

Description

This invention relates to a surface mountable electrical device comprising an electrical component having a plurality of contacts. It also relates to a method of making a plurality of such devices in the form of capacitors by processing a length of capacitive structure.

Surface mounted electrical components are rapidly gaining acceptance in industry. It has been estimated that nearly one half of all electrical and electronic components may be directly surface mounted to a circuit substrate by the year 1990. Consequently, the use of lead wires with such electronic and electrical components and through holes in circuit substrates will be sharply reduced in their usage.

Presently, ceramic chip capacitors are the most commonly used surface mounted capacitors because such ceramic chip capacitors tolerate the high temperature exposure required for reflow or wave soldering manufacturing techniques, for attachment of components to circuit substrates. Metallized film capacitors and film foil capacitors have been used very little in surface mounted applications because of the high cost and greater size required to thermally protect the metallized film from such high temperature soldering techniques than attend the use of ceramic chip capacitors for similar applications.

For example, polyester film melts at about 252°C. However, for an electronic part such as a capacitor, to survive wave soldering, it must withstand temperatures as high as 260°C for a period of up to ten seconds without suffering degradation in its physical or electrical properties.

One attempt to provide a leadless, surface mountable electrical component of a capacitor type has been to attach flat leads to a film capacitor section to form a capacitor assembly, which assembly is then insert moulded to provide a moulded package with the flat leads formed to lie adjacent the package and accessible for electrical connection. Such a package can be made capable of withstanding the thermal exposure of wave soldering or other soldering techniques sufficiently to protect its encased capacitor section. Such packages, however, are significantly more expensive than a comparable box-type capacitor where a capacitor is inserted in a plastic box and sealed in that box with such material as epoxy with leads protruding from the interior of the epoxy sealed box for electrical connection within a circuit. Thus, in view of the greater expense of the insert molded package flat lead structure described above, film capacitors (i.e. metallized film and film foil capacitors) are penalized because the economics of production costs bias industry towards ceramics and away from film capacitors for surface mountable applications.

Such economic bias is unfortunate because film capacitors, such as polyester metallized film capacitors, exhibit improved performance characteristics over many ceramic types of capacitors.

Improved self healing characteristics and a higher production yield with attendant lower cost to manufacture while more consistently meeting tight specifications are but two of the improved performance characteristics of metallized film capacitors over ceramic capacitors.

It would be advantageous for circuit designers to have metallized film capacitors available for surface mounting applications, but to justify a manufacturer's equipping his plant for production of such capacitors, it is economically necessary for them to be of smaller size and of lower cost of manufacture than are obtainable with existing devices and methods to promote sufficient usage of film capacitors in surface mounted devices.

According to one aspect of the present invention, a surface mountable electrical device as initially described is characterised by a plurality of layers of thermally insulative material covering the electrical component, access means affording electrical access to each of the contacts while impeding thermal access to the contact, and discrete electrically conductive means associated with each of the access means for increasing the electrical contact area of each of the access means.

The invention also consists in a method of processing a length of capacitive structure to make a plurality of surface mountable electrical devices in the form of capacitors in accordance with the invention just described, the length of capacitive structure having first and second electrical contact areas extending along it, the method comprising the steps of:

delineating a plurality of boundaries across said length of capacitive structure to define dimensional limits for each of said plurality of capacitors;

applying at least one layer of thermally and electrically insulative material to said length of capacitive structure, said at least one layer covering at least a substantial portion of the length of the capacitive structure;

forming a plurality of electrical access means alternately arranged with said plurality of boundaries for accommodating electrical access while restricting thermal access to said first and second electrical contact areas through said at least one layer;

establishing a plurality of electrical contact means to said length of capacitive structure for providing an expanded area of electrical contact with said first and second electrical contact areas through said plurality of access means;

severing said length of capacitive structure at each of said plurality of boundaries to form said plurality of capacitors; and

applying at least one additional layer of thermally and electrically insulative material to each of said plurality of capacitors, said at least one additional layer covering at least all portions of each of said plurality of capacitors not previously covered and leaving at least a portion of each of said plurality of electrical contact means exposed.

In a preferred embodiment of the invention, the at least one layer of thermally insulative material comprises at least one wrap of thermally insulative tape. In an alternative embodiment, the at least one layer of thermally insulative material is comprised of conformal coating material.

Whatever the material of the thermally insulative at least one layer covering all sides of the capacitor, the preferred embodiment of the invention further includes at least two strata of material forming the discrete electrically conductive means. The first of these strata is of highly electrically conductive and moderately thermally insulative material adjacent the at least one thermally insulative layer surrounding the capacitor. The second stratum is of moderately electrically conductive material and highly thermally insulative material adjacent the first stratum.

In the preferred embodiment of the present invention, there can be, additionally, a barrier layer among the layers of thermally insulative material, which barrier layer is comprised of material having a high heat of fusion. One example of such a material is porous paper impregnated with a microcrystalline wax material.

Devices incorporating all the preferred features of the invention are capable of being manufactured by highly automated processes economic in scale and yet they provide satisfactory electrical performance. The devices may also be made physically small in size in order that they may occupy a small area on a circuit substrate when mounted thereon. Still more importantly, they are capable of withstanding the heat of such manufacturing processes as reflow or wave soldering without suffering degradation of their electrical or physical properties.

Examples of devices and of methods in accordance with the invention will now be further described with reference to the accompanying drawings, in which:—

Fig. 1 illustrates, in perspective view, a length of capacitive structure suitable for subsequent processing to form individual surface mountable capacitors;

Fig. 2 illustrates a preferred embodiment of the application of thermally insulative material to a length of the capacitive structure;

Fig. 3 illustrates an alternative embodiment of the application of thermally insulative material to a length of the capacitive structure;

Fig. 4 illustrates in cross sectional view, another alternative embodiment of the application of thermally insulative material to the length of capacitive structure;

Fig. 5 illustrates a length of capacitive structure with boundaries for delineation of individual capacitors established and electrical access passages formed along the length of capacitive structure;

Fig. 6 illustrates a preferred method of forming electrical access passages along the length of capacitive structure;

Fig. 7 illustrates the application of electrical contact pads to a plurality of lengths of capacitive structure with thermally insulative material applied thereto and electrical access passages formed therein;

Fig. 8 illustrates an individual capacitor formed from a length of capacitive structure with electrical contact pads applied and before final application of thermally insulative material;

Fig. 9 illustrates application of thermally insulative material to an individual capacitor such as that shown in Fig. 8 to form a finished capacitor configured for leadless attachment within electrical circuitry.

