Approved
NETWORKS

3HE08313AA-A
1GBASE, SFP, 2-CH BIDI Transceiver

Features

- 1250Mbps Typical Data Rate and compliant to 1000Base BX20 IEEE802.3ah

- 1310nm FP laser transmitter for type A

- 1490nm DFB laser transmitter for type B

- PIN photo-detector

- Up to 20km on 9/125µm SMF

- Hot-pluggable CSFP footprint

- LC/UPC type pluggable optical interface

- Achieve operational compatibility with conventional SFP

- Metal enclosure, for lower EMI

- RoHS compliant and lead-free

- Single +3.3V power supply

- Support Digital Diagnostic Monitoring interface

- Case operating temperature
  Commercial: 0°C to +70°C
  Industrial: -40°C to +85°C

Applications

- Gigabit Ethernet(1000BASE-BX20)

- Point to Point FTTH Application

- Switched Backplane Applications

- Router/Server Interface

- Switch to Switch Interface

- Other Optical Links

1. Description

Approved Networks 3HE08313AA-A transceivers are compatible with the Compact Small Form- Factor Pluggable (CSFP) Multi-Source Agreement (MSA) option 2, The transceiver consists of 2-channel Bi-directional Optical Transceiver unit with five sections: the LD driver, the limiting amplifier, the digital diagnostic monitor, the 1310nm FP laser (the 1490nm DFB laser) and the PIN photo-detector .The module data link up to 20KM in 9/125um single mode fiber.

The optical output can be disabled by a TTL logic high-level input of Tx Disable, and the system also can disable the module via I2C. Tx Fault is provided to indicate that degradation of the laser. Loss of signal (LOS) output is provided to indicate the loss of an input optical signal of receiver or the link status with partner. The system can also get the LOS (or Link)/Disable/Fault information via I2C register access.

2. Absolute Maximum Ratings

Operation in excess of any absolute maximum ratings might cause permanent damage to this module.

Parameter	Symbol	Min	Typ	Max	Units
Storage Temperature	TS	-40		+85	ºC
Power Supply Voltage	VCC	-0.5		4	V
Relative Humidity	RH	5		95	%
Damage Threshold		3			dBm

3. Recommended Operating Environment

Parameter	Symbol	Min	Typ	Max	Unit
Case operating Temperature (Commercial)	TC	0		70	°C
Supply Voltage	VCC	3.13	3.3	3.47	V
Supply Current (per channel)	Icc			450	mA
Power Supply Noise Rejection				100	mVp-p
Data Rate			1.25/1.25		Gbps
Transmission Distance				20	KM
Coupled Fiber	Single mode fiber - 9/125um SMF				

4. Specification of Transmitter

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Average Output Power	POUT	-9		-3	dBm	Note (1)
Extinction Ratio	ER	9			dB	
Center Wavelength	λC	1260	1310	1360	nm	
		1480	1490	1500		
Spectrum Width (RMS)	σ			3.5	nm	FP Laser (TX:1310nm)
Side Mode Suppression Ratio	SMSR	30			dB	DFB Laser (TX:1490nm)
Spectrum Bandwidth(-20dB)	σ			1	nm	
Transmitter OFF Output Power	POff			-45	dBm	
Differential Line Input Impedance	RIN	90	100	110	Ohm	
Output Eye Mask	Compliant with IEEE802.3 ah (class 1 laser safety)					Note (2)

Notes:

1. Measure at 2^7-1 NRZ PRBS pattern

2. Transmitter eye mask definition, and eye mask diagram with at least 10% margin.

Normalized Time (Unit Interval)
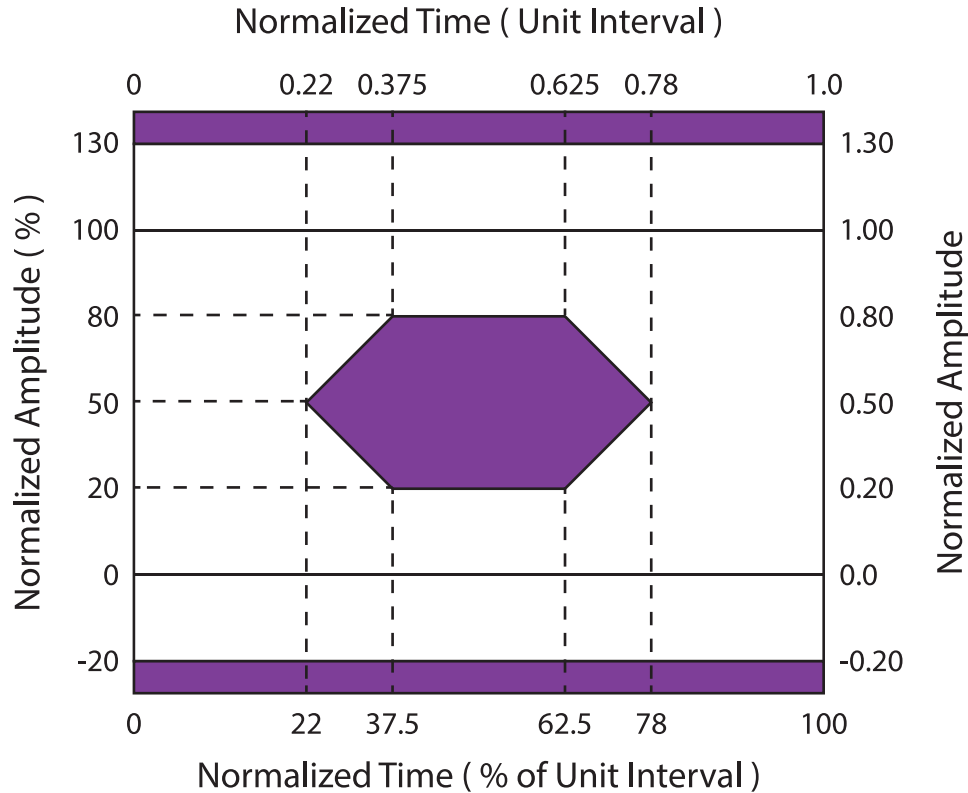
5. Specification of Receiver

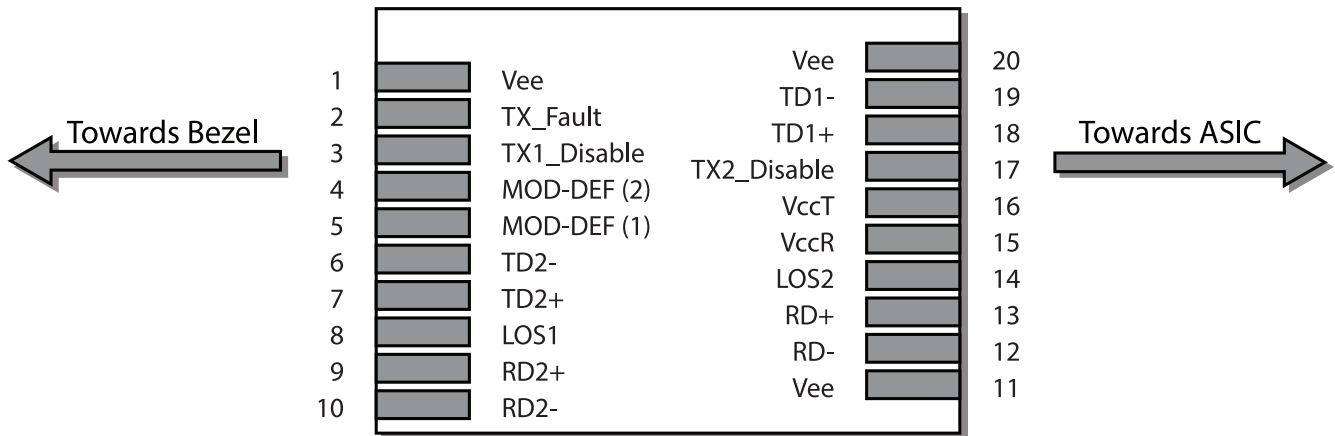| Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Input Optical Wavelength	λIN	1480	1490	1500	nm	
		1260	1310	1360		
Receiver Sensitivity	PIN			-19.5	dBm	Note (1)
Input Saturation Power (Overload)	PSAT	-3			dBm	
LOS Assert	LOSA	-35			dBm	
LOS De-assert	LOSD			-22	dBm	Note (2)
LOS Hysteresis		0.5	2	6	dB	

