Product Specification

112Gb/s QSFP28 LR4 1310nm 10km
DOM Optical Transceiver

P/N: 112G-Q28-LR4

Features

- Hot Pluggable QSFP28 form factor
- Operating data rate 112Gbps
- Single +3.3V power supply
- Duplex LC receptacle
- Max power dissipation 3.5W
- Up to 10km reach for G.652 SMF
- 4x25Gb/s LAN WDM DFB TOSA
- 4 channel PIN receivers
- Built-in digital diagnostic function
- Commercial temperature range 0°C to 70°C

Compliance

- QSFP28 MSA
- Compliant with QSFP Electrical MSA SFF-8636
- Compliant with QSFP Mechanical MSA SFF-8665
- IEEE 802.3bm
- RoHS

Applications

- Switches with QSFP28 ports
- Router with QSFP28 Ports
- Server or Network Adapter Card
- Optical Transmission System
- Other devices with QSFP28 Ports

Description

The 112G-Q28-LR4 Transceiver is a high-performance optical module designed for 112Gb/s data transmission, compliant with the IEEE P802.3ba 100GBASE-LR4 and OTU4 4I1-9D1F standards. It is engineered to support optical communication applications over single-mode fiber (SMF) with a reach of up to 10 kilometers, making it ideal for data center interconnects, enterprise networks, and telecommunications.

The module features a 4-lane architecture, converting 4 input channels of 28Gb/s electrical data into 4 channels of LAN WDM optical signals, which are then multiplexed into a single channel for 112Gb/s optical transmission. On the receiver side, it demultiplexes a 112Gb/s optical input into 4 LAN WDM channels and converts them back into 4 output channels of electrical data. The central wavelengths of the 4 LAN WDM channels are 1295.56 nm, 1300.05 nm, 1304.58 nm, and 1309.14 nm, adhering to the LAN WDM wavelength grid defined in IEEE 802.3ba.

Designed for reliability and efficiency, the 112G-Q28-LR4 integrates high-performance cooled LAN WDM DFB transmitters and high-sensitivity PIN receivers, ensuring superior signal integrity and low power consumption. It complies with the QSFP28 MSA standard, offering a compact form factor, advanced digital diagnostics (DDM) via a 2-wire serial interface, and robust performance across extreme temperature, humidity, and EMI conditions. This transceiver is a future-proof solution for next-generation high-speed optical networks.

Product performance Specifications

1. Basic Product Characteristics

Parameter	Symbol	Min	Typ.	Max	Unit
Storage Temperature	T_S	-40	-	+85	°C
Supply Voltage	V_{CC}	-0.5	-	3.6	V
Relative Humidity	RH	0	-	85	%
Operating Case Temperature	T_C	0	-	70	°C
Power Supply Voltage	V_{CC}	3.135	3.3	3.465	V
Power Supply Current	I_{CC}			1.22	A
Power Dissipation	PD	-	-	3.5	W
Data Rate, each Lane		25.78		27.95	Gb/s
Control Input Voltage High		2		VCC	V
Control Input Voltage Low		0		0.8	V
Link Distance with G.652	D	0.002		10	km

2. Product Optical and Electrical Characteristic

Parameter	Symbol	Min	Typ.	Max	Unit
Input Differential Impedance	Zin	90	100	110	Ohm
Differential Input Voltage Swing	Vin,pp			900	mVpp
Differential Output Voltage Swing[3]	Vout,pp	100		400	mVpp
		300		600	
		400		800	
		600		1200	
Differential Output Impedance	Zout	90	100	110	Ohm
QSFP28 100G LR4					
Signaling Speed per Channel[1]			25.78125		Gbps
Center Wavelength[2]	L0	1294.53		1296.59	nm
	L1	1299.02		1301.09	nm
	L2	1303.54		1305.63	nm
	L3	1308.09		1310. 19	nm
Transmitter					
SMSR		30			dB
Total Average Launch Power	PT			10.5	dBm
Average Launch Power	Pave	-4.3		4.5	dBm
OMA each Lane	Poma	-1.3		4.5	dBm
Difference in Launch Power between any Two Lanes (OMA)	Ptx,diff			5	dB
TDP, each Lane	TDP			2.2	dB
Extinction Ratio	ER	4			dB
Extinction Ratio	ER	4			dB
RIN20OMA	RIN			-130	dB/Hz
Optical Return Loss Tolerance	TOL			20	dB
Transmitter Reflectance	Rt			-12	dB
Average Launch Power OFF Transmitter, each Lane	Poff			-30	dBm
Receiver					
Total Average Receive Power				10.5	dBm
Average Receive Power, each Lane		-10.6		4.5	dBm
Receive Power (OMA), each Lane				4.5	dBm
Receiver Sensitivity, each Lane	SEN			-8.6	dBm
Stressed Receiver Sensitivity (OMA), each Lane				-6.8	dBm

