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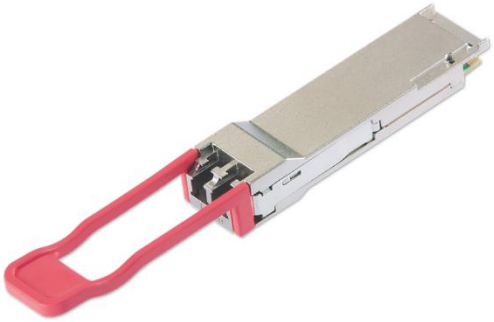
SKU: 04H0Q01

50G QSFP28 ER Transceiver
Hot Pluggable, Duplex LC, 1311nm EML, SMF 40KM, DDM, C-Temp

Part Number: FQ28-Q7-C13-40D



Overview

FQ28-Q7-C13-40D is a QSFP28 Single Lambda transceiver for 50GbE applications especially in Mobile, Telecom & Enterprise networks applications. It works based on the 50G Single Lambda MSA 50GBASE-ER Standard with the typical center wavelength 1311nm. The transceiver incorporates one channel optical signal of 50Gbps(PAM4) from two channels electrical signal of 25Gbps(NRZ) and vice versa up to SMF 40km optical links..

Applications

- 50GBASE-ER Ethernet
- Mobile Network
- Telecom & Enterprise Network

Features

- Compliant with IEEE802.3cn 50GBASE-ER
- Compliant with SFF-8665, 8679 QSFP28 MSA
- 26.5625Gbps Electrical Channel compliant with 50GAUI-2 Interface
- 1CH 50G PAM4 Transmitter / Receiver
- Support 53.125Gbps Aggregate Data Rate.
- Built in Tx CDR and Rx CDR
- Hot Pluggable QSFP28 footprint
- CWDM 1311nm EML transmitter
- APD receiver
- Duplex LC connector
- 2-wire interface for management and diagnostic monitor compliant with SFF-8636
- Single 3.3V power supply
- Link distance 40km over SM fiber
- 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
Storage Relative Humidity	RH	0	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 Data Rate, per Lane (NRZ)	DR_{ELE}		26.5625		Gb/s
Optical Data Rate (PAM4)	DR_{OPT}		26.5625		GBd
Data Rate Accuracy	ΔDR	-100		+100	ppm
Bit Error Rate (Pre-FEC)	BER_{PRE}			$2.4x10^{-4}$	
Bit Error Rate (Post-FEC)*1	BER_{POST}			$1x10^{-12}$	
Supply Current	I_{CC}			1300	mA
Power Consumption	P			4.5	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

Note1: FEC is provided by Host.

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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
Operating Data Rate	DR		26.5625		GBd	PAM4
Optical Center Wavelength	λc	1304.5	1311	1317.5	nm	
Average Launch Power	P_{AVG}	+1.5		+8	dBm	1
Optical Modulation Amplitude (OMA)	P_{OMA}	+4.5		+9	dBm	
Launch Power in OMA_{Outer} minus TDECQ	OMA-TDECQ	+2			dBm	
Transmitter and Dispersion Eye Closure	TDECQ			3.2	dB	2
Spectral Width (-20dB)	Δλ			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Optical Extinction Ratio	ER	6			dB	
Relative Intensity Noise	RIN			-132	dB/Hz	
Average Launch Power OFF	P_{OFF}			-15	dBm	
Optical Return Loss Tolerance	ORLT			15.6	dB	
Transmitter Reflectance	R_{TX}			-26	dB	
Input Differential Impedance	Z_{IN}	90	100	110	Ω	
Differential Data Input Voltage	V_{IN-PP}			900	mVpp	
Common Mode Voltage (Vcm)	TP1	-350		2850	mV	3

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

Note3: 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
Operating Data Rate	DR		26.5625		GBd	PAM4
Optical Center Wavelength	λc	1304.5	1311	1317.5	nm	
Damage Threshold	D_{TH}	-2.4			dBm	1
Average Receive Power	P_{RX-AVG}	-15		-3	dBm	
Receiver Power (OMA)	P_{RX-OMA}			-2.6	dBm	
Receiver Sensitivity (OMA)	SEN_{OMA}			-13.5	dBm	2
Stressed Receiver Sensitivity (OMA)	SRS_{OMA}			TBD	dBm	
Receiver Reflectance	R_{RX}			-26	dB	
LOS De-Assert	LOS_D			-20	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	
Common Mode Voltage (Vcm)	TP4	-350		2850	mV	3
Conditions of Stress Receiver Sensitivity Test (Note.4)						
Stress Eye Closure for PAM4 (SECQ)			3.2		dB	
SECQ – $10*\log_{10}(Ceq)$				3.2	dB	

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: Sensitivity is specified at $2.4x10^{-4}$ BER with PRBS31Q.

