

FPQ28DRLR4-10D

100 QSFP28 LR4/OTU4 10km Optical Transceiver

FEATURES

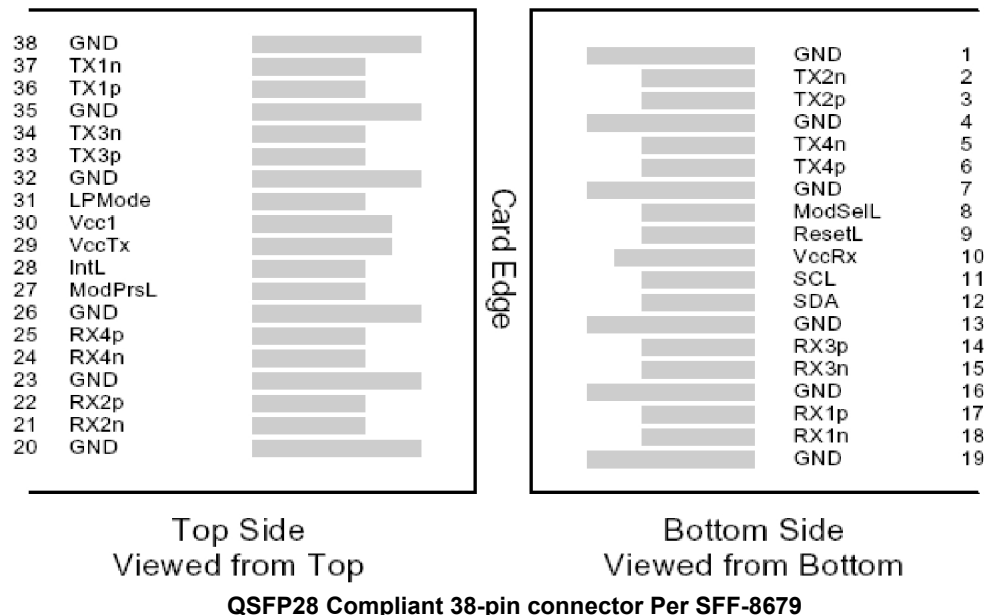
- Hot-pluggable QSFP28 form factor
- Supports 103.1Gb/s and 112Gb/s aggregate bit rate
- Power dissipation < 3.5W
- RoHS10 compliant
- Commercial case temperature range of 0°C to 70°C
- Single 3.3V power supply
- Maximum link length of 10km on Single Mode Fiber (SMF)
- 4x28Gb/s DFB-based LAN-WDM transmitter
- 4x28G retimed electrical interface
- Duplex LC receptacles
- I2C management interface

APPLICATIONS

- 100GBASE-LR4 100G Ethernet
- OTU4

FPQ28DRLR4-10D QSFP28 transceiver modules are designed for use in 100 Gigabit Ethernet and 4x28G OTN interfaces up to 10km of single mode fiber. They are compliant with the QSFP28 MSA, IEEE 802.3ba 100GBASE-LR4 and OTU4 specified in ITU-T G.959.1 Recommendation. Digital diagnostic functions are available via the I2C interface, as specified by the QSFP28 MSA.

Pin Descriptions



Pin	Symbol	Name/Description	Notes
1	GND	Ground	1
2	Tx2n	Transmitter Inverted Data Input	
3	Tx2p	Transmitter Non-Inverted Data Input	
4	GND	Ground	1
5	Tx4n	Transmitter Inverted Data Input	
6	Tx4p	Transmitter Non-Inverted Data Input	
7	GND	Ground	1
8	ModSelL	Module Select	
9	ResetL	Module Reset	
10	Vcc Rx	+3.3 V Power supply receiver	
11	SCL	2-wire serial interface clock	
12	SDA	2-wire serial interface data	
13	GND	Ground	1
14	Rx3p	Receiver Non-Inverted Data Output	
15	Rx3n	Receiver Inverted Data Output	
16	GND	Ground	1
17	Rx1p	Receiver Non-Inverted Data Output	
18	Rx1n	Receiver Inverted Data Output	
19	GND	Ground	1
20	GND	Ground	1
21	Rx2n	Receiver Inverted Data Output	
22	Rx2p	Receiver Non-Inverted Data Output	
23	GND	Ground	1
24	Rx4n	Receiver Inverted Data Output	
25	Rx4p	Receiver Non-Inverted Data Output	
26	GND	Ground	1
27	ModPrsL	Module Present	
28	IntL	Interrupt	
29	Vcc Tx	+3.3 V Power supply transmitter	
30	Vcc1	+3.3 V Power Supply	
31	LPMMode	Low Power Mode	
32	GND	Ground	1
33	Tx3p	Transmitter Non-Inverted Data Input	
34	Tx3n	Transmitter Inverted Data Input	
35	GND	Ground	1
36	Tx1p	Transmitter Non-Inverted Data Input	
37	Tx1n	Transmitter Inverted Data Input	
38	GND	Ground	1

