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SKU: 00T0S01

200G QSFP56 SR4 Transceiver
Hot Pluggable, MPO / MTP, 850nm VCSEL, OM3 70M / OM4 100M, DSP Solution, SFF-8636 Management & DDM, C-Temp

Part Number: FQ56-S9-M85-X1D-DS1



Overview

FQ56-S9-M85-X1D-DS1 is a parallel fiber optical transceiver module for 212.5Gbps data transmission applications at 850nm. It is ideally suited for datacom & storage area network (SAN/NAS) applications based on IEEE 802.3cd 200GBASE-SR4 and InfiniBand HDR standard. Designed for short range multi-lane data communication, the QSFP56 full-duplex optical module with MPO-12 APC receptacle integrates four independent transmitter and receiver channels each capable 53.125Gbps operation for an aggregate data rate of 212.5Gbps up to MMF OM3 70m / OM4 100m optical links.

Applications

- 200GBASE-SR4 Ethernet @212.5G
- Breakout to 4 x 50GBASE-SR Ethernet
- InfiniBand HDR interconnect
- Data Centers Switch Interconnect
- Server and Storage Area Network Interconnect

Features

- Compliant with IEEE802.3cd 200GBASE-SR4
- Compliant with SFF-8665 QSFP56 MSA
- Compliant with IEEE 802.3bs 200GAUI-4 Interface
- 4 independent full-duplex channels
- Signaling Rate PAM4 26.5625GBd per Lane
- DSP with built in quad Tx CDR and Rx CDR
- Hot Pluggable QSFP56 footprint
- 4CH 850nm VCSEL array transmitter & PIN receiver
- MPO-12 APC receptacle connector
- 2-wire interface for management and diagnostic monitor compliant with SFF-8636
- Single 3.3V power supply
- Link distance 70m over OM3 fiber and 100m over OM4 fiber with KP4 FEC
- Operating Temperature 0~+70°C
- Maximum power consumption 4.5W
- RoHS compliant

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Laser Safety

- This is a Class 1 Laser Product complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019.
- Caution: Use of control or adjustments or performance of procedure other than those specified herein may result in hazardous radiation exposure.

Absolute Maximum Ratings

Parameters	Symbol	Min.	Max.	Unit
Storage Temperature	T_{ST}	-40	+85	°C
Relative Humidity	RH	5	85	%
Supply Voltage	V_{CC}	-0.5	+3.6	V

Recommended Operating Conditions

Parameters	Symbol	Min.	Typ.	Max.	Unit
Case Operating Temperature	T_{OP}	0	-	+70	°C
Supply Voltage	V_{CC}	+3.13	+3.3	+3.47	V
Electrical Signaling Rate, per Lane (PAM4)			26.5625		GBd
Optical Signaling Rate, per Lane (PAM4)			26.5625		GBd
Data Rate Accuracy	ΔDR	-100		+100	ppm
Bit Error Rate (Pre-FEC)	BER			$2.4x10^{-4}$	
Bit Error Rate (Post-FEC)	I_{CC}			$1x10^{-12}$	
Supply Current (+3.3V)	P			1360	mA
Power Consumption				4.5	W
Transceiver Power-on Initialization Time	V_{IH}			2000	ms

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Transmitter Electro-optical Characteristics

