

Description

ESD protection component and component comprising an ESD protection component and an LED

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An ESD protection component is specified. Furthermore, a component which comprises an LED and an ESD protection component is specified.

10 The document DE 10 2008 024 481 A1 discloses an electrical component arrangement which has a semiconductor component and a varistor element for protecting the semiconductor component from electrostatic discharges.

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A problem to be solved consists in specifying an ESD protection component with improved properties. A further problem consists in specifying a component comprising an LED and an improved ESD protection component.

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An ESD protection component is specified. Preferably, the ESD protection component comprises a ceramic material.

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"ESD" in the text below stands for "electrostatic discharge". This means that the ESD protection component is preferably designed to protect other components, for example semiconductor components, from overvoltages. The ESD protection component can also be used for protecting other components from overcurrent. For example, the ESD protection component is designed for protecting an LED. "LED" in the text which follows stands for "light-emitting diode".

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The ESD protection component is preferably in the form of an ultrathin protection component. Preferably, the ESD protection component has a height of between 50 μm

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and 150 μm , in particular between 70 μm and 100 μm . For example, the ESD protection component has a height of 80 μm . Preferably, a component with this height can be installed in a space-saving manner. In addition, in the case of an arrangement of the ESD protection component next to an LED, less shading of the LED occurs the flatter the ESD protection component is.

Preferably, the ceramic material comprises a varistor ceramic or consists of a varistor ceramic.

Preferably, the ceramic material, in particular the varistor ceramic, comprises a ZnO-Bi-Sb material or a ZnO-Pr material or consists of a ZnO-Bi-Sb material or a ZnO-Pr material. With these ceramics, preferably a particularly thin component with a high strength can be achieved.

Preferably, the ceramic of the ESD protection component comprises a composite of a varistor material and a metal or consists of a composite of a varistor material and a metal. For example, the resistance of the varistor ceramic is influenced by the metal.

The ESD protection component preferably has a basic body. The basic body preferably has a lower side. The lower side of the basic body of the ESD protection component is that side which, in a state in which the ESD protection component is mounted on a carrier, faces the carrier. The basic body can comprise a layer stack, in particular a stack of dielectric layers. The dielectric layers preferably comprise the ceramic material. Preferably, the basic body of the ESD protection component is formed by a monolithic sintered body.

Preferably, a contact connection is arranged on the lower side of the basic body. Preferably, the contact

connection comprises two contact elements. For example, the contact elements have contact areas. Preferably, the contact elements are designed for electrically contact-connecting the basic body of the ESD protection component, in particular to a printed circuit board.

Preferably, the contact elements are arranged directly on the basic body of the ESD protection component. Preferably, the contact elements are arranged at a distance from one another. Preferably, in the event of overshooting of a voltage present between the contact elements, a current flow can take place through the ESD protection component via the contact elements.

Preferably, the ESD protection component comprises a BGA termination.

"BGA" in the text which follows stands for "ball grid array". In the case of the BGA termination, solder in the form of solder balls, for example, is provided on a component. In the case of the BGA termination, solder material can also be provided in the form of partial balls, for example hemispherical balls. The BGA termination enables particularly flat soldering of the ESD protection component on a carrier. The solder balls can be provided on the component as early as before soldering of the component, in particular fused onto the component, and thus form part of the component.

Preferably, the BGA termination is arranged on a lower side of the ESD protection component. The solder balls are preferably arranged in structured fashion. For example, the solder balls are arranged in the form of a uniform grid having columns and rows. Preferably, the solder balls are particularly flat.

In an alternative embodiment, the ESD protection component comprises an LGA termination.

"LGA" in the text which follows stands for "land grid array", i.e. a grid array of contact areas. Preferably, the contact areas are arranged in the form of a uniform grid having columns and rows on the ESD protection component. In the case of an LGA termination, too, the ESD protection component can be soldered to a carrier, wherein, in this case, in contrast to the BGA termination, solder material is arranged on the carrier prior to soldering, in particular solder material which has been fused to form solder balls.

