

**ASFP16-xx-S55xx**

2.488Gbps SFP Optical Transceiver, 40 80 120km Reach

**Features**

- Up to 2.488Gb/s bi-directional data links
- 1550nm DFB laser and PIN or APD photodetector
- Compliant with SFP MSA and SFF-8472 with duplex LC receptacle
- Digital Diagnostic Monitoring:  
Internal Calibration or External Calibration
- Compatible with RoHS
- +3.3V single power supply
- Operating case temperature:  
Standard : 0 to +70°C  
Industry: -40 to +85°C

**Applications**

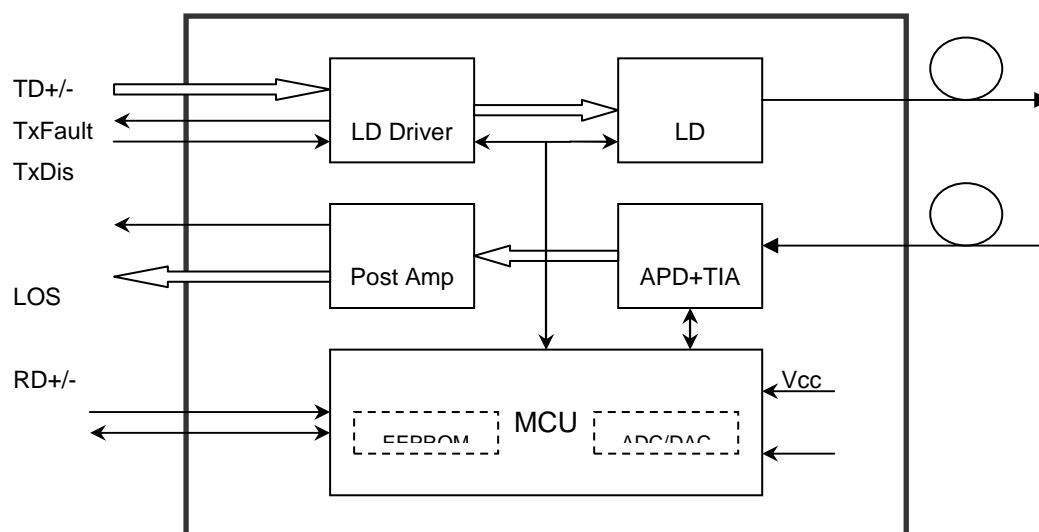
- SDH STM-16 and SONET OC-48 system
- 2X Fiber Channel
- Switch to Switch interface
- Switched backplane applications
- Router/Server interface
- Other optical transmission systems

**Description**

The SFP transceivers are high performance, cost effective modules supporting dual data-rate of 2.488Gbps and 80km transmission distance with SMF.

The transceiver consists of three sections: a DFB laser transmitter, a APD photodiode integrated with a trans-impedance preamplifier (TIA) and MCU control unit. All modules satisfy class I laser safety requirements.

The transceivers are compatible with SFP Multi-Source Agreement (MSA) and SFF-8472. For further information, please refer to SFP MSA.



## Absolute Maximum Ratings

**Table 1 - Absolute Maximum Ratings**

Parameter	Symbol	Min	Max	Unit
Supply Voltage	Vcc	-0.5	4.5	V
Storage Temperature	Ts	-40	+85	℃
Operating Humidity	-	5	85	%

## Recommended Operating Conditions

**Table 2 - Recommended Operating Conditions**

Parameter	Symbol	Min	Typical	Max	Unit
Operating Case Temperature	Standard	Tc	0	+70	℃
	Industry	Tc	-40	+85	℃
Power Supply Voltage	Vcc	3.13	3.3	3.47	V
Power Supply Current	Icc			300	mA
Data Rate			2.488		Gbps

