

## SFPTURKIYESSM(XXX)10GD(X)

### 10.3125Gbps 1310nm LC Duplex 10km SFP+ Transceiver

#### Features :

- Up to 9.95 Gbps to 10.5Gbps
- 1310nm Uncooled DFB Laser and PIN photo detector
- Duplex LC receptacle optical interface compliant
- Single +3.3V power supply
- Hot-pluggable
- AC coupling of LVPECL signals
- International Class1 laser safety certified
- Operating temperature range:
  - Commercial: -5°C~+70°C
  - Industry: -40°C~+85°C
- RoHS Compliant
- DDMI function available with internally calibrated mode
- Up to 10km transmission distance over Single Mode Fiber(SMF) without CDR inside

#### Applications:

- 10GBASE-LR/LW
- 10G Fiber Channel

#### Standard

- Compliant with MSA SFP+ specification(SFF-8431)
- Compliant with SFF-8472
- CPRI Line Rate Option: 9830.4Mbps
- Compliant to IEEE 802.3ae

#### Description:

SFPTURKIYESSM(XXX)10GD is a very compact 10Gb/s optical transceiver module for serial optical communication applications at 10Gb/s. SFPTURKIYESSM(XXX)10GD 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 SFI specification.



## Absolute Maximum Ratings

Table 1- Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit
Storage Temperature	T <sub>S</sub>	-40		+85	°C
Case Operating Temperature	T <sub>A</sub>	0		70	°C
Maximum Supply Voltage	V <sub>CC</sub>	-0.5		4	V
Relative Humidity	RH	0		85	%

### Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit
Operating Case Temperature (Commercial)	T <sub>C</sub>	-5		70	°C
Operating Case Temperature (industry)	T <sub>C</sub>	-40		85	°C
Power Supply Voltage	V <sub>CC3</sub>	3.13	3.3	3.47	V
Supply Current	I <sub>CC3</sub>			285	mA
Data Rate			10.3125		Gbps
Fiber Length 9/125µm core SMF		-	10	-	km

## Electrical Characteristics (TOP = 0 to 70 °C, VCC = 3.135 to 3.465 Volts)

### Electrical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Transmitter differential input voltage	V <sub>in,pp</sub>	180		700	m V	
Receiver differential output Voltage	V <sub>out,pp</sub>	300		850	m V	
Transmit Fault (TX_Fault)	V <sub>oh</sub>	2.4		V <sub>dd3</sub> +0.3	V	LVTTL
	V <sub>ol</sub>	-0.3		0.4	V	LVTTL
Transmit disable voltage	V <sub>IH</sub>	2.0		V <sub>CC</sub> +0.3	V	LVTTL
Transmit enable voltage	V <sub>IL</sub>	-0.3		0.8	V	LVTTL
Loss of Signal (LOS)	V <sub>oh</sub>	2.4		V <sub>dd3</sub> +0.3	V	LVTTL
	V <sub>ol</sub>	-0.3		0.4	V	LVTTL

#### Notes:

- 1) The supply current is SFP+ module's working current.
- 2) For the measurements, the device was driven with 10.3125Gbps data pattern with 2<sup>31</sup>-1 PRBS payload.
- 3) Optical transition time is the time interval required for the rising or falling edge of an optical pulse to transition between the 20% and 80% amplitudes relative to the logical 1 and 0 levels.
- 4) Measured with a PRBS 2<sup>31</sup>-1 test pattern, @10.3125Gbps, ER=3.5dB, BER<10<sup>-12</sup>.  
The LOS Hysteresis minimizes 'chatter' on the output line. In principle, Hysteresis alone does not guarantee chatter-free operation



