
Product Specification

10Gb/s 1310nm single-mode SFP+

ASFP6410S31xM

Features:

- 10Gb/s serial optical interface compliant to SONET OC192/SDH STM64 and 802.3ae
- Electrical interface compliant to SFF-8431 specifications for enhanced 8.5 and 10 Gigabit small form factor pluggable module "SFP+"
- 1310nm DFB transmitter, PIN photo-detector
- 2-wire interface for management specifications compliant with SFF 8472 digital diagnostic monitoring interface for optical transceivers
- Operating case temperature:
Commercial: 0°C to 70°C
Industrial: -40°C to 85°C
- Built-in CDR on RX side with very low jitter (<0.18UI) enabling direct and longer



Applications:

- SONET(OC-192)/SDH(STM64) line card
- 10GBASE-LR (10.3125Gbps)
- 10GBASE-LW (9.953Gbps)

Compliance

- Compliant with IEEE 802.3ae-2002 10G Base-LR
- Compliant with SFF-8431 & SFF-8083 & SFF-8432 & SFF 8472

Description:

The ASFP6410S31xM is a very compact 10Gb/s optical transceiver module for serial optical communication applications at 10Gb/s. The ASFP6410S31xM series converts a 10Gb/s serial electrical data stream to 10Gb/s optical output signal and a 10Gb/s optical input signal to 10Gb/s serial electrical data streams. The high speed 10Gb/s electrical interface is fully compliant with XFI specification (built in CDR on both TX and RX) and allows FR4 host PCB trace up to 200mm. The ASFP6410S31xM is designed for use in a variety of 10Gb/s equipment SDH/SONET (9.95

Gb/s), Ethernet LAN (10.3Gb/s) and FC (10.5Gb/s). The customer can adjust interface' electrical level to select 8.5G-11.3G bit rate. The high performance 1310nm DFB transmitter coupled with a high sensitivity PIN receiver provide superior performance for applications up to 10km SMF. The fully compliant SFP form factor provides high density applications, hot pluggability, easy optical port upgrades and low EMI emission. The SFP+ LR w/CDR module electrical interface is compliant to XFI electrical specifications. The transmitter input and receiver output impedance is 100 Ohms differential. Data lines are internally AC coupled. The module provides differential termination and reduce differential to common mode conversion for quality signal termination and low EMI. XFI typically operates over 200 mm of improved FR4 material or up to about 150mm of standard FR4 with one connector.

Specification

● Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Storage Temperature	T _{ST}	-40	+85	°C
Operating Case Temperature	T _C	-40	+85	°C
Rx Input Average Power	P _{max}	-	0	dBm
Supply Voltage	V _{CC3}	-0.5	+3.6	V
Relative Humidity	RH	5	95	%

● Recommend Operation Environment:

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	V _{CC}	+3.135	3.3	+3.465	V
Supply Current	I _{CC}	-	-	300	mA
Power Dissipation	-	-	0.8	1.0	W
Operating Temperature		-40	25	+85	°C
		0	25	+70	°C

● Optical Characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Note
Transmitter						
Date Rate	-	9.95	10.3125	10.7	Gb/s	1
Output Center Wavelength	l _{tc}	1290	1310	1330	nm	
Average output power	P _o	-6	-	-1	dBm	2
Optical Extinction Ratio	ER	6	-	-	dB	2
RMS spectral width	dl	-	-	1	nm	
Side Mode Suppression	SMSR	30	-	-	dB	