V_{CC} = 3.13V to 3.47V, T_{OP} = 0 °C to +70 °C

Parameters	Symbol	Min.	Typ.	Max.	Unit	Note
Optical Signaling Rate, per Lane			26.5625		GBd	PAM4
Optical Wavelength, each Lane	λc	840	850	860	nm	
Spectral Width (RMS) (Modulated)	Δλ			0.6	nm	
Average Launch Power, per Lane	P_{AVG}	-6.5		+4	dBm	1
Outer Optical Modulation Amplitude (OMA_{Outer}), per Lane	P_{OMA}	-4.5		+3	dBm	2
Launch Power in OMA_{Outer} minus TDECQ, per Lane	OMA-TDECQ	-5.9			dB	
Transmitter and Dispersion Eye Clouser for PAM4, per Lane	TEQCQ			4.5	dB	3
Optical Extinction Ratio	ER	3			dB	
Average Launch Power OFF, per Lane	P_{OFF}			-30	dBm	
Optical Return Loss Tolerance	ORLT			12	dB	
Input Differential Impedance	Z_{IN}	90	100	110	Ω	
Differential Data Input Voltage	V_{IN-PP}	300		900	mVpp	
Differential Termination Mismatch				10	%	
Single-ended Voltage Tolerance Range		-0.4		3.3	V	
DC Common Mode Input Voltage	CMV_{IN}	-350		2850	mV	4

Note1: Average launch power, each lane (min) is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant; however, a value above this does not ensure compliance.

Note2: Even if the TDECQ < 1dB, the OMA_{Outer} (min) must exceed the minimum value specified here.

Note3: TDECQ is specified and measured as per IEEE802.3.cm Clause 150.8.5.

Note4: DC common mode voltage generated by the host. Specification includes effects of ground offset voltage.

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Receiver Electro-optical Characteristics

V_{CC} = 3.13V to 3.47V, T_{OP} = 0 °C to +70 °C

Parameters	Symbol	Min.	Typ.	Max.	Unit	Note
Optical Signaling Rate, per Lane	DR_{OP}		26.5625		GBd	PAM4
Optical Wavelength, each Lane	λc	840	850	860	nm	
Damage Threshold, per Lane	D_{TH}	+5			dBm	1
Average Receive Power, per Lane	P_{RX-AVG}	-8.4		+4	dBm	2
Receive Power (OMA_{Outer}), per Lane	P_{RX-OMA}			+3	dBm	
Receive Sensitivity (OMA_{Outer}), per Lane	SEN_{OMA}	Max (-6.5, SECQ-7.9)			dBm	3
Stressed Receiver Sensitivity (OMA_{Outer}), per Lane	SRS_{OMA}			-3.4	dBm	4
Receiver Reflectance	R_{RX}			-12	dB	
LOS De-Assert	LOS_D			-12	dBm	
LOS Assert	LOS_A	-30			dBm	
LOS Hysteresis	LOS_{HY}	0.5			dB	
Output Differential Impedance	Z_{OUT}	90	100	110	Ω	
Differential Data Output Voltage	V_{OUT-PP}	300		900	mVpp	
Near-end Eye Symmetry Mask Width (ESMW)		0.265			UI	
Near-end Eye Height, Differential		70			mV	
Far-end Eye Symmetry Mask Width (ESMW)		0.2			UI	
Far end Eye Height, Differential		30			mV	
Transition Time, 20% to 80%		9.5			ps	
DC Common Mode Output Voltage	CMV_{OUT}	-350		2850	mV	5

Note1: 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.

Note2: Average receive power, per 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 compliance.

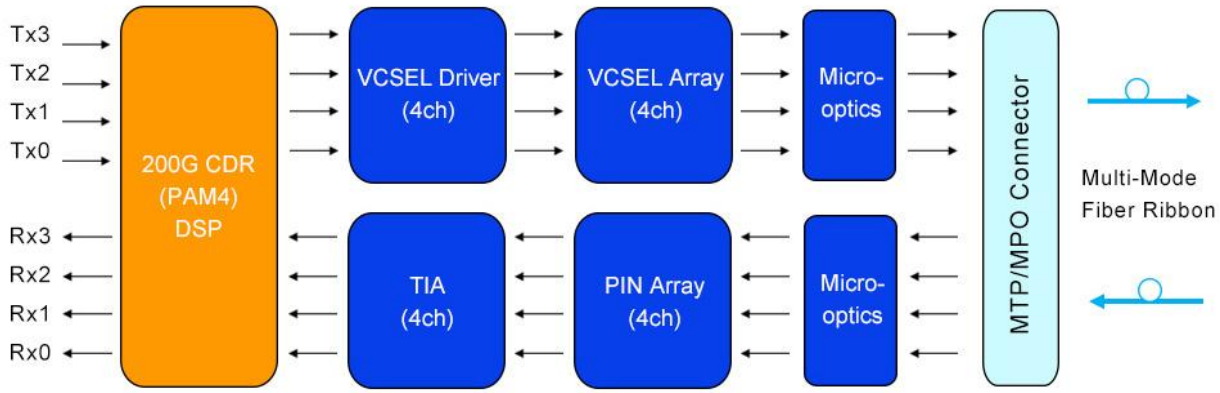
Note3: Receiver sensitivity is informative and is defined for a transmitter with a value of SECQ up to 4.5dB.

