

## FTL4S1QE1C-C

### Finisar<sup>®</sup> Compatible 40G QSFP+ SWDM4 Optical Transceiver

#### FEATURES

- Compliant with QSFP+ MSA; SWDM MSA; SFF-8636; IEEE 802.3ba
- Hot-pluggable QSFP+ form factor
- 4x10Gb/s VCSEL-based SWDM transmitter
- Supports 41.2Gbps aggregate bit rate
- Power dissipation <3.5W
- Maximum link length of 240m on OM3 MMF and 350m on OM4 MMF
- Case temperature range: 0°C to 70°C
- Duplex LC receptacles
- XLPPI electrical interface
- RoHS compliant

#### APPLICATIONS

- 40G Ethernet over Duplex MMF

#### ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min.	Typical	Max.	Units
Storage Temperature	T <sub>s</sub>	-40		+85	°C
Maximum Supply Voltage	V <sub>CC</sub>	-0.5		3.6	V
Relative Humidity	RH	15		85	%

## RECOMMENDED OPERATING ENVIRONMENT

Parameter	Symbol	Min.	Max.	Units
Case Temp-Operating	Tcase	0	70	°C
Supply Voltage	Vcc	3.14	3.46	V
Power Consumption	P		3.5	W
Link Distance on OM3 Fibre		2	240	m
Link Distance on OM4 Fibre		2	350	m
Link Distance on OM5 Fibre		2	440	m

## OPTICAL CHARACTERISTICS

Parameter	Lane	Min.	Typical	Max.	Unit	Note
<b>TRANSMITTER</b>						
Signaling rate, each lane		10.3125 , 9.953±100ppm			Gb/s	
Lane Wavelength Range	Lane 0	844		858	nm	
	Lane 1	874		888		
	Lane 2	904		918		
	Lane 3	934		948		
Difference in launch power between any two lanes				4.5	dBm	
RMS Spectral width @ 850nm	Lane 0			0.53	nm	
RMS Spectral Width @ 880nm, 910nm, 940nm	Lane 1,2,3			0.59	nm	
Optical Modulation Amplitude (OMA), each lane		-5.5		3	dBm	
Average Launch power per Lane		-7.5		3	dBm	
Launch Power Tx OMA-TDP	Lane 0	-6.4			dBm	
	Lane 1	-6.0				
	Lane 2	-6.5				
	Lane 3	-7.0				
Transmitter and Dispersion Eye Closure	Lane 0			3.7	dB	
	Lane 1			4.0		
	Lane 2			4.5		
	Lane 3			5.0		
Extinction Ratio		2			dB	
Optical Return Loss Tolerance		12			dB	
Average Launch Power per Lane @ TX Off State				-30	dBm	
Encircled Flux		>=86% at 19um <=30% at 4.5um				

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Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3} Hit ratio 5x10 <sup>-5</sup> hits per sample		{0.23,0.34,0.43,0.27,0.35,0.4}			
<b>RECEIVER</b>					
Signaling rate, each lane		10.3125, 9.953 ± 100ppm			Gb/s
Lane Wavelength Range	Lane 0	844		858	nm
	Lane 1	874		888	
	Lane 2	904		918	
	Lane 3	934		948	
Damage threshold, each lane		3.8			dBm
Average Receive Power, each lane	Lane 0	-12.9		2.4	dBm
	Lane 1	-12.5			
	Lane 2	-12.2			
	Lane 3	-11.9			
Receiver Power, each lane (OMA)				3	dBm
Receiver sensitivity OMA, per lane				-9.1	dB
Difference in receive power between any two lanes (OMA)				5	dB
RX_Los_Assert		-30			dBm
RX_Los_De-ASSERT				-13	dBm
RX_Los_Hysteresis		0.5			dBm
Return reflectance				-12	dB

