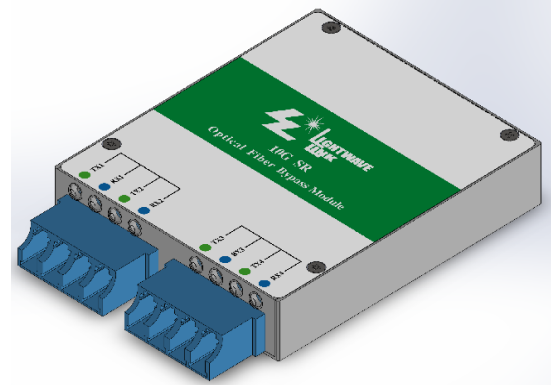


10GBPS SR/SW QUAD PORT FIBER BYPASS MODULE

Product Description

The SR/SW Quad port fiber bypass modules is design expressly for Intrusion Prevention System (IPS) provides complete visibility to network traffic, It also introduces a point of failure should the IPS lose power, cable fail or application freeze.

The module design for PCI Express X8 interface, which means it can support 10.3Gbit/s in full duplex mode per port of data transfer rate and Multi-mode fiber operations. SR/SW Quad port fiber bypass modules designed to be compliant digital diagnostic monitoring function: Temperature, VCC , TX optical power, TX laser bias current, and RX received optical power. The post-amplifier of the SR/SW Quad port fiber bypass modules also includes a Loss of Signal (LOS) circuit that provides a TTL logic-high output when the received optical level is below a preset LOS Assert threshold.



Features

- Compliant with 10GBASE-SR
- Compliant with 10GBASE-SW
- Link Distances at 10.3Gbps 300m links with OM-3 MMF Cable
- EEPROM with Series ID Function
- Quad LC Connector interface with optical Bypass Function
- Laser Class 1 Product with comply with Requirements of IEC 60825-1 and IEC 60825-2
- LED indicate operation function

