QSFP28-ZR1S-DCO-CMIS-I

100GBASE, QSFP28, ZR, DCO, SMF TRANSCEIVER
C-BAND TUNABLE, 80km REACH, DUPLEX LC CONNECTOR

Features

- Digital Coherent Optics module, hot-pluggable QSFP28 form factor
- IEEE 100G Ethernet (CAUI-4) or ITU-T 100G OTN (OTL4.4) compliant host interface
- 100G optical coherent interface with DP-DQPSK modulation and Staircase FEC per IEEE Std. 802.3-2022 100GBASE-ZR or ITU-T G.709.2
- Transmission reach:
  - Up to 80km unamplified (loss limited)
  - Up to 120km amplified (dispersion limited, optionally extendable to 300km)
- Full C-band tunable, 50GHz or 100GHz grid with optional FlextuneTM automatic wavelength tuning
- Case temperature range 0°C to 70°C (C-temp) or -40°C to 85°C (I-temp)
- Power dissipation < 5.5W (C-temp) or < 6.0W (I-temp)
- Remote digital diagnostics monitoring
- Supports CMIS host interface

Applications

- Access and aggregation networks
- Cable TV networks
- Wireless front-haul & mid-haul

Absolute Maximum Ratings						
Parameter	**Conditions**	**Symbol**	**Minimum**	**Typical**	**Maximum**	**Unit**
DC supply voltage		Vcc	-0.3		3.6	V
Low speed I/O voltages			-0.3		3.6	V
Storage temperature		Ts	-40		85	°C
Case operating temperature	Central office applications (C-temp)	Top	-5		75	°C
	Outside plant applications (I-temp)		-40		85	
Relative humidity	Non-condensing	RH	5		95	%

Absolute Maximum Ratings							
Parameter	**Conditions**		**Symbol**	**Minimum**	**Typical**	**Maximum**	**Unit**
Rx input power			$P_{RX,IN}$			10	dBm
ESD damage threshold	Human body model (HBM)	DC pins		2000			V
		RF pins		1000			

Environmental Specifications							
Parameter	**Conditions**		**Symbol**	**Minimum**	**Typical**	**Maximum**	**Unit**
Storage temperature			T_S	-40		85	°C
Case operating temperature	Central office applications	Long term	T_{OP}	0		70	°C
	(C-temp)	Short term < 96h		-5		75	
	Outside plant applications	Long term		-20		85	
	(I-temp)	Start-up (Note 1)		-40		85	
Relative humidity	Non-condensing		RH	5		85	%

Note 1:

No optical performance specifications need to be met during start-up at cold, but module will power up and respond to commands.

Electrical Characteristics - Power & Low Speed I/O							
Parameter	**Conditions**	**Symbol**	**Minimum**	**Typical**	**Maximum**	**Unit**	**Notes**
General							
Power supply voltages	Including ripple, droop and noise below 100kHz		3.135	3.300	3.465	V	
Host RMS noise output	10Hz - 10MHz				25	mV	
Module RMS noise output	10Hz - 10MHz				15	mV	
Module supply noise tolerance	10Hz - 10MHz, peak-to-peak	$PSNR_{MOD}$			66	mV	
Module inrush	Instantaneous peak duration	T_{IP}			50	µs	
	Initialization time	T_{INIT}			500	ms	
Low power mode							
Power dissipation		P_{LP}			1.5	W	
Power supply current	Instantaneous peak current	$I_{CC,IP,LP}$			600	mA	
	Sustained peak current	$I_{CC,SP,LP}$			495		
	Steady state current	$I_{CC,LP}$			478		1
High power mode (Central office applications)							
Power dissipation		P_{HP}			5.5	W	
Power supply current	Instantaneous peak current	$I_{CC,IP,HP}$			2200	mA	
	Sustained peak current	$I_{CC,SP,HP}$			1815		
	Steady state current	$I_{CC,HP}$			1754		1
High power mode (Outside plant applications)							
Power dissipation		P_{HP}			6.0	W	
Power supply current	Instantaneous peak current	$I_{CC,IP,HP}$			2400	mA	
	Sustained peak current	$I_{CC,SP,HP}$			1980		
	Steady state current	$I_{CC,HP}$			1914		1
Low speed I/O							
Clock frequency, SCL	Default	f_{SCL}			400	kHz	
	Fast mode+				1000		

Electrical Characteristics - Power & Low Speed I/O								
Parameter	**Conditions**		**Symbol**	**Minimum**	**Typical**	**Maximum**	**Unit**	**Notes**
Output voltage, SCL and SDA	Output low		V_{OL}	0.0		0.4	V	
	Output high		V_{OH}	VCC-0.5		VCC+0.3		
Input voltage, SCL and SDA	Input low		V_{IL}	-0.3		0.3×VCC		
	Input high		V_{IH}	0.7×VCC		VCC+0.5	V	
Capacitance for SCL and SDA I/O signal			C_I			14	pF	
Total bus capacitive load for SCL and SDA	400kHz clock rate	3.0kΩ pull-up resistor, max.	C_B			100	pF	2
		1.6kΩ pull-up resistor, max.				200		
Input voltage / current, LPMode/TxDis, ResetL and ModSelL	Input voltage, low		V_{IL}	-0.3		0.8	V	
	Input voltage, high		V_{IH}	2.0		VCC+0.3		
	Input current, 0V < V_{IN} < V_{CC}		I_{IN}	-365		125	µA	
Output voltage, ModPrsL and IntL/RxLOSL	Output low, IOL = 2mA		V_{OL}	0.0		0.4	V	
	Output high, 10kΩ pull-up resistor to host VCC		V_{OH}	VCC-0.5		VCC+0.3		

