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Platinum-chip temperature sensors in SMD design type according to DIN EN 60751:2009 / IEC 60751:2008

- For temperatures from -50 to +150 °C (-70 to +250 °C)
- In accordance with DIN EN 60751, nominal values Pt100, Pt500, and Pt1000
- Tolerance classes F0.1, F0.15, F0.3 (standard) and F0.6
- SMD design type 1206 (3216M) and 0805 (2012M)
- Gold-plated nickel solder contact
- Solderability according to IEC / DIN EN 60068-2-58
- Belt packaging according to DIN IEC 60286-3
- High load capacity

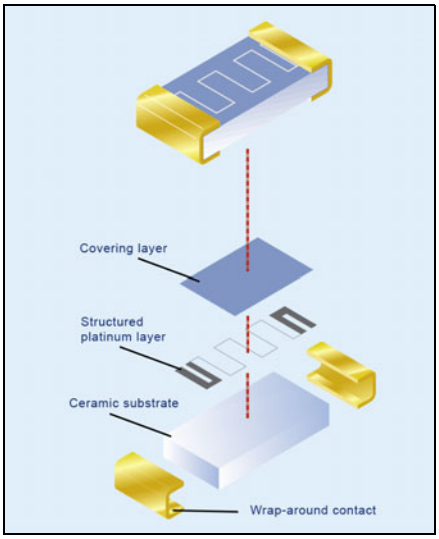
Introduction

Platinum-chip temperature sensors belong to the category of thin-film technology temperature sensors. During the manufacturing of these temperature sensors, a thin layer of platinum is deposited on a substrate of ultrapure aluminum oxide ceramic and structured in a meander-style pattern.
The temperature sensors are based on a temperature-dependent resistance, the curve and admissible tolerance of which are defined in the international standard IEC 60751:2008. The thin-film technology used enables the production of particularly small and robust design types.
The favorable, linear characteristic curve, the wide temperature measuring range, and high measuring accuracy, together with outstanding long-term stability, make these standardized temperature sensors the ideal choice.

JUMO platinum temperature sensors

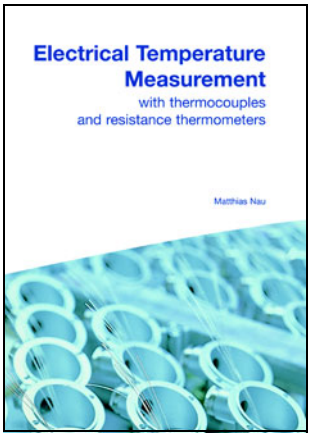
Construction and application of platinum temperature sensors	Data sheet 906000
Platinum-ceramic temperature sensors	Data sheet 906022
Platinum-chip temperature sensors with connection wires	Data sheet 906121
Platinum-chip temperature sensors on circuit boards	Data sheet 906122
Platinum-chip temperature sensors with terminal clamps	Data sheet 906123
Platinum-chip temperature sensors in SMD design type	Data sheet 906125

Design type PCS/PCF



Construction of the SMD temperature sensor (using the example PCS with wrap-around contact)

Technical literature



The revised version of this book was reviewed due to changed standards and further developments. The principle of the internationally approved "Guide of the expression of uncertainty in measurement" (abbreviated: GUM) ISO guide is particularly conveyed by the new chapter "Measurement uncertainty". In addition, a chapter on explosion protection for thermometers has been added.