Ratio						
Average launch power of Tx OFF	Pave_off	-	-	-30	dBm	2
Generation Jitter 1 (20kHz - 80MHz)				0.15	Ulp-p	2,4
Generation Jitter 2 (4MHz - 80MHz)				0.1	Ulp-p	2,4
Chromatic Dispersion (SONET/SDH)	CD			6.6	ps/nm	
Operating Distance (10G Ethernet)				10	km	
Tx Input Diff Voltage	VI	180		700	mV	
Data Dependent Input Jitter	DDJ			0.1	UI	
Data Input Total Jitter	TJ			0.28	UI	
Eye Mask 1(SONET/SDH)	-	GR-253-CORE/ITU-T G.691				2
Eye Mask 2 (10G Ethernet)	-	IEEE802.3ae				3
Receiver						
Operating Data Rate	-	9.95		10.7	Gb/s	1
Input Center Wavelength	Irc	1260		1565	nm	
Overload	Rovl	0.5			dBm	
Minimum Sensitivity	Pmin		-18	-14.6	dBm	2
RX_LOS Assert Level	RLOSa	-25			dBm	
RX_LOS Deassert Level	RLOSd			-15	dB	
RX_LOS Hysteresis	RLOSh	1		5	dB	
Optical Path Penalty	PN			1	dB	1
Optical Return Loss	ORL	14			dB	
Jitter Tolerance	JTL	GR-253-CORE/ITU-TG.783				
Rx Output Diff Voltage	Vo	300		850	mV	
Rx Output Rise and Fall Time	Tr/Tf	30			ps	
Total Jitter	TJ			0.7	UI	
Deterministic Jitter	DJ			0.42	UI	

Notes:

[1]Data rate tolerance 10GBASE-LR/LW: typ.+/-100ppm

[2]Measured at 10.3125Gbps,Non-framed PRBS2^31-1,NRZ

[3] Measured by using SFP+ evaluation board.

● Control and Status I/O Timing Characteristics

Parameter	Symbol	Min	Max	Unit	Note
TX Disable Assert Time	t_off		10	us	1
TX Disable Negate Time	t_on		1	ms	2
Time to initialize including reset of TX_Fault	t_init		300	ms	3
TX Fault Assert Time	t_fault		100	us	4
TX Disable to Reset	t_reset	10		us	5
LOS Assert Time	t_loss_on		100	us	6
LOS Deassert Time	t_loss_off		100	us	7
Rate-Select Change Time	t_ratesel		10	us	8
Serial ID Clock Rate	f_serial_clock		100	kHz	

Notes:

[1] Time from rising edge of TX Disable to when the optical output falls below 10% of nominal

[2] Time from falling edge of TX Disable to when the modulated optical output rises above 90% of nominal

[3] From power on or negation of TX Fault using TX Disable

[4] Time from fault to TX fault on

[5] Time TX Disable must be held high to reset TX_fault

[6] Time from LOS state to RX LOS assert

[7] Time from non-LOS state to RX LOS deassert.

[8] Time from rising or falling edge of Rate Select input until receiver bandwidth is in conformance with appropriate specification

DITITAL DIAGNOSTIC FUNCTIONS

The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF8472 Rev10.2 with internal calibration mode. For external calibration mode please contact our sales stuff.

● Digital diagnostic specification table

Parameter	Symbol	Min	Max	Unit	Note
Temperature monitor absolute error	DMI_Temp	-3	3	degC	Over operating temp
Laser power monitor absolute error	DMI_TX	-3	3	dB	
RX power monitor absolute error	DMI_RX	-3	3	dB	-1dBm to -15dBm range
Supply voltage monitor absolute error	DMI_VCC	-0.08	0.08	V	Full operating range

Bias current monitor	DMI_Ibias	-10%	10%	mA	
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Pin-out Definition

The SFP+ modules are hot-pluggable. Hot pluggable refers to plugging in or unplugging a module while the host board is powered. The SFP+ host connector is a 0.8 mm pitch 20 position right angle improved connector specified by SFF-8083, or stacked connector with equivalent with equivalent electrical performance. Host PCB contact assignment is shown in Figure 1 and contact definitions are given in below Table.

SFP+ module contacts mates with the host in the order of ground, power, followed by sign al as illustrated by Figure 2 and the contact sequence order listed in Table7.

