FICER Technology Co., Ltd.
明虹科技股份有限公司

2F, No.138, Daye Rd., Beitou Dist.,
Taipei City 11268, Taiwan
www.Ficer.com

Rev. 00U3.30_20230927

40G / 100G Dual-Rate QSFP28 SRBD Transceiver
Hot Pluggable, Dual Bidi LC, 850 / 908nm VCSEL, MMF 100M, DDM

Part Number: FQ28-KC-C85-X1DR

Overview

FQFP-KC-C85-X1DR is a pluggable optical transceiver with a Dual Bidi LC connector for short-reach 40G/100G Dual-Rate communication and interconnect applications using multi-mode fiber. It allows reuse existing 10G/25G duplex MMF cabling infrastructure for easy migration to 40G/100G Gigabit Ethernet connectivity. The transceiver internally multiplexes XLPPI 4x10G/25G interface into 2x20G/50G electrical channels, then converting to PAM4 2x20G/50G optical channels for an aggregated data rate of 40G/100G up to MMF OM4 100m optical link.

Applications

- 100GBASE-SR2 BiDi Ethernet @103.1G
- 40GBASE-SR2 BiDi Ethernet @41.3G
- Data Centers Switch Interconnect
- Server and Storage Area Network Interconnect

Features

- Compliant with 100GBASE-SR2 BiDi and 40GBASE-SR2 BiDi
- 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 2x10.3125GBd / 26.5625GBd
- Electrical Data Rate NRZ 4x10.3125Gbps / 25.78125Gbps
- Data Rate changed by Host software command (CDR bypass)
- Built in quad Tx CDR and Rx CDR
- 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 100m over OM4 fiber and 70m over MM OM3 fiber
- Maximum power consumption 3.5W
- 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
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	DR	10.3125	25.78125		Gb/s
Data Rate Accuracy	ΔDR	-100		+100	ppm
Bit Error Rate (NO FEC)	BER			$5x10^{-5}$	
Supply Current	I_{CC}			1000	mA
Power Consumption	P			3.5	W
Transceiver Power-on Initialization Time				2000	ms
Control Input Voltage High	V_{IH}	2.0		Vcc	V
Control Input Voltage Low	V_{IL}	GND		0.7	V
Control Output Voltage High	V_{OH}	2.0		Vcc	V
Control Output Voltage Low	V_{OL}	GND		0.7	V

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
Electrical Data Rate, per CAUI-4 Lane	DR_{EL}	10.3125	25.78125		Gb/s	
Optical Data Rate, per Optical Channel	DR_{OP}	10.3125	26.5625		GBd	
Average Launch Power, per Channel	P_{AVG}	-3		+4	dBm	
Optical Wavelength, CH1	λ_{CH1}	832	850	868	nm	1
Optical Wavelength, CH2	λ_{CH2}	882	908	928	nm	1
Spectral Width (RMS)	$\Delta\lambda$		0.5	0.65	nm	1
Optical Extinction Ratio	ER	3			dB	
Average Launch Power OFF, per Channel	P_{OFF}			-30	dBm	
Optical Return Loss Tolerance	ORLT			12	dB	
Input Differential Impedance	Z_{IN}	80	100	120	Ω	
Differential Data Input Voltage	V_{IN-PP}	120		1200	mVpp	

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

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Receiver Electro-optical Characteristics