August 2002
Publication FAS 146
Part no.: 00085081
ISBN: 3-935742-07-X

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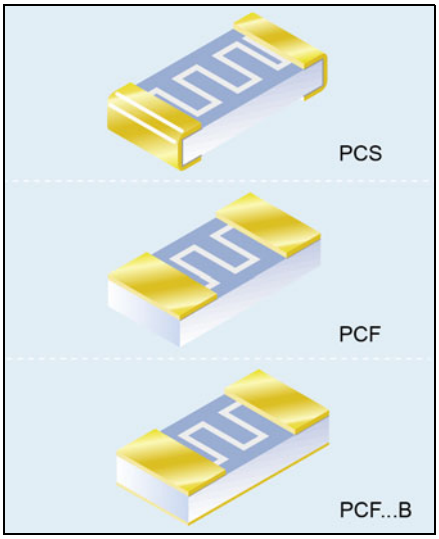
Type PCS/PCF



Brief description

Due to their small size, the SMD temperature sensors can be applied at a very high placement density. The sensors are used for surface and ambient temperature measurements on circuit boards. For example, they are frequently applied in temperature monitoring or compensation circuits, as well as an array of applications in temperature probes. Here, an assembled circuit board (data sheet 906122) is used as a measuring insert, which allows for easy installation. Application as a heated resistor for calorimetric measurements is also possible. As well as all forms of reflow soldering, the gold-plated nickel solder contact can also be used with alternative forms of connection technology, such as wave soldering, conductive adhesion, and wired bonds.
The high-quality plating on the contacts also ensures a high level of reliability during operation of the temperature sensor. In order to achieve extra-high resistance to temperature changes, it is important to select a suitable circuit board material with a modified expansion coefficient. In applications with high temperature cycling loads, we recommend using the design type 1302 (0805 or 2012M).
Two baked-in glass covering layers reliably protect the platinum layer of the temperature sensor from external influences.
The temperature sensors are designed for use in temperature ranges from -50 to +150 °C. If suitable connection technology is used, the temperature sensors can even be used in a temperature range from -70 to +250 °C. Adherence to tolerance limits then has to be checked according to the application. The connection technology and housing selected determine the thermal resistance.
The sensors are delivered in belt packaging in standard rolls. Thanks to the high-quality layered structure of the original packaging, they can also be stored for long periods without any issues.
The temperature sensor is available as a wrap-around contact (type PCS) or with one-sided contact (type PCF (flip chip)) for "face-down installation".
The flip chip types (see Fig. Type PCF...B) can be provided with a complete solderable nickel/gold metal layer on the rear/underside. This enables direct thermal contact with another body via a solder connection.

Item overview

Temperature sensor			Material / quantity		Part no. for tolerance class			
Type	Design type	R_0/Ω	Solder connection / material	Packaging unit in belt on reel	F0.1 (Class AA)	F0.15 (Class A)	F0.3 (Class B)	F0.6 (Class 2B)
PCS 1.1302.1M	0805	1×100	Gold-plated nickel	5,000	00647797	00659407	00585849	Upon request
PCS 1.1302.5M	0805	1×500	Gold-plated nickel	5,000	Upon request	Upon request	00649601	Upon request
PCS 1.1302.5M	0805	1×500	Gold-plated nickel	20,000	Upon request	00628428	00585853	Upon request
PCS 1.1302.10M	0805	1×1000	Gold-plated nickel	5,000	00647795	00647798	00649602	00695344
PCS 1.1302.10M	0805	1×1000	Gold-plated nickel	20,000	Upon request	Upon request	00585854	Upon request
PCS 1.1503.1M	1206	1×100	Gold-plated nickel	5,000	00647835	00700543	00585846	Upon request
PCS 1.1503.5M	1206	1×500	Gold-plated nickel	5,000	Upon request	Upon request	00649603	Upon request
PCS 1.1503.5M	1206	1×500	Gold-plated nickel	20,000	Upon request	Upon request	00585847	Upon request
PCS 1.1503.10M	1206	1×1000	Gold-plated nickel	5,000	Upon request	00647834	00649605	Upon request
PCS 1.1503.10M	1206	1×1000	Gold-plated nickel	20,000	Upon request	Upon request	00585848	Upon request
PCF 1.1302.1	0805	1×100	Gold-plated nickel, one-sided contact	5,000	-	-	00674541	-
PCF 1.1302.5	0805	1×500	Gold-plated nickel, one-sided contact	5,000	-	-	00667826	-
PCF 1.1302.10	0805	1×1000	Gold-plated nickel, one-sided contact	5,000	-	-	00674549	-
PCF 1.1302.10B	0805	1×1000	Gold-plated nickel, one-sided contact	5,000	-	-	00713969	00714764

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Order example:
PCS 1.1302.10M (part no. 00649602) corresponds to temperature sensor Pt1000 and SMD design type 0805.
The tolerance class is indicated in the part no.

