SFP+d-2SM-1310nm-20LC

1310nm SFP+ single-Mode Transceiver, With Diagnostic Monitoring
10G BASE-LW/LR
Duplex SFP+ Transceiver, RoHS 6 Compliant

Features

- Operating data rate up to 10.3Gbps
- 1310nm DFB-LD Transmitter
- Distance up to 20km
- Single 3.3V Power supply and TTL Logic Interface
- Duplex LC Connector Interface
- Hot Pluggable
- Power Dissipation < 1.5W
- Compliant with MSA SFP+ Specification SFF-8431
- Compliant with IEEE 802.3ae 10GBASE-LR/LW
- Operating Case Temperature

  Standard: -5℃~+70℃

  Industrial: -40℃~+85℃

Applications

- 10GBASE-LR at 10.31Gbps
- 10GBASE-LW at 9.95Gbps
- Other optical links

Ordering information

Part No.	Data Rate	Laser	Fiber Type	Distance	Optical Interface	Temp.	DDMI
SFP+d-2SM-1310nm-20LC*[note1]	9.95Gbps to 10.3Gbps	1310nm DFB	SMF	20km	LC	Standard	YES
SFP+d-2SM-1310nm-20LC-I	9.95Gbps to 10.3Gbps	1310nm DFB	SMF	20km	LC	Industrial	YES

Note1:Standard version.

Regulatory Compliance

Feature	Standard
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883G Method 3015.7
Electrostatic Discharge to the enclosure	EN 55024:1998+A1+A2 IEC-61000-4-2 GR-1089-CORE
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022:2006 CISPR 22B :2006 VCCI Class B
Immunity	EN 55024:1998+A1+A2 IEC 61000-4-3
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN (IEC) 60825-1:2007 EN (IEC) 60825-2:2004+A1
Component Recognition	UL and CUL EN60950-1:2006
RoHS6	2002/95/EC 4.1&4.2 2005/747/EC 5&7&13

Product Description

The SFP+d-2SM-1310nm-20LC 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 IEC-60825.

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

Absolute Maximum Ratings*note3

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	T_S	-40	+85	°C
Supply Voltage	V_{CC}	-0.5	3.6	V
Input Voltage	Vin	-0.5	Vcc	V
Output Current	Io	-	50	mA

Note3: Exceeding any one of these values may destroy the device permanently.

Recommended Operating Conditions

Parameter	Symbol		Min.	Typical	Max.	Unit
Operating Case Temperature	T_c	SFP+d-2SM-1310nm-20LC	-5		+70	°C
		SFP+d-2SM-1310nm-20LC-I	-40		+85	
Power Supply Voltage	V_{CC}		3.15	3.3	3.45	V
Power Supply Current	I_{CC}				430	mA
Surge Current	I_{Surge}				+30	mA
Baud Rate	10GBASE-LR			10.31		Gbps
	10GBASE-LW			9.95		

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	$S_{DD}11$	-	-	-10	dB	
Differential to Common Mode Conversion	$S_{CD}11$	-	-	-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; 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 AC Common Mode Voltage		0		15	mV	RMS
Output Impedance (Differential)	Zout	90	100	110	ohm	
Differential Output S-parameter	S_D22	-	-	-10	dB	

Rx_LOS Output Voltage – High		2		Vcc+0.3	V	Io = 400μA; Host Vcc
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	

