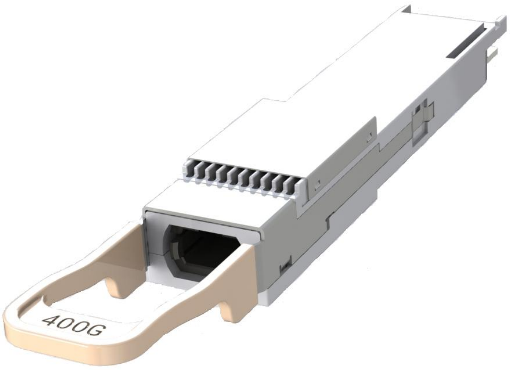
XN9251CDR
400G100mQSFP112SR4Transceiver
400GBASE-SR4

Product Features

- Compliant with IEEE Std 802.3db on 400Gb/s Optical interfaces
- Compliant with IEEE Std 802.3ck on 400Gb/s Electrical interfaces
- Compliant with QSFP112 MSA
- Compliant with CMIS5.0 specifications
- MPO-12 APC male connector receptacle
- 4 channels 850nm VCSEL array
- 4 channels PIN photo detector array
- 4*53.125GBd PAM4 electrical interface
- Single +3.3V power supply
- Commercial operating temperature:0°C to +70°C
- Up to 60m on OM3 MMF and 100m on OM4 and OM5 MMF
- RoHS Compliant



Applications

- 400G BASE-SR4 Ethernet
- Data Center

Descriptions

XN9251CDR transceiver is designed for using in 400Gb/s network applications.

The maximum transmission distance is 100m in OM4 and OM5 MMF.

XN9251CDR is a fully integrated optical transceiver modulated

using PAM4 format that transmits and receives optical signals with aggregated data rate of 4x106.25Gbps over 4 lanes 850nm. It is compliant with the QSFP112 MSA and 400GBASE-SR4 optical specifications. XN9251CDR is compliant with RoHS.

Ordering Information

Table 1. Ordering Information

Part Number	Transmitter	Average Launch Power	OMAouter	Receiver	OMA Sensitivity	Reach	Temp	DDM	RoHS
XN9251CDR	850nm VCSEL	-4.6~ +4dBm	-2.6~+3.5dBm	PIN	< -4.6dBm	100m	0~ 70 °C	Available	Compliant

Pin Description

Table 2. Pin Description

Pin	Name	Function/Description	Plug Sequence	Notes
1	GND	Transmitter Ground (Common with Receiver Ground)	1	1
2	Tx2-	Transmitter Inverted Data Input	3	
3	Tx2+	Transmitter Non-Inverted Data output	3	
4	GND	Transmitter Ground (Common with Receiver Ground)	1	1
5	Tx4-	Transmitter Inverted Data Input	3	
6	Tx4+	Transmitter Non-Inverted Data output	3	
7	GND	Transmitter Ground (Common with Receiver Ground)	1	1
8	ModSelL	Module Select	3	
9	ResetL	Module Reset	3	
10	VccRx	3.3V Power Supply Receiver	2	3
11	SCL	2-Wire serial Interface Clock	3	
12	SDA	2-Wire serial Interface Data	3	
13	GND	Transmitter Ground (Common with Receiver Ground)	1	1
14	Rx3+	Receiver Non-Inverted Data Output	3	
15	Rx3-	Receiver Inverted Data Output	3	
16	GND	Transmitter Ground (Common with Receiver Ground)	1	1
17	Rx1+	Receiver Non-Inverted Data Output	3	
18	Rx1-	Receiver Inverted Data Output	3	
19	GND	Transmitter Ground (Common with Receiver Ground)	1	1
20	GND	Transmitter Ground (Common with Receiver Ground)	1	1
21	Rx2-	Receiver Inverted Data Output	3	
22	Rx2+	Receiver Non-Inverted Data Output	3	
23	GND	Transmitter Ground (Common with Receiver Ground)	1	1
24	Rx4-	Receiver Inverted Data Output	3	
25	Rx4+	Receiver Non-Inverted Data Output	3	
26	GND	Transmitter Ground (Common with Receiver Ground)	1	1
27	ModPrsL	Module Present	3	
28	IntL/RxLOS	Interrupt	3	2
29	VccTx	3.3V power supply transmitter	2	3
30	Vcc1	3.3V power supply	2	3
31	LPMode/TxDis	Low Power Mode	3	
32	GND	Transmitter Ground (Common with Receiver Ground)	1	1
33	Tx3+	Transmitter Non-Inverted Data Input	3	
34	Tx3-	Transmitter Inverted Data Output	3	
35	GND	Transmitter Ground (Common with Receiver Ground)	1	1
36	Tx1+	Transmitter Non-Inverted Data Input	3	
37	Tx1-	Transmitter Inverted Data Output	3	
38	GND	Transmitter Ground (Common with Receiver Ground)	1	1

