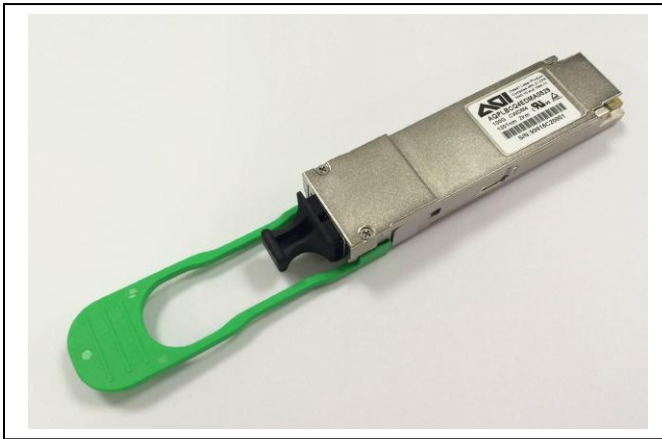


**QSFP28 Dual LC 100G SMF 2km Transceiver**

**AQPLBCQ4EDMA0829**



**Features**

- ❑ Hot-pluggable QSFP28 form factor
- ❑ 4 x CWDM – Uncooled DFB Laser (1270/1290/1310/1330 nm)
- ❑ PIN Photo Detector
- ❑ -5°C to +70°C case operating temperature range
- ❑ 2Km transmission with SMF
- ❑ 3.3V power supply
- ❑ Contain Clock Data Recovery (CDR)
- ❑ Power consumption < 3.5W
- ❑ Compliant with QSFP+ MSA SFF-8665
- ❑ Compliant with IEEE 802.3bm/100G-CWDM4 MSA Specification
- ❑ Digital diagnostic functions (Via I<sup>2</sup>C)
- ❑ Compliant with RoHS
- ❑ Compliant with UL & TUV

**Applications**

- ❑ 100 Gigabit Ethernet

**Ordering Information**

Form Factor	Data Rate	Media	Distance	Wavelength (nm)	TX Power (each lane) (dBm)	Voltage (V)	Coupling	DDM (Y/N)	Temperature (°C)	Part Number
QSFP28 Dual LC	100G	SMF	2km	1271 nm 1291 nm 1311 nm 1331 nm	-6.5 ~ 2.5	3.3	AC/AC	Y	-5 ~ +70	AQPLBCQ4EDMA0829

## QSFP28 Dual LC 100G SMF 2km Transceiver

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**Absolute Maximum Ratings**

Parameter	Symbol	Conditions	Min	Max	Unit
Storage Temperature	$T_S$	--	-40	+85	°C
Storage Relative Humidity	RH	Non condensing	0	85	%
Supply Voltage # 3.3	$V_{CC}$	--	0	3.6	V

**Recommended Operating Conditions**

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating Temperature (Case)	$T_C$	--	-5	--	70	°C
Supply Voltage	$V_{CC}$	--	3.13	3.3	3.47	V
Supply Current	$I_{CC}$	--	--	--	1000	mA
Data Rate	DR	--	--	100	--	Gbps
Distance		--	0.002	--	2	km

**Electrical Characteristics**

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>Transmitter</b>						
Differential Input Impedance	$R_{DI}$	--	--	100	--	Ohm
High speed Differential Input Voltage (CML)	$V_{CML\_DI}$	AC-Coupled, peak to peak	0.02	--	1.0	V
Low speed Input Voltage - Low (LVCOMS)	$V_{LVCMOS\_IL}$	--	--	--	$V_{CC} \cdot 0.2$	V
Low speed Input Voltage - High (LVCOMS)	$V_{LVCMOS\_IH}$	--	$V_{CC} \cdot 0.75$	--	3.465	V
<b>Receiver</b>						
Differential Output Impedance	$R_{DO}$	--	--	100	--	Ohm
High speed Differential Output Voltage (CML)	$V_{CML\_DO}$	AC-Coupled, peak to peak	0.3	--	0.9	V
Low speed Output Voltage - Low (LVCOMS)	$V_{LVCMOS\_OL}$	--	--	--	$V_{CC} \cdot 0.2$	V
Low speed Output Voltage - High (LVCOMS)	$V_{LVCMOS\_OH}$	--	$V_{CC} \cdot 0.75$	--	3.465	V



