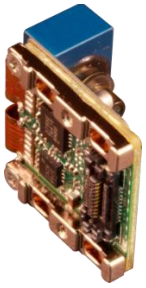
050-321

PRODUCT BRIEF

10MBPS-200 MBPS
PRINTED CIRCUIT BOARD (PCB) MOUNT TRANSCEIVER
1300NM LED TRANSMITTER, PIN TIA RECEIVER
SMALL & COMPACT WITH RUGGED CONSTRUCTION FOR HARSH ENVIRONMENTS

REV	DESCRIPTION	DATE	APPROVED
A	Initial Release	01/16/2015	SZ
B	Per DCN 53850	02/06/2015	SZ
C	Per DCN 54154	02/26/2015	SZ
D	Per DCN 54586	03/27/2015	SZ
E	Per DCN55452 (revised Samtec connector part numbers)	05/29/2015	TC
F	Per DCN55669 (Changed Maximum LOS Assert Level to -34dBm)	06/11/2015	SZ
G	Updated description on Pin Assignment Table per DCN58224	01/04/2016	SZ
H	Per DCN60359; Add ECCN	05/26/2016	RAS
J	Per DCN62204; Edit PRBS specification to 2^7-1	10/12/2016	GC
K	Per DCN62625; Replace "mm" with "um" on I2C table	11/08/2016	SZ/GC
L	Per DCN62958; Edit Bag and Tag Labeling	12/07/2016	RAS/GC
M	Per DCN63730; Remove incorrect reference to ATMEL AT240C01A, added optional I2C addressing	02/23/2017	RAS/GC

PCB Mount Fiber Optic Transceiver, 20Mbps-200Mbps, MMF, 3.3V



Glenair 050-321, is a ruggedized harsh environment PCB Mount 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 transceivers also support optional Digital Monitoring Interface (DMI) features in accordance with SFF 8472. The Transceiver is comprised of a transmitter section and a receiver section that resides on a common package and interface with a host board through a high speed electrical connector.

The transmitter section includes the Transmitter Optical Subassembly (TOSA) and LED driver circuitry. The TOSA, containing a 1300nm LED light source, is located at the optical interface and mates with the GC optical connector. The TOSA is driven by a LED driver, which converts differential logic signals into an analog drive current.

The receiver section includes the Receiver Optical Subassembly (ROSA) and amplification/quantization circuitry. The ROSA, containing a PIN photodiode and trans-impedance preamplifier, is located at the optical interface and mates with the GC optical connector. The ROSA is mated to a limiting amplifier IC that provides post-amplification and quantization. Also included is a Loss Of Signal (LOS) detection circuit.

KEY FEATURES/BENEFITS

- SFP Compatible Electrical I/O signal levels
- 1300nm LED to support up to 200Mbps
- PIN PD to support high sensitivity up to 200Mbps
- Industry standard LVPECL input and outputs that make for simple integration on customer host PCB
- Glenair Rugged GC Optical connector
- High Operational Shock (650 g) & Vibration (54 g rms) – test reports available
- 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
- Captive screws to simplify logistics and assembly
- Small: Approx. 0.8” x 0.9” x 0.5”
- -40°C to +85°C Operating Case Temperature
- Glenair fiber jumpers connect from transceiver to any Glenair Mil/Aero Fiber Optic Connector Style
- Evaluation fixtures available
- Digital Diagnostic and Monitoring (DMI) based on SFF-8472, enables monitoring of:
  - Temperature
  - Supply voltage

APPLICATIONS

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

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

Part Number	Two Wire Address	Data Rate	Temperature	Screw Length** (Mod Code)
050-321 PCB Mount Transceiver, SMF, 1300nm 10-200 Mbps	Blank = A2h Other Options: C0, C2, C4, C6, C8, CA, CC, CE, D0, D2, D4, D6, D8, DA, DC, DE	-1-D = 10 Mbps - 200 Mbps	Blank = Standard	Blank = Standard -954-xxx = IAW Mod Code 954

