

## LS-SM314G-10I

### SFP 4.25Gb/s Transceiver SM 10KM

### Product Features

- Up to 4.25Gb/s Data Links
- Hot-pluggable SFP footprint
- 1310nm DFB laser transmitter
- Duplex LC connector
- RoHS compliant and Lead Free
- Compatible with RoHS
- Up to 10KM on 9/125μm SMF
- Single +3.3V Power Supply, Digital Diagnostic Monitor Interface
- Compatible with SFF-8472
- Low power dissipation <600mW typically
- Operating case temperature:
  - Standard: -5 to +70°C
  - Industrial: -40 to +85°C



### Applications

- Tri-Rate 1.0625 / 2.125 / 4.25Gb/s Fiber Channel

### Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit
Storage Temperature	TS	-40		+85	°C
Supply Voltage	VCCT, R	-0.5		4	V
Relative Humidity	RH	0		85	%
Case Operating Temperature	Industrial	-40		85	C
	Extended	-20		85	
	Commercial	0		70	

## Recommended Operating Environment:

Parameter	Symbol	Min.	Typical	Max.	Unit
Case operating Temperature	T <sub>C</sub>	-40		85	
		-20		85	
		0		70	°C
Supply Voltage	V <sub>CCT,R</sub>	3.0		3.6	V
Power Supply Rejection		100			mV <sub>P-P</sub>

## Electrical Characteristics (T<sub>OP</sub> = 0 to 70 °C, VCC = 3.0 to 3.60 Volts)

Supply Voltage	V <sub>CC</sub>	3.0		3.6	V	
Supply Current	I <sub>CC</sub>		200	300	mA	
<b>Transmitter</b>						
Input differential impedance	R <sub>in</sub>		100		Ω	1
Single ended data input swing	V <sub>in,pp</sub>	250		1200	mV	
Transmit Disable Voltage	VD	2		V <sub>CC</sub>	V	
Transmit Enable Voltage	VEN	V <sub>EE</sub>		V <sub>EE</sub> +0.8	V	2
<b>Receiver</b>						
Single ended data output swing	V <sub>out,pp</sub>	250	400	800	mV	3
Data output rise/fall time ≤ 2.125 Gb/s	Tr/f			175	ps	4
Data output rise/fall time =4.25 Gb/s	Tr/f			120	ps	4
LOS Fault	V <sub>LOS fault</sub>	V <sub>CC</sub> -0.		V <sub>CC</sub> HOST	V	5
LOS Normal	V <sub>LOS norm</sub>	V <sub>EE</sub>		V <sub>EE</sub> +0.5	V	5
Power Supply Rejection	PSR	100			mV <sub>pp</sub>	6
Deterministic Jitter Contribution ≤ 2.125 Gb/s	RX Δ DJ			51.7	ps	7,8
Deterministic Jitter Contribution =4.25 Gb/s	RX Δ DJ			25.9	ps	8,9
Total Jitter Contribution ≤ 2.125 Gb/s	RX Δ TJ			122.4	ps	8
Total Jitter Contribution =4.25 Gb/s	RX Δ TJ			61.2	ps	9

### Notes:

- 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 1.5 MHz up to specified value applied through the power supply filtering network shown on page 23 of the Small Form-factor Pluggable (SFP) Transceiver MultiSource Agreement (MSA)<sup>1</sup>, September 14, 2000. The Power Supply Rejection applies for a supply voltage range of 3.1 to 3.6 V.
7. Measured with DJ-free data input signal. In actual application, output DJ will be the sum of input DJ and DJ. Δ
8. As measured at 0.022 mW OMA.
9. As measured at 0.048 mW OMA.

