

## Features:

- Source Full Spectrum 400ZR Coherent 60GBaud DP-16QAM design
- Support 100, 200, and 400G Gbps QPSK / 16QAM / PCS-16QAM transmission modes
- Support ZR dual data rates: 4x100 GbE & 400 GbE
- Support ZR+ OFEC and SFEC configurations
- Compliant with IEEE802.3-2022 standard:
  - 100G on 100GAUI-2, CAUI-4
  - 200G on 200GAUI-4
  - 400G on 400GAUI-8
  - OTU4 on OTL4.4
  - CEI-56G-PAM4-VSR electrical interface
- Compliant with QSFP-DD Type 2A (Rev5.0)
- Compliant with QSFP-DD CMIS Rev 5.0, and OIF C-CMIS 1.2
- Optional Ethernet Management Interface (EMI) for advanced feature support
- Support fully C-band tunable single carrier
- Support Data Center Interconnect up to 500km
- Supports 3dB channel insertion loss
- 400GbE-ZR Max power consumption 18W
- 400GbE-ZR+ Max power consumption 22.2W
- Case operating temperature 0°C to 75°C
- I<sup>2</sup>C Interface with digital diagnostic monitoring at rates of 100kb/s, 400kb/s, or 1Mb/s
- Complies with RoHS 2015/863/EU
- Class 1/1M Laser
- Complies with FDA performance standards for laser products except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019



## 1. Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	Notes
Storage Temperature	TS	-40	85	°C	
Supply Voltage	VCC	-0.3	3.6	V	
Relative Humidity (non-condensing)	RH	5	95	%	Non-condensing
Control Input Voltage	VI	-0.3	3.6	V	

ESD rating - high speed pins - all other pins	-1000 -1000		+1000 +1000	V	Human body model
Tx input power damage threshold	14			dBm	
Rx input power damage threshold	14			dBm	Instantaneous balanced dual polarization signal

## 2. Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Operating Case Temperature	TOPR	0	-	75	°C	
Operating humidity		5		85	%	Non-condensing
Power Supply Voltage	VCC	3.135	3.3	3.465	V	
Instantaneous peak current at hot plug	ICC_IP	-	-	4000	mA	
Sustained peak current at hot plug	ICC_SP	-	-	3300	mA	
Maximum Power Dissipation 200G-O-31.5 100G-O-31.5 400G-E-ZR 400G-E-ZR+ 400G-E-65 200G-E-60	PD	-	17.9 16.8 16.3 20.3 20.8 19.6	19.7 18.6 18.0 22.2 22.7 21.5	W	Note 1 Note 2
Maximum Power Dissipation, Low Power Mode	PDLP	-	-	3.5	W	
Signalling Rate per Lane 400ZR	SRL	-	59.84375		GBaud	16QAM
Two Wire Serial Interface Clock Rate	-	-	400	1000	kHz	
fGbaud Power Supply Noise Tolerance (10Hz - 10MHz)	-	-	-	66	mV	
Rx Differential Data Output Load	-	-	100	-	Ohm	
Operating Distance	-	-	80	120	km	

**Note 1:** 400GE client traffic. Typical power represents the highest power at 45°C case start of life. Max power represents the highest power at 75°C case end of life.

**Note 2:** 4x100GE client mode increases power by 0.5W

### 3. Transmitter Optical Specifications

Parameter	Min	Typ	Max	Unit	Note
Tx provisionable carrier frequency range	191.250		196.125	THz	Note 1.
Carrier frequency fine-tuning range	-5		5	GHz	
Carrier frequency fine-tuning step size	100		100	MHz	
Carrier frequency error	-1.5		1.5	GHz	EOL
Local / In-band OSNR	40.0			dB/ 12.5 GHz	
Global / Out-of-band OSNR	45.0			dB/ 12.5 GHz	
Symbol rate 200G-O-31.5 100G-O-31.5 400G-E-ZR 400G-E-ZR+ 400G-E-65 200G-E-60		31.6 31.6 59.8 60.1 64.6 60.5		GBd	
Modulated spectral width 200G-O-31.5 100G-O-31.5 400G-E-ZR 400G-E-ZR+ 400G-E-65 200G-E-60		31.6 31.6 59.8 60.1 64.6 60.5		GHz	-3dB width
Modulated spectral width 200G-O-31.5 100G-O-31.5 400G-E-ZR 400G-E-ZR+ 400G-E-65 200G-E-60		33.9 33.9 64.3 64.6 69.3 62.7		GHz	-10dB width

