

LQ-SM31100-LR1C

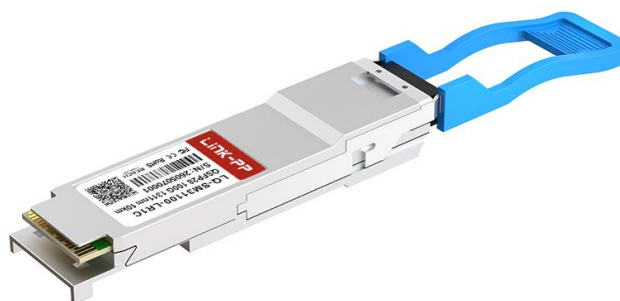
100G QSFP28 LR1 10KM LC Optical Transceiver

Features

- Lane signaling rate 106.25Gb/s with PAM4
- Up to 10km transmission on SMF
- EML Laser and PIN receiver
- 4x25.78Gb/s with NRZ electrical interface (CAUI-4)
- Support KP4 FEC inside the module
- High speed I/O electrical interface
- I2C interface with integrated Digital Diagnostic monitoring
- QSFP28 MSA package with simplex LC connector
- Single +3.3V power supply
- Power consumption <3.5 W
- Operating case temperature: 0 to +70 °C
- Compliant to 802.3cu, SFF-8636&SFF-8679 standard
- Compliant to 100G Lambda MSA 100G-LR1 Optical Specifications
- Complies with EU Directive 2015/863/EU

Applications

- Data Center
- 100G Ethernet



Description

The 100G QSFP28 LR1 is designed for 10km optical communication applications. It is intended for the service with single mode fiber in 100Gb/s high speed data communications. The optical signals are multiplexed to a single-mode fiber through commercial standard LC connector.

Absolute Maximum Ratings

It has to be noted that the operation in excess of any individual absolute maximum ratings might cause permanent damage to this module.

Parameter	Symbol	Min	Max	Units	Notes
Storage Temperature	TS	-40	85	degC	
Operating Case Temperature	TOP	0	70	degC	
Power Supply Voltage	VCC	-0.5	4.0	V	
Relative Humidity (non-condensation)	RH	0	85	%	

Recommended Operating Conditions and Power Supply Requirements

Parameter	Symbol	Min	Typical	Max	Units
Operating Case Temperature	TOP	0		70	degC
Power Supply Voltage	VCC	3.135	3.3	3.465	V
Transmission Distance(SMF)	TD	-		10	km

Electrical Characteristics

The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

Parameter	Symbol	Min	Typical	Max	Units	Notes
Transmitter (Module Input)						
Differential Input Impedance	Zin	90	100	110	Ohm	
Differential Data Input Amplitude	VIN,P-P		-	900	mVpp	
Differential termination mismatch (max)	D-mismatch	-	-	10	%	
DC common-mode input voltage		-0.3	-	2.8	V	
Transition time(20%~80%)	Tr Tf	10	-	-	ps	
LPMODE, Reset and ModSelL / Tx dis	VIL	-0.3	-	0.8	V	
LPMODE, Reset and ModSelL / Tx dis	VIH	2.0	-	VCC+0.3	V	
Receiver (Module Output)						
Output Differential Impedance	Rout	-	100	-	Ohm	
Differential Data Output Amplitude	VOUPT-P	-	-	900	mVpp	

Differential termination mismatch (max)	D-mismatch	-	-	10	%	
Transition time, 20% to 80%	Tr Tf	12	-		ps	
ModPrsL and IntL/ Rx los	VOL	0	-	0.4	V	
ModPrsL and IntL/ Rx los	VOH	VCC-0.5	-	VCC+0.3	V	