**Optical Parameters(TOP = 0 to 70 °C, VCC = 3.00 to 3.60 Volts)**

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
<b>Transmitter</b>						
Output Opt. Power	POUT	-8.4		-1	dBm	1
Optical Wavelength	$\lambda$	1285		1345	nm	2
Spectral Width	$\sigma$			1	nm	2
Optical Modulation Amplitude =4.25 Gb/s	OMA	190			$\mu$ W	2,3
Optical Modulation Amplitude $\leq$ 2.125 Gb/s	OMA	174			$\mu$ W	2,3
Optical Rise/Fall Time =4.25 Gb/s	tr/ tf			90	ps	4
Optical Rise/Fall Time $\leq$ 2.125 Gb/s	tr/ tf			160	ps	5
Relative Intensity Noise	RIN			-118	dB/Hz	
Deterministic Jitter Contribution $\leq$ 2.125 Gb/s	TX $\Delta$ DJ			59.8	ps	6
Deterministic Jitter Contribution =4.25 Gb/s	TX $\Delta$ DJ			28.2	ps	6
Total Jitter Contribution $\leq$ 2.125 Gb/s	TX $\Delta$ TJ			119	ps	
Total Jitter Contribution = 4.25 Gb/s	TX $\Delta$ TJ			59.8	ps	
Extinction Ratio = 1.25 Gb/s	ER	9			dB	7
<b>Receiver</b>						
Receiver Sensitivity = 1.0625 Gb/s	RxSENS			0.015	mW	8
				-22	dBm	9
Receiver Sensitivity = 2.125 Gb/s	RxSENS			0.015	mW	8
				-21	dBm	9
Receiver Sensitivity = 4.25 Gb/s	RxSENS			0.029	mW	8
				-18	dBm	9
Average Receiver Power	RxMAX			0	dBm	
Optical Center Wavelength	$\lambda$ C	1260		1600	nm	
Optical Return Loss		12			dB	
LOS De-Assert	LOSD			-20	dBm	
LOS Assert	LOSA	-30			dBm	
LOS Hysteresis		0.5			dB	
<b>General Specifications</b>						
Data Rate	BR	1062		4250	Mb/s	10
Bit Error Rate	BER			$10^{-12}$		11
Max. Supported Link Length on 9/125 $\mu$ m SMF@ 4X Fibre Channel	LMAX1		10		km	12
Max. Supported Link Length on 9/125 $\mu$ m SMF@ 1X and 2X Fibre Channel	LMAX2		20		km	12

**Notes:**

- Class 1 Laser Safety per FDA/CDRH and EN (IEC) 60825 regulations.
- Also specified to meet curves in FC-PI-2 10.0 Figures 18, 19, and 21, which allow trade-off between wavelength, spectral width and OMA. Rate selectable part is specified to meet IEEE Draft P802.3ah /D2.0 Figure 59-3.
- Equivalent extinction ratio specification for Fibre Channel. Allows smaller ER at higher average power.
- Unfiltered, 20-80%.
- Unfiltered, 20-80%.
- Measured with DJ-free data input signal. In actual application, output DJ will be the sum of input DJ and DJ.  $\Delta$
- Applicable for Rate Selectable version only in low bandwidth mode.

- 8. Measured with conformance signals defined in FC-PI-2 10.0 specifications. Value in OMA. Measured with PRBS 27-1 at 10-12 BER
- 9. Measured with conformance signals defined in FC-PI-2 10.0 specifications. Represents sensitivity based on OMA spec, as corrected to incoming Extinction Ratio of 13 dB (for example, at 5.75dB incoming extinction ratio, an OMA of 0.029 mW corresponds to -16 dBm sensitivity). Measured with PRBS 27-1 at 10-12 BER .
- 10. Gigabit Ethernet and 1x/2x/4x Fibre Channel compliant.
- 11. Tested with a PRBS 27-1 test pattern.
- 12. Distances are based on FC-PI-2 10.0 and IEEE 802.3 standards.

## 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 sales staff.

Temperature monitor absolute error	DMI_Temp	-3	3	degC
Laser power monitor absolute error	DMI_TX	-3	3	dB
RX power monitor absolute error	DMI_RX	-3	3	dB
Supply voltage monitor absolute error	DMI_VCC	-0.1	0.1	V
Bias current monitor	DMI_Ibias	-10%	10%	mA