Fig. 10 illustrates employment of a capacitor of the present invention employed within electrical circuitry by leadless attachment therein.

Fig. 11 illustrates, in a partial cut away view, the preferred embodiment of the completed capacitor of the present invention.

Referring to Fig. 1, a length of capacitive structure 10 suitable for subsequent processing as will be hereinafter described in detail to form individual capacitors configured for leadless attachment in electrical circuitry is shown. The length of capacitive structure 10 is a plurality of parallel capacitive plates 12, a first electrical contact 14 and a second electrical contact 16.

Fig. 2 illustrates the preferred embodiment of application of thermally insulative material 18, such as thermally insulative tape, to the length of capacitive structure 10 in a manner whereby the top 20 and the bottom 22 of the capacitive structure 10 as well as first and second electrical contacts 14, 16 are covered by the thermally insulative material 18.

For ease of understanding the invention of this application, similar elements will be identified by similar reference numerals in the various drawings. Similar, yet slightly different, elements will be given similar reference numerals with subscripts to further enhance understanding of the invention.

Fig. 3 illustrates an alternate embodiment of the application of a thermally insulative material 18a to a length of capacitive structure 10 such that the thermally insulative material 18a, which may also be a thermally insulative tape, covers the top 20, the bottom 22, and the first and second electrical contacts 14 and 16.

Referring to Fig. 4, a cross sectional view of a length of capacitive structure 10 is shown with yet another alternate embodiment of the application of thermally insulative material 18b in a manner similar to the application illustrated in Fig. 3. However, in the application illustrated in Fig. 4, the thermally insulative material 18b, rather than meeting in a butt seam 24, as illustrated in Fig. 3, overlaps at the top 20 of the length of capacitive structure such that a first tail 26 underlies a second tail 28 of the thermally insulative material 18c.

Other common wrapping techniques would be equally applicable to this invention for the application of thermally insulative material.

Referring to Fig. 5, a length of capacitive structure 10 is illustrated with a thermally insulative material 18 applied thereto. A boundary 30 is shown in phantom in Fig. 5 illustrating establishment of a physical limit of an individual capacitor to be formed from the length of capacitive structure 10 as shall be discussed in greater detail hereinafter. Similar boundaries 30 (not shown) are established at similar intervals along the length of capacitive structure 10 in order to delineate a plurality of capacitors to be formed from the length of capacitive structure 10. Alternating with the boundaries 30 are a plurality of electrical access passages 32 providing electrical access through the thermally insulative layer 18 to the first electrical contact 14 of the length of capacitive structure 10. Similarly, on the opposite edge of the length of capacitive structure 10 there are formed a plurality of electrical access passages 34 alternating with the boundaries 30 to provide electrical access through the thermally insulative layer 18 to the second electrical contact 16 of the length of capacitive structure 10. Thus, when the length of capacitive structure 10 is severed along the plurality of boundaries 30, a plurality of capacitors is formed, each which capacitors has formed therein electrical access passages 32 and 34 to provide electrical access to its respective first electrical contact 14 and second electrical contact 16 from without the thermally insulative layer 18.

Fig. 6 illustrates, in sectional view, the preferred method for forming electrical access passages 32 and 34 in the length of capacitive structure 10. In Fig. 6 a saw 36 is applied to the length of capacitive structure 10 at a position where it is desired to form an electrical passage 34. In this preferred embodiment, the saw 36 is rotated in a direction 38 about an axis of rotation 40 and the electrical access passage 34 is formed traversing the thermally insulative layer 18, entering the second electrical contact 16, and stopping short of the capacitive plates 12 of the length of capacitive structure 10. The physical dimensions of the electrical access passages 32 and 34 are established to allow substantially free electrical communication to the first and second electrical contacts 14 and 16 of the length of capacitive structure 10 while substantially restricting thermal communication therethrough from without the thermally insulative layer 18.

Following the formation of electrical access passages 32 and 34 as discussed with respect to Figs. 5 and 6, and before severing the length of capacitive structure 10 along boundaries 30 to form individual capacitors, a plurality of lengths of capacitive structure 10 are compressed by force "F" within a fixture 42 and electrical contact pads are applied to edges 44 and 46 preferably, as shown in Fig. 7, by spraying electrically conductive material 48 from a spraying device 50, which spraying device 50 is maneuverable to ensure even distribution of the electrically conductive material 48 across all edges 44 and 46 of the plurality of lengths of capacitive structure 10. The plurality of lengths of capacitive structure 10 are

separated while being held within the fixture 42 by separator strips 52 to facilitate separation of the plurality of lengths of capacitive structure 10 upon completion of application of the electrically conductive material 48.

Following the application of electrically conductive material 48, as described above with respect to Fig. 7, the lengths of capacitive structure 10 are severed along boundaries 30 (described with respect to Fig. 5) to form a plurality of capacitive units 53, such as shown in Fig. 8. Each capacitive unit 53, it should be noted, has its capacitive plates 12 exposed. Further, each capacitive unit 53 has formed thereon electrical contact pads 54 and 56 associated respectively with first electrical contact 14 and second electrical contact 16. Each electrical contact pad 54, 56 fills and extends beyond its respective electrical access passage 32, 34 (not visible in Fig. 8) to increase electrical contact area for the first electrical contact 14 and second electrical contact 16 accessible from without the layer of thermally insulative material 18.

Referring to Fig. 9, the final step of fabrication of an individual capacitor 58 is illustrated. The individual capacitor 58 has applied thereto an additional application of thermally insulative material 60, shown in Fig. 9 in its preferred embodiment as thermally insulative tape. The thermally insulative tape 60 is so applied as to complete thermal protection of the capacitive unit 52, covering the capacitive plates 12 (not visible in Fig. 9) yet leaving exposed electrical contact pads 54 and 56.

Thus, as illustrated in Fig. 10, the capacitor 58 may be held in place for handling and processing upon a circuit substrate 62 and across circuit elements 66 and 68 by adhesive material 64. The circuit substrate 62 with the capacitor 58 attached thereto by adhesive material 64 is then subjected to a soldering process, such as wave soldering or reflow soldering, so that the solder material adheres to electrical contact pad 54 and circuit element 66 to complete a circuit and a physical joint therebetween while also adhering to electrical contact pad 56 and circuit element 68 to provide an electrical and physical joint therebetween as well.

Such surface mounting applications, as discussed hereinbefore, are particularly advantageous and desirable in industry and it is for these particular applications that the invention of the present application is specifically designed.

Referring to Fig. 11, a partial cut away view of a finished capacitor according to the preferred embodiment of the present invention is shown.

