

EOLP-1396-40-RM

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

Features

- ◆ Data rate selectable for 8.5Gb/s, 9.95-11.3Gb/s
- ◆ 1310nm DFB-LD Transmitter
- ◆ Distance up to 40km
- ◆ Single 3.3V Power supply and TTL Logic Interface
- ◆ Duplex LC Connector Interface
- ◆ Hot Pluggable
- ◆ Built-in CDR
- ◆ Build-in dual CDR optional
- ◆ Power Dissipation < 1.5W
- ◆ Compliant with MSA SFP+ Specification SFF-8431
- ◆ Compliant with IEEE 802.3ae 10GBASE-ER/EW
- ◆ Operating Case Temperature
 Standard: 0°C~+70°C
 Extended: -5°C~+75°C



Applications

- ◆ 10GBASE-ER at 10.31Gbps
- ◆ 10GBASE-EW at 9.95Gbps
- ◆ 10G FC
- ◆ 8G FC
- ◆ Other optical links

Ordering information

Part No.	Data Rate	Laser	CDR	Distance	Optical Interface	Temp.	DDMI
EOLP-1396-40-RM *note1	9.95Gbps to 11.3Gbps	1310nm DFB	YES	40km	LC	Standard	YES
	8.5Gbps						
EOLP-1396-40-RMI	9.95Gbps to 11.3Gbps	1310nm DFB	YES	40km	LC	Extended	YES
	8.5Gbps						

Note1: *Standard version.

*The product image only for reference purpose.

Regulatory Compliance ^{*Note2}

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

*Note2: 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 Eoptolink.

Product Description

The EOLP-1396-40-RM 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.

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	T _s	-40	+85	°C
Supply Voltage	V _{cc}	-0.5	3.6	V
Input Voltage	V _{in}	-0.5	V _{cc}	V
Output Current	I _o	-	70	mA

Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit
Operating Case Temperature	T _c	EOLP-1396-40-RM	0	+70	°C
		EOLP-1396-40-RMI	-5	+75	
Power Supply Voltage	V _{cc}	3.15	3.3	3.45	V

