

Specification

Small Form Factor Pluggable

Duplex LC Receptacle – SFP

Optical Transceivers

4250Mbit/s



Ordering Information

TSD-SxKH1-A1Gx

Model Name	TSD-S1KH1-A1G1	TSD-S6KH1-A1G1	TSD-S1KH1-A1G2	TSD-S6KH1-A1G2
Voltage	3.3V			
Interface	VCSEL / PIN			
SD/LOS	AC / AC Coupling			
Temperature	+0°C~+70°C	-20°C~+85°C	+0°C~+70°C	-20°C~+85°C
Circuit ground	Ground	Ground	No Ground	No Ground
Latch Color	Black ■			

Media	Wavelength	Fiber Core Dimension	Distance	Note
Multi-Mode Fiber	850nm	50/125 μm	550m	@1.0625Gbps
			300m	@2.125Gbps
			150m	@4.25Gbps
		62.5/125 μm	300m	@1.0625Gbps
			150m	@2.125Gbps
			70m	@4.25Gbps

■ Features

- ROHS Compliant
- Digital Diagnostic are Internal Calibrated
- Temperature Optional : +0°C~+70°C or -20°C~+85°C
- 850nm VCSEL
- Hot Pluggable
- Metal enclosure, low EMI
- Single + 3.3 V Power Supply
- Low Power Consumption
- Complies with INF-8074i and SFF-8472 specifications

■ Applications

- Metro Access Rings
- Point – to – Point networking
- 4/2/1x Fiber Channel
- Gigabit Ethernet
- Suitable for Fast Ethernet and OC-12

■ Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit
Storage temperature	T _s	-40		85	°C
Supply voltage	V _{cc}	0		4	V
Operating Relative Humidity	RH	0		85	%
Non-Operating Relative Humidity	RH	0		85	%
Operating Atmospheric Pressure		70		106	kPa
Non-Operating Atmospheric Pressure		50		106	kPa

■ Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	V _{cc}	3.1	3.3	3.5	V
Operating Case temperature (TSD-S1KH1-A1G1)	T _c	0	--	70	°C
Operating Case temperature (TSD-S6KH1-A1G1)		-20	--	85	
Total Current (Transmitter + Receiver)	I _{cc}	--	200	300	mA

Data Rate		1.0625	--	4.25	Gbps
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Transmitter Specifications ($V_{CC}=3.1V\sim 3.5V$; $T_C=0^{\circ}C\sim 70^{\circ}C$ / $T_C=-20^{\circ}C\sim 85^{\circ}C$)

