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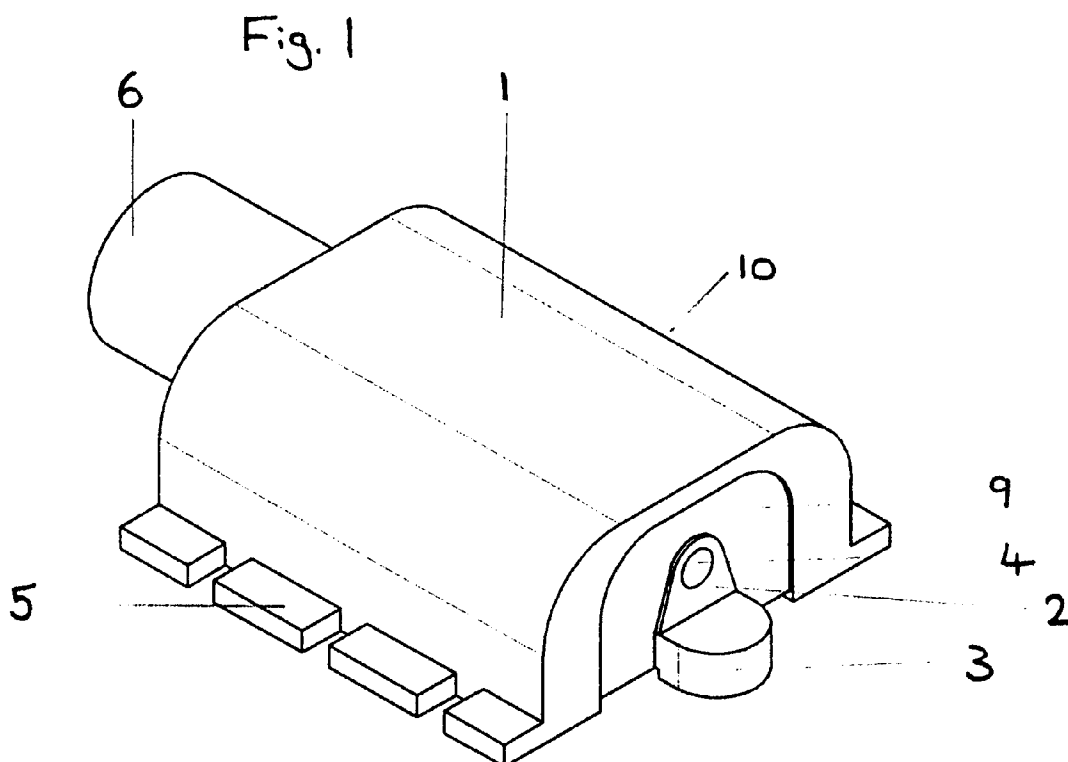
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(54) Radio frequency connector to printed circuit board adapter

(57) An adapter for connection of an RF connector to a printed circuit board (PCB), the adapter comprising a plastics body adapted to mate with an RF connector, one or more contacts for electrical connection with the RF connector upon mating therewith and one or more

attachment means disposed so as to permit connection to tracks on a printed circuit board, wherein coupling between each contact and an associated attachment means is effected via a conductive layer provided on the surface of the body.



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Description

The present invention relates to an adapter for attaching to a printed circuit board (PCB) that facilitates the production of an electrical interface between the PCB and one or more radio frequency (RF) connectors.

Presently, one method of connecting RF connectors to printed circuit boards uses right angle connectors that mate directly with a plated through hole in the PCB and/or are soldered to a printed circuit track on one side of the board. It is expensive to produce the right angled body for the connector and it is also difficult to fit an electrical contact bent at 90° into the body. These problems have previously been overcome by producing the right angled body in more than one piece and fitting it together after the contact is inserted. A further problem is encountered if two or more right angle connectors are stacked one above another. The mating end of a right angled connector stacked on top of another of the same size would not be coplanar with the PCB and therefore mating would not be possible. In this situation special connectors must be produced, each level of stacking requiring a specialised connector.

Another way of making connection to PCB's uses an adapter mounted onto the PCB having an opposite mating piece to that of an RF connector. The mating part of the adapter is commonly at 90° to the PCB mounting so that when an RF connector is mated with the adapter, the mating pressure is not applied directly to the PCB. To allow the mating part of the adapter to be at right angles to the PCB mounting, the electrical contact(s) in the adapter connecting the mating part to the PCB mounting have to bend through 90° as in the right angled connectors above, posing the same problems. In addition, the adapters have to be assembled from parts, since the electrically conductive and insulating parts have to be produced from different materials.

