


## TSQS-CW1HG02-LC Optical Transceiver

Single-Mode CPRI/100GBASE Transceiver, With Diagnostic Monitoring  
Duplex QSFP28 CWDM4 2km Transceiver

### Features

- Electrical interface: retimed CAUI-4 per 100G Ethernet IEEE 802.3bm Annex 83E
- Hot pluggable
- Link budget assumes the use of KR4 FEC by the host
- Uncooled CWDM DFB lasers, directly modulated
- User controllable Transmit Input Equalization and Receiver Output Amplitude
- Fiber connector: SMF LC duplex connector
- Power dissipation < 3.5W
- Distance up to 2km
- 2-wire interface with integrated Digital Diagnostic monitoring
- Operating case temperature: 0°C~+70°C
- RoHS6 compliant (lead free) 



### Applications

- Data Center Interconnect
- 100G CWDM4 applications with FEC

### Description

The QSFP28 100G-CWDM4-2km module is a highly integrated 4x25G transceiver focused on reach, bandwidth, density and cost for high port-count 100G systems, and client-side 100G interfaces. It is compliant with the 100G 4WDM-10 MSA, which is based on the CWDM4 MSA version 1.1. It is interoperable with CWDM4 transceivers over a 2 km reach.

### Absolute Maximum Ratings

Parameters	Symbol	Min.	Max.	Unit
Power Supply Voltage	VCC	-0.5	+3.6	V
Storage Temperature	Tc	-40	+85	°C
Relative Humidity	RH	0	85	%

Information and specifications are subject to change without notice.  
Please visit [www.china-tscom.com](http://www.china-tscom.com) for more information

8 Jinxiu Middle Road, Pingshan, Shenzhen, Guangdong, 518118, P. R. China  
+86 755 32983688 | [info@china-tscom.com](mailto:info@china-tscom.com) | [www.china-tscom.com](http://www.china-tscom.com)



## Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit
Power Supply Voltage	VCC	3.15	3.30	3.45	V
Supply current	Icc	-	-	1014	mA
Operating Case Temperature	Tca	0	-	70	°C

## Electrical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit
<b>Transmitter</b>					
Input differential impedance <sup>1</sup>	Rin	-	100	-	Ω
Single-ended Input Voltage Tolerance	-	-0.3	-	4.0	V
AC Common Mode Input Voltage Tolerance	-	15	-	-	mV
Differential Input Voltage	-	50	-	-	mV
Differential Input Voltage swing, per lane	Vin	190	-	1000	mV
<b>Receiver</b>					
Output differential impedance <sup>1</sup>	Rout	-	100	-	Ω
Differential Output Swing, per lane <sup>2</sup>	Vout	300	-	900	mV
AC Common Mode Output Voltage Tolerance	-	-	-	7.5	mV
Single-ended Output Voltage	-	-0.3	-	4.0	V

### Notes:

[1] AC coupled.

[2] Into 100 ohm differential termination.

## Transmitter Specifications – Optical

Parameter	Symbol	Min	Typical	Max	Unit	
Center Wavelength	Ch0	λ0	1264.5	1271	1277.5	nm
	Ch1	λ1	1284.5	1291	1297.5	nm
	Ch2	λ2	1304.5	1311	1317.5	nm
	Ch3	λ3	1324.5	1331	1337.5	nm
Bit Rate per Channel <sup>1</sup>	DR	25.78125±100ppm			Gbps	
Side Mode Suppression Ratio	SMSR	30	-	-	dB	
Average launch power each lane <sup>7</sup>	-	-6.5	-	2.5	dBm	
Optical Modulation Amplitude (each lane)	OMA	-4.0	-	2.5	dBm	

Information and specifications are subject to change without notice.  
Please visit [www.china-tscom.com](http://www.china-tscom.com) for more information

8 Jinxiu Middle Road, Pingshan, Shenzhen, Guangdong, 518118, P. R. China  
+86 755 32983688 | [info@china-tscom.com](mailto:info@china-tscom.com) | [www.china-tscom.com](http://www.china-tscom.com)



Transmit OMA per Lane @TDP max <sup>2</sup>	-	-2.0	-	-	dBm
Launch power in OMA minus TDP, each lane	OMA-TDP	-5.0	-	-	dBm
Transmission & dispersion penalty, each lane <sup>3</sup>	TDP	-	-	3.0	dB
Transmitter Reflectance	-	-	-	-12	dB
Extinction Ratio	ER	3.5	-	-	dB
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}	{0.31, 0.4, 0.45, 0.34, 0.38, 0.4} CWDM4 MSA Technical Specifications Rev 1.1				
Total average launch power	Po	-	-	8.5	dBm
Average launch power of OFF transmitter, each lane	Poff	-	-	-30	dBm
Optical return loss tolerance	ORL	-	-	20	dB

