

Features

- QSFP112 MSA compliant
- CMS compliance
- Optical Interface: IEEE 802.3db compliant
- Supports 425Gb/s aggregate bit rate.
- Electrical Interface IEEE 802.3ck 400GAUI-4
- 4 Parallel optical lanes
- Up to 50m transmission over OM4 with KP4 FEC
- Maximum power consumption 8W
- MPO-12 connector
- Operating case temperature: 0°C ~70°C
- RoHS compliant



Applications

- Application case1: 1x400G SR4, 1 of 400G per port point to point connections.
- Application case2: 4x100G SR, 4 of 100G per port point to point connections.

Description

This product is a 400Gb/s Quad Small Form-factor Pluggable (QSFP) optical module design for 50m optical communication applications. The module converts 4 input channels of 100Gb/s electrical data to 4 channels of parallel optical signals, each capable of 100Gb/s operation for an aggregate data rate of 400Gb/s. Reversely, on the receiver side, the module converts 4 channels of parallel optical signals of 100Gbs each channel for an aggregate data rate of 400Gb/s into 4 channels of 100Gb/s electrical output data.

An optical fiber cable with an MTP/MPO-12 connector can be plugged into the QSFP112 SR4 module receptacle. Proper alignment is ensured by the guide pins inside the receptacle. The cable usually cannot be twisted for proper channel to channel alignment. Electrical connection is achieved through a QSFP112 MSA-compliant edge type connector.

This product is designed with form factor, optical/electrical connection and digital diagnostic interface according to the QSFP112 MSA Type 2. It has been designed to meet the harshest external iperations including temperature, humidity and EMI interference.

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Units	Note
Storage Temperature	T_{st}	-40	85	°C	
Power Supply Voltage	V_{cc}	-0.5	3.6	V	
Case Operating Temperature	T_{op}	0	70	°C	
Relative Humidity (non-condensing)	Rh	0	85	%	

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Operating Case Temperature	T_{ca}	0		70	°C	
Supply Voltage	V_{cc}	3.135	3.3	3.465	V	
Data Rate, each Lane			53.125		Gb/s	PAM4
Data Rate Accuracy		-100		100	ppm	
Pre-FEC Bit Error Ratio				2.4×10^{-4}		
Post-FEC Bit Error Ratio				1×10^{-12}		1
Link Distance (OM4)	$D1$	2		100	m	2
Link Distance (OM3)	$D2$	2		50	M	2

Notes:

1. FEC provided by host system.
2. FEC required on host system to support maximum distance.

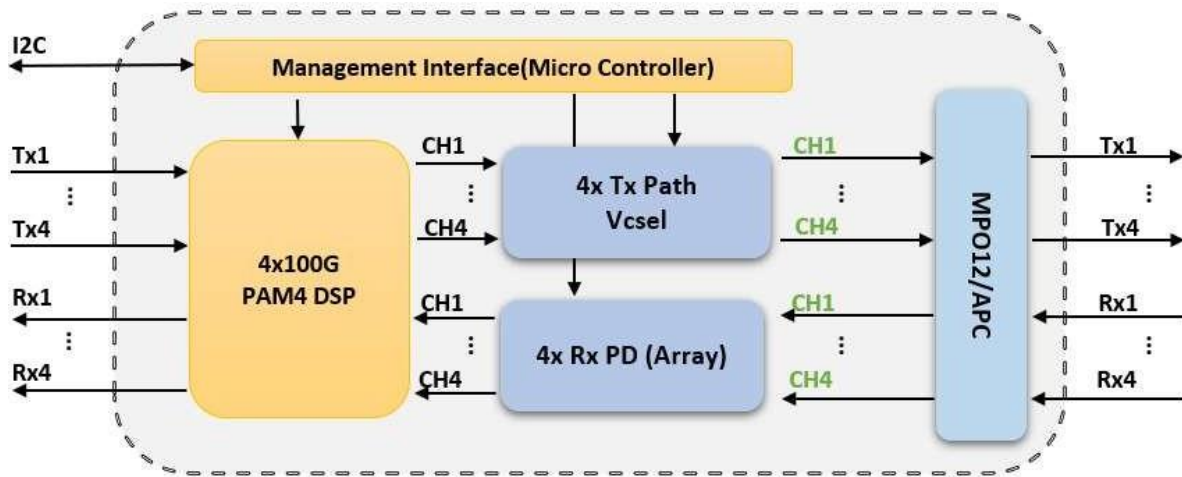
Diagnostic Monitoring Interface

Parameter	Symbol	Accuracy	Unit	Notes
Temperature monitor absolute error	DMI_Temp	± 3	°C	Over operating
Supply voltage monitor absolute error	DMI_VCC	± 0.1	V	Over full operating range
Channel RX power monitor absolute error	DMI_RX_Ch	± 2	dB	1
Channel Bias current monitor	DMI_Ibias_Ch	$\pm 10\%$	mA	
Channel TX power monitor absolute error	DMI_TX_Ch	± 2	dB	1

Notes:

1. Due to measurement accuracy of different single mode fibers, there could be an additional +/-1 dB fluctuation, or a +/-3 dB total accuracy.