One advantage of BGA and LGA terminations consists in that no additional connection pins for soldering a component are required and that the soldering can be particularly flat.

Preferably, the ESD protection component comprises at least one floating inner electrode. The floating inner electrode is not intended for contact connection externally. A floating inner electrode does not extend on any side as far as the outside of a basic body, for example.

Preferably, the floating inner electrode serves to match the breakdown voltage of the ESD protection component. Preferably, there is no further inner electrode located between the floating inner electrode. In the text which follows, such an inner electrode is also referred to as first floating inner electrode. For example, the breakdown voltage is determined inter alia by the distance between the floating inner electrode and the lower side of the basic body of the ESD protection component. Preferably, the breakdown voltage is higher the greater the distance between the floating inner electrode and the lower side of the basic body. Preferably, once the breakdown voltage has been reached, a current flow takes place via the floating inner electrode.

For example, the ESD protection component comprises precisely one floating inner electrode.

5 In a further embodiment, the ESD protection component comprises precisely two floating inner electrodes. For example, a first and a second floating inner electrode are arranged one above the other. For example, a distance between the second floating inner electrode and the lower side of the basic body of the ESD
10 protection component is greater than a distance between the first floating inner electrode and the lower side of the basic body of the ESD protection component. For example, the second floating inner electrode is primarily used for the symmetry of the component. In
15 particular, the second inner electrode can serve the purpose of preventing a sintering warping of the component, with the result that the component has in particular flat side faces.

20 In a preferred embodiment, the ESD protection component comprises a basic body with a symmetrical design. Preferably, the basic body has a symmetrical design in terms of the arrangement of the inner electrodes.

25 Preferably, the basic body, with respect to each floating inner electrode which has a certain distance from the lower side of the basic body, also has a floating inner electrode, which has the same distance from the upper side of the basic body. If the inner
30 electrode runs precisely centrally between the upper and lower sides, no further corresponding inner electrode needs to be provided.

In particular, the basic body can have a symmetrical
35 design with respect to a plane of symmetry which runs parallel to the lower side of the basic body.

In particular, the plane of symmetry runs centrally through the basic body. In this way, it is possible to achieve, for example, a situation in which the basic body is mechanically stable even in the case of a very thin embodiment. For example, the basic body has precisely two, precisely four, or precisely eight floating inner electrodes, wherein the inner electrodes are arranged symmetrically with respect to the plane of symmetry. In a further embodiment, the basic body has an uneven number of inner electrodes, wherein one of the inner electrodes is arranged centrally between the upper and lower sides. Preferably, only the first, i.e. the lowermost, inner electrode contributes to the ESD protection function of the component, while the further inner electrodes are used for mechanical stabilization of the component.

In a further embodiment, the basic body is rotationally symmetrical. For example, the basic body is rotationally symmetrical with respect to an axis of rotation which runs parallel to the lower side and perpendicular to the longitudinal axis of the basic body.

Preferably, a distance between the lower side of the basic body of the ESD protection component and the floating inner electrode, in particular the first floating inner electrode, is two ceramic grains.

In the case of a distance of two grains, this is also referred to as a single grain boundary design. For example, by means of the single grain boundary design, an ultrathin formation of the ESD protection component can be achieved. For example, the distance between the first floating inner electrode and the lower side of the basic body of the ESD protection component is between 7 μm and 10 μm . For example, the distance between the first floating inner electrode and the

lower side of the basic body of the ESD protection component is approximately 8 μm .

5 In a further embodiment, the distance between the first floating inner electrode and the lower side of the basic body is between 2 and 100 ceramic grains.

10 A distance of clearly more than two ceramic grains, for example of 80 ceramic grains, makes it possible to use the ESD protection component at relatively high voltages, right up to high-voltage applications.

15 The active volume which is primarily critical for the functionality of the ESD protection component is preferably located between the lower side of the basic body of the ESD protection component and the first floating inner electrode. The active volume preferably influences the breakdown voltage of the ESD protection component, while a volume above the first floating
20 inner electrode, in particular a second floating inner electrode, does not have any influence on the breakdown voltage.

