Features

- 4 CWDM lanes MUX/DEMUX design.
- 4 independent full-duplex channels Up to 11,3Gbps data rate per wavelength.
- 4 CWDM channels are 1271, 1291,1311 and 1331 nm.
- Single +3.3V power supply.
- QSFP+MSA compliant.
- Up to 10km transmission.
- Operating case temperature: 0~70C.
- RoHS compliant.
- Compliant with IEEE802.3ba.
- Compliant with QSFP+ MSA: SFF-8436

Applications

- 40G Ethernet.
- Infiniband 4X SDR DDR QDR.
- Datacenter.
- 40G Telecom connections.

Description

The Spectrum Terrabit QSFP-S10-13-CM is a Four-CWDM Channel of wavelength 1271, 1291, 1311 and 1331 nm, Pluggable, Parallel, Fiber-Optic QSFP+ Transceiver for InfiniBand FDR/QDR/ DDR/SDR, 12G/10G/8G/4G/2G fiber channel, PCIe and SAS Applications. The QSFP full-duplex optical module offers 4 independent transmit and receive channels, each capable of 11.3Gbps operation for an aggregate data rate of 45.2Gbps 10km using SM fiber. These modules are designed to operate over SM fiber systems using CWDM 1271, 1291, 1311 and 1331 nm DFB laser array.
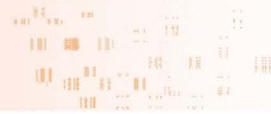
Absolute Maximum Ratings

The operation in excess of any absolute maximum ratings might cause permanent damage to this module.

| Parameter	Symbol	Min	Max	Unit	Note
Storage Temperature	TST	-40	85	degC	
Relative Humidity(non-condensing)	RH	0	85	%	
Operating Case Temperature	TOPC	0	70	degC	
Supply Voltage	VCC	-0.3	3.6	V	
Input Voltage	Vin	-0.3	Vcc+0.3	V	

Recommended Operating Conditions and Supply Requirements

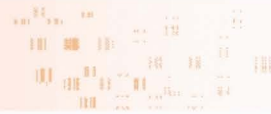| Parameter	Symbol	Min	Typical	Max	Unit
Operating Case Temperature	TOPC	0		70	degC
Power Supply Voltage	VCC	3.13	3.3	3.47	V
Power Consumption		-		3.6	W
Data Rate	DR		10.3	11.3	Gbps
Data Speed Tolerance	ΔDR	-100		+100	ppm
Link Distance with OM3 fiber	D	0		300	m

Recommend Circuit Schematic
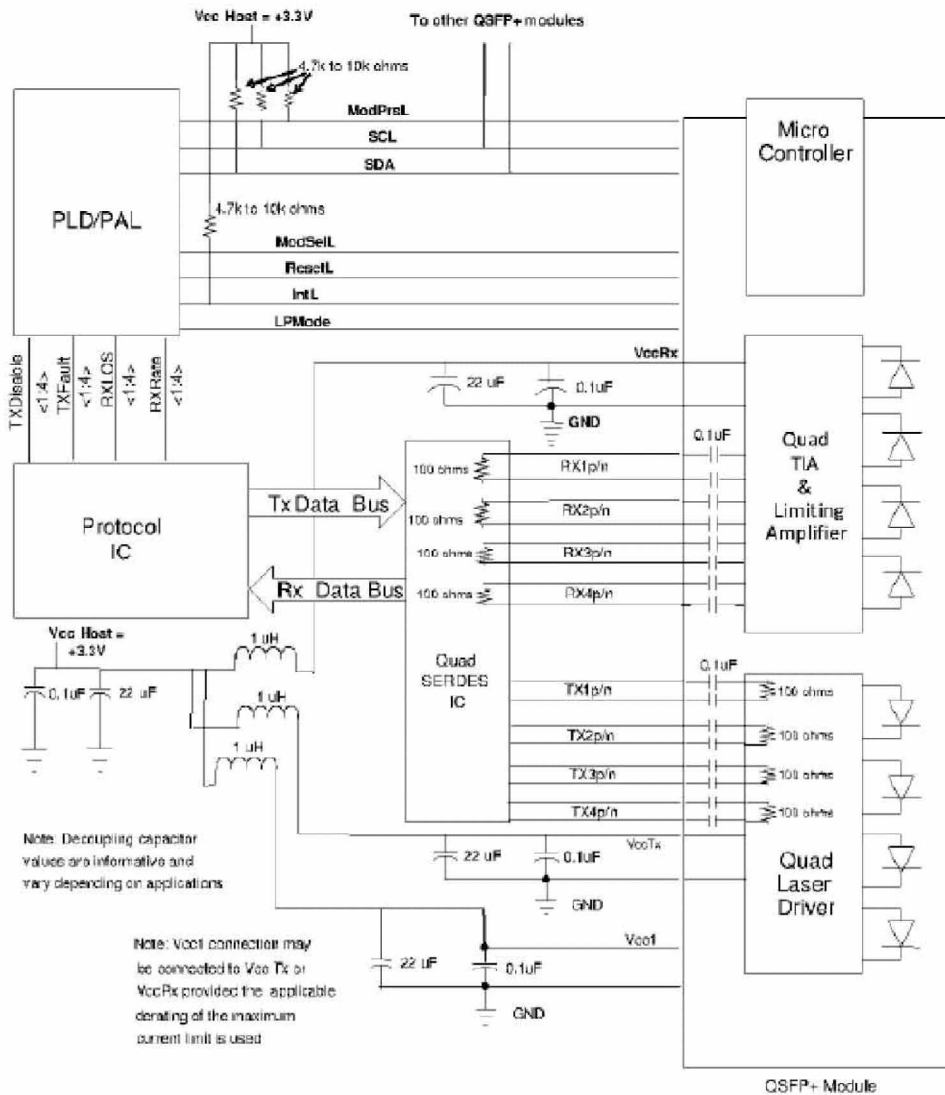
Optical Characteristics

