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SMALL FOOTPRINT OPTOELECTRONIC TRANSCEIVER WITH LASER

Background of the Invention

The present invention relates to optoelectronic interface systems and more particularly to an optoelectronic transceiver with a laser diode package.

An optoelectronic transceiver having a small footprint is generally known as a 1 x 9 package. Such transceivers are used in desktop Fiber Distributed Data Interface (FDDI) applications. The transceivers having a common footprint are used for Low Cost Fiber Physical Layer Medium Dependent (LCF-PMD) FDDI products such as workstations and personal computers. An LCF-PMD FDDI proposed draft is being developed by the American National Standards Institute (ANSI) X3T9.5 Task Group. Such transceivers interconnect with duplex SC style connectors and interface directly with FDDI integrated circuit (IC) chip sets. SC fiber optic connectors are covered by Japanese Industrial Standard C 5973. The FDDI standard supports transmission rates of up to 100 megabits per second. Such transceivers are compatible with ATM, Sonet and Fiber Channel Communication Standards. Such transceivers commonly use LED's (light emitting diodes) to transmit light over optical fibers at megabit transmission rates. These common transceiver packages also require complicated and expensive assemblies.

Accordingly, it is desired that an optoelectronic transceiver having higher transmission rates and an easily and inexpensively manufactured and assembled package be provided.

Summary of the Invention

Therefore, it is an object of the present invention to provide an optoelectronic transceiver having transmission rates as high as 1.5 gigabits per second.

It is another object of the present invention to provide an optoelectronic transceiver including an easily assembled package.

It is a further object of the present invention to provide an optoelectronic transceiver having a means for locking an optical subassembly within the housing of the transceiver package.

The present invention comprises a housing having a first end for receiving a fiber optic plug and a second end for mounting a circuit board. A laser diode package is mounted in the second end. A plug latch is mounted in the first end. The plug latch is held between a subassembly and the housing. The subassembly contains the laser diode package. The subassembly includes a first aperture for receiving a mounting pin. The housing includes a second aperture for receiving the pin wherein insertion of the pin through the second aperture locks the subassembly within the housing.

These and other features of the invention are set forth below in the following detailed description of the presently preferred embodiments.

Brief Description of the Drawings

Figure 1 is a perspective view of an optoelectronic transceiver of the present invention.

Figure 2 is a bottom perspective view of the optoelectronic transceiver of the present invention.

Figure 3 is an enlarged cut-away view of an optoelectronic transceiver of the present invention.

Figure 4 is a plan view of the optoelectronic transceiver of Figure 3 taken at line 4-4.

Figure 5 is a side elevation view of the optoelectronic transceiver of Figure 4 taken at line 5-5.

Figure 6 is a side elevation view of the optoelectronic transceiver of Figure 4 taken at line 6-6.

Figure 7 is an end view of the optoelectronic transceiver of Figure 5 taken at line 7-7.

Detailed Description of the Presently Preferred Embodiments

A preferred embodiment of the present invention is best shown in Figures 1-7. Turning to Figure 1, an optoelectronic transceiver 10 is shown having a housing 20 preferably injection molded of a plastic material such as reinforced Ultem or Lexan. The housing 20 includes a first end 40 and a second end 60. The first end 40 includes receptacles 42,44 for receiving fiber optic connector plugs. In a preferred embodiment, the receptacles 42,44 will receive an SC duplex plug. The receptacles 42,44 are specifically dimensioned for receiving the SC plugs. For example, keying channels 46,48 are provided to ensure that the SC plugs are inserted properly. Generally, receptacle 42 is for the transmitting plug, and receptacle 44 is for the receiving plug. The center lines of the receptacles 42,44 are spaced 12.70 mm from each other in a preferred embodiment. The overall optoelectronic transceiver 10 is 25.40 mm x 39.12 mm in a preferred embodiment, and the housing is 12.0 mm thick.

The second end 60 of the transceiver 10 includes a cover 62 which provides for protection of the active devices and for shielding purposes. The cover 62 includes retaining tabs 64 and 65 (other tabs shown in

Figure 2).

