050-385

PRODUCT BRIEF

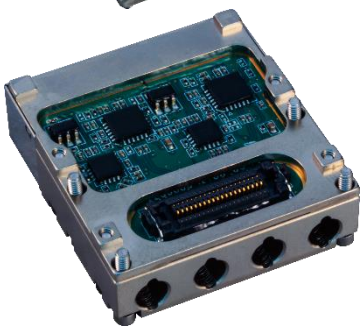
100 MBPS – 5 GBPS
PRINTED CIRCUIT BOARD (PCB) MOUNT DUAL TRANSCEIVER
850NM VCSEL TRANSMITTER, PIN TIA RECEIVER
COMPACT WITH RUGGED CONSTRUCTION FOR
HARSH ENVIRONMENTS INCLUDING RADIATION EXPOSURE

REV	DESCRIPTION	DATE	APPROVED
1	Preliminary	09/23/2016	SZ
2	Change PRBS Specification to 2^7-1	10/20/2016	SZ/GC
3	General Update	11/18/2016	SZ/GC
4	Edit Bag and Tag Labeling	12/14/2016	RAS/GC
5	Add Material/Finish Table	02/09/2017	RAS/GC

BF16U2-6549

050-385 PRODUCT BRIEF
PCB Mount Dual Transceiver
100 Mbps – 5 Gbps , MMF, 3.3V

Radiation-Tolerant Fiber Optic Dual-Transceiver, 100M-5Gbps, 850nm, MMF, 3.3V



The Glenair 050-385, is a ruggedized harsh environment PCB mount Dual Transceiver 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. The receivers utilize a GaAs PIN photo-detector, a transimpedance amplifier, and a limiting amplifier. Each 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 dual-transcevier interfaces with the host PCB through a high speed surface-mount electrical connector.

Each transmitter section includes the 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 a ARINC 801 optical connector. The TOSA is driven by a laser driver, which converts differential 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).

Each receiver section includes two (2) Receiver Optical Subassemblies (ROSA) and amplification/quantization circuitry. The ROSAs, containing a PIN photodiode and trans-impedance preamplifier, are located at the optical interface and mate with the GC optical connector. Each ROSA is followed by 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
- 850nm VCSEL lasers to support up to 5 Gbps
- PIN PD to support high sensitivity 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” x 1” x 0.39”
- -40°C to +85°C Operating Case Temperature
- Glenair fiber jumpers connect from the dual-transceiver to any Glenair Mil/Aero Fiber Optic Connector Style
- Evaluation fixtures available
- Radiation exposure test without errors:
  - Gamma: >165 Krad
  - Neutron: 250 x 10^{10} /cm^2

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
050-385-1	100Mbps - 2.5Gbps
050-385-2	2.5Gbps – 4.25Gbps

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		360	400	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}	-6.5	-5	-1	dBm	850nm VCSEL
Extinction Ratio, 1.25Gbps	Er	7	10		dB	Exceeds OMA for GbE, 1FC
Extinction Ratio, 2.125 Gbps & 3.2 Gbps	Er	6			dB	Exceeds OMA for 2FC
Extinction Ratio, 4.25 Gbps & 5 Gbps	Er	5			dB	Exceeds OMA for 4FC
Optical Wavelength	λ_{OUT}	830	850	860	nm	
Spectral Width, rms	$\Delta\lambda$			0.85	nm	
Relative Intensity Noise	RIN			-117	dB/Hz	
Transmitter Differential Input Impedance	Rin		100		Ohms	AC coupled Internally
Differential Input Voltage	Vin_d	250		2200	mV_{p-p}	CML, 100 ohm

TABLE 5 ELECTRO-OPTICAL CHARACTERISTICS - RECEIVER

Parameter	Symbol	Min	Typ	Max	Units	Notes
050-385-1						
Sensitivity, BER 10^{-12}, PRBS 2^7-1, Er 10 dB	P_{IN}		-22.5	-19	dBm	PIN PD @ 1.25 Gbps
Sensitivity, BER 10^{-12}, PRBS 2^7-1, Er 10 dB	P_{IN}		-22.5		dBm	PIN PD @ 2.5 Gbps
050-385-2						
Sensitivity, BER 10^{-12}, PRBS 2^7-1, Er 10 dB	P_{IN}		-18.5		dBm	PIN PD @ 3.2 Gbps
Sensitivity, BER 10^{-12}, PRBS 2^7-1, Er 10 dB	P_{IN}		-18		dBm	PIN PD @ 4..25Gbps
Sensitivity, BER 10^{-12}, PRBS 2^7-1, Er 10 dB	P_{IN}		-17.5	-16	dBm	PIN PD @ 5 Gbps
Overload, BER 10^{-12}, PRBS 2^7-1	P_{IN}	-1			dBm	@1.25Gbps or @ 5 Gbps
Optical Wavelength	λ_{IN}	830		860	nm	
Receiver Differential Output Impedance	Rout		100		Ohms	AC coupled internally
Differential Output Voltage Swing	Vout_d	600		1200	mV	CML, 100 ohm
LOS Assert Level	LOS		-24	-22	dBm	@ 1.25Gbps
LOS Hysteresis	LOS_{HYS}	1.5	2.3		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)

