(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 098 547 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
09.05.2001 Bulletin 2001/19

(51) Int Cl.[7]: **H04R 1/08**

(21) Application number: **00309481.0**

(22) Date of filing: **27.10.2000**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **27.10.1999 JP 81699999 U**

(71) Applicants:
- **Phone-Or Ltd**
  Or-Yehudah 60252 (IL)
- **Nippon Ceramic Co., Ltd.**
  Tottori-shi, Tottori 680-0862 (JP)

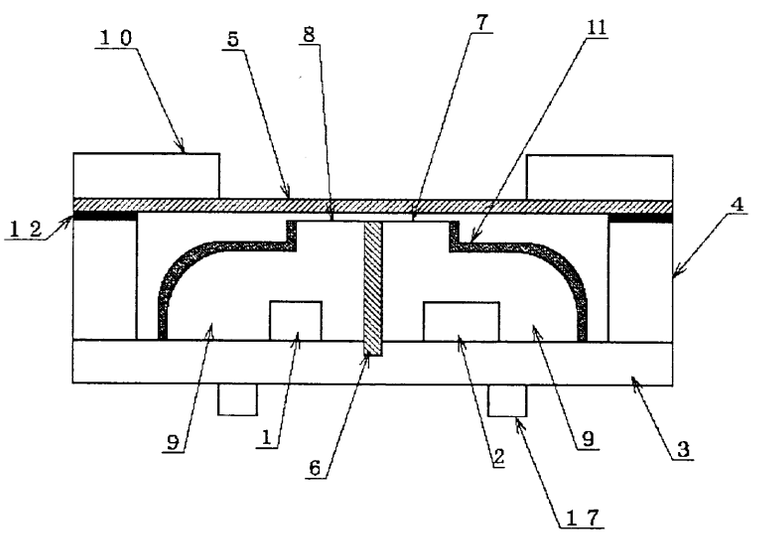
(72) Inventors:
- **Paritsky, Alexander**
  Or-Yehuda 60252 (IS)
- **Kots, Alexander**
  Or-Yehuda 60252 (IS)

(74) Representative: **Pratt, David Martin**
Withers & Rogers,
Goldings House,
2 Hays Lane
London SE1 2HW (GB)

(54) Microphone

(57) There is provided a microphone which does not require a capsule and is made small, and whose production cost is reduced. There is also provided a microphone utilizing optical signals for surface mounting, in which the light emission element and the light-receiving element are hardly broken due to the heat at the time of soldering. Specifically, a membrane frame and a membrane support disposed on a substrate are bonded, the membrane support and a sidewall of the membrane frame are designated as a microphone sidewall, and an upper face of the membrane frame is designated as a microphone top plate. Diameter of the substrate is made larger than that of the membrane support, and a soldering terminal on the substrate is disposed between the membrane support and the substrate end face.

Fig.1



EP 1 098 547 A2

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The microphone of the present invention is applied to a field of small type microphones used for car telephones, mobile phones or the like, and a field of intruder detection utilizing a pressure change due to the intruder.

2. Description of the Related Art

[0002] A microphone utilizing optical signals is constructed such that, as shown in FIG. 3, a light emission element 51 and a light-receiving element 52 mounted on a substrate 53 are sealed with a transparent resin 59, and an optically nontransparent film 56 is disposed between the light emission element and the light-receiving element within the sealed portion. An optically nontransparent film 61 is formed in an area other than an area serving as a light exit 58 and a light entrance 57 on the outer surface of the transparent resin-sealing portion. Above the light exit and the light entrance, a photoreflective membrane 55 that vibrates due to sound, pressure or the like is held by a membrane support 54. The light from the light emission element 51 is emitted via the light exit 58, and reaches the light-receiving element 52 via the light entrance 57.

[0003] The sealing portion other than the light exit and the light entrance has a low height, so that the vibration of the membrane is not disturbed due to the air viscosity. When the membrane position is shifted due to the vibration, the reflection position also moves, the output of the light-receiving element is changed. Sound, pressure or the like is detected by reading this output. This is the principle of the microphone utilizing optical signals.

