

## Specification

**Small Form Factor Pluggable**


Duplex LC Receptacle – SFP+

**16GFC Optical Transceiver**



## Ordering Information

**TAS-A1LH1-911**

Model Name	Voltage	Category	Device type	Interface	LOS	Temperature	Distance	Latch Color
TAS-A1LH1-911	3.3V	With DDMI	850 nm VCSEL	AC / AC Coupling	LVTTL	0°C ~+70°C	35m / 100m (OM2/OM3)	Black 

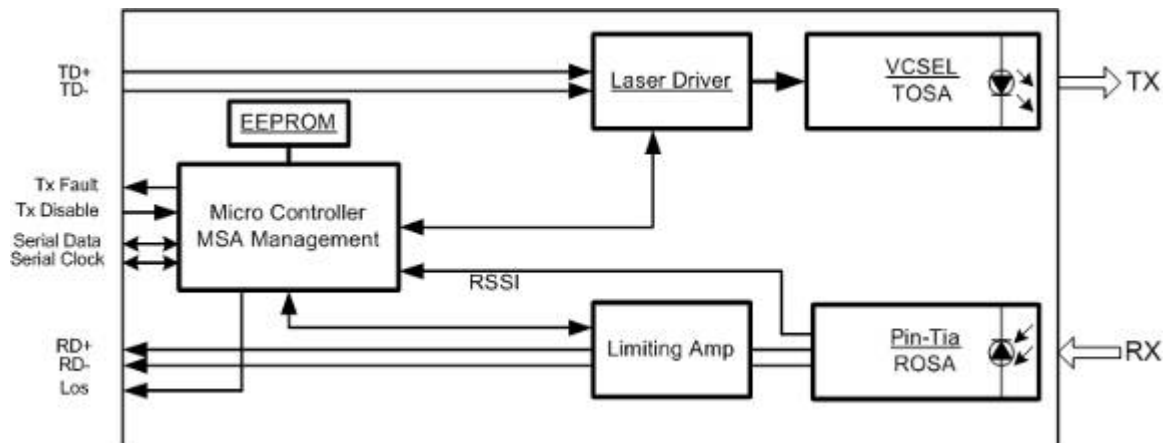
## Features

- Up to 14.025 Gb/s bi-directional data links, the serial line rate of 16G FC
- Automatic rate detect
- 850nm Vertical Cavity Surface Emitting Laser (VCSEL)
- Duplex LC connector optical interface
- Hot-pluggable SFP
- All-metal housing for superior EMI performance
- Built in digital diagnostic functions
- Operating case temperature range: 0°C ~ 70°C
- RoHS Compliant
- Single 3.3V power supply

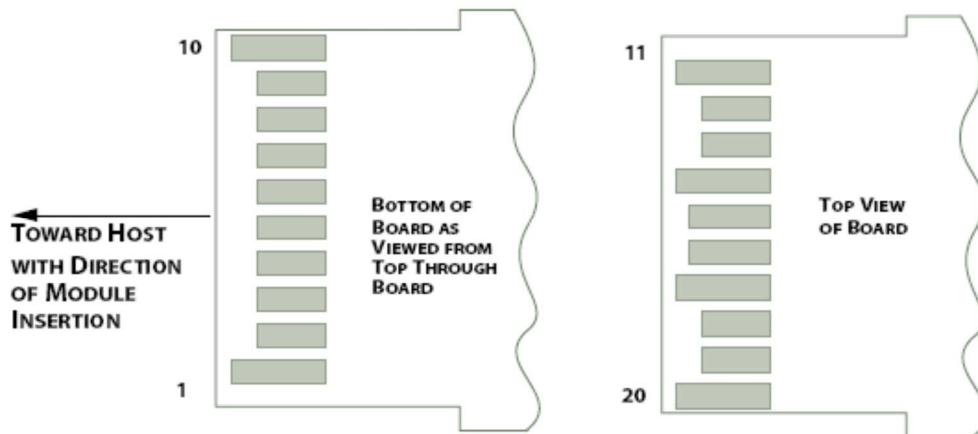
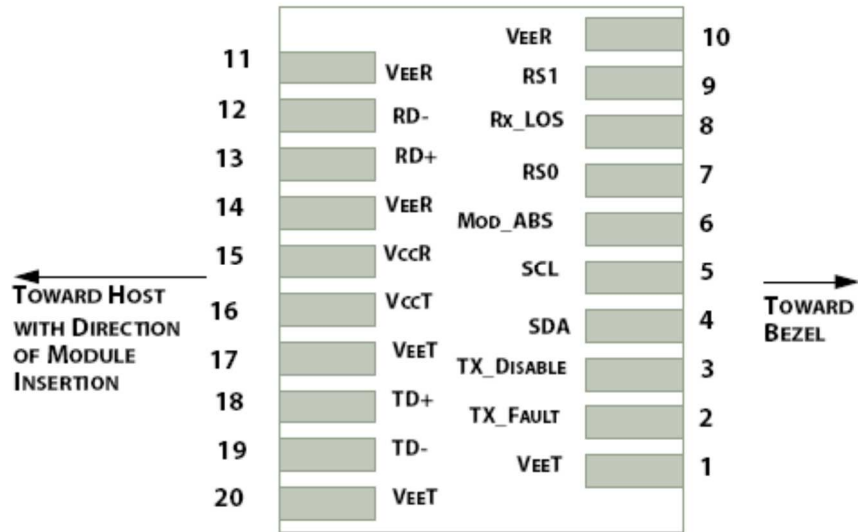
## Application