Notes:

1. QSFP112 uses common ground (GND) for all signals and supply (power). All are common within the QSFP DD module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board

signal-common ground plane. Each connector Gnd contact is rated for a maximum current of 500 mA.

2. This is an open collector/drain output that on the host board requires a 4.7KΩ to 10KΩ pull-up resistor to VccHost.

3. VccRx, Vcc1, and VccTx shall be applied concurrently. Supply requirements defined for the host side of the Host Card Edge Connector are listed in Table 10. For power classes 4 and above the module differential loading of input voltage pads must not result in exceeding contact current limits. Each connector Vcc contact is rated for a maximum current of 1500 mA.

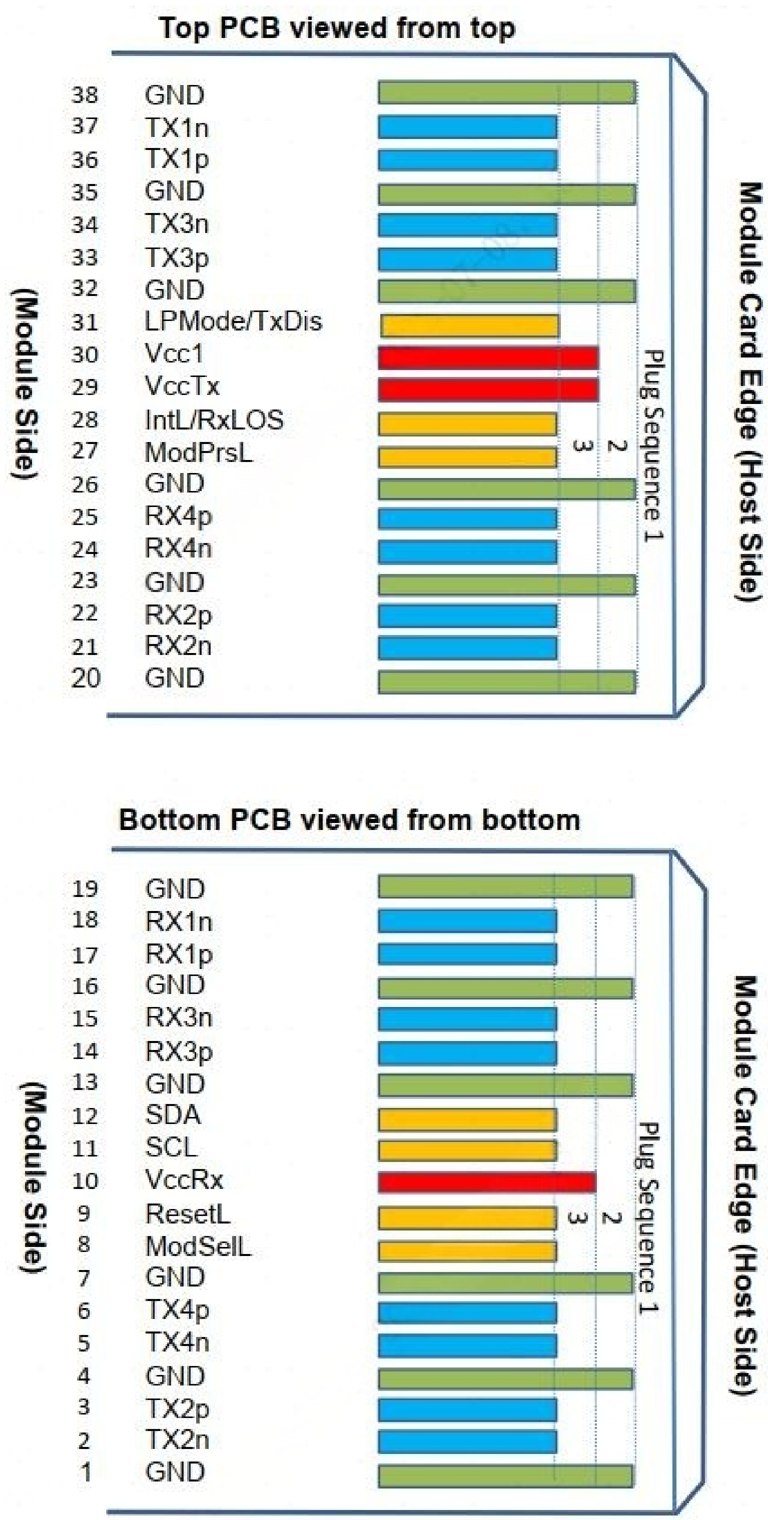


Figure 1. Host PCB QSFP112 pad assignment top view

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Table 3. Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Unit
Storage Temperature	T_S	-40	85	ºC
Relative Humidity	RH	15	85	%
Supply Voltage	V_{CC}	-0.5	3.6	V

Recommended Operating Conditions

Table 4. Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Operating Case Temperature	T_C	0	25	70	ºC
Supply Voltage	V_{CC}	3.135	3.3	3.465	V
Data Rate PER Channel	-	-	53.125	-	Gbaud
Modulation format			PAM4		

Transceiver Electrical Characteristics

Table 5. Transceiver Electrical Characteristics