Power Supply Current	I_{cc}			455	mA
Baud Rate		9.95		11.3	Gbps
			8.5		

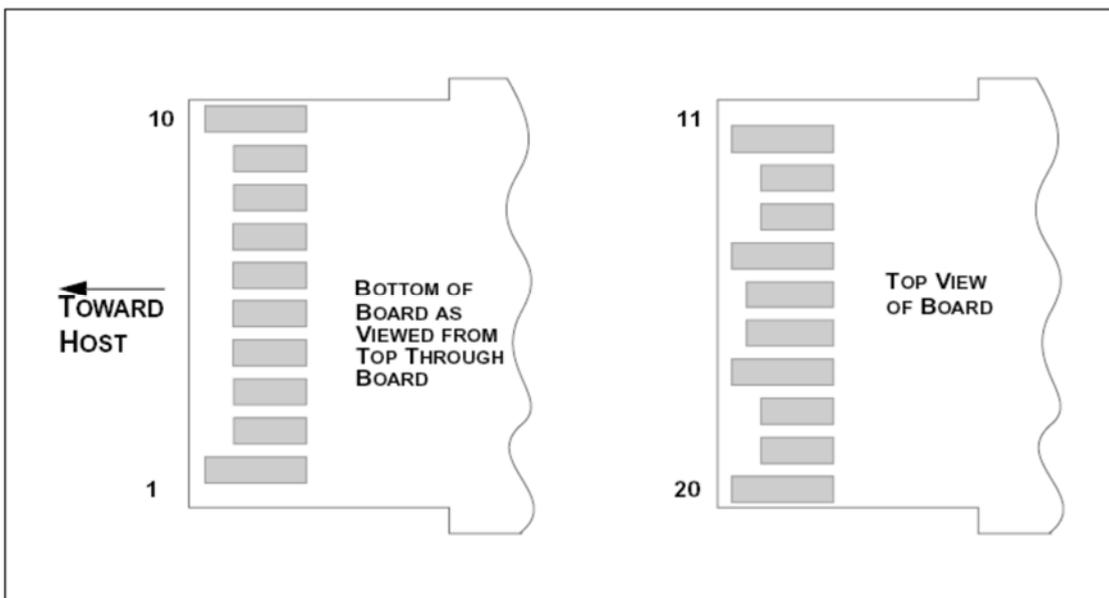
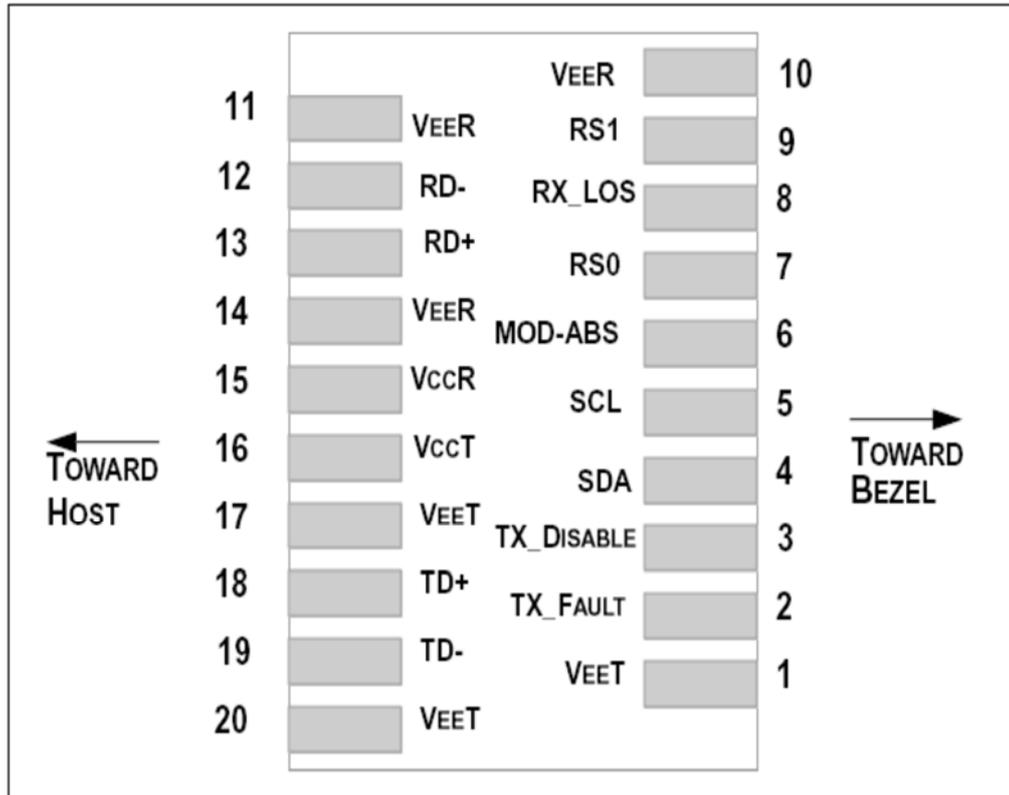
Performance Specifications – Electrical

Parameter	Symbol	Min.	Typ.	Max	Unit	Notes
Transmitter						
CML Inputs(Differential)	V_{in}	150		1200	mVpp	AC coupled inputs
Input AC Common Mode Voltage		0		25	mV	RMS
Input Impedance (Differential)	Z_{in}	85	100	115	ohm	$R_{in} > 100 \text{ kohms @ DC}$
Differential Input S-parameter	S_{DD11}	-	-	-10	dB	
Differential to Common Mode Conversion	S_{CD11}	-	-	-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		2.4		$V_{cc}+0.3$	V	$I_o = 400\mu A$; Host V_{cc}
Tx_FAULT Output Voltage – Low		0		0.4	V	$I_o = -4.0mA$
Receiver						
CML Outputs (Differential)	V_{out}	350		700	mVpp	AC coupled outputs
Output AC Common Mode Voltage		0		15	mV	RMS
Output Impedance (Differential)	Z_{out}	90	100	110	ohm	
Differential Output S-parameter	S_{D22}	-	-	-10	dB	
Rx_LOS Output Voltage – High		2.4		$V_{cc}+0.3$	V	$I_o = 400\mu A$; Host V_{cc}
Rx_LOS Output Voltage – Low		0		0.4	V	$I_o = -4.0mA$
MOD_DEF (0:2)	V_{oH}	2.5			V	With Serial ID
	V_{oL}	0		0.5	V	