Difference in Receive Power between any Two Lanes (OMA)	Prx,diff			5.5	dB
LOS Assert	losa	25			dBm
LOS De-assert	losd			-13	dBm
LOS Hysteresis	losh	0.5		6	dB
QSFP28 112G OTU4					
Center Wavelength	L0	1294.53		1296.59	nm
	L1	1299.02		1301.09	nm
	L2	1303.54		1305.63	nm
	L3	1308.09		1310.19	nm
Signaling Speed per Channel			27.95		Gbps
Transmitter					
SMSR		30			dB
Total Average Launch Power	PT			10	dBm
Average Launch Power,each Lane	Pave	-0.6		4	dBm
Channel Power Difference	Pout,diff			5	dB
Extinction Ratio	ER	4		6.5	dB
Optical Return Loss Tolerance	TOL			20	dB
Transmitter Reflectance	Rt			-12	dB
Average Launch Power OFF Transmitter, each Lane	Poff			-30	dBm
Receiver					
Total Average Receive Power				10.5	dBm
Average Receive Power, each Lane		-6.9		4	dBm
Receiver Sensitivity, each Lane	SEN			-8.4	dBm
Total Average Launch Power	PIN			10	dBm
Difference in Receive Power between any Two Lanes (OMA)	Prx,diff			5.5	dB
LOS Assert	LOSA	-25			dBm
LOS De-assert	LOSD			-13	dBm
LOS Hysteresis	LOSH	0.5		6	dB

Note1: Compliant to IEEE 802.3ba.

Note2: Measured with conformance test signal at receiver input for BER = 1x10-12

Note3: Output voltage is settable in 4 discrete ranges via I2C. Default range is 400 - 800mV