## Optical and Electrical Characteristics

### DFB and PIN, 1550nm, 40km Reach

Parameter		Symbol	Min	Typical	Max	Unit	Notes
Transmitter							
Centre Wavelength		$\lambda_c$	1520	1550	1580	nm	
Spectral Width (-20dB)		$\sigma$			1	nm	
Side Mode Suppression Ratio		SMSR	30			dB	
Average Output Power		P <sub>out</sub>	-2		+3	dBm	1
Extinction Ratio		ER	8.2			dB	
Optical Rise/Fall Time (20%~80%)		tr/tf			0.16	ns	
Data Input Swing Differential		V <sub>IN</sub>	400		1800	mV	2
Input Differential Impedance		Z <sub>IN</sub>	90	100	110	$\Omega$	
TX Disable	Disable		2.0		V <sub>cc</sub>	V	
	Enable		0		0.8	V	
TX Fault	Fault		2.0		V <sub>cc</sub>	V	
	Normal		0		0.8	V	
Receiver							
Centre Wavelength		$\lambda_c$	1260		1580	nm	
Receiver Sensitivity					-20	dBm	3
Receiver Overload			-9			dBm	3
LOS De-Assert		LOS <sub>D</sub>			-21	dBm	
LOS Assert		LOS <sub>A</sub>	-42			dBm	
LOS Hysteresis			0.5			dB	
Data Output Swing Differential		V <sub>out</sub>	370		1800	mV	4
LOS	High		2.0		V <sub>cc</sub>	V	
	Low				0.8	V	

### DFB and APD, 1550nm, 80km Reach

Parameter		Symbol	Min	Typical	Max	Unit	Notes
Transmitter							
Centre Wavelength		$\lambda_c$	1520	1550	1580	nm	
Spectral Width (-20dB)		$\sigma$			1	nm	
Side Mode Suppression Ratio		SMSR	30			dB	
Average Output Power		P <sub>out</sub>	-2		+3	dBm	1
Extinction Ratio		ER	9			dB	

Optical Rise/Fall Time (20%~80%)		tr/tf			0.16	ns	
Data Input Swing Differential		V <sub>IN</sub>	400		1800	mV	2
Input Differential Impedance		Z <sub>IN</sub>	90	100	110	Ω	
TX Disable	Disable		2.0		V <sub>cc</sub>	V	
	Enable		0		0.8	V	
TX Fault	Fault		2.0		V <sub>cc</sub>	V	
	Normal		0		0.8	V	
<b>Receiver</b>							
Centre Wavelength		λ <sub>c</sub>	1260		1580	nm	
Receiver Sensitivity					-28	dBm	3
Receiver Overload			-9			dBm	3
LOS De-Assert		LOS <sub>D</sub>			-29	dBm	
LOS Assert		LOS <sub>A</sub>	-40			dBm	
LOS Hysteresis			0.5			dB	
Data Output Swing Differential		V <sub>out</sub>	370		1800	mV	4
LOS	High		2.0		V <sub>cc</sub>	V	
	Low				0.8	V	

## DFB and APD, 1550nm, 120km Reach

Parameter		Symbol	Min	Typical	Max	Unit	Notes
<b>Transmitter</b>							
Centre Wavelength		λ <sub>c</sub>	1520	1550	1580	nm	
Spectral Width (-20dB)		σ			1	nm	
Side Mode Suppression Ratio		SMSR	30			dB	
Average Output Power		P <sub>out</sub>	+2		+7	dBm	1
Extinction Ratio		ER	8.2			dB	
Optical Rise/Fall Time (20%~80%)		tr/tf			0.16	ns	
Data Input Swing Differential		V <sub>IN</sub>	400		1800	mV	2
Input Differential Impedance		Z <sub>IN</sub>	90	100	110	Ω	
TX Disable	Disable		2.0		V <sub>cc</sub>	V	
	Enable		0		0.8	V	
TX Fault	Fault		2.0		V <sub>cc</sub>	V	
	Normal		0		0.8	V	
<b>Receiver</b>							
Centre Wavelength		λ <sub>c</sub>	1260		1580	nm	

Receiver Sensitivity				-30	dBm	3
Receiver Overload		-9			dBm	3
LOS De-Assert	LOS <sub>D</sub>			-31	dBm	
LOS Assert	LOS <sub>A</sub>	-40			dBm	
LOS Hysteresis		0.5			dB	
Data Output Swing Differential	V <sub>out</sub>	370		1800	mV	4
LOS	High	2.0		V <sub>cc</sub>	V	
	Low			0.8	V	

## Notes:

1. The optical power is launched into SMF.
2. PECL input, internally AC-coupled and terminated.
3. Measured with a PRBS 2<sup>23</sup>-1 test pattern @2488Mbps, BER ≤1×10<sup>-12</sup>.
4. Internally AC-coupled.