Example: ***050-321C0-1-D***

PCB Mount Transceiver, MMF, 850nm, Two Wire Address = C0h, Data Rate = 10 Mbps – 200 Mbps, Standard Temperature Range, Standard Screw Length

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

 REV: M US Cage Code 06324 Printed in USA

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, Case	T_{op}	-40		+85	°C	
Supply Voltage	V_{cc}	3.135	3.3	3.465	V	
Supply Current	Icc		230	310	mA	Typical @ +85°C
Power Supply Noise (Peak-Peak)	V_{cc_ripple}			100	mV	

TABLE 4 ELECTRO-OPTICAL CHARACTERISTICS – TRANSMITTER (T_{OP} UNLESS NOTED OTHERWISE)

Parameter	Symbol	Min	Typ	Max	Units	Notes
Optical Output Power	P_{OUT}	-18.5		-14	dBm	1300 nm LED, OM1 (62.5/125 µm)
Extinction Ratio	Er	8	10		dB	
Optical Wavelength	λ_{OUT}	1260	1300	1380	nm	
Spectral Width, FWHM	$\Delta\lambda$		147		nm	
Transmitter Differential Input Impedance	Zin		100		Ohms	AC coupled Internally
Differential Input Voltage	Vin_d	500		1800	mV_{p-p}	LVPECL, 100 ohm

TABLE 5 ELECTRO-OPTICAL CHARACTERISTICS – RECEIVER (T_{OP} UNLESS NOTED OTHERWISE)

Parameter	Symbol	Min	Typ	Max	Units	Notes
Sensitivity, BER 10^{-10}, PRBS 2^7-1, Er 10 dB	P_{IN}		-34	-32	dBm	PIN PD @ 125Mbps
Overload, BER 10^{-10}, PRBS 2^7-1	P_{IN}	-14			dBm	@125Mpbs
Optical Wavelength	λ_{IN}	1100		1600	nm	
Receiver Differential Output Impedance	Zout		100		Ohms	AC coupled internally
Differential Output Voltage Swing	Vout_d	400		2000	mV_{p-p}	LVPECL, 100 ohm
LOS Assert Level	LOS			-34	dBm	@ 125 Mbps
LOS Hysteresis	LOS_{HYS}	1.5	3		dB	@ 125 Mbps

Ratings and Specifications (cont'd)

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		1000V HBM
Flame Resistance	MIL-STD-1344	Method 1012, Cond. B	30 seconds
Altitude	RTCA DO160 G		
Altitude, 25Kft		Section 4.6.1 Category B1	Operating Altitude, 25,000 ft
Altitude, 70Kft		Section 4.6.1 Category E1	Operating Altitude, 70,000 ft
Decompression		Section 4.6.2 Category A2	Operating Altitude, 45,000 ft
Overpressure		Section 4.6.3 Category A1	28 psia
Damp Heat	RTCA DO160G MIL-STD-1344	Section 6 Category A Method 1002.2, Cond. B	48 hours, Non-operational 10 cycles, 24 hours, Operational
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)

FIGURE 1 - OUTLINE DRAWING CONTINUED (MARKING)

LABELING:

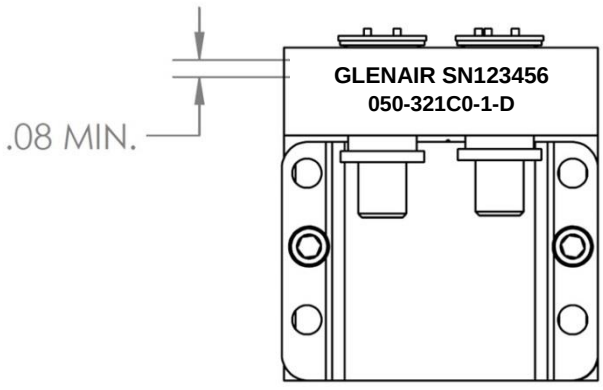
Each unit will be shipped in an antistatic bag. The label on the antistatic bag shall be at a minimum Arial size 10 black font and contain at a minimum the following information:

