Datasheet

40GBASE-SR Bi-Directional QSFP LC Duplex Transceiver for MMF

QSFP-BD-40G

Features

- Compliant to the 40GbE XLPPI electrical specification per IEEE 802.3ba-2010
- Compliant to QSFP+ SFF-8436 Specification
- Aggregate bandwidth of > 40Gbps
- Operates at 10.3125 Gbps per electrical channel with 64b/66b encoded data
- QSFP MSA compliant
- Capable of over 100m transmission on OM3 Multimode Fiber (MMF)and 150m on OM4 MMF
- Single +3.3V power supply operating
- Built-in digital diagnostic functions
- Temperature range 0°C to 70°C
- RoHS Compliant Part
- Utilizes a standard LC duplex fiber cable allowing reuse of existing cable infrastructure

Application

- 40 Gigabit Ethernet interconnects
- Datacom/Telecom switch & router connections
- Data aggregation and backplane applications
- Proprietary protocol and density applications

Description

It is a Four-Channel, Pluggable, LC Duplex, Fiber-Optic QSFP+ Transceiver for 40 Gigabit Ethernet Applications. This transceiver is a high performance module for short-range duplex data communication and interconnect applications. It integrates four electrical data lanes in each direction into transmission over a single LC duplex fiber optic cable. Each electrical lane operates at 10.3125 Gbps and conforms to the 40GE XLPPI interface.

The transceiver internally multiplexes an XLPPI 4x10G interface into two 20Gb/s electrical channels, transmitting and receiving each optically over one simplex LC fiber using bi-directional optics. This results in an aggregate bandwidth of 40Gbps into a duplex LC cable. This allows reuse of the installed LC duplex cabling infrastructure for 40GbE application. Link distances up to 100 m using OM3 and 150m using OM4 optical fiber are supported. These modules are de- signed to operate over multimode fiber systems using a nominal wavelength of 850nm on one end and 900nm on the other end. The electrical interface uses a 38 contact QSFP+ type edge connector. The optical interface uses a conventional LC duplex connector.
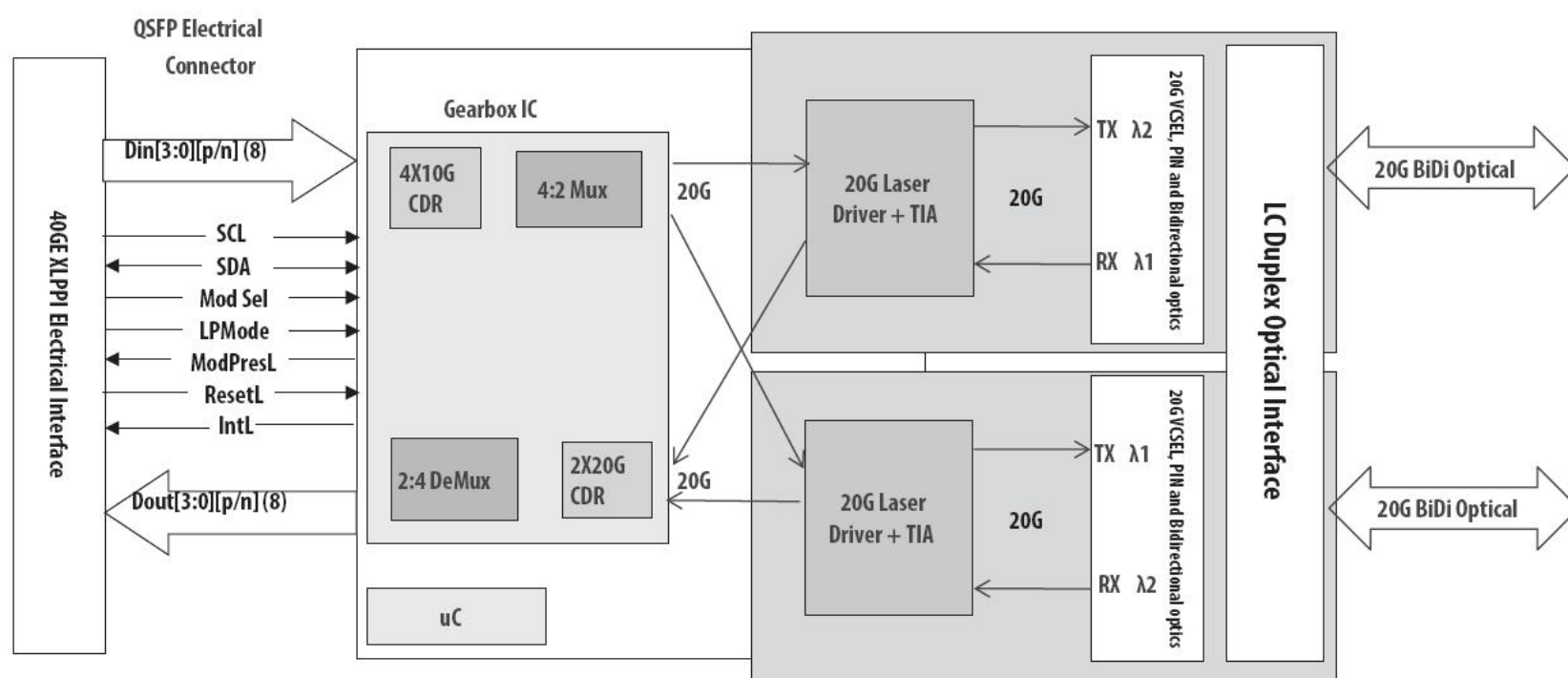
Product Specifications