## Timing and Electrical

**Table 3 - Timing and Electrical**

Parameter	Symbol	Min	Typical	Max	Unit
Tx Disable Negate Time	t <sub>on</sub>			1	ms
Tx Disable Assert Time	t <sub>off</sub>			10	μs
Time To Initialize, including Reset of Tx Fault	t <sub>init</sub>			300	ms
Tx Fault Assert Time	t <sub>fault</sub>			100	μs
Tx Disable To Reset	t <sub>reset</sub>	10			μs
LOS Assert Time	t <sub>loss_on</sub>			100	μs
LOS De-assert Time	t <sub>loss_off</sub>			100	μs
Serial ID Clock Rate	f <sub>serial_clock</sub>			400	KHz
MOD_DEF (0:2)-High	V <sub>H</sub>	2		V <sub>cc</sub>	V
MOD_DEF (0:2)-Low	V <sub>L</sub>			0.8	V

## Diagnostics

**Table 4 – Diagnostics Specification**

Parameter	Range	Unit	Accuracy	Calibration
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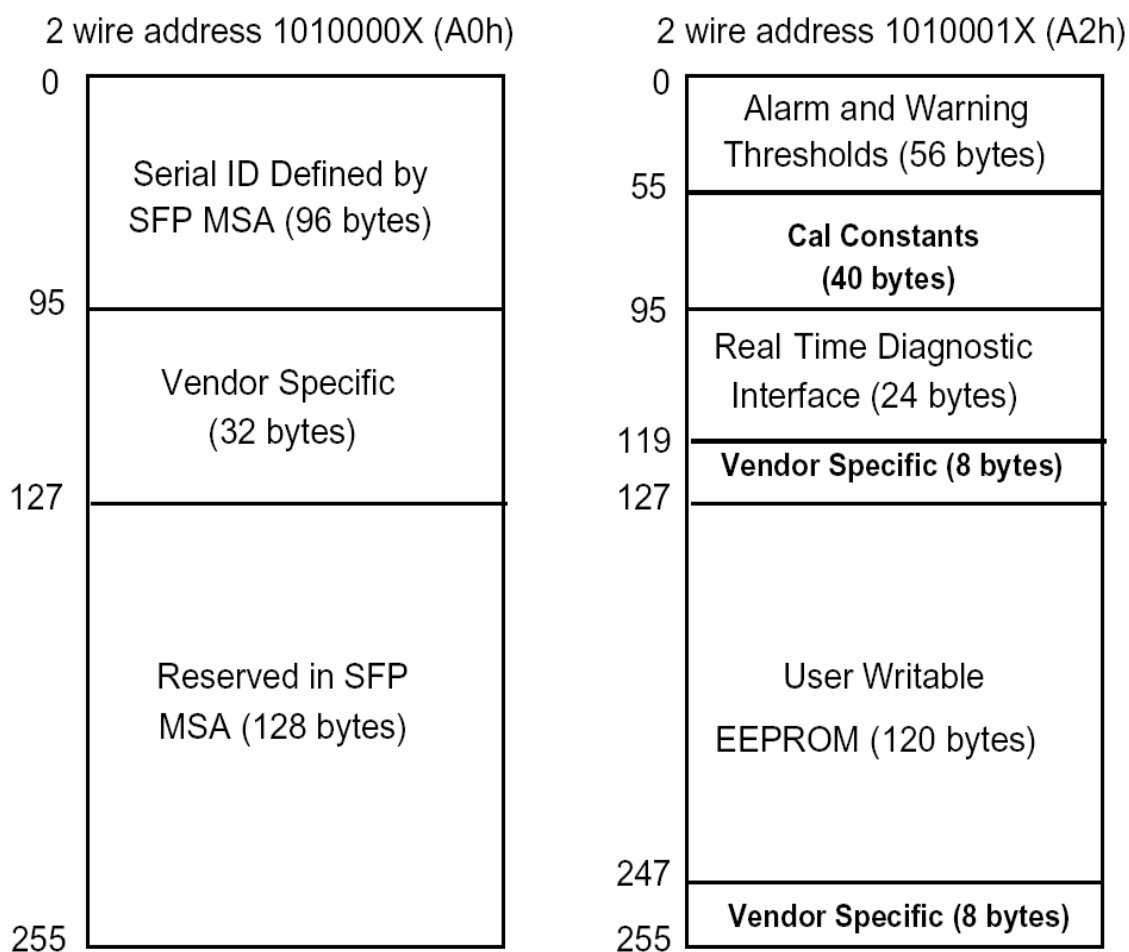
Temperature	0 to +70	℃	±3℃	Internal / External
	-40 to +85			
Voltage	3.0 to 3.6	V	±3%	Internal / External
Bias Current	0 to 100	mA	±10%	Internal / External
TX Power	0 to +5	dBm	±3dB	Internal / External
RX Power	-30 to -9	dBm	±3dB	Internal / External