## Block Diagram of Transceiver:

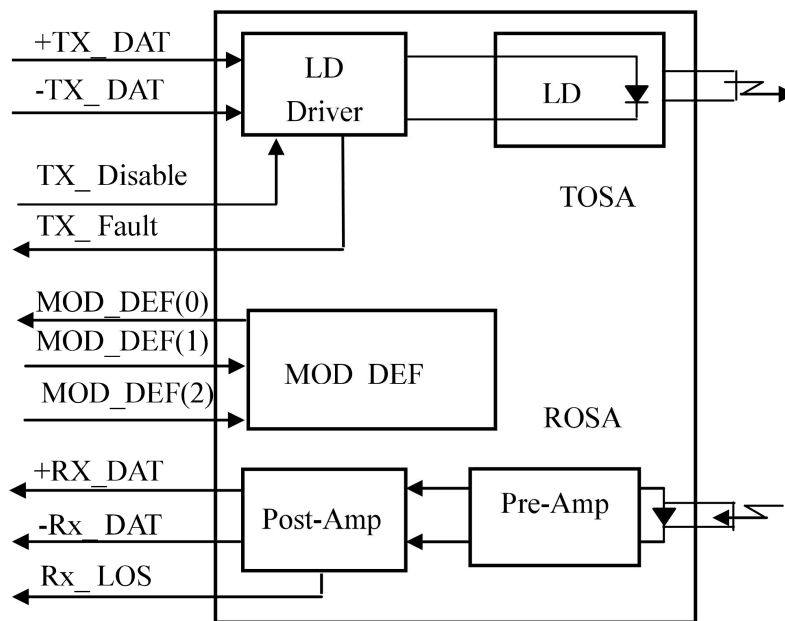


Figure1: Block Diagram

## Pin Assignment:

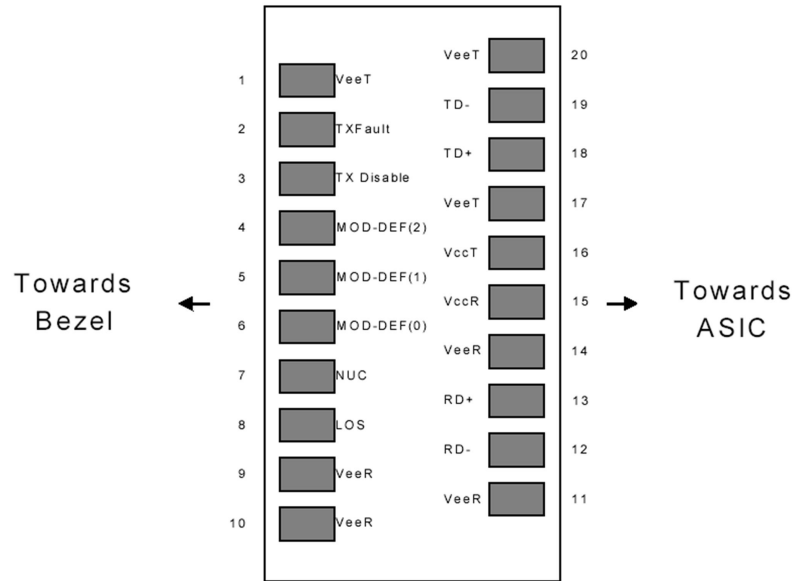


Figure2:Diagram of Host Board Connector Block Pin Numbers and Names