I. Absolute Maximum Ratings

Data Rate Specifications	Symbol	Min	Typical	Max	Unit
Storage Temperature	T_S	-40		+85	° C
Supply Voltage	$V_{CC}T, R$	-0.5		4	V
Relative Humidity	RH	0		85	%

II. Recommended Operating Environment

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

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III. Electrical Characteristics (TOP = 0 to 70℃, VCC = 3.1 to 3.47 Volts)

Parameter	Symbol	Min	Type	Max	Unit	Note
Data Rate per Channel			10.3125	11.2	Gbps	
Power Consumption			2.5	3.5	W	
Supply Current			0.75	1.0	A	
Control I/O Voltage-High	Icc			Vcc	V	
Control I/O Voltage-Low	VIH	2.0		0.7	V	
Inter-Channel Skew	VIL	0		150	Ps	
RESETL Duration	TSK		10		Us	
RESETL De-assert time				100	ms	
Power On Time				100	ms	
Transmitter						
Single Ended Output Voltage Tolerance		0.3		4	V	1
Common mode Voltage Tolerance		15			mV	
Transmit Input Diff Voltage	VI	120		1200	mV	
Transmit Input Diff Impedance	ZIN	80	100	120		
Data Dependent Input Jitter	DDJ			0.1	UI	
Data Input Total Jitter	TJ			0.28	UI	

Receiver						
Single Ended Output Voltage Tolerance		0.3		4	V	
Rx Output Diff Voltage	Vo		600	800	mV	
Rx Output Rise and Fall Voltage	Tr/Tf			35	ps	1
Total Jitter	TJ			0.7	UI	
Deterministic Jitter	DJ			0.42	UI	

Note:
1.20～80%

IV. Optical Characteristics (TOP = 0 to 70℃, VCC = 3.1 to 3.47 Volts)

Parameter	Symbol	Min	Type	Max	Unit	Ref.
Transmitter						
Optical Wavelength CH1	λ	832	850	868	nm	
Optical Wavelength CH2	λ	882	900	918	nm	
RMS Spectral Width	Pm		0.5	0.65	nm	
Average Optical Power per Channel	Pavg	-4	-2.5	+5.0	dBm	
Laser Off Power Per Channel	Poff			-30	dBm	
Optical Wavelength CH1	ER	3.5			dB	
Relative Intensity Noise	Rin			-128	dB/HZ	1
Optical Return Loss Tolerance				12	dB	

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Receiver						
Optical Center Wavelength CH1	λ	882	900	918	nm	
Optical Center Wavelength CH2	λ	832	850	868	nm	
Receiver Sensitivity per Channel	R		-11		dBm	
Maximum Input Power	P_{MAX}	+0.5			dBm	
Receiver Reflectance	Rrx	30		-12	dB	
LOS De-Assert	LOS_D			-14	dBm	
LOS Assert	LOS_A	-30			dBm	
LOS Hysteresis	LOS_H	0.5			dB	