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Notes
Module Supply Current	Icc	-	-	2.55	A	-
Power Dissipation	P_D	-	-	8	W	-
Transmitter						
Input Differential Impedance	Z_{IN}	-	100	-	Ω	-
Differential Data Input Swing	$V_{IN,\ P-P}$	180	-	900	mV_{P-P}	-
Receiver						
Output Differential Impedance	Z_O		100		Ω	-
Differential Data Output Swing	$V_{OUT,\ P-P}$	-	-	800	mV_{P-P}	1

Notes:
1. Internally AC coupled, but requires a external 100Ω differential load termination.

Transmitter Optical Characteristics

Table 6. Transmitter Optical Characteristics

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Notes
Signaling rate, each lane	\		53.125 ± 100 ppm		GBd	
Average launch power, each lane	Po	-4.6	-	+4	dBm	1
OMAouter max (TECQ, TDECQ) < 1.8 dB	OMA	-2.6		+3.5	dBm	2
OMAouter 1.8 < max (TECQ, TDECQ) < 4.4 dB		-4.4+ max (TECQ, TDECQ)				2
Center Wavelength	λc	844		863	nm	
Extinction Ratio	EX	2.5	-		dB	
RMS spectral width	Δλ	-	-	0.6	nm	
Transmitter and dispersion eye closure for PAM4	TDECQ	-	-	4.4	dB	2
Transmitter eye closure for PAM4	TECQ			4.4	dB	2
Average launch power of OFF transmitter	P_{off}	-	-	-30	dBm	
Optical Return Loss Tolerance	ORLT	-	-	14	dB	
Encircled flux	\		≥ 86% at 19 µm		\	
			≤ 30% at 4.5 µm		\	
TX Disable Assert Time	T_{off}	-	-	100	ms	
TX Disable De-assert Time	T_{on}	-	-	400	ms	

Notes:

1. RMS spectral width is the standard deviation of the spectrum
2. Measured with a SSPRQ test pattern @ 53.125Gbaud PAM4 format.