Optical transmitter Characteristics							
Parameter		Symbol	Min	Typical	Max	Unit	Notes
Launched Power (avg.)		Pout	-8.2		+0.5	dBm	EOL
			-8.2		+0.5	dBm	BOL
Operating Wavelength Range		$\lambda_c$	1260	1310	1355	nm	
Spectral Width		$\Delta\lambda$			1	nm	
Side Mode Suppression Ratio		SMSR	30			dB	
Extinction Ratio		ER	3.5			dB	2
Transmitter and Dispersion Penalty		TDP			3.2	dB	
Optical Modulation Amplitude		POMA	-5.2			dBm	
Optical Return Loss Tolerance					12	dB	
Relative Intensity Noise		RIN			-128	dB/Hz	
Optical Rise/Fall Time		Tris/Tfall	28			PS	3
Optical Tx Output disable		Pdis			-30	dBm	
Output Eye Diagram		Compliant with ITU-T G.691 eye mask and IEEE802.3ae eye mask					
Optical receiver Characteristics							
Parameter		Symbol	Min	Typical	Max	Unit	Notes
Receiver Sensitivity		S			-14.4	dBm	4
Wavelength Range		$\lambda_c$	1260		1355	nm	
Receiver Reflectance					-12	dB	
Optical Power Input Overload		Pin-max	0.5			dBm	4
LOS	Optical De-assert	Pd			-17	dBm	4
	Optical Assert	Pa	-30				
LOS hysteresis			0.5		5	dB	5

### Digital Diagnostic Monitoring Information

Parameter	Accuracy	Calibration	Range
Temperature	$\pm 3^\circ\text{C}$	internal	-5~70
Voltage	$\pm 3\%$	internal	Vcc=3.3V $\pm 5\%$
Bias Current	$\pm 10\%$	internal	5 to 100mA
TX Power	$\pm 2\text{dB}$	internal	-8.2 to 0.5dBm
RX Power	$\pm 3\text{dB}$	internal	-14.4 to 0.5dBm



