100G CFP2 Optical Transceiver Module, LR4

Features

- Compliant with 100GBase-LR4 and OTU4
- Supports 103.125 to 111.81 Gbps line rates
- Integrated LAN WDM TOSA/ROSA for up to 10 km reach over SMF-28
- Duplex LC optical receptacle
- Operating temperature range of up to –5 to 70°C
- Low power dissipation < 9 W (< 8 W typical)
- RoHS 6/6 compliant
- Single 3.3 V power supply
- No external reference clock
- Fast Tx_DIS deassert time (< 5 ms) for service disruption recovery
- Compliant with CEI-28G-VSR electrical interface
- Real-time digital diagnostic monitoring (DDM) support

Applications

- Local and wide area networks (LAN and WAN)
- Ethernet switches and router applications
- ITU-T OTU4 OTL4.4 applications Compliance
- IEEE 802.3-2012 Clause 88 standard
- MDIO IEEE 802.3-2012 Clause 45 standard
- ITU-T G.959.1-2012-02 OTL4.4 standard
- OIF2010.404.08 CEI-28G-VSR standard
- MSA CFP2 Hardware Specification Rev. 1.0
- CFP MSA Management Interface Specification V2.2 (R06a)
- Class 1 laser safety
- Tested in accordance with Telcordia GR-468

Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
Storage temperature	T_{ST}	–40 to +85	°C
Operating case temperature	T_{OP}	–5 to +70	°C
Relative humidity	RH	5 to 85 (noncondensing)	%
Static electrical discharge (human body model)	ESD	500	V
Power supply voltages	V_{CC}, max	–0.3 to 3.6	V
Receive input optical power (damage threshold)	P_{dmg}	+5.5	dBm

Low-Speed Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Supply Currents and Voltages						
Voltage	V_{CC}	3.135	3.3	3.465	V	With respect to GND
Supply current	I_{CC}			3.75	A	Per MSA MSA CFP2 Hardware Specification Rev. 1.0 Table 4-1 Class 3
Power dissipation	P_{wt}			9.0	W	
Power dissipation (low power mode)	P_{lp}			2.0	W	
Inrush current	I_inrush			100	mA/µs	
Turn-off current	I_turnoff	–100			mA/µs	
Low-Speed Control and Sense Signals, 3.3 V LVCMOS						
Outputs low voltage	V_{OL}			0.2	V	I_{OH} = 100 µA
Output high voltage	V_{OH}	V_{CC} –0.2			V	I_{OH} = –100 µA
Input low voltage	V_{IL}	–0.3		0.8	V	
Input high voltage	V_{IH}	2		V_{CC} + 0.3	V	
Input leakage current	I_{IN}	–10		10	µA	
Low-Speed Control and Sense Signals, 3.3 V LVCMOS						
Outputs low voltage	V_{OL}	–0.3		0.2	V	
Output high voltage	V_{OH}	1.0		1.5	V	
Output low current	I_{OL}	4			mA	
Output high current	I_{OH}			–4	mA	
Input low voltage	V_{IL}	–0.3		0.36	V	
Input high voltage	V_{IH}	0.84		1.5	V	
Input leakage current	I_{IN}	–100		100	µA	
Input capacitance	C			10	pF	
MDC clock rate		0.1		4	MHz	

High-Speed Electrical Specifications

Parameter	Symbol	Min.	Max.	Unit	Notes
Transmitter Electrical Input from Host at TP1a (detailed specification in CEI-28G-VSR)					
Differential voltage pk-pk			900	mV	
Common mode noise (rms)			17.5	mV	
Differential termination mismatch			10	%	
Transition time		10		ps	20/80%
Common mode voltage		–0.3	2.8	V	
Eye width	EW15	0.46		UI	At 10^{-15} probability
Eye height	EH15	100		mV	At 10^{-15} probability
Receiver Electrical Output to Host at TP4 (detailed specification in CEI-28G-VSR)					
Differential voltage pk-pk			900	mV	
Common mode noise (rms)			17.5	mV	
Differential termination mismatch			10	%	
Transition time		9.5		ps	20/80%
Vertical eye closure	VEC		5.5	dB	
Eye width	EW15	0.57		UI	At 10^{-15} probability
Eye height	EH15	228		mV	At 10^{-15} probability

