050-394

PRODUCT BRIEF

125 MBPS - 1.25 GBPS
PRINTED CIRCUIT BOARD (PCB) MOUNT
BI-DIRECTIONAL SINGLE FIBER TRANSCEIVER FOR SMF
SMALL & COMPACT WITH RUGGED CONSTRUCTION FOR HARSH ENVIRONMENTS

REV	DESCRIPTION	DATE	APPROVED
1	Preliminary	02/11/2019	YA/SZ
2	Update the EO Transmitter characteristics & the Eval Board picture. Add Input/Output Definition and Drawing	05/03/2019	SZ/YA/RAS
3	Update Picture, and 2D drawing	10/31/2019	OAE/HM

BF17U2-8773

050-394 PRODUCT BRIEF
PCB Mount Bi-Directional 1310/1490 Single Fiber Transceiver, 125 Mbps – 2.5 Gbps, SMF, 3.3V

PCB Mount Bi-Directional Single Fiber Transceiver, 125 Mbps-2.5 Gbps

Glenair 050-394, is a ruggedized harsh environment PCB mount full duplex Single Fiber Transceiver with electrical and optical functionality equivalent to SFP transceivers but with mechanical design that is suited to the harsh temperature and vibration environments found in Military, Aerospace, Railway, Oil and Gas, and Industrial applications. The PCB mount optical transceiver supports Digital Monitoring Interface (DMI) features in accordance with SFF 8472. The transceiver consists of a Diplexer Bidirectional optical subassembly (BOSA) capable of full duplex data transmission over a single fiber optic cable. The BOSA consists of a transmitter, receiver and a wave division multiplexer filter (WDM) to isolate the received light from the transmitted light. The transceiver interfaces to an optical fiber through a GC connector. The transmitter is a DFB (Distributed Feedback) Laser source and laser driver circuit which converts digital DC balanced encoded CML signals into digitally modulated light. The receiver is a PIN/TIA with a limiting amplifier to convert digitally modulated light signals to digital CML signals.

KEY FEATURES/BENEFITS

- SFP Compatible Electrical I/O signal levels
- 1310nm or 1490nm DFB lasers to support up to 2.5 Gbps
- 10km SMF links
- PIN PD/TIA to support high sensitivity up to 2.5 Gbps
- Transceiver is securely mounted with screws to PCB to ensure excellent shock and vibration performance
- High-Speed Electrical plug-in connector eliminates the need for soldering & enables ease of servicing
- Meets 802.3z 1000BASE-BX10
- Compact size: approx. 0.8” x 0.9” x 0.5”
- -40°C to +85°C Operating Temperature Range
- Glenair fiber jumpers connect from transceiver to any Glenair Mil/Aero Fiber Optic Connector Style
- Evaluation fixtures available
- Optional Digital Diagnostic and Monitoring (DMI) based on SFF-8472, enables monitoring of:
  - TX optical power, RX optical power, Laser bias current, Temperature, Supply voltage

APPLICATIONS

- Harsh Environment such as: Airborne, Tactical, Railway, Industrial, Oil and Gas and Shipboard applications
  - Fast Ethernet, Gigabit Ethernet, Fiber Channel

HOW TO ORDER **Table 1 Part Number Development Options**

Part Number	Two Wire Address	Wavelengths	Temperature**	Screw Length** (Mod Code)
050-394 PCB Mount BiDi Transceiver, 125 Mbps- 2.5 Gbps	Blank = A2h Other Options: C0, C2, C4, C6, C8, CA, CC, CE, D0, D2, D4, D6, D8, DA, DC, DE	-T13R14-1D = 1310nm TX, 1490nm RX -T14R13-1D = 1490nm TX, 1310nm RX	Blank = Standard	Blank = Standard -954-xxx = IAW Mod Code 954

