

# DS-16G-ER-Cxx

SFP+, 16/8/4 Gbps FC/FICON, CWDM, SM, DDM, 13dB, 40km

## OVERVIEW

The DS-16G-ER-Cxx fiber optical SFP+ (small form pluggable) transceivers are uniquely layer 1 tested and approved by Cisco. They include a PIN diode and temperature stabilized DFB-EML transmitter. The modules operate at data-rates up to 14.025 Gbps. The CWDM modules operate at nominal Coarse Wavelength Division Multiplexing (CWDM) wavelengths as defined in the ITU-T 694.2 standard. The module has a duplex LC optical interface and all mechanical characteristics are compliant with the current SFP+ specification (SFF-8431 and SFF-8432). All SFP modules fulfill the content of the serial EEPROM described in the SFP MSA, Appendix B4, table 3.1, at base data fields (defined as addresses 0 to 63) and extended data fields (defined as addresses 64 to 95). The nominal transmitter output wavelength is stated at the reserved addresses 60-61 according to SFF document SFF-8472 rev 10.5, "Digital Diagnostics Monitoring Interface". Wavelengths stated in the specification are measured in vacuum. All requirements in this specification are valid throughout the specified lifetime and operational environmental temperature range unless otherwise stated. The transceiver modules are compliant to RoHS-6/6.

## PRODUCT FEATURES

- Layer 1 tested and approved by Cisco
- Up to 14.025 Gbps data-rates
- 8 lambda from 1470nm – 1610nm
- Up to 40km on 9/125um SMF (G.652)
- Rx clock data recovery (CDR) IC
- RX Rate Selection for 16G FC and 8G/4G FC
- Flexibility in RX rate selection through either hardware or software control
- Duplex LC connector
- Compliant with SFP+ MSA
- Hot-pluggable SFP footprint
- Single power supply 3.3V
- RoHS6 Compliant
- Class 1 laser product complies with EN 60825-1
- Operating temperature range: 0°C to 70°C.
- Power consumption <1.8W

## APPLICATIONS

- 16/8/4 Gbps Fibre Channel / FICON
- CWDM, SAN, WAN connectivity

## ORDERING INFORMATION

Part Number	Description
DS-16G-ER-Cxx	SFP+, 16/8/4 Gbps FC/FICON, CWDM, SM, DDM, 13dB, 40km

Subject to change without notice.

For more information visit [smartoptics.com](http://smartoptics.com).

## GENERAL SPECIFICATIONS

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Data Rate	DR	4.25		14.025	Gbps	
Bit Error Rate	BER			10 <sup>-12</sup>		
Operating Temperature	TOP	0		70	°C	Case temperature
Storage Temperature	TSTO	-40		85	°C	Ambient temperature
Supply Current	IS		350	550	mA	For electrical power interface
Rush-in current	IRush			550	mA	
Input Voltage	VCC	3.13	3.3	3.45	V	
Maximum Voltage	VMAX	-0.5		3.6	V	For electrical power interface
Total Power Dissipation			1.5	1.82	W/1	

## OPTICAL CHARACTERISTICS – TRANSMITTER

End of Life, overall operating conditions

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Output Optical Power	$P_{Tx}$	-1		+3	dBm	Average, coupled into 9/125um SMF
Extinction ratio	$E_r$	8.2			dB	
Optical Center Wavelength	$\lambda_c$	According to ITU-T 694.2			nm	±6.5nm
Spectral Width (-20dB)	$\Delta\lambda$			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Transmitter and Dispersion Penalty				2	dB	800ps/nm, 14.025Gb/s
Relative Intensity noise	RIN			-130	dB/Hz	Peak-to-Peak
Launch Power OFF	$P_{off}$			-30	dBm	Average

## OPTICAL CHARACTERISTICS – RECEIVER

End of Life, overall operating conditions

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Optical Receiver Power	$P_{Rx}$			+1	dBm	Average
Optical Center Wavelength	$\lambda_c$	1260		1620	nm	
Receiver Sensitivity @ 14.25GBps	$RX\_SENS1$			-14	dBm	BER<10 <sup>-12</sup> , PRBS 2 <sup>31</sup> -1
Receiver Sensitivity @ 8.5GBps	$RX\_SENS2$			-14	dBm	BER<10 <sup>-12</sup> , PRBS 2 <sup>7</sup> -1
Receiver Sensitivity @ 4.25GBps	$RX\_SENS3$			-14	dBm	BER<10 <sup>-12</sup> , PRBS 2 <sup>7</sup> -1
Loss of Signal-Asserted	$P_{LOS\_A}$			-24	dBm	
Loss of Signal-Deasserted	$P_{LOS\_D}$	-14			dBm	
Loss of Signal-Hysteresis	$P_{LOS\_H}$	1		4	dB	

