

10Gbps SFP+ 1310nm 40km Single-Mode Optical Transceiver SFP-10G31-40-xx



Features

- Operating data rate up to 10.3Gbps
- 1310nm DFB-LD Transmitter
- Distance up to 40km
- Single 3.3V Power supply and TTL Logic Interface
- Duplex LC Connector Interface, Hot Pluggable
- Compliant with MSA SFP+ Specification SFF-8431
- Compliant with IEEE 802.3ae 10GBASE-ER/EW
- Build-in dual CDR optional
- Power Dissipation < 1.5W
- Operating Case Temperature
Standard : 0°C to +70°C

Applications

- 10GBASE-ER at 10.31Gbps
- 10GBASE-EW at 9.95Gbps
- Other Optical Link

Description

The SFP-10G31-40-xx series single mode transceiver is small form factor pluggable module for serial optical data communications such as IEEE 802.3ae 10GBASE-ER/EW. 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 IEC-60825.

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

Specifications

Table 1 - Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Supply Voltage	Vcc	-0.5	3.6	V
Storage Temperature	Ts	-40	+85	°C
Input Voltage	Vin	-0.5	Vcc	V
Output Current	Io	-	50	mA

Table 2 - Recommended Operating Conditions

Parameter		Symbol	Min.	Typical	Max.	Unit
Operating Case Temperature	Standard	Tc	0		70	° C
	Industrial	Tc	-40		85	
Power Supply Voltage		VCC	3.15	3.3	3.45	V
Power Supply Current		ICC			300	mA
Surge Current		I _{Surge}			+30	mA
Baud Rate		10GBASE-ER		10.31		Gbps
		10GBASE-EW		9.95		

Table 3 - Performance Specifications - Electrical

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Transmitter						
CML Inputs(Differential)	Vin	150		1200	mVpp	AC coupled inputs
Input Impedance (Differential)	Zin	85	100	115	ohms	Rin > 100 kohms@ DC
Tx_DISABLE Input Voltage - High		2		Vcc+0.3	V	
Tx_DISABLE Input Voltage - Low		0		0.8	V	
Tx_FAULT Output Voltage - High		2		Vcc+0.3	V	Io = 400 μ A; Host Vcc
Tx_FAULT Output Voltage - Low		0		0.5	V	Io = -4.0mA
Receiver						
CML Outputs (Differential)	Vout	350		700	mVpp	AC coupled outputs
Output Impedance (Differential)	Zout	85	100	115	ohms	
Rx_LOS Output Voltage - High		2		Vcc+0.3	V	Io = 400 μ A; Host Vcc
Rx_LOS Output Voltage - Low		0		0.8	V	Io = -4.0mA
MOD_DEF (2:0)	VoH	2.5			V	With Serial ID
	VoL	0		0.5	V	

Table 4- Optical and Electrical Characteristics

Parameter	Symbol	Min.	Typical	Max	Unit	Notes
9 μ m Core Diameter SMF	-	-	40	-	km	
Data Rate	-	-	-	10.3	Gbps	
Transmitter						
Center Wavelength	λ_c	1270	1310	1355	nm	
Spectral Width (RMS)	$\Delta \lambda$	-	-	1	nm	
Average Optical Power	P_{out}	-1	-	4	dBm	
Average Power of OFF Transmitter	P_{off}	-	-	-30	dBm	
Extinction Ratio	ER	3.5	-	-	dB	
Side Mode Suppression Ratio	SMSR	30			dB	
Transmitter Dispersion Penalty	TDP	-	-	2	dB	
Input Differential Impedance	Z_{IN}	90	100	110	Ω	
TX Disable	Disable	-	2	-	VCC+0.3	V
	Enable	-	0	-	0.8	
TX Fault	Fault	-	2	-	VCC+0.3	
	Normal	-	0	-	0.8	
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						
Center Wavelength	λ_c	1260	-	1565	nm	
Receiver Sensitivity	P_{min}	-	-	-15	dBm	
Receiver Overload	P_{max}	0.5	-	-	dBm	1
Optical Return Loss	ORL	-	-	-12	dB	
LOS De-Assert	LOS_D	-	-	-16	dBm	
LOS Assert	LOS_A	-25	-	-	dBm	
LOS	High	-	2	-	VCC+0.3	V
	Low	-	0	-	0.8	

