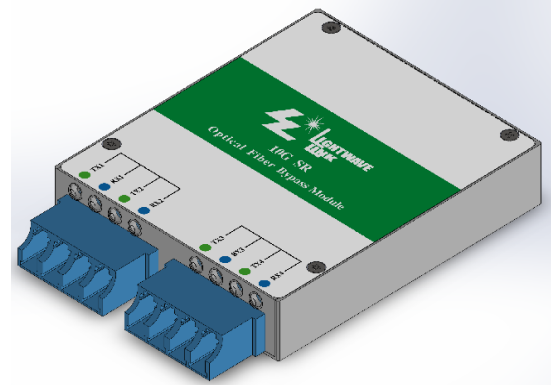


10.3GBPS LR/LW QUAD PORT FIBER BYPASS MODULE

Product Description

The LR/LW 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 Single-mode fiber operations. LR/LW 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 LR/LW 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-LR
- Compliant with 10GBASE-LW
- Link Distances at 10.3Gbps 20Km links with 9/125um Single Mode Fiber 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

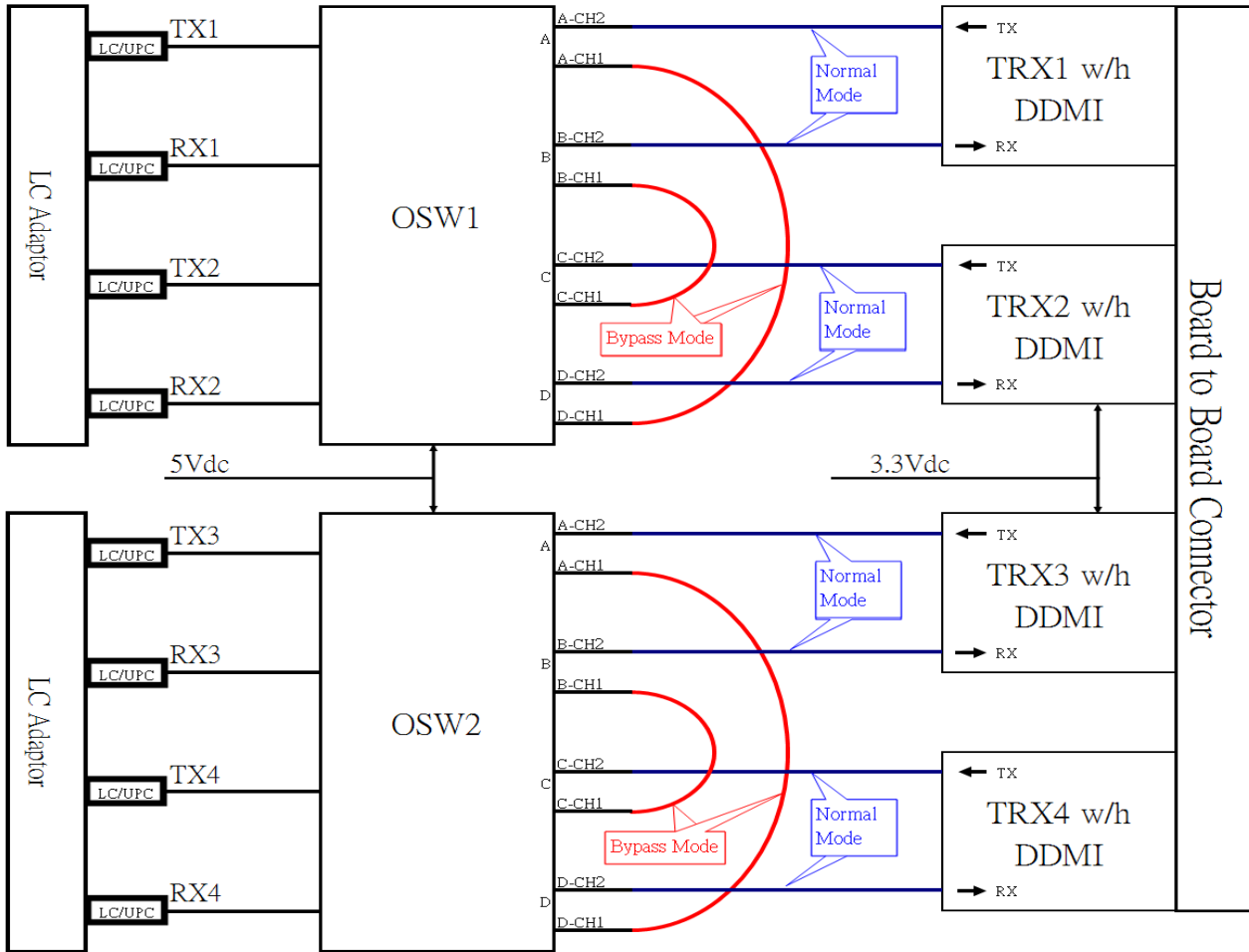
Applications

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

LASER SAFETY

This Single-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.