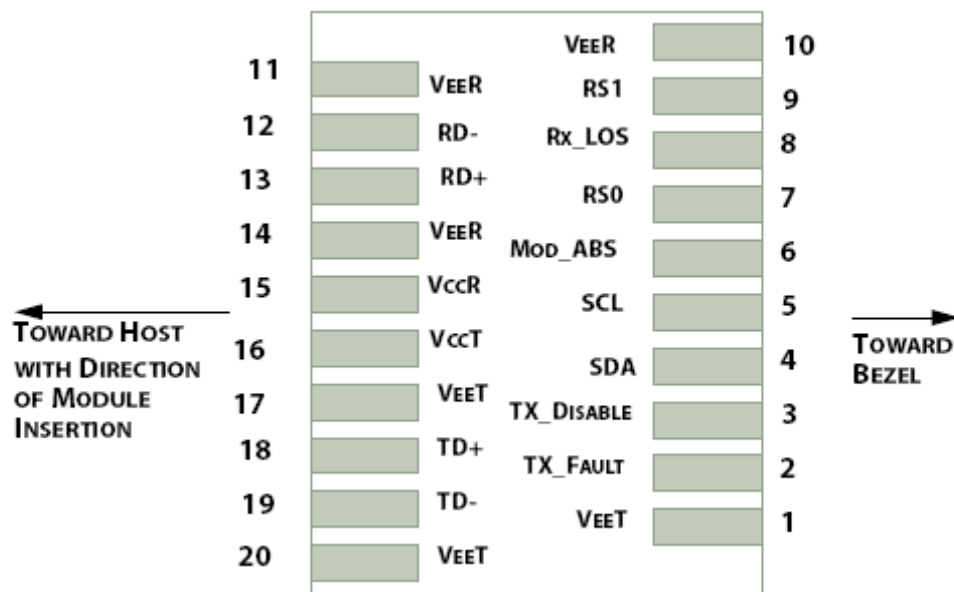


Figure1: Module Interface to Host

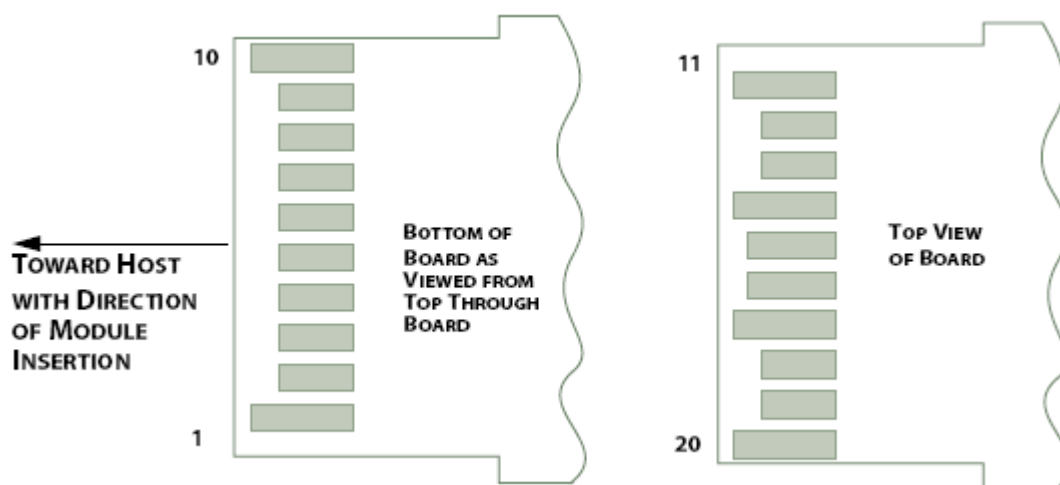


Figure2: Module Contact Assignment

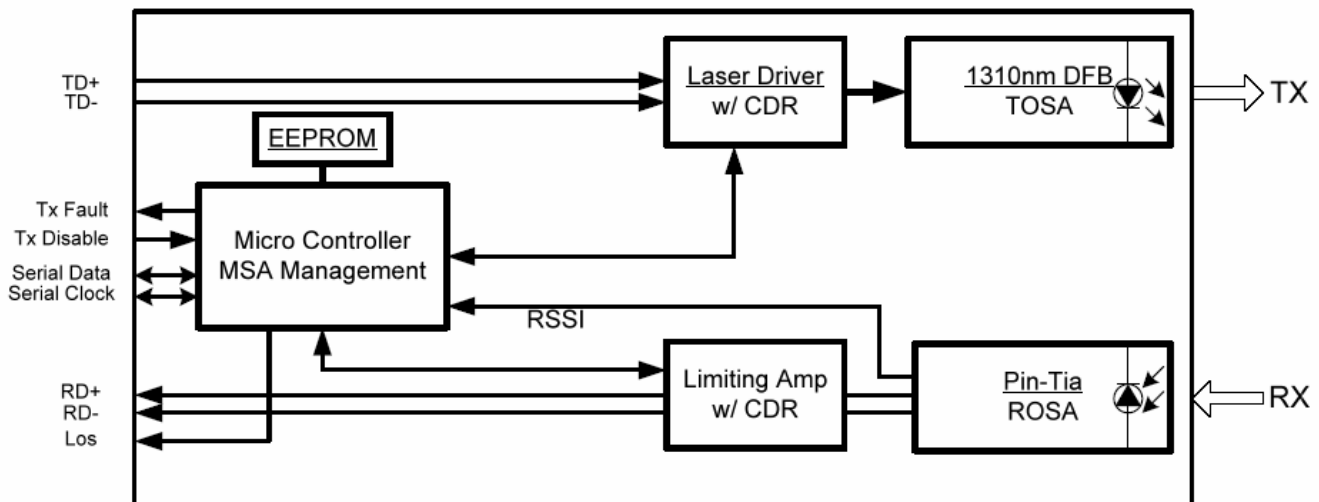
PIN Definitions

PIN	Logic	Symbol	Name / Description	Note
1		VeeT	Module Transmitter Ground	1
2	LVTTL-O	TX_Fault	Module Transmitter Fault	
3	LVTTL-I	TX_Dis	Transmitter Disable; Turns off transmitter laser output	
4	LVTTL-I/O	SDA	2-Wire Serial Interface Data Line	2
5	LVTTL-I	SCL	2-Wire Serial Interface Clock	2
6		MOD_DEF0	Module Definition, Grounded in the module	
7	LVTTL-I	RS0	Receiver Rate Select	
8	LVTTL-O	RX_LOS	Receiver Loss of Signal Indication Active High	
9	LVTTL-I	RS1	Transmitter Rate Select	
10		VeeR	Module Receiver Ground	1
11		VeeR	Module Receiver Ground	1
12	CML-O	RD-	Receiver Inverted Data Output	
13	CML-O	RD+	Receiver Data Output	
14		VeeR	Module Receiver Ground	1
15		VccR	Module Receiver 3.3 V Supply	
16		VccT	Module Receiver 3.3 V Supply	
17		VeeT	Module Transmitter Ground	1
18	CML-I	TD+	Transmitter Non-Inverted Data Input	
19	CML-I	TD-	Transmitter Inverted Data Input	
20		VeeT	Module Transmitter Ground	1

Notes:

- [1] Module ground pins GND are isolated from the module case.
- [2] Shall be pulled up with 4.7K-10Kohms to a voltage between 3.15V and 3.45V on the host board.
- [3] When RS0=0 RS1=0, 8G FC for both TX and RX
 When RS0=0 RS1=1, Bypass CDR in both TX and RX
 When RS0=1 RS1=0, Bypass CDR in both TX and RX
 When RS0=1 RS1=1, 9.95Gbps and 11.3Gbps for both TX and RX.