Notes:

1. Measured with Light source 1490nm(1310nm), ER=9dB; BER =<10^-12 @PRBS=2^7-1 NRZ

2. When LOS de-asserted, the RX data+/- output is signal output.

6. Electrical Interface Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Transmitter						
Total Supply Current	ICC			A	mA	Note (1)
Transmitter Disable Input-High	VDISH	2		Vcc+0.3	V	
Transmitter Disable Input-Low	VDISL	0		0.8	V	
Transmitter Fault Input-High	VTxFH	2		Vcc+0.3	V	
Transmitter Fault Input-Low	VTxFL	0		0.8	V	
Receiver						
Total Supply Current	ICC			B	mA	Note (1)
LOSS Output Voltage-High	VLOSH	2		Vcc+0.3	V	LVTTL
LOSS Output Voltage-Low	VLOSL	0		0.8	V	

Note (1): A (TX) + B (RX) = 450mA (Not include termination circuit)

7. Pin Descriptions

Towards Bezel

1	Vee
2	TX_Fault
3	TX1_Disable
4	MOD-DEF (2)
5	MOD-DEF (1)
6	TD2-
7	TD2+
8	LOS1
9	RD2+
10	RD2-

Towards ASIC

Vee	20
TD1-	19
TD1+	18
TX2_Disable	17
VccT	16
VccR	15
LOS2	14
RD+	13
RD-	12
Vee	11

Pin	Name	Channel #	Function	Notes
1	Vee	Common	Transceiver Ground	Note 3
2	TX Fault	Common	Transmitter Fault Indication	Note 8
3	TX1_ Disable	1	Transmitter Disable of Ch1	Note 1, Module disables on high or open
4	MOD-DEF2	Common	Two-Wires interface Data	Note 2, 2wire serial ID interface SDA
5	MOD-DEF1	Common	Two-Wires interface Clock	Note 2, 2wire serial ID interface SCL
6	TD2-	2	Inverted Transmit Data Input of Ch2	Note6
7	TD2+	2	Transmit Data Input of Ch2	Note6
8	LOS1	1	Loss of Signal of CH1	Note7

Pin	Name	Channel #	Function	Notes
9	RD2+	2	Received Data output of Ch2	Note4
10	RD2-	2	Inverted Received Data output of Ch2	Note4
11	VEE	Common	Transceiver Ground	Note3
12	RD1-	1	Inverted Received Data output of Ch1	Note4
13	RD1+	1	Received Data output of Ch1	Note4
14	LOS2	2	Loss of Signal of CH2	Note7
15	VCCR	Common	Receiver power	Note 5, 3.3V±5%
16	VCCT	Common	Transmitter Power	Note 5, 3.3V±5%
17	TX2_ Disable	2	Transmitter Disable of Ch2	Note 1, Module disables on high or open
18	TD1+	1	Transmit Data Input of Ch1	Note6
19	TD1-	1	Inverted Transmit Data Input of Ch1	Note6
20	VEE	Common	Transceiver Ground	Note6

Notes:

1. TX_disable1, 2 are 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_ 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

2. Mod-Def 1, 2. These are the module definition pins. They should be pulled up with a 4.7K –10K_ resistor on the host board. The pull-up voltage shall be VccT or VccR. Mod-Def 1 is the clock line of two wire serial interfaces for serial ID. Mod-Def 2 is the data line of two wire serial interface for serial ID

3. VEE may be internally connected within the SFP module.

4. RD1, 2-/+: These are the differential receiver outputs. They are AC coupled 100_ differential lines which should be terminated with 100_ (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board.

5. VccT,VccR are the power supplies. They are defined as 3.3V ±5% at the SFP connector pin. Maximum supply current is 400Ma@3.3V. Vcc may be internally connected within the SFP transceiver module.

6. TD1, 2-/+: These are the differential transmitter inputs. They are AC-coupled, differential lines with 100_

differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board.