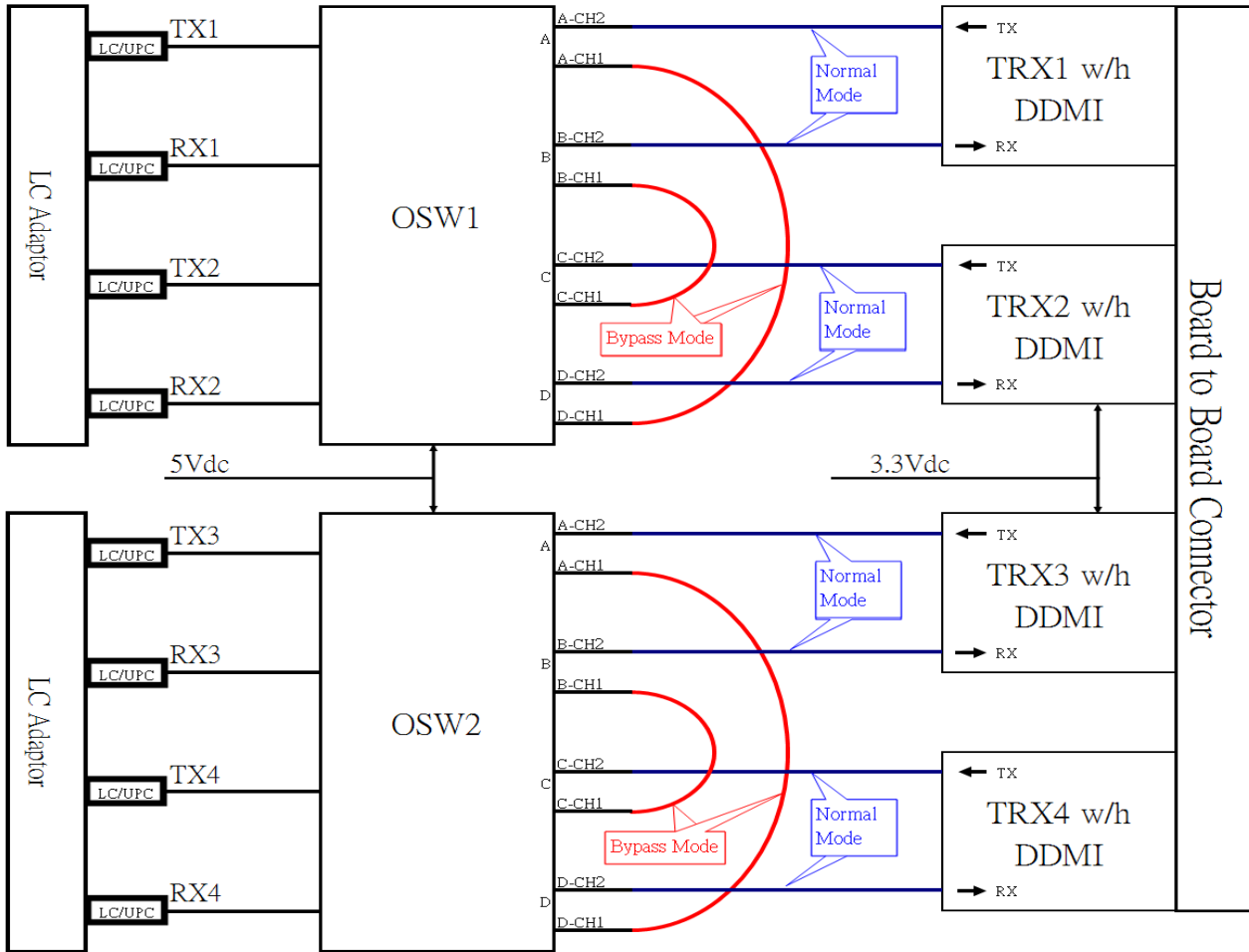
Applications

- In-Line traffic Monitoring, Analyzing and Optimization
- Intrusion Prevention System
- Quality of Service
- In-Line Security
- Load balance
- Web Acceleration Appliances

LASER SAFETY

This Multi-mode Quad Port Fiber Bypass Module is a Class 1 laser product. It complies with IEC 68025 and FDA 21 CFR 1040.10 and 1040.11. The module must be operated within the specified temperature and voltage limits. The optical port of the module shell be terminated with an optical connector or with a dust plug.

SR/SW Quad Port Bypass Module – Optical Path Portion



Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Storage Temperature	Ts	-40		85	°C	
Supply Voltage	Vcc	0		5	V	

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Case Operation Temperature	Ts	-5		70	°C	1
+5V Supply Voltage	Vcc5	4.75		5.25	V	Vcc5,6
+3.3V Supply Voltage	Vcc3	3.135		3.465	V	Vcc1,2,3,4
+5V Supply Current	Icc5			500	mA	Icc5,6
+3.3V Supply Current	Icc3			1200	mA	Icc1,2,3,4
Relative Humidity	—	5		85	%	2

Note :

- 1. Consuming Temperature
- 2. Non Condensation

Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Transmitter						
Differential Input Impedance	Z _d		100		Ω	1
Differential Input Voltage Swing	V _{DIFF}	180		700	mV	1
Differential Input Voltage	V _{DT}	0.5		2.4	V	1
Disable Input-High	V _{DISH}	2.4		V _{cc} +0.3	V	
Disable Input-Low	V _{DISL}	0		0.8	V	
Fault Pull Up Resistor	R _{TX_FAULT}	4.7		10	KΩ	2
Fault Output-High	V _{TXFH}	2.4		V _{cc}	V	2
Fault Output-Low	V _{TXFL}	0		0.5	V	2
TX_DISABLE Asserted Time	t _{OFF}			10	μsec	
TX_DISABLE Deasserted Time	t _{ON}			1	msec	
Time to initialize, include reset of TX_FAULT	t _{init}			300	msec	
TX_FAULT from fault to assertion	t _{fault}			100	μsec	
TX_DISABLE time to reset	t _{reset}	10			μsec	
Receiver						
Differential Output Impedance	Z _d		100		Ω	1
Differential Output Voltage	V _{DR}	0.35		0.85	V	3
LOS Load Resistor	R _{RX_LOS}	4.7		10	KΩ	2
LOS Output Voltage-High	V _{LOSH}	2.4		V _{cc}	V	2
LOS Output Voltage-Low	V _{LOSL}	0		0.5	V	2
LOS Asserted Time (Transmitter off to on)	t _{A.RX_LOS}			100	μsec	4
LOS Deasserted Time (Transmitter on to off)	t _{D.RX_LOS}			100	μsec	4
Optical Bypass Switch						
Operation Voltage	V _{SW}	4.5	5.0	5.5	V	
Operation Current	I _{SW}		80	100	mA	
Latching Voltage-High	V _{LATH}	4.5	5.0	5.5	V	
Latching Voltage-Low	V _{LATL}	0		0.8	V	
Latching Resistance	R _{LAT}		125		Ω	±10%
Switching Time (Input Pulse ≥ 20ms)	t _{ST}			5.0	msec	
Timing						
Series ID Clock Rate	F _{serial_clock}			100	KHz	DDMI function

Note :

1. Internally AC couples and terminated to 100-Ohms differential load.
2. Pull up to Vcc on Host-Board.
3. Internally AC coupled, but requires a 100-Ohms differential termination at or internal to Serializer/Deserializer.
4. These are 20%~80% values.

