MULTIGIG Transceiver Platform
850nm Multimode

DS-163001 REV 10

Features

- Differential, DC-coupled data I/Os
- Modular, individually add, remove, replace single transceiver blades.
- IEEE 10GBase-SR compliant for 10G variants
- Low speed 4.25G 4xFC compatible variant
- Wavelength of operation at 850 nm (VCSEL and PIN PD)
- Low power dissipation, less than 130 mW per transceiver at 10.3125G.
- Supports a wide variety of rugged industry standard fiber optic termini and cables
- Up to 12 positions; duplex or single fiber pigtail
- Operating temperature range from -40°C to 85°C
- Dual Tx, Dual Rx, and TRx blade options for full height, duplex pigtail
- Tx and Rx options for half height, simplex pigtail.
- Leverages TE Connectivity's MULTIGIG connector high speed press fit printed circuit board (PCB) attachment

Applications

- High-speed interconnects within and between switches, routers and transport equipment
- Interconnects rack-to-rack, shelf-to-shelf, board-to-board, board-to-optical backplane
- Ethernet applications
- InfiniBand™ applications
- ARINC 818 applications
- IFE servers and end points

MULTIGIG transceiver platform Description

TE Connectivity's (TE) MULTIGIG transceiver platform (MULTIGIG TRX) leverages up to 12 **C**hiclet-**b**ased **O**ptical **T**ransceivers (CBOT) transceivers capable of transmitting and receiving up to 10 Gbps each.

The electrical interface is provided through TE's MULTIGIG press fit pin PCB interface. Each duplex pigtailed transceiver occupies one position in the press fit housing and can be individually removed for replacement in case of damaged cables, without having to remove and replace the entire module.

A wide range of TE optical termini are available for the OM3 & OM4 based fiber pigtails. Single mode versions are planned in the future. Also, the individual duplex blades can be in a range of functional combinations, Dual Tx, Dual Rx, TRx, and, on the simplex option, a Tx or Rx. These can be combined in varying counts in an individual full height and half height housing, respectively.

The high-speed inputs are DC-coupled to a floating input termination. The laser driver converts the signal to the VCSEL drive current. The very efficient optical coupling offered by the LEP technology enhances the low power consumption of each transceiver blade. On the Rx side, the incoming optical signal is converted to a current by the PIN diode. The transimpedance amplifier converts the current to a voltage which is then limited by an amplifier. The output stage is current-mode-logic (CML) and provides 50 ohm back-terminations.

Contents

Absolute Maximum Ratings

Not necessarily applied together. Exceeding these values may cause permanent damage. Functional operation under these conditions is not implied.

Parameter	Symbol	Unit	Min	Max
Supply Voltage[1]	VCC	V	-0.5	3.6
Diff. input Voltage Amplitude[2]	ΔV	mV_{p-p}	1600	
Voltage on any pin	VPIN	V	-0.3	3.6
Relative humidity (non-condensing)	MOS	%	5	95
Operating Case Temperature	TCASE	ºC	-40	85
Storage Temperature	TSTG	ºC	-55	125
ESD resistance[3]	VESD	V		120

1. Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only and functional operation of the devices at those or anyother conditions above those indicated in the Recommended Operating Conditions of this specification is NOT implied. Also note that exposure to maximum rating conditions for extended periods of time may affect device reliability
2. Differential input voltage amplitude is peak to peak value.
3. All pins withstand 120 V based on Human Body Model, JEDEC JESD22-A114-D.

