

10G BASE-LR Duplex SFP+ single-Mode Transceiver

AXS13-192-10

Features

- Operating data rate up to 11.3Gbps
- 1310nm DFB-LD Transmitter
- Distance up to 10km
- Single 3.3V Power supply and TTL Logic Interface
- Duplex LC Connector Interface
- Hot Pluggable
- Power Dissipation < 1.0W
- Compliant with MSA SFP+ Specification SFF-8431
- Compliant with IEEE 802.3ae 10GBASE-LR/LW
- Operating Case Temperature

Standard: 0°C~+70°C

Industrial:-40°C~+85°C



Applications

- 10GBASE-LR at 10.31Gbps
- 10GBASE-LW at 9.95Gbps
- OBSAI rates 6.144 Gb/s, 3.072 Gb/s, 1.536 Gb/s, 0.768Gb/s
- CPRI rates 10.138Gb/s ,9.830 Gb/s,7.373Gb/s, 6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s

Product Description

The AXS13-192-10 series single mode transceiver is small form factor pluggable module for serial optical data communications such as IEEE 802.3ae 10GBASE-LR/LW. It is with the SFP+ 20-pin connector to allow hot plug capability.

This module is designed for single mode fiber and operates at a nominal wavelength of 1310 nm. The transmitter section uses a 1310nm multiple quantum well DFB laser and is a class 1 laser compliant according to International Safety Standard AXS13-192-10.

The receiver section uses an integrated InGaAs detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

Absolute Maximum Ratings^{*note2}

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Supply Voltage	Vcc	-0.5	3.6	V
Input Voltage	Vin	-0.5	Vcc	V

Note2: Exceeding any one of these values may destroy the device permanently.

Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit
Operating Case Temperature	TC	AXS13-192-10	0	+70	°C
		AXS13-192-10+	-40	+85	
Power Supply Voltage	Vcc	3.15	3.3	3.45	V
Power Supply Current	Icc			300	mA
Surge Current	ISurge			+30	mA
Baud Rate		0.6		11.3	Gbps

Performance Specifications – Electrical

Parameter	Symbol	Min.	Typ.	Max	Unit	Notes
Transmitter						
CML Inputs(Differential)	Vin	150		1200	mVpp	AC coupled inputs
Input AC Common Mode Voltage		0		25	mV	RMS
Input Impedance (Differential)	Zin	85	100	115	ohm	Rin > 100 kohms@ DC

Differential Input S-parameter	SDD11	-	-	-10	dB	
Differential to Common Mode Conversion	SCD11	-	-	-10	dB	
Tx_DISABLE Input Voltage –High		2		3.45	V	
Tx_DISABLE Input Voltage –Low		0		0.8	V	
Tx_FAULT Output Voltage –High		2		Vcc+0.3	V	Io = 400µA; HostVcc
Tx_FAULT Output Voltage –Low		0		0.5	V	Io = -4.0mA
Receiver						
CML Outputs (Differential)	Vout	350		700	mVpp	AC coupled outputs
Output AC Common Mode Voltage		0		15	mV	RMS
Output Impedance (Differential)	Zout	90	100	110	ohm	
Differential Output S-parameter	SD22	-	-	-10	dB	
Rx_LOS Output Voltage – High		2		Vcc+0.3	V	Io = 400µA; HostVcc
Rx_LOS Output Voltage – Low		0		0.8	V	Io = -4.0mA
MOD_DEF (0:2)	VoH	2.5			V	With Serial ID
	VoL	0		0.5	V	

Performance Specifications – Optical

Parameter	Symbol	Min.	Typical	Max.	Unit
9µm Core Diameter SMF			10		km
Data Rate		0.6		11.3	Gbps
Transmitter					
Centre Wavelength	λ_C	1270	1310	1355	nm
Spectral Width (-20dB)	$\Delta\lambda$			1	nm
Side Mode Suppression Ratio	SMSR	30			dB
Average Output Power*note3	Pout	-8.2		+0.5	dBm
Extinction Ratio	ER	3.5			dB
Average Power of OFF Transmitter	Poff			-30	dBm

Transmitter Dispersion Penalty	TDP			3.2	dB
TX Disable Assert Time	t_off	-	-	10	us
TX_DISABLE Negate Time	t_on	-	-	1	ms
TX_BISABLE time to start reset	t_reset	10	-	-	us
Time to initialize, include reset of TX_FAULT	t_init	-	-	300	ms
TX_FAULT from fault to assertion	t_fault	-	-	100	us
Total Jitter	TJ	-	-	0.28	UI(p-p)
Data Dependant Jitter	DDJ	-	-	0.1	UI(p-p)
Uncorrelated Jitter	UJ	-	-	0.023	RMS
Receiver					
Centre Wavelength	λ	1260		1565	nm
Sensitivity*note4	Pmin			-14.4	dBm
Receiver Overload	Pmax	0.5			dBm
Optical Return Loss	ORL			-12	dB
LOS De-Assert	LOSD			-16	dBm
LOS Assert	LOSA	-28			dBm

