

SFP-SX-MM-0401

4.25Gbps SFP Transceiver

Features

- ◆ Operating data rate up to 4.25Gbps
- ◆ 850nm VCSEL Laser Transmitter
- ◆ 150m with 50/125 μ m MMF, 70m on 62.5/125 μ m MMF
- ◆ Single 3.3V Power supply and TTL Logic Interface
- ◆ Duplex LC Connector Interface
- ◆ Hot Pluggable
- ◆ Operating Case Temperature
Standard: 0°C~+70°C,
Industrial:-40°C~+85°C
- ◆ Compliant with MSA SFP Specification
- ◆ Digital diagnostic monitor interface
- Compatible with SFF-8472



Applications

- ◆ Tri-Rate 1.063/2.125/4.25 Gb/s Fiber Channel
- ◆ 1.25 Gb/s 1000Base-SX Ethernet

Product Description

The SFP-SX-MM-0401 series multi-mode transceivers is small form factor pluggable module for bi-directional serial optical data communications such as 4X / 2X / 1X Fibre Channel and Gigabit Ethernet 1000BASE-SX. It is with the SFP 20-pin connector to allow hot plug capability. This module is designed for multi-mode fiber and operates at a nominal wavelength of 850 nm.

The transmitter section uses a Vertical Cavity Surface Emitted Laser (VCSEL) and is a Class 1 laser compliant according to International Safety Standard IEC 60825. The receiver section uses an integrated GaAs detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

The SFP-SX-MM-0401 series are designed to be compliant with SFF-8472 SFP Multi-source Agreement (MSA).

Regulatory Compliance

Feature	Standard	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883E Method 3015.7	Class 1(>500 V) Isolation with the case
Electromagnetic Interference (EMI)	FCC Part 15 Class B	Compatible with standards
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN60950, EN (IEC) 60825-1,2	Compatible with Class I laser product. Compatible with TüV standards
Component Recognition	UL and CUL	UL file E317337
Green Products	RoHS	RoHS6

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	T _S	-40	+85	°C
Supply Voltage	V _{CC}	-0.5	3.6	V

Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit
Operating Case Temperature	T _A	SFP-SX-MM-0401	0	+70	°C
		SFP-SX-MM-0401I	-40	+85	
Power Supply Voltage	V _{CC}	3.15	3.3	3.45	V
Power Supply Current	I _{CC}			300	mA
Surge Current	I _{Surge}			+30	mA
Baud Rate		1.0625		4.25	GBaud

PERFORMANCE SPECIFICATIONS - ELECTRICAL

Parameter	Symbol	Min.	Typ.	Max	Unit	Notes
TRANSMITTER						
LVPECL Inputs(Differential)	V _{in}	400		2500	mVp	AC coupled inputs
Input Impedance (Differential)	Z _{in}	85	100	115	ohms	R _{in} > 100 kohms @ DC
Tx_DISABLE Input Voltage - High		2		3.45	V	
Tx_DISABLE Input Voltage - Low		0		0.8	V	

