

# 100BASE-FX SFP 1310nm 2km DOM Industrial Transceiver

DEM-211-LL



## Application

- SONET OC-3/SDH STM-1
- Fast Ethernet
- Other Optical Links

## Features

- Up to 155M b/s Data Links
- Hot-Pluggable
- 1310nm FP Laser Transmitter
- Duplex LC Connector
- RoHS Compliant and Lead Free
- Up to 2 km on 50/125 $\mu$ m MMF
- Single +3.3V Power Supply
- Monitoring Interface Compliant with SFF-8472
- Industrial Operating Temperature Range: -40°C to 85°C

## Description

DEM-211-LL Small Form Pluggable (SFP) modules are based on the SFP Multi Source Agreement (MSA). It is compliant with the Gigabit Ethernet and 100BASE-T standards as specified in IEEE 802.3U and GR-468.

## Product Specifications

### I. Absolute Maximum Ratings

Parameter	Symbol	Min	Typical	Max	Unit
<b>Storage Temperature Range</b>	$T_s$	-40		85	°C
<b>Relative Humidity</b>	RH	0		85	%
<b>Supply Voltage</b>	$V_{cc}$	-0.3		+4	V
<b>Case Operating Temperature</b>	<b>Industrial</b>	$T_{op}$	-40	85	°C

### II. Recommended Operating Environment

Parameter	Symbol	Min	Typical	Max	Unit
<b>Case Operating Temperature</b>	<b>Industrial</b>	$T_c$	-40	85	°C
<b>Supply Voltage</b>	$V_{CCT,R}$	3.0		3.6	V

### III. Electrical Characteristics (T<sub>OP</sub> = 0 to 70°C, V<sub>CC</sub> = 3.00 to 3.60 Volts)

Parameter	Symbol	Min	Type	Max	Unit	Note
<b>Supply Voltage</b>	V <sub>CC</sub>	3.0	3.30	3.60	V	
<b>Supply Current</b>	I <sub>CC</sub>			300	mA	
<b>Inrush Current</b>	I <sub>surge</sub>			I <sub>CC</sub> +30	mA	
<b>Maximum Power</b>	P <sub>max</sub>			1.0	W	

#### Transmitter Section

<b>Input Differential Impedance</b>	R <sub>in</sub>	90	100	110	W	1
<b>Single Ended Data Input Swing</b>	V <sub>in PP</sub>	200		1200	mVp-p	
<b>Transmit Disable Voltage</b>	V <sub>D</sub>	V <sub>CC</sub> - 1.3		V <sub>CC</sub>	V	2
<b>Transmit Enable Voltage</b>	V <sub>EN</sub>	V <sub>EE</sub>		V <sub>EE</sub> + 0.8	V	
<b>Transmit Disable Assert Time</b>	T <sub>dessert</sub>			10	us	

#### Receiver Section

<b>Single Ended Data Output Swing</b>	V <sub>out,pp</sub>	300		1000	mv	3
<b>Data Output Rise Time</b>	t <sub>r</sub>			1300	ps	4
<b>Data Output Fall Time</b>	t <sub>f</sub>			1300	ps	4
<b>LOS Fault</b>	V <sub>losfault</sub>	V <sub>CC</sub> - 0.5		V <sub>CC_host</sub>	V	5
<b>LOS Normal</b>	V <sub>losnorm</sub>	V <sub>EE</sub>		V <sub>EE</sub> +0.5	V	5
<b>Power Supply Rejection</b>	PSR	100			mVpp	6

**Note:**

1. AC coupled.
2. Or open circuit.
3. Into 100 ohm differential termination.
4. 20 – 80 %
5. LOS is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.
6. All transceiver specifications are compliant with a power supply sinusoidal modulation of 20 Hz to 1.5MHz up to specified value applied through the power supply filtering network shown on page 23 of the Small Form-factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), September 14, 2000.