Transceiver Block Diagram



Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Center Wavelength	λ_c	842		948	nm	
Data Rate, each Lane		53.125 ± 100ppm			GBd	
Modulation Format		PAM4				
Transmitter						
RMS Spectral Width				0.65	Nm	1
Average Launch Power, each Lane	P_{AVG}	-4.6		4	dBm	
Optical Modulation Amplitude (OMA _{outer}), each Lane	P_{OMA}	-2.6 (for max(TECQ,TDECQ) ≤ 1.8 dB) - 4.4+max(TECQ, TDECQ) (For 1.8 < max (TDCQ, TDECQ) ≤ 4.4dB)		3.5	dBm	
Transmitter and Dispersion Eye Closure for PAM4, each Lane	$TDECQ$			4.4	dB	
Transmitter Eye Closure for PAM4, each Lane	$TECQ$			4.4	dB	
Overshoot/undershoot				29	%	
Extinction Ratio	ER	2.5			dB	
Transition Time	T_t			17	ps	
Average Launch Power of OFF Transmitter, each Lane	P_{off}			-30	dBm	
RIN ₁₄ OMA	RIN			-132	dB	
Optical Return Loss Tolerance	TOL			14	dB	
Encircled Flux				≥ 86% at 19μm ≤ 30% at 4.5μm		2
Receiver						
Damage Threshold, each Lane	THd	5			dBm	3
Average receiver Power, each Lane		-6.3		4	dBm	
Receiver Power (OMA _{outer}), each Lane				4.2	dBm	
Receiver Reflectance	R_R			-15	dB	

Receiver Sensitivity (OMA_{outer}), each Lane	SEN		-4.4 (for $\max(TECQ, \leq 1.8$ dB) -6.2(TECQ, dBm 5 (for $1.8 < TECQ$) ≤ 4.4 dB)
Stressed Receiver Sensitivity in OMA outer, each Lane	SRS		-1.8 dBm 6
Receiver Reflectance	R_R		-26 dB
LOS Assert	$LOSA$	-15	dBm
LOS De-assert	$LOSD$		-9.2 dBm
LOS Hysteresis	$LOSH$	0.5	dB
Conditions of Stress Receiver Sensitivity Test (Note 7)			
Stressed Eye Closure for PAM4 (SECQ), Lane under Test		4.4	dB
OMA_{outer} of each aggressor lane		3.5	dBm

Notes:

- 1 · RMS spectral width is the standard deviation of the spectrum.
- 2 · If measured into type A1a.2 or type A1a.3, or A1a.3, or A1a.4, 50 μ m fiber, in accordance with IEC 61280-1-4.
- 3 · The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power.
- 4 · Average receiver power, each lane (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliant
- 5 · Receiver sensitivity (OMA_{outer}), each lane (max) is informative and is defined for a transmitter with a value of TECQ up to 4.4dB. It should meet Equation (1)

$$RS = \max(-4.4, TECQ - 6.2) \text{ dBm}$$

Where

RS is the receiver sensitivity

TECQ is the TECQ of the transmitter used to measure the receiver sensitivity.

