



### Features:

- Hot Pluggable
- 1310nm FP Transmitter
- Distance up to 220m with MMF
- Compliant to SFP+ Electrical MSA SFF-8431
- Compliant to SFP+ Mechanical MSA SFF-8432
- Duplex LC Connector Interface
- Multi rate of up to 11.3Gbps
- +3.3V single power supply
- Low power consumption
- Operating case temp : Standard: 0°C~+70°C
- RoHS 6/6 compliant

### Applications

- 10GBASE-LRM
- OBSAI rates 6.144 Gb/s, 3.072 Gb/s, 1.536 Gb/s, 0.768Gb/s
- CPRI rates 9.830 Gb/s, 7.373Gb/s, 6.144 Gb/s, 4.915 Gb/s, 2.458 Gb/s, 1.229 Gb/s, 0.614Gb/s
- Other optical links

### Order Information

Table 1-Order Information

Part No.	Bit Rate (Gbps)	Laser (nm)	Distance	Fiber Type	DDMI	Connector	Temp <sup>note1</sup>
GACP-1396-02	10.3125	1310	220m	MMF	YES	LC	0°C~+70°C

Note:1 Case Temperature

## Absolute Maximum Ratings

Table2- Absolute Maximum Ratings

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Supply Voltage	V <sub>CC3</sub>	-0.5	-	+3.6	V	
Storage Temperature	T <sub>s</sub>	-40	-	+85	°C	
Operating Humidity	RH	+5	-	+95	%	

Note2: Exceeding any one of these values may destroy the device permanently.

## Recommended Operating Conditions

Table 3- Recommended operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit	Notes
Operating Case Temperature	T <sub>C</sub>	0	-	+70	°C	
Power Supply Voltage	V <sub>CC</sub>	3.14	3.3	3.47	V	
Power Supply Current	I <sub>CC</sub>	-	-	300	mA	
Power Dissipation	P <sub>d</sub>	-	-	1.0	W	
Bit Rate	BR	-	10.3125	-	Gbps	

## Electrical Characteristics

Table 4- Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units	Notes
<b>Transmitter</b>						
Differential Data Input Swing	V <sub>in,P-P</sub>	120	-	850	mV <sub>pp</sub>	
Input Differential Impedance	Z <sub>IN</sub>	80	100	120	Ω	
Tx_Fault	Normal Operation	V <sub>OL</sub>	0	0.8	V	
	Transmitter Fault	V <sub>OH</sub>	2.0	-	V <sub>CC</sub>	V
Tx_Disable	Normal Operation	V <sub>IL</sub>	0	0.8	V	
	Laser Disable	V <sub>IH</sub>	2.0	-	V <sub>CC</sub> +0.3	V
<b>Receiver</b>						
Differential Date Output	V <sub>out</sub>	100	-	800	mV	
Output Differential Impedance	Z <sub>D</sub>	80	100	120	Ω	
Output Rise Time(20-80%)	T <sub>R</sub>	24	-	-	ps	
Output Fall Time (20-80%)	T <sub>F</sub>	24	-	-	ps	
Rx_LOS	Normal Operation	V <sub>OL</sub>	0	0.8	V	
	Lose Signal	V <sub>oH</sub>	2.0	-	V <sub>CC</sub>	V

## Optical Characteristics

Table 5-Optical Characteristics

Parameter	Symbol	Unit	Min	Typ	Max	Notes
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Optical transmitter Characteristics						
Bit Rate	BR	Gbps	9.953	10.3125	11.3	
Center Wavelength Range	$\lambda_c$	nm	1260	1310	1360	
Average Launch power Tx_off	P <sub>off</sub>	dBm	-	-	-45	
Launch Optical Power	P <sub>0</sub>	dBm	-6	-	+0.5	
Extinction Ratio	ER	dB	3	-	-	
Jitter P-P	JP	ps	-	-	27	
Jitter RMS	JR	ps	-	-	5	
Optical Rise/Fall time	Tr/tf	ps	-	-	100	
Eye Diagram	Compliant With IEEE 802.3-2005					
Optical Receiver Characteristics						
Bit Rate	BR	Gbps	9.953	10.3125	11.3	
Receiver Sensitivity	RS	dBm	-	-	-6.5	1
Overload Input Optical Power	P <sub>IN</sub>	dBm	1.5	-	-	1
Center Wavelength Range	$\lambda_c$	nm	1260	-	1600	
LOS	LOS <sub>D</sub>	dBm	-	-	-18	
	LOS <sub>A</sub>		-28	-	-	
LOS Hysteresis		dB	0.5	-	-	