[0004] The membrane support 54 is disposed on the substrate 53, and the membrane 55 is held by the membrane frame 60 by a method such as bonding. The height of the membrane support is set to the same height as that of the light exit 58 and the light entrance 57. A spacer 64 is disposed between the membrane frame 60 and the membrane support 54, so that the space between the membrane 55 and the light exit 58 or the light entrance 57 becomes constant. The substrate 53 on which these membrane frame 60, spacer 64 and membrane support 54 are disposed is housed in a capsule 65 having a hole on its top panel, by bending an end portion of a side wall of the capsule, to thereby form a microphone. Microphone input/output terminals are provided on a face of the substrate 53 opposite to the face on which the light emission element and the light-receiving element are mounted. The above-described shape is adopted also for surface mounting applications.

[0005] With the related art, there is a drawback in that the size of the microphone becomes large due to the thickness of the capsule top panel and the sidewall. Moreover, in the case of the surface mounting applications, since the distance between the soldering terminals, serving as the microphone input/output terminals, and the light emission element and the light-receiving element are close, there is a drawback in that these elements may be broken due to the heat at the time of soldering.

SUMMARY OF THE INVENTION

[0006] With the present invention, the membrane frame and the membrane support are bonded, the membrane support and the sidewall of the membrane frame are designated as the microphone sidewall, and the upper face of the membrane frame is designated as the microphone top plate.

[0007] In another embodiment of the present invention, the circumference of the substrate is made larger than the circumference of the membrane support, and a soldering terminal for the microphone input/output terminal is disposed on the substrate between the membrane support and the substrate end face.

[0008] Moreover, the membrane frame and the membrane support are bonded, the membrane support and the sidewall of the membrane frame are designated as the microphone sidewall, the upper face of the membrane frame is designated as the microphone top plate, the circumference of the substrate is made larger than the circumference of the membrane support, and a soldering terminal is disposed on the substrate between the membrane support and the substrate end face.

BRIEF DESCRIPTION OF DRAWINGS

[0009] FIG. 1 shows an embodiment of a microphone utilizing optical signals in the present invention.

[0010] FIG. 2 shows another embodiment of a microphone utilizing optical signals for surface mounting in the present invention.

[0011] FIG. 3 shows a conventional microphone utilizing optical signals.

[0012] In these figures, reference symbol 1 denotes a light emission element, 2 denotes a light-receiving element, 3 denotes a substrate, 4 denotes a membrane support, 5 denotes a membrane, 6 denotes an optically nontransparent substance, 7 denotes a light entrance, 8 denotes a light exit, 9 denotes a transparent resin, 10 denotes a membrane frame, 11 denotes an optically nontransparent film, 12 denotes an adhesive layer, 13 denotes a soldering terminal, and 17 denotes an input/output terminal.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] FIG. 1 shows an embodiment of a microphone

utilizing optical signals in the present invention. The microphone utilizing optical signals is constructed such that a light emission element 1 and a light-receiving element 2 mounted on a substrate 3 are sealed with a transparent resin 9, and an optically nontransparent film 6 is disposed between the light emission element and the light-receiving element within the sealed portion. An optically nontransparent film 11 is formed in an area other than the area serving as a light exit 8 and a light entrance 7 on the outer surface of the transparent resin-sealing portion. Above the light exit and the light entrance, a photo-reflective membrane 5 which vibrates due to sound, pressure or the like is held by a membrane support 4. The light from the light emission element 1 is emitted via the light exit 8, and reaches the light-receiving element 2 via the light entrance 7.

[0014] The sealing portion other than the light exit and the light entrance has a low height, so that the vibration of the membrane is not disturbed due to the air viscosity. When the membrane position is shifted due to the vibration, the reflection position also moves, to thereby change the output of the light-receiving element. Sound, pressure or the like is detected by reading this output.

[0015] The membrane support 4 is disposed on the substrate 3, and the membrane 5 is held by a membrane frame 10 by a method such as bonding. A microphone input/output terminal 17 is provided on a face of the substrate 3 opposite to the face on which the light emission element and the light-receiving element are mounted.

