

Microcircuit module intended to be mounted in a microcircuit board

The present invention relates to a microcircuit module intended to be mounted in a microcircuit card, as well as a card comprising such a module. More specifically, it relates to microcircuit cards used for contact or contactless payments, with the latter being completed by means of a communication between a bank reader terminal and an antenna of the microcircuit card.

In order to implement a contact transaction, the card comprises a module comprising contact pads connected to a microcircuit of the card. The contact pads come into contact with pins of the terminal in order to exchange data between the terminal and the microcircuit of the card. In order to implement a contactless transaction between a microcircuit card and a bank terminal, the known practice involves positioning the card close to the terminal so that the card and the terminal can communicate and exchange secure data in order to implement the payment protocol.

During a communication in contact mode, i.e., via a physical connection, in which the electronic document is inserted into the card reader of the terminal, a user is generally notified, via a message displayed on a screen of the terminal, that the transaction has been completed and that the electronic document can be removed.

During a contactless communication, in which the electronic document merely approaches the terminal, the document is generally positioned above the screen of the terminal and then masks the notification message. As a result, the user is no longer notified when the transaction has ended and risks removing the electronic document prematurely.

The risk of prematurely removing the electronic document from the terminal before the end of the transaction is then high and results in the failure of the transaction.

In order to overcome this disadvantage, a card is known from document EP 2426627 that comprises at least one light source indicating a communication status between the terminal and the card. To this end, the card comprises a microcircuit module able to be mounted in a cavity of the body of the card. This module comprises a light source supported by an inner face of a support of the module. The light source is powered by an antenna disposed in the body of the card. Light is emitted when a current with a predefined intensity flows through the antenna, i.e., when the near-field communication is established with an external contactless card reader. Thus, when a contactless mode transaction is in progress, the light source emits radiation indicating that the transaction is in progress.

A card is also known from document EP 4033408 that comprises a luminous means for indicating the state of a transaction. This means is made up of an LED mounted inside the electronic module. The module is unique in that it comprises an opening on the upper face of the module, and more specifically on one of the contact pads of the module, through which opening the light emitted by the light source is visible.

However, integrating the light source on the module, in particular according to the arrangement described in patent EP 4033408, can raise several issues. Firstly, producing an opening on the upper face of a module can result in a risk of deterioration of the face of the module in the vicinity of the opening. Indeed, when inserting the card into a reader, the pins of the terminal rub on the contact pads of the module and deform the upper face of the module. In particular, the repetitive passages of the pins over the opening in the insertion direction for inserting the card and then in the opposite direction when removing the card result in premature wear at the opening, with a risk of enlarging or deforming the profile thereof.

Moreover, the arrangements of the outer faces of the modules must meet constraints specified in the ISO 7810 standards, notably in order to guarantee sufficient rigidity in order to support the passage of the pins of the reader, while having sufficient deformation properties for withstanding any torsion tests without risking any sudden pulling apart of the module mounted in the cavity of the card.

The invention aims to overcome these disadvantages in that it proposes a microcircuit module intended to be mounted in a microcircuit card, the module comprising: a substantially rectangular shaped substrate having an outer face and an inner face; contact pads supported on the outer face of the substrate, the contact pads being formed by depositing metal onto the substrate; the contact pads being disposed in two series parallel to a first direction of a plurality of contact pads, separated by a central zone; each contact pad covering at least one theoretical contact zone, the theoretical contact zones being disposed in two series parallel to the first direction of a plurality of theoretical contact zones, the theoretical contact zones being substantially identical and being positioned symmetrically relative to the first direction, with two theoretical contact zones symmetrical relative to the first direction defining a theoretical strip for the passage of the pins of a terminal; the contact pads being separated by gaps substantially extending in the first direction and in a second direction perpendicular to the first direction, the gaps having an initial reference width l devoid of metal; a microcircuit supported on the inner face of the substrate, and electrically connected with the contact pads through the substrate; at least one light-emitting component supported on the inner face of the substrate, characterized in that at least one gap portion has a width L greater than the reference width, with this widened gap portion being positioned outside the theoretical strips, the light-emitting component being positioned in the vicinity of the image zone of the gap portion, beyond the reference width applied to the widened gap portion.

By virtue of these provisions, light-emitting components can be added to the inner face of a module without increasing the fragility of this module or risking damaging the light-emitting component.

Particularly simple, convenient and economic preferred features of the device according to the invention are described hereafter:

the widened portion is formed on a gap formed in the central zone and connecting two gaps defining two contact pads located substantially symmetrically relative to the first

direction;

the light-emitting component has a light radiation-emitting element oriented toward the widened gap portion;

the radiation-emitting element is partially positioned under the widened gap portion,
5 outside the reference width l;

wherein the radiation-emitting element is made up of a light source of a transparent light-diffusing cover;

that the light-emitting component is powered by the antenna;
turning-on is controlled by the microcircuit.