**QSFP28 Dual LC 100G SMF 2km Transceiver**

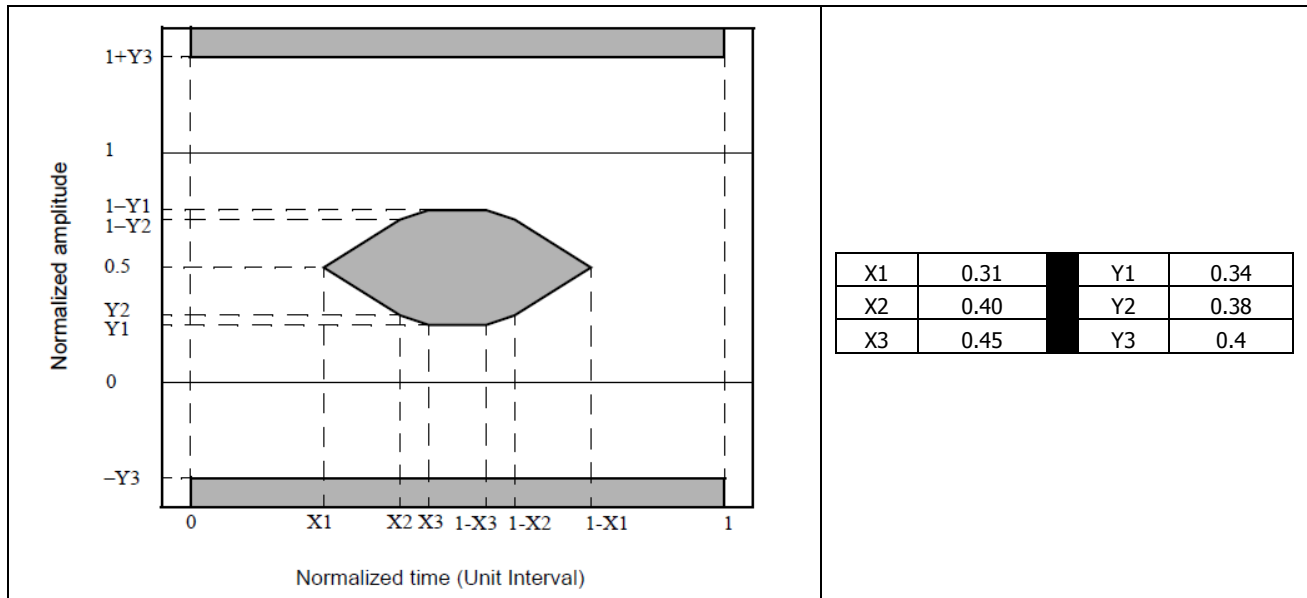
**AQPLBCQ4EDMA0829**

**Optical Characteristics**

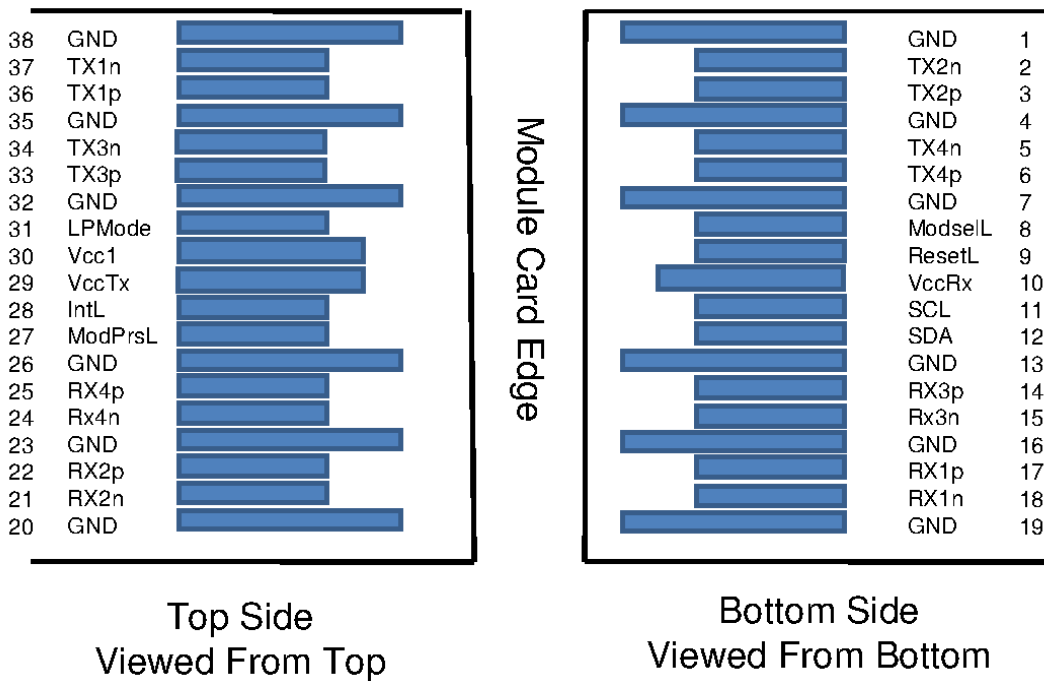
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>Transmitter</b>						
Lane wavelengths (Range)	$\lambda_c$	--	1264.5	1271	1277.5	nm
			1284.5	1291	1297.5	nm
			1304.5	1311	1317.5	nm
			1324.5	1331	1337.5	nm
Side Mode Suppression Ratio	SMSR	--	30	--	--	dB
Total average launch power	P <sub>tot</sub>	--	--	--	8.5	dBm
Average launch power, each lane	P <sub>o</sub>	--	-6.5	--	2.5	dBm
OMA, each lane	OMA	CW, ER>3.5dB	-4	--	2.5	dBm
Difference in launch power between any two lanes (OMA)	--	--	--	--	5	dB
TDP, each lane	TDP	--	--	--	3.0	dB
Average launch power of OFF transmitter, each lane	P <sub>off</sub>	--	--	--	-30	dBm
Extinction ratio	ER	--	3.5	--	--	dB
Eye mask definition {X1, X2, X3, Y1, Y2, Y3}	--	--	{0.31, 0.40, 0.45, 0.34, 0.38, 0.4}			
<b>Receiver</b>						
Center Wavelength - lane 0	$\lambda_{c0}$	--	1264.5	--	1277.5	nm
Center Wavelength - lane 1	$\lambda_{c1}$	--	1284.5	--	1297.5	nm
Center Wavelength - lane 2	$\lambda_{c2}$	--	1304.5	--	1317.5	nm