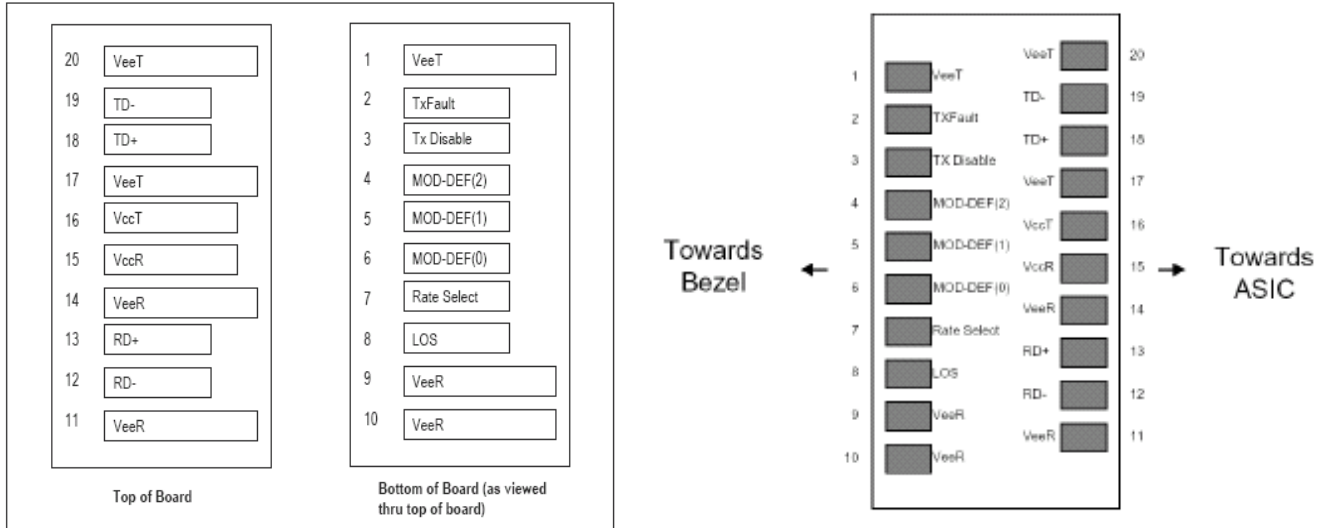
Parameter	Symbol	Min	Typ	Max	Unit
Optical Characteristics					
Transmitter Differential Input	TD +/-	400	--	2000	mVp-p
Optical Output Power	P _O	-9	--	-1	dBm
Extinction Ratio	ER	9	--	--	dB
Center Wavelength	λ_c	830	850	860	nm
Spectral Width (RMS)	$\Delta\lambda$	--	--	0.85	nm
Optical Rise/Fall time (20-80%)	T _r / T _f	--	--	90	ps
Electrical Characteristics					
Tx_Fault_High	V _{Fault_H}	2.0	--	V _{CC}	V
Tx_Fault_Low	V _{Fault_L}	V _{EE}	--	V _{EE} +0.5	V
Tx_Disable_High	V _{Disable_H}	2.0	--	V _{CC}	V
Tx_Disable_Low	V _{Disable_L}	V _{EE}	--	V _{EE} +0.8	V

Note: All of data is measured at 4250Mbps, PRBS 2⁷-1, NRZ.

Receiver Specifications ($V_{CC}=3.1V\sim 3.5V$; $T_C=0^{\circ}C\sim 70^{\circ}C$ / $T_C=-20^{\circ}C\sim 85^{\circ}C$)

