

**Electrical connector for
a high capacity memory card**

The present invention relates to an electrical connector for a contact smart card of rectangular overall shape.

5 The invention relates more particularly to an electrical connector of the type comprising a support made of insulating material which defines a housing open in its upper face for a contact memory smart card of rectangular overall shape having on its lower main face a series of parallel longitudinal conducting pads which are arranged near a
10 transverse edge of the card, in a non-regular transverse distribution, and each of which engages with a free connection end, placed in the bottom of the housing in the support, of an electrical contact blade which is carried by the support and which belongs to a series of parallel longitudinal blades, each of which is fitted into the support by an
15 operation of inserting it in a longitudinal direction, and of the type in which, when the card is in its contact position, each free end of a contact blade defines with the corresponding conducting pad a contact point.

Such an example of an electrical connector, sold by ITT, has
20 been described and illustrated in EP-A-0.738.983.

This document discloses a connector for connecting a standardized card of the MICROSIM type, which is a card of small dimensions. Thus, the larger longitudinal part constituting the front portion of the card is received in the housing of the support of the
25 connector, that is to say the lower face of the card extends virtually over its entire area facing the bottom of the housing formed in the insulating support, only a small rear longitudinal portion of the card projecting out of the housing, especially in order to make it easier to grip it.

Moreover, the connection ends of the contact elements extend in
30 groups longitudinally towards the front and towards the rear,

respectively, of the insulating support beyond the front and rear transverse faces of the latter, in order to engage with conducting tracks of a printed circuit board which receives the connector.

Finally, that document also discloses the placing of a metal cover
5 which is mounted so as to slide on the support and retains the card in the housing of the insulating support by means of its upper plate-shaped main part which lies above the upper face of the card when the latter is in place in the housing.

Document WO-A-00/17805 (ITT MANUFACTURING ENTERPRISES INC.)
10 discloses a connector suitable in particular for connecting another type of card, also standardized, which is used especially for storing a large amount of data and thus constitutes a small removable data medium of high storage capacity. Several embodiments of such a type of memory card, also called a "flash" card, the dimensions of which are becoming
15 smaller and the storage capacity of which is becoming greater, are known.

This is especially the case with the so-called MMC (MultiMediaCard) card sold by SanDisk, the dimensions of whose body containing the integrated circuits and the positioning of its conducting
20 contact pads are precisely defined by its manufacturer and by a users' association so as to provide a standardized definition of such a card. This definition forms the subject, for example, of the publication MultiMediaCard System Specification, Version 2.11 Official Release @ June 1999 MMCA.

25 This type of MMC card, illustrated in Figure 6 appended to the present description, is generally similar in its shape and in its proportions to a MICROSIM card, especially in that it includes polarization means for correctly and unambiguously positioning it in a connector and/or in a read/write device, which means consist of a cut

corner 64 formed at one of the corners of the card, which is generally rectangular in shape.

On the other hand, the contact pads P1 on the MMC card consist of a series of seven substantially adjacent conducting pads which are aligned transversely near the short front end transverse edge 66 of the MMC card, in which front edge the polarizing cut corner 64 is also formed.

The seven contact pads P1 to P7 are distributed transversely with a uniform pitch of 2.50 mm and their lower free contact faces are mutually coplanar and coplanar with the lower face 76 of the plastic body of the card. The minimum transverse width of each pad Pi is 1.55 mm.

The card has a constant thickness of 1.4 mm, its length is 32 mm and its total transverse width is 24 mm.

The overall dimensions of the MMC card are therefore larger than those of a MICROSIM card and the design of a connector proposed in the abovementioned International patent application is not completely suitable for this type of card in so far as it results in the connector having a very large overall size, which is an appreciable drawback in so far as the area occupied by the insulating support of the connector, on the upper face of a printed circuit board on which it is mounted, is large, this area therefore being, of course, no longer available for mounting other electronic components on the printed circuit board.

To remedy this drawback, various designs have already been proposed, such as those illustrated in the document WO-A-0017806 (ITT MANUFACTURING ENTERPRISES INC.) which discloses a connector for simultaneously connecting a MICROSIM card and an MMC card, or in WO-A-01/29934 (ITT MANUFACTURING ENTERPRISES INC.) which discloses a connector for an MMC card with a card ejector.

In the latter document, the number of resilient contact blades is seven, five of these blades being transversely aligned near the front transverse bottom edge of the housing, while the other two blades are offset longitudinally rearwards, when considering the direction of longitudinal insertion of the card, from the rear forwards, so that their two free contact ends are longitudinally offset rearwards. This feature allows the two pads numbered P3 and P4 on the card to be electrically connected to the earth circuit and to an electrical power supply, prior to the other pads being connected.

Among cards having a large storage capacity, there now exists a new card called an SD (Secure Digital) card, also sold by SanDisk, the overall dimensions (length and width) of which are identical to those of the MMC card, as may be seen in Figure 6 appended to the present description, with the exception of its thickness, which is larger and equal to 2.1 mm.

All of the features and performance characteristics of this SD card are defined by the documents issued by SDCA (SD Card Association), the address of which is 53 Muckelemy St. P.O.Box 189, San Juan Baustista, CA 95045-0189 –USA.

This card has in particular improved performance characteristics as regards tolerance to electrostatic discharge (ESD) of about 10 kilovolts in the case of contact discharges and about 15 kilovolts in the case of discharges in the air, this improvement resulting especially from the contact pads being separated by plastic partitions, as will be explained below.

The lower face 76 of the card has, near its front transverse edge, six contact pads P1 to P6 which are identical to the six pads P1 to P6 on the MMC card in that they are uniformly distributed transversely with a pitch of 2.5 mm, their minimum transverse width being 1.4 mm, and also in that they are positioned transversely in the same manner,

especially with respect to the cut corner 64 of the insulating body of the card.

On the other hand, the contact pad P7 is narrower, with a transverse width of 1.1 mm, and is transversely offset by
5 8.05 - 5.625=1.425 mm with respect to the contact pad P6 which is adjacent to it on the left, while it is offset by 9.75 - 8.05=1.70 mm with respect to a first additional contact pad P8 which is adjacent to it to the right, the transverse width of the contact pad P8 being 0.9 mm.

The SD card also has a second additional contact pad P9 which
10 has a transverse width, like the pads P1 to P6, of 1.4 mm and is offset, firstly transversely to the left, by 2.5 mm with respect to the contact pad P1, and, secondly, longitudinally towards the rear, by about 1.7 mm with respect to the pads P1 to P8 which are all aligned.

Moreover, all the free lower faces of the nine contact pads P1 to
15 P9 are coplanar and vertically offset upwards with respect to the plane of the lower face 76 of the SD card.

Because of this offset, the adjacent and consecutive contact pads P9 then P1 to P6, from the left to the right, are separated in pairs by a partition 67 made of insulating material and of longitudinal orientation,
20 each having a transverse width of 0.7 mm and a height of 0.7 mm in the case of the two partitions located near the longitudinal edges of the card and a height of 0.7 mm and a width of 0.6 mm in the case of the other seven partitions. However, there is no insulating partition between the adjacent contact pads P7 and P8 which are simply electrically isolated
25 from each other.

In addition, each of the two opposed longitudinal edges 70 and 72 of the SD card has a grooved profile 71, 73 in the lower face 76, which gives the SD card an unsymmetrical profile allowing, on the one hand, it to be precisely guided in the connector which receives it and, on
30 the other hand, an additional means of polarization for distinguishing

insertion of the card into a connector in the face-up sense from the face-down sense. The depth of the grooving 71, 73 is 0.7 mm, i.e. the thickness difference $2.1 - 1.4 = 0.7$ mm between the two, SD and MMC, types of card.