Center Wavelength - lane 3	$\lambda_{c3}$	--	1324.5	--	1337.5	nm
Damage threshold	--	--	3.5	--	--	dBm
Receiver Power (OMA), each Lane	--	--	--	--	2.5	dBm
Receiver Reflectance	--	--	--	--	-26	dB
Difference in receiver power between any two lanes(OMA) (max)	--	--	--	--	5.5	dB
Average receive power, each lane	--	--	-11.5	--	2.5	dBm
Receiver sensitivity (OMA), each lane	R <sub>sens</sub>	At 5E-5 BER	--	--	-10.0	dBm
Stressed receiver sensitivity (OMA), each lane	SRS	At 5E-5 BER	--	--	-7.3	dBm
Conditions of stressed receiver sensitivity test:						
Vertical eye closure penalty, each lane	VECP	--	1.9	--	--	dB
Stressed eye J2 jitter, each lane	J2	--	0.33	--	--	UI
Stressed eye J4 jitter, each lane	J4	--	0.48	--	--	UI
SRS eye mask definition {X1, X2, X3, Y1, Y2, Y3}	--	--	{0.39, 0.50, 0.50, 0.39, 0.39, 0.4}			

1. FEC requirements as defined by the 100G CWDMA MSA Technical Specification Rev 1.0
2. The Receiver sensitivity (OMA), each lane (Max) at 5E-5 BER is a normative specification
3. The conditions of the stressed receiver sensitivity test section are NOT characteristics of the receiver

