Product Specification

400G-DR4+ OSFP Optical Finisar® Transceiver

FTCD4535E2PxM

PRODUCT FEATURES

- Hot-pluggable OSFP form factor
- Supports 425Gb/s aggregate bit rate
- Power dissipation <10W (limited temp) or < 12W (c-temp)
- RoHS-6 compliant
- Case temperature range of 20°C to +60°C (limited temp) or 0°C to +70°C (c-temp)
- Single 3.3V power supply
- Aligned with IEEE 802.3cu
- 4x100Gb/s PAM4 serial lanes
- 8x50G PAM4 retimed electrical interface
- Parallel MPO receptacle
- I2C management interface

APPLICATIONS

- 400G DR4+ (2km) applications with FEC
- 100GbE breakout applications

Finisar's FTCD4535E2PxM DR4+ OSFP transceiver modules are designed for use in 400 Gigabit Ethernet links on up to 2km of single mode fiber. They are compliant with the OSFP MSA, IEEE 802.3bs[6] and IEEE802.3cu[7]. Digital diagnostic functions are available via the I2C interface, as specified by the OSFP MSA. The transceiver is RoHS-6 compliant per Directive 2011/65/EU4 and Finisar Application Note AN-2038[3].

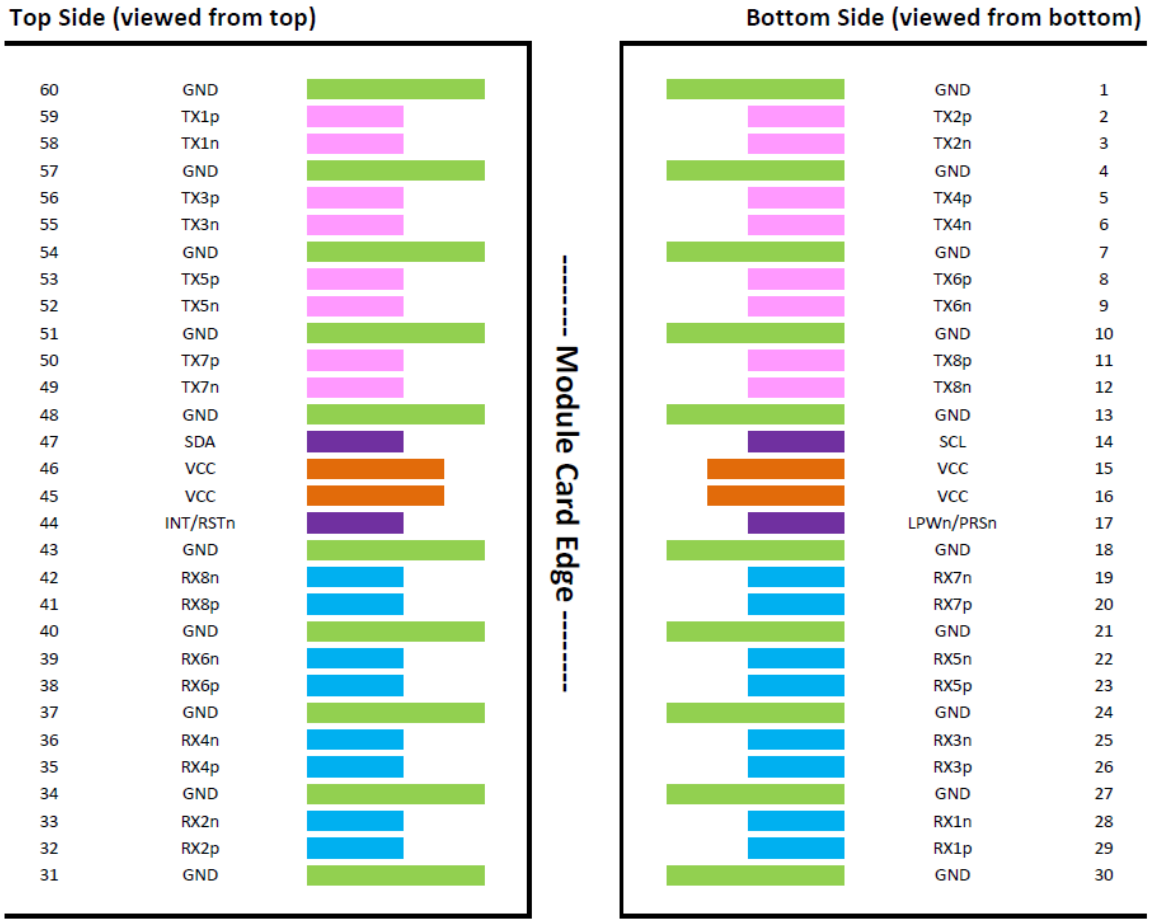
PRODUCT SELECTION

FTCD4535E2PxM (Application select 1 set to 4x100G mode)
FTCD4535E2PxM-4A (Application select 1 set to 400G mode)

E:	Ethernet protocol
P:	Pull-tab type release
C or L:	Commercial or limited temperature range
M:	MPO receptacle

I. Pin Descriptions

The electrical pinout of the OSFP module is shown in Figure 1 below



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	Vcc	-0.5		4.0	V	
Storage Temperature	T_S	-40		+85	°C	
Case Operating Temperature	T_{OP}	0 20		+70 +60	°C	c-temp limited temp
Relative Humidity	RH	15		85	%	1
Receiver Damage Threshold, per Lane	P_{Rdmg}	5			dBm	

Notes:
1. Non-condensing.

