



### Features

- Compliant with SONET/SDH Standard
- Compliant with Fast Ethernet standard
- Industry standard small form pluggable (SFP) package
- Duplex LC connector
- Differential LVPECL inputs and outputs
- Single power supply 3.3V
- TTL signal detect indicator
- Hot Pluggable
- Class 1 laser product complies with EN 60825-1
- RoHS Compliant

### Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Units	Note
Storage Temperature	$T_S$	-40	85	°C	
Supply Voltage	$V_{CC}$	-0.5	4.0	V	
Input Voltage	$V_{IN}$	-0.5	$V_{CC}$	V	
Output Current	$I_o$	---	50	mA	
Operating Current	$I_{OP}$	---	400	mA	

### Recommended Operating Conditions

Parameter	Symbol	Min.	Max.	Units	Note
Operating Case Temperature	$T_C$	0	70	°C	OP6A-S60-13-C
		-40	85	°C	OP6A-S60-13-I
Supply Voltage	$V_{CC}$	3.1	3.5	V	
Supply Current	$I_{TX} + I_{RX}$	---	300	mA	

### Transmitter Electro-optical Characteristics

$V_{CC} = 3.1\text{ V to }3.5\text{ V}$ ,  $T_c = 0\text{ }^\circ\text{C to }70\text{ }^\circ\text{C}$  (-40 °C to 85 °C)

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Data Rate	$B$	50	155	200	Mb/s	
Output Optical Power 9/125 $\mu\text{m}$ fiber	$P_{out}$	-5	---	0	dBm	Average
Extinction Ratio	$ER$	10	---	---	dB	
Center Wavelength	$\lambda_C$	1270	1310	1355	nm	
Spectral Width (RMS)	$\Delta\lambda$	---	---	2.5	nm	
Rise/Fall Time, (10–90%)	$T_{r,f}$	---	1	2	ns	
Max. $P_{out}$ TX-DISABLE Asserted	$P_{OFF}$	---	---	-45	dBm	
Output Eye	Compliant with Telcordia GR-253-CORE Issue 3 and ITU-T recommendation G-957					
Differential Input Voltage	$V_{DIFF}$	0.4	---	2.0	V	

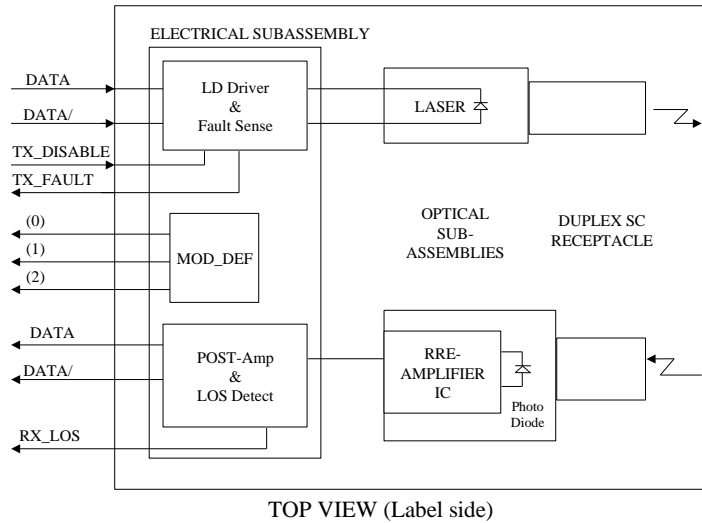
### Receiver Electro-optical Characteristics

$V_{CC} = 3.1 \text{ V to } 3.5 \text{ V}$ ,  $T_c = 0^\circ \text{ C to } 70^\circ \text{ C}$  ( $-40^\circ \text{ C to } 85^\circ \text{ C}$ )

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Data Rate	$B$	50	155	200	Mb/s	
Optical Input Power-maximum	$P_{IN}$	0	---	---	dBm	Note 1
Optical Input Power-minimum (Sensitivity)	$P_{IN}$	---	---	-35	dBm	Note 1
Operating Center Wavelength	$\lambda_C$	1260	---	1600	nm	
Data Output Rise, Fall Time (10%–90%)	$T_{r,f}$	---	1	2	ns	
Loss of Signal-Asserted	$P_A$	---	---	-35	dBm	
Loss of Signal-Deasserted	$P_D$	-45	---	---	dBm	
Loss of Signal-Hysteresis	$P_A - P_D$	1.0	---	---	dB	
Differential Output Voltage	$V_{DIFF}$	0.5	---	1.2	V	
Receiver Loss of Signal Output Voltage-Low	$RX\_LOS_L$	0	---	0.5	V	
Receiver Loss of Signal Output Voltage-High	$RX\_LOS_H$	2.4	---	$V_{CC}$	V	

Note 1: The input data is at 155.52 Mbps,  $2^{23}-1$  PRBS data pattern. The receiver is guaranteed to provide output data with Bit Error Rate (BER) better than or equal to  $1 \times 10^{-10}$ .