**Eye Mask Definition**



**Pin Descriptions**



**QSFP28 Dual LC 100G SMF 2km Transceiver**

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**Pin Definition**

Pin	Logic	Symbol	Description	Notes
1		GND	Ground	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	
4		GND	Ground	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	
7		GND	Ground	1
8	LVTTTL-I	ModSelL	Module Select	
9	LVTTTL-I	ResetL	Module Reset	
10		Vcc Rx	+3.3V Power Supply Receiver	2
11	LVC MOS I / O	SCL	2-wire serial interface clock	
12	LVC MOS I / O	SDA	2-wire serial interface data	
13		GND	Ground	1
14	CML-O	Rx3p	Receiver Non-Inverted Data Output	
15	CML-O	Rx3n	Receiver Inverted Data Output	
16		GND	Ground	1
17	CML-O	Rx1p	Receiver Non-Inverted Data Output	
18	CML-O	Rx1n	Receiver Inverted Data Output	
19		GND	Ground	1
20		GND	Ground	1
21	CML-O	Rx2n	Receiver Inverted Data Output	
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	
23		GND	Ground	1
24	CML-O	Rx4n	Receiver Inverted Data Output	
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	
26		GND	Ground	1
27	LVTTTL-O	ModPrsL	Module Present	
28	LVTTTL-O	IntL	Interrupt	
29		Vcc Tx	+3.3V Power supply transmitter	2
30		Vcc1	+3.3V Power supply	2
31	LVTTTL-I	LPMode	Low Power Mode	
32		GND	Ground	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	
34	CML-I	Tx3n	Transmitter Inverted Data Input	
35		GND	Ground	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	
37	CML-I	Tx1n	Transmitter Inverted Data Input	
38		GND	Ground	1

Note 1 :

GND is the symbol for signal and supply (power) common for the QSFP+ module. All are common within the QSFP+ module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal-common ground plane.

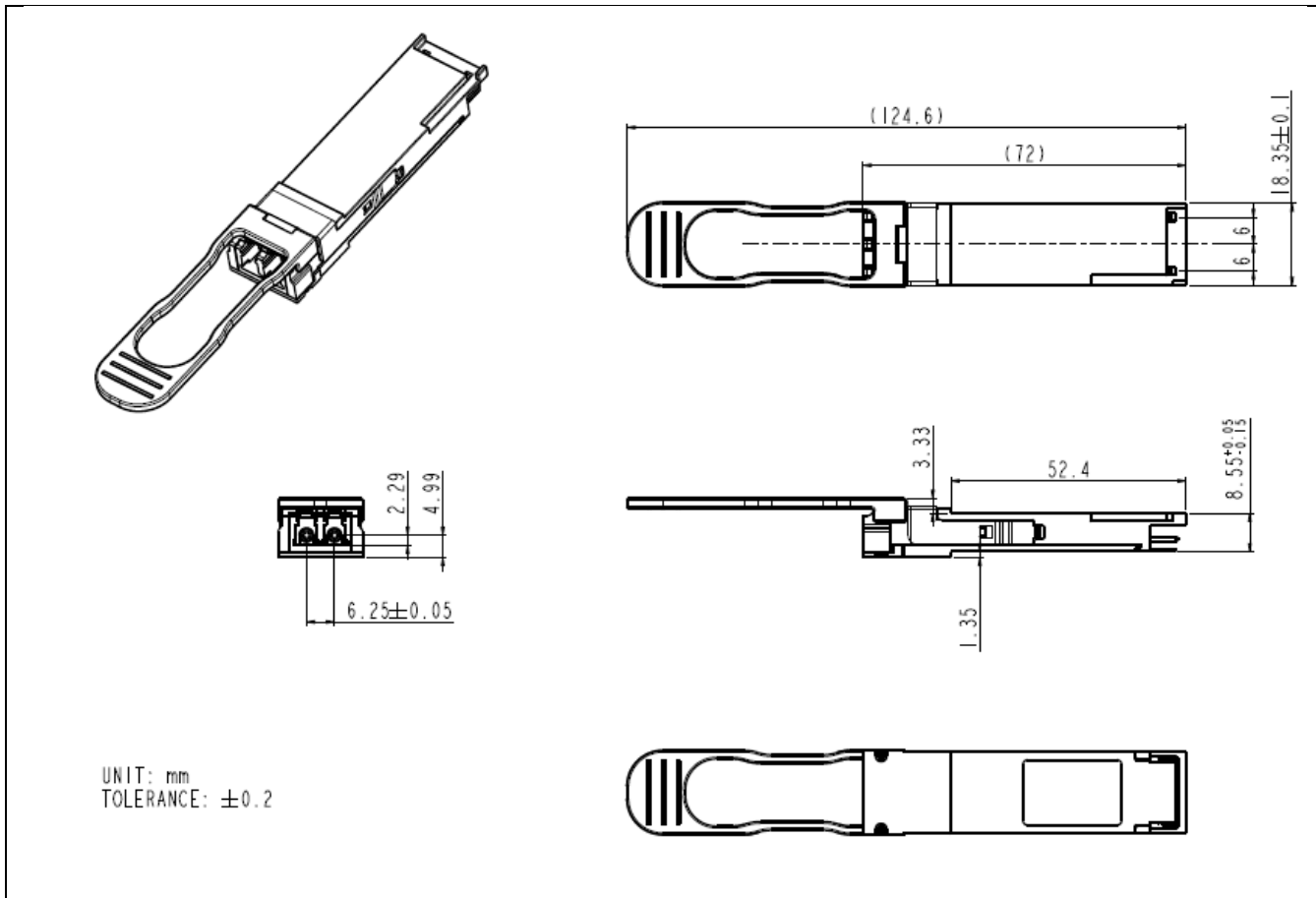
Note 2 :

