Platinum temperature sensors in operation

Described in more detail below are a few of the parameters influenced by platinum temperature sensors during their operating time:

Measured currents and self-heating

A flow heats the platinum temperature sensor. The resulting temperature measuring fault is given by:

$$\Delta t = P*S,$$

with P, the power loss $=I^2R$ and S, the self-heating coefficient in K/mW.

The self-heating coefficients are specified in the datasheets for the individual products. Self-heating is dependent on thermal contact between the platinum temperature sensor and the surrounding medium. If the heat transfer to the environment is efficient, higher measured currents can be used.

Platinum temperature sensors set no lower limits for measured current. They depend to a great extent on the application.

We recommend:

100Ω :	max. 1mA
500Ω :	max. 0.7mA
1000Ω :	max. 0.3mA
2000Ω :	max. 0.25mA
10000Ω :	max. 0.1mA

Thermal response times

The thermal response time is the time required by a platinum temperature sensor to react to a step-by-step temperature change with a change in resistance, which corresponds to a certain percentage share of the temperature change. DIN EN 60751 recommends the use of times for a 50% and 90% change. $t_{0.5}$ and $t_{0.9}$ are indicated in the datasheets for water and air flows of 0.4 or 1.0 m/s.
Conversion to other media and speeds can be carried out with the aid of the VDI/VDE 3522 manual.

Thermo-electrical effect

Platinum temperature sensors generate practically no electromotive power. Low potential differences may result from a temperature drop along the platinum temperature sensor; because of their low magnitude and in connection with a heat-conductive Al_2O_3 substrate material, but these can be ignored. Typical faults occurring in unfavourable cases are less than 0.005°C. These faults can be further reduced by using alternating current.

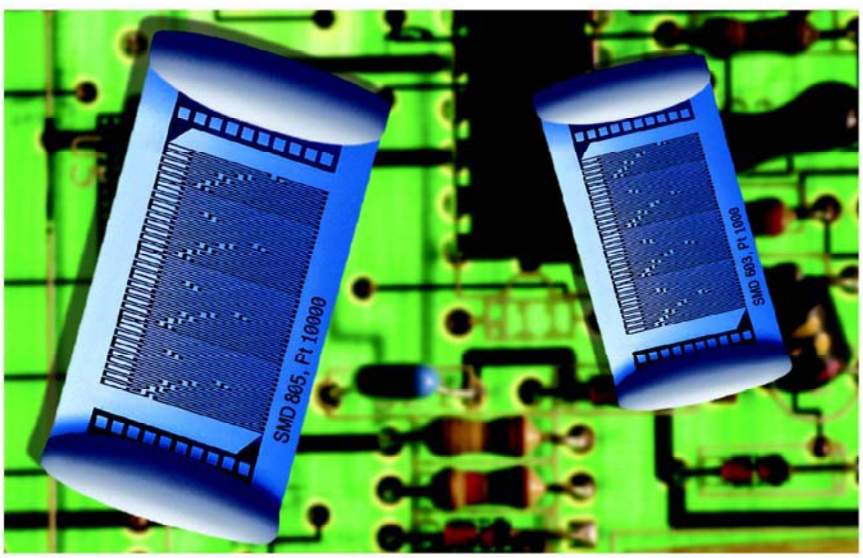

Figure 8: Platinum temperature sensors as SMD 805-type and SMD 603-type

Vibration and impact

Platinum temperature sensors are solid components and as such extremely resistant to vibration and impact. The qualifying factor is normally the mounting method. Testing well mounted thin-film platinum temperature sensors revealed:

Vibration resistance:	40 g over a range of 10 Hz up to 2 kHz
Shock resistance:	100 g, 8 ms half sine

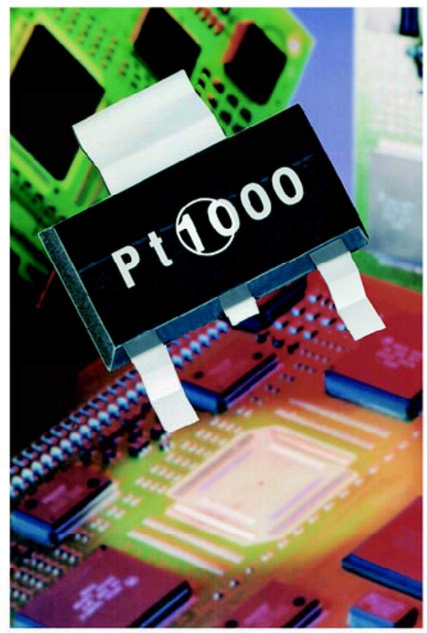

Figure 9: A Pt 1000 as an SOT223-type

General electrical parameters of F-series
Inductivity: < 1µH
Capacity: 1 to 6 pF
Insulation: > 10 MΩ at 20°C > 1 MΩ at 500°C
High voltage resistance > 1000 V at 20°C > 25 V at 500°C

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Mechanical load capability

F and SMD platinum temperature sensors are sensitive to mechanical loads which may, under extreme conditions, lead to a rupture or chipping of the glass cover or the ceramic substrate.
Improper handling or unsuitable mounting processes may lead to permanent changes in the measuring signals. The user instructions should be followed.