Recommended Host Board Power Supply Circuit

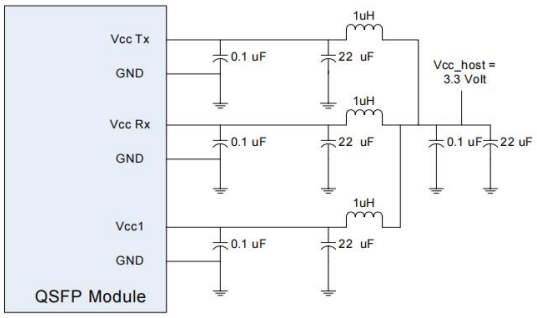


Figure 1: Recommended Host Board Power Supply Circuit

Recommended Interface Circuit

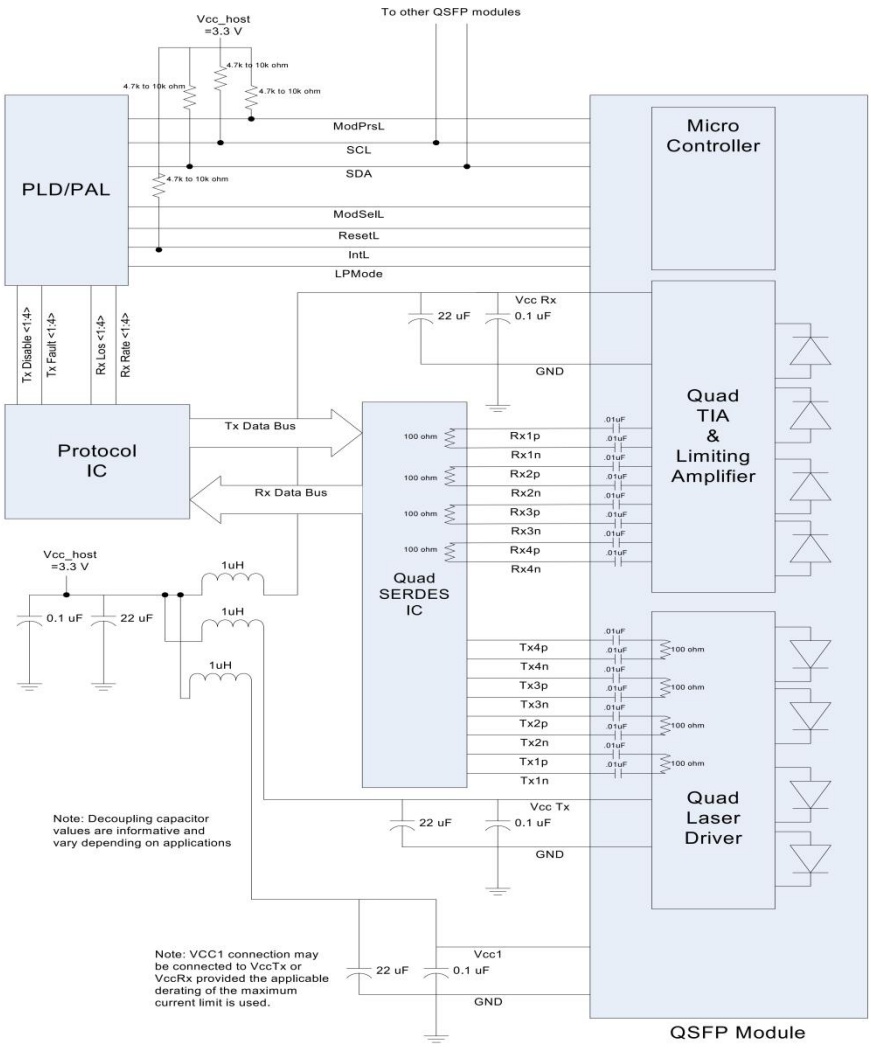


Figure2: Recommended Interface Circuit

Optical Interface

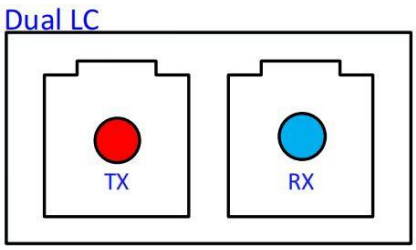


Figure3: Optical Lane Sequence

Pin-out Definition

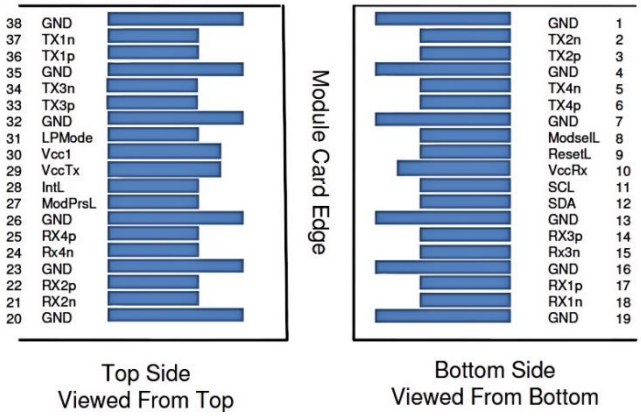


Figure4: Pin view

Pin Function Definitions

Pin	Logic	Symbol	Description	Note
1		GND	Ground	1
2	CML-I	Tx2n	Transmitter Inverted Data Input	3
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input	3
4		GND	Ground	1
5	CML-I	Tx4n	Transmitter Inverted Data Input	3
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input	3
7		GND	Ground	1
8	LVTTL-I	ModSelL	Module Select	4
9	LVTTL-I	ReSelL	Module Select	4
10		Vcc Rx	+3.3V Power Supply Receiver	2
11	LVCMOS-I/O	SCL	2-wire serial interface clock	4
12	LVCMOS-I/O	SDA	2-wire serial interface data	4
13		GND	Ground	1
14	CML-O	Rx3p	Receiver Non-Inverted Data Output	3

