QSFP-LR4-100G Datasheet (Ethernet)

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Application

• 100GBASE-LR4 100G Ethernet

Features

• Hot Pluggable QSFP28 form factor

• Supports 103.1Gb/s aggregate bit rate

• Compliant with lEEE802.3 100GBASE-LR4

• Maximum link length of 10km on Single Mode Fiber (SMF)

• Single 3.3V power supply

• Maximum power consumption 3.5W

• LAN WDM DML laser and PIN Receiver Array

• QSFP28 MSA package with duplex LC connector

• Commercial operating case temperature range: 0°C to 70°

• RoHS-6 compliant

• Class 1 Laser

Product Specifications

I. Absolute Maximum Ratings

Parameter	Symbol	Unit	Min	Type	Max	Notes
Storage Temperature Range	T_S	°C	-40		85	
Operating Case Temperature	T_{op}	°C	0		70	
Supply Voltage	V_{CC}	V	-0.5		3.6	
Relative Humidity (non-condensing)	RH	%	0		85	
Damage Threshold, each Lane	TH_d	dBm	5.5			

II. Recommended Operating Conditions

Parameter	Symbol	Unit	Min	Type	Max	Notes
Case Temperature Operating	T_{OPR}	°C	0		70	
Supply Voltage	V_{CC}	V	3.135	3.3	3.465	
Data Rate per Lane		Gb/s	25.78		27.95	
Control Input Voltage High		V	2		V_{CC}	
Control Input Voltage Low		V	0		0.8	
Link Distance with G.652	D		2		10000	

III. Optical Specifications

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- **Transmitter**

Parameter	Symbol	Unit	Min	Type	Max	Notes
Signaling Speed per Channel		Gbps		25.78125		
Wavelength L0	λ_{C0}	nm	1294.53		1296.59	
Wavelength L1	λ_{C1}	nm	1299.02		1301.09	
Wavelength L2	λ_{C2}	nm	1303.54		1305.63	
Wavelength L3	λ_{C3}	nm	1308.09		1310. 19	
Side-mode Suppression Ratio	SMSR	dB	30			
Total Average Optical Launch Power	P_T	dBm			10.5	
Average Launch Power Tx_Off (each Lane)	P_{AVG}	dBm	-4.3		4.5	
Optical Modulation Amplitude (each Lane)	P_{OMA}	dBm	- 1.3		4.5	
Difference in Launch Power Between Any Two Lanes (OMA)	$P_{tx.diff}$	dB			5	
Launch Power in OMA Minus TDP (each Lane)		dBm	-2.3			
TDP, each Lane	TDP	dB			2.2	
Extinction Ratio	ER	dB	4			
$RIN_{20}OMA$	RIN	dB/Hz			-130	
Optical Return Loss Tolerance	TOL	Gbps		25.78125		
Transmitter Reflectance	Rr	dB			-12	
Eye Mask {X1, X2, X3,Y1,Y2,Y3}			{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}			1
Average Launch Power OFF Transmitter, each Lane	Poff	dBm			-30	

- **Receiver**

Parameter	Symbol	Unit	Min	Type	Max	Notes
Signaling Speed per Channel		Gbps		25.78125		
Wavelength L0	λ_{C0}	nm	1294.53		1296.59	
Wavelength L1	λ_{C1}	nm	1299.02		1301.09	
Wavelength L2	λ_{C2}	nm	1303.54		1305.63	
Wavelength L3	λ_{C3}	nm	1308.09		1310. 19	
Total Average Receive Power		dBm			10.5	
Average Receive Power, each Lane		dBm	-10.6		4.5	

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Receive Power (OMA), each Lane		dBm			4.5	
Receiver Sensitivity (OMA), each Lane	SEN	dBm			-8.6	2
Stressed Receiver Sensitivity (OMA), each Lane		dBm			-6.8	
Difference in Receive Power between any Two Lanes (OMA)	$P_{rx.diff}$	dB			5.5	
LOS Assert	LOSA	dBm	-25			
LOS De-assert	LOSD	dBm			-13	
LOS Hysteresis	LOSH	dB	0.5		6	

ⓘ **Notes:** 1.Compliant to IEEE 802.3ba.