In the finished capacitor 70 of Fig. 11, the plurality of parallel capacitive plates 12 and the first electrical contact 14 exposed in Fig. 11 are seen to be wrapped with thermally insulative material 18 in a manner consistent with Figs. 2, 3, or 4 as hereinbefore discussed.

The electrical access passage 32 is shown in exaggerated proportions in Fig. 11 to facilitate illustration of exposure of first electrical contact 14 within the electrical access passage 32.

Electrical contact pad 54 is shown in Fig. 11 as

comprising a first stratum 72 and a second stratum 74. The first stratum 72 is adjacent and adheres to the thermally insulative material 18 and fills and extends beyond electrical access passage 32 to increase the electrical contact area for the first electrical contact 14 accessible from without the layer of thermally insulative material 18 through the electrical access passage 32.

The second stratum 74, which second stratum would be applied by a second application of material as described with respect to Fig. 7, is applied to the first stratum 72.

In the preferred embodiment illustrated in Fig. 11, the first stratum 72 would be comprised of highly electrically conductive and highly thermally conductive material, and the second stratum 74 would be comprised of material which is moderately electrically conductive and moderately thermally insulative in its properties.

In the preferred embodiment of Fig. 11, the thermally insulative layer 18 is preferably comprised of porous paper, which porous paper is to be later impregnated during processing with a material having a high heat of fusion such as microcrystalline wax material, for purposes hereinafter described in more detail. A first transverse thermally insulative layer 76 is also comprised of porous paper for similar impregnation during later processing. The second transverse thermally insulative layer 78 is preferably comprised of thermally insulative tape or a thermally insulative conformal coating. The third transverse thermally insulative layer 80 is, likewise, preferably comprised of thermally insulative tape or thermally insulative conformal coating material.

The thermally insulative layers 18 and 76 comprise barrier layers since, during processing of the capacitor to be hereinafter described in detail, they are impregnated with a material having a high heat of fusion, such as microcrystalline wax material.

Thus, the thermally insulative layers 78 and 80 are wrapped transversely about the capacitive unit 53, as described in Figs. 8 and 9, to impede the rate of heat flow to the capacitive unit 53.

Heat flow, generally, follows the linear relationship:

$$\frac{Q}{t} = \frac{KA\Delta T}{d}$$

where:

Q equals amount of heat

t equals time

K equals thermal conductivity coefficient

A equals cross-sectional area perpendicular to the heat flow direction

d equals length of the heat flow path

ΔT equals temperature difference across the length d

Q/t is the power which is being conducted into the capacitor. The film thickness d, should be small to keep the capacitor size as small as possible. The cross-section, A, is determined by

the capacitor size and shape. ΔT is determined by the soldering process temperature. K is a constant which is dependent upon materials used.

It can be seen that the maintenance of a small cross-sectional area, A, in electrical access passages 32 and 34 (Fig. 5) serves to minimize the thermal conductive path by minimizing A in the linear relationship cited above.

Rather than rely solely upon impeding thermal conductivity to limit the thermal power conducted into a capacitor during high temperature processes of circuit assembly, such as wave soldering, a further principle involving the heat of fusion of a covering material is also employed by the preferred embodiment of the present invention. Specifically, barrier layers 18 and 76 in Fig. 11 are comprised of porous paper which, during processing, is impregnated with a microcrystalline wax material having a high heat of fusion.

Thus, during soldering operations, heat may be conducted through the thermally insulative layers 78 and 80 to barrier layers 76 and 18. Having a high heat of fusion, the microcrystalline wax material which impregnates barrier layers 76 and 18 changes state from a solid to a liquid at a temperature below the temperature which will damage the capacitor plates 12 for short time thermal exposure. For example, for MYLAR® polyester film, a safe short time temperature is 160°C. After the change of state substance is (i.e., the high heat of fusion material) elevated to its melting point, its temperature ceases to rise but remains nearly constant until the substance has absorbed sufficient energy to change its state. A measure of the energy required to melt the change of state material, per unit mass, is the heat of fusion. Therefore, a small mass of material is perceived to have a high thermal capacity as heat is added to take it through its melting point.

For example, the heat required to raise a sheet of KAPTON® film 1 cm² and .012 cm thick from 25°C to 160°C is:

$$\begin{aligned} \text{Heat} &= (\text{thermal capacity})(\text{mass})(\Delta T) \\ &= (.261 \text{ cal/gm}^\circ\text{C}) \times (.012 \text{ cm}^2 \times \\ &\quad 1.42 \text{ gms/cm}^3) \times (135^\circ\text{C}) \\ &= .60 \text{ calories} \end{aligned}$$

And the heat required to raise a sheet of 50% porous paper 1 cm² and .012 cm thick impregnated with microcrystalline wax from 25°C to 160°C is:

$$\begin{aligned} H_1 &= \text{heat to raise paper } 135^\circ\text{C} \\ &= (.65)[(.35)(.012)](135) \\ &= .368 \text{ calories} \end{aligned}$$

Presuming the thickness of the impregnating wax to be one-half the thickness of its host medium (the porous paper):

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$$\begin{aligned}
 H_2 &= \text{heat to raise wax to melting point, } 85^\circ\text{C} \\
 &= (.5)[(.93)(.006)](60) \\
 &= .167 \text{ calories}
 \end{aligned}$$

$$\begin{aligned}
 H_3 &= \text{heat to raise wax from melting point to } 160^\circ\text{C} \\
 &= (.6)[(.74)(.006)](75) \\
 &= .199 \text{ calories}
 \end{aligned}$$

$$\begin{aligned}
 H_4 &= \text{heat required to change state of wax} \\
 &= (.93)(.006)(48) \\
 &= .268 \text{ calories}
 \end{aligned}$$

Total heat = 1.002 calories

Thus, the wax paper requires more heat to raise its temperature to 160°C than an equal thickness of KAPTON®. Assuming the source temperature differential is equal across each of the two example films and equal power (Q/t) is transmitted through each film:

$$\begin{aligned}
 \frac{Q \text{ KAPTON}^\circ}{t \text{ KAPTON}^\circ} &= \frac{Q \text{ waxpaper}}{t \text{ waxpaper}} \\
 \frac{t \text{ waxpaper}}{t \text{ KAPTON}^\circ} &= \frac{Q \text{ waxpaper}}{Q \text{ KAPTON}^\circ} \\
 \frac{t \text{ waxpaper}}{t \text{ KAPTON}^\circ} &= \frac{1.00}{.60} = 1.67
 \end{aligned}$$

Therefore, a simple change of state system, sandwiched between covering of thermally resistive layers 78, 80 and the capacitive unit 53 can significantly increase the time required to raise the capacitive unit 53 to a damaging temperature.