Receiver Optical Characteristics

Table 7. Receiver Optical Characteristics

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Notes
Signaling rate, each lane			53.125 ± 100 ppm		GBd	
Center Wavelength	λc	842		948	nm	
Receiver Sensitivity (OMA_{outer}) For TECQ≤1.8db For 1.8<TECQ<4.4db	S	- -	- -	-4.6 -6.4+TECQ	dBm dBm	1
Stressed receiver sensitivity (OMA_{outer})	$S_{stressed}$			-2.0	dBm	1
Receiver Overload (P_{avg})	P_{OL}	4	-	-	dBm	
Damage Threshold	P_{OL}	5	-	-	dBm	
Optical Reflectance	ORL	-	-	-15	dB	
LOS De-Assert	LOS_D	-	-	-9	dBm	
LOS Assert	LOS_A	-30	-	-	dBm	
LOS Hysteresis	-	0.5	-	-	dB	

Notes:

1. Measured with PRBS31Q test pattern, 53.125GBd, PAM4, BER<2.4E-4.

Management Interface

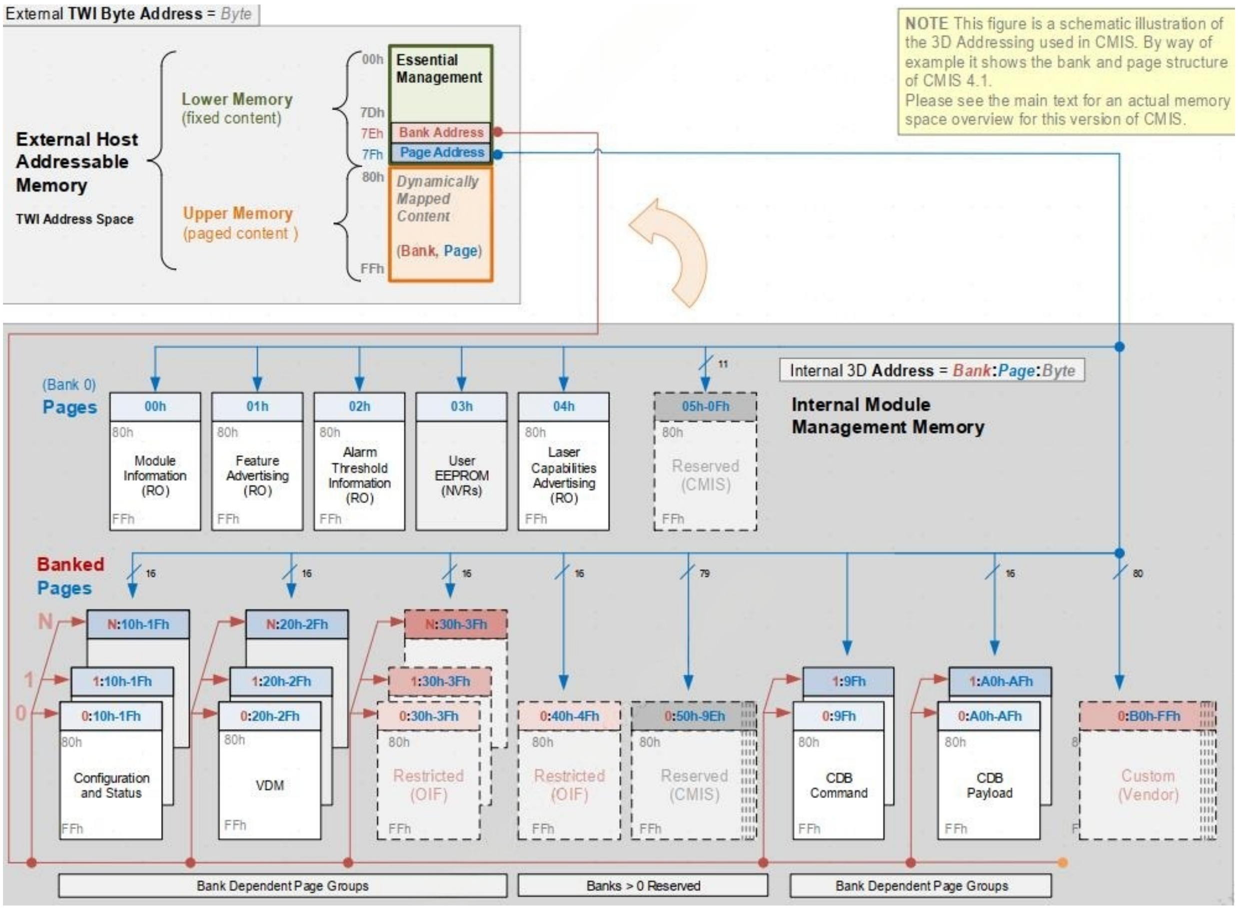
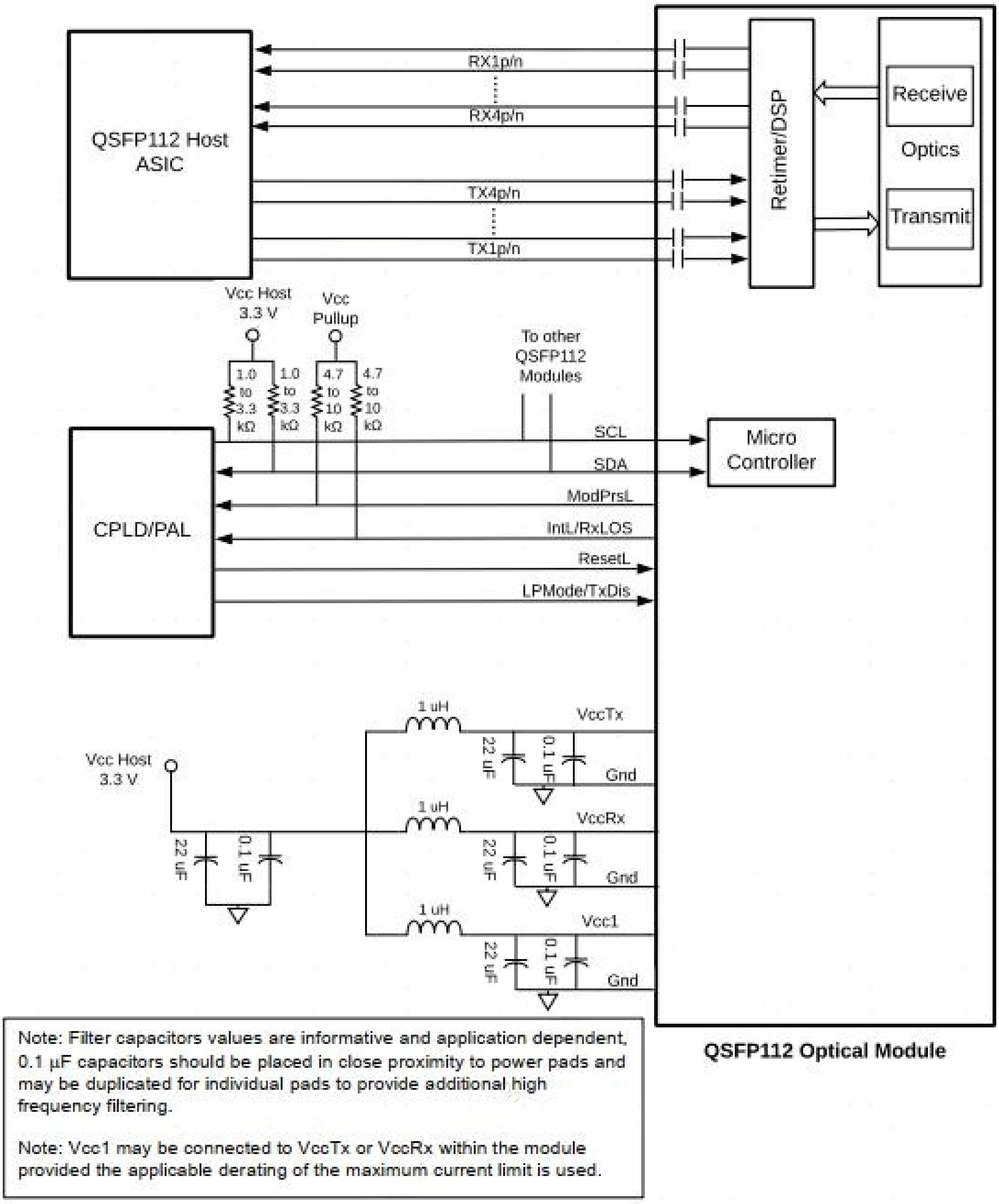