Recommended Operating Conditions

Parameter	Symbol	Unit	Min		Max
Power Supply voltage	VCC	V	3.135	3.3	3.465
TRx Operating Current – 10G[1]	I_D	mA		40	45
TRx Operating Current – 4.25G[1]	I_D	mA		25	30
Dual Rx Operating Current – 10G[1]	I_D	mA		64	70
Dual Rx Operating Current – 4.25G[1]	I_D	mA		34	40
Dual Tx Operating Current – 10G[1]	I_D	mA		14	19
Dual Tx Operating Current – 4.25G[1]	I_D	mA		14	19
Single Rx Operating Current – 10G[1]	I_D	mA		32	35
Single Rx Operating Current – 4.25G[1]	I_D	mA		17	20
Single Tx Operating Current – 10G[1]	I_D	mA		7	9
Single Tx Operating Current – 4.25G[1]	I_D	mA		7	9
Operating case temperature	TCASE	°C	-40		85
Signaling rate (per channel)[2]	fD	Gbps	.020		10.3125
Signaling rate (per channel)[2]	fD	Gbps	.020		4.25
Differential input voltage amplitude	ΔV	mVp-p	200		1200

1. Varies with platform configuration. These values are for a single blade.
2. Data patterns are to have maximum run lengths and DC balance shifts no worse than that of a Pseudo Random Bit Sequence of length 2^{31}-1 (PRBS-31)

The transmitter unit

The transmitter unit consists of a driver IC and a Vertical Cavity Surface Emitting Laser (VCSEL), both mounted on a substrate. Since the laser output of the VCSEL is directly modulated with a current by an on-off-keying scheme, the driver needs to convert the Non-Return to Zero (NRZ) differential input signal into a single-ended output current. By programming the output of the driver as a function of temperature, the laser output power is nearly constant over the total ambient temperature range of -40°C to 85°C. All parameters below require operating conditions according to “Recommended Operating Conditions“.

Optical and Electrical Parameters – 4.25G

Specification	Unit	Min	Typ.	Max	Comment
Wavelength	nm	840	850	860	
RMS spectral width (nm)	nm		0.45		
RIN12 (OMA)	dB/Hz			-128	
Optical Modulation Amplitude	dBm		-2.3		
Average Launch Power[1]	dBm	-3.0	-1.5	+1.0	
Extinction Ratio	dB		4		
Data Rate	Gb/s	0.020		4.25	8b/10b or 64b/66b
Diff. input Voltage Swing	mVpp	150		1400	AC coupled
Diff. input impedance	Ω	80	100	125	
Input data transition time 20%-80%	UI			0.4	200 ps Max

Optical and Electrical Parameters – 10G

Specification	Unit	Min	Typ.	Max	Comment
Wavelength	nm	840	850	860	
RMS spectral width (nm)	nm		0.45		
RIN12 (OMA)	dB/Hz			-128	
Optical Modulation Amplitude	dBm		-2.3		
Average Launch Power1	dBm	-3.0	-1.5	+1.0	
Extinction Ratio	dB		4		
Data Rate	Gb/s	0.020		10.3125	8b/10b or 64b/66b
Diff. input Voltage Swing	mVpp	150		1400	AC coupled
Diff. input impedance	Ω	80	100	125	
Input data transition time 20%-80%	UI			0.4	200 ps Max

1. The output optical power is compliant with IEC 60825-1 Amendment 2, Class 1M Accessible Emission Limits. The min. value is for information only.

The receiver unit

The receiver unit consists of a Trans-Impedance Amplifier (TIA) IC and a photodiode, both mounted on a substrate. The photodiode converts the incoming laser light into an electrical current. This current is amplified and converted to a differential output signal by the TIA.

All parameters below require operating conditions according to “Recommended Operating Conditions“ and a termination load of 100 Ω differential at the electrical output.

Optical and Electrical Parameters – 4.25G

Specification	Unit	Min	Typ.	Max	Comment
Wavelength	nm	840	850	860	
Sensitivity	dBm	-14	-15		At BER 10^{-12}
Average Received Power	dBm			0	Saturation
Data Rate	Gb/s	0.002		4.25	8b/10b or 64b/66b
Output Common Mode Voltage	mV	180		330	
Diff. input Voltage Swing	mVpp		500		
Diff. input impedance	Ω	80	100	125	
Input data transition time 20%-80%	ps		25	35	
Signal detect Output - Rx input > -14 dBm	V	3.2	3.4	3.6	For units with comparator
Signal detect Output - Rx input < -16 dBm	V			0.1	For units with comparator
Photodiode Voltage	V			3.3	For units with comparator
Signal Detect Output – Active mode	V	1.1	1.5	1.55	For units with **no** comparator
Signal Detect Output – Sleep mode	V	0		0.1	For units with **no** comparator
Photodiode current	uA	I_{PD} -15%	I_{PD}	I_{PD} +15%	For units with **no** comparator

