

<b>TITLE</b>  <b>40G QSFP+ ER4 Transceiver</b>	<b>DOC No.</b>	<b>DTRX-170035</b>
	<b>REVISION :</b> <b>02</b>	<b>AUTHORIZED BY :</b> <b>Mike Sun</b>
	<b>DATE :</b> <b>2022.08.09</b>	<b>CLASSIFICATION :</b> <b>CONFIDENTIAL</b>

## 1. SCOPE

This product is a transceiver module designed for 40km optical communication applications. The design is compliant to 40GBASE-ER4 of the IEEE P802.3ba standard. The module converts 4 inputs channels (ch) of 10Gb/s electrical data to 4 CWDM optical signals, and multiplexes them into a single channel for 40Gb/s optical transmission. Reversely, on the receiver side, the module optically de-multiplexes a 40Gb/s input into 4 CWDM channels signals, and converts them to 4 channel output electrical data. The central wavelengths of the 4 CWDM channels are 1271, 1291, 1311 and 1331 nm as members of the CWDM wavelength grid defined in ITU-T G.694.2. It contains a duplex LC connector for the optical interface and a 38-pin connector for the electrical interface. To minimize the optical dispersion in the long-haul system, single-mode fiber (SMF) has to be applied in this module. The product is designed with form factor, optical/electrical connection and digital diagnostic interface according to the QSFP+ Multi-Source Agreement (MSA). It has been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference.

## 2. PRODUCT DESCRIPTION

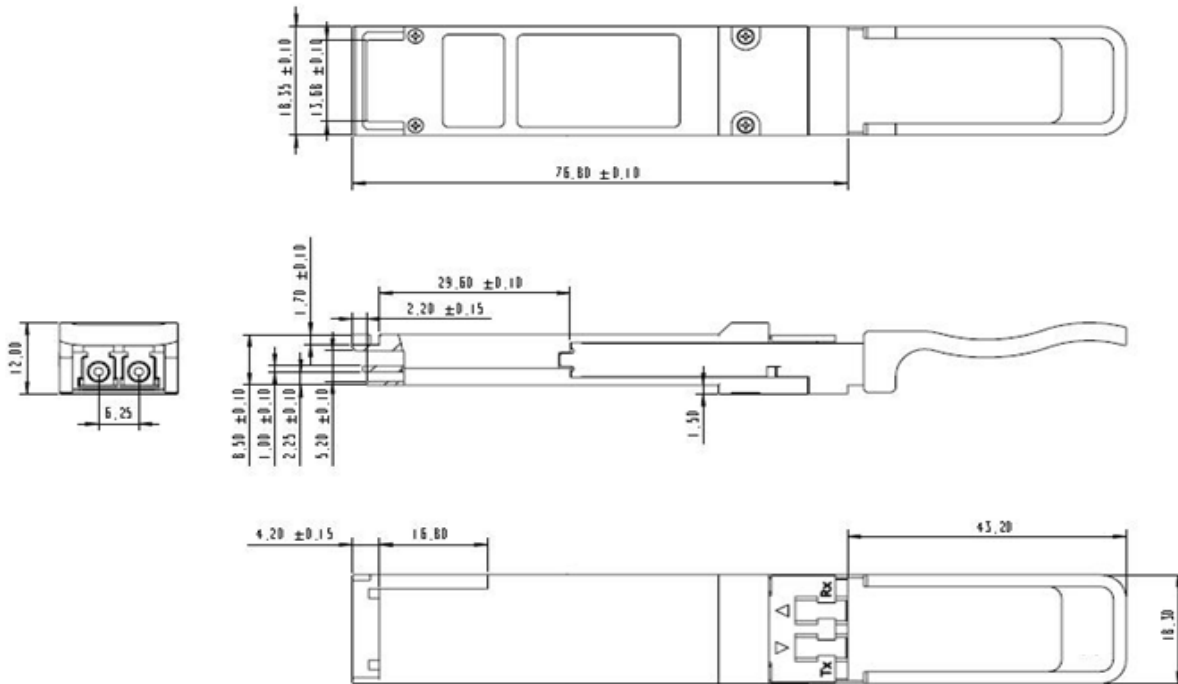
### 2.1 PRODUCT NAME AND SERIES NUMBER(S)

#### 40G ER QSFP+ Transceiver

Part Number	Data Rate	Wavelength (nm)	Distance	Media	Power (dBm)	Sen. (dBm)	Connector	Tem.
P58000DGCB40-1	40G	CWDM	40km	SMF	-2.7~+4.5	-21	LC	C

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## 2.2 DIMENSIONS, MATERIALS, PLATINGS AND MARKING



Unit is millimeter. All dimensions are  $\pm 0.1$ mm unless otherwise specified.

