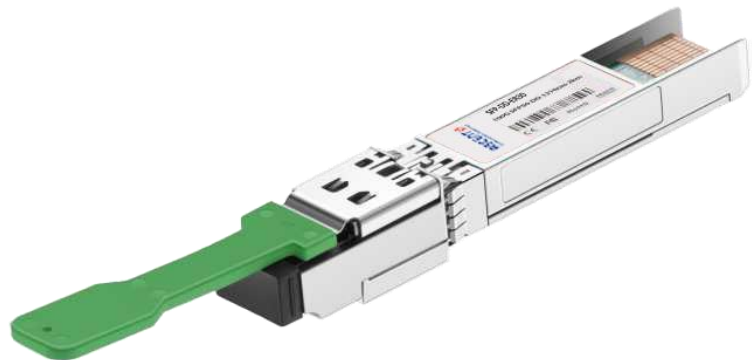


SFP-DD 100G-FR1 Optical Transceiver 2km

SFP-DD Series



- **Compliant to IEEE 100GBASE-FR**
- **100GAUI-2 Compliant-2x 26.5625Gbaud**
- **3.5W maximum power consumption**
- **Single PIN PD+Low-power TIA**
- **CMIS Management Interface**

Ascent's 100G FR1 2km SFP-DD duplex LC transceiver, is a fully integrated, 53.125GBaud PAM4 single optical channel transceiver. The optical channel uses a 4-level pulse amplitude modulation(PAM4) format by means of a DSP, a 1310 nm wavelength EA-DFB laser diode, a PIN photo-diode connecting to a PAM4-based 2 channel x 26.5625GBaud 100GAUI-2 electrical interface by means of a 2:1 mux/demux. This single optical channel technology enables a cost-optimized solution for 100GE optical links. The CMIS compliant 2-wire management interface enables control, alarm and monitoring of the SFP-DD module.

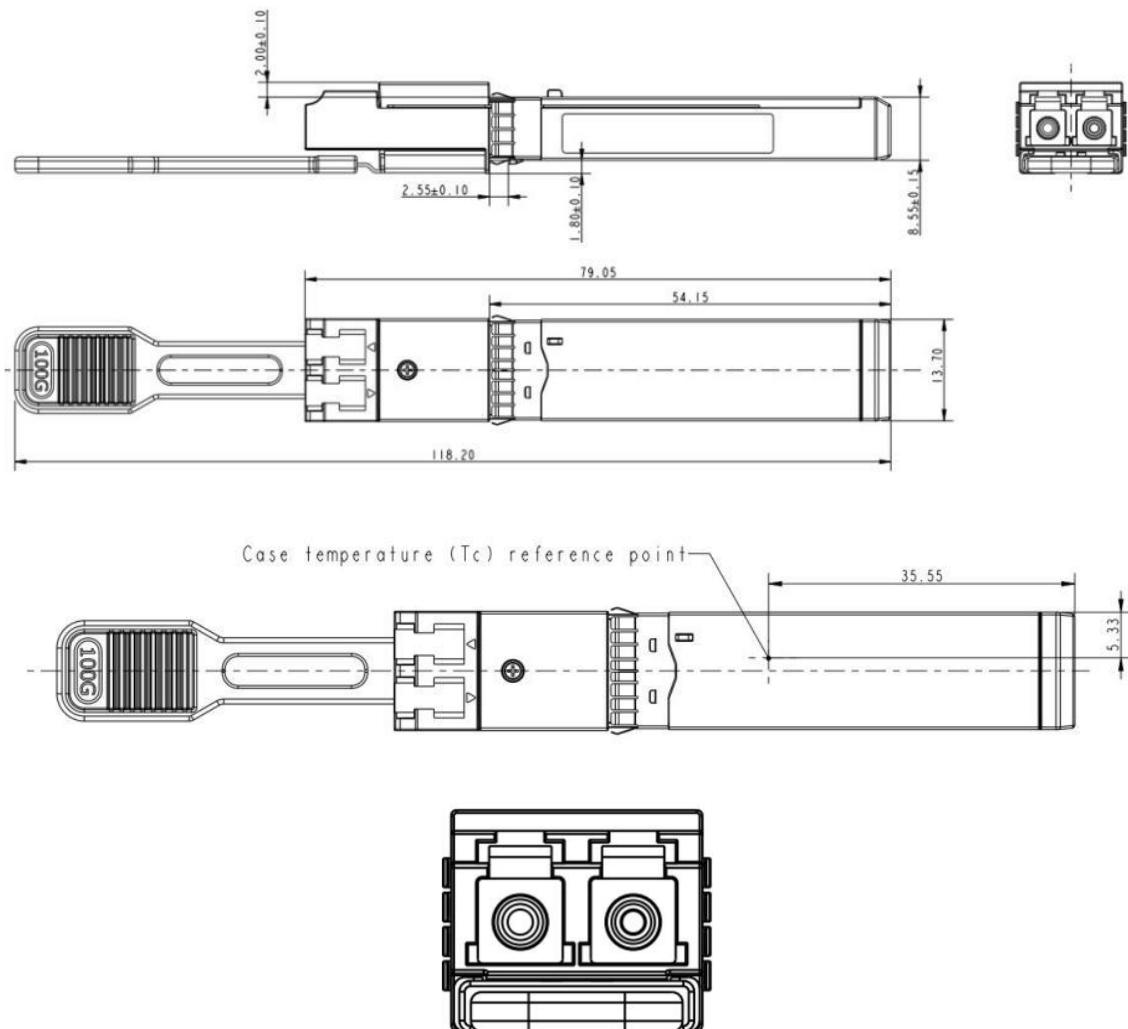
The 100GBASE-FR Single Lambda SFP-DD module is designed for use in 100GBASE Ethernet throughput up to 2km over single mode fiber (SMF) using a wavelength of 1310nm via duplex LC connectors. This transceiver is compliant with SFPDD MSA and SFP-DD MIS Rev 2.0 standard. It combines 2x26.5625GBd PAM4 electrical lane sin to one 53.125GBd PAM4 optical channel in compliance with IEEE100GBASE-FR. With these features, this easy to install, hot swappable transceiver is suitable to be used in various applications, such as Data Center, 100G Ethernet.