III. Electrical Characteristics (EOL, T_{OP} = 0 to +70 °C, V_{CC} = 3.135 to 3.465 Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Supply Voltage	Vcc	3.135	3.3	3.465	V	
Supply Current	Icc			3.83	A	
Module total power	P			12	W	1
Transmitter						
Signaling rate per lane		26.5625± 100 ppm.			Gbd	
Differential data input voltage per lane	Vin,pp,diff	900			mV	2
Differential input return loss		Per equation (83E–5) IEEE802.3bm			dB	
Differential to common mode input return loss		Per equation (83E–6) IEEE802.3bm			dB	
Differential termination mismatch				10	%	
Module stress input test		Per 120E.3.4.1 IEEE802.3bs				3
Single-ended voltage tolerance range		-0.4		3.3	V	
DC common mode voltage		-350		2850	mV	4
Receiver						
Signaling rate per lane		26.5625± 100 ppm.			Gbd	
AC common-mode output voltage (RMS)				17.5	mV	
Differential output voltage				900	mV	
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)		0.2			UI	
Far-end Eye height, differential (min)		30			mV	
Far-end pre-cursor ISI ratio		-4.5		2.5	dB	
Differential output return loss		Per equation 83E-2 IEEE802.3bm				
Common to differential mode conversion return loss		Per equation 83E-3 IEEE802.3bm				
Differential termination mismatch				10	%	
Transition time (min, 20% to 80%)		9.5			ps	
DC common mode voltage (min)		-350		2850	mV	4

Notes:

1. Maximum total power value is specified across the full temperature and voltage range.
2. With the exception to 120E.3.1.2 that the pattern is PRBS31Q or scrambled idle.
3. Meets specified BER
4. DC common mode voltage generated by the host. Specification includes effects of ground offset voltage.

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

Meets 4x100GBASE-FR1 as being defined by IEEE P802.3cu

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Transmitter						
Signaling rate (each lane (range)		53.125 ± 100 ppm			GBd	
Modulation format		PAM4				
Lane wavelength (range)		1304.5 to 1317.5			nm	
Side-mode suppression ratio (SMSR)		30			dB	
Average launch power, each lane				4	dBm	
Average launch power, each lane		-3.1			dBm	1
Outer Optical Modulation Amplitude (OMAouter), each lane				4.2	dBm	
Outer Optical Modulation Amplitude (OMA_{outer}) (min)b for TDECQ <1.4 dB for 1.4 dB ≤ TDECQ ≤ 3.4 dB		–0.1 –1.5 + TDECQ			dBm	
Transmitter and dispersion eye closure for PAM4 (TDECQ), each lane				3.4	dB	
Transmitter eye closure for PAM4 (TECQ)				3.4	dB	
TDECQ – TECQ				2.5	dB	
Average launch power of OFF transmitter, each lane				-15	dBm	
Extinction ratio		3.5			dB	
Transmitter transition time				17	pS	
Transmitter over/under-shoot				22	%	
Transmitter peak-to-peak power				5	dBm	
RIN_xOMA, where x is the optical return loss tolerance				-136	dB/Hz	
Optical return loss tolerance				17.1	dB	
Transmitter reflectance				-26	dB	2

Notes:

1. 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.
2. Transmitter reflectance is defined looking into the transmitter

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Receiver						
Signaling rate (each lane (range)		53.125 ± 100 ppm			GBd	
Modulation format		PAM4				
Lane wavelength (range)		1304.5 to 1317.5			nm	
Damage threshold, each lane		5			dBm	1
Average receive power, each lane				4	dBm	
Average receive power, each lane		-7.1			dBm	2
Receive power (OMAouter), each lane				4.2	dBm	
Receiver reflectance				-26	dB	
Receiver sensitivity (OMAouter) for TECQ < 1.4 dB for 1.4 dB ≤ TECQ ≤ 3.4 dB				–4.5 –5.9 + TECQ	dBm	
Stressed receiver sensitivity (OMAouter), each lane				-2.5	dBm	3
Conditions of stressed receiver sensitivity test:[4]						
Stressed eye closure for PAM4 (SECQ), lane under test		3.4			dB	

Notes:
1. The receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having this average power level.
2. Average receive power, each lane (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliance.
3. Measured with conformance test signal at TP3 (see 140.7.10) for the BER specified in 140.1.1.
4. These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

V. General Specifications

Parameter	Symbol	Min	Typ	Max	Units	Ref.
Bit Rate (all wavelengths combined)	BR			425	Gb/s	1
Bit Error Ratio	BER			2.4E-4		2
Maximum Supported Distances						
Fiber Type						
SMF per G.652	Lmax1			2000	m	

Notes:
1. Supports 4x100GBASE-FR1 per IEEE P802.3cu.
2. As defined by IEEE P802.3cu.