Note4: Measured with conformance test signal at receiver input for the BER of $2.4x10^{-4}$.

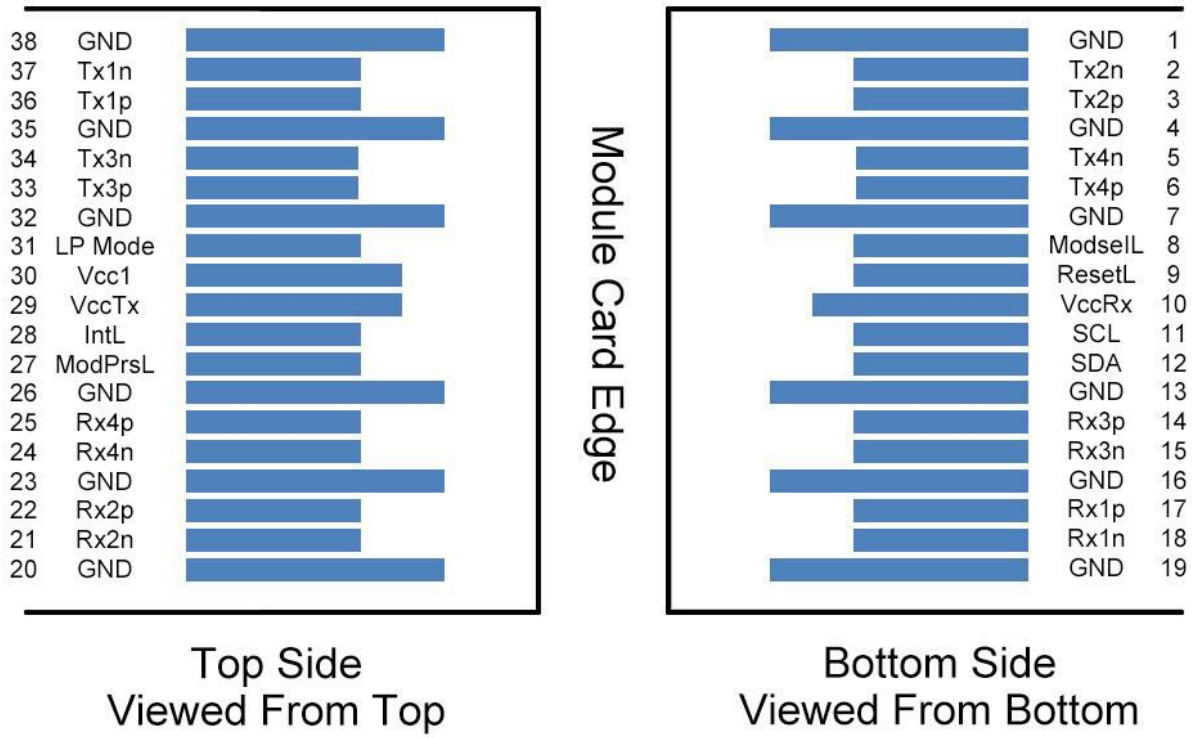
Note5: DC common mode voltage generated by the host. Specification includes effects of ground offset voltage.