Block Diagram of Transceiver



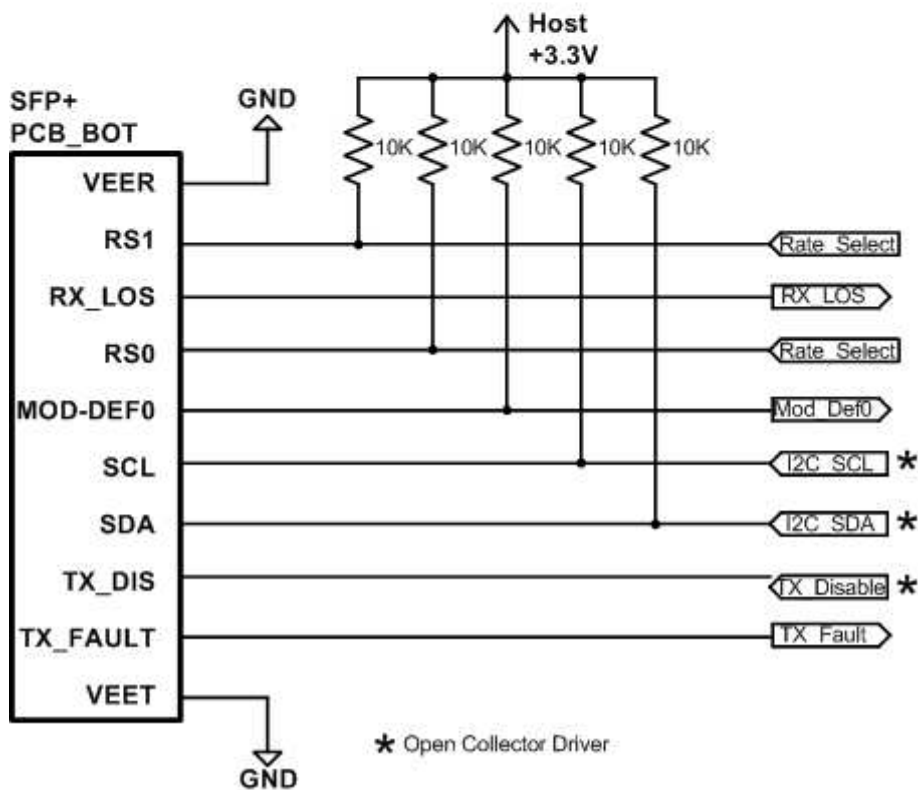
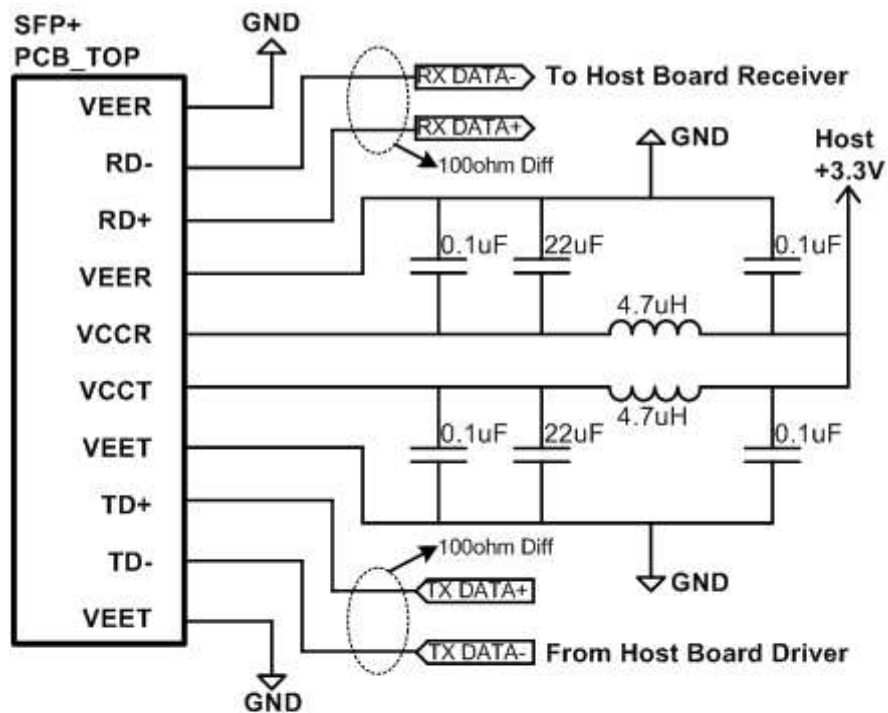
Transmitter Section