25 Preferably, the distance between the first floating inner electrode and an optionally provided second floating inner electrode is greater than the distance between the first floating inner electrode and the lower side of the basic body of the ESD protection component.

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In a preferred embodiment, the ESD protection component comprises a basic body comprising a lower side, on which a contact connection is arranged, a first floating inner electrode and, adjacent to this, a
35 second floating inner electrode, wherein the distance between the first floating inner electrode and the second floating inner electrode is greater than the distance between the first floating inner electrode and

the lower side of the basic body of the ESD protection component.

5 In a further preferred embodiment, the ESD protection component comprises a basic body comprising a lower side, wherein the basic body comprises a ceramic material and at least one floating inner electrode, wherein the distance between the lower side of the basic body of the ESD protection component and the
10 floating inner electrode is between two and 100 ceramic grains. Preferably, the distance is two ceramic grains.

In a further preferred embodiment, the ESD protection component comprises a ceramic material and a BGA or LGA
15 termination.

All of the preferred embodiments can include the further above-described features.

20 Furthermore, a component with a basic body on which an LED and an ESD protection component are arranged is specified. The ESD protection component is preferably designed as described previously.

25 Preferably, the LED and the ESD protection component are arranged on the basic body of the component. The basic body of the component will also be referred to below as the carrier. Preferably, the LED and the ESD protection component are arranged on an upper side of
30 the basic body. Preferably, the LED and the ESD protection component are arranged at a distance from one another.

By virtue of the ultrathin formation of the ESD
35 protection component, preferably the physical height of the component can be kept low. In particular, the physical height of the LED can be kept low without

shading of the LED by the ESD protection component occurring.

5 The basic body of the component is preferably used as the carrier for the LED and the ESD protection component. Preferably, the basic body acts as heat-dissipating carrier for the LED and the ESD protection component. In addition, the basic body can have electrical contacts for electrically contact-connecting
10 the LED and the ESD protection component.

The basic body of the component preferably comprises a ceramic material or consists of a ceramic material. For example, the basic body comprises an LTCC material,
15 wherein LTCC stands for low temperature co-fired ceramic. Preferably, the basic body comprises at least one of the materials aluminum oxide or aluminum nitride or consists of one of the materials aluminum oxide or aluminum nitride. Alternatively, the basic body
20 comprises an organic material or consists of an organic material. Alternatively, the basic body comprises a metallic material. For example, the basic body comprises one of the materials aluminum or copper. Preferably, the cited materials have good thermal
25 conductivity.

Preferably, the basic body is in the form of an insulating basic body. Preferably, at least part of the basic body is electrically insulating. For example, at
30 least part of the basic body which faces the LED and the ESD protection component is electrically insulating.

By way of example, the basic body comprises a metal,
35 wherein the metal is coated with an electrically insulating layer. For example, the basic body is coated with the electrically insulating layer at least on a side facing the LED and the ESD protection component.

For example, the electrically insulating layer comprises aluminum oxide or consists of aluminum oxide. The basic body consisting of a metal and an electrically insulating layer can be considered to be
5 an insulating basic body.

Preferably, the basic body has good thermal conductivity. For example, the basic body can contain metal particles. The thermal conductivity of the basic
10 body can be additionally improved by the metal particles, for example.

The basic body has the shape of a plate, for example.

15 Preferably, the basic body has at least one via. Via stands for "vertical interconnect access". Preferably, the at least one via runs perpendicular to a surface of the basic body. Preferably, the basic body has a plurality of vias.

20 Preferably, the basic body has at least one thermal via. Preferably, the at least one thermal via serves to improve thermal conductivity. For example, the basic body comprises a ceramic material and thermal vias or
25 consists of a ceramic material and thermal vias. For example, the basic body comprises an organic material and thermal vias or consists of an organic material and thermal vias. Preferably, heat is dissipated from the LED via the thermal vias. For example, heat is
30 dissipated from the LED to a housing of the component. Preferably, a thermal via improves the thermal conductivity of the LED to a housing and therefore results in an extension of the life of the LED.

