

TITLE**40G QSFP+ LR4 Transceiver****1. SCOPE**

The transceiver consists of two sections: The transmitter section incorporates four CWDM DFB laser. And the receiver section consists of a PIN photodiode integrated with a TIA. All modules satisfy class I laser safety requirements. Digital diagnostics functions are available via a 2-wire serial interface, as specified in SFF-8436 which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, and received optical power and transceiver supply voltage.

2. PRODUCT FEATURES

- Hot Pluggable QSFP+ form factor
- Support 41.2 Gb/s aggregate bit rates
- Maximum link length of 10km on Singlemode Fiber(SMF)
- Duplex LC receptacles
- Power dissipation <3.5W
- Commercial operating case temperature range: : 0°C to 70°C
- RoHS-6 Compliant
- Single 3.3V power supply

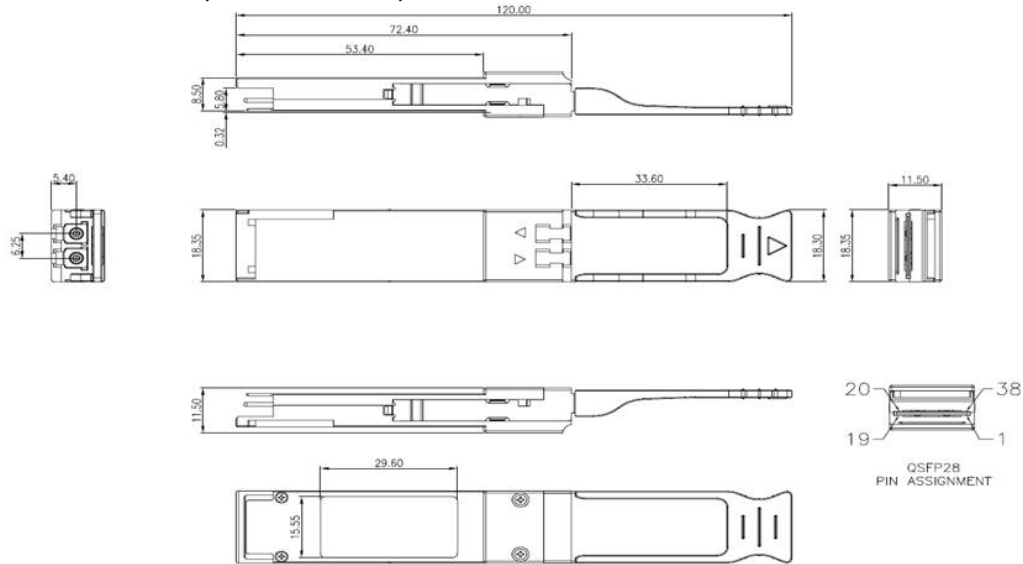
3. PRODUCT DESCRIPTION**3.1 PRODUCT NAME AND SERIES NUMBER(S)****40G LR4 QSFP+ Transceiver**

Part Number	Data Rate	Wavelength (nm)	Distance	Media	Power (dBm)	Sen. (dBm)	Connector	Tem.
ZFTEL4E1310A1ST	40G	1310	10km	SMF	-7 ~ 2.3	-11.5	LC	C

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3.2 DIMENSIONS, MATERIALS, PLATINGS AND MARKING



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

4. APPLICABLE DOCUMENTS AND SPECIFICATIONS

- QSFP+ MSA compliant
- Compliant with 40G Ethernet IEEE 802.3ba 40GBASE LR4 standard

5. QUALIFICATION

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

6. Absolute Maximum Ratings & Recommended Operating Conditions

Absolute Maximum Ratings				
Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	T _s	-40	85	degC

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Power Supply Voltage	VCC	-0.5	3.6	V
Relative Humidity (non-condensation)	RH	0	85	%
Damage Threshold, per Lane	DT	3.4		

Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit
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		10		Km
Power Consumption				1.5	W
Supply Current	Icc			1130	mA

Transmitter Operating Characteristic-Optical, Electrical

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Optical Characteristics						
Signaling Speed per Lane				10.3125	GBd	6
Center Wavelength	$\lambda 1$	1264.5		1277.5	nm	
	$\lambda 2$	1284.5		1297.5	nm	
	$\lambda 3$	1304.5		1317.5	nm	
	$\lambda 4$	1324.5		1337.5	nm	
Total Average Launch Power	POUT			8.3	dBm	
Launch Optical Power, each lane	Po	-7		2.3	dBm	1
Average Launch Power, each Lane	Po	-4		3.5	dBm	
Extinction Ratio	ER	3.5			dB	
Pout @TX-Disable Asserted	Poff			-30	dBm	

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Relative Intensity Noise	RIN _{OMA}			-128	dB/Hz	2
Side Mode Suppression Ratio	SMSR	30			dB	
Optical Return Loss Tolerance	ORLT			20	dB	
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}		{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}				
Electrical Characteristics						
Single ended input voltage tolerance	V _{inT}	-0.3		4.0	V	
Differential Input Voltage Swing	V _{in,pp}	120	-	1200	mVpp	3
Differential input threshold			50		mV	
AC common mode input voltage tolerance (RMS)		15			mV	
Differential input return loss		Per IEEE P802.3ba, Section 86A.4.1.1			dB	4
J2 Jitter Tolerance	Jt2	0.17			UI	
Eye mask coordinates {X1, X2, Y1, Y2}		0.11, 0.31 95 , 350			UI mV	5

Notes:

1. Minimum value is informative.
2. RIN is scaled by $10 \cdot \log(10/4)$ to maintain SNR outside of transmitter
3. After internal AC coupling. Self-biasing 100 differential input
4. 10 MHz to 11.1 GHz range.
5. Hit ratio = $5 \times 10E-5$
6. Transmitter consists of 4 lasers operating at 10.3Gb/s each.