Notes:
1.12dB Reflection
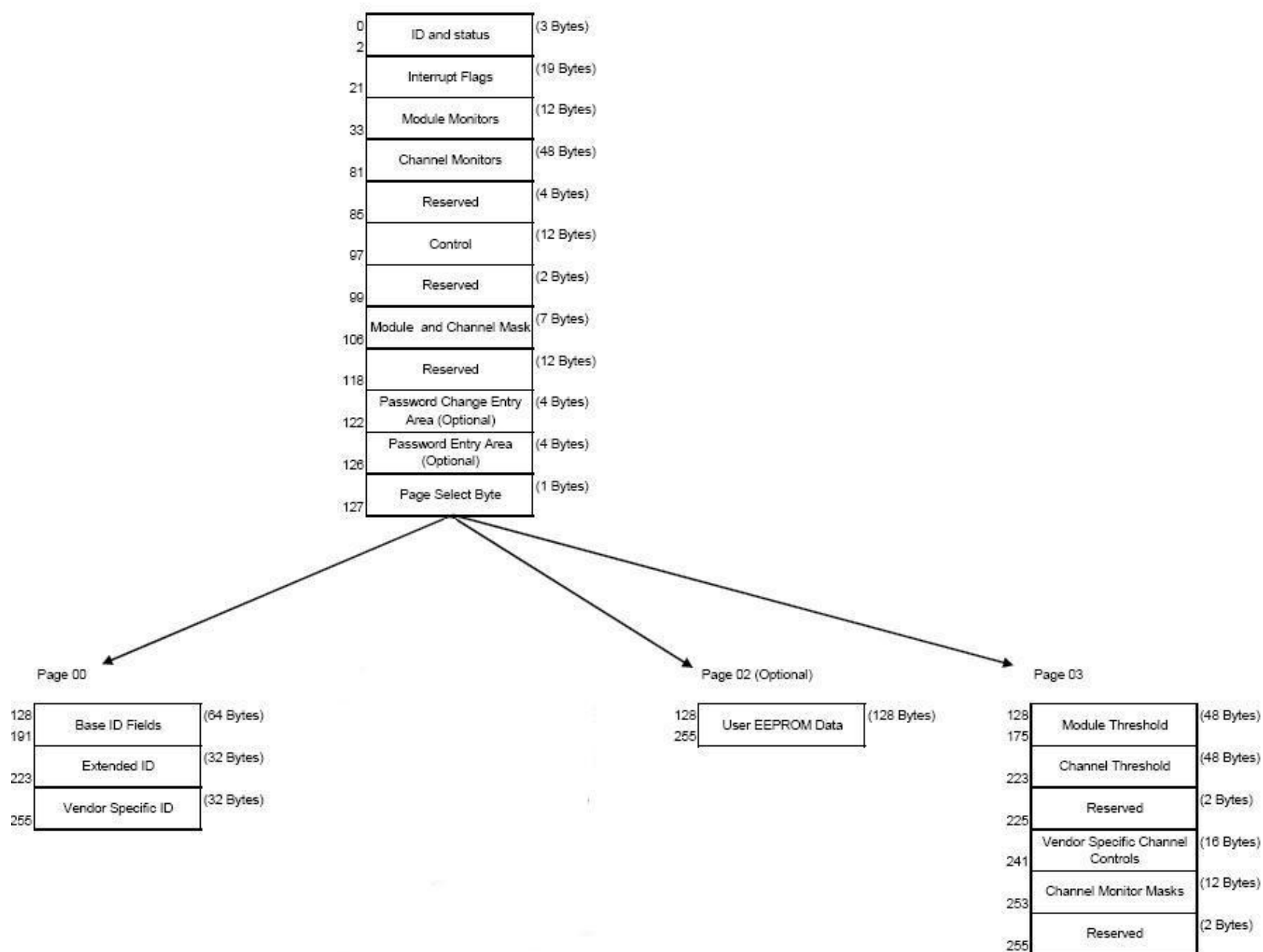
V. Diagnostic Monitoring Interface

Digital diagnostics monitoring function is available on all QSFP+ SRBD. 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 /Write
86-97	Control (12 Bytes)	Read /Write
98-99	Reserved (2 Bytes)	Read /Write
100-106	Module and Channel Masks (7 Bytes)	Read /Write
107-118	Reserved (12 Bytes)	Read /Write
119-122	Reserved (4 Bytes)	Read /Write
123-126	Reserved (4 Bytes)	Read /Write
127	Page Select Byte	Read /Write
128-175	Module Thresholds (48 Bytes)	Read Only
176-223	Reserved (48 Bytes)	Read Only

224-225	Reserved (2 Bytes)	Read /Write
226-239	Reserved (14 Bytes)	Read /Write
240-241	Channel Controls (2 Bytes)	Read /Write
242-253	Reserved (12 Bytes)	Read /Write
254-255	Reserved (2 Bytes)	Read /Write

2-wire serial address, 1010000x (A0h)"

Address	Field	Size
0–2	ID and status	(3 Bytes)
–21	Interrupt Flags	(19 Bytes)
–33	Module Monitors	(12 Bytes)
–81	Channel Monitors	(48 Bytes)
–85	Reserved	(4 Bytes)
–97	Control	(12 Bytes)
–99	Reserved	(2 Bytes)
–106	Module and Channel Mask	(7 Bytes)
–118	Reserved	(12 Bytes)
–122	Password Change Entry Area (Optional)	(4 Bytes)
–126	Password Entry Area (Optional)	(4 Bytes)
–127	Page Select Byte	(1 Bytes)

