

QSFP28 100G CWDM4 2km Transceiver



Features

- Hot-pluggable QSFP28 form factor
- 4 x CWDM uncooled DFB laser
- (1271/1291/1311/1331 nm)
- PIN photo detector
- 0°C to 70°C case operating temperature range
- 2km transmission with SMF
- 3.3 V power supply
- Contain clock data recovery (CDR)
- Power consumption < 3.5 W
- Compliant with QSFP+ MSA SFF-8665
- Compliant with IEEE 802.3bm/100G-CWDM4 MSA specification
- Digital diagnostic functions (Via I²C)
- RoHS compliant
- Compliant with UL & TUV



Applications

• 100 Gigabit Ethernet, Dual LC, CWDM4





Part Numbers

Part Number	Form Factor	Data Rate	Media	Distance	Wavelength	TX Power	Voltage	Coupling	DDM	Temp
STA-100G-CWDM4	QSFP28 Dual LC	100G	SMF	2km	1271 nm 1291 nm 1311 nm 1331 nm	-6.5 ~ 2.5	3.3 V	AC/AC	Y	0 ~ +70 C

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Min	Max	Unit
Storage temperature	T _s		-40	+85	°C
Supply relative humidity	RH	Non condensing	0	85	%
Supply voltage	V _{cc}		0	3.6	V

Recommended Operating Conditions

Parameter	Symbol	Conditions	Min	Typical	Max	Unit
Case operating temperature	T _c		0		70	°C
Supply voltage	V _{cc}		3.13	3.3	3.47	V
Supply voltage	I _{cc}				1000	mA
Data rate	DR			100		Gbps
Distance			0.002		2	km

Electrical Characteristics

Parameter	Symbol	Conditions	Min	Typical	Max	Unit
Transmitter						
Differential input impedance	R _{DI}			100		Ohm
High speed differential input voltage (CML)	V_{CML_DI}	AC-coupled, peak to peak	0.2		1.0	V
Low speed input voltage - low (LVCOMS)	V _{LVCMOS_IL}				Vcc*0.2	V
Low speed input voltage - high (LVCOMS)	V _{LVCMOS_IH}		Vcc*0.75		3.465	V
Receiver						
Differential output impedance	R _{DO}			100		Ohm
High speed differential output voltage (CML)	$V_{\text{CML}_{DO}}$	AC-coupled, peak to peak	0.3		0.8	V
Low speed output voltage - low (LVCOMS)	V _{LVCMOS_OL}		0		0.4	V
Low speed output voltage -high (LVCOMS)	$V_{\rm LVCMOS_OH}$		Vcc-0.5		Vcc+0.3	V



