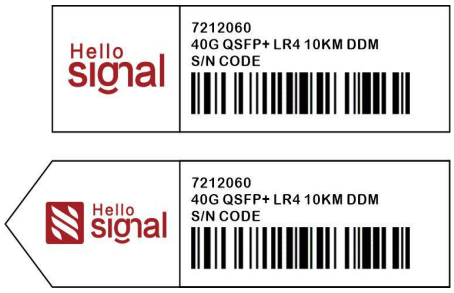
40G QSFP+ LR4 CWDM 10KM LC SMF Fiber Optic Transceiver



Zion Code and Description

Zion Code	Zion Description
7212060	40G QSFP+ LR4 CWDM 10KM LC SMF Fiber Optic Transceiver

Applications

- 40GBASE-LR4 40G Ethernet Links; InfiniBand DDR and QDR applications
- 40G Telecom connections

Features

- Up to 11.2Gbps per channel bandwidth; Aggregate bandwidth of > 40Gbps
- QSFP MSA compliant
- 4 CWDM un-cooled DFB lasers
- High Sensitivity PIN-TIA with optical DEMUX
- Up to 10km reach over standard single mode fiber
- Duplex LC connector
- Hot pluggable electrical interface
- Compliant with QSFP+ MSA: SFF-8436
- Lower power consumption <2.5W
- Single +3.3V power supply operating
- Commercial Temperature range 0°C to 70°C
- RoHS Compliant Part

Description

The 40 QSFP+ LR4 2KM is a 4x10G hot-pluggable optical transceiver module. It is designed for up to 10KM optical communication applications over multimode fiber using 4 wavelength of CWDM via LC connectors. 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 G694.2.
It is compliant with QSFP+ MSA, IEEE 802.3bm 40GBASE-LR4 standard.
It 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. With these features, this easy to install, hot swappable transceiver is suitable to be used in various applications, such as high-performance computing networks, enterprise core and distribution layer applications, data centers.

Main product parameters

Form Factor	QSFP+	Max Data Rate	41.2 Gbps (4×10.3 Gbps)
Wavelength	1310nm	Center Wavelength	1271,1291,1311,1331nm
Max Cable Distance	10KM	Connector type	Duplex LC
Fiber cable Type	SMF	Vendor Name	Zion Communication/fibre-com
Transimitter Type	DFB CWDM	Receiver Type	PIN
Transmit Power	- 7.0 ~ +2.3 dBm	Max Receiver sensitivity	- 12.5 dBm
Overload Power	3.3 dBm	Extinction Ratio	3.5 dB
DDM	Supported	Operating Temp.	0°C to 70°C (32°F to 158°F)

Zion Communication's Hot 40G transceiver types

Zion Code	Zion Description
7212010	40G QSFP+ SR4 850nm 150M MPO MMF Fiber Optic Transceiver
7212020	40G BiDi QSFP+ SR4 850nm & 900nm 100M LC MMF Fiber Optic Transceiver
7212030	40G QSFP+ SR4 850nm 400M LC MMF Fiber Optic Transceiver
7212050	40G QSFP+ LR4 CWDM 2KM LC SMF Fiber Optic Transceiver
7212060	40G QSFP+ LR4 CWDM 10KM LC SMF Fiber Optic Transceiver
7212070	40G QSFP+ ER4 CWDM 40KM LC SMF Fiber Optic Transceiver
7212080	40G QSFP+ PSM4 1310nm 2KM MPO SMF Fiber Optic Transceiver
7212090	40G QSFP+ PSM4 1310nm 10KM MPO SMF Fiber Optic Transceiver

Detailed product specifications

1 Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit
Storage Temperature (°C)	T_S	-40		85	°C
Max. Supply Voltage	$V_{CC}T$, R	-0.5		4	V
Relative Humidity	RH	0		85	%