Modulated spectral width					
200G-O-31.5		35.0			
100G-O-31.5		35.0			
400G-E-ZR		66.4		GHz	-20dB width
400G-E-ZR+		66.7			
400G-E-65		71.6			
200G-E-60		63.8			
Tx Spectral Shaping					
200G-O-31.5		0.125		RRC	Fixed
100G-O-31.5		0.125			
400G-E-ZR		0.125			
400G-E-ZR+		0.125			
400G-E-65		0.125			
200G-E-60		0.0625			
Laser Linewidth			150	kHz	
Tx DC I-Q offset			-26	dB	
TX I-Q instantaneous offset			-20	dB	
TX I-Q power imbalance			1	dB	
TX I-Q orthogonality	-3		3	deg	
TX X-Y power imbalance			1.5	dB	

Note 1: All grids specified in CMIS are supported.

#### 4. Transmitter Optical Power Specifications

Parameter	Min	Typ	Max	Unit	Note
Tx provisionable output power range					
200G-O-31.5	-13		-9		
100G-O-31.5	-13		-9		
400G-E-ZR	-13		-9	dBm	
400G-E-ZR+	-13		-9		
400G-E-65	-13		-11		
200G-E-60	-13		-11		
Tx provisionable output power step size		0.1		dB	
Tx total output power monitor accuracy					
400G-E-ZR	-0.7		0.7	dB	Note 1
All other modes	-1.0		1.0		
Output power stability	-0.5		0.5	dB	Note 2
Output power enable time			4	s	Note 3
Output power during blanking			-20	dBm	

Output power disable time			100	ms	Note 4
Tx optical return loss	20			dB	
Tolerable optical reflection			-27	dB	

**Notes:**

- 1: Output power monitor accuracy and output power tuning accuracy are equivalent.
- 2: Stability is defined as variation over time at a fixed temperature and wavelength.
- 3: Time to reach 90% of steady-state optical power upon de-assertion of Tx disable.
- 4: Time to reach output power during blanking upon assertion of Tx disable.

## 5. Receiver Optical Specifications

Parameter	Min	Typ	Max	Unit	Note
ROSNR					
200G-O-31.5			19.1	dB/ 12.5GHz	Note.1
100G-O-31.5			11.1		
400G-E-ZR			24.8		
400G-E-ZR+			22.4		
400G-E-65			20.6		
200G-E-60			14.0		
Minimum Rx channel input power for no ROSNR power penalty					
200G-O-31.5			-7.5	dBm	Note2
100G-O-31.5			-7.5		
400G-E-ZR			N/A		
400G-E-ZR+			-6.0		
400G-E-65			-6.0		
200G-E-60			-6.0		
Minimum Rx input power for 1dB ROSNR power penalty					
200G-O-31.5			-16	dBm	
100G-O-31.5			-23		
400G-E-ZR			-14		
400G-E-ZR+			-13		
400G-E-65			-14		
200G-E-60			-22		

Rx sensitivity					
200G-O-31.5			-23	dBm	Note3
100G-O-31.5			-30		
400G-E-ZR			-18		
400G-E-ZR+			-19		
400G-E-65			-20		
200G-E-60			-26		
PMD tolerance (mean)				ps	400G-E-ZR: ROSNR penalty < 0.5dB  All other modes: ROSNR penalty< 0.1dB
200G-O-31.5			50		
100G-O-31.5			50		
400G-E-ZR			10		
400G-E-ZR+			50		
400G-E-65			50		
200G-E-60			50		
SOP tracking				krad/s	<1.0 dB ROSNR penalty <2.0 dB ROSNR penalty <0.5 dB ROSNR penalty <1.0 dB ROSNR penalty <1.0 dB ROSNR penalty <2.0 dB ROSNR oenaltv
200G-O-31.5			300		
100G-O-31.5			1500		
400G-E-ZR			50		
400G-E-ZR+			300		
400G-E-65			300		
200G-E-60			1500		
PDL tolerance (peak)				dB	<2.4 dB ROSNR penalty <2.4 dB ROSNR penalty <1.3 dB ROSNR penalty <2.4 dB ROSNR penalty <2.4 dB ROSNR penalty <2.4 dB ROSNR penalty
200G-O-31.5			5.4		
100G-O-31.5			5.4		
400G-E-ZR			3.5		
400G-E-ZR+			5.4		
400G-E-65			5.4		
200G-E-60			5.4		
CD tolerance				ns/ nm	<0.5 dB ROSNR penalty
200G-O-31.5	-120		120		
100G-O-31.5	-120		120		
400G-E-ZR	-2.4		2.4		
400G-E-ZR+	-60		60		
400G-E-65	-60		60		
200G-E-60	-60		60		
Adjacent Channel Crosstalk ROSNR Penalty			0.1	dB	Note.4
400G-E-ZR					