The microcrystalline wax contemplated by the present invention has two additional advantages: (1) when impregnated throughout the capacitive unit 53, it displaces air voids and forms an excellent moisture barrier; and (2) the wax coats the electrical contact pad 54, thereby reducing the rate of oxidation of the electrical contact pad 54 and, consequently, improving its solderability during circuit assembly processing.

The method for processing a length of capacitive structure 10 to form a plurality of capacitors 70 configured for leadless attachment within electrical circuitry involves the steps of measuring the total capacitance of the length of capacitive structure 10 and ascertaining and delineating a plurality of boundaries 30 athwart the length of capacitive structure 10 to define the dimensional limits for each of the plurality of finished capacitors 70. Then there is applied at least one layer of thermally and electrically insulative material 18 to the length of capacitive structure 10, which layer or layers cover at least a substantial portion of the length of capacitive structure 10, including the first and second electrical contacts 14, 16. Next a plurality of electrical access means 32, 34 are formed in an alternately

arranged pattern with respect to the plurality of boundaries 30; the plurality of eligible access means 32, 34, in the preferred embodiment, comprise narrow passages through the at least one layer of thermally and electrically insulative material 18 and expose, respectively, first electrical contact 14 or second electrical contact 16.

Next, electrically conductive material 48 is applied to the edges 44 and 46 of the length of capacitive structure 10 to provide an expanded area of electrical contact with the first and second electrical contacts 14, 16 through the plurality of electrical access means 32, 34. In the preferred embodiment of the present invention, the method includes a second application of electrically conductive material different in its thermal and electrical characteristics from the first application of electrically conductive material 48. The first application of electrically conductive material 48 comprises material having high electrical conductivity and moderate thermal conductivity characteristics. The second application of electrically conductive material 48 comprises material having a relatively lower electrical conductivity and higher thermal conductivity.

Then the length of capacitive structure 10 is severed at each of the plurality of boundaries 30 to form a plurality of capacitive units 53.

Then at least one additional layer of thermally and electrically insulative material 60 is applied to each of the capacitive units 53, which at least one additional layer 60 covers at least all portions of each of the capacitive units 53 not previously covered by the thermally and electrically insulative material 18 and, further, the at least one additional layer leaves at least a portion of each of the electrical contact means 54, 56 exposed and available for electrical connection thereto.

In the preferred embodiment of the present method the first of the at least one layers of thermally insulative material 18 constitutes a barrier layer. The barrier layer 18 is comprised of a porous material, such as paper. Further, in the preferred embodiment of the present method, the first additional layer of thermally and electrically insulative material comprises a barrier layer 76, also comprised of a porous material such as paper. Still further, according to the preferred embodiment of the present method, prior to application of succeeding layers of the at least one additional layer of thermally and electrically insulative material, such as layers 78 and 80 in Fig. 11, the capacitive units 53 are impregnated with a material having a high heat of fusion, such as a microcrystalline wax.

In the preferred embodiment of the present method invention, the layers of electrically and thermally insulative material 18 and the additional layers of electrically and thermally insulative material 60 are comprised of electrically and thermally insulative tape.

In an alternate embodiment of the present invention, some or all of the electrically and thermally insulative layers and the additional electrically and thermally insulative layers, except

for the barrier layers (such as 18 and 76 in Fig. 11) may be comprised of conformal coating material rather than adhesive tape.

Claims

1. A surface mountable electrical device (58, 70) comprising an electrical component (12) having a plurality of contacts (14, 16) characterised by a plurality of layers (18, 18a, 60, 76, 78, 80) of thermally insulative material covering the electrical component (12), access means (32, 34) affording electrical access to each of the contacts (14, 16) while impeding thermal access to the contact, and discrete electrically conductive means (54, 56, 72, 74) associated with each of the access means (32, 34) for increasing the electrical contact area of each of the access means.

2. A device according to claim 1, in which the electrical component is a metallized film capacitor (12) and there are two contacts (14, 16).

3. A device according to claim 1 or claim 2, in which the plurality of layers of thermally insulative material include a first layer (18, 18a) adjacent the electrical component (12), the first layer including a material having a high heat of fusion.

4. A device according to claim 3, in which the plurality of layers of thermally insulative material further includes at least one layer of thermally insulative tape (60, 76).

5. A device according to claim 3 or claim 4, in which the access means comprise narrow passages (32, 34) extending through the first layer of thermally insulative material.

6. A device according to any one of claims 1 to 3, in which the discrete electrically conductive means comprises a plurality of discrete patterns (54, 56, 72, 74) of electrically conductive material applied to a layer (18, 18a) of the thermally insulative material, each of the patterns effecting electrical contact with one of the contacts (14, 16) through its access means and a second layer (60, 80) of thermally insulative material around the component, the second layer (60, 80) leaving the patterns (54, 56, 72, 74) of electrically conductive material at least partially unmasked to enable electrical connection of the component to be made in an electrical circuit by the plurality of patterns.

7. A device according to claim 6, in which the component has an upper face and a lower face, a first end and a second end, and a first edge and a second edge, the contacts being on the edges, the first layer (18, 18a) of insulative material covering at least the upper face, the lower face, and the edges, the access means being configured to restrict thermal communication to the contacts through the first layer of insulative material and the second layer of insulative material (60, 80) covering at least the first end and the second end, and leaving at least a portion of the access means exposed.

3. A device according to claim 1, wherein the access means comprises a notch (32) in the first layer (18) at the first edge and the second edge,

the notches (32) traversing the first layer and exposing the contacts, the conductive means (54) comprising electrically conductive material applied to the first layer at the first edge and at the second edge, the electrically conductive material being electrically connected with the contacts through the notches (32), and the notches (32) being proportioned to enable substantially unrestricted electrical communication to be made therethrough while substantially limiting thermal communication therethrough.

9. A device according to any one of claims 3 to 5, in which the first layer (18) is of thermally insulative tape.

10. A device according to any one of claims 3 to 5, in which the first layer is a thermally resistive conformal coating.

11. A device according to any one of claims 3 to 5, in which each of the discrete electrically conductive means comprises a first stratum (72) of highly electrically conductive and highly thermally conductive material adjacent the first layer (16), and a second stratum (74) adjacent the first stratum of moderately electrically conductive and moderately thermally insulative material.

12. A device according to claim 11, in which the layers of insulative material includes at least one barrier layer of a material having a high heat of fusion.