Vcc Rx, Vcc1 and Vcc Tx are the receiver and transmitter power supplies and shall be applied concurrently.

**QSFP28 Dual LC 100G SMF 2km Transceiver**

**AQPLBCQ4EDMA0829**

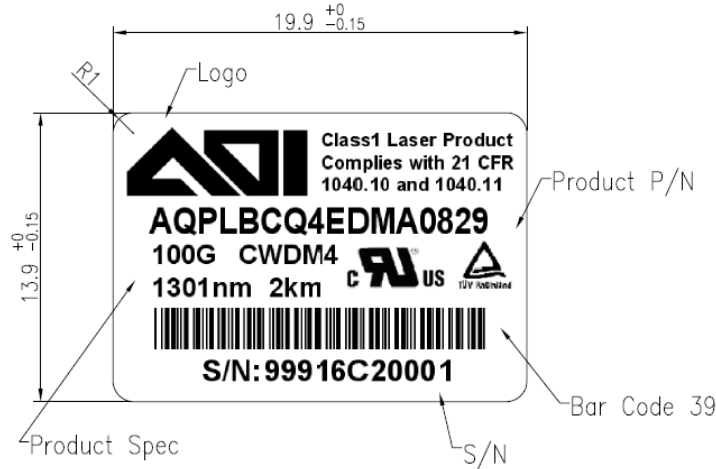
**Mechanical Design Diagram (mm)**



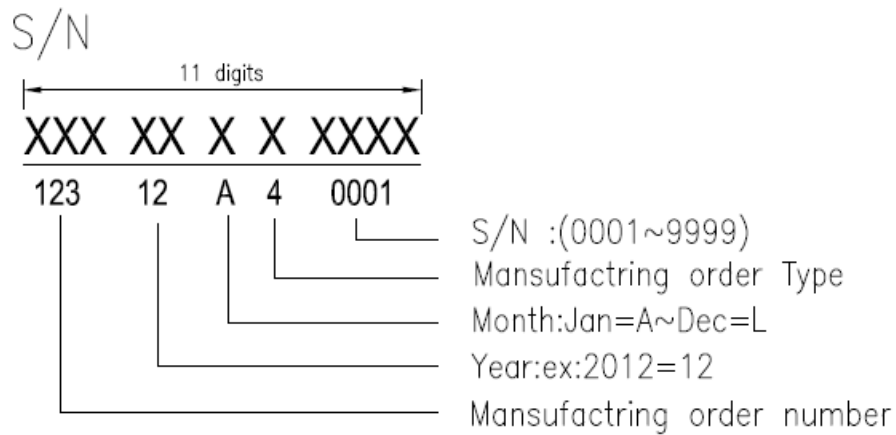
**QSFP28 Dual LC 100G SMF 2km Transceiver**