ANTISTATIC BAG LABEL:
Glenair
Cage Code: 06324
PN: 050-321XX-1-D
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:

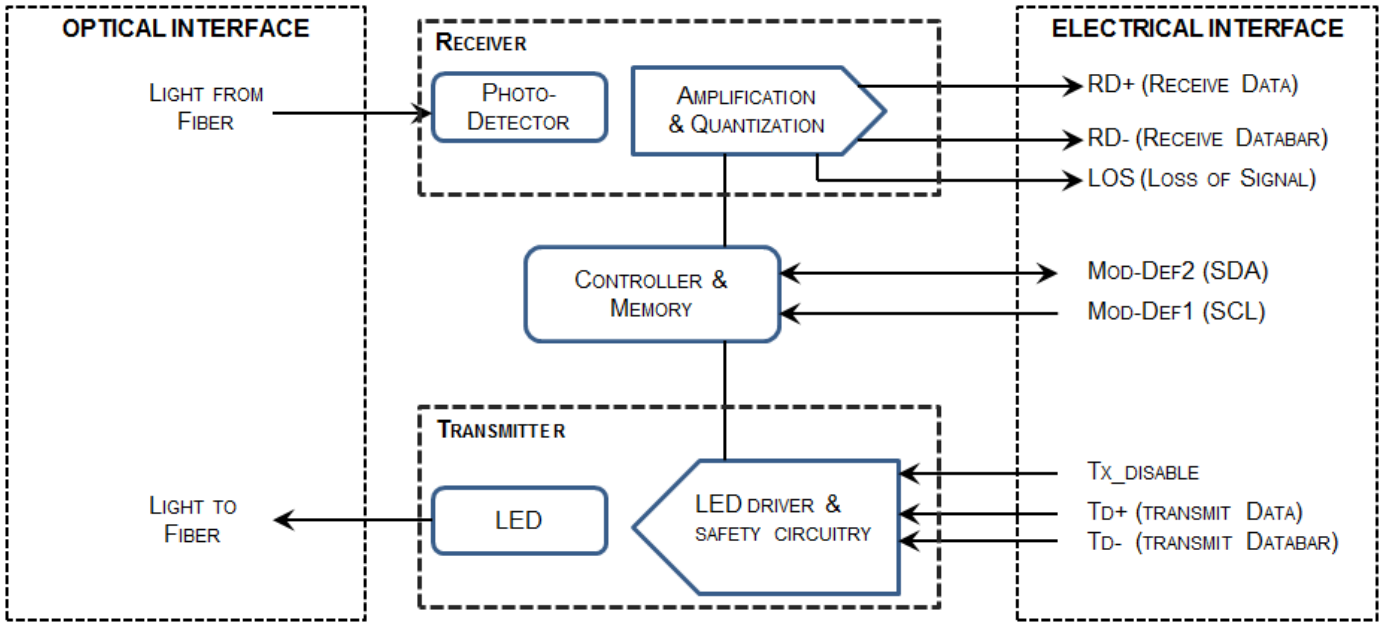
- Marking font to be Arial, greater than .08 inches in height.
- Marking:
  - FIRST LINE OF TEXT
    - Glenair
    - Serial Number (6 digits)
  - SECOND LINE OF TEXT:
    - Part number

Example



FUNCTIONAL DESCRIPTION

Figure 2 PCB mount Transceiver Block Diagram



TRANSMITTER SECTION

Transmit Disable (Tx_Disable, pin 10)

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 LED is enabled when TX Disable is open.

RECEIVER SECTION

Receiver Loss of Signal (LOS, Pin 20)

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 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.

