FICER Technology Co., Ltd.
明虹科技股份有限公司

2F, No.138, Daye Rd., Beitou Dist.,
Taipei City 112030, Taiwan
www.Ficer.com

SKU: 05H0S07

200G QSFP56 FR4 Transceiver
Hot Pluggable, Duplex LC, CWDM EML, SMF 2km,
DSP Solution, OIF-CMIS Management & DDM, C-Temp

Part Number: FQ56-S7-C13-02D-DS2



Overview

FQ56-S7-C13-02D-DS2 is 4-Channel CWDM 1300nm QSFP56 transceiver module for 200GbE applications especially in Telecom, Datacom, Data Center & Storage networks. The transmitter converts 4-Channel PAM4 26.5625GBd electrical input data to four CWDM optical signals and multiplex that into one 200G signal. The receiver de-multiplex the 200G signal reversely and converts that to 4-Channel 26.5625GBd electrical output data. The techniques bring a compact transceiver module for an aggregate bandwidth of 212.5Gbps up to SMF 2km optical links.

Applications

- 200GBASE-FR4 Ethernet @212.5G
- Data Centers Switch Interconnect
- Server and Storage Area Network Interconnect

Features

- Compliant with IEEE802.3bs 200GBASE-FR4
- Compliant with SFF-8665 QSFP56 MSA
- Compliant with IEEE 802.3bs 200GAUI-4 Interface
- 4CH CWDM MUX / DEMUX design
- Signaling Rate PAM4 26.5625GBd per Lane
- DSP with built in quad Tx CDR and Rx CDR
- Hot Pluggable QSFP56 footprint
- 4CH CWDM EML transmitter & PIN receiver
- Duplex LC connector
- 2-wire interface for management and diagnostic monitor compliant with OIF-CMIS
- Single 3.3V power supply
- Link distance 2km over SM fiber with KP4 FEC
- Operating Temperature 0~+70°C
- Maximum power consumption 6.5W
- RoHS compliant

TEL+886-2-2898-3830 FAX+886-2-2898-3840 Sales@Ficer.com
Link Fiber to Future

SKU: 05H0S07

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			1970	mA
Power Consumption				6.5	W
Transceiver Power-on Initialization Time	V_{IH}			2000	ms

TEL+886-2-2898-3830 FAX+886-2-2898-3840 Sales@Ficer.com

SKU: 05H0S07

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		λ_{L0}	1264.5	1271	1277.5	nm	
		λ_{L1}	1284.5	1291	1297.5	nm	
		λ_{L2}	1304.5	1311	1317.5	nm	
		λ_{L3}	1324.5	1331	1337.5	nm	
Spectral Width (-20dB)		$\Delta\lambda$			1	nm	
Average Launch Power, per Lane		P_{AVG}	-4.2		+4.7	dBm	1
Outer Optical Modulation Amplitude (OMA_{Outer}), per Lane		P_{OMA}	-1.2		+4.5	dBm	2
Difference in launch Power between any Two Lanes(OMA_{Outer})					4	dB	
Launch Power in OMA_{Outer} minus TDECQ, per Lane	ER≧4.5dB	OMA-TDECQ	-2.6			dBm	
	ER<4.5dB		-2.5				
Transmitter and Dispersion Eye Clouser for PAM4, per Lane		TDECQ			3.3	dB	3
Optical Extinction Ratio		ER	3.5			dB	
Average Launch Power OFF, per Lane		P_{OFF}			-30	dBm	
Optical Return Loss Tolerance		ORLT			16.5	dB	
Transmitter Reflectance		R_{TX}			-26	dB	
Input Differential Impedance		Z_{IN}	90	100	110	Ω	
Differential Data Input Voltage		V_{IN-PP}	900		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.