Key Features

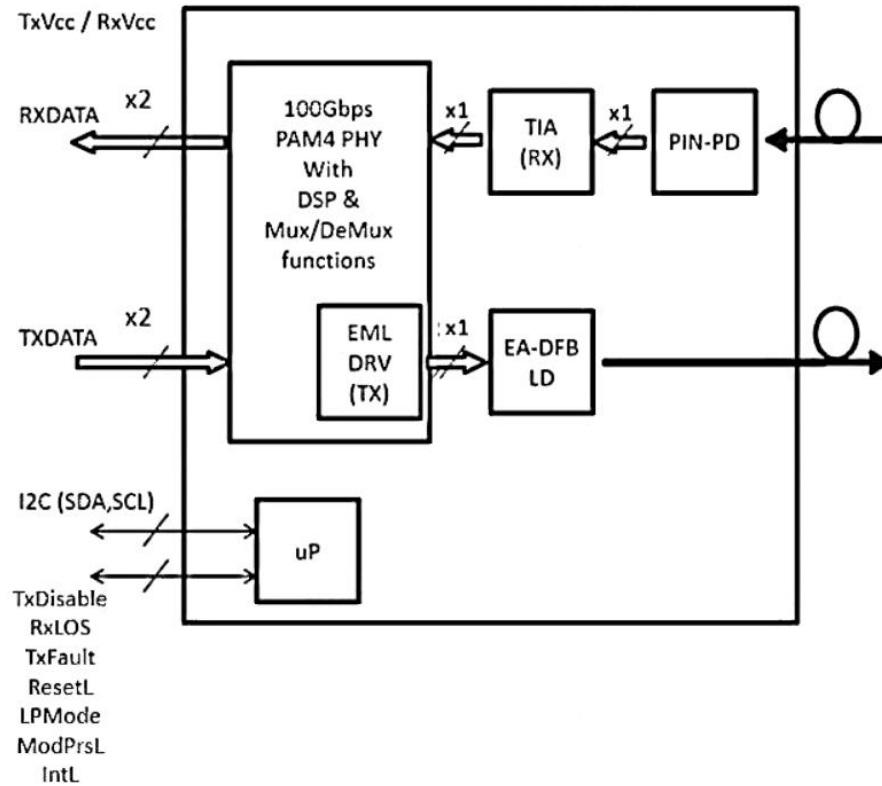
- IEEE 100GBASE-FR Compliant
- 100GAUI-2 Compliant-2x 26.5625Gbaud
- SFP-DD MSA Compliant
- 3.5W Max Power Consumption (3.0W typ)
- Operating case temperature range: 0 to 70°C
- Single Cooled 100Gb/s 1310nm EML
- Single PIN PD+Low-power TIA
- CMIS Management Interface

