CL-Q28-ER4
100G QSFP28 Optical Transceiver Module
RoHS 6 compliant

Features

- Hotpluggable QSFP28 MSA form factor
- Compliantto Ethernet 100GBASE-ER4Lite
- Supports 103.1Gb/saggregatebitrate
- Up to 30km reach for G.652 SMF without FEC
- Up to 40km reach for G.652 SMF with FEC
- Single+3.3Vpowersupply
- Operatingcasetemperature: -5~70oC
- Transmitter: cooled 4x25Gb/s LAN WDM EML
- TOSA (1295.56, 1300.05, 1304.58, 1309.14nm)
- Receiver: 4x25Gb/s APD ROSA
- 4x25G electrical interface (OIF CEI-28G-VSR)
- Maximum power consumption 4.5W
- Duplex LC receptacle

Applications

- 100GBASE-ER4 Ethernet Links
- Infiniband QDR and DDR interconnects
- Client-side 100G Telecom connections

PART NUMBER	Monitor	INPUT/OUTPUT	SIGNAL DETECT	TEMPERATURE
CL-Q28-ER4	X	AC/AC	TTL	-5°C to 70 °C
CL-Q28-ER4i	X	AC/AC	TTL	-40°C to 85 °C

Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Units	Notes
Storage Temperature	TS	-40	85	degC	
Operating Case Temperature	TOP	-5	70	degC	
Power Supply Voltage	VCC	-0.5	3.6	V	
Relative Humidity (non-condensation)	RH	0	85	%	
Damage Threshold, each Lane	THd	-3.0		dBm	

Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Units	Notes
Operating Case Temperature	T_{OP}	-5		70	degC	
Power Supply Voltage	V_{CC}	3.135	3.3	3.465	V	
Data Rate, each Lane			25.78125		Gb/s	
Data Rate Accuracy		-100		100	ppm	
Control Input Voltage High		2		Vcc	V	
Control Input Voltage Low		0		0.8	V	
Link Distance with G.652 (without FEC)	D1			30	km	1
Link Distance with G.652 (with FEC)	D2			40	km	1

Notes:
1. Depending on actual fiber loss/km (link distance specified is for fiber insertion loss of 0.4dB/km)

Electrical Characteristics

Parameter	Test Point	Min	Typical	Max	Units	Notes
Power Consumption				4.5	W	
Supply Current	Icc			1.36	A	
Transmitter (each Lane)						
Overload Differential Voltage pk-pk	TP1a	900			mV	
Common Mode Voltage (Vcm)	TP1	-350		2850	mV	1
Differential Termination Resistance Mismatch	TP1			10	%	At 1MHz

Differential Return Loss (SDD11)	TP1			See CEI-28G-VSR Equation 13-19	dB	
Common Mode to Differential conversion and Differential to Common Mode conversion (SDC11, SCD11)	TP1			See CEI-28G-VSR Equation 13-20	dB	
Stressed Input Test	TP1a	See CEI-28G-VSR Section 13.3.11.2.1				
Receiver (each Lane)						
Differential Voltage, pk-pk	TP4			900	mV	
Common Mode Voltage (Vcm)	TP4	-350		2850	mV	1
Common Mode Noise, RMS	TP4			17.5	mV	
Differential Termination Resistance Mismatch	TP4			10	%	At 1MHz
Differential Return Loss (SDD22)	TP4			See CEI-28G-VSR Equation 13-19	dB	
Common Mode to Differential conversion and Differential to Common Mode conversion (SDC22, SCD22)	TP4			See CEI-28G-VSR Equation 13-21	dB	
Common Mode Return Loss (SCC22)	TP4			-2	dB	2
Transition Time, 20 to 80%	TP4	9.5			ps	
Vertical Eye Closure (VEC)	TP4			5.5	dB	
Eye Width at 10^{-15} probability (EW15)	TP4	0.57			UI	

Eye Height at 10^{-15} probability (EH15)	TP4	228			mV	

Notes:
2. Vcm is generated by the host. Specification includes effects of ground offset voltage.
3. From 250MHz to 30GHz.