Note 1: Measured with a PRBS 2³¹-1 test pattern @ 10.3125Gbps, BER ≤ 10⁻¹²

SFP+ Transceiver Electrical Pad Layout

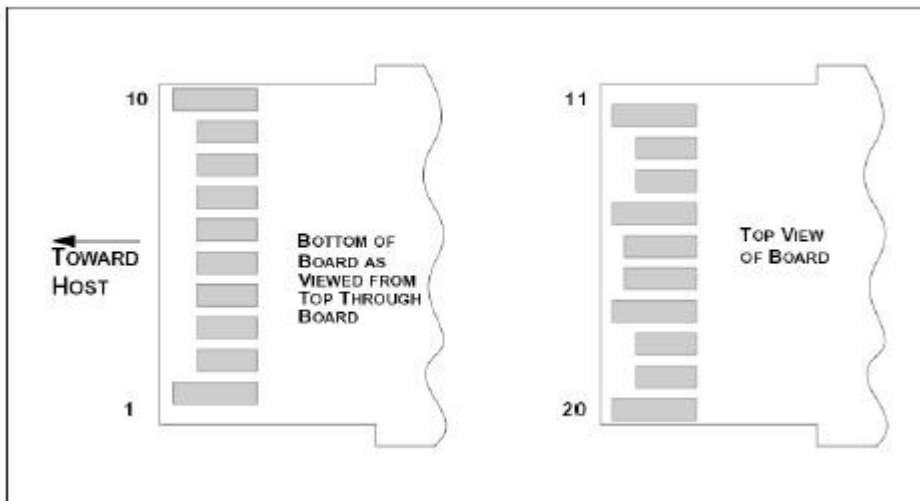
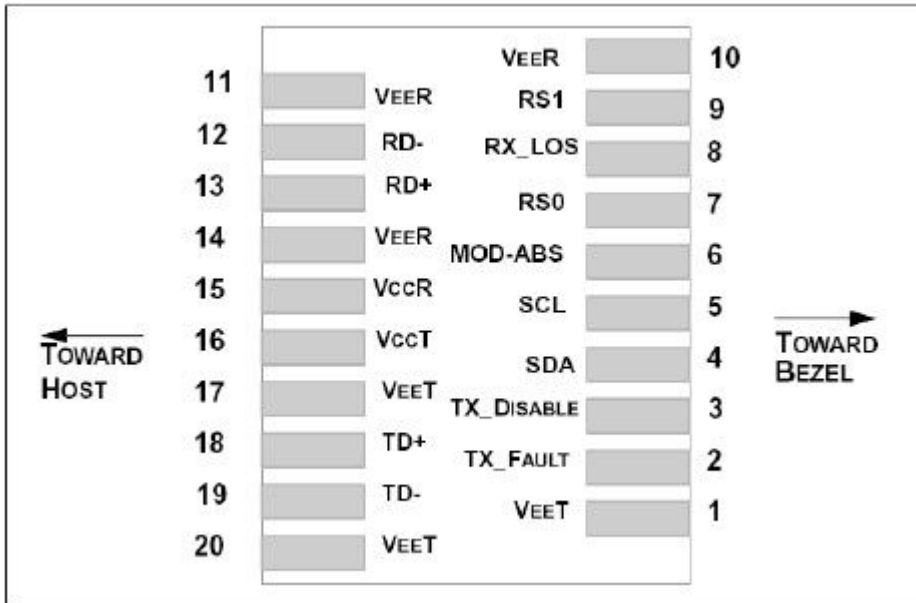