Optical Characteristics

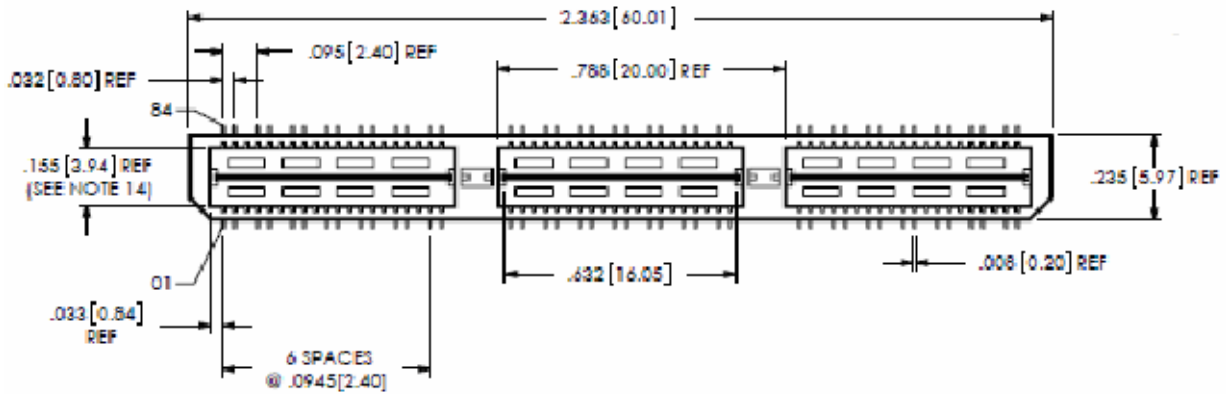
Parameter	Multimode Fiber Type	Min. Modal Bandwidth (MHz-Km)	Operating Distance Range (m)	Max. Channel Insertion Loss (dB)
Operating Range 10.3Gbps	50um MMF OM3	2000	300	6.0

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Transmitter						
Output Optical Power	P _{OUT}	-7.1		-1.0	dBm	50/125um
Optical Modulation Amplitude	OMA	-4.3			dBm	
Center Wavelength	λ _C	840	850	860	nm	
Spectral Width (RMS)	Δλ			0.45	nm	
Transmitter and Dispersion Penalty	TDP			3.9	dB	
Relative Intensity Noise	RIN			-128	dB	
Output Eye	Compliant with IEEE802.3ae					
Max. Pout TX-DISABLE Asserted	P _{OFF}			-35	dB	
Receiver						
Optical Input Power (Over Load)	P _{IN1}	-1.0			dBm	1, 50/125um
Receiver Sensitivity (AVG.) (BER<10E-12 and PRBS=231-1)	P _{IN2}			-9.9	dBm	1, 50/125um
Receiver Sensitivity (OMA) (BER<10E-12 and PRBS=231-1)	P _{IN3}			-11.1	dBm	1, 0/125um
Stressed Receiver Sensitivity (OMA) (BER<10E-12 and PRBS=231-1)	P _{IN4}			-7.5	dBm	1, 50/125um ISI=3.5dB
Center Wavelength	λ _C	840	850	860	nm	
Optical Return Loss	ORL	12			dB	
LOS Asserted (AVG.)	P _A	-30			dBm	
LOS Deasserted (AVG.)	P _D	-30		-14	dBm	
LOS Hysteresis	P _A -P _D	0.5		3.0	dB	
Optical Bypass Switch						
Center Wavelength	λ _C	670	850	980	nm	
Insertion Loss	IRL	2.5		3.0	dB	1, 0/125um
Return Loss	ORL	30			dB	1, 0/125um

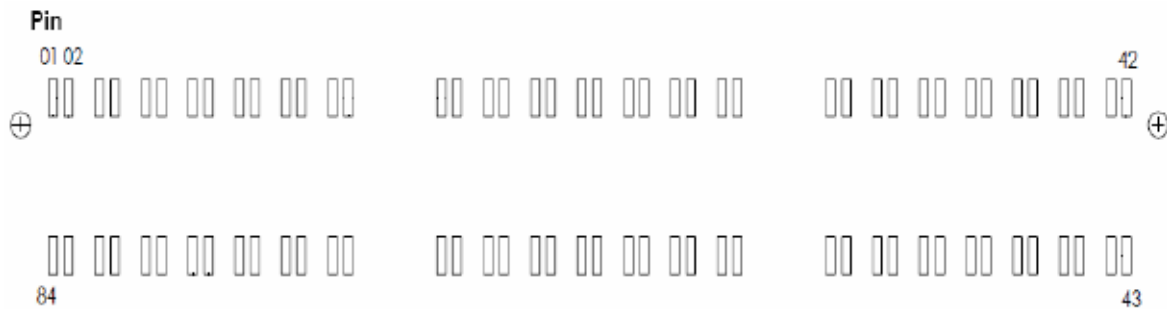
Note :

Normal Mode (Bypass Mode Off).