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

Note4: These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

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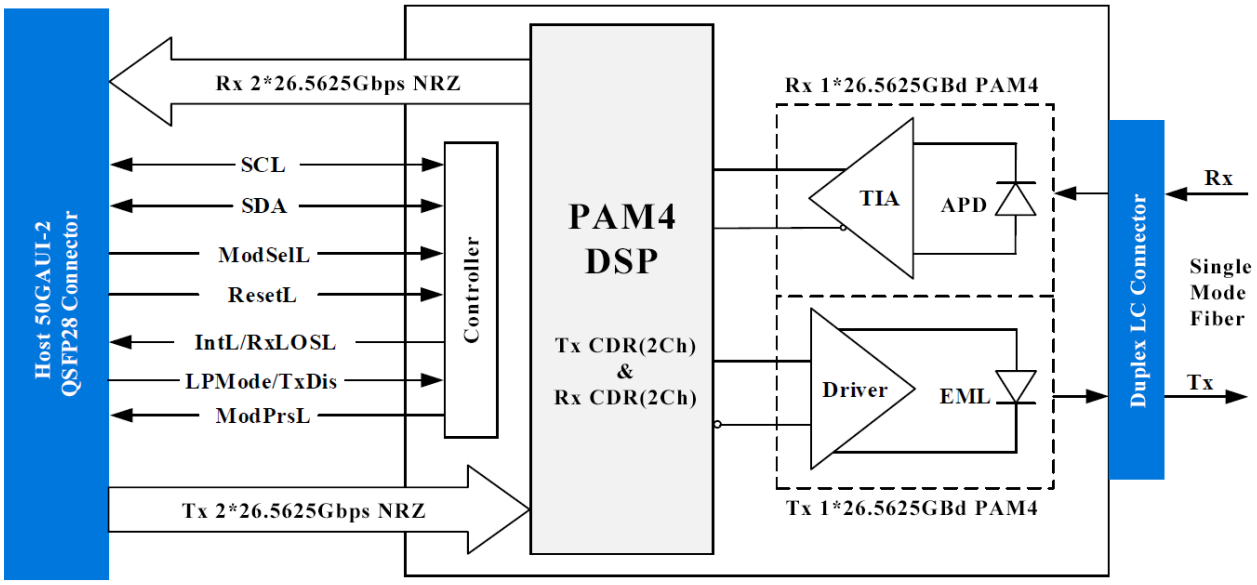
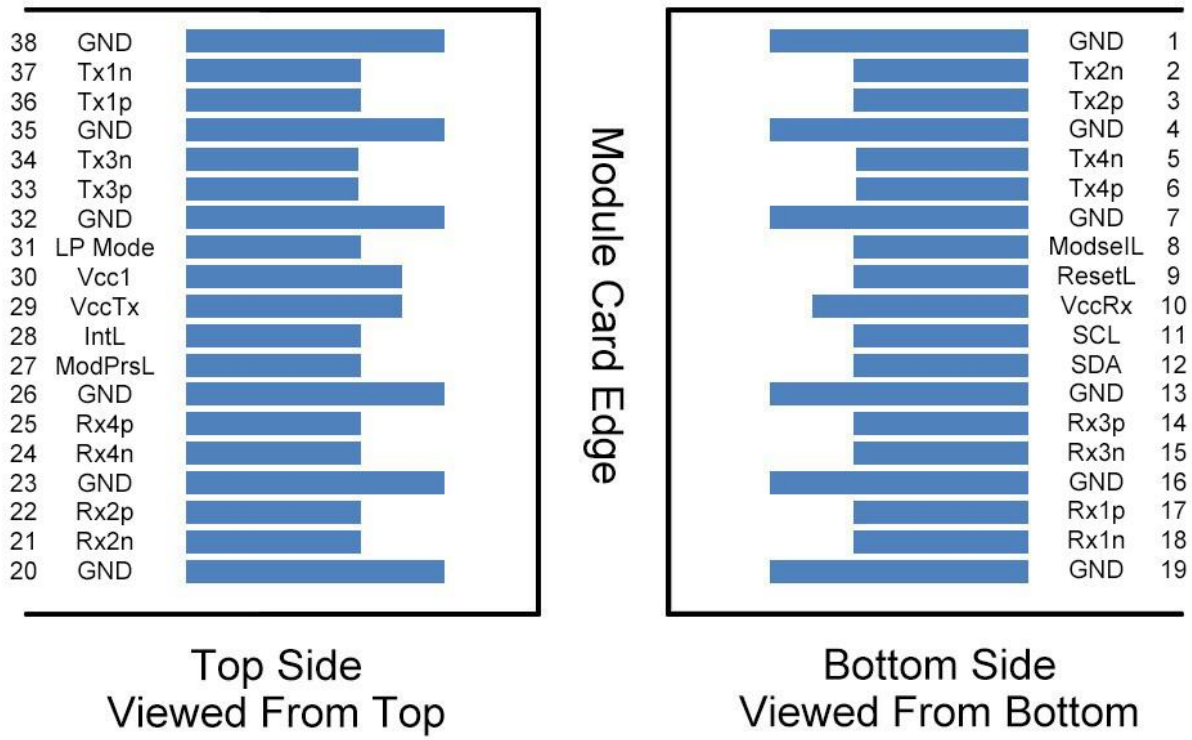
Transceiver Block Diagram