Page 00

Address	Field	Size
128–191	Base ID Fields	(64 Bytes)
–223	Extended ID	(32 Bytes)
–255	Vendor Specific ID	(32 Bytes)

Page 02 (Optional)

Address	Field	Size
128–255	User EEPROM Data	(128 Bytes)

Page 03

Address	Field	Size
128–175	Module Threshold	(48 Bytes)
–223	Channel Threshold	(48 Bytes)
–225	Reserved	(2 Bytes)
–241	Vendor Specific Channel Controls	(16 Bytes)
–253	Channel Monitor Masks	(12 Bytes)
–255	Reserved	(2 Bytes)

Address	Name	Description
128	Identifier (1 Byte)	Identifier Type of serial transceiver
129	Ext. Identifier (1 Byte)	Extended identifier of Serial transceiver
130	Connector (1 Byte)	Code for connector type
131-138	Transceiver (8 Bytes)	Code for electronic compatiblility or optical compatibility
139	Encoding (1 Byte)	Code for serial encoding algorithm
140	BR, nominal (1 Byte)	Nominal bit rate, units of 100 Mbits/s
141	Extended RateSelect Compliance (1 Byte)	Tags for Extended RateSelect compliance
142	Length SMF (1 Byte)	Link length supported for SM fiber in km
143	Length E-50µm (1 Byte)	Link length supported for EBW 50/125 µm fiber, units of 2m
144	Length 50 µm (1 Byte)	Link length supported for 50/125µm fiber, units of 1m
145	Length 62.5µm (1 Byte)	Link length supported for 62.5/125µm fiber, units of 1m
146	Length copper (1 Byte)	Link length supported for copper, units of 1m
147	Device Tech (1 Byte)	Device technology
148-163	Vendor name (16 Bytes)	QSFP vendor name (ASCII)
164	Extended Transceiver (1 Byte)	Extended Transceiver Codes for InfiniBand ↑
165-167	Vendor OUI (3 Bytes)	QSFP vendor IEEE vendor company (ASCII)
168-183	Vendor PN (16 Bytes)	Part number provided by QSFP vendor (ASCII)

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Address	Name	Description
184-185	Vendor rev (2 Bytes)	Revision level for part number provided by vendor (ASCII)
186-187	Wavelength (2 Bytes)	Nominal laser wavelength (Wavelength = value / 20 in nm
188-189	Wavelength Tolerance (2 Bytes)	Guaranteed range of laser wavelength (+/- value) from Nominal wavelength (Wavelength Tol. = value/ 200 in nm
190	Max Case Temp (1 Byte)	Maximum Case Temperature in Degree C
191	CC-BASE (1 Byte)	Check code for Base ID fields (addresses 128-190)
192-195	Options (4 Bytes)	Rate Select, TX Disable, TX Fault, LOS
196-211	Vendor SN (16 Bytes)	Serial number provided by vendor (ASCII)
212-219	Date code (8 Bytes)	Vendor's manufacturing date code
220	Diagnostic Monitoring Type (1Byte)	Indicates which type of diagnostic monitoring is implemented
221	Enhanced Options (1Byte)	Indicates which optional enhanced features are implemented
222	Reserved (1Byte)	Reserved
223	CC-EXT	Check code for the Extended ID Fields (addresses 192-222)
224-255	Vendor Specific (32 Bytes)	Vendor Specific EEPROM

Page02 is User EEPROM and its format decided by user.
The detail description of low memory and page00.page03 upper memory please see SFF-8436 document.

VI. Timing for Soft Control and Status Functions

Parameter	Symbol	Max	Unit	Conditions
Initialization Time	t_init	2000	ms	Time from power on1, hot plug or rising edge of Reset until the module is fully functional2
Reset Init Assert Time	t_reset_init	2	µs	A Reset is generated by a low level longer than the minimum reset pulse time present on the ResetL pin.
Serial Bus Hardware Ready Time	t_serial	2000	ms	Time from power on1 until module responds to data transmission over the 2-wire serial bus
Monitor Data ReadyTime	t_data	2000	ms	Time from power on1 to data not ready, bit 0 of Byte 2, deasserted and IntL asserted
Reset Assert Time	t_reset	2000	ms	Time from rising edge on the ResetL pin until the module is fully functional2
LPMode Assert Time	ton_LPMode	100	µs	Time from assertion of LPMode (Vin:LPMode =Vih) until module power consumption enters lower Power Level
IntL Assert Time	ton_IntL	200	ms	Time from occurrence of condition triggering IntL until Vout:IntL = Vol
IntL Deassert Time	toff_IntL	500	µs	toff_IntL 500 µs Time from clear on read3 operation of associated flag until Vout:IntL = Voh. This includes deassert times for Rx LOS, Tx Fault and other flag bits.