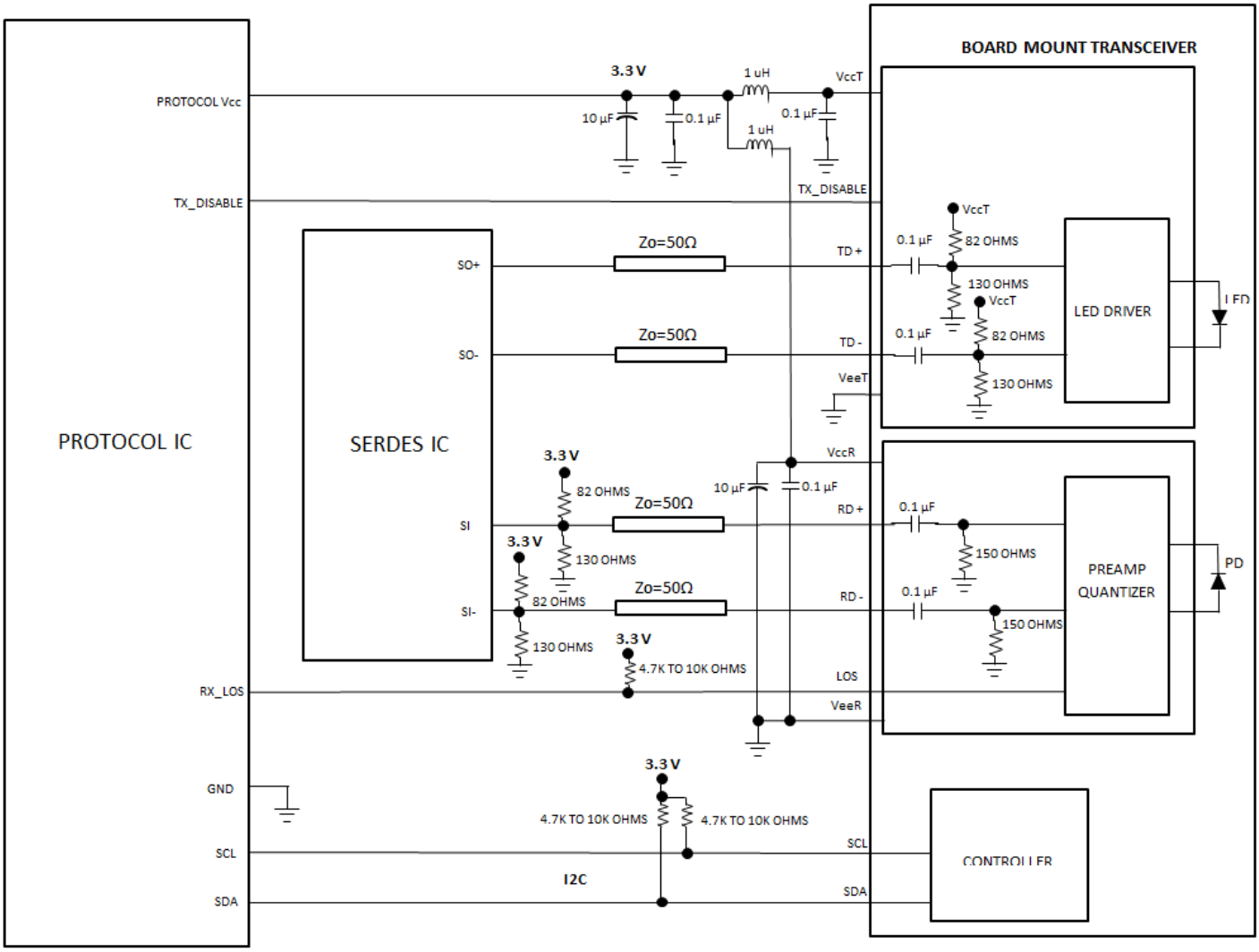
Figure 3 illustrates a recommended interface circuit to link the PCB Mount Transceiver to the supporting Physical Layer integrated circuits.

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 Rx_LOS line require TTL lines on the host board (per SFF-8074i) if used. If an application chooses not to take advantage of the functionality of this pins, RX_LOS does 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. Temperature and power supply VCC voltage can be monitored via 2 wire serial interface.