## 3. APPLICABLE DOCUMENTS AND SPECIFICATIONS

- Compliant with 40G Ethernet
- IEEE802.3ba and 40GBASE-ER4 Standard QSFP+ MSA compliant
- 4 CWDM lanes MUX/DEMUX design
- Up to 40km transmission on single mode fiber (SMF)

## 4. QUALIFICATION

- Electrostatic Discharge (ESD) to the Electrical Pins
- Electrostatic Discharge (ESD) to the LC Connector
- RoHS compliance

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## 5. Absolute Maximum Ratings & Recommended Operating Conditions

<b>Absolute Maximum Ratings</b>				
<b>Parameter</b>	<b>Symbol</b>	<b>Min.</b>	<b>Max.</b>	<b>Unit</b>
Storage Temperature	T <sub>s</sub>	-40	85	degC
Power Supply Voltage	VCC	-0.5	3.6	V
Relative Humidity (non-condensation)	RH	0	85	%

<b>Recommended Operating Conditions</b>					
<b>Parameter</b>	<b>Symbol</b>	<b>Min.</b>	<b>Typical</b>	<b>Max.</b>	<b>Unit</b>
Operating Case Temperature	TCT	0		70	degC
Operating Case Temperature	TIT	-40		85	degC
Power Supply Voltage	VCC	3.135	3.3	3.465	V
Data Rate, each Lane			10.3125		Gb/s
Operating Distance	D		40		Km
Power Consumption				3.5	W
Supply Current	I <sub>cc</sub>			1.13	A

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<b>Transmitter Operating Characteristic-Optical, Electrical</b>						
<b>Parameter</b>	<b>Symbol</b>	<b>Min.</b>	<b>Typical</b>	<b>Max.</b>	<b>Unit</b>	<b>Note</b>
<b>Optical Characteristics</b>						
Center Wavelength	$\lambda_1$	1264.5	1271	1277.5	nm	
	$\lambda_2$	1284.5	1291	1297.5	nm	
	$\lambda_3$	1304.5	1311	1317.5	nm	
	$\lambda_4$	1324.5	1331	1337.5	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Total Average Launch Power	$P_T$			10.5	dBm	
Average Launch Power, each Lane	$P_{AVG}$	-2.7		4.5	dBm	
Optical Modulation Amplitude (OMA), each Lane	$P_{OMA}$	-0.3		5	dBm	1
Difference in Launch Power between any Two Lanes (OMA)	$P_{Tx,diff}$			4.7	dB	
Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP), each Lane		-0.5			dBm	
TDP, each Lane	TDP			2.6	dB	
Extinction Ratio	ER	3.5			dB	
Relative Intensity Noise	RIN			-128	dB/Hz	12dB reflection
Optical Return Loss Tolerance	TOL			20	dB	
Transmitter Reflectance	$R_T$			-12	dB	
Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}		{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}				
Average Launch Power OFF Transmitter, each Lane	$P_{off}$			-30	dBm	
<b>Electrical Characteristics</b>						
Input differential impedance	$Z_{in}$		100			

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Differential Input Voltage Swing	V <sub>in,pp</sub>	180	-	1000	mVpp	
Tx_Fault,LOS output voltage	High	2.0		V <sub>CCHOST</sub>	V	
	LOW	0		0.8	V	
Tx Disable	High	2.0		V <sub>CCHOST</sub>	V	
	LOW	0		0.8	V	

