

## 200GBASE-FR4 QSFP56 Optical Transceiver Module GQS-SPO201-FR4CW

### Features

- ✓ IEEE 802.3-2018 200GE FR4 specification compliant
- ✓ 4 CWDM lanes MUX/DEMUX design
- ✓ 4x 53.125 Gbps PAM4 electrical interface (200GAUI-4, CEI-56G-VSR-PAM4)
- ✓ Non-hermetic package design
- ✓ Maximum power consumption 6.0 W
- ✓ LC duplex connector
- ✓ 212.5 Gbps aggregate bit rate
- ✓ Up to 2 km transmission on single mode fiber with FEC
- ✓ Operating case temperature: 0 to 70°C
- ✓ Single 3.3 V power supply
- ✓ I2C digital management interface
- ✓ Hardware SFF-8679 Rev 1.8 compliant
- ✓ Software QSFP-DD CMIS Rev 4.0 compliant
- ✓ RoHS 2 compliant

### Applications

- ✓ IEEE 802.3bs 200GBASE-FR4 Ethernet (PAM4)
- ✓ 5G Back-haul
- ✓ Data center

### Description

Gigalight's GQS-SPO201-FR4CW 200GE QSFP56 Optical Transceiver is a QSFP56 transceiver module designed for 2km optical communication applications with single mode fiber. It is compliant with IEEE 802.3-2018 200GBASE FR4, SFF-8679, and CEI-56G-VSR-PAM4 standards. Digital diagnostic management interface (DDMI) is realized by I2C interface in compliance with CMIS4. The module is RoHS 2 compliant. The module can convert 4-channel 53.125 Gbps electrical data to 4-channel optical signals, and multiplex them into a single channel for 212.5 Gbps optical transmission. Similarly, it optically de-multiplexes a 212.5 Gbps input into 4-channel signals, and converts them to 4-channel output electrical data on the receiver side. It has been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference. A block diagram is shown in below picture.

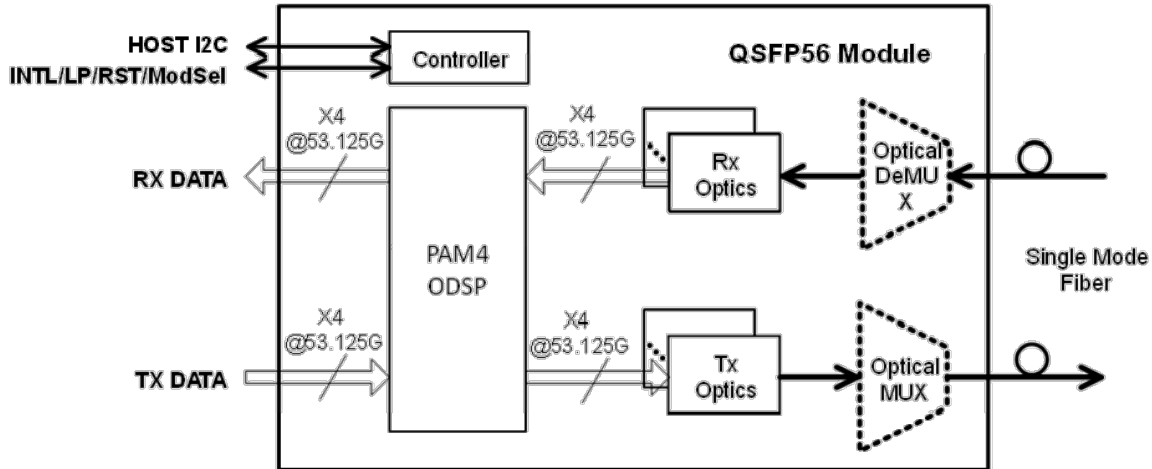


Figure 1. Transceiver block diagram

### Absolute Maximum Ratings

It has to be noted that the operation in excess of any individual absolute maximum ratings might cause permanent damage to this module.