35 Preferably, a metal plating is arranged on a lower side of the basic body of the component. The lower side of the basic body is preferably the side facing away from the LED and the ESD protection component. Preferably,

the metal plating serves to electrically contact-connect the component. Preferably, the metal plating is arranged in the form of two contact areas on the lower side. Preferably, the two contact areas are arranged
5 next to one another, at a distance from one another.

Preferably, the basic body has electrical vias. Preferably, the basic body has two electrical vias. Preferably, the electrical vias are used for
10 electrically contact-connecting the LED and the ESD protection component. Preferably, the electrical vias connect the upper side of the basic body to the metal plating on the lower side. Preferably, the electrical vias connect the LED and the ESD protection component
15 directly or indirectly to the metal plating.

In a further embodiment, electrical conductor tracks are arranged on an upper side of the basic body. The electrical conductor tracks can each have profiles with
20 multiple changes of direction or can each be in the form of flat, geometric patterns. They can be arranged on the basic body by means of screen printing, for example. For example, the electrical conductor tracks are in contact with the metal plating on the lower side
25 of the basic body via the electrical vias. Preferably, the electrical conductor tracks connect the LED and the ESD protection component to the metal plating of the basic body of the component via the electrical vias.

30 For example, the LED and the ESD protection component are contact-connected on the basic body by means of the electrical conductor tracks arranged on the basic body. Alternatively, the LED and the ESD protection component are contact-connected directly to the metal plating via
35 the electrical vias. In this embodiment, no electrical conductor tracks are required. Preferably, the ESD protection component is contact-connected in parallel with the LED.

The LED preferably has a metal plating on its lower side. Preferably, the metal plating of the LED is contact-connected to the electrical conductor tracks applied to the basic body or to an electrical via.

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Preferably, the LED and the ESD protection component are arranged on the basic body with a flipchip design. In the case of flipchip mounting, a component is mounted directly on a carrier, without any connecting
10 wires, with a contact-connection side on the bottom. The contact-connection side is the side on which the contact connection provided for electrically contact-connecting the component is arranged, in particular the lower side of the component. Preferably, a BGA or LGA
15 termination is arranged on the contact-connection side. Preferably, the BGA or LGA termination enables a mechanical and electrical connection of the LED and the ESD protection component to the basic body with a flipchip design.

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Preferably, the LED comprises at least one of the following materials: gallium phosphide (GaP), gallium nitride (GaN), gallium arsenic phosphide (GaAsP), aluminum gallium indium phosphide (AlGaInP), aluminum
25 gallium phosphide (AlGaP), aluminum gallium arsenide (AlGaAs), indium gallium nitride (InGaN), aluminum nitride (AlN), aluminum gallium nitride (AlGaN), aluminum gallium indium nitride (AlGaInN) or zinc selenide (ZnSe).

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The ESD protection component is preferably used for protecting the LED from overvoltages. Preferably, the ESD protection component has a resistance which decreases significantly above a breakdown voltage, with
35 the result that, in the event of an overvoltage, a current can be dissipated via the ESD protection component. In particular, the resistance of the ESD protection component is such that the risk of damage to

the LED as a result of an overvoltage is reduced. For example, the breakdown voltage of the ESD protection component is between 7 and 8 V. Preferably, the breakdown voltage of between 7 and 8 V can be achieved by the single grain boundary design.

In a further embodiment, the component has a thermal sensor. Preferably, the thermal sensor is interconnected with the LED. For example, the thermal sensor has NTC properties. "NTC" stands for "negative temperature coefficient". That is to say that the thermal sensor conducts current better at high temperatures than at low temperatures.

Preferably, the thermal sensor contributes to the regulation of a control current of the LED, with the result that said LED can be operated gently. The regulation of the control current is preferably performed in such a way that the LED is not subjected to any current surges or is operated on an alternating current which is as constant as possible.

