LQ-LW112-LR4C

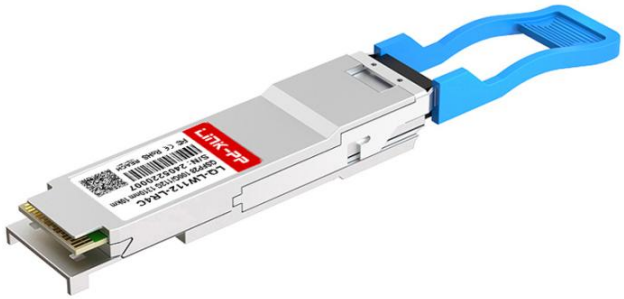
100G QSFP28 LR4

Features

- Compliant with the QSFP28 MSA Technical Specifications.
- Maximum link length of 10km on Single Mode Fiber (SMF).
- Digital diagnostic functions are available via the I2C interface, as specified by SFF-8636.
- High speed electrical signal is compliant with 802.3bm CAUI-4.
- IEEE 802.3-2015 100 GBASE-LR4 Ethernet and OTU4 4I1-9D1F specification compliant
- C-Temp of 0ºC to 70ºC and I-Temp of -40ºC to 85ºC operating case temperature support Low power consumption of max 3.5W for C-Temp, max 4.5W for I-Temp
- Hermetic TOSA with LAN-WDM based DFB 25.78G/s and 27.95G/s data rate support
- Internal CDR circuits on both transmitter and receiver
- 3.3 V power supply only
- RoHS-10 compliant

Applications

- 100GBASE-LR4 Ethernet Links
- Infiniband QDR and DDR interconnects
- Client-side 100G Telecom connections



Description

The 100G QSFP28 LR4 is a fully-integrated 4x 28Gbps optical transceiver module which can support links of up to 10 km.The transmitter consists of 4 channels of cooled DFBs and driver ICs.

The receiver consists of a PIN array and TIA ICs and has CDR circuits (Clock and Data Recovery) on both transmitter and receiver channels. It has 4x 28Gbps optical interfaces for operation over a pair of single mode fibers with duplex LC connectors.

The 100G QSFP28 LR4 contains several variants, includingSingle Rate, Dual Rate, C- Temp and I-Temp, the Single Rate LR4 is compliant with IEEE802.3-2015 100GBASE-LR4

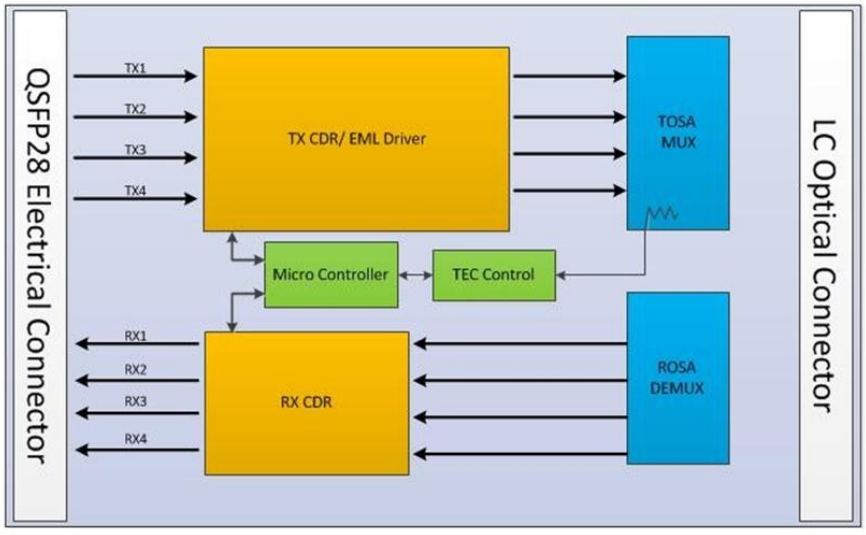
Ethernet specification, the Dual Rate LR4 is compliant with both IEEE 802.3-2015 100GBASE- LR4 Ethernetand OTU4 4I1-9D1F specification, the C-Temp part can work in case temperature at rang of 0ºC to 70ºC, and theI-Temp part can work in case temperature at the rang of -40ºto 85ºC.