5 Finally, in its left longitudinal edge 70, the SD card has a write protection device which is a notch 65 in which a cursor 69 can occupy two opposed longitudinal positions - a rear position when the protection is not activated and a forward position when the protection is activated.

 The SD card also has, in its right longitudinal edge 72, a notch 75
10 which, in some applications, ensures that the SD card is immobilized longitudinally by complementary means received in the notch 75.

 Compared with the MMC card, the SD card therefore has a non-uniform arrangement of the contact pads Pi and substantial differences in design.

15 However, it is desirable to be able to have a reliable connector for this type of SD card, while still being able, when required, to also receive cards of the MMC type.

 This would result in a high degree of complexity as regards the arrangement of the contact blades in the connector, and especially as
20 regards their precise positioning.

 All the known designs of this type of connector make use of contact blades which are transversely distributed with a non-uniform separation or pitch and/or contact blades which are different and non-homogeneous for each card type.

25 The term "non-homogeneous" is especially understood to mean contact blades which are not manufactured from the same strip of material and/or contact blades which belong to different batches obtained with different settings of the cutting and shaping tools. Hereafter, the expression "identical blades" will refer to identical and
30 homogeneous blades.

The contact blades are thus produced and fitted, by a longitudinal insertion, by means of different tools.

Apart from the complexity, and therefore the resulting increase in costs, of such solutions, they have the major shortcoming of increasing
5 the risk of the free connection ends of the various contact blades not being coplanar with the conducting tracks on the printed circuit board which carries the connector.

To remedy these drawbacks, the invention provides a connector of the abovementioned type, characterized in that all the said contact
10 blades are identical and arranged with a constant transverse pitch compatible with the distribution of the conducting pads on the card, so as to allow the said blades to be fitted simultaneously in a single insertion operation.

According to other features of the invention:

15 - the said contact blades are inserted simultaneously into the insulating support and belong to the same manufacturing batch so as to have uniform dimensional characteristics;

- the card is a card of the MMC type, especially a card of the SD type, in which at least two pads belonging to a pair of consecutive
20 conducting pads are separated by an insulating partition which projects, vertically downwards, with respect to the horizontal plane in which the free lower contact faces of the conducting pads substantially lie;

- all the said partitions are bounded vertically downwards by a lower edge which is coplanar with the lower face of the card which, in
25 the contact position, is vertically against the upper face of the bottom of the housing;

- the said identical contact blades of the connector are arranged with a constant pitch whose value is chosen between 2.35 and 2.45 mm;

- the said identical contact blades of the connector are arranged
30 with a constant pitch of 2.4 mm ;

- the transverse width of the free contact end of each contact blade, which projects vertically upwards out of the plane of the upper face of the bottom of the housing, is 0.5 mm;

5 - the housing houses at least one portion of the card which is inserted longitudinally into the housing in a direction parallel to the overall plane of the card and is bounded transversely by a bottom edge against which the said transverse edge of the card comes into abutment in order to define the contact position of the card;

10 - the longitudinal position of each of the said contact blades, and therefore of its free contact end, with respect to the insulating support is determined by a portion of the contact blade coming into longitudinal abutment against a corresponding part of the insulating support after the insertion operation

15 - the said transverse edge of the card has a cut corner at approximately 45°, intended to engage with a corresponding surface inclined at 45° formed at one of the ends of the bottom transverse edge of the housing in order to constitute polarization means defining the correct orientation of the card in the housing of the connector;

20 - the connector has a stop which is formed as a relief in the bottom of the housing and is placed transversely adjacent to one of the contact blades, near its free contact end and upstream of the latter when considering the direction of longitudinal insertion of the card, so as to be housed with the free contact end between two consecutive partitions when the card has been inserted in the said correct orientation and

25 so as to engage with a transverse surface portion of the card in order to prevent a complete longitudinal insertion of the card when the latter has not been inserted in the said correct orientation;

30 - the connector includes a metal cover for holding the card in the housing, which extends over the upper face of the card and has at least

one contact blade, made as one piece with the cover, which belongs to a switch for detecting the state of a write protect device for an SD card;

- the cover has an elastically deformable blade for locking an SD card in the contact position;

5 - the cover includes an elastically deformable blade belonging to a switch for detecting the end of insertion of the card into the connector;

- the cover has lateral rims which go around and stiffen the complementary lateral parts of the insulating support;

10 - each contact blade has a rear connection end, on the opposite side from its front free contact end, and a section for fixing in the insulating support, which lie below the plane of the lower face of an SD card; and

- the insulating support of the connector for the MMC card or the SD card is common, made of a single piece by moulding, with the

15 insulating support of another integrated connector intended to receive a MICROSIM card.

Further features and advantages of the invention will become apparent on reading the detailed description which follows, for the understanding of which a reader should refer to the appended drawings

20 in which:

- Figure 1 is a perspective top and left rear three-quarter view which illustrates a connector according to the invention, depicted without a card;

- Figure 2 is a view similar to that of Figure 1, in which the

25 connector is shown together with an SD-type card in the contact position fully inserted into the connector;

- Figure 3 is a perspective top and right rear three-quarter view of the connector of Figure 2;

- Figure 4 is a view of the connector of Figure 1, without its metal

30 lid or cover;

- Figure 5 is a view of the connector of Figure 2, without its metal lid or cover;

- Figure 6 is a schematic bottom view on a large scale of an SD card with its main standardized dimensions;

5 - Figure 7 is a view similar to that of Figure 6, which illustrates an MMC card;

10 - Figure 8 is a top view on a large scale of the front end part of the connector of Figures 2 and 3, in which have also been shown, as if the connector were transparent, the nine contact pads on the lower face of the SD card in order to reveal the relative position of each free end of a contact blade with respect to the associated corresponding conducting pad;

- Figure 9 is a cross-sectional view from the line 9-9 of Figure 8;

15 - Figure 10 is a view entirely similar to that of Figure 8, but on a reduced scale, which illustrates the connector without its metal cover;

- Figure 11 is a similar view of the previous figure, without the SD card;

- Figure 12 is a perspective view on a large scale of the detail in the direction of the arrow F12 in Figure 11;

20 - Figure 13 is a top view of the connector of Figure 1;

- Figure 14 is a cross-sectional view on the line 14-14 of Figure 13;

- Figure 15 is a left side view of the connector of Figure 13;

25 - Figure 16 is a perspective left rear three-quarter view of the metal cover of the connector;

- Figure 17 is a bottom view of the cover of Figure 16;

30 - Figure 18 is a perspective view on a large scale, in the direction of the arrow F18 in Figure 11, which shows the moving contact blade of the switch for detecting the position, activated or not activated, of the SD card write protect device;

- Figure 19 is a view of the detail D19 of Figure 13, with partial cut-away of the upper wall of the cover, which shows the switch in the open position corresponding to detection of the locked position of the write protect device;

5 - Figure 20 is a view similar to that of Figure 19, which illustrates the switch in the closed position corresponding to detection of the unlocked position of the write protect device;

10 - Figure 21 is a perspective top and left rear three-quarter view which illustrates one of the nine identical contact blades of the connector according to the invention;

- Figure 22 is a view on a large scale in cross section on the line 22-22 in Figure 11, which shows a contact blade in the rest position, that is to say without a card in the connector;

