

Temperature Sensor with a Measuring Resistance

Description

The invention is directed to a temperature sensor with a measuring resistance made of a substrate with an electrical insulating surface and a resistive film deposited thereon, where the measuring resistance is enveloped in a plastic jacket that is able to resist high temperatures and through which connecting conductors of the measuring resistance are led.

A method for the production of an electrical measuring resistance for a resistance thermometer is known from DT 25 27 739 B 2, where a thin platinum film with a predetermined temperature coefficient is applied onto a carrier of ceramic material, and the measuring resistance is subsequently provided with a coating able to resist high temperatures, for instance a coating of epoxy resin, in order to be able to withstand thermal and mechanical stress. Furthermore, this coating is intended to provide protection against diffusion from the gaseous phase, solids from the environment and against objects coming into contact with the measuring resistance.

Further, a resistance thermometer for measuring surface temperature is known from the German utility patent 89 13 803.1, where a metal film temperature sensor is enveloped by a plastic jacket through which the connecting conductors of the resistance thermometer are led to the outside. The plastic jacket is manufactured in a multiple plastic injection mould and consists of epoxy resin. The temperature sensor is intended to be directly mounted onto a surface the temperature of which is to be measured.

Further, a temperature sensor is known from DE 41 04 674 A 1, where the measuring resistance serving as sensor is formed by a platinum film resistance at the face of a plate-shaped carrier made of ceramics; it is enclosed in a pressure-tight manner in an essentially tube-shaped casing made of glass, where it is essentially only aligned with its longitudinal edges in a tension-free manner, whilst all other straight surfaces and edge surfaces as well as the measuring resistance

itself are configured vis-a-vis the casing in a manner which is entirely non-contacting. In this way, the carrier can be enclosed in a vibration-free manner without this resulting in a significant deterioration of the response.

- 5 Due to the relatively exact centering and precise alignment of the carrier vis-a-vis the casing, the manufacture is relatively costly.

Further, from the German utility patent 79 19 142 a film-type measuring resistance for temperature measurement is known, where a small ceramic plate with a thin
10 platinum coating as a resistive film is used as carrier, and where the resistive film has electrical connecting wires; the film-type measuring resistance is arranged in a ceramic casing, which consists of two halves, where the halves are fused or bonded with each other at the separation surfaces by means of a binding medium and the connecting wires leading from the measuring resistance to the outside are
15 embedded into the binding medium.

Due to the two-chamber casing, relatively precise mounting is required.

It is the object of the present invention to produce a temperature sensor which can
20 be manufactured relatively easily and cost-effectively and can be used in long-life consumer goods such as washing machines and dryers as well as temperature regulation in motor vehicles.

The solution being offered is by way of a jacket serving as a primary casing which,
25 together with the embedded measuring resistance, is enveloped by an additional plastic moulding as an outer casing, whereby the connecting conductors are led to the outside through the plastic moulding.

The simple robust assembly proves to be particularly advantageous when it is
30 sealed in an optimum manner against the ambient atmosphere so that the sensor

can also be applied in an aggressive environment; furthermore, it can be produced in a cost-effective manner.

Preferred embodiments of the invention are specified in claims 2 to 7.

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The object of the invention is described in more detail below in Figures 1a, 1b, 2a and 2b.

Figure 1 a shows a top view of a temperature sensor in section, where the measuring resistance is mounted on a board by way of SMD technique;

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Figure 1 b shows the temperature sensor in accordance with Figure 1 a in longitudinal section;

Figures 2 a and 2 b show a temperature sensor with TO-casing or SOT-casing and connecting contacts.

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In Figure 1a, the measuring resistance 1 is arranged at an end 2 of a longitudinal board 3 and mounted by way of SMD-soldering; the measuring resistance is connected with the external connecting contacts 8, 9 of the temperature sensor via connecting contacts 6,7 and via conducting paths 4,5. The measuring resistance 1 consists of a plate-shaped ceramic substrate with electrically insulating surface, on which the measuring resistance has been deposited in the form of a platinum film. As is known from DE 25 27 739 B 2, such measuring elements can, for instance, have a meander-type resistive film, which however, shall not be discussed in detail here. In the top view of the sensor shown in section, the plastic jacket 10 is depicted as a sealed primary casing, which is opened by way of a lead-through opening for that portion of board 3 leading to the external connecting contacts 8,9; the external connecting contacts 8,9 are in the form of plugs. The primary casing formed by plastic jacket 10 and board 3 are in turn enveloped by a plastic moulding 13, where the external connecting contacts 8,9 protrude in the form of plugs from

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this moulded plastic 13, which hermetically seals the board as well as the measuring resistance. Measuring resistance 1 is soldered directly onto the respective conducting paths 4,5 on board 3 in the region of the connecting contacts 6,7.