Functional Description

The transceiver module receives 4 channels of 25Gb/s electrical data, which are processed by a 4-channel Clock and Data Recovery (CDR) IC that reshapes and reduces the jitter of each electrical signal. Subsequently, each of 4 EML laser driver IC's converts one of the 4 channels of electrical signals to an optical signal that is transmitted from one of the 4 cooled EML lasers which are packaged in the Transmitter Optical Sub-Assembly (TOSA). Each laser launches the optical signal in specific wavelength specified in IEEE802.3ba 100GBASE-LR4 requirements. These 4-lane optical signals will be optically multiplexed into a single fiber by a 4-to-1 optical WDM MUX. The optical output power of each channel is maintained constant by an automatic power control (APC) circuit. The transmitter output can be turned off by TX_DIS hardware signal and/or 2-wire serial interface.

The receiver receives 4-lane LAN WDM optical signals. The optical signals are de-multiplexed by a 1-to-4 optical DEMUX and each of the resulting 4 channels of optical signals is fed into one of the 4 receivers that are packaged into the Receiver Optical Sub-Assembly (ROSA). Each receiver converts the optical signal to an electrical signal. The regenerated electrical signals are retimed and de-jittered and amplified by the RX portion of the 4-channel CDR. The retimed 4-lane output electrical signals are compliant with IEEE CAUI-4 interface requirements. In addition, each received optical signal is monitored by the DOM section. The monitored value is reported through the 2-wire serial interface. If one or more received optical signal is weaker than the threshold level, RX_LOS hardware alarm will be triggered.

A single +3.3V power supply is required to power up this product. Both power supply pins VccTx and VccRx are internally connected and should be applied concurrently. As per MSA specifications the module offers 7 low speed hardware control pins (including the 2-wire serial interface): ModSelL, SCL, SDA, ResetL, LPMode, ModPrsL and IntL.



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	3.6	V	
Relative Humidity (non-condensation)	RH	0	85	%	
Damage Threshold, each Lane	THd	5.5		dBm	

Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Units
Operating Case Temperature	TOP	0		70	degC
Power Supply Voltage	VCC	3.135	3.3	3.465	V
Data Rate, each Lane			25.78125	27.95	Gb/s
Control Input Voltage High		2		Vcc	V
Control Input Voltage Low		0		0.8	V
Link Distance with G.652	D	0.002		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
Power Consumption				4.0	W	
Supply Current	Icc			1.21	A	
Transceiver Power-on Initialization Time				2000	ms	1
Transmitter (each Lane)						
Single-ended Input Voltage Tolerance (Note 2)		-0.3		4.0	V	Referred to TP1 signal common
AC Common Mode Input Voltage Tolerance		15			mV	RMS
Differential Input Voltage Swing Threshold		50			mVpp	LOSA Threshold
Differential Swing Input Voltage	Vin,pp	190		700	mVpp	
Differential Input Impedance	Zin	90	100	110	Ohm	
Receiver (each Lane)						
Single-ended Voltage Output		-0.3		4.0	V	Referred to signal common
AC Common Mode Output Voltage				7.5	mV	RMS
Differential Output Voltage Swing	Vout,pp	300		850	mVpp	
Differential Impedance Output	Zout	90	100	110	Ohm	

Notes:
1.Power-on Initialization Time is the time from when the power supply voltages reach and remain above the minimum recommended operating supply voltages to the time when the module is fully functional.
2.The single ended input voltage tolerance is the allowable range of the instantaneous input signals.