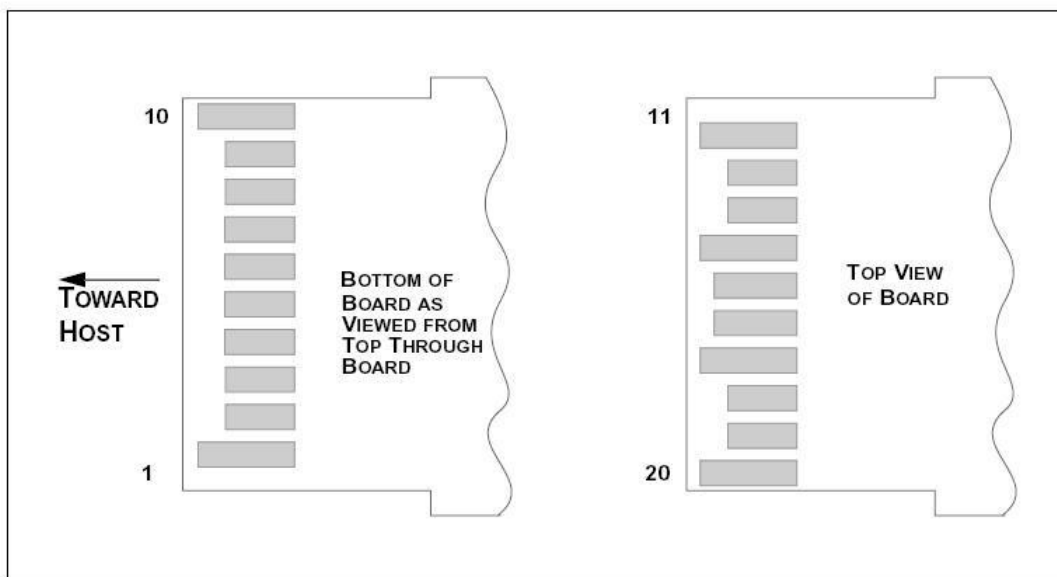
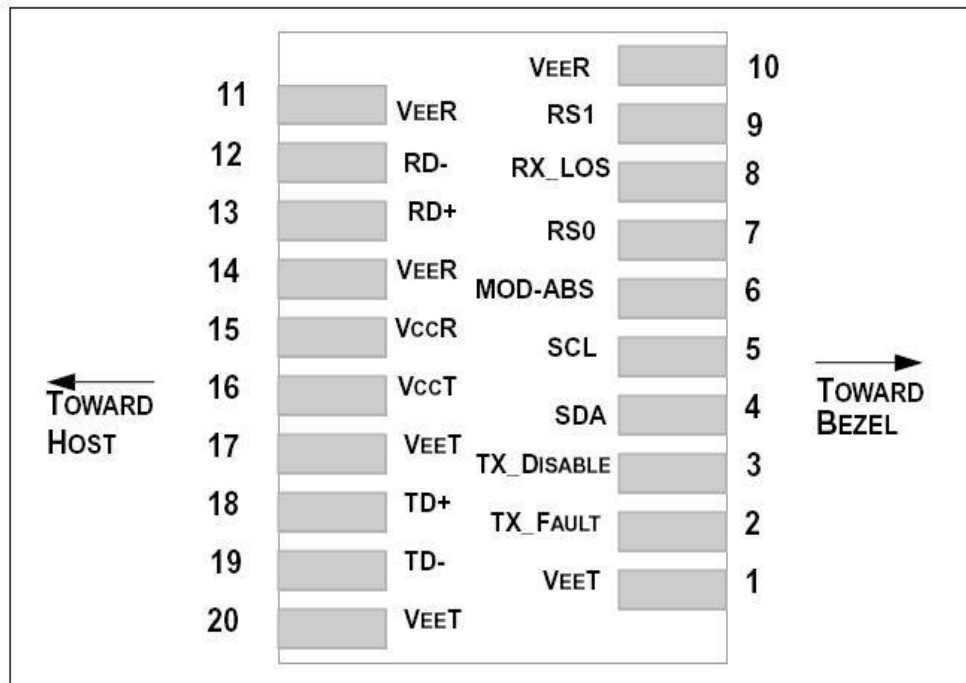
Note3: Output is coupled into a 9/125um SMF. The -4.7dBm is reference IEEE 802.3ae, the typical value is -1dBm. Note4: Minimum average optical power measured at the BER less than 1E-12, back to back. The measure pattern is PRBS 2³¹-1.