10 The invention, according to one embodiment, will be better understood, and the advantages thereof will become more clearly apparent, upon reading the following detailed description, which is provided by way of a non-limiting indication, with reference to the appended drawings, in which:

figure 1 shows a view of a card comprising a module according to the invention;

15 figure 2 shows a view of the outer face of the module according to a first embodiment;
figure 3 shows a view similar to that of the claim of a second embodiment of the module;

figure 4 illustrates a detailed view of the module;

figure 5 illustrates a similar view to figure 4 according to an alternative embodiment;

20 figure 6 is a schematic sectional view in the direction A-A of figure 2.

The invention relates to ID-1 format cards 10 compliant with the dimensional specifications notably stipulated by standard ISO 7810, as illustrated in figure 1. This standard defines the dimensions and tolerances that a card 10 must comply with, according to its format, so as to be able to cooperate, through contact in good conditions, with all the
25 reading terminals provided for this purpose. Non-compliance with this standardized format can result in notable problems when the card 10 interacts with a reading terminal.

Typically, a card 10 that does not comply with standard ISO 7810 risks not being detected by the reading terminal or degrading the operation thereof, or even not being read. The ID-1 format corresponds to a card 10 defined by a rectangular shape of 85.6
30 mm × 54 mm × 0.76 mm thick.

In addition, the constraints stipulated by the ISO 7810 standard also limit the size and the arrangement of the electronic components that are likely to be integrated on a card 10. In particular, this standard specifies the positioning constraints of a microcircuit module 12 mounted in the body of a card 10 and supporting a microcircuit 36, schematically shown in figure 6 and allowing contact mode communication between the micro-
35 circuit 36 and the reader.

In addition to the constraints associated with the physical structure of the card 10, constraints also exist that are linked to the resistance of the card 10. To this end, the card 10 must remain compliant with the ISO 7810 standards specifying the various torsion tests and resilient deformations that the card 10 must withstand.
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The present invention proposes a new module 12 adapted to meet the requirements

specified in the standards. The module 12 according to the invention initially will be described with reference to figures 2 to 3. For the sake of the clarity of the drawings, all the references indicated in one of the figures are not indicated in the other figure, although figures 2 and 3 illustrate two identical modules 12, with the exception of a gap that will be described in further detail throughout the remainder of the description. With the exception of this difference, the references in figure 2 apply in like manner to figure 3, and vice versa.

As can be seen in figures 2 to 3, the module 12 comprises a dielectric substrate 16 that is generally of rectangular shape with an outer face flush with a surface of the card 10 and an inner face. For a better illustration, the substrate 16 of figures 2 and 3 is shown bigger than the contact pads 14. In reality, the substrate 16 and the contact pads 14 have a similar profile. The module 12 further comprises individual contact pads 14 or surfaces connected to a microcircuit 36 mounted on the inner face of the module 12. The inner face of the module can also comprise capacitors 38 for managing the electric power supply of the microcircuit 36 or other microcircuits, as illustrated in figure 6. The contact pads 14, supported on the outer face of the substrate 16, are formed by depositing metal onto the substrate 16 using chemical etching techniques known to a person skilled in the art. The purpose of these contact pads 14 is to provide the electrical connection between the microcircuit 36 and an external terminal, such as a bank terminal. The microcircuit 36 is supported on the inner face of the substrate 16, and is electrically connected with the contact pads 14 through the substrate 16, for example, by gold wires, not shown in the figures.

As can be seen in figures 2 and 3, the contact pads 14 are distributed in two series parallel to a first direction 18 of a plurality of contact pads 14. Figures 2 and 3 illustrate two series of three contact pads 14. Other modules, not shown, comprise two series of four contact pads 14. The six or eight contact pads 14 are commonly designated using the designations C1 to C6 (or C8). In figures 1 to 3, a first series 14a, 14b, 14c, forming a first column, comprises the contact pads 14 designated C1 to C3, and a second series 14d, 14e, 14f, forming a second column parallel to the first column, comprises the contact pads 14 designated C4 to C6. The two series of contact pads are separated by a central zone 20, which is also covered with metal and is separated from a portion of the contact pads 14 by gaps 22.

For information purposes, the contact pads 14 designated C1 and C5 are used for the power supply: C1 VCC (power supply voltage) and C5 GND (ground); the contact pad C2, also called RST, is used to reset the chip; the contact surface C3, also called CLK, is used as the clock of the chip; the contact surface C7, also called I/O, is used for the inputs and outputs for the information of the chip.

The contact surfaces C4, C6 and C8 are intended for “reserved” contacts, which do not have particular functions. Nowadays, these contacts C4 and C8 can be used for USB ports and the contact C6 can be used for the SWP (“Single Wire Protocol”) communication protocol.