## Pin Assignment

Diagram of Host Board Connector Block Pin Numbers and Name

Figure 1 SFP+ Pad assignment Top View

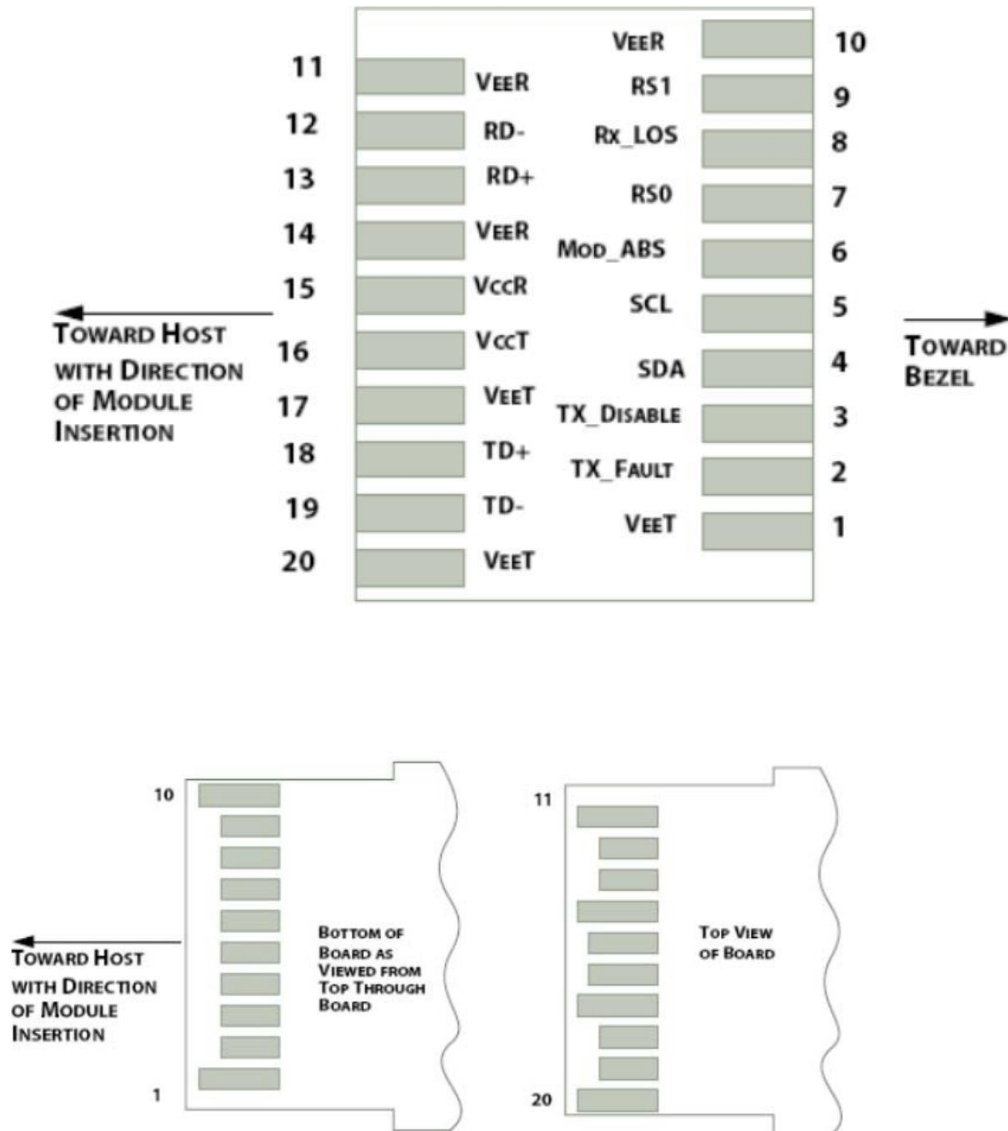


Figure 2 SFP+ Module Contact Assignments

## Pin Function Definitions

Pin	Power Seq.	Symbol	Description	Ref
1	1st	VeeT	Module Ground(Common with Receiver Ground)	1
2	3rd	TX_Fault	Transmitter Fault, Low: normal; High: abnormal	2
3	3rd	TX_Disable	Transmitter Disable High: Transmitter off Low: Transmitter on	3
4	3rd	SDA	2-Wire Serial Interface Data Line (Same as MOD-DEF2 in INF-8074i)	4
5	3rd	SCL	2-Wire Serial Interface Data Line (Same as MOD-DEF2 in INF-8074i)	4
6	3rd	Mod_ABS	Module Absent, Connect to VeeT or VeeR in Module	5
7	3rd	RS0	Rate Select 0, optionally controls SFP+ module receiver	6
8	3rd	RX_LOS	Receiver Loss of Signal indication High: loss of signal Low: signal detected	7
9	3rd	RS1	Rate Select 1, optionally controls SFP+ module transmitter	8
10	1st	VeeR	Receiver Ground	1
11	1st	VeeR	Receiver Ground	1
12	3rd	RD-	Receiver Inverted DATA out. AC Coupled. CML-O	9
13	3rd	RD+	Receiver Non-inverted DATA out. AC Coupled. CML-O	9
14	1st	VeeR	Receiver Ground	1
15	2nd	VccR	Receiver Power Supply	10
16	2nd	VccT	Transmitter Power Supply	10
17	1st	VeeT	Transmitter Ground	1
18	3rd	TD+	Transmitter Non-Inverted DATA in. AC Coupled. CML-I	11
19	3rd	TD-	Transmitter Inverted DATA in. AC Coupled. CML-I	11
20	1st	SDA	Transmitter Ground	1

### Notes:

- 1) The module signal ground contacts.
- 2) This pin is an open drain/collector and should be pulled up to Vcc-host in the host with a 4.7k~10k Ohm resistor.
- 3) This pin should be pulled up to Vcct with a 4.7k~10k Ohm resistor in modules.
- 4) SDA&SCL (IIC) are needed pull up 4.7k~10k Ohm resistors on host board.
- 5) Mod\_ABS is connected to VeeT or VeeR in the SFP+ module.
- 6) Rate Select 0,Optionally controls SFP+ module receiver , High: RX input signaling rate>4.25GBd and Low: RX input signaling rate≤4.25GBd.
- 7) Module RX\_Los of signal indication need pull up 4.7k~10k Ohm resistor on host board.
- 8) Rate Select 1,Optionally controls SFP+ module transmitter, High: Tx input signaling rate>4.25GBd and Low : Tx input signaling rate≤4.25GBd.
- 9) RD -/+: These are the differential receiver outputs. They are CML AC-coupled with 100 Ohm terminal resistor matching internal.
- 10) VccR and VccT are the receiver and transmitter power supplies.
- 11) TD -/+: These are the differential transmitter inputs. They are CML AC-coupled with 100 Ohm terminal resistor matching internal.



## SFP Module EEPROM Information and Management

The optical transceiver contains an EEPROM. It provides access to sophisticated identification information that describes the transceiver's capabilities, standard interfaces, manufacturer, and other information. When the serial protocol is activated, the host generates the serial clock signal (SCL, Mod Def 1). The positive edge clocks data into those segments of the EEPROM that are not writing protected within the SFP transceiver. 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.