LR/LW 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
Data Rate			10.3125	10.5	Gbps	

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	K Ω	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	μ sec	
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	μ sec	
TX_DISABLE time to reset	t_{reset}	10			μ sec	
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	K Ω	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	μ sec	4
LOS Deasserted Time (Transmitter on to off)	$t_{D.RX_LOS}$			100	μ sec	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	$\pm 10\%$
Switching Time (Input Pulse ≥ 20 ms)	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.

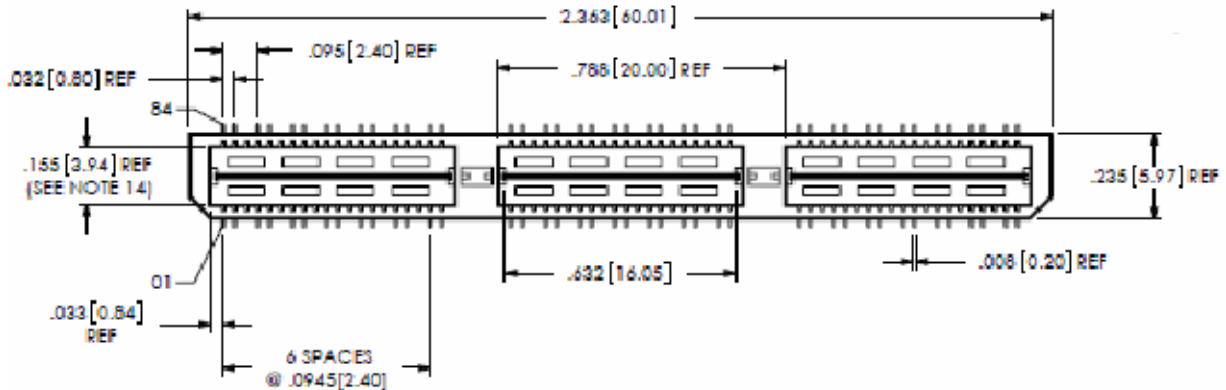
Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Transmitter						
Output Optical Power	P_{OUT}	-3		1	dBm	1 (9/125um)
Optical Modulation Amplitude	OMA	-3.5			dBm	
Center Wavelength	λ_c	1290	1310	1330	nm	
Spectral Width (RMS)	$\Delta\lambda$			1.0	nm	-20dB width
Transmitter and Dispersion Penalty	TDP	30			dB	
Relative Intensity Noise	RIN	3.5				1 (9/125um)
Output Eye	Compliant with IEEE802.3ae					
Max. Pout TX-DISABLE Asserted	P_{OFF}			-128	dB/Hz	
Receiver						
Optical Input Power (Over Load)	P_{IN1}	0.5			dBm	2 (9/125um)
Receiver Sensitivity (AVG.) (BER<10E-12 and PRBS=231-1)	P_{IN2}			-14.4	dBm	2 (9/125um)
Receiver Sensitivity (OMA) (BER<10E-12 and PRBS=231-1)	P_{IN3}			-12.6	dBm	2 (9/125um))
Stressed Receiver Sensitivity (OMA) (BER<10E-12 and PRBS=231-1)	P_{IN4}			-10.3	dBm	2 (9/125um) 4
Center Wavelength	λ_c	1260		1560	nm	
Optical Return Loss	ORL			-12	dB	
LOS Asserted (AVG.)	P_A			-16	dBm	
LOS Deasserted (AVG.)	P_D	-28			dBm	
LOS Hysteresis	P_A-P_D	0.5		3.0	dB	
Optical Bypass Switch						
Center Wavelength	λ_c	1260		1560	nm	
Insertion Loss	IRL	2.0		4.0	dB	3 (9/125um)
Return Loss	ORL			-50	dB	2 (9/125um)

