

10 Gb/s Single-Mode CWDM SFP+ 40 km Transceiver

SFP+ Series

- 1270 nm to 1610 nm
- Up to 11.3 Gbps data rate
- Up to 40 km transmission distance
- Metal enclosure for lower EMI
- Hot-pluggable SFP+ footprint
- Compliant with SFF 8472
- Low power dissipation
- Digital diagnostic monitoring
- RoHS compliant



ASCENT's CWDM SFP+ transceivers are designed for use in 10-Gigabit Ethernet links with distances up to 80 km over single-mode fiber. These transceivers include a PIN photo detector diode and uncooled CWDM DFB laser transmitter (1260 nm to 1370 nm) or an APD receiver and CWDM EML transmitter (1470 nm to 1610 nm). Digital diagnostic functions are available via an I2C interface. This module is designed for single-mode fiber and operates at wavelengths between 1270 nm to 1610 nm.

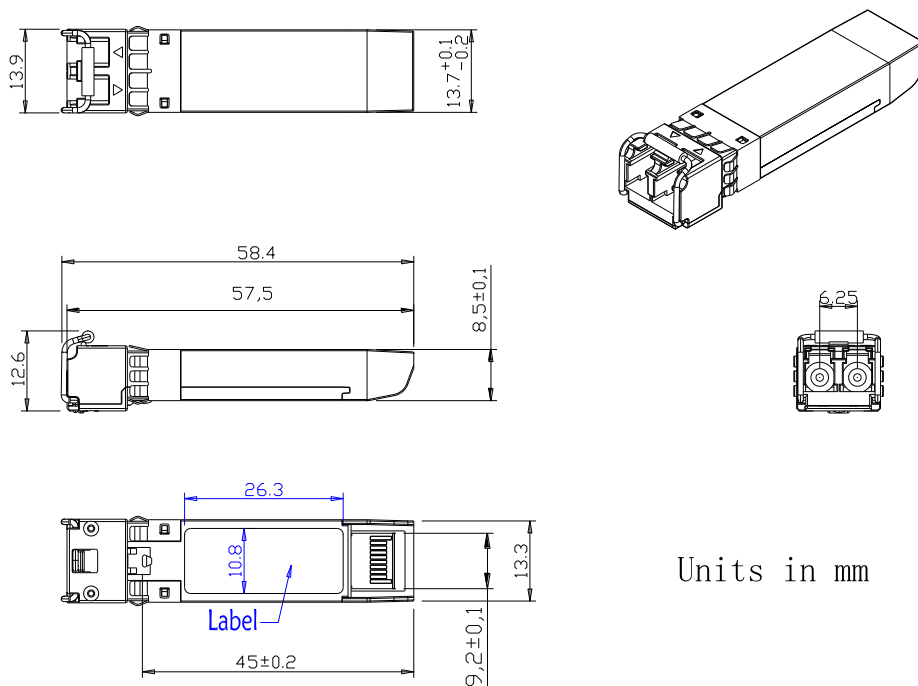
ASCENT SFP+ transceivers provide a unique enhanced digital diagnostic monitoring interface which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, received optical power, and transceiver supply voltage. It also defines a sophisticated system of alarm and warning flags which alerts end users when particular operating parameters are outside of a factory set normal range.

ASCENT's 10G CWDM SFP+ transceivers are compliant with SFF 8472 standards, and offer a convenient solution for 10GBASE-LR/LW, 10G SONET/SDH, and OTU2/2e applications.