2. Measured with conformance test signal at receiver input for BER= $1x10^{-12}$.

IV. Electrical Characteristics

Parameter	Symbol	Unit	Min	Type	Max	Notes
Power Consumption		W			3.5	
Supply Current	I_{CC}	A			1.12	

- **Transmitter**

Parameter	Symbol	Unit	Min	Type	Max	Notes
Differential Input Voltage Swing	$V_{IN, PP}$	mVpp			900	
Differential Input Impedance	Z_{IN}	Ohm	90	100	110	

- **Receiver**

Parameter	Symbol	Unit	Min	Type	Max	Notes
Differential Output Voltage Swing	$V_{OUT, PP}$	mVpp	100		400	1
			300		600	
			400		800	
			600		1200	
Differential Output Impedance	Z_{OUT}	Ohm	90	100	110	

ⓘ **Notes: Output voltage is settable in 4 discrete ranges via I2C. Default rangeis 400-800 mV.**

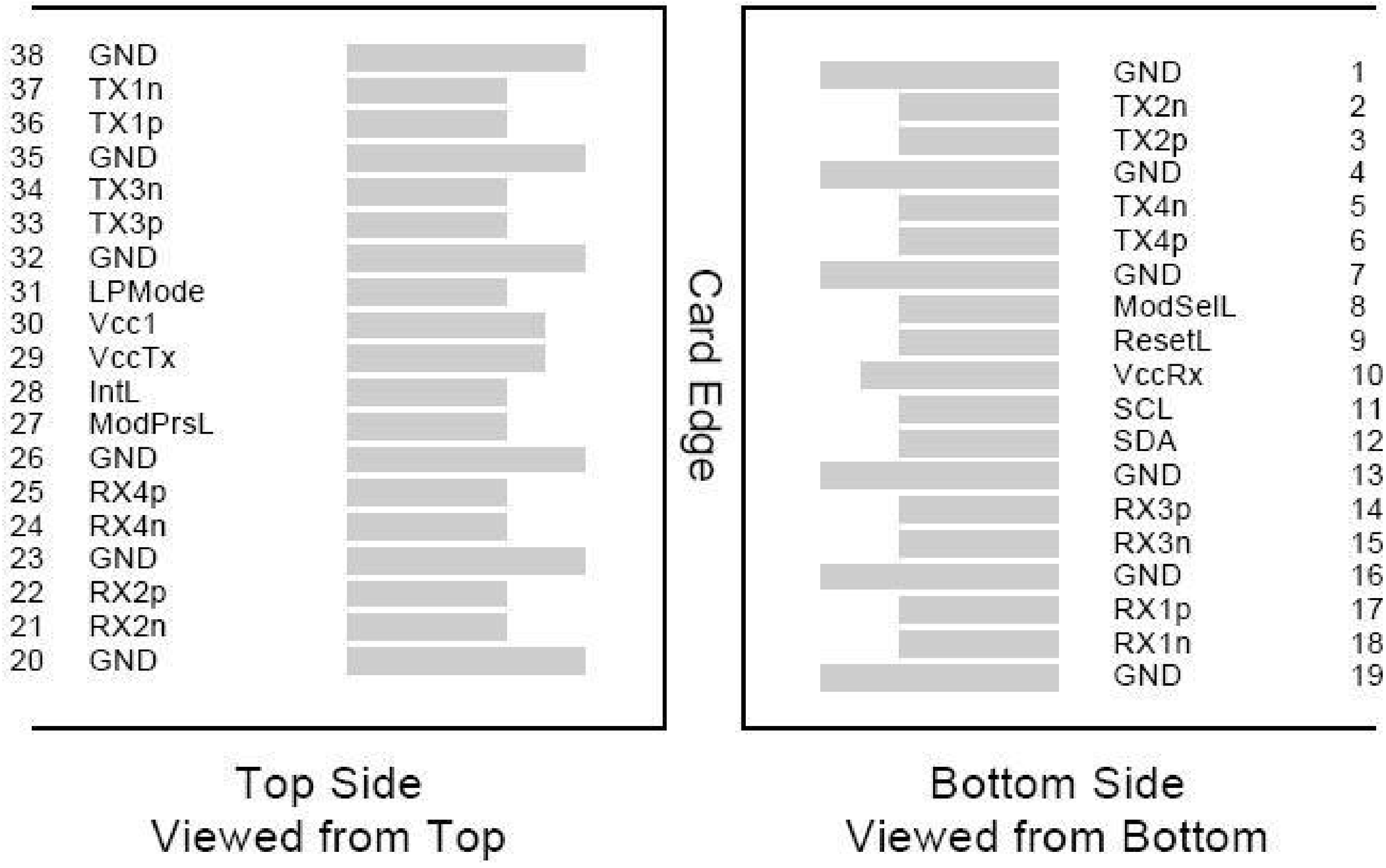
V. Digital Diagnostic Functions

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.

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Temperature Monitor Absolute Error	DMI_Temp	-3		3	℃	Over operating temperature range
Supply Voltage Monitor Absolute Error	DMI_VCC	-3%		+3%	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	

VI. Pin Definitions



Pin	Logic	Symbol	Description	Plug Sequence	Notes
1		GND	Ground		1
2		Tx2n	Transmitter Inverted Data Input		
3		Tx2p	Transmitter Non-Inverted Data Input		
4		GND	Ground		1
5		Tx4n	Transmitter Inverted Data Inputt		