Note:

1. Measured with PRBS 2<sup>31</sup>-1 test pattern @10.3125Gbps.BER=10E-12

### Recommended Host Board Power Supply Circuit

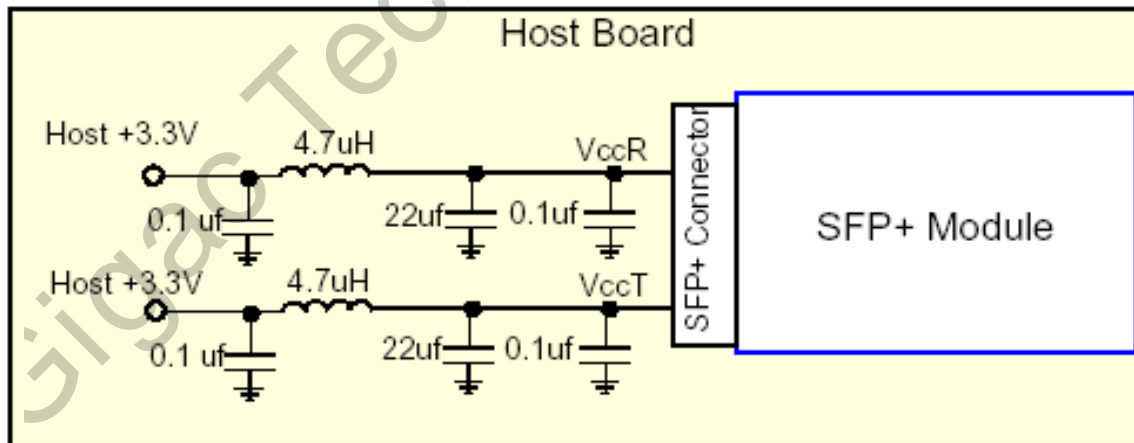


Figure 1, Recommended Host Board Power Supply Circuit

### Recommended Interface Circuit

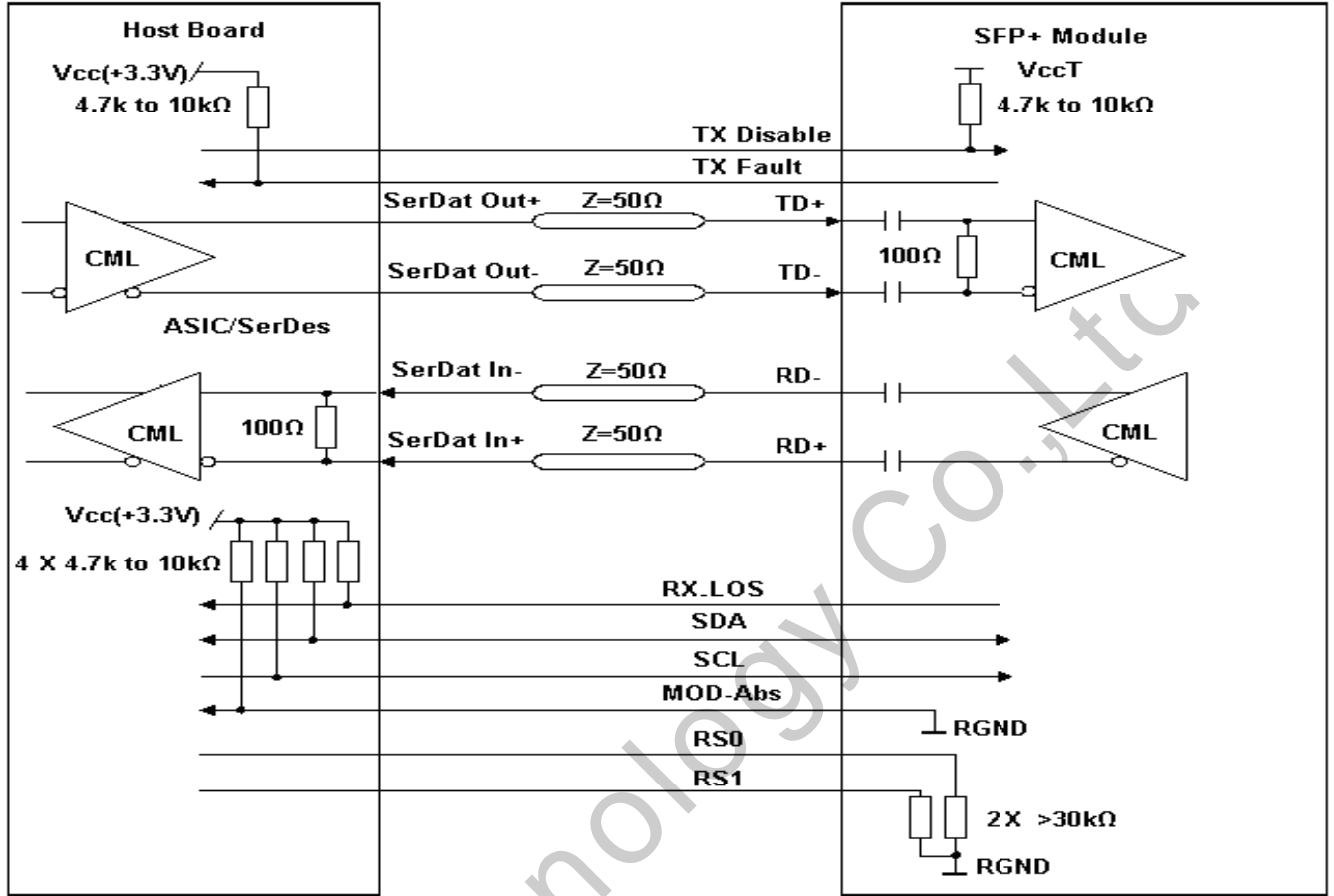


Figure 2, Recommended Interface Circuit

### Pin arrangement

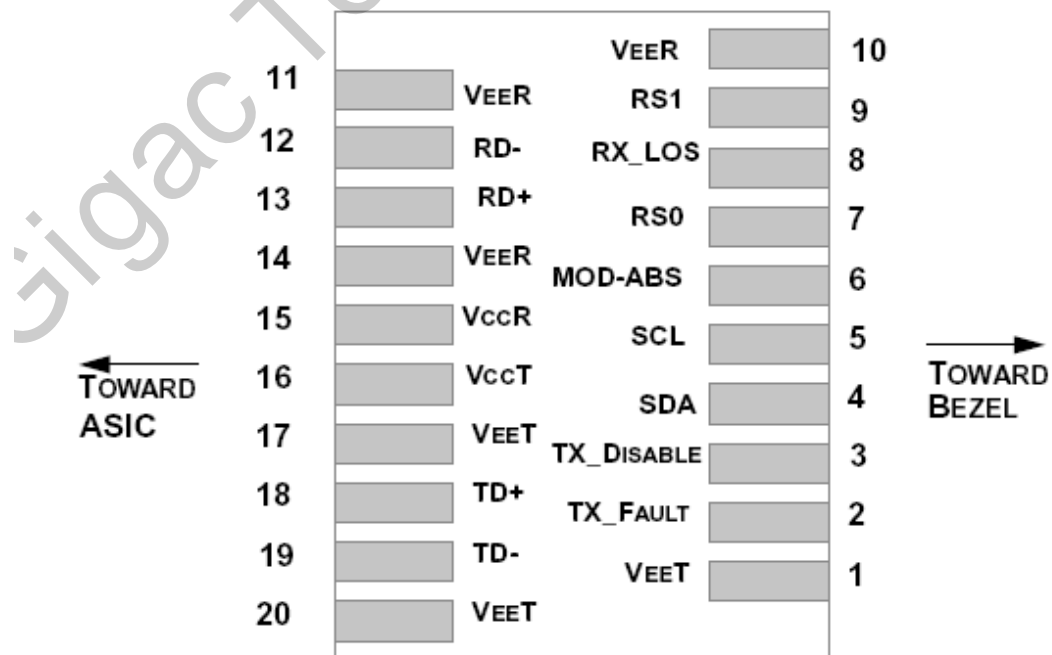


Figure 3, Pin View

Table 5-Pin Function Definitions

Pin	Symbol	Name/Description	Notes
1	VEET	Module Transmitter Ground	1
2	TX_FAULT	Module Transmitter Fault	2
3	TX_DISABLE	Transmitter Disable; Turns off transmitter laser output	3
4	SDA	2-Wire Serial Interface Data Line (MOD-DEF2)	
5	SCL	2-Wire Serial Interface Clock (MOD-DEF1)	