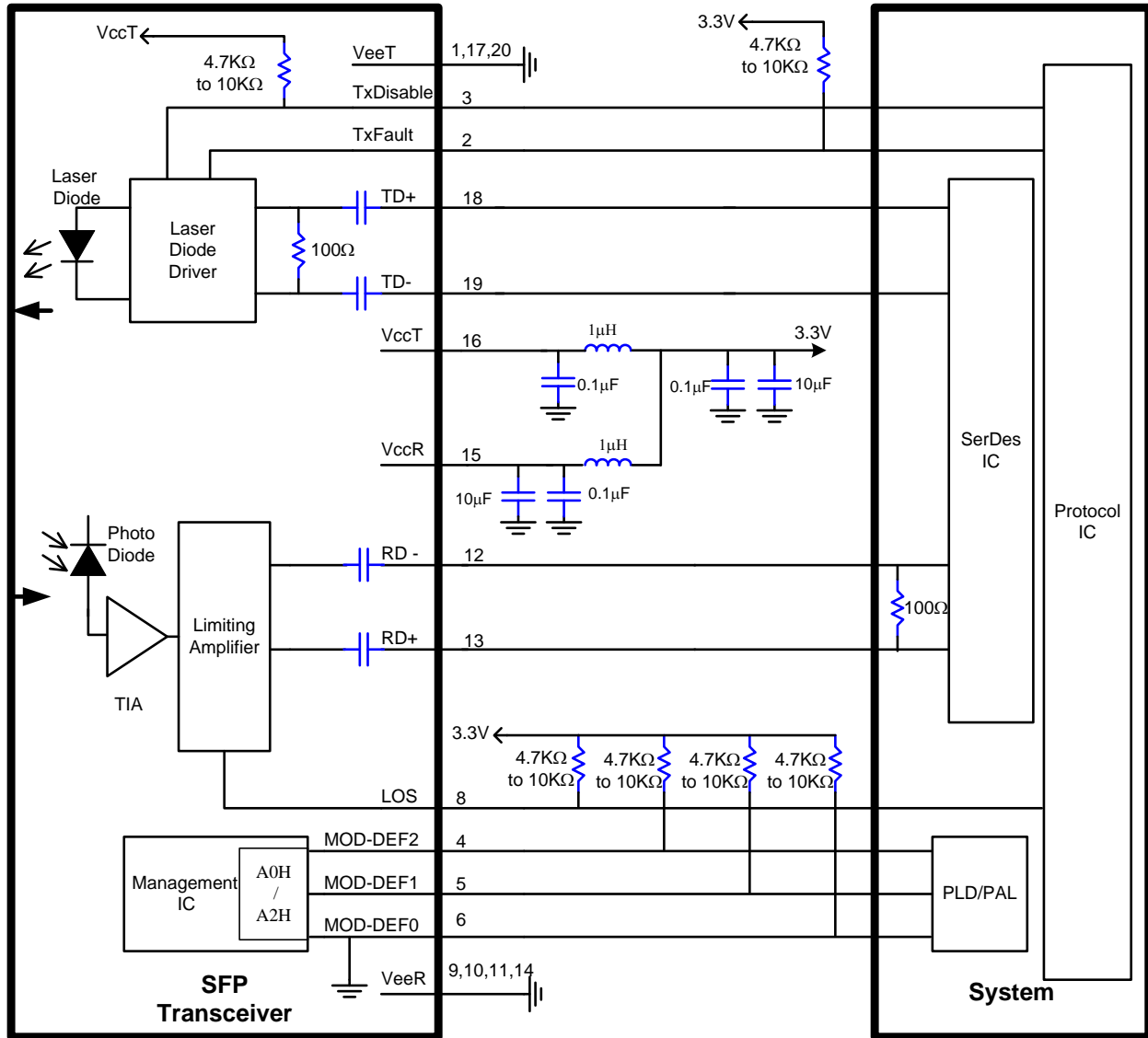
Parameter	Symbol	Min	Typ	Max	Unit
Optical Characteristics					
Receiver Differential Output Voltage	RD +/-	600	800	--	mVp-p
Receiver Overload	P _{INMAX}	0	--	--	dBm
Receiver Sensitivity @ 4.25Gbps (PRBS=2 ⁷ -1 ; BER ≤ 10 ⁻¹⁰)	P _{INMIN}	--	-18	-16	dBm
Receiver Sensitivity @ 2.125Gbps (PRBS=2 ⁷ -1 ; BER ≤ 10 ⁻¹⁰)	P _{INMIN}	--	-20	-18	dBm
Receiver Sensitivity @ 1.25Gbps (PRBS=2 ⁷ -1 ; BER ≤ 10 ⁻¹⁰)	P _{INMIN}	--	-20	-20	dBm
Operating Center Wavelength	λ_c	770	--	860	nm
Receiver LOS Assert Level	P _{RX_LOS_A}	-30	--	--	dBm
Receiver LOS Deassert Level	P _{RX_LOS_D}	--	--	-17	dBm
Receiver Loss of Signal Hysteresis	P _A - P _D	0.5	2	--	dB

Pin Definition and Descriptions



Pin	Name	Input/Output Level	Description
1	VeeT	Input	Transmitter ground
2	TXFault	Output/LVTTL	Laser failure indication. High level indicates "laser failure". Externally pulled up
3	TXDisable	Input/LVTTL	Transmitter disable, High signal/open disables TX laser output. Low level enables TX output, internally pulled up.
4	MOD-DEF(2)	Input/output	Module definition 2, SDA, Data line for I2C bus. Externally pulled up
5	MOD-DEF(1)	Input	Module definition 1, SCL, Clock for I2C bus. Externally pulled up
6	MOD-DEF(0)	Output	Module definition 0, Module present. Ground inside module.
7	Rate Select	-	No connection.
8	LOS	Output/LVTTL	Receiver loss of signal indication. Low signal indicates optical signal is present at RX input. Should be Externally pulled up.
9	VeeR	Input	Receiver ground
10	VeeR	Input	Receiver ground
11	VeeR	Input	Receiver ground
12	RD -	Output/LVPECL	Inverted receiver data output (AC coupled)
13	RD +	Output/LVPECL	Non-inverted receiver data output (AC coupled)
14	VeeR	Input	Receiver ground
15	VccR	Input	Receiver power supply
16	VccT	Input	Transmitter power supply
17	VeeT	Input	Transmitter ground
18	TD +	Input/LVPECL	non-inverted transmitter data input (AC coupled)
19	TD -	Input/LVPECL	Inverted transmitter data input (AC coupled)
20	VeeT	Input	Transmitter ground