15 - Figure 23 is a view similar to that of Figure 22, in which the contact blade is shown in the working position;

- Figure 24 is a view similar to that of Figure 22, in which the contact blade is shown in the position of maximum deformation, pressing vertically downwards on the insulating support;

20 - Figure 25 is a schematic view illustrating the manufacture in strip form of identical and homogeneous contact blades;

- Figure 26 is a perspective top and rear three-quarter view illustrating another embodiment of a connector according to the invention, which is a double connector allowing both a MICROSIM card and an SD card to be connected;

25 - Figure 27 is a view similar to that of Figure 26, from another viewing angle and with an SD card being inserted;

- Figure 28 is a view similar to that of Figure 27, in which the SD card is shown in the contact position in the connector;

- Figure 29 is a bottom view of the connector of Figure 28;

- Figures 30, 31 and 32 are views similar to those of Figures 27, 28 and 29 which illustrate another embodiment of a double connector according to the invention for connecting both a MICROSIM card and an SD card;

5 - Figures 33 to 35 and 37 to 40 are similar views to those of Figures 1, 3, 4, 5, 8, 16 and 17, which illustrate an alternative form of the first embodiment of the connector according to the invention, which includes stop or locking means in the longitudinal position of the SD card, together with a switch for detecting the presence of the card in the
10 contact position, while Figure 36 is a view on a larger scale of a detail of Figure 35;

 - Figures 41, 42 and 44 to 51 are views similar to those of Figures 1, 4, 8, 13, 14, 15 and 21 to 23, which illustrate another embodiment of a connector according to the invention in which the
15 output tabs of the contact blades are oriented forwards;

 - Figure 43 is a perspective view which shows the insulating support of this connector;

 - Figure 52 is a perspective bottom and left front three-quarter view of the insulating support of the connector shown in Figures 41 to
20 51, which also constitutes the insulating support of the other embodiment of a connector according to the invention illustrated in Figure 53 and the following figures;

 - Figure 53 is a perspective top and right rear three-quarter view of a connector according to the invention with a card in the contact
25 position, the contact pads of which card are oriented so as to face the upper face of the printed circuit board which carries the connector;

 - Figure 54 is a bottom view of the connector of Figure 53, without a card in the connector;

 - Figure 55 is a perspective top view of the cover of the connector
30 of Figures 53 and 54;

- Figure 56 is a bottom view of the cover of Figure 55; and
- Figure 57 is a perspective view of one of the nine identical and homogeneous blades of the connector of Figures 53 and 54.

In the description which follows, identical, similar or analogous
5 components will be denoted by the same reference numbers.

By convention, without being limiting, the terms "lower", "upper",
"front", and "rear", with reference to Figure 1, will be adopted.

The figures show an electrical connector 50 which essentially
consists of an overall plate-shaped plastic insulating support 52 and a
10 metal or metallized lid or cover 54 which especially extends above that
plane horizontal upper face 56 of the insulating support 52 in which a
card housing 58 is formed, this housing being open vertically upwards
opposite the main upper plate-shaped part 60 of the cover 54.

The housing 58 is bounded vertically downwards by a horizontal
15 lower bottom wall 62 and it is open longitudinally rearwards so as to
have a slot for the longitudinal insertion of the front portion of an
electronic memory card which is, for example, a card C of the SD type or
of the MMC type.

The card C, of known design, has a rectangular overall shape
20 bounded longitudinally by a transverse front end edge 66, by a
transverse rear end edge 68 and by two parallel and opposed lateral
edges 70 and 72.

The front right corner corresponding to the intersection of the
edges 66 and 72 has a cut corner 64 cut at the standardized 45° for
25 polarizing the position and orientation of the card C.

Moreover, the card C has a horizontal upper face 74 and an
opposed parallel lower face 76 which is turned towards the free contact
ends 102 of the contact blades of the connector, and in this case
downwards towards the printed circuit board and which has, near its
30 transverse front end edge 66, a series of conducting contact pads Pi

which are oriented downwards towards the printed circuit board (not shown) which carries the connector on its upper face.

The two types of card - SD and MMC - described in detail in the introduction are shown in Figures 6 and 7, seen from their lower faces

5 76.

The card C is thus capable of being inserted, in the direction L1 indicated in Figure 2, from the rear forwards into the housing 58 until its front transverse edge 66 butts against a front transverse bottom edge 78 which defines the housing 58 towards the front.

10 The opposed lateral edges 70 and 72 of the card C are guided so as to slide in the housing 58 by parallel and opposed longitudinal edges 80 and 82 respectively, by which the housing 58 is bounded transversely.

More specifically, as may be seen in Figures 4 and 9, the edges

15 80 and 82 have a stepped profile complementary to the profile of the edges 70 and 72 of the SD card (each edge of which has a step 71, 73) with a horizontal step 81, 83, on which steps the card inserted into the connector "slides" so as to be able to take either an SD card, as shown in the figures, or an MMC card (not shown in position in the connector)

20 which is then housed above the steps 81 and 83.

As may be seen in the figures, the housing 58 proper, which receives the front portion of the card C, is bounded transversely forwards by the front transverse bottom edge 78 and transversely towards the rear by a transverse rear end face 84 of the insulating

25 support 52.

Moreover, the insulating support 52 is bounded transversely forwards by a front transverse face 86.

In order to improve the lateral guiding of the card C as it slides during its insertion into or its extraction from the housing 58, the body of

30 the insulating support 52 has two long opposed longitudinal extensions

or arms 88 and 90 which extend longitudinally rearwards beyond the rear transverse face 84 in order to increase the length of the longitudinal guiding edges 80 and 82.

5 The extensions 88 and 90 also have profiles which extend those of the guiding edges 80, 82 with an insertion chamfer 92, 94.

According to an alternative form (not shown), it is possible to provide a version of the connector having arms or extensions of shorter length, this shorter length being, however, sufficient to allow the fitting of the switch 140 which will be described below.

10 In order to fulfil the function of polarizing the position and orientation of the card C, the corner of the housing 58 corresponding to the intersection of the front transverse bottom edge 78 and the longitudinal edge 82 has a vertical face 98 inclined at 45°, which is complementary to the shape and the size of the cut corner 64, as may
15 be seen in Figure 5, when the card C is inserted into a correct position.

According to a technique known in the field of connectors for connecting smart cards, the insulating support 52 carries a series of electrical contact elements 100 which are made in the form of elastically deformable blades, a free contact end 102 of which projects vertically
20 above the plane of the bottom 62 in order to engage with the conducting pads on the lower face 76 of the card C.

In the example illustrated in the figures, the resilient contact blades 100 are nine in number, six of these blades being aligned transversely near the front transverse bottom edge 78 of the housing 58
25 whereas three other blades, corresponding to the contact pads P3, P4 and P9 of the SD card, are longitudinally offset rearwards so that their contact ends 102 are longitudinally offset rearwards. In the case of the pad P9, the offset results from the design of the SD card, whereas the offset of the blades associated with the pads P3 and P4 is due to the
30 "hot plug-in" connection explained above.

All the contact blades 100 are identical and each has a rear free connection end 104 in the form of a tab which terminates approximately in line with the rear transverse face 84, each end 104 here being designed in the form of a tab to be soldered to the surface of the upper
5 face of the printed circuit board.

Each tab here is bent at 90° for soldering it to a track on a printed circuit board, but it may also be of the type suitable for insertion into plated-through holes.