Flag Assert Time	ton_flag	200	ms	Time from occurrence of condition triggering flag to associated flag bit set and IntL asserted
Mask Assert Time	ton_mask	100	ms	Time from mask bit set4 until associated IntL assertion is inhibited
Mask De-assert Time	toff_mask	100	ms	Time from mask bit cleared4 until associated IntlL operation resumes
ModSelL Assert Time	ton_ModSelL	100	µs	Time from assertion of ModSelL until module responds to data transmission over the 2-wire serial bus
ModSelL Deassert Time	toff_ModSelL	100	µs	Time from deassertion of ModSelL until the module does not respond to data transmission over the 2-wire serial bus
				transmission over the 2-wire serial bus
Power_over-ride or Power-set Assert Time	ton_Pdown	100	ms	Time from P_Down bit set 4 until module power consumption enters lower Power Level
Power_over-ride or Power-set De-assert Time	toff_Pdown	300	ms	Time from P_Down bit cleared4 until the module is fully functional3

Note：
1. Power on is defined as the instant when supply voltages reach and remain at or above the minimum specified value.
2. Fully functional is defined as IntL asserted due to data not ready bit, bit 0 byte 2 de-asserted.
3. Measured from falling clock edge after stop bit of read transaction.
4. Measured from falling clock edge after stop bit of write transaction.

VII. Pin Description

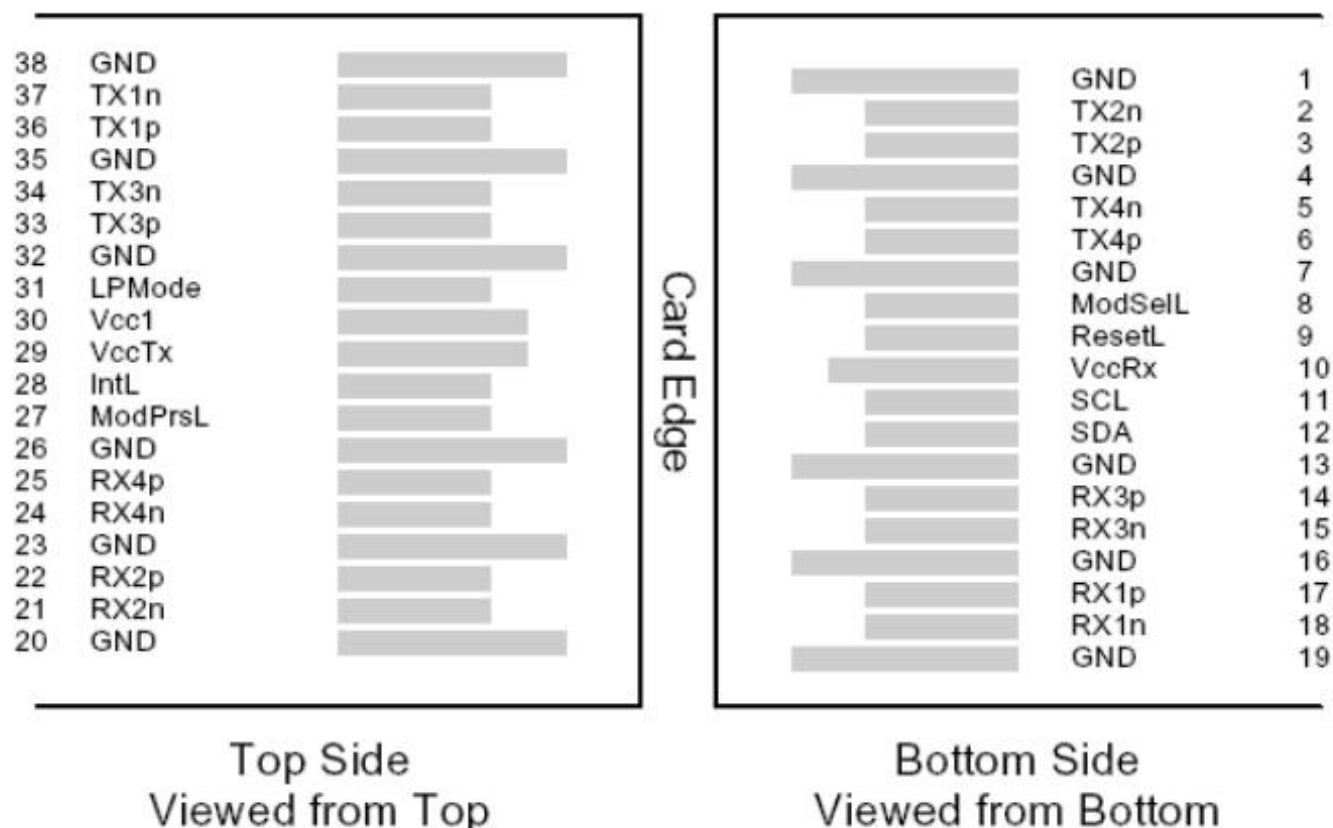| 38 | GND |
37	TX1n
36	TX1p
35	GND
34	TX3n
33	TX3p
32	GND
31	LPMode
30	Vcc1
29	VccTx
28	IntL
27	ModPrsL
26	GND
25	RX4p
24	RX4n
23	GND
22	RX2p
21	RX2n
20	GND