Optical and Electrical Parameters – 10G

Specification	Unit	Min	Typ.	Max	Comment
Wavelength	nm	840	850	860	
Sensitivity	dBm	-9.0	-11		BER10^{-12}, PRBS31, 10.3125G
Average Received Power	dBm			0	Saturation
Data Rate	Gb/s	1.0		10.3125	8b/10b or 64b/66b
Output Common Mode Voltage	mV	180		330	
Diff. input Voltage Swing	mVpp		500		
Diff. input impedance	Ω	80	100	125	
Input data transition time 20%-80%	ps		25	35	
Signal detect Output - Rx input > -9 dBm	V	3.2	3.4	3.6	For units with comparator
Signal detect Output - Rx input < -11 dBm	V			0.1	For units with comparator
Photodiode Voltage	V			3.3	For units with comparator
Signal Detect Output – Active mode	V	1.1	1.5	1.55	For units with **no** comparator
Signal Detect Output – Sleep mode	V	0		0.1	For units with **no** comparator
Photodiode current	uA	I_{PD} -15%	I_{PD}	I_{PD} +15%	For units with **no** comparator

Transceiver module footprint

The footprint of Optical MULTIGIG TRX is the same as the one for the electrical MULTIGIG RT-2 plug in module daughtercard connector with the exception that only every other column is used. A reference PCB for three column footprint is shown in Figure 5.

The resulting Host PCB layout footprint is shown in Figure 6 for the full 12 channel configuration. For more specific details about, for example, break-out routing possibilities, anti-pad design and back drilling, we refer to the MULTIGIG TRX Layout Guide 114-160595.

Consult customer drawings for more details on signal assignments for the various CBOT Blade options and housing channel sizes.