2 Recommended Operating Environment

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Case operating Temperature	T_C	0		70	°C	
Supply Voltage	$V_{CCT, R}$	3.13	3.3	3.47	V	
Supply Current	I_{CC}			1000	mA	
Power Dissipation	PD			3.5	W	

3 Electrical Characteristics (TOP = 0 to 70 °C, VCC = 3.1 to 3.47 Volts)

Parameter	**Symbol**	**Min.**	**Typical**	**Max.**	**Unit**	**Note**
Supply Voltage	Vcc	3.1		3.47	V	
Supply Current	Icc			1000	mA	
Transmit turn-on-time				2000	ms	1
Transmitter						
Single Ended Output Voltage Tolerance	Vin T	-0.3		4	V	
Differential data input swing	Vin.pp	120		1200	mVpp	2
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	3
J2 Jitter Tolerance	Jt2	0.17			UI	
J9 Jitter Tolerance	Jt9	0.29			UI	
Data Dependent Pulse Width Shrinkage	DDPWS	0.07			UI	
Eye mask colordinates {X1, X2 ,Y1, Y2}			0.11 , 0.31 95 , 350		UI mV	4

Receiver						
Single Ended Output Voltage Tolerance		-0.3		4	V	
Differential data output swing	Vout,pp	0		800	mVpp	5,6
AC common mode output voltage (RMS)				7.5	mV	
Termination mismatch at 1 MHx				5	%	
Differential output return loss	Per IEEE P802.3ba,Section 86A.4.2.1				dB	
Common mode output return loss	Per IEEE P802.3ba,Section 86A.4.2.1				ps	
J2 Jitter output	Jo2			0.42	UI	
J9 Jitter output	Jo9			0.65	UI	
Eye mask colordinates #1 {X1, X2 ,Y1, Y2}	0.29, 0.50，150 , 425				UI mV	4
Power Supply Ripple Tolerance	PSR	50			mVpp	

Note:
1. From power-on and end of any fault conditions.
2. After internal AC coupling. Self-biasing 100Ω differential input.
3. 10 MHz to 11.1 GHz range
4.Hit ratio = 5 x $10E^{-5}$.
5.AC coupled with 100Ω differential output impedance.
6. Settable in 4 discrete steps via the I2C interface.

4 Optical Parameters(TOP = 0 to 70 °C, VCC = 3.1 to 3.47 Volts)

Parameter	Symbol	Min.	Typical	Max.	Unit	Ref.
Transmitter						
Wavelength Assignment	L0	1264.5	1271	1277.5	nm	
	L1	1284.5	1291	1297.5	nm	
	L2	1304.5	1311	1317.5	nm	
	L3	1324.5	1331	1337.5	nm	
Side-mode Suppression Ratio	SMSR	30	-	-	dB	
Total Average Launch Power	PT	-	-	4.3	dBm	
Average Launch Power, each Lane		-7	-	2.3	dBm	
Difference in Launch Power between any two Lanes (OMA)		-	-	4	dB	
Optical Modulation Amplitude, each Lane	OMA	-4		2.5	dBm	
Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP), each Lane		-4.8	-		dBm	
TDP, each Lane	TDP			2.3	dB	
Extinction Ratio	ER	3.5	-	-	dB	
Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}	{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}					
Optical Return Loss Tolerance		-	-	20	dB	
Average Launch Power OFF Transmitter, each Lane	Poff			-30	dBm	
Transmitter, each Lane						
Relative Intensity Noise	Rin			-128	dB/HZ	1
Optical Return Loss Tolerance		-	-	12	dB	

Receiver

Damage Threshold	THd	3.3			dBm	1
Average Power at Receiver Input, each Lane	R	-14		0	dBm	
Receive Electrical 3 dB upper Cut off Frequency, each Lane				12.3	GHz	
RSSI Accuracy		-2		2	dB	
Receiver Reflectance	Rrx			-26	dB	
Receiver Power (OMA), each Lane		-	-	3.5	dBm	
Receive Electrical 3 dB upper Cutoff Frequency, each Lane				12.3	GHz	
LOS De-Assert	LOS_D			-15	dBm	
LOS Assert	LOS_A	-25			dBm	
LOS Hysteresis	LOS_H	0.5			dB	

Note: Measured with a PRBS 2^{31}-1 test pattern, @10.325Gb/s, BER<10^{-12}.

