



# 050-363

## PRODUCT BRIEF

100 MBPS – 5 GBPS

PRINTED CIRCUIT BOARD (PCB) MOUNT QUAD TRANSMITTER

850NM VCSEL TRANSMITTER

COMPACT WITH RUGGED CONSTRUCTION FOR

HARSH ENVIRONMENTS INCLUDING RADIATION EXPOSURE

REV	DESCRIPTION	DATE	APPROVED
2	Preliminary	08/17/2015	SZ
3	Update radiation test data	10/01/2015	RL
4	Add ECCN	07/19/2016	GC/SZ
5	Update Outline Drawing. Change transceiver height	08/30/2016	GC/NH
6	General Update	11/18/2016	SZ/GC
7	Edit Bag and Tag Labeling	12/02/2016	RS/GC
8	Add Material/Finish Table	02/06/2017	RAS/GC
9	Change ER for 4.25 and 5 Gbps to 5dB	03/17/2017	SZ/GC

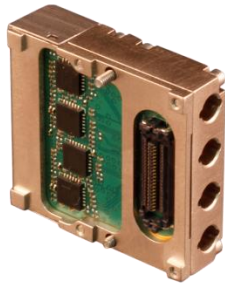
BF15U2-3323

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**050-363 PRODUCT BRIEF**  
**PCB Mount Quad Fiber Optic Transmitter**  
**5 Mbps – 4.25 Gbps , MMF, 3.3V**



**Quad Fiber Optic Transmitter for Harsh and Radiation Exposed Environments**



Glenair 050-363, is a ruggedized harsh environment PC Board Mount quad-transmitter designed for use in harsh environments that include high levels of gamma and neutron radiation. The transmitters utilize GaAs vertical cavity surface emitting laser (VCSEL) devices and SiGe/CMOS driver and control electronics that have been tested and found to be tolerant of gamma and neutron radiation exposure to high levels. The electrical control circuitry does not employ a microprocessor; The mechanical design is suited to the harsh temperature and vibration environments found in the Aerospace, Military and Nuclear Industrial applications. The quad-transmitter interfaces with the host PCB through a high speed surface-mount electrical connector.

Each transmitter section includes a Transmitter Optical Subassembly (TOSA) and laser driver circuitry. The TOSA, containing an 850 nm VCSEL (Vertical Cavity Surface Emitting Laser) light source, is located at the optical interface and mates with an ARINC 801 optical connector. The TOSA is driven by a laser driver, which converts differential CML logic signals into an analog laser diode drive current. This laser driver circuit regulates the optical power at a constant level provided the data pattern is DC balanced (for example 8B10B encoding).

**KEY FEATURES/BENEFITS**

- SFP Compatible Electrical I/O signal levels
- 850nm VCSEL lasers to support up to 5 Gbps
- Industry standard CML input and outputs that make for simple integration on customer host PCB
- ARINC 801 optical contacts
- Easy assembly - module is securely mounted with screws from the top to PCB to ensure excellent shock and vibration performance
- High-Speed Electrical plug-in connector eliminates the need for soldering & enables ease of servicing
- Compact Size: 1.1" x1" x 0.39"
- -40°C to +85°C Operating Case Temperature
- Glenair fiber jumpers connect from the transmitter to any Glenair Mil/Aero Fiber Optic Connector Style
- Evaluation fixtures available
- Radiation exposure test without errors:
  - Gamma: >165 Krad
  - Neutron: 250 x 10<sup>10</sup> /cm<sup>2</sup>

**APPLICATIONS**

- Harsh Environment such as: Airborne, Tactical, Railway, Industrial, Oil and Gas and Shipboard applications
- Radiation exposed environments such as Nuclear Power Plants, Medical equipment, particle accelerators, spacecraft, satellites and other payloads
- Ethernet, Fibrechannel (1FC,2FC,4FC), SFPDP

**HOW TO ORDER**

**Table 1 Part Number Options**

Part Number	Description
050-363-1	5Mbps-2.5Gbps
050-363-2	2.5Gbps – 4.25Gbps

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**Ratings and Specifications**