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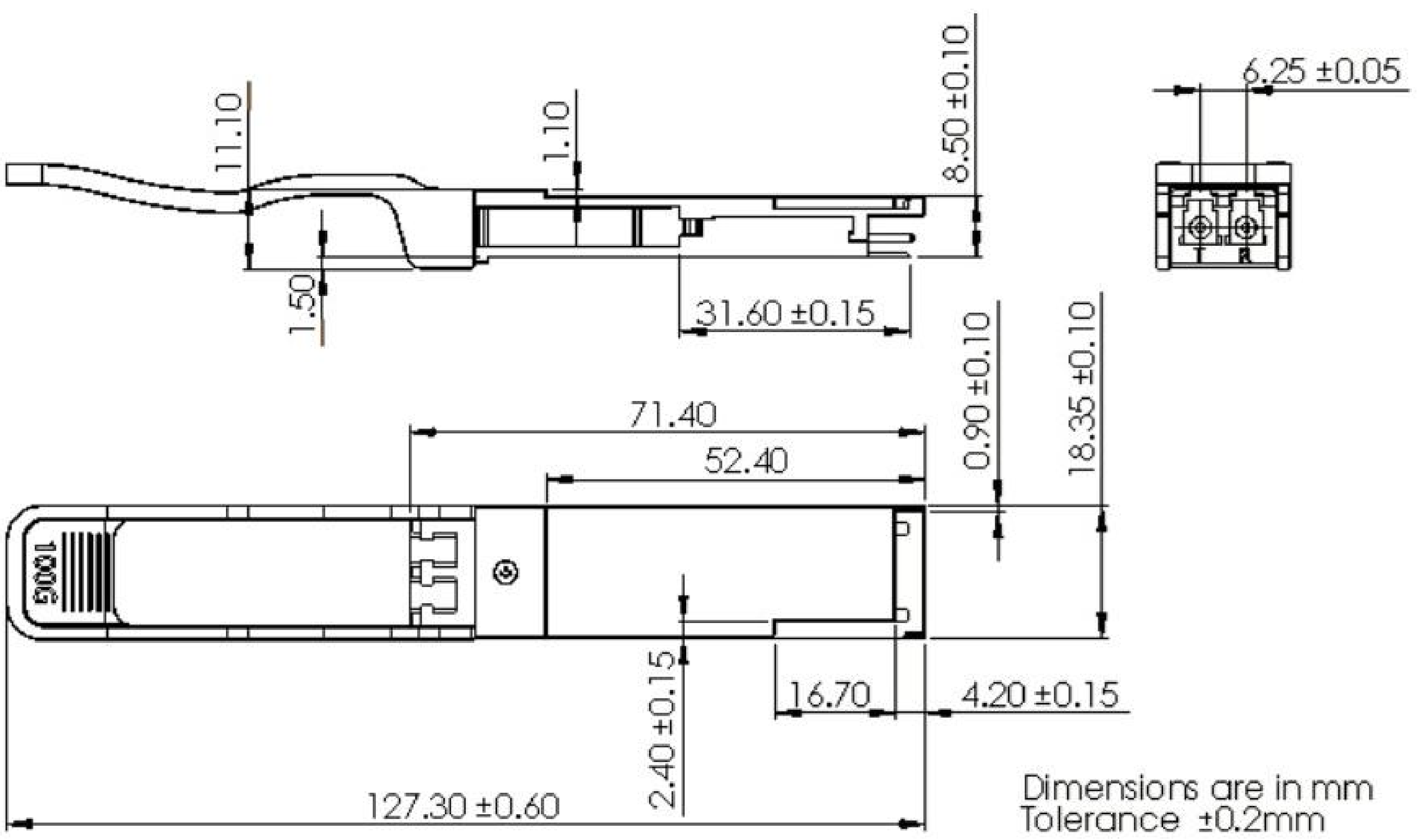
6		Tx4p	Transmitter Non-Inverted Data Input		
7		GND	Ground		1
8		ModSelL	Module Select		
9		ResetL	Module Reset		
10		VccRx	+3.3V Power Supply Receiver		2
11		SCL	2-Wire Serial Interface Clock		
12		SDA	2-Wire Serial Interface Data		
13		GND	Ground		
14		Rx3p	Receiver Non-Inverted Data Output		
15		Rx3n	Receiver Inverted Data Output		
16		GND	Ground		1
17		Rx1p	Receiver Non-Inverted Data Output		
18		Rx1n	Receiver Inverted Data Output		
19		GND	Ground		1
20		GND	Ground		1
21		Rx2n	Receiver Inverted Data Output		
22		Rx2p	Receiver Non-Inverted Data Output		
23		GND	Ground		1
24		Rx4n	Receiver Inverted Data Output		
25		Rx4p	Receiver Non-Inverted Data Output		
26		GND	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		LPMode	Low Power Mode		
32		GND	Ground		1
33		Tx3p	Transmitter Non-Inverted Data Input		
34		Tx3n	Transmitter Inverted Data Input		
35		GND	Ground		1
36		Tx1p	Transmitter Non-Inverted Data Input		
37		Tx1n	Transmitter Inverted Data Input		
38		GND	Ground		1

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> ⓘ **Notes:**
>
> 1.GND is the symbol for signal and supply (power)common for QSFP28 modules. All are common within the QSFP28 module and all module voltages are referencedto 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. Vcc Rx,Vcc1 and Vcc Tx maybe internally connected within the QSFP28 transceiver module in any combination. The connector pins are each rated for a maximum current of 1000mA.

VII. Mechanical Specifications

The mechanical specifications are compliant to the QSFP+MSA transceiver module specifications.



Regulatory and Standards Compliance

Standard

1. SFF-8665: QSFP28+ 28 Gb/s 4X Pluggable Transceiver Solution (QSFP28)
2. SFF-8636: Common Management Interface
3. 802.3™-2012 IEEE Standard for Ethernet
4. IEEE 802.3ba Amendment of IEEE Std 802.3
5. IEEE 802.3bm Amendment of IEEE Std 802.3
6. GR-20-CORE: Generic Requirements for Optical Fiber and Optical Fiber Cable
7. GR-326-CORE: Generic Requirements for Single-Mode Optical Connectors and Jumper Assemblies
8. GR-468-CORE: Generic Requirements for Optoelectronic Devices Used in TelecommunicationsEquipmet
9. GR-1435-CORE: Generic Requirements for Multifiber Optical Connectors
10. RoHS 6