Regulatory Compliance*

Product Certificate	Certificate Number	Applicable Standard
TUV	R50135086	EN 60950-1:2006+A11+A1+A12+A2
		EN 60825-1:2014
		EN 60825-2:2004+A1+A2
UL	E317337	UL 60950-1
		CSA C22.2 No. 60950-1-07
EMC CE	AE 50285865 0001	EN 55022:2010
		EN 55024:2010
FCC	WTF14F0514417E	47 CFR PART 15 OCT., 2013
FDA	/	CDRH 1040.10
ROHS	/	2011/65/EU

*The above certificate number updated to June 2014, because some certificate will be updated every year, such as FDA and ROHS. For the latest certification information, please check with 10Gtek.

SFP+ Transceiver Electrical Pad Layout



Pin Function Definitions

Pin Num.	Name	FUNCTION	Plug Seq.	Notes
1	VeeT	Transmitter Ground	1	Note 5
2	TX Fault	Transmitter FaultIndication	3	Note 1
3	TXDisable	Transmitter Disable	3	Note 2, Module disables on high or open
4	SDA	Module Definition 2	3	2-wire Serial Interface Data Line.
5	SCL	Module Definition 1	3	2-wire Serial Interface Clock.
6	MOD-ABS	Module Definition 0	3	Note 3
7	RS0	RX Rate Select (LVTTTL).	3	Rate Select 0, optionally controls SFP+ module receiver. This pin is pulled low to VeeT with a >30K resistor..
8	LOS	Loss of Signal	3	Note 4
9	RS1	TX Rate Select (LVTTTL).	1	Rate Select 1, optionally controls SFP+ module transmitter. This pin is pulled low to VeeT with a >30K resistor.
10	VeeR	Receiver Ground	1	Note 5
11	VeeR	Receiver Ground	1	Note 5
12	RD-	Inv. Received DataOut	3	Note 6
13	RD+	Received Data Out	3	Note 7
14	VeeR	Receiver Ground	1	Note 5
15	VccR	Receiver Power	2	3.3V ± 5%, Note 7
16	VccT	Transmitter Power	2	3.3V ± 5%, Note 7
17	VeeT	Transmitter Ground	1	Note 5
18	TD+	Transmit Data In	3	Note 8
19	TD-	Inv. Transmit DataIn	3	Note 8
20	VeeT	Transmitter Ground	1	Note 5

1) TX Fault is an open collector/drain output, which should be pulled up with a 4.7K – 10KΩ resistor on the host board. Pull up voltage between 2.0V and VccT/R+0.3V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.

2) 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 – 10 KΩ resistor. Its states are:
 Low (0 – 0.8V): Transmitter on (>0.8, < 2.0V): Undefined
 High (2.0 – 3.465V): Transmitter Disabled Open: Transmitter Disabled

3) Module Absent, connected to VeeT or VeeR in the module.

4) LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K – 10KΩ resistor. Pull up voltage between 2.0V and VccT/R+0.3V. When high, this output indicates the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.

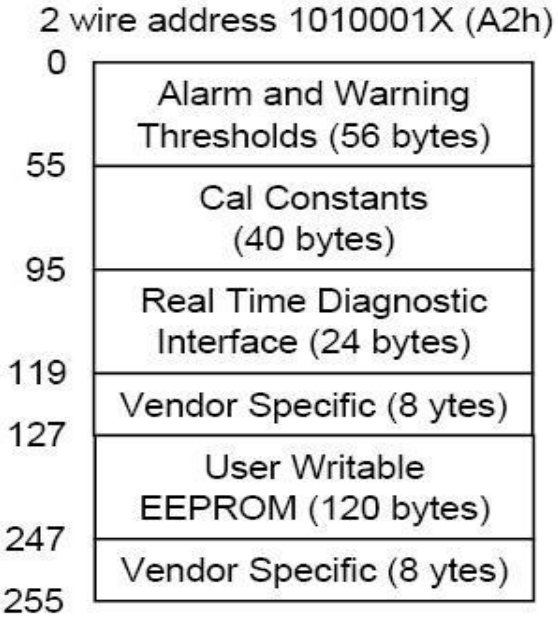
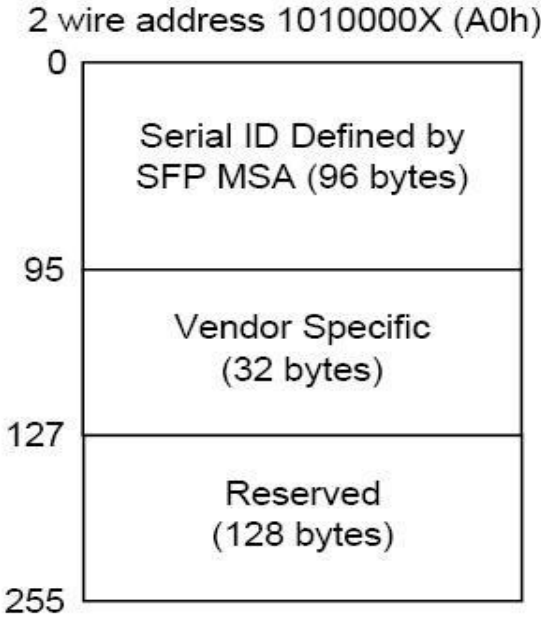
5) The module signal ground contacts, VeeR and VeeT, should be isolated from the module case.