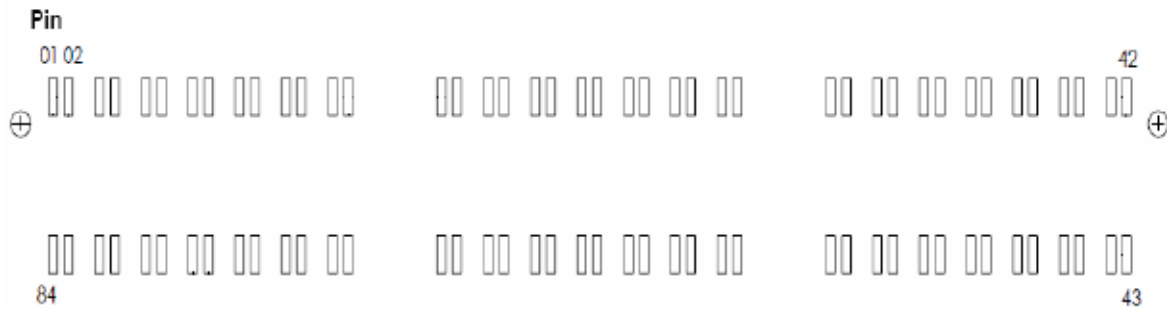
Note :

1. Output power is power couples into a 9/125um single-mode fiber.
2. Normal Mode (Bypass Mode Off).
3. Bypass Mode (Normal Mode Off).
4. Pre IEEE802.3ae. Equivalent to -13.3dBm average power at Infinite ER.

10.3Gbps LR/LW 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

Pin #	Pin Name	I/O Port	Pin Function	Note
16	MOD-DEF2-3	I/O	2 Wire Serial ID Interface (Data) for TRX-3	3
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	

Pin #	Pin Name	I/O Port	Pin Function	Note
54	RX_LOS4	O	Receiver Loss of Signal Out for TRX-4	4
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 differentia 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)

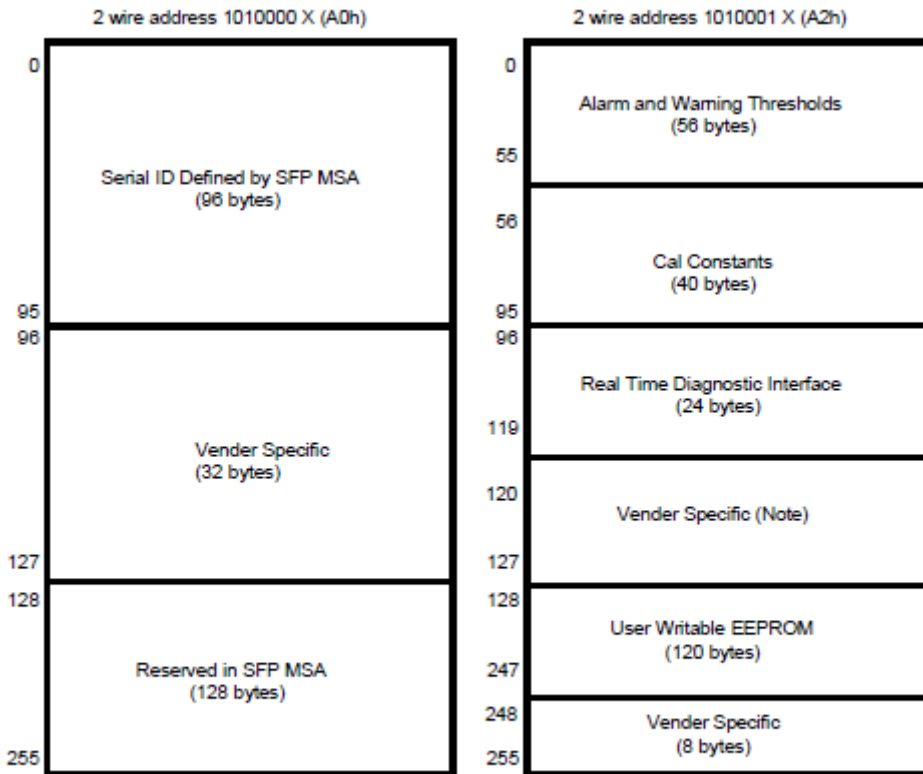
LED								
Definition	Link1	Speed1	Link2	Speed2	Link3	Speed3	Link4	Speed4
LED type	Single	Single	Single	Single	Single	Single	Single	Single
Color	Green	Blue	Green	Blue	Green	Blue	Green	Blue

