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(54) **Title:** MODULAR JACK WITH ENHANCED SHIELDING

(57) **Abstract:** An electrical connector includes a dielectric housing having a mating face, a plurality of openings therein configured as pairs of aligned openings and a receptacle for receiving a plurality of internal modules therein. A plurality of electrically conductive contacts are positioned within the housing with a portion of each contact extending into one of the openings for engaging contacts of a mateable connector. At least one conductive inter-module shield is located within the receptacle and extends gen-

MODULAR JACK WITH ENHANCED SHIELDING

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This patent application claims the benefit of U.S. Provisional Patent Application No. 61/258,979, filed November 6, 2009, which is incorporated herein by reference in its entirety.

BACKGROUND

[0002] The disclosure relates generally to modular telecommunications jacks and, more particularly, to a high data rate capable modular jack.

[0003] Modular jack ("modjack") receptacle connectors mounted to printed circuit boards ("PCBs") are well known in the telecommunications industry. These connectors are often used for electrical connection between two electrical communication devices. With the ever-increasing operating frequencies and data rates of data and communication systems and the increased levels of encoding used to transmit information, the electrical characteristics of such connectors are of increasing importance. In particular, it is desirable that these modjack connectors do not negatively affect the signals transmitted and where possible, noise is removed from the system. Based on these requirements and desires, various proposals have been made in order to improve modjack connectors used with communication or transmission links.

[0004] When used as Ethernet connectors, modjacks generally receive an input signal from one electrical device and then communicate a corresponding output signal to a second device coupled thereto. Magnetic circuitry can be used to provide conditioning and isolation of the signals as they pass from the first device to the second and typically such circuitry uses components such as a transformer and a choke. The transformer often is toroidal in shape and includes primary and secondary windings coupled together and wrapped around a toroid so as to provide magnetic coupling between the primary and secondary wire while ensuring electrical isolation. Chokes are also commonly used to filter out unwanted noise, such as common-mode noise, and can be toroidal ferrite designs used in differential signaling applications. Modjacks having such magnetic circuitry are typically referred to in the trade as magnetic jacks.

[0005] As system data rates have increased, improving the isolation between the ports of the magnetic jacks has become desirable in order to permit a corresponding increase in the data rate of signals that pass through the magnetic jacks without being influenced by adjacent magnetic

jacks. Cross-talk and electro-magnetic radiation and interference between ports of the magnetic jack can have a significant impact on the performance of the magnetic jack and thus the entire system as system speeds and data rates increase. Improvements in shielding and isolation within the magnetic jack is thus desirable.

SUMMARY

[0006] An electrical connector includes a dielectric housing having a mating face, a plurality of openings therein configured as pairs of aligned openings and a receptacle for receiving a plurality of internal modules therein. A plurality of electrically conductive contacts are positioned within the housing with a portion of each contact extending into one of the openings for engaging contacts of a mateable connector. At least one conductive inter-module shield is located within the receptacle and extends generally towards the mating face to define a plurality of module receiving cavities.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Various other objects, features and attendant advantages will become more fully appreciated as the same becomes better understood when considered in conjunction with the accompanying drawings in which like reference characters designate the same or similar parts throughout the several views, and in which:

[0008] FIG. 1 is a front perspective view of a multiport magnetic jack assembly in accordance with a first embodiment;

[0009] FIG. 2 a partially exploded view of the magnetic jack assembly of Fig. 1 with the front outer shielding and shield interconnection clip removed;

[0010] FIG. 3 is a is a rear perspective view of the magnetic jack assembly of Fig. 1;

[0011] FIG. 4 is a partially exploded rear perspective view of the magnetic jack assembly of Fig. 1 with the internal subassembly modules and inter-module shields in various stages of insertion within the housing and with the outer shielding removed for clarity;

[0012] FIG. 5 is a rear perspective view similar to Fig. 4 but with each of the internal modules removed and the inter-module shields fully inserted;

