Product Specification

425Gb/s DR4 QSFP112 1310nm 500m
Optical Transceiver

P/N: 400G-Q112-DR4

Features

- Hot Pluggable QSFP112 form factor
- Operating data rate 425Gbps
- Single +3.3V power supply
- Single MPO-12 APC connector
- Max power dissipation ←10W
- Up to 500m transmission on single mode fiber (SMF) with FEC
- 1310nm EML laser
- PIN receivers
- Built-in digital diagnostic function
- Commercial temperature range 0°C to 70°C

Compliance

- Compliant to QSFP112 MSA
- IEEE 802.3ck and IEEE 802.3bs
- RoHS
- Class 1 laser

Applications

- 400G Ethernet
- Data Center Interconnect
- Data center Enterprise networking
- Switches with QSFP112 ports

Description

The 400G-Q112-DR4 is a high-performance, single-mode optical transceiver module designed for 400 Gigabit Ethernet applications. It supports data rates of up to 425 Gbps (4x106.25 Gbps per channel) and is optimized for medium-reach communication, with a maximum transmission distance of up to 500 meters over single-mode fiber (SMF). This QSFP112 module operates at a wavelength of 1310nm and utilizes an MTP/MPO-12 APC connector, making it ideal for high-speed data center interconnects, enterprise networks, and telecommunications infrastructure. It is fully compliant with industry standards, including IEEE 802.3bs, IEEE 802.3ck, CMIS 4.0/5.0, and QSFP112 MSA, ensuring reliable and efficient data transmission.

The 400G-Q112-DR4 features advanced digital diagnostics monitoring (DDM) capabilities, enabling real-time monitoring of key parameters such as temperature, voltage, and optical power. It employs a 4-channel EML (Electro-Absorption Modulated Laser) transmitter and PIN receiver array, ensuring high sensitivity and performance. With a maximum power consumption of ⩽10W and a compact QSFP112 form factor, the 400G-Q112-DR4 is a cost-effective and energy-efficient solution for high-speed networking needs. Its robust design and compliance with environmental standards make it a dependable choice for modern network operators seeking to enhance their infrastructure with reliable, high-performance connectivity.

Product performance Specifications

1、Basic Product Characteristics

Parameter	Symbol	Min	Typ.	Max	Unit
Absolute Maximum Ratings					
Storage Temperature	T_S	-40	-	85	°C
Relative Humidity (non-condensing)	RH	10	-	90	%
Supply Voltage	V_{CC}	-0.5	-	3.6	V
Operational Specifications					
Operating temperature (Case)	T_C	0	-	70	°C
Bit Rate (all wavelengths combined)	BR	-	-	425	Gbps
Pre-FEC Bit Error Ratio	BER	-	-	$2.4x10^{-4}$	
Post-FEC Bit Error Ratio	BER	-	-	$1x10^{-12}$	
Link Distance	2	-	-	500	m
Supply Voltage	V_{CC}	3.135	-	3.465	V

2、Product Optical and Electrical Characteristics

Parameter	Min	Typ.	Max	Unit	Note
Transmitter					

Signaling Rate Each Lane		53.125		GBd	
Lane Wavelength Range	1304.5	1310	1317.5	nm	
Modulation Format			PAM4		
Average Optical Power Per Lane	-2.9		4	dBm	
Outer Optical Modulation Amplitude (OMAouter), Each Lane	-0.8		4.2	dBm	
Average Launch Power Per Lane @ TX Off State			-15	dBm	
Launch Power in OMAouter Minus T DECQ, Each Lane	-2.2			dB	
Transmitter and Dispersion Eye Closure for PAM4, Each Lane			3.4	dB	
Extinction Ratio	3.5			dB	
Relative Intensity Noise21.4 (OMA)			-136	dB/Hz	
Side-Mode Suppression Ration (SMSR)	30			dB	
Optical Return Loss Tolerance			21.4	dB	
Transmitter Reflectance			-26	dB	
Receiver					
Signaling Rate Each Lane		53.125		GBd	
Lane Wavelength Range	1304.5	1310	1317.5	nm	
Modulation Format			PAM4		
Damage Threshold	5			dBm	
Average Receive Power, Each Lane	-5.9		4	dBm	
Receiver Power, Each Lane (OMA)			4.2	dBm	
Receiver Reflectance			-26	dB	
Receiver Sensitivity Each Lane (OMAouter)			-3.9	dBm	1
Stressed Receiver Sensitivity (OMAouter), Each			-1.9	dBm	
Stressed Conditions for Stress Receiver Sensitivity					
Stressed Eye Closure for PAM4 (SECQ) , Lane under Test		3.4		dB	
OMAouter of Each Aggressor Lane		4.2		dBm	
RX_LOS_Assert Min/Max	-15			dBm	
RX_LOS_De-Assert Min/Max			-8.9	dBm	
RX_LOS_Hysteresis		1.5		dB	