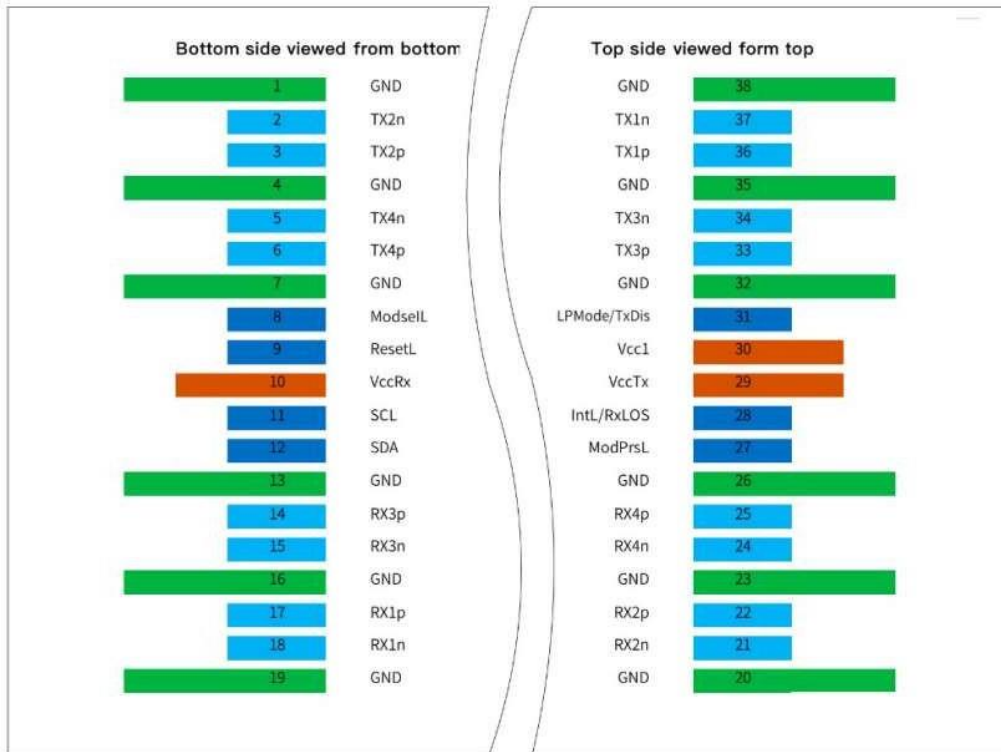
- 6 · Measured with conformance test signal at TP3 for the BER equal to 2.4×10^{-4}
- 7 · These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Power Consumption				8	W	
Supply Current	<i>I_{cc}</i>			2.55	A	
Transmitter (each Lane)						
Signaling Rate, each Lane	<i>TP1</i>	53.125 ± 100 ppm			GBd	
Differential pk-pk voltage tolerance	<i>TP1a</i>	750			mV	
Peak-to-Peak AC common mode voltage tolerance	<i>TP1a</i>				mV	
Low-frequency, VCM _{LF}		32				
Full-band, VCM _{FB}		80				
Differential-mode to common-mode return loss, RL _{cd}	<i>TP1</i>	IEEE802.3ck Equation (120G-2)			dB	
Effective Return Loss, ERL	<i>TP1</i>	8.5			dB	
Differentia termination Mismatch	<i>TP1</i>			10	%	
Module Stressed Input Tolerance	<i>TP1a</i>	IEEE 802.3bck 120G.3.4.3				
Single-ended Voltage Tolerance Range	<i>TP1a</i>	-0.4 to 3.3			V	
DC Common-mode Voltage Tolerance	<i>TP1</i>				V	
Upper Limit		2.85				
Lower Lomit		-0.35				
Receiver (each Lane)						
Peak-to-Peak AC Common Mode Voltage	<i>TP4</i>				mV	
Low-frequency, VCM _{LF}		32				
Full-band, VCM _{FB}		80				
Differential peak-to-peak Output Voltage	<i>TP4</i>				mV	
Short Mode		600				
Long Mode		845				
Eye Height	<i>TP4</i>	15			mV	
Vertical Eye Closure, VEC	<i>TP4</i>			12	dB	
Common-mode to Differential-mode	<i>TP4</i>	IEEE802.3ck			dB	

Return Loss, RLdc	Equation (120G-1)		
Effective Output Return Loss, ERL	TP4	8.5	dB
Differential Termination Mismatch	TP4	10	%
Transition Time, 20% to 80%	TP4	8.5	ps
DC Common-mode Voltage			
Tolerance	TP4		V
Upper Limit		2.85	
Lower Limit		-0.35	

