

# QSFP28 100GBASE-LR4 1310nm 10km Transceiver

QSFP28-LR4-100G-LL



## Application

- 100GBASE-LR4 100G Ethernet

## Features

- Hot Pluggable QSFP28 form factor
- Supports 103.1Gb/s aggregate bit rate
- Compliant with IEEE 802.3ba 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° C
- RoHS-6 compliant
- Class 1 Laser

## Product Specifications

### I. Absolute Maximum Ratings

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
Storage Temperature	$T_S$	-40		85	°C	
Operating Case Temperature	$T_{OP}$	0		70	°C	
Power Supply Voltage	$V_{CC}$	-0.5		3.6	V	
Relative Humidity (non-condensation)	RH	0		85	%	
Damage Threshold, each Lane	$TH_d$	5.5			dBm	

### II. Recommended Operating Environment

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
Operating Case Temperature	$T_{OP}$	0		70	°C	
Power Supply Voltage	$V_{CC}$	3.135	3.3	3.465	V	
Data Rate, each Lane		25.78		27.95	Gb/s	
Control Input Voltage High		2		$V_{CC}$	V	
Control Input Voltage Low		0		0.8	V	
Link Distance with G.652	$D$	2		10000	m	

### III. Electrical Characteristics (Defined over the Recommended Operating Environment)

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
Power Consumption				3.5	W	
Supply Current	$I_{CC}$			1.12	A	
<b>Transmitter (each Lane)</b>						
Differential Input Voltage Swing	$V_{in,pp}$			900	mVpp	
Differential Input Impedance	$Z_{in}$	90	100	110	Ohm	

**Receiver (each Lane)**

<b>Differential Output Voltage Swing</b>	$V_{out,pp}$	100	400	mVpp	1
		300	600		
		400	800		
		600	1200		

<b>Differential Output Impedance</b>	$Z_{out}$	90	100	110	Ohm	
--------------------------------------	-----------	----	-----	-----	-----	--

**Notes:**

1. Output voltage is settable in 4 discrete ranges via I2C. Default range is 400 – 800 mV.

**IV. Electrical Characteristics (Defined over the Recommended Operating Environment)**

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
<b>Signaling Speed per Channel</b>			25.78125		Gbps	
<b>Lane Wavelength</b>	L0	1294.53	/	1296.59	nm	
	L1	1299.02	/	1301.09	nm	
	L2	1303.54	/	1305.63	nm	
	L3	1308.09	/	1310.19	nm	
<b>Transmitter</b>						
<b>Side Mode Suppression Ratio</b>	SMSR	30			dB	
<b>Total Average Launch Power</b>	$P_T$			10.5	dBm	
<b>Average Launch Power, each Lane</b>	$P_{AVG}$	-4.3		4.5	dBm	
<b>OMA, each Lane</b>	$P_{OMA}$	-1.3		4.5	dBm	
<b>Difference in Launch Power between any Two Lanes (OMA)</b>	$P_{tx,diff}$			5	dB	
<b>Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP), each Lane</b>		-2.3			dBm	
<b>TDP, each Lane</b>	TDP			2.2	dB	
<b>Extinction Ratio</b>	ER	4			dB	
<b>RIN<sub>20</sub>OMA</b>	RIN			-130	dB/Hz	

<b>Optical Return Loss Tolerance</b>	TOL		25.78125		Gbps	
<b>Transmitter Reflectance</b>	$R_T$			-12	dB	
<b>Eye Mask {X1, X2, X3, Y1, Y2, Y3}</b>			{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}			1
<b>Average Launch Power OFF Transmitter, each Lane</b>	$P_{off}$			-30	dBm	
<b>Receiver</b>						
<b>Signaling Speed per Channel</b>			25.78125		Gbps	
<b>Lane Wavelength</b>	L0	1294.53	/	1296.59	nm	
	L1	1299.02	/	1301.09	nm	
	L2	1303.54	/	1305.63	nm	
	L3	1308.09	/	1310.19	nm	
<b>Total Average Receive Power</b>				10.5	dBm	
<b>Average Receive Power, each Lane</b>		-10.6		4.5	dBm	
<b>Receive Power (OMA), each Lane</b>				4.5	dBm	
<b>Receiver Sensitivity (OMA), each Lane</b>	SEN			-8.6	dBm	2
<b>Stressed Receiver Sensitivity (OMA), each Lane</b>				-6.8	dBm	
<b>Difference in Receive Power between any Two Lanes (OMA)</b>	$P_{rx,diff}$			5.5	dB	
<b>LOS Assert</b>	LOSA	-25			dBm	
<b>LOS De-assert</b>	LOSD			-13	dBm	
<b>LOS Hysteresis</b>	LOSH	0.5		6	dB	