Table 5 – Diagnostics Specification

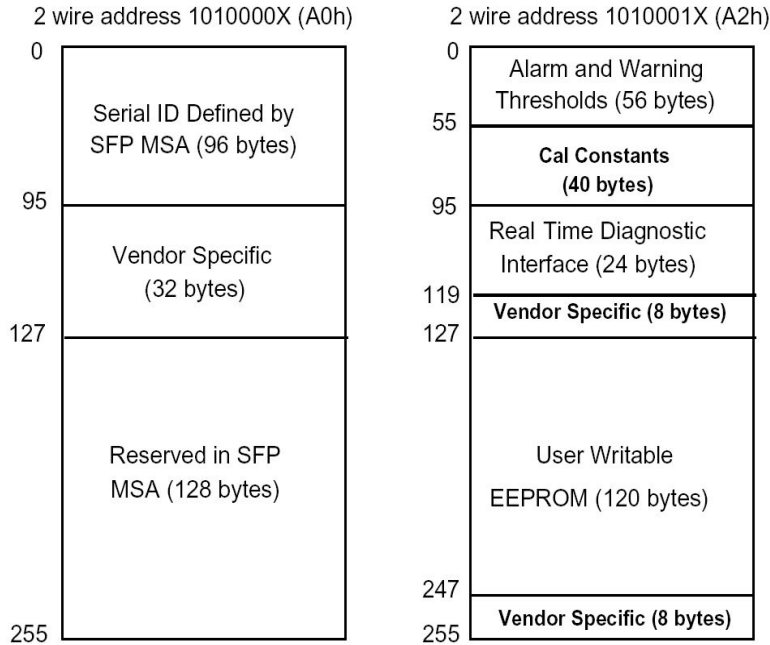
Parameter	Range	Unit	Accuracy	Calibration
Temperature	0 to +70	°C	±3°C	Internal / External
Voltage	3.0 to 3.6	V	±3%	Internal / External
Bias Current	0 to 100	mA	±10%	Internal / External
TX Power	0 to +5	dBm	±3dB	Internal / External
RX Power	-23 to -3	dBm	±3dB	Internal / External

Digital Diagnostic Memory Map

The transceivers provide serial ID memory contents and diagnostic information about the present operating conditions by the 2-wire serial interface (SCL, SDA).

The diagnostic information with internal calibration or external calibration all are implemented, including received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring.

The digital diagnostic memory map specific data field defines as following.



Pin Function Definitions

Pin	Name	Function	Plug Seq.	Notes
1	VeeT	Transmitter Ground	1	Note 5
2	TX FAULT	Transmitter Fault Indication	3	Note 1
3	TX Disable	Transmitter Disable	3	Note 2, Module disables on high or open
4	MOD_DEF(2)	Serial Data Signal	3	2-wire Serial Interface Data Line. Note 3
5	MOD_DEF(1)	SCL Serial Clock Signal	3	2-wire Serial Interface Clock. Note 3
6	MOD_DEF(0)	TTL Low	3	Note 3
7	RS0	RX Rate Select (LVTTTL).	3	This pin has an internal 30k pull down to ground. A signal on This pin will not affect module performance.
8	LOS	Loss of Signal	3	Note 4
9	RS1	TX Rate Select (LVTTTL)	1	This pin has an internal 30k pull down to ground. A signal on This pin will not affect module performance.
10	VeeR	Receiver ground	1	Note 5

11	VeeR	Receiver ground	1	Note 5
12	RD-	Inv. Received Data Out	3	Note 6
13	RD+	Received Data Out	3	Note 6
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 Data In	3	Note 8
20	VeeT	Transmitter Ground	1	Note 5

Notes:

Plug Seq.: Pin engagement sequence during hot plugging.

- 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~10KΩ 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) Mod-Def 0, 1, 2. These are the module definition pins. They should be pulled up with a 4.7k~10kΩ resistor on the host board. The pull-up voltage shall be VccT or VccR.
 Mod-Def 0 is grounded by the module to indicate that the module is present
 Mod-Def 1 is the clock line of two wire serial interface for serial ID
 Mod-Def 2 is the data line of two wire serial interface for serial ID

- 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.