Pin Assignment and Description



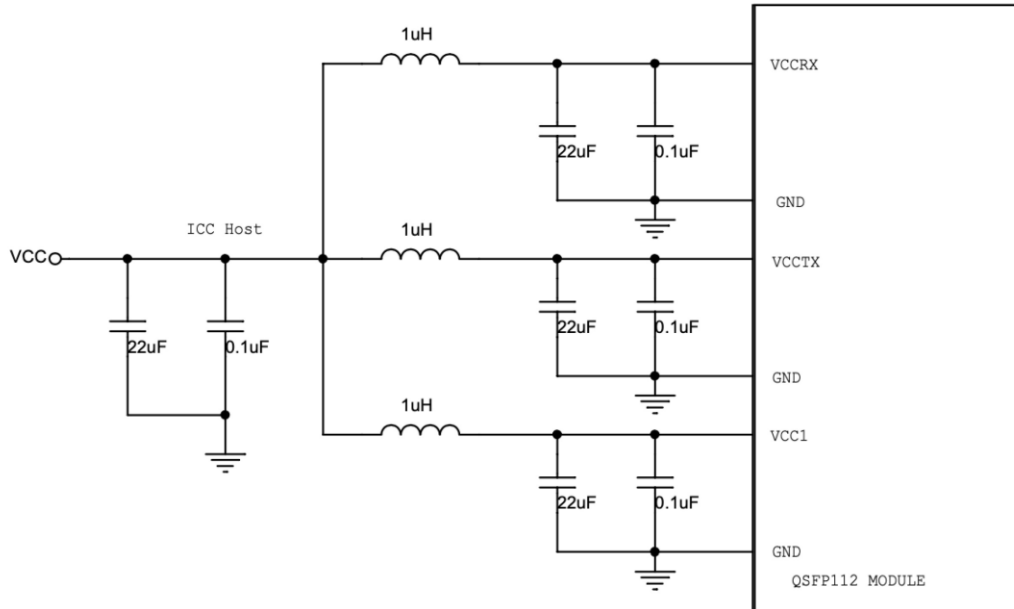
MSA compliant Connector

Pin Descriptions

PIN	Logic	Symbol	Name / Description	Note
1	Ground	GND	Ground	
2	CML-I	Tx2n	Transmitter inverted data input	
3	CML-I	Tx2p	Transmitter non-inverted data input	
4	Ground	GND	Ground	
5	CML-I	Tx4n	Transmitter inverted data input	
6	CML-I	Tx4p	Transmitter non-inverted data input	
7	Ground	GND	Ground	
8	LVTTL-I	MoDSelL	Module Select	
9	LVTTL-I	ResetL	Module Reset	
10		VccRx	+3.3v Receiver Power Supply	
11	LVC MOS-I/O	SCL	2-wire Serial interface clock	
12	LVC MOS-I/O	SDA	2-wire Serial interface data	
13	Ground	GND	Ground	
14	CML-O	RX3p	Receiver non-inverted Data Output	
15	CML-O	RX3n	Receiver inverted Data Output	
16	Ground	GND	Ground	
17	CML-O	Rx1p	Receiver non-inverted Data Output	
18	CML-O	Rx1n	Receiver inverted Data Output	
19	Ground	GND	Ground	
20	Ground	GND	Ground	
21	CML-O	Rx2n	Receiver Inverted Data Output	
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	
23	Ground	GND	Ground	
24	CML-O	Rx4n	Receiver Inverted Data Output	
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	
26	Ground	GND	Ground	
27	LVTTL-O	ModPrsL	Module Present	
28	LVTTL-O	IntL	Interrupt	
29		VccTx	+3.3v Power supply transmitter	

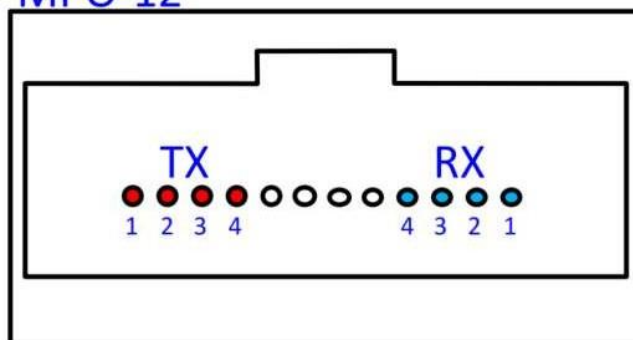
30		Vcc1	+3.3v Power supply
31	LVTTL-I	LPMode	Low Power Mode
32	Ground	GND	Ground
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input
34	CML-I	Tx3n	Transmitter Inverted Data Input
35	Ground	GND	Ground
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input
37	CML-I	Tx1n	Transmitter Inverted Data Input
38	Ground	GND	Ground