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	λ_{L0}	1264.5	1271	1277.5	nm	
	λ_{L1}	1284.5	1291	1297.5	nm	
	λ_{L2}	1304.5	1311	1317.5	nm	
	λ_{L3}	1324.5	1331	1337.5	nm	
Damage Threshold, per Lane	D_{TH}	+5.7			dBm	1
Average Receive Power, per Lane	P_{RX-AVG}	-8.2		+4.7	dBm	2
Receive Power (OMA_{Outer}), per Lane	P_{RX-OMA}			+4.5	dBm	
Difference in receive Power between any Two Lanes(OMA_{Outer})				4.1	dB	
Receive Sensitivity (OMA_{Outer}), per Lane	SEN_{OMA}			-6	dBm	3
Stressed Receiver Sensitivity (OMA_{Outer}), per Lane	SRS_{OMA}			-3.6	dBm	4
Receiver Reflectance	R_{RX}			-26	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}			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

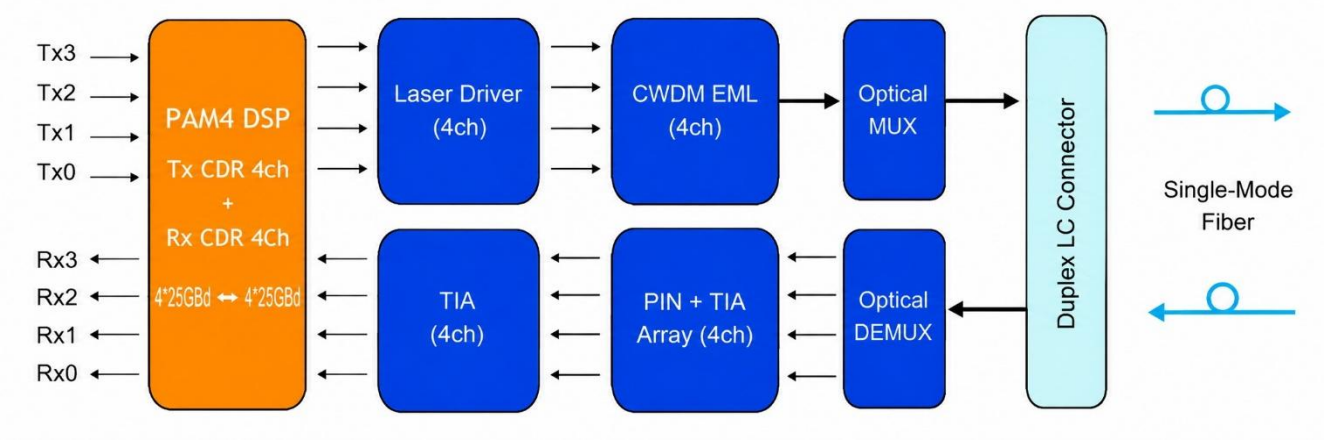
Note1: The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power.

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.