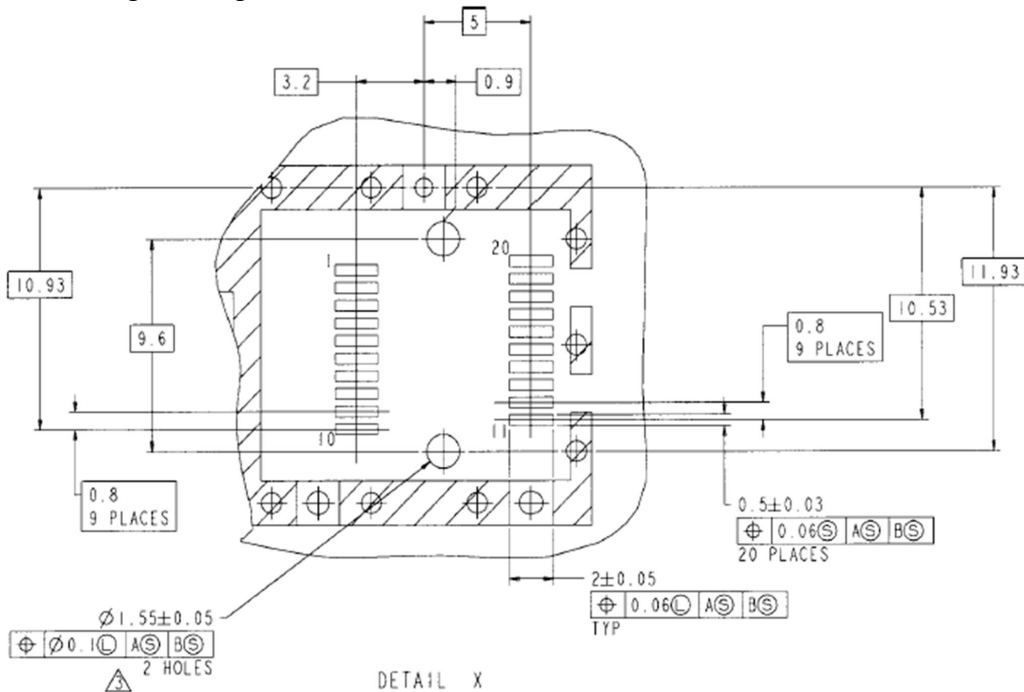


Figure 3. SFP Host Board Mechanical Layout

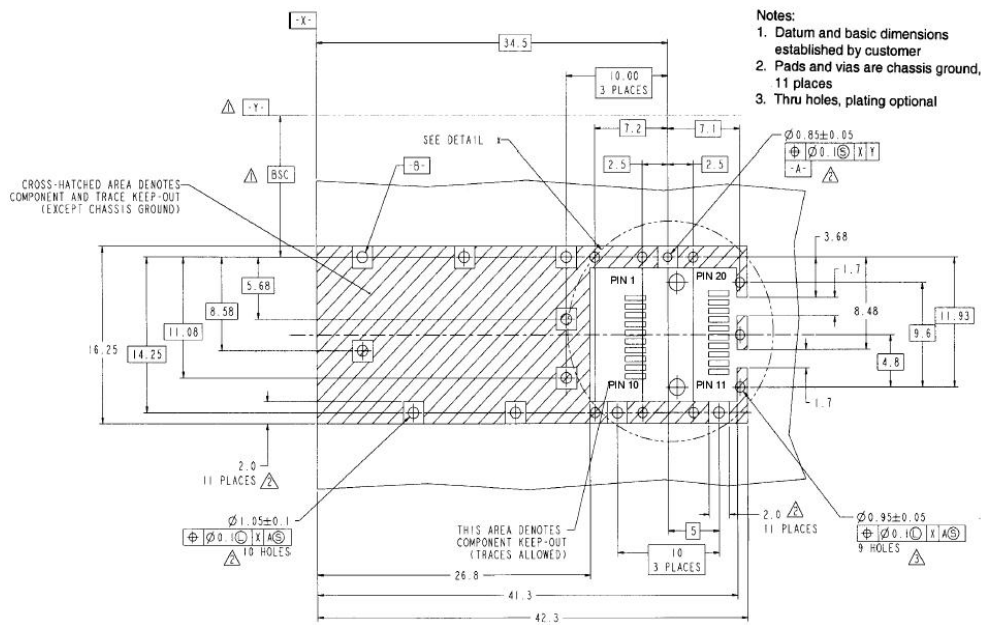


Figure 4. SFP Host Board Mechanical Layout(Cont)