**TABLE 2 ABSOLUTE MAXIMUM RATINGS**

Parameter	Symbol	Min	Typ	Max	Units	Notes
Storage Temperature	T <sub>s</sub>	-55		+100	°C	
Supply Voltage	V <sub>cc</sub>	-0.4		3.8	V	V <sub>cc</sub> may not differ by more than 0.5V

**TABLE 3 OPERATING CONDITIONS**

Parameter	Symbol	Min	Typ	Max	Units	Notes
Operating Temperature, Case	T <sub>op</sub>	-40		+85	°C	
Supply Voltage	V <sub>cc</sub>	3.135	3.3	3.465	V	
Supply Current	I <sub>cc</sub>		360	400	mA	Typical @ +85°C
Power Supply Noise (Peak-Peak)	V <sub>cc, ripple</sub>			100	mV	

**TABLE 4 ELECTRO-OPTICAL CHARACTERISTICS**

Parameter	Symbol	Min	Typ	Max	Units	Notes
Optical Output Power	P <sub>OUT</sub>	-6.5	-5	-1	dBm	850nm VCSEL
Extinction Ratio, 1.25 Gbps, 2.5 Gbps	E <sub>r</sub>	7	10		dB	Exceeds OMA for GbE, 1FC
Extinction Ratio, 2.5 Gbps & 3.2 Gbps	E <sub>r</sub>	6			dB	Exceeds OMA for 2FC
Extinction Ratio, 4.25 Gbps & 5 Gbps	E <sub>r</sub>	5			dB	Exceeds OMA for 4FC
Optical Wavelength	λ <sub>OUT</sub>	830	850	860	nm	
Spectral Width, rms	Δλ			0.85	nm	
Relative Intensity Noise	RIN			-117	dB/Hz	
Transmitter Differential Input Impedance	R <sub>in</sub>		100		Ohms	AC coupled Internally
Differential Input Voltage	V <sub>in_d</sub>	250		2200	mV <sub>p-p</sub>	CML, 100 ohm

**TABLE 5 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	

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**Ratings and Specifications (continued)**

**TABLE 6 MATERIAL/FINISH**

<b>Item</b>	<b>Material/Finish</b>
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)

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**LABELING:**

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

ANTISTATIC BAG LABEL:

Glenair

Cage Code: 06324

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 as follows:

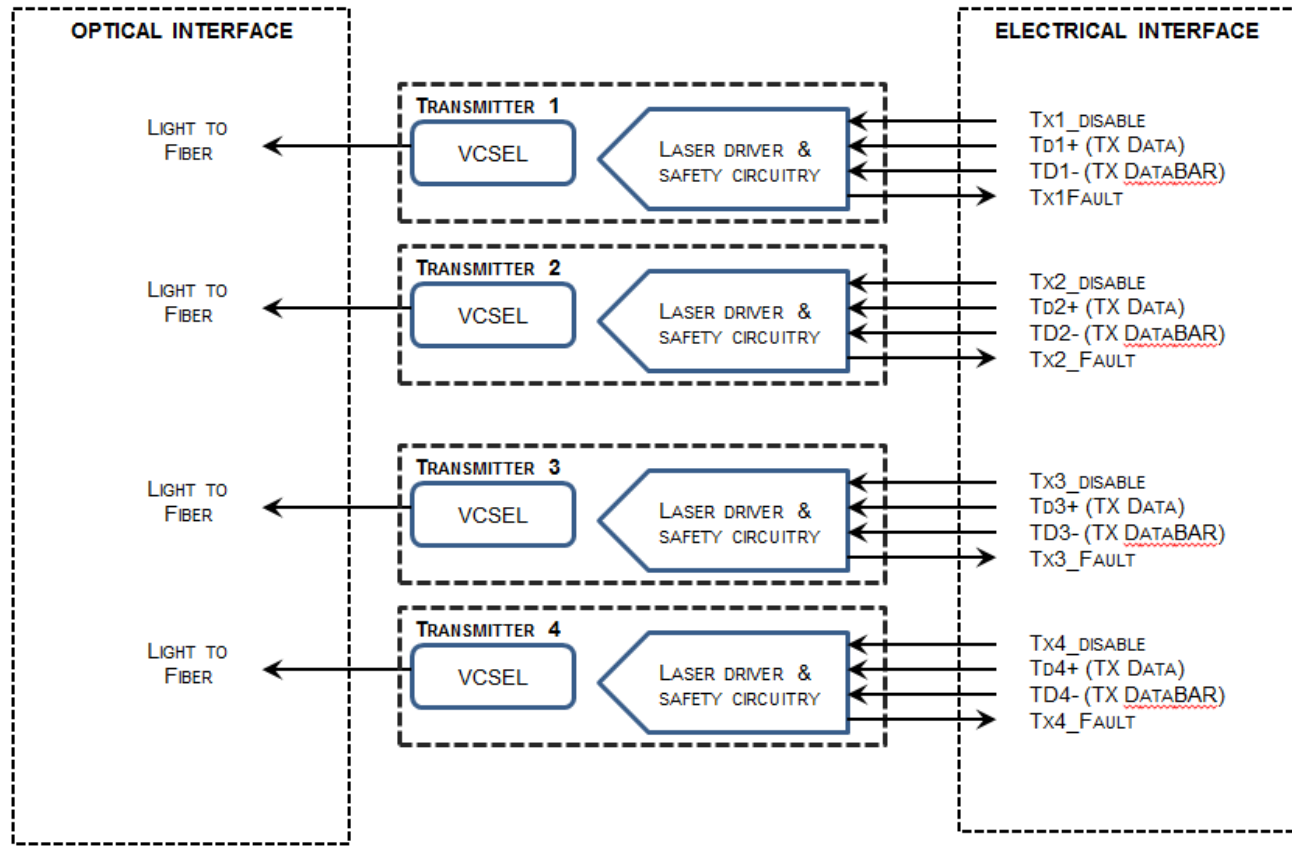
- Marking:
  - Glenair
  - Part Number
  - Serial Number (6 digits)

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**FUNCTIONAL DESCRIPTION**

**FIGURE 2 - BLOCK DIAGRAM – QUAD TRANSMITTER**



**TRANSMITTER SECTION**

Transmit Enable (TX Enable)

The transmitter section accepts a TTL and CMOS compatible transmit enable control signal input that turns on the transmitter optical output. A high signal disables the transmitter while a low signal allows normal transmitter operation. Also laser is disabled when TX Enable 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 ENABLE input or cycling the power of the transmitter.

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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.