DIGITAL DIAGNOSTIC MONITORING SPECIFICATIONS

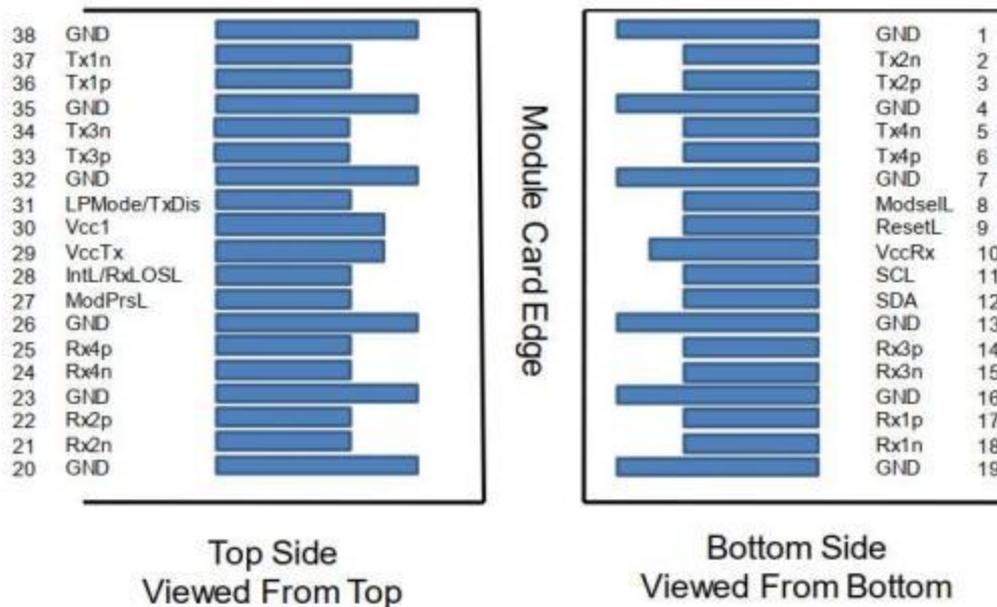
Parameters	Unit	Specification
Temperature Monitor	°C	± 3
Voltage Monitor	V	± 5 %
I_bias Monitor	mA	± 10 %
Received Power (Rx) Monitor	dB	± 3.0
Transmit Power (Tx) Monitor	dB	± 3.0

## ELECTRICAL CHARACTERISTICS

Electrical input signal characteristics (TP1)	Min	Typical	Max	Units	Conditions
<b>TRANSMITTER</b>					
Single ended input voltage tolerance	-0.3		4	V	Referred to TP1 signal common
AC common-mode input voltage tolerance	15			mV	RMS
Differential input return loss	See 86A.4.1.1			dB	10MHz to 11.1GHz
Differential to common-mode input return loss	10			dB	10MHz to 11.1GHz
J2 Jitter tolerance	0.17			UI	
J9 Jitter tolerance	0.29			UI	
Data Dependent Pulse Width Shrinkage (DDP WS) tolerance	0.07			UI	
<b>SPECIFICATION VALUES</b>					
Eye mask coordinates: {X1, X2, Y1, Y2}	{0.11, 0.31, 95, 350}				Hit Ratio=5E-5
Crosstalk calibration signal VMA	850			mV	While calibrating compliance signal
Crosstalk calibration signal transition times, 20% to 80%	34			ps	
<b>RECEIVER</b>					
Single ended output voltage tolerance range	-0.3		4	V	Referred to signal common
AC common-mode output voltage (RMS)			7.5	mV	
Termination mismatch at 1MHz			5	%	
Differential output return loss	See 86A.4.2.1			dB	10MHz to 11.1GHz
Common-mode output return loss	See 86A.4.2.2			dB	10MHz to 11.1GHz
Output transition time, 20% to 80%	28			ps	
J2 Jitter output			0.42	UI	
J9 Jitter output			0.65	UI	
<b>SPECIFICATION VALUES</b>					
Eye mask coordinates: {X1, X2, Y1, Y2}	{0.29, 0.5, 150, 425}				Hit ratio=5E-5
Crosstalk source VMA, each lane	700			mV	At TP1a
Crosstalk source transition times, 20% to 80%	37			PS	At TP1a

## QSFP+ CONNECTOR & PINOUT DESCRIPTION

The electrical interface to the transceiver is a 38 pin edge connector. The 38 pins provide high speed data, low speed monitoring and control signals, I2C communication, power and ground connectivity. The top and bottom views of the connector are provided below, as well as a table outlining the contact numbering, symbol and full description.