The transmitter converts 10Gbit/s serial PECL or CML electrical data into serial optical data compliant with the 10GBASE-LR standard. An open collector compatible Transmit Disable (Tx_Dis) is provided. A logic "1," or no connection on this pin will disable the laser from transmitting. A logic "0" on this pin provides normal operation. The transmitter has an internal automatic power control loop (APC) to ensure constant optical power output across supply voltage and temperature variations. An open collector compatible Transmit Fault (Tx_Fault) is provided. TX_Fault is a module output contact that when high, indicates that the module transmitter has detected a fault condition related to laser operation or safety. The TX_Fault output contact is an open drain/collector and shall be pulled up to the Vcc_Host in the host with a resistor in the range 4.7-10 kΩ. TX_Disable is a module input contact. When TX_Disable is asserted high or left open, the SFP+ module transmitter output shall be turned off. This contact shall be pulled up to VccT with a 4.7 kΩ to 10 kΩ resistor.

Receiver Section

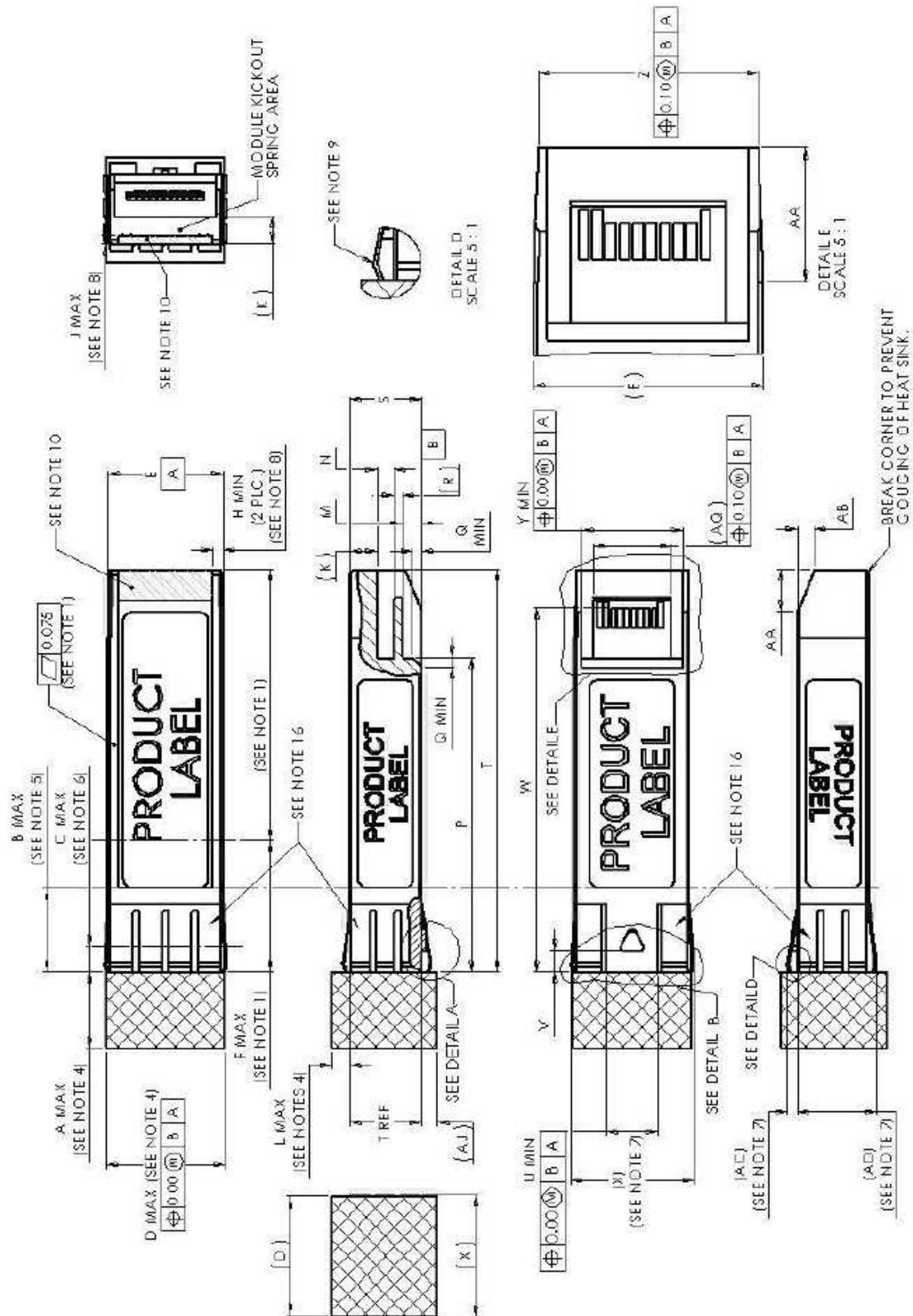
The receiver converts 10Gbit/s serial optical data into serial PECL/CML electrical data. An open collector compatible Loss of Signal is provided. Rx_LOS when high indicates an optical signal level below that specified in the relevant standard. The Rx_LOS contact is an open drain/collector output and shall be pulled up to Vcc_Host in the host with a resistor in the range 4.7-10 kΩ, or with an active termination. Power supply filtering is recommended for both the transmitter and receiver. The Rx_LOS signal is intended as a preliminary indication to the system in which the SFP+ is installed that the received signal strength is below the specified range. Such an indication typically points to non-installed cables, broken cables, or a disabled, failing or a powered off transmitter at the far end of the cable.