Mechanical Dimensions

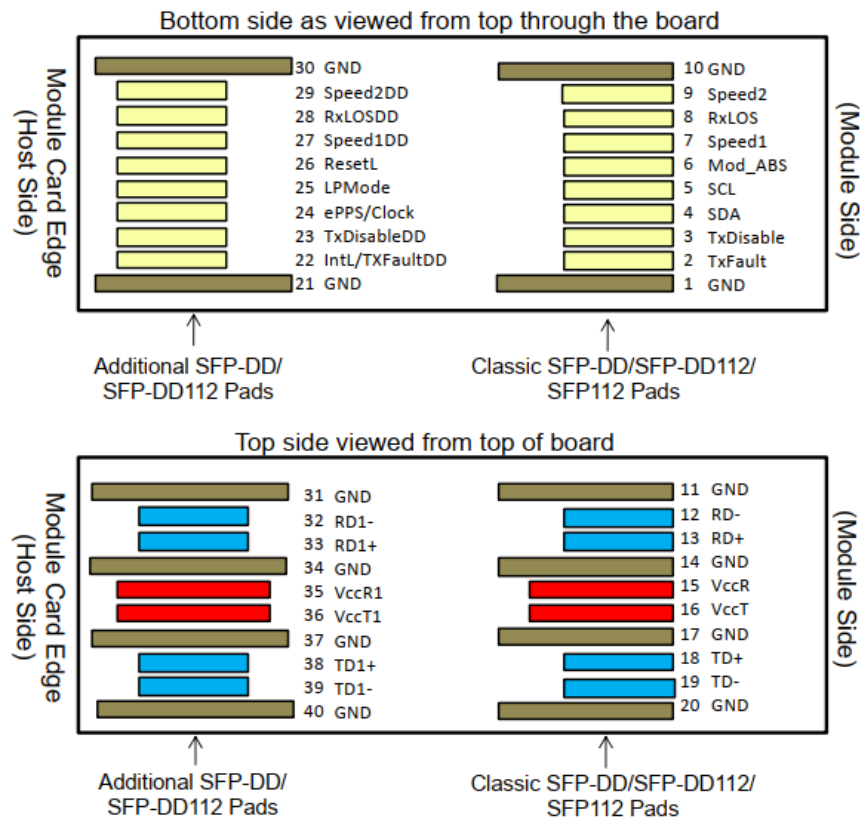
Unit: mm



Block Diagram



Pin Assignment



Pin	Logic	Symbol	Name/Description	PlugSequence	Note
1		GND	Module Ground	1B	1
2	LVTTTL-O	TXFault	Module Fault Indication: Optionally configured as classic SFP Module Fault Indication via TWI as described in the SFP-DD MIS	3B	
3	LVTTTL-I	TxDisable	Transmitter Disable for classic SFP channel	3B	
4	LVC MOS-I/O	SDA	Management I/F data line	3B	
5	LVC MOS-I/O	SCL	Management I/F clock	3B	
6	LVTTTL-O	Mod_ABS	Module Absent	3B	
7	LVTTTL-I	Speed1	Rx Rate Select for classic SFP channel	3B	
8	LVTTTL-O	RxLOS	Rx Loss of Signal for classic SFP channel	3B	
9	LVTTTL-I	Speed2	Tx Rate Select for classic SFP channel	3B	
10		GND	Ground	1B	1
11		GND	Ground	1B	1
12	CML-O	RD0-	Inverse Received Data Out for classic SFP+ channel	3B	
13	CML-O	RD0+	Received Data Out for classic SFP+ channel	3B	
14		GND	Ground	1B	1
15		VccR	Receiver Power	2B	2
16		VccT	Transmitter Power	2B	2
17		GND	Ground	1B	1
18	CML-I	TD0+	Transmit Data In for classic SFP channel	3B	
19	CML-I	TD0-	Inverse Transmit Data In for classic SFP channel	3B	