**IV. Optical Parameters** ( $T_{OP} = 0$  to  $70^{\circ}C$ ,  $V_{CC} = 3.00$  to  $3.60$  Volts)

Parameter	Symbol	Min	Type	Max	Unit	Note
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**Transmitter Section**

<b>Center Wavelength</b>	$\lambda_c$	1270	1310	1360	nm	1
<b>Spectral Width</b>	$\sigma$			3	nm	
<b>Optical Output Power</b>	$P_{out}$	-15		-8	dBm	2
<b>Optical Rise/Fall Time</b>	$t_r / t_f$			1300	ps	3
<b>Extinction Ratio</b>	ER	9.2			dB	

**Eye Mask for Optical Output**

Compliant with Eye Mask Defined in IEEE 802.3 standard

**Receiver Section**

<b>Optical Input Wavelength</b>	$\lambda$	1100		1670	nm	
<b>Receiver Overload</b>	$P_{ol}$			-3	dBm	4.5

Parameter	Symbol	Min	Type	Max	Unit	Note
<b>RX Sensitivity</b>	Sen			-32	dBm	4.5
<b>RX_LOS Assert</b>	LOS <sub>A</sub>	-42			dBm	
<b>RX_LOS Deassert</b>	LOS <sub>D</sub>			-33	dBm	
<b>RX_LOS Hysteresis</b>	LOS <sub>H</sub>		2	2.5	dB	

### General Specifications

<b>Data Rate</b>	BR		155		Mb/s	
<b>Bit Error Rate</b>	BER			10 <sup>-12</sup>		
<b>Max. Supported Link Length on 50/125µm MMF@155Mb/s</b>	L <sub>MAX</sub>		2		km	6
<b>Total System Budget</b>	LB	13			dB	7

#### Notes:

- Also specified to meet curves in FC-PI 13.0 Figures 18 and 19, which allow trade-off between wavelength spectral width.
- Class 1 Laser Safety per FDA/CDRH and EN (IEC) 60825 regulations.
- Unfiltered, 20-80%. Complies with IEEE 802.3 (Gig. E), FC 1x and 2x eye masks when filtered.
- Measured with conformance signals defined in FC-PI 13.0 specifications.
- Measured with PRBS 231-1 at 10-12 BER
- Dispersion limited per FC-PI Rev. 13
- Attenuation of 1dB/km is used for the link length calculations. Distances are indicative only. Please refer to the Optical Specifications in Table IV to calculate a more accurate link budget based on specific conditions in your application.

## Digital Diagnostic Monitor Characteristics

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 account manager.

Parameter	Symbol	Min	Max	Unit
<b>Temperature Monitor Absolute Error</b>	DMI_Temp	-3	3	degC
<b>Laser Power Monitor Absolute Error</b>	DMI_TX	-3	3	dB
<b>RX Power Monitor Absolute Error</b>	DMI_RX	-3	3	dB
<b>Supply Voltage Monitor Absolute Error</b>	DMI_VCC	-0.1	0.1	V
<b>Bias Current Monitor Absolute Error</b>	DMI_Ibias	-10%	10%	mA