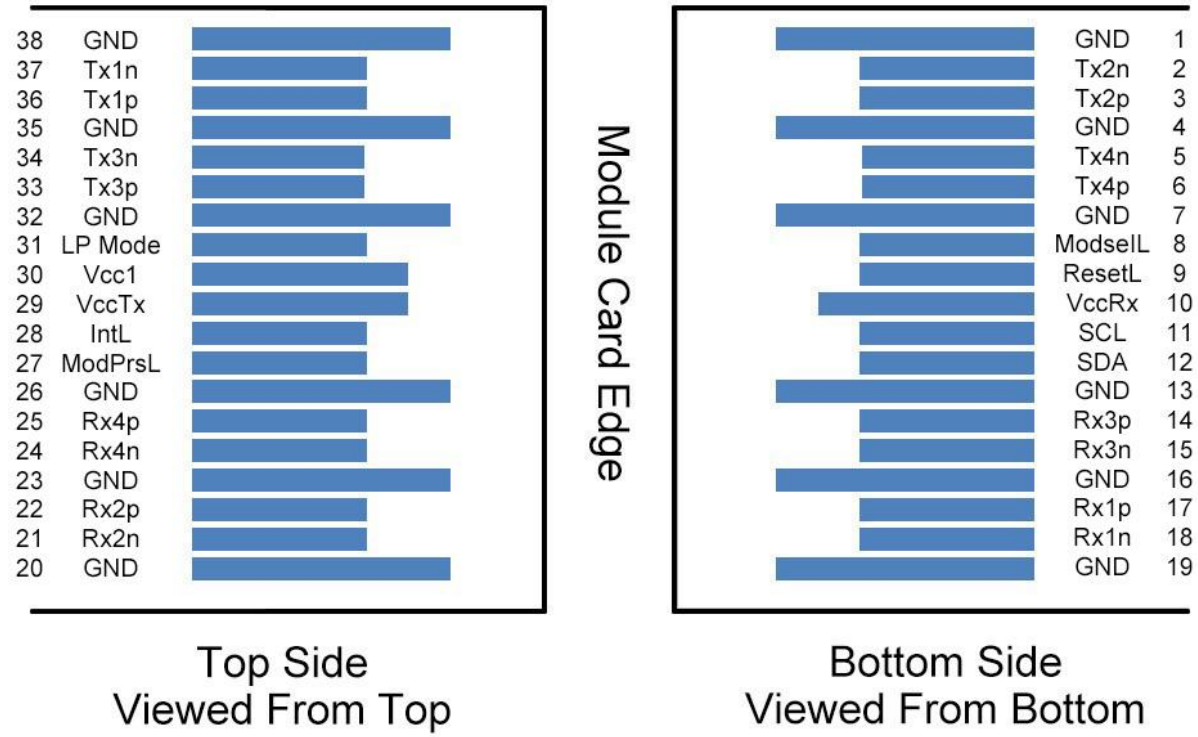
Note3: Receiver sensitivity is informative and is defined for a transmitter with a value of SECQ up to 4.5dB.

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.

Transceiver Block Diagram



Pin Assignment



Top Side
Viewed From Top

Bottom Side
Viewed From Bottom

SKU: 05H0S07

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

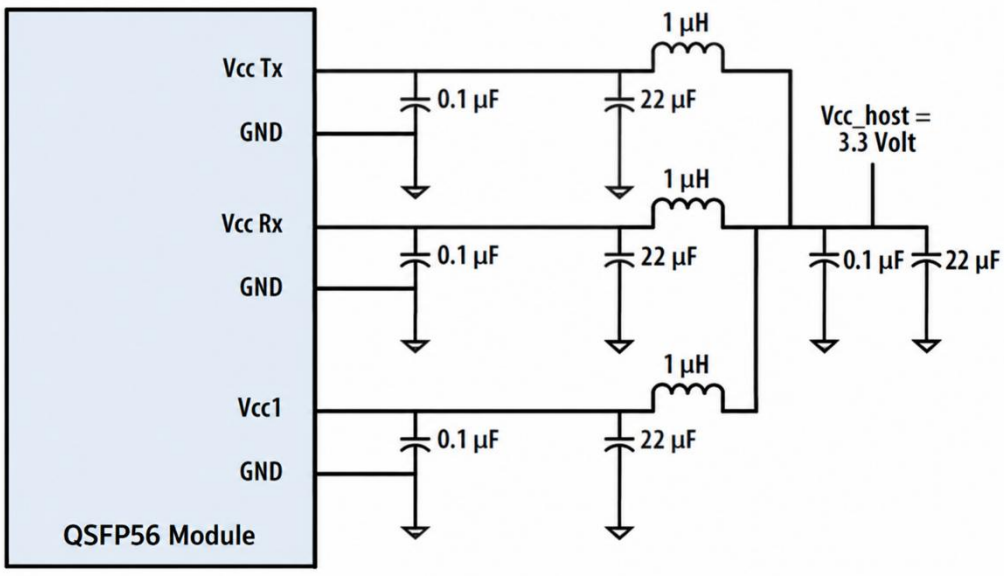
TEL+886-2-2898-3830 FAX+886-2-2898-3840 Sales@Ficer.com

