

Features:

- Digital Coherent Optics module, QSFP-DD form factor, Type 2A
- IEEE 400GE or n×100GE (n = 1...4) Ethernet compliant host interface
- Coherent 400G/300G/200G/100G optical interface based on OpenZR+ MSA
- High Tx output power (0dBm) and Tx OSNR for compatibility with deployed ROADM line systems
- Transmission reach > 600km amplified at 400G, with extended reaches at lower data rates
- Full C-band tunable with flexible grid support
- Transmitter type EML



- Case temperature range 0°C to 70°C
- Power dissipation < 22.5W

Applications:

- Metro / regional ROADM networks
- Data center interconnect

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	Typ	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		TOP	-5		75	°C
Relative humidity	Non-condensing	RH	5		95	%
Rx input power		PRx,in			18	dBm
ESD damage threshold	Human body model (HBM)	DC pins		2000		
		RF pins		1000		

* Caution: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

2. Environmental Specifications

Parameter	Conditions	Symbol	Min	Max	Unit
Storage temperature		TS	-40	85	°C
Case operating temperature		TOP	0	70	°C
Relative humidity	Non-condensing	RH	5	85	%

3. Host and Line Interface Modes

Host Interface Modes					
Host Interface ID	Host Interface Description	Modulation	Forward Error Correction Code	Nominal Symbol Rate (GBd)	Supported Line Interface IDs
17	400GAUI-8	PAM4	RS(544,514)	26.5625	70, 62
13	4 × 100GAUI-2	PAM4	RS(544,514)	26.5625	70, 62
13	3 × 100GAUI-2	PAM4	RS(544,514)	26.5625	71
13	2 × 100GAUI-2	PAM4	RS(544,514)	26.5625	72
13	100GAUI-2	PAM4	RS(544,514)	26.5625	73
Line Interface Modes					
Line Interface ID	Line Interface Description	Modulation	Forward Error Correction Code	Nominal Symbol Rate (GBd)	Spectral Shaping
70	ZR400-OFEC-16QAM	16QAM	O-FEC	60.1385	None
71	ZR300-OFEC-8QAM	8QAM	O-FEC	60.1385	None
72	ZR200-OFEC-QPSK	QPSK	O-FEC	60.1385	None
73	ZR100-OFEC-QPSK	QPSK	O-FEC	30.0693	None
62	400ZR, DWDM, Amplified	16QAM	C-FEC	59.8438	None

4. Electrical Characteristics

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	40Hz - 10MHz				25	mV
Module RMS noise output	10Hz - 10MHz				30	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	Instantaneous peak current	ICC,ip,lp			600	mA
	Sustained peak current	ICC,sp,lp			495	
	Steady state current	ICC,lp			475	
Power supply - High power mode						
Power dissipation		Php			22.5	W
Power supply current	Instantaneous peak current	ICC,ip,hp			9.0	A
	Sustained peak current	ICC,sp,hp			7.5	
	Steady state current	ICC,hp			7.2	
Low speed I/O						
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 ¹	400kHz clock rate, 3.0kΩ pull-up, max.	Cb			100	pF
	400kHz clock rate, 1.6kΩ pull-up, max.				200	
Input voltage / current, InitMode, 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			360	μA
Output voltage, IntL	Output low, IOL = 2mA	VOL			0.4	V
	Output high, 10kΩ pull-up resistor to host VCC	VOH	VCC-0.5		"VCC+0.3"	
Output voltage, ModPrsL ²	Output low, IOL = 2mA	VOL	0.0		0.4	V
	Output high	VOH				

High Speed Data I/O		
Transmitter (module input) - 400GAUI-8, 100GAUI-2		
Signaling rate per lane	Per IEEE Std 802.3 [1], Annex 120E, Table 120E-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
Receiver (module output) - 400GAUI-8, 100GAUI-2		
Signaling rate per lane	Per IEEE Std 802.3 [1], Annex 120E, Table 120E-3	GBd
AC common-mode output voltage		mV
Differential peak-to-peak output voltage		mV
Near-end ESMW		UI
Near-end eye height, differential		mV
Far-end ESMW		UI
Far-end eye height, differential		mV
Far-end pre-cursor ISI ratio		%
Differential output return loss		dB
Common to differential mode conversion return loss		dB
Differential termination mismatch		%
Transition time		ps
DC common mode voltage		mV

Notes:

1. For 1000kHz clock rate refer to Figure 6 in [4].
2. ModPrsL can be implemented as a short-circuit to GND on the module.