SR/SW Quad Port Fiber Bypass Module PCB Layout



Top View



Pin Function Definitions

Pin #	Pin Name	I/O Port	Pin Function	Note
1	Vcc6		5.0V Power Supply (OSW2 Power) – 500mA	
2	GND		Ground	
3	On-Line	O	1K-Ohms to Ground	
4	GND		Ground	
5	TX Disable1	I	Transmitter Disable for TRX-1	2
6	TX Fault4	O	Transmitter Fault Indication for TRX-1	1
7	MOD-DEF2-1	I/O	2 Wire Serial ID Interface (Data) for TRX-1	3
8	MOD-DEF1-1	I	2 Wire Serial ID Interface (Clock) for TRX-1	3
9	Vcc1		3.3V for Tx1 Power Supply and Rx1 Power Supply – 300mA	
10	TRX-1-Link	I	TRX-1-Link LED Indicator (Voltage Low / LED Green)	
11	TRX-1-Speed	I	TRX-1-Speed LED Indicator (Voltage Low / LED Blue)	
12	Rate Select1	I	Rate Select for TRX-1, High: 10.3Gbps; Low: 1.25Gbps	
13	GND		Ground	
14	TX Disable3	I	Transmitter Disable for TRX-3	2
15	TX Fault3	O	Transmitter Fault Indication for TRX-3	1
16	MOD-DEF2-3	I/O	2 Wire Serial ID Interface (Data) for TRX-3	3

Pin #	Pin Name	I/O Port	Pin Function	Note
17	MOD-DEF1-3	I/O	2 Wire Serial ID Interface (Clock) for TRX-32	3
18	Vcc3		3.3V for Tx3 Power Supply and Rx3 Power Supply – 300mA	
19	TRX-3-Link	I	TRX-3-Link LED Indicator (Voltage Low / LED Green)	
20	TRX-3-Speed	I	TRX-3-Speed LED Indicator (Voltage Low / LED Blue)	
21	Rate Select3	I	Rate Select for TRX3, High: 10.3Gbps; Low: 1.25Gbps	
22	GND		Ground	
23	TX Disable2	I	Transmitter Disable for TRX-2	2
24	TX Fault2	O	Transmitter Fault Indication for TRX-2	1
25	MOD-DEF2-2	I/O	2 Wire Serial ID Interface (Data) for TRX-2	3
26	MOD-DEF1-2	I	2 Wire Serial ID Interface (Clock) for TRX-2	3
27	Vcc2		3.3V for Tx2 Power Supply and Rx2 Power Supply – 300mA	
28	TRX-2-Link	I	TRX-2-Link LED Indicator (Low: Green)	
29	TRX-2-Speed	I	TRX-2-Speed LED Indicator (Yellow: 10Gbps)	
30	Rate Select2	I	Rate Select for TRX-2, High: 10.3Gbps; Low: 1.25Gbps	
31	GND		Ground	
32	TX Disable4	I	Transmitter Disable for TRX-4	2
33	TX Fault4	O	Transmitter Fault Indication for TRX-4	1
34	MOD-DEF2-4	I/O	2 Wire Serial ID Interface (Data) for TRX-4	3
35	MOD-DEF1-4	I	2 Wire Serial ID Interface (Clock) for TRX-4	3
36	Vcc4		3.3V for Tx4 Power Supply and Rx4 Power Supply – 300mA	
37	TRX-4-Link	I	TRX-4-Link LED Indicator (Low: Green)	
38	TRX-4-Speed	I	TRX-4-Speed LED Indicator (Yellow: 10Gbps)	
39	Rate Select4	I	Rate Select for TRX-4, High: 10.3Gbps; Low: 1.25Gbps	
40	GND	I	Ground	
41	GND		Ground	
42	Vcc5		5.0V Power Supply (OSW 1 Power) – 500mA	
43	Normal Mode Drive1	I	Change to Normal Mode for OSW1	
44	Bypass Mode Drive1	I	Change to Bypass Mode for OSW1	
45	State Output1	O	High=Normal Mode for OSW1, Low=Bypass Mode for OSW1	
46	RX4 GND		RX4 Signal Ground	
47	RD4-	O	Inverse RX4 Data Out	5
48	RD4+	O	RX4 Data Out	5
49	RX4 GND		RX4 Signal Ground	
50	TX4 GND		TX4 Signal Ground	
51	TD4+	I	TX4 Data In	6
52	TD4-	I	Inverse TX4 Data In	6
53	TX4 GND		TX4 Signal Ground	
54	RX_LOS4	O	Receiver Loss of Signal Out for TRX-4	4