## Digital Diagnostic Memory Map

The transceivers provide serial ID memory contents and diagnostic information about the present operating conditions by the 2-wire serial interface (SCL, SDA).

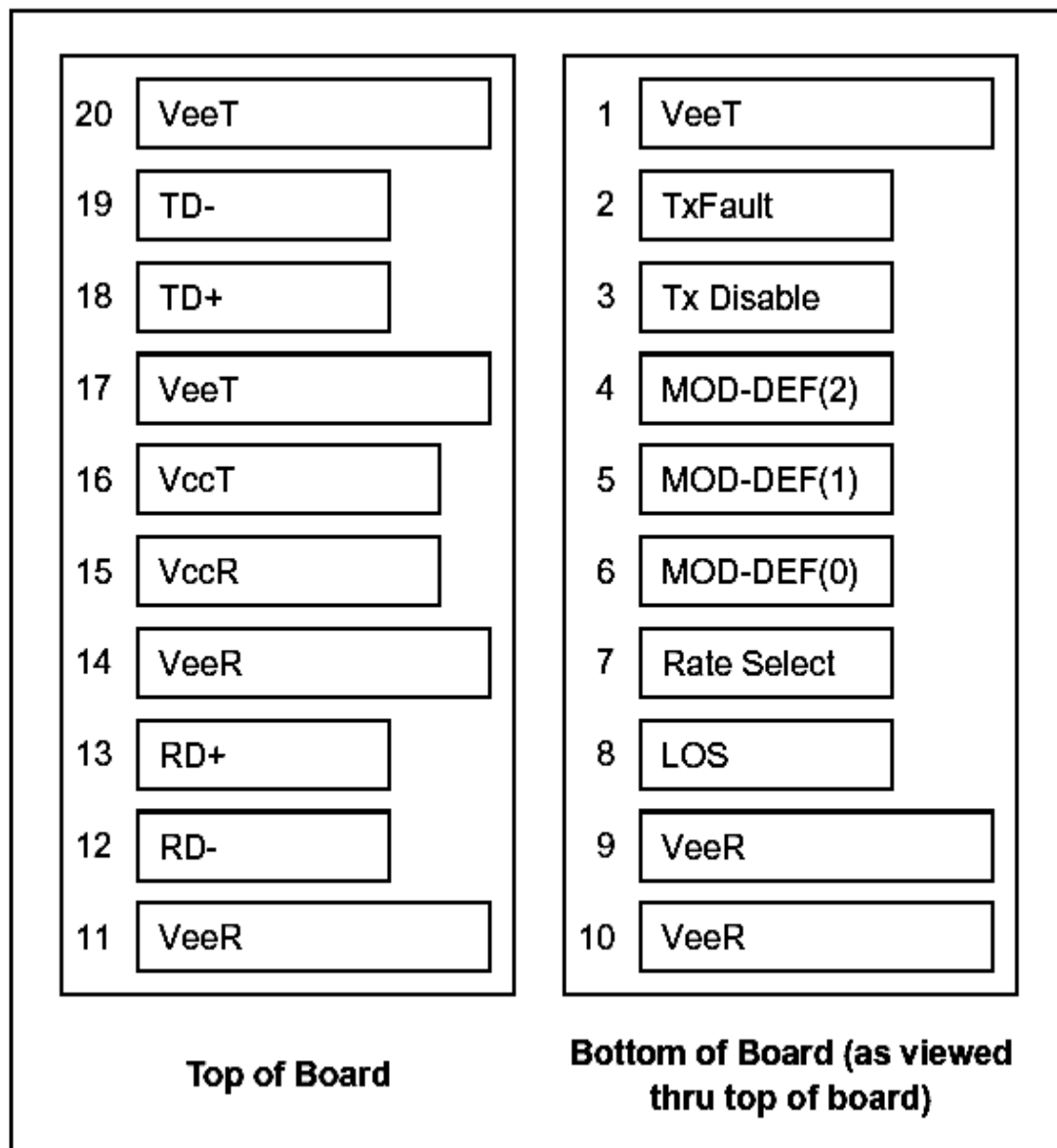
The diagnostic information with internal calibration or external calibration all are implemented, including received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring.