The Module provides diagnostic information about the present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Calibration and alarm/warning threshold data is written during device manufacture. Received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring all are implemented. The diagnostic data are raw A/D values and must be converted to real world units using calibration constants stored in EEPROM locations 56 – 95 at wire serial bus address A2h. The digital diagnostic memory map specific data fields define as following.

**Table 1.** Digital Diagnostic Memory Map (Specific Data Field Descriptions)

2 wire address 1010000X (A0h)	2 wire address 1010001X (A2h)
0	0
Serial ID Defined by SFP MSA (96 bytes)	Alarm and Warning Thresholds (56 bytes)
95	55
Vendor Specific (32 bytes)	Cal Constants (40 bytes)
127	95
Reserved (128 bytes)	Real Time Diagnostic Interface (24 bytes)
255	119
	127
	User Writable EEPROM (120 bytes)
	247
	Vendor Specific (8 ytes)
	255

**Table 2 - EEPROM Serial ID Memory Contents (A0h)**

Address	Name of field	Hex	Description
<b>BASE ID Fields</b>			
00	Identifier	03	SFP transceiver
01	Ext. Identifier	04	Serial ID module supported for SFP
02	Connector	07	LC
03-05	Transceiver Codes	20 00 00	Not defined
06	Transceiver Codes	00	Not defined
07-10	Transceiver Codes	00 00 00	Not defined
11	Encoding	06	Encoding codes
12	BR, Nominal	67	10.3GHz
13	Rate Identifier	00	Not defined
14	Length(9um)-km	0A	10(km)
15	Length(9um)-m	64	10000m
16	Length(50um)	00	Transceiver transmit distance
17	Length(62.5um)	00	Transceiver transmit distance
18	Length(cable)	00	Not support cable
19	Length(OM3)	00	Not support OM3
20-35	Vendor Name	41 43 2D 55 4E 49 48 4F 4E...	"SFPTURKEY"(ASCII character)
36	Reserved	00	Not defined
37-39	Vendor OUI	00 00 00	Not defined
40-55	Vendor P/N		AC-XP-3G10-10
56-59	Vendor P/N Rev.	56 30 2E 30	"V0.0"(ASCII character)
60-61	Laser Wavelength	05 1E	1310nm
62	Reserved	00	Not defined
63	CC_BASE	XX	Check sum of bytes 0-62
<b>Extended ID Fields</b>			
64-65	Options	00 1A	RX_LOS、TX_Fault are implemented
66	BR, max	14	Upper bit rate margin,20%
67	BR, min	14	Lower bit rate margin,20%
68-83	Vendor SN		Vendor Serial Number in ASCII character
84-91	Date Code	Data Code	Vendor Date Code in ASCII character
92	Diagnostic Monitoring Type	68	Digital Diagnostic monitoring implemented "Internally calibrated " is implemented, RX measurement type is "Average Power"
93	Enhanced options	B0	Optional Alarm/warning flags, soft





			Tx_Fault monitoring, soft LOS monitoring are implemented
94	SFF-8472 compliant	05	SFF-8472 compliant with revision 11.0
95	CC-EXT	XX	Check sum of bytes 64-94
<b>Vendor Specific ID Field</b>			
96-127	Vendor Specific	00	Vendor specific EEPROM
128-255	Reserved	00	Reserved for future use

## Digital Diagnostic Monitoring Interface: Alarm and Warning Thresholds (2-Wire Address A2h)

Address	#Bytes	Name	Real Value		Unit	Hex
			Industrial	Commercial		
00-01	2	Temp High Alarm	100	80	°C	
02-03	2	Temp Low Alarm	-50	-10	°C	
04-05	2	Temp High Warning	85	70	°C	
06-07	2	Temp Low Warning	-40	-5	°C	
08-09	2	Voltage High Alarm	4		V	
10-11	2	Voltage Low Alarm	3		V	
12-13	2	Voltage High Warning	3.5		V	
14-15	2	Voltage Low Warning	3.1		V	
16-17	2	Bias High Alarm	100		mA	
18-19	2	Bias Low Alarm	5		mA	
20-21	2	Bias High Warning	80		mA	
22-23	2	Bias Low Warning	10		mA	
24-25	2	TX Power High Alarm	1.5		dBm	
26-27	2	TX Power Low Alarm	-10.2		dBm	
28-29	2	TX Power High Warning	0.5		dBm	
30-31	2	TX Power Low Warning	-8.2		dBm	
32-33	2	RX Power High Alarm	1.5		dBm	
34-35	2	RX Power Low Alarm	-18.4		dBm	
36-37	2	RX Power High Warning	0.5		dBm	
38-39	2	RX Power Low Warning	-14.4		dBm	
40-55	16	Reserved	Reserved			