Pin #	Pin Name	I/O Port	Pin Function	Note
55	RX_LOS2	O	Receiver Loss of Signal Out for TRX-2	4
56	RX2 GND		RX2 Signal Ground	
57	RD2-	O	Inverse RX2 Data Out	5
58	RD2+	O	RX2 Data Out	5
59	RX2 GND		RX2 Signal Ground	
60	TX2 GND		TX2 Signal Ground	
61	TD2+	I	TX2 Data In	6
62	TD2-	I	Inverse TX2 Data In	6
63	TX2 GND		TX2 Signal Ground	
64	RX3 GND		RX3 Signal Ground	
65	RD3-	O	Inverse RX3 Data Out	5
66	RD3+	O	RX3 Data Out	5
67	RX3 GND		RX3 Signal Ground	
68	TX3 GND		TX3 Signal Ground	
69	TD3+	I	TX3 Data In	6
70	TD3-	I	Inverse TX3 Data In	6
71	TX3 GND		TX3 Signal Ground	
72	RX_LOS3	O	Receiver Loss of Signal Out for TRX-3	4
73	RX_LOS1	O	Receiver Loss of Signal Out for TRX-1	4
74	RX1 GND		RX1 Signal Ground	
75	RD1-	O	Inverse RX1 Data Out	5
76	RD1+	O	RX1 Data Out	5
77	RX1 GND		RX1 Signal Ground	
78	TX1 GND		TX1 Signal Ground	
79	TD1+	I	TX1 Data In	6
80	TD1-	I	Inverse TX1 Data In	6
81	TX1 GND		TX1 Signal Ground	
82	Normal Mode Drive2	I	Change to Normal Mode for OSW2	
83	Bypass Mode Drive2	I	Change to Bypass Mode for OSW2	
84	State Output2	O	High=Normal Mode, Low=Bypass Mode for OSW2	

Note :

- 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 Vcc1~4. 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.
- 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. It's 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 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 Vcc1~4 (see pin function definitions). 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 Vcc1~4 (see pin function definitions). 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. 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 180~700mV (90~350mV single-ended), though it is recommended that values between 500~1200mV differential (250~600mV single-ended) be used for best EMI performance.
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 350~850mV differential (175~425mV single ended) when properly terminated.
7. Latching Type – The input is used to control the optical switch mode for OSW
 Normal mode: OSW Normal1/Normal2: > 3.75V and OSW Bypass1/Bypass2: < 0.5V and over 20ms.
 Bypass mode: OSW Normal1/Normal2: < 0.5V and OSW Bypass1/Bypass2: > 3.75V and over 20ms.
8. Non-Latching Type – Pin 43, 82: Ground.
9. Non-Latching Type – Pin 44, 83: High=Normal Mode, Low=Bypass Mode for OSW

LED Indicator Status for 10.3Gbps Operation (from the front look)

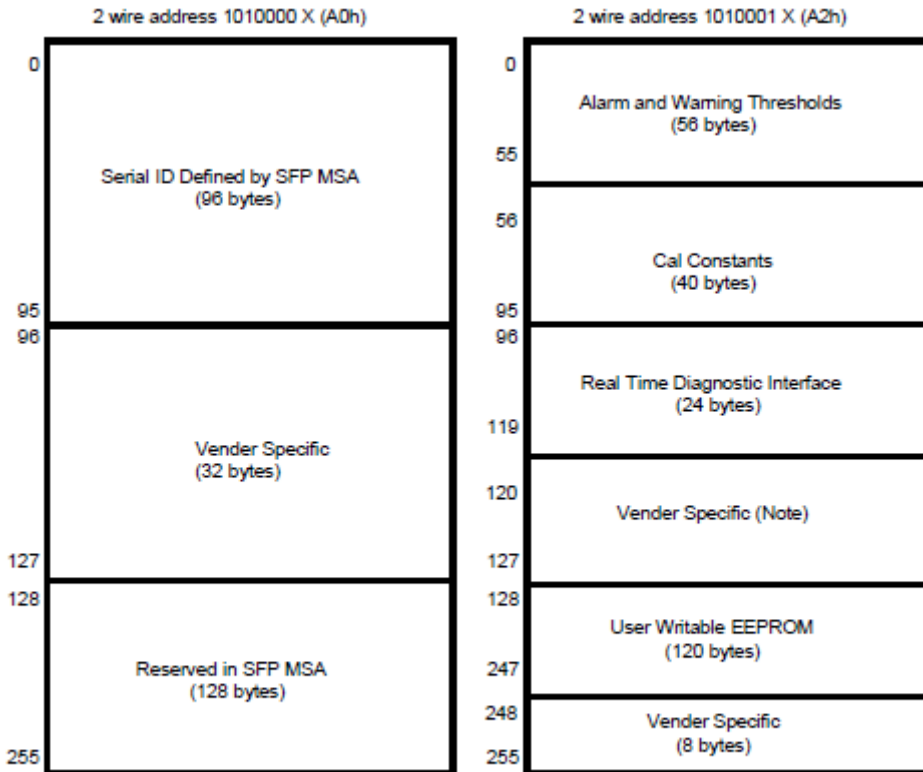
LED								
Definition	Link1	Speed1	Link2	Speed2	Link3	Speed3	Link4	Speed4
LED type	Single	Single	Single	Single	Single	Single	Single	Single
Color	Green	Blue	Green	Blue	Green	Blue	Green	Blue