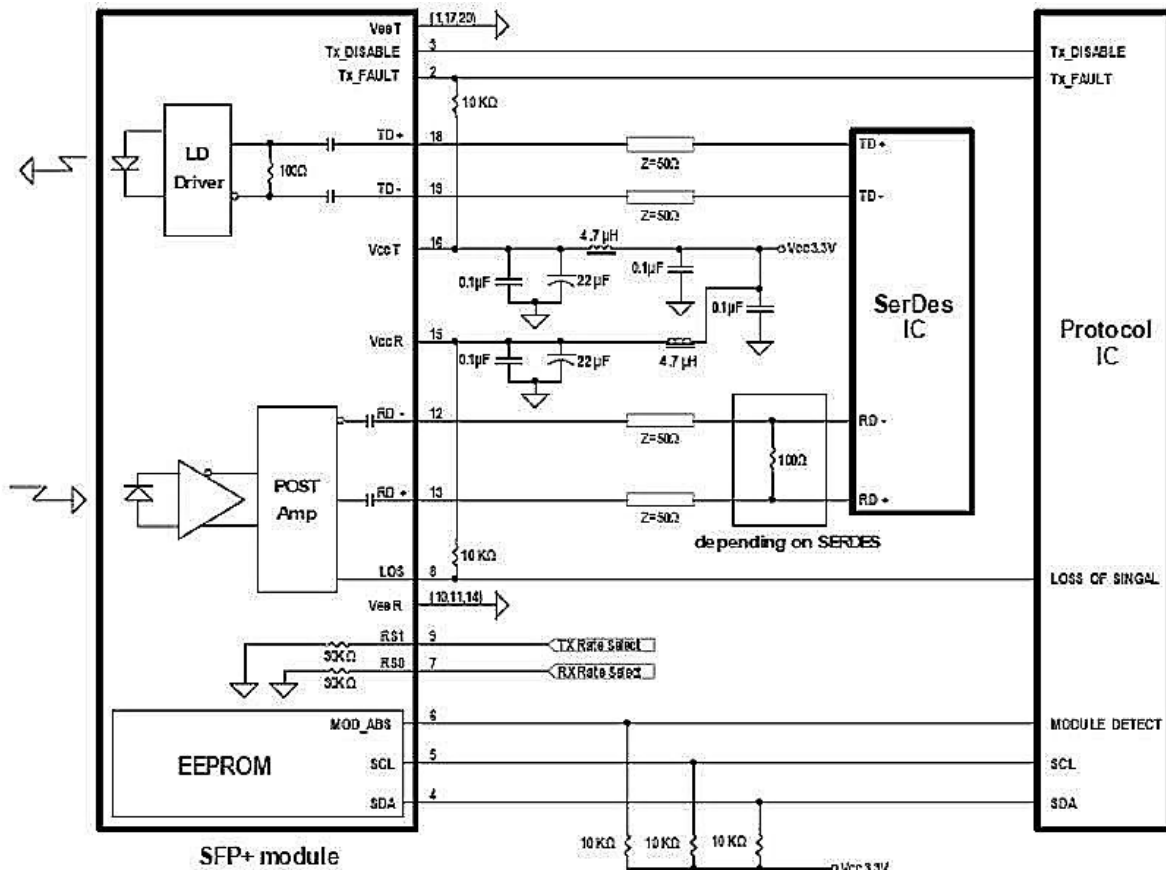
- 6) RD-/+ : These are the differential receiver outputs. They are AC coupled 100Ω differential lines which should be terminated with 100Ω (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board. The voltage swing on these lines will be between 370 and 700 Mv differential (185 –350 Mv single ended) when properly terminated.

- 7) VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V ±5% at the SFP+ connector pin.

