



Q112-400G-SR4 QSFP112 Transceiver

400Gb/s SR4 MMF 50m Over OM4

Introduction

Q112-400G-SR4 400G QSFP112 transceiver modules are designed for use in 400 Gigabit Ethernet links over multimode fiber up to 70m on OM3 MMF or 100m on OM4 MMF. They are compliant with the QSFP112 MSA and IEEE 802.3db 400GBASE-SR4 and IEEE 802.3ck 400GAUI-4. Digital diagnostics functions are available via the I2C interface, as specified by the QSFP112 MSA. The transceiver is RoHS-6 compliant per Directive 2011/65/EU and Coherent Application Note AN-2038.

PRODUCT FEATURES

- Hot-pluggable QSFP112 form factor
- Supports 425Gb/s aggregate bit rate
- Power dissipation < 8W
- RoHS-6 compliant
- Commercial case temperature range of 0°C to 70°C
- Single 3.3V power supply
- Maximum link length of 50m on OM4 Multimode Fiber (MMF)
- 4x100Gb/s 850nm VCSEL-based transmitter
- 4x100G electrical interface
- Single MPO12 APC receptable
- I2C management interface

APPLICATIONS

- 400GBASE-SR4 400G Infiniband&Ethernet
- 2x200GBASE-SR2 200G Infiniband&Ethernet

Ordering Information

Part Number	Data Rate (Gbps)	Wavelength (nm)	Transmission Distance(m)	Temperature (°C) (Operating Case)
Q112-400G-SR4	400Gb	850nm	50m over OM4	0°C~+70°C

