

Method for manufacturing an electronic device comprising a non-removable module, and resulting device.

5 The invention relates to a method for manufacturing an electronic device comprising a non-removable module, and resulting device.

10 The invention more particularly concerns a device including an electronic module attached in a recess of a carrier body, said module including a backing film having a metal coating on an upper surface side and on a lower surface side, an integrated-circuit chip connected to the metal coating using electric connection wires through the backing film, the
15 integrated-circuit chip being coated with a coating and mechanically protective material.

20 It finds particular applications in chip cards requiring safety as regards the disassembling of the micro-module and the card body, whether for banking, identification or other purposes. As a matter of fact, in the international context of ever growing safety and authentication, as well as identification, the chip cards manufacturers must be in a position to provide their clients with chip cards the micro-module of which
25 cannot be stripped without being damaged or destroyed.

 Disassembling the micro-module is already impossible without entailing the destruction thereof,

thanks to other techniques such as a structural gluing,
or a mechanical anchoring of the chip and electric
connection wires in a resin made integral with the
bottom of the recess of a plastic card body. Upon
5 stripping the module, the chip thus remains glued at
the bottom of the recess while being disconnected from
the contact pads and separated from the dielectric
backing film.

The main disadvantage of this method is that it
10 makes it impossible to easily transfer or store the
module once the chip is connected since the wires are
bare and might be damaged.

The aim of the invention is to provide a device
including an electronic module attached on a carrier
15 body having an efficient stripping-proof function
without the above-mentioned disadvantage.

For this purpose, the aim of the invention is a
method for manufacturing an electronic device including
a module attached in a recess of a carrier body, said
20 module including a backing film having a metal coating
on an upper surface side and on a lower surface side,
an integrated-circuit chip connected to the metal
coating using electric connection wires, the
integrated-circuit chip being coated with a coating and
25 mechanically protective material.

The method is characterized in that it includes
an anchoring step according to which a second anchoring

material is provided for bonding a portion of at least one of said electric wires and for anchoring said wire portion to the carrier body.

5 An attempted separation of the module and the carrier body entails the wire sectioning at said portion.

According to other characteristics or embodiments of the method:

10 - a step of coating the chip with a first coating material except for said wire portion is carried out;

15 - a step of coating the chip with a first coating material and a step of partially removing the coating material around said portions are executed, which enhance the protection of the wires up to the inseting operation;

- the removing of the coating material is executed by laser machining;

20 - removing the coating material forms a groove or cut-out joining at least two electric wires and leading to the surface of the protective material;

25 - a calibrated quantity of anchoring material is deposited at the bottom of the recess prior to placing the module in the recess so that the anchoring material can penetrate around said wire portions upon placing the module in the recess;

- the cut-out is filled with anchoring material;

the anchoring material is deposited onto the surface of the module intended to be inset and above the groove, as a hotmelt film with a thermosetting phase, prior to placing the module in the recess.

An object of the invention is the resulting device.

The invention is described while referring to examples illustrated in the following figures:

10 - Figure 1 illustrates a step of the method of the invention according to a first embodiment showing the preparation of a module;

- Figure 2 illustrates another step of the method of the invention according to the first embodiment;

15 - Figure 3 illustrates the device obtained by the first embodiment of the method of the invention;

- Figure 4 illustrates a step of the method of the invention according to a second embodiment showing the preparation of a module;

20 - Figure 5 illustrates another step of the method of the invention according to the second embodiment showing the machining of the groove;

- Figure 6 illustrates another step of the method of the invention according to the second embodiment showing the filling of the grooves;

5 - Figure 7 illustrates the device obtained by the second embodiment of the method of the invention;

- Figure 8 illustrates a stripping of the module along a longitudinal section.

10 Figure 1 illustrates a step of the method for manufacturing an electronic device of the invention according to a first embodiment showing the preparation of a module and relates to the preparation of a module. The final device is shown along a longitudinal section in Figure 3; it includes a carrier body 10 provided with a recess 12 and a module 1 attached in the recess.

