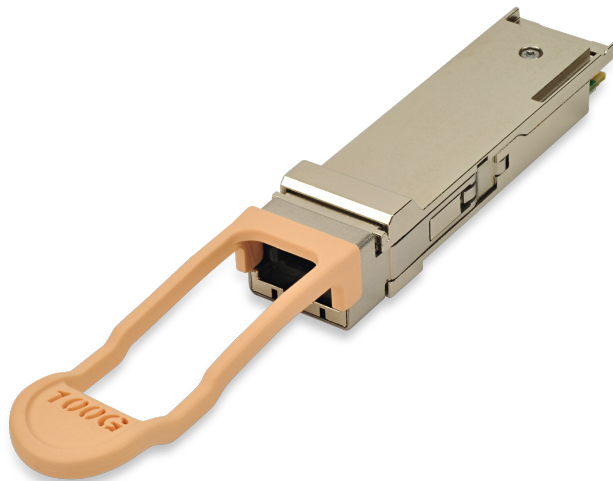


FTLC9555FEPM

128G Fibre Channel Parallel 100m MMF QSFP28 Optical Transceiver

FTLC9555FEPM 128G QSFP28 transceiver modules are designed for use in 16/32/128G Fibre Channel links over multimode fiber. They are compliant with the QSFP28 MSA¹, 128GFC2 and IEEE 802.3bm CAUI-4³. Digital diagnostics functions are available via the I2C interface, as specified by the QSFP28 MSA¹ and Finisar Application Note AN-20414. The transceiver is RoHS-6 compliant per Directive 2011/65/EU⁵ and Finisar Application Note AN-2038⁶. *See section V for compliance information.



FEATURES

- Hot-pluggable QSFP28 form factor
- Supports up to 112.2Gb/s aggregate bit rates
- Power dissipation < 2.5W
- RoHS-6 compliant
- Commercial case temperature range of 0°C to 70°C
- Single 3.3V power supply
- Maximum link length of 100m on OM4 Multimode Fiber (MMF)
- 4x28Gb/s 850nm VCSEL-based transmitter
- 4x25G electrical interface
- Single MPO12 receptacle
- I2C management interface

APPLICATIONS

- 8/16/32/128G Fibre Channel*

Product Selection

FTLC9555FEPM

- F: 128G FC maximum bit rate (112.2 Gb/s)
- E: 4x28G parallel optics
- P: Pull tab release
- M: MPO receptacle

1. Pin Descriptions

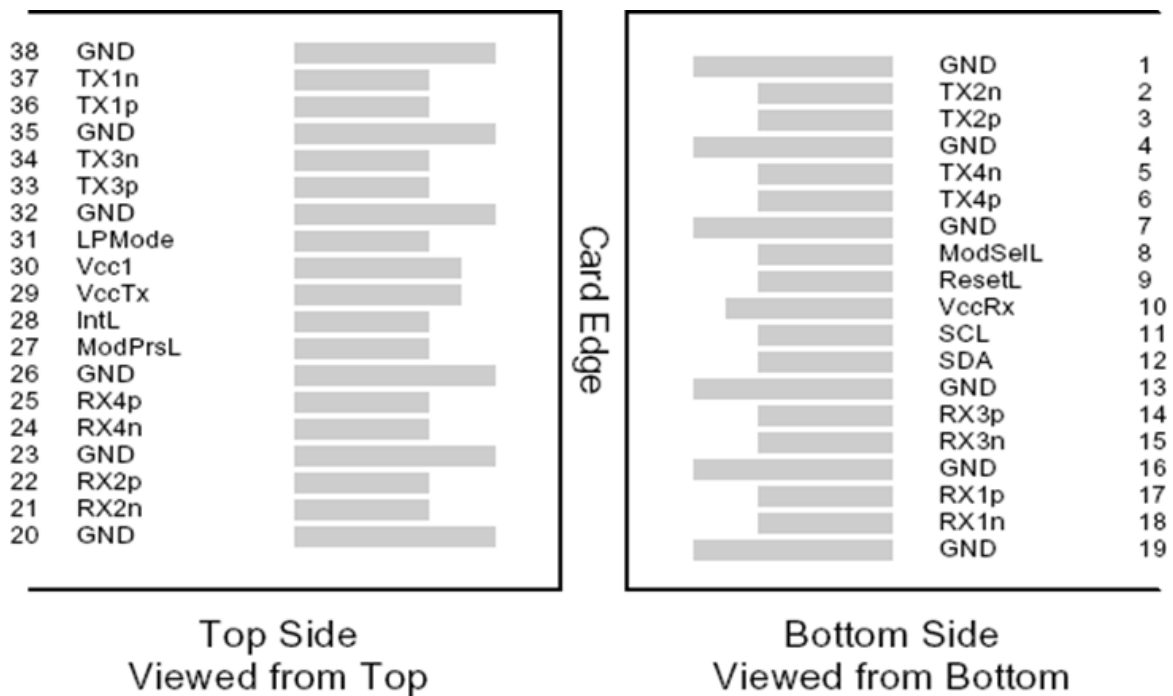


Figure 1 – QSFP28-compliant 38-pin connector (per SFF-8679)

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	LPMode	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.