Example: ***050-394C0-T13R14-1D***

PCB Mount BiDi Transceiver, SMF, 1310nm TX 1490nm RX, Two Wire Address = C0h, Data Rate = 125 Mbps – 2.5Gbps, Standard Temperature Range, Standard Screw Length

***Temperature and Screw Length Mod Codes will not be added onto Digital Memory ID (See Table 9)*

Ratings and Specifications

Table 2 ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Typ	Max	Units	Notes
Storage Temperature	Ts	-55		+100	°C	
Supply Voltage	V_{cc}	-0.4		3.8	V	VccT & VccR may not differ by more than 0.5V

Table 3 OPERATING CONDITIONS

Parameter	Symbol	Min	Typ	Max	Units	Notes
Operating Temperature	T_{op}	-40		+85	°C	
Supply Voltage	V_{cc}	3.135	3.3	3.465	V	
Supply Current	Icc		190	250	mA	Typical @ +85°C
Power Supply Noise (Peak-Peak)	$V_{cc\ ripple}$			100	mV	

Table 4 ELECTRO-OPTICAL CHARACTERISTICS – TRANSMITTER

Parameter	Symbol	Min	Typ	Max	Units	Notes
Optical Output Power	P_{OUT}	-7		+2	dBm	
Extinction Ratio	Er	7	9		dB	
Optical Wavelength, T13	λ_{OUT}	1260	1310	1360	nm	Typical is at 25°C
Optical Wavelength, T14	λ_{OUT}	1440	1490	1540	nm	Typical is at 25°C
Side Mode Suppression Ration (SMSR)	SMSR	35	40		dB	
Transmitter Differential Input Impedance	R_{in}		100		Ohms	AC coupled Internally
Differential Input Voltage	$V_{in\ d}$	250		2200	mV_{p-p}	CML, 100 ohm

Table 5 ELECTRO-OPTICAL CHARACTERISTICS - RECEIVER

Parameter	Symbol	Min	Typ	Max	Units	Notes
Sensitivity, BER 10^{-12}, PRBS 2^7-1, Er 10 dB	P_{IN}		-24	-22	dBm	PIN PD @ 1.25 Gbps
Sensitivity, BER 10^{-12}, PRBS 2^7-1, Er 10 dB	P_{IN}		-25	-24	dBm	PIN PD @ 125 Mbps
Overload, BER 10^{-12}, PRBS 2^7-1	P_{IN}	+0.5			dBm	@1.25Gbps
Optical Wavelength, R13	λ_{IN}	1250		1370	nm	
Optical Wavelength, R14	λ_{IN}	1430		1550	nm	
Receiver Differential Output Impedance	R_{out}		100		Ohms	AC coupled internally
Differential Output Voltage Swing	$V_{out\ d}$	600		1200	mV_{p-p}	CML, 100 ohm
LOS Assert Level	LOS			-27	dBm	@ 1.25Gbps
LOS Hysteresis	LOS_{HYS}	1.25	2.5		dB	@ 1.25Gbps

Ratings and Specifications (continued)

TABLE 6 COMPLIANCE SPECIFICATIONS

CHARACTERISTIC	Standard	Condition	Notes
Mechanical Shock	MIL-STD-810	Para. 516.6, proc. I, 650g	0.9 ms operating
Mechanical Vibration	MIL-STD-810	Para. 514.6, 40g rms	Random, operating
ESD	MIL-STD-883		500V HBM
Flame Resistance	MIL-STD-1344	Method 1012, Cond. B	30 seconds
Damp Heat	MIL-STD-1344	Method 1002.2, Cond. B	10 cycles , 24 hours
Eye Safety	CDRH and IEC-825	Class 1 Laser Product	

TABLE 7 MATERIAL/FINISH

Item	Material/Finish
PCB	FR4
PCB flex	FR4 & Polyimide
Railings	Aluminum 6061-T6 per ASTM-B221/B211M or Equivalent
Screws	CRES Type, 302, 303, 304, 305, or 316
Optical Ferrules & Sleeves	Zirconia, Ceramic
Solder type	RoHS compliant Sn95/Sb5 (232°C melting temp) & RoHS compliant Sn96.5/Ag3.0/Cu0.5 (217° melting)