5 In Figure 1b, the measuring resistance 1 is shown in longitudinal section; its substrate 15 is in the form of a plate-shaped ceramics part, which at least on its surface area is electrically insulated against resistive film 16. At the opposite ends of resistive film 16, the connecting contacts 6,7 are situated, each of which is soldered directly onto conducting paths 4,5 of board 3 in a mutually electrically
10 insulating manner. So, for instance, connecting contact 6 is electrically and mechanically firmly connected with conducting path 4 by soldering as is connecting contact 7 in the same way with conducting path 5. Measuring resistance 1, together with end 2 of board 3, is embedded into the plastic jacket 10, the latter representing the primary casing. The plastic jacket 10 (as well as a major portion)
15 of circuit board 3, are enclosed by the plastic moulding 13 forming the outer casing, which, in the area of end 18 has an opening to feed-through the lead for the external connecting contacts 8,9 which are in the form of plugs. By shortening circuit board 3, it is possible to arrange a temperature sensor for instance in a conventional semi-conductor casing, as is illustrated in Figures 2a and 2b below.

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Figure 2 a shows a perspective view of a temperature sensor in accordance with Figures 1a, 1b, whose plastic moulding 13 is in the form of a TO-casing, as is conventionally used in the area of semi-conductor elements. The description TO is customary for transistor casings in circuit board placement, where the external
25 connecting contacts 8,9 are designed in the form of elongated pins 8', 9', which are suitable for soldering onto conventional circuit boards; it is, however, also possible to insert the pins 8', 9' into a plug-in socket, in order to achieve a speedy interchangeability, if so desired.

30 Further, Figure 2b shows a plastic moulding 13, which is in the form of a so-called SOT-casing. Such SOT-casings are used for circuit board placement using the

SMD-technique, where the contacts 8, 9 which are led to the outside, with their soldering surfaces 8", 9", can be soldered directly onto contact surfaces of circuit boards by the SMD technique. Such SOT casings are particularly suited to miniaturisation purposes.

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Claims

1. Temperature sensor with a measuring resistance made of a substrate with an electrical insulating surface and a resistive film deposited thereon, where the measuring resistance is enveloped in a plastic jacket that is able to resist high temperatures and through which connecting conductors of the measuring resistance are led, characterised in that the jacket (10) serves as primary casing which, together with the embedded measuring resistance (1) is enveloped by an additional plastic moulding (13) forming an outer casing, where the connecting conductors (4,5) are led to the outside through the plastic moulding (13).
2. Temperature sensor in accordance with claim 1, characterised in that the measuring resistance (1) is in the form of an SMD-part and is sealed against its environment by way of a plastic jacket (10) where at least two connecting conductors (4,5) between measuring resistance (1) and the external connecting contacts (8,9) are led through plastic jacket (10) and plastic moulding (13) in a gas-tight and liquid-tight manner.
3. Temperature sensor in accordance with claim 2, characterised in that the external connecting contacts (8,9) are in the form of soldering contacts for SMD assembly.
4. Temperature sensor in accordance with claim 2, characterised in that the measuring resistance (1) is soldered onto a board (3) which, at the far end from the measuring resistance, has at least one electrical connection which is connected with a plug in the form of a pin being the external connecting contact (8,9).
5. Temperature sensor in accordance with one of the claims 1 to 4 characterised in that the plastic jacket (10) is made of silicone varnish.
6. Temperature sensor in accordance with one of claims 1 to 5 characterised in that the external plastic moulding (13) is made of thermosetting plastic.
7. Temperature sensor in accordance with one of claims 1 to 6 characterised in that the external plastic moulding (13) is in the form of a TO-casing which in the region of its connection surface (20) has external connecting contacts in the form of pins (8',9').

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