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Optical Characteristics

any availanging (ange) λ_{CP} 124.5 121.4 127.5 101.4 124.5 121.4 127.5 101.4 101.5 101.4 124.5 131.4 131.5 101.4 101.5 101.4 124.5 131.4 131.5 101.4 101.5 101.4 124.5 101.4 101.5 101.4 101.5 101.4 101.4 124 and a parage launch power, each lane $0MA$ $0MA$ $0MA$ $0MA$ $0MA$ $0MA$ $0MA$ $0MA$ 101.4 1.5 <	Parameter	Symbol	Conditions	Min	Typical	Max	Unit
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NoteNo	Lane wavelengths (range)	λς		1264.5	1271	1277.5	nm
index of the sector of the s				1284.5	1291	1297.5	nm
Side mode suppression ratioSMSR30				1304.5	1311	1317.5	nm
Add average launch powerPick				1324.5	1331	1337.5	nm
Normage launch power, each lane Po -6.5 2.5 dBm NMA, each lane OMA CW,ER>3.56 -4 2.5 dBm Difference in launch power between any two lanes (OMA) TDP 5 dB DP, each lane TDP 3.0 dB DP, each lane Poff 3.5 - dB Striction ratio ER 3.5 - dB Seve mask definition (X1, X2, X3, Y1, Y2, Y3) ER 1264.5 1277.5 nm Seve mask definition (X1, X2, X3, Y1, Y2, Y3) F 1284.5 1277.5 nm Seve mask definition (X1, X2, X3, Y1, Y2, Y3) Kaceo 1284.5 1277.5 nm Seve mask definition (X1, X2, X3, Y1, Y2, Y3) λca 1284.5 1277.5 nm Seve mask definition K1, K2, X3, Y1, Y2, Y3 λca 1304.0 1377.5 nm Seve mask definition K1, K2, X3, Y1, Y2, Y3 λca 1304.5 1377.5 nm Seve mask definition K1, K2, X3, Y1, Y2, Y3 K2 1304.5 1277.5 nm	Side mode suppression ratio	SMSR		30			dB
MAA, ach lane OMA CW,ER>3.5dB 4 2.5 dB Difference in launch power between any two lanes (OMA) TDP 5 dB DDP, ach lane TDP 3.0 dB Warage launch power of OFF transmitter, each lane Poff 3.5 dB Extinction ratio ER 3.5 T dB Extendement of V(X), X2, X3, Y1, Y2, Y3) E 1284.5 1284.5 177.5 nm Perfer wavelength - lane 0 λ _{co} 1284.5 1297.5 nm Center wavelength - lane 1 λ _{co} 1304.5 1317.5 nm Center wavelength - lane 3 λ _{co} 1324.5 1337.5 nm Center wavelength - lane 3 λ _{co} 3.5 E 2.5 dB Center wavelength - lane 3 λ _{co} 1324.5 130.5 m 100.0 Center wavelength - lane 3 λ _{co} 1.5 E 2.6 dB Center wavelength - lane 3 K K 1.5 E 2.6 dB Center wavelength - lane 3 K K K K	Total average launch power	Ptot				8.5	dBm
Difference in launch power between any two lanes (OMA) 5 dB DP, each laneTDPTDP 3.0 dB DP, each lanePoff 3.5 -3.0 dB Extinction ratioER 3.5 -3.0 dB Extenction ratioER 3.5 -3.0 dB Extenction ratio Re 3.5 -27.5 RB Extenction ratio λ_{cn} 1264.5 127.5 nm Perfer wavelength - lane 0 λ_{cn} 1264.5 127.5 nm Penter wavelength - lane 1 λ_{cn} 1304.5 1317.5 nm Penter wavelength - lane 3 λ_{cn} 1324.5 1337.5 nm Penter wavelength - lane 3 λ_{cn} 1324.5 1337.5 nm Damage threshold -1.5 2.5 dBm Receiver power (OMA), each lane -1.5 2.5 dBm Receiver sensitivity (OMA), each laneResm $A E E - 5 BER$ $-1.0.0$ Bm Reseed receiver sensitivity (OMA), each laneResm $A E E - 5 BER$ $-1.0.0$ Bm Reseed receiver sensitivity (OMA), each lane $RemA E E - 5 BER-1.0.0BmReseed receiver sensitivity (OMA), each laneRem1.5 - 5 BER-1.0.0BmReseed receiver sensitivity (OMA), each laneRem1.5 - 5 BER-1.0.0BmReseed receiver sensitivity (OMA), each laneRem1.5 - 5 BER-1.0.0BmReseed receiver sensitivity (ABA end lane<$	Average launch power, each lane	Po		-6.5		2.5	dBm
TDP, each laneTDP 3.0 <	OMA, each lane	OMA	CW,ER>3.5dB	-4		2.5	dBm
warage launch power of OFF transmitter, each lane Poff -30 dBm Extinction ratio ER 3.5 .2 .03 .2 .03 .2 .03 .2 .03 .2	Difference in launch power between any two lanes (OMA)					5	dB