[0016] Moreover, the membrane frame 10 and the membrane support 4 are bonded by an adhesive such as epoxy. The thickness of this adhesive layer 12 is controlled by a viscosity of the adhesive and a bonding pressure. As a result, the membrane support 4 and the sidewall of the membrane frame 10 serve as a microphone sidewall. Also, the upper face of the membrane frame 10 serves as a microphone top plate.

[0017] In an embodiment of the present invention, the thickness of the substrate 3 becomes 0.25 mm if an equivalent to the alumina substrate in a commercially available LED chip is used. The height from the substrate 3 to the light exit 8 and the light entrance 7 requires 0.6 mm due to the height of the light-receiving element and the light emission element and the height of bonding wire. The height of the membrane support 4 is the same as that of the light exit and the light entrance, and hence it is 0.6 mm. The thickness of the adhesive layer 12 is 0.03 mm, which is the same as the thickness of the spacer. Also 0.3 mm is required for the thickness of the membrane frame 10. Accordingly, a microphone having a total thickness of 1.18 mm can be produced according to the present invention.

[0018] The capsule conventionally used has an outer diameter of 6.0 mm, a top plate thickness of 0.3 mm, and a sidewall thickness of 0.2 mm. The membrane frame or the like housed in the capsule is set to have a diameter of 5.5 mm or less, taking assembly margin into consideration. As a result, miniaturization can be contemplated according to the present invention, such as, in the thickness direction, 0.3 mm in the thickness of the capsule top plate, and 0.2 mm in the thickness of the sidewall end portion, in total 0.5 mm, and 0.5 mm in the diametral direction.

[0019] FIG. 2 shows another embodiment of a microphone utilizing optical signals for surface mounting in the present invention. In this embodiment, the diameter of the substrate 23 is made larger than that of the membrane support 4, and a soldering terminal 13 is disposed on a substrate 23 between the membrane support and the substrate end face. Moreover, the membrane support 4 and the membrane frame 10 are bonded, the membrane support 4 and the sidewall of the membrane frame 10 are designated as the microphone sidewall, and the upper face of the membrane frame 10 is designated as the microphone top plate. As a result, a microphone utilizing optical signals for surface mounting can be obtained, wherein the distance between the soldering terminal 13 and the light emission element 1 or the light-receiving element 2 is larger than that in the conventional case.

[0020] According to the present invention, the capsule is not necessary, to thereby make the microphone small, and also the initial investment cost such as for materials of the capsule portion and mold or the like is not required, thereby enabling cost reduction.

[0021] Furthermore, there can be obtained a microphone utilizing optical signals for surface mounting in which the light emission element and the light-receiving element are hardly broken due to the heat at the time of soldering.

Claims

1. A microphone utilizing optical signals, having a light emission element, a light-receiving element, a substrate for mounting these elements, a membrane support disposed on the substrate, and a membrane held by a membrane frame;

   wherein said membrane frame and said membrane support are bonded, said membrane support and a sidewall of said membrane frame are designated as a microphone sidewall, and an upper face of said membrane frame is designated as a microphone top plate.

2. A microphone utilizing optical signals, having a light emission element, a light-receiving element, a substrate for mounting these elements, a membrane support disposed on the substrate, and a membrane held by a membrane frame;

   wherein circumference of the substrate is made larger than the circumference of the membrane support, and a soldering terminal on the substrate is disposed in an area between the membrane support and the substrate end face.

3. A microphone utilizing optical signals, having a light emission element, a light-receiving element, a substrate for mounting these elements, a membrane support disposed on the substrate, and a membrane held by a membrane frame;

wherein the membrane support and the membrane frame are bonded, said membrane support and a sidewall of said membrane frame are designated as a microphone sidewall, and an upper face of said membrane frame is designated as a microphone top plate; and

wherein circumference of the substrate is made larger than the circumference of the membrane support, and a soldering terminal on the substrate is disposed in an area between the membrane support and the substrate end face.