Performance Specifications – Optical

Parameter	Symbol	Min.	Typical	Max.	Unit
9µm Core Diameter SMF			40		Km
Data Rate				11.3	Gbps
Transmitter					
Centre Wavelength	λ_C	1270	1310	1355	nm
Spectral Width (-20dB)	$\Delta\lambda$			1	nm
Average Output Power	P_{out}	-1		+4	dBm
Extinction Ratio	ER	6			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 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	P_{min}			-16	dBm
Receiver Overload	P_{max}	0.5			dBm
Optical Return Loss	ORL			-12	dB
LOS De-Assert	LOS_D			-17	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	5)
2	TX Fault	Transmitter Fault Indication	3	1)
3	TX Disable	Transmitter Disable	3	Note 2, Module disables on high or open
4	SDA	Module Definition 2	3	Data line for Serial ID.
5	SCL	Module Definition 1	3	Clock line for Serial ID.
6	MOD-ABS	Module Definition 0	3	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	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	5)
11	VeeR	Receiver Ground	1	5)
12	RD-	Inv. Received Data Out	3	6)
13	RD+	Received Data Out	3	7)
14	VeeR	Receiver Ground	1	5)
15	VccR	Receiver Power	2	3.3V ± 5%, 7)
16	VccT	Transmitter Power	2	3.3V ± 5%, 7)
17	VeeT	Transmitter Ground	1	5)
18	TD+	Transmit Data In	3	8)
19	TD-	Inv. Transmit Data In	3	8)
20	VeeT	Transmitter Ground	1	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) 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.

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 455mA. 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.

Rate Select Fuction

This module provides two inputs RS0 and RS1 that can optionally be used for rate selection. This rate select functionality can also be controlled by software as defined by SFF-8472. Soft RS0 is set at Bit 3, Byte 110, Address A2h. Soft RS1 is set at Bit 3, Byte 118, Address A2h. Soft RS0 and soft RS1 default state on power up is logic low, and the state is reset following a power cycle.