13. A device according to claim 12, in which the at least one barrier layer is of porous paper impregnated with a microcrystalline wax material.

14. A method of processing a length of capacitive structure to make a plurality of surface mountable electrical devices in the form of capacitors in accordance with claim 1, the length of capacitive structure having first and second electrical contact areas extending along it, the method comprising the steps of:

delineating a plurality of boundaries across said length of capacitive structure to define dimensional limits for each of said plurality of capacitors;

applying at least one layer of thermally and electrically insulative material to said length of capacitive structure, said at least one layer covering at least a substantial portion of the length of the capacitive structure;

forming a plurality of electrical access means alternately arranged with said plurality of boundaries for accommodating electrical access while restricting thermal access to said first and second electrical contact areas through said at least one layer;

establishing a plurality of electrical contact means to said length of capacitive structure for providing an expanded area of electrical contact with said first and second electrical contact areas through said plurality of access means;

severing said length of capacitive structure at each of said plurality of boundaries to form said plurality of capacitors; and

applying at least one additional layer of thermally and electrically insulative material to

for the barrier layers (such as 18 and 76 in Fig. 11) may be comprised of conformal coating material rather than adhesive tape.

Claims

1. A surface mountable electrical device (58, 70) comprising an electrical component (12) having a plurality of contacts (14, 16) characterised by a plurality of layers (18, 18a, 60, 76, 78, 80) of thermally insulative material covering the electrical component (12), access means (32, 34) affording electrical access to each of the contacts (14, 16) while impeding thermal access to the contact, and discrete electrically conductive means (54, 56, 72, 74) associated with each of the access means (32, 34) for increasing the electrical contact area of each of the access means.

2. A device according to claim 1, in which the electrical component is a metallized film capacitor (12) and there are two contacts (14, 16).

3. A device according to claim 1 or claim 2, in which the plurality of layers of thermally insulative material include a first layer (18, 18a) adjacent the electrical component (12), the first layer including a material having a high heat of fusion.

4. A device according to claim 3, in which the plurality of layers of thermally insulative material further includes at least one layer of thermally insulative tape (60, 76).

5. A device according to claim 3 or claim 4, in which the access means comprise narrow passages (32, 34) extending through the first layer of thermally insulative material.

6. A device according to any one of claims 1 to 3, in which the discrete electrically conductive means comprises a plurality of discrete patterns (54, 56, 72, 74) of electrically conductive material applied to a layer (18, 18a) of the thermally insulative material, each of the patterns effecting electrical contact with one of the contacts (14, 16) through its access means and a second layer (60, 80) of thermally insulative material around the component, the second layer (60, 80) leaving the patterns (54, 56, 72, 74) of electrically conductive material at least partially unmasked to enable electrical connection of the component to be made in an electrical circuit by the plurality of patterns.

7. A device according to claim 6, in which the component has an upper face and a lower face, a first end and a second end, and a first edge and a second edge, the contacts being on the edges, the first layer (18, 18a) of insulative material covering at least the upper face, the lower face, and the edges, the access means being configured to restrict thermal communication to the contacts through the first layer of insulative material and the second layer of insulative material (60, 80) covering at least the first end and the second end, and leaving at least a portion of the access means exposed.

8. A device according to claim 1, wherein the access means comprises a notch (32) in the first layer (18) at the first edge and the second edge,

the notches (32) traversing the first layer and exposing the contacts, the conductive means (54) comprising electrically conductive material applied to the first layer at the first edge and at the second edge, the electrically conductive material being electrically connected with the contacts through the notches (32), and the notches (32) being proportioned to enable substantially unrestricted electrical communication to be made therethrough while substantially limiting thermal communication therethrough.

9. A device according to any one of claims 3 to 5, in which the first layer (18) is of thermally insulative tape.

10. A device according to any one of claims 3 to 5, in which the first layer is a thermally resistive conformal coating.

11. A device according to any one of claims 3 to 5, in which each of the discrete electrically conductive means comprises a first stratum (72) of highly electrically conductive and highly thermally conductive material adjacent the first layer (16), and a second stratum (74) adjacent the first stratum of moderately electrically conductive and moderately thermally insulative material.

12. A device according to claim 11, in which the layers of insulative material includes at least one barrier layer of a material having a high heat of fusion.

13. A device according to claim 12, in which the at least one barrier layer is of porous paper impregnated with a microcrystalline wax material.

14. A method of processing a length of capacitive structure to make a plurality of surface mountable electrical devices in the form of capacitors in accordance with claim 1, the length of capacitive structure having first and second electrical contact areas extending along it, the method comprising the steps of:

delineating a plurality of boundaries across said length of capacitive structure to define dimensional limits for each of said plurality of capacitors;

applying at least one layer of thermally and electrically insulative material to said length of capacitive structure, said at least one layer covering at least a substantial portion of the length of the capacitive structure;

forming a plurality of electrical access means alternately arranged with said plurality of boundaries for accommodating electrical access while restricting thermal access to said first and second electrical contact areas through said at least one layer;

establishing a plurality of electrical contact means to said length of capacitive structure for providing an expanded area of electrical contact with said first and second electrical contact areas through said plurality of access means;

severing said length of capacitive structure at each of said plurality of boundaries to form said plurality of capacitors; and

applying at least one additional layer of thermally and electrically insulative material to



each of said plurality of capacitors, said at least one additional layer covering at least all portions of each of said plurality of capacitors not previously covered and leaving at least a portion of each of said plurality of electrical contact means exposed.

15. A method according to claim 14, wherein said at least one layer comprises at least one layer of tape.

16. A method according to claim 14, wherein said at least one layer comprises at least one layer of thermally insulative conformal coating material.

17. A method according to any one of claims 14 to 16, wherein each of said plurality of access means comprises at least one narrow passage through said at least one layer to said first and second electrical contact areas.

18. A method according to any one of claims 14 to 17, wherein each of said plurality of electrical contact means comprises a first stratum of highly electrically conductive and highly thermally conductive material adjacent said at least one layer, and a second stratum adjacent said first stratum of moderately electrically conductive and moderately thermally insulative material.

19. A method according to any one of claims 14 to 18, wherein said at least one layer further comprises at least one barrier layer comprising a material having a high heat of fusion.

20. A method according to any one of claims 14 to 19, wherein said at least one barrier layer is comprised of porous paper impregnated with a microcrystalline wax material.