Input/Output Definition

FIGURE 1 – OUTLINE DRAWING CONTINUED (MARKING)

LABELING:

Each unit will be shipped in an antistatic bag. The label on the antistatic bag shall be at a minimum Arial size 10 black font and contain at a minimum the following information:

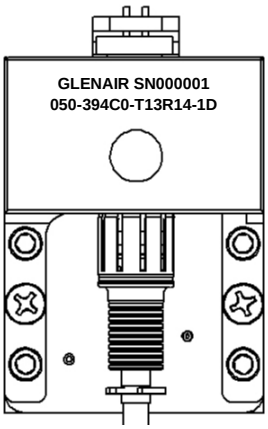
ANTISTATIC BAG LABEL:
Glenair
Cage Code: 06324
PN: 050-394XX-XXXXXX-XX
Rev: X
QTY: X
J/N: X
D/C:X
S/N*: XXXXXX
*If QTY is more than 1, there is no S/N

Each unit will be marked, either with a label or laser engraving, as follows:

- Marking font to be Arial, greater than .08 inches in height.
- Marking:
  FIRST LINE OF TEXT
  - Glenair
  - Serial Number (6 digits)

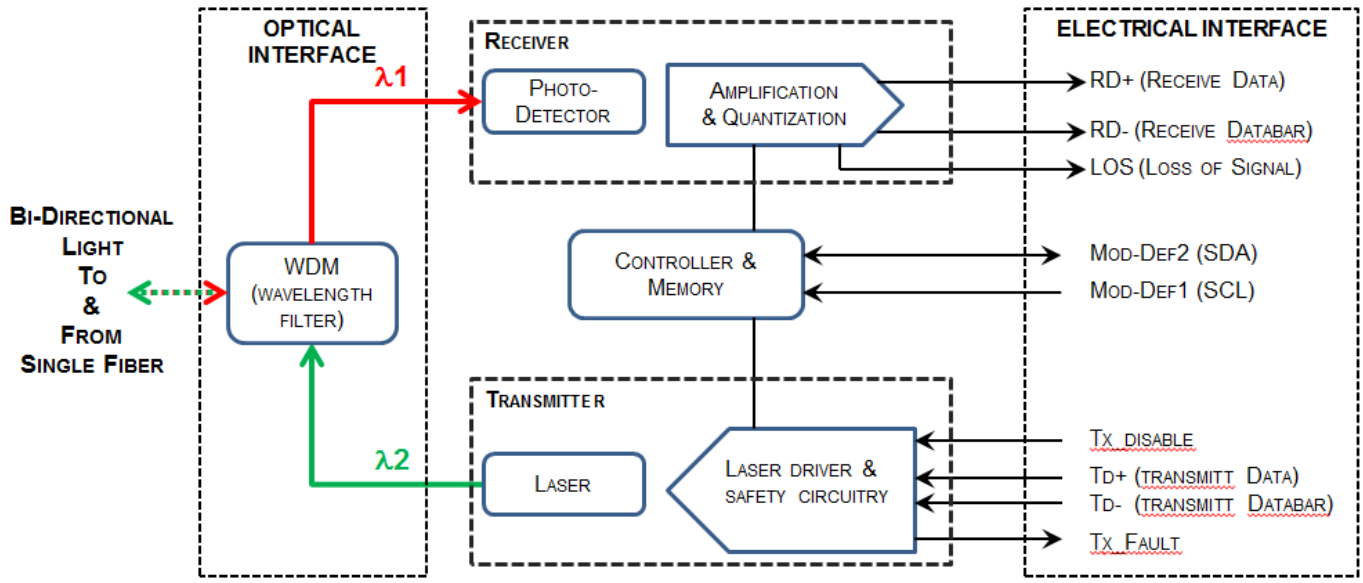
  SECOND LINE OF TEXT:
  - Part number

Example



FUNCTIONAL DESCRIPTION

Figure 2 **PCB mount Transceiver Block Diagram**



TRANSMITTER SECTION

Transmit Disable (Tx_Disable)