## Block Diagram of Transceiver



### Transmitter Section

The transmitter section consists of a 1310 nm InGaAsP laser in an eye safe optical subassembly (OSA) which mates to the fiber cable. The laser OSA is driven by a LD driver IC which converts differential input LVPECL logic signals into an analog laser driving current.

### TX\_DISABLE

The TX\_DISABLE signal is high (TTL logic "1") to turn off the laser output. The laser will turn on when TX\_DISABLE is low (TTL logic "0").

### Receiver Section

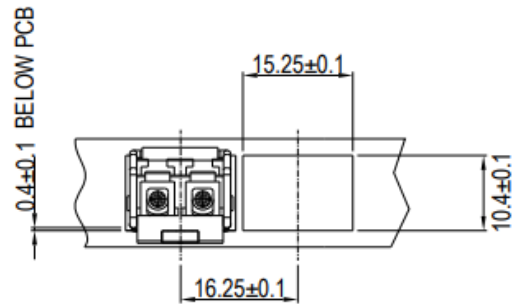
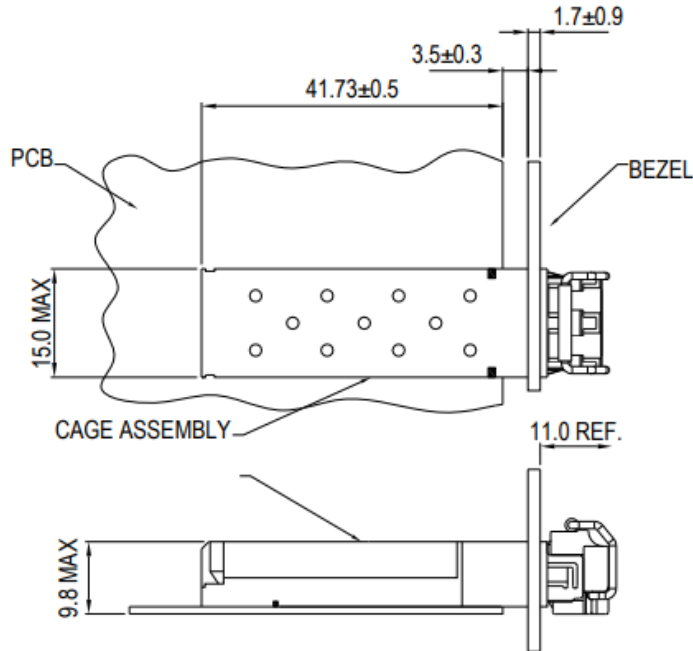
The receiver utilizes InGaAs PIN photodiode mounted together with a trans-impedance preamplifier in an OSA. This OSA is connected to a circuit providing post-amplification quantization, and optical signal detection.

### Receive Loss (RX\_LOS)

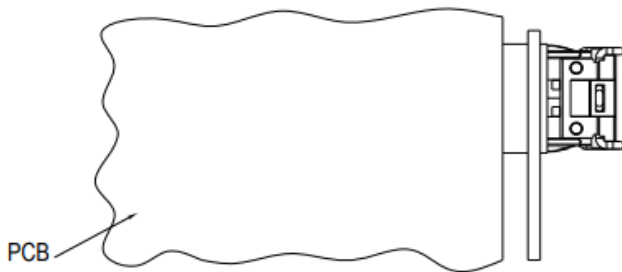
The RX\_LOS is high (logic "1") when there is no incoming light from the companion transceiver. This signal is normally used by the system for the diagnostic purpose. The signal is operated in TTL level.