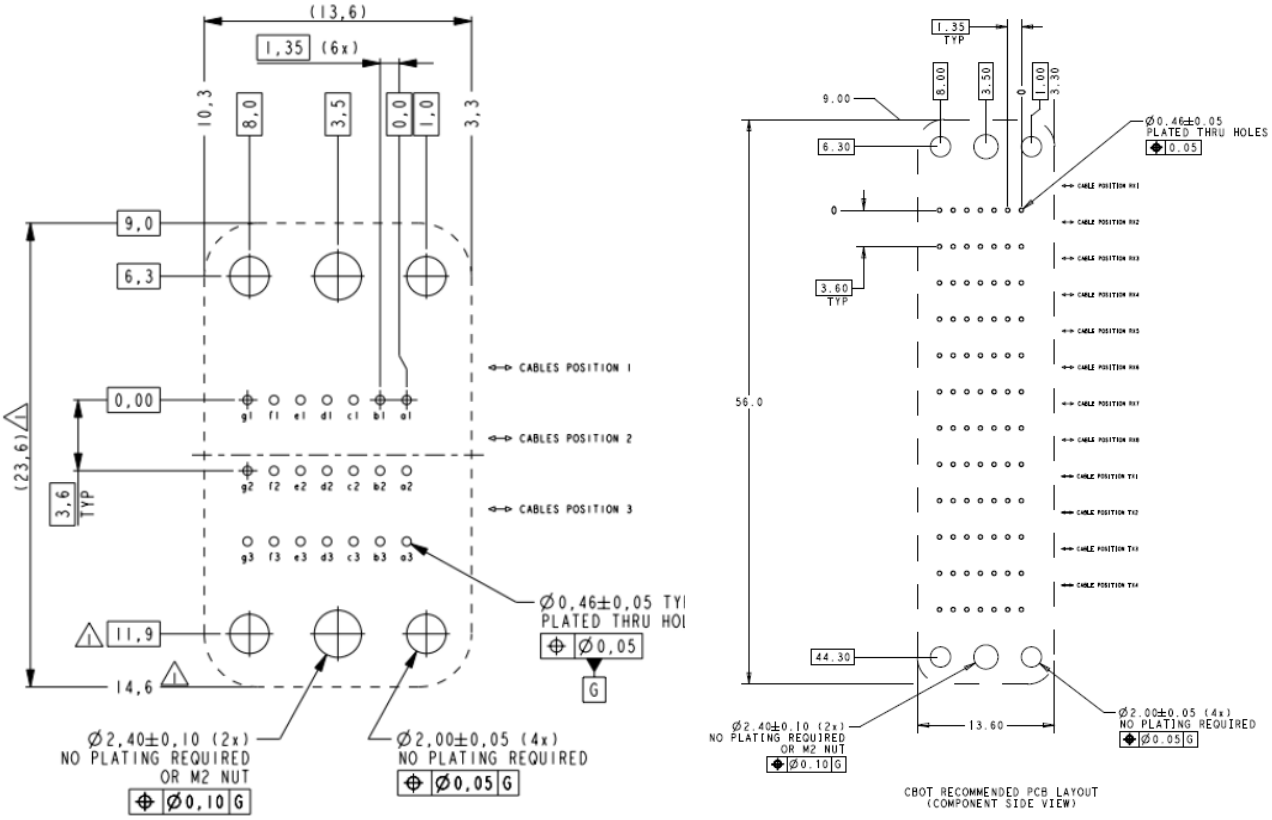
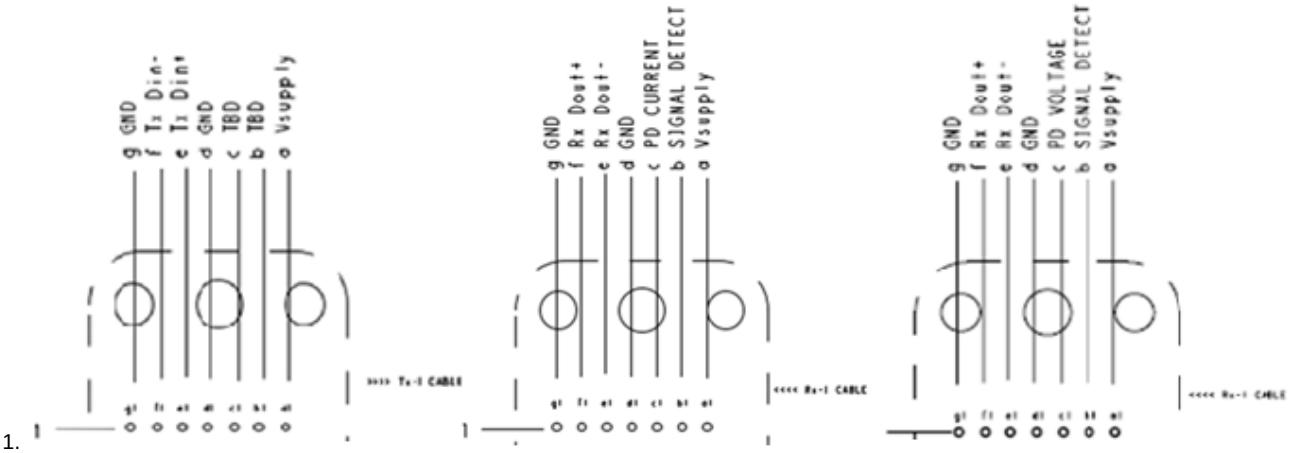


Figure 1 Example of PCB footprint. Left: 3-position bracket. Right: 12-position bracket. Dimensions in mm.