Pin	Logic	Symbol	Name/Description	PlugSequence	Note
20		GND	Ground	1B	1
21		GND	Ground	1A	1
			Interrupt: optionally configured as	3A	
22	LVTTL-O	IntL/TxFaultDD	TxFaultDD via TWI as described in the SFP-DD MIS		
23	LVTTL-I	TxDisableDD	Transmit Data In for classic SFP channel	3A	
24	LVTTL-I	ePPS/Clock	Precision Time Protocol (PTP) reference clock input	3A	3
25	LVTTL-I	LPMODE	Low Power Mode Control	3A	
26	LVTTL-I	ResetL	Module Reset	3A	
27	LVTTL-I	Speed1DD	Rx Rate Select for DD channel	3A	
28	LVTTL-O	RxLOSDD	Loss of Signal for DD channel	3A	
29	LVTTL-I	Speed2DD	Tx Rate Select for DD channel	3A	
30		GND	Ground	1A	1
31		GND	Ground	1A	1
32	CML-O	RD1-	Inverse Received Data Out for DD	3A	
33	CML-O	RD1+	Received Data Out for DD channel	3A	
34		GND	Ground	1A	1
35		VccR1	Receiver Power for DD channel	2A	2
36		VccT1	Transmitter Power for DD channel	2A	2
37		GND	Ground	1A	1
38	CML-I	TD1+	Transmit Data In for DD channel	3A	
39	CML-I	TD1-	Inverse Transmit Data In for DD channel	3A	
40		GND	Ground	1A	1

Note:

1. SFP-DD uses common ground (GND) for all signals and supply (power). All are common within the SFP-DD module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal common ground plane.
2. VccR, VccT shall be applied concurrently and VccR1, VccT1 shall be applied concurrently. VccR, VccT, VccR1, VccT1 may be internally connected within the module in any combination. The connector Vcc pins are each rated for a maximum current of 1000 mA.
3. The ePPS pins (if not used) may be terminated with 50 to ground on the host.
4. Plug Sequence specifies the mating sequence of the host connector and module. The sequence is 0, 1A, 2A, 3A, 1B, 2B, 3B' see above figure for pad locations) Contact sequence A will make, then break contact with additional SFP-DD/SFP-DD112 pads. Sequence 1A, 1B will then occur simultaneously, followed by 2A, 2B, followed by 3A, 3B.

Specifications

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at the severity other conditions in excess of those given in the operational sections of the datasheet. Exposure to absolute maximum ratings will cause permanent damage and/or adversely affect device reliability.

Parameter	Symbol	Min.	Max.	Unit	Notes
Supply Voltage	V_{CC}	0	3.6	V	+3.3
Storage Temperature		-40	85	°C	
Optical Receiver Input		-	+5.5	dBm	Average

Recommended Operating Conditions

Electrical and optical characteristics below are defined under this operating environment, unless otherwise specified.

Parameter	Symbol	Min.	Typ.	Max	Unit	Notes
Supply Voltage	V_{CC}	3.135	3.3	3.465	V	
Supply Voltage Noise Tolerance	PSNR	-	-	66	mV	10Hz to 10MHz
Power Consumption		-	3.0	3.5	W	
Supply Current		-	-	1116.4	mA	Steady state
Case Temperature	T_C	0	25	70	°C	

Optical Characteristics

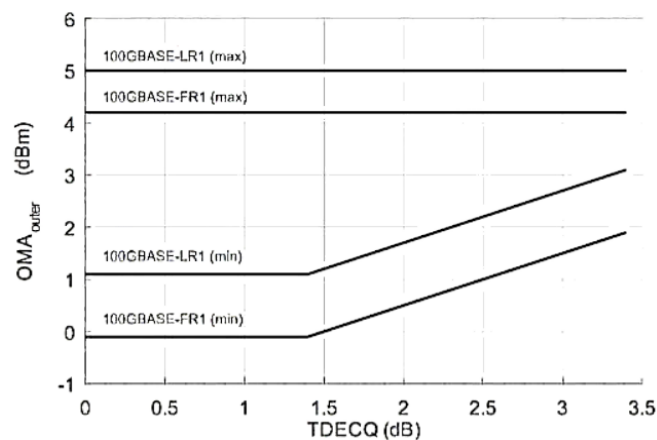
Parameter	Min	Typ.	Max	Unit	Notes
PAM4 Signaling Rate (Range)		53.125 + 100 ppm		GBd	
Lane Wavelengths (Range)	1304.5		1317.5	nm	
Side-Mode Suppression Ratio (SMSR), (Min)		30		dB	
Average Launch Power (Max)		4		dBm	
Average Launch Power (Min)		-3.1		dBm	1
Outer Optical Modulation Amplitude (OMA _{outer}) (Max)		4.2		dBm	
Outer Optical Modulation Amplitude (OMA _{outer}) (Min) for TDECQ < 1.4 dB		-0.1		dBm	
Outer Optical Modulation Amplitude (OMA _{outer}) (Min) for 1.4dB STDECQ < 3.4 dB		-1.5+TDECQ		dBm	
Transmitter and Dispersion Penalty Eye Closure for PAM4 TDECQ, (Max)		3.4		dB	
Transmitter Eye Closure for PAM4 (TECQ) (Max)		3.4		dB	
TDECQ-TECQ (Max)		2.5		dB	
Over/Under-Shoot (Max)		22		%	
Transmitter Power Excursion (max)		2		dBm	