The digital diagnostic memory map specific data field defines as following.



## Pin Definitions

### Pin Diagram



## Pin Descriptions

Pin	Signal Name	Description	Plug Seq.	Notes
1	V <sub>EET</sub>	Transmitter Ground	1	
2	TX FAULT	Transmitter Fault Indication	3	Note 1
3	TX DISABLE	Transmitter Disable	3	Note 2
4	MOD_DEF(2)	SDA Serial Data Signal	3	Note 3
5	MOD_DEF(1)	SCL Serial Clock Signal	3	Note 3
6	MOD_DEF(0)	TTL Low	3	Note 3
7	Rate Select	Not Connected	3	
8	LOS	Loss of Signal	3	Note 4
9	V <sub>EER</sub>	Receiver ground	1	
10	V <sub>EER</sub>	Receiver ground	1	
11	V <sub>EER</sub>	Receiver ground	1	
12	RD-	Inv. Received Data Out	3	Note 5
13	RD+	Received Data Out	3	Note 5
14	V <sub>EER</sub>	Receiver ground	1	
15	V <sub>CCR</sub>	Receiver Power Supply	2	
16	V <sub>CCT</sub>	Transmitter Power Supply	2	
17	V <sub>EET</sub>	Transmitter Ground	1	
18	TD+	Transmit Data In	3	Note 6
19	TD-	Inv. Transmit Data In	3	Note 6
20	V <sub>EET</sub>	Transmitter Ground	1	

### Notes:

Plug Seq.: Pin engagement sequence during hot plugging.

- TX Fault is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor on the host board to a voltage between 2.0V and V<sub>cc</sub>+0.3V. Logic 0 indicates normal operation; Logic 1 indicates a laser fault of some kind. In the low state, the output will be pulled to less than 0.8V.
- TX Disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7k~10kΩ resistor. Its states are:
 