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

Diagram of Host Board Connector Block Pin Numbers and Name

Pin	Logic	Symbol	Name/Description	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	

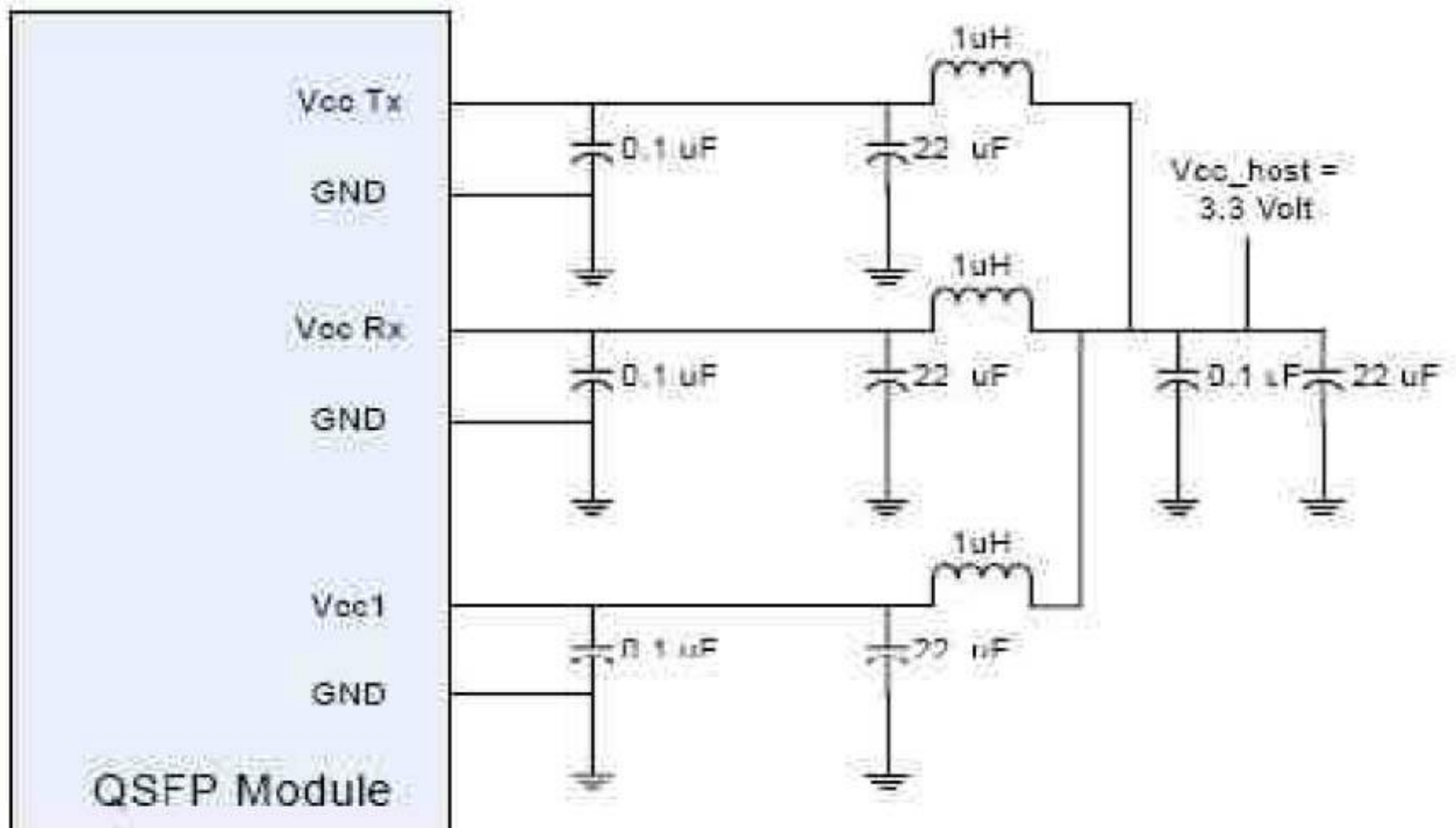| 34 | CML-I | Tx3n | Transmitter Non-Inverted Data Output | |
35		GND	Ground	1
36	CML-I	Tx1p	Transmitter Inverted Data Output	
37	CML-I	Tx1n	Transmitter Non-Inverted Data Output	
38		GND	Ground	1