In a further embodiment, the component has an overcurrent protection means. Preferably, the overcurrent protection means is interconnected with the LED. For example, the overcurrent protection means has PTC properties. "PTC" stands for "positive temperature coefficient". That is to say that the overcurrent protection means conducts current better at low temperatures than at high temperatures.

An ESD protection component and various arrangements with an LED and an ESD protection component will be explained below with reference to schematic figures, which are not true to scale.

Figure 1A shows an ESD protection component on a carrier in a sectional illustration,

Figure 1B shows a detail of the ESD protection component from figure 1A in a sectional illustration,

5 Figure 2 shows a component with an LED and an ESD protection component as shown in figure 1A on a carrier in a sectional illustration,

10 Figure 3 shows a component with an LED and an ESD protection component as shown in figure 1A on a carrier with thermal vias in the carrier in a sectional illustration,

15 Figure 4 shows a component with an LED, an ESD protection component and a thermal sensor on a carrier with thermal vias in the carrier in a sectional illustration,

20 Figure 5 shows a component with an LED, an ESD protection component and a thermal sensor on a metallic carrier in a sectional illustration,

25 Figure 6 shows a wafer for producing ESD protection components as shown in figure 1A.

Figure 1A shows an ESD protection component 3 for protecting against electrostatic discharges. The ESD protection component 3 is arranged on a carrier 1. The
30 ESD protection component 3 comprises a ceramic material. For example, the ESD protection component 3 comprises a ZnO-Pr material. ZnO-Pr has a high strength, and therefore very thin, planar components can be produced with a ZnO-Pr material. Alternatively,
35 the ESD protection component 3 can have, for example, a ZnO-Bi-Sb material.

The ESD protection component 3 has a basic body 21 with a lower side 12. The lower side 12 of the ESD protection component 3 is preferably a side facing the carrier 1. The carrier 1 is preferably a basic body of a component.

Two floating inner electrodes 4a, 4b are arranged one above the other in the basic body 21 of the ESD protection component 3. The floating inner electrodes 4a, 4b do not extend as far as an outer side of the ESD protection component 3 on any side. The floating inner electrodes 4a, 4b preferably comprise a metallic material, for example they comprise silver palladium or consist of silver palladium.

A contact connection in the form of a BGA termination 22 is arranged on the lower side 12 of the ESD protection component 3. The BGA termination 22 comprises two contact elements 22a, 22b. The contact elements 22a, 22b have contact areas 6a, 6b. The contact areas 6a, 6b comprise, for example, the materials Cu/Ni/Au, Cr/Ni/Au or Cr/Cu/Ni/Au or consist of these materials. For example, a contact area 6a, 6b has a width 19 of 200 μm . For example, a contact area 6a, 6b has a depth of 150 μm .

Prior to soldering of the ESD protection component 3, solder balls for soldering the ESD protection component 3 are applied to the contact areas 6a, 6b of the ESD protection component 3. Figure 1A shows the ESD protection component after soldering to a carrier 1, wherein the solder balls are fused to form a solder layer 5. The BGA termination 22 can comprise an SnAu solder material, for example.

Alternatively, the ESD protection component can comprise an LGA termination. In this case, no solder material is applied to the contact areas 6a, 6b of the

ESD protection component prior to the soldering. The solder material is applied to the carrier 1 prior to soldering and fused in the case of the LGA termination.

5 A distance 16 between the first, lower floating inner electrode 4a and the lower side 12 of the ESD protection component 3 is 7 μm to 10 μm , for example. For example, the distance 16 is 8 μm . This corresponds to a distance of two ceramic grains, in particular of
10 two ZnO-Pr grains. This is also referred to as a single grain boundary design since only one grain boundary is located between the first floating inner electrode 4a and the lower side 12 of the basic body 21 of the ESD protection component 3. Depending on the desired
15 voltage range, the distance can also be greater than two ceramic grains, for example ten ceramic grains.