7. LOS1,2 (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 <0.4V.

8. TX Fault report transceiver status as following:
   TX Fault is an open collector/drain output, which should be pulled up with a 4.7K–10K_ 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 either in Channel 1 or Channel 2. The Host shall read Channel 1/2: A2H/AAH:110 for details: TX Fault from channel 1 if bit 2 is set in [A2H:110]; TX Fault from channel 2 if bit 2 is set in [B2H: 110]. Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.
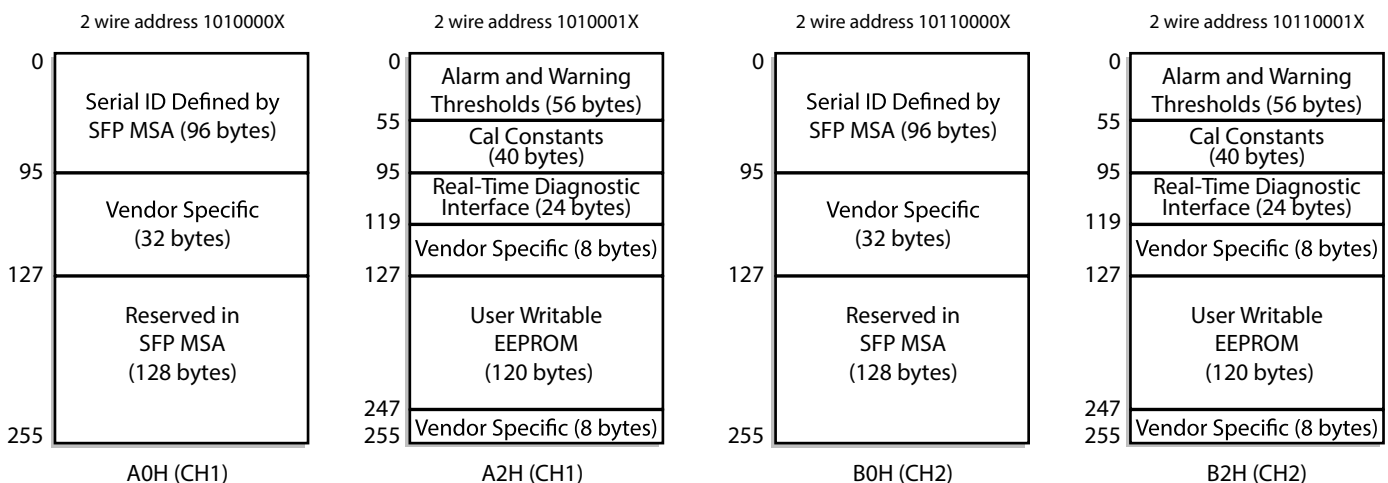
8. EEPROM

This module supports the 2-wire serial communication protocol as defined in the CSFP MSA. It is very closely related to the E2PROM defined in the GBIC standard, with the same electrical specifications.

The standard CSFP serial ID provides access to identification information that describes the transceiver's capabilities, standard interfaces, manufacturer, and other information.

Additionally, This transceiver provides a unique enhanced digital diagnostic monitoring interface, which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, received optical power and transceiver supply voltage. It also defines a sophisticated system of alarm and warning flags, which alerts end-users when particular operating parameters are outside of a factory set normal range.

The CSFP MSA defines a 256-byte memory map in E2PROM that is accessible over a 2-wire serial interface at the 8 bit address 1010000X (A0h) or 1011000X(B0h). The digital diagnostic monitoring interface makes use of the 8 bit address 1010001X (A2h) or 1011001X(B2h), so the originally defined serial ID memory map remains unchanged. The digital diagnostic memory is defined as follow:

| 2 wire address 1010000X	2 wire address 1010001X	2 wire address 10110000X	2 wire address 10110001X
0 Serial ID Defined by SFP MSA (96 bytes) 95 Vendor Specific (32 bytes) 127 Reserved in SFP MSA (128 bytes) 255	0 Alarm and Warning Thresholds (56 bytes) 55 Cal Constants (40 bytes) 95 Real-Time Diagnostic Interface (24 bytes) 119 Vendor Specific (8 bytes) 127 User Writable EEPROM (120 bytes) 247 Vendor Specific (8 bytes) 255	0 Serial ID Defined by SFP MSA (96 bytes) 95 Vendor Specific (32 bytes) 127 Reserved in SFP MSA (128 bytes) 255	0 Alarm and Warning Thresholds (56 bytes) 55 Cal Constants (40 bytes) 95 Real-Time Diagnostic Interface (24 bytes) 119 Vendor Specific (8 bytes) 127 User Writable EEPROM (120 bytes) 247 Vendor Specific (8 bytes) 255
A0H (CH1)	A2H (CH1)	B0H (CH2)	B2H (CH2)

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller (DDTC) inside the transceiver, which is accessed through a 2-wire serial interface.