Fig.1

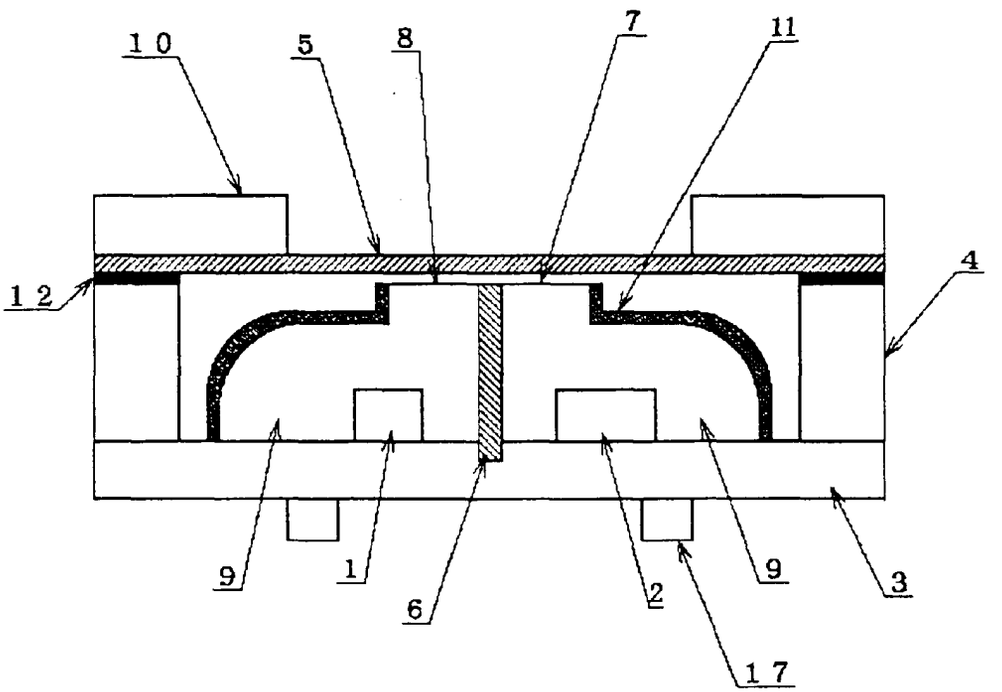


fig.2

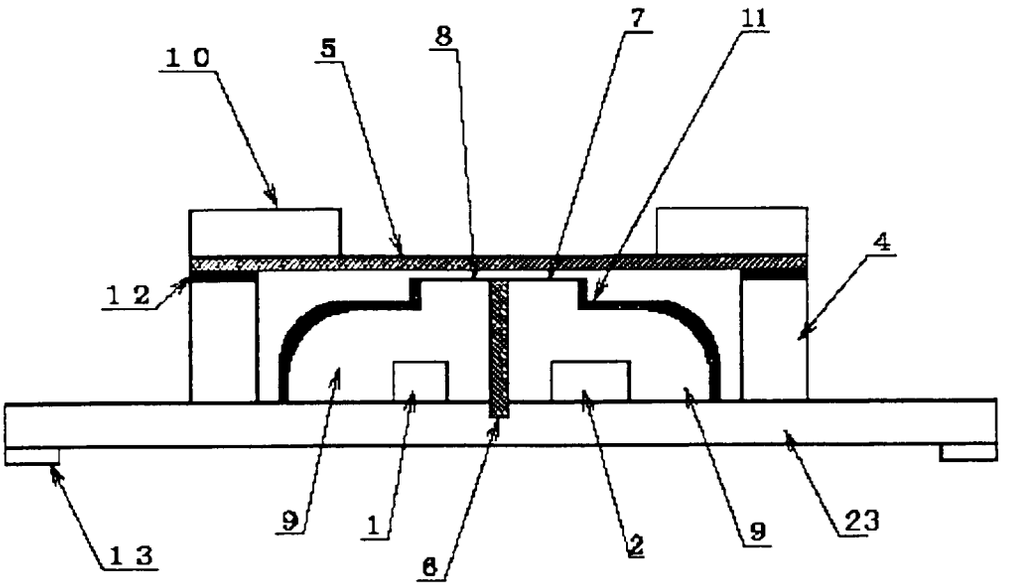


fig.3