Timing Requirement of Control and Status I/O

Parameter	Symbol	Min.	Max.	Unit	Notes
Minimum pulse width of control pin signal	t_CNTL	100		µs	
Hardware MOD_LOPWR assert	t_MOD_LOPWR_assert		1	ms	
Hardware MOD_LOPWR deassert	t_MOD_LOPWR_deassert		60	s	Stored in NVR register 8072h
RX_LOS assert time	t_loss_assert		100	µs	From occurrence of loss of signal to assertion of RX_LOS
RX_LOS deassert time	t_loss_deassert		100	µs	From occurrence of return of signal to deassert of RX_LOS
GLB_ALRM assert time	GLB_ALRMn_assert		150	ms	A logic "OR" of associated MDIO alarm and status registers
GLB_ALRM deassert time	GLB_ALRMn_deassert		150	ms	A logic "OR" of associated MDIO alarm and status registers
Management interface clock period	t_prd	250		ns	MDC is 4 MHz rate or less
Host MDIO setup time	t_setup	10		ns	
Host MDIO hold time	t_hold	10		ns	
CFP2 MDIO delay time	t_delay	0	175	ns	
Initialization time from reset	t_initialize		2.5	s	
TX_Disable assert time	t_deassert		100	µs	Transmitter disable, application specific
TX_Disable deassert time[1]	t_assert		5	ms	Time from Tx Disable pin deasserted until CFP2 module enters the Tx-turn-on state Stored in NVR register 8073h

Optical Receiver Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Signaling rate, each lane		25.78125 ±100 ppm			GBd	100GBase-LR4
		27.9525 ±20 ppm				OTU4
The following specifications are applicable within the operating case temperature range						
Average receive power, each lane[4]	P_{avg}	–10.6		4.5	dBm	100GBase-LR4
Average receive power, each lane[5]	P_{avg}	–6.9		4	dBm	OTU4 with Tx ER of 4 to 6.5 dB
		–8.8		2.9		OTU4 with Tx ER > 7 dB
Receive power, each lane (OMA)				4.5	dBm	100GBase-LR4
Difference in launch power between any two lanes (OMA)				5.5	dB	100GBase-LR4, OTU4
Receiver Sensitivity (OMA), each lane[4] at BER= $1x10^{-12}$	R_{sen}			–8.6	dBm	100GBase-LR4
Equivalent receiver sensitivity[5] at BER=$1.8x10^{-4}$				–8.4	dBm	OTU4 with Tx ER of 4 to 6.5 dB
				–10.3		OTU4 with Tx ER > 7 dB
Optical path penalty				1.5	dB	OTU4
Stressed receiver sensitivity (OMA), each lane	SRS			–6.8	dBm	100GBase-LR4, at TP3 for BER= $1x10^{-12}$
Stressed receiver sensitivity test conditions						
Vertical eye closure penalty, each lane[6]	VECP		1.8		dB	100GBase-LR4
Stressed sys J2 jitter, each lane[6]	J2		0.3		UI	100GBase-LR4
Stressed sys J9 jitter, each lane[6]	J9		0.47		UI	100GBase-LR4
Receiver reflectance				–26	dB	100GBase-LR4, OTU4
LOS assert[7]	Plos_on			–15	dBm	
LOS hysteresis[7]		0.5		4	dB	

1. Average launch power, each lane (min) is informative for 100GBase-LR4, not the principal indicator of signal strength.
2. Even if the TDP < 1 dB, the OMA (min) must exceed this value.
3. Transmitter reflectance is defined looking into the transmitter.
4. Minimum average receive power and maximum receiver sensitivity (OMA), each lane, is informative for 100GBase-LR4.
5. For OTU4, 4I1-9D1F defines two sets of specification based on two options of transmitter ER. The minimum average receive power represents an Rx_sensitivity (OMA) of –7.5 dBm at worst case ER over all condition with 10 km fiber link at post GFEC of BER $1x10^{-12}$.
The maximum receiver sensitivity is informative and representing Rx_sensitivity (OMA) of –9.05 dBm at worst case ER over all condition at pre-GFEC of BER 1.8×10^{-4}.
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.
7. LOS function is implemented per modulated input signal.

