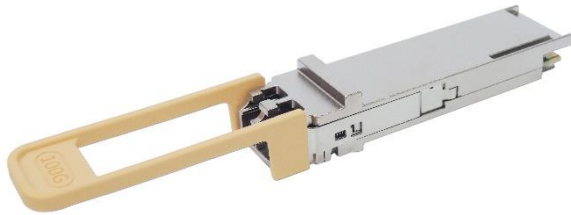




100G QSFP28 SR1.2 BiDi Transceiver

Hot Pluggable, Dual BiDi LC, 850 / 908nm VCSEL, OM3 70M / OM4 100M, DDM

Part Number: FQ28-KC-C85-X1D



Overview

FQ28-KC-C85-X1D is a pluggable optical transceiver with a Dual BiDi LC connector for short-reach 100G data communication and interconnect applications using multi-mode fiber. It allows reuse existing 25G duplex MMF cabling infrastructure for easy migration to 100 Gigabit Ethernet connectivity. The transceiver internally multiplexes XLPP 4x25G interface into 2x50G electrical channels, then converting to PAM4 2x50G optical channels for an aggregated data rate of 100G up to MMF OM3 70m / OM4 100m optical link.

Applications

- 100GBASE-SR1.2 Ethernet @103.1G
- Infiniband HDR
- Data Centers Switch Interconnect
- Server and Storage Area Network Interconnect

Features

- Compliant with IEEE 802.3bm 100GBASE-SR1.2
- Compliant with SFF-8665 QSFP28 MSA
- Compliant with IEEE 802.3bm CAUI-4 Interface
- Dual wavelength 850/908nm VCSEL Bi-Directional optical interface
- Optical Data Rate PAM4 2x26.5625GBd
- Electrical Data Rate NRZ 4x25.78125Gbps
- Built in quad Tx CDR and Rx CDR
- Support KP4 FEC at 100Gbps
- Hot Pluggable QSFP28 footprint
- Dual BiDi LC connector
- 2-wire interface for management and diagnostic monitor compliant with SFF-8636
- Single 3.3V power supply
- Link distance 150m over OM5 fiber, 100m over OM4 fiber and 70m over MM OM3 fiber
- Operating Temperature 0~+70°C
- Maximum power consumption 4W
- RoHS compliant



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
Storage Relative Humidity	RH	0	85	%
Supply Voltage	V _{CC3}	-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 Data Rate, per Lane	D _{REL}		25.78125		Gb/s
Optical Data Rate, per Lane	D _{ROP}		26.5625		GBd
Data Rate Accuracy	ΔDR	-100		+100	ppm
Bit Error Rate (Pre-FEC)	BER			2.4x10 ⁻⁴	
Bit Error Rate (Post-FEC)	BER			1x10 ⁻¹²	
Supply Current	I _{CC}			1200	mA
Power Consumption (+3.3V)	P			4	W
Transceiver Power-on Initialization Time				2000	ms
Control Input Voltage High	V _{IH}	2.0		V _{CC}	V
Control Input Voltage Low	V _{IL}	GND		0.8	V
Control Output Voltage High	V _{OH}	2.0		V _{CC}	V
Control Output Voltage Low	V _{OL}	GND		0.8	V



Transmitter Electro-optical Characteristics

$V_{CC} = 3.13V$ to $3.47V$, $T_{OP} = 0\text{ }^{\circ}C$ to $70\text{ }^{\circ}C$