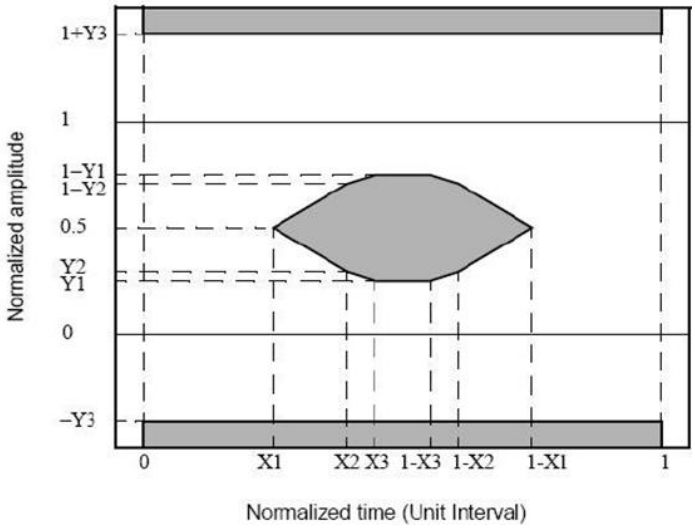
Optical Characteris

QSFP28 100GBASE-LR4						
Parameter	**Symbol**	**Min**	**Typical**	**Max**	**Unit**	**Notes**
Lane Wavelength	L0	1294.53	1295.56	1296.59	nm	
	L1	1299.02	1300.05	1301.09	nm	
	L2	1303.54	1304.58	1305.63	nm	
	L3	1308.09	1309.14	1310.19	nm	
Transmitter						
Side Mode Suppression Ratio	SMSR	30			dB	
Total Average Launch Power	PT			10.5	dBm	
Average Launch Power, each Lane	PAVG	-4.3		4.5	dBm	
OMA, each Lane	POMA	-1.3		4.5	dBm	1
Difference in Launch Power between any Two Lanes (OMA)	Ptx,diff			5	dB	
Launch Power in OMA minus Transmitter and Dispersion		-2.3			dBm	
Penalty (TDP), each Lane						
TDP, each Lane	TDP			2.2	dB	
Extinction Ratio	ER	4			dB	
RIN20OMA	RIN			-130	dB/Hz	
Optical Return Loss Tolerance	TOL			20	dB	
Transmitter Reflectance	RT			-12	dB	
Eye Mask{X1, X2, X3, Y1, Y2, Y3}		{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}				2
Average Launch Power OFF Transmitter, each Lane	Poff			-30	dBm	
Receiver						
Damage Threshold, each Lane	THd	5.5			dBm	3
Total Average Receive Power				10.5	dBm	
Average Receive Power, each Lane		-10.6		4.5	dBm	
Receive Power (OMA), each Lane				4.5	dBm	

Receiver Sensitivity (OMA), each Lane	SEN			-8.6	dBm	
Stressed Receiver Sensitivity (OMA), each Lane				-6.8	dBm	4
Receiver Reflectance	RR			-26	dB	
Difference in Receive Power between any Two Lanes (OMA)	Prx,diff			5.5	dB	
LOS Assert	LOSA		-18		dBm	
LOS Deassert	LOSD		-15		dBm	
LOS Hysteresis	LOSH	0.5			dB	
Receiver Electrical 3 dB upper Cutoff Frequency, each Lane	Fc			31	GHz	
Conditions of Stress Receiver Sensitivity Test (Note 5)						
Vertical Eye Closure Penalty, each Lane			1.8		dB	
Stressed Eye J2 Jitter, each Lane			0.3		UI	
Stressed Eye J9 Jitter, each Lane			0.47		UI	

Notes：

1. Even if the TDP <1 dB, the OMA (min) must exceed this value.
2. Minimum value is informative.
3. Transmitter reflectance is to look into the transmitter.
4. Receiver Sensitivity (OMA) per lane is informative.
5. Measured with conformance test signal at TP3 for 1E-12 BER.
6. Vertical eye closure penalty, stressed eye J2 Jitter, and stressed eye J9 Jitter are test conditions for measuring stressed receiver sensitivity. They are not characteristics of the receiver.



Eye Mask Definition

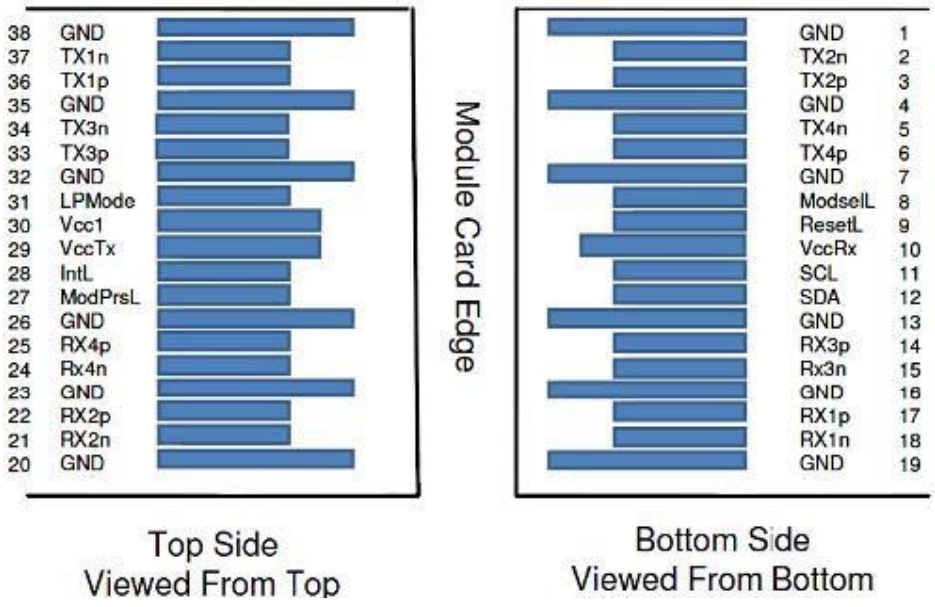
Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the normal operating conditions unless otherwise specified.