Pin Descriptions

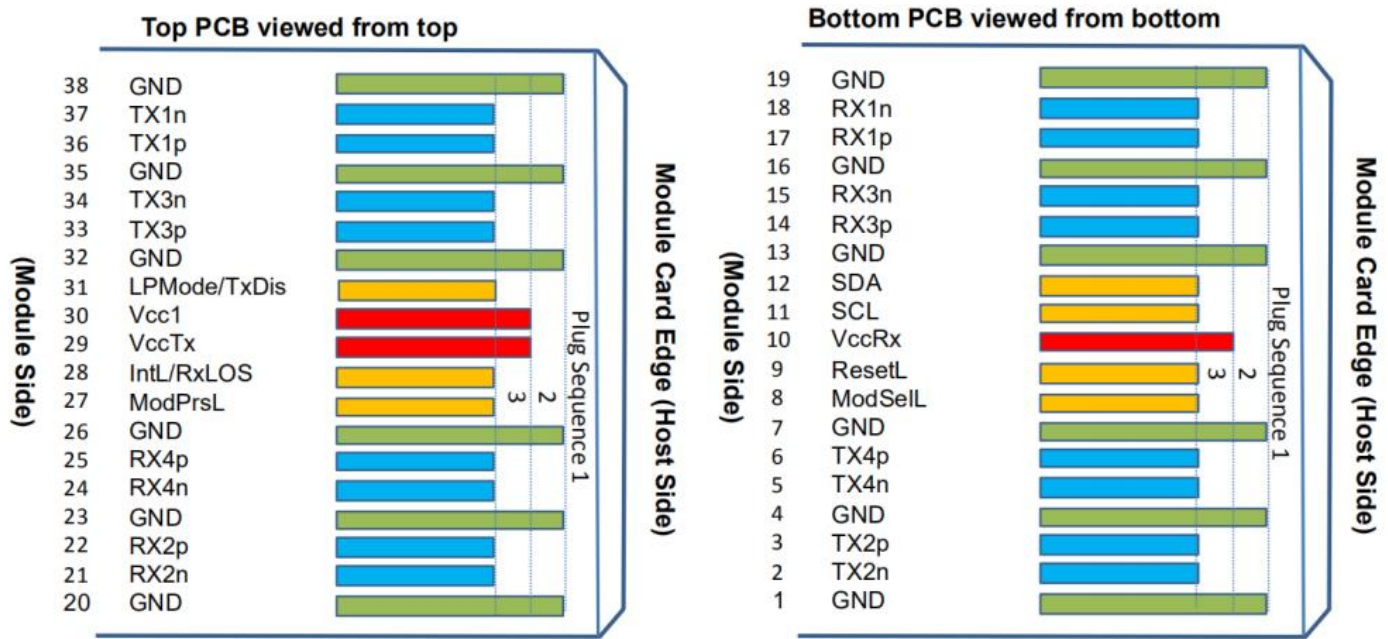


Figure 1 - QSFP112-compliant 38-pin connector

Pin	Symbol	Name/Description	Notes
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	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	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	

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18	Rx1n	Receiver Inverted Data Output	
19	GND	Ground	1
20	GND	Ground	1
21	Tx2n	Transmitter Inverted Data Input	
22	Tx2p	Transmitter Non-Inverted Data Input	
23	GND	Ground	1
24	Tx4n	Transmitter Inverted Data Input	
25	Tx4p	Transmitter Non-Inverted Data Input	
26	GND	Ground	1
27	ModSelL	Module Select	
28	IntL/RxLOSL	Interrupt/optional RxLOS	
29	Vcc Tx	+3.3 V Power Supply Transmitter	
30	Vcc1	+3.3 V Power Supply	
31	LPMoDe/TxDis Low Power	mode/optional TX Disable	
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

Notes

1.Circuit ground is internally isolated from chassis ground.

Absolute Maximum Ratings

Module performance is not guaranteed beyond the operating range. Exceeding the limits below may damage the transceiver module permanently.

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Maximum Supply Voltage	Vcc	-0.5		4.0	V	
Storage Temperature	TS	-40		+85	°C	
Case Operating Temperature	TOP	0		+70	°C	c-temp
Relative Humidity	RH	15		85	%	1
Receiver Damage Threshold, per Lane	PRdmg	5			dBm	

Notes:

1.Non-condensing.

Electrical Characteristics (EOL, TOP = 0 to +70 °C, VCC = 3.135 to 3.465 Volts)

Aligned to IEEE P802.3ck

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Supply Voltage	Vcc	3.135	3.3	3.465	V	
Supply Current	Icc			2.8	A	
Module total power	P			8	W	1
Transmitter						
Signaling rate per lane		53.125± 100 ppm.			Gbd	
Differential pk-pk input voltage tolerance		750			mV	
Differential termination mismatch				10	%	
Single-ended voltage tolerance range		-0.4		3.3	V	
DC common mode voltage		0.35		2.85	V	
Receiver						
Signaling rate per lane		53.125± 100 ppm.			Gbd	
Differential peak-to-peak output voltage (Short mode)				600	mV	
Differential peak-to-peak output voltage (Long mode)				845	mV	
Transition time (20% to 80%)	tr, tf	8.5			Ps	
Eye height	EH			15	mV	
Vertical eye closure,	VEC			12	dB	
Differential termination mismatch				10	%	
DC common mode voltage		0.35		2.85	V	

Notes:

1. Maximum total power value is specified across the full operational temperature and voltage range when CDRs are locked or a lack of input signal results in squelch being activated. If incorrect frequencies cause the CDRs to continuously attempt to lock, maximum power dissipation may reach 8W.