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



SKU: 05H0S07

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

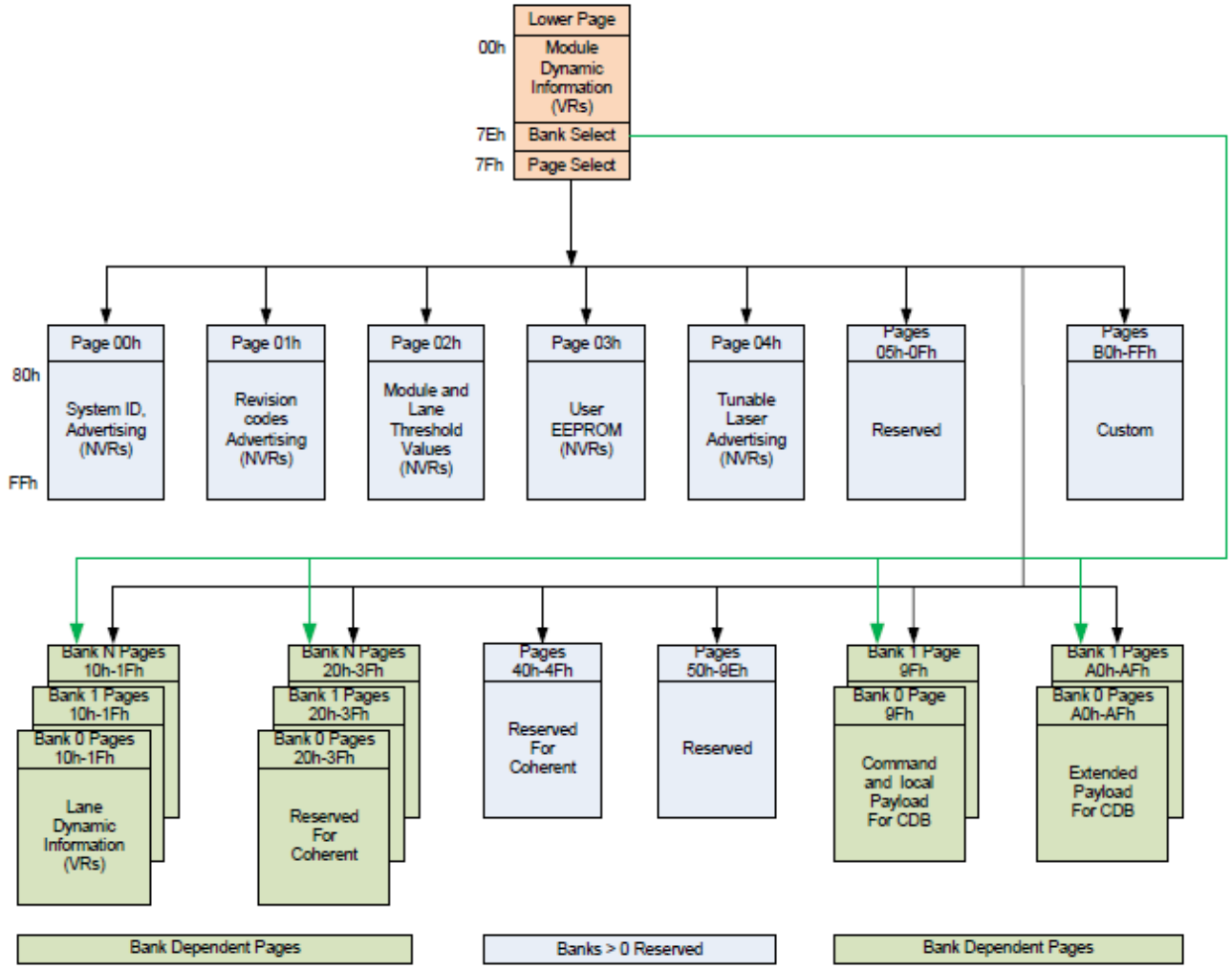
It also provides a sophisticated system of alarm and warning flags, which may be used to alert end-users when particular operating parameters are outside of a factory-set normal range.