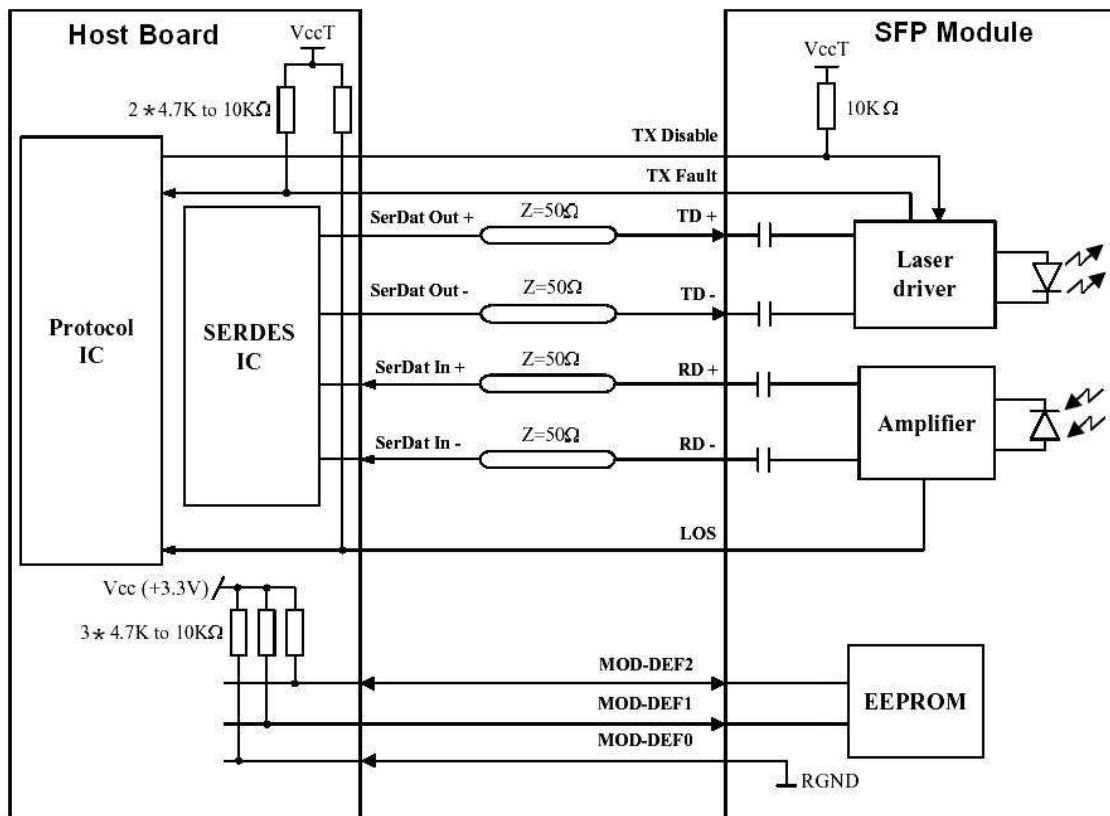
Low (0 to 0.8V):	Transmitter on
(>0.8V, < 2.0V):	Undefined
High (2.0 to 3.465V):	Transmitter Disabled
Open:	Transmitter Disabled
- Mod-Def 0,1,2. These are the module definition pins. They should be pulled up with a 4.7k~10kΩ resistor on the host board. The pull-up voltage shall be V<sub>ccT</sub> or V<sub>ccR</sub>.  
 Mod-Def 0 is grounded by the module to indicate that the module is present  
 Mod-Def 1 is the clock line of two wire serial interface for serial ID  
 Mod-Def 2 is the data line of two wire serial interface for serial ID
- LOS is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor. Pull up voltage between 2.0V and V<sub>cc</sub>+0.3V. Logic 1 indicates loss of signal; Logic 0 indicates normal operation. In the low state, the output will be pulled to less than 0.8V.
- RD-/+ : These are the differential receiver outputs. They are internally AC-coupled 100 differential lines which should be