Parameter	Symbol	Min	Typ.	Max	Unit	Note
Maximum supply voltage	Vcc	-0.3	3.3	3.6	V	
Storage temperature	Ts	-40		85	°C	
Relative humidity	RH	0		85	%	Non-condensing
Damage threshold, each lane	THd	5.7			dBm	

### Operating Environments

Electrical and optical characteristics below are defined under this operating environment, unless otherwise specified.

Parameter	Symbol	Min	Typical	Max	Unit
Supply voltage	Vcc	3.135	3.3	3.465	V
Case temperature	T	0		70	°C
Signaling rate, each lane			26.5625		GBd
Data rate accuracy		-100		100	ppm
Link distance with G.652		2		2000	m

### Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Power dissipation				6.0	W	
Supply current	Icc			1.9138	A	
<b>Transmitter (module output)</b>						
Signaling rate per lane (range)			26.5625 ± 100 ppm		GBd	

Differential voltage pk-pk	Vpp			900	mV	At 1 MHz
Common mode voltage	Vcm	-350		2850	mV	
Common mode noise, RMS				17.5	mV	
Differential termination resistance mismatch				10	%	
Differential return loss	SDD22	Complaint to CEI-56G-VSR-PAM4				
Common mode to differential mode conversion	SDC22	Complaint to CEI-56G-VSR-PAM4				
Common mode return loss	SCC22			-2	dB	From 250MHz to fb GHz
Transition time	Trise/Tf all	9.5			ps	20%~80%
Near-end eye width at 10-6 probability	EW6	0.265			UI	
Near-end eye height at 10-6 probability	EH6	70			mV	
Far-end eye width at 10-6 probability	EW6	0.2			UI	
Far-end eye height at 10-6 probability	EH6	30			mV	
Near-end eye linearity		0.85				
<b>Receiver (module input)</b>						
Signaling rate per lane (range)		26.5625 ± 100 ppm			GBd	
Overload differential voltage pk-pk	Vpp	900			mV	
Common mode voltage	Vcm	-350		2850	mV	
Differential termination resistance mismatch				10	%	At 1 MHz
Differential return loss	SDD11	Complaint to CEI-56G-VSR-PAM4				
Differential mode to common mode conversion	SCD11	Complaint to CEI-56G-VSR-PAM4				
Stressed input test		Complaint to CEI-56G-VSR-PAM4				

**Optical Characteristics**

Parameters	Unit	Min.	Typ.	Max.
<b>Transmitter</b>				
Signaling rate, each lane	GBd	26.5625 ± 100 ppm		
Total average launch power	dBm			10.7
Average launch power, each lane	dBm	-4.2		4.7
Line wavelengths	nm	1264.5		1277.5
		1284.5		1297.5
		1304.5		1317.5
		1324.5		1337.5
Optical modulation amplitude (OMA <sub>outer</sub> ), each lane	dBm	-1.2		4.5
Difference in launch power between any two lanes (OMA <sub>outer</sub> )	dB			4
Extinction ratio (ER)	dB	3.5		
Side-mode suppression ratio (SMSR)	dB	30		
Launch power in OMA <sub>outer</sub> minus TDECQ, each lane for extinction ratio ≥ 4.5 dB for extinction ratio < 4.5 dB	dBm	-2.6 -2.5		
Transmitter and dispersion eye closure for PAM4 (TDECQ), each lane	dB			3.3
<b>Receiver</b>				
Average launch power of OFF transmitter, each lane	dBm			-30
Optical return loss tolerance	dB			17.1
Transmitter reflectance	dB			-26
Signaling rate, each lane	GBd	26.5625 ± 100 ppm		
Line wavelengths	nm	1264.5		1277.5
		1284.5		1297.5
		1304.5		1317.5
		1324.5		1337.5