All parameters are specified under the recommended operating conditions with PRBS31 data pattern unless otherwise specified.

Parameter	Symbol	Min	Typ	Max	Unit	Note
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	
Transmitter						
Side-mode Suppression Ratio	SMSR	30			dB	
Total Average Launch Power	P_T			8.3	dBm	
Average Launch Power, each Lane		-7		2.3	dBm	
Optical Modulation Amplitude, each Lane	OMA	-4		+3.5	dBm	
Difference in Launch Power between any two Lanes (OMA)				6.5	dB	
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	
Relative Intensity Noise	R_{in}			-128	dB/Hz	12dB reflection
Optical Return Loss Tolerance				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	
Receiver						
Damage Threshold	TH_d	3.3			dBm	1
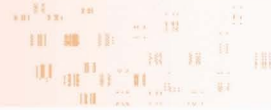
| Average Power at Receiver Input, each Lane			-13.7		2.3	dBm
Receiver Reflectance	R$_R$				-26	dB
Receiver Power (OMA), each Lane					3.5	dBm
Stressed Receiver Sensitivity in OMA, each Lane					-9.9	dBm
Receiver Sensitivity, each Lane	S$_R$				-11.5	dBm
Difference in Receive Power between any two Lanes (OMA)					7.5	dB

Note:
1.   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.

Electrical Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Note
Data Rate, each Lane		1	10.3	11.3	Gbps	
Control I/O Voltage, High	VIH	2.0		VCC	V	
Control I/O Voltage, Low	VIL	0		0.7	V	
Inter-Channel Skew	TSK			150	ps	
RESETL Duration		2	10		us	
RESETL De-assert time				2000	ms	
Power on time				2000	ms	
Transmitter (XLPPI)						
Single Ended Output Voltage Tolerance		-0.3		4	V	1
AC Common mode Voltage Tolerance (RMS)		15			mV	
Tx Input Diff Voltage	Vi	100		1000	mV	
Tx Input Diff Impedance	Zi	80	100	120	Ω	
Differential Input Return Loss		See IEEE 802.3ba 86A.4.11			dB	2
J2 Jitter Tolerance	Jt2			0.18	UI	
J9 Jitter Tolerance	Jt9			0.26	UI	
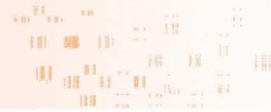
Data Dependent Pulse Width Shrinkage	DDPWS			0.07	UI	
Eye Mask Coordinates {X1, X2 , Y1, Y2}			0.1 , 0.31 95 , 350		UI mV	
Receiver (XLPPI)						
Single Ended Output Voltage Tolerance1		-0.3		4	V	
AC Common mode Voltage Tolerance (RMS)				7.5	mV	
Termination Mismatch at 1MHz				5	%	
Differential Output Return Loss			See IEEE 802.3ba 86A.4.2.1		dB	2
Common-mode Output Return Loss			See IEEE 802.3ba 86A.4.2.2		dB	2
Rx Output Diff Voltage	Vo		600	800	mV	
Rx Output Rise and Fall Time	Tr/Tf			35	ps	3
J2 Jitter Tolerance	Jr2			0.46	UI	
J9 Jitter Tolerance	Jr9			0.63	UI	
Eye Mask Coordinates {X1, X2 , Y1, Y2}			0.29 , 0.5 150 , 425		UI mV	