The transmitter section of the transceiver accepts a TTL and CMOS compatible transmit disable control signal input that shuts down the transmitter optical output. A high signal disables the transmitter while a low signal allows normal transceiver operation. Also laser is disabled when TX Disable is open. In the event of a fault (e.g. eye safety circuit activated), cycling this control signal resets the module. Host systems should allow a 10ms interval between successive assertions of this control signal.

Transmit Fault (Tx_Fault)

A catastrophic laser fault will activate the transmitter signal, TX_FAULT, and disable the laser. This signal is an open collector output (pull-up required on the host board). A low signal indicates normal laser operation and a high signal indicates a fault. The TX_FAULT will be latched high when a laser fault occurs and is cleared by toggling the TX_DISABLE input or cycling the power of the transceiver. The transmitter fault condition can also be monitored via the 2-wire serial interface (address A2, byte 110, bit 2).

Eye Safety Circuit

The Transmitter section provides Class 1 eye safety by design and is compliant with US FDA CDRH AEL Class 1 and EN(IEC) 60825-1,2, EN60950 Class 1. The eye safety circuit continuously monitors optical output power levels and will disable the transmitter and assert a TX_FAULT signal upon detecting an unsafe condition. Such unsafe conditions can be created by inputs from the host board (Vcc fluctuation, unbalanced code) or faults within the module.

RECEIVER SECTION

Receiver Loss of Signal (LOS)

The Loss Of Signal (LOS) output indicates an unusable optical input power level. The post-amplification IC includes transition detection circuitry which monitors the ac level of incoming optical signals and provides a TTL/CMOS compatible status signal to the host. A low LOS logic level indicates the presence of an optical input while a high LOS logic level indicates an unusable optical input. The LOS thresholds are factory-set so that a high output indicates a definite optical fault has occurred (e.g. failed transmitter, broken or disconnected fiber connection to the transceiver, etc.). The LOS can also be monitored via the 2-wire serial interface (address A2h, byte 110, bit 1).

FUNCTIONAL I/O

The PCB mount transceiver accepts industry standard differential signals such as LVPECL and CML within the scope of the SFP MSA. To simplify board requirements, transmitter bias resistors and ac coupling capacitors are incorporated, per SFF-8074i, and hence are not required on the host board. The module is AC-coupled and internally terminated.