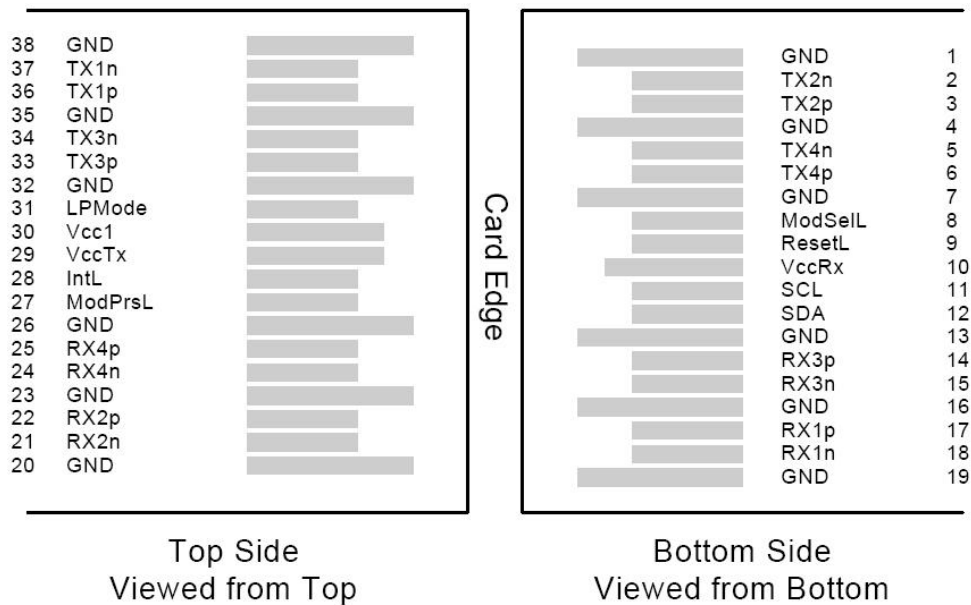
Average receiver power, each lane	dBm	-8.2		4.7
Receiver power, each lane (OMA)	dBm			4.5
Damage threshold, each lane	dBm	5.7		
Difference in receive power between any two lanes (OMAouter)	dB			4.1
Receiver sensitivity (OMA), each lane	dBm			max (-5.5, SECQ-6.9)
Receiver reflectance	dB			-26
Stressed receiver Sensitivity (OMA), each lane	dBm			-3.6
<b>Conditions of stressed receiver sensitivity</b>				
Stressed eye closure for PAM4 (SECQ), lane under test		dB		3.3
OMAouter of each aggressor lane		dBm		0.5

## Pin Description

Pin	Symbol	Name/Description	
1	GND	Ground	1
2	Tx2n	Transmitter Inverted Data Input	
3	Tx2p	Transmitter Non-Inverted Data Input	
4	GND	Ground	1
5	Tx4n	Transmitter Inverted Data Input	
6	Tx4p	Transmitter Non-Inverted Data Input	
7	GND	Ground	1
8	ModSelL	Module Select	
9	ResetL	Module Reset	
10	VccRx	+3.3 V Power Supply Receiver	2
11	SCL	2-wire Serial Interface Clock	
12	SDA	2-wire Serial Interface Data	
13	GND	Ground	1
14	Rx3p	Receiver Non-Inverted Data Output	
15	Rx3n	Receiver Inverted Data Output	
16	GND	Ground	1
17	Rx1p	Receiver Non-Inverted Data Output	
18	Rx1n	Receiver Inverted Data Output	
19	GND	Ground	1

20	GND	Ground	1
21	Rx2n	Receiver Inverted Data Output	
22	Rx2p	Receiver Non-Inverted Data Output	
23	GND	Ground	1
24	Rx4n	Receiver Inverted Data Output	
25	Rx4p	Receiver Non-Inverted Data Output	
26	GND	Ground	1
27	ModPrsL	Module Present	
28	IntL/RxLOS	Interrupt. Optionally configurable as RxLOSL	
29	VccTx	+3.3 V Power Supply Transmitter	2
30	Vcc1	+3.3 V Power Supply	2
31	LPMoDe/Tx	Low Power Mode. Optionally configurable as	
32	GND	Ground	1
33	Tx3p	Transmitter Non-Inverted Data Input	
34	Tx3n	Transmitter Inverted Data Input	
35	GND	Ground	1
36	Tx1p	Transmitter Non-Inverted Data Input	
37	Tx1n	Transmitter Inverted Data Input	
38	GND	Ground	1