■ Recommended Circuit Diagram



SPF Side: Address A0H

Address	Name of Field	HEX	Description
00	Identifier	03	SFP
01	Extended Identifier	04	SFP
02	Connector type	07	LC
03	10G Ethernet Compliance Codes	00	
04	SONET Compliance Codes	00	
05	SONET Compliance Codes	00	
06	Ethernet Compliance Codes	01	1000BASE-SX
07	Fiber Channel link length	20	intermediate distance (I)
08	Fiber Channel transmitter technology	40	Shortwave laser w/o OFC (SN) *7
09	Fiber Channel transmission media	0C	Multimode, 62.5um (M6), 50um (M5, M5E)
10	Fiber Channel speed	15	400 MBytes/sec 200 MBytes/sec 100 MBytes/sec
11	Encoding codes:	01	8B10B
12	Nominal Bit Rate (units of 100Mbps)	2B	4.3
13	Rate identifier	00	Unspecified
14	Link length supported for 9um fiber	00	0
15	Link length supported for 9um fiber	00	0
16	Link length supported for 50um,OM2	0F	150
17	Link length supported for 62.5um,OM1	07	70
18	Link length supported for copper, OM4	00	0
19	Link length supported for 50um,OM3	00	0
20 ~ 35	Vendor Name	46,4F,52,4D,45,52,49,43, 41,4F,45,20,20,20,20,20	FORMERICA OE
36	Unallocated	00	Unspecified
37 ~ 39	Vendor IEEE OUI	00,00,00	Unidentified Vendor
40 ~ 55	Part Number	54,53,44,2D,53,31(36),4B,48, 31,2D,41,31(32),47,31,20,20	TSD-S1(6)KH1-A1G1(2)
56 ~ 59	Vendor Revision number	00,00,00,00	
60 ~ 61	Laser Wavelength	03,52	850
62	Unallocated	00	0
63	CC_BASE:	xx	
64	Options	00	Unspecified
65	Options	3A	Rate_Selection TX_Disable TX_Fault RX_LOS
66	Bit Rate, max.	00	0
67	Bit Rate, min.	00	0
68 ~ 83	Serial Number		
84 ~ 89	Date Code		
90 ~ 91	Vendor specific lot code	20,20	
92	Diagnostic Monitoring Type	68	Diagnostic Monitor Internally Calibrated Average Power
93	Enhanced Options (soft)	F0	Alarm/Warning soft TX_DISABLE TX_FAULT RX_LOS