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.

VIII.Recommended Circuit

IX. Mechanical Dimensions
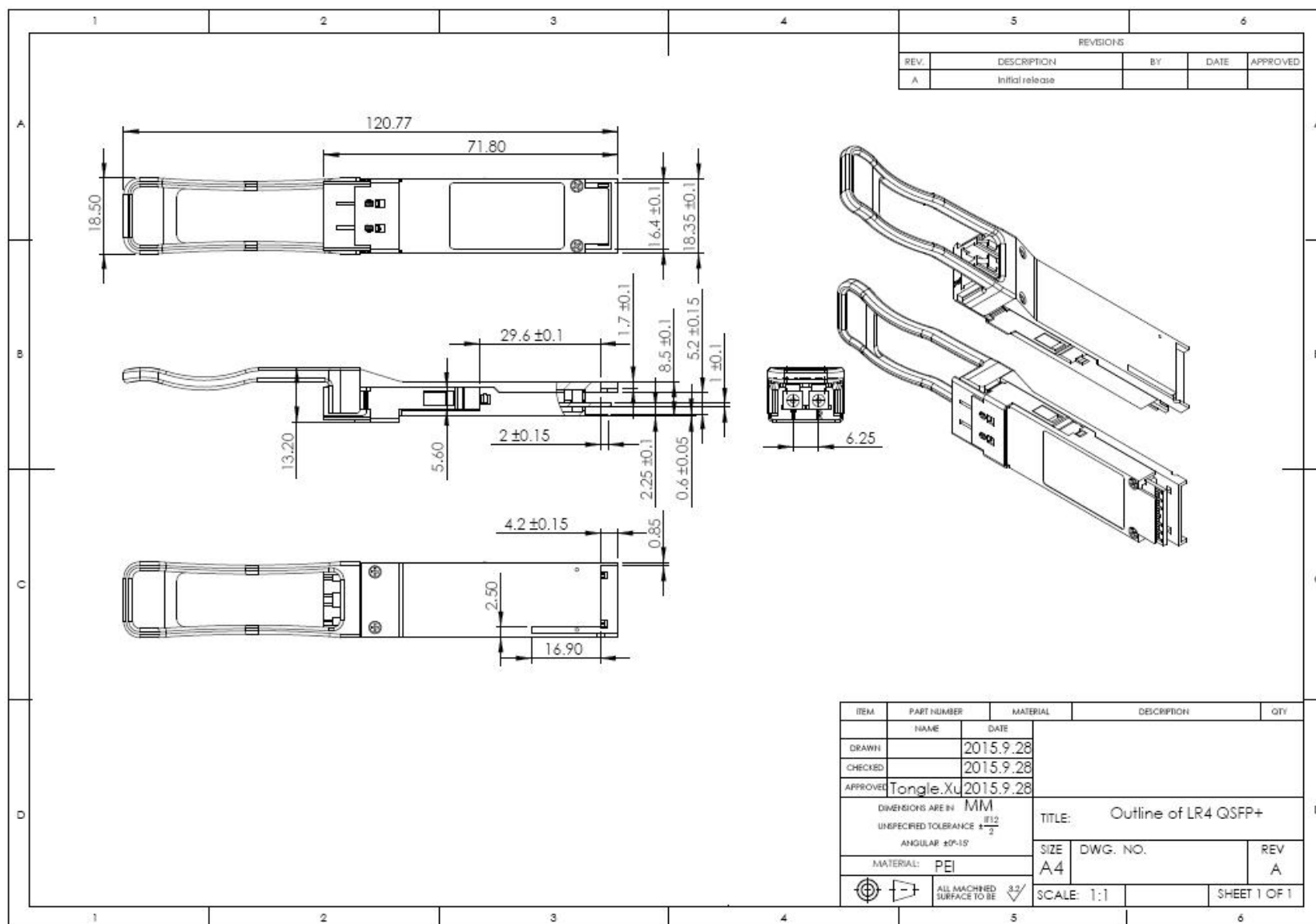
Test Center

Only when quality and 100% compatibility is verified and proved do our modules enter the market. This depends on Fiberstore test center which is supported by a variety of mainstream original brand switches and professional staff. We are proud of this test center and believe all of these devices worth the investments, because it brings the best to our customers.