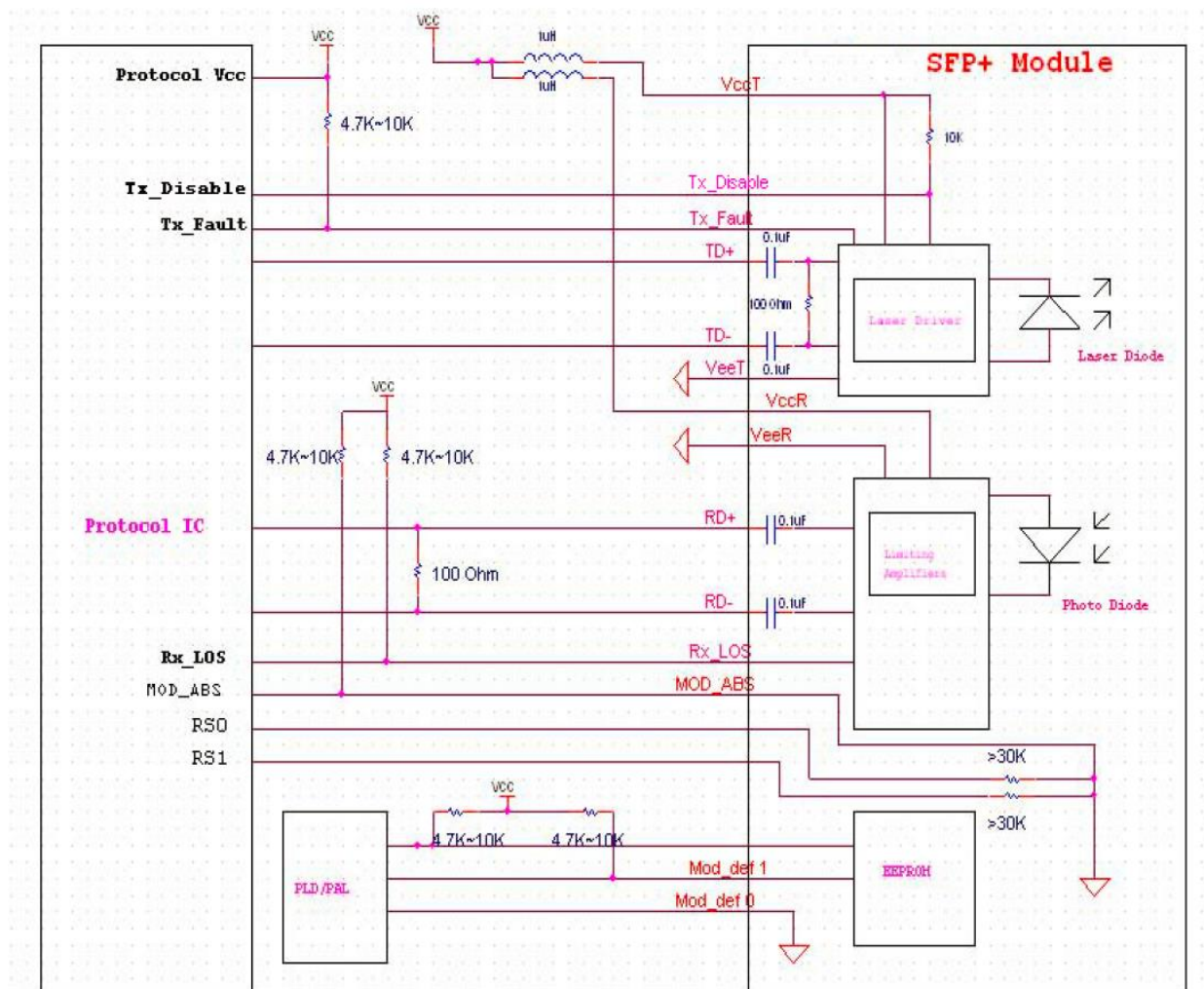
Key Features

- Up to 11.3 Gbps Data Links
- Up to 40 km transmission on SMF
- Uncooled CWDM DFB Laser and PIN receiver (1270 nm to 1370 nm)
- CWDM EML transmitter and PIN receiver (1470 nm to 1610 nm)
- Metal enclosure for lower EMI
- 2-wire interface with integrated Digital Diagnostic monitoring
- Hot-pluggable SFP+ footprint
- Specifications compliant with SFF 8472
- Compliant with SFP+ MSA with LC connector
- Single 3.3 V power supply
- Commercial/Industrial case operating temperature range: 0 °C to +70 °C / -40 °C to +85 °C
- Without CDR (standard) or with CDR supported 9.95 Gb/s to 11.3Gb/s reference-free