Optical Characteristics

QSFP28 100GBASE-LR1						
Parameter	Symbol	Min	Typical	Max	Unit	Notes
Transmitter						
Center Wavelength	λ_C	1304.5	1311	1317.5	nm	
Signaling Rate	SR			53.125	GBd	
Frequency Offset	Foffset	-100		100	ppm	
Average Launch Power	PTX	-1.4	-	4.5	dBm	1
Outer Optical Modulation Amplitude	OMA	0.7	-	4.7	dBm	1
Launch power in OMA minus TDECQ	OMA-TDECQ	-0.7	-	-	dBm	ER $\geq$ 4.5 dB
		-0.6	-	-	dBm	ER<4.5dB
Transmitter and dispersion eye closure for PAM4 (TDECQ) (max)	TDECQ	-	-	3.4	dBm	
Average Output Power (Laser Turn off)	Poff	-	-	-30	dBm	
Side Mode Suppression Ratio	SMSR	30	-	-	dB	
Extinction Ratio	ER	3.5	-	-	dB	
RIN_OMA	RIN	-	-	-136	dB/Hz	
Transmitter reflectance	Tref	-	-	-26	dB	
Optical Return Loss Tolerance	ORLT	-	-	15.6	dB	
Receiver						
Center Wavelength	CW		1311		nm	
Damage threshold	Pdamage	5.5	-	-	dBm	2
Average Rx Power	PRx	-7.7	-	4.5	dBm	3

Receive power _OMAouter	POMA	-	-	4.7	dBm	
Receiver sensitivity _OMAouter for $TDECQ < 1.4$ dB for $1.4 \text{ dB} \leq TDECQ \leq 3.4$ dB	SEN_OMA	-	-	-6.1 -7.5 + TDECQ	dBm	4
Reflectance	Ref	-	-	-26	dB	
Los Assert	LosA	-26	-		dBm	
Los De-Assert	LosDA	-	-	-10	dBm	
Los Hysteresis	LosH	0.5	-	-	dB	
Stressed receiver sensitivity _OMAouter	SRS	-	-	-4.1	dBm	5
Conditions of Stress Receiver Sensitivity Test (Note 5)						
Stressed eye closure for PAM4 (SECQ)				3.4	dB	6
SECQ-10*IgCeq				3.4	dB	6

Notes:

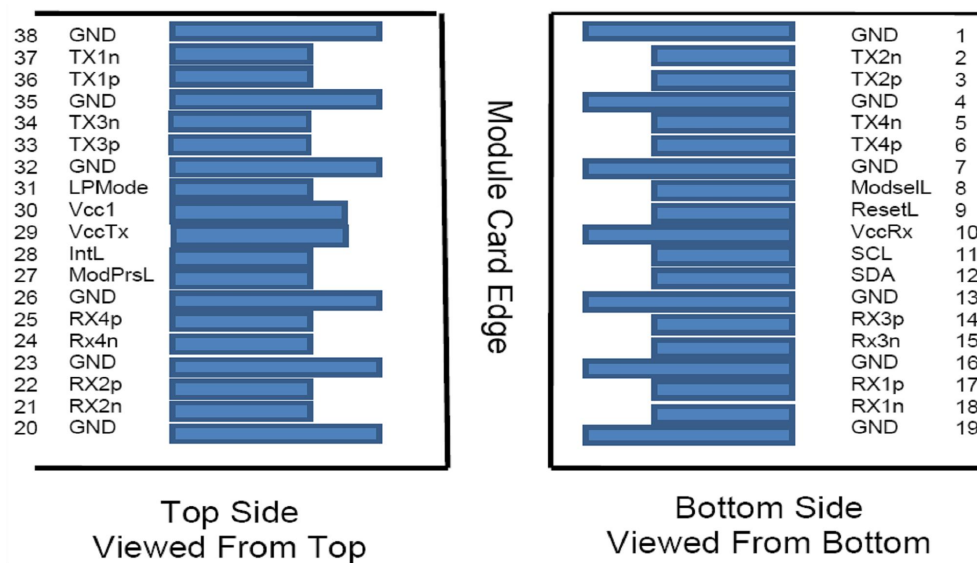
- 1.The optical power is launched into SMF.
- 2.The receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having this average power level. The receiver does not have to operate correctly at this input power.
- 3.Average receive power, each lane (min) is informative and not the principal indicator of signal strength.
- 4.Measured with conformance test signal at TP3 using the test pattern PRBS31Q or scrambled idle for stressed receiver sensitivity for the BER= 2.4×10^{-4} .
- 5.Measured with conformance test signal at TP3 (see3.11) for the BER specified in IEEE Std 802.3cu
- 6.Ceq is a coefficient defined in IEEE Std 802.3-2022 clause 121.8.5.3 which accounts for reference equalizer noise enhancement.