So-called "solderless" versions may also be provided, in which
10 the output tabs are in elastic bearing contact against the corresponding tracks on the printed circuit board. The vertical bearing is provided by the equipment which receives the connector, part of which bears on the cover 54, or else the connector is fixed to the printed circuit board by snap-fastening the earth tabs 132, 134, (see earlier in the description)
15 which are then, for example, designed in the shape of harpoons housed in plated-through holes in the printed circuit board.

The length bounded by the front transverse bottom edge 78 and the rear transverse face 84 is in this case approximately 1/4 of the total length of the SD-type or MMC-type card C.

20 Thus, as may more particularly be seen in Figure 10, about three-quarters of the card C extends longitudinally rearwards out of the housing 58 in a cantilever fashion above the facing portion of the upper face of the printed circuit board.

As may also be seen in Figures 11 and 13, the length of the
25 upper plate 60 of the cover 54, bounded by its front transverse edge 108 and rear transverse edge 110, is roughly equal to double the length of the housing 58, whereas more than half of the total length of the card is guided and held in place by the edges 80 and 82 and the extensions 88 and 90.

The edge 110 of the metal or metallized cover 54, which is connected to the earth of the printed circuit board which carries the connector, allows the card to be electrostatically discharged at the start of its longitudinal insertion into the connector 50.

5 As may be seen in particular in Figures 14 and 15, the free connection ends 104 lie approximately below the plane of the lower plane face 57 of the insulating support 52 which here has feet 96.

According to a known general design, the metal cover 54 has, in order to mount it on the insulating support 52, two parallel and opposed
10 lateral rims 120 and 122 which extend vertically downwards along corresponding portions 116 and 118 of the vertical and external longitudinal faces of the insulating support 52.

The rims 120 and 122 are shaped in the form of slideways, that is to say they are extended horizontally under the insulating support 52 by
15 horizontal branches 124 and 126 which are bent inwards and are received in corresponding housings formed in the lower face 57 of the insulating support 52 so as to allow it to be mounted by longitudinal sliding and so as not to project out of the plane of the latter.

As may be seen especially in Figures 2, 3, 9 and 15, the rims 120
20 and 122 shaped in the form of a slideway with the bent-in parts 124 and 126 give an enveloping shape to the cover which completely goes around the two long arms 88 and 90 which help to guide the MMC card or the SD card as it is being inserted longitudinally into the connector in the direction of the housing 58.

25 This enveloping shape gives the arms 88 and 90 great robustness in all directions.

This is because the design of the cover also allows it to prevent two arms from "coming closer together" in the transverse direction by means of the two rear upper corners 133 and 135 of the upper plate 60

which are housed in complementarily shaped parts 137 and 139 of the upper face of the arms 88 and 90.

The cover 54 is fitted onto the support 52 by sliding longitudinally from the front to the rear, that is to say from the left to the right when considering Figure 1 for example, and the cover 54 is immobilized in the mounted position on the insulating support 52 by means of two snap-fastening tabs 121 and 123 which are for example visible in detail in Figures 16 and 17 and which, in the mounted position of the cover 54, are housed in notches 127 and 129 formed for this purpose in the upper face 56 of the insulating support 52 between the transverse faces 78 and 86 (see Figure 4).

During mounting, the snap-fastening of the tabs 121 and 123 results from their engagement with the front upper edge of the insulating support beyond which they go by elastic deformation of the cover.

In order to remove or retract the cover 54 longitudinally, all that is required is for the cover 54 to be elastically deformed slightly, by raising its front transverse edge 108, by means of one's nail or an inserted tool, thanks to the notch 131 formed in the insulating support (see Figure 4) for disengaging the tabs or lugs 121 and 123.

Near its front transverse edge 108, the cover 54 may have two front lower horizontal tabs 132 and 134 which extend from the rims 120 and 122 so that the tabs 132, 134 can be soldered, for example by reflow, to the corresponding conducting tracks on the printed circuit board which are preferably connected to the earth plane of the electrical circuit of the printed circuit board so as to electrically connect the metal cover 54 to this earth plane. The tabs 132 and 134 may be bent over towards the outside of the connector, as illustrated for example in Figures 1 and 13 to 17, or else bent over inwards, as illustrated in Figures 2 to 5, 8 and 9.

When the tabs 132 and 134 are bent over towards the outside, it is then possible to disconnect the cover 54 for the purpose of carrying out maintenance work on the electronic components which are carried by the printed circuit board and are located under the cover, by
5 desoldering the tabs 132 and 134 from the cover, which can then be partially or completely moved away by sliding.

Mechanically fastening, by soldering, the cover 54 by its solder tabs can allow the connector 50 to be mechanically held in place at its front part without making use of any additional piece or component. In
10 addition, this fastening of the front part balances the fastening of the rear part, provided by soldering the outputs 104.

As may especially be seen in Figure 1, the upper plate 60 of the cover 54 has a series of holes 61 which, like the contact ends 102, are oriented upwards, allowing the equipment to be tested after the
15 components and the connectors have been soldered, by being directly connected, by means of a test apparatus or tester, to the ends which are accessible when a card C is absent.

A transverse slot 63 allows the output tabs 104 to be soldered and the soldered joints to be checked.

20 If it is desired to improve the electromagnetic screening that the cover provides, it is possible to make the upper plate without any holes 61 or slot 63.

In accordance with the teachings of the invention, all the contact blades 100, 102 are identical to one another and are arranged with a
25 constant transverse pitch compatible with the position and the distribution of the conducting pads Pi on the multimedia card housed in the connector, and especially compatible with those on the SD card.

This arrangement and this compatibility are illustrated on a large scale in Figure 8, which is a representation of a connector according to

the invention with slight differences in detail of the shapes of certain components compared with the other figures.

As may be seen in this Figure 8, and in Figures 10 and 11, the longitudinal mid-axes A1 to A9 of the nine contact blades 100, 102 associated respectively with each of the contact pads P1 to P9 are shown with a uniform and constant centre-to-centre spacing "E" which in this case is equal to 2.4 mm.

By means of this design, all the identical and equidistant blades 100, 102 may be treated simultaneously by means of a single tool, by longitudinal insertion, in this case from the rear forwards.

As shown in Figure 8 or Figure 10, each contact blade 100, 102 of axis Ai is not "centred" transversely with respect to the contact pad Pi with which it engages, but each free end of a blade is in electrical contact with a facing portion of the rectangular lower face of the corresponding contact pad Pi, by defining with the latter at least one point of contact lying substantially on the longitudinal mid-axis Ai of the contact blade.

As may be seen, it is the blades associated with the pads P6, P7 and P8 which are the least transversely "centred" and which are especially very close to the internal lateral faces opposite the corresponding intermediate partitions 67.

The particular design of each blade 100, 102 will be explained in detail below, together with its insertion and retention technology, but it should be noted here that the longitudinal position of each contact blade with respect to the insulating support 52, which is different for the blades associated with the pads P3, P4 and P9 compared with the group of furthest advanced blades associated with the contact pads P1, P2 and P5 to P8, results from the operation of mounting them by insertion, during which operation each blade butts against its housing provided for this purpose near the rear transverse edge 84.

As shown only in Figures 10 and 11, the 2.4 mm centre-to-centre spacing between the various blades and the transverse position of the group of blades with respect to the insulating support 52, and therefore with respect to the contact pads Pi, allows a depolarization stop 136 to
5 be fitted which is moulded as one piece with the insulating support and is formed as a vertical relief on the bottom 62 of the housing 58.