## ELECTRICAL CHARACTERISTICS – HIGH-SPEED SIGNAL INTERFACE (CML)

End of Life, overall operating conditions

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Input Data Rate		4.25	14.025		Gb/s	

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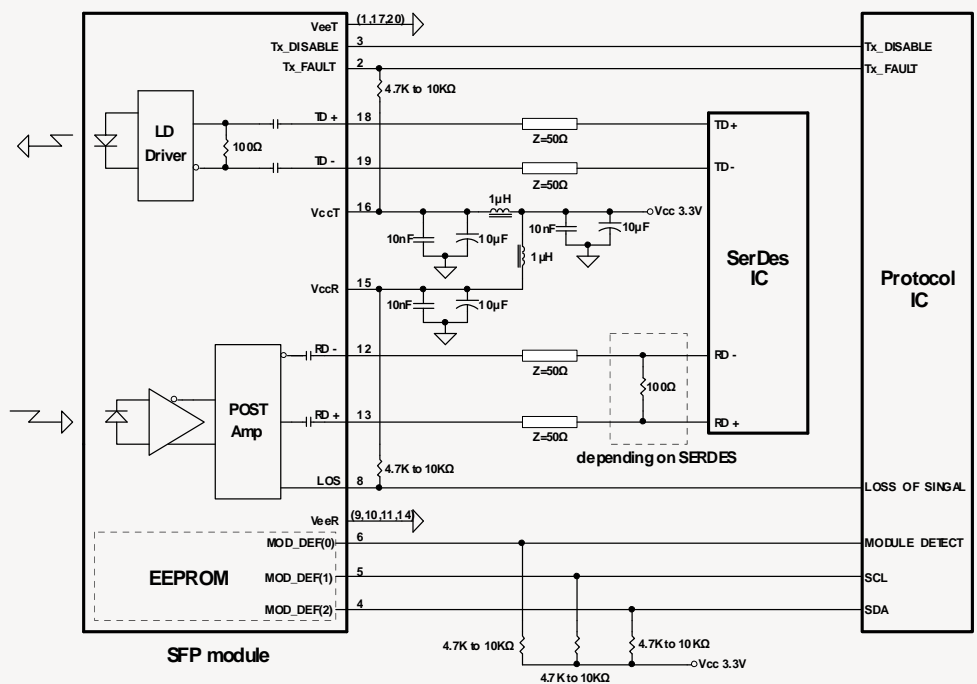
TX Clock Tolerance			±100	ppm	
Differential Input Impedance	$R_{IN}$		100	$\Omega$	
Differential data input amplitude		150	1200	mVpp	Internally AC coupled
Output Data Rate		4.25	14.025	Gb/s	
RX Clock Tolerance			±100	ppm	
Differential Output Impedance	$R_{OUT}$		100	$\Omega$	
Differential data output amplitude		350	600	700	mVpp Internally AC coupled

### ELECTRICAL CHARACTERISTICS – LOW-SPEED SIGNAL INTERFACE (LVTTTL)

End of Life, overall operating conditions

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Input High Voltage		2.0		$V_{CC}+0.3$	V	TX-DIS, TX-FAULT
Input Low Voltage		GND		0.8	V	
Output High Voltage		2.4		$V_{CC}$	V	RX-LOS
Output Low Voltage		GND		0.5	V	