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:

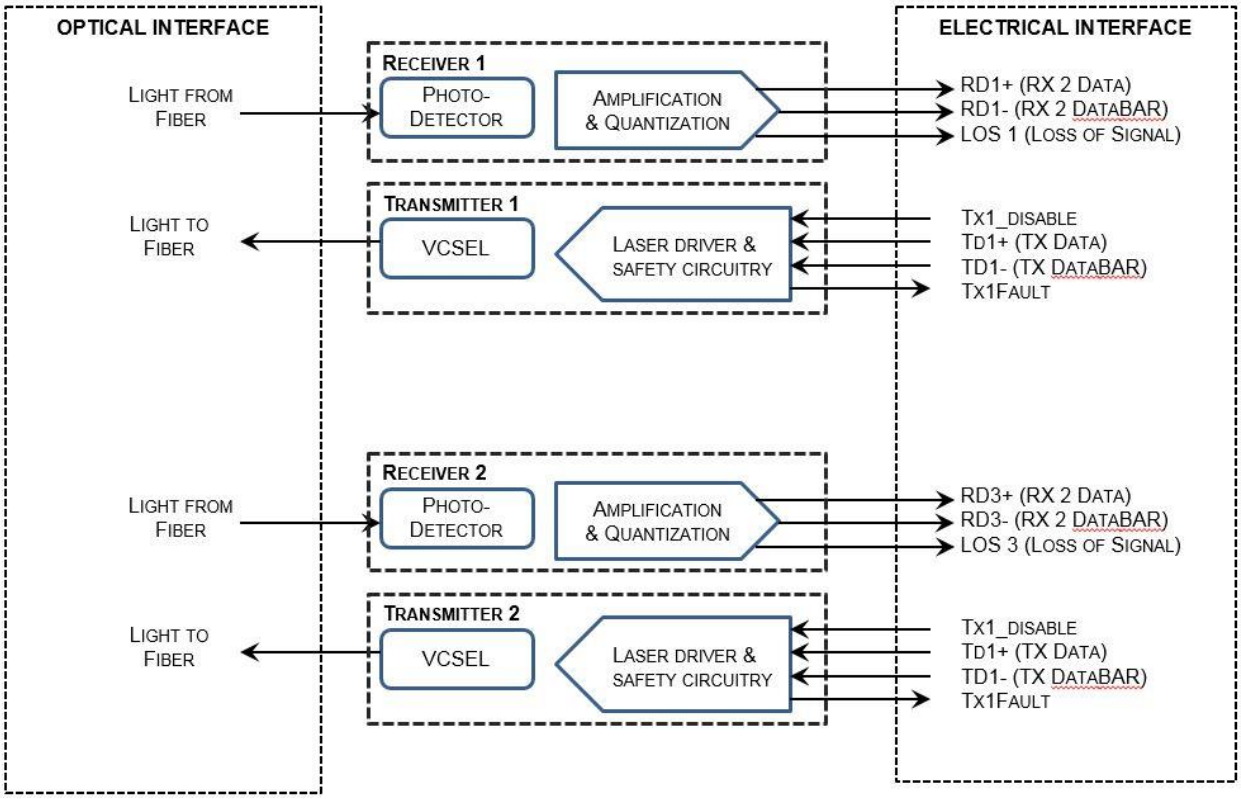
ANTISTATIC BAG LABEL:
Glenair
Cage Code: 06324
PN: 050-385-X
Rev: X
QTY: X
J/N: X
D/C:X
S/N*: XXXXXX
*If QTY is more than 1, there is no S/N

Each unit will be marked as follows:

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

FUNCTIONAL DESCRIPTION

FIGURE 2 - BLOCK DIAGRAM – DUAL TRANSCEIVER



TRANSMITTER SECTION

Transmit Enable (TX_Enable)

The transmitter section of the transceiver 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 transceiver 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 transceiver.

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.).