Figure 2 shows a bottom perspective view of an optoelectronic transceiver of the present invention. The housing 20 having the first end 40 and the second end 60 is shown. In a preferred embodiment, the second end 60 of the housing 20 includes a rear frame portion 61 which is integrally molded with the front end 40. The receptacles 42,44 are included at the first end 40. At the second end 60 mounted on the frame 61 is a printed circuit board 63 which is retained within the housing 20 via fingers 70, 71, 72, 73, 74 and 75. The printed circuit board 63 is secured to the housing 20 via retention peg 12 engaging slot 14 formed in the printed circuit board 63. The cover 62 is secured to the housing 20 via tabs 64, 65, 66, 67, 68 and 69. Mounting pins 80,81 protrude from the housing 20 and provide for the mounting of the transceiver 20 to a motherboard (not shown) and serve as a pre-established footprint guideline. Contacts 76 protrude from the printed circuit board 63 and are also spaced to mount on a motherboard according to a pre-established footprint. Specifically, there in one row of nine contacts 76, *i.e.* a "1 x 9 package" spaced on 2.54 mm centers on the printed circuit board 63,20.32 mm from the mounting pins 80,81 of the optoelectronic transceiver 10.

Turning to Figure 3, a perspective view of the optoelectronic transceiver 10 is shown having the cover 62 cut-away. Whereas Figure 1 is a perspective view of the transceiver 10 taken from the first end 40, Figure 3 is a perspective view taken from the second end 60, so that the receptacles 42 and 44 are facing away. The housing 20 includes the frame 61 surrounding the second end 60. Covering the frame 61 is the cover 62. The

cover 62 is secured to the frame via the tabs 64, 65, 66 (see Figure 2), 67, 68 and 69. Mounted on the frame 61 is the printed circuit board 63. In a preferred embodiment, the printed circuit board 63 is slid into the frame 61 along channels 90 and is supported by fingers 70, 71, 72, 73, 74, and 75. The contacts 76 are mounted in the printed circuit board 63. Any type of electrical connector could be used to provide for the contacts 76.

Optical subassemblies 83,84 are mounted within the housing 20. The subassemblies 83,84 include a laser diode package 86 and a photo diode package 85. In a preferred embodiment, a TO56 laser diode package and a TO18 photo diode package is mounted to the optical subassembly 84. Diode leads 89 exit the rear of the diode packages 85,86. The diode leads 89 may be attached to the printed circuit board 63 via surface mount or through-hole. Such a preferred embodiment has been tested and provided error free performance to 1.5 Gb/s at 10 dB attenuation with a mean wavelength of 780 nm to 870 nm with transmitted optical power at 0.5 ± 1.0 dBm with sensitivity measurements of -14 dBm, total link jitter of 125 ps and average rise and fall times(T_r,T_f) of 350 ps. In a preferred embodiment, circuitry was incorporated with the laser diode to enhance performance as outlined in U.S. Patent No. 4,541,685 which is incorporated herein by reference in its entirety.

The housing 20 includes a first latch arm 91 and a second latch arm 92 for mounting the optical subassemblies 83,84 to the housing 20. The subassembly 83 includes a projection 87 for engaging the first latch 91. A corresponding detente protrudes from optical subassembly 84 for mating with second latch 92. The latches 91,92 include an angled head 93 for slidingly

engaging the angled surface 94 of the projection 87 upon insertion of the subassembly 83 into the housing 20. Upon insertion of the subassembly 83, the angled surface 94 will rub against angled head 93 of the first latch 91 forcing the first latch 91 to flex outwardly as the projection 87 slides past. Upon the subassembly 83 reaching its fully mated position, the latch 91 will spring back and block the projection 87 so that the subassembly 83 is secured within the housing 20. In this way, the assembly of the transceiver 10 is achieved quickly and easily.