By virtue of the single grain boundary design, an ultrathin design of the ESD protection component 3 can
20 be realized. The physical height 15 of the ESD protection component 3 is preferably 50 μm to 150 μm , particularly preferably 70 μm to 100 μm , including the BGA termination 22. For example, the physical height 15 of the ESD protection component 3, including the BGA
25 termination, is 80 μm .

An active volume of the ESD protection component 3 is located between the first floating inner electrode 4a and the lower side 12 of the basic body 21 of the ESD
30 protection component 3. The active volume is critical for the functionality of the ESD protection component 3. The distance 16 between the first floating inner electrode 4a and the lower side 12 in combination with the properties of the ceramic material used determines,
35 critically, the breakdown voltage of the ESD protection component. A distance 16 of two ceramic grains corresponds to a breakdown voltage of between 7 and 8 V, for example. For example, a distance 16 of two

ZnO-Pr grains corresponds to a breakdown voltage of 7.2 V. When the breakdown voltage is reached, the resistance of the ESD protection component 3 preferably decreases, with the result that, for example, an overcurrent occurring can be dissipated via the ESD protection component 3.

The ceramic material arranged over the first floating inner electrode 4a and the upper, second floating inner electrode 4b preferably merely serve to provide the symmetry of the component. As a result of this symmetrical formation of the ESD protection component 3, it is preferably the case that the ESD protection component 3 warps less during sintering than in the case of an asymmetrical formation and that the mechanical stability of the ESD protection component 3 is increased. The region which is located above the first floating inner electrode 4a preferably does not have any ESD functionality or only a low level of ESD functionality in the ESD protection component 3.

The carrier 1 comprises, for example, a ceramic material or consists of a ceramic material. For example, the carrier 1 comprises aluminum oxide or aluminum nitride or consists of aluminum oxide or aluminum nitride. Alternatively, the carrier 1 comprises an organic material or consists of a ceramic material. Preferably, the carrier 1 has a high thermal conductivity. For example, the carrier 1 is in the form of an insulating carrier. For example, at least part of the carrier 1 is insulating. For example, at least part of the carrier 1, which faces the ESD protection component 3, is insulating.

Electrical conductor tracks (not illustrated) for contact-connecting the ESD protection component 3 are arranged on the carrier 1, for example.

Figure 1B shows an enlarged detail of an ESD protection component 3 as shown in figure 1A in a sectional illustration. This detail shows schematically the grain boundaries of the ceramic material. The distance 16 between the lower side 12 of the ESD protection component 3 and the first floating inner electrode 4a is 8 μm , for example. This distance 16 corresponds to the grain size of two ceramic grains. This results in a single grain boundary layer 14 between the lower side 12 and the first floating inner electrode 4a. For example, the ESD protection component 3 can be formed so as to be ultrathin by virtue of the single grain boundary design. In the detail shown, the solder balls which are arranged on the contact area 6b in the case of the BGA termination are not shown.

Figure 2 shows a component 20, wherein an LED 2 and an ESD protection component 3 designed as shown in figure 1 are arranged on a carrier 1. The carrier 1 is also referred to as basic body of the component 20. Owing to the ultrathin design of the ESD protection component 3, no or only little shading of the LED 2 by the ESD protection component 3 occurs. As a result, the LED 2 can also have a flat design, with the result that the physical height of the component 20 can be kept low.

The LED 2 and the ESD protection component 3 are arranged on the carrier 1 in a flipchip design, for example. In the case of the flipchip design, components are mounted directly, without any further connecting wires, on a basic body. This results in small dimensions of the arrangement and short conductor lengths. The LED 2 is in contact with electrical conductor tracks (not illustrated) of the carrier 1, for example, via a metal contact 10. The ESD protection component 3 is soldered to the carrier 1 by means of a

BGA or LGA termination having contact elements 22a, 22b.