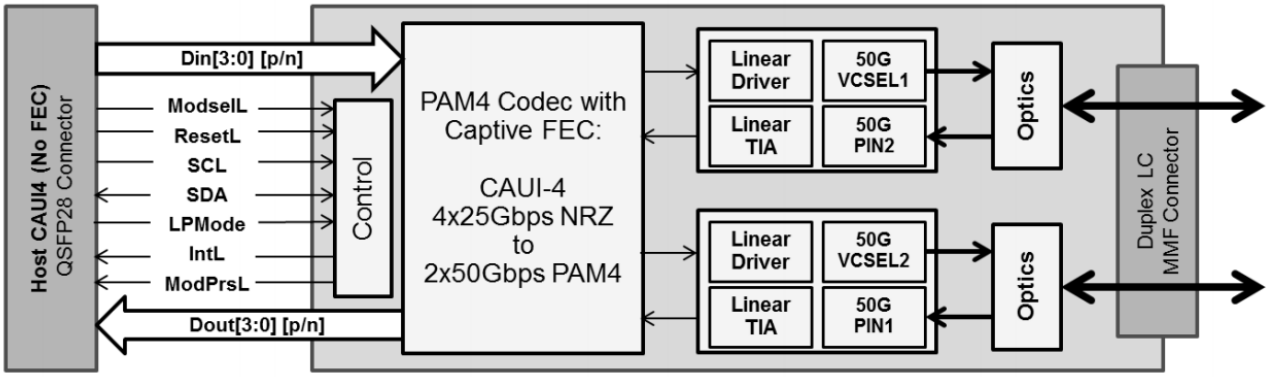
V_{CC} = 3.13V to 3.47V, T_{OP} = 0 °C to 70 °C

Parameters	Symbol	Min.	Typ.	Max.	Unit	Note
Optical Data Rate, per Optical Channel	DR_{OP}	10.3125	26.5625		GBd	
Electrical Data Rate, per CAUI-4 Lane	DR_{EL}	10.3125	25.78125		Gb/s	
Maximum Receive Power, per Channel	P_{RX-MAX}	+0.5			dBm	1
Receiver Sensitivity (OMA), per Channel	SEN_{OMA}			-8	dBm	2
Optical Wavelength, CH1	λ_{CH1}	882	908	928	nm	
Optical Wavelength, CH2	λ_{CH2}	832	850	868	nm	
Receiver Reflectance	R_{RX}			-15	dB	
LOS De-Assert	LOS_D			-10	dBm	
LOS Assert	LOS_A	-30			dBm	
LOS Hysteresis	LOS_{HY}	0.5			dB	
Output Differential Impedance	Z_{OUT}	80	100	120	Ω	
Differential Data Output Voltage	V_{OUT-PP}	300	600	800	mVpp	

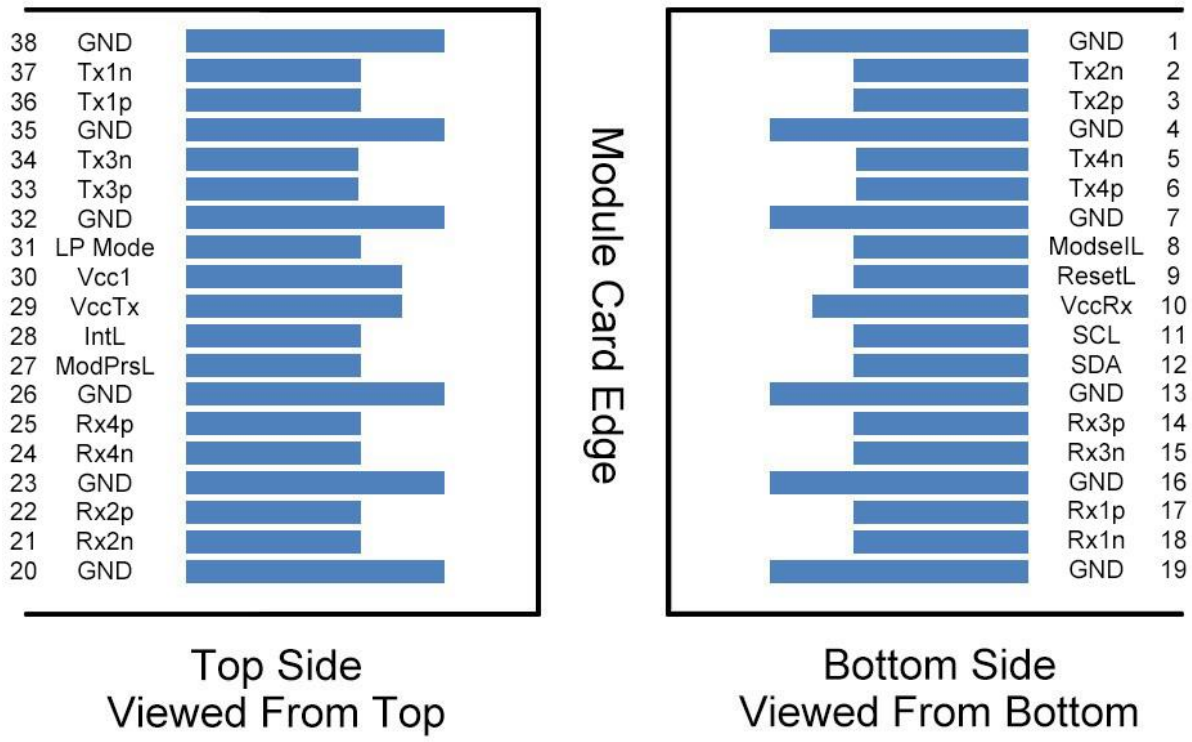
Note1: The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power.