II. Absolute Maximum Ratings

Module performance is not guaranteed beyond the operating range (see Section VI). Exceeding the limits below may damage the transceiver module permanently.

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Maximum Supply Voltage	V _{CC}	-0.5		4.0	V	
Storage Temperature	T _s	-40		85	°C	
Case Operating Temperature	T _{OP}	0		70	°C	1
Relative Humidity	RH	15		85	%	2
Receiver Damage Threshold, per Lane	P _{Rdmg}	3.4			dBm	

Notes:

1. Can support temporary excursions of case operating temperature from -5 to -75 °C not exceeding 72 hours.
2. Non-condensing.

III. Electrical Characteristics (EOL, TOP = 0 to 70 °C, V_{cc} = 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}			1.5	A		
Module total power	P			2.5	W	1	
Transmitter							
Signaling rate per lane		25.78		28.05	Gb/s	2	
Differential data input voltage per lane	V _{in,pp,diff}			900	mV		
Single-ended voltage tolerance	V _{in,pp}	-0.35		+3.3	V		
Module stress input test		Per Section 13.3.11.2.1, OIF CEI-28G-VSR					
Receiver							
Signaling rate per lane		25.78		28.05	Gb/s	2	
Differential data output swing	V _{out,pp}	100		400	mV _{pp}	3	
		300		600			
		400	600	800			
		600		1200			
Eye width		0.57			UI		
Eye height, differential		228		5.5	mV		
Vertical eye closure	VEC	5.5		10	dB		
Transition time (20% to 80%)	t _r t _f	12			ps		

Notes:

1. Maximum total power value is specified across the full operational temperature and voltage range when CDRs are locked or a lack of input signal results in squelch being activated. If incorrect frequencies cause the CDRs to continuously attempt to lock, maximum power dissipation may reach 3.5 W.
2. ± 100ppm
3. Output voltage is settable in 4 discrete ranges via I2C. Default range is 400 – 800 mV.

IV. Optical Characteristics (EOL, $T_{OP} = 0$ to 70 °C, $V_{CC} = 3.135$ to 3.465 Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.		
Transmitter		8.5		28.05	Gb/s	1		
Signaling Speed per Lane		840		860	nm			
RMS Spectral Width	SW	128GFC per T.11			nm			
Average Launch Power per Lane	TXP _x				dBm			
Transmit OMA per Lane	TxOMA				dBm			
Difference in Power between any two lanes [OMA]	DP _x				dB			
Peak Power per Lane	PP _x				dBm			
Launch Power [OMA] minus TDP per Lane	P-TDP				dBm			
TDP per Lane	TDP				dBm			
Optical Extinction Ratio	ER				dB			
Optical Return Loss Tolerance	ORL				dB			
Encircled Flux	FLX				dBm			
Average launch power of OFF transmitter, per lane					dBm			
Relative Intensity Noise	RIN				dB/Hz			
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}								
Receiver								
Signaling Speed per Lane		8.5		28.05	GBd	2		
Center wavelength		840		860	nm			
Damage Threshold	DT	128GFC per T.11			dBm			
Average Receive Power per Lane	RXP _x				dBm			
Receive Power (OMA) per Lane	RxOM A				dBm			
Stressed Receiver Sensitivity (OMA) per Lane	SRS				dBm			
Back to Back Receiver Sensitivity (OMA) per Lane	RxSens				dBm			
Peak Power, per lane	PP _x				dBm			
Receiver Reflectance	Rfl				dB			
Vertical eye closure penalty, per lane					dB			
Stressed eye J2 jitter, per Lane					UI			
Stressed eye J9 jitter, per Lane					UI			
OMA of each aggressor lane					dBm			
Receiver jitter tolerance [OMA], per Lane					dBm			
Rx jitter tolerance: Jitter frequency and p-p amplitude					kHz, UI			
					kHz, UI			
LOS De-Assert	LOS _D			-13	dBm			
LOS Assert	LOS _A	-30			dBm			
LOS Hysteresis		0.5	2		dB			

Notes:

1. Transmitter consists of 4 lasers operating at a maximum speed of 28.05Gb/s each.
2. Receiver consists of 4 photodetectors operating at a maximum speed of 28.05Gb/s each.