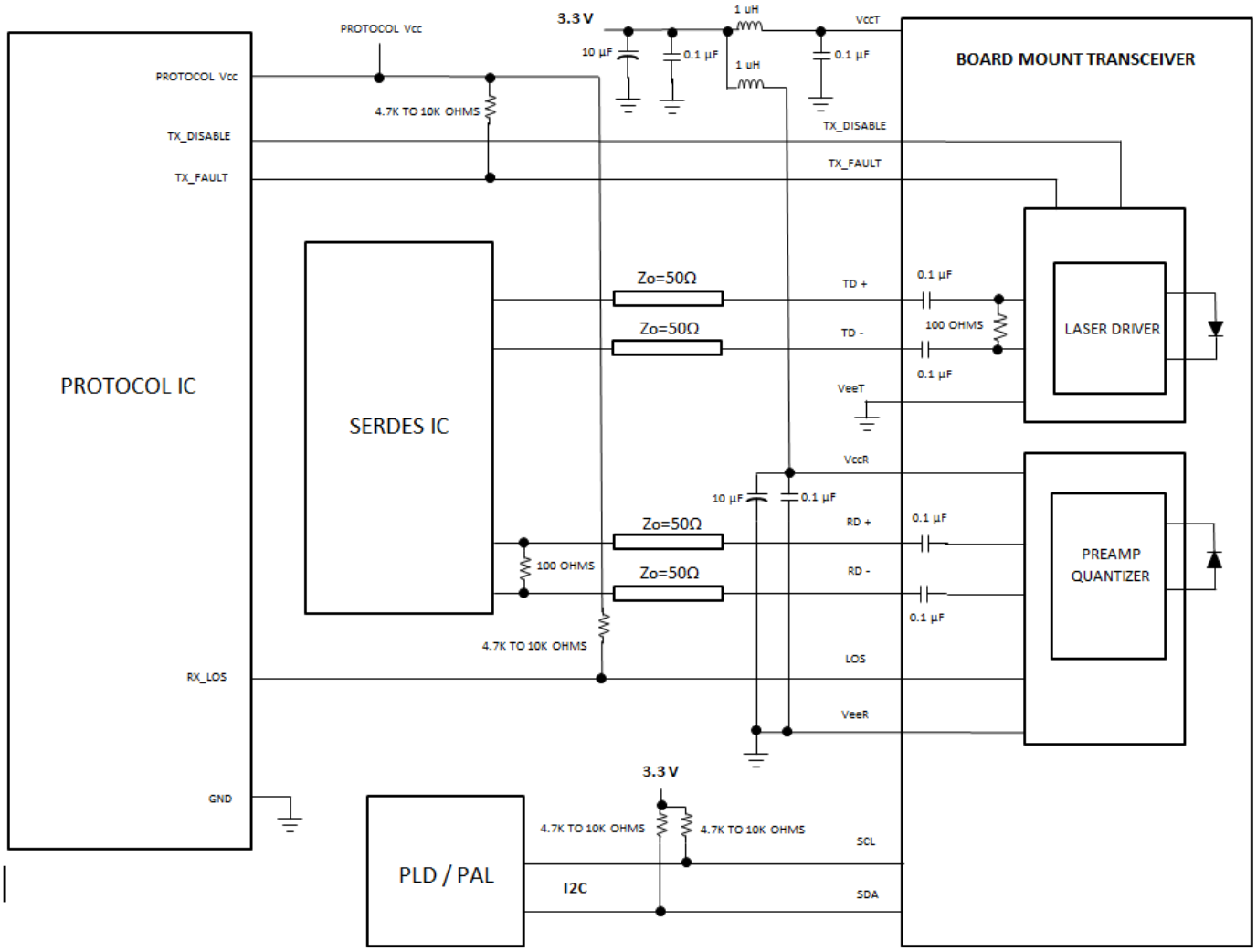
Figure 3 illustrates a recommended interface circuit to link the PCB mount transceiver to the supporting Physical Layer integrated circuits.

The PCB mount transceiver interfaces with the host circuit board through twenty I/O pins identified by function in Table 8. The transceiver high speed transmit and receive interfaces requires SFP MSA compliant signal lines on the host board. The Tx_Disable, Tx_Fault, and Rx_LOS lines require TTL lines on the host board (per SFF-8074i) if used. If an application chooses not to take advantage of the functionality of these pins, TX_Disable need to be tied to GND, TX_Fault and RX_LOS do not need to be connected.

Digital Diagnostic Interface and Serial Identification (EEPROM)

The PCB mount transceiver is compatible with the SFF-8074i SFP specification and with SFF-8472, the SFP specification for Digital Diagnostic Monitoring Interface. Both specifications can be found at http://www.sffcommittee.org.

FIGURE 3 RECOMMENDED PCB MOUNT TRANSCEIVER HOST BOARD SCHEMATIC



The PCB mount transceiver features EEPROM for Serial ID, which contains the product data stored for retrieval by host equipment. This data is accessed via the 2-wire serial EEPROM protocol in compliance with the industry standard SFP Multi-Source Agreement. The base EEPROM memory, bytes 0-255 at memory address 0xA0, is organized in compliance with SFF-8074i.