Note2: Measured with conformance test signal at receiver input for BER= 5x10-5.

Transceiver Block Diagram



Pin Assignment



Top Side
Viewed From Top

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	LVCMOS-I/O	SCL	2-Wire Serial Interface Clock
12	LVCMOS-I/O	SDA	2-Wire Serial Interface Data

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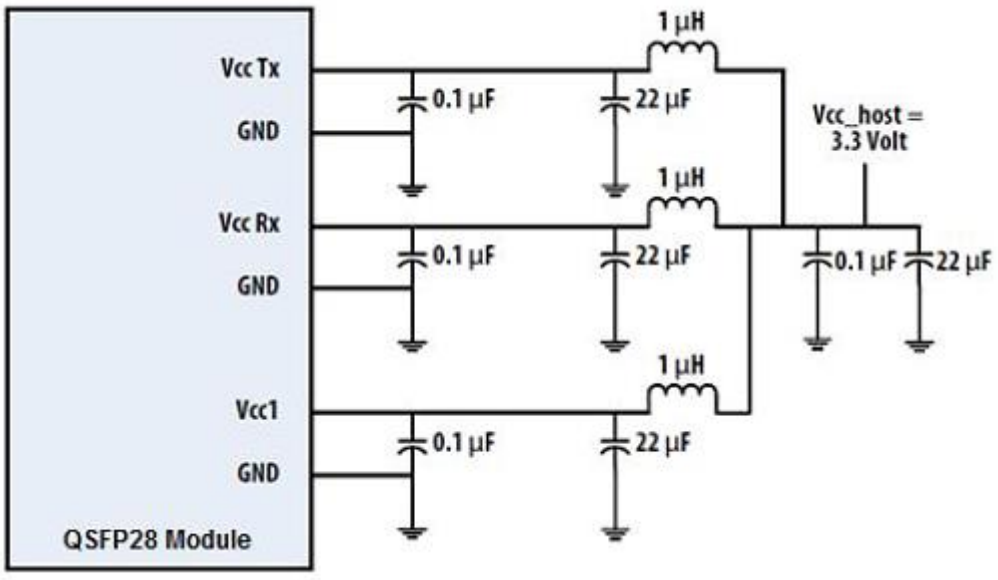
13		GND	Module Ground
14	CML-O	Rx3p	Receiver Non-Inverted Data Output
15	CML-O	Rx3n	Receiver Inverted Data Output
16		GND	Module Ground
17	CML-O	Rx1p	Receiver Non-Inverted Data Output
18	CML-O	Rx1n	Receiver Inverted Data Output
19		GND	Module Ground
20		GND	Module Ground
21	CML-O	Rx2n	Receiver Inverted 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:

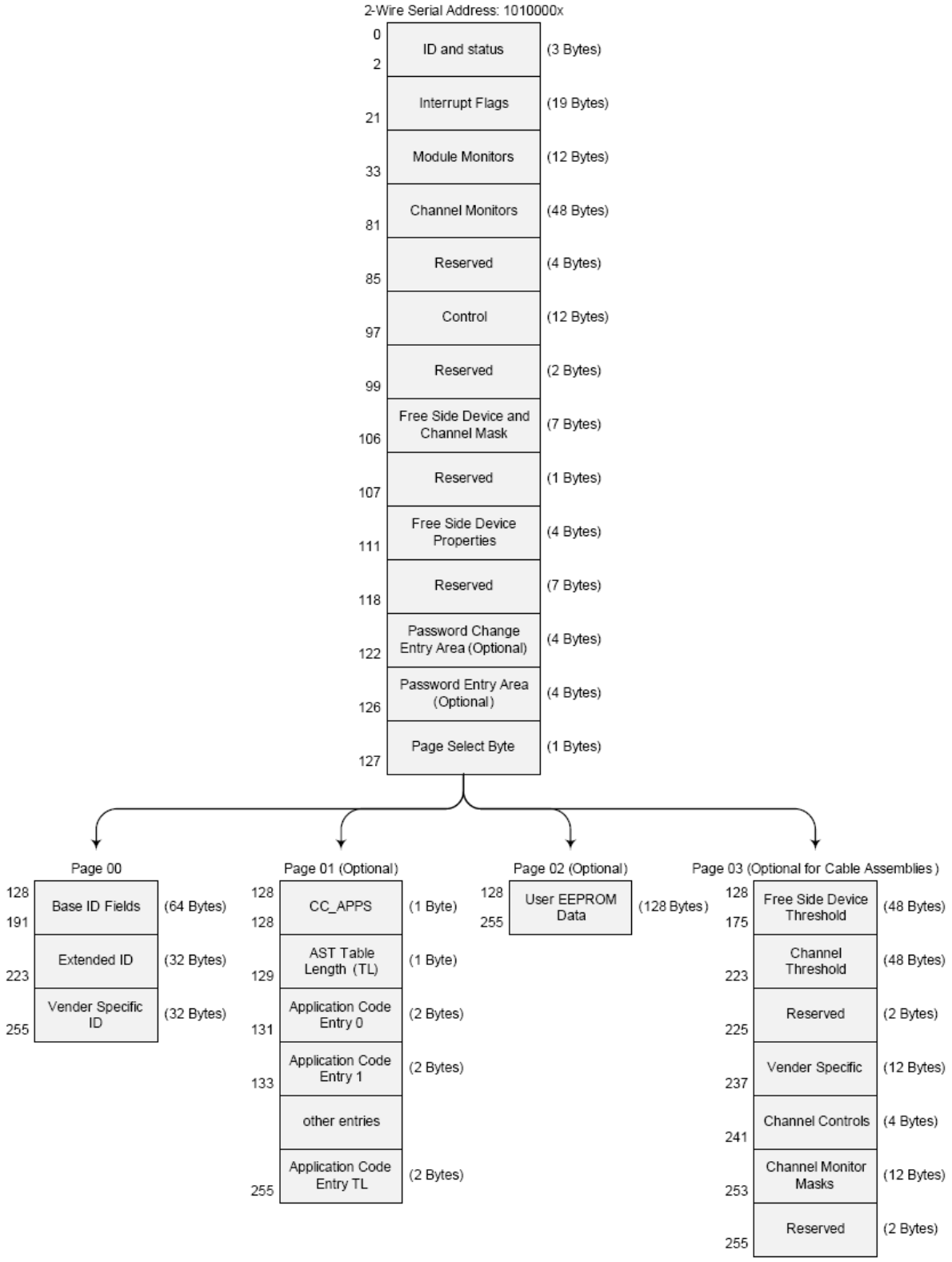
- Transceiver temperature
- Laser bias current (4-Channel)
- Transmitted optical power (4-Channel)
- Received optical power (4-Channel)
- Transceiver supply voltage

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.