5. Optical Characteristics

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Symbol rate		Rbaud	30.07		60.14	GBd
Modulation format			16QAM, 8QAM, QPSK			
Channel frequency range		vC	191.300		196.100	THz
Channel spacing	Flexible grid	Δ vC	6.25	100		GHz

Frequency accuracy		δvC	-1.5		1.5	GHz
Frequency fine tune range	Fine tuning with Tx output enabled (bright tuning)	v_{adj}	-6.25		6.25	GHz
Frequency fine tune resolution					0.10	GHz
Laser intrinsic linewidth	Calculated based on FM noise power spectral density (PSD) measurement	LW			300	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 configurable range ¹		$P_{Tx,out}$	-6	0	1	dBm
Tx output power adjustment resolution					0.1	dB
Tx output power tolerance ²		$\delta P_{Tx,out}$	-1.0		1.0	dB
Tx output power monitor range		$P_{Tx,m}$	-8		2	dBm
Tx output power monitor accuracy ³		$\delta P_{Tx,m}$	-1.0		1.0	dB
Tx output power during tuning or when Tx disabled		$P_{Tx,dark}$			-40	dBm
Tx output power imbalance between X- and Y-polarizations		$\Delta P_{X/Y}$			1.0	dB
Tx XY skew					5.0	ps
Tx IQ offset					-26	dB
Tx IQ imbalance					0.8	dB

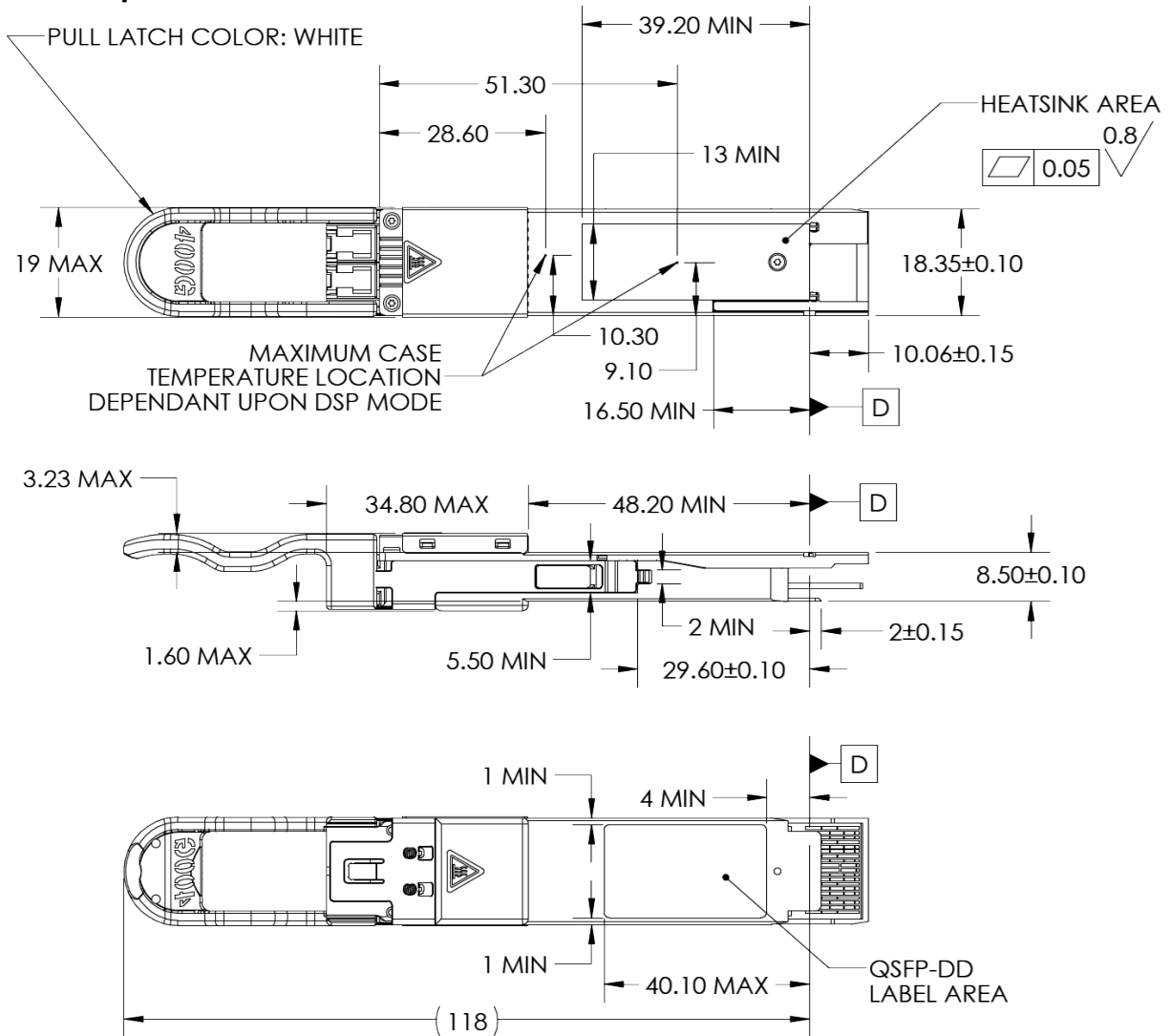
Tx quadrature error				-5.0		5.0	°
Tx IQ skew						0.75	ps
Tx in-band optical signal to noise ratio	Under modulation, $ \Delta f < 150$ GHz		OSNR _{in}	43			dB/0.1nm
Tx out-of-band optical signal to noise ratio	Under modulation, $ \Delta f > 150$ GHz, excluding side mode peaks	Max P _{Tx,out}	OSNR _{out}	43			dB/0.1nm
		Min P _{Tx,out}		40			
Tx reflectance						-27	dB
Receiver							
Rx total input power			PR _{x,tot}	-30		13	dBm
Rx signal input power (amplified) ⁴	Full Rx OSNR tolerance		PR _{x,sig}	-12		0	dBm
	Extended range	ZR _x 00-OFEC		-18		3	
		400ZR		-15		3	
Rx OSNR tolerance		ZR400-OFEC-16QAM		23.5			dB/0.1nm
		ZR300-OFEC-8QAM		20.0			
		ZR200-OFEC-QPSK		15.0			
		ZR100-OFEC-QPSK		12.0			
		400ZR		26.0			
CD tolerance ⁵	OSNR penalty < 0.5dB	ZR400-OFEC-16QAM				12.0	ns/nm
		ZR300-OFEC-8QAM				18.0	
		ZR200-OFEC-QPSK				24.0	
		ZR100-OFEC-QPSK				48.0	
		400ZR			-2.4		
PMD tolerance ⁵	OSNR penalty < 0.5dB	ZR400-OFEC-16QAM				20	ps
		ZR300-OFEC-8QAM				25	
		ZR200-OFEC-QPSK				25	
		ZR100-OFEC-QPSK				30	
		400ZR				10	
Tolerance to change in SOP ⁵	OSNR penalty < 0.5dB	ZR400-OFEC-16QAM				100	krad/s
		ZR300-OFEC-8QAM				180	
		ZR200-OFEC-QPSK				300	
		ZR100-OFEC-QPSK				600	
		400ZR				60	