<b>Receiver Operating Characteristic-Optical, Electrical</b>						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
<b>Optical Characteristics</b>						
Center Wavelength	λ <sub>1</sub>	1264.5	1271	1277.5	nm	
	λ <sub>2</sub>	1284.5	1291	1297.5	nm	
	λ <sub>3</sub>	1304.5	1311	1317.5	nm	
	λ <sub>4</sub>	1324.5	1331	1337.5	nm	
Average Receive Power, each Lane		-19		-4.5	dBm	
Damage Threshold, each Lane	TH <sub>d</sub>	3			dBm	2
Receiver Reflectance	R <sub>R</sub>			-26	dB	
Receive Power (OMA), each Lane				-4	dBm	3
Receiver Sensitivity (OMA), each Lane	SEN			-19	dBm	
Difference in Receive Power between any Two Lanes (OMA)	Prx,diff			7.5	dB	
LOS Assert	LOSA	-35			dBm	
LOS Deassert	LOSD			-19	dBm	

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LOS Hysteresis	LOSH	0.5			dB	
Vertical Eye Closure Penalty, each Lane			2.2		dB	4
Stressed Eye J2 Jitter, each Lane		Per OTL3.4, G.8251			UI	
Stressed Eye J9 Jitter, each Lane		Per OTL3.4, G.8251			UI	

**Electrical Characteristics**

Differential Output Voltage Swing	Vout,pp	300		850	mVpp	
Differential Output Impedance	Zout	90	100	110	Ohm	

Notes:

1. Even if the TDP < 0.8 dB, the OMA min must exceed the minimum value specified here.
2. The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power.
3. Measured with conformance test signal at receiver input for BER = 1x10<sup>-12</sup>.
4. M Vertical eye closure penalty and stressed eye jitter are test conditions for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

**6. Digital Diagnostic Functions**

The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF-8436.

Parameter	Symbol	Min	Max	Units	Notes
Temperature monitor absolute error	DMI_Temp	-3	3	degC	Over operating temperature range
Supply voltage monitor absolute error	DMI_VCC	-0.1	0.1	V	Over full operating range
Channel RX power monitor absolute error	DMI_RX_Ch	-2	2	dB	

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Channel Bias current monitor	DMI_Ibias_Ch	-10%	10%	mA	Ch1~Ch4
Channel TX power monitor absolute error	DMI_TX_Ch	-2	2	dB	

Notes:

Due to measurement accuracy of different single mode fibers, there could be an additional +/-1 dB fluctuation, or a +/- 3 dB total accuracy.

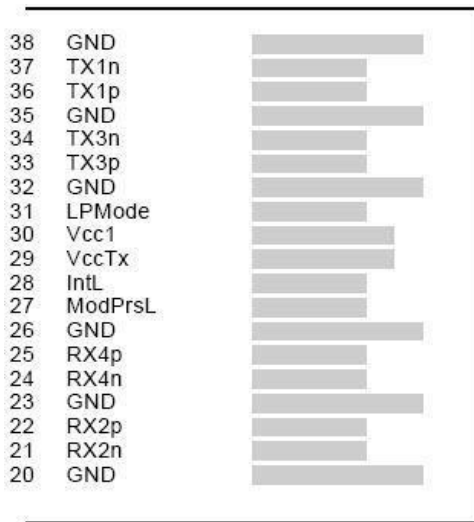
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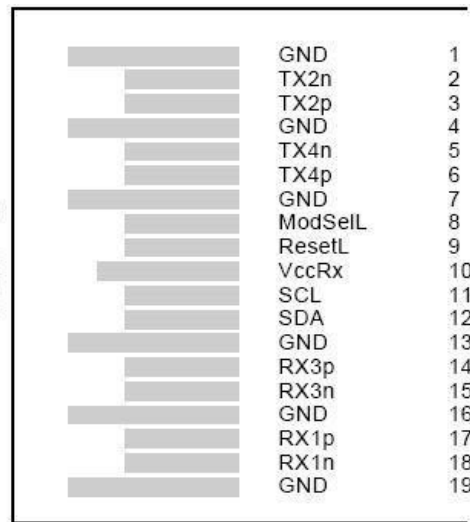
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Top Side  
Viewed from Top