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 *3
6	CML-I	Tx4p	Transmitter Non-Inverted Data Input *3
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 *3
15	CML-O	Rx3n	Receiver Inverted Data Output *3
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 *3
25	CML-O	Rx4p	Receiver Non-Inverted Data Output *3
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

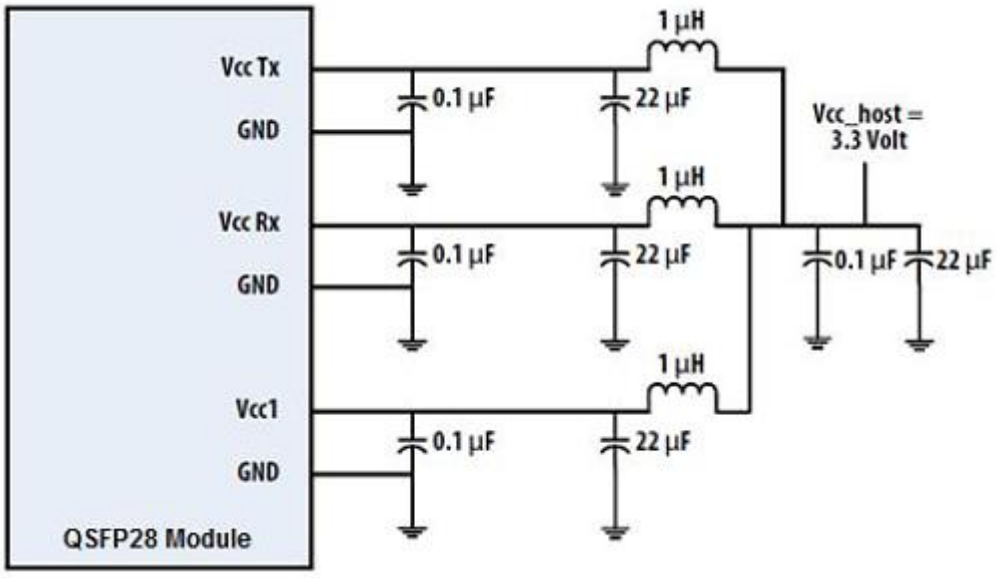
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input *3
34	CML-I	Tx3n	Transmitter Inverted Data Input *3
35		GND	Module Ground
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input
37	CML-I	Tx1n	Transmitter Inverted Data Input
38		GND	Module Ground

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.

Note3: This PIN is not used for 50G PAM4 QSFP28 module.