Receiver Operating Characteristic-Optical, Electrical						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Optical Characteristics						
Signaling Speed per Lane				10.3125	GBd	6
Center Wavelength	λ1	1264.5		1277.5	nm	
	λ2	1284.5		1297.5	nm	
	λ3	1304.5		1317.5	nm	

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	λ4	1324.5		1337.5	nm	
Receiver Sensitivity	S			-11.5	dBm	
Receive power, each lane (OMA)				3.5	dBm	
Average Receive Power per Lane	RXPx	-13.7		2.3	dBm	1
Stressed Receiver Sensitivity (OMA) per Lane	SRS			-9.6	dBm	
Damage Threshold per Lane	PMAX			3.4	dBm	
Vertical eye closure penalty, per lane				1.9	dB	
Receive electrical 3 dB upper cutoff frequency, per lane				12.3	GHz	
Optical Return Loss	ORL			-26	dB	
LOS Assert	LOSA	-28			dBm	
LOS Dessert	LOSD			-15	dBm	
LOS Hysteresis	LOSH	0.5			dBm	
Electrical Characteristics						
Single-ended output voltage		-0.3		4.0	V	
Differential Output Voltage Swing	Vout,pp	200		400	mVpp	4,5
		300		600		
		400	550	800		
		600		1200		
AC common mode output voltage (RMS)				7.5	mV	
Output transition time, 20% to 80%		28			ps	
Eye mask coordinates #1 {X1, X2 Y1, Y2}			0.29, 0.5 150, 425		UI mV	3
Power Supply Ripple Tolerance	PSR	50			mVpp	

Notes:

1. Minimum value is informative.
2. 10 MHz to 11.1 GHz range.
3. Hit ratio = $5 \times 10E-5$

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4. AC coupled with 100 differential output impedance
5. Output voltage is settable in 4 discrete steps via I2C. Default is 400 – 800 mV.
6. Receiver consists of 4 photodetectors operating at 10.3Gb/s each.

7. Digital Diagnostic Functions

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

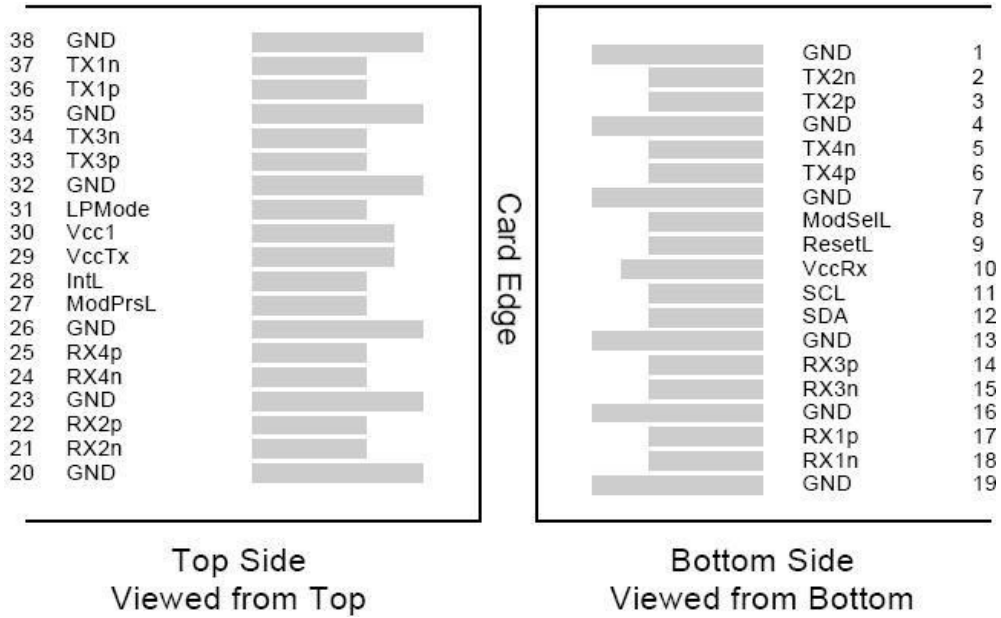
Parameter	Symbol	Min	Max	Units	Notes
Temperature monitor absolute error	DMI_Temp	-3	3	degC	Over operating temperature range
Supply voltage monitor absolute error	DMI_VCC	-0.1	0.1	V	Over full operating range
Channel RX power monitor absolute error	DMI_RX_Ch	-2	2	dB	
Channel Bias current monitor	DMI_Ibias_Ch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

8. **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	LVTLL-I	ModSelL	Module Select	
9	LVTLL-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	
13		GND	Ground	
14	CML-O	Rx3p	Receiver Non-Inverted Data Output	

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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	LVTTL-O	ModPrsL	Module Present	
28	LVTTL-O	IntL	Interrupt	
29		VccTx	+3.3 V Power Supply transmitter	2
30		Vcc1	+3.3 V Power Supply	2
31	LVTTL-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