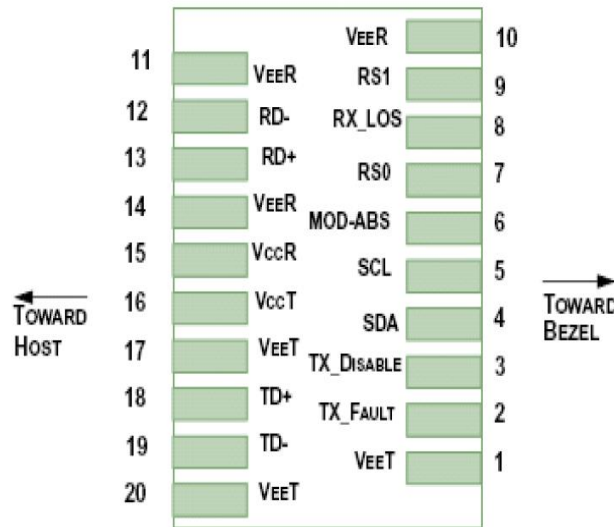
Outline Dimensions



Host - Transceiver Interface Block Diagram



Pin Assignment



Pin	Symbol	Name/Description	Note
1	V _{EET}	Transmitter Ground (Common with Receiver Ground)	1
2	T _{FAULT}	Transmitter Fault	2
3	T _{DIS}	Transmitter Disable. Laser output disabled on high or open.	3
4	SDA	2-wire Serial Interface Data Line	4
5	SCL	2-wire Serial Interface Clock Line	4
6	MOD_ABS	Module Absent. Grounded within the module	4
7	RS0	No connection	
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation.	6
9	RS1	Internally connect to circuit ground	
10	V _{EEr}	Receiver Ground (Common with Transmitter Ground)	1
11	V _{EEr}	Receiver Ground (Common with Transmitter Ground)	1
12	RD-	Receiver Inverted DATA out. AC Coupled	
13	RD+	Receiver Non-inverted DATA out. AC Coupled	
14	V _{EEr}	Receiver Ground (Common with Transmitter Ground)	1
15	V _{CCR}	Receiver Power Supply	
16	V _{CCT}	Transmitter Power Supply	
17	V _{EET}	Transmitter Ground (Common with Receiver Ground)	1
18	TD+	Transmitter Non-Inverted DATA in. AC Coupled.	
19	TD-	Transmitter Inverted DATA in. AC Coupled.	
20	V _{EET}	Transmitter Ground (Common with Receiver Ground)	1

Notes:

1. Circuit ground is internally isolated from chassis ground.
2. T_{FAULT} is an LVTTTL output. A high output indicates a transmitter fault caused by either the TX bias current or the TX output power or the laser temperature exceeding the preset alarm thresholds. A low output

indicates normal operation. In the low state, the output is pulled to <0.8 V. Laser output disabled on T_{DIS} > 2.0 V or open, enabled on $T_{DIS} < 0.8$ V.

3. Laser output disabled on $T_{DIS} > 2.0$ V or open, enabled on $T_{DIS} < 0.8$ V.
4. Should be pulled up with 4.7 k Ω to 10 k Ω on host board to a typical 3.3 V voltage. MOD_ABS pulls line low to indicate module is plugged in.
5. LOS is open collector output. It should be pulled up with 4.7 k Ω to 10 k Ω on host board to a voltage between 2.0 V and 3.6 V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

Digital Diagnostic Functions

ASCENT SFPP-ATLP-CXX-40 transceivers support the 2-wire serial communication protocol as defined in the SFP+ MSA.

The standard SFP serial ID provides access to identification information that describes the transceiver's capabilities, standard interfaces, manufacturer, and other information.

Additionally, ASCENT SFP+ transceivers provide a unique enhanced digital diagnostic monitoring interface which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, received optical power, and transceiver supply voltage. It also defines a sophisticated system of alarm and warning flags which alerts end users when particular operating parameters are outside of a factory set normal range.