15	CML-O	Rx3n	Receiver Inverted Data Output	3
16		GND	Ground	1
17	CML-O	Rx1p	Receiver Non-Inverted Data Output	3
18	CML-O	Rx1n	Receiver Inverted Data Output	3
19		GND	Ground	1
20		GND	Ground	1
21	CML-O	Rx2n	Receiver Inverted Data Output	3
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	3
23		GND	Ground	1
24	CML-O	Rx4n	Receiver Inverted Data Output	3
25	CML-O	Rx4p	Receiver Non-Inverted Data Output Ground	3
26		GND	Ground	1
27	LVTTL-O	ModPrsL	Module Present	4
28	LVTTL-O	IntL	Interrupt	4
29		Vcc Tx	+3.3V Power supply transmitter	2
30		Vcc1	+3.3V Power supply	2
31	LVTTL-I	LPMode	Low Power Mode	4
32		GND	Ground	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	3
34	CML-I	Tx3n	Transmitter Inverted Data Input	3
35		GND	Ground	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	3
37	CML-I	Tx1n	Transmitter Inverted Data Input	3
38		GND	Ground	1

Note1: GND is the symbol for signal and supply (power) common for the QSFP+ module. All are common within the QSFP+ module and all module 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. Recommended host board power supply filtering is shown in Host board power supply circuit. Vcc Rx Vcc1 and Vcc Tx may be internally connected within the QSFP module in any combination. The connector pins are each rated for a maximum current of 500 mA.

Note3: High-speed signal interfaces require differential pairs (e.g. TX1+/TX1-) with tightly matched impedances (typically 100Ω).

Note4: The management and control signals are based on LVTTL level logic and are used for functions such as module selection and reset.