## Block Diagram Definitions of Transceiver

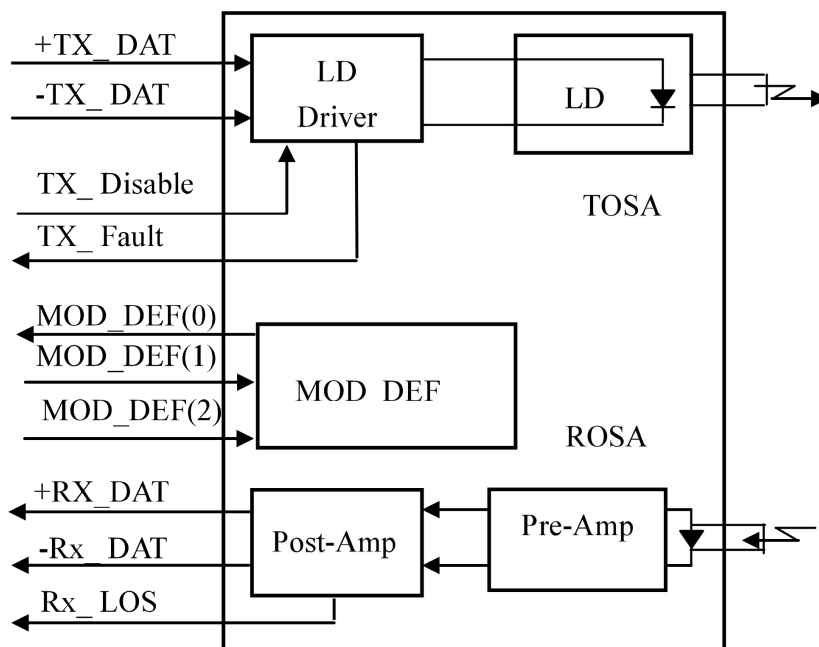


Figure1. Block Diagram

### Pin Assignment

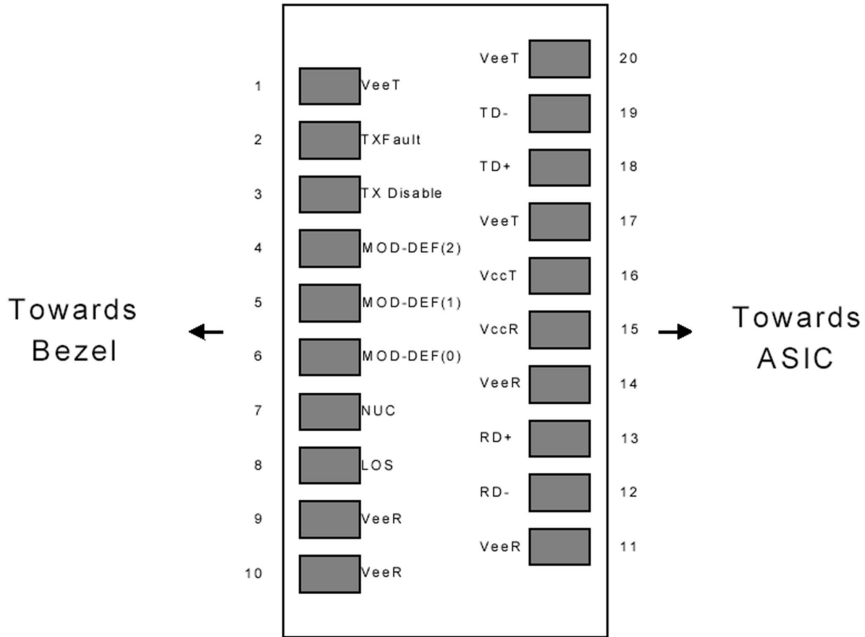


Figure 2. Diagram of Host Board Connector Block Pin Numbers and Names

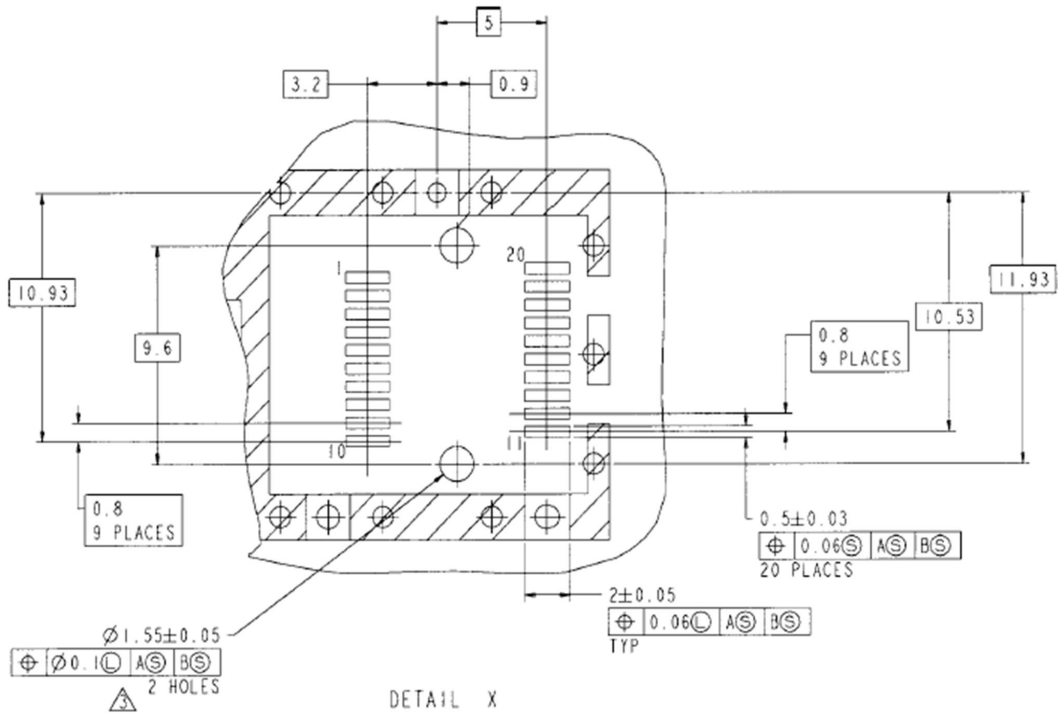


Figure 3. SFP Host Board Mechanical Layout

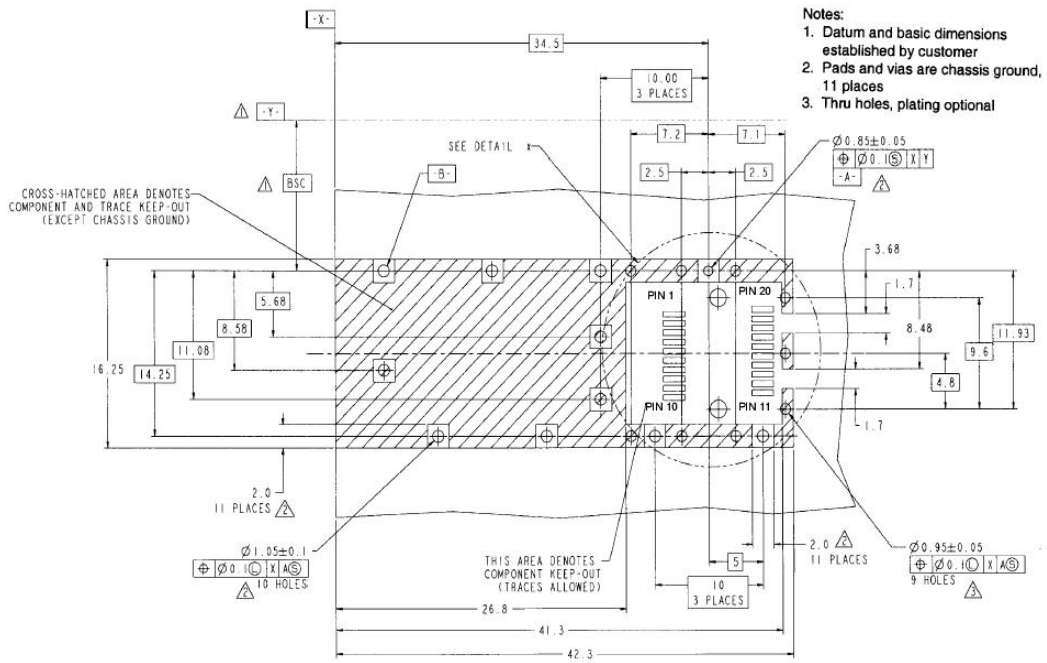


Figure 4. SFP Host Board Mechanical Layout(Cont)

### Pin Description

Pin No	Name	Function	Plug Seq	Notes
1	VeeT	Transmitter Ground	1	1
2	TX Fault	Transmitter Fault Indication	3	
3	TX Disable	Transmitter Disable	3	2
4	MOD-DEF2	Module Definition	2	3
5	MOD-DEF1	Module Definition 1	3	3
6	MOD-DEF0	Module Definition 0	3	3
7	Rate Select	Not Connected	3	4



Pin No	Name	Function	Plug Seq	Notes
8	LOS	Loss of Signal	3	5
9	VeeR	Receiver Ground	1	1
10	VeeR	Receiver Ground	1	1
11	VeeR	Receiver Ground		1
12	RD-	Inv. Received Data Out	3	6
13	RD+	Received Data Out	3	6
14	VeeR	Receiver Ground	3	1
15	VccR	Receiver Power	2	1
16	VccT	Transmitter Power	2	
17	VeeT	Transmitter Ground	1	
18	TD+	Transmit Data In	3	6
19	TD-	Inv. Transmit In	3	6
20	VeeT	Transmitter Ground	1	

**Notes:**

1. Circuit ground is internally isolated from chassis ground.
2. Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
3. Should be pulled up with 4.7k - 10 kohms on host board to a voltage between 2.0V and 3.6V. MOD\_DEF(0) pulls line low to indicate module is plugged in.
4. Rate select is not used
5. LOS is open collector output. Should be pulled up with 4.7k – 10 kohms on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.
6. AC Coupled