The SFP MSA defines a 256-byte memory map in EEPROM that is accessible over a 2-wire serial interface at the 8-bit address $1010000X$ (A0h). The digital diagnostic monitoring interface makes use of the 8-bit address $1010001X$ (A2h), so the originally defined serial ID memory map remains unchanged.

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller (DDTC) inside the transceiver, which is accessed through a 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL, Mod Def 1) is generated by the host. The positive edge clocks data into the SFP transceiver into those segments of the E2PROM that are not write-protected. The negative edge clocks data from the SFP transceiver. The serial data signal (SDA, Mod Def 2) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially.

Specifications

Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Storage Temperature	Ts	-40	-	85	°C	
Relative Humidity	RH	5	-	95	%	
Power Supply Voltage	VCC	-0.3	-	4	V	
Signal Input Voltage		Vcc-0.3	-	Vcc+0.3	V	

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Case Operating Temperature	Tcase	0	-	70	°C	Commercial
		-40	-	85	°C	Industrial
Power Supply Voltage	VCC	3.14	3.3	3.47	V	
Power Supply Current	ICC	-		450	mA	
Data Rate	BR		10.3125	11.3	Gbps	
Transmission Distance	TD		-	40	km	
Coupled fiber	Single-mode fiber					9/125 μm SMF

Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Transmitter						
Average Launched Power (1270 nm to 1370 nm)	P _{OUT}	0		5	dBm	1
Average Launched Power (1470 nm to 1610 nm)	P _{OUT}	-1		3	dBm	2
Extinction Ratio (1270 nm to 1370 nm)	ER	3.5			dB	
Extinction Ratio (1470 nm to 1610 nm)	ER	8.2			dB	
Center Wavelength	λ _c	λ _c -6.5		λ _c +6.5	nm	3
Spectral Width (-20dB)	σ			1.0	nm	
SMSR		30			dB	
Transmitter OFF Output Power (1470 nm to 1610 nm)	P _{off}			-30	dBm	
Transmitter and Dispersion Penalty (1470 nm to 1610 nm)	TDP			2.0	dB	
Output Eye Mask	Compliant with IEEE 802.3ae					
Receiver						
Input Optical Wavelength	λ	1270		1610	nm	
Receiver Sensitivity (1270 nm to 1370 nm)	P _{sen}			-15	dBm	4
Receiver Sensitivity (1470 nm to 1610 nm)				-16		5
Input Saturation Power (Overload) (1270 nm to 1370 nm)	P _{sat}	0.5			dBm	

Input Saturation Power (Overload) (1470 nm to 1610 nm)	Psat	0		dBm
LOS Assert (1270 nm to 1370 nm)	LOSA	-30		dBm
LOS Assert (1470 nm to 1610 nm)	LOSA	-35		dBm
LOS De-Assert (1270 nm to 1370 nm)	LOSD		-17	dBm
LOS De-Assert (1470 nm to 1610 nm)	LOSD		-26	dBm
LOS Detect Hysteresis	PHys	0.5		dB

Notes:

1. Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.
2. Launched power (avg.) is power coupled into a single-mode fiber with master connector. (Before of Life)
3. For λ_c refer to wavelength selection
4. Measured with a PRBS $2^{31}-1$ test pattern, @ 10.325 Gb/s, BER $<10^{-12}$.
5. Measured with conformance test signal for BER = 10^{-12} @ 10.3125 Gbps, PRBS = $2^{31}-1$, NRZ, Optical source with worst ER, Wavelength between 1470 nm and 1610 nm; back to back.