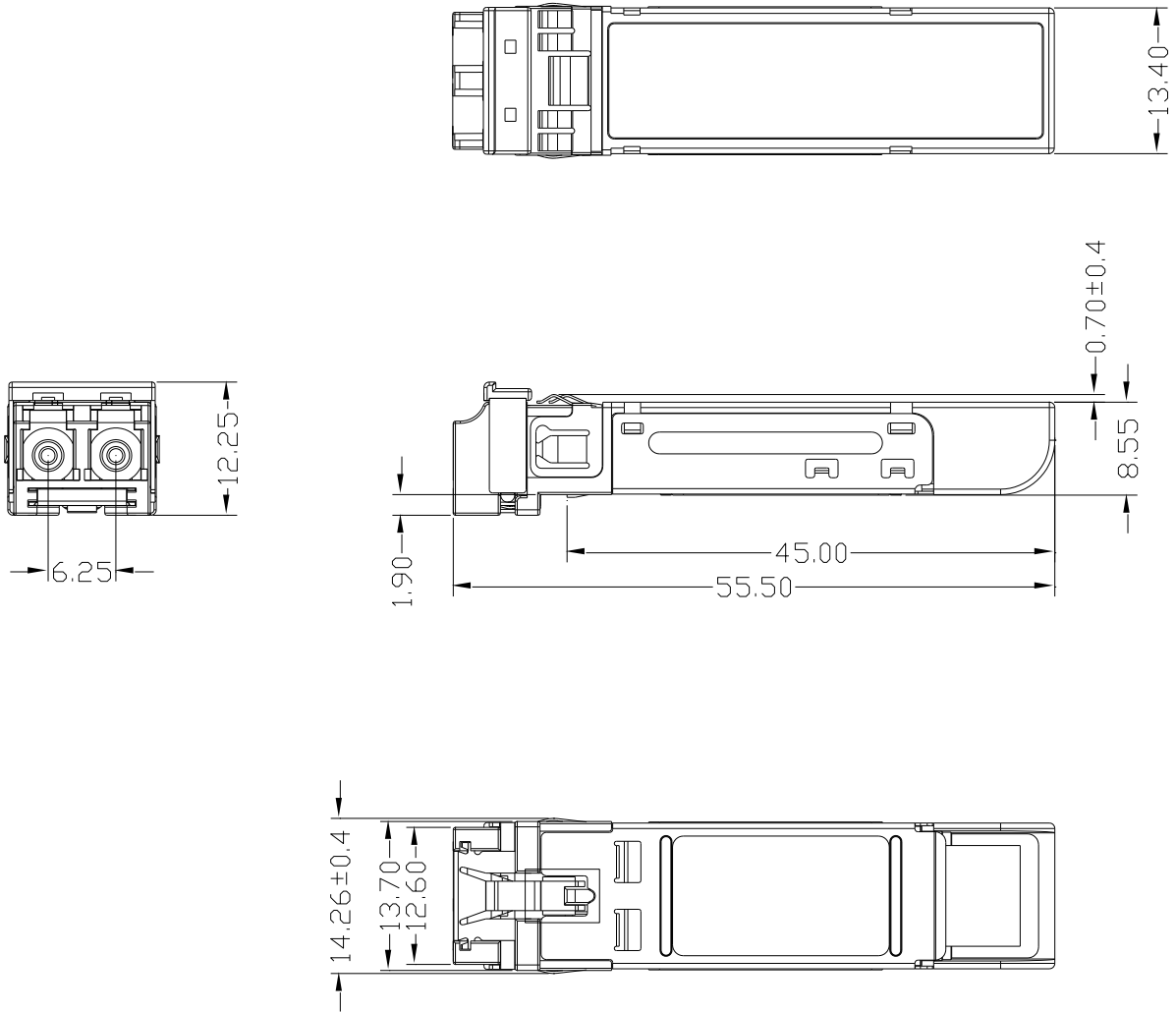
94	SFF-8472 Compliance	01	Rev 9.3 of SFF-8472.
95	CC_EXT	xx	
96~127	Vendor specific		