SFP Series

up to 4.25G 150m transmission

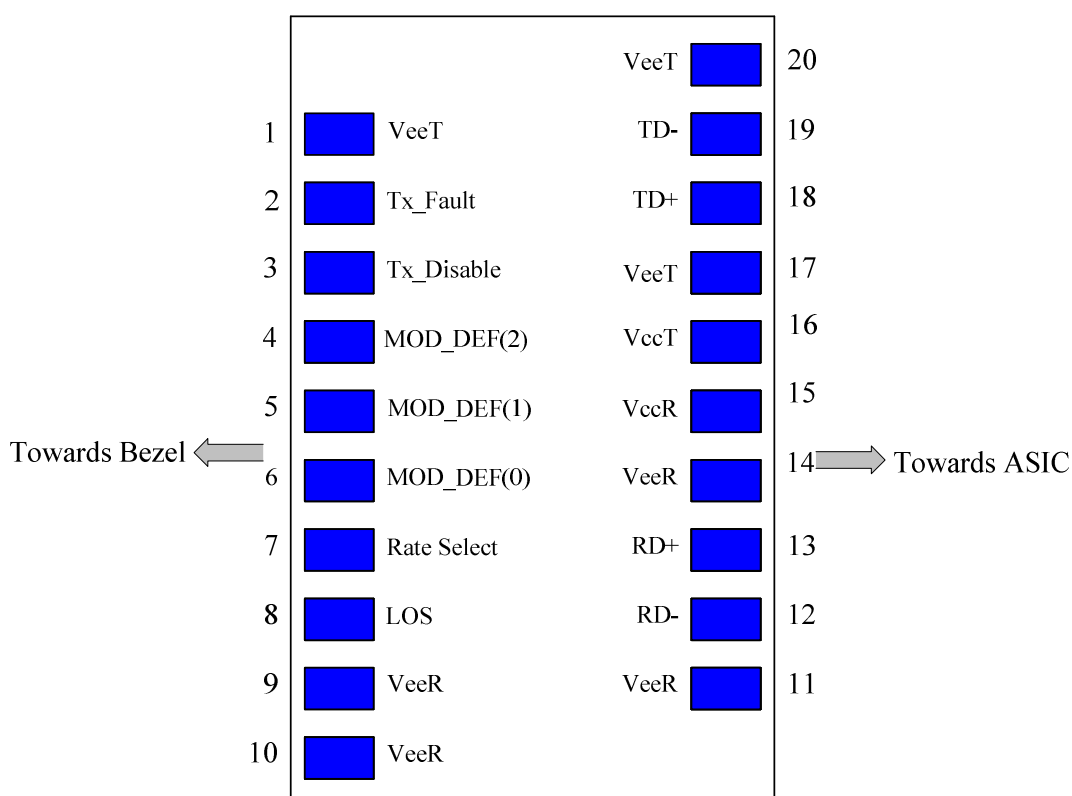
Tx_FAULT Output Voltage -- High		Vcc-0.5		Vcc+0.3	V	Io = 400μA; Host Vcc
Tx_FAULT Output Voltage -- Low		0		0.5	V	Io = -4.0mA
RECEIVER						
LVPECL Outputs (Differential)	Vout	400	800	1200	mVpp	AC coupled outputs
Output Impedance (Differential)	Zout	85	100	115	ohms	
Rx_LOS Output Voltage - High		Vcc-0.5		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	

Optical and Electrical Characteristics

Parameter		Symbol	Min.	Typical	Max.	Unit
50μm Core Diameter MMF	1.063G	L		550		m
	2.125G			300		
	4.25			150		
62.5μm Core Diameter MMF	1.063G			300		
	2.125G			150		
	4.25			70		
Data Rate			1.0625		4.25	Gbps
Transmitter						
Centre Wavelength		λ _C	820	850	860	nm
Spectral Width (RMS)		σ			0.85	nm
Average Output Power		P _{Out}	-9		-2	dBm
Extinction Ratio		EX	9			dB
Rise/Fall Time(20%~80%)		tr/tf			90	ps
Total Jitter		TJ			56.5	ps
Output Optical Eye		IUT-T G.957 Compliant				
Data Input Swing Differential		V _{IN}	500		2000	mV
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

Receiver					
Centre Wavelength	λ_C	760		860	nm
Receiver Sensitivity @ 1.0625 Gb/s	PIN			-18	dBm
Receiver Sensitivity @ 1.25Gb/s				-18	
Receiver Sensitivity @ 2.125Gb/s				-17	
Receiver Sensitivity @ 4.25Gb/s				-15	
Output Differential Impedance	P_{IN}	90	100	110	Ω
Optical Return Loss	ORL	12			dB
Data Output Swing Differential	V_{OUT}	370		2000	mV
Rise/Fall Time	Tr/tf			2.2	ns
LOS De-Assert	LOS_D			-18	dBm
LOS Assert	LOS_A	-30			dBm
LOS	High		2.0	$V_{CC}+0.3$	V
	Low		0	0.8	

SFP Transceiver Electrical Pad Layout



Pin Function Definitions

Pin Num.	Name	FUNCTION	Plug Seq.	Notes
1	VeeT	Transmitter Ground	1	
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-DEF2	Module Definition 2	3	Note 3, Data line for Serial ID.
5	MOD-DEF1	Module Definition 1	3	Note 3, Clock line for Serial ID.
6	MOD-DEF0	Module Definition 0	3	Note 3, Grounded within the module.
7	Rate Select	Not Connect	3	Function not available
8	LOS	Loss of Signal	3	Note 4
9	VeeR	Receiver Ground	1	Note 5
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	3.3 ± 5%, Note 7
16	VccT	Transmitter Power	2	3.3 ± 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 – 10K Ω 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 4.7 – 10 K Ω 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 – 10K Ω resistor on the host board. The pull-up voltage shall be VccT or VccR (see Section IV for further details). 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 – 10K Ω 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) VeeR and VeeT may be internally connected within the SFP module.