Note1:Receiver sensitivity (OMAouter), each lane (max) is informative and is defined for a transmitter with a value of SECQ up to 3.4 dB. It should meet Equation : RS=max (-3.9, -SECQ5.3), where RS is the receiver sensitivity, and SECQ is the SECQ of the transmitter used to measure the receiver sensitivity.

Recommended Host Board Power Supply Circuit

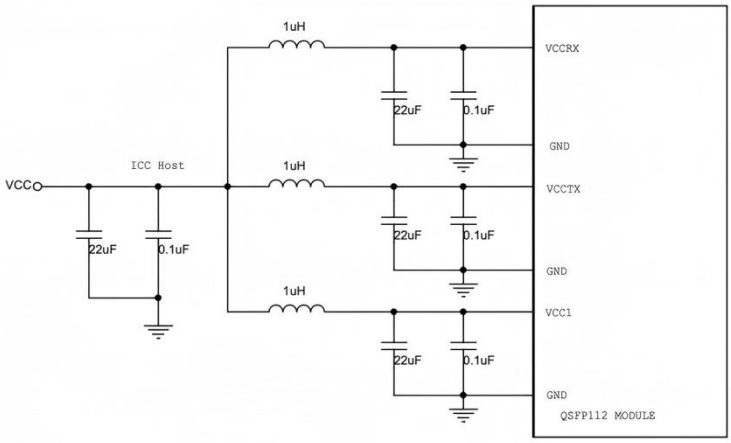


Figure 1:Recommended Host Board Power Supply Circuit

Recommended Interface Circuit

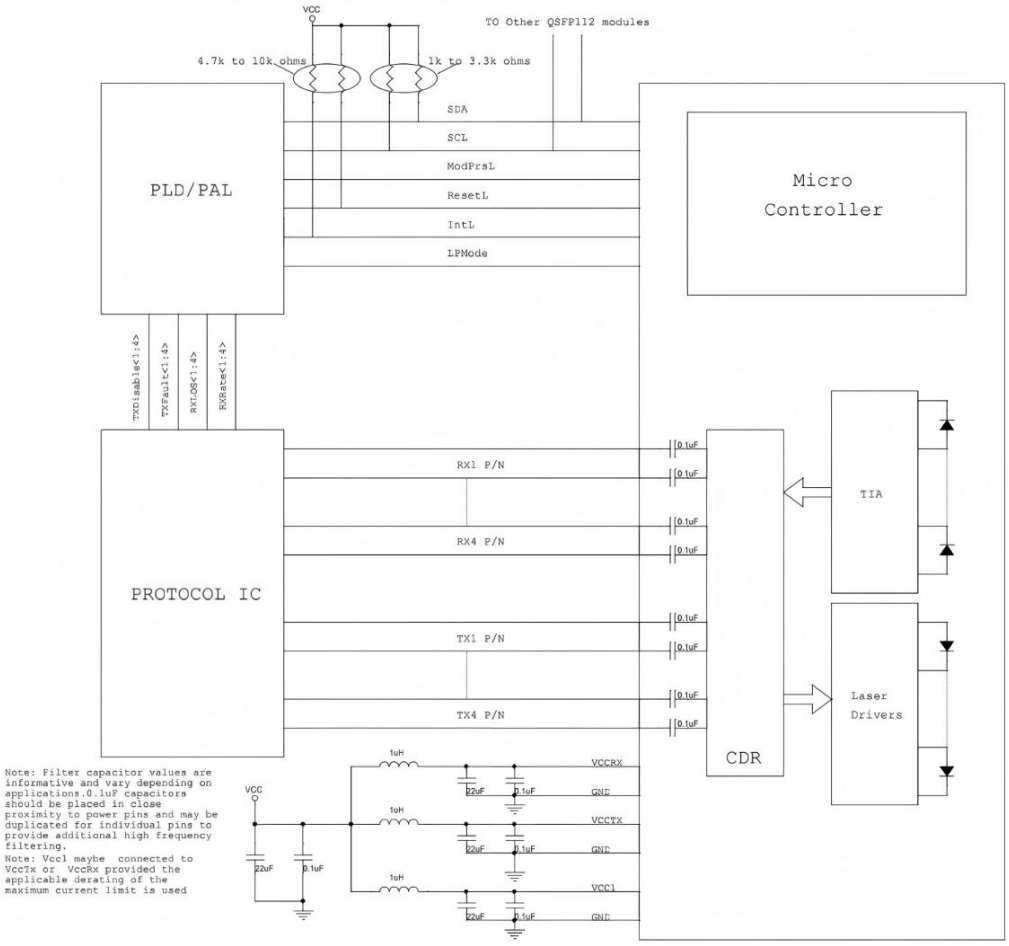


Figure2:Recommended Interface Circuit

Optical Interface

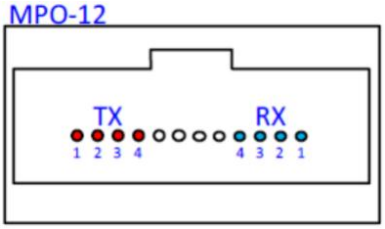


Figure3:Optical Lane Sequence

Pin-out Definition

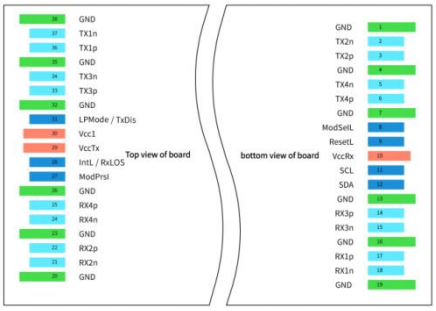


Figure4:QSFP112 Module contact assignment

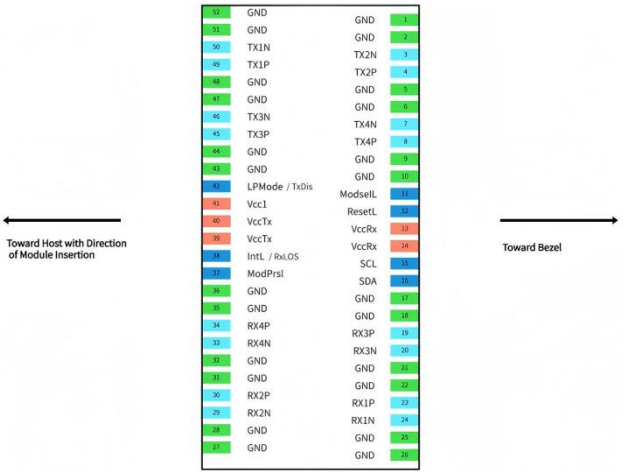


Figure5:Pin view

Pin Function Definitions

PIN	Module contact	Logic	Symbol	Description	Note
1	1		GND	Ground	1
2			GND	Ground	1
3	2	CML-I	Tx2n	Transmitter Inverted Data Input	
4	3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	
5	4		GND	Ground	1
6			GND	Ground	1
7	5	CML-I	Tx4n	Transmitter Inverted Data Input	
8	6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	
9	7		GND	Ground	1
10			GND	Ground	1
11	8	LVTTL-I	ModSelL	Select	
12	9	LVTTL-1	ResetL	Reset	
13	10		Vcc Rx	+3.3V Power supply receiver	2
14			Vcc Rx	+3.3V Power supply receiver	2
15	11	LVCMOS-I/O	SCL	2-wire serial interface clock	
16	12	LVCMOS-I/O	SDA	2-wire serial interface data	
17	13		GND	Ground	1
18			GND	Ground	1
19	14	CML-O	Rx3p	Receiver Non-Inverted Data Output	
20	15	CML-O	Rx3n	Receiver Inverted Data Output	
21	16		GND	Ground	1
22			GND	Ground	1
23	17	CML-O	Rx1p	Receiver Non-Inverted Data Output	
24	18	CML-O	Rx1n	Receiver Inverted Data Output	
25	19		GND	Ground	1
26			GND	Ground	1
27	20		GND	Ground	1
28			GND	Ground	1
29	21	CML-O	Rx2n	Receiver Inverted Data Output	
30	22	CML-O	Rx2p	Receiver Non-Inverted Data Output	
31	23		GND	Ground	1
32			GND	Ground	1
33	24	CML-O	Rx4n	Receiver Inverted Data Output	