Recommended Interface Circuit



Dimensions

Comply to SFF-8432 rev. 5.0, the improved Pluggable form factor specification



Key Mechanical Dimensions

Designator	Dimension (mm)	Tolerance (mm)	Comments
A	10.00	Recommended Maximum	Module length extending outside of cage, see Note 4. Other lengths are application specific.
B	10.00	Maximum	Designated EMI ground spring area, see Note 5
C	3.00	Maximum	EMI spring/Cage Contact Point, see Note 6
D	14.00	Maximum	Module width extending outside of cage, see Note 4
E	13.55	±0.25	Module width
F	15.50	Maximum	Distance to front end of optional heat sink area, see Note 1
H	1.25	Minimum	Top slot distance from edge, see note 8
J	1.00	Maximum	Top slot depth, see note 8
K	3.25	Reference	Height of module kick-out spring area
L	2.10	Maximum	Module top height extending outside of cage see Note 4
M	2.25	±0.10	Distance from bottom of Module to printed circuit board
N	2.00	±0.25	Distance from rear shoulder to printed circuit board
P	37.10	±0.30	Distance from positive stop to bottom opening of Module and beginning of bottom rear relief

Ordering Information

Part No.	Specification								
	Pack	Rate	Tx	Pout	Rx	S	Top	Reach	Others
ASFP6410S31CM	SFP+	10G	1310nm DFB	-6- -1dBm	PIN-TIA	<-14.6dBm	0~70℃	10km	DDM/RoHS
ASFP6410S31IM	SFP+	10G	1310nm DFB	-6- -1dBm	PIN-TIA	<-14.6dBm	-40~85℃	10km	DDM/RoHS

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