

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 DPDQPSK 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 FlexTune™ automatic wavelength tuning
- Case temperature range 0°C to 70°C (C-temp)
- Power dissipation < 5.5W (C-temp)



- Remote digital diagnostics monitoring
- Support Management Interface SFF86362

Applications

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

1. Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Conditions	Symbol	Min	Max	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
Relative humidity	Non-condensing	RH	5	95	%
Rx input power		PRx,in		10	dBm
ESD damage threshold	Human body model (HBM)	DC pins	2000		V
		RF pins	1000		

Caution: Use of controls or adjustments or performance of procedures other than those specified hazardous radiation exposure.

2. Environmental Specifications

Parameter	Conditions		Symbol	Min	Typ	Max	Unit
Storage temperature			TS	-40		85	°C
Case operating temperature ¹	Central office appl. (C-temp)	Long term	TOP	0		70	°C
		Short term < 96h		-5		75	
	Outside plant appl. (I-temp)	Long term		-20		85	
		Start-up		-40		85	
Relative humidity	Non-condensing		RH	5		85	%

Notes:

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

3. Electrical Specification

A. Power & Low Speed I/O

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Power supply - 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	PSNRmod			66	mV
Module inrush	Instantaneous peak duration	Tip			50	µs
	Initialization time	Tinit			500	ms
Power supply - Low power mode						
Power dissipation		Plp			1.5	W

Power supply current ¹	Instantaneous peak current		ICC,ip,lp		600	mA
	Sustained peak current		ICC,sp,lp		495	
	Steady state current		ICC,lp		478	
Power supply - High power mode (Central office applications - C-Temp)						
Power dissipation			Php		5.5	W
Power supply current ¹	Instantaneous peak current		ICC,ip,hp		2200	mA
	Sustained peak current		ICC,sp,hp		1815	
	Steady state current		ICC,hp		1754	
Power supply - High power mode (Outside plant applications - I-Temp)						
Power dissipation			Php		6.0	W
Power supply current ¹	Instantaneous peak current		ICC,ip,hp		2400	mA
	Sustained peak current		ICC,sp,hp		1980	
	Steady state current		ICC,hp		1914	
Low speed I/O						
Clock frequency, SCL	Default		Fsc1		400	kHz
	Fast mode+				1000	
Output voltage, SCL and SDA	Output low		VOL	0.0	0.4	V
	Output high		VOH	VCC-0.5	VCC+0.3	
Input voltage, SCL and SDA	Input low		VIL	-0.3	0.3×VCC	V
	Input high		VIH	0.7×VCC	VCC+0.5	
Capacitance for SCL and SDA I/O signal			Ci		14	pF
Total bus capacitive load for SCL and SDA ²	400kHz clock rate	3.0kΩ pull-up resistor, max.	Cb		100	pF
		1.6kΩ pull-up resistor, max.			200	
Input voltage / current, LPMoDe/TxDis, ResetL and ModSelL	Input voltage, low		VIL	-0.3	0.8	V
	Input voltage, high		VIH	2.0	VCC+0.3	
	Input current, 0V < Vin < VCC		Iin	-365	125	μA

Output voltage, ModPrsL and IntL/RxLOSL	Output low, IOL = 2mA	VOL	0.0		0.4	V
	Output high, 10kΩ pull-up resistor to host VCC	VOH	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]

B. High Speed Data I/O

Parameter	Min	Typ	Max	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				

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

4. Optical Specification

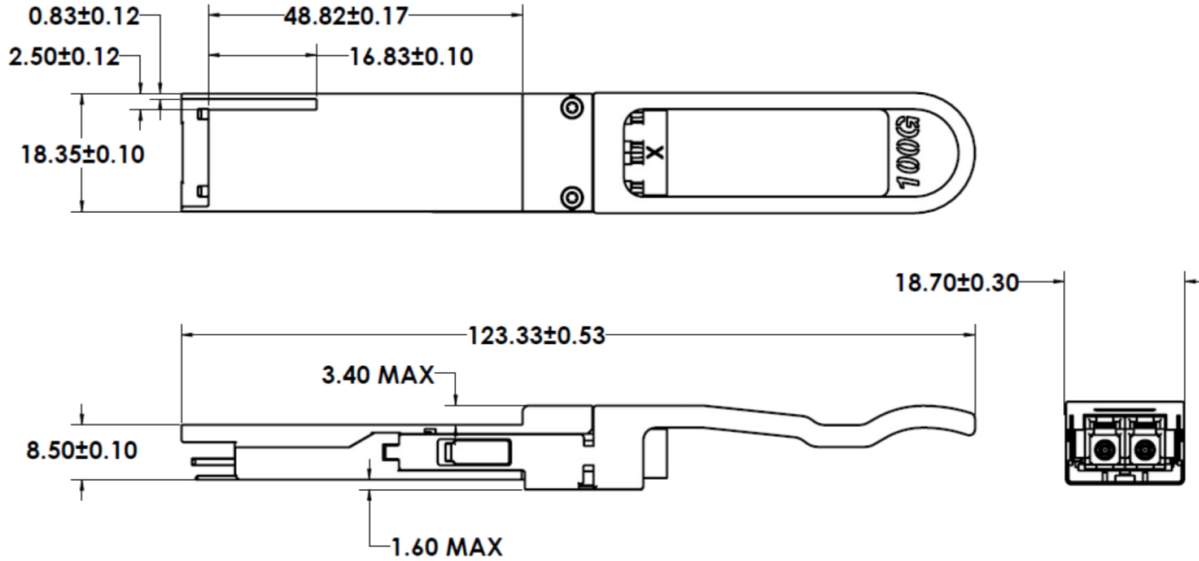
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Symbol rate		Rbaud		27.95		GBd
Modulation format			DP-DQPSK			
Channel frequency range	100GHz grid		191.400	193.700	196.100	THz
	50GHz grid		191.350	193.700	196.100	
Channel Spacing	0GHz grid	$\Delta\nu_C$		100		GHz
	50GHz grid			50		
Frequency accuracy		$\delta\nu_C$	-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	δ PTx, mon	-1.5		1.5	dB
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		Δ PX/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				23	%
Tx in-band optical signal to noise ratio	Under modulation, $ \Delta f < 60$ GHz	OSNRin	40			dB/ 0.1nm
Tx out-of-band optical signal to noise ratio	Under modulation, $ \Delta f > 60$ GHz, excl. side mode peaks	OSN- Rout	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		PR _{x,sig}	-18		1	dBm
	Extended range ¹			-22		3	
Rx OSNR tolerance	Back-to-back, PR _{x,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			μs
Rx signal input power (unamplified)	OSNR > 35dB/0.1nm	100G DQPSK SC		-30		1	dBm
		100G DQPSK RS		-24		1	
Rx signal input power monitor range			PR _{x,mon(s)}	-21		3	dBm
Rx signal input power monitor accuracy			δPR _{x,mon(s)}	-2.5		2.5	dB
Rx total input power monitor range			PR _{x,mon(t)}	-21		6	dBm
Rx total input power monitor accuracy			δPR _{x,mon(t)}	-2.0		2.0	dB
Rx reflectance						-20	dB

Note 1: Rx signal input power range over which performance can be guaranteed with <1dB OSNR penalty relative to Rx OSNR tolerance limit

5. 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.

6. Ordering Information

OEM	Part Number	OEM	Part Number
MSA	AN-QSFP28-ZR1R-DCO		

7. Contact Information

Tel: 800.590.9535

Web: <http://www.approvednetworks.com>