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Transceiver Block Diagram



Pin Assignment



Top Side
Viewed From Top

Bottom Side
Viewed From Bottom

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Pin Description

Pin	Logic	Name	Function / Description
1		GND	Module Ground
2	CML-I	Tx2n	Transmitter Inverted Data Input
3	CML-I	Tx2p	Transmitter Non-Inverted Data Input
4		GND	Module Ground
5	CML-I	Tx4n	Transmitter Inverted Data Input
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input
7		GND	Module Ground
8	LVTLL-I	ModSelL	Module Select
9	LVTLL-I	ResetL	Module Reset
10		VccRx	+3.3V Power Supply Receiver
11	LVCMOS-I/O	SCL	2-Wire Serial Interface Clock
12	LVCMOS-I/O	SDA	2-Wire Serial Interface Data
13		GND	Module Ground
14	CML-O	Rx3p	Receiver Non-Inverted Data Output
15	CML-O	Rx3n	Receiver Inverted Data Output
16		GND	Module Ground
17	CML-O	Rx1p	Receiver Non-Inverted Data Output
18	CML-O	Rx1n	Receiver Inverted Data Output
19		GND	Module Ground
20		GND	Module Ground
21	CML-O	Rx2n	Receiver Inverted Data Output
22	CML-O	Rx2p	Receiver Non-Inverted Data Output
23		GND	Module Ground
24	CML-O	Rx4n	Receiver Inverted Data Output
25	CML-O	Rx4p	Receiver Non-Inverted Data Output
26		GND	Module Ground
27	LVTLL-O	ModPrsL	Module Present
28	LVTLL-O	IntL	Interrupt
29		VccTx	+3.3V Power Supply Transmitter
30		Vcc1	+3.3V Power Supply
31	LVTLL-I	LPMode	Low Power Mode
32		GND	Module Ground

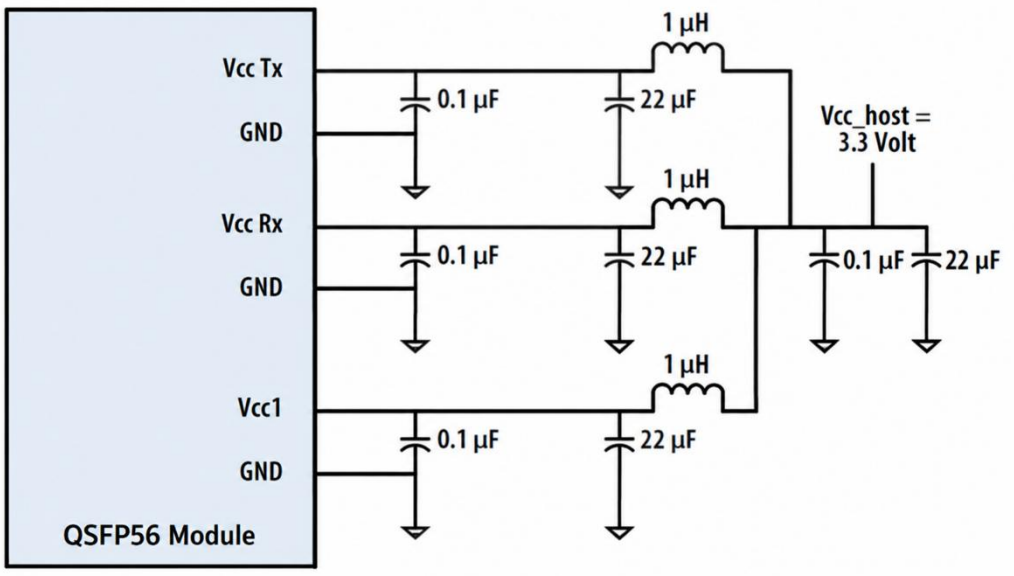
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33	CML-I	Tx3p	Transmitter Non-Inverted Data Input
34	CML-I	Tx3n	Transmitter Inverted Data Input
35		GND	Module Ground
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input
37	CML-I	Tx1n	Transmitter Inverted Data Input
38		GND	Module Ground

Note1: GND is the symbol for signal and supply (power) common for QSFP56 modules. All are common within the QSFP56 module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal common ground lane.