### RECOMMENDED CIRCUIT SCHEMATIC



## PIN FUNCTION DEFINITIONS

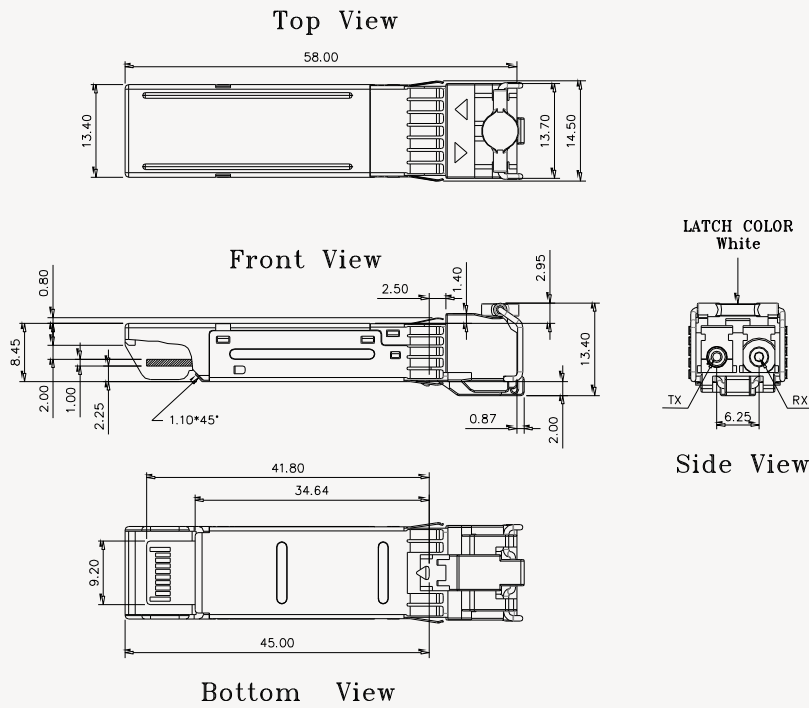
PIN	Signal Name	Description	PIN	Signal Name	Description
1	V <sub>EE</sub> T	Transmitter Signal Ground	11	V <sub>EE</sub> R	Receiver Signal Ground
2	TX_Fault	Transmitter Fault Indication. Logic "1" Output = Laser Fault. Logic "0" Output = Normal Operation	12	RD-	Inverse Receiver Data Out
3	TX_Disable	Logic "1" Input (or no connection) = Laser off, Logic "0" = Laser on.	13	RD+	Receiver Data Out
4	SDA	Modulation Definition 2 – Two wires serial ID Interface	14	V <sub>EE</sub> R	Receiver Signal Ground
5	SDL	Modulation Definition 1 – Two wires serial ID Interface	15	V <sub>CC</sub> R	Receiver Power – 3.3V±5%
6	MOD-ABS	Modulation Definition 0 – Ground in Module	16	V <sub>CC</sub> T	Transmitter Power – 3.3V±5%
7	RS0	RX Rate Select (LVTTTL). Open or Low: 8.5 or 4.25 Gb/s High: enable CDR for 16GFC	17	V <sub>EE</sub> T	Transmitter Signal Ground
8	RX_LOS	Loss of Signal Out (OC).	18	TD+	Transmitter Data In
9	RS1	TX Rate Select (LVTTTL). This pin has an internal 30k pulldown to ground. A signal on this pin will not affect module performance.	19	TD-	Inverse Transmitter Data In
10	V <sub>EE</sub> R	Receiver Signal Ground	20	V <sub>EE</sub> T	Transmitter Signal Ground

## RX RATE SELECT CONTROL

RX rate can be independently controlled by either RS0 input pin (Hardware) or via register write to soft RS0 select bit (Software). RS0 input pin (pin 7) is used to select RX rate. Status of RS0 input pin logic level is reflected to register byte 110 bit 4 on address A2h. RX rate can also be controlled by register write to soft RS0 select bit (byte 110 bit 3 on address A2h). Power on default of soft RS0 select bit is logic low. Hardware and software control inputs are OR'd to allow flexible control. See following RX operation logic table:

<i>RS0 Control Input</i>		<i>RX speed</i>	<i>RX CDR</i>
<i>RS0 Input Pin (Hardware Pin 7)</i>	<i>Soft RS0 Select Bit (Software Byte 110 Bit 3, A2h)</i>		
0	0	4G/8G FC	Bypassed
0	1		
1	0	16G FC	Enabled
1	1		

MECHANICAL DRAWING



ORDERING INFORMATION (EVEN WAVELENGTHS)

Label part number	Frequency (THz)	Center Wavelength (nm)
DS-16G-ER-C47		1470
DS-16G-ER-C49		1490
DS-16G-ER-C51		1510
DS-16G-ER-C53		1530
DS-16G-ER-C55		1550
DS-16G-ER-C57		1570
DS-16G-ER-C59		1590
DS-16G-ER-C61		1610