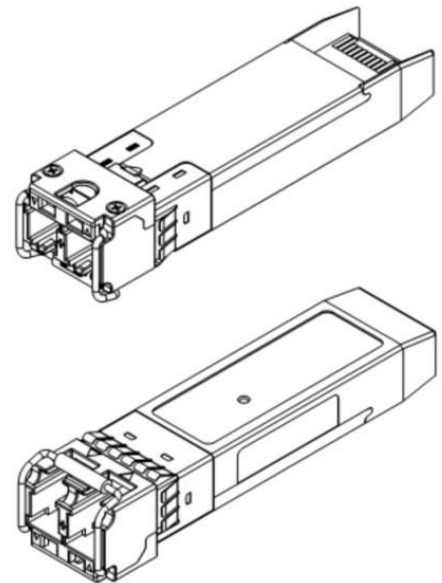
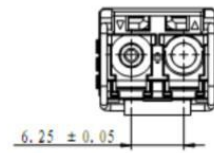
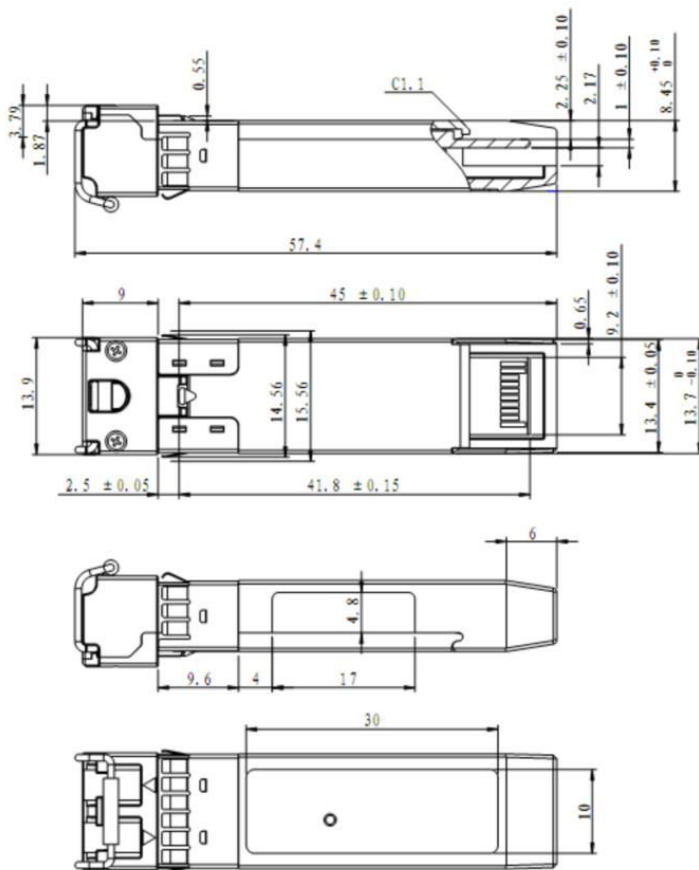
Maximum supply current is 300mA. Inductors with DC resistance of less than 1 ohm should be used in order to maintain the required voltage at the SFP+ input pin with 3.3V supply voltage. When the recommended supply-filtering network is used, hot plugging of the SFP+ transceiver module will result in an 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. The inputs will accept differential swings of 150 – 1200 Mv (75 – 600Mv single-ended), though it is recommended that values between 150 and 1200 Mv differential (75 – 600Mv single-ended) be used for best EMI performance.

Recommended Interface Circuit



Mechanical Dimensions



Ordering Information

Part No.	Data Rate (Gbps)	Wavelength (nm)	Connector Type	Transmission Distance	Operating case temperature (°C)	Digital Diagnostics
SFP-10G31-40-xx	≤ 10.3	1310	LC	40km	0 to +70	Yes

Notes:

xx means compatible brand. (For example: CO= Cisco, JU=Juniper, FD=Foundry, EX=Extreme, NE=Netgear,etc.)

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