Polarization dependent loss OSNR penalty ⁵	QPSK	1dB PDL				0.3	dB
		2dB PDL				0.5	
		4dB PDL				1.5	
	8QAM, 16QAM	1dB PDL				0.5	
		2dB PDL				1.0	
		4dB PDL				2.0	
Rx signal input power transient amplitude	Peak excursion from steady state (within Rx signal input power range)			-7		7	dB
Rx signal input power transient rise/fall time				0.1			ms
Tolerance to change in SOP	OSNR penalty < 0.5dB	ZR400-OFEC-16QAM		-23		0	dBm
		ZR300-OFEC-8QAM		-26		0	
		ZR200-OFEC-QPSK		-30		0	
		ZR100-OFEC-QPSK		-32		0	
		400ZR		-20		0	
Rx signal input power monitor range			PR _{x,m} (s)	-22		1	dBm
Rx signal input power monitor accuracy			δPR _{x,m} (s)	-2.0		2.0	dB
Rx total input power monitor range			PR _{x,m} (t)	-22		13	dBm
Rx total input power monitor accuracy		-22dBm to -18dBm	δPR _{x,m} (t)	-2.0		2.0	dB
		-18dBm to +3dBm		-1.5		1.5	
		+3dBm to +13dBm		-2.0		2.0	
Rx reflectance						-27	dB

Notes:

1. Range of target Tx output power values for which other Tx specifications can be maintained.
2. Deviation from target value under closed loop control, over all operating conditions and life.
3. Tx optical output power monitor reading relative to actual Tx output power.
4. Rx signal input power range over which performance can be guaranteed with <1dB OSNR penalty relative to Rx OSNR tolerance limit.
5. Rx OSNR penalty is specified for Rx signal input powers < 0dBm.

6. Mechanical Specifications



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-QSFPDD-400G-ZRP-0D	Arista	QDD-400G-ZRP-0D-A
Juniper	QDD-400G-ZR-M-0D-A		

8. Contact Information

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