Transceiver Pin Descriptions

Signal Name	Type	Description	Comments
Tx D_{in+}	Data input CML-I	Transmitter data in	Internal DC-coupled and differential termination at 100Ω.
Tx D_{in-}	Data input CML-I	Transmitter data in, inverted	Internal DC-coupled and differential termination at 100Ω.
V_{Supply}	3.3V	Power supply rail	
Rx D_{out+}	Data output CML-O	Receiver data out.	Internally DC-coupled. Connect to 100Ω differential termination athost ASIC.
Rx D_{out-}	Data output CML-O	Receiver data out, Inverted	Internally DC-coupled. Connect to 100Ω differential termination athost ASIC.
PD Current	DC Current	Current mirror of PD Current	
Signal Detect	DC Voltage	Hi Logic Level for Rx Input Power above a threshold	CML 1.5V on 4G version $V_{Supply\ on}$ 10G version
PD Voltage	DC Voltage	Voltage proportional to Rx pigtail received Power	
GND	N/A	Signal and supply common	Directly connect to host board signal common ground plane.



1.

Figure 2 Half Height Pin Assignments. Left: Transmitter, Middle: Receiver w/o comparator: Right: Receiver with comparator

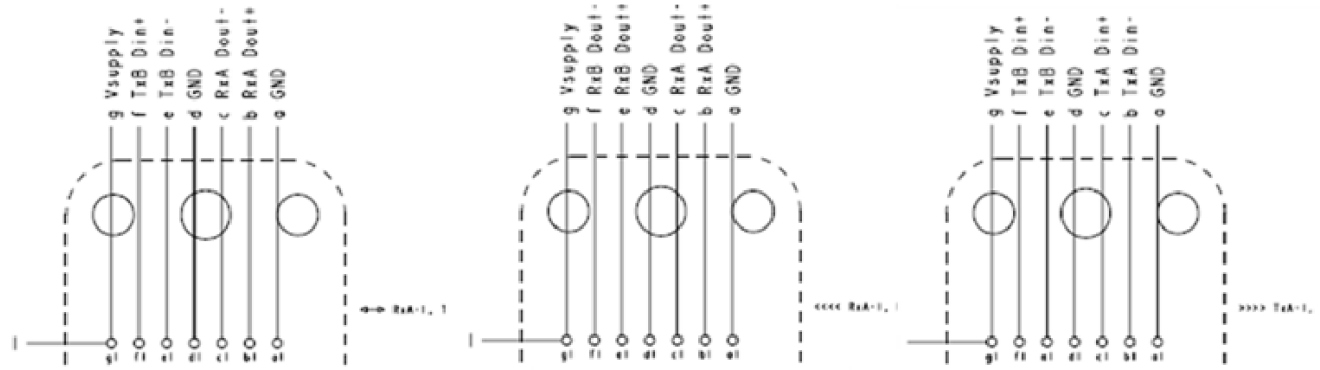


Figure 3 Full Height Pin Assignments. Left: Transceiver, Middle: Dual Receiver, Right: Dual Transmitter.

High Speed Electrical Specification

High-speed Tx Inputs

The high-speed inputs have floating DC-coupled input terminations followed by DC-blocking capacitors as seen in the figure. The differential inputs are self-biased for AC-coupled connections and may also be DC-coupled to appropriate signals.

High-speed Rx Outputs

The module data output consists of a current-mode-logic output stage and has 50 ohm back termination. The Rx output amplitude can be adjusted from 300 mV to 800 mV, and the pre- emphasis from 0 dB to 6 dB, by changing the memory register values via the I2C interface.
The high-speed outputs may be disabled by the LOS circuit if squelch is asserted. This feature eliminates chatter in LOS conditions.

Host Board Power Supply Filtering

The host board should use the power supply filtering shown in the figure below.

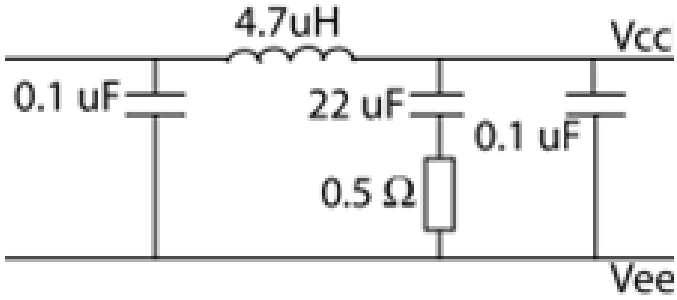


Figure 4 Power supply noise filtering circuit.