21. An electrical device configured for surface mounting to a printed circuit board comprising a metallized film capacitor having an upper face and a lower face, a first end and a second end, and a first edge and a second edge, said capacitor having electrical connection means on said first edge and said second edge; a first wrap of thermally and electrically insulative material, said first wrap covering at least said upper face, said lower face, said first edge and said second edge; access means for accommodating discrete electrical connection to said electrical connection means through said first wrap, said access means being configured to restrict thermal communication to said electrical connection means through said first wrap; and a second wrap of thermally and electrically insulative material covering at least said first end and said second end, said second wrap leaving at least a portion of said access means sufficiently exposed to enable electrical connection of said access means to said printed circuit board.

Patentansprüche

1. Auf eine Oberfläche montierbare elektrische Vorrichtung (58, 70) mit einem elektrischen Bauteil (12) mit einer Vielzahl von Kontakten (14, 16), gekennzeichnet durch eine Vielzahl von Schichten (18, 18a, 60, 76, 78, 80) eines thermisch isolierenden Werkstoffs, welche das elektrische Bauteil

(12) bedecken, Zugangsmittel (32, 34), die elektrischen Zugang zu jedem der Kontakte (14, 16) gewähren, während sie thermischen Zugang zu dem Kontakt verhindern, und getrennte elektrisch leitende Mittel (54, 56, 72, 74) die jedem der Zugangsmittel (32, 34) zugeordnet sind, um den elektrischen Kontaktbereich von jedem der Zugangsmittel zu vergrößern.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß das elektrische Bauteil ein Kondensator (12) mit metallisiertem Film ist und zwei Kontakte (14, 16) vorgesehen sind.

3. Vorrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Vielzahl von Schichten des thermisch isolierenden Werkstoffs eine erste Schicht (18, 18a) nahe dem elektrischen Bauteil (12) aufweisen, wobei die erste Schicht einen Werkstoff mit hoher Schmelzwärme aufweist.

4. Vorrichtung nach Anspruch 3, dadurch gekennzeichnet, daß die Vielzahl von Schichten des thermisch isolierenden Werkstoffs weiter zumindest eine Schicht eines thermisch isolierenden Bandes (60, 76) aufweist.

5. Vorrichtung nach Anspruch 3 oder 4, dadurch gekennzeichnet, daß die Zugangsmittel schmale Zugänge (32, 34) aufweisen, die sich durch die erste Schicht des thermisch isolierenden Werkstoffs erstrecken.

6. Vorrichtung nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß die getrennten elektrisch leitenden Mittel eine Vielzahl von getrennten Mustern (54, 56, 72, 74) eines elektrisch leitenden Werkstoffs aufweisen, welche auf eine Schicht (18, 18a) des thermisch isolierenden Werkstoffs aufgetragen sind, wobei jedes der Muster elektrischen Kontakt mit einem der Kontakte (14, 16) durch ihre Zugangsmittel bewirkt, und eine zweite Schicht (60, 80) thermisch isolierenden Werkstoffs um das Bauteil, wobei die zweite Schicht (60, 80) die Muster (54, 56, 72, 74) des elektrisch leitenden Werkstoffs zumindest teilweise unmaskiert läßt, um eine elektrische Verbindung des Bauteils in einem elektrischen Schaltkreis durch die Vielzahl von Mustern herzustellen.

7. Vorrichtung nach Anspruch 6, dadurch gekennzeichnet, daß das Bauteil eine obere Fläche und eine unter Fläche aufweist, ein erstes Ende und ein zweites Ende und eine erste Kante und eine zweite Kante, wobei die Kontakte auf den Kanten liegen, die erste Schicht (18, 18a) des isolierenden Werkstoffs zumindest die obere Fläche, die untere Fläche und die Kanten bedeckt, wobei die Zugangsmittel so ausgebildet sind, daß sie thermische Verbindung mit den Kontakten durch die erste Schicht isolierenden Werkstoffs beschränken, und die zweite Schicht des isolierenden Werkstoffs (60, 80) zumindest das erste Ende und das zweite Ende bedeckt und zumindest einen Teil der Zugangsmittel exponiert läßt.

8. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß das Zugangsmittel eine Kerbe (32) in der ersten Schicht (18) an der ersten Kante und der zweiten Kante aufweist, wobei die Kerben (32) die erste Schicht durchziehen und die



Kontakte exponieren, wobei die leitenden Mittel (54) einen elektrisch leitenden Werkstoff aufweisen, der auf die erste Schicht an der ersten Kante und an der zweiten Kante aufgebracht ist, wobei der elektrisch leitende Werkstoff elektrisch mit den Kontakten durch die Kerben (32) verbunden ist und wobei die Kerben (32) so bemessen sind, daß sie im wesentlichen unbeschränkte elektrische Verbindung durch sie hindurch ermöglichen, während sie eine thermische Verbindung durch sie hindurch im wesentlichen beschränken.

9. Vorrichtung nach einem der Ansprüche 3 bis 5, dadurch gekennzeichnet, daß die erste Schicht (18) aus thermisch isolierendem Band besteht.

10. Vorrichtung nach einem der Ansprüche 3 bis 5, dadurch gekennzeichnet, daß die erste Schicht eine thermisch widerstandsfähige konforme Beschichtung ist.

11. Vorrichtung nach einem der Ansprüche 3 bis 5, dadurch gekennzeichnet, daß jedes der getrennten elektrisch leitenden Mittel eine erste Schicht (72) eines hochelektrisch leitenden und hochthermisch leitenden Werkstoffs nahe der ersten Schicht (16) aufweist und eine zweite Schicht (74) nahe der ersten Schicht aus mäßig elektrisch leitfähigem und mäßig thermisch isolierendem Werkstoff.

12. Vorrichtung nach Anspruch 11, dadurch gekennzeichnet, daß die Schichten des isolierenden Werkstoffs zumindest eine Sperrschicht eines Werkstoffs mit einer hohen Schmelzwärme aufweisen.

13. Vorrichtung nach Anspruch 12, dadurch gekennzeichnet, daß die zumindest eine Sperrschicht aus porösem Papier besteht, welches mit einem mikrokristallinen Wachswerkstoff imprägniert ist.