Monitoring Specification

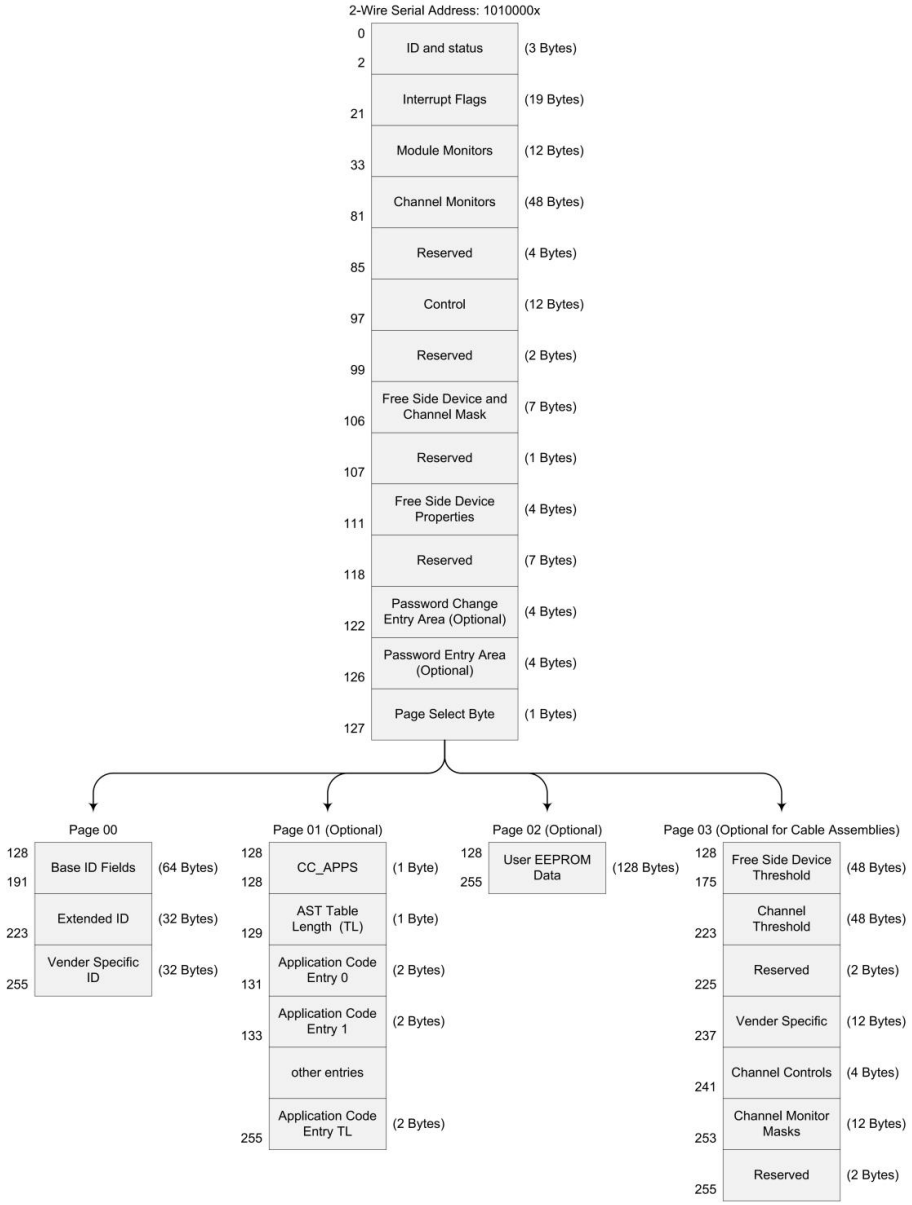


Figure5: Memory map

Memory map Table

Byte	Unit	Name	Description
Lower Page 00h			
0	1	Identifier	Type of transceiver,Page 00h Byte 0 and Page 00h Byte 128 shall contain the same parameter values.
1	1	Status	Revision Compliance
2	1	Status	Status indicators

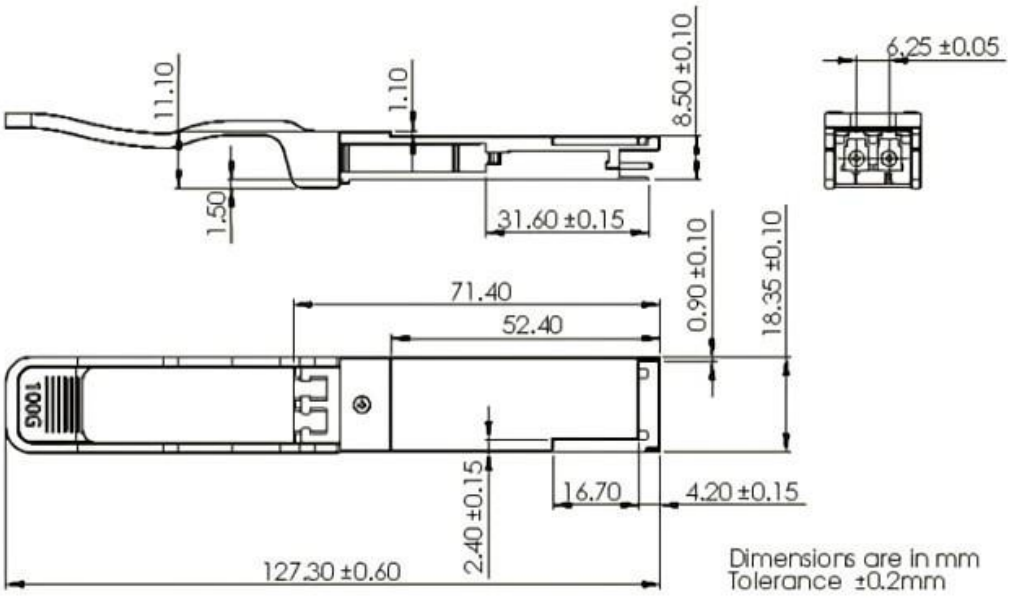
3-21	19	Interrupt Flags	Consist of interrupt flags for LOS, Tx Fault, warnings and alarms. The non-asserted state shall be 0b.
22	1	Temperature MSB	Internally measured temperature (MSB)
23	1	Temperature LSB	Internally measured temperature (LSB)
24-25	2	Reserved	Reserved
26	1	Supply Voltage MSB	Internally measured supply voltage (MSB)
27	1	Supply Voltage LSB	Internally measured supply voltage (LSB)
28-29	2	Reserved	Reserved
30-33	4	Vendor Specific	Vendor Specific
34	1	Rx1 Power MSB	Internally measured Rx1 input power
35	1	Rx1 Power LSB	
36	1	Rx2 Power MSB	Internally measured Rx2 input power
37	1	Rx2 Power LSB	
38	1	Rx3 Power MSB	Internally measured Rx3 input power
39	1	Rx3 Power LSB	
40	1	Rx4 Power MSB	Internally measured Rx4 input power
41	1	Rx4 Power LSB	
42	1	Tx1 Bias MSB	Internally measured Tx1 bias
43	1	Tx1 Bias LSB	
44	1	Tx2 Bias MSB	Internally measured Tx2 bias
45	1	Tx2 Bias LSB	
46	1	Tx3 Bias MSB	Internally measured Tx3 bias
47	1	Tx3 Bias LSB	
48	1	Tx4 Bias MSB	Internally measured Tx4 bias
49	1	Tx4 Bias LSB	
50	1	Tx1 Power MSB	Internally measured Tx1 Power
51	1	Tx1 Power LSB	
52	1	Tx2 Power MSB	Internally measured Tx2 Power
53	1	Tx2 Power LSB	
54	1	Tx3 Power MSB	Internally measured Tx3 Power
55	1	Tx3 Power LSB	
56	1	Tx4 Power MSB	Internally measured Tx4 Power
57	1	Tx4 Power LSB	
58-65	8	Reserved	Reserved channel monitor set 4
66-73	8	Reserved	Reserved channel monitor set 5
74-81	8	Vendor Specific	Vendor Specific
82-85	4	Reserved	Reserved
86-99	14	Control	Control
100-106	7	Free Side Device and Channel Masks	Free Side Device and Channel Masks
107-110	4	Free Side Device Properties	Free Side Device Properties