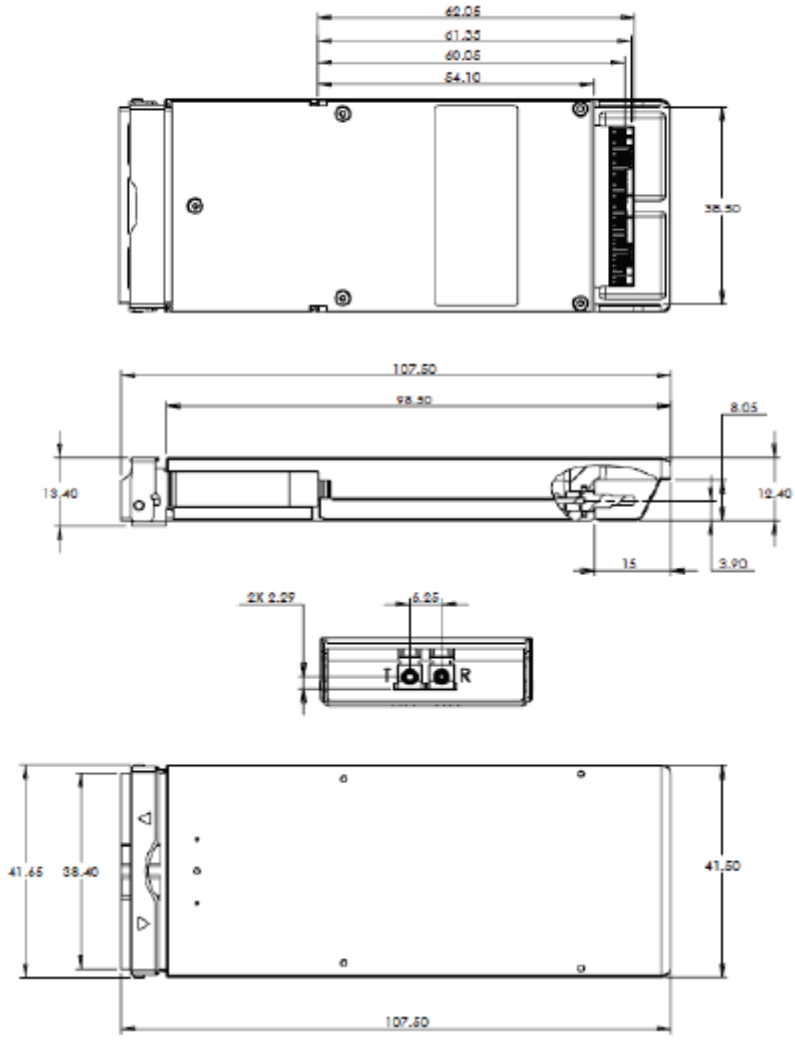
Optical Transmitter Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Signaling rate, each lane		25.78125 ±100 ppm			GBd	100GBase-LR4
		27.9525 ±20 ppm				OTU4
The following specifications are applicable within the operating case temperature range						
Side-mode suppression ratio	SMSR	30			dB	
Total launch power				10.5	dBm	100GBase-LR4
				10.0		OTU4
Average launch power, each lane[1]	P_{avg}	−4.3		4.5	dBm	100GBase-LR4
		−0.6		4.0		OTU4
Extinction ratio	ER	4			dB	100GBase-LR4
		4		6.5		OTU4
Optical modulation amplitude, each lane (OMA)[2]	OMA	−1.3		4.5	dBm	100GBase-LR4
Difference in launch power between any two lanes (OMA)				5	dB	100GBase-LR4, OTU4
Transmitter and dispersion penalty, each lane	TDP			2.2	dB	100GBase-LR4
OMA minus TDP, each lane	OMA-TDP	−2.3			dBm	100GBase-LR4
Average launch power of OFF transmitter, each lane				−30	dBm	100GBase-LR4
Optical return loss tolerance				20	dB	
Relative intensity noise	$RIN_{20}OMA$			−130	dB/Hz	100GBase-LR4
Transmitter reflectance[3]				−12	dB	
Transmitter eye mask {X1, X2, X3, Y1, Y2, Y3}		{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}				100GBase-LR4

CFP2 Lane Assignment

Lane	Center Frequency	Center Wavelength	Wavelength Range
L0	231.4 THz	1295.56 nm	1294.53 to 1296.59 nm
L1	230.6 THz	1300.05 nm	1299.02 to 1301.09 nm
L2	229.8 THz	1304.58 nm	1303.54 to 1305.63 nm
L3	229.0 THz	1309.14 nm	1308.09 to 1310.19 nm

Mechanical Dimensions



Ordering information

Part Number	Product Description
CFP2-LR4-1	CFP2 100G LR4, 100 GE, Single Rate
CFP2-LR4-2	CFP2 100G LR4, 100 GE/OTU4, Dual Rate