SFP Side: Address A2H

Add	Bytes	Name	Hex	Real Value
00-01	2	Temp High Alarm	5F,00	95°C
02-03	2	Temp Low Alarm	E0,00	-32°C
04-05	2	Temp High Warning	5A,00	90°C
06-07	2	Temp Low Warning	E7,00	-25°C
08-09	2	Voltage High Alarm	8D,CC	3.63V
10-11	2	Voltage Low Alarm	74,04	2.97V
12-13	2	Voltage High Warning	8B,10	3.56V
14-15	2	Voltage Low Warning	76,C0	3.04V
16-17	2	Bias High Alarm	19,64	13mA
18-19	2	Bias Low Alarm	03,E8	2mA
20-21	2	Bias High Warning	17,70	12mA
22-23	2	Bias Low Warning	05,DC	3mA
24-25	2	TX Power High Alarm	1F,04	-1.0dBm
26-27	2	TX Power Low Alarm	04,EC	-9.0dBm
28-29	2	TX Power High Warning	18,A6	-2.0dBm
30-31	2	TX Power Low Warning	05,82	-8.5dBm
32-33	2	RX Power High Alarm	27,10	0.0dBm
34-35	2	RX Power Low Alarm	00,FA	-16.0dBm
36-37	2	RX Power High Warning	1F,04	-1.0dBm
38-39	2	RX Power Low Warning	01,40	-14.9dBm
40-55	16	Reserved	00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00	
56-59	4	RX_PWR(4)	00,00,00,00	0
60-63	4	RX_PWR(3)	00,00,00,00	0
64-67	4	RX_PWR(2)	00,00,00,00	0
68-71	4	RX_PWR(1)	3F,80,00,00	1
72-75	4	RX_PWR(0)	00,00,00,00	0
76-77	2	TX_I(Slope)	01,00	1
78-79	2	TX_I(Offset)	00,00	0
80-81	2	TX_PWR(Slope)	01,00	1
82-83	2	TX_PWR(Offset)	00,00	0
84-85	2	T(Slope)	01,00	1
86-87	2	T(Offset)	00,00	0
88-89	2	V(Slope)	01,00	1
90-91	2	V(Offset)	00,00	0
92-94	3	Reserved	00,00,00	-
95	1	Checksum		-

■ Mechanical Outlines

(Unit : mm)



No.	Item	Standard/Regulation	Test Condition	Test point
1	Biased Damp Heat	JEDEC STANDARD NO. 22-A101	Tc = 85°C, 85% RH, bias applied to UUT, Release point: 1000 hrs	0 hrs/Post test, Function Test @100 hrs, 300 hrs, 500 hrs, 1000 hrs
2	High Temperature Operating Life	Telcordia GR-468-CORE	Powered on, Tc = 70°C, Release point: 2000 hrs	0 hrs/Post test, Function Test @168 hrs, 500 hrs, 1000 hrs, 1500 hrs, 2000 hrs
3	Cyclic Moisture Resistance	MIL-STD-883 Method 1004.7	Powered on, 95% RH, Ta = -10°C to +65°C, 20 cycles	0 hrs/Post test, Function Test after 20 cycles
4	Non-operating Thermal Cycle Test	IPC 9701, JESD22-A104	Ta=-40°C~70°C, 30 min dwell, ramp rate<15/min, no bias.	0 hrs/Post test, Function Test @100 hrs, 300 hrs, 500 hrs
5	High Temp. Storage	Telcordia GR-468-CORE	Ta = 85°C, 2000hrs	0 hrs/Post test, Function Test @168 hrs, 500 hrs, 1000 hrs, 1500 hrs, 2000 hrs
6	Low Temp. Storage	Telcordia GR-468-CORE	Ta = -40°C, 72hrs	0 hrs/Post test, Function Test after 72 hrs
7	ESD_SFP Pins	MIL-STD_883E Method 3015.7	4KV for all pins	0 hrs/Post test, Function Test after ESD testing
8	ESD_ Enclosure	IEC 61000-4-2	+/- 8KV for Contact Discharge +/- 15KV for Air Discharge	0 hrs/Post test, Function Test after ESD testing
9	EMI Testing	CISPR 11, EN55011	Group 2, Class A	Under Limit with 10 dB margin
10	Laser Safety	EN 60825-1	Class 1 Laser Product	Comply with Class 1 Laser Product
11	EU LVD	EN 62368-1	Compliance	Compliance
12	USA & Canada Safety	UL 62368-1, CAN/CSA C22.2 No. 62368-1-14	Compliance	Compliance

■ Revision History

Date	Version	Description
01/23/2018	1.0	Initial release
04/09/2018	1.1	Add description in the section of Features
05/10/2018	1.2	Typo correction.
03/18/2020	1.3	Add the environment condition of atmospheric pressure
01/05/2021	1.4	1. Add Non-Operating relative humidity 2. Revise max center wavelength for 860nm 3. A0A2 Table 4. Add summary table of reliability test