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. The I2C accessible memory page address 0xB0 is reserved and used internally by SFP for the test and diagnostic purposes.

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 and supply voltage. These parameters are internally calibrated, per the SFF-8472 MSA. The digital diagnostic interface also adds the capability to 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.

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.

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 Vcc, and Temperature 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.

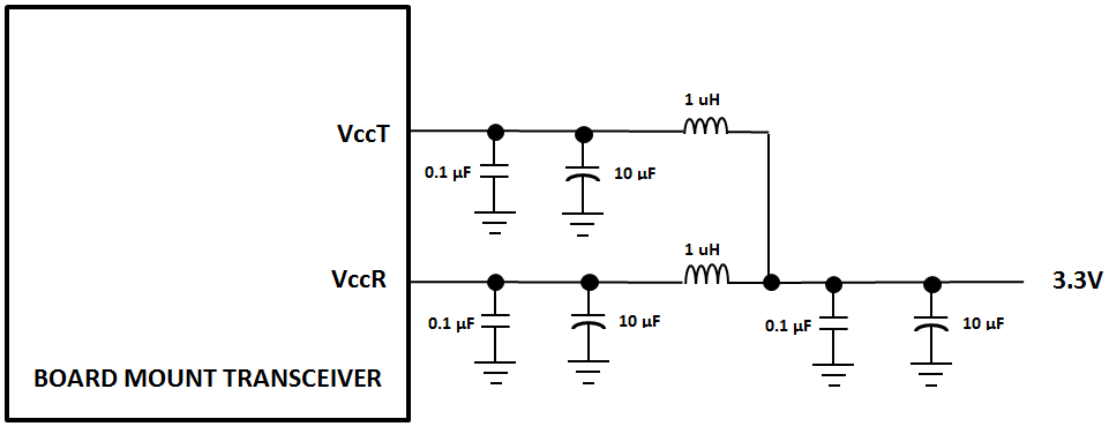
Component Monitoring

Component evaluation is another use of the PCB Mount Transceiver real-time monitors of Vcc, and Temperature. 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 600 mA DC and 0.5 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 LOS, SCA and SDL lines.

FIGURE 4 RECOMMENDED HOST BOARD POWER SUPPLY FILTERING CIRCUIT



Fiber Compatibility

The transceiver is capable of transmission at 2 to 2000 meters with 50/125 µm fiber, and at 2 to 2000 meters with 62.5/ 125 µm fiber, for 125 Mbps FDDI.

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 500V 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 these processes.