When the serial protocol is activated, the serial clock signal (SCL, Mod Def 1) is generated by the host. The positive edge clocks data into the SFP transceiver into those segments of the E2PROM that are not write-protected. The negative edge clocks data from the SFP transceiver. The serial data signal (SDA, Mod Def 2) 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.

Digital diagnostics are internally calibrated by default.

9. Recommended Circuit Schematic
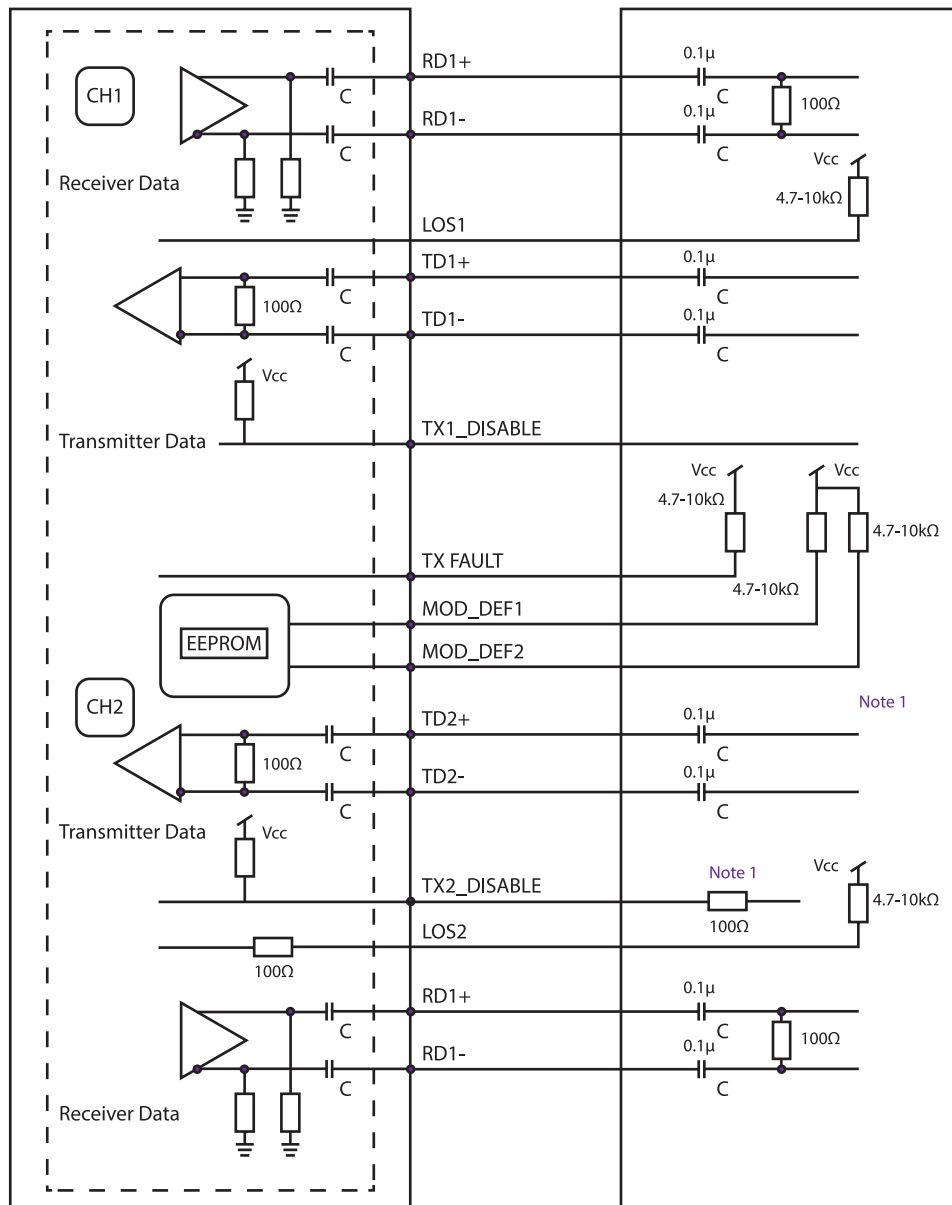
Note 1: Recommendation 100Ω series resistance on host board.