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**Modul Label Diagram**



Unit:mm





**QSFP28 Dual LC 100G SMF 2km Transceiver**

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**EEPROM Memory A0h contents Address**

	AOI	AQPLBCQ4EDMA0829	E130	2 km
Add	Name of field	Description	ACSII	HEX
128	Identifier	11:QSFP28		11
129	Ext. Identifier	QSFP Transceiver .: bit7-6:11 Power Max 3.5W bit3: 1 CDR present in TX bit2: 1 CDR present in RX		CC
130	Connector	07 :LC Connector Codes are maintained in the Transceiver Management section of SFF-8024 Table 4-3		07
131	Transceiver	80: The Extended Specification Compliance Codes are maintained in the Transceiver Management section of SFF-8024 Table 4-4 (The extended information show in Byte 192)		80
132		SONET Compliance codes		00
133		SAS/SATA compliance codes		00
134		Gigabit Ethernet compliance codes		00
135		Fiber Channel Compliant codes		00
136		Fiber Channel link length		00
137		Fiber Channel transmission media		00
138		Fiber Channel Speed		00
139	Encoding	05: 64B/66B (see SFF-8024 Table 4-2)		05
140	BR, Nominal	100Mbps/unit -> HEX FF:25.78125G / each channel (over 25.4G reference Byte 222)		FF
141	Ext. RateSelect	bit7-2:0 reserved bit1:0 no QSFP+ Rate Select Version2 bit0:0 no QSFP+ Rate Select Version1 (see Table 6-18)		00
142	Length(9um, SMF)	1km /unit -> HEX 02 :2km		02
143	Length (50um, OM3)	2m /unit -> HEX		00
144	Length (50um, OM2)	1m /unit -> HEX		00
145	Length (62.5um, OM1)	1m /unit -> HEX		00
146	Length (52um, OM4) / Length (Copper)	2m /unit -> HEX / 1m /unit -> HEX		00
147	Device Tech	Device technology (see Table 6-19, 6-20) 40: 1310nm DFB		40
148	Vendor name	QSFP Vendor Name (ASCII)	A	41
149			O	4F
150			I	49
151				20
152				20
153				20





**QSFP28 Dual LC 100G SMF 2km Transceiver**

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154				20
155				20
156				20
157				20
158				20
159				20
160				20
161				20
162				20
163				20
164	Ext. Transceiver	Ext. Transceiver (see <a href="#">Table 6-21</a> ) 10:EDR		10
165				00
166	Vendor OUI	QSFP+ Vendor IEEE company ID		29
167				26
168			A	41
169			Q	51
170			P	50
171			L	4C
172			B	42
173			C	43
174			Q	51
175	Vendor PN	SFP Vendor Part Number (ASCII)	4	34
176			E	45
177			D	44
178			M	4D
179			A	41
180			0	30
181			8	38
182			2	32
183			9	39
184	Vendor rev	Vendor Revision		20
185			1	31
186	Wavelength	Nominal laser wavelength (Wavelength = value / 20 in nm) 65A4:1301nm		65
187				A4
188	Wavelength Tolerance	Guaranteed range of laser wavelength (+/- value) from Nominal wavelength. (Wavelength Tol. = value/200 in nm) 0514:6.5nm		05
189				14
190	Max Case Temp	Maximum Case Temperature 46:70°C		46