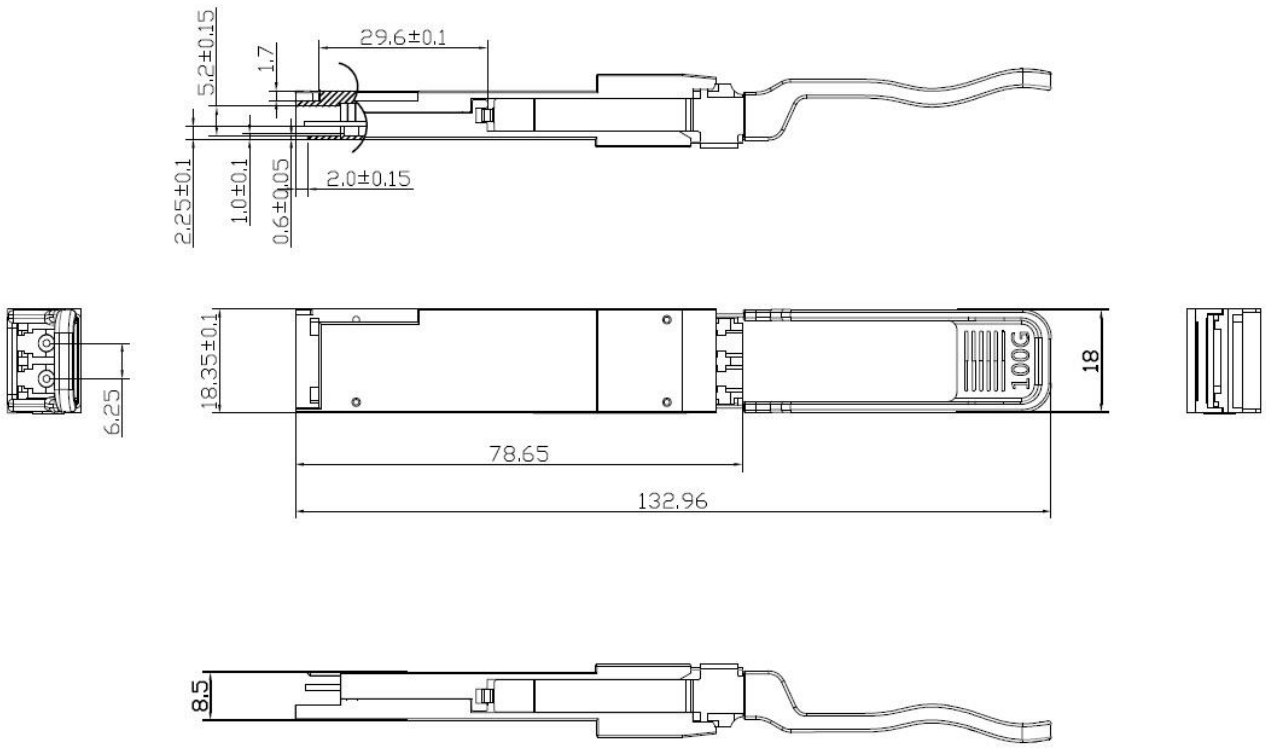
The operating and diagnostics information is monitored and reported by a Digital Diagnostics Controller (DDC) inside the transceiver, which is accessed through the 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL pin) is generated by the host. The positive 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


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

Mechanical Dimensions



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

Ordering Information

Part No.	Tx	Rx	Link	DDM	Temp.
FQ28-KC-C85-X1DR	850nm 908nm	908nm 850nm	MM OM3 70m MM OM4 100m	Yes	0~70°C

Note1: 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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