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

TABLE 9 TWO-WIRE INTERFACE ID: DATA FIELDS – ADDRESS A0h

Byte Decimal	# Hex	Data Notes	Byte Decimal	# Hex	Data Notes
0	80	Glenair PCB Mount Transceiver	**37**	00	Vendor OUI (NOT USED)
1	04	Serial ID Module Definition	**38**	00	Vendor OUI (NOT USED)
2	80	"GC" Fiber Optic Connector	**39**	00	Vendor OUI (NOT USED)
3	00		**40**	30	"0" Vendor Part Number ASCII Character (Note 5)
4	00		**41**	35	"5" Vendor Part Number ASCII Character (Note 5)
5	00		**42**	30	"0" Vendor Part Number ASCII Character (Note 5)
6	20	100BASE-FX	**43**	2D	"-" Vendor Part Number ASCII Character (Note 5)
7	00		**44**	33	"3" Vendor Part Number ASCII Character (Note 5)
8	00		**45**	32	"2" Vendor Part Number ASCII Character (Note 5)
9	00		**46**	31	"1" Vendor Part Number ASCII Character (Note 5)
10	00		**47**	43	"C" Vendor Part Number ASCII Character (Note 5)
11	01	Compatible with 8B/10B encoded data	**48**	30	"0" Vendor Part Number ASCII Character (Note 5)
12	01	BR, 100Mbps	**49**	2D	"-" Vendor Part Number ASCII Character (Note 5)
13	00		**50**	31	"1" Vendor Part Number ASCII Character (Note 5)
14	00		**51**	2D	"-" Vendor Part Number ASCII Character (Note 5)
15	00		**52**	44	"D" Vendor Part Number ASCII Character (Note 5)
16	C8	2km of 50/125µm Fiber @ 125Mbps	**53**	20	" " Vendor Part Number ASCII Character (Note 5)
17	C8	2km 62.5/125µm Fiber @ 125Mbps	**54**	20	" " Vendor Part Number ASCII Character (Note 5)
18	00		**55**	20	" " Vendor Part Number ASCII Character (Note 5)
19	00		**56**	20	" " Vendor REV Level ASCII Character (Note 5)
20	47	"G" Vendor NAME ASCII Character	**57**	20	" " Vendor REV Level ASCII Character (Note 5)
21	4C	"L" Vendor NAME ASCII Character	**58**	20	" " Vendor REV Level ASCII Character (Note 5)
22	45	"E" Vendor NAME ASCII Character	**59**	20	" " Vendor REV Level ASCII Character (Note 5)
23	4E	"N" Vendor NAME ASCII Character	**60**	05	Hex Byte of Laser Wavelength (Note 6)
24	41	"A" Vendor NAME ASCII Character	**61**	14	Hex Byte of Laser Wavelength (Note 6)
25	49	"I" Vendor NAME ASCII Character	**62**		RESERVED
26	52	"R" Vendor NAME ASCII Character	**63**		Check sum code for ID fields 0-62 (Note 7)
27	20	" " Vendor NAME ASCII Character	**64**	00	
28	20	" " Vendor NAME ASCII Character	**65**	12	Hardware TX_Disable & LOS
29	20	" " Vendor NAME ASCII Character	**66**	00	
30	20	" " Vendor NAME ASCII Character	**67**	00	
31	20	" " Vendor NAME ASCII Character	**68-83**		Serial Number, ASCII (Note 8)
32	20	" " Vendor NAME ASCII Character	**84-91**		Date Code (Note 9)
33	20	" " Vendor NAME ASCII Character	**92**	68	Diagnostic Monitoring Type
34	20	" " Vendor NAME ASCII Character	**93**	90	Enhanced Options
35	20	" " Vendor NAME ASCII Character	**94**	05	SFF-8472 rev 11.0
36	00		**95**		Checksum for bytes 64-94 (Note 7)
			96-255	00	

Notes:
1. RESERVED
2. RESERVED
3. RESERVED
4. RESERVED
5. Table 1, Part number options/extensions. Temperature and Screw Length Mod Codes will not be added onto Digital Memory ID.
6. Laser wavelength is represented in 16 unsigned bits. The hex representation of 1300nm is 0514.
7. Addresses 63 and 95 are checksums calculated per SFF-8472 and SFF-8074, and stored prior to product shipment.
8. Addresses 68-83 specify the module's ASCII serial number and will vary by unit.
9. Addresses 84-91 specify the module's ASCII date code and will vary according to manufactured date-code.

Table 10 Two-Wire interface ID: Data Fields – Address A2h is standard – other options available, see part number development