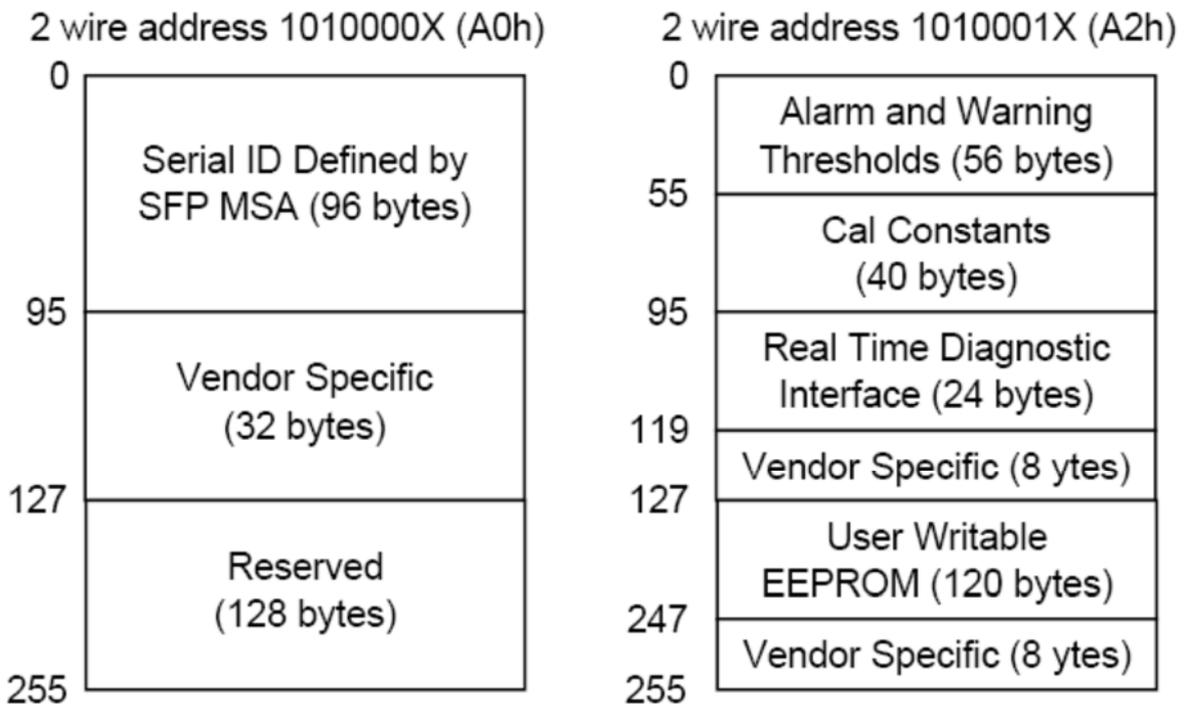
RS0 and soft RS0 bit control the receive path signal rate capability, RS1 and soft RS1 bit control the transmit path signal rate capability. RX data rate is the logic OR of the input state of the RS0 pin and soft RS0. Either RS0 or soft RS0 bit is high RX operate at 9.95~11.3Gbps, if both RS0 and soft RS0 are low RX operate at 8.5Gbps. RS1 and soft RS1 bit control TX in the same way. RX and TX should work at same rate instead of RX high and TX low. And the module TX and RX should operate at 8.5Gbps by default.

Parameter	State	Conditions
RS0 AND soft RS0	Low	RX data rate is selected as 8.5Gbp
RS0 OR soft RS0	High	RX data rate is selected as 9.95~11.3Gbps
RS1 AND soft RS1	Low	TX data rate is selected as 8.5Gbps
RS1 OR soft RS1	High	TX data rate is selected as 9.95~11.3Gbps

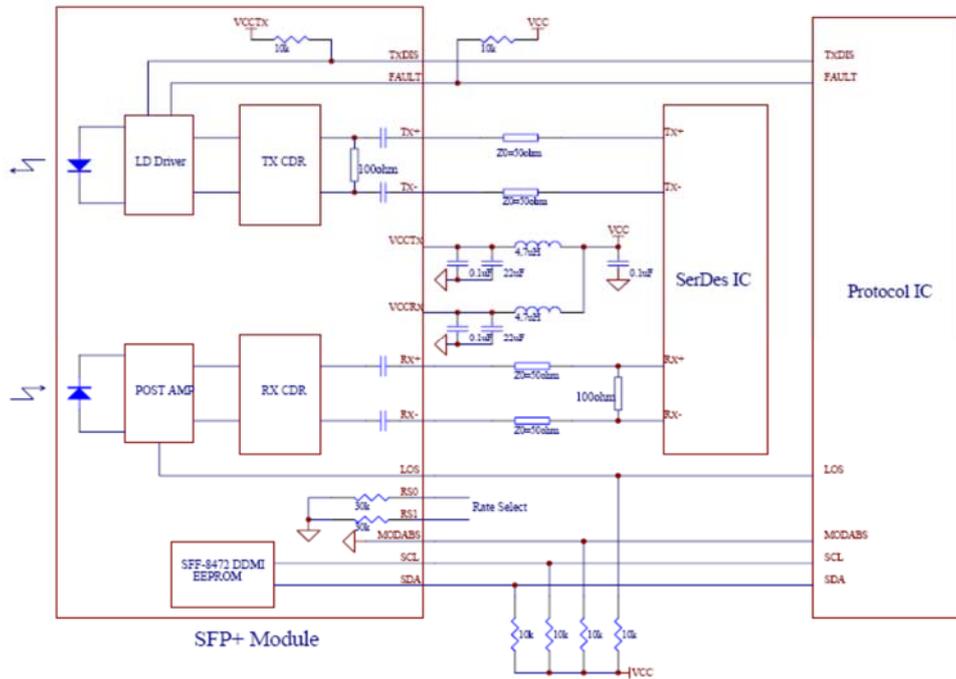
EEPROM

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.