34	25	CML-O	Rx4p	Receiver Non-Inverted Data Output	
35	26		GND	Ground	1
36			GND	Ground	1
37	27	LVTTL-O	ModPrsL	Present	
38	28	LVTTL-O	IntL/RxLOS	Interrupt/optional RxLOS	
39	29		Vcc Tx	+3.3V Power supply transmitter	2
40			Vcc Tx	+3.3V Power supply transmitter	2
41	30		$Vcc1_2$	+3.3V Power Supply	2
42	31	LVTTL-I	LPMode/TxD is	Low Power Mode/optional TX Disable	
43	32		GND	Ground	1
44			GND	Ground	1
45	33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	
46	34	CML-I	Tx3n	Transmitter Inverted Data Input	
47	35		GND	Ground	1
48			GND	Ground	1
49	36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	
50	37	CML-I	Tx1n	Transmitter Inverted Data Input	
51	38		GND	Ground	1
52	39		GND	Ground	1

Note1:GND is the symbol for signal and supply(power)common for the QSFP112module.Allare common within the QSFP112 module and all voltages are referenced to this potential unless otherwise noted.Connect these directly to the host board signal-common ground plane.

Note2:Vcc Rx,Vcc1 and Vcc Tx are the receiver and transmitter power supplies and shall be applied concurrently. Requirements,defined for the host side of the Host Edge Card Connector,are listed in Table 4.Recommended host board power supply fitering is shown in Figure 4.Vcc Rx,Vecc1and Vcc Tx may be intemally connected within the QSFP112 module in any combination.The connector pins are each rated for amaximum current of 1.5A(max.current of 2.0 Ais required for high module power of15-20W).