Recommendation

It is recommended to place DC blocking capacitors in the differential traces on the main PCB. Further, to suppress power supply noise, a suitable voltage supply filter is recommended. A possible implementation is given in Figure 4, showing an excerpt of the power supply noise filtering circuitry in the SFF-8431 specification for a 10 Gb/s SFP+ module.

Ordering Information

Specify your need using the guidance and parameters below. Then please reach out to your TE representative to finalize your need and part number. You can also add your choice of connectivity to your requirement, i.e. EN4165, D38999 and TE will offer a complete solution. Customized marking, performance or fiber routing is available upon request.

Parameter	Options	Comments
Data rate	4.25 Gbps	I.e. ARINC 818 video
	10.3125 Gbps	I.e. 4k video
Size	Full height	2 channels / CBOT
	Half height	1 channel / CBOT
Configuration	Tx and Rx	Free to mix Tx and Rx to suit your needs
Fiber	Free choice	Typically, 1.8 mm or 900 um
Termini	Free choice	Typically, ARINC 801, ST or MT
Housing	1-12 CBOT blades	From table below. Full height **or** half height

Connector Housing Assembly (including Press Fit PCB contacts)

CBOT Positions	Half Height Part number	Full Height Part number
1	2381854-1	2375213-1
2	2381854-2	2375213-2
3	2381854-3	2375213-3
4	2381854-4	2375213-4
5	2381854-5	2375213-5
6	2381854-6	2375213-6
7	2381854-7	2375213-7
8	2381854-8	2375213-8
9	2381854-9	2375213-9
10	1-2381854-0	1-2375213-0
11	1-2381854-1	1-2375213-1
12	1-2381854-2	1-2375213-2

Handling instructions

Cleaning the Optical Interface

A protective connector plug is supplied with each pigtail fiber optic contact. This plug should remain in place whenever a fiber pigtail cable is not inserted. This will keep the optical contact free from dust or other contaminants, which may potentially degrade the optical signal.

Before reattaching the connector plug to the module, visually inspect the contact and remove any contamination. Cleaning method will follow those recommended for the selected fiber optic termini and considering the connector form factor into which the termini are installed.

Before a fiber cable connector is attached to the module, it is recommended to clean the fiber cable connector using an optical connector cleaner, or according to the cable manufacturer's instructions.

CBOT Blade Insertion and Removal

The CBOT blades are designed to be removed and replace should the need arise. Please see 408-160060 for detailed CBOT blade insertion and removal instructions. For optimum performance, it is recommended that the number of insertions is limited to 5 for the electrical connector mating to CBOT blades. Consult the respective fiber optic termini specifications for mating durability limits on the various termini options.

Housing Installation to Host Circuit Board

The CBOT housings are designed to be press fit to the host circuit board. Please see 408-160061 for detailed housing assembly to the host PCB.

ESD Handling

When handling the modules, precautions for ESD sensitive devices should be taken. These include use of ESD protected work areas with wrist straps, controlled work-benches, floors etc.