**QSFP28 Dual LC 100G SMF 2km Transceiver**

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191	CC_BASE	Check Sum (128-190)		5D
192	Options (see Table 6-22)	Reference Extended: The Extended Specification Compliance Codes are maintained in the Transceiver Management section of SFF-8024 (see Table 4-4) 10G/40G/100G Ethernet 06:100G CWDM4 MSA with FEC		06
193		bit7-4:0 reserved bit3:0 no TX Input Equalization Auto Adaptive Capable bit2:0 no TX Input Equalization Fixed Programmable Settings bit1:0 no RX Output Emphasis Fixed Programmable Settings bit0:0 no RX Output Amplitude Fixed Programmable Settings		00
194		bit7:1 TX CDR On/Off Control bit6:1 RX CDR On/Off Control bit5:1 Tx CDR Loss of Lock (LOL) Flag bit4:1 Rx CDR Loss of Lock (LOL) Flag bit3:0 no Rx Squelch Disable bit2:0 no Rx Output Disable capable bit1:0 no Tx Squelch Disable bit0:0 no Tx Squelch		F0
195		bit7:1 memory page02 bit6:0 no memory page01 bit5:0 no RATE_SELECT bit4:1 TX_DISABLE bit3:1 TX_FAULT bit2:0 no TX Squelch bit1:1 TX Loss bit0:0 reserved		9A
196	Vendor SN	Vendor SN (ASCII)		XX
197				XX
198				XX
199				XX
200				XX
201				XX
202				XX
203				XX
204				XX
205				XX
206				XX
207		XX		
208		XX		
209		XX		
210		XX		
211		XX		
212	Date code	Year (ASCII)		XX
213				XX



**QSFP28 Dual LC 100G SMF 2km Transceiver**

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214		Month (ASCII)		XX	
215				XX	
216			Day (ASCII)		XX
217					XX
218					20
219			Blank		20
220	Diagnostic Monitoring Type	bit3:1 = Average power / 0 = OMA bit2:1 Transmitter power measurement others:0 reserved (see Table 6-24)		0C	
221	Enhanced Options	bit7-5:0 Reserved bit4:1 Initialization Complete Flag implemented(See Table 6-5) bit3:0 no Rate Select bit2:0 Application select bit1-0:0 reserved (see Table 6-25)		10	
222	BR, Nominal	250Mbps/unit -> HEX 67: 25.78125G / each channel		67	
223	CC_EXT	Check Sum 64 to 94 byte		XX	
224	Read-only	Read-only		00	
225				00	
226				00	
227				00	
228				00	
229				00	
230				00	
231				00	
232				00	
233				00	
234				00	
235				00	
236				00	
237		00			
238		00			
239		00			
240		00			
241		00			
242		00			
243		00			
244		00			
245		00			
246		00			



**QSFP28 Dual LC 100G SMF 2km Transceiver**

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247				00
248				00
249				00
250				00
251				00
252				00
253				00
254				00
255				00



**Regulatory Compliance**

Item	Standard
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022 Class B (CISPR 22B) VCCI Class B
Electrostatic Discharge to the Electrical Pins (ESD)	MIL-STD-883E Method 3015.7
Electrostatic Discharge to the Receptacle (ESD)	IEC 61000-4-2
RoHS	2011/65/EU
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11
Component Recognition	UL and TUV

**Laser Safety Information**

All versions of this laser are Class 1 laser products per IEC1/EN2 60825-1. Users should observe safety precautions such as those recommended by ANSI<sup>3</sup> Z136.1, ANSI Z36.2 and IEC 60825-1.

This product conforms to FDA (CDRH) 21 CFR 1040.10 and 1040.11 except for deviations of laser safety class designation pursuant to '[Laser Notice No.50](#)'

Product labeling:

Class 1 Laser Product  
Compliance with 21 CFR  
1040.10 and 1040.11

If labeling is not affixed to the module due to size constraints; then rather, labeling is placed on the outside of the shipping box.

This product is not shipped with a power supply.

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

**Certifications**

<b>UL</b>	<b>60950-1 (E243407)</b>
<b>TUV</b>	<b>EN60950-1, EN 60825-1, EN 60825-2</b>

Documentation is available upon request.

(1) IEC is a registered trademark of the International Electrotechnical Commission

(2) Within Europe the IEC standard has been adopted as a European Normative standard known as EN 60825, and each European country will have its own version of this standard, for example, the British Standards version known as BS EN 60825. There can be small differences between the different countries versions of EN 60825, and these are in part caused by the process of translating the standard into the native language of that country.

(3) ANSI is a registered trademark of the American National Standards Institute

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