The stop 136 is a rectangular parallelepipedal block which, because of its short transverse width of about 0.4 mm, is housed between the right lateral edge of the blade 100, 102 associated with the
10 pad P9 and the left internal lateral edge of the partition 67, by which edge this pad P9 is bounded transversely towards the right.

The height of the stop is around 0.6 mm so as to allow full correct insertion of the SD card as illustrated in the figures.

However, the solid stop 136 is positioned longitudinally so that,
15 when the SD card is inserted improperly, that is to say with its transverse edge 68 inserted first, it prevents any penetration of the body of the SD card into the housing 58, the lower edge corresponding to the intersection of the transverse edge 68 with the lower face 76 then butting against the rear transverse face 138 of the stop 136, as shown
20 schematically by the dot-dash line in Figure 11.

In the absence of such a stop, the card would partly penetrate the housing 58 and, before the intervention of the inclined polarizing face 98, would "crush" the free ends 102 of the two contact blades set furthest back, which are associated with the pads P3 and P4.

25 To prevent such crushing, another solution consists in providing holes or recesses which emerge in the insulation beneath each blade, but this then generally results in the blade being bent beyond the yield point of the material and therefore results in permanent deformation of the blade. There is therefore then also a risk of the free contact ends

colliding with the upper face of the printed circuit board or with electronic components located beneath the connector.

It should be noted that this risk does not exist in the case of a conventional MMC card which has a small thickness and which is in the "high" position above the steps 81 and 83 and which therefore does not crush the contact blades, even if it is improperly inserted. Polarization of the improperly inserted MMC card is achieved by the inclined surface 98.

During longitudinal insertion of the SD card into the connector in the correct position, that is to say with its front transverse edge 66 penetrating the connector first and with its upper face 74 oriented upwards, the plastic partition 67, which lies between the contact pad P9 and the longitudinal edge 72 and which terminates in the cut corner 64, would run the risk of butting against the rear end transverse edge 91 of the longitudinal arm 90.

To remedy this drawback and further improve the ergonomics of the connector, a cut-away 93 is provided in the inner longitudinal edge 95 of the arm 90 near its rear free end (see for example Figures 1 and 4) which prevents such an abutment of the partition 67 until the SD card bears in guiding contact on the steps 81 and 83.

The connector according to the invention also includes a switch 140 for detecting the longitudinal position of the SD card write protect cursor 69.

For this purpose, the switch 140 has what is called a fixed contact blade 142 incorporated into the metal or metallized cover 54 and a moving detection blade 144 carried by the insulating support 52. As will be explained below, the blade 142 is called a fixed blade in the operating principle of the switch, but it has the ability to undergo elastic deformation so as in particular to avoid a "hard spot" during insertion

and/or extraction of the card making it possible to take up the dimensional tolerances on the inserted card.

As may be seen especially in Figures 1, 16 and 17, the left lateral rim 120 of the cover 54 has a cut-out fixed blade, of longitudinal orientation, which is slightly deformed transversely outwards. By being part of the cover 54, the fixed blade 142 of the switch 140 is connected to the electrical earth, as is the cover 54, by its soldered tabs 132 and 134. In addition, this blade 142 is "free", that is to say it is made as one piece with the cover.

The moving blade 144 has a longitudinal overall orientation and includes a front foot 146 for fitting and for connection, which extends vertically downwards, being housed in a complementary hole formed for this purpose in the insulating support 52 near the lateral edge 80. The foot 146 has a connection tab 147 intended to be soldered to or inserted into a hole in contact with a conducting track associated with the printed circuit board.

Beyond the set-in foot 146, the moving blade is extended longitudinally rearwards by an elastically deformable branch 148 which terminates in a curved detection portion 150 with its convex side facing inwards in the direction of the left longitudinal edge 70 of the SD card (see Figures 19 and 20).

Beyond the curved portion 150, the moving blade 144 has a contact tab 152 which is capable of coming into electrical contact with the facing internal surface portion 143 of the fixed contact blade 142.

At rest and as illustrated in Figure 19, the position of the detection blade 144 is determined by a slight elastic prestress by means of which the tab 152 bears against a fixed surface 154 of the insulating support 52.

In this rest position corresponding to the rear position of the protection cursor 67, the switch is in its normal "open" state, whereas it

is closed when the cursor 67 is in the forward position as may be seen in Figure 20.

In order to ensure the change of state of the detection switch 140 whatever the manufacturing and positioning tolerances, the dimensions and the positions of the two blades - the fixed blade 142 and the moving
5 blade 144 - are such that the fixed blade 142 is slightly deformed elastically outwards by the contact tab 152 when the switch is in the closed, working position, as may be seen in Figure 20.

As may be seen especially in Figures 4, 10 and 11, the moving
10 blade 144 is placed in a cut-out 145 in the left longitudinal edge 80, 88. Thus, the widths of the two lateral, transversely opposed parts of the insulating support 52 are identical and the switch 140 can be fitted without the minimal and the small width of the connector being increased. This minimal transverse width results from the dimensions of
15 the card and from the minimal structural amount of plastic needed to guide the card.

If a blade is fitted symmetrically along the right edge of the insulating support, it is possible to produce in the same way a switch for detecting the insertion of a card into the connector.

20 The general design of each contact blade, one of which is illustrated in Figure 21, is of known type. In particular, it has a mounting or fitting section 151 which lies in a horizontal plane and is extended towards the front by two insertion tabs 153, which also have a stabilizing function. Each tab 153 is designed, in a known manner, to be
25 inserted longitudinally forwards into a complementary slot 155 which is open towards the rear in the rear transverse edge 84 of the insulating support 52.

Beyond the mounting section 151, and between the two insertion tabs 153, each blade 100 has an upwardly inclined intermediate section
30 153 which constitutes the elastically flexing body of the blade and which

is itself extended by a free contact end portion 102 which is curved with its convex side oriented upwards.

In order to allow connection with all the contact pads P_i , as was explained above, the width of each contact section 102 is small and
5 equal to 0.5 mm.

In order to mount each blade 100, 151, 153 and to allow it to undergo elastic deformation vertically downwards, the upper face of the bottom 62 has throughout a groove 158 which is itself bounded by a blind bottom 160.

10 In line with the end edge 159 of the contact section 102, the insulating support has a "box" 162 formed as a relief with respect to the bottom 62. Each box is longitudinally open towards the rear in order to allow the edge 159 to be freely inserted therein during insertion of the contact blade into position in the insulating support 52 (see Figure 12).

15 The internal upper face 164 of the box 162 is chamfered in order to make insertion easier during mounting.

In the mounted position and at rest, as may be seen in Figure 22, the blade is slightly prestressed elastically with the upper face of the contact section bearing vertically upwards against the chamfer 164, so
20 as to define a precise height of the contact section 102 projecting above the bottom 62.

The bottom of the box is open vertically downwards in line with the end edge 159 so that the latter can be inserted thereinto when the contact blade is flexed, as may be seen in Figures 23 and 24.

25 Figure 25 shows a portion of a strip 166 of contact blades 100 of the type of those used for the manufacture of connectors according to the invention.

The blades are manufactured in a known manner by successive cutting, folding and/or bowing, and coating, steps starting from a thin
30 strip 166 of metallic material.

After the various manufacturing steps, all the blades thus belong to the same strip 166 and are joined together by a linking band or border 188, each via a pair of long longitudinal straps 170 of small transverse width.