Note2: VccRx, Vcc1 and VccTx are the receiver and transmitter power suppliers and shall be applied concurrently. Recommended host board power supply filtering is shown below. Vcc Rx, Vcc1 and Vcc Tx may be internally connected within the QSFP56 transceiver module in any combination. The connector pins are each rated for a maximum current of 1000mA.

Recommended Power Supply Filter



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Digital Diagnostic Functions

As defined by the QSFP56 MSA, Ficer's QSFP56 transceivers provide digital diagnostic functions via a 2-wire serial interface, which allows real-time access to the following operating parameters:

- Transceiver temperature
- Laser bias current (4-Channel)
- Transmitted optical power (4-Channel)
- Received optical power (4-Channel)
- Transceiver supply voltage

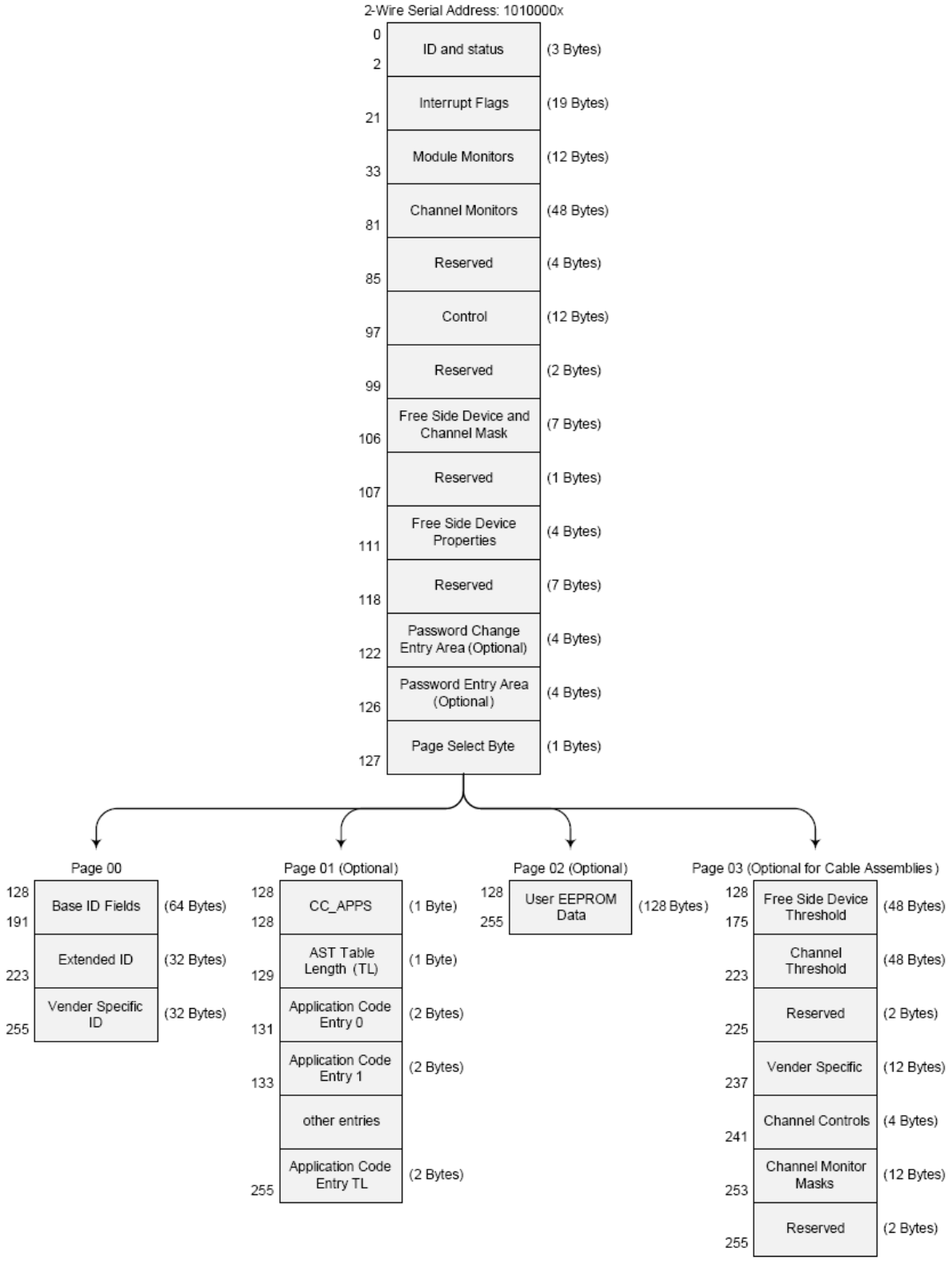
It also provides a sophisticated system of alarm and warning flags, which may be used to alert end-users when particular operating parameters are outside of a factory-set normal range.