## 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
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:

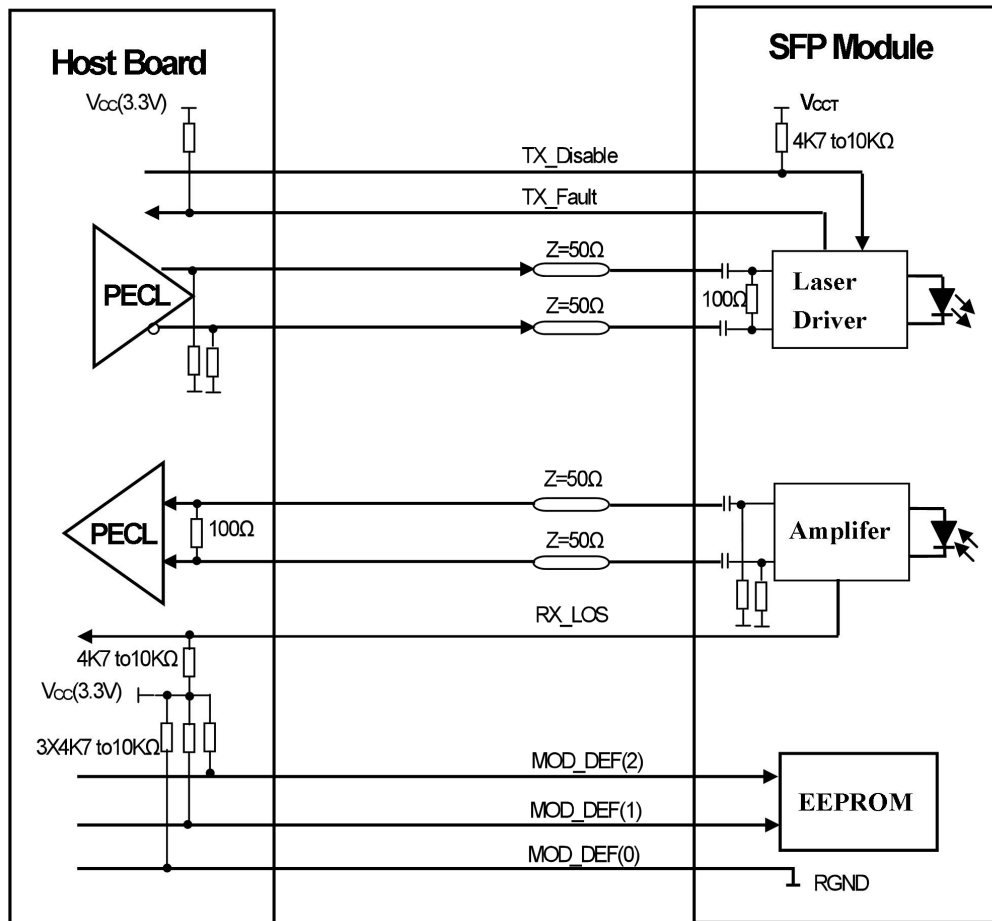


Figure 5. SFP Host Recommended Circuit

## 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	Fiber Channel
11	1	Encoding	8B10B (01h)
12	1	BR,Nominal	Nominal baud rate, unit of 100Mbps
13	1	Reserved	(0000h)
14	1	Length(9um,km)	Link length supported for 9/125um fiber, units of km
15	1	Length(9um)	Link length supported for 9/125um fiber, units of 100m
16	1	Length(50um)	Link length supported for 50/125um fiber, units of 10m
17	1	Length(62.5um)	Link length supported for 62.5/125um fiber, units of 10m
18	1	Length(Copper)	Link length supported for copper, units of meters
19	1	Reserved	
20-35	16	Vendor Name	SFP vendor name:
36	1	Reserved	
37-39	3	Vendor OUI	SFP transceiver vendor OUI ID
40-55	16	Vendor PN	Part Number: "OPXXXX" (ASCII)
56-59	4	Vendor rev	Revision level for part number
60-61	2	Wavelength	Laser wavelength
62	1	Reserved	
63	1	CCID	Least significant byte of sum of data in address 0-62
<b>Extended ID Fields</b>			
64-65	2	Option	Indicates which optical SFP signals are implemented(001Ah = LOS, TX_FAULT, TX_DISABLE all supported)
66	1	BR, max	Upper bit rate margin, units of %
67	1	BR, min	Lower bit rate margin, units of %
68-83	16	Vendor SN	Serial number (ASCII)
84-91	8	Date code	Manufacturing date code
92	1	Diagnostic Type	Diagnostics
93	1	Enhanced Options	Diagnostics
94	1	SFF-8472	Diagnostics
95	1	CCEX	Check code for the extended ID Fields (addresses 64 to 94)
<b>Vendor Specific ID Fields</b>			
96-127	32	Readable	Vendor specific date, read only