Link 1, 2, 3, 4 LED indicators: Green color.

Speed 1, 2, 3, 4 LED indicators: Blue color (Data Rate 10.3Gbps).

Enhanced Digital Diagnostic Interface

The memory map in the following describes an extension to the memory map defined in SFP MSA. The enhanced interface uses the two wire serial bus address 1010001X(A2h) to provide diagnostic information about the module’s present operating conditions.



Digital Diagnostic Memory Map Specific Data Field Descriptions

Note: Write the password(11h,11h,11h,11h) on the bytes of 123~126 of address A2h then the address of bytes 128255 (User Writeable) can be read and written.

Digital Diagnostic Monitoring Interface

Alarm and Warning Thresholds (2-Wire Address A2h)

Address	Bytes	Name	Value (Dec °)	Unit	Note
00—01	2	Temperature High Alarm	$T_c (Max °) + 15$	°C	1
02—03	2	Temperature Low Alarm	$T_c (Min °)$	°C	1
04—05	2	Temperature High Warning	$T_c (Max °) + 10$	°C	1
06—07	2	Temperature Low Warning	$T_c (Min °) + 10$	°C	1
08—09	2	Voltage High Alarm	$V_{cc} + 5\%$	V	
10—11	2	Voltage Low Alarm	$V_{cc} - 5\%$	V	
12—13	2	Voltage High Warning	$V_{cc} + 3\%$	V	
14—15	2	Voltage Low Warning	$V_{cc} - 3\%$	V	

16—17	2	Bias High Alarm	$I_{OP} + 10$	mA	2
18—19	2	Bias Low Alarm	$I_{OP} - 5$	°C	2
20—21	2	Bias High Warning	$I_{OP} + 7$	°C	2
22—23	2	Bias Low Warning	$I_{OP} - 3$	°C	2
24—25	2	TX Power High Alarm	$P_{OUT} + 3$	°C	3
26—27	2	TX Power Low Alarm	$P_{OUT} - 3$	V	3
28—29	2	TX Power High Warning	$P_{OUT} + 2$	V	3
30—31	2	TX Power Low Alarm	$P_{OUT} - 2$	V	3
32—33	2	RX Power High Alarm	$P_{OVER} + 3$	V	4
34—35	2	RX Power Low Alarm	$P_{SEN} - 3$	mA	4
36—37	2	RX Power High Warning	$P_{OVER} + 2$	°C	4
38—39	2	RX Power Low Alarm	P_{SEN}	°C	4
40—45	16	Reversed			
56—91	36	External Calibration Constants			
92—94	3	Reversed			
95	1	Checksum			5
96—97	2	Real Time Temperature	$V_{CC} + 3\%$	V	
98—99	2	Real Time Supply Voltage	$V_{CC} - 3\%$	V	
100—101	2	Real Time TX Bias Current	$I_{OP} + 10$	mA	
102—103	2	Real Time TX Optical Power	$T_C (Max \text{ } ^\circ) + 15$	°C	
104—105	2	Real Time Receiver Power	$T_C (Min \text{ } ^\circ)$	°C	
106—109	4	Reserved	$T_C (Max \text{ } ^\circ) + 10$	°C	
110	1	Optional Status/Control Bits	$T_C (Min \text{ } ^\circ) + 10$	°C	
111	1	Reserved	$V_{CC} + 5\%$	V	
112—119	8	Optional Set of Alarm and Warning	$V_{CC} - 5\%$	V	