- Tri-Rate 4G/8G/16G Fiber Channel
- 10GBASE-SR Ethernet

## Transceiver Block Diagram



Pin Definition and Descriptions



PIN	Logic	Symbol	Name / Description	Note
1		VeeT	Module Transmitter Ground	1
2	LVTTL-O	TX_Fault	Module Transmitter Fault	2
3	LVTTL-I	TX_Dis	Transmitter Disable; Turns off transmitter laser output	3
4	LVTTL-I/O	SDA	2-Wire Serial Interface Data Line	
5	LVTTL-I	SCL	2-Wire Serial Interface Clock	
6		Mod_ABS	Module Absent, connected to VeeT or VeeR in the module	2
7	LVTTL-I	RS0	Rate Select 0, optionally controls SFP+ module receiver. When high input signaling rate > 4.25 GBd and when low input signal rate $\leq$ 4.25 GBd.	
8	LVTTL-O	RX_LOS	Receiver Loss of Signal Indication	2
9	LVTTL-I	RS1	Rate Select 1, optionally controls SFP+ module transmitter. When high input signaling rate > 4.25 GBd and when low input signal rate $\leq$ 4.25 GBd.	
10		VeeR	Module Receiver Ground	1
11		VeeR	Module Receiver Ground	1
12	CML-O	RD-	Receiver Inverted Data Output	
13	CML-O	RD+	Receiver Data Output	
14		VeeR	Module Receiver Ground	1
15		VccR	Module Receiver 3.3 V Supply	
16		VccT	Module Transmitter 3.3 V Supply	
17		VeeT	Module Transmitter Ground	1
18	CML-I	TD+	Transmitter Non-Inverted Data Input	
19	CML-I	TD-	Transmitter Inverted Data Input	
20		VeeT	Module Transmitter Ground	1

**Note:**

1. Module ground pins are isolated from the module case and chassis ground within the module.
2. Shall be pulled up with 4.7k to 10k ohm to a voltage between 3.15V and 3.45V on the host board.
3. Shall be pulled up with 4.7k to 10k ohm to VccT in the module.

## Absolute Maximum Ratings

Parameters	Symbol	Min.	Max.	Unit
Power Supply Voltage	$V_{CC}$	-0.5	4	V
Storage Temperature	$T_s$	-40	85	°C
Relative Humidity	RH	0	85	%

## Recommended Operating Environment

Parameters	Symbol	Min.	Typical	Max	Unit	Notes
Power Supply Voltage	$V_{CC}$	3.15	3.3	3.46	V	
Operating Case Temperature	$T_{op}$	0	25	70	°C	
Supply Current	$I_{CC}$			290	mA	
Data Rate	BR	4.25		14.025	Gb/s	
Bit Error Rate	BER			$10^{-12}$		1

### Notes:

1. PRBS 2<sup>7</sup>-1 for 8GFC. PRBS 2<sup>31</sup>-1 for 16GFC.

## Optical Characteristics

The following optical characteristics are defined over the Recommended Operating Environment unless otherwise specified. (Vcc = 3.15 to 3.45 Volts)