Recommended Power Supply Filter



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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
- Transmitted optical power
- Received optical power
- 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

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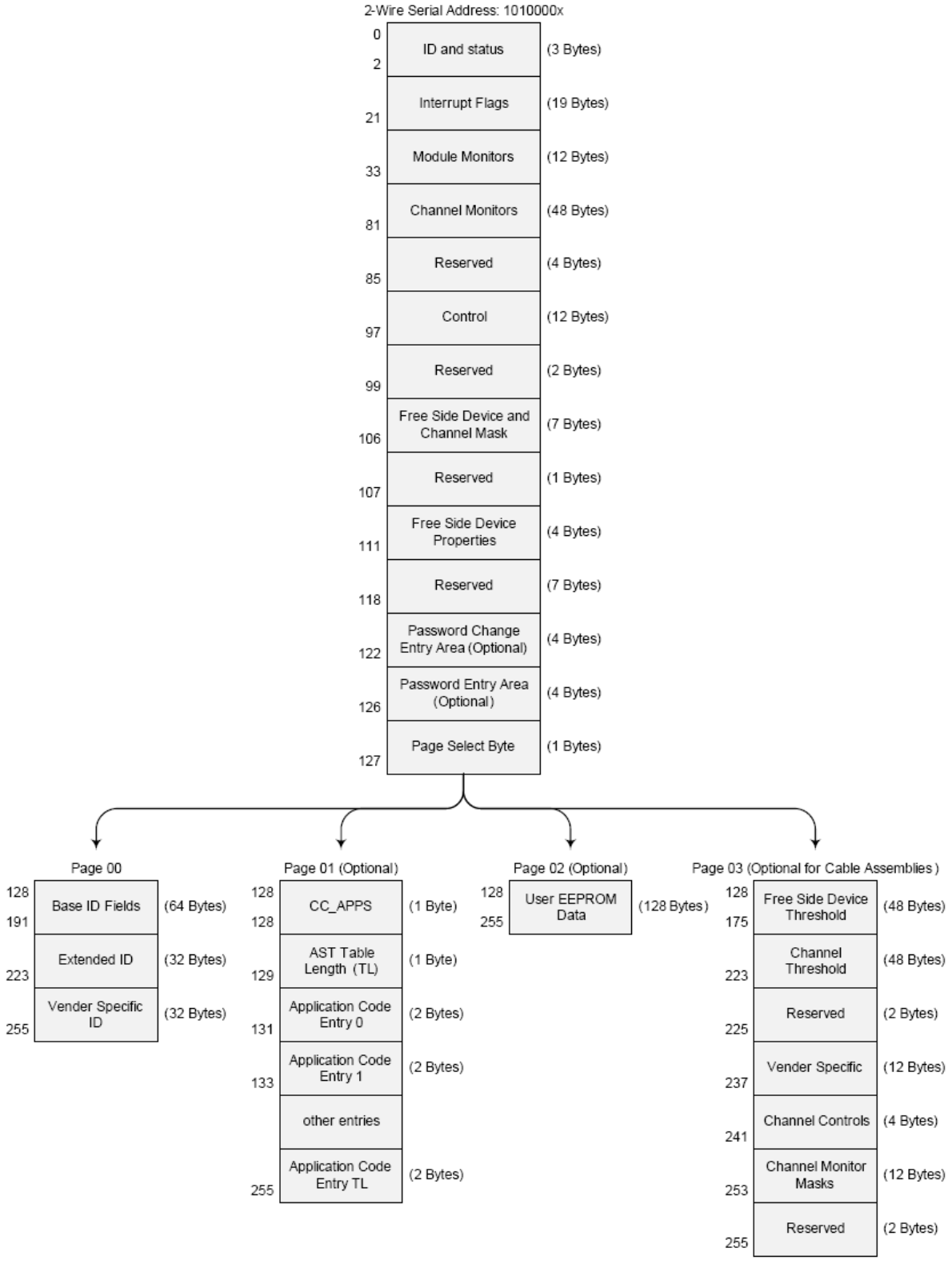
2-Wire Serial Address: 1010000x
0
2
ID and status
(3 Bytes)
21
Interrupt Flags
(19 Bytes)
33
Module Monitors
(12 Bytes)
81
Channel Monitors
(48 Bytes)
85
Reserved
(4 Bytes)
97
Control
(12 Bytes)
99
Reserved
(2 Bytes)
106
Free Side Device and Channel Mask
(7 Bytes)
107
Reserved
(1 Bytes)
111
Free Side 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
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
Application Code Entry TL
(2 Bytes)
255
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

