Approved Networks
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QSFP28-LR420-OTU4-I

100GBASE, QSFP28, LR4, OTU4, SMF TRANSCEIVER
1295nm, 1300nm, 1304nm, 1309nm, 20km REACH, DUPLEX LC CONNECTOR

Features

- Hot-pluggable QSFP28 form factor
- Supports 103.1Gb/s and 112Gb/s aggregate bit rates
- Power dissipation < 4.5W
- RoHS-6 compliant
- Industrial case temperature range of -40°C to 85°C
- Single 3.3V power supply
- Maximum link length of 10km on Single Mode Fiber (SMF)
- 4x28Gb/s DFB-based LAN-WDM transmitter
- 4x28G retimed electrical interface
- Duplex LC receptacles
- I2C management interface

Applications

- OTN OTU4 4I1-9D1F
- 100G 4WDM applications with FEC
- Outside plant
- Reduced air flow central office

1. Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit
Maximum Supply Voltage	Vcc	-0.5		3.6	V
Storage Temperature	TS	-40		85	°C
Case Operating Temperature	TOP	-40		85	°C
Relative Humidity [1]	RH	15		85	%
Receiver Damage Threshold, per Lane	PRdmg	5.5			dBm

1. Non-condensing.

2. Environmental Specifications

Parameter	Symbol	Min	Typ	Max	Unit
Case Operating Temperature	Top	-40		85	°C
Storage Temperature	Tsto	-40		85	°C

3. Electrical Characteristics

(EOL, TOP = -40 to +85 °C, VCC = 3.135 to 3.465 Volts)

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	Vcc	3.135		3.465	V
Supply Current	Icc			1.6	A
Module total power [1]	P			4.5	W
Transmitter					
Signaling rate per lane		25.78		27.95	Gb/s
Differential data input swing per lane	Vin,pp			900	mV
Differential input return loss (min) at LR4	RLd(f)	9.5 – 0.37f, 0.01≤f<8 4.75 – 7.4log10(f/14), 8 ≤f<19			dB
Differential to common mode input return loss (min) at LR4	RLdc(f)	22-20(f/25.78), 0.01≤f<12.89 15-6(f/25.78), 12.89≤f<19			dB
Differential input return loss (min) at OTU4 2	SDD11	-11, 0.05<f<fb -6.0+9.2log10(2f/fb), fb/7<f<fb			dB
Different to common mode input return loss (min) at OTU4 [2]	SDC11 SCD11	-22+14(f/fb), 0.05<f<fb/2 -18+6f/fb, fb/2<f<fb			dB
Differential termination mismatch				10	%
Stressed input parameters					
Eye width			0.46		UI
Applied pk-pk sinusoidal jitter		Per IEEE 802.3bm Table 88-13			
Eye height			95		mV
DC common mode voltage		-350		2850	mV
Receiver					
Signaling rate per lane		25.78125		27.9525	GBd
Differential data output swing [3]	Vout,pp	100		400	mVpp
		300		600	
		400		800	
		600		1200	
Eye width 4	EW15	0.57			UI
Eye height 4	EH15	228			mV
Vertical eye closure				5.5	dB
Differential output return loss (min) at LR4	RLd(f)	9.5 – 0.37f, 0.01≤f<8 4.75 – 7.4log10(f/14), 8 ≤f<19			dB

Common to differential mode conversion return loss (min) at LR4	RLdc(f)	22-20(f/25.78), 0.01≤f<12.89 15-6(f/25.78), 12.89≤f<19			dB
Differential output return loss (min) at OTU4	SDD22	-11, 0.05<f<fb -6.0+9.2log10(2f/fb), fb/7<f<fb			dB
Common to differential mode conversion return loss (min) at OTU4 [2]	SDC22 SCD22	-25+20(f/fb), 0.05<f<fb/2 -18+6f/fb, fb/2<f<fb			dB
Common mode return loss at OTU4 5	SCC22			-2	dB
Common mode noise, RMS				17.5	mV
Differential termination mismatch				10	%
Transition time, 20% to 80% at LR4	tr tf	12			ps
Transition time, 20% to 80% at OTU4	tr tf	9.5			ps

Notes:
1. Maximum total power value is specified across the full temperature and voltage range. Power consumption ≤ 4.5W when stabilized (both Tx and Rx CDR locked), but may be ≤ 5W during locking acquisition.
2. fb is the data rate per lane in Gb/s
3. Output voltage is settable in 4 discrete ranges via I2C. Default range is 400 – 800 mV.
4. Defined at 10-15 probability.
5. From 250 MHz to 30 GHz.