5 Diagnostic Monitoring Interface

Digital diagnostics monitoring function is available on all QSFP+ LR4. A 2-wire serial interface provides user to contact with module. The structure of the memory is shown in flowing. The memory space is arranged into a lower, single page, address space of 128 bytes and multiple upper address space pages. This structure permits timely access to addresses in the lower page, such as Interrupt Flags and Monitors. Less time critical time entries, such as serial ID information and threshold settings, are available with the Page Select function. The interface address used is A0xh and is mainly used for time critical data like interrupt handling in order to enable a one-time-read for all data related to an interrupt situation. After an interrupt, IntL has been asserted, the host can read out the flag field to determine the affected channel and type of flag.

Byte Address	Description	Type
0	Identifier(1 Byte)	Read Only
1-2	Status (2 Bytes)	Read Only
3-21	Interrupt Flags (31 Bytes)	Read Only
22-33	Module Monitors (12 Bytes)	Read Only
34-81	Channel Monitors (48 Bytes)	Read Only
82-85	Reserved (4 Bytes)	Read Only
56-97	Control (12 Bytes)	Read Only
98-99	Reserved (2 Bytes)	Read Only
100-106	Module and Channel Masks (7 Bytes)	Read Only
107-118	Reserved (12 Bytes)	Read Only
119-122	Reserved (4 Bytes)	Read Only
123-126	Reserved (4 Bytes)	Read Only
127	Page Select Byte	Read Only
128-175	Module Thresholds (48 Bytes)	Read Only
176-223	Reserved(48 Bytes)	Read Only
224-225	Reserved(2 Bytes)	Read Only
226-239	Reserved(14 Bytes)	Read Only
240-240	Channel Controls (2 Bytes)	Read Only
242-253	Reserved(12 Bytes)	Read Only
254-255	Reserved (2 Bytes)	Read Only