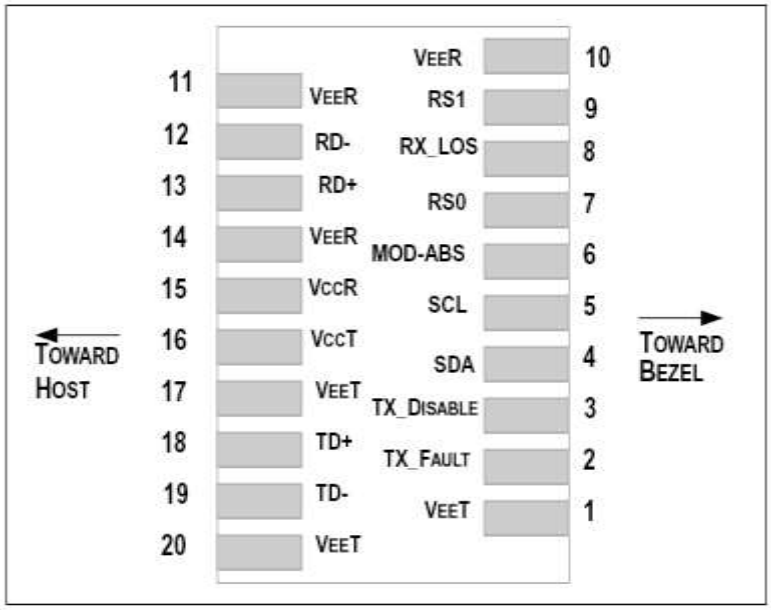
Performance Specifications – Optical

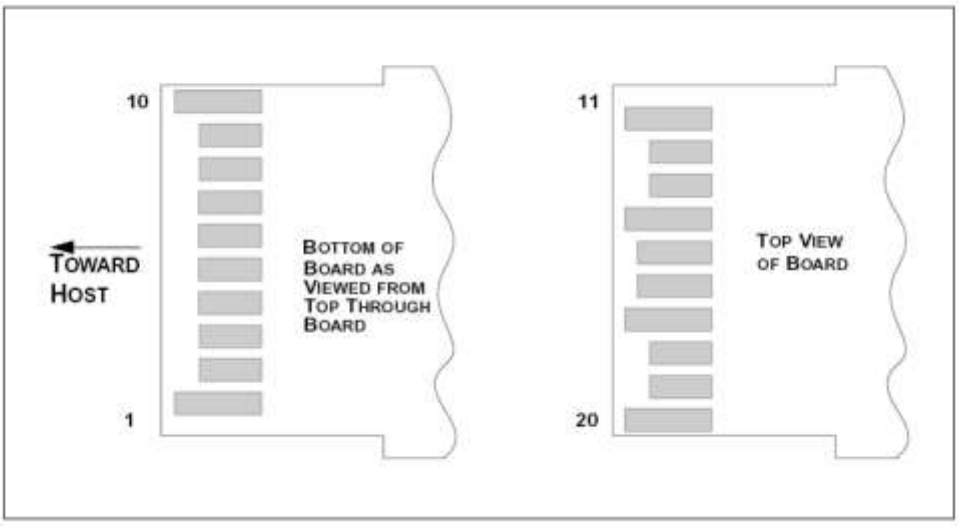
Parameter		Symbol	Min.	Typical	Max.	Unit
9μm Core Diameter SMF				20		Km
Data Rate					10.3	Gbps
Transmitter						
Centre Wavelength		λ_C	1270	1310	1355	nm
Spectral Width (-20dB)		Δλ			1	nm
Average Output Power*note4		P_{out}	-3		+1	dBm
Extinction Ratio		ER	3.5			dB
Average Power of OFF Transmitter		P_{off}			-30	dBm
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		2.0		Vcc+0.3	V
	Enable		0		0.8	
TX Fault	Fault		2.0		V_{CC}+0.3	V
	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						
Centre Wavelength		λ	1260		1565	nm
Sensitivity*note5		P_{min}			-14.4	dBm
Receiver Overload		P_{max}	0.5			dBm
Optical Return Loss		ORL			-12	dB
LOS De-Assert		LOS_D			-15	dBm
LOS Assert		LOS_A	-25			dBm
LOS	High		2.0		V_{CC}+0.3	V
	Low		0		0.8	

Note4: Output is coupled into a 9/125um SMF. The -4.7dBm is reference IEEE 802.3ae, the typical value is -1dBm.

Note5: Minimum average optical power measured at the BER less than 1E-12, back to back. The measure pattern is PRBS 2^{31}-1.

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 Fault Indication	3	Note 1
3	TX Disable	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 (LVTTL).	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 (LVTTL).	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 Data Out	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 Data In	3	Note 8
20	VeeT	Transmitter Ground	1	Note 5

Notes:

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.