Optical Characteristics (EOL, TOP = 0 to 70 °C, VCC = 3.135 to 3.465 Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Transmitter						
Signaling rate per lane		53.125 ± 100 ppm.			Gbd	1
Modulation format		PAM4				
Center wavelength		840		860	nm	
RMS Spectral Width	SW			0.6	nm	
Average Launch Power per Lane	TXPx	-4.6		-4	dBm	
Outer Optical Modulation Amplitude (OMA _{outer}), each lane	OMA	-2.6		3.5	dBm	2
Outer Optical Modulation Amplitude (OMA _{outer}), each lane	OMA	- 4.4 + max (TECQ, TDECQ)		3.5	dBm	3
Transmitter and dispersion eye closure for PAM4 (TDECQ), each lane	TDECQ			4.4	dBm	
Transmitter eye closure for PAM4 (TECQ), each lane	TECQ			4.4	dBm	
Overshoot/undershoot	OS			29	%	
Transmitter power excursion, each lane	TPE			2.3	dBm	
Optical Extinction Ratio	ER	2.5			dB	
Transmitter transition time, each lane	Tt			17	dBm	
RIN _{14OMA}				-132	dB/Hz	
Optical Return Loss Tolerance	ORL			-14	dB	
Encircled Flux	FLX	>86% at 19 um <30% at 4.5 um				
Average Launch Power of OFF Transmitter, per Lane				-30	dBm	
Receiver						
Signaling rate per lane		53.125 ± 100 ppm.			Gbd	
Modulation format		PAM4				
Center wavelength		840		948	nm	
Damage Threshold	DT	5			dBm	
Average Launch Power per Lane	TXPx	-6.4		-4	dBm	
Receive power, each lane (OMA _{outer})	RxOMA			3.5	dBm	
Receiver Reflectance	Rfl			-15	dB	
LOS Hysteresis		0.5	1		dB	
Receiver sensitivity (OMA _{outer})	RxSen			-4.6		2
Receiver sensitivity (OMA _{outer})	RxSen			- 6.4 + TECQ		3

Notes:

1. Transmitter consists of 4 lasers operating at a maximum speed of $53.125 \pm 100\text{ppm}$ Gbaud each;
2. For max (TECQ, TDECQ) ≤ 1.8 dB;
3. For $1.8 \leq \text{max (TECQ, TDECQ)} \leq 4.4$ dB;
4. Minimum value is informative only and not the principal indicator of signal strength.

General Specifications

Maximum Supported Distances	Symbol	Min	Typ	Max	Units	Ref.
Fiber Type						
OM3 MMF	Lmax1		30		m	1,2
OM4 MMF	Lmax2		50		m	1,2
Data Rate Specifications	Symbol	Min	Typ	Max	Units	Ref.
Bit Rate per Lane	BR			106.25	Gb/s	3
Pre-FEC Bit Error Ratio	BER			2.4×10^{-4}		4
Post-FEC Bit Error Ratio	BER			10-12		4,5

Notes:

1. Tested with a 231 – 1 PRBSQ.
2. Requires FEC on the host to support maximum distance, per 400GBASE-SR4.
3. Supports 400 Gigabit Ethernet applications.
4. Tested with a PRBSQ 231-1 test pattern.
5. Assumes FEC provided by host system.

Environmental Specifications

Q112-400G-SR4 QSFP112 transceivers have a commercial operating case temperature range of 0°C to $+70^{\circ}\text{C}$. They can support temporary excursions to case temperatures of -5°C and $+75^{\circ}\text{C}$ without permanent damage.

Parameter	Symbol	Min	Typ	Max	Units	Ref.
Case Operating Temperature	Top	0		+70	$^{\circ}\text{C}$	
Storage Temperature	Tsto	-40		+85	$^{\circ}\text{C}$	

Regulatory Compliance

Q112-400G-SR4 QSFP112 transceivers 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
Laser Eye Safety	TÜV	EN 60825-1:2014 EN 60825-2:2004+A1+A2
Electrical Safety	TÜV	EN 60950-1:2006+A11+A1+A12+A2
Electrical Safety	UL/CSA	CAN/CSA-C22.2 No. 60950-1-07+A2:2014 ANSI/UL Std. No. 60950-1:2014

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Copies of the referenced certificates will be available at Coherent upon request.

All laser products Comply with 21 CFR 1040.10 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019.