6 Transceiver Block Diagram

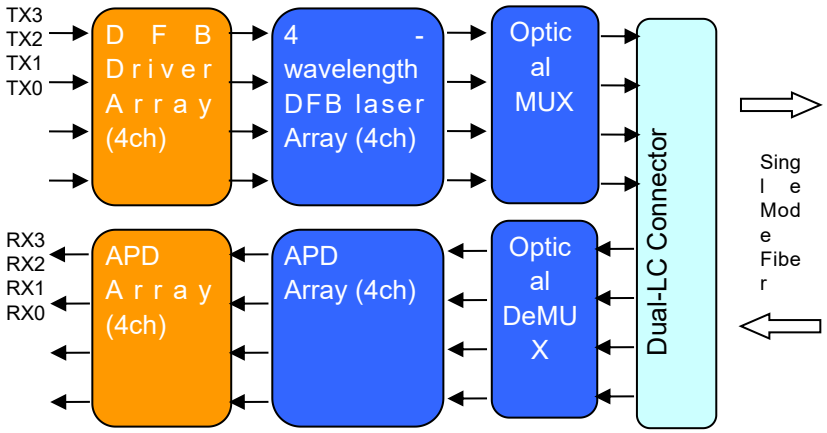
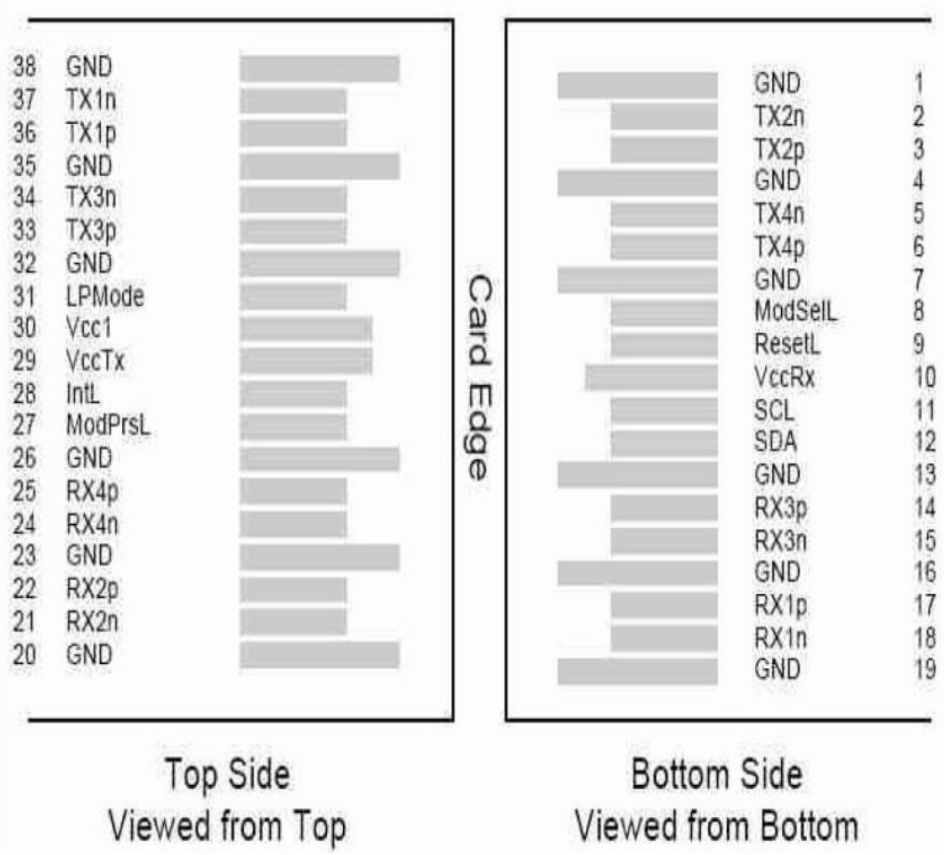