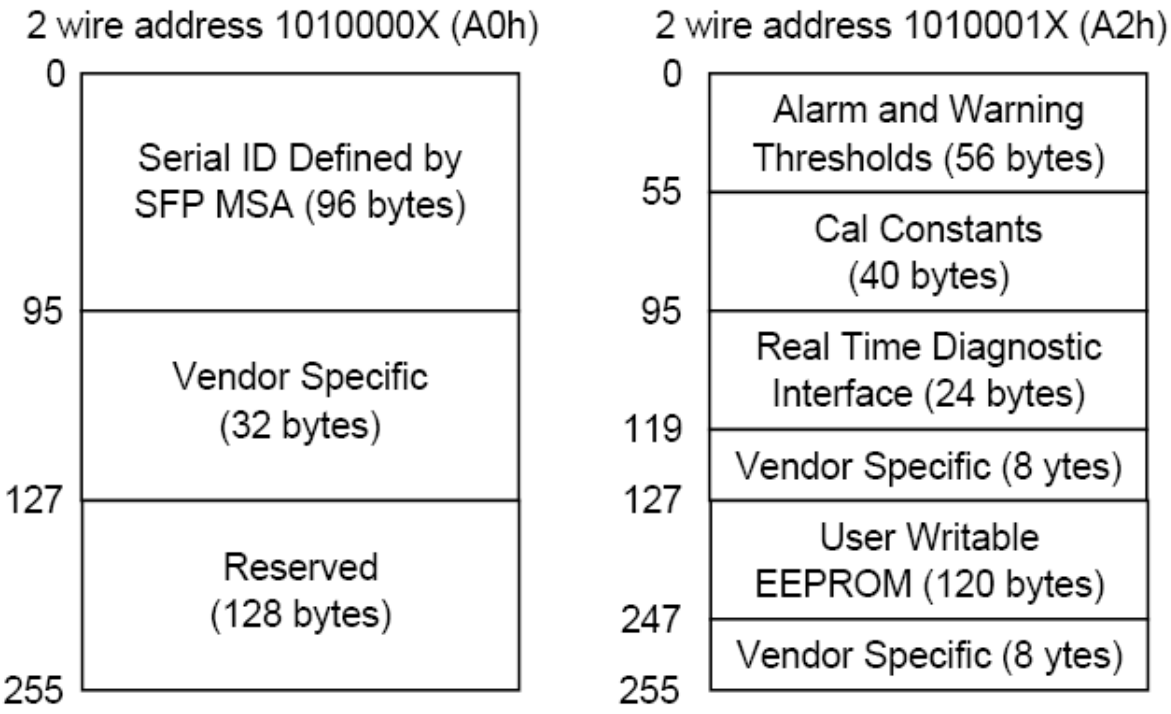
7) VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V ±5% at the SFP+ connector pin. Maximum supply current is 300mA. Inductors with DC resistance of less than 1 ohm should be used in order to maintain the required voltage at the SFP+ input pin with 3.3V supply voltage. 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.