Optical Characteristics

QSFP28 100GBASE-ER4 Lite						
Parameter	**Symbol**	**Min**	**Typical**	**Max**	**Units**	**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						
SMSR	SMSR	30			dB	
Total Average Launch Power	P_T			10.5	dBm	
Average Launch Power, each Lane	P_{AVG}	-2.9		4.5	dBm	1
OMA, each Lane	P_{OMA}	0.1		4.5	dBm	2
Difference in Launch Power between any Two Lanes (OMA)	Ptx,diff			3.6	dB	
Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP), each Lane		-0.65			dBm	
TDP, each Lane	TDP			2.5	dB	
Extinction Ratio	ER	7			dB	
$RIN_{20}OMA$	RIN			-130	dB/Hz	
Optical Return Loss Tolerance	TOL			20	dB	
Transmitter Reflectance	R_T			-12	dB	
Average Launch Power OFF Transmitter, each Lane	Poff			-30	dBm	

Eye Mask{X1, X2, X3, Y1, Y2, Y3}		{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}				
Receiver						
Damage Threshold, each Lane	TH_d	-3.0			dBm	3
Average Receive Power, each Lane		-16.9		-4.9	dBm	for 30km Link Distance
Average Receive Power, each Lane		-20.9		-4.9	dBm	for 40km Link Distance
Receive Power (OMA), each Lane				-1.9	dBm	
Receiver Sensitivity (OMA), each Lane	SEN1			-14.65	dBm	for BER = $1x10^{-12}$
Stressed Receiver Sensitivity (OMA), each Lane				-12.65	dBm	for BER = $1x10^{-12}$
Receiver Sensitivity (OMA), each Lane	SEN2			-18.65	dBm	for BER = $5x10^{-5}$
Stressed Receiver Sensitivity (OMA), each Lane				-16.65	dBm	for BER = $5x10^{-5}$
Receiver reflectance				-26	dB	
Difference in Receive Power between any Two Lanes (Average and OMA)	Prx,diff			3.6	dB	
LOS Assert	LOSA		-26		dBm	
LOS Deassert	LOSD		-24		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 4)						
Vertical Eye Closure Penalty, each Lane			1.5		dB	
Stressed Eye J2 Jitter, each Lane			0.3		UI	
Stressed Eye J9 Jitter, each Lane			0.47		UI	

Digital Diagnostic Functions

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:

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

Digital Diagnostic Functions

Carelink CL-Q28-ER4 support the 2-wire serial communication protocol as defined in the QSFP28 MSA. Which allows real-time access to the following operating parameters:

- Transceiver temperature
- Laser bias current
- Transmitted optical power
- Received optical power
- Transceiver supply voltage

It also provides a sophisticated system of alarm and warning flags, which may be used to alert end-users when particular operating parameters are outside of a factory-set normal range.

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller inside the transceiver, which is accessed through the 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL pin) is generated by the host. The positive edge clocks data into the QSFP28 transceiver into those segments of its memory map that are not write-protected. The negative edge clocks data from the QSFP28 transceiver. The serial data signal (SDA pin) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially. The 2-wire serial interface provides sequential or random access to the 8 bit parameters, addressed from 00h to the maximum address of the memory.

This clause defines the Memory Map for QSFP28 transceiver used for serial ID, digital monitoring and

certain control functions. The interface is mandatory for all QSFP28 devices. The memory map has been changed in order to accommodate 4 optical channels and limit the required memory space. The structure of the memory is shown in Figure 2 -QSFP28 Memory Map. 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, e.g. Interrupt Flags and Monitors. Less time critical entries, e.g. serial ID information and threshold settings, are available with the Page Select function. The structure also provides address expansion by adding additional upper pages as needed. For example, in Figure 2 upper pages 01 and 02 are optional. Upper page 01 allows implementation of Application Select Table, and upper page 02 provides user read/write space. The lower page and upper pages 00 and 03 are always implemented. 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

Outline Dimensions