Electrical Characteristics

Parameter	Symbol	Min	Typ.	Max	Unit	Note
Supply Voltage	Vcc	3.14	3.3	3.46	V	
Supply Current (Note 1)	Icc			450	mA	1270 nm to 1370 nm
				400	mA	1470 nm to 1610 nm
				460	mA	1470 nm to 1610 nm (industrial)
				430	mA	1470 nm to 1610 nm with CDR
				490	mA	1470 nm to 1610 nm (industrial) with CDR

Transmitter

Input Differential Impedance	Rin		100		Ω	2
Differential Data Input Swing (1270 nm to 1370 nm)	Vin, pp	180		1200	mV	
Differential Data Input Swing (1470 nm to 1610 nm)	Vin, pp	180		700	mV	
Transmit Disable Voltage (1270 nm to 1370 nm)	VDis	Vcc-1.3		Vcc	V	
Transmit Disable Voltage (1470 nm to 1610 nm)	VDis	2.0		Vcc	V	
Transmit Enable Voltage	VEN	Vee		Vee+ 0.8	V	3
Transmit Disable Assert Time				10	μ s	

Receiver

Differential Data Output Swing (1270 nm to 1370 nm)	Vout, pp	300	850	mV	4
Differential Data Output Swing (1470 nm to 1610 nm)	Vout, pp	400	800	mV	4
Data Output Rise Time (1270 nm to 1370 nm)	tr	30		ps	5
Data Output Rise Time (1470 nm to 1610 nm)	tr	30		ps	5
Data Output Fall Time (1270 nm to 1370 nm)	tf	28		ps	5
Data Output Fall Time (1470 nm to 1610 nm)	tf	28		ps	5
LOS Fault (1270 nm to 1370 nm)	V _{LOS_fault}	Vcc-1.3	V _{CCHOST}	V	6
LOS Output High Level (1470 nm to 1610 nm)	V _{LOS-H}	2.0	V _{CCHOST}	V	6
LOS Normal (1270 nm to 1370 nm)	V _{LOS_norm}	Vee	Vee+0.8	V	6
LOS Output Low Level (1470 nm to 1610 nm)	V _{LOS-L}	Vee	Vee+0.8	V	6

Notes:

1. Measured with receive Pin = Psen, Vcc = 3.3 V, operation temperature range, without air flow.
2. Connected directly to TX data input pins. AC coupled.
3. Or open circuit.
4. Input 100 Ω differential termination.
5. These are unfiltered 20 % to 80 % values.
6. Loss Of Signal is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

Regulatory Compliance

Feature	Reference	Performance
Electrostatic Discharge (ESD)	IEC/EN 61000-4-2	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN 550222 Class B (CISPR 22a)	Compatible with standards
Laser Eye Safety	FDA 21CFR 1040.10, 1040.11 IEC/EN 60825-1, 2	Class 1 laser product
Component Recognition	IEC/EN 60950, UL	Compatible with standards
RoHS	2002/95/EC	Compatible with standards
EMC	EN61000-3	Compatible with standards

Ordering Information

Product part Number	Media	Wavelength (nm)	Transmission Distance	Temperature Range (Tcase)	With/Without CDR
SFPP-ATLP-CXX-40	Single-mode fiber	Refer to wavelength selection	40 km	0 °C to +70 °C	Without CDR
SFPP-ATLP-CXX-40A	Single-mode fiber	Refer to wavelength selection	40 km	-40 °C to +85 °C	Without CDR
SFPP-ATLP-CXX-40C	Single-mode fiber	Refer to wavelength selection	40 km	0 °C to +70 °C	With CDR
SFPP-ATLP-CXX-40CA	Single-mode fiber	Refer to wavelength selection	40 km	-40 °C to +85 °C	With CDR

Note: Max. Transmission Distance is 70 km for input wavelength 1570 nm, 1590 nm, and 1610 nm

Product Name	Product Description
SFPP-ATLP-CXX-40	SFP+ Plug-in, 10Gbps, 40km, TX=CWDM Ch xx (1270 nm to 1610 nm) /RX wide, on two single mode fibers, LC/PC Blue

Wavelength	XX	Clasp Color Code	Wavelength	XX	Clasp Color Code
1270 nm	27	Gray	1330 nm	33	Purple
1290 nm	29	Gray	1350 nm	35	Blue
1310 nm	31	Gray	1370 nm	37	Green
1470 nm	47	Gray	1550 nm	55	Yellow
1490 nm	49	Purple	1570 nm	57	Orange
1510 nm	51	Blue	1590 nm	59	Red
1530 nm	53	Green	1610 nm	61	Brown

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