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Controller (DDC) inside the transceiver, which is accessed through the 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL pin) is generated by the host. The positive edge clocks data into the QSFP56 transceiver into those segments of its memory map that are not write-protected. The negative edge clocks data from the QSFP56 transceiver. The serial data signal (SDA pin) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially. The 2-wire serial interface provides sequential or random access to the 8 bit parameters, addressed from 000h to the maximum address of the memory.

For more detailed information including memory map definitions, please see the QSFP56 MSA Specification.

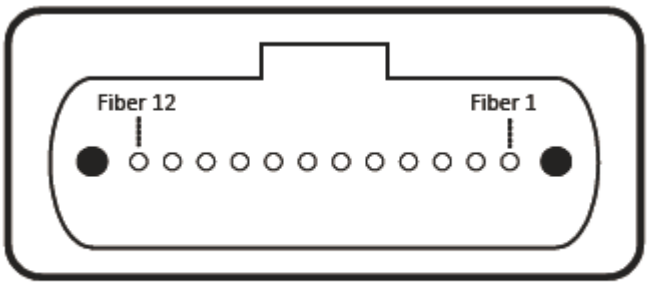
Digital Diagnostic Memory Map (SFF-8636)

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2-Wire Serial Address: 1010000x
0
2
ID and status
(3 Bytes)
21
Interrupt Flags
(19 Bytes)
33
Module Monitors
(12 Bytes)
81
Channel Monitors
(48 Bytes)
85
Reserved
(4 Bytes)
97
Control
(12 Bytes)
99
Reserved
(2 Bytes)
106
Free Side Device and Channel Mask
(7 Bytes)
107
Reserved
(1 Bytes)
111
Free Side Device Properties
(4 Bytes)
118
Reserved
(7 Bytes)
122
Password Change Entry Area (Optional)
(4 Bytes)
126
Password Entry Area (Optional)
(4 Bytes)
127
Page Select Byte
(1 Bytes)
Page 00
128
191
Base ID Fields
(64 Bytes)
223
Extended ID
(32 Bytes)
255
Vender Specific ID
(32 Bytes)
Page 01 (Optional)
128
128
CC_APPS
(1 Byte)
129
AST Table Length (TL)
(1 Byte)
131
Application Code Entry 0
(2 Bytes)
133
Application Code Entry 1
(2 Bytes)
other entries
255
Application Code Entry TL
(2 Bytes)
Page 02 (Optional)
128
255
User EEPROM Data
(128 Bytes)
Page 03 (Optional for Cable Assemblies)
128
175
Free Side Device Threshold
(48 Bytes)
223
Channel Threshold
(48 Bytes)
225
Reserved
(2 Bytes)
237
Vender Specific
(12 Bytes)
241
Channel Controls
(4 Bytes)
253
Channel Monitor Masks
(12 Bytes)
255
Reserved
(2 Bytes)