Notes:

1. Circuit ground is internally isolated from chassis ground.

Absolute Maximum Ratings

Parameter	Symbol	Min	Typ.	Max	Unit
Maximum Supply Voltage	V _{cc}	-0.5		3.6	V
Storage Temperature	T _s	-40		+85	°C
Case Operating Temperature	TOP	0		+70	°C
Relative Humidity	RH	15		85	%
Receiver Damage Threshold, Per Lane	PRdmg	5.5			dBm

Electrical Characteristics

(EOL, TOP = 0 to +70 C, VCC = 3.135 to 3.465 Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Supply Voltage	V _{cc}	3.135		3.465	V	
Supply Current	I _{cc}			1.12	A	
Module total power	P			3.5	W	1
Transmitter						
Signaling rate per lane		25.78		27.95	Gb/s	
Differential data input swing per lane	V _{in,pp}			900	mV	
Differential input return loss (min) @ 25.78	RLd(f)	9.5 – 0.37f, 0.01 ≤ f < 8 4.75 – 7.4log ₁₀ (f/14), 8 ≤ f < 19			dB	3
Differential input return loss (min) @ 27.95	SDD11	-11, 0.05 < f < f _b -6.0 + 9.2log ₁₀ (2f/f _b), f _b /7 < f < f _b			dB	3
Differential termination mismatch				10	%	
Applied pk-pk sinusoidal jitter		Per IEEE 802.3bm Table 88-13				
Eye height			95		mV	
DC common mode voltage		-350		2850	mV	
Receiver						
Signaling rate per lane		25.78		27.95	Gb/s	
Differential data output Swing	V _{out,pp}	100		400	mVpp	2
		300		600		
		400		800		
		600		1200		
Differential Output return loss (min) @ 25.78	RLd(f)	9.5 – 0.37f, 0.01 ≤ f < 8 4.75 – 7.4log ₁₀ (f/14), 8 ≤ f < 19			dB	3
Differential Output return loss (min) @ 27.95	SDD22	-11, 0.05 < f < f _b -6.0 + 9.2log ₁₀ (2f/f _b), f _b /7 < f < f _b			dB	3
Common Mode return loss at OTU4	SCC22			-2	dB	
Common mode noise, RMS				17.5	mV	
Transition time, 20%-80% @LR4	t _r t _f	12		-2	ps	
Transition time, 20%-80% @OTU4	t _r t _f	9.5		-2	ps	

Notes:

- Maximum total power value is specified across the full temperature and voltage range.
- Output voltage is settable in 4 discrete ranges via I2C. Default range is 400 – 800 mV.
- F_b is the data rate per lane in Gb/s

Optical Characteristics - 100GBASE-LR4 (EOL, TOP = 0 to +70 °C, VCC = 3.135 to 3.465 Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Transmitter						
Data rate per Lane		25.78 ± 100 ppm			Gb/s	1
Center wav. per lane (range)		1294.53 – 1296.59			nm	
		1299.02 – 1301.09				
		1303.54 – 1305.63				
		1308.09 – 1310.19				
Total Ave. Launch Power	P _{OUT}			10.5	dBm	
Transmit OMA per Lane	TxOMA	-1.3		4.5	dBm	
Ave. Launch Power per Lane	TXP _x	-4.3		4.5	dBm	3
Optical Extinction Ratio	ER	4			dB	
SMSR		30			dB	
Average launch power of OFF transmitter, per lane				-30	dBm	
Relative Intensity Noise	RIN			-130	dB/Hz	
Optical Return Loss				20	dB	
Transmitter Reflectance				-12	dB	
Transmitter eye mask {X1, X2, X3, Y1, Y2, Y3}		{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}				2
Receiver						
Data rate per Lane		25.78125 ± 100 ppm			Gb/s	4
Center wav. per lane (range)		1294.53 – 1296.59			nm	
		1299.02 – 1301.09				
		1303.54 – 1305.63				
		1308.09 – 1310.19				
Receive Power (OMA) per Lane	RxOMA			4.5	dBm	
Ave.receive Power per Lane	RXP _x	-10.6		4.5	dBm	3
Receiver Sensitivity (OMA) per Lane	Rxsens			-8.6	dBm	5
Return Loss	RL	-26			dB	
LOS De-Assert	LOS _D			-11.6	dBm	
LOS Assert	LOS _A	-24		-13.6	dBm	
LOS Hysteresis			1.5		dBm	

Notes:

1. Transmitter consists of 4 lasers operating at 25.78Gb/s each.
2. Hit ratio 5x10⁻⁵.
3. Power value and power accuracy are with all channels on.
4. Receiver consists of 4 PD operating at 25.78 Gb/s each
5. Sensitivity is measured with vertical eye closure penalty of 1.8dB max.