Parameter	Min	Typ.	Max	Unit	Notes
Average Launch Power of OFF Transmitter (Max)		-15		dBm	
Extinction Ratio (Min)		3.5		dB	
Optical Return Loss Tolerance (Max)		17.1		dB	
Transmitter Reflectance (Max)		-26		dB	2
Transmitter Transition Time (Max)		17		ps	
RIN15.5 OMA (Max)		-136		dB/Hz	
Receiver					
PAM4 Signaling Rate (Range)		53.125+ 100 ppm		GBd	
Lane Wavelengths (Range)	1304.5		1317.5	Nm	
Damage Threshold (min)		5		dBm	3
Average Receive Power (max)		4		dBm	
Average Receive Power (min)		-7.1		dBm	4
Receive Power (OMAouter) (Max)		4.2		dBm	
Receiver Reflectance (Max)		-26		dB	
Receiver Sensitivity (OMAouter) (Max)		-4.5, TE -5.9, (See Below Figure Receiver Sensitivity)		dBm	5
Stressed Receiver Sensitivity (OMAouter) (max)		-2.5			6
Conditions of Stressed Receiver Sensitivity Test					7
Stressed Eye Closure for PA4 (SECQ)		3.4		dB	
SECQ-10*log10(Ceq)(max)		-		dB	8

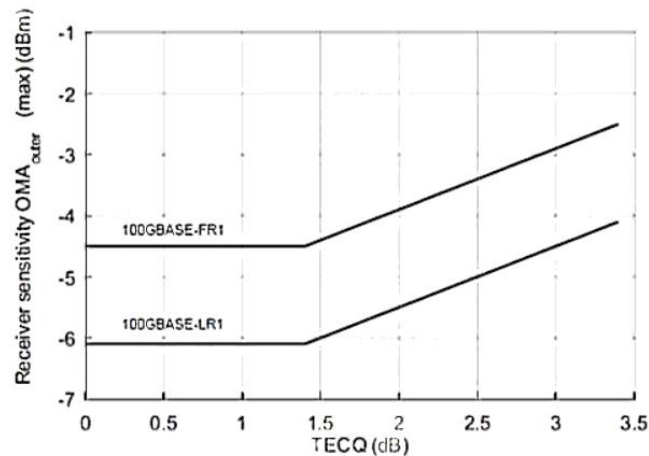
Note:

1. Average launch power (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.
3. The receiver shall be able to tolerate, without damage, continuous exposure to an optical signal having this average power level.
4. 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.
5. Receiver sensitivity (OMAouter), (max) is informative and is defined for a transmitter with a value of SECQ up to 3.4dB.
6. Measured with conformance test signal at TP3 (see IEEE Std 802.3cd clause 140.7.10) for the BER specified in IEEE Std 802.3cd clause 140.1.1.
7. These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.
8. Ceq is a coefficient defined in IEEE Std 802.3-2018 clause 121.8.5.3 which accounts for reference equalizer noise enhancement.

OMA Outer



Receiver Sensitivity



RX LOS Alarm Characteristics

Parameter	Symbol	Min.	Max	Unit	Notes
Receiver Loss of Signal Indicator		-15	-7.5	dBm	Average power
Receiver Loss of Signal Indicator Hysteresis	RX_LOS	-	-7	dBm	Average power
		0.5	-	dB	