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Optical Interface Lanes and Assignment



Outside View of the QSFP56 Module MPO-12

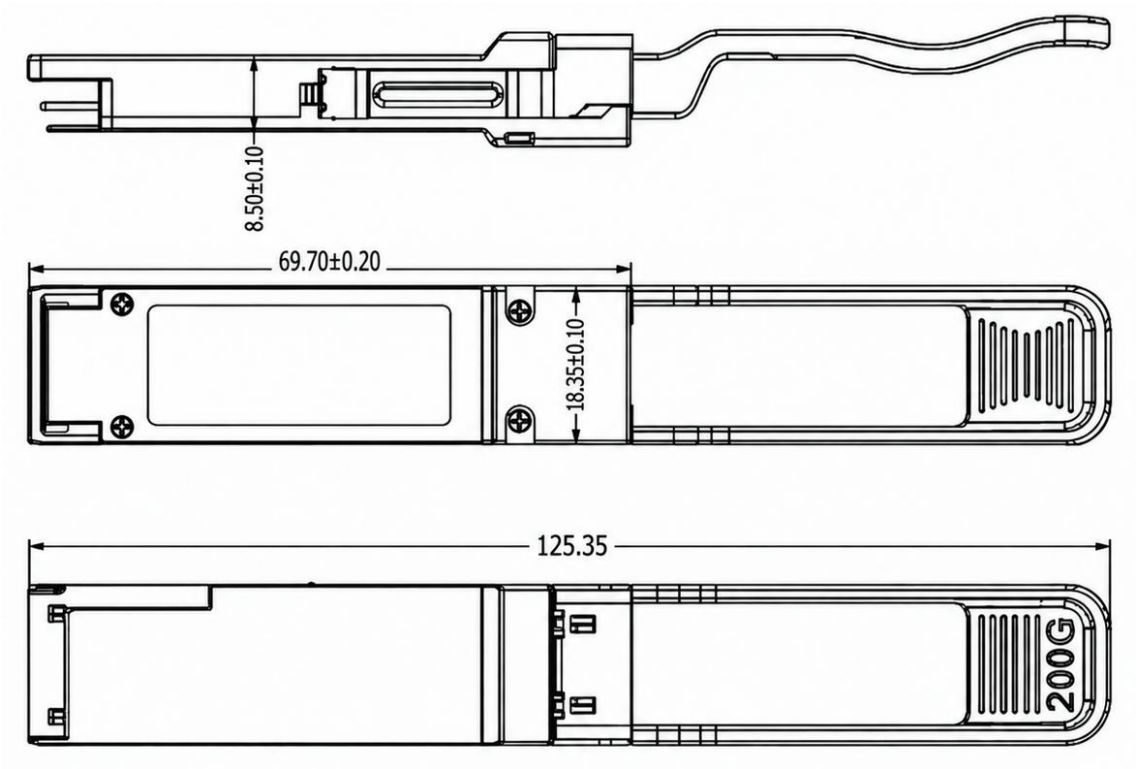
Fiber #	Lane Assignment
1	Rx0
2	Rx1
3	Rx2
4	Rx3
5,6,7,8	Not used
9	Tx3
10	Tx2
11	Tx1
12	Tx0

lane assignment

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Mechanical Dimensions



(All Dimensions are ±0.20mm Unless Otherwise Specified, Unit: mm)

Ordering Information

Part No.	Tx	Rx	Link	DDM	Temp.
FQ56-S9-M85-X1D-DS1	850 nm	850 nm	MM OM3 70m MM OM4 100m	Yes	0~+70°C

Note: Distances are indicative only. To calculate a more precise link budget based on specific conditions in your application, please refer to the optical characteristics.

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