10. Regulatory Compliance

This transceiver complies with international Electromagnetic Compatibility (EMC) and international safety requirements and standards (see details in Table following).

Feature	Reference	Performance
Electrostatic discharge (ESD)	IEC/EN 61000-4-2	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN 55022 Class B (CISPR 22A)	Compatible with standards
ROHS	2002/95/EC	Compatible with standards
EMC	EN61000-3	Compatible with standards

11. Mechanical Specifications

Latch with color code

Label
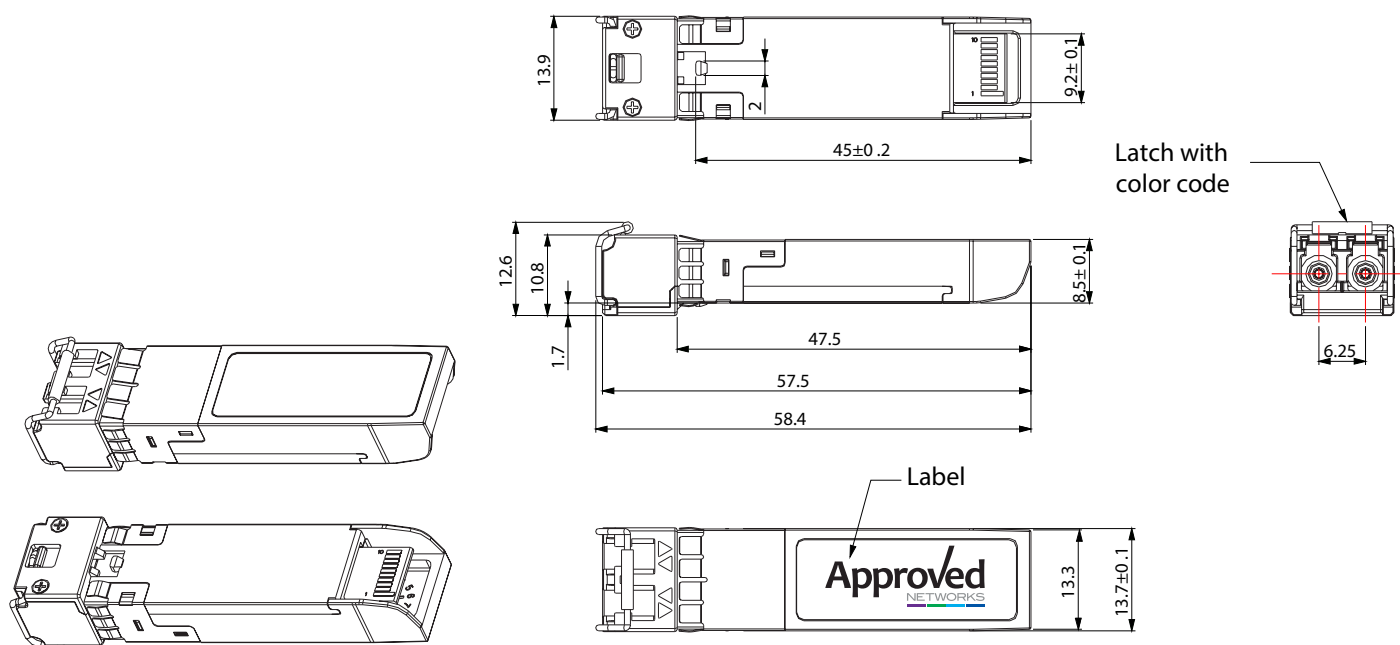
12. Contact Information

Approved Networks is a leading supplier of Network Transceivers and Connectivity products to Channel Partners, Resellers, and OEMs. With more than 9 years of direct industry experience, our products are resident in the most demanding and mission critical functional networks Worldwide. We serve as a Master Distributor to the largest CMs in the world and deploy the most rigorous testing and firmware management programs to bring the highest level of functional product to the market at a cost that makes sense.

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