Monitoring Specification

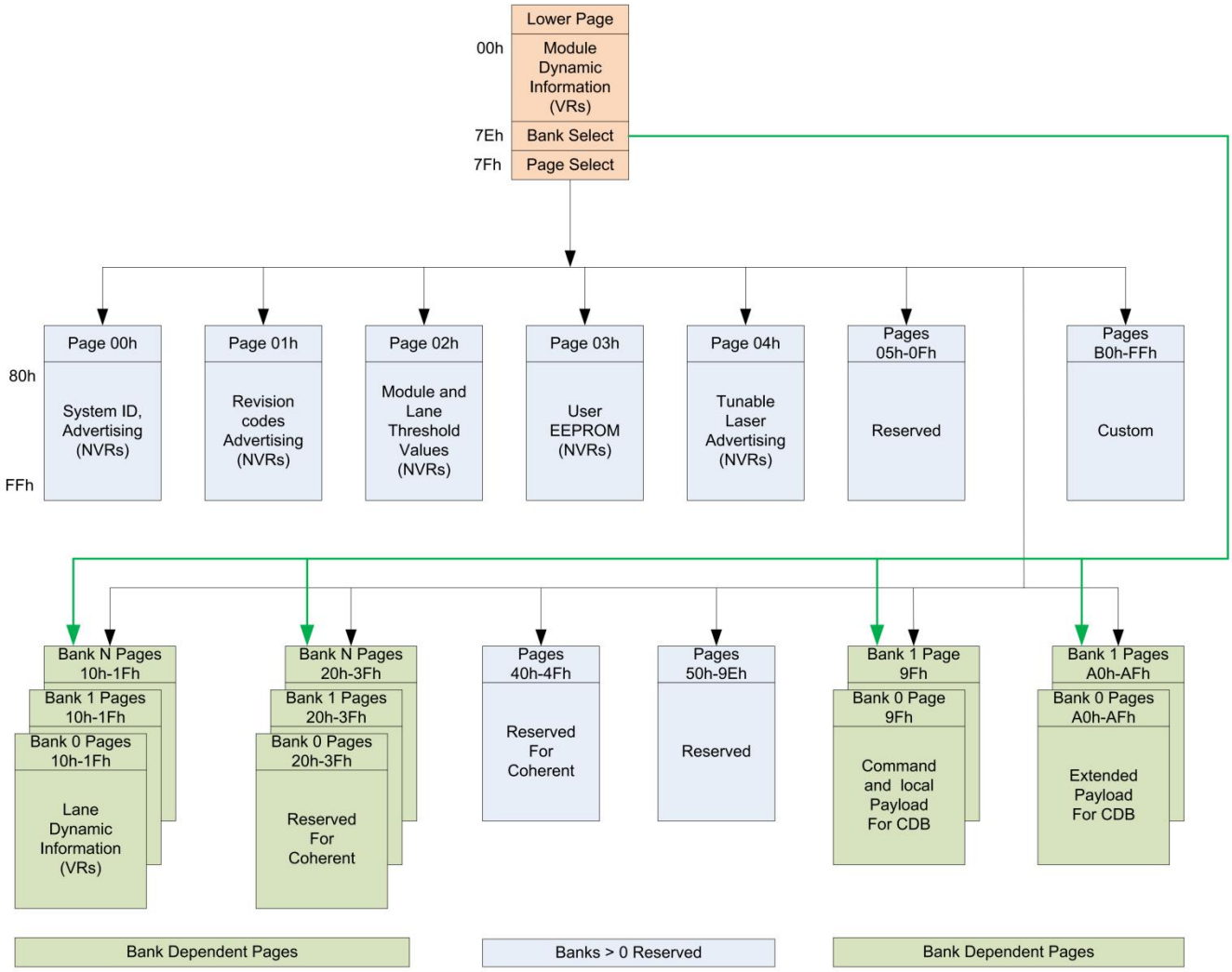


Figure5:Memory map

Memory map Table

Byte	Unit	Name	Description
Lower Page 00h			
0	1	Identifier	Identifier - Type of Serial Module - See SFF-8024.
1	1	Revision Compliance	Identifier – CMIS revision; the upper nibble is the whole number part and the lower nibble is the decimal part.

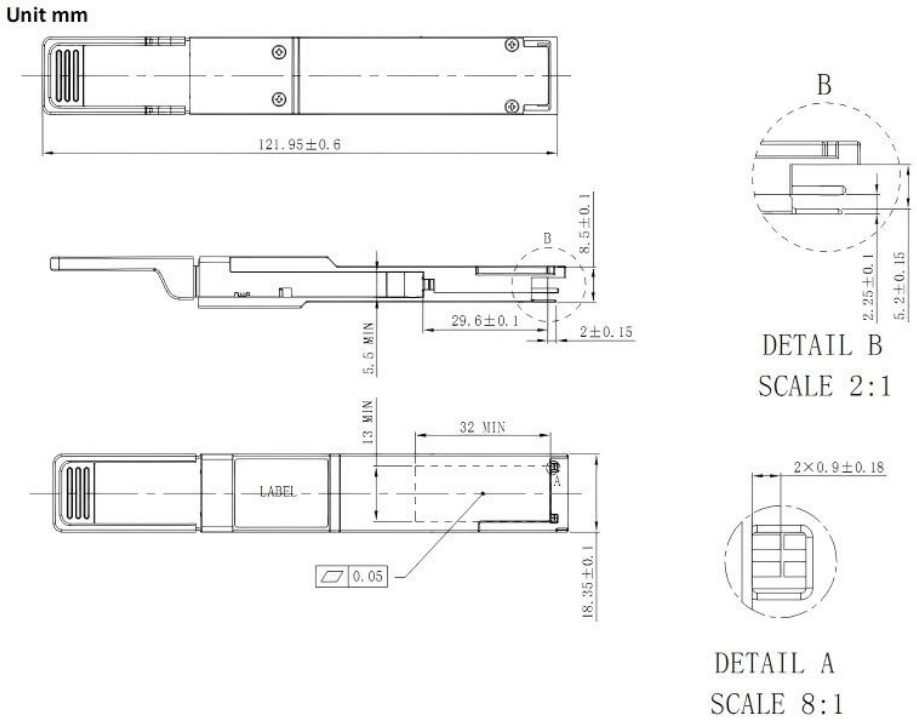
			Example: 01h indicates version 0.1, 21h indicates version 2.1.
2-3	2	ID and Status Area	Flat mem indication, CLEI present indicator, Maximum TWI speed, Current state of Module, Current state of the Interrupt signal.
4-7	4	Lane Flag Summary	Flag summary of all lane flags on pages 10h-1Fh.
8-13	6	Module-Level Flags	All flags that are not lane or data path specific.
14-25	12	Module-Level Monitors	Monitors that are not lane or data path specific.
26-30	5	Module Global Controls	Controls applicable to the module as a whole
31-36	6	Module-Level Flag Masks	Masking bits for the Module-Level flags
37-38	2	CDB Status Area	Status of most recent CDB command
39-40	2	Module Firmware Version	Module Firmware Version.
41-63	23	Reserved Area	Reserved for future standardization
64-82	19	Custom Area	Vendor or module type specific use
83-84	2	Inactive Firmware Version	Version Number of Inactive Firmware. Values of 00h indicates module supports only a single image.
85-117	33	Application Advertising	Combinations of host and media interfaces that are supported by module data path(s)