5 The ends 172 of the straps 170 are joined to the rear part (to the right when considering Figure 25) of the mounting section 51, each with a fracture initiator 174.

10 Thus, a continuous series of contact strips is used which, in the case of the present invention, are inserted longitudinally in groups of nine contact blades into an insulating support 52, without having to separate each of the blades beforehand, that is to say all the blades inserted into the same insulating support for the manufacture of a connector belong to the same batch and are homogeneous from the standpoint of their dimensional characteristics so as to ensure that there
15 is no lack of coplanarity of the output or connection tabs 104.

During insertion, and taking into account the different longitudinal positions of the nine blades, the linking straps 170 for the blades associated with the pads P9, and then P3 and P4, deform by buckling so as to allow all the blades to be fully inserted in forward abutment by
20 means of an automatic insertion tool (not shown) before the blades 100 are separated from their straps 170.

The separating operation is carried out by fracturing the initiators 174 by performing alternating bending operations on the straps.

25 Thus it is certain that all the blades are homogeneous within the meaning of the invention, as they all come from one strip of material and have been formed by the same cutting tool, with no modification to the settings of this tool.

It should be noted that the embodiment of a connector according to the invention that has just been described, in which the contact
30 blades 100 are inserted from the rear, with their outputs or connection

tabs 104 oriented rearwards, has the advantage of minimizing the footprint of the connector 50 on the printed circuit board, especially by optimising the total length between the transverse stop face 78 for the card and the front transverse face 86 of the connector.

5 The invention is not limited to the basic embodiment that has just been described.

 It is also possible to incorporate into the connector means for simultaneously connecting a MICROSIM card in a manner similar to that described in document WO-A-00/17806 (ITT MANUFACTURING
10 ENTERPRISES INC.).

 Two embodiments of such a double connector type are illustrated in Figures 26 to 31.

 In the first embodiment illustrated in Figures 26 to 29, the MICROSIM card is designed to be housed in a connector 50' which is
15 placed "upwards" when considering Figures 26 to 28, that is to say like the main connector 50 for the SD card, the connector 50' and the connector 50 sharing the insulating support 52 whose rear part 52' is modified and lowered with respect to the horizontal plane of the bottom
62 in order to constitute a housing 58' which is designed to take a
20 MICROSIM card and in which contact blades 102' are arranged, the connection outputs 104' of which are oriented transversely on either side (to the left and to the right) of the common insulating support 52, 52', a lower part of which constitutes the insulating support 52' for the connector 50', as may be seen especially in Figure 29.

25 The connector 50' has its own hinged closure cover 54', the design of which is described and illustrated in WO-A-01/61790 (ITT MANUFACTURING ENTERPRISES INC.).

 When the cover 54' is in the closed position, as illustrated in the figures, the plane of the upper face of the cover 54' is offset vertically
30 downwards with respect to the plane of the bottom 62 of the housing 58

for the connector 50 which is completed, in order to guide the SD card, by a rear end part.

In this case the connector 50 illustrated in Figures 26 to 29 does not have a cover 54 as previously, and the vertically upward retention of the SD card and its guiding, during its longitudinal insertion, are provided by horizontally oriented upper guiding tabs 176 and 178 moulded with the insulating body 52, 52'.

To make it easier to insert the SD card, it may also be seen that the cover 54' of the connector 50' has two vertically oriented lateral guiding tabs 180' and 182' which, made as one piece with the cover 54', are produced by cutting and bending.

In so far as that part of the main connector 50 for the SD card which is located to the rear of the contact ends 102 of the blades 100 (that is to say that part located to the right when considering Figure 26) is "occupied" by the connector 50', the contact blades 100 are, of course, mounted longitudinally the opposite way round compared with the embodiment of a single connector described above with reference to Figures 1 to 25.

Thus, the blades are inserted longitudinally from the front rearwards, that is to say in the direction L2 indicated in Figures 26 and 29.

The orientation of the boxes 162 is, of course, also reversed and the vertically oriented transverse bottom wall 78, by which the housing 58 is bounded longitudinally at the front, has holes 184 for allowing the contact ends 102 of the blades 100 to pass through it as they are being mounted by longitudinal insertion in the direction L2.

In the second embodiment of a double connector illustrated in Figures 30 to 32, the connector 50' for the MICROSIM card is located below the lower face 57 of the insulating body 52 of the connector 50

which takes the SD card and which is itself located in the upper part, as in the previous examples.

In this embodiment, the contact blades 100 of the connector 50 which takes the SD card are of the type inserted from the front, with the advantages which result therefrom and which will be described below. Among these advantages, there is the small overall height of the insulating support 52 of 2.5 mm between the faces 56 and 57.

The insulating part which projects below the plane of the face 57, in order to constitute the support 52' of the connector 50' projects by about 0.7 mm from this plane, that is to say the distance separating the faces 57 and 57' is around 0.7 mm.

The projecting part 52 may also be fitted into a window or cut-out in the printed circuit board which carries the connector 50. It is not necessary to provide a cover 54' if it is desired to reduce the total height of the connector further.

With regard to the connector 50, the tabs 176 and 178 may also be fitted into complementary holes in another printed circuit board, without therefore increasing the total height of the assembly, the double connector 50-50' then being sandwiched between the opposing faces of the two printed circuit boards which are separated by 2.5 mm.

According to another embodiment, it is also possible to replace the tabs 176 and 178 with a metal cover 54 whose thickness is around 0.2 mm, i.e. less than the thickness of the moulded tabs 176 and 178, which is around 0.4 mm.

The embodiment illustrated in Figures 33 to 40 is an alternative version of the first embodiment according to the invention illustrated in Figures 1 to 20, which firstly has a blade for retaining or locking the SD card in the longitudinal position, which blade is designed to engage with the notch 75 in the card.

The locking blade 184 is advantageously made as one piece with the cover 54, said blade being formed in its lateral rim or wall 122, in the same way as the fixed blade 142 of the switch 140.

5 The blade 184 extends longitudinally rearwards and has a V-shaped catch 186 at its free end, the tip of the V of which is oriented transversely towards the inside of the connector, facing the right longitudinal edge 72 of the SD card which has the notch 75.

10 At rest, that is to say in the absence of a card, the catch 186 lies inside the connector, thanks to the notch 188 formed in the insulating support (see Figure 35), this notch being positioned longitudinally so as to lie to the right of the notch 75 in the SD card when the latter is in the contact position, as may be seen in Figure 37.

When the SD card is in the contact position in the connector 50, the catch 186 is caught in the notch 75 (see Figure 38).

15 During insertion of the SD card into the connector, the catch 186 automatically snaps into the notch 75.

The V-shaped part of the catch 186 engages with the cut corner 64 of the SD card, which allows the catch 186 to be progressively moved aside by a low resistance force applied by the blade 184.

20 During extraction of the SD card longitudinally rearwards, the force to release the catch 186 from the notch 75 is higher since the V-shaped part then engages with a right-angled edge of the notch 75.

Of course, a choice of angles of the branches of the V-notch 186 makes it possible to "adjust" by design the value of the force to release
25 the catch 186.

When an MMC card has been inserted into the connector, the blade 184 with its catch 186 is moved aside transversely towards the outside in the same way as in the case when an SD card is inserted, and the catch 186 then engages with the right longitudinal edge 72 of the

MMC card, without a notch, against which it remains elastically pre-stressed by the blade 184, thus constituting a card friction brake.