As an enhancement to the conventional SFP interface defined in SFF-8074i, the PCB mount Transceiver is compliant to SFF-8472 (digital diagnostic interface for optical transceivers). This new digital diagnostic information is stored in bytes 0-255 at memory address 0xA2.Using the 2-wire serial interface defined in the MSA, the PCB mount Transceiver provides real time temperature, supply voltage, laser bias current, laser average output power and received input power. These parameters are internally calibrated, per the SFF-8472 MSA. The digital diagnostic interface also adds the capability to monitor for Transmitter Faults (TX_FAULT), and monitor for Receiver Loss of Signal (RX_LOS). The diagnostic

information provides the opportunity for Predictive Failure Identification, Compliance Prediction, Fault Isolation and Component Monitoring.

Predictive Failure Identification

The predictive failure feature allows a host to identify potential link problems before system performance is impacted. Prior identification of link problems enables a host to service an application via “fail over” to a redundant link or replace a suspect device, maintaining system uptime in the process. For applications where ultra-high system uptime is required, the PCB mount Transceiver provides a means to monitor two real-time laser metrics associated with observing laser degradation and predicting failure: average laser bias current (Tx_Bias) and average laser optical power (Tx_Power).

Compliance Prediction

Compliance prediction is the ability to determine if an optical transceiver is operating within its operating and environmental requirements. The PCB mount Transceiver provide real-time access to transceiver internal supply voltage and temperature, allowing a host to identify potential component compliance issues. Received optical power is also available to assess compliance of fiber cable plant and remote transmitter. When operating out of requirements, the link cannot guarantee error free transmission.

Fault Isolation

The fault isolation feature allows a host to quickly pinpoint the location of a link failure, minimizing downtime. For optical links, the ability to identify a fault at a local device, remote device or cable plant is crucial to speeding service of an installation. PCB mount Transceiver real-time monitors of Tx_Bias, Tx_Power, Vcc, Temperature and Rx_Power can be used to assess local transceiver current operating conditions. In addition, status flag Rx Loss of Signal (LOS) is mirrored in memory and available via the two-wire serial interface.

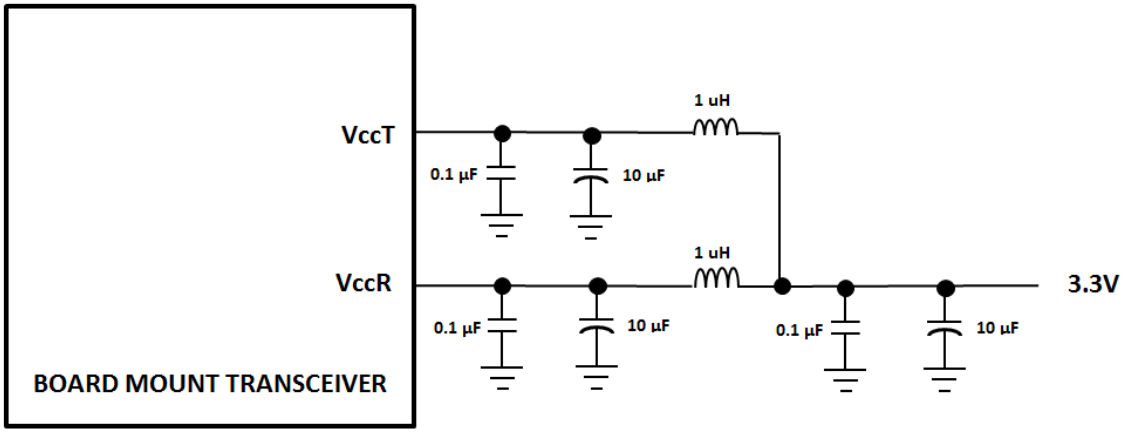
Component Monitoring

Component evaluation is another use of the PCB mount Transceiver real-time monitors of Tx_Bias, Tx_Power, Vcc, Temperature and Rx_Power. Potential uses are as debugging aids for system installation and design, and transceiver parametric evaluation for factory or field qualification. For example, temperature per module can be observed in high density applications to facilitate thermal evaluation of systems that incorporate this PCB mount transceiver