111-112	2	Assigned for use by PCI Express	Used for: - The PCI Express External Cable Specification - The PCI Express OCuLink Specification
113-117	4	Free Side Device Properties	Free Side Device Properties
118	1	Reserved	Reserved
119-122	4	Password Change Entry Area	Password Change Entry Area
123-126	4	Password Entry Area	Password Entry Area
127	1	Page Select Byte	Page Select Byte
Upper Page 00h			
128	1	Identifier	Identifier Type of free side device.(See SFF-8024 Transceiver Management)
129	1	Ext. Identifier	Extended Identifier of free side device. Includes power classes, CLEI codes, CDR capability.
130	1	Connector Type	Code for media connector type. (See SFF-8024 Transceiver Management)
131-138	8	Specification Compliance	Code for electronic or optical compatibility.
139	1	Encoding	Code for serial encoding algorithm. (See SFF-8024 Transceiver Management)
140	1	Signaling rate, nominal	Nominal signaling rate, units of 100 MBd. For rate > 25.4 GBd, set this to FFh and use Byte 222.
141	1	Extended Rate Select Compliance	Tags for extended rate select compliance.
142	1	Length (SMF)	Link length supported at the signaling rate in byte 140 or page 00h byte 222, for SMF fiber in km *. A value of 1 shall be used for reaches from 0 to 1 km.
143	1	Length (OM3 50 um)	Link length supported at the signaling rate in byte 140 or page 00h byte 222, for EBW 50/125 um fiber (OM3), units of 2 m *
144	1	Length (OM2 50 um)	Link length supported at the signaling rate in byte 140 or page 00h byte 222, for 50/125 um fiber (OM2), units of 1 m *
145	1	Length (OM1 62.5 um) or Copper Cable Attenuation	Link length supported at the signaling rate in byte 140 or page 00h byte 222, for 62.5/125 um fiber (OM1), units of 1 m *, or copper cable attenuation in dB at 25.78 GHz.
146	1	Length (passive copper or active cable or OM4 50 um)	Length of passive or active cable assembly (units of 1 m) or link length supported at the signaling rate in byte 140 or page 00h byte 222, for OM4 50/125 um fiber (units of 2 m) as indicated by Byte 147. See 6.3.12.
147	1	Device technology	Device technology
148-163	16	Vendor name	Free side device vendor name (ASCII)
164	1	Extended Module	Extended Module codes for InfiniBand.
165-167	3	Vendor OUI	Free side device vendor IEEE company ID.
168-183	16	Vendor PN	Part number provided by free side device vendor(ASCII)
184-185	2	Vendor rev	Revision level for part number provided by the vendor(ASCII)

