# DukeVilla
DATA TRANSMISSION & SIGNAL PROCESSING

400Gb/s QSFP-DD FR4 Transceiver
QSFP-DD-400G-FR4

Features

- Compliant with 400G-FR4 optical specifications
- Compliant with QSFP-DD MSA
- Compliant with CMIS4.0 Management interface specifications
- 8x53.125Gb/s electrical interface (400GAUI-8)
- Up to 2km transmission on single mode fiber (SMF) with FEC
- Single +3.3V power supply
- Case temperature range: 0 ~ +70℃
- Maximum power consumption 10W
- Duplex LC connector
- RoHS complaint
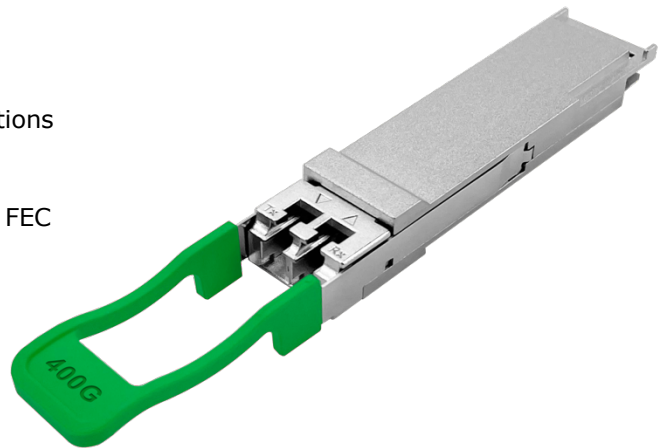
Applications

- 400G BASE-FR4 Ethernet
- Enterprise Networking
- Infiniband Interconnect
- Data center network

Description

This product is designed for 2km optical communication applications. The module converts 8 channels of 50Gb/s (PAM4) electrical input data to 4 channels of CWDM optical signals, and multiplexes them into a single channel for 400Gb/s optical transmission. Reversely, on the receiver side, the module optically demultiplexes a 400Gb/s optical input into 4 channels of CWDM optical signals and converts them to 8 channels of 50Gb/s (PAM4) electrical output data.

The module incorporates 4 independent channels on CWDM4 1271/1291/1311/1331nm center wavelength, operating at 100G per channel. The transmitter path incorporates 4 independent EML drivers and EML lasers together with an optical multiplexer. On the receiver path, an optical demultiplexer is coupled to a 4-channel photodiode array.

It is a cost-effective and lower power consumption solution for 400GBASE data center. It has been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference.

The module offers very high functionality and feature integration, accessible via a two-wire serial interface.

Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Supply Voltage	Vcc	-0.3	3.6	V
Input Voltage	Vin	-0.3	Vcc+0.3	V
Storage Temperature	Tst	-40	85	℃
Case Operating Temperature	Top	0	70	℃
Humidity(non-condensing)	Rh	5	95	%

Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit
Supply Voltage	Vcc	3.13	3.3	3.47	V
Operating Case temperature	Tca	0		70	℃
Data Rate Per Lane	fd		106.25		Gbit/s
Humidity	Rh	15		85	%
Power Dissipation	Pm			10	W

Electrical Specifications

Parameter	Symbol	Min	Typical	Max	Unit
Differential input impedance	Zin	90	100	110	ohm
Differential Output impedance	Zout	90	100	110	ohm
Differential input voltage amplitude	ΔVin	900			mVp-p
Differential output voltage amplitude	ΔVout			900	mVp-p
Bit Error Rate	BER			2.4E-4	
Near-end ESMW (Eye symmetry mask width)		0.265			UI
Near-end Eye height, differential(min)		70			mV
Far-end ESMW (Eye symmetry mask width)		0.20			UI

Far-end Eye height, differential(min)		30				mV
Far-end pre-cursor ISI ratio		-4.5		2.5		%

Note：
1.BER=2.4E-4; PRBS31Q@26.5625GBd. Pre-FEC
2.Differential input voltage amplitude is measured between TxnP and TxnN.
3.Differential output voltage amplitude is measured between RxnP and RxnN.