5 The carrier 1 preferably comprises a material which has a high thermal conductivity. For example, the carrier 1 comprises a ceramic material, a metallic material or an organic material. For example, the basic body consists of a ceramic material or an organic material. For example, the basic body comprises aluminum oxide or
10 aluminum nitride or consists of aluminum oxide or aluminum nitride. A metal plating 8 is applied to the lower side of the carrier 1. The metal plating 8 serves to electrically connect the component 20.

15 Owing to the thermal conductivity of the carrier 1, heat dissipation from the LED 2 to a housing (not illustrated) can take place. As a result of reduced thermal loading, the life of an LED can be extended. At an operating temperature of an LED which is reduced by
20 20°C, the life of the LED can be increased by a factor of 2, for example.

A protective coating 7 is applied over the LED 2 and the ESD protection component 3.

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Figure 3 shows a similar arrangement to that shown in figure 2 of an LED 2 and an ESD protection component 3 with a formation as shown in figure 1 on a carrier 1. In addition, in the exemplary embodiment shown in
30 figure 3, thermal vias 9 are arranged in the carrier 1. For example, a plurality of, for example, three, thermal vias are arranged in the carrier 1. The thermal vias 9 lead from the LED 2 to the metal plating 8 applied to the lower side of the carrier 1. The thermal
35 vias 9 comprise, for example, silver, copper or silver palladium or consist of silver, copper or silver palladium. By virtue of the use of these thermal vias

9, better heat dissipation from the LED 2 to a housing can be achieved.

Figure 4 shows a further exemplary embodiment of a component 20, wherein an LED 2, an ESD protection component 3 and a plurality of thermal vias 9 are arranged similar to the manner described in figure 3. In addition, a thermal sensor 11 is arranged on the carrier 1. The thermal sensor 11 is in the form of an NTC element, for example, i.e. it conducts current better at high temperatures than at low temperatures. The thermal sensor 11 is preferably used for regulating the control current, with the result that the LED is not subject to any current surges. Prior to being switched on, said thermal sensor is cold and therefore conducts poorly and reduces the inrush current. Once it has been switched on, it is heated by the current flow and loses its high initial resistance.

In addition or as an alternative, an overcurrent protection means can be arranged on the carrier 1 (not illustrated). The overcurrent protection means is in the form of a PTC element, for example, i.e. it conducts current better at low temperatures than at high temperatures. A protective coating 7 is applied over the components.

Figure 5 shows an exemplary embodiment of a component 20, wherein an LED 2, an ESD protection component 3 and a thermal sensor 11 are arranged on a carrier 1. The carrier 1 is also referred to as the basic body of the component 20. The thermal sensor 11 is in the form of an NTC element, for example.

The basic body 1 comprises, for example, a metallic material. The carrier 1 is coated with an electrically insulating layer 13 on a side which faces the LED 2 and the ESD protection component 3. Therefore, the carrier

1 can be considered to be an insulating basic body. The carrier 1 comprises aluminum or copper, for example. The electrically insulating layer 13 comprises a ceramic insulation layer, for example, or consists of a ceramic insulation layer. The electrically insulating layer 13 comprises aluminum oxide or aluminum nitride, for example, or consists of aluminum oxide or aluminum nitride. Preferably, electrical conductor tracks (not illustrated) for contact-connecting the components of the LED 2, of the ESD protection component 3 and the thermal sensor 11 are arranged on the electrically insulating layer 13. Preferably, heat can be dissipated from the components to a housing particularly well via a metallic part of the carrier 1.

In addition or as an alternative, an overcurrent protection means can be arranged on the carrier 1 (not illustrated). A protective coating 7 is applied over the components.

Figure 6 shows a wafer 18, which is used as substrate for producing electronic component parts. The wafer 18 shown in figure 6 is used for producing ESD protection components. A plurality of ESD protection components can be produced from one wafer. The ESD protection components are formed as shown in figure 1, for example. In this case, contact areas 6a, 6b are applied to the wafer 18 at uniform distances in the manner of a chessboard. The contact areas 6a, 6b are applied, for example, by means of masking technology or stencil printing.