- 6) RD-/+ : These are the differential receiver outputs. They are AC coupled 100Ω differential lines which should be terminated with 100Ω (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board.
- 7) VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V ±5% at the SFP+ connector pin. Maximum supply current is 300mA. Inductors with DC resistance of less than 1 ohm should be used in order to maintain the required voltage at the SFP+ input pin with 3.3V supply voltage. When the recommended supply-filtering network is used, hot plugging of the SFP+ transceiver module will result in an inrush current of no more than 30mA greater than the steady state value. VccR and VccT may be internally connected within the SFP+ transceiver module.
- 8) TD-/+ : These are the differential transmitter inputs. They are AC-coupled, differential lines with 100Ω differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board.

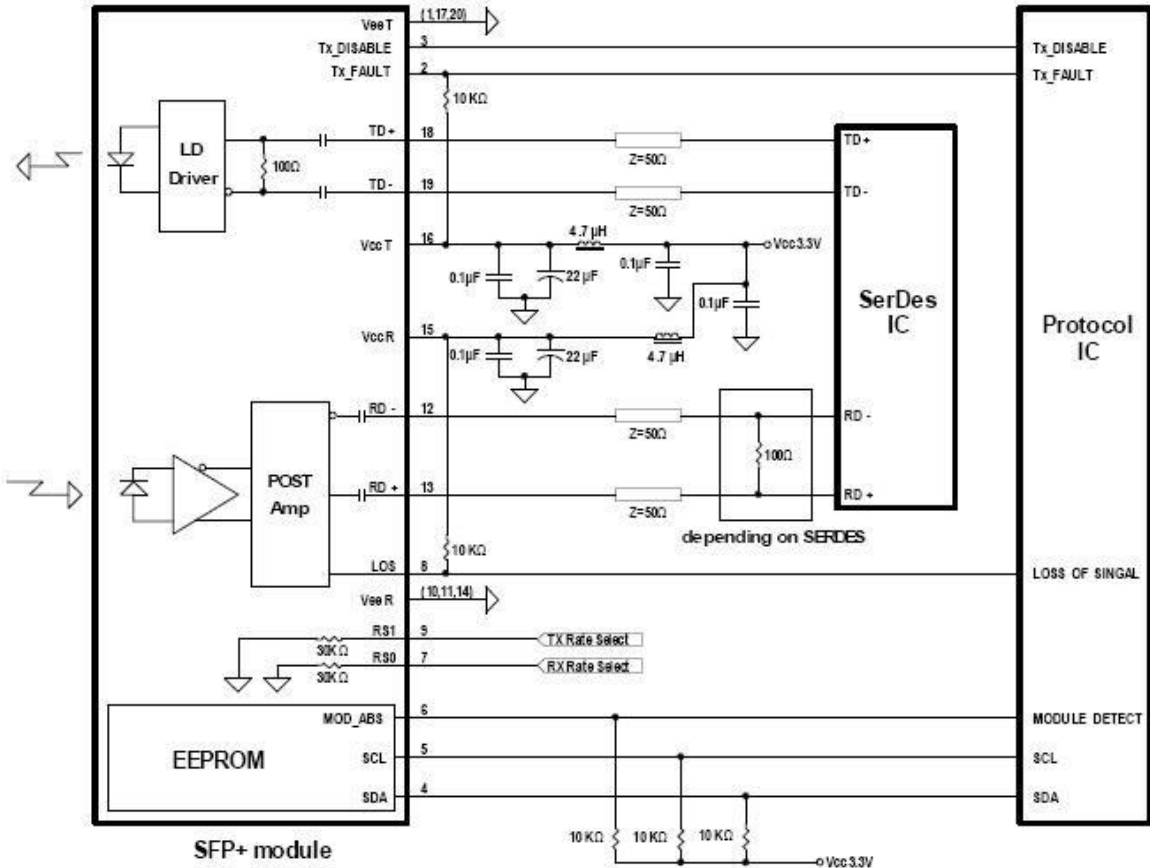
EPROM

The serial interface uses the 2-wire serial CMOS EEPROM protocol defined for the ATMEL AT24C02/04 family of components. When the serial protocol is activated, the host generates the serial clock signal (SCL). The positive edge clocks data into those segments of the EEPROM that are not written protected within the SFP+ transceiver. The negative edge clocks data from the SFP+ transceiver. The serial data signal (SDA) 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.

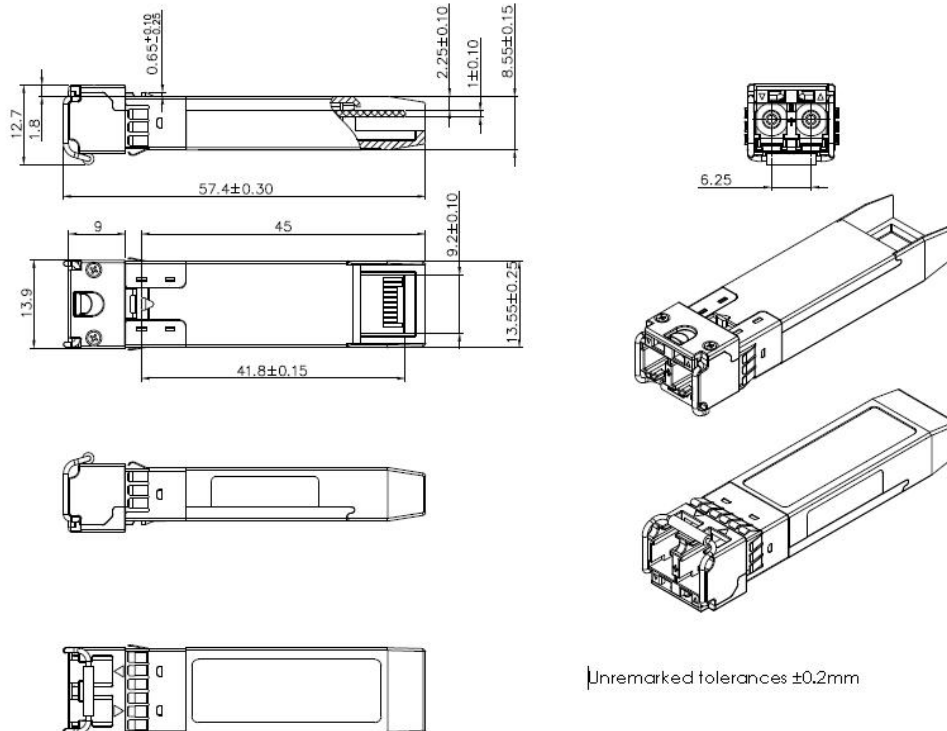