118-125	8	Password Entry and Change	Password Entry and Change
126	1	Bank Select Byte	Bank address of currently visible Page
127	1	Page Select Byte	Page address of currently visible Page
Upper Page 00h			
128	1	Identifier	Identifier - Type of Serial Module - See SFF-8024.
129-144	16	Vendor name	Vendor name (ASCII)
145-147	2	Vendor OUI	Vendor IEEE company ID
148-163	16	Vendor PN	Part number provided by vendor (ASCII)
164-165	8	Vendor rev	Revision level for part number provided by vendor (ASCII)
166-181	10	Vendor SN	Vendor Serial Number (ASCII)
182-183	2	Date code year	ASCII code, two low order digits of year (00=2000)
184-185	2	Date code month	ASCII code digits of month (01=Jan through 12=Dec)
186-187	2	Date code day of month	ASCII code day of month (01-31)
188-189	2	Lot code	ASCII code, custom lot code, may be blank
190-199	10	CLEI code	Common Language Equipment Identification code
200-201	2	Module power characteristics	Module power characteristics
202	1	Cable assembly length	Cable assembly length
203	1	Media Connector Type	Media Connector Type
204	1	5 GHz attenuation	Passive copper cable attenuation at 5 GHz in 1 dB increments
205	1	7 GHz attenuation	Passive copper cable attenuation at 7 GHz in 1 dB increments
206	1	12.9 GHz attenuation	Passive copper cable attenuation at 12.9 GHz in 1 dB increments
207	1	25.8 GHz attenuation	Passive copper cable attenuation at 25.8 GHz in 1 dB increments
208-209	2	Reserved	Reserved