**FUNCTIONAL I/O**

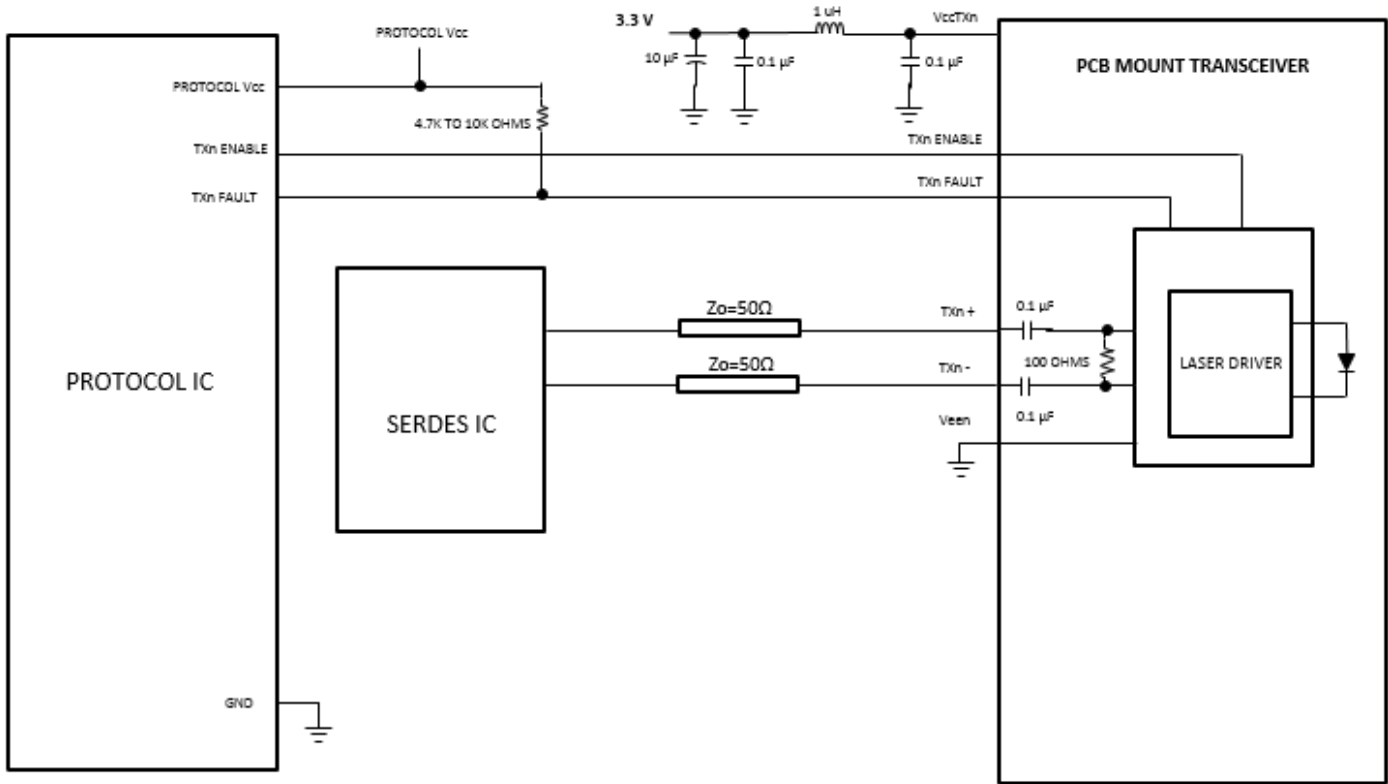
The PCB mount transmitter accepts industry standard differential signals such as LVPECL and CML within the scope of the SFP MSA. To simplify board requirements, transmitter bias resistors and ac coupling capacitors are incorporated and hence are not required on the host board. The module is AC-coupled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

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

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**FIGURE 3 – HOST BOARD RECOMMENDED SCHEMATIC**  
**SINGLE TRANSMITTER SHOWN (X4 TRANSMITTERS PER MODULE)**



**RECOMMENDED PCB MOUNT QUAD TRANSMITTER HOST BOARD SCHEMATIC**

The PCB mount transmitter interfaces with the host circuit board through forty I/O pins identified by function in Table 7. The high speed signal interfaces require SFP MSA compliant signal lines on the host board. The TX Enable and TX Fault, lines require TTL lines on the host board if used. If an application chooses not to take advantage of the functionality of these pins, TX1\_Enable, TX2\_Enable, TX3\_Enable and TX4\_Enable need to be tied to GND, TX1\_Fault, TX2\_Fault, TX3\_Fault, and TX4\_Fault do not need to be connected.