6	MOD_ABS	Module Absent, connected to V <sub>EE</sub> T or V <sub>EE</sub> R in the module	2
7	RS0	Rate Select 0, optionally controls SFP+ module receiver as the following when HIGH input Bit Rate > 4.25 Gbps and when LOW input Bit Rate ≤ 4.25 Gbps.	
8	RX_LOS	Receiver Loss of Signal Indication (in FC designated as RX_LOS, in SONET designated as LOS, and in Ethernet designated as NOT Signal Detect)	2
9	RS1	Rate Select 1, optionally controls SFP+ module transmitter as the following when HIGH input Bit Rate > 4.25 Gbps and when LOW input Bit Rate ≤ 4.25 Gbps	
10	V <sub>EE</sub> R	Module Receiver Ground	1
11	V <sub>EE</sub> R	Module Receiver Ground	1
12	RD-	Receiver Inverted Data Output	
13	RD+	Receiver Non-Inverted Data Output	
14	V <sub>EE</sub> R	Module Receiver Ground	1
15	V <sub>CC</sub> R	Module Receiver 3.3 V Supply	
16	V <sub>CC</sub> T	Module Transmitter 3.3 V Supply	
17	V <sub>EE</sub> T	Module Transmitter Ground	1
18	TD+	Transmitter Non-Inverted Data Input	
19	TD-	Transmitter Inverted Data Input	
20	V <sub>EE</sub> T	Module Transmitter Ground	1

**Note:**

1. The module ground pins are isolated from the module case.
2. The pins shall be pulled up with 4.7K-10Kohms to a voltage between 3.14V and 3.46V on host board.
3. The pin is pulled up to VCCT with a 4.7K-10KΩ resistor in the module.

## Monitoring Specification

The digital diagnostic monitoring interface also defines another 256-byte memory map in EEPROM. For detail EEPROM information; please refer to the related document of SFF-8472 Rev 9.5. The monitoring specification of this product is described in Table 6 and Table 7.