The Module provides diagnostic information about the present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Calibration and alarm/warning threshold data is written during device manufacture. Received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring all are implemented. If the module is defined as external calibrated, 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 field define as following .For detail EEPROM information, please refer to the related document of SFF 8472 Rev 10.2.



Recommend Circuit Schematic



Mechanical Specifications



*This 2D drawing only for reference, please check with 10Gtek before ordering.

Eye Safety

This single-mode transceiver is a Class 1 laser product. It complies with AXS13-192-10 and FDA 21 CFR 1040.10 and 1040.11. The transceiver must be operated within the specified temperature and voltage limits. The optical ports of the module shall be terminated with an optical connector or with a dust plug.

Notice

10Gtek reserves the right to make changes to or discontinue any optical link product or service identified in this publication, without notice, in order to improve design and/or performance. Applications that are described herein for any of the optical link products are for illustrative purposes only. 10Gtek makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Ordering information

Part No.	Data Rate	Laser	Fiber Type	Distance	Optical Interface	Temp.	DDMI
AXS13-192-10	0.614Gbps to11.3Gbps	1310nm DFB	SMF	10km	LC	Standard	YES
AXS13-192-10+	0.614Gbps to11.3Gbps	1310nm DFB	SMF	10km	LC	Industrial	YES

Note1: Standard version.

*The product image only for reference purpose.

Revision History

Revision	Initiated	Approved	content	Release Date
Ver1.0	HT.HUANG	Nicky	Released	Nov/2017