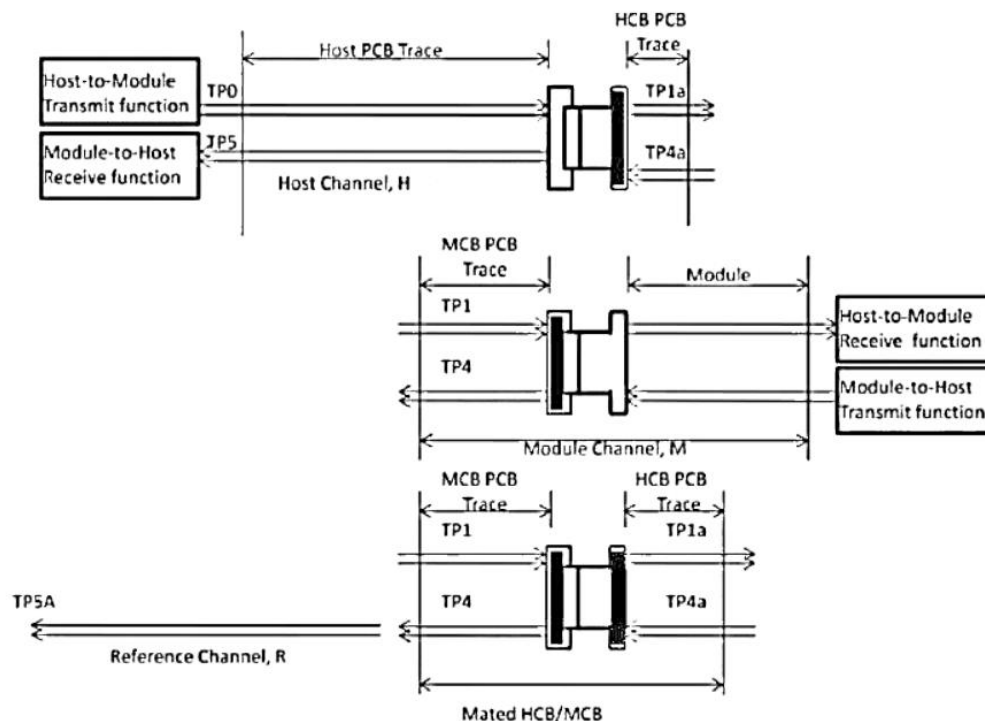
Electrical Characteristics

Parameter	Min.	Typ.	Max	Unit	Notes
Module Output (per Lane, at TP4)					1
Signaling Rate per Lane (Range)	-100ppm	26.5625	+100ppm	GBd	
AC Common-Mode Output Voltage (RMS)	-	-	17.5	mV	
Differential Peak-to-Peak Output Voltage	-	-	900	mV	
Near-end ESMW (Eye Symmetry Maskwidth)	0.265	-	-	UI	
Near-end Eye Height, Differential	70	-	-	mV	
Far-end ESMW (Eye Symmetry Maskwidth)	0.2	-	-	UI	
Far-end Eye Height, Differential	30	-	-	mV	

Parameter	Symbol	Min.	Max	Unit	Notes
Far-end Pre-cursor ISI Ratio	-4.5	-	2.5	%	
Differential Output Return Loss	Equation (83E-2)	-	-	dB	2
Common to Differential Mode Conversion Return Loss	Equation (83E-3)	-	-	dB	2
Differential Termination Mismatch	-	-	10	%	
Transition Time (20% to 80%)	9.5	-	-	ps	
DC Common Mode Voltage	-350	-	2850	mV	
Module Input (per Lane, at TP1)					
Signaling Rate per Lane (Range)	-100ppm	26.5625	+100ppm	GBd	
Differential Pk-Pk Input Voltage Tolerance	900	-	-	mV	at TP1a
Differential Input Return Loss	Equation (83E-5)	-	-	dB	at TP1, Note 2
Differential to Common Mode Input Return Loss	Equation (83E-6)	-	-	dB	at TP1. Note 2
Differential Termination Mismatch	-	-	10	%	at TP1
ESMW (Eye Symmetry Mask Width)	0.22	-	-	UI	at TP1a
Eye Width	0.22	-	-	UI	at TP1a
Eye Height	32	-	-	mV	at TP1a
Single-ended Input Voltage Tolerance Range	-0.4	-	3.3	V	at TP1a
DC Common Mode Voltage	-350	-	2850	mV	at TP1

Notes:

1. Electrical module output is squelched for loss of optical input signal.
2. IEEE 802.3-2018 Section 6.



Ordering Information

Product Name

SFP-DD-FR1-02

Product Description

SFPDD 100GBASE-FR Single Lambda 1310nm 2km DOM Duplex LC/UPC SMF Optical Transceiver

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