### Recommended Circuit

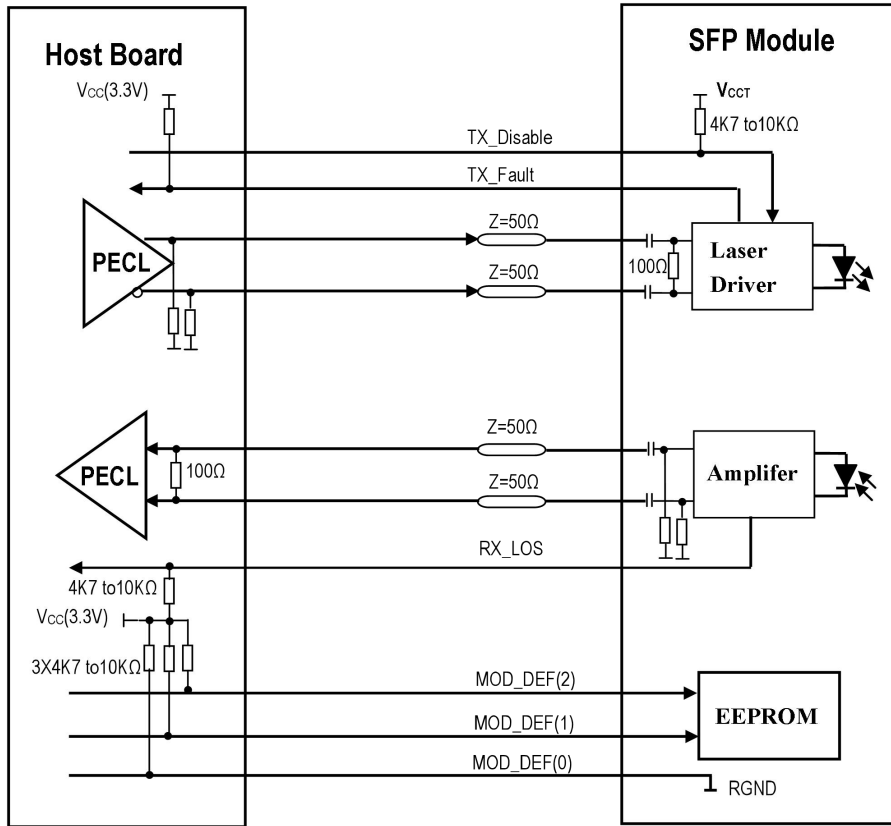


Figure 5. SFP Host Recommended Circuit

### Serial ID Memory Contents

Data Address	Length (Byte)	Name of Length	Description and Contents
<b>Base ID Fields</b>			
0	1	Identifier	Type of Serial transceiver (03h=SFP)
1	1	Reserved	Extended identifier of type serial transceiver (04h)
2	1	Connector	Code of optical connector type (07=LC)
3-10	8	Transceiver	SONET

Data Address	Length (Byte)	Name of Length	Description and Contents
<b>11</b>	1	Encoding	SONET Scrambled
<b>12</b>	1	BR,Nominal	Nominal baud rate, unit of 100Mbps
<b>13</b>	1	Reserved	(0000h)
<b>14</b>	1	Length(9um,km)	Link length supported for 9/125um fiber, units of km
<b>15</b>	1	Length(9um)	Link length supported for 9/125um fiber, units of 100m
<b>16</b>	1	Length(50um)	Link length supported for 50/125um fiber, units of 10m
<b>17</b>	1	Length(62.5um)	Link length supported for 62.5/125um fiber, units of 10m
<b>18</b>	1	Length(Copper)	Link length supported for copper, units of meters
<b>19</b>	1	Reserved	
<b>20-35</b>	16	Vendor Name	SFP vendor name:Longline
<b>36</b>	1	Reserved	
<b>37-39</b>	3	Vendor OUI	SFP transceiver vendor OUI ID
<b>40-55</b>	16	Vendor PN	Part Number:SFP-100FX-31-LL
<b>56-59</b>	4	Vendor rev	Revision level for part number
<b>60-61</b>	2	Wavelength	Laser wavelength
<b>62</b>	1	Reserved	
<b>63</b>	1	CCID	Least significant byte of sum of data in address 0-62

Data Address	Length (Byte)	Name of Length	Description and Contents
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#### Extended ID Fields