The ISO 7816 standard defines theoretical contact zones 24, namely, the dimensions of the minimum zones of these pads 14, namely, 2 mm wide and 1.7 mm high. The ISO 7816 standard also defines their relative locations relative to the edges of the card 10.

The theoretical contact zones 24 are disposed in two series parallel to the first direction 18. The two series of theoretical zones 24 are substantially identical and are positioned symmetrically relative to the first direction 18.

Since these theoretical zones 24 are minimal, each contact pad has to cover a theoretical contact zone as defined in the ISO 7816 standard. Indeed, two theoretical contact zones 24 that are symmetrical relative to the first direction 18 define a theoretical strip 26 for the passage of the pins of a terminal.

The contact pads 14 are separated by gaps 22 substantially extending in the first direction 18 and in a second direction perpendicular to the first direction. The gaps 22 have an initial reference width l devoid of metal. The gaps 22 correspond to very thin zones of the dielectric substrate 16 of the module 12 devoid of metal. The gaps 22 therefore allow two contact pads 14 to be electrically isolated.

As indicated in the preamble, the microcircuit cards must meet certain standards concerning their resilient deformation properties and must be able to withstand torsion or deformation forces whose parameters are specified in said standards. Consequently, the modules integrated into these cards simultaneously experience these torsion forces applied in both directions of the card 10. The module 12 absorbs some of the applied forces by virtue of the gaps 22 formed by non-metallized lines that are therefore less rigid than the metallized surfaces. Thus, it is possible to prevent the module 12 from being pulled apart from the cavity in which it is mounted when the card 10 is deformed.

The card 10 according to the invention further comprises an antenna for establishing a contactless communication with the reader, at a pre-defined communication frequency, such as 13.56 MHz defined by the ISO 14443 standard. The antenna and the microcircuit 36 of the module 12 are conventionally electrically connected by means of metal parts and a conductive adhesive, or conductive paste, when embedding the module 12. The card 10 according to the invention also comprises a light-emitting component 28.

This light-emitting component 28 is a light source, such as a light diode. The light-emitting component 28 is disposed on the inner face of the substrate 16 of the module 12 and allows the module 12 to be backlit when it is powered via the antenna. Thus, when the card 10 is used in contactless mode, the light-emitting component 28 is activated and diffuses light through the substrate 16 of the module 12.

The light-emitting component 28 is a rigid or semi-rigid component that risks breaking or disconnecting when it is subjected to mechanical deformations. Therefore, it is important that the light-emitting component 28 is not positioned in the vicinity of the gaps 22 forming the deformation lines of the module 12. However, the light emitted by the component is diffused through these gaps 22 devoid of metal since the metal is completely opaque and does not allow through the light rays, while the dielectric substrate 16 of the module 12 allows through the radiation of the light-emitting component 28.

Therefore, the positioning of the light-emitting component 28 relative to the gaps 22 needs to be optimized in order to meet the two aforementioned conditions.

In order to meet these two conditions, the present invention proposes producing at least one gap portion 30 with a width L greater than the reference width l and that this widened portion 30 is positioned outside the theoretical strips 26 for the passage of the pins of the reader. This arrangement is shown in figure 2.

According to a variant, illustrated in figure 3, the module 12 comprises two widened portions 30.

By virtue of these provisions, the module 12 comprises a widened gap portion 30 through which the light is diffused. The widened portion 30 is then formed by a reference width portion l and a secondary portion, called widening e , such that $l + e = L$.

In addition, according to the invention, the light-emitting component 28 is positioned in the vicinity of the image zone of the widened gap portion 30, i.e., in the vicinity of the projection of the widened gap portion 30 on the inner face of the module 12. The proximity of the light-emitting component 28 with the widened gap portion 30 ensures that a significant portion of the radiation is emitted close to the widened gap portion 30 and is thus diffused through said widened gap portion 30.

In order to protect the light-emitting component 28, said component is positioned in the vicinity of the widened gap portion 30, but outside the portion of the reference width l . This prevents the component from being positioned on the deformation lines of the module 12 and experiencing significant mechanical stresses.

According to a variant illustrated in figure 4, the light-emitting component 28 is positioned so that the light source diffusing light is positioned facing the widening e , beyond the reference width l applied to the widened L gap portion 30. According to another variant, illustrated in figure 5, the light-emitting component 28 is positioned under the contact pad delimiting the widening e , with the component then being protected from any deformations by the rigid metal contact pad.

By virtue of these provisions, no new zones are created devoid of metal in the theoretical strips 26 for the passage of the metal pins and the solution allows the light emitted by the light-emitting component 28 to be able to be diffused without increasing the fragility of the module 12.