14. Verfahren zur Herstellung einer Länge einer kapazitiven Struktur, um eine Vielzahl von oberflächenmontierbaren elektrischen Vorrichtungen in der Form der Kondensatoren gemäß Anspruch 1 herzustellen, wobei sich entlang der Länge der kapazitiven Struktur erste und zweite elektrische Kontaktbereiche erstrecken, gekennzeichnet durch die Schritte:

Vorzeichnen einer Vielzahl von Grenzlinien über die Länge der kapazitiven Struktur, um Grenzen der Ausdehnung für jeden der Vielzahl der Kondensatoren zu bestimmen;

Aufbringen zumindest einer Schicht eines thermisch und elektrisch isolierenden Werkstoffs auf die Länge der kapazitiven Struktur, wobei die zumindest eine Schicht zumindest einen wesentlichen Abschnitt der Länge der kapazitiven Struktur bedeckt;

Bilden einer Vielzahl von elektrischen Zugangsmitteln, die abwechselnd mit der Vielzahl von Grenzlinien angeordnet sind, um elektrischen Zugang zu ermöglichen, während sie thermischen Zugang zu dem ersten und zweiten elektrischen Kontaktbereich durch die zumindest eine Schicht einschränken;

Einrichten einer Vielzahl von elektrischen Kontaktmitteln auf der Länge der kapazitiven Struktur, um einen ausgeweiteten elektrischen Kontaktbe-

reich mit den ersten und zweiten elektrischen Kontaktbereichen durch die Vielzahl der Zugangsmittel zu erzeugen;

Losbrechen der Länge der kapazitiven Struktur an jeder der Vielzahl von Grenzlinien, um die Vielzahl von Kondensatoren zu erzeugen, und

Aufbringen zumindest einer zusätzlichen Schicht von thermisch und elektrisch isolierendem Werkstoff auf jeden der Vielzahl von Kondensatoren, wobei die zumindest eine zusätzliche Schicht zumindest alle Abschnitte jedes der Vielzahl von Kondensatoren bedeckt, die nicht vorher bedeckt wurden, und zumindest einen Abschnitt von jedem der Vielzahl von elektrischen Kontaktmitteln exponiert läßt.

15. Verfahren nach Anspruch 14, dadurch gekennzeichnet, daß zumindest eine Schicht zumindest eine Schicht eines Bandes aufweist.

16. Verfahren nach Anspruch 14, dadurch gekennzeichnet, daß die zumindest eine Schicht zumindest eine Schicht eines thermisch isolierenden konformen Beschichtungswerkstoffes aufweist.

17. Verfahren nach einem der Ansprüche 14 bis 16, dadurch gekennzeichnet, daß jedes der Vielzahl von Zugangsmitteln zumindest einen schmalen Zugang durch die zumindest eine Schicht zu den ersten und zweiten elektrischen Kontaktbereichen aufweist.

18. Verfahren nach einem der Ansprüche 14 bis 17, dadurch gekennzeichnet, daß jedes der Vielzahl elektrischer Kontaktmittel eine erste Schicht eines hochelektrisch leitenden und hochthermisch leitenden Werkstoffs nahe der zumindest einen Schicht aufweist und eine zweite Schicht nahe der ersten Schicht eines mäßig elektrisch leitenden und mäßig thermisch isolierenden Werkstoffs.

19. Verfahren nach einem der Ansprüche 14 bis 18, dadurch gekennzeichnet, daß die zumindest eine Schicht weiter zumindest eine Sperrschicht aufweist, die einen Werkstoff mit einer hohen Schmelzwärme enthält.

20. Verfahren nach einem der Ansprüche 14 bis 19, dadurch gekennzeichnet, daß die zumindest eine Sperrschicht aus porösem Papier besteht, das mit einem mikrokristallinen Wachswerkstoff imprägniert ist.

21. Elektrische Vorrichtung, die zur Oberflächenmontage auf ein gedrucktes Schaltbrett ausgebildet ist, gekennzeichnet durch einen metallisierten Filmkondensator mit einer oberen Fläche und einer unteren Fläche, einem ersten Ende und einem zweiten Ende, einer ersten Kante und einer zweiten Kante, wobei der Kondensator elektrische Verbindungsmittel auf der ersten Kante und der zweiten Kante aufweist, eine erste Wicklung von thermisch und elektrisch isolierendem Werkstoff, wobei die erste Wicklung zumindest die obere Fläche, die untere Fläche, die erste Kante und die zweite Kante bedeckt, Zugangsmittel, um eine getrennte elektrische Verbindung mit den elektrischen Verbindungsmitteln durch die erste Wicklung herzustellen, wobei die Zugangsmittel so ausgebildet sind, daß sie thermische



Verbindung mit den elektrischen Verbindungsmitteln durch die erste Wicklung einschränken, und eine zweite Wicklung aus thermisch und elektrisch isolierendem Werkstoff, der zumindest das erste Ende und das zweite Ende bedeckt, wobei die zweite Wicklung zumindest einen Abschnitt der Zugangsmittel genügend exponiert läßt, um elektrische Verbindung mit den Zugangsmitteln zu dem gedruckten Schaltungs Brett zu ermöglichen.

Revendications

1. Dispositif électrique (58, 70) à monter sur une surface, comprenant un composant électrique (12) ayant plusieurs contacts (14, 16), caractérisé par plusieurs couches (18, 18a, 60, 76, 78, 80) de matière thermiquement isolante couvrant le composant électrique (12), des moyens d'accès (32, 34) permettant un accès électrique à chacun des contacts (14, 16) tout en faisant obstacle à un accès thermique au contact, et des moyens électriquement conducteurs, discrets (54, 56, 72, 74) associés à chacun des moyens d'accès (32, 34) pour augmenter la surface de contact électrique de chacun des moyens d'accès.

2. Dispositif selon la revendication 1, dans lequel le composant électrique est un condensateur à films métallisés (12) et dans lequel il y a deux contacts (14, 16).

3. Dispositif selon la revendication 1 ou la revendication 2, dans lequel les diverses couches de matière thermiquement isolante comprennent une première couche (18, 18a) adjacent au composant électrique (12), la première couche comprenant une matière ayant une chaleur élevée de fusion.

4. Dispositif selon la revendication 3, dans lequel les diverses couches de matière thermiquement isolante comprennent en outre au moins une couche formée d'un ruban thermiquement isolant (60, 76).

5. Dispositif selon la revendication 3 ou la revendication 4, dans lequel les moyens d'accès comprennent des passages étroits (32, 34) s'étendant à travers la première couche de matière thermiquement isolante.

6. Dispositif selon l'une quelconque des revendications 1 à 3, dans lequel les moyens électriquement conducteurs, discrets, comprennent plusieurs configurations discrètes (54, 56, 72, 74) de matière électriquement conductrice appliquée sur une couche (18, 18a) de matière thermiquement isolante, chacune des configurations établissant un contact électrique avec l'un des contacts (14, 16) par l'intermédiaire de ses moyens d'accès, et une seconde couche (60, 80) de matière thermiquement isolante entourant le composant, la seconde couche (60, 80) laissant au moins partiellement non masquées les configurations (54, 56, 72, 74) de matière électriquement conductrice afin de permettre la réalisation d'une connexion électrique du composant dans un circuit électrique par les diverses configurations.