Parameters	Symbol	Min.	Typ.	Max.	Unit	Note
Optical Data Rate, per Optical Lane	DR _{OP}		26.5625		GBd	
Optical Wavelength, λ_1	λ_1	844	850	863	nm	1
Optical Wavelength, λ_2	λ_2	900	908	918	nm	1
Spectral Width (RMS)	$\Delta\lambda$			λ_1 : 0.6 λ_2 : 0.65	nm	1
Average Launch Power, per Lane	P _{AVG}	-6.2		+4	dBm	
Optical Modulation Amplitude (OMA), per Lane	P _{OMA}	-4.2		+3	dBm	
Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP), per Lane	OMA-TDP	-5.6			dBm	
TDECQ, per Lane				4.5	dB	
Optical Extinction Ratio	ER	3			dB	
Average Launch Power OFF, per Channel	P _{OFF}			-30	dBm	
Optical Return Loss Tolerance	ORLT			12	dB	
Electrical Data Rate, per CAUI-4 Lane	DR _{EL}		25.78125		Gb/s	
Input Differential Impedance	Z _{IN}	80	100	120	Ω	
Differential Data Input Voltage (TP1a)	V _{IN-PP}	120		900	mVpp	
Differential Termination Mismatch (TP1)				10	%	
DC Common Mode Input Voltage (TP1)	CMV _{IN}	-350		2850	mV	2

Note1: Transmitter wavelength, RMS spectral width and launch power need to meet the OMA minus TDP specs to guarantee link performance.

Note2: DC common mode voltage generated by the host. Specification includes effects of ground offset voltage.



Receiver Electro-optical Characteristics

$V_{CC} = 3.13V$ to $3.47V$, $T_{OP} = 0\text{ }^{\circ}C$ to $70\text{ }^{\circ}C$

Parameters	Symbol	Min.	Typ.	Max.	Unit	Note
Optical Data Rate, per Optical Lane	DR _{OP}		26.5625		GBd	
Damage Threshold, per Lane	D _{TH}	+5				1
Average Receive Power, per Lane	PRX-AVG	-8.2		+4	dBm	1
Receiver Sensitivity (OMA), per Lane	SEN _{OMA}			-6.6	dBm	2
Optical Wavelength, λ_1	λ_1	900	908	920	nm	
Optical Wavelength, λ_2	λ_2	832	850	868	nm	
Receiver Reflectance	R _{RX}			-12	dB	
LOS De-Assert	LOS _D			-11.2	dBm	
LOS Assert	LOS _A	-30		-14.2	dBm	
LOS Hysteresis	LOS _{HY}	0.5			dB	
Electrical Data Rate, per CAUI-4 Lane	DR _{EL}		25.78125		Gb/s	
Output Differential Impedance	Z _{OUT}	80	100	120	Ω	
Differential Data Output Voltage	V _{OUT-PP}	300		900	mVpp	
AC Common Mode Output Voltage, RMS (TP4)				17.5	mV	
Differential Termination Mismatch (TP4)				10	%	
Transition Time, 20% to 80% (TP4)		9.5			ps	
DC Common Mode Output Voltage (TP4)	CMV _{OUT}	-350		2850	mV	3

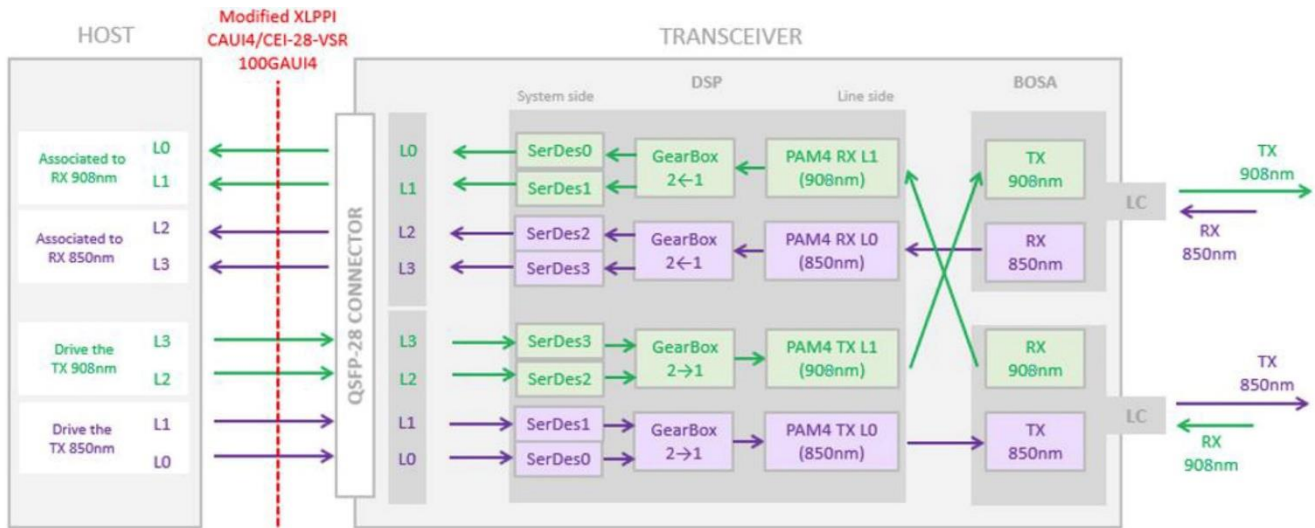
Note1: The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power.