<b>64-65</b>	2	Option	Indicates which optical SFP signals are implemented(001Ah = LOS, TX_FAULT, TX_DISABLE all supported)
<b>66</b>	1	BR, max	Upper bit rate margin, units of %
<b>67</b>	1	BR, min	Lower bit rate margin, units of %
<b>68-83</b>	16	Vendor SN	Serial number (ASCII)
<b>84-91</b>	8	Date code	Manufacturing date code
<b>92</b>	1	Diagnostic Type	Diagnostics
<b>93</b>	1	Enhanced Options	Diagnostics
<b>94</b>	1	SFF-8472	Diagnostics
<b>95</b>	1	CCEX	Check code for the extended ID Fields (addresses 64 to 94)

#### Vendor Specific ID Fields

<b>96-127</b>	32	Readable	Vendor specific date, read only
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## Diagnostics Memory Contents (A2h)

Data Address	Length (Byte)	Name of Length	Description and Contents
<b>Diagnostic and Control/Status Fields</b>			
<b>0-39</b>	40	A/W Thresholds	Diagnostic Flag Alarm and Warning Thresholds
<b>40-55</b>	16	Unallocated	
<b>56-91</b>	16	Ext Cal Constants	Diagnostic calibration constants for optional External Calibration
<b>92-94</b>	3	Unallocated	
<b>95</b>	1	CC_DMI	Check code for Base Diagnostic Fields (addresses 0 to 94)
<b>96-105</b>	10	Diagnostics	Diagnostic Monitor Data (internally or externally calibrated)
<b>106-109</b>	4	Unallocated	
<b>110</b>	1	Status/Control	Optional Status and Control Bits
<b>111</b>	1	Reserved	Reserved for SFF-8079
<b>112-113</b>	2	Alarm Flags	Diagnostic Alarm Flag Status Bits
<b>114-115</b>	2	Unallocated	
<b>116-117</b>	2	Warning Flags	Diagnostic Warning Flag Status Bits
<b>118-119</b>	2	Ext Status/Control	Extended module control and status bytes

Data Address	Length (Byte)	Name of Length	Description and Contents
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**General Use Fields**

<b>120-127</b>	8	Vendor Specific	Vendor specific memory addresses
<b>128-247</b>	120	User EEPROM	User writable non-volatile memory
<b>248-255</b>	8	Vendor Control	Vendor specific control addresses

**References**

1. Small Form-factor Pluggable (SFP) Transceiver Multi-source Agreement (MSA) September 14, 2000.
2. Bellcore GR-253 and ITU-T G.957 Specifications.

**Mechanical Dimensions**

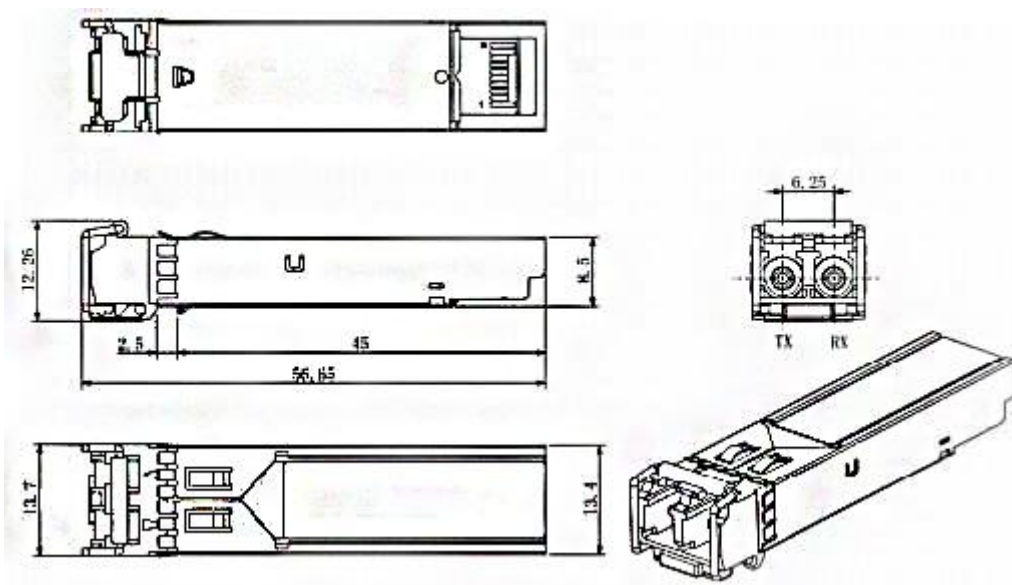


Figure 6. Mechanical Drawing