Bottom Side  
Viewed from Bottom

Card Edge

**Pin Definitions**

**7. Applications Note :**

**Pin Assignment**

PIN	Logic	Symbol	Name/Description	Notes
1		GND	Ground	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	
3	CML-I	Tx2p	Transmitter Non-Inverted Data output	
4		GND	Ground	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	
6	CML-I	Tx4p	Transmitter Non-Inverted Data output	
7		GND	Ground	1
8	LVTTLL-I	ModSelL	Module Select	
9	LVTTLL-I	ResetL	Module Reset	
10		VccRx	+3.3V Power Supply Receiver	2
11	LVC MOS-I/O	SCL	2-Wire Serial Interface Clock	
12	LVC MOS-I/O	SDA	2-Wire Serial Interface Data	



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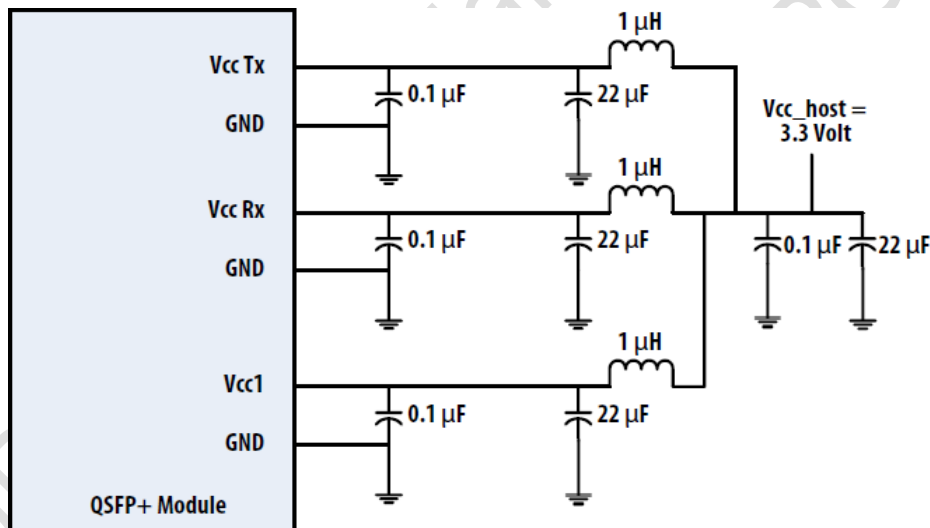
13		GND	Ground	
14	CML-O	Rx3p	Receiver Non-Inverted Data Output	
15	CML-O	Rx3n	Receiver Inverted Data Output	
16		GND	Ground	1
17	CML-O	Rx1p	Receiver Non-Inverted Data Output	
18	CML-O	Rx1n	Receiver Inverted Data Output	
19		GND	Ground	1
20		GND	Ground	1
21	CML-O	Rx2n	Receiver Inverted Data Output	
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	
23		GND	Ground	1
24	CML-O	Rx4n	Receiver Inverted Data Output	1
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	
26		GND	Ground	1
27	LVTTTL-O	ModPrsL	Module Present	
28	LVTTTL-O	IntL	Interrupt	
29		VccTx	+3.3 V Power Supply transmitter	2
30		Vcc1	+3.3 V Power Supply	2
31	LVTTTL-I	LPMODE	Low Power Mode	
32		GND	Ground	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	
34	CML-I	Tx3n	Transmitter Inverted Data Output	
35		GND	Ground	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	
37	CML-I	Tx1n	Transmitter Inverted Data Output	
38		GND	Ground	1

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Notes:

1. GND is the symbol for signal and supply (power) common for QSFP+ modules. All are common within the QSFP+ module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal common ground plane.
2. VccRx, Vcc1 and VccTx are the receiver and transmitter power suppliers and shall be applied concurrently. Recommended host board power supply filtering is shown in Figure 4 below. Vcc Rx, Vcc1 and Vcc Tx may be internally connected within the QSFP+ transceiver module in any combination. The connector pins are each rated for a maximum current of 500mA.

**Recommended Interface Circuit**



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**8. Modification History**

<b>Rev.</b>	<b>Comments</b>	<b>Date</b>	<b>Originator</b>	<b>Approval</b>
01	Preliminary Draft	2017.12.11	Albert Lin	Mike Sun
02	Modify PN	2022.08.09	Albert Lin	Mike Sun