Standard packaging according to IEC 60286-3:
- Packaging unit of 5,000 pieces in an 8-mm belt on a 7" plastic reel with roll feed line
- Packaging unit of 20,000 pieces in an 8-mm belt on a 330-mm plastic reel with roll feed line
- Small quantities upon request, without roll feed line

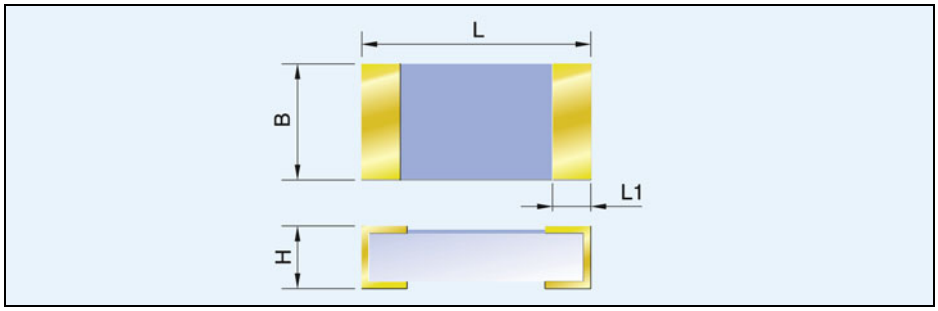
Dimensions

The dimensions are based on the standard DIN EN 140401-801:2014-09; all dimensions are in mm.

Type	SMD design type Imperial / metric	L	B	H	L1
PCS 1.1302.xM	0805 / 2012M	2.0	1.25	0.4	0.45
PCS 1.1503.xM	1206 / 3216M	3.0	1.50	0.4	0.45
PCF 1.1302.x	0805 / 2012M	2.0	1.25	0.4	0.5
PCF 1.1302.xB	0805 / 2012M	2.0	1.25	0.4	0.5
Dimension tolerances	All	ΔL = +0.2/-0.1	ΔB = +0.2/-0.1	ΔH = ±0.1	ΔL1 = +0.2/-0.2

x = Nominal value ÷ 100 Ω

Dimensional drawing (example design type PCS)