**Assembly Drawing**



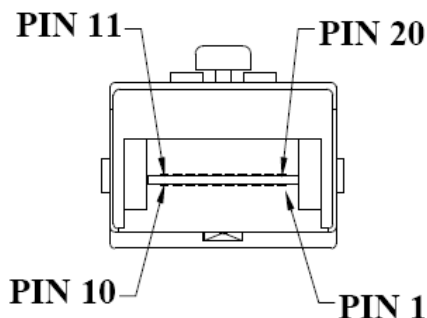
MSA-SPECIFIED BEZEL



DIMENSIONS ARE IN MILLIMETERS

Unit: mm

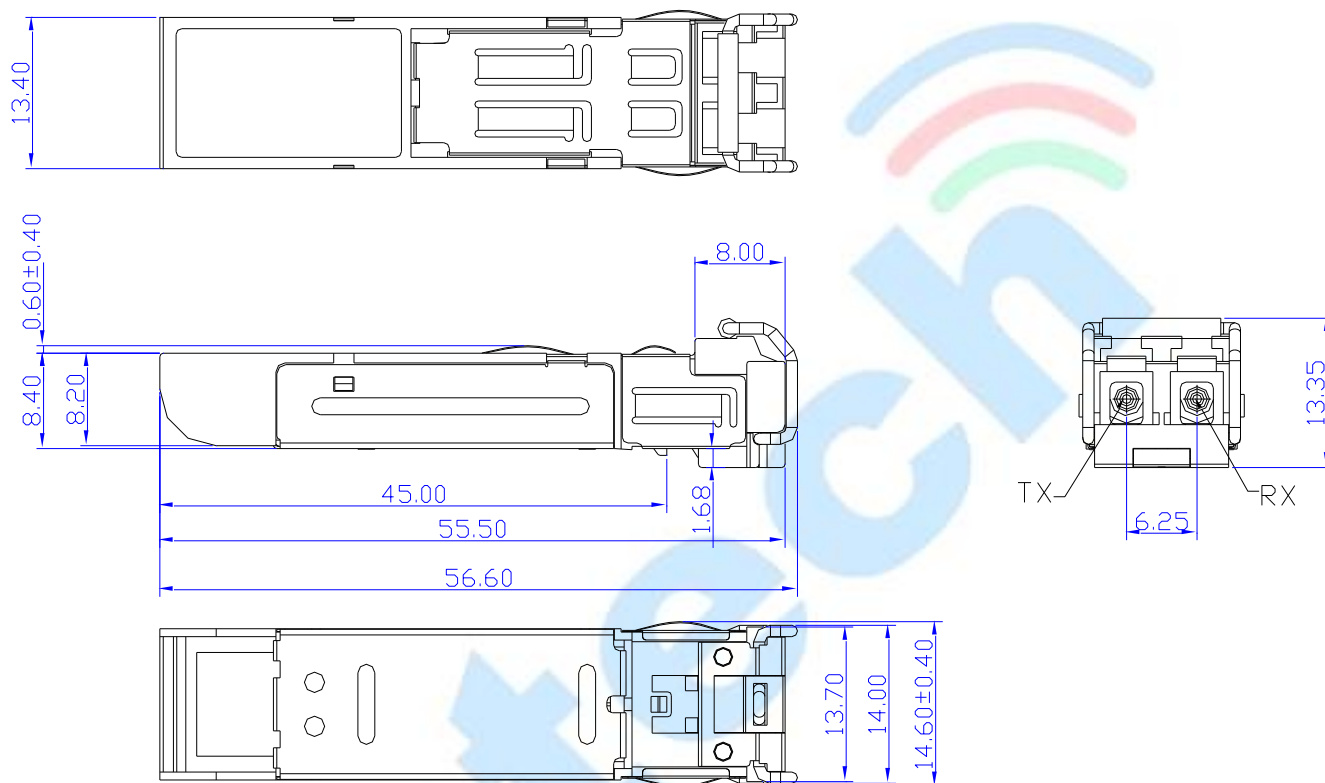
## Pin Assignment



## Pin Descriptions

Pin	Signal Name	Description
1	T <sub>GND</sub>	Transmitter Ground
2	TX_FAULT	Transmit Fault
3	TX_DISABLE	Transmit Disable
4	MOD_DEF(2)	SDA Serial Data Signal
5	MOD_DEF(1)	SCL Serial Clock Signal
6	MOD_DEF(0)	TTL Low
7	RATE SELECT	Open Circuit
8	RX_LOS	Receiver Loss of Signal, TTL High, Open collector
9	R <sub>GND</sub>	Receiver Ground
10	R <sub>GND</sub>	Receiver Ground
11	R <sub>GND</sub>	Receiver Ground
12	RX-	Receive Data Bar, Differential PECL, ac coupled
13	RX+	Receive Data, Differential PECL, ac coupled
14	R <sub>GND</sub>	Receiver Ground
15	V <sub>CCR</sub>	Receiver Power Supply
16	V <sub>CCT</sub>	Transmitter Power Supply
17	T <sub>GND</sub>	Transmitter Ground
18	TX+	Transmit Data, Differential PECL, ac coupled
19	TX-	Transmit Data Bar, Differential PECL, ac coupled
20	T <sub>GND</sub>	Transmitter Ground