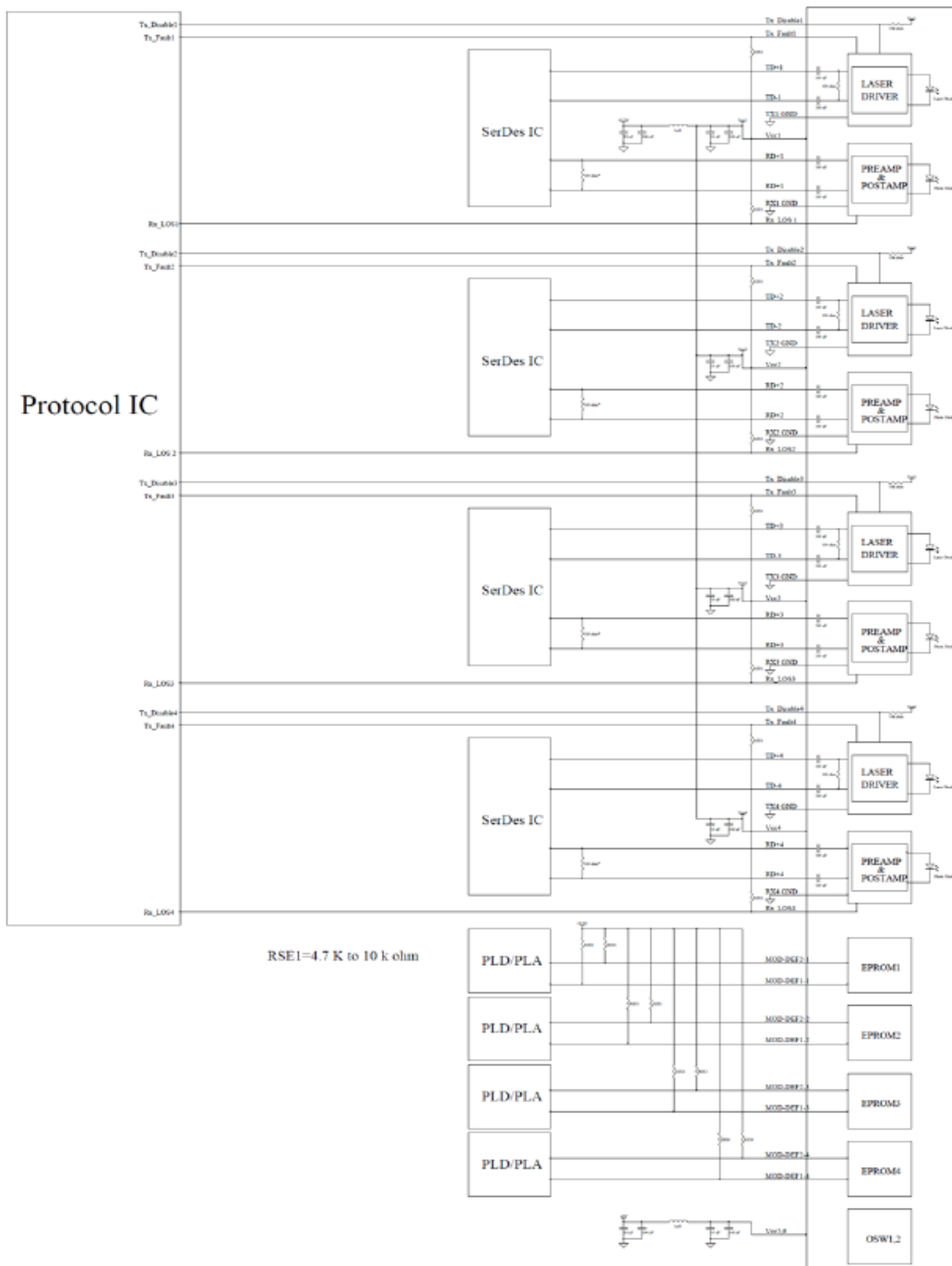
Note :

1. T_C : Case operation temperature.
2. I_{OP} : Operating current at room temperature. The minimum setting current is 0mA.
3. P_{OUT} : Operating optical power of transmitter at room temperature.
4. P_{OVER} : Overload optical power of receiver at room temperature.
5. P_{SEN} : Sensitivity optical power of receiver at room temperature.
6. Bytes 95 contains the low order 8bits of sum of bytes 0~94.