4. Optical Characteristics

(EOL, TOP = -40 to +85 °C, VCC = 3.135 to 3.465 Volts)

OTU4 4I1-9D1F Operation					
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**
Transmitter					
Signaling Speed per Channel [1]		27.9525± 20 ppm			Gb/s
Channel center wavelengths (range)		1294.53 – 1296.59			nm
		1299.02 – 1301.09			
		1303.54 – 1305.63			
		1308.09 – 1310.19			
Total Average Launch Power	POUT			10	dBm
Average Launch Power per Channel [5]	TXPx	-0.6		4.0	dBm
Optical Channel Extinction Ratio	ER	4.0		6.5	dB
Channel Power Difference	ΔPOUT			5	dB
Optical Return Loss	ORL			20	dB

Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3} [2]		{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}			
Reciever					
Signaling Speed per Channel [3]		27.9525± 20 ppm			GBd
Channel center wavelengths (range)		1294.53 – 1296.59			nm
		1299.02 – 1301.09			
		1303.54 – 1305.63			
		1308.09 – 1310.19			
Average Input Power per Channel [4,5]	RXPx	-6.9		4.0	dBm
Optical Path Penalty	OPP			1.5	dB
Equivalent Sensitivity per Channel [4]	Rxsens			-8.4	dBm
Total Average Input Power	PIN			10.0	dBm
Channel Power Difference	ΔPIN			5.5	dB
LOS De-Assert	LOSD			-11.6	dBm
LOS Assert	LOSA	-24		-13.6	dBm
LOS Hysteresis			1.5		dBm

Notes:
1. Transmitter consists of 4 lasers operating at 27.95Gb/s each.
2. Hit ratio 5x10-5.
3. Receiver consists of 4 photodetectors operating at 27.95Gb/s each.
4. Specified at a BER of 10-6 (pre-FEC), per ITU-T G.sup39.
5. Power value and power accuracy are with all channels on.

100GBASE-LR4 Operation					
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**
Transmitter					
Signaling Speed per Lane 1		25.78125 ± 100 ppm			Gb/s
Lane center wavelengths (range)		1294.53 – 1296.59			
		1299.02 – 1301.09			
		1303.54 – 1305.63			
		1308.09 – 1310.19			
Total Average Launch Power	POUT			10.5	dBm
Transmit OMA per Lane	TxOMA	-1.3		4.5	dBm
Average Launch Power per Lane [2,7]	TXPx	-4.3		4.5	dBm
Optical Extinction Ratio	ER	4			dB
Sidemode Suppression ratio	SSRmin	30			dB
Average launch power of OFF transmitter, per lane				-30	dBm
Relative Intensity Noise	RIN			-130	dB/Hz

Optical Return Loss Tolerance				20	dB
Transmitter Reflectance				-12	dB
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3} [3]		{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}			
Reciever					
Signaling Speed per Lane [4]		25.78125 ± 100 ppm			GBd
Lane center wavelengths (range)		1294.53 – 1296.59			nm
		1299.02 – 1301.09			
		1303.54 – 1305.63			
		1308.09 – 1310.19			
Receive Power (OMA) per Lane	RxOMA			4.5	dBm
Average Receive Power per Lane [5,7]	RXPx	-14.5		4.5	dBm
Unstressed Receiver Sensitivity (OMA) per Lane	Rxsens			-12.5	dBm
Receiver Sensitivity (OMA) per Lane	Rxsens			-8.6	dBm
Return Loss	RL	-26			dB
Stressed Receiver Sensitivity (OMA) per Lane 6,8	SRS			-10	dBm
Receive electrical 3 dB upper cutoff frequency, per lane				31	GHz
LOS De-Assert	LOSD			-13.5	dBm
LOS Assert	LOSA	-24		-14	dBm
LOS Hysteresis			1.5		dBm

Notes:
1. Transmitter consists of 4 lasers operating at 25.78Gb/s each.
2. Minimum value is informative.
3. Hit ratio $5x10^{-5}$.
4. Receiver consists of 4 photodetectors operating at 25.78Gb/s each.
5. Minimum value is informative, equals min TxOMA with infinite ER and max channel insertion loss.
6. SRS is measured with vertical eye closure penalty of 1.8 dB max, J2 of 0.30 UI, and J9 of 0.47 UI.
7. Power value and power accuracy are with all channels on.
8. Measured with 4WDM MSA[7] conformance test signal at TP3 for $5x10^{-5}$ BER.