kinction ratio ER 3.5 yeak definition {X1, X2, X3, Y1, Y2, Y3} (0.31, 0.4. ∪, 2.3. ∪, 3.4	TDP, each lane	TDP				3.0	dB
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Receiver 1264.5 1277.5 nm Center wavelength - lane 0 λ_{c0} 1264.5 1277.5 nm Center wavelength - lane 1 λ_{c1} 1284.5 1297.5 nm Center wavelength - lane 2 λ_{c2} 1304.5 1317.5 nm Center wavelength - lane 3 λ_{c2} 1324.5 1337.5 nm Denter wavelength - lane 3 λ_{c3} 1324.5 1337.5 nm Denter wavelength - lane 3 λ_{c3} 1324.5 1337.5 nm Denter wavelength - lane 3 λ_{c3} 1324.5 1337.5 nm Denter wavelength - lane 3 λ_{c3} 1324.5 1337.5 nm Denter wavelength - lane 3 λ_{c3} 1324.5 1337.5 nm Denter wavelength - lane 3 λ_{c3} 1324.5 125.5 dBm Denter wavelength reshold Incervice resolution (OMA) (max) Incervice resolution (om A) Incervice resolution (max) Incervice res	Extinction ratio	ER		3.5			dB
Center wavelength - lane 0 λ_{co} 1264.51277.5nmCenter wavelength - lane 1 λ_{c1} 1284.51297.5nmCenter wavelength - lane 2 λ_{c2} 1304.51317.5nmCenter wavelength - lane 3 λ_{c3} 1324.51337.5nmCenter wavelength - lane 3 λ_{c3} 3.5137.5dBmCenter wavelength - lane 3 λ_{c3} 5.5dBmCenter wavelength - lane 4 \cdot \cdot 2.5dBmCenter wavelength - lane 3 \cdot \cdot \cdot 2.5dBmCenter wavelength - lane 4 \cdot \cdot \cdot \cdot \cdot \cdot Center wavelength - lane 3 \cdot <t< td=""><td>Eye mask definition {X1, X2, X3, Y1, Y2, Y3}</td><td></td><td></td><td>{0.31, 0.40</td><td>, 0.45, 0.34,</td><td>0.38, 0.4}</td><td></td></t<>	Eye mask definition {X1, X2, X3, Y1, Y2, Y3}			{0.31, 0.40	, 0.45, 0.34,	0.38, 0.4}	
Control wavelength - lane 1 λ_{c1} 1284.5 1297.5 nm Center wavelength - lane 2 λ_{c2} 1304.5 1317.50 nm Center wavelength - lane 3 λ_{c3} 1324.5 1337.50 nm Center wavelength - lane 3 λ_{c3} 1324.5 1337.50 nm Center wavelength - lane 3 λ_{c3} 1324.5 1337.50 nm Center wavelength - lane 3 λ_{c3} 1324.5 1337.50 nm Center wavelength - lane 3 λ_{c3} 1324.5 1337.50 nm Center wavelength - lane 3 λ_{c3} 1324.5 1337.50 nm Center wavelength - lane 3 λ_{c3} 1324.5 1337.50 dBm Receiver power (OMA), each lane Image 1 -11.5 2.5 dBm Receiver sensitivity (OMA), each lane Resens At 5E-5 BER -10.0 dBm Receiver sensitivity (OMA), each lane SRS At 5E-5 BER -11.9 dB Conditions of stressed receiver sensitivity test: 1.9 JB JB JB Receiver geneitivity (exter lane J2	Receiver						
Center wavelength - lane 2 λ_{c2} 1304.5 1317.5 nm Center wavelength - lane 3 λ_{c3} 1324.5 1337.5 nm Damage threshold λ_{c3} 3.5 dBm Damage threshold λ_{c3} λ_{c3} 0.5 dBm Receiver power (OMA), each lane λ_{c3} λ_{c3} 0.5 dBm Receiver reflectance -26 dB dBm Difference in receiver power between any two lanes (OMA) (max) -11.5 2.5 dB Nerage receive power, each lane Resens At 5E-5 BER -10.0 dBm Receiver sensitivity (OMA), each lane Resens At 5E-5 BER -10.0 dBm Stressed receiver sensitivity (OMA), each lane SRs At 5E-5 BER -10.0 dBm Stressed receiver ponality, each lane VECP 1.9 dB dBm Stressed eye J2 jitter, each lane J2 0.33 UI UI Stressed eye J4 jitter, each lane J4 0.48 UI UI	Center wavelength - lane 0	λ_{C0}		1264.5		1277.5	nm
Center wavelength - lane 3 λ_{c3} 1324.51337.5nmDamage threshold 3.5 5.5 dBm Receiver power (OMA), each lane -26 dBm Receiver reflectance -26 dBm Difference in receiver power between any two lanes (OMA) (max) -11.5 5.5 dBm Receiver sensitivity (OMA), each laneResens $A ext{5E-5 BER}$ -11.5 2.5 dBm Receiver sensitivity (OMA), each laneResens $A ext{5E-5 BER}$ -10.00 dBm Conditions of stressed receiver sensitivity test:VECP 1.9 -10.00 dBm Stressed eye J2 jitter, each laneJ2 0.33 UIStressed eye J4 jitter, each laneJ4 -0.48 UI	Center wavelength - lane 1	λ_{C1}		1284.5		1297.5	nm