The original switches could be found nowhere but at Fiberstore's test center, eg: Juniper MX960 & EX 4300 series, Cisco Nexus 9396PX & Cisco ASR 9000 Series, HP 5900 Series & HP 5406R ZL2 V3(J9996A), Arista 7050S-64, Brocade ICX7750-26Q & ICX6610-48, Avaya VSP 7000 MDA 2, etc.

Cisco ASR 9000 Series(A9K-MPA-1X40GE)

ARISTA 7050S-64(DCS-7050S-64)

Juniper MX960

Brocade ICX 7750-26Q

Extreme Networks X670V VIM-40G4X

Mellanox M3601Q

Dell N4032F

HP 5406R ZL2 V3(J9996A)


AVAYA 7024XLS(7002QQ-MDA)

Test Assured Program

Fiberstore truly understands the value of compatibility and interoperability to each optics. Every module Fiberstore provides must run through programming and an extensive series of platform diagnostic tests to prove its performance and compatibility. In our test center, we care of every detail from staff to facilities—professionally trained staff, advanced test facilities and comprehensive original-brand switches, to ensure our customers to receive the optics with superior quality.

Our smart data system allows effective product management and quality control according to the unique serial number, properly tracing the order, shipment and every part.
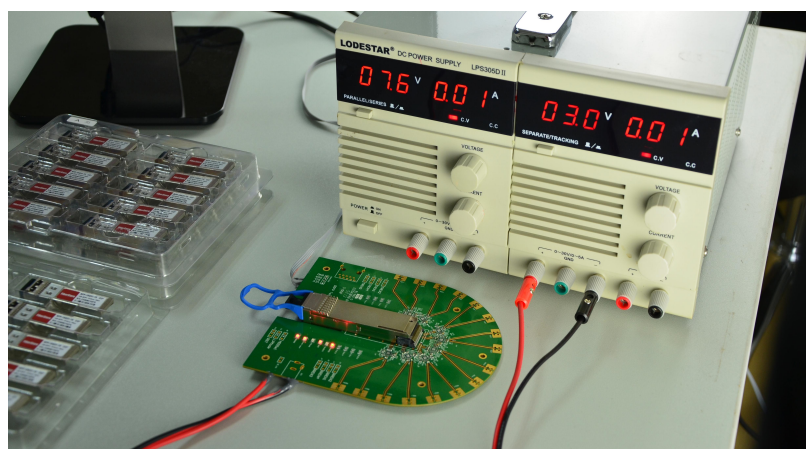
Our in-house coding facility programs all of our parts to standard OEM specs for compatibility on all major vendors and systems such as Cisco, Juniper, Brocade, HP, Dell, Arista and so on.

With a comprehensive line of original-brand switches, we can recreate an environment and test each optics in practical application to ensure quality and distance.

The last test assured step to ensure our products to be shipped with perfect package.

Datasheet

Order Information

Part Number	Description
QSFP-SR4-40G	40GBASE-SR4 QSFP+ 850nm 150m MTP/MPO Transceiver for MMF
QSFP-CSR4-40G	40GBASE-CSR4 QSFP+ 850nm 400m MTP/MPO Transceiver for MMF
QSFP-PIR4-40G	40GBASE-PLRL4 QSFP+ 1310nm 1.4km MTP/MPO Transceiver for SMF
QSFP-LX4-40G	40GBASE-UNIV QSFP+ 1310nm 2km LC Transceiver for SMF&MMF
QSFP-IR4-40G	40GBASE-LR4L QSFP+ 1310nm 2km LC Transceiver for SMF
QSFP-LR4-40G	40GBASE-LR4 and OTU3 QSFP+ 1310nm 10km LC Transceiver for SMF
QSFP-PLR4-40G	40GBASE-PLR4 QSFP+ 1310nm 10km MTP/MPO Transceiver for SMF
QSFP-ER4-40G	40GBASE-ER4 and OTU3 QSFP+ 1310nm 40km LC Transceiver for SMF
QSFP-BD-40G	40GBASE-SR Bi-Directional QSFP LC Duplex Transceiver for MMF

Note:
Every transceiver is individually tested on corresponding equipment, walks through the testing challenges and 100% compatible with Cisco, Arista, Juniper, Dell, Brocade and other brands.

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