210-211	2	Cable Assembly Lane Information	Cable Assembly Lane Information
212	1	Media Interface Technology	Media Interface Technology
213-220	8	Reserved	Reserved
221	1	Custom	Custom
222	1	Checksum	Includes bytes 128-221
223-255	33	Custom Info NV	Custom Info NV
Page 01h (Optional)			
128	1	Inactive Module firmware major revision	Numeric representation of inactive module firmware major revision
129	1	Inactive Module firmware minor revision	Inactive Module firmware minor revision
130	1	Module hardware major revision	Module hardware major revision
131	1	Module hardware minor revision	Module hardware minor revision
132	1	Length (SMF)	Bits7-6 Length multiplier(SMF),Bits 5-0 Base Length (SMF)
133	1	Length (OM5)	Link length supported for OM5 fiber, units of 2 m (2 to 510 m)
134	1	Length (OM4)	Link length supported for OM4 fiber, units of 2 m (2 to 510 m)
135	1	Length (OM3)	Link length supported for EBW 50/125 µm fiber (OM3), units of 2m (2 to 510 m)
136	1	Length (OM2)	Link length supported for 50/125 µm fiber (OM2), units of 1m (1 to 255 m)
137	1	Reserved	Reserved
138-139	2	Nominal Wavelength	Nominal Wavelength
140-141	2	Wavelength Tolerance	Wavelength Tolerance
142-144	3	Implemented Memory Pages and Durations advertising	Implemented Memory Pages and Durations advertising
145-154	10	Module Characteristics advertising	Module Characteristics advertising
155-156	2	Implemented Controls advertising	Implemented Controls advertising
157-158	2	Implemented Flags advertising	Implemented Flags advertising
159-160	2	Implemented Monitors advertising	Implemented Monitors advertising
161-162	2	Implemented Signal Integrity Controls advertising	Implemented Signal Integrity Controls advertising
163-166	4	CDB support advertising	CDB support advertising
167-168	2	Additional Durations advertising	Additional Durations advertising
169-175	7	Reserved	Reserved
176-190	15	Module Media Lane advertising	Coded 1 if the Application is allowed to begin on a given media lane. Bits 0-7 correspond to Host Lanes 1-8. In multi-lane Applications each instance of an Application shall use contiguous media lane