Example Drawing – Half Height

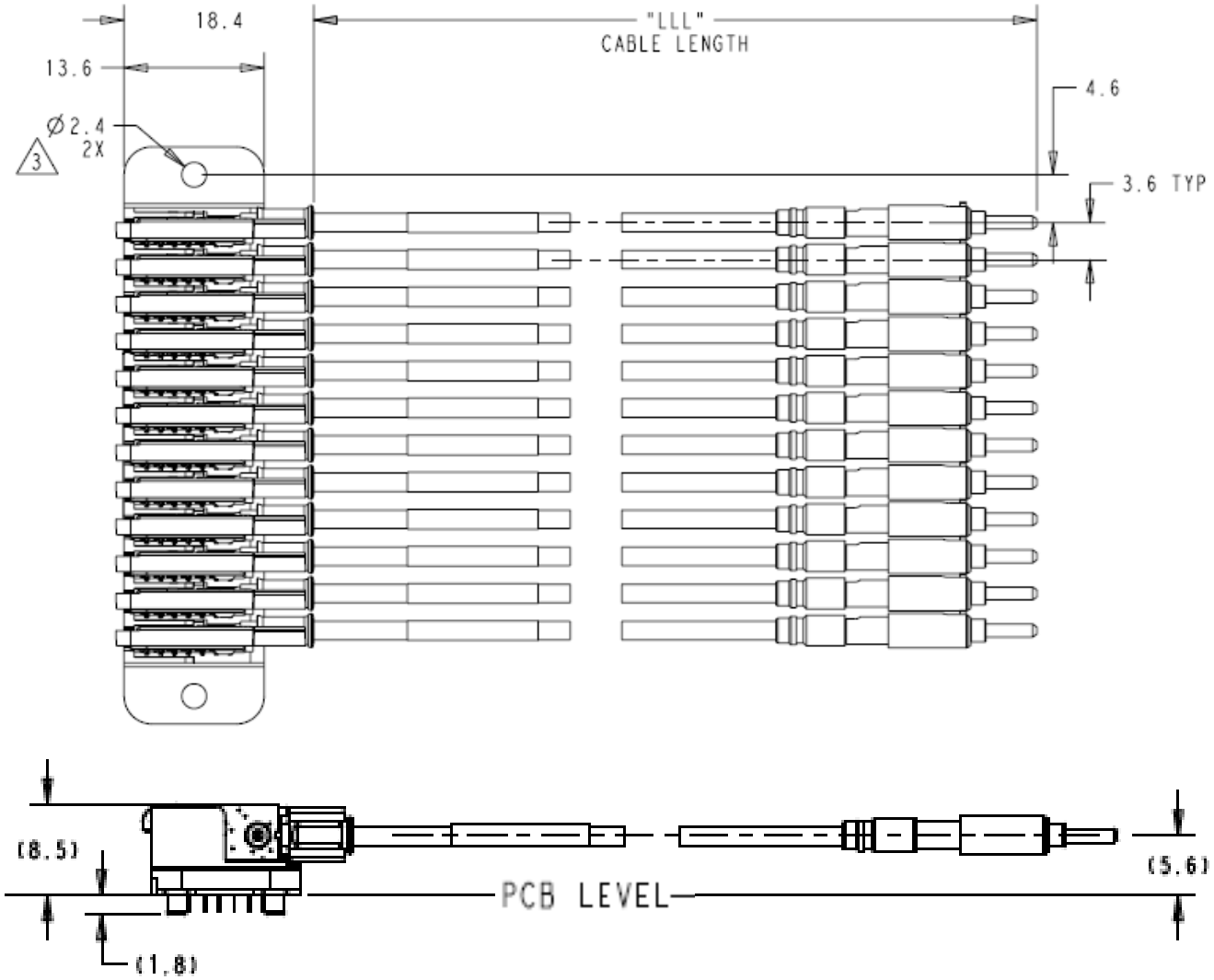


Figure 5 Sample schematic of MULTIGIG TRX populated with CBOT transceivers. Dimensions in mm.