Optical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Transmitter						
Centre Wavelength	λ0	1264.5	1271	1277.5	nm	
	λ1	1284.5	1291	1297.5	nm	
	λ2	1304.5	1311	1317.5	nm	
	λ3	1324.5	1331	1337.5	nm	
Side-mode suppression ratio	SMSR	30			dB	
Average launch power, each lane	Pout	-3.3		3.5	dBm	
Optical Modulation Amplitude(OMA outer), each lane	OMA	-0.3		3.7	dBm	
Transmitter and dispersion eye closure for PAM4 (TDECQ),each lane	TDECQ			3.4	dB	
Extinction Ratio	ER	3.5			dB	
Average launch power of OFF transmitter, each lane				-20	dB	
Receiver						
Centre Wavelength	λ0	1264.5	1271	1277.5	nm	
	λ1	1284.5	1291	1297.5	nm	
	λ2	1304.5	1311	1317.5	nm	
	λ3	1324.5	1331	1337.5	nm	

Receiver Sensitivity in OMA outer	RXsen			-4.6	dBm	1
Average power at receiver, each lane input, each lane	Pin	-7.3		3.5	dBm	
Receiver Reflectance				-26	dB	
LOS Assert		-12			dBm	
LOS De-Assert				-10	dBm	
LOS Hysteresis		0.5			dB	

Note:
1.Measured with conformance test signal at TP3 for BER = 2.4E-4 Pre-FEC

Pin Description

Pin #	Logic	Symbol	Definition
1		GND	Ground
2	CML-I	Tx2n	Transmitter Inverted Data Input
3	CML-I	Tx2p	Transmitter Non-inverted Data Input
4		GND	Ground
5	CML-I	Tx4n	Transmitter Inverted Data Input
6	CML-I	Tx4p	Transmitter Non-inverted Data Input
7		GND	Ground
8	LVTTL-I	ModSelL	Module Select
9	LVTTL-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	Ground
14	CML-O	Rx3p	Receiver Non-inverted Data Output
15	CML-O	Rx3n	Receiver Inverted Data Output
16		GND	Ground
17	CML-O	Rx1p	Receiver Non-inverted Data Output
18	CML-O	Rx1n	Receiver Inverted Data Output
19		GND	Ground
20		GND	Ground
21	CML-O	Rx2n	Receiver Inverted Data Output
22	CML-O	Rx2p	Receiver Non-inverted Data Output
23		GND	Ground
24	CML-O	Rx4n	Receiver Inverted Data Output
25	CML-O	Rx4p	Receiver Non-inverted Data Output

26		GND	Ground
27	LVTTL-O	ModPrsL	Module Present
28	LVTTL-O	IntL	Interrupt
29		VccTx	+3.3V Power Supply Transmitter
30		Vcc1	+3.3V Power Supply
31	LVTTL-I	InitMode	Initialization mode
32		GND	Ground
33	CML-I	Tx3p	Transmitter Non-inverted Data Input
34	CML-I	Tx3n	Transmitter Inverted Data Input
35		GND	Ground
36	CML-I	Tx1p	Transmitter Non-inverted Data Input
37	CML-I	Tx1n	Transmitter Inverted Data Input
38		GND	Ground
39		GND	Ground
40	CML-I	Tx6n	Transmitter Inverted Data Input
41	CML-I	Tx6p	Transmitter Non-inverted Data Input
42		GND	Ground
43	CML-I	Tx8n	Transmitter Inverted Data Input
44	CML-I	Tx8p	Transmitter Non-inverted Data Input

45		GND	Ground
46		Reserved	
47		VS1	Module Vendor Specific 1
48		VccRx1	3.3V Power Supply
49		VS2	Module Vendor Specific 2
50		VS3	Module Vendor Specific 3
51		GND	Ground
52	CML-O	Rx7p	Receiver Non-inverted Data Output
53	CML-O	Rx7n	Receiver Inverted Data Output
54		GND	Ground
55	CML-O	Rx5p	Receiver Non-inverted Data Output
56	CML-O	Rx5n	Receiver Inverted Data Output
57		GND	Ground
58		GND	Ground
59	CML-O	Rx6n	Receiver Inverted Data Output
60	CML-O	Rx6p	Receiver Non-inverted Data Output
61		GND	Ground
62	CML-O	Rx8n	Receiver Inverted Data Output

63	CML-O	Rx8p	Receiver Non-inverted Data Output
64		GND	Ground
65		NC	Not connected
66		Reserved	
67		VccTx1	3.3V Power Supply
68		Vcc2	3.3V Power Supply
69		Reserved	
70		GND	Ground
71	CML-I	Tx7p	Transmitter Non-inverted Data Input
72	CML-I	Tx7n	Transmitter Inverted Data Input
73		GND	Ground
74	CML-I	Tx5p	Transmitter Non-inverted Data Input
75	CML-I	Tx5n	Transmitter Inverted Data Input
76		GND	Ground