Note2: Measured with conformance test signal at receiver input for BER= 5×10^{-5} .

Note3: DC common mode voltage generated by the host. Specification includes effects of ground offset voltage.



Transceiver Block Diagram



Pin Assignment

38	GND	
37	Tx1n	
36	Tx1p	
35	GND	
34	Tx3n	
33	Tx3p	
32	GND	
31	LP Mode	
30	Vcc1	
29	VccTx	
28	IntL	
27	ModPrsL	
26	GND	
25	Rx4p	
24	Rx4n	
23	GND	
22	Rx2p	
21	Rx2n	
20	GND	

Top Side
Viewed From Top

Module Card Edge

	GND	1
	Tx2n	2
	Tx2p	3
	GND	4
	Tx4n	5
	Tx4p	6
	GND	7
	ModselL	8
	ResetL	9
	VccRx	10
	SCL	11
	SDA	12
	GND	13
	Rx3p	14
	Rx3n	15
	GND	16
	Rx1p	17
	Rx1n	18
	GND	19

Bottom Side
Viewed From Bottom



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	LVC MOS-I/O	SCL	2-Wire Serial Interface Clock
12	LVC MOS-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

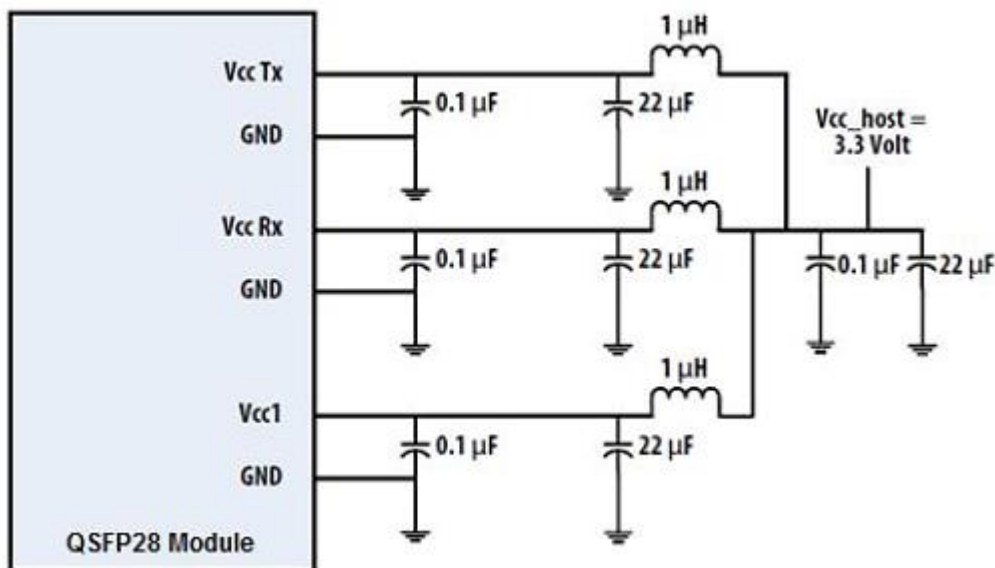


33	CML-I	Tx3p	Transmitter Non-Inverted Data Input
34	CML-I	Tx3n	Transmitter Inverted Data Input
35		GND	Module Ground
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input
37	CML-I	Tx1n	Transmitter Inverted Data Input
38		GND	Module Ground

Note1: GND is the symbol for signal and supply (power) common for QSFP28 modules. All are common within the QSFP28 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 QSFP28 transceiver module in any combination. The connector pins are each rated for a maximum current of 1000mA.