VI. Environmental Specifications

Finisar FTCD4535E2PxM DR4+ OSFP transceivers have an operating case temperature range of 0°C to +70°C.

Parameter	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 FTCD4535E2PxM DR4+ OSFP 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 56
Laser Eye Safety	UL	IEC 60825-1:2014 IEC 60825-2: 2004+A1+A2
Electrical Safety	UL	IEC 62368-1:2018
Electrical Safety	UL/CSA	CLASS 3862.07 CLASS 3862.87

Copies of the referenced certificates are available at Finisar Corporation upon request.

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

III. Digital Diagnostics Functions

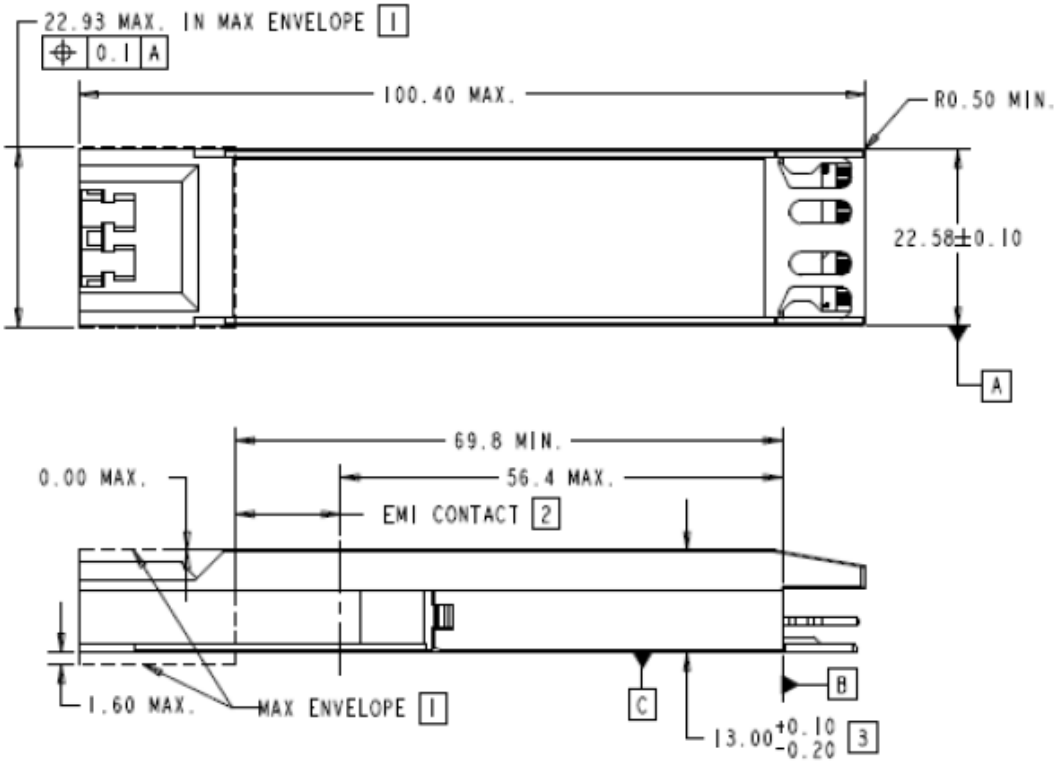
FTCD4535E2PxM DR4+ OSFP transceivers support the I2C-based diagnostics interface specified by the SFF Commitee[1]. See also Finisar Application Note AN-20xx (TBD).

IX. Memory Contents

Per MSA.

XI. Mechanical Specifications

Finisar FTCD4535E2PxM DR4+ OSFP transceivers are compatible with the OSFP Specification for pluggable form factor modules.



NOTES:

1. FRONT OF THE MODULE, PULL TAB AND OTHER COMPONENTS CAN EXTEND 1.60 mm MAX FROM THE BOTTOM AND 0.00 mm FROM THE TOP WITH UP TO 22.93MM WIDTH IN THE MAX ENVELOPE SHOWN.

2. INDICATED SURFACES (ALL 4 SIDES) TO BE CONDUCTIVE FOR CONNECTION TO CHASSIS GROUND.

3. APPLIES FROM THE TOP OF THE MODULE TO THE BOTTOM OF THE MODULE, INSIDE THE CAGE.

Figure 2. FTCD4535E2PxM Mechanical Dimensions.

Figure 3. Product Label

XII. References

1. OSFP Specification for OSFP Octal small form factor pluggable module

2. 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.

3. "Application Note AN-2038: Finisar Implementation Of RoHS Compliant Transceivers", Finisar Corporation, January 21, 2005.

4. Application Note AN-2153, Initialization, Finisar Corporation.

5. Application Note AN-2154, EEPROM Map, Finisar Corporation.

6. IEEE P802.3bs, 400GBASE-DR4 and 400GAUI-8 Interface.

7. IEEE P802.3cu, 100GBASE-FR1

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