Parameter	Symbol	Min.	Typical	Max	Unit	Notes
<b>Transmitter</b>						
Center Wavelength	$\lambda$	840		860	nm	
RMS spectral width	$\sigma$			0.59	nm	
Average Optical Power(OM2/OM3)	P <sub>out</sub>	-7.8			dBm	1
Optical Modulation Amplitude 14.025Gb/s	OMA	-4.8			dBm	
Extinction Ratio	E <sub>R</sub>	4			dB	
Optical Modulation Amplitude 10.3125Gb/s	OMA	-5.0			dBm	
Optical Modulation Amplitude 8.5Gb/s	OMA	-5.2			dBm	
Optical Modulation Amplitude 4.25Gb/s	OMA	-6.1			dBm	
Relative Intensity Noise	RIN			-128	dB/Hz	
Vertical Eye Closure Penalty 14.025 Gb/s	CEVPQ			2.56	dB	
<b>Receiver</b>						
Average Receiver Power	RxMAX			0	dBm	
Unstressed Receiver OMA Sensitivity 14.025Gb/s	RxSENS			-10.5	dBm	2
Unstressed Receiver OMA Sensitivity 10.3125Gb/s	RxSENS			-7.5	dBm	2
Unstressed Receiver OMA Sensitivity 8.5Gb/s	RxSENS			-11.2	dBm	2
Unstressed Receiver OMA Sensitivity 4.25Gb/s	RxSENS			-12.1	dBm	2
Optical Return Loss		12			dB	
LOS Assert	LOS <sub>A</sub>	-30			dBm	
LOS De-Assert	LOS <sub>D</sub>			-13	dBm	
LOS Hysteresis	LOS <sub>H</sub>	0.5			dB	

**Notes:**

1. Class 1 Laser safety limits CDRH and EN60825 standards.
2. Unstressed Rx sensitivity

**Electrical Characteristics**

The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified. (Vcc = 3.15 to 3.45 Volts)

Parameter	Symbol	Min.	Typical	Max	Unit	Notes
<b>Transmitter</b>						
Input differential impedance	Rin		100		Ω	
Single-ended data input swing	Vin,pp	90		800	mV	
Transmit Disable Voltage	VD	2		Vcc	V	
Transmit Enable Voltage	VEN	Vee		Vee+0.8	V	
<b>Receiver</b>						
Single ended data output swing	V <sub>out,pp</sub>	185		425	mV	
LOS Fault	V <sub>LOS fault</sub>	2		V <sub>CCHOST</sub>	V	
LOS Normal	V <sub>LOS norm</sub>	Vee		Vee+0.8	V	
Power Supply Rejection	PSR	100			mVpp	
Receiver Deterministic Jitter (14.025Gb/s)	DJ			0.22	UI	
Receiver Deterministic Jitter (8.5Gb/s)	DJ			0.42	UI	

## Digital Diagnostic Functions

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.