Of course, in this configuration it is not possible to produce a switch for detecting the presence of a card in the contact position in the
5 connector by producing one of the blades of the switch by cutting it out from the wall 122 of the cover 54, as mentioned previously.

The embodiment illustrated in Figures 33 to 40 thus provides a switch 190 for detecting the end of insertion and the presence of a card, MMC or SD, in the contact position near the front longitudinal end of the
10 connector.

The switch 190 has a "fixed" blade 192, similar to the blade 142 of the switch 140, which, being made as one piece with the cover 54, is formed by cutting and bending, and which is visible in detail especially in Figures 39 and 40.

15 The blade 192 thus lies in a transverse vertical plane facing a cut-out 195 formed in the front transverse wall of the insulating support 52 so as to lie facing a moving blade 194 of the switch 190, which is of similar design to the moving blade 144 of the switch 140 and which has, in particular, a connection foot 196, 197, a convex actuating portion 200
20 and a free end contact tab 202.

In this embodiment, the metal or metallized cover 54 constitutes a common connection, with the earth tracks on the printed circuit board, for the switches 140 and 190 via its "fixed" blades 142 and 192.

As may be seen in detail in Figure 36, the bearing face 204,
25 against which the contact tab 202 is pressed elastically when the switch is at rest, is advantageously made in a box 162 so that this face 204 lies below the SD card, or the MMC card, thus making it possible to reduce the overshoot of the switch when the card C is in the working position or contact position.

A first embodiment of a single connector, similar to that described and illustrated in Figures 1 to 15, will now be described and illustrated in Figures 41 to 51, in which embodiment the contact blades 100 are inserted longitudinally rearwards in the direction L2 in Figure 44, with their connection tabs or outputs 104 oriented towards the front.

This version with the outputs 104 oriented towards the front has the advantage of reducing the total thickness of the connector, if one compares it with the version with the outputs oriented towards the rear. Here, the connector is in a first configuration in which, as previously, the contact pads Pi on the card C are directed towards the printed circuit board, that is to say with the housing 58 open upwards.

Another version of a connector with outputs 104 oriented towards the front is illustrated in Figure 52 and the following figures, in which version the contact pads Pi on the card are oriented away from the printed circuit board, that is to say upwards, with the housing 58 for the insulating support entirely oriented downwards towards the upper face of the printed circuit board.

In the version in Figures 41 to 51, the total thickness of the connector, including the thickness of the SD card which is 2.1 mm (plus or minus 0.15 mm) and the thickness of the cover 54 which is 0.2 mm, is 2.7 mm.

In the version illustrated in Figure 52 and the following figures, the total thickness is 2.5 mm, the vertical retention of the card then being provided, downwards, by the printed circuit board. This connector of low height, equal to 2.5 mm, may take an SD card whose maximum height is $2.1 + 0.15 = 2.25$ mm.

As may be seen in the figures, especially Figures 41 to 43, the total length of the connector 50, and more particularly the length of the main part of the insulating support 52 bounded by its transverse faces 84 and 86, is greater in order to have a rear block 220 allowing the

contact blades 100, 102 to be mounted by longitudinal insertion in the direction L2.

As may be seen in Figures 42 and 43, the boxes 162 are, of course, reversed longitudinally and that one associated with the contact
5 blade 100 located furthest to the right thus constitutes the stop 136 for polarizing the insertion of the SD card, with its rear transverse stop face 138.

Referring to Figures 22 to 24 of the version with the outputs 104 oriented rearwards, it may be seen that the flexible branch 157 of the
10 contact 100 and its part 151 for fixing it in the insulator 52 lie below the plane of the lower face 76 of the SD card, i.e. with a thickness or height "H" of 0.7 mm, which comprises 0.2 mm for the thickness of the contact and 0.25 mm of plastic on either side, above and below, the contact blade 151.

It may also be seen that the free contact 102 of the blade 100
15 must project by at least 0.7 mm from the plane of the flexible branch 157 of the blade in order to ensure that the end 102 is in contact with the pad Pi on the SD card without the lower face of the said card touching the flexible branch 157, in order to prevent any loss of electrical contact
20 which would result therefrom.

Because of the 0.7 mm height between the planes 62 and 83 of the insulating support, dictated by the design of the SD card, the design of the blade 100 and of the cavity 158 of the insulating support has been optimised by reversing the design currently adopted for the electrical
25 contact blades of the "crook" type normally used for the connectors for MICROSIM cards, for example those described in the documents WO-A-00/17805 and WO-A-00/17806.

In the rest state illustrated in Figure 22, the flexible branch 57 is inclined towards the pads on the card at an angle of 10° with respect to
30 the horizontal so as to minimize the height between the point of contact

of the end 102 and the flexible branch 157, while still ensuring an overshoot of about 0.5 mm of the point of contact 102 with respect to the plane of contact of the conducting pads on the SD card or MMC card.

5 In the working position of each blade, illustrated in Figure 23, the flexible branch 157 is returned by elastic deformation close to the horizontal.

 If, according to the prior art, a design had been adopted in which the cavity 158 is open downwards in the lower face 57 of the insulating
10 support, it would have been necessary, in order to prevent both the branch 157 in the elastically deformed position and the end 159 from colliding with the upper face of the printed circuit board, on the one hand for the angle of inclination of the branch 157 in the rest state to be considerably reduced (that is to say the overshoot height of the point of
15 contact 102 in its rest state would have to be reduced, with a loss of reliability of the electrical contact) or, on the other hand, for the thickness between the region 151 of the contact blade 100 and the lower face 57 of the insulating support to be substantially increased, that is to say the total thickness of the connector would have to be increased.

20 If we now compare this design with that with the outputs 104 oriented towards the front, which is shown in Figures 49 to 51, it may be seen that the bottom of the insulating support lying below the SD or MMC card has a height "h" reduced to 0.25 mm.

 The robustness of this very thin bottom 226 is provided
25 longitudinally by beams 222 (see Figure 42) between which the flexible branches 157 lie and which terminate in the boxes 162.

 On the other hand, the thin bottom 226 does not contribute to the transverse robustness of the insulating support as there is no transverse link between the beams.

It may also be seen that the blade retention region, with its part 151 inserted longitudinally, is located in the block 220 at the front of the insulating support 52 over a length of 4 mm bounded by the transverse faces 78 and 86.

5 The main features of this design are the following.

There is no heightwise constraint for the insulating support in this region, which may be brought up to the upper level of the insulating support 52, i.e. 2.5 mm.

10 However, as may be seen in the figures, it is not possible to use all of this height in order to avoid having excessively great thicknesses of material which would impair the quality of the moulding. Thus, the block 220 is bounded upwards by an upper face 224 which lies vertically set back with respect to the upper face 56 of the support 52.

15 There is no dimensional constraint for the position of the blade retention region 151 since this region does not lie below the SD or MMC card.

The plane of contact of each of the pads P_i on the SD or MMC card with the free end 102 of the associated contact blade lies at $0.7 + 0.25 = 0.95$ mm from the lower face 57 of the insulating support.

20 This 0.95 mm value is similar to the thickness of the insulators (1 mm) used in the connectors developed for MICROSIM cards and for which the thickness of material under the contact retention region is equal to 0.25 mm and for which the cavities of the insulating support are oriented away from the conducting pads P_i on the card.