Parameter	Symbol	Min	Max	Units	Notes
Temperature monitor absolute error	DMI_Temp	-3	+3	degC	Over operating temperature range
Supply voltage monitor absolute error	DMI _VCC	-0.1	0.1	V	Over full operating range
Channel RX power monitor absolute error	DMI_RX_Ch	-2	2	dB	1
Channel Bias current monitor	DMI_Ibias_Ch	-10%	10%	mA	
Channel TX power monitor absolute error	DMI_TX_Ch	-2	2	dB	1

Notes:
Due to measurement accuracy of different single mode fibers, there could be an additional +/-1 dB fluctuation, or a +/-3 dB total accuracy.

QSFP28 Connector Pin Definition



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	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

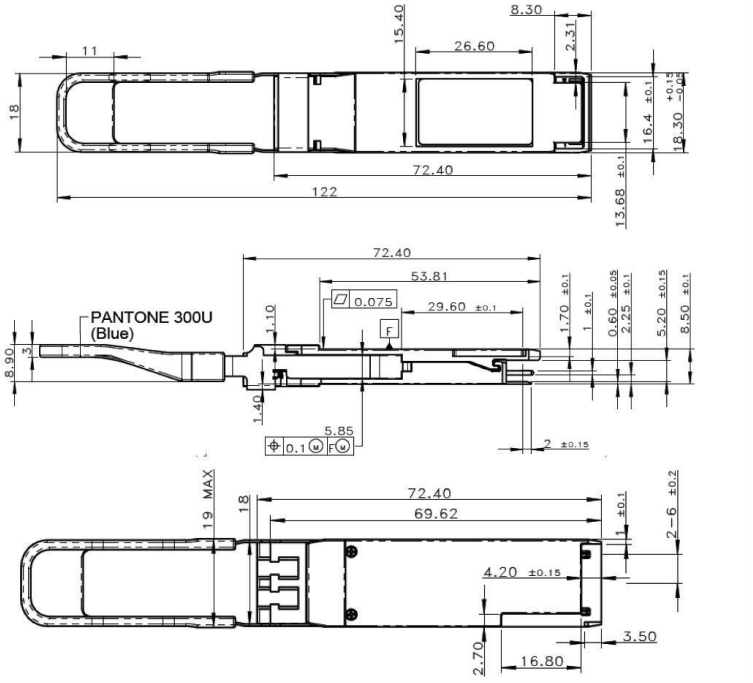
31	LVTTL-I	LPMode	Low Power Mode	
32		GND	Ground	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	
34	CML-I	Tx3n	Transmitter Inverted Data Output	
35		GND	Ground	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	
37	CML-I	Tx1n	Transmitter Inverted Data Output	
38		GND	Ground	1

Notes:

• GND is the symbol for signal and supply (power) common for the QSFP28 module. All are common within the QSFP28 module, and all module voltages are in reference to this potential unless otherwise noted. Connect these directly to the host board signal- common ground plane.

• V_{CC} Rx, V_{CC}1, and V_{CC} Tx are the receiver and transmitter power supplies and should be applied concurrently. Requirements defined for the host side of the Host Edge Card Connector are listed in Table. Recommended host board power supply filtering is shown in Figure. V_{CC} Rx, V_{CC}1, and V_{CC} Tx may be internally connected within the QSFP28 module in any combination. The connector pins are each rated for a maximum current of 500 mA.

Mechanical Drawing and Dimensions



Ordering Information

Part Number	Description
LQ-LW112-LR4C	100G/112G, SMF, LWDM, 10km, QSFP28, LC, 0~70℃,DDM
LQ-LW112-LR4I	100G/112G, SMF, LWDM, 10km, QSFP28, LC, -40~85℃,DDM