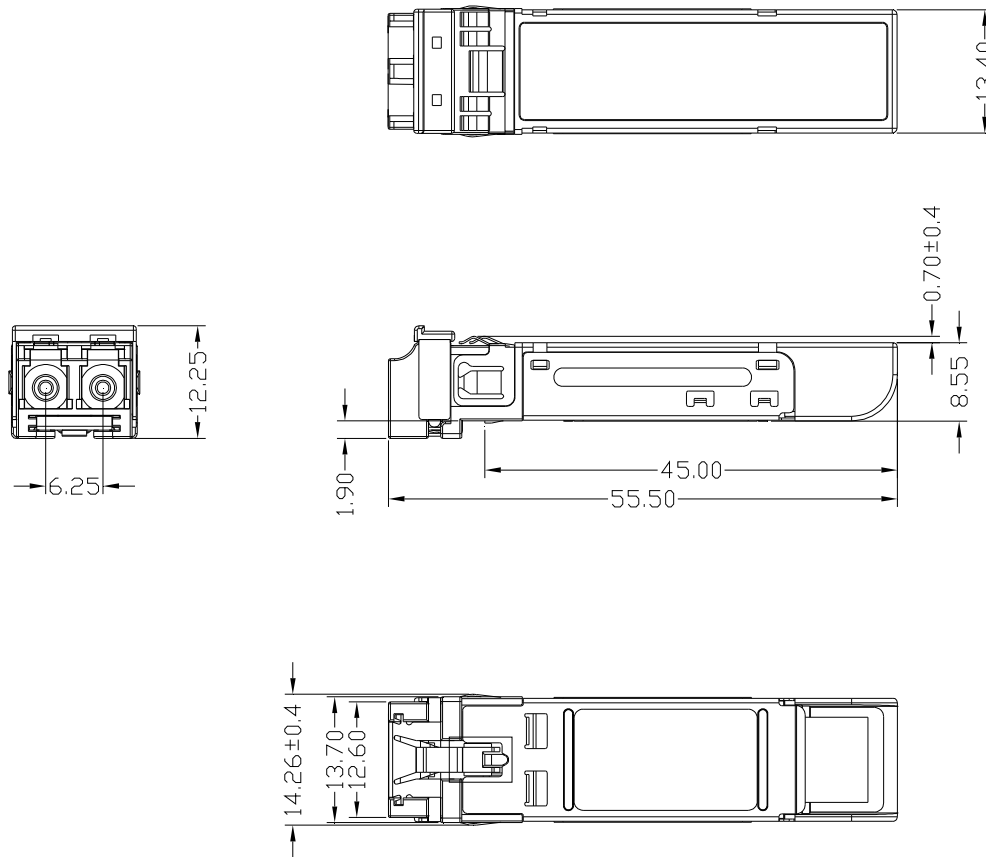
Parameter	Symbol	Min.	Max	Accuracy	Unit	Notes
Transceiver Temperature Accuracy	DMI_Temp	0	70	$\pm 5^{\circ}\text{C}$	$^{\circ}\text{C}$	
Transceiver Supply Voltage Accuracy	DMI_Voltage	3.15	3.45	$\pm 3\%$	V	
Transmitter Bias Current	DMI_Bias	0	20	$\pm 10\%$	mA	
Transmitter Output Power Accuracy	DMI_Tx power	-8	-1	$\pm 3\text{ dB}$	dBm	
Receiver Optical Input Power Accuracy	DMI_Rx power	-12	0	$\pm 3\text{ dB}$	dBm	



## Control and Status I/O Timing Characteristics

Timing characteristics of control and status I/O are included in Table 9, which is also defined in SFF-8431.

Parameter	Symbol	Min	Max	Unit	Condition
TX Disable Assert Time	t_off		10	μs	Time from rising edge of TX Disable to when the optical output falls below 10% of nominal
TX Disable Negate Time	t_on		1	ms	Time from falling edge of TX Disable to when the modulated optical output rises above 90% of nominal
Time to initialize, including reset of TX_Fault	t_init		300	ms	From power on or negation of TX Fault using TX Disable
TX Fault Assert Time	t_fault		100	μs	Time from fault to TX fault on.
TX Disable to reset	t_reset	10		μs	Time TX Disable must be held high to reset TX_fault
LOS Assert Time	t_loss_on		100	μs	Time from LOS state to RX LOS assert
LOS Deassert Time	t_loss_off		100	μs	Time from non-LOS state to RX LOS deassert
Rate-Select Change Time	t_ratesel		10	μs	Time from rising or falling edge of Rate Select input until receiver bandwidth is in conformance with appropriate specification.
Serial ID Clock Rate	f_serial_clock		100	kHz	

**Mechanical (mm)****Reference**

- “Fibre Channel – Physical Interfaces – 5”, INCITS 479-2011 (Defines 4GFC, 8GFC, and 16GFC)
- IEEE STD 802.3ae, Clause 52, PMD Type 10GBASE-SR. IEEE Standards Department.
- “Improved Pluggable Form Factor,” SFF Document Number SFF-8432, Revision 5.0, July 16, 2007.
- “Enhanced Small Form Factor Pluggable Module ‘SFP+’,” SFF Document Number SFF-8431, Revision 4.1, July 6, 2009; Addendum Jun 21, 2013.
- SFF-8402, Revision 0.2
- Small Form Factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), September 14, 2000 which is available as SFF Document Number INF-8074, Revision 1.0 May 12, 2001.
- “Digital Monitoring Interface for Optical Transceivers,” SFF Document Number SFF-8472, Revision 12.1.

## ESD

Normal ESD precautions are required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.

## Contact Information

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