			numbers. If multiple instances of a single Application are allowed each starting point is identified. If multiple instances are advertised, all instance must be supported concurrently.
191-222	32	Custom	Custom
223-250	28	Extended Module Host-Media Interface Advertising options	Extended Module Host-Media Interface Advertising options
251-254	4	Reserved	Reserved
255	1	Checksum	Checksum
Page 02h (Optional)			
128-129	2	Temperature monitor high alarm	Thresholds for internally measured temperature monitor: signed 2's complement in 1/256 degree Celsius increments
130-131	2	Temperature monitor low alarm	
132-133	2	Temperature monitor high warning	
134-135	2	Temperature monitor low warning	
136-137	2	Supply 3.3-volt monitor high alarm	Thresholds for internally measured 3.3 volt input supply voltage: in 100 µV increments
138-139	2	Supply 3.3-volt monitor low alarm	
140-141	2	Supply 3.3-volt monitor high warning	
142-143	2	Supply 3.3-volt monitor low warning	
144-145	2	Aux 1 monitor high alarm	Thresholds for TEC Current or Reserved monitor TEC Current: signed 2's complement in 100/32767% increments of maximum TEC current +32767 is max TEC current (100%) – Max Heating -32767 is min TEC current (100%) – Max Cooling
146-147	2	Aux 1 monitor low alarm	
148-149	2	Aux 1 monitor high warning	
150-151	2	Aux 1 monitor low warning	
152-153	2	Aux 2 monitor high alarm	Thresholds for TEC Current or Laser Temperature monitor TEC Current: signed 2's complement in 100/32767%increments of maximum TEC current +32767 is max TEC current (100%) – Max Heating -32767 is min TEC current (100%) – Max Cooling Laser Temperature: signed 2's complement in 1/256 degree Celsius increments
154-155	2	Aux 2 monitor low alarm	
156-157	2	Aux 2 monitor high warning	
158-159	2	Aux 2 monitor low warning	
160-161	2	Aux 3 monitor high alarm	Thresholds for Laser Temperature or additional supply voltage monitorLaser Temperature: signed 2's complement in 1/256 degree Celsius increments NOTE: Laser Temp can be below 0 if uncooled or in Tx Disable.Additional supply voltage monitor: in 100 µV increments
162-163	2	Aux 3 monitor low alarm	
164-165	2	Aux 3 monitor high warning	
166-167	2	Aux 3 monitor low warning	
168-169	2	Custom monitor high alarm	Custom monitor: signed or unsigned 16 bit value

170-171	2	Custom monitor low alarm	
172-173	2	Custom monitor high warning	
174-175	2	Custom monitor low warning	
176-177	2	Tx optical power high alarm	Threshold for Tx optical power monitor: unsigned integer in 0.1 uW increments, yielding a total measurement range of 0 to 6.5535 mW (~-40 to +8.2 dBm)See section 8.8.3 for monitor details including accuracy
178-179	2	Tx optical power low alarm	
180-181	2	Tx optical power high warning	
182-183	2	Tx optical power low warning	
184-185	2	Tx bias current high alarm	Threshold for Tx bias monitor: unsigned integer in 2 uA increments, times the multiplier from Table 8-33. See section 8.8.3 for monitor details including accuracy
186-187	2	Tx bias current low alarm	
188-189	2	Tx bias current high warning	
190-191	2	Tx bias current low warning	
192-193	2	Rx optical power high alarm	Threshold for Rx optical power monitor: unsigned integer in 0.1 uW increments, yielding a total measurement range of 0 to 6.5535 mW (~-40 to +8.2 dBm) See section 8.8.3 for accuracy.
194-195	2	Rx bias current low alarm	
196-197	2	Rx bias current high warning	
198-199	2	Rx bias current low warning	
200-229	30	Reserved	Reserved
230-254	25	Custom	Custom
255	1	Checksum	Covers bytes 128-254