Required Host Board Components

A power supply noise rejection filter as describe in SFP MSA is required on the host PCB to meet data sheet performance. This is filter incorporates an inductor which should be rated to 400 mADC and 1 Ω series resistance or better. It should not be replaced with a ferrite. The required filter is illustrated in Figure 4. Also, the host PCB for the PCB mount transceiver requires 4.7 K to 10 KΩ pull-up resistors for TX_FAULT, LOS, SCA and SDL lines.

FIGURE 4 RECOMMENDED HOST BOARD POWER SUPPLY FILTERING CIRCUIT



Fiber Compatibility

The transceiver is capable of transmission up to 10km with 9/125 µm fiber

Electrostatic Discharge (ESD)

The Transceiver is compatible with ESD levels found in typical manufacturing and operating environments as described JEDEC EIA JESD22-A114, Class 1C (<2000Volts) HBM. Glenair recommends that devices are handled with ESD precautions to limit exposure to below 250V HBM.

There are two design cases in which immunity to ESD damage is important. The first case is during handling of the transceiver prior to insertion to the host board. To protect the transceiver, it's important to use standard industry ESD handling precautions. These precautions include using grounded wrist straps, work benches, and floor mats in ESD controlled areas. The ESD sensitivity of the Glenair PCB mount transceiver is compatible with typical industry production environments.

The second case to consider is static discharges to the exterior of the host equipment after installation, in which case the transceiver may be subject to system-level ESD requirements.

Application Support

To assist in the transceiver design and evaluation process, Glenair offers the following aids:

- Evaluation board & Product Manual, part number 050-329, which facilitates in the testing of the PCB mount transceiver.
- 3D Step file to support modeling of mechanical fit and routing
- PADS schematic and PCB layout library files that can be exported into customer's PCB software design program
- Applications Aid Example of PCB layout including details of high speed transmission designs

Customer Manufacturing Processes

This module is mounted with screws and interfaces with a high-speed low cost surface mount electrical connector residing on the host PC board. The PCB mount transceiver is not designed for aqueous wash, IR reflow, or wave soldering processes and should be mounted on the host board after host PC board has been through its assembly process.

Proper torque values for mounting screws must be observed. Please contact Glenair for hardware mounting process recommendations.

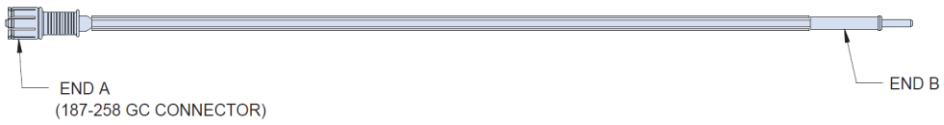
ACCESSORIES

Fiber Optic Jumper Cables to support connection to Mil/Aerospace Connectors

KEY FEATURES:

- Jumper cable between Glenair Transceiver (end A) and Mil/Aero Connector termini (End B)
- Offered with either Multimode and Single Mode fibers

FIGURE 5
Fiber Optic Jumper Cable Assembly (see separate Glenair sales drawing FA02454 for details)



PCB Threaded Inserts, (PN 990-05017-1) sold as a kit of 100 pcs under kit part number 059-0007-1

KEY FEATURES:

- Simplifies installation of PCB Mount transceivers eliminating the need for washers and nuts.
- Soldered to PCB to eliminate need for handling nuts during assembly

EVALUATION Boards, PN 050-329, include

- Datasheet with test block diagram, schematic and Evaluation board PCBA
- Multiple types of PCB Mount Transceiver modules supported by this evaluation board
- 2 fiber optic cables (P/N: FA02318, 1m, 9µm/125 µm, GC connector to LC connector)