Byte # Decimal	Data Notes	Byte # Decimal	Data Notes	Byte # Decimal	Data Notes
0	Temp H Alarm MSB (Note 1)	**26**	N/A	**104**	N/A)
1	Temp H Alarm LSB (Note 1)	**27**	N/A	**105**	N/A
2	Temp L Alarm MSB (Note 1)	**28**	N/A	**106**	Reserved
3	Temp L Alarm LSB (Note 1)	**29**	N/A	**107**	Reserved
4	Temp H Warning MSB (Note 1)	**30**	N/A	**108**	Reserved
5	Temp H Warning LSB (Note 1)	**31**	N/A	**109**	Reserved
6	Temp L Warning MSB (Note 1)	**32**	N/A	**110**	Status/Control
7	Temp L Warning LSB (Note 1)	**33**	N/A	**111**	Reserved
8	Vcc H Alarm MSB (Note 2)	**34**	N/A	**112**	Flag Bits
9	Vcc H Alarm LSB (Note 2)	**35**	N/A	**113**	Flag Bits
10	Vcc L Alarm MSB (Note 2)	**36**	N/A	**114**	Reserved
11	Vcc L Alarm LSB (Note 2)	**37**	N/A	**115**	Reserved
12	Vcc H Warning MSB (Note 2)	**38**	N/A	**116**	Flag Bits
13	Vcc H Warning LSB (Note 2)	**39**	N/A	**117**	Flag Bits
14	Vcc L Warning MSB (Note 2)	**40-45**	Reserved	**118**	Reserved
15	Vcc L Warning LSB (Note 2)	**56-94**	External Cal Constants (Note 4)	**119**	Reserved
16	N/A	**95**	Checksum for bytes 0-94	**120-122**	Reserved
17	N/A	**96**	Temperature MSB (Note 1)	**123**	Reserved
18	N/A	**97**	Temperature LSB (Note 1)	**124**	Reserved
19	N/A	**98**	Vcc MSB (Note 2)	**125**	Reserved
20	N/A	**99**	Vcc LSB (Note 2)	**126**	Reserved
21	N/A	**100**	N/A	**127**	Reserved (Note 8)
22	N/A	**101**	N/A)	**128-247**	Customer Writable (Note 9)
23	N/A	**102**	N/A	**248-255**	Vendor Specific
24	N/A	**103**	N/A		
25	N/A				

Notes:

1. Temperature (Temp) is decoded as a 16 bit signed twos compliment integer in increments of 1/256 °C.
2. Supply voltage (VCC) is decoded as a 16 bit unsigned integer in increments of 100 µV.
3. Reserved
4. Reserved
5. Reserved
6. Bytes 55-94 are not intended for use but have been set to default values per SFF-8472.
7. Bytes 95 is a checksum calculated (per SFF-8472) and stored prior to product shipment.
8. Byte 127 accepts a write but performs no action (reserved legacy byte).
9. Bytes 128-247 are write enabled (customer writable).

TABLE 11 TRANSCEIVER DIGITAL DIAGNOSTIC MONITOR CHARACTERISTICS (WHEN APPLICABLE)

PARAMETER	SYMBOL	MIN.	UNITS	NOTES
Transceiver Internal Temperature Accuracy	TINT	±3.0	°C	Temperature is measured internal to the transceiver and is valid from -40°C to +85 °C case temperature
Transceiver Internal Supply Voltage accuracy	VINT	±0.1	V	Supply voltage is measured internal to the transceiver and can, with less accuracy, be correlated to the voltage at the Vcc pin. Valid over 3.3V ±5%

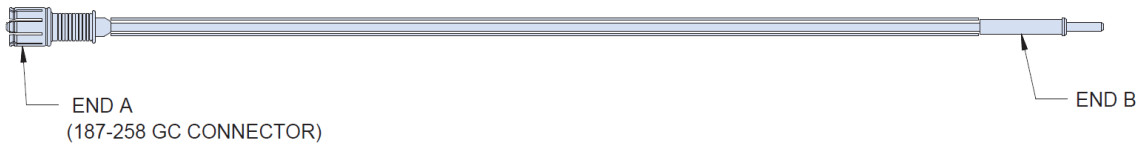
ACCESSORIES

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 or Single Mode fibers

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



PCB Threaded Inserts, PN 059-0007

KEY FEATURES

- Simplifies installation of PCB Mount Transceivers eliminating the need for washers and nuts
- Existing Options to support PCB thickness from 0.03” to 0.92”
- Can support thicker PCB if required

EVALUATION Boards, PN 050-329, include

- MANUAL 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 (~1m, GC connector to LC connector)