Notes:

1. Referred to signal common
2. 10MHz- 11.1GHz
3. 20% to 80%
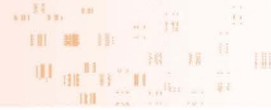
Pin Descriptions

PIN	Logic	Symbol	Name/Description	Note
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	LVCMOS-I/O	SCL	2-Wire Serial Interface Clock	
12	LVCMOS-I/O	SDA	2-Wire Serial Interface Data	
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
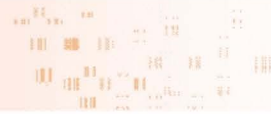
27	LVTTL-O	ModPrsL	Module Present	
28	LVTTL-O	IntL	Interrupt	
29		VccTx	+3.3 V Power Supply transmitter	2
30		Vcc1	+3.3 V Power Supply	2
31	LVTTL-I	LPMode	Low Power Mode	
32		GND	Ground	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	
34	CML-I	Tx3n	Transmitter Inverted Data Output	
35		GND	Ground	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	
37	CML-I	Tx1n	Transmitter Inverted Data Output	
38		GND	Ground	1

Notes:

1. Module circuit ground is isolated from module chassis ground within the module. GND is the symbol for signal and supply (power) common for QSFP modules.

2. The connector pins are each rated for a maximum current of 500mA.

38	GND
37	TX1n
36	TX1p
35	GND
34	TX3n
33	TX3p
32	GND
31	LPMode
30	Vcc1
29	VccTx
28	IntL
27	ModPrsL
26	GND
25	RX4p
24	RX4n
23	GND
22	RX2p
21	RX2n
20	GND

Card Edge

GND	1
TX2n	2
TX2p	3
GND	4
TX4n	5
TX4p	6
GND	7
ModSelL	8
ResetL	9
VccRx	10
SCL	11
SDA	12
GND	13
RX3p	14
RX3n	15
GND	16
RX1p	17
RX1n	18
GND	19

Top Side
Viewed from Top

Bottom Side
Viewed from Bottom

ModSelL Pin

The ModSelL is an input pin. When held low by the host, the module responds to 2-wire serial communication commands. The ModSelL allows the use of multiple QSFP modules on a single 2-wire interface bus. When the ModSelL is "High", the module will not respond to any 2-wire interface communication from the host. ModSelL has an internal pull-up in the module.

ResetL Pin

Reset. LPMode_Reset has an internal pull-up in the module. A low level on the ResetL pin for longer than the minimum pulse length (t_Reset_init) initiates a complete module reset, returning all user module settings to their default state. Module Reset Assert Time (t_init) starts on the rising edge after the low level on the ResetL pin is released. During the execution of a reset (t_init) the host shall disregard all status bits until the module indicates a completion of the reset interrupt. The module indicates this by posting an IntL signal with the Data_Not_Ready bit negated. Note that on power up (including hot insertion) the module will post this completion of reset interrupt without requiring a reset.

LPMode Pin

Spectrum Terrabit QSFP-S10-13-CM operate in the low power mode (less than 3.6W power consumption) This pin active high will decrease power consumption to less than 3.6W.

ModPrsL Pin

ModPrsL is pulled up to Vcc on the host board and grounded in the module. The ModPrsL is asserted "Low" when the module is inserted and deasserted "High" when the module is physically absent from the host connector.