15 The exemplary module is a chip card module; it conventionally includes a backing film 2 having a metal coating 3 on an upper surface side 4 and on a lower surface side 5, an integrated-circuit chip 6 connected to the metal coating using electric connection wires 7, 8 (or at least one wire); the conductive wires go
20 through the perforations in the insulating backing film to reach the contact pads. The module includes at least a coating and mechanically protective material 9 covering at least the integrated-circuit chip. The
25 module can thus be handled, stored up to the insetting thereof. As the coating resin covers the chip, it protects the active face of the chip and the connection

points of the outward-turned chip which are connected to the connection wires.

5 In the example, the metal coating is composed of electric contact pads, more particularly made of copper, intended to be connected by an external reader. The chip is connected to the metal coating through the film. Such pads may be obtained by laminating a metal coat onto the dielectric and chemical etching thereof afterwards. Any metallic pattern can be provided
10 according to various techniques known to the persons skilled in the art, for example through mechanical cutting or chemical etching, or even through screen printing of the conductive material. The metal coating may also be a communication interface as an antenna.

15 According to a characteristic embodiment of the invention, the method includes an anchoring step according to which an anchoring material (or any other anchoring means: sewing thread, staple in addition to the coating material 9) is provided for bonding a
20 portion of at least one wire and for anchoring said wire portion to the carrier body through the material. Anchoring is such that an attempted separation of the module and the carrier body entails the sectioning of at least one wire at said portion.

25 The above characteristic may be obtained according to a first embodiment wherein the chip is previously coated with a first coating material except

for at least one electric wire portion located on the metal coating side.

In the exemplary first embodiment, a droplet of the chip coating resin is calibrated, sized and deposited so as not to cover at least an electric wire portion 7, 8. The resin thus covers only one end of at least one electric wire welded to a pad of the chip, whereas the other end attached to a metal coating is not covered. The wire portion 7p, 8p extending from the metal coating to the resin surface is thus not covered and is exposed to the open air.

In Figure 2, (a longitudinal section of the device) is illustrated the operation of insetting the module into a carrier body 10, i.e. a chip card body. Prior to positioning the module, a bonding material 11 is deposited onto the bottom of the recess 12, prior to placing the module into the recess. A calibrated quantity of the bonding material is deposited so as to surround and bond the not coated wire portions 7p, 8p upon placing the module. The pressure exerted onto the module upon the placing thereof distributes the anchoring material throughout the space available in the recess and around the protective coating 9 while going up around the wire portions 7p, 8p.

In Figure 3, the longitudinal section shows that the electronic device 13 resulting from the method of the invention, is a chip card. The card conventionally includes an electronic module or micro-module 1

attached to the body 10 of the card, more particularly in a recess 12 arranged in the body. Attaching means can use an adhesive 14, more particularly as a layer or a film of the thermosetting or heat-sealable type,
5 currently called a "hotmelt" adhesive.

The wire portions 7p, 8p which are not covered with the chip coating material, are then at least partially covered with the bonding resin 11.

In Figure 4, the same numbers as mentioned in the
10 previous figures represent the same elements. A second embodiment of the method starts with the preparation of a module 15 in a substantially different way. As a matter of fact, this time a complete coating of the chip and of the electric wires 7, 8 with a coating
15 material 19 is provided.

According to a general principle of the second embodiment, a step of partial removing of the coating material 19 around wire portions that are wished to be sectioned in case the module is disassembled is
20 subsequently executed. Any wire portion can be concerned, more particularly one of the ends thereof. In the example, the coating material is removed around wire portions located between the ends of the wires. Here linear (or alternately non linear) cut-outs or
25 grooves are created in the material; electric wire portions go through such grooves. The grooves extend from one transversal edge of the resin to the opposite edge like a trench cut in the resin, more particularly

up to the backing film. The grooves preferably extend through at least two electric wires and lead to the surface of the coating material. The two grooves cut the coating, here in three coating portions A, B, C.
5 The grooves may not lead to the side edges of the coating so as to form a dish for a subsequent adhesive.

The step of removing the coating material is executed here by laser machining. For instance a CO₂ laser having a power of 100W is used. However, any
10 other means can be used for chemical etching.

In Figure 6, the method includes a step of filling the grooves (or cut-out) with an adhesive for bonding the wires. The adhesive is so selected as to have a better adhesion to the carrier body than to the
15 chip-coating resin. Cyanoacrylate glue can be chosen for instance.