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Safety Instructions

Safety

1. Modules are compliant with Laser Class 1 as defined in IEC 60825-1, IEC 60825-2 and Comply with 21CFR 1040.10 and 1040.11
2. http://www.qsfp-dd.com/specification/ (QDD Power Class)

Table 6- Power Classes

Power Class	Max Power (W)
1	1.5
2	3.5
3	7.0
4	8.0
5	10
6	12
7	14
8	>14

3. https://www.snia.org/technology-communities/sff/specifications?field_doc_status_value=All&combine=8679&items_per_page=20 （QSFP Power Class ）

TABLE 5-3 QSFP+ MODULE POWER CLASSES

Power Class	Maximum power consumption per module (W)
1	1.5
2	2.0
3	2.5
4	3.5
5	4.0
6	4.5
7	5.0
8	10.0 (Note)

4. https://www.snia.org/technology-communities/sff/specifications?field_doc_status_value=All&combine=8431&items_per_page=20

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（SFP Power Class）

Table 4- Power Classification

Power Class	Max Power (W)
1	1.0
2	1.5
3	2.0
4	3.5
5	5.0
6	reserved
7	reserved
8	See management register for maximum power consumption

Test Center

FS.COM transceivers are tested to ensure connectivity and compatibility in our test center before shipped out. FS.COM test center issupported by a variety of mainstream original brand switches and groups of professional staff, helping our customers makethemostefficient use of our products in their systems, network designs and deployments.

The original switches could be found nowhere but at FS.COM 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, AvayaVSP7000MDA 2, etc.

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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)

Order Information

Part Number	Description
QSFP-SL4-100G	QSFP28 100GBASE-SL4 850nm 30m Transceiver, MPO-12/UPC, 20m@OM3/30m@OM4 MMF
QSFP-SR4-100G	QSFP28 100GBASE-SR4 850nm 100m Transceiver, MPO-12/UPC, 70m@OM3/100m@OM4 MMF
QSFP-ESR4-100G	QSFP28 100GBASE-ESR4 850nm 300m Transceiver, MPO-12/UPC, 200m@OM3/300m@OM4 MMF
QSFP-SR1.2-100G	QSFP28 100GBASE-SR1.2 BiDi 850/910nm 100m Transceiver, Duplex LC/UPC, 70m@OM3/100m@OM4/150m@OM5 MMF
QSFP-LX4-100G	QSFP28 100GBASE-LX4 1310nm 2km/100m Transceiver, Duplex LC/UPC, 2km@SMF/100m@OM3 MMF
QSFP-LR4-100G	QSFP28 100GBASE-LR4 1310nm 10km Transceiver, Duplex LC/UPC , 10km@SMF
QSFP-ZR4-100G	QSFP28 100GBASE-ZR4 1310nm 80km Transceiver, Duplex LC/UPC, 80km@SMF
QSFP-EZR4-100G	QSFP28 100GBASE-ZR4 1310nm 100km Transceiver, Duplex LC/UPC, 100km@SMF
QSFP-PLR4L-100G	QSFP28 100GBASE-PLR4L 1310nm 2km Transceiver, MPO-12/APC, 2km@SMF
QSFP-PLR4-100G	QSFP28 100GBASE-PLR4 1310nm 10km Transceiver, MPO-12/APC, 10km@SMF

