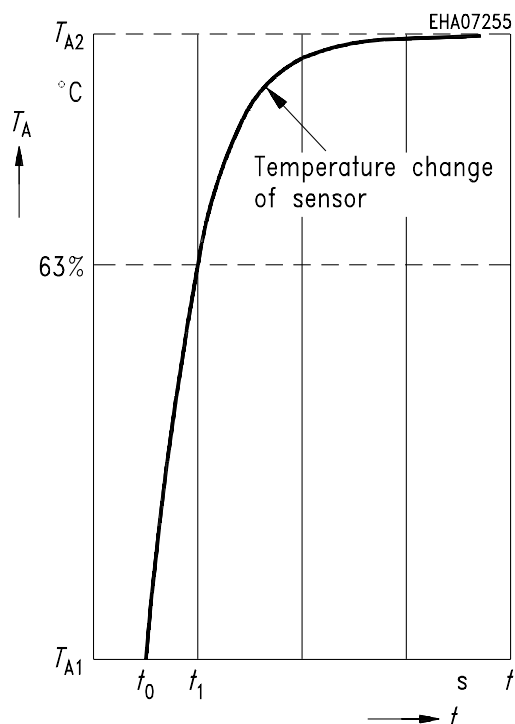


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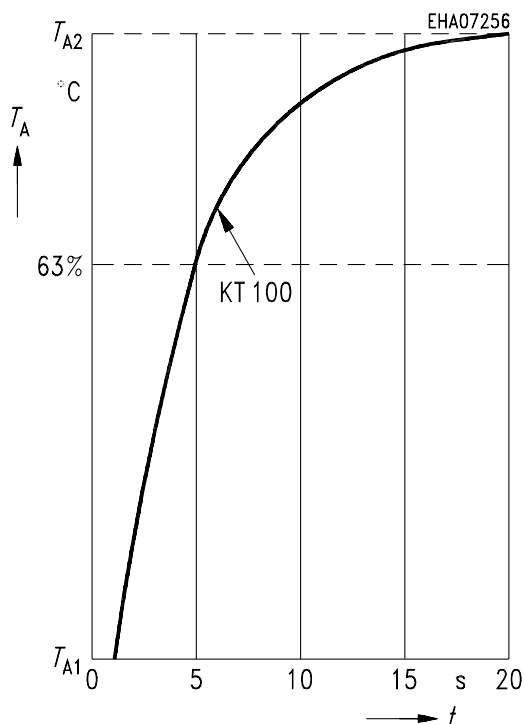


Definition of the Thermal Time Constant τ

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

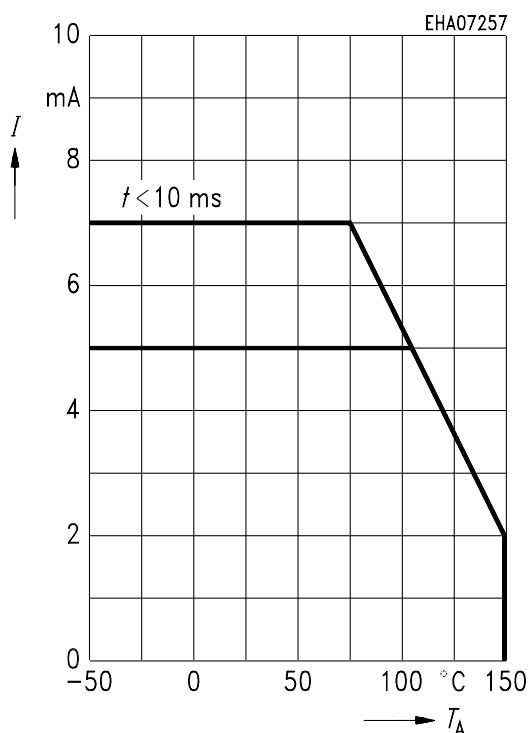


Thermal Time constant $\tau = 5 \text{ s}$



Peak Current in Air

$$R_{25} = 2000 \Omega; \hat{I} = f(T_A)$$



Peak Current in Air

$$R_{25} = 1000 \Omega; \hat{I} = f(T_A)$$