Notes:

1. The module will stay within its advertised power class for all supply voltages.
2. For 1000kHz clock rate, refer to Figure 6-4 in [2]

Electrical Characteristics - High Speed Data I/O				
Parameter	**Minimum**	**Typical**	**Maximum**	**Unit**
Transmitter (module input) – CAUI-4				
Signaling rate per lane	Per IEEE Std 802.3 [8], Annex 83E, Table 83E–7			GBd
Differential pk-pk input voltage tolerance				mV
Differential input return loss				dB
Differential to common mode input return loss				dB
Differential termination mismatch				%
Module stressed input test				
Single-ended voltage tolerance range				V
DC common mode voltage				mV
Transmitter (module input) – OTL4.4				
Overload differential voltage pk-pk	Per OIF-CEI-04.0 [14], Clause 13 CEI-28G-VSR, Table 13-2			mV
Common mode voltage				mV
Differential termination resistance mismatch				%
Differential return loss				dB
Differential mode to common mode conversion				dB
Stressed input test				

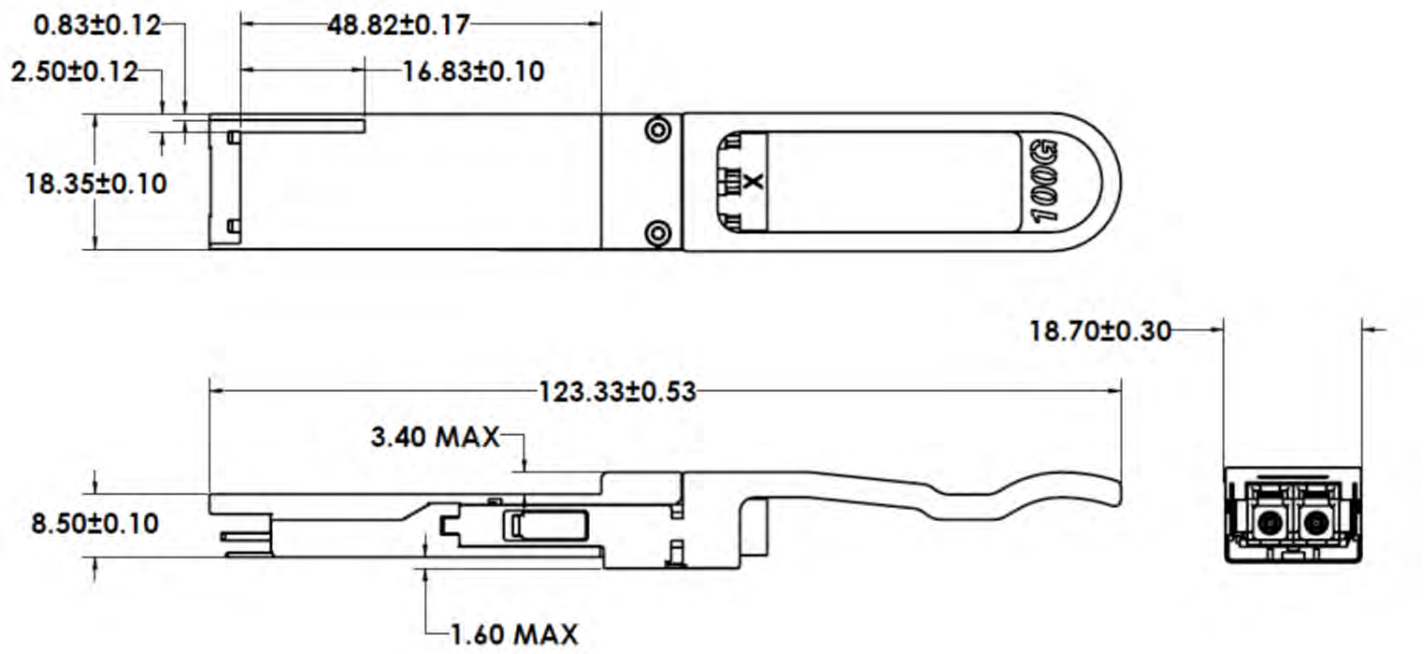
Electrical Characteristics - High Speed Data I/O				
Parameter	**Minimum**	**Typical**	**Maximum**	**Unit**
Receiver (module output) – CAUI-4				
Signaling rate per lane	Per IEEE Std 802.3 [8], Annex 83E, Table 83E–3			GBd
AC common-mode output voltage				mV
Differential peak-to-peak output voltage				mV
Eye width				UI
Eye height, differential				mV
Vertical eye closure				dB
Differential output return loss				dB
Common to differential mode conversion return loss				dB
Differential termination mismatch				%
Transition time				ps
DC common mode voltage				mV
Receiver (module output) – OTL4.4				
Differential voltage, pk-pk	Per OIF-CEI-04.0 [14], Clause 13 CEI-28G-VSR, Table 13-4			mV
Common mode voltage				mV
Common mode noise, RMS				mV
Differential termination resistance mismatch				%
Differential return loss				dB
Common mode to differential mode conversion				dB
Common mode return loss				dB
Transition time				ps
Vertical eye closure				dB
Eye width				UI
Eye height				mV