**Notes:**

- Note 1: ROSNR test conditions as follows (unless stated otherwise):
  - Back-to-back, single wavelength present.
  - No dispersion

- Rx signal power within the valid range for the transmission mode.
  - Tx power provisioned to -12 dBm.
  - No PDL other than the Module itself.
  - PMD/DGD <= 2ps mean
  - <= 5krad/s rate of change of SOP.
  - ROSNR is defined to be constant across all frequency channels. At different wavelength, ROSNR is defined by  $OSNR_{linear\_per\_0.1nm}(\lambda) = OSNR_{linear\_per\_12.5GHz} \times (\lambda_0 / \lambda \text{ nm})^2$ , where  $\lambda_0 = \sqrt{c/12.5GHz} = 1548.65735 \text{ nm}$ . Noise bandwidth of 0.1 nm = 12.5 GHz at 1548.65735 nm.
2. No ROSNR Rx power penalty across plug population obtained at greater than or equal to the maximum of this value. 400ZR ROSNR is valid over the stated Rx Input power range.
  3. Error free performance @ OSNR > 35 dB/12.5GHz
  4. ROSNR penalty due to crosstalk interference from neighboring 400ZR channels.
    - Back-to-back test setup, no dispersion.
    - Neighboring channels are launched into the mux filter with up to +3dB Tx output power relative to the channel under test.
    - Neighboring channels can be offset up to 1.8GHz towards the channel under test.
    - The mux/demux frequency shift can be up to the +/-4GHz specified in OIF 13.3.147.
    - No PDL other than the Module itself.

## 6. Receiver Optical Power Specifications

Parameter	Min	Typ	Max	Unit	Note
Rx operating input power range					
200G-O-31.5	-23		5	dBm	Note 1
100G-O-31.5	-30		5		
400G-E-ZR	-12		0		
400G-E-ZR+	-19		5		
400G-E-65	-20		5		
200G-E-60	-26		5		
Rx input power monitor range	-32		5	dBm	
Rx total input power monitor accuracy				dB	
For [-22, 5] dBm	-2.0		2.0		
For [-32, -22] dBm	-3.0		3.0		
Rx signal power monitor accuracy	-3.0		3.0	dB	
Rx input power transient tolerance	-4.0		4.0	dB	Note 2
Rx optical return loss	-22			dB	400ZR compliant input signal
Rx LOS hysteresis	1.0			dB	

### Notes:

1. Note 1: Rx input operating dynamic range guaranteed across plug population . For 400ZR, this is the input power range over which the stated ROSNR is supported.