**Notes:**

1. Compliant to IEEE 802.3ba.
2. Measured with conformance test signal at receiver input for BER =  $1 \times 10^{-12}$ .

### V. Digital Diagnostic Functions (Defined over the Recommended Operating Environment)

Parameter	Symbol	Min	Typ.	Max	Unit	Ref.
<b>Temperature Monitor Absolute Error</b>	DMI_Temp	-3		3	°C	Over operating temperature range
<b>Supply Voltage Monitor Absolute Error</b>	DMI_VCC	-3%		+3%	V	Over full operating range
<b>Channel RX Power Monitor Absolute Error</b>	DMI_RX_Ch	-2		2	dB	
<b>Channel Bias Current Monitor</b>	DMI_Ibias_Ch	-10%		10%	mA	Ch1~Ch4
<b>Channel TX Power Monitor Absolute Error</b>	DMI_TX_Ch	-2		2	dB	

### VI. Pin Description

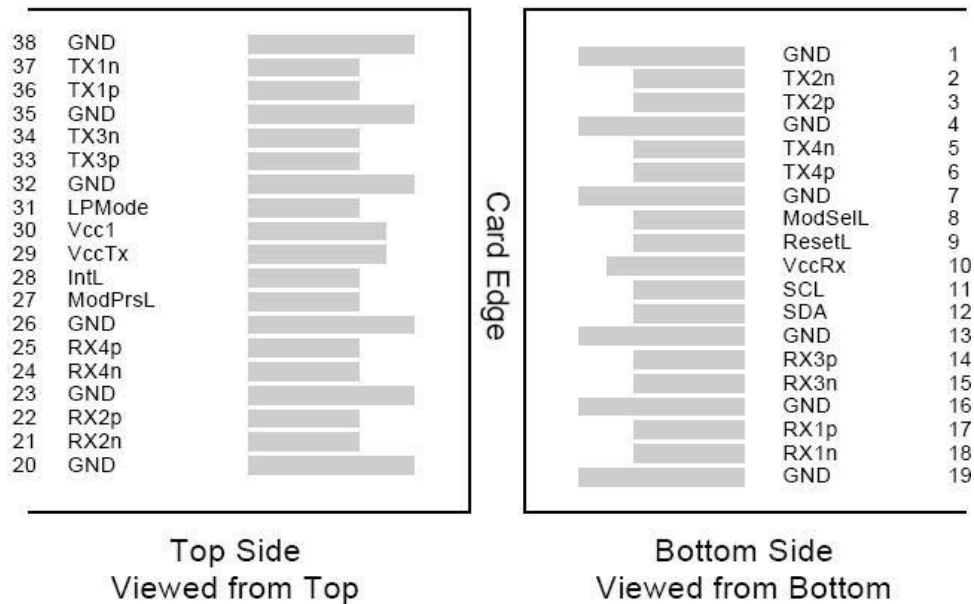


Figure 1 – QSFP+ MSA-Compliant 38-Pin Connector

Pin	Symbol	Name/Description	Ref.
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 Input	
6	Tx4p	Transmitter Non-Inverted Data Input	
7	GND	Ground	1
8	ModSelL	Module Select	
9	ResetL	Module Reset	
10	VccRx	+3.3 V 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	+3.3 V Power Supply Transmitter	2
30	Vcc1	+3.3 V 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

**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 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 receiver and transmitter power suppliers and shall be applied concurrently. Vcc Rx, Vcc1 and Vcc Tx may be internally connected within the QSFP28 transceiver module in any combination. The connector pins are each rated for a maximum current of 1000mA.