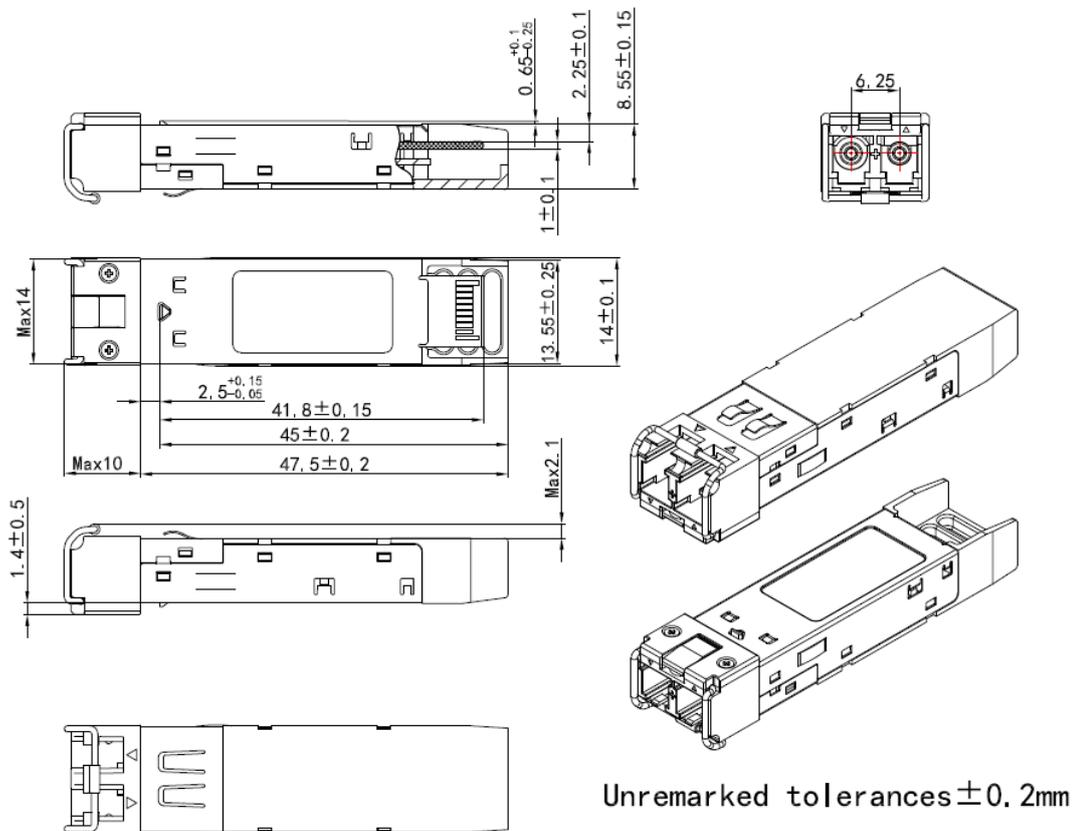
The Module provides diagnostic information about the present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Calibration and alarm/warning threshold data is written during device manufacture. Received power monitoring, transmitted power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



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

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.

Obtaining Document

You can visit our website: <http://www.eoptolink.com>

Or contact Eoptolink Technology Inc., Ltd. Listed at the end of the documentation to get the latest document.

Revision History

Revision	Initiated	Reviewed	Approved	Revision History	Release Date
V1.a	Paul	Frank,Kelly,Fing ,JP,Abby,Eason, Angela		Preliminary released.	July 9, 2014
V1.b	Abby	Kelly/Vina		Update Mechanical Specifications	Feb 3, 2015
V1.c	Angela	Kelly/William/Chao/Wang		Update the regulatory compliance. Update the picture, 2D drawing and contact.	March 22, 2018

Notice:

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