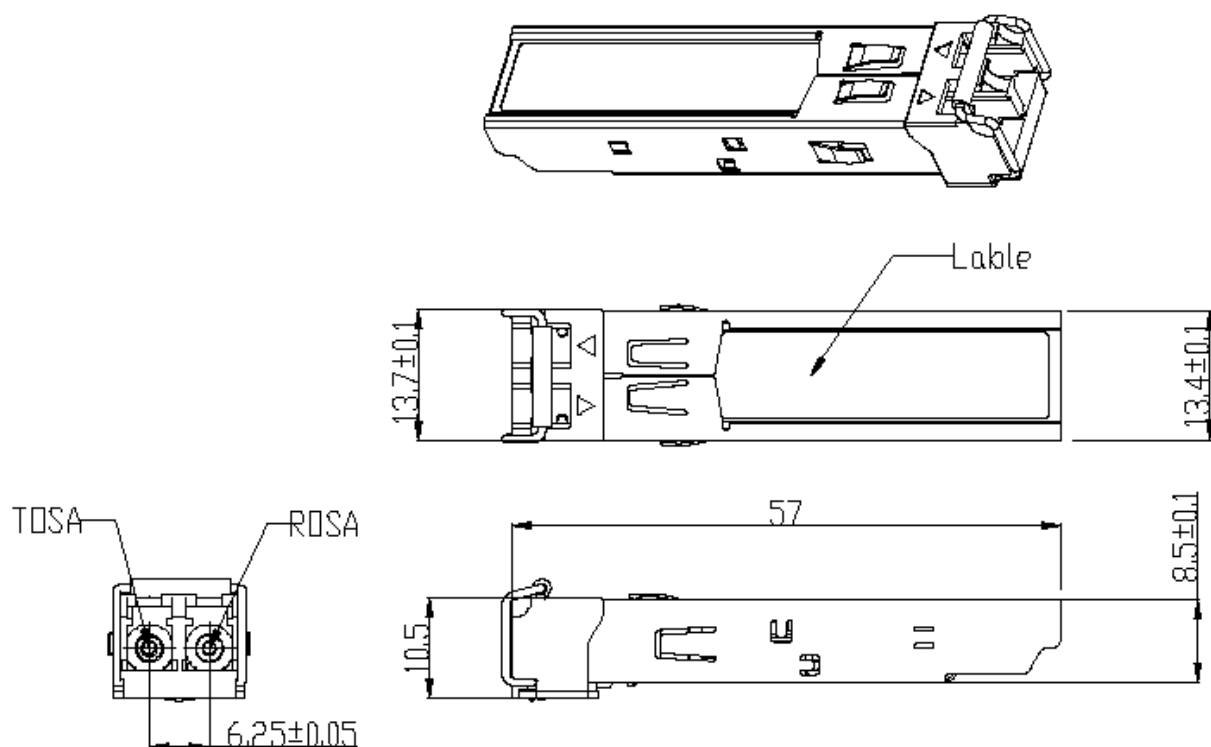
terminated with 100Ω (differential) at the user SERDES.

- 6) TD-/+: These are the differential transmitter inputs. They are internally AC-coupled, differential lines with 100Ω differential termination inside the module.

## Recommended Interface Circuit



## Mechanical Dimensions



## Ordering information

Part Number	Product Description
ASFP16-40-S55C	1550nm, 2.488Gbps, 40km, 0°C ~ +70°C
ASFP16-40-S55I	1550nm, 2.488Gbps, 40km, -40°C ~ +85°C,
ASFP16-40-S55CD	1550nm, 2.488Gbps, 40km, 0°C ~ +70°C, With Digital Diagnostic Monitoring
ASFP16-40-S55ID	1550nm, 2.488Gbps, 40km, -40°C ~ +85°C, With Digital Diagnostic Monitoring
ASFP16-80-S55C	1550nm, 2.488Gbps, 80km, 0°C ~ +70°C
ASFP16-80-S55I	1550nm, 2.488Gbps, 80km, -40°C ~ +85°C,
ASFP16-80-S55CD	1550nm, 2.488Gbps, 80km, 0°C ~ +70°C, With Digital Diagnostic Monitoring
ASFP16-80-S55ID	1550nm, 2.488Gbps, 80km, -40°C ~ +85°C, With Digital Diagnostic Monitoring
ASFP16-100-S55C	1550nm, 2.488Gbps, 100km, 0°C ~ +70°C
ASFP16-100-S55I	1550nm, 2.488Gbps, 100km, -40°C ~ +85°C,
ASFP16-100-S55CD	1550nm, 2.488Gbps, 100km, 0°C ~ +70°C, With Digital Diagnostic Monitoring
ASFP16-100-S55ID	1550nm, 2.488Gbps, 100km, -40°C ~ +85°C, With Digital Diagnostic Monitoring
ASFP16-120-S55C	1550nm, 2.488Gbps, 120km, 0°C ~ +70°C
ASFP16-120-S55I	1550nm, 2.488Gbps, 120km, -40°C ~ +85°C,
ASFP16-120-S55CD	1550nm, 2.488Gbps, 120km, 0°C ~ +70°C, With Digital Diagnostic Monitoring
ASFP16-120-S55ID	1550nm, 2.488Gbps, 120km, -40°C ~ +85°C, With Digital Diagnostic Monitoring