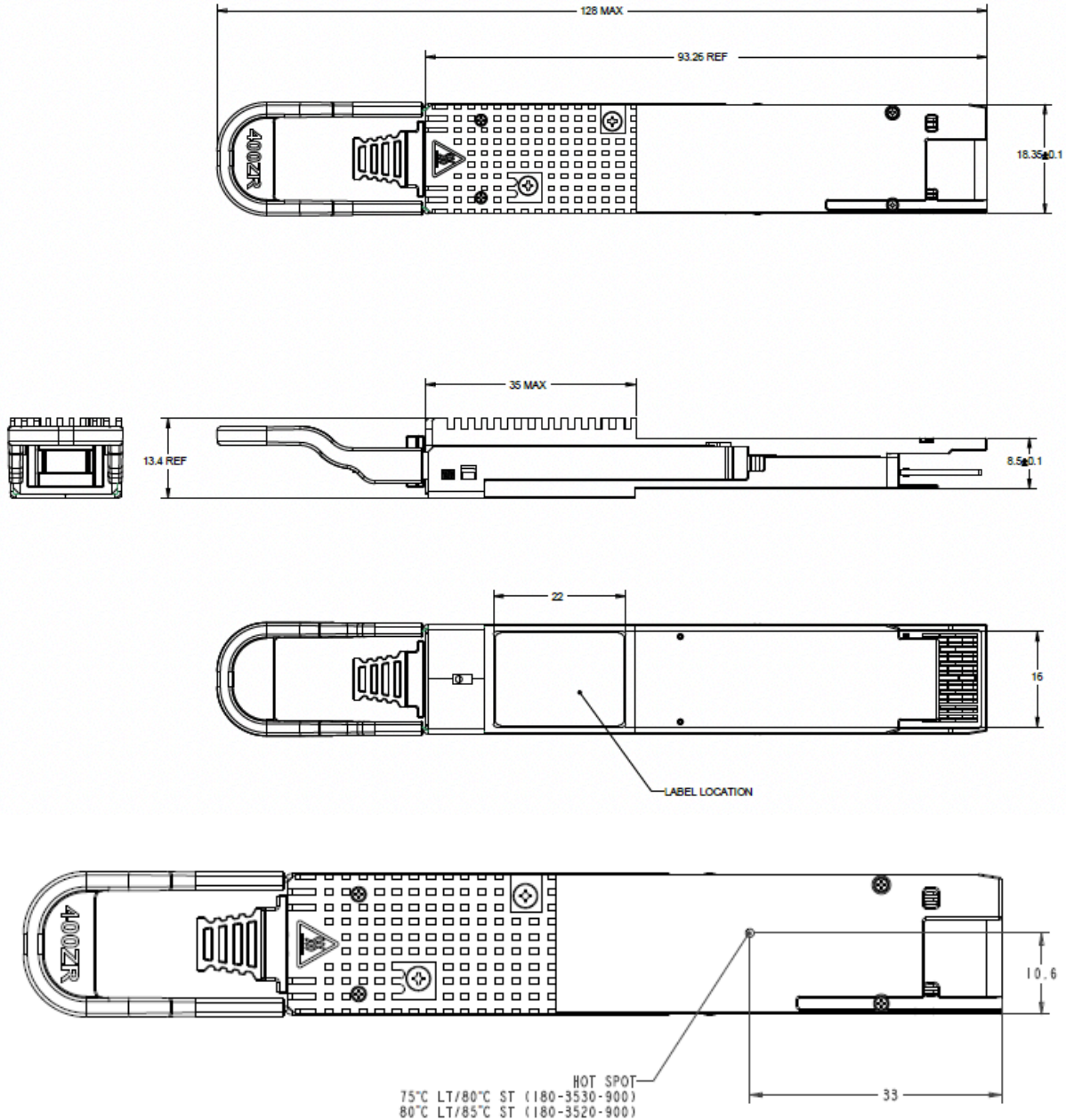
2. Minimum/maximum power during transient contained within the Rx input operating power range for the transmission mode. ROSNR penalty is referenced versus the steady state ROSNR at the minimum power of the input transient. At 50us 10%-90% maximum slew rate, and operation within Rx operating input power range.

## 6. Electrical Specification High and Low Speed Signal

Parameter	Min	Typ	Max	Unit	Note
SCLand SDA	VOL	0	0.4	V	IOL(max)= 3mA for fast mode, 20 mA for Fast-mode plus
SCL and SDA	VIL	-0.3	Vcc*0.3	V	
	VIH	Vcc*0.7	Vcc+0.5	V	
Capacitance for SCL and SDA 10 signal	Ci		14	pF	
Total bus capacitive load for SCL and SDA	Cb		100	pF	For 400 kHz clock rate, use 3 kOhm Pull Up resistor.
			200	pF	For 400 kHz clock rate, use 1.6 kOhm Pull Up resistor.
LPMode, ResetL, ModSelL	VIL	-0.3	0.8	V	
	VIH	2	VCC+0.3	V	
LPMode, ResetL and ModSel	I <sub>lin I</sub>		360	uA	0V <Vin< Vee
IntI	VOL	0	0.4	V	IOL=2.0mA
	VOH	VCC-0.5	VCC+0.3	V	10k Ohm pull-up to Host Vcc
ModPrsl	VOL VOH	0	0.4	V	IOL=2.0 mA. Note: shorted to ground in module.



## 7. 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.

## 8. Ordering Information

OEM	Part Number	OEM	Part Number
Arista	QDD-400G-ZRP-A	Juniper	QDD-400G-ZR-M-A
Cisco	QDD-400G-ZRP-S-A	MSA	AN-QSFPDD-400G-ZRP

## 9. Contact Information

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