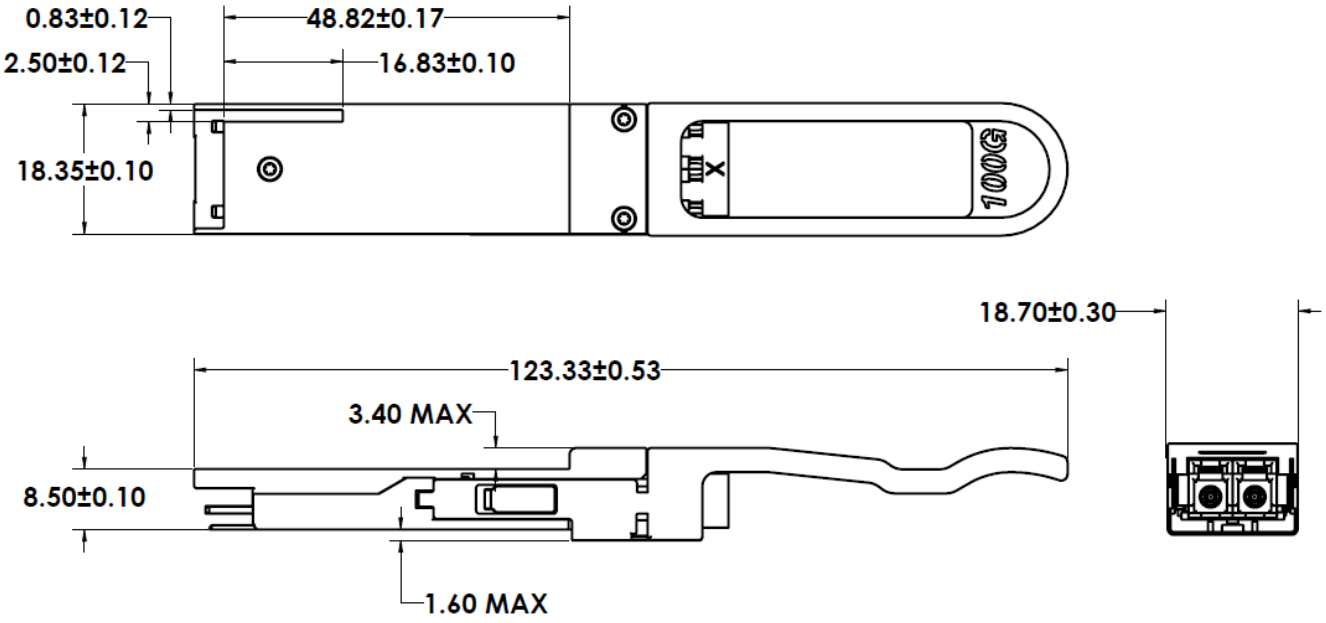
5. General Specifications

Parameter	Symbol	Min	Typ	Max	Unit
Bit Rate (all wavelengths combined) [1]	BR	103.1		112.0	Gb/s
Bit Error Ratio @25.78Gb/s [2]	BER1			10-12	
Bit Error Ratio @27.95Gb/s [3]	BER2			10-6	

Maximum Supported Distances					
Fiber Type					
SMF per G.652		Lmax1			20

Notes:
1. Supports OTU4 4l1-9D1F per ITU-T G.959.1 and 100GBASE-LR4 per IEEE 802.3ba.
2. Tested with a 2^{31} – 1 PRBS.
3. Tested with a 2^{31} – 1 PRBS. Per ITU-T G.959.1 and G.sup39, the BER of 10^{-12} for the OTU4 (112 Gb/s) application code is required to be met only after forward error correction has been applied. ITU-T G.sup39 defines the pre-FEC BER to be met as 10^{-6}. The values for receiver sensitivity and optical path penalty measured at the receiver output at a BER of 10^{-12} after the FEC decoder.

6. Mechanical Diagram



Note: External physical characteristics are subject to variation. This may include, but is not limited to, external case designs, pull tab colors and/or shapes, removal latch styles or colors, and label sizes and placement. These variations do not affect the function or characteristics of the transceivers.

7. Ordering Information

OEM	Part Number	OEM	Part Number
MSA	AN-Q28-LR420-OTU4-I	MSA OnePort	OP-Q28-LR420-OTU4-I

8. Contact Information

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