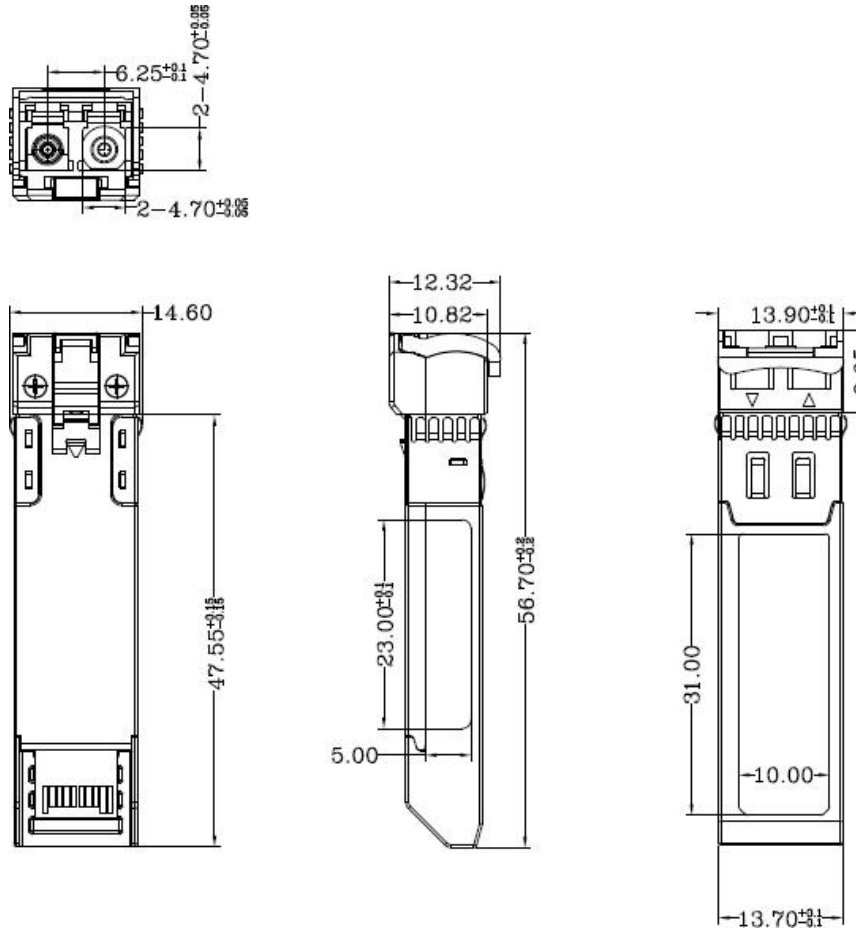
## Diagnostics Memory Contents(A2h):

Data Address	Length (Byte)	Name of Length	Description and Contents
<b>Diagnostic and control/status fields</b>			
0-39	40	A/W Thresholds	Diagnostic Flag Alarm and Warning Thresholds
40-55	16	Unallocated	
56-91	16	Ext Cal Constants	Diagnostic calibration constants for optional External Calibration
92-94	3	Unallocated	
95	1	CC_DMI	Check code for Base Diagnostic Fields (addresses 0 to 94)
96-105	10	Diagnostics	Diagnostic Monitor Data (internally or externally calibrated)
106-109	4	Unallocated	
110	1	Status/Control	Optional Status and Control Bits
111	1	Reserved	Reserved for SFF-8079
112-113	2	Alarm Flags	Diagnostic Alarm Flag Status Bits
114-115	2	Unallocated	
116-117	2	Warning Flags	Diagnostic Warning Flag Status Bits
118-119	2	Ext Status/Control	Extended module control and status bytes
<b>General use fields</b>			
120-127	8	Vendor Specific	Vendor specific memory addresses
128-247	120	User EEPROM	User writable non-volatile memory
248-255	8	Vendor Control	Vendor specific control addresses

## References

1. "Fibre Channel Physical and Signaling Interface (FC-PH, FC-PH2, FC-PH3)". American National Standard for Information Systems.
2. "Fibre Channel Draft Physical Interface Specification (FC-PI 13.0)". American National Standard for Information Systems.
3. Small Form-factor Pluggable (SFP) Transceiver Multi-source Agreement (MSA) September 14, 2000.
4. "Digital Diagnostics Monitoring Interface for Optical Transceivers". SFF Document Number SFF-8472, Revision 9.3.

**Mechanical Dimensions:**



**Figure 6. Mechanical Drawing**

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**Ordering information**

Part Number	Product Description
LS-SM314G-10C	SFP 1310nm, 4.25Gbps, LC, 10km, 0°C~+70°C, with DDM
LS-SM314G-10I	SFP 1310nm, 4.25Gbps, LC, 10km, -40°C~+85°C, with DDM