**Dimensions**



**DIMENSIONS ARE IN MILLIMETERS**

**ALL DIMENSIONS ARE ± 0.2mm UNLESS OTHERWISE SPECIFIED**



**Ordering Information**

<b>OP</b>	<b>6</b>	<b>A</b>	<b>-</b>	<b>S</b>	<b>60</b>	<b>-</b>	<b>13</b>	<b>-</b>	<b>C</b>	<b>M</b>
	↑	↑		↑	↑		↑		↑	↑
<b>Product Code:</b>	<b>Data Rate:</b>	<b>Type:</b> S=Single-mode; M=Multi-mode; W=BWDM; B=DUAL-BWDM; C=CWDM; D=DWDM; T=Copper-T (RJ-45); E=GEPON ONU; F=GEPON OLT; G=GPON ONU; H=GPON OLT; X=MMF/SMF	<b>Reach:</b>	<b>Wavelength:</b>	<b>Operating Temperature:</b>	<b>Additional Feature:</b>				
5=GBIC; 6=SFP-LC; 7=XFP; 8=XENPAK; 9=X2; A=SFP+ (SFP28); C=QSFP+ (QSFP28); F=CFP; G=CFP2; H=CFP4; P=SFP-SC; Q=SFP-MTRJ	A=155Mb/s; B=622Mb/s; C=1.25Gb/s; D=2.125Gb/s; E=2.5Gb/s; F=4.25Gb/s; G=3.1Gb/s; J=2.97G; P=6.144G; Q=7.37G; H=8.5Gb/s; K=10Gb/s; T=1/10Gb/s; L=16Gb/s; R=20Gb/s; X=25Gb/s; S=40Gb/s; W=100Gb/s (4x25G or 10x10G); M=100Base-X SGMII; N=100/1000Base-X SGMII;	X1=Under 150m; X2=220m; X3=300m; X5=550m; O2=2km, 10=10km; 70=70km; A0=100km; C0=120km  CWDM: 20=20dB; 24=24dB; 28=28dB	Normal: 85=850nm; 13=1310nm; 15=1550nm; 00=Copper T (RJ-45)  CWDM: 27=1270nm; 47=1470nm; 61=1610nm  BWDM: B3=Tx1310/Rx1550; B5=Tx1550/Rx1310; B4=Tx1310/Rx1490; B9=Tx1490/Rx1310; 51=Tx1510/Rx1570; 57=Tx1570/Rx1510; 27=Tx1270/Rx1330; 33=Tx1330/Rx1270; B2=Tx1270/Rx1577; B7=Tx1577/Rx1270 T2=2TX1310nm; T3=TX1310nm; T5=TX1550nm  DWDM: 17=Channel 17 34= Channel 34 00=Channel 17-61 Tunable	Normal: 85=850nm; 13=1310nm; 15=1550nm; 00=Copper T (RJ-45)  CWDM: 27=1270nm; 47=1470nm; 61=1610nm  BWDM: B3=Tx1310/Rx1550; B5=Tx1550/Rx1310; B4=Tx1310/Rx1490; B9=Tx1490/Rx1310; 51=Tx1510/Rx1570; 57=Tx1570/Rx1510; 27=Tx1270/Rx1330; 33=Tx1330/Rx1270; B2=Tx1270/Rx1577; B7=Tx1577/Rx1270 T2=2TX1310nm; T3=TX1310nm; T5=TX1550nm  DWDM: 17=Channel 17 34= Channel 34 00=Channel 17-61 Tunable	C=Commercial Purpose (0~70℃); I= Industrial Purpose (Extended Range)	M=Digital Optical Monitoring (DOM) (RX_LOS for Copper TX); F=with Fiber Stub; I=with Isolator; S=Customized Style				

Model Number	Part Number	Reach	Input/Out	Signal Detect	Voltage	Temperature
SFP-155-60	OP6A-S60-13-C	60 km	AC/AC	TTL	3.3V	0°C to 70 °C
SFP-155-60-I	OP6A-S60-13-I	60 km	AC/AC	TTL	3.3V	-40°C to 85 °C

**Note: All information contained in this document is subject to change without notice.**