Upon conventionally placing the module into the recess, the adhesive, preferably still in a viscous condition, will flux against the surface of the card
20 body, into the recess. Viscosity, or the groove shape, are so adapted as to enable the adhesive to remain in the groove after the delivery thereof. If the adhesive is viscous, the level thereof will gravitationally go down a little at the carrier film 2, when the latter is
25 turned upside down for insetting purposes. When the adhesive is no longer viscous, a droplet of anchoring adhesive may also be added, if need be, at the bottom

of the recess to adhere to the anchoring material having previously filled the grooves.

5 In another alternative embodiment, the anchoring material 20 is deposited as a hotmelt film onto the surface of the module intended to be inset and above the groove, prior to placing the module into the recess. The "hotmelt" film is then used as an adhesive for inseting the module, like the film 14, as well as as an adhesive for anchoring the electric wire
10 portions.

The « hotmelt » film is preferably of the phenolic type with a high fluxing power; it preferably includes a thermosetting phase to avoid the repeated melting thereof and thus the disassembling of the
15 module.

According to an alternative solution, the anchoring material may be made not to adhere to the coating material thanks, in particular, to a surface treatment of the groove with an anti-adhesive layer or
20 a flared shape of the groove outward.

Figure 8 illustrates (along a longitudinal section, like the previous ones) the stripping of the module by a force F. Stripping results in the sectioning 22 of each wire portion going through the
25 groove and surrounded by the anchoring adhesive. The anchoring adhesive bonds the wire portions in the grooves and holds same in the recess thanks to the

adhesional force of the adhesive material relative to the carrier body.

5 A similar result is obtained for the first embodiment. The wires will however be sectioned at the interface of the coating resin with the bonding resin, which remains in the recess at the ends of the wires welded to the metal coating.

10 As an example, the coating resin is an epoxy resin, the anchoring / bonding resin is a cyanoacrylate or epoxy resin identical with or different from the first resin, the carrier body may be made of plastics. It may be made of ABS, PVC, or polycarbonate, PET (Polyethylene Terephthalate) or PEN (Polyethylene Naphthalate of the polyesters group but having a higher
15 resistance to temperature than PET)

CLAIMS

1. A method for manufacturing an electronic device (13a, 13b) including a module (1, 15) attached
5 in a recess of a carrier body, said module including a backing film (2) having a metal coating (3) on an upper surface side and on a lower surface side, an integrated-circuit chip (6) connected to the metal coating using electric connection wires (7, 8), the
10 integrated-circuit chip being coated with a coating and mechanically protective material (9),

characterized in that it includes an anchoring step according to which a second anchoring material (11) is provided for bonding a portion (7p, 8p, 17p, 18p) of at least one of said electric wires and for anchoring said wire portion to the carrier body.

2. A method according to the previous claim, characterized in that it includes a step of coating the chip with a first coating material (9) except for said
20 wire portion (7p, 8p, 17p, 18p).

3. A method according to claim 1, characterized in that it includes a step of coating the chip with a first coating material (9) and a step of partially removing the coating material around said portions
25 (17p, 18p).

4. A method according to the previous claim, characterized in that the step of partially removing the coating material is executed by laser machining.

5. A method according to claim 3, characterized in that removing the coating material forms a groove (R) joining at least two electric wires and leading to the surface of the coating material.

6. A method according to any one of the preceding claims, characterized in that a calibrated quantity of anchoring material (20) is deposited at the bottom of the recess prior to placing the module in the recess so that the anchoring material can penetrate around said wire portion upon placing the module in the recess.

7. A method according to claim 5, characterized in that a certain quantity of anchoring material (20) is deposited into the groove prior to placing the module in the recess.

8. A method according to claim 5, characterized in that the anchoring material (20) is deposited onto the surface of the module intended to be inset and above the groove, as a hotmelt film with a thermosetting phase, prior to placing the module in the recess.

9. An electronic device including a module (1, 15) attached in a recess of a carrier body, said module including a backing film (2) having a metal coating (3) on an upper surface side and on a lower surface side,

an integrated-circuit chip (6) connected to the metal coating using electric connection wires (7, 8), the integrated-circuit chip being at least partially coated with at least a coating and mechanically protective material, characterized in that the device includes a
5 second anchoring material (11, 20) provided for coating a portion of at least one wire and for anchoring said wire portion to the carrier body (10).