The present invention seeks to simplify or reduce the cost of manufacture of connectors and may reduce the part count of the previously mentioned connectors and adapters.

According to the invention there is provided an adapter for connection of an RF connector to a printed circuit board (PCB), the adapter comprising a plastics body adapted to mate with an RF connector, one or more contacts for electrical connection with the RF connector upon mating therewith and one or more attachment means disposed so as to permit connection to tracks on a printed circuit board, wherein coupling between at least one of said contacts and an associated attachment means is effected via a conductive coating provided on the surface of the body. The adapter may be adapted to mate with a plurality of RF connectors and having for each connector one or more contacts for electrical connection with the RF connector upon mating therewith and one or more attachment means disposed so as to permit connection to tracks on a printed circuit board, wherein coupling between at least one of said

contacts and an associated attachment means is effected via a conductive coating provided on the surface of the body. The conductive coatings may be provided on the surface of the body by selective plating.

In one version of the adapter wherein for the or each RF connector a bore is provided in the inside of the body which bore is plated to form a female contact for engagement by a male contact of an RF connector, which plated bore adjoins the, or one of the, conductive coating(s). A male or female contact may be secured in the or each plated bore to permit engagement by a respective female or male contact of an RF connector. The or each plated bore may be a through hole in electrical communication at one end with the contact and at the other end with an associated conductive coating.

One or more plastics projection may be provided at one end of the body the or each of which projection is plated together with the conductive coatings, one of which coatings adjoins the plated projection and is in electrical communication therewith. For each projection a bore may be provided through the body and through the projection which bore is plated to form a plated through hole in electrical communication at one end with the plated projection and at the other end with an associated conductive coating.

The or each plated bore may adjoin an associated one of the conductive coatings at the contact end, which conductive coating extends over an outer surface of the body to the associated attachment means.

In a particularly advantageous embodiment the adapter may comprise two coaxial contacts for the, or for each of the, RF connector(s).

The adapter may comprise, for each RF connector, two coaxial contacts the outer one of which contacts is formed by a cylindrical projection. Wherein the inner and/or outer surface of the or each cylindrical projection may be plated to provide one of the contacts. Preferably, a major part of the outer surface of the plastics body is plated and extends to the plating on the surface of the cylindrical projection and to an associated attachment means.

The body may have oppositely disposed surfaces and for the, or each, RF connector a through hole to receive a pin of the RF connector inserted from one side, the other side of which body is provided with the conductive coating which extends to the associated attachment means. For each RF connector there may be provided a plurality of through holes each for receiving a pin of the connector inserted from one side, and the other side of the body is provided with the conductive coatings which extend to the associated attachment means. The or each conductive layer may be in the form of a track and the attachment means is/are formed by the end of the track(s). Alternatively, the or each conductive coating may be in the form of a track and the attachment means is/are formed by a pin. The ends of the attachment means are preferably coplanar.

The body on said one side may have a fully plated

surface for connection to the body of one or more coaxial connector(s) mated therewith. The plated surface on said one side may be recessed to receive the or each coaxial connector. The plated surface on said one side may be linked to a conductive track on the other side via a plated through hole or slot which track extends to an associated attachment means.

In order that the invention and its various other preferred features may be understood more easily, embodiments thereof will now be described, by way of example only, with reference to the accompanying drawings, in which :-

Figure 1 is an isometric elevational view of an adapter constructed in accordance with the invention,

Figure 2 is a cross section of Figure 1 taken vertically through the centre,

Figure 3 is an isometric view of the adapter of Figures 1 and 2 taken from the front and slightly above,

Figure 4 is an isometric view of another adapter constructed in accordance with the invention together with 4 RF coaxial connectors,

Figure 5 is an isometric view of the adapter shown in Figure 4 together with the 4 RF coaxial connectors but taken from the opposite side of the adapter,

Figure 6 is an isometric view of a further adapter constructed in accordance with the invention together with 4 RF coaxial connectors and a screw threaded insert, and

Figure 7 is an isometric view of the adapter shown in Figure 6 together with the 4 RF coaxial connectors and the screw threaded insert but taken from the opposite side of the adapter.

Throughout Figures 1 to 3 and 4 to 7 the same reference numerals are used for similar parts.

Referring to figures 1, 2 and 3, there is shown an adapter (10) formed as a Moulded Interconnect Device (MID) for attaching to a PCB. MID technology allows the adapter to be moulded in plastics preferably as a single piece which is then selectively plated with a electrically conductive material so that certain areas can carry an electrical signal.