7. Dispositif selon la revendication 6, dans

lequel le composant présente une face supérieure et une face inférieure, une première extrémité et une seconde extrémité, et un premier bord et un second bord, les contacts étant sur les bords, la première couche (18, 18a) de matière isolante couvrant au moins la face supérieure, la face inférieure et les bords, les moyens d'accès étant configurés de façon à restreindre la communication thermique vers les contacts à travers la première couche de matière isolante et la seconde couche de matière isolante (60, 80) couvrant au moins la première extrémité et la seconde extrémité, et laissant exposée au moins une partie des moyens d'accès.

8. Dispositif selon la revendication 1, dans lequel les moyens d'accès comprennent une encoche (32) dans la première couche (18) au premier bord et au second bord, les encoches (32) traversant la première couche et exposant les contacts, les moyens conducteurs (54) comprenant une matière électriquement conductrice appliquée sur la première couche au premier bord et au second bord, la matière électriquement conductrice étant connectée électriquement aux contacts par l'intermédiaire des encoches (32) et les encoches (32) étant proportionnées pour permettre de réaliser par ces encoches une communication électrique sensiblement non restreinte tout en limitant sensiblement la communication thermique par lesdites encoches.

9. Dispositif selon l'une quelconque des revendications 3 à 5, dans lequel la première couche (18) est un ruban thermiquement isolant.

10. Dispositif selon l'une quelconque des revendications 3 à 5, dans lequel la première couche est un revêtement thermiquement résistif épousant la forme du support.

11. Dispositif selon l'une quelconque des revendications 3 à 5, dans lequel chacun des moyens électriquement conducteurs, discrets, comprend une première nappe (72) en matière hautement électriquement conductrice et hautement thermiquement conductrice, adjacente à la première couche (16), et une seconde nappe (74) adjacente à la première nappe, en matière modérément électriquement conductrice et modérément thermiquement isolante.

12. Dispositif selon la revendication 11, dans lequel les couches de matière isolante comprennent au moins une couche d'arrêt en une matière ayant une chaleur élevée de fusion.

13. Dispositif selon la revendication 12, dans lequel la, au moins une, couche d'arrêt est en papier poreux imprégné d'une matière du type cire microcristalline.

14. Procédé de traitement d'une longueur de structure capacitive pour réaliser plusieurs dispositifs électriques à monter sur une surface, sous la forme de condensateurs conformément à la revendication 1, la longueur de la structure capacitive ayant des première et seconde surfaces de contact électrique s'étendant le long d'elle, le procédé comprenant les étapes qui consistent:

à tracer le contour de plusieurs limites en travers de ladite longueur de structure capacitive



pour définir des limites dimensionnelles pour chacun desdits plusieurs condensateurs;

à appliquer au moins une couche de matière thermiquement et électriquement isolante sur ladite longueur de structure capacitive, ladite, au moins une, couche couvrant au moins une partie importante de la longueur de la structure capacitive;

à former plusieurs moyens d'accès électriques agencés de façon alternée avec lesdites plusieurs limites pour permettre un accès électrique tout en restreignant l'accès thermique auxdites première et seconde surfaces de contact électrique à travers ladite, au moins une, couche;

à établir plusieurs moyens de contacts électriques sur ladite longueur de structure capacitive pour former une surface étendue de contact électrique avec lesdites première et seconde surfaces de contact électrique par l'intermédiaire desdits plusieurs moyens d'accès;

à sectionner ladite longueur de structure capacitive en chacune desdites plusieurs limites pour former lesdits plusieurs condensateurs; et

à appliquer au moins une couche supplémentaire de matière thermiquement et électriquement isolante à chacun desdits condensateurs, ladite, au moins une, couche supplémentaire couvrant au moins toutes les parties de chacun desdits condensateurs non précédemment recouvertes et laissant exposée au moins une partie de chacun desdits moyens de contact électrique.

15. Procédé selon la revendication 14, dans lequel ladite, au moins une, couche comprend au moins une couche formée d'un ruban.

16. Procédé selon la revendication 14, dans lequel ladite, au moins une, couche comprend au moins une couche de matière de revêtement thermiquement isolante, épousant la forme de son support.

17. Procédé selon l'une quelconque des revendications 14 à 16, dans lequel chacun desdits moyens d'accès comprend au moins un passage étroit traversant ladite, au moins une, couche jusqu'auxdites première et seconde surfaces de contact électrique.

18. Procédé selon l'une quelconque des revendications 14 à 17, dans lequel chacun desdits

moyens de contact électrique comprend une première nappe de matière hautement électriquement conductrice et hautement thermiquement conductrice, adjacente à ladite, au moins une, couche, et une seconde nappe adjacente à ladite première nappe, en matière modérément électriquement conductrice et modérément thermiquement isolante.

19. Procédé selon l'une quelconque des revendications 14 à 18, dans lequel ladite, au moins une, couche comprend en outre au moins une couche d'arrêt constituée d'une matière ayant une chaleur élevée de fusion.

20. Procédé selon l'une quelconque des revendications 14 à 19, dans lequel ladite, au moins une, couche d'arrêt est constituée d'un papier poreux imprégné d'une matière du type cire microcristalline. -

21. Dispositif électrique configuré pour un montage sur la surface d'une plaquette à circuit imprimé, comprenant un condensateur à films métallisés ayant une face supérieure et une face inférieure, une première extrémité et une seconde extrémité, et un premier bord et un second bord, ledit condensateur comportant des moyens de connexion électrique sur ledit premier bord et ledit second bord; une première enveloppe de matière thermiquement et électriquement isolante, ladite première enveloppe couvrant au moins ladite face supérieure, ladite face inférieure, ledit premier bord et ledit second bord; des moyens d'accès pour établir une connexion électrique discrète avec lesdits moyens de connexion électrique à travers ladite première enveloppe, lesdits moyens d'accès étant configurés de façon à restreindre la communication thermique vers lesdits moyens de connexion électrique à travers ladite première enveloppe; et une seconde enveloppe en matière thermiquement et électriquement isolante, couvrant au moins ladite première extrémité et ladite seconde extrémité, ladite seconde enveloppe laissant au moins une partie desdits moyens d'accès suffisamment exposée pour permettre une connexion électrique desdits moyens d'accès avec ladite plaquette à circuit imprimé.



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