IntL Pin

TERRABIT NETWORKS PTE LTD
33. Ubi Avenue 3 #05-42. Vertex Tower A. Singapore 408868
[Tel] 65.6741.1232 [Fax] 65.6749.0670 [Web] http://www.terrabitnet.com
Reg. no. 200607441N

9

Terrabit
Networks

IntL is an output pin. When "Low" , it indicates a possible module operational fault or a status critical to the host system. The host identifies the source of the interrupt by using the 2-wire serial interface. The IntL pin is an open collector output and must be pulled up to Vcc on the host board.

Power Supply Filtering

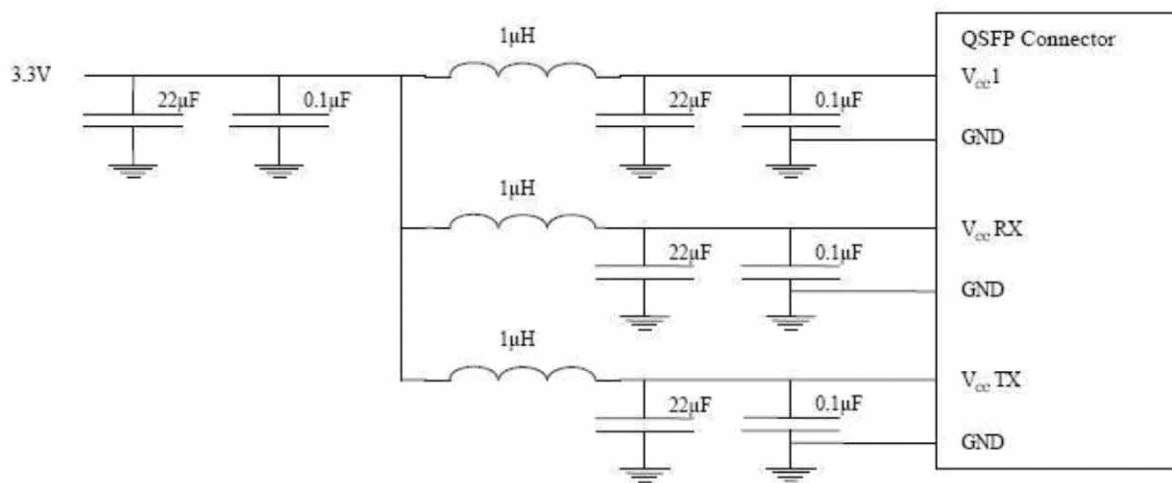The host board should use the power supply filtering shown in Figure 1.

Figure1. Host Board Power Supply Filtering

Diagnostic Monitoring Interface

Digital diagnostics monitoring function is available on all Spectrum Terrabit QSFP-S10-13-CM. A 2-wire serial interface provides user to contact with module. The structure of the memory is shown in Figure 3. 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 fortime 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.

Parameter	Range	Accuracy	Calibration
Temperature	0 to +70°C	±3°C	Internal
Voltage	2.97 to 3.63V	±3%	Internal
Bias Current	0 to 100mA	±10%	Internal
RX Power	-13 to 0.5dBm	±2dB	Internal

Figure 3

EEPROM Serial ID Memory Contents:

Serial ID: Data Fields (Page 00)

Address	Size (Bytes)	Name	Description of Base ID Field	Optical Module
128	1	Identifier	Identifier Type of serial Module	R
129	1	Ext. Identifier	Extended Identifier of Serial Module	R
130	1	Connector	Code for connector type	R
131-138	8	Specification compliance	Code for electronic compatibility or optical compatibility	R
139	1	Encoding	Code for serial encoding algorithm	R
140	1	BR, nominal	Nominal bit rate, units of 100 MBits/s	R
141	1	Extended rateselect Compliance	Tags for extended rate select compliance	R
142	1	Length(SMF)	Link length supported for SMF fiber in km (note 1)	R
143	1	Length(9um)	Link length supported for SMF 9/125 um fiber 10KM	R
144	1	Reserved		
145	1	Reserved		