The adapter (10) has a plated body area (1) and a plated through hole (4), for carrying electrical signals. The two plated areas (1,4) are electrically independent of each other. Solder tabs (3,5) form attachment means and allow the plated areas (1,4) to be directly connected to tracks on a PCB but these could equally be substituted by other means of electrical attachment such as plated pins. The electrical independence between the plat-

ed body area (1) and the plated through hole (4) is due to the non-plated areas (9) which are dielectrics and separate the two electrical signal carrying areas. The required impedance between the two signal carrying areas (1,4) could be adjusted according to, for example, the spacing between the plated through hole and the plated body area (1). The electrical continuity between the plated through hole and the PCB is provided by a conductive layer formed by a plated link (2) to a solder tab (3).

The plated through hole (4) may form a female contact for receiving a male contact of an RF connector. Alternatively, an electrical contact (7) may be inserted into the hole to provide a male contact for connection to a female contact of an RF connector. The contact (7) may be an interference fit with the hole (4), providing a first electrical signal path communicating between the contact (7) and the plated through hole (4) to the solder tab (3). An outer shell of the RF connector (not shown) would mate with a connector interface (6) of the adapter, providing a second electrical signal path communicating between the outer shell of the RF connector and solder tabs (5) via the plated body area (1) and the connector interface (6). The first and second signal paths could then be connected to the PCB by the solder tabs (3) and (5) respectively which are coplanar.

The contact (7) could be moulded as part of the adapter (10) as long as electrical continuity between the contact (7) and the plated through hole (4) is ensured by, for example, continuing the plated through hole through the contact.

Various other modifications to the shown embodiment are possible, for example the plated through hole (4) could be replaced by a plated track running around the outside of the adapter from the contact (7) to the solder tab (3). A dielectric area would be formed on either side of the plated track to ensure electrical independence from the plated body area (1).

Referring to figures 4 and 5, an alternative construction of an adapter (100) for attaching to a PCB is shown with four RF coaxial connectors (101). As in the previous embodiment, the adapter (100) is constructed employing Moulded Interconnect Device (MID) technology.

The adapter (100) has a non-plated body area (102) and a plated body area (111) and a number of plated through holes (107,110), which form contacts, for accepting the contacts (103,104) of the RF connectors (101). The plated through holes (110) are electrically connected to conductive layers in the form of first plated tracks (105) that extend between the holes (110) and attachment means in the form of solder tab (113) extending over the end of projection (106) allowing electrical signal communication between a track on a PCB and the coaxial connector centre contacts (104) once the adapter is attached to the PCB. Further solder tabs (114) are each connected by further plated tracks (108) to plated through holes or slots (112). The plated through slots (112) electrically connect the plated tracks

(108) to the plated body area (111) which in turn is electrically connected to the plated through holes (107), thus allowing electrical signal communication between the PCB and coaxial outer contacts (103) once the adapter is attached to the PCB. The plated tracks (105) are electrically independent of each other and of the tracks (108). The solder tabs (113,114) are coplanar and allow the adapter (100) to be directly connected to tracks on the PCB but this could equally be substituted by other means of electrical attachment such as plated pins.

Once the RF connectors (101) are mated with the adapter (100), their contacts (103,104) are soldered into place e.g. by reflow soldering.

Referring to figures 6 and 7, a further alternative construction of an adapter (100) for attaching to a PCB is shown with four RF coaxial connectors (101). As in the previous embodiments, the adapter (100) is constructed employing Moulded Interconnect Device (MID) technology.

The adapter (100) is formed by a two part moulding process. A substructure (106,122, 123) is moulded from a first platable plastic which then has a superstructure (121) moulded around it, the plastic of the superstructure being resistant to plating. When the adapter is then plated, the exposed areas of the substructure (106,122,123) accept the plating whilst those of the superstructure (121) do not.

In the shown construction, a common tracking area (122) is used to connect the outer contacts (103) of RF connectors (101) to a solder tab (106). A plated through hole (123) is adapted to accept a metal insert (124). The insert (124) has a screw threaded hole (125) allowing a housing (not shown) that holds the RF connectors (101) to be screwed to the adapter (100) ensuring a secure fit. The plating of the hole (123) and the metal insert (124) allow the housing to be connected to ground, if necessary.

In addition to the embodiments and variations described, other modifications and variations are possible. For example although only mating to interference fit and solder fit connectors has been shown, the construction could be easily modified to allow mating with other connectors such as locking connectors, the connectors could be, for example, cable connectors or u-link connectors. It would also be possible to produce an embodiment of the invention where more than one connector type could be mated with by the provision of a number of different mating portions. In addition the invention could be varied according to the number of signals each individual cable or connector could carry so that the invention could connect for example a multi-core cable according to the principles described.