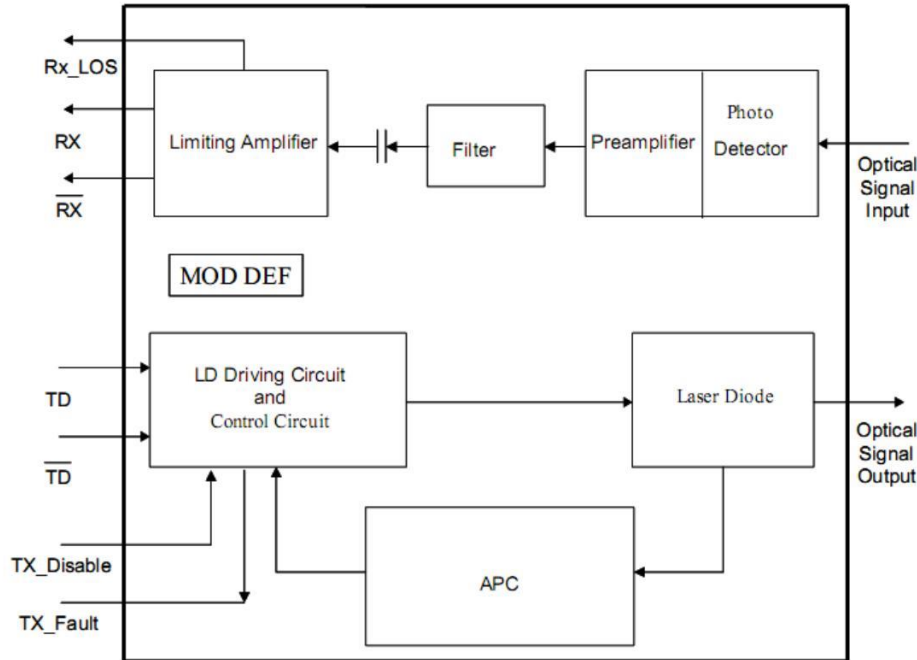


## Regulatory Compliance

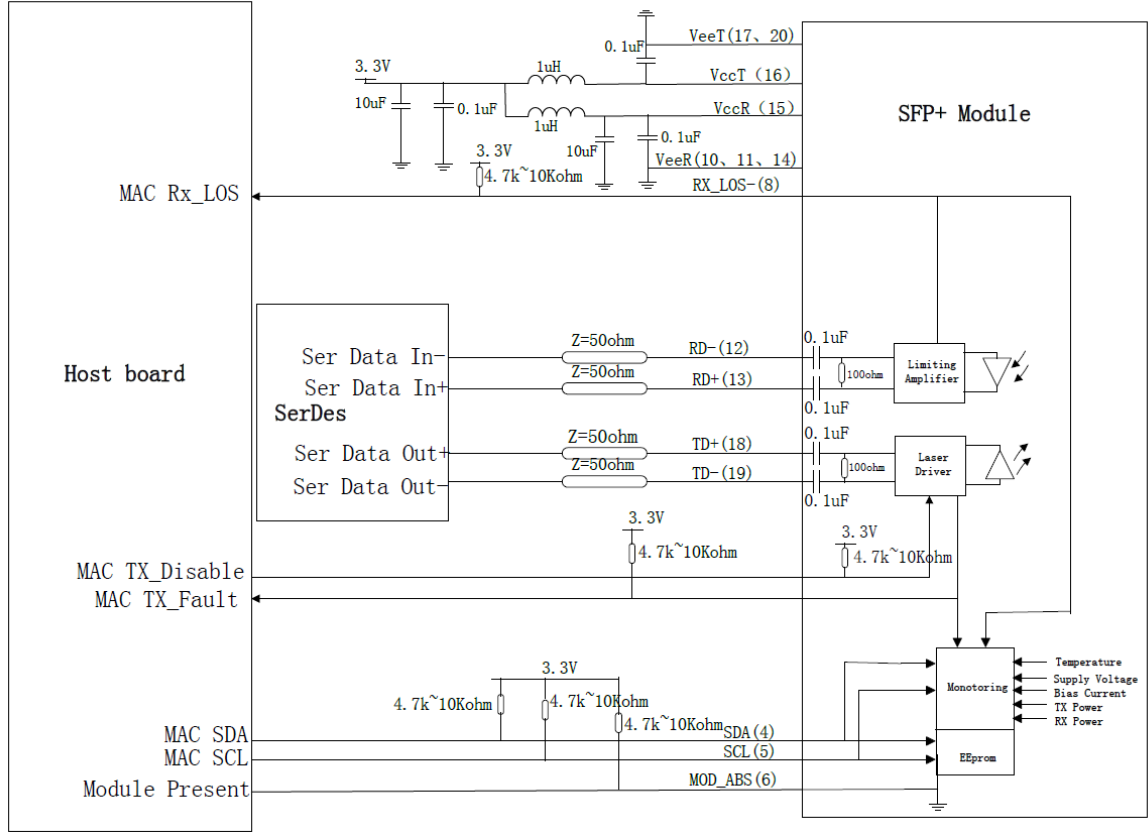
SFPTURKIYESSM(XXX)10GD complies with international Electromagnetic Compatibility (EMC) and international safety requirements and standards (see details in Table following).