Damage threshold3.5dBmReceiver power (OMA), each lane2.5dBmReceiver reflectance-26dBDifference in receiver power between any two lanes (OMA) (max)5.5dBOutference in receiver power, each lane-11.52.5dBmReceiver sensitivity (OMA), each laneRsensAt 5E-5 BER-10.0dBmStressed receiver sensitivity (OMA), each laneSRSAt 5E-5 BER-10.0dBmConditions of stressed receiver sensitivity test:VECP1.9dBStressed eye J2 jitter, each laneJ20.33UIStressed eye J4 jitter, each laneJ40.48UI	Center wavelength - lane 2	λ_{C2}		1304.5		1317.5	nm
Receiver power (OMA), each lane 2.5 dBm Receiver reflectance 2.5 dBm Difference in receiver power between any two lanes (OMA) (max) 5.5 dB Average receive power, each lane 0.5 dBm Receiver sensitivity (OMA), each lane 8.8 and 5.5 BER 1.0 dBm Bressed receiver sensitivity (OMA), each lane 8.8 and 5.5 BER 1.0 dBm Bressed receiver sensitivity (OMA), each lane 8.8 and 5.5 BER 1.0 dBm Conditions of stressed receiver sensitivity test: 1.0 dBm Conditions of stressed receiver sensitivity test: 1.9 dB Bressed eye J2 jitter, each lane J2 0.33 UI Bressed eye J4 jitter, each lane J4 0.48 UI	Center wavelength - lane 3	λ_{C3}		1324.5		1337.5	nm
Acceiver reflectance -26 dB Difference in receiver power between any two lanes (OMA) (max) -11.5 5.5 dB Average receive power, each lane Acceiver sensitivity (OMA), each lane Receiver sensitivity test: Aretrical eye closure penalty, each lane VECP 1.9 CP 1.9 JB	Damage threshold			3.5			dBm
Difference in receiver power between any two lanes (OMA) (max) Average receive power, each lane -11.5 5.5 dB Receiver sensitivity (OMA), each lane Rsens $A ext{ 5E-5 BER}$ -10.0 dB Reseever sensitivity (OMA), each lane $Rsens A ext{ 5E-5 BER}$ -10.0 dB Conditions of stressed receiver sensitivity test: Vertical eye closure penalty, each lane $VECP$ 1.9 0.33 UI Bressed eye J2 jitter, each lane $J2$ 0.48 UI	Receiver power (OMA), each lane					2.5	dBm
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Receiver sensitivity (OMA), each laneRsensAt 5E-5 BER-10.0dBmStressed receiver sensitivity (OMA), each laneSRSAt 5E-5 BER-10.0dBmConditions of stressed receiver sensitivity test:VECP1.9dBVertical eye closure penalty, each laneJ20.33UIStressed eye J2 jitter, each laneJ40.48UI	Difference in receiver power between any two lanes (OMA) (max)					5.5	dB
Stressed receiver sensitivity (OMA), each lane SRS At 5E-5 BER 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	Average receive power, each lane			-11.5		2.5	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	Receiver sensitivity (OMA), each lane	Rsens	At 5E-5 BER			-10.0	dBm
Vertical eye closure penalty, each laneVECP1.9dBStressed eye J2 jitter, each laneJ20.33UIStressed eye J4 jitter, each laneJ40.48UI	Stressed receiver sensitivity (OMA), each lane	SRS	At 5E-5 BER				
Stressed eye J2 jitter, each laneJ20.33UIStressed eye J4 jitter, each laneJ40.48UI	Conditions of stressed receiver sensitivity test:						
Stressed eye J2 jitter, each laneJ20.33UIStressed eye J4 jitter, each laneJ40.48UI	Vertical eye closure penalty, each lane	VECP			1.9		dB
Stressed eye J4 jitter, each lane J4 0.48 UI	Stressed eye J2 jitter, each lane				0.33		UI
	SRS eye mask definition {X1, X2, X3,Y1, Y2, Y3}			{(0. 0.39. 0.39	