25 The lower face of the region 151 of the contact blade corresponds to the upper face of the thin bottom 226 with a thickness of 0.25 mm. Care therefore has to be taken to ensure that this retention region is located entirely beyond the stop face 78 for the card, so that the partitions 67 having a height of 0.6 or 0.7 mm, which separate the
30 pads P_i on the SD card, do not collide with the latter.

The free end 102 of the blade 100 overshoots by 0.5 mm in the rest state illustrated in Figure 49.

Thus, the deformation kinetics of a contact blade 100 illustrated in Figures 49 to 51 are identical to those of a conventional "crook"-type
5 contact blade used in the known designs for connecting MICROSIM cards.

Since the upper face 224 is not limited heightwise, the thickness of plastic above the contact blade retention region 151 is very large, for example about 1.2 mm in the embodiment illustrated in the figures,
10 giving the insulating support great transverse robustness.

In addition, since the cavities which house the contact blades are open downwards, this provides a natural passage for the free end 102 and the resilient branch 157 of each contact blade during their longitudinal insertion in the direction L2.

15 The cover 54 shown in Figure 41 and the following figures is overall similar to the cover 54 described previously, with the exception of its tabs 132 and 134 which are placed in the rear part of the cover so that, after soldering to the printed circuit board, the fastening and the mechanical behaviour of the connector may be balanced.

20 Finally, as may be seen in Figures 53 and 54, the insulating support 52 may also be "turned upside down" so that its face 57 is oriented upwards in order to take an SD card with its conducting pads Pi, the latter also being oriented upwards, that is to say away from the upper face of the printed circuit board.

25 This embodiment of the connector also provides a cover or plate 54 whose main function is, in particular, to ensure rigidity of the longitudinal arms 88 and 90 thanks to the enveloping shape of its slideway-forming portions 120 and 122 and to contribute to the electromagnetic screening.

The cover 54 is mounted vertically by snapping onto the face 57 of the insulating support 52 which in this case is oriented upwards when the connector is in the mounted position on the upper face of the printed circuit board.

5 The 0.2 mm thickness of the upper plate 60 of the cover 54 is between the face 57 of the insulating support 52 and the other face, in this case oriented downwards, of the thin bottom or web 226 having a thickness of 0.25 mm (see Figure 53).

10 As may be seen in Figures 54 and 57, the output ends 104 of the contact blades 100, 102 are, of course, modified, as is the output pad 146, 147 of the moving blade 144 of the switch 140.

CLAIMS

1. Electrical connector (50) of the type comprising a support (52) made of insulating material which defines a housing (58) open in its upper face (56) for a contact memory smart card (C) of rectangular overall shape having on its lower main face (76) a series of parallel longitudinal conducting pads (Pi) which are arranged near a transverse edge (66) of the card, in a non-regular transverse distribution, and each of which engages with a free connection end (102), placed in the bottom (62) of the housing in the support (52), of an electrical contact blade (100) which is carried by the support and which belongs to a series of parallel longitudinal blades (100), each of which is fitted into the support by an operation of inserting it in a longitudinal direction, and of the type in which, when the card (C) is in its contact position, each free end (102) of a contact blade defines with the corresponding conducting pad (Pi) a contact point, at least two contact points being longitudinally offset one with respect to the other,

characterized in that all the said contact blades (100, 102) are identical and arranged with a constant transverse pitch (E) compatible with the distribution of the conducting pads (Pi) on the card, so as to allow the said blades to be fitted simultaneously in a single insertion operation.

2. Electrical connector according to the preceding claim, characterized in that the card is a card of the MMC type, especially a card of the SD type, in which at least two pads belonging to a pair of consecutive conducting pads are separated by an insulating partition (67) which projects, vertically downwards, with respect to the horizontal plane in which the free lower contact faces of the conducting pads (Pi) substantially lie.

3. Connector according to the preceding claim, characterized in that all the said partitions (67) are bounded vertically downwards by a

lower edge which is coplanar with the lower face (76) of the card which, in the contact position, is vertically against the upper face of the bottom (62) of the housing (58).

4. Connector according to either of Claims 2 and 3,
5 characterized in that the said identical contact blades (100, 102) are arranged with a constant pitch (E) whose value is chosen between 2.35 and 2.45 mm.

5. Connector according to the preceding claim, characterized in that the said identical contact blades (100, 102) are arranged with a
10 constant pitch (E) of 2.4 mm.

6. Connector according to the preceding claim, characterized in that the transverse width of the free contact end of each contact blade, which projects vertically upwards out of the plane of the upper face of the bottom (62) of the housing (58), is 0.5 mm.

15 7. Connector according to any one of the preceding claims, characterized in that the housing (58) houses at least one portion of the card (C) which is inserted longitudinally into the housing (58) in a direction parallel to the overall plane of the card and is bounded transversely by a bottom edge (78) against which the said transverse
20 edge (66) of the card (C) comes into abutment in order to define the contact position of the card.

8. Connector according to any one of the preceding claims, characterized in that the longitudinal position of each of the said contact blades (100), and therefore of its free contact end (102), with respect to
25 the insulating support (52, 78) is determined by a portion of the contact blade coming into longitudinal abutment against a corresponding part of the insulating support after the insertion operation.

9. Connector according to any one of the preceding claims, characterized in that the said transverse edge (66) of the card (C) has a
30 cut corner (64) at approximately 45°, intended to engage with a

corresponding surface (98) inclined at 45° formed at one of the ends of the bottom transverse edge (78) of the housing (58) in order to constitute polarization means defining the correct orientation of the card (C) in the housing (58) of the connector (50).

5 10. Connector according to the preceding claim, taken in combination with Claim 7, characterized in that it has a stop (136) which is formed as a relief in the bottom (62) of the housing and is placed transversely adjacent to one of the contact blades, near its free contact end (102) and upstream of the latter when considering the direction of
10 longitudinal insertion of the card,
so as to be housed with the free contact end between two consecutive partitions (67) when the card has been inserted in the said correct orientation and
so as to engage with a transverse surface portion (68) of the card in
15 order to prevent a complete longitudinal insertion of the card when the latter has not been inserted in the said correct orientation.

 11. Connector according to any one of the preceding claims, characterized in that it includes a metal cover (54) for holding the card (C) in the housing (58), which extends over the upper face (74) of the
20 card (C) and has a contact blade (142), made as one piece with the cover, which belongs to a switch (140) for detecting the state of a write protect device (65, 69) for an SD card.

 12. Connector according to the preceding claim, characterized in that the cover (54) has an elastically deformable blade (184, 186) for
25 locking an SD card in the contact position.

 13. Connector according to Claim 11, characterized in that the cover includes an elastically deformable blade (192) belonging to a switch (190) for detecting the end of insertion of the card (C) into the connector.

14. Connector according to any one of Claims 11 to 13, characterized in that the cover has lateral rims (120, 122, 124, 126, 133, 135) which go around and stiffen the complementary lateral parts (80, 82, 88, 90) of the insulating support.

5 15. Connector according to any one of the preceding claims, characterized in that each contact blade (100) has a rear connection end (104), on the opposite side from its front free contact end (102), and a section (151) for fixing in the insulating support (52), which lie below the plane of the lower face of an SD card.

10 16. Connector according to any one of the preceding claims, characterized in that its insulating support (52) is common, made of a single piece by moulding, with the insulating support (52') of another integrated connector (50') intended to receive a MICROSIM card.

15 17. Connector according to any one of the preceding claims, characterized in that the said contact blades (100) are inserted simultaneously into the insulating support (52) and belong to the same manufacturing batch so as to have uniform dimensional characteristics.