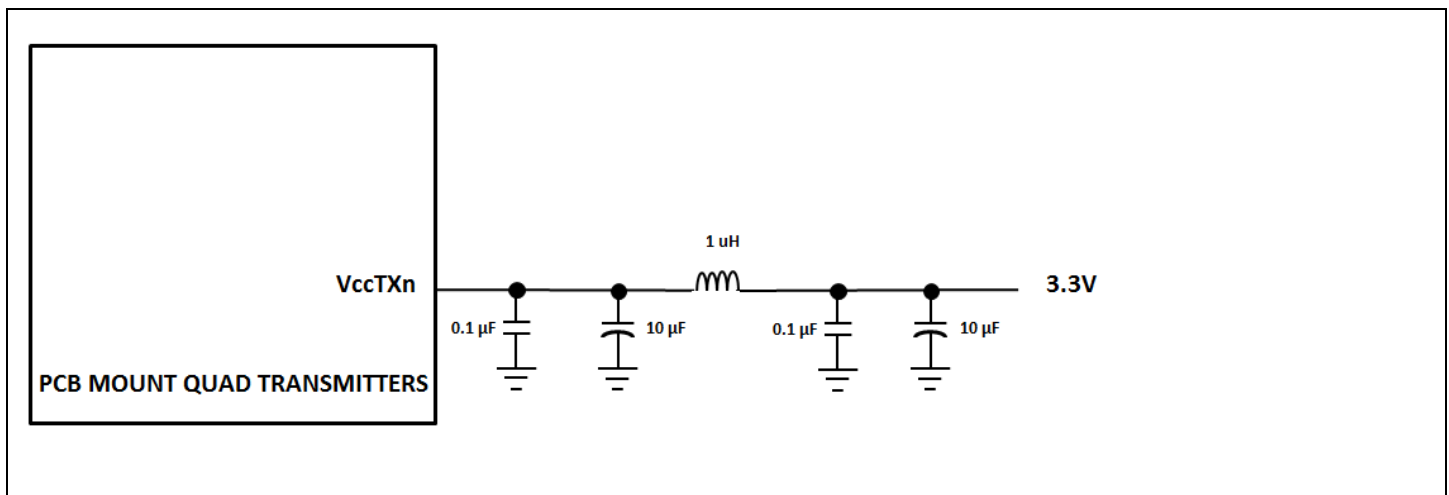
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**Required Host Board Components**

A power supply noise rejection filter is required on the host PCB to meet data sheet performance. This is the same filter incorporates an inductor which should be rated 400 mADC and 1  $\Omega$  series resistance or better. It should not be replaced with a ferrite. The required filter is illustrated in Figure 5. Also, the host PCB for the PCB mount transmitter requires 4.7 K to 10 K $\Omega$  pull-up resistors for TX\_FAULT lines.

**FIGURE 5 – RECOMMENDED HOST BOARD POWER SUPPLY FILTERING CIRCUIT  
SINGLE TRANSMITTER SHOWN (X4 TRANSMITTERS PER MODULE)**



**Fiber Compatibility**

The transmitter is capable of transmission at 2 to 550 meters with 50/125  $\mu\text{m}$  fiber, and at 2 to 275 meters with 62.5/125  $\mu\text{m}$  fiber, for 1.25 GBd Ethernet. It is capable of transmission up to 550m with 50/125  $\mu\text{m}$  fiber and up to 300m with 62.5/125  $\mu\text{m}$  fiber, for 1.0625 GBd Fiber Channel.

**Electrostatic Discharge (ESD)**

The transmitter is compatible with ESD levels found in typical manufacturing and operating environments as described JDEC/EIAJESD22-A114-A, Class 1 (<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 transmitter prior to insertion to the host board. To protect the unit, 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 transmitter 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 transmitter may be subject to system-level ESD requirements.

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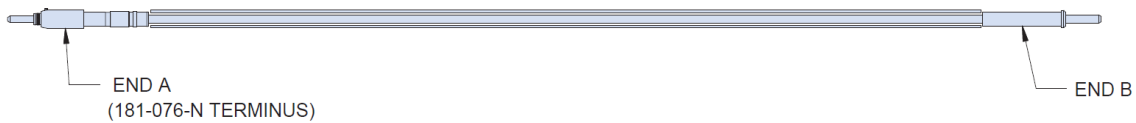
**ACCESSORIES**

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

**KEY FEATURES:**

- Jumper cable between ARINC 801 (end A) and Mil/Aero Connector termini (End B)
- Offered with Multimode fibers

**FIGURE 6**  
**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 Modules eliminating the need for washers and nuts
- Soldered to PCB to eliminate need for handling nuts during assembly
- Existing Options to support PCB thickness from 0.03" to 0.92"
- Can support thicker PCB if required

**EVALUATION Boards, PN 050-338 Include**

- MANUAL with test block diagram, schematic
- Evaluation board PCBA
- 4 fiber optic cables (~1m MMF, ARINC 801 connector to LC connector)