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Technical data

Standard	DIN EN 60751:2009 / IEC 60751/2008		
Temperature coefficient	$\alpha = 3.850 \times 10^{-3}\ °C^{-1}$ (between 0 and 100 °C)		
Temperature range	Nominal temperature -50 to +150 °C, expanded temperature range -70 to +250 °C		
Tolerance	Temperature validity range class F0.1 (class AA): 0 to 150 °C Temperature validity range class F0.15 (class A): -30 to +150°C Temperature validity range class F0.3 (class B): -50 to +250 °C Temperature validity range class F0.6 (class 2B): -70 to +250 °C		
Measuring/maximum current	Pt100: recommend 1.0 mA, maximum 7.0 mA Pt500: recommend 0.7 mA, maximum 3.0 mA Pt1000: recommend 0.1 mA, maximum 1.0 mA		
Self-heating	$\Delta t = I^2 \times R \times E$ (see data sheet 906000 for definitions)		
Self-heating coefficient E	Type	In water (0 °C, v ≥ 0.2 m/s), fitted as RTD temperature probe	
	PCS/PCF 1.1302 (0805)	0.15 K/mW	
	PCS/PCF 1.1503 (1206)	0.09 K/mW	
Response times	Type	In water (v = 0.4 m/s)	In air (v = 1 m/s)
		$t_{0.5}$ $t_{0.9}$	$t_{0.5}$
	PCS/PCF 1.1302 (0805)	0.1 s 0.3 s	2.6 s
	PCS/PCF 1.1503 (1206)	0.1 s 0.3 s	3.3 s
Stability at maximum temperature	1000 h at 160 °C in air: measured value drift ΔT_0 < 100 mK		
Long-term stability	Max. drift ≤ 0.05 % per year (for definition, see data sheet 906000)		
Processing	Reflow soldering, lead-free and leaded, see "Processing notes" The user must adapt the soldering profile. Only circuit boards with suitable coefficients of thermal expansion are admissible. Type PCF (flip chip): Depending on the solder used, it may be necessary to adapt the printed solder quantity compared to a sensor/component with wrap-around contact. Application of the metallized top side: Optimized for soft-soldering in a reflow method.		
Solder connections	Gold-plated nickel solder contact, thickness of nickel layer ≥ 1 µm, gold ≥ 40 nm, solderability according to IEC / DIN EN 60068-2-58: Class 3 soldering process "Higher temperatures", solder Sn96.5Ag3.0Cu0.5, Solder profile according to IEC / DIN EN 60068-2-58 / Figure 2b / Table 3 / Table 1 Resistance to dissolution according to IEC / DIN EN 60068-2-58: Class 3 soldering process "Higher temperatures", solder Sn96.5Ag3.0Cu0.5, Solder profile according to IEC / DIN EN 60068-2-58 / Figure 2b / Table 4		
Operating conditions	Platinum-chip temperature sensors must be protected when used in a humid environment or in aggressive atmospheres. The user may have to carry out some checks before using the sensors. **Please also refer to the installation instructions B 906121.4 "Information for the application of platinum-chip temperature sensors."**		
Storage	In the original unopened belt packaging, JUMO temperature sensors of PCS/PCF design type can be stored for at least 5 years under normal ambient conditions. Storage in an aggressive atmosphere or in corrosive or reductive media or under high air humidity is not permitted.		
Shearing strength of soldered connection	Tested as JUMO PCSE module (data sheet 906122): According to IEC 62137-1-2:2007; temperature cycling a) Rapid change of temperature; test Na, defined in IEC 60068-2-14 b) Lower temperature (TA) -40 °C, upper temperature (TB) +125 °C c) Dwell time at TA and TB, 10 minutes each d) Number of temperature cycles: 1000 0 cycles F ≥ 17.7 N, 1000 cycles F ≥ 8 N		
ESD	Typically ≥ 2 kV, HBM (direct contact), soldered onto circuit board as module according to data sheet 906122, in accordance with AEC - Q200-002 Level 2		
Compliant with RoHS 2011/65/EU and 2015/863/EU	Yes		
Compliant with REACH 1907/2006	Yes		

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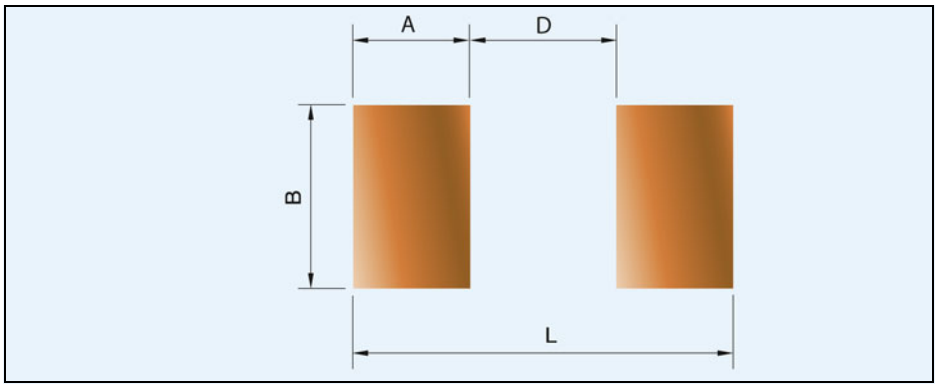
Processing notes