The width of the widened gap portion 30 is advantageously equal to twice the reference width l .

Advantageously, the widened gap portion 30 is formed in the central zone 20 connecting two gaps 22 defining two contact pads 14 located substantially symmetrically relative to the first direction 18. This is illustrated in figures 2 and 3. The widened gap portion 30 is thus positioned in the central zone 20 separating the two series of contact pads. This central zone 20 is predominantly covered with metal and therefore is more rigid and less stressed by deformation. The light-emitting component 28 positioned close to the widened gap portion 30 therefore can be positioned under this central zone 20 and therefore can be protected from any deformations applied to the card 10.

The light-emitting component 28 comprises a light radiation-emitting element 32 and a connection means 34 for connecting with the microcircuit 36 or the antenna that powers the component when a current flows through the antenna. According to the invention, the light radiation-emitting element 32 is oriented toward the widened gap portion 30.

5 Thus, the radiation is oriented directly toward the widened gap portion 30 in order to optimize the illumination of said widened portion 30. These arrangements are shown in figures 2 and 3, in which the light radiation-emitting element 32 is positioned laterally relative to the connection means 34.

10 According to an alternative embodiment, the light radiation-emitting element 32 is partially positioned under the widened gap portion 30 in order to maximize the radiation projected under the widened gap portion 30. According to the invention, the light radiation-emitting element 32 of the light-emitting component 28 is positioned outside the portion of the gap of reference width l .

15 The light radiation-emitting element 32 is made up of a light source covered with a transparent cover diffusing light in a determined direction, namely, the widened gap portion 30.

As indicated in the preamble of the description, the module 12 according to the invention is integrated into a microcircuit card 10. This microcircuit card 10 comprises an antenna that is adapted for powering the light-emitting component 28. To this end, the component is electrically connected to the antenna. Light is emitted when a current with a predefined intensity flows through the antenna, i.e., when the near-field communication is established with an external contactless card reader 10. Thus, when a contactless mode transaction is in progress, the light source emits radiation indicating that the transaction is in progress. According to an alternative embodiment, the light-emitting component 28 is connected to the microcircuit 36 of the module 12 so that turning on the light-emitting component 28 is controlled by the microcircuit 36 according to a scenario that is pre-recorded in the microcircuit.

Claims

[Claim 1] A microcircuit module (12) intended to be mounted in a microcircuit card, the module (12) comprising:

a substantially rectangular shaped substrate (16) having an outer face and an inner face;

contact pads (14) supported on the outer face of the substrate (16), the contact pads (14) being formed by depositing metal onto the substrate (16);

the contact pads (14) being disposed in two series parallel to a first direction (18) of a plurality of contact pads (14), separated by a central zone (20);

each contact pad covering at least one theoretical contact zone, the theoretical contact zones (24) being disposed in two series parallel to the first direction (18) of a plurality of theoretical contact zones (24), the theoretical contact zones (24) being substantially identical and being positioned symmetrically relative to the first direction (18), with two theoretical contact zones (24) symmetrical relative to the first direction (18) defining a theoretical strip (26) for the passage of the pins of a terminal;

the contact pads (14) being separated by gaps (22) substantially extending in the first direction (18) and in a second direction perpendicular to the first direction, the gaps (22) having an initial reference width l devoid of metal;

a microcircuit supported on the inner face of the substrate (16), and electrically connected with the contact pads (14) through the substrate (16);

at least one light-emitting component (28) supported on the inner face of the substrate (16),

characterized in that

at least one gap portion (30) has a width L greater than the reference width l ,

with this widened gap portion (30) being positioned outside the theoretical strips (26);

the light-emitting component (28) being positioned in the vicinity of the image zone of the widened gap portion (30), beyond the reference width l applied to the widened gap portion (30).

[Claim 2] The microcircuit module (12) as claimed in claim 1, wherein the widened portion (30) is formed on a gap formed in the central zone (20) and connecting two gaps (22) defining two contact pads (14) located substantially symmetrically relative to the first direction (18).

- [Claim 3] The microcircuit module (12) as claimed in claim 1 or 2, wherein the light-emitting component (28) has a light radiation-emitting element (32) oriented toward the widened gap portion (30).
- [Claim 4] The microcircuit module (12) as claimed in claim 3, wherein the radiation-emitting element (32) is partially positioned under the widened gap portion (30), outside the reference width l.
- [Claim 5] The microcircuit module 12 as claimed in any of the preceding claims, wherein the radiation-emitting element (32) is made up of a light source of a transparent light-diffusing cover.
- [Claim 6] A microcircuit card comprising an antenna and a microcircuit module (12) according to the invention, characterized in that the light-emitting component (28) is powered by the antenna.
- [Claim 7] The microcircuit card as claimed in the preceding claim, wherein turning-on is controlled by the microcircuit.