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 128~255 (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	$I_{OP} - 5$	$^{\circ}C$	2
20–21	2	Bias High Warning	$I_{OP} + 7$	$^{\circ}C$	2
22–23	2	Bias Low Warning	$I_{OP} - 3$	$^{\circ}C$	2
24–25	2	TX Power High Alarm	$P_{OUT} + 3$	$^{\circ}C$	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	$P_{OVER} + 2$	$^{\circ}C$	4
38–39	2	RX Power Low Alarm	P_{SEN}	$^{\circ}C$	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	$T_C (Max^{\circ}) + 15$	$^{\circ}C$	
104–105	2	Real Time Receiver Power	$T_C (Min^{\circ})$	$^{\circ}C$	
106–109	4	Reserved	$T_C (Max^{\circ}) + 10$	$^{\circ}C$	
110	1	Optional Status/Control Bits	$T_C (Min^{\circ}) + 10$	$^{\circ}C$	
111	1	Reserved	$V_{CC} + 5\%$	V	
112–119	8	Optional Set of Alarm and Warning	$V_{CC} - 5\%$	V	

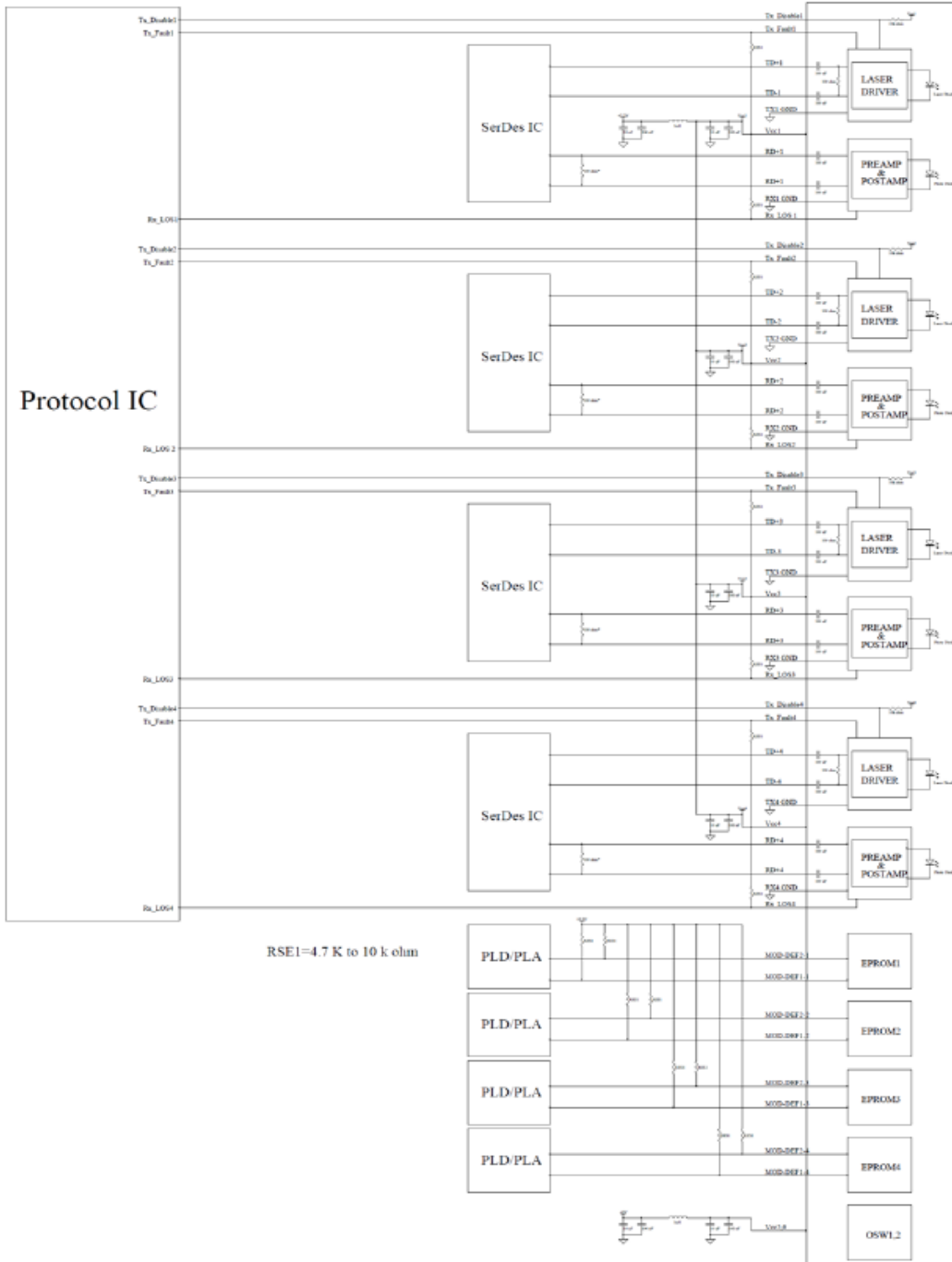
Note :