All forms of reflow soldering are preferred. The temperature sensors could be damaged when soldering with a soldering iron. The manufacturer has tested lead-free SAC solder as well as leaded standard solder (up to 95 % Pb). The soldering temperature can be raised slightly in comparison to tin-plated components.
Type PCF (flip chip): Depending on the solder used, it may be necessary to adapt the printed solder quantity compared to a sensor/component with wrap-around contact.
Application of the metallized top side: Optimized for soft-soldering in a reflow method.

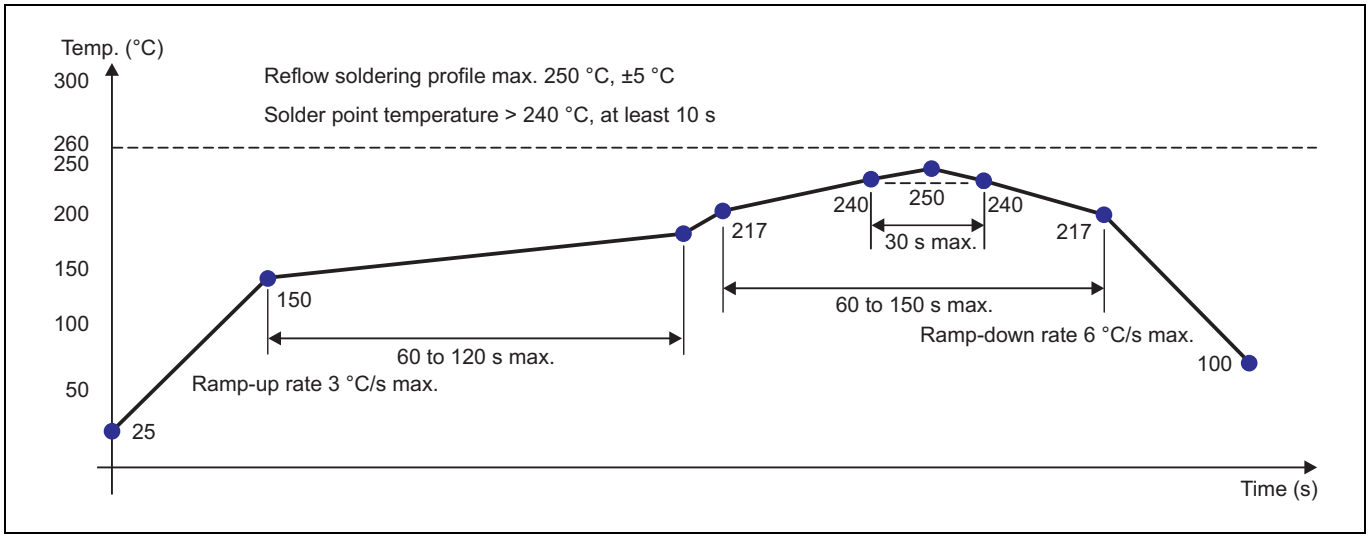
Recommended pad dimensions on the circuit board



Type	SMD design type (imperial)	SMD design type (metric)	A	B	D	L
PCS 1.1302.xM	0805	2012M	0.80	1.25	1.0	2.6
PCS 1.1503.xM	1206	3216M	0.80	1.50	2.0	3.6
PCF 1.1302.x	0805	2012M	0.65	1.25	0.9	2.2

All measurements in mm.
x = Nominal value ÷ 100 Ω

Recommended soldering profile for lead-free solder, type SAC 305/405



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PCA1.2005.1S	CP1.140.05.0100.0100	ZCKY31
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