Whilst the embodiments described have employed MID technology employing selective plating of conductive coatings to provide electrical interconnectors by for example using different plastics materials one of which accepts plating and one of which does not, any alternative techniques for providing conductive coatings or

tracks on the surface of a plastic body can be employed e.g. selective etching of a coating or application of conductive coatings or tracks by masking and sputtering. Such constructions are intended to fall within the scope of this invention.

Claims

1. An adapter for connection of an RF connector to a printed circuit board (PCB), the adapter comprising a plastics body adapted to mate with an RF connector, one or more contacts for electrical connection with the RF connector upon mating therewith and one or more attachment means disposed so as to permit connection to tracks on a printed circuit board, wherein coupling between at least one of said contacts and an associated attachment means is effected via a conductive layer provided on the surface of the body.
2. An adapter as claimed in claim 1 adapted to mate with a plurality of RF connectors and having for each connector one or more contacts for electrical connection with the RF connector upon mating therewith and one or more attachment means disposed so as to permit connection to tracks on a printed circuit board, wherein coupling between at least one of said contacts and an associated attachment means is effected via a conductive layer provided on the surface of the body.
3. An adapter as claimed in claim 1 or 2, wherein the conductive layers are provided on the surface of the body by selective plating.
4. An adapter as claimed in claim 3, wherein for the or each RF connector a bore is provided in the inside of the body which bore is plated to form a female contact for engagement by a male contact of an RF connector, which plated bore adjoins the, or one of the, conductive layer(s).
5. An adapter as claimed in claim 4, wherein a male contact is secured in the or each plated bore to permit engagement by a female contact of an RF connector.
6. An adapter as claimed in claim 4, wherein a female contact is secured in the or each plated bore to permit engagement by a male contact of an RF connector.
7. An adapter as claimed in claim 4,5 or 6, wherein the or each bore is a through hole in electrical communication at one end with the contact and at the other end with an associated conductive layer.

8. An adapter as claimed in claim 3, wherein one or more plastics projection is provided at one end of the body, the or each of which projection is plated together with the conductive layers, one of which layers adjoins the plated projection and is in electrical communication therewith.
9. An adapter as claimed in claim 8, wherein for each projection a bore is provided through the body and through the projection which bore is plated to form a plated through hole in electrical communication at one end with the plated projection and at the other end with an associated conductive layer.
10. An adapter as claimed in any one of claims 4, 5, 6 or 8 wherein the or each plated bore adjoins an associated one of the conductive layers at the contact end, which conductive layer extends over an outer surface of the body to the associated attachment means.
11. An adapter as claimed in any one of the preceding claims comprising two coaxial contacts for the, or for each of the, RF connector(s).
12. An adapter as claimed in any one of claims 3 to 10, comprising, for each RF connector, two coaxial contacts the outer one of which contacts is formed by a cylindrical projection.
13. An adapter as claimed in claim 12, wherein the inner and/or outer surface of the or each cylindrical projection is plated to provide one of the contacts.
14. An adapter as claimed in claim 13, wherein a major part of the outer surface of the plastics body is plated and extends to the plating on the surface of the cylindrical projection and to an associated attachment means.
15. An adapter as claimed in claim 1 or 2 or 3, wherein the body has oppositely disposed surfaces and for the, or each, RF connector a through hole to receive a pin of the RF connector inserted from one side, the other side of which body is provided with the conductive layer which extends to the associated attachment means.
16. An adapter as claimed in claim 14 or 15 wherein for each RF connector there are a plurality of through holes each for receiving a pin of the connector inserted from one side, and the other side of the body is provided with the conductive layers which extend to the associated attachment means.
17. An adapter as claimed in claim 15 or 16 wherein the or each conductive layer is in the form of a track and the attachment means is/are formed by the end of the track(s).
18. An adapter as claimed in claim 15 or 16 wherein the or each conductive layer is in the form of a track and the attachment means is/are formed by a pin.
19. An adapter as claimed in claim 17 or 18 where ends of the attachment means are coplanar.
20. An adapter as claimed in any one of claims 15 to 19, wherein the body on said one side has a fully plated surface for connection to the body of one or more coaxial connector(s) mated therewith.
21. An adapter as claimed in claim 20, wherein the plated surface on said one side is recessed to receive the or each coaxial connector.
22. An adapter as claimed in claim 20 or 21, wherein the plated surface on said one side is linked to a conductive track on the other side via a plated through hole or slot which track extends to an associated attachment means.