[0013] FIG. 6 is an enlarged fragmented perspective view of a portion of Fig. 5;

[0014] FIG. 7 is a front perspective view of the magnetic jack assembly of Fig. 1 with the outer housing removed for clarity;

[0015] FIG. 8 is a fragmented front perspective view of the housing taken generally along line 8-8 of Fig. 7;

[0016] FIG. 9 is a fragmented front perspective view taken generally along line 9-9 of Fig. 7 but with the circuit board and connector of the internal subassembly module un-sectioned for clarity;

[0017] FIG. 10 is an enlarged fragmented perspective view of a portion of Fig. 9;

[0018] FIG. 11 is a fragmented front perspective view similar to Fig. 9 but with an inter-module shield un-sectioned, an additional internal subassembly module inserted and the shield interconnection clip extended for clarity;

[0019] FIG. 12 is a rear perspective view of an internal subassembly module;

[0020] FIG. 13 an exploded perspective view of the internal module of Fig. 12 with the windings removed for clarity;

[0021] FIG. 14 is a side elevational view of the twisted wires that may be used with the transformer and noise reduction components of the disclosed embodiments; and

[0022] FIG. 15 is a side elevational view of a transformer and choke subassembly that may be used with the disclosed embodiments.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

[0023] The following description is intended to convey the operation of exemplary embodiments to those skilled in the art. It will be appreciated that this description is intended to aid the reader, not to limit the invention. As such, references to a feature or aspect are intended to describe a feature or aspect of an embodiment, not to imply that every embodiment must have the described characteristic. Furthermore, it should be noted that the depicted detailed description illustrates a number of features. While certain features have been combined together to illustrate potential system designs, those features may also be used in other combinations not expressly disclosed. Thus, the depicted combinations are not intended to be limiting unless otherwise noted.

[0024] Fig. 1 illustrates the front side of a multiple input, magnetic, stacked jack 30 having a housing 32 made of an insulating material such as a synthetic resin (for example, PBT) and

includes front side openings or ports 33 arranged in vertically aligned pairs 33' with each port configured to receive an Ethernet or RJ-45 type jack (not shown). The magnetic jack 30 is configured to be mounted on circuit board 100. A metal or other conductive shield assembly 50 surrounds the magnetic jack housing 32 for RF and EMI shielding purposes as well as for providing a ground reference.

[0025] It should be noted that in this description, representations of directions such as up, down, left, right, front, rear, and the like, used for explaining the structure and movement of each part of the disclosed embodiment are not intended to be absolute, but rather are relative. These representations are appropriate when each part of the disclosed embodiment is in the position shown in the figures. If the position or frame of reference of the disclosed embodiment changes, however, these representations are to be changed according to the change in the position or frame of reference of the disclosed embodiment.

[0026] Shield assembly 50 fully encloses housing 32 except for openings aligned with ports 33 and the bottom or lower surface of the housing and includes a front shield component 52 and a rear shield component 53. Additional shielding components 54 are positioned adjacent and generally surround ports 33 to complete shield assembly 50. The joinable front and rear shield components are formed with interlocking tabs 55 and openings 56 for engaging and securing the components together when the shield assembly 50 is placed into position around the magnetic jack housing 32. Each of the shield components 52, 53 includes ground pegs 57, 58, respectively, that extend into ground through-holes 102 in the circuit board 100 when mounted thereon.

[0027] As depicted in Figs. 4-6, the rear portion of the magnetic jack housing 32 includes a large opening or receptacle 34 with three evenly spaced metal inter-module shields 60 positioned therein to define four subassembly receiving cavities 35. Each cavity 35 is sized and shaped to receive an internal subassembly module 70. While three inter-module shields 60 are depicted, a different number of shields may be used to define a different number of cavities. More specifically, to provide vertical electrical isolation or shielding between each module 70, one shield fewer in number than the desired number of modules is utilized. Shield 60 as depicted is stamped and formed of sheet metal material but could be formed of other conductive material such as die cast metal or plated plastic material.

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