Top side viewed from top

Legacy QSFP28 Pads

Additional QSFP-DD Pads

Additional QSFP-DD Pads

Legacy QSFP28 Pads

Bottom side viewed from bottom
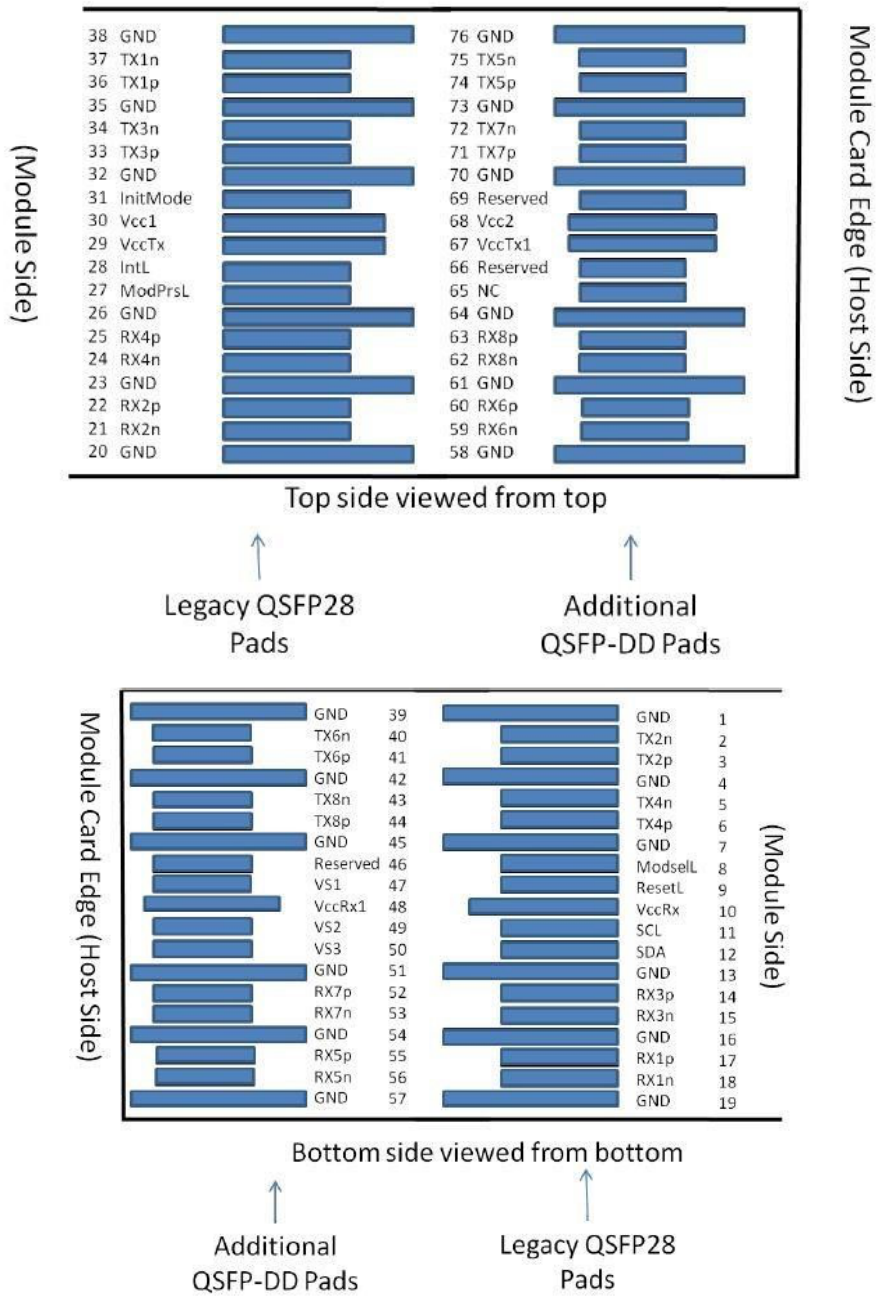
Diagnostic Monitoring Interface

Digital diagnostics monitoring function is available on all QSFP DD products. A 2-wire serial interface provides user to contact with module.

Ordering Information

Part Number	Product Description
QSFP-DD-400G-FR4	400GE QSFP-DD FR4, 2km on Single mode Fiber (SMF)

Important Notice

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sales@duke-villa.com
www.duke-villa.com