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 2000 mV differential (185 –1000 mV single ended) when properly terminated.

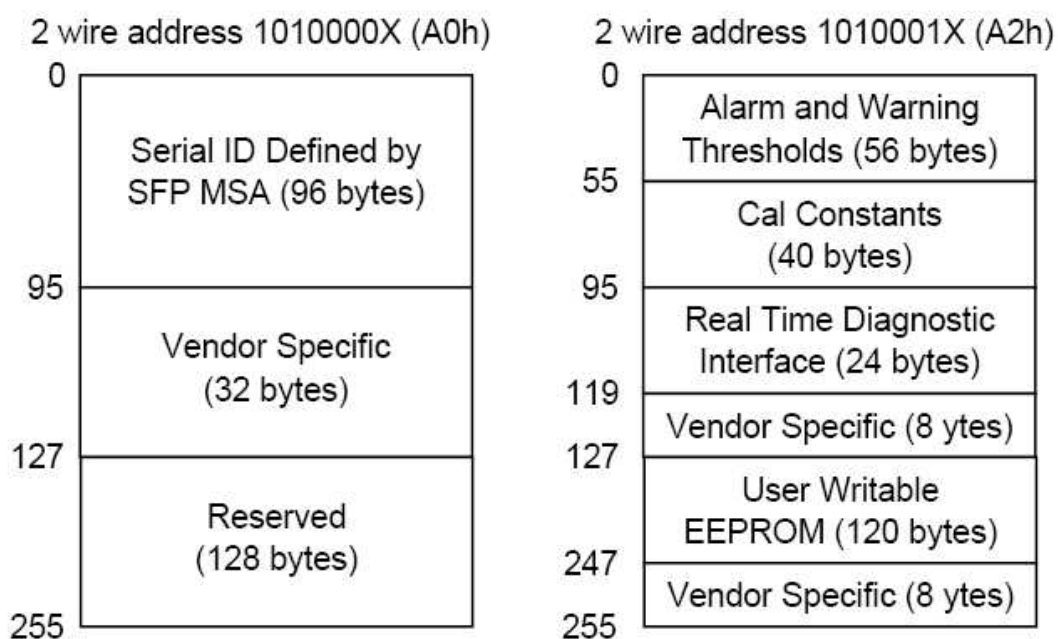
7) VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V \pm 5% at the SFP connector pin. Maximum supply current is 300mA. Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than 1 ohm should be used in order to maintain 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 500 – 2400 mV (250 – 1200mV single-ended), though it is recommended that values between 500 and 1200 mV differential (250 – 600mV single-ended) be used for best EMI performance.