1. FEC reqiurements as defined by the 100G CWDM4 MSA Technical Specification Rev 1.1

The Receiver sensitivity (OMA), each lane (Max) at 5E-5 BER is a normative specification
 The conditions of the stressed receiver sensitivity test section are NOT characteristics of the reciever

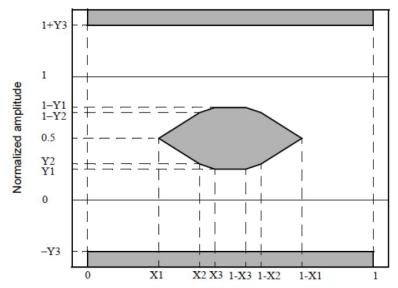




Product Label



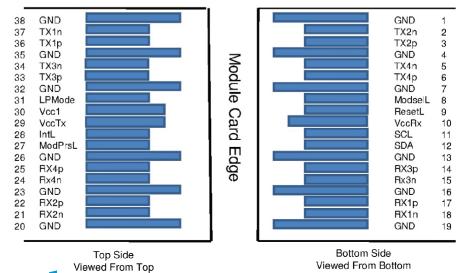
Eye Mask Definition



X1	0.31	Y1	0.34
X2	0.40	Y2	0.38
X3	0.45	Y3	0.4

Normalized time (Unit Interval)

Pin Description





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Pin Function Definitions

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	LVTTL-I	ModSelL	Module select	
9	LVTTL-I	ResetL	Module reset	
10		Vcc Rx	+3.3 V power supply receiver	2
11	LVCMOS I / O	SCL	2-wire serial interface clock	
12	LVCMOS 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	LVTTL-O	ModPrsL	Module present	
28	LVTTL-O	IntL	Interrupt	
29		Vcc Tx	+3.3 V power supply transmitter	2
30		Vcc1	+3.3 V power supply	2
31	LVTTL-I	LPMode	Low power mode	
32		GND	Ground	1
33	CML-I	Тх3р	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

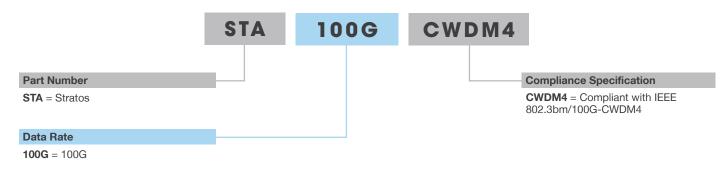
Note 1 : GND is the symbol for signal and supply (power) common for the QSFP+ module. All are common within the QSFP+ module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal-common ground plane.

Note 2 : Vcc Rx, Vcc1 and Vcc Tx are the receiver and transmitter power supplies and shall be applied concurrently.



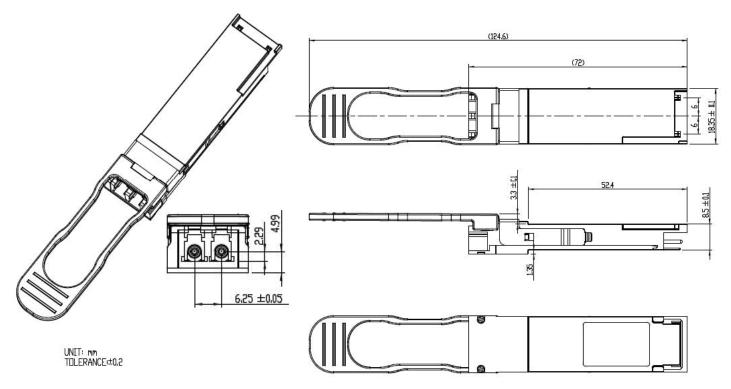


Ordering Information



Part Drawings

Mechanical Design Diagram (mm)







Regulatory Compliance

Item	Standard
Electromagnetic interference (EMI)	FCC art 15 Class B CE EN55032+EN55035 VCCI CISPR32
ESD (Module case)	Contact discharge EN61000-4-2 criterion B
ESD (Module case)	Air discharge EN61000-4-2 criterion B
ESD (Electrical connector)	ANSI/ESDA/JEDEC JS-001
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 IEC/EN 60825-1. Users should observe safety precautions such as those recommended by ANSI³ 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

UL: 62368-1 TUV: EN62368-1, EN 60825-1, EN 60825-2 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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