Recommended Power Supply Filter





Digital Diagnostic Functions

As defined by the QSFP28 MSA, Ficer's QSFP28 transceivers provide digital diagnostic functions via a 2-wire serial interface, which allows real-time access to the following operating parameters:

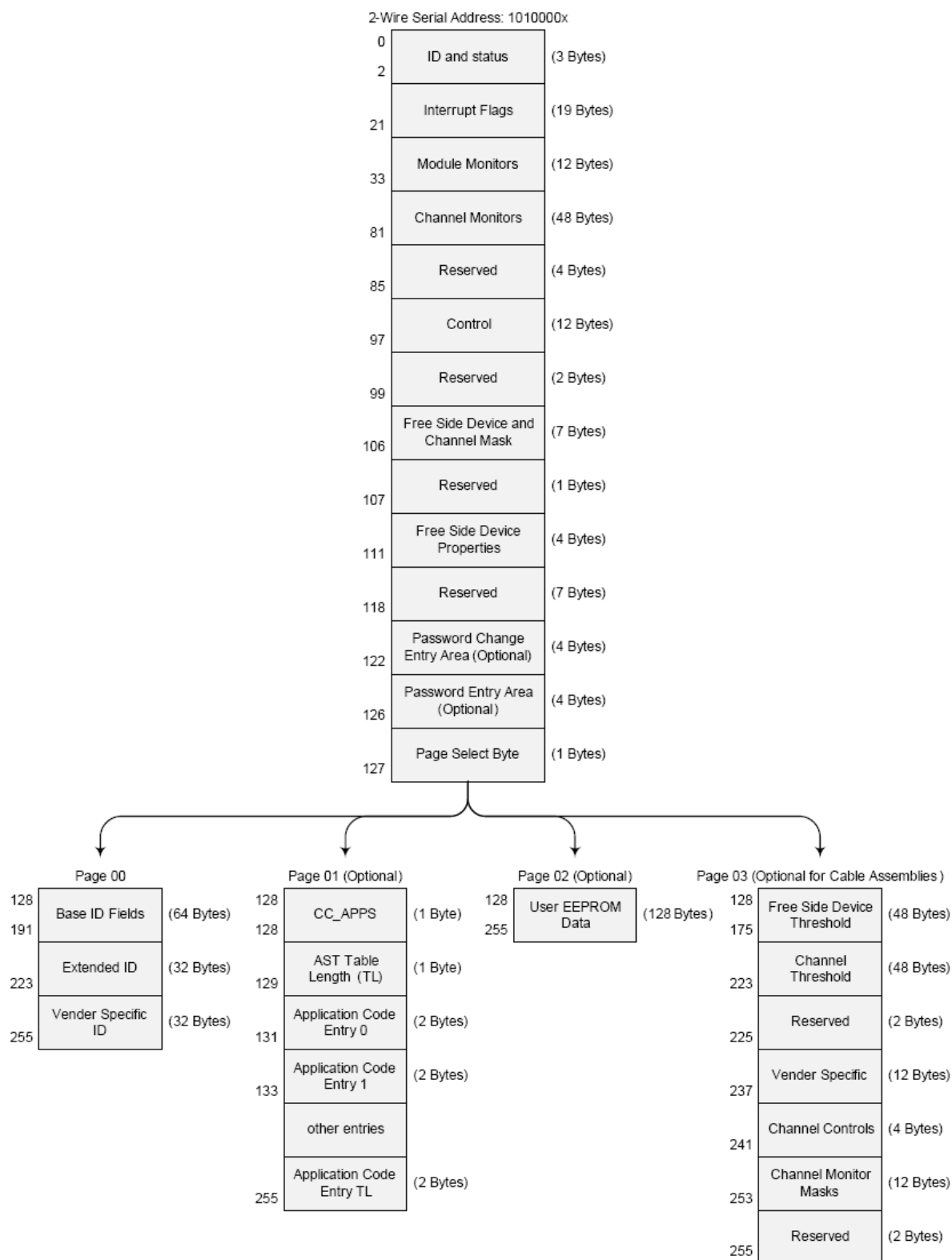
- Transceiver temperature
- Laser bias current (4-Channel)
- Transmitted optical power (4-Channel)
- Received optical power (4-Channel)
- Transceiver supply voltage