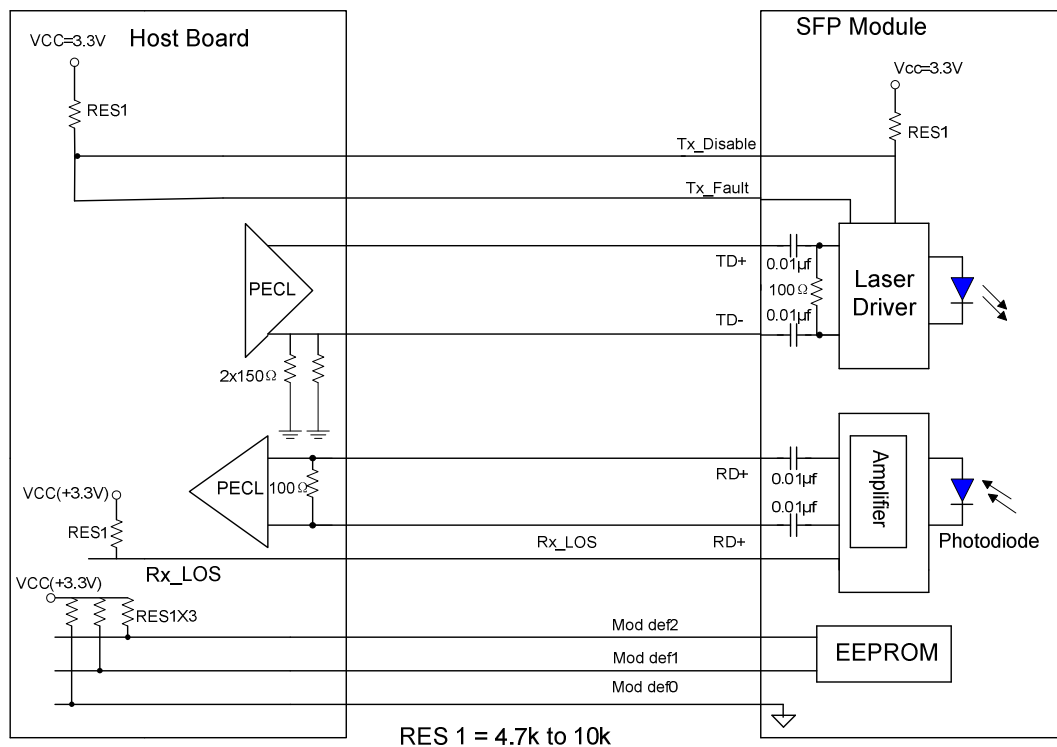
EEPROM

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 write 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.

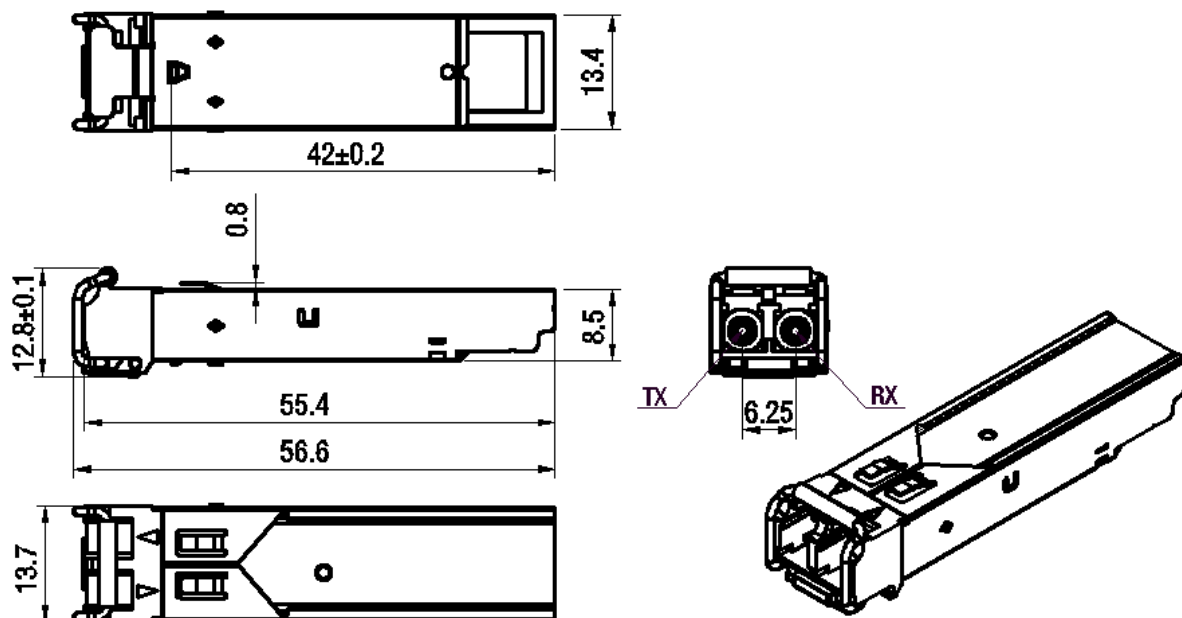
The Module provides diagnostic information about the present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Calibration and alarm/warning threshold data is written during device manufacture. Received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring all are implemented. 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 9.3



Recommend Circuit Schematic



Mechanical Specifications



Ordering information

Part No.	Data Rate	Laser	Fibre Type	Distance	Optical Interface
SFP-SX-MM-0401	up to 4.25Gbps	850nm VCSEL	MMF	150m	LC
SFP-SX-MM-0401I	up to 4.25Gbps	850nm VCSEL	MMF	150m	LC
SFP-SX-MM-0401D	up to 4.25Gbps	850nm VCSEL	MMF	150m	LC
SFP-SX-MM-0401ID	up to 4.25Gbps	850nm VCSEL	MMF	150m	LC

* I--- Industrial operating temperature

* D--- DDMI

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