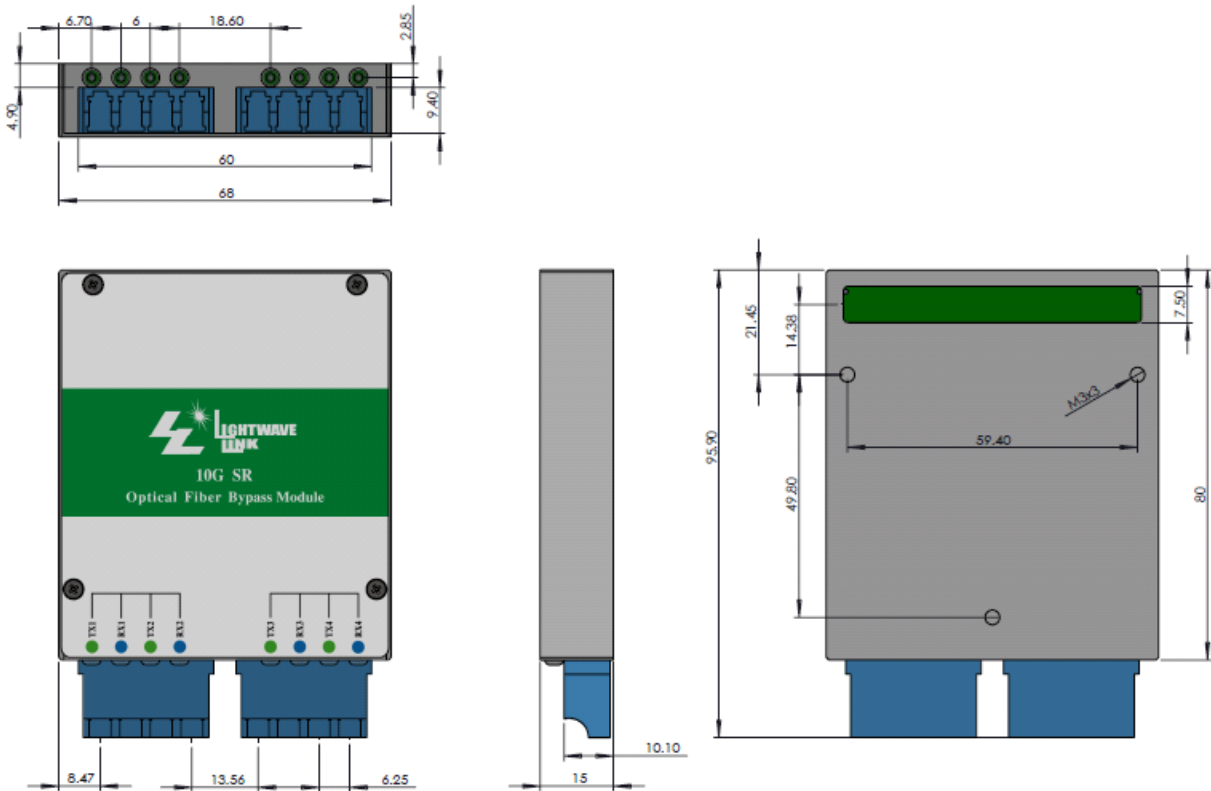
Digital Diagnostic Monitor Accuracy

Parameter	Typical Value	Note
Transceiver Temperature	$\pm 3^{\circ}\text{C}$	Transceiver internal temperature
Power Supply Voltage	$\pm 3\%$	Transceiver internal voltage
TX Bias Current	$\pm 10\%$	
TX Optical Power	$\pm 3\text{dB}$	
RX Optical Power	$\pm 3\text{dB}$	

Recommend Circuit Schematic



Dimensions



Eye Safety Mark

<p>The LM2 series multimode transceiver is a class 1 laser product. It complies with EN 60825-1 and FDA 21 CFR 1040.10 and 1040.11. In order to meet laser safety requirements the transceiver shall be operated within the Absolute Maximum Ratings.</p> <p>Caution All adjustments have been done at the factory before the shipment of the devices. No maintenance and user serviceable part is required. Tampering with and modifying the performance of the device will result in voided product warranty.</p>	<p>Required Mark</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> Class 1 Laser Product Complies with 21 CFR 1040.10 and 1040.11 </div>
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ORDER INFORMATION

PART NUMBER	Bit Rate (Gbps)	10GBASE	Distance (m)	Wavelength (nm)	Optical Connector	Temp.(°C)
QPBM-4-4-L-50-L-8-192	10.3	SR	300	850 VCSEL	LC/PC	0 to 70
QPBM-4-4-L-50-L-D-192	10.3	SR	300	850 VCSEL	LC/APC	0 to 70

* Distance 300m: for 50/125um OM3 MMF.

192: for data Rate 10.3Gbps.

Note: All information contained this document is subject to change without notice.