186-187	2	Wavelength or Copper Cable Attenuation	Nominal laser wavelength (wavelength=value/20 in nm) or copper cable attenuation in dB at 2.5 GHz (Byte 186) and 5.0 GHz (Byte 187)
188-189	2	Wavelength tolerance or Copper Cable Attenuation	The range of laser wavelength (+/- value) from nominal wavelength. (wavelength Tol. =value/200 in nm) or copper cable attenuation in dB at 7.0 GHz (Byte 188) and 12.9 GHz (Byte 189)
190	1	Max case temp	Maximum case temperature
191	1	CC_BASE	Check code for base ID fields (Bytes 128-190)
192	1	Link codes	Extended Specification Compliance Codes (See SFF-8024)
193-195	3	Options	Optional features implemented.
196-211	16	Vendor SN	Serial number provided by vendor.(ASCII)
212-219	8	Date Code	Vendor's manufacturing date code.
220	1	Diagnostic Monitoring Type	Indicates which type of diagnostic monitoring is implemented (if any) in the free side device. Bit 1,0 Reserved.
221	1	Enhanced Options	Indicates which optional enhanced features are implemented in the free side device.
222	1	CC_EXT	Check code for the Extended ID Fields (Bytes 192-222)
224-255	32	Vendor Specific	Vendor Specific EEPROM
Page 02h (Optional)			
128-255	128	User EEPROM Data	
Page 03h (Optional)			
128-129	2	Temp High Alarm	MSB at lower byte address
130-131	2	Temp Low Alarm	MSB at lower byte address
132-133	2	Temp High Warning	MSB at lower byte address
134-135	2	Temp Low Warning	MSB at lower byte address
136-143	8	Reserved	Reserved
144-145	2	Vcc High Alarm	MSB at lower byte address
146-147	2	Vcc Low Alarm	MSB at lower byte address
148-149	2	Vcc High Warning	MSB at lower byte address
150-151	2	Vcc Low Warning	MSB at lower byte address
152-159	8	Reserved	Reserved
160-175	16	Vendor Specific	Vendor Specific
176-177	2	Rx Power High Alarm	MSB at lower byte address
178-179	2	Rx Power Low Alarm	MSB at lower byte address
180-181	2	Rx Power High Warning	MSB at lower byte address
182-183	2	Rx Power Low Warning	MSB at lower byte address
184-185	2	Tx Bias High Alarm	MSB at lower byte address
186-187	2	Tx Bias Low Alarm	MSB at lower byte address
188-189	2	Tx Bias High Warning	MSB at lower byte address
190-191	2	Tx Bias Low Warning	MSB at lower byte address
192-193	2	Tx Power High Alarm	MSB at lower byte address
194-195	2	Tx Power Low Alarm	MSB at lower byte address
196-197	2	Tx Power High Warning	MSB at lower byte address

198-199	2	Tx Power Low Warning	MSB at lower byte address
200-207	8	Reserved	Reserved thresholds for channel parameter set 4
208-215	8	Reserved	Reserved thresholds for channel parameter set 5
216-223	8	Vendor Specific	Vendor Specific
224	1	Tx EQ & Rx Emphasis Magnitude ID	Tx EQ & Rx Emphasis Magnitude ID
225	1	Rx output amplitude support indicators	Rx output amplitude support indicators
226-229	4	Control options advertising	Control options advertising
230-241	12	Optional Channel Controls	Optional Channel Controls
242-247	6	Channel Monitor Masks	Channel Monitor Masks
248-249	2	Reserved	Reserved channel monitor masks set 4
250-251	2	Reserved	Reserved channel monitor masks set 5
252-255	4	Reserved	Reserved