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 QSFP28 transceiver into those segments of its memory map that are not write-protected. The negative edge clocks data from the QSFP28 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.

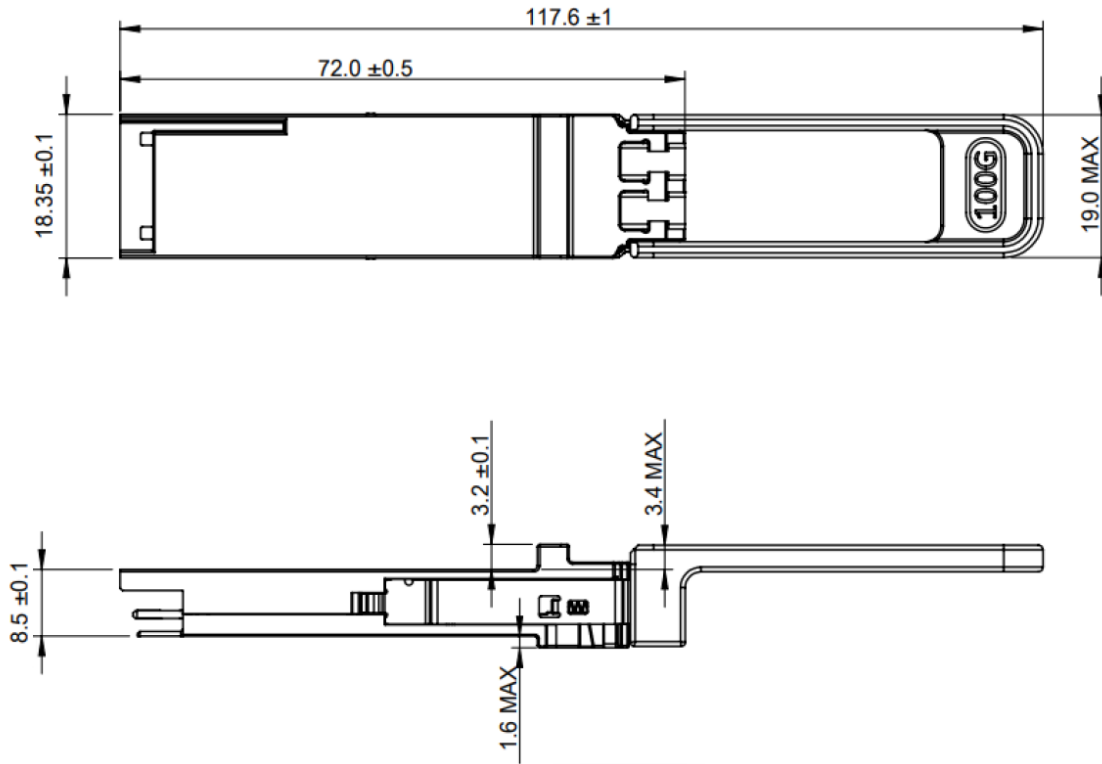
For more detailed information including memory map definitions, please see the QSFP28 MSA Specification.

Digital Diagnostic Memory Map





Mechanical Dimensions



(All Dimensions are $\pm 0.20\text{mm}$ Unless Otherwise Specified, Unit: mm)

Ordering Information

Part No.	Tx	Rx	Link	DDM	Temp.
FQ28-KC-C85-X1D	850nm 908nm	908nm 850nm	MM OM3 70m MM OM4 100m MM OM5 150m	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.