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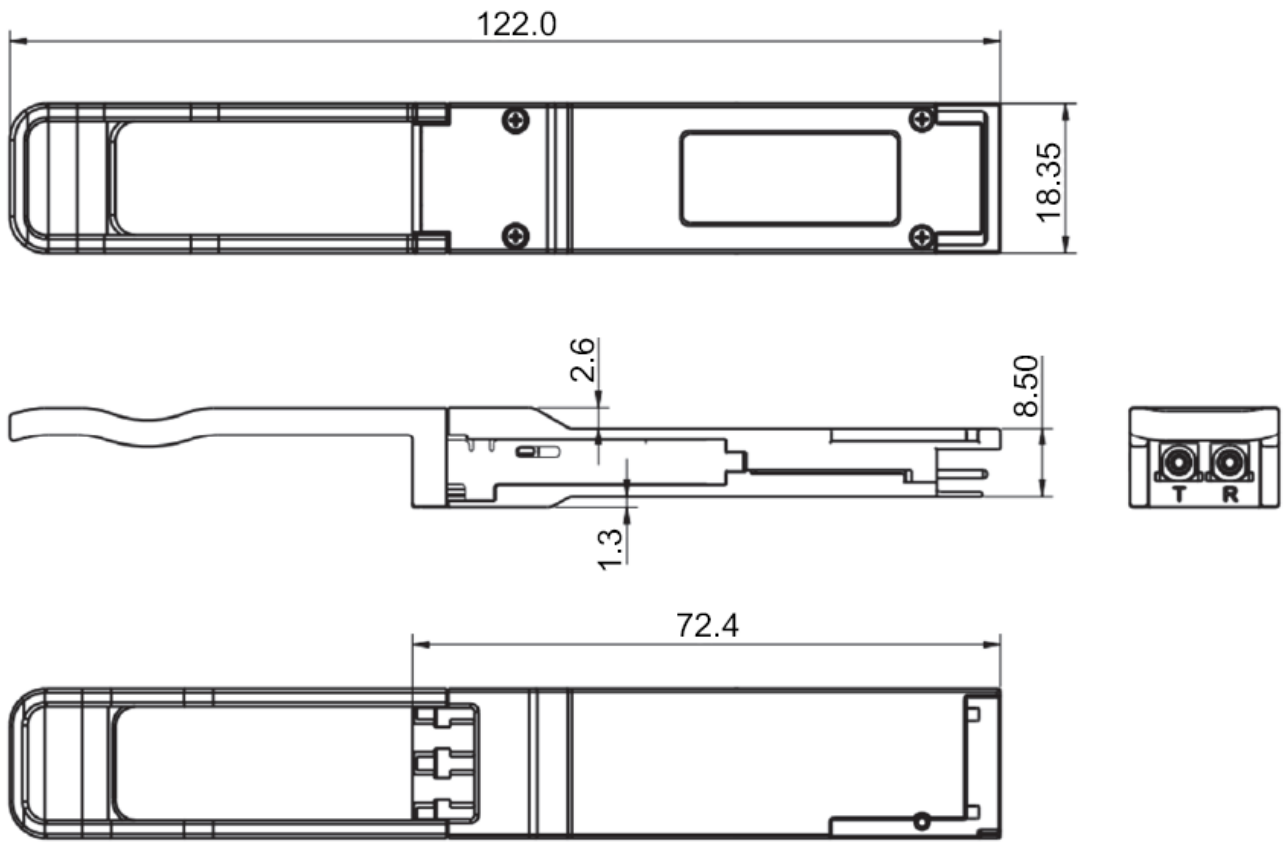
Mechanical Dimensions



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

Ordering Information

Part No.	Tx	Rx	Link	DDM	Temp.
FQ28-Q7-C13-40D	1311nm	1311nm	SMF 40km (with FEC)	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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