Turning to Figure 4, a plan view of the optoelectronic transceiver 10 is shown, taken at line 4-4 of Figure 3. The housing 20 is shown having the first end 40 and the second end 60. The frame 61 is shown partially surrounding the transceiver package 10. The receptacles 42 and 44 are shown at the first end 40. The printed circuit board 63 is mounted within the second end 60 along channel 90 (See Figure 3) of the frame 61. The printed circuit board 63 includes space for transmitter and receiver circuitry. The cover 62 is shown having the tabs 64, 65, 66, 67, 68 and 69. The housing 20 includes the first latch 91 and the second latch 92. In a preferred embodiment, the latches 91,92 are integrally molded with the housing 20. The subassemblies 83,84 are mounted with the housing 20. Captured by each subassembly 83,84 is a plug latch 57,58. In a preferred embodiment, the plug latch 57,58 receives an SC plug via latch members 96,97,98 and 99. The plug matches 57,58 include rear wall 94 which abuts against the subassembly 83,84. The plug latch 57,58 is mounted to subassemblies 83,84 via a friction fit of a rod 11,11 of the subassemblies 83,84 which are inserted within the ferrule

receiving portion 101,102 of the plug latch 57,58. The plug latch 57,58 is further mounted to the subassembly 83,84 via an arm 103,104 which engages channels 105,106 of the subassemblies 83,84, respectively. As the plug latches 57,58 are mounted to the rods 11,11 of the subassemblies 83,84, plug latches 57,58 are limited from rotating on the rods 11,11 via the arms 103,104. The insertion of the arms 103,104 into the channels 105,106 prohibit the plug latches 57,58 from rotating when mounted to the rods 11,11 of subassemblies 83,84.

The subassemblies 83,84 are mounted into the housing 20 via the first latch 91 engaging the projection 87 of the subassembly 83 and second latch 92 engaging detente of the subassembly 84. The subassemblies 83,84 include photo diode package 85 and laser diode package 86, respectively. The subassemblies 83,84 include first apertures 110,111, which receive the mounting pins 80,81. After the subassembly 83,84 is mounted within the housing 20 (See Figure 3), it is secured therein by the mounting pins 80,81. The mounting pins 80,81 are inserted through a second aperture in the bottom of the housing and through first apertures 110,111 to lock the subassemblies 83,84 within the housing 20. This use of the mounting pins 80,81 to lock the subassemblies 83,84 within the housing prevents the subassemblies 83,84 and the plug latches 57,58 from moving axially or radially within the housing.

Figure 5 is a side elevation cut-away view of the transceiver 10 taken at line 5-5 of Figure 4. The housing 20 is shown with the first end 40 and the second end 60. The receptacle 44 is shown at the first end 40 having the plug latch 57 therein for receiving an optical connector plug. The plug latch 57 is mounted to the

subassembly 83 which is mounted to the housing via the first latch 91. The second latch 92 receives the subassembly 84 (not shown). Photo diode package 85 is shown mounted to subassembly 83 having diode leads 89 which attach to the printed circuit board 63. The contacts 76 are mounted within the printed circuit board 63. The printed circuit board 63 is secured to the housing 20 via retention peg 12 which is a flexible member which engages slot 14 of the printed circuit board 63. The cover 62 is mounted on a frame 61 of the housing 20. The mounting pin 81 is shown inserted within the housing 20 and serves to lock the subassembly 83 within the housing 20 and also the mount housing 20 to a motherboard. In a preferred embodiment, the mounting pins 80,81 are spaced 20.32 mm from the center line of the contacts 76 and 15.88 mm from the front end 15 of the housing 20.

Figure 6 is a further cut-away side elevation view of the transceiver 10 taken at line 6-6 of Figure 4. The housing 20 is shown having the first end 40 and the second end 60. Mounted to the housing 20 is the subassembly 84. Mounted to the subassembly 84 is the plug latch 58 including plug latch member 99 for receiving a fiber optic connector plug. The subassembly 84 includes a first aperture 121 which is co-linear with a second aperture 122 of the housing 20. The mounting pin 80 is inserted through the second aperture 122 of the housing 20 and through the first aperture 121 of the subassembly 84 and attains full insertion when the head of the pin reaches a third aperture 123. Upon insertion of the mounting pin 80, the subassembly 84 is locked within the housing 20. The mounting pin 80 may be secured within the apertures 121,122,123 via any means including a

friction fit or retention lip on the pin or housing or subassembly 80. The mounting pin 80 also acts to mount the transceiver 10 to a motherboard.