Optical Characteristics - OTN OTU4 (EOL, TOP = 0 to +70 °C, VCC = 3.135 to 3.465 Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Transmitter						
Data rate per Lane		27.95 ± 20 ppm			Gb/s	1
Center wav. per lane (range)		1294.53 – 1296.59			nm	
		1299.02 – 1301.09				
		1303.54 – 1305.63				
		1308.09 – 1310.19				
Total Ave. Launch Power	P _{OUT}			10	dBm	
Ave. Launch Power per Lane	TXP _x	-0.6		4.0	dBm	3
Optical Extinction Ratio	ER	4		6.5	dB	
SMSR		30			dB	
Average launch power of OFF transmitter, per lane				-30	dBm	
Optical Return Loss				20	dB	
Transmitter Reflectance				-12	dB	
Transmitter eye mask {X1, X2, X3, Y1, Y2, Y3}		{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}				2
Receiver						
Data rate per Lane		27.95 ± 20 ppm			Gb/s	4
Center wav. per lane (range)		1294.53 – 1296.59			nm	
		1299.02 – 1301.09				
		1303.54 – 1305.63				
		1308.09 – 1310.19				
Ave.receive Power per Lane	RXP _x	-7		4.0	dBm	3
Optical Path Penalty	OPP			1.5	dB	
Receiver Sensitivity per Lane	Rxsens			-8.4	dBm	5
Total Ave. Input Power	P _{IN}			10	dBm	
LOS De-Assert	LOS _D			-11.6	dBm	
LOS Assert	LOS _A	-24		-13.6	dBm	
LOS Hysteresis			1.5		dBm	

Notes:

1. Transmitter consists of 4 lasers operating at 27.95 Gb/s each.
2. Hit ratio 5x10⁻⁵.
3. Power value and power accuracy are with all channels on.
4. Receiver consists of 4 PD operating at 27.95 Gb/s each
5. Specified at BER of 10⁻⁶(Pre-FEC), per ITU-T G.sup39.

Parameter	Symbol	Min	Typ	Max	Units	Ref.
Bit Rate (all wavelengths combined)	BR	103.1		112	Gb/s	1
Bit Error Ratio @25.78Gb/s	BER			10 ⁻¹²		2
Bit Error Ratio @27.95Gb/s	BER			10 ⁻⁶		3
Maximum Supported Distances						
Fiber Type			SMF-28e			
SMF per G.652	Lmax			10	km	

1. Supports OTU4 per ITU-T G.959.1 and 100GBASE-LR4 per IEEE 802.3ba.
2. Tested with a $2^{31}-1$ PRBS.
3. Tested with a $2^{31}-1$ PRBS. Per ITU-T G.959.1 and G.sup39, the BER of 10^{-12} for the OTU4(112Gb/s) application code is required to be met only after FEC has been applied. ITU-T G.sup39 defines the pre-FEC BER to be met as 10^{-6} .

Parameter	Symbol	Min	Typ	Max	Units	Ref.
Ambient Operating Temperature	Top	0		70	°C	
Storage Temperature	Tsto	-40		85	°C	

FPQ28DRLR4-10D QSFP28 transceivers Support the I2C-based diagnostics interface specified by the SFF-8636, SFF-8665.

Technical drawing of a 12V 100Ah battery showing front, side, and top views with dimensions in mm.

Front View Dimensions:

- Overall Height: 170 ± 0.1
- Terminal Height: 2.30 ± 0.1
- Terminal Spacing: 1.00 ± 0.1
- Terminal Width: 0.90 ± 0.1
- Case Height: 4.20 ± 0.15
- Bottom Flange Width: 8.50 ± 0.1
- Bottom Flange Spacing: 2.25 ± 0.1
- Bottom Flange Thickness: 5.20 ± 0.15

Side View Dimensions:

- Overall Length: 63.70 ± 0.2
- Terminal Length: 3.2 ± 0.2
- Terminal Spacing: $1.60^{+0.0}_{-0.1}$
- Terminal Width: 5.80 ± 0.1
- Terminal Thickness: 2.70 ± 0.1
- Case Length: 29.60 ± 0.1
- Case Width: $3.60^{+0.1}_{-0.0}$
- Case Thickness: 2.00 ± 0.1
- Bottom Flange Width: 0.60 ± 0.05

Top View Dimensions:

- Overall Width: 19 MAX
- Terminal Spacing: 6.25 ± 0.10
- Case Width: 13.68 ± 0.1
- Case Thickness: 16.40 ± 0.1
- Bottom Flange Width: 18.35 ± 0.1

PN	Orbis product code:	Data Rate	Laser	Receiver	Distance	Interface	DDM	Temp.
FPQ28DRLR4-10D	3008930	112Gbps	DML	PIN	10KM	LC	YES	C