Example Drawing – Full Height

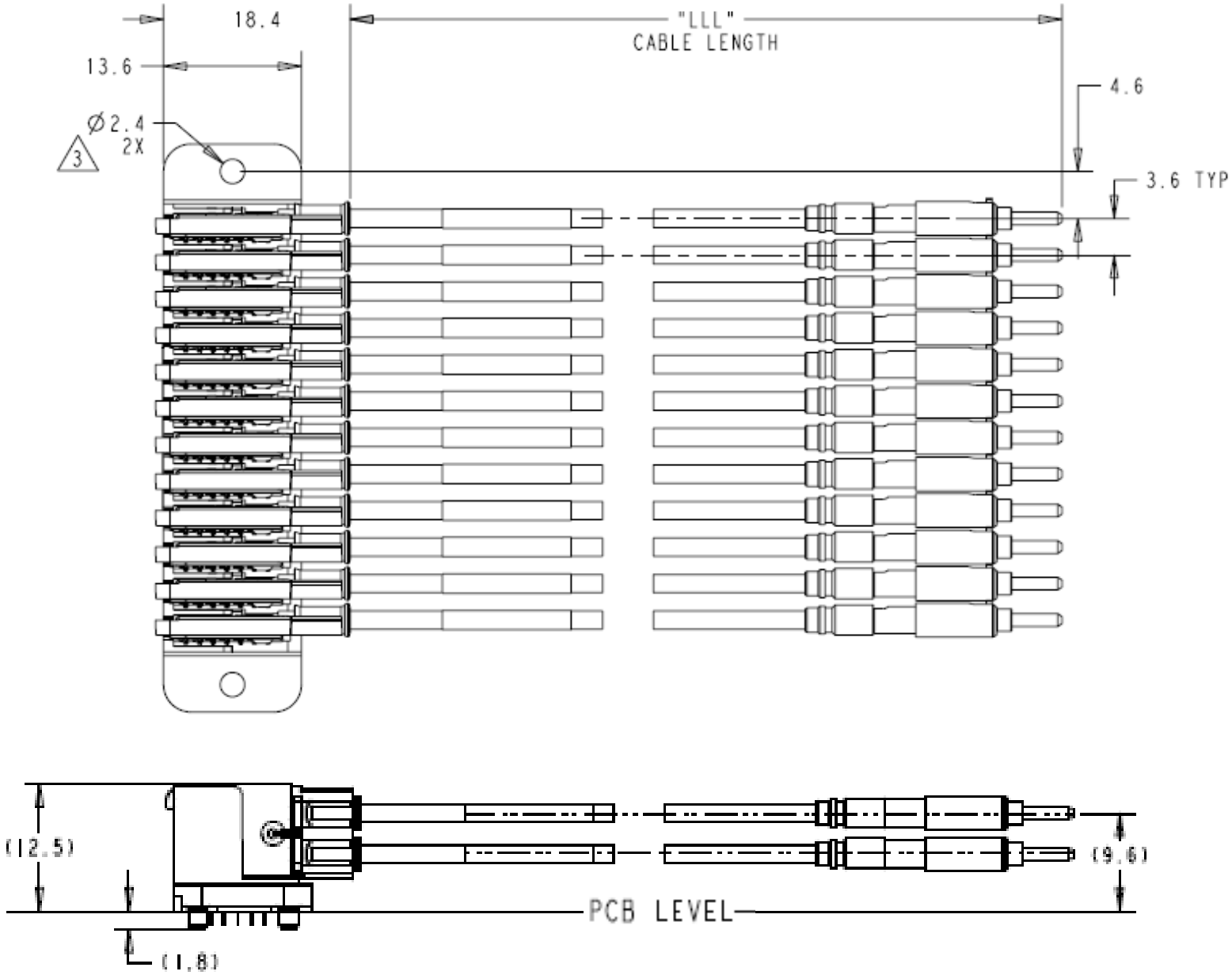


Figure 6 Sample schematic of MULTIGIG TRX populated with CBOT transceivers. Dimensions in mm

Regulatory Compliance

Compliance Area	Standard / Classification
Laser safety classification	IEC 60825-1:2014 , EN 60825-1:2014+A11:2021 CDRH Laser Notice No. 50. Laser Class 1. Invisible laser radiation at 850 nm.
Electromagnetic Compatibility	N/A – Pending
RoHS Compliance	Compliant with EU Directive 2002/95/EC (RoHS) for circuit assembly and connector housing only. Varies with selected FO contacts or cables used.
REACH Compliance	N/A - Pending
FDA accession number	2412454-000

Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

Caution-Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

For information pertaining to product certification please contact:

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