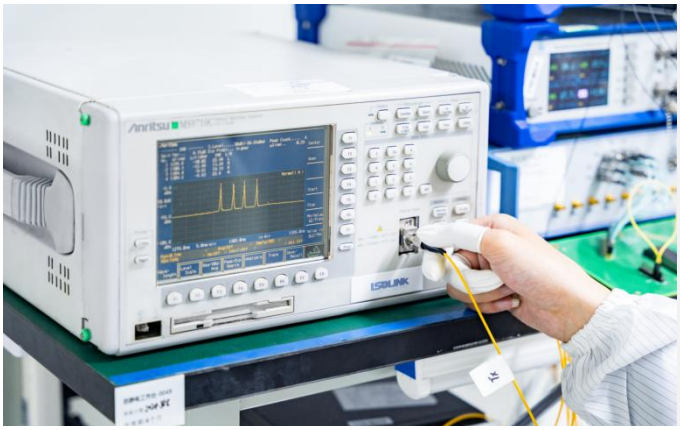
Mechanical Dimension



Test Center

1. Performance Testing

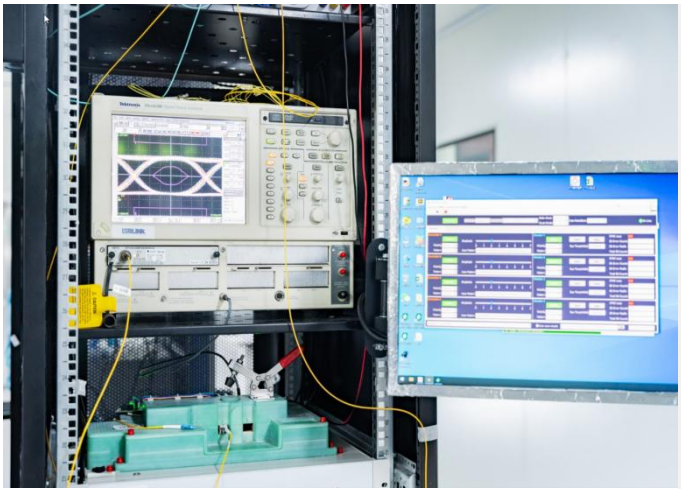
Every fiber optic transceiver is thoroughly tested by the LSOLINK Assurance Program, which is equipped with the world's most advanced analytical equipment to ensure that our transceivers meet the industry's international public protocol standards while still functioning flawlessly in your facility.



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 LSOLINK's library of compatibility test equipment to ensure perfect compatibility with multiple brands on the market.

Juniper QFX5110-48S-4C

Cisco N9K-C9318YC-EX

Cisco C9500-24Y4C

Aruba 8360-32Y4C

Huawei S6720-30L-HI-24S

Arista DCS-7060SX2-48YC6-R

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
100G-Q28-SR4	100GBASE-SR4 QSFP28 100G 850nm 100m DOM MTP/MPO-12 UPC MMF Transceiver Module
100G-Q28-PSM4	100GBASE-PSM4 QSFP28 100G 1310nm 2km DOM MTP/MPO-12 APC SMF Transceiver Module
100G-Q28-CWDM4	100GBASE-CWDM4 QSFP28 100G 1310nm 2km DOM LC SMF Transceiver Module
100G-Q28-SR-BD	100GBASE-SR Bi-Directional QSFP28 850nm 100m DOM Duplex LC MMF Optical Transceiver Module
100G-Q28-SWDM4	100GBASE-SWDM4 QSFP28 100G 850nm 100m DOM LC MMF Transceiver Module
100G-Q28-LX4	100GBASE-LX4 QSFP28 100G 1310nm 100m/2km DOM LC MMF/SMF Transceiver Module
100G-Q28-LR4	100GBASE-LR4 QSFP28 100G 1310nm 10km DOM LC SMF Transceiver Module
100G-Q28-ER4	100GBASE-ER4 QSFP28 100G 1310nm 40km DOM LC SMF Transceiver Module
100G-Q28-ZR4	100GBASE-ZR4 QSFP28 100G 1310nm 80km DOM LC SMF Transceiver Module
112G-Q28-LR4	100/112GBASE-LR4 QSFP28 100G Dual Rate 1310nm 10km DOM LC SMF Transceiver Module
112G-Q28-ER4	100/112GBASE-ER4 QSFP28 100G Dual Rate 1310nm 40km DOM LC SMF Transceiver Module
100G-Q28-DR	100GBASE-DR QSFP28 100G PAM4 1310nm 500m DOM LC SMF Transceiver Module
100G-Q28-FR	100GBASE-FR QSFP28 100G PAM4 1310nm 2km DOM LC SMF Transceiver Module
100G-Q28-LR	100GBASE-LR QSFP28 100G PAM4 1310nm 10km DOM LC SMF Transceiver Module
100G-Q28-ER	100GBASE-ER QSFP28 Single Lambda 1310nm 40km DOM Duplex LC SMF Optical Transceiver Module

Further Information

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Web | www.lsolink.com

Email | For Sales@lsolink.com

Disclaimer

1. We are committed to continuous product improvement and feature upgrades, and the contents con t ained in this manual are subject to change without notice.
2. Nothing herein should be construed as constituting an additional warranty.
3. LSOLINK assumes no responsibility for the use or reliability of equipment or software not provided by LSOLINK.