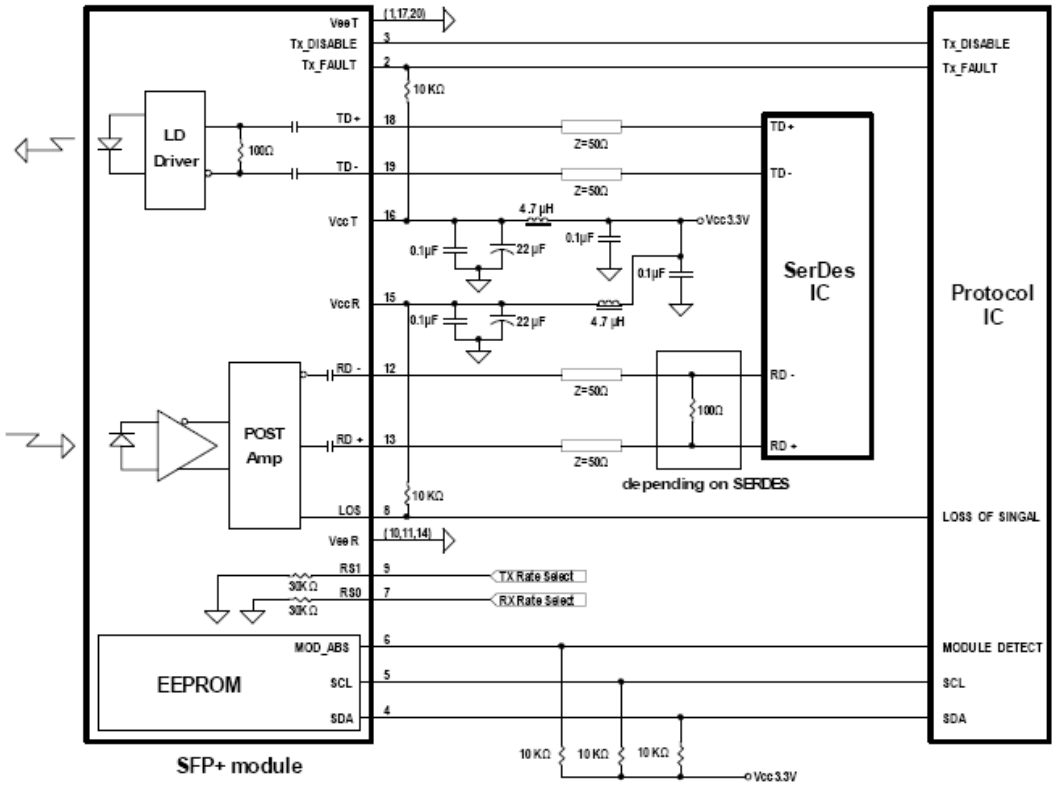
EEPROM

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.

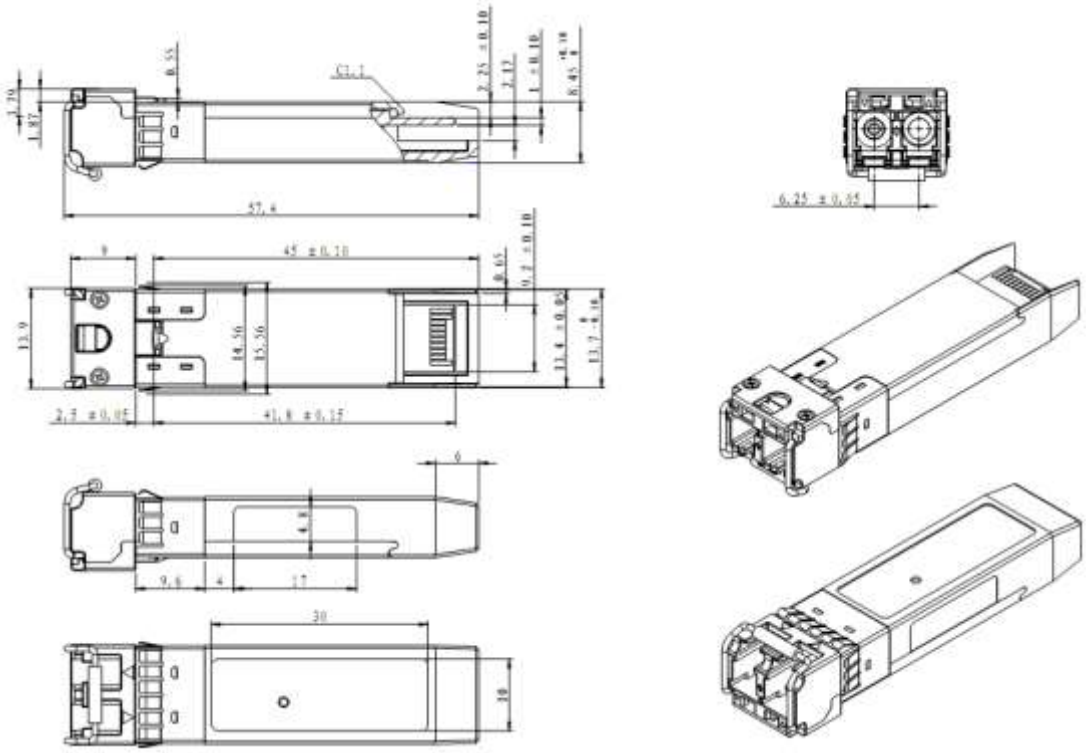
The Module provides diagnostic information about the present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Calibration and alarm/warning threshold data is written during device manufacture. Received power monitoring, transmitted power 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



Eye Safety

This single-mode transceiver is a Class 1 laser product. It complies with IEC-60825 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.

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