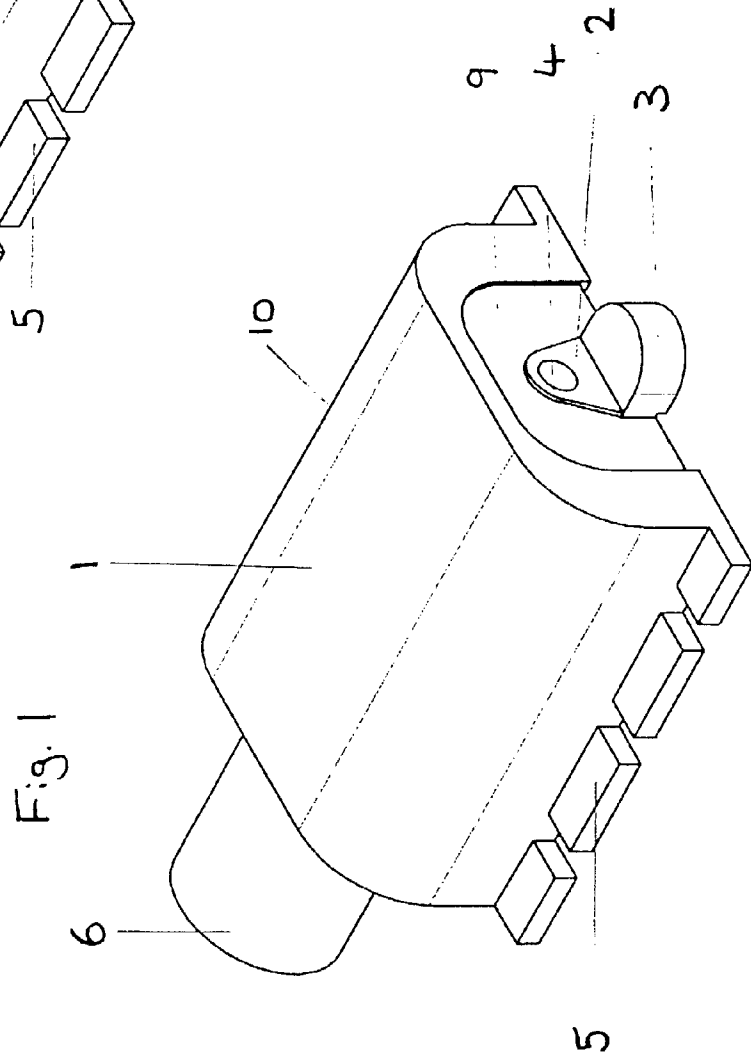
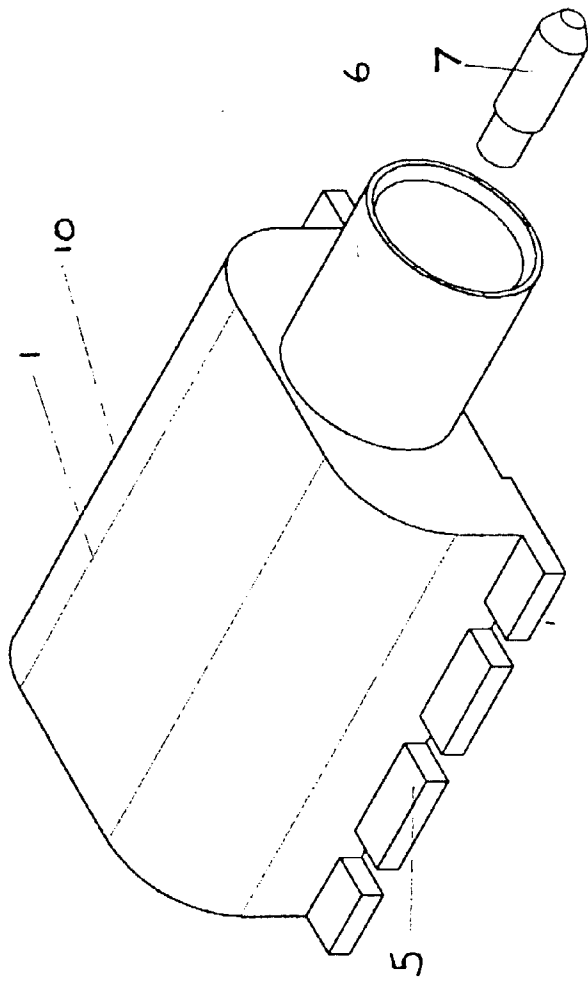


Fig. 2