Feature	Test	Method
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883E Method 3015.7	Class 1(>1000V for SFI pins, >2000Vfor other pins.)
Electrostatic Discharge (ESD) Immunity	IEC61000-4-2	Class 2(>4.0kV)
Electromagnetic Interference (EMI)	CISPR22 ITE Class B FCC Class B CENELEC EN55022 VCCI Class 1	Comply with standard
Immunity	IEC61000-4-3	Comply with standard
Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN (IEC) 60825-1,2	Compatible with Class I laser Product

## Recommended Circuit

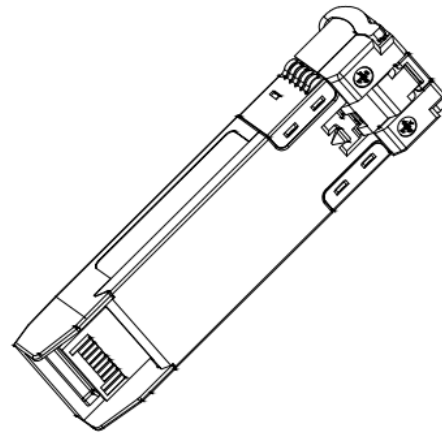
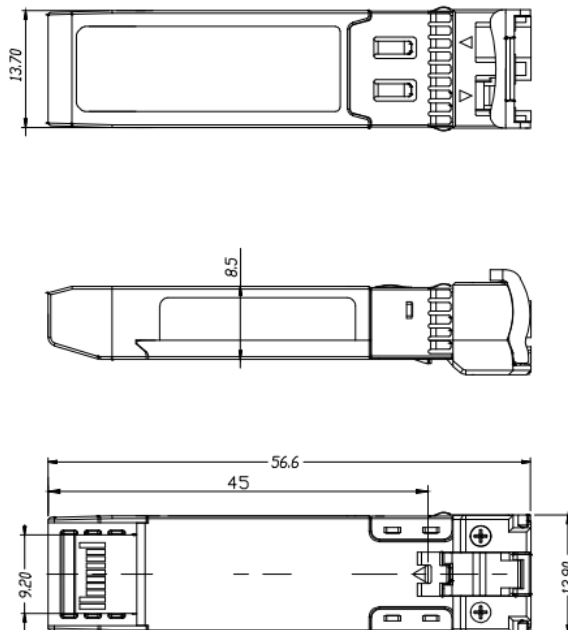


## Recommended Host Board Power Supply Circuit



## Recommended High-speed Interface Circuit

## Mechanical Dimensions



All dimensions are  
±0.2mm unless otherwise  
specified.  
Unit: mm



## Order Information

Table 6-Order Information

Part No.	Laser TX(nm)	Laser RX(nm)	Fiber Type	Connector
SFPTURKIYESSM01010GD	1310	1310	SMF	LC
SFPTURKIYESSM01010GD(HP)	1310	1310	SMF	LC
SFPTURKIYESSM01010GDB21	1310	1310	SMF	LC
SFPTURKIYESSM02010GD	1310	1310	SMF	LC

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