CAUTION – Use of Controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Digital Diagnostics Functions

Q112-400G-SR4 QSFP112 transceivers support the I2C-based diagnostics interface specified by the QSFP112 MSA.

Parameter	Symbol	Min	Max	Units	Notes
Temperature monitor	DMI_Temp	-3	3	°C	Over operating temp
TX power monitor	DMI_TX	-3	3	dB	
RX power monitor	DMI_RX	-3	3	dB	
Supply voltage monitor	DMI_VCC	-0.1	0.1	V	Full operating range

Mechanical Specifications

Q112-400G-SR4 QSFP112 transceivers are compatible with the QSFP112 MSA specification.

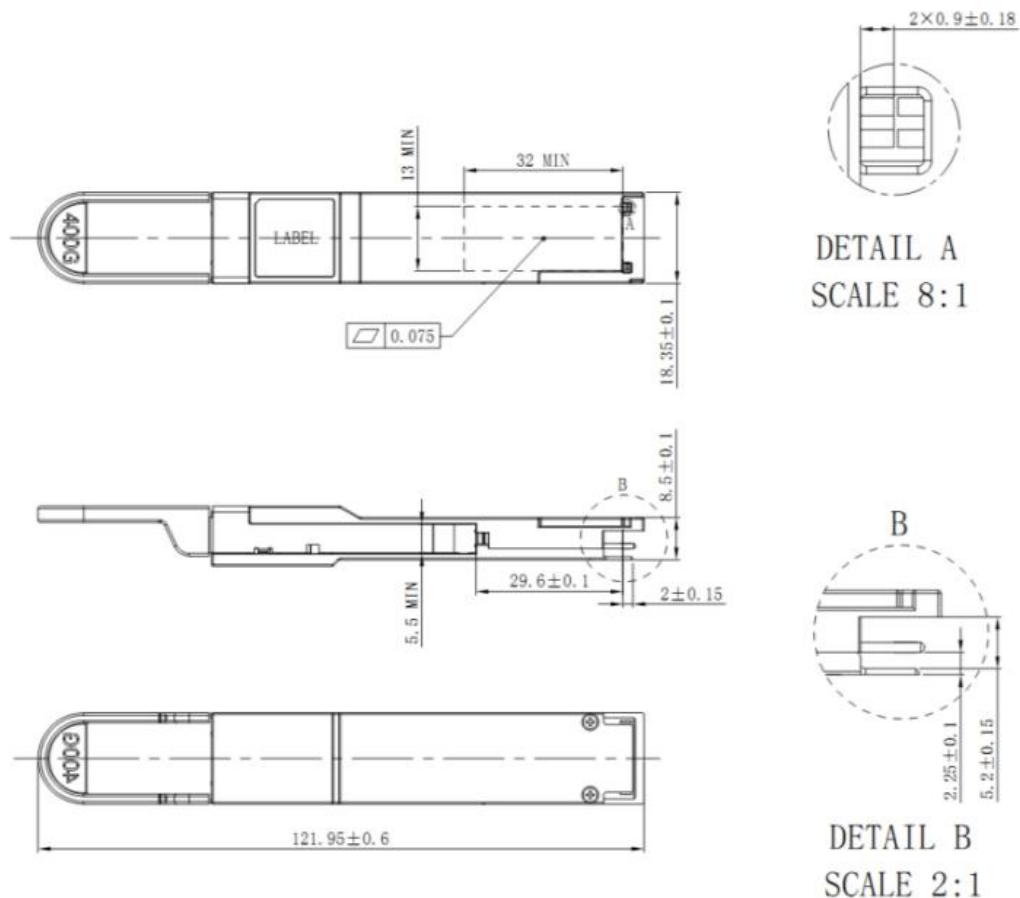


Figure 2. Mechanical Dimensions.

Memory Contents

Per the QSFP112 MSA. Compatible with QSFP112 CMIS rev 5.2.