- Note:
1. Circuit ground is internally isolated from chassis ground. GND is the symbol for signal and supply (power) common for the module. All are common within the module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal-common ground plane.
  2. VccRx, Vcc1 and VccTx are applied concurrently and may be internally connected within the module in any combination. Vcc contacts in SFF-8662 and SFF-8672 each have a steady state current rating of 1 A.

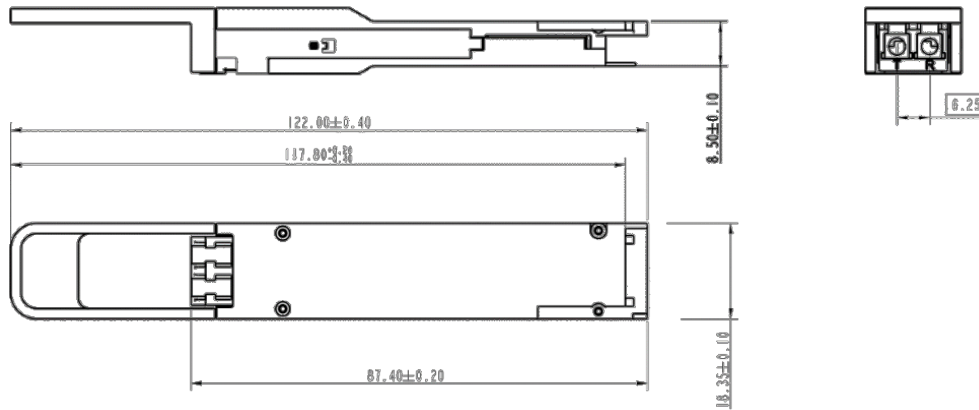


**Figure 2. Electrical Pin-out Details**

## Digital Diagnostic Functions

Performance Item	Data Address	
	Alarm & Warning	Alarm & Warning Thresholds
Module temperature	Lower page 9	Page2h (128-135)
Module voltage	Lower page 9	Page2h (136-143)
Bias current	Page11h (143-146)	Page2h (184-191)
Transmitter optical power	Page11h (139-142)	Page2h (176-183)
Receiver optical power	Page11h (149-152)	Page2h (192-199)

## Mechanical Dimensions



**Figure 3. Mechanical Specifications**

## Regulatory Compliance

Gigalight QQS-SPO201-FR4CZ QSFP56 transceiver are Class 1 Laser Products. They are certified per the following standards:

Feature	Agency	Standard
Laser Eye Safety	FDA/CDRH	CDRH 21 CFR 1040 and Laser Notice 50
EMC	FCC	47 CFR FCC Part 15 Subpart B
EMC	CE-EMC	EN 55032:2015 EN 55024:2010+A1:2015 EN 61000-3-2:2014 EN 61000-3-3:2013

Complies with FDA performance standards for laser products except for deviations pursuant to Laser Notice No.

50, dated June 24, 2007.

## References

1. QSFP MSA
2. CMIS V4.0
3. SFF-8636
4. IEEE 802.3bs 200GBASE-FR4 specification
5. Directive 2011/65/EU of the European Parliament and of the Council, “on the restriction of the use of certain hazardous substances in electrical and electronic equipment,” July 1, 2011.

## CAUTION:

Use of controls or adjustment or performance of procedures other than those specified herein may result in hazardous radiation exposure.

## Ordering Information

Part Number	Product Description
GQS-SPO201-FR4CW	QSFP56, 200GBASE-FR4 Transceiver, 2km over SMF, PAM4.

## Important Notice

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

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## Revision History

Revision	Date	Description
V0	Sep-14-2022	Initial Release.