Figure 7 shows a cut-away end view of the transceiver 10 showing housing 20 and subassemblies 83,84 mounted therein. The first apertures 121,121 are shown in the subassemblies 83,84, the second apertures 122,122 are shown in the housing 20, and the third apertures 123,123 are shown in the housing 20. The mounting pins 80,81 are shown inserted through the second aperture 122 of the housing 20, through the first aperture 121 of the subassembly 84,83 and into the third aperture 123,123 of the housing 20. It can be seen that the mounting pins 80,81 lock the subassemblies 83,84 within the housing 20 and restrict all axial and radial movement of the subassemblies 83,84. The projections 87,88 are shown engaged with the first movement of the subassemblies 83,84. The projections 87,88 are shown engaged with the first latch 91 and the second latch 92 of the housing 20.

From the foregoing, it will be observed that numerous variations and modifications may be effected without departing from the spirit and scope of the novel concept of the invention. It is to be understood that no limitation with respect to the specific apparatus illustrated herein is intended or should be inferred. It is, of course, intended to cover by the appended claims all such modifications as fall within the scope of the claims.

I CLAIM:

1. An optoelectronic transceiver comprising:

a housing having a first end and a second end, the first end having an SC duplex fiber optic receptacle;

a printed circuit board mounted at said second end and having optical transmitter and receiver circuitry connected to one row of nine contacts mounted to the printed circuit board;

an optical subassembly mounted within said second end of said housing connected to the optical transmitter and receiver circuitry; and

a laser diode subassembly mounted within said optical subassembly.

2. The optoelectronic transceiver of Claim 1 wherein said housing includes latch members for retaining said optical subassembly.

3. The optoelectronic transceiver of Claim 1 wherein said laser diode subassembly transmits at speeds of 1.0 Gb/s.

4. The optoelectronic transceiver of Claim 1 wherein said laser diode package transmits at speeds of 1.0 Gb/s.

5. The optoelectronic transceiver of Claim 1 wherein said second end is enclosed by a cover.

6. The optoelectronic transceiver of Claim 5 wherein said cover includes tabs for mounting said cover to said housing.

7. The optoelectronic transceiver of Claim 1 wherein a plug latch is mounted to an optical subassembly and the optical subassembly includes a channel for receiving an arm of the plug latch to retain the plug latch thereon.

8. The optoelectronic transceiver of Claim 1 wherein said optical subassembly includes a means for locking said optical subassembly within said housing.

9. The optoelectronic transceiver of Claim 8 wherein said locking means provides for locking said optical subassembly with said housing and also mounting said housing to a motherboard.

10. The optoelectronic transceiver of Claim 9 wherein said locking means includes a mounting pin inserted within a first aperture of said optical subassembly and a second aperture of said housing in order to lockingly mount said optical subassembly to said housing.

11. The optoelectronic transceiver of Claim 10 wherein said mounting pin is received by a third aperture of said housing.

12. The optoelectronic transceiver of Claim 10 wherein two mounting pins are inserted within said transceiver.

13. The optoelectronic transceiver of Claim 1 wherein said optical subassembly includes a rod for receiving a plug latch thereon.

14. The optoelectronic transceiver of Claim 1 wherein said printed circuit board is mounted on fingers extending from said housing.

15. The optoelectronic transceiver of Claim 1 wherein said housing second end includes a channel for receiving a printed circuit board.

16. The optoelectronic transceiver of Claim 1 wherein a retention peg protrudes from said housing and is received by a slot of said printed circuit board.

17. An optoelectronic transceiver comprising:

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a housing having a first end and a second end, the first end having a fiber optic receptacle;

a printed circuit board mounted at said second end and having an optical transmitter and receiver circuitry connected to one row of nine contacts mounted to the printed circuit board on 2.54 mm spacing;

an optical subassembly mounted within said second end of said housing connected to the optical transmitter and receiver circuitry;

a laser diode subassembly mounted within said optical subassembly; and

said laser diode subassembly transmits at speeds of 1.0 Gb/s.