Optical Characteristics						
Parameter	**Conditions**	**Symbol**	**Minimum**	**Typical**	**Maximum**	**Unit**
General						
Symbol rate		RBAUD		27.95		GBd
Modulation format			DP-DQPSK			
Channel frequency range	100GHz grid	Vc	191.400	193.700	196.100	THz
	50GHz grid		191.350	193.700	196.100	
Channel spacing	100GHz grid	ΔVc		100		GHz
	50GHz grid			50		
Frequency accuracy		δVc	-1.8		1.8	GHz
Laser intrinsic linewidth	Calculated based on FM noise power spectral density (PSD) measurement	LW			500	kHz
Side-mode suppression ratio	No modulation	SMSR	40			dB
Relative intensity noise	Peak over 0.2GHz < f < 10GHz	RIN			-140	dB/Hz
Transmitter						
Tx output power		PTx,out	-8		-4	dBm
Tx output power monitor range		PTx,mon	-10		-2	dBm
Tx output power monitor accuracy	Tx optical power monitor reading relative to actual Tx output power	δPTx,mon	-1.5		1.5	dB

Optical Characteristics							
Parameter	**Conditions**		**Symbol**	**Minimum**	**Typical**	**Maximum**	**Unit**
Tx output power during tuning or when Tx disabled			PTx,dark			-35	dBm
Tx spectral excursion	ITU-T G.698.2 §7.2.3 [11]			-15		15	GHz
Tx output power imbalance between X- and Y-polarizations			ΔPX/Y			1.5	dB
Tx XY skew						6.0	ps
Tx IQ offset						-25	dB
Tx IQ imbalance						1.0	dB
Tx quadrature error				-7.0		7.0	°
Tx IQ skew						1.5	ps
Tx error vector magnitude mask ratio	ITU-T G.698.2 §7.2.12 [11], with 24dB/0.1nm noise loading						
24dB/0.1nm noise loading					23	%	
Tx in-band optical signal to noise ratio	Under modulation, |Δf| < 60 GHz		OSNRin	40			dB/ 0.1nm
Tx out-of-band optical signal to noise ratio	Under modulation, |Δf| > 60 GHz, excl. side mode peaks		OSNRout	35			dB/ 0.1nm
Tx reflectance						-20	dB
Receiver							
Rx total input power	Broadband		PRx,tot	-30		3	dBm
Rx signal input power (amplified)	Full Rx OSNR tolerance		PRx,sig	-18		1	dBm
	Extended range (Note 1)			-22		3	
Rx OSNR tolerance	Back-to-back, PRx,sig > -18dBm	100G DQPSK SC		16.5			dB/ 0.1nm
		100G DQPSK RS		21.5			
CD tolerance	OSNR penalty < 0.5dB					2.4	ns/nm
PMD tolerance	OSNR penalty < 0.5dB					10	ps
DGD tolerance	OSNR penalty < 0.5dB					20	ps
Tolerance to change in SOP	OSNR penalty < 0.5dB					50	krad/s
PDL OSNR penalty	Change in principal state of polarization < 1rad/ms	1dB PDL				0.5	dB/ 0.1nm
		2dB PDL				1.0	
		4dB PDL				3.0	
Rx signal input power transient amplitude	Peak excursion from steady state, transient within Rx signal input power (amplified) range, OSNR penalty < 0.5dB			-3		3	dB
Rx signal input power transient rise/fall time	Rise/fall time for the above peak excursion, OSNR penalty < 0.5dB			100		1	µs
Rx signal input power (unamplified)	OSNR > 35dB/0.1nm	100G DQPSK SC		-30		1	dBm
		100G DQPSK RS		-24			
Rx signal input power monitor range			PRx,mon(s)	-21		3	dBm

Optical Characteristics						
Parameter	**Conditions**	**Symbol**	**Minimum**	**Typical**	**Maximum**	**Unit**
Rx signal input power monitor accuracy		δPRx,mon(s)	-2.5		2.5	dB
Rx total input power monitor range		PRx,mon(t)	-21		6	dBm
Rx total input power monitor accuracy		δPRx,mon(t)	-2.0		2.0	dB
Rx reflectance					-20	dB

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.

Ordering Information			
OEM	**Part Number**	**OEM**	**Part Number**
MSA	AN-QSFP28-ZR1S-DCO-CMIS-I		

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