During manufacture, the connection wires are subjected to pulling and tear resistance tests in accordance with MIL 833 and IEC 40046. In the case of platinum/nickel coated wires, the products are approved when the f_{axial} is > 8 N (without glass ceramic connection sealing).

Repeatability

Platinum temperature sensors manufactured by Heraeus Sensor-Nite are characterised by a high degree of repeatability of the signal. Long-term faults may only be significant if the sensor is repeatedly exposed to thermal shocks in the limit areas of its permissible temperature range.

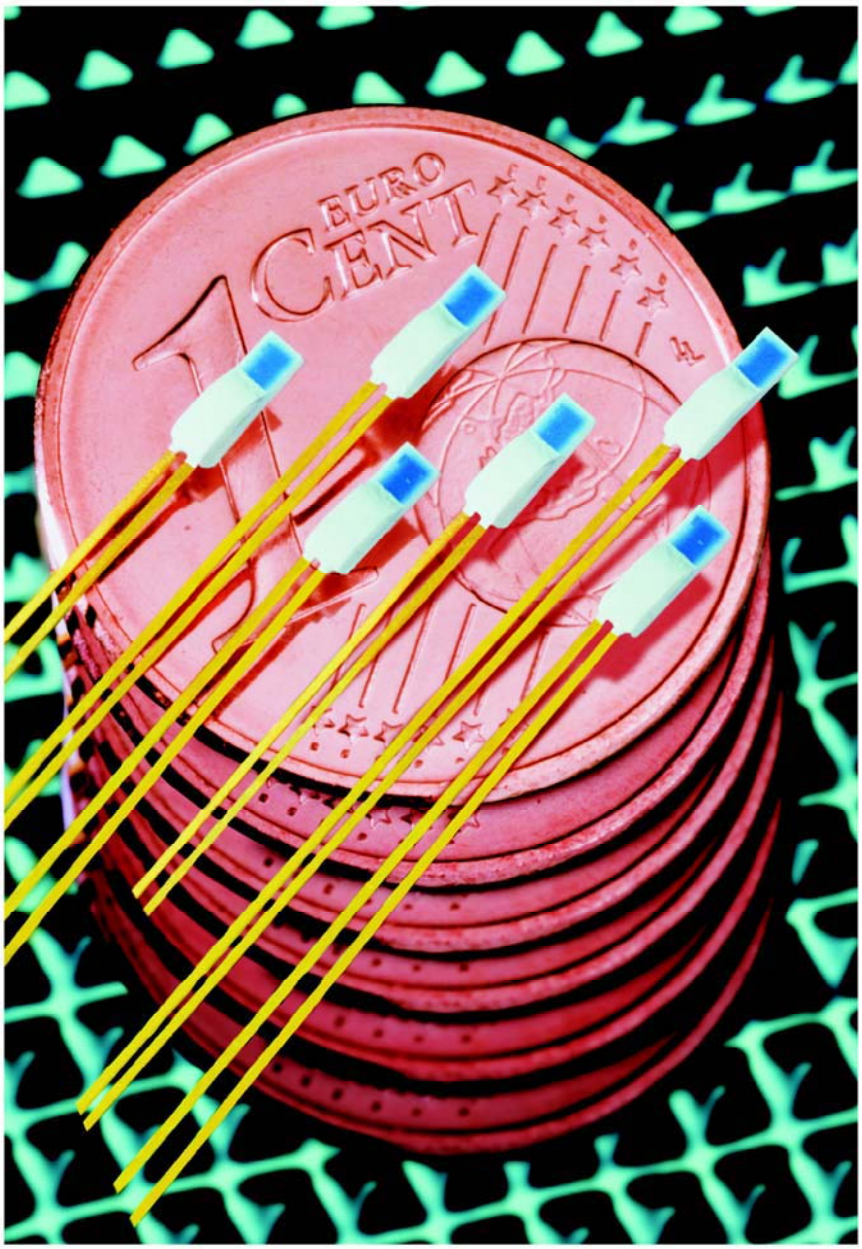

Figure 10: FK 310-type with gold-plated strips

Accuracy tolerance classification

Heraeus Sensor-Nite supplies Platinum temperature sensors in accordance with DIN EN 60751 in the accuracy tolerance classifications A and in addition B and 1/3 B (see Table 2). Proportionally limited tolerances are calculated as:

$$\Delta t = \pm 1/_a (0.3\ °C + 0.005\ |t|)$$

where a = 1, 2 or 3.

Platinum temperature sensors can also be selected in tolerance groups with a maximum Δt = ±0.05 K over a range of 0°C to 100°C. For applications with a high price sensitivity, accuracy tolerances of ±0.5% are also available.

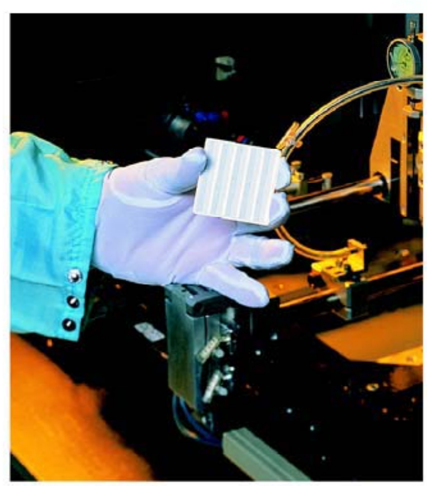

Figure 11: 2 x 2 - inch substrate

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