## Receiver Specifications – Optical

Parameter		Symbol	Min	Typical	Max	Unit
Center Wavelength	Ch0	$\lambda_0$	1264.5	1271	1277.5	nm
	Ch1	$\lambda_1$	1284.5	1291	1297.5	nm
	Ch2	$\lambda_2$	1304.5	1311	1317.5	nm
	Ch3	$\lambda_3$	1324.5	1331	1337.5	nm
Bit Rate per Channel <sup>4</sup>		DR	25.78125 ± 100ppm			Gbps
Unstressed Sensitivity (OMA) <sup>5</sup>		OMAIN	-	-	-10	dBm
Receiver Overload		P <sub>MAX</sub>	2.5	-	-	-
Stressed Sensitivity (OMA) <sup>6</sup>		OMAIN, str	-	-	-7.3	dBm
Optical Return Loss		ORL	-	-	-26	dB
Vertical eye closure penalty, each lane		VECP	-	-	1.9	dB
Stressed eye J2 Jitter, each lane		J2	-	-	0.3	UI
Stressed eye J9 Jitter, each lane		J9	-	-	0.5	UI
Stressed eye J4 Jitter, each lane		J4	-	-	0.48	UI
SRS eye mask definition {X1, X2, X3, Y1, Y2, Y3}		{0.39, 0.5, 0.5, 0.39, 0.39, 0.4} CWDM4 MSA Technical Specifications Rev 1.1				
Damage threshold, each lane		-	3.5	-	-	dB

### Notes:

- [1] Transmitter consists of 4 lasers operating at 25.78Gb/s each.  
[2] At maximum TDP.  
[3] TDP value does not include MPI penalty.  
[4] Receiver consists of 4 photodetectors operating at 25.78Gb/s each.  
[5] Sensitivity is specified at 5x10<sup>-5</sup> BER.

[6] Measured with CWDM4 MSA2 conformance test signal at TP3 for 5x10<sup>-5</sup> BER.

[7] Power value and power accuracy are with all channels on.

### General Specifications

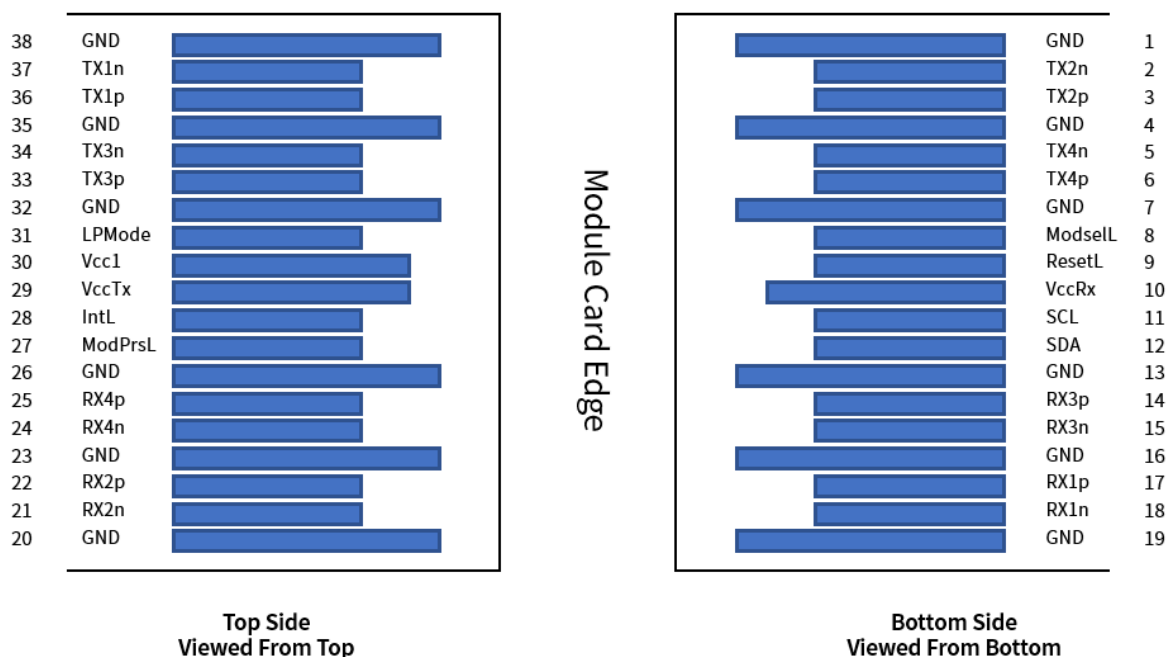
Parameter	Symbol	Min	Typical	Max	Unit
Bit Rate (all wavelengths combined)	BR	-	-	103.1	Gb/s
Bit Error Ratio @25.78Gb/s <sup>1</sup>	BER	-	-	5x10 <sup>-5</sup>	-
Maximum Supported Distances					
Fiber Type	-	-	-	-	-
SMF per G.652 <sup>2</sup>	LossBdgt	-	-	5	dB