Recommended Power Supply Filter

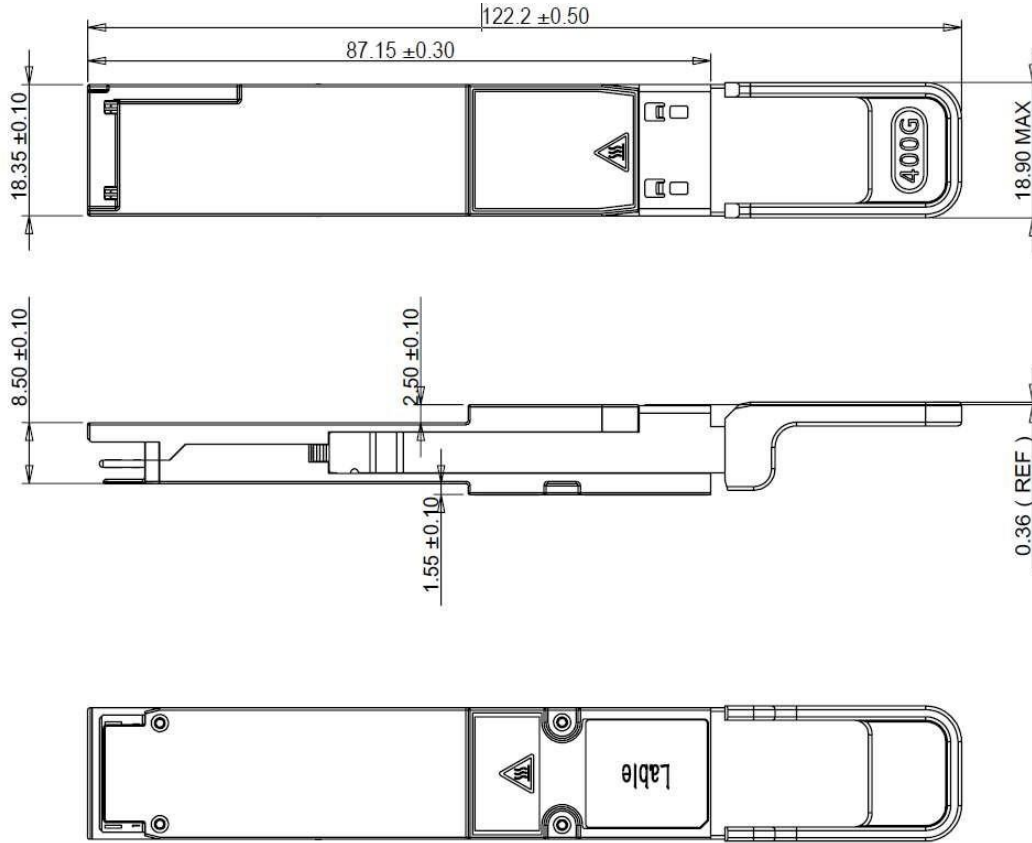


Recommended Power Supply Filter

MPO-12


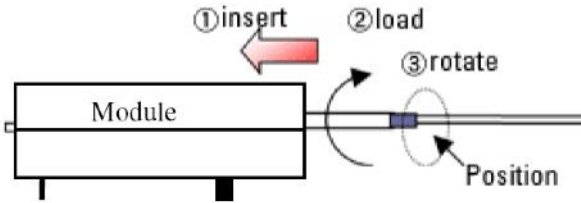


Dimensions



Optical Receptacle Cleaning Recommendations

All fiber stubs inside the receptacle portions were cleaned before shipment. In the event of contamination of the optical ports, the recommended cleaning process is the use of forced nitrogen. If contamination is thought to have remained, the optical ports can be cleaned using a NTT international Cletop® stick type and HFE7100 cleaning fluid. Before the mating of patch-cord, the fiber end should be cleaned up by using Cletop® cleaning cassette.

Cleaning of patch-cord	Cleaning of fiber stub
	 <ol style="list-style-type: none"> 1. Insert Ensure that stick is held straight when inserting into sleeve. 2. Load Apply sufficient pressure (approx 600-700g) to ensure ferrule a little depressed in sleeve. 3. Rotate Rotate stick clockwise 4-5 times, while ensuring direct contact with ferrule end-face is maintained. <p><i>Notice: Number of possible wipes: Maintenance (repair) ~1 use / piece Equipment construction: 4 uses / piece (max.)</i></p>

Note: The pictures were extracted from NTT-ME website. And the Cletop® is a trademark registered by NTT-ME

Ordering Information

<i>Model Number</i>	<i>Part Number</i>	<i>Reach</i>	<i>Wavelength</i>	<i>Temperature</i>
QSFP112 400G VR4	OPEY-MT5-85-CB4	50m	850nm	0°C to 70°C

Modification History

<i>Revision</i>	<i>Date</i>	<i>Description</i>
A1	May 2023	Initial Release

Note: All information contained in this document is subject to change without notice.