V. Data Rate and Reach Specifications

Finisar FTLC9555F QSFP28 Fibre Channel transceivers are compliant with 128G Fibre Channel (32GFC per lane), and compatible with 8GFC and 16GFC (per lane).

Parameter	Symbol	Typ	Max	Units	Ref.
Bit Rate (all wavelengths combined)	BR		112.2	Gb/s	1
Bit Error Ratio @28.05Gb/s	BER2		5x10 ⁻¹²		2
Maximum Supported Distances					
Fiber Type					
OM3 MMF	Lmax1		70	m	3
OM4 MMF	Lmax2		100	m	3

Notes:

1. Supports 8/16/32/128G FC per T11.
2. Tested with a 2³¹ - 1 PRBS.
3. Requires FEC on the host to support maximum distance.

VI. Environmental Specifications

Finisar FTLC9555 QSFP28 transceivers have a commercial operating case temperature range of 0°C to +70°C. They can support temporary excursions to case temperatures of -5°C and +75°C without permanent damage (see Section II).

Environmental Specifications	Symbol	Min	Typ	Max	Units	Ref.
Case Operating Temperature	T _{op}	0		70	°C	
Storage Temperature	T _{sto}	-40		85	°C	

VII. Regulatory Compliance

Finisar FTLC9555 QSFP28 transceivers are Class 1 Laser Products. They are certified per the following standards:

Feature	Agency	Standard
Laser Eye Safety	FDA/CDRH	CDRH 21 CFR 1040 and Laser Notice 50
	TÜV	EN 60825-1:2014 EN 60825-2:2004+A1+A2
Electrical Safety	TÜV	EN 60950-1:2006+A11+A1+A12+A2
	UL/CSA	CAN/CSA-C22.2 No. 60950-1-07+A2:2014 ANSI/UL Std. No. 60950-1:2014

Copies of the referenced certificates will be available at Finisar upon request. Complies with FDA performance standards for laser products except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

CAUTION – Use of Controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

VIII. Digital Diagnostics Functions

FTLC9555 QSFP28 transceivers support the I2C-based diagnostics interface specified by the QSFP28 MSA¹. See Finisar Application Note AN-2041⁴.

IX. Memory Contents

Per the QSFP28 MSA¹. See Finisar Application Note AN-2041⁴.

XI. Mechanical Specifications

Finisar FTLC1154RDPL transceivers are compatible with the QSFP28 Specification for pluggable form factor modules.

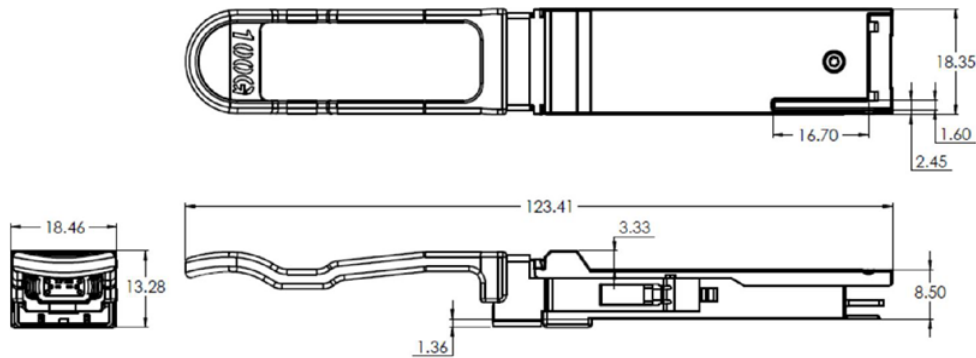


Figure 2. FTLC9555FEPM Mechanical Dimensions.



Figure 3. Product Label (Not to Scale)

X. References

1. SFF-8665: "QSFP+ 28Gb/s 4X Pluggable Transceiver Solution (QSFP28)", Rev 1.9, June 29, 2015 (and associated SFF documents)
 - i. SFF-8661
 - ii. SFF-8679
 - iii. SFF-8636
 - iv. SFF-8662
 - v. SFF-8663
 - vi. SFF-8672
 - vii. SFF-8683
2. 128G Fibre Channel Specification, per ANSI T.11.
3. IEEE 802.3bm CAUI-4.
4. Application Note AN-2041, Finisar Corporation.
5. Directive 2011/65/EU of the European Parliament and of the Council, "on the restriction of the use of certain hazardous substances in electrical and electronic equipment," July 1, 2011.
6. "Application Note AN-2038: Finisar Implementation Of RoHS Compliant Transceivers", Finisar Corporation, January 21, 2005.