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.

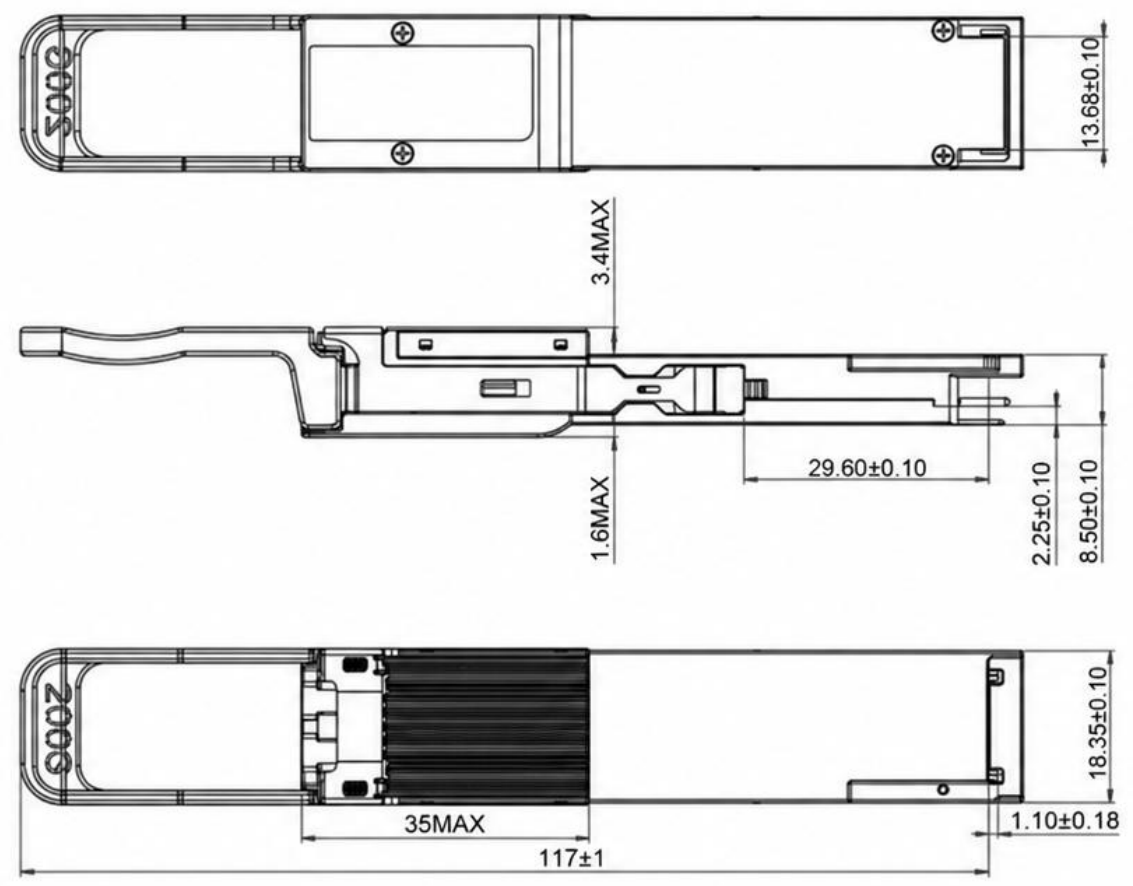
SKU: 05H0S07

Digital Diagnostic Memory Map (CMIS)



SKU: 05H0S07

Mechanical Dimensions



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

Ordering Information

Part No.	Tx	Rx	Link	DDM	Temp.
FQ56-S7-C13-02D-DS2	1271nm 1291nm 1311nm 1331nm	1271nm 1291nm 1311nm 1331nm	SMF 2km	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.