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.

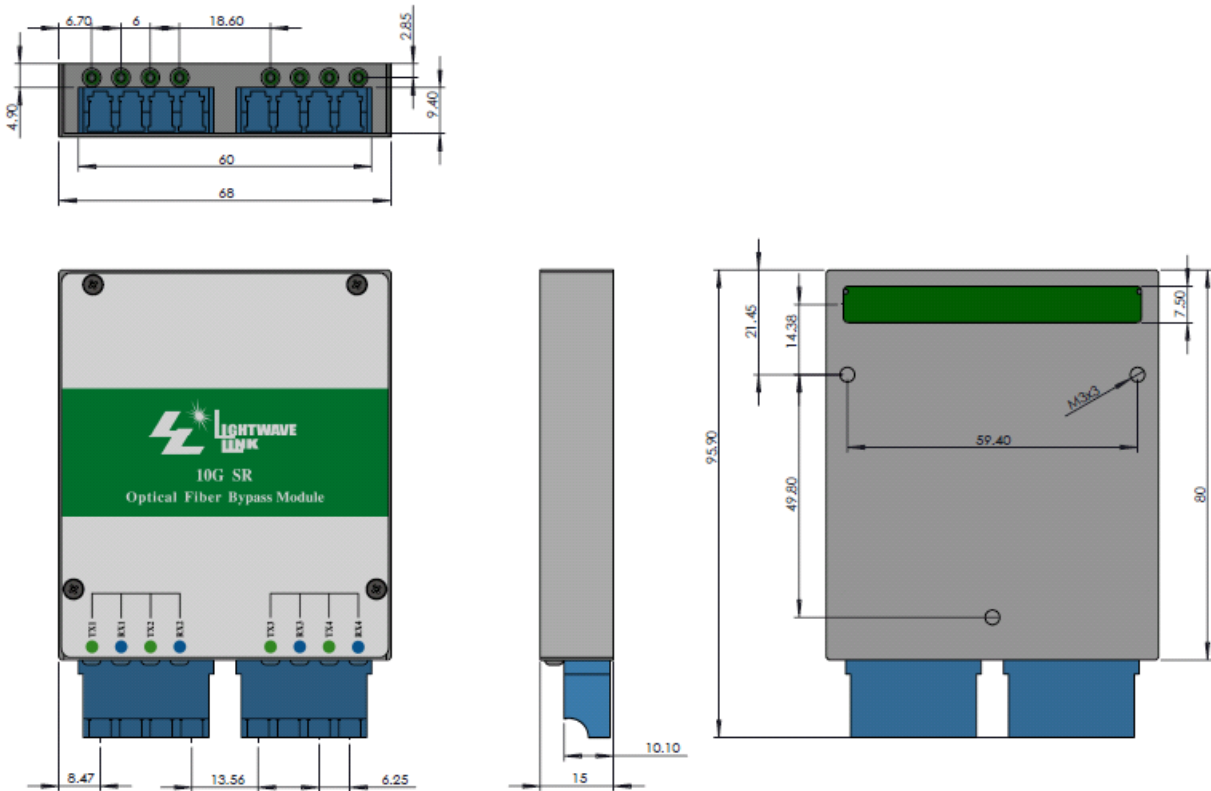
Digital Diagnostic Monitor Accuracy

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 (Km)	Wavelength (nm)	Optical Connector	Temp.(°C)
10GQPBM13-4-4-L-9-L-8	10.3	LR/LW	20	1310DFB	LC/PC	0 to 70
10GQPBM13-4-4-L-9-L-D	10.3	LR/LW	20	1310DFB	LC/APC	0 to 70

*192: for data Rate 10.3Gbps.

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