Figure 1: 40Gb/s QSFP ER4 Transceiver Block Diagram

7 Pin Assignment



8 Transceiver Block Diagram

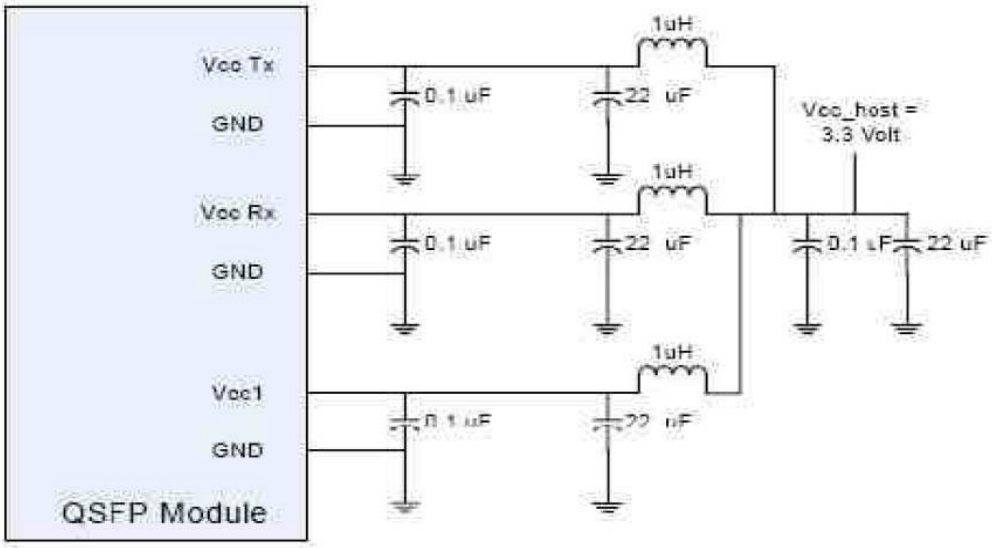
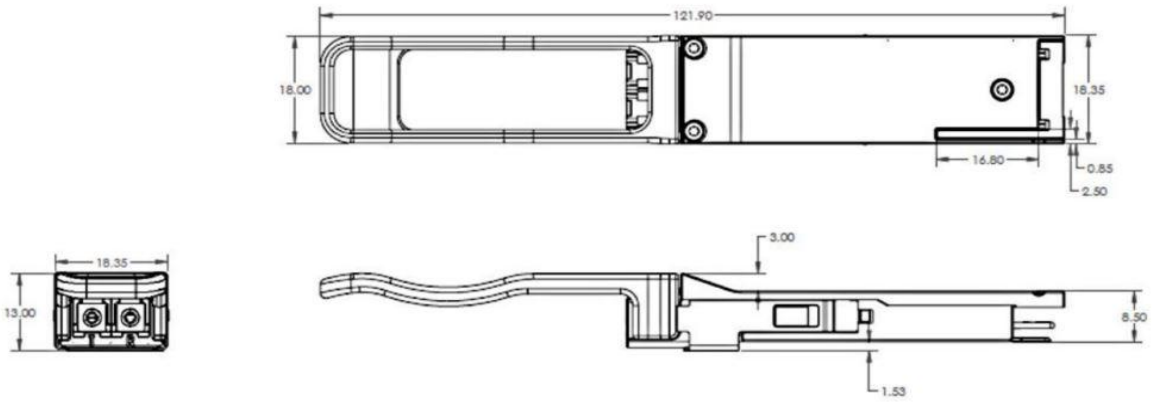
Pin	Logic	Symbol	Max Unit Conditions	Ref.
1		GND	Ground	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	
3	CML-I	Tx2p	Transmitter Non-Inverted Data output	
4		GND	Ground	1
5	CML-I	Tx4n	Transmitter Inverted Data Output	
6	CML-I	Tx4p	Transmitter Non-Inverted Data Output	
7		GND	Ground	1
8	LVTTL-I	ModSelL	Module Select	
9	LVTTL-I	ResetL	Module Reset	
10		VccRx	+3.3V Power Supply Receiver	2
11	LVCMOS-I/O	SCL	2-Wire Serial Interface Clock	
12	LVCMOS-I/O	SDA	2-Wire Serial Interface Data	
13		GND	Ground	1
14	CML-O	Rx3p	Receiver Inverted Data Output	
15	CML-O	Rx3n	Receiver Non-Inverted Data Output	
16		GND	Ground	1
17	CML-O	Rx1p	Receiver Inverted Data Output	
18	CML-O	Rx1n	Receiver Non-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	
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	+3.3V Power Supply Transmitter	2
30		Vcc1	+3.3V Power Supply	2
31	LVTTL-I	LPMode	Low Power Mode	
32		GND	Ground	1
33	CML-I	Tx3p	Transmitter Inverted Data Output	
34	CML-I	Tx3n	Transmitter Non-Inverted Data Output	
35		GND	Ground	1
36	CML-I	Tx1p	Transmitter Inverted Data Output	
37	CML-I	Tx1n	Transmitter Non-Inverted Data Output	
38		GND	Ground	1

Note:

1.GND is the symbol for single and supply(power) common for QSFP modules, All are common within the QSFP module and all module voltages are referenced to this potential otherwise noted. Connect these directly to the host board signal common ground plane. Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.

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 below. VccRx, Vcc1 and VccTx may be internally connected within the QSFP transceiver module in any combination. The connector pins are each rated for maximum current of 500mA.

9 Recommended Circuit



10 Diagram Mechnical Drawing