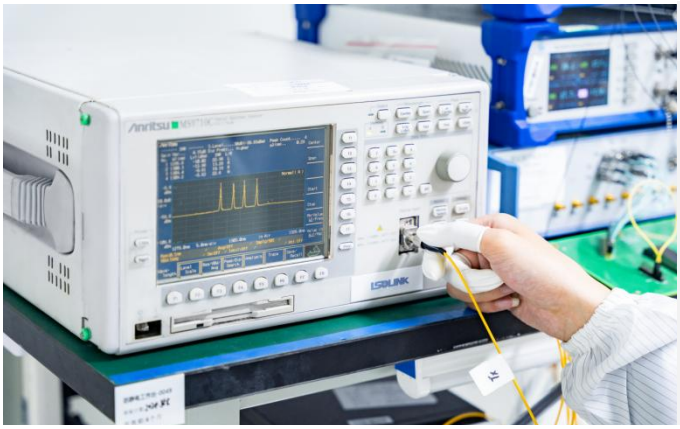
Mechanical Dimension



Test Center

1、Performance Testing

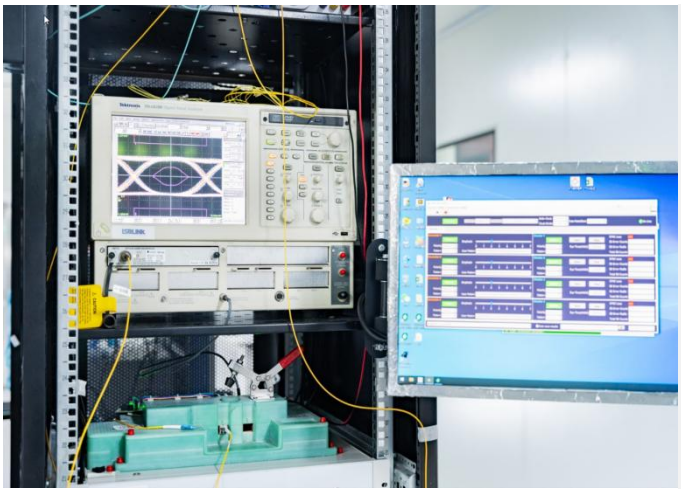
Every fiber optic transceiver is thoroughly tested by the AICPLIGHT Assurance Program, which is equipped with the world's most advanced analytical equipment to ensure that our transceivers meet the industry's international public protocol standards while still functioning flawlessly in your facility.



Optical Spectrum Inspection

Using the industry's leading optical spectrum analyser to check in real time that the parameters of the optical transceiver's laser comply with industry standards.

- **Peak:** Peak wavelength and peak level
- **2nd Peak:** Side-mode wavelength and level
- **Mean WI:** Center wavelength
- **Total Power:** Total power of spectrum
- **SMSR:** Side-Mode Suppression Ratio



Optical Signal Quality Inspection

Using highly efficient sampling oscilloscopes and BERT testers, equipped with an automated test platform to accurately test the signal quality of the transceiver, test records are kept for up to 5 years to ensure the traceability of each transceiver.

- **Eye Mask Margin(NRZ)**
- **TDECQ(PAM4):**transmitter dispersion eye closure
- **OMA:** Optical modulation amplitude
- **BER:** Bit error rate
- **ER:** Extinction Ratio

Flow Pressure Test

Using multi-protocol network traffic analyser with various brands of switches to test the transceiver's ability to transmit at full speed.

- **Bandwidth:** Actual transceiver bandwidth on the port
- **Packet Loss**
- **Packet Errors:**CRC Errors/PCS Errors/Symbol Errors
- **LinkDown Counts**
- **latency**

Aboveis part of our test bed network equipment. For more information, Please click download for optical transceiver performance test report.

2、Quality Control

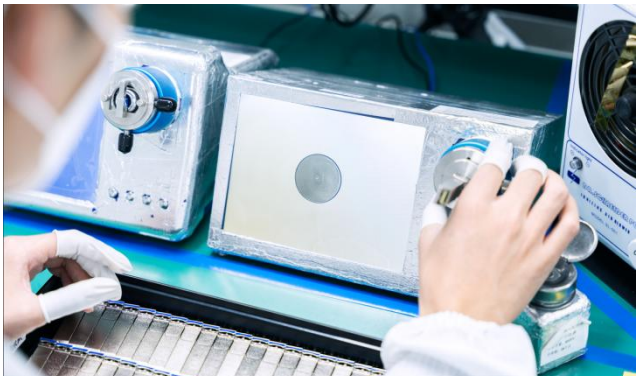
We adopt advanced quality management solutions. Each transceiver is self-inspected, including:20x microscope inspection, 200x microscope inspection, and QC process inspection.

visual inspection

Microscopic inspection: 20X

Microscopic inspection: 200X

Reliability Verification



Optical endface inspection

OQC Inspection

3、Compatibility Testing

Each optical transceiver is tested in AICPLIGHT's library of compatibility test equipment to ensure perfect compatibility with multiple brands on the market.

Cisco Nexus N9K-C9318YC-EX

juniper QFX5110-48S-4C

Huawei S6720-30L-HI-24S

Arista DCS-7060SX2-48YC6-R

Aruba Aruba 8360-32Y4C

Extreme X670G2-48X-4Q

Aboveis part of our test bed network equipment. For more information, Please click download to get the compatibility test report of each brand of optical transceiver.

Order Information

Part Number	Description
400G-Q112-VR4	400GBASE-VR4 QSFP112 PAM4 850nm 50m DOM MTP/MPO-12 APC MMF Transceiver Module
400G-Q112-SR4	400GBASE-SR4 QSFP112 PAM4 850nm 100m DOM MTP/MPO-12 APC MMF Optical Transceiver Module
400G-Q112-DR4	400GBASE-DR4 QSFP112 PAM4 1310nm 500m DOM MTP/MPO-12 APC SMF Optical Transceiver Module