**Notes:**

[1] Tested with a 2<sup>31</sup> - 1 PRBS.

[2] This 5 dB loss budget includes 2.5dB optical coding gain from FEC on the host [RS-FEC (528,514) per Clause 91]. The maximum informative link length is 2km. The option to bypass RS-FEC is not supported. Loss budget may include up to 1dB MPI loss penalty with worse case Transmitter and worst case connector MPI.

### Electrical Pad Layout



### Pin Definition

Pin	Symbol	Name/Description
1	GND	Ground
2	Tx2n	Transmitter Inverted Data Input

Information and specifications are subject to change without notice. Please visit [www.china-tscom.com](http://www.china-tscom.com) for more information



3	Tx2p	Transmitter Non-Inverted Data Input
4	GND	Ground
5	Tx4n	Transmitter Inverted Data Input
6	Tx4p	Transmitter Non-Inverted Data Input
7	GND	Ground
8	ModSelL	Module Select
9	ResetL	Module Reset
10	VCC Rx	+3.3 V Power supply receiver
11	SCL	2-wire serial interface clock
12	SDA	2-wire serial interface data
13	GND	Ground
14	Rx3p	Receiver Non-Inverted Data Output
15	Rx3n	Receiver Inverted Data Output
16	GND	Ground
17	Rx1p	Receiver Non-Inverted Data Output
18	Rx1n	Receiver Inverted Data Output
19	GND	Ground
20	GND	Ground
21	Rx2n	Receiver Inverted Data Output
22	Rx2p	Receiver Non-Inverted Data Output
23	GND	Ground
24	Rx4n	Receiver Inverted Data Output
25	Rx4p	Receiver Non-Inverted Data Output
26	GND	Ground
27	ModPrsL	Module Present
28	IntL	Interrupt
29	VCC Tx	+3.3 V Power supply transmitter
30	VCC1	+3.3 V Power Supply
31	LPMode	Low Power Mode
32	GND	Ground
33	Tx3p	Transmitter Non-Inverted Data Input
34	Tx3n	Transmitter Inverted Data Input
35	GND	Ground
36	Tx1p	Transmitter Non-Inverted Data Input

Information and specifications are subject to change without notice.  
Please visit [www.china-tscom.com](http://www.china-tscom.com) for more information

8 Jinxiu Middle Road, Pingshan, Shenzhen, Guangdong, 518118, P. R. China  
+86 755 32983688 | [info@china-tscom.com](mailto:info@china-tscom.com) | [www.china-tscom.com](http://www.china-tscom.com)



37	Tx1n	Transmitter Inverted Data Input
38	GND	Ground

## Ordering Information

Part Number	Product Description
TSQS-CW1HG02-LC	100Gbps QSFP28 CWDM4 2km 0°C ~ +70°C

## References

1. SFF-8665: “QSFP+ 28Gb/s 4X Pluggable Transceiver Solution (QSFP28)” , Rev 1.9, June 29 100G CWDM4 MSA.
2. “100G CWDM4 MSA Technical Specifications: 2km Optical Specifications” , Rev. 1.1, November 23, 2015.
3. IEEE 802.3bm.
4. IEEE 802.3ba.

## Important Notice

Performance figures, data and any illustrative material provided in this data sheet are typical and must be specifically confirmed in writing by T&S before they become applicable to any particular order or contract. In accordance with the T&S policy of continuous improvement specifications may change without notice.

The publication of information in this data sheet does not imply freedom from patent or other protective rights of T&S or others. Further details are available from any T&S sales representative.