Figure 2. CMIS Module Memory Map Memory Map

Recommended Host Board Schematic



Note: Filter capacitors values are informative and application dependent, 0.1 µF capacitors should be placed in close proximity to power pads and may be duplicated for individual pads to provide additional high frequency filtering.

Note: Vcc1 may be connected to VccTx or VccRx within the module provided the applicable derating of the maximum current limit is used.

Figure 3. Recommended Host BoardHost Board Schematic

Mechanical specifications

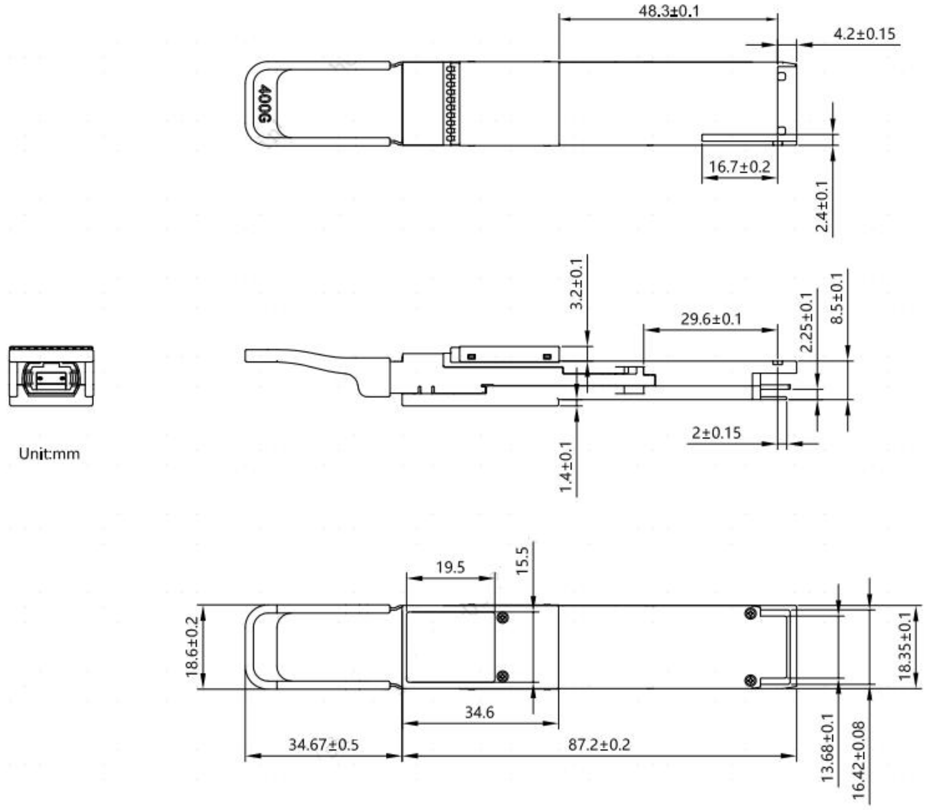


Figure 4. Outline Drawing

Revision History

Date	Rev	Description	Modified By
09/21/2023	V1.0	Initial Release.	Xiuhong Jia
1/11/2024	V1.1	revised some describing mistakes	Xiuhong Jia
1/25/2024	V1.2	updated module picture and output swing	Xiuhong Jia
1/31/2024	V1.3	Updated outline drawing and card edge view	Stellan Shen