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QSFP-ELR4-100G	QSFP28 100GBASE-ELR4 1310nm 20km Transceiver, Duplex LC/UPC, 20km@SMF
QSFP-eER4-100G	QSFP28 100GBASE-eER4 1310nm 60km Transceiver, Duplex LC/UPC, 60km@SMF
QSFP-ER4L-100G	QSFP28 100GBASE-ER4L 1310nm 40km Transceiver, Duplex LC/UPC, 40km@SMF
QSFP-PSM4-100G	QSFP28 100GBASE-PSM4 1310nm 500m Transceiver, MPO-12/APC, 500m@SMF
QSFP-CWDM4-100G	QSFP28 100GBASE-CWDM4 1310nm 2km Transceiver, Duplex LC/UPC, 2km@SMF
QSFP-CWDM4-100G-I	QSFP28 100GBASE-CWDM4 1310nm 2km Transceiver (Industrial), Duplex LC/UPC, 2km@SMF
QSFP-LR4-100G-I	QSFP28 100GBASE-LR4 1310nm 10km Transceiver (Industrial), Duplex LC/UPC, 10km@SMF
QSFP-SR4-100G-I	QSFP28 100GBASE-SR4 850nm 100m Transceiver (Industrial), MPO-12/UPC, 70m@OM3/100m@OM4
QSFP-ZR4-100G-I	QSFP28 100GBASE-ZR4 1310nm 80km Transceiver (Industrial), Duplex LC/UPC, 80km@SMF
QSFP-DR-100G	QSFP28 100GBASE-DR Single Lambda 1310nm 500m Transceiver, Duplex LC /UPC, 500m@SMF
QSFP-FR-100G	QSFP28 100GBASE-FR Single Lambda 1310nm 2km Transceiver, Duplex LC /UPC, 2km@SMF
QSFP-LR-100G	QSFP28 100GBASE-LR Single Lambda 1310nm 10km Transceiver, Duplex LC /UPC, 10km@SMF
QSFP-ER-100G	QSFP28 100GBASE-ER Single Lambda 1310nm 40km Transceiver, Duplex LC /UPC, 40km@SMF
QSFP-ERL-100G	QSFP28 100GBASE-ERL Single Lambda 1310nm 25km Transceiver, Duplex LC /UPC, 25km@SMF
QSFP-4W10-100G	QSFP28 100GBASE-4W10 1310nm10km Transceiver, Duplex LC /UPC, 10km@SMF
QSFP-4W20-100G-I	QSFP28 100GBASE-4WDM-20 1310nm 20km Transceiver (Industrial), Duplex LC /UPC, 20km@SMF
QSFP-4W40-100G-E	QSFP28 100GBASE-4WDM-40 1310nm 20km Transceiver (Extended Temp), Duplex LC /UPC, 40km@SMF
QSFP-4W40-100G-I	QSFP28 100GBASE-4WDM-40 1310nm 20km Transceiver (Industrial), Duplex LC /UPC, 40km@SMF
QSFP-BIDI-100G	QSFP28 100GBASE-SR SWDM4 BiDi 850/880/910/940nm 100m Transceiver, Duplex LC/UPC, 75m@OM3/100m@OM4/150m@OM5
QSFP-BX40-100G	QSFP28 100GBASE-BX40-U BiDi 1304.58nm-TX/1309.14nm-RX 40km Transceiver, Simplex LC/UPC, 40km@SMF
QSFP-BX40-100G	QSFP28 100GBASE-BX40-D BiDi 1309.14nm-TX/1304.58nm-RX 40km Transceiver, Simplex LC/UPC, 40km@SMF
QSFP-BX30-100G	QSFP28 100GBASE-BX30-U BiDi 1304.58nm-TX/1309.14nm-RX 30km Transceiver, Simplex LC/UPC, 30km@SMF
QSFP-BX30-100G	QSFP28 100GBASE-BX30-D BiDi 1309.14nm-TX/1304.58nm-RX 30km Transceiver, Simplex LC/UPC, 30km@SMF
QSFP-BX20-100	QSFP28 100GBASE-BX20-U BiDi 1280nm-TX/1310nm-RX 20km Transceiver, Simplex LC/UPC, 20km@SMF
QSFP-BX20-100	QSFP28 100GBASE-BX20-D BiDi 1310nm-TX/1280nm-RX 20km Transceiver, Simplex LC/UPC, 20km@SMF
QSFP-BX10-100-U	QSFP28 100GBASE-BX10-U BiDi 1271nm-TX/1331nm-RX 10km Transceiver, Simplex LC/UPC, 10km@SMF
QSFP-BX10-100-D	QSFP28 100GBASE-BX10-D BiDi 1331nm-TX/1271nm-RX 10km Transceiver, Simplex LC/UPC, 10km@SMF

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