Digital Diagnostic Functions

Parameter	Range	Accuracy	Unit	Calibration
Temperature	0 to 70	±3	°C	Internal
Voltage	0 to Vcc	±3%	V	Internal
Tx Bias Current	0 to 100	±10%	mA	Internal
Tx Output Power	-1.4 to 4.5	±3	dB	Internal
Rx Input Power	-7.7 to 4.5	±3	dB	Internal

QSFP28 Connector and Pinout Description

The electrical interface to the transceiver is a 38 pins 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.



QSFP28-compliant 38-pin connector

PIN	Logic	Symbol	Name/Description	Notes
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	LVC MOS-I/O	SCL	2-Wire Serial Interface Clock	
12	LVC MOS-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	3
29		VccTx	+3.3 V Power Supply transmitter	2
30		Vcc1	+3.3 V Power Supply	2
31	LVTTL-I	LPMODE	Low Power Mode	3

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. GND is the symbol for signal and supply (power) common for the QSFP28 module. All are common within the 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 in Figure 3 below. Vcc Rx, Vcc1 and Vcc Tx may be internally connected within the module in any combination. The connector pins are each rated for a maximum current of 1000mA.
3. Two Multi-Purpose Pin for supporting Tx_DIS and Rx_LOS function in the 100G QSFP28 LR1 module.

Mechanical Specifications

Unit: mm

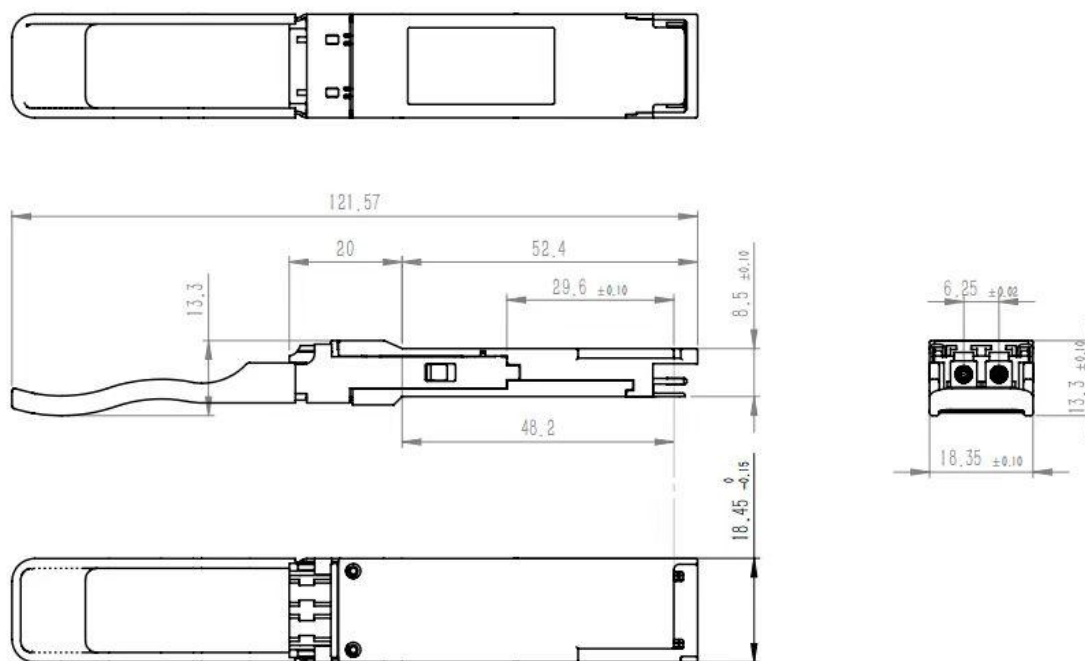


Figure 3. Mechanical Dimensions

Ordering Information

Part Number	Description
LQ-SM31100-LR1C	106.25Gbps, EML, SMF, 1311nm, 10km, QSFP28, 0~70°C, LC, DDM
LQ-SM31100-LR1I	106.25Gbps, EML, SMF, 1311nm, 10km, QSFP28, -40~85°C, LC, DDM