| 146	1	Reserved		
147	1	Device tech	Device technology	R
148-163	16	Vendor name	QSFP+ vendor name(ASCII)	R
164	1	Extended Module	Extended Module codes for InfiniBand	R
165-167	3	Vendor OUI	QSFP+ vendor IEEE company ID	R
168-183	16	Vendor PN	Part number provided by QSFP+ vendor(ASCII)	R
184-185	2	Vendor rev	Revision level for part number provided by vendor(ASCII)	R
186-187	2	Wave length or Copper cable Attenuation	Nominal laser wavelength (wavelength=value/20 in nm) or copper cable attenuation in dB at 2.5GHz (Adrs 186) and 5.0GHz (Adrs 187)	R
188-189	2	Wavelength tolerance	Guaranteed range of laser wavelength(+/- value) from nominal wavelength.(wavelength Tol.=value/200 in nm)	R
190	1	Max case temp.	Maximum case temperature in degrees C	R
191	1	CC_BASE	Check code for base ID fields (addresses 128-190)	R
192-195	4	Options	Rate Select, TX Disable, TX Fault, LOS, Warning indicators for: Temperature, VCC, RX power, TX Bias	R
196-211	16	Vendor SN	Serial number provided by vendor (ASCII)	R
212-219	8	Date Code	Vendor's manufacturing date code	R
220	1	Diagnostic Monitoring Type	Indicates which types of diagnostic monitoring are implemented (if any) in the Module. Bit 1,0 Reserved	R
221	1	Enhanced Options	Indicates which optional enhanced features are implemented in the Module.	R
222	1	Reserved		

223	1	CC_EXT	Check code for the Extended ID Fields (addresses 192-222)	R
Vendor Specific ID Fields				
224-255	32	Vendor Specific EEPROM		

Mechanical Dimensions
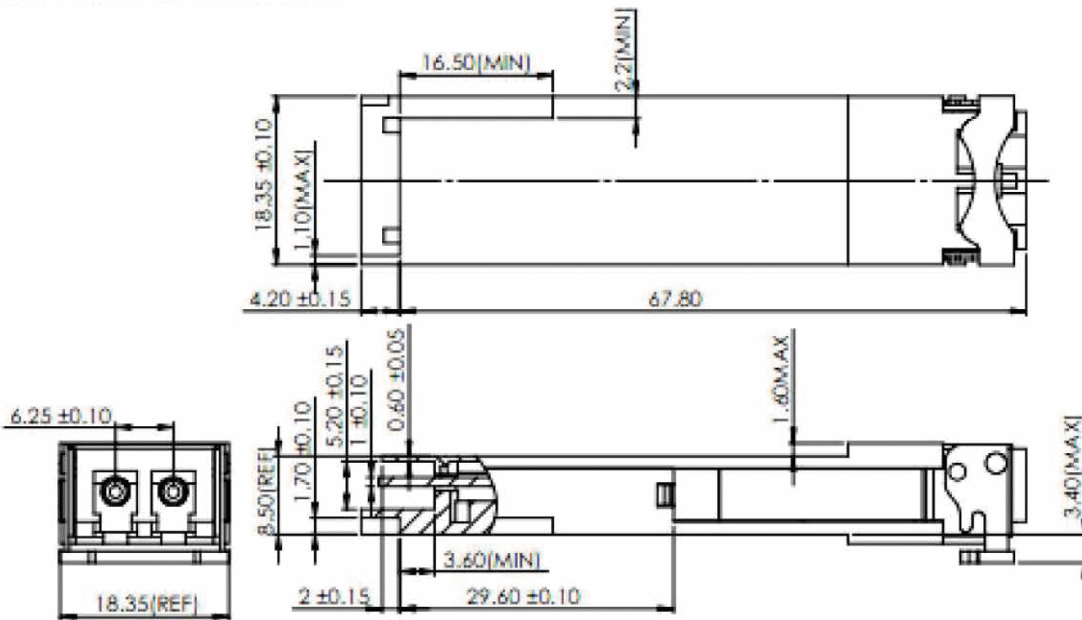
ESD

This transceiver is specified as ESD threshold 1KV for high speed data pins and 2KV for all others electrical input pins, tested per MIL-STD-883, Method 3015.4 /JESD22-A114-A (HBM). However, normal ESD precautions are still required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.

Laser Safety

This is a Class 1 Laser Product according to IEC 60825-1:2007. This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated (June 24, 2007)

Order Information

Part Number	Product Description
QSFP-S10-13-CM	4X10.3G QSFP+, LC connector, 4DDM, 10KM C-temp

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