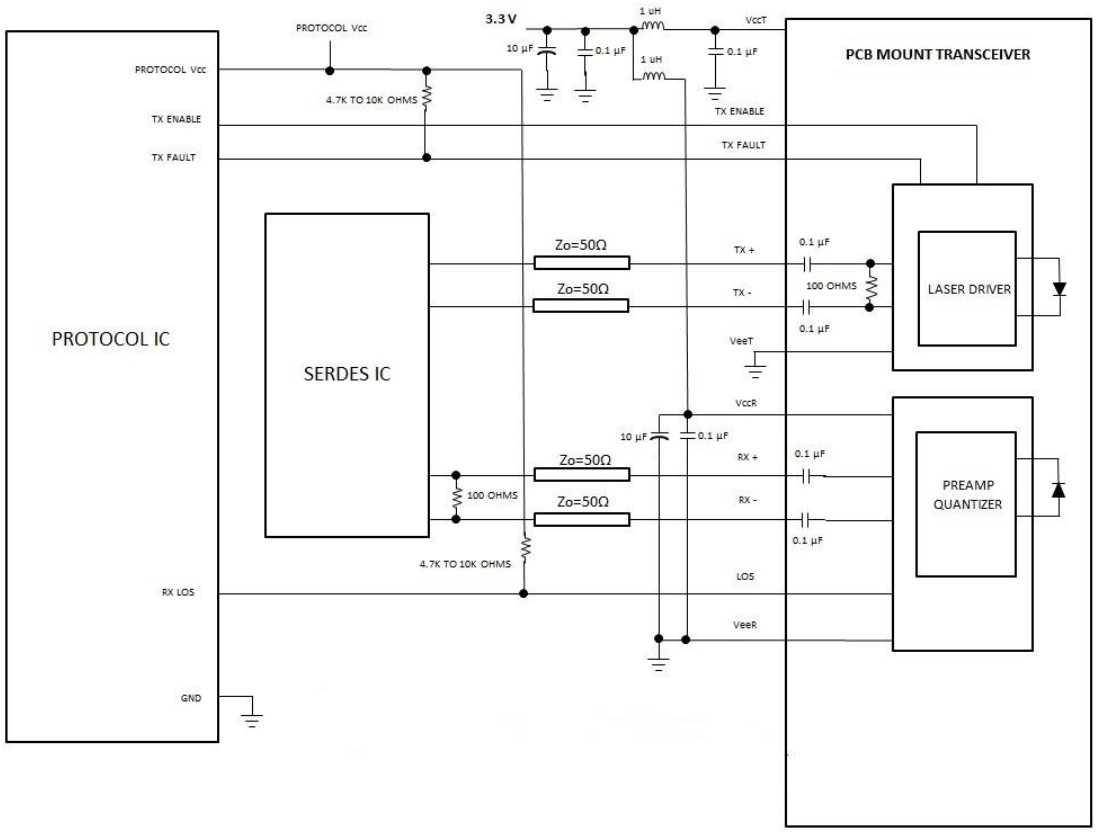
FUNCTIONAL I/O

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 require SFP MSA compliant signal lines on the host board. The TX_Enable, 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, TX1_Enable and TX2_Enable need to be tied to GND, TX1_Fault, TX2_Fault, RX1_LOS, and RX2_LOS do not need to be connected.

FIGURE 3

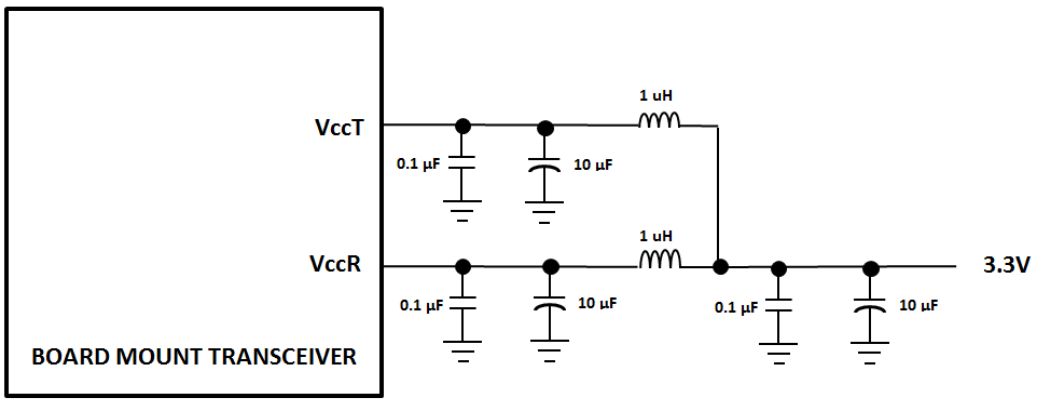


RECOMMENDED PCB MOUNT TRANSCEIVER HOST BOARD SCHEMATIC
SINGLE TRANSCEIVER SHOWN (x2 TRANSCEIVERS PER MODULE)

Required Host Board Components

A power supply noise rejection 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 Ω 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 transceiver requires 4.7 K to 10 KΩ pull-up resistors for TX_FAULT and LOS lines.

FIGURE 5 RECOMMENDED HOST BOARD POWER SUPPLY FILTERING CIRCUIT FOR EACH TRANSCEIVER



Fiber Compatibility

The transceiver is capable of transmission at 2 to 550 meters with 50/125 µm fiber, and at 2 to 275 meters with 62.5/ 125 µm fiber, for 1.25 GBd Ethernet. It is capable of transmission up to 550m with 50/125 µm fiber and up to 300m with 62.5/125 µm fiber, for 1.0625 GBd Fiber Channel.

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.