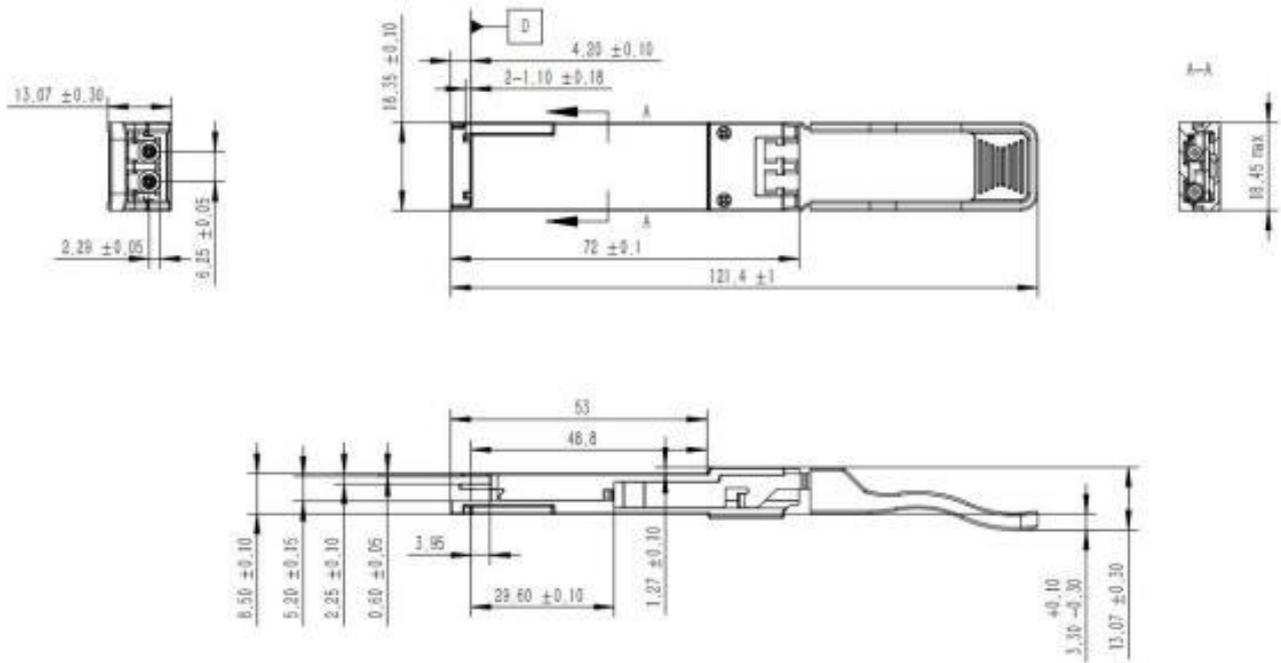
QSFP+ 38-pin connector

Pin	Symbol	Name/Description	Note
1	GND	Transmitter Ground (Common with Receiver Ground)	1
2	Tx2n	Transmitter Inverted Data Input	
3	Tx2p	Transmitter Non-Inverted Data output	
4	GND	Transmitter Ground (Common with Receiver Ground)	1
5	Tx4n	Transmitter Inverted Data Input	
6	Tx4p	Transmitter Non-Inverted Data output	
7	GND	Transmitter Ground (Common with Receiver Ground)	1
8	ModSelL	Module Select	
9	ResetL	Module Reset	
10	VccRx	3.3V Power Supply Receiver	2
11	SCL	2-Wire serial Interface Clock	
12	SDA	2-Wire serial Interface Data	
13	GND	Transmitter Ground (Common with Receiver Ground)	
14	Rx3p	Receiver Non-Inverted Data Output	
15	Rx3n	Receiver Inverted Data Output	
16	GND	Transmitter Ground (Common with Receiver Ground)	1
17	Rx1p	Receiver Non-Inverted Data Output	
18	Rx1n	Receiver Inverted Data Output	
19	GND	Transmitter Ground (Common with Receiver Ground)	1
20	GND	Transmitter Ground (Common with Receiver Ground)	1
21	Rx2n	Receiver Inverted Data Output	
22	Rx2p	Receiver Non-Inverted Data Output	
23	GND	Transmitter Ground (Common with Receiver Ground)	1
24	Rx4n	Receiver Inverted Data Output	1
25	Rx4p	Receiver Non-Inverted Data Output	
26	GND	Transmitter Ground (Common with Receiver Ground)	1
27	ModPrsl	Module Present	
28	IntL	Interrupt	
29	VccTx	3.3V power supply transmitter	2
30	Vcc1	3.3V power supply	2
31	LPMMode	Low Power Mode, not connect	
32	GND	Transmitter Ground (Common with Receiver Ground)	1
33	Tx3p	Transmitter Non-Inverted Data Input	
34	Tx3n	Transmitter Inverted Data Output	
35	GND	Transmitter Ground (Common with Receiver Ground)	1
36	Tx1p	Transmitter Non-Inverted Data Input	
37	Tx1n	Transmitter Inverted Data Output	
38	GND	Transmitter Ground (Common with Receiver Ground)	1

Note:

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 receiving and transmission power suppliers and shall be applied concurrently. Recommended host board power supply filtering is shown 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 1000mA.

MECHANICAL DIMENSIONS (UNIT: mm)



Mechanical Drawing