In the case of a BGA termination, solder balls are applied to the contact areas 6a, 6b. In the case of an LGA termination, solder balls are applied to the carrier preferably prior to soldering. The solder balls are, for example, between 100 nm and 200 μ m high. For

example, ESD protection components as shown in figure 1 are produced from the wafer 18.

Reference symbols

	1	Carrier
	2	LED
5	3	ESD
	4a	First floating inner electrode
	4b	Second floating inner electrode
	5	Solder layer
	6a	Contact area
10	6b	Contact area
	7	Protective coating
	8	Metal plating
	9	Thermal vias
	10	Metal contact
15	11	Thermal sensor
	12	Lower side of ESD protection component
	13	Electrically insulating layer
	14	Single grain boundary layer
	15	Physical height of ESD protection component with
20		contact connection 6a, 6b
	16	Distance between a lower side 12 of the ESD
		protection component and first floating inner
		electrode 4a
	17	Solder body
25	18	Wafer
	19	Width of a contact connection 6a, 6b
	20	Component
	21	Basic body of ESD protection component
	22	BGA termination
30	22a	Contact element
	22b	Contact element

Patent claims

1. An ESD protection component (3), comprising a basic body (21) with a lower side (12), wherein the
5 basic body (21) comprises a ceramic material, and at least one floating inner electrode (4a), wherein a distance (16) between the lower side (12) and the floating inner electrode (4a) is two to 100 ceramic grains.
- 10 2. The ESD protection component according to claim 1, in which the distance (16) is two ceramic grains.
3. The ESD protection component according to either
15 of claims 1 and 2, comprising a BGA or LGA termination (22).
4. An ESD protection component (3), comprising a ceramic material and a BGA or LGA termination (22).
- 20 5. The ESD protection component according to claim 4, having at least one floating inner electrode (4a).
6. The ESD protection component according to claim 5,
25 having a basic body (21) with a lower side (12), wherein a distance (16) between the lower side (12) and the floating inner electrode (4a) is two to 100 ceramic grains.
- 30 7. The ESD protection component according to one of the preceding claims, comprising a second floating inner electrode (4b), wherein a distance between the first floating inner electrode (4a) and the second floating inner electrode (4b) is greater than the
35 distance (16) between the first floating inner electrode (4a) and the lower side (12) of the basic body (21).

8. The ESD protection component according to one of the preceding claims, having a contact connection for electrically contact-connecting the basic body (21), wherein the contact connection is arranged on the lower side (12) of the basic body (21).

9. The ESD protection component according to one of the preceding claims, wherein the basic body (21) is formed symmetrically with respect to a plane which runs parallel to the lower side (12) of the basic body (21).

10. An ESD protection component, comprising a basic body (21) with a lower side (12), a first floating inner electrode (4a) and, adjacent to this, a second floating inner electrode (4b), wherein the distance between the first floating inner electrode (4a) and the second floating inner electrode (4b) is greater than the distance (16) between the first floating inner electrode (4a) and the lower side (12) of the basic body (21), and wherein a contact connection is arranged on the lower side (12) of the basic body (21).

11. The ESD protection component according to one of the preceding claims, in which the ceramic material comprises a ZnO-Bi-Sb material or ZnO-Pr material or consists of a ZnO-Bi-Sb material or ZnO-Pr material.

12. A component (20) comprising a carrier (1), on which an LED (2) and an ESD protection component (3) are arranged, wherein the ESD protection component (3) is designed according to one of claims 1 to 11.

13. The component according to claim 12, in which the carrier (1) comprises a ceramic material or an organic material or consists of a ceramic material or an organic material.

14. The component according to either of claims 12 and 13, in which the carrier (1) has at least one thermal via, which runs perpendicular to a surface and improves the thermal conductivity of the LED (2) to a housing.

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15. The component according to one of claims 12 to 14, in which the carrier (1) comprises a metal, wherein the metal is coated with an electrically insulating layer (13).