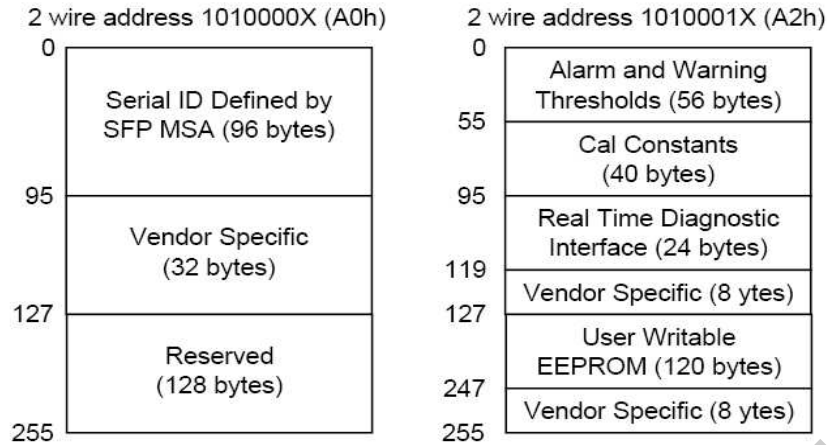


Figure 4, Memory Map

## A0h EEPROM Definition

Table 6-A0h EEPROM Definition

Data Addr	Field Size (Byte)	Name Of filed	Description of field	Coded value	Hex
0	1	Identifier	Type of serial transceiver	SFP	03
1	1	Ext.Identifier	Extended identifier of type of serial transceiver	MOD_DEF4	04
2	1	Connector	Code for connector type	LC	07
3	8	Transceiver	Infiniband compliance codes	10G Base-LRM	40
4			Part of SONET compliance codes		00
5			SONET compliance codes		00
6			Gigabit ethernet compliance codes		00
7			Fiber channel link length & part of transmitter technology		00
8			Part of fiber channel transmitter technology		00
9			Fiber channel transmission media		00
10			Fiber channel speed		00
11	1	Encoding	Code for serial encoding algorithm	64B/66B	06
12	1	BR, Nominal	Nominal bit rate, units of 100 Mbits/sec.	10.3 Gb/s	67
13	1	Reserved	Reserved	Unspecified	00
14	1	Length (9um)	Link length supported for 9/125 um fiber, units of km		00
15	1	Length (9um)	Link length supported for 9/125 um fiber, units of 100 m		00
16	1	Length (50um)	Link length supported for 50/125 um fiber, units of 10 m		00
17	1	Length (62.5um)	Link length supported for 62.5/125 um fiber, units of 10 m		00

18	1	Length (Copper)	Link length supported for copper or direct attach cable, units of m		00
19	1	Length (50um)	Link length supported for 50 um OM3 fiber, units of 10 m	220m	16
20	16	Vendor name	Vendor name (ASCII)	G	47
21				i	69
22				g	67
23				a	61
24				c	63
25				<space>	20
26				L	4C
27				t	74
28				d	64
29				.	2E
30				<space>	20
31				<space>	20
32				<space>	20
33				<space>	20
34				<space>	20
35				<space>	20
36	1	Reserved	Reserved	Reserved	00
37	3	Vendor OUI	Vendor IEEE company ID	0x00-0x00-0x00	00
38					00
39					00
40	16	Vendor PN	Part number provided by vendor (ASCII)	G	47
41				A	41
42				C	43
43				P	50
44				-	2D
45				1	31
46				3	33
47				9	39
48				6	36
49				-	2D
50				0	30
51				2	32
52				M	4D
53				<space>	20
54				<space>	20

55				<space>	20
56	4	Vendor rev	Revision level for part number provided by vendor (ASCII)	1	31
57				0	30
58				<space>	20
59				<space>	20
60	2	Wavelength	Laser wavelength	1310nm	05
61					1E
62	1	Reserved	Reserved	Reserved	00
63	1	CC_BASE	The sum of all the bytes from byte 0 to byte 62	00	00
64	2	Options	Indicates which optional transceiver signals are implemented	Rx_LOS	00
65				TX_FAULT TX_DISABLE	1A
66	1	BR, max	Upper bit rate margin, units of %	0%	00
67	1	BR, min	Lower bit rate margin, units of %	0%	00
68	16	Vendor SN	Serial number provided by vendor (ASCII)	<space>	20
69				<space>	20
70				<space>	20
71				<space>	20
72				<space>	20
73				<space>	20
74				<space>	20
75				<space>	20
76				<space>	20
77				<space>	20
78				<space>	20
79				<space>	20
80				<space>	20
81				<space>	20
82				<space>	20
83				<space>	20
84	8	Date code	Vendor's manufacturing date code	Year	20
85				Year	20
86				Month	20
87				Month	20
88				Day	20
89				Day	20
90				<space>	20
91				<space>	20



92	1	Diagnostic Monitoring Type	Compliant with SFF-8472 V9.5 Externally Calibrated Received power measurement type-Average Power	Average power Internally calibrated Digital diagnostic monitoring implemented	68
93	1	Enhanced Options	Diagnostics (Optional Alarm/warning flags) Soft TX_FAULT monitoring implemented Soft RX_LOS monitoring implemented	Optional soft RX_LOS monitoring implemented; Optional soft TX_FAULT monitoring implemented; Optional soft TX_DISABLE control and monitoring implemented; Optional Alarm/warning flags implemented for all monitored quantities;	F0
94	1	SFF-8472 Compliance	Diagnostics Compliance(SFF-8472 V9.5)	Rev 10.5 of SFF-8472	05
95	1	CC_EXT	The sum of all the bytes from byte 64 to byte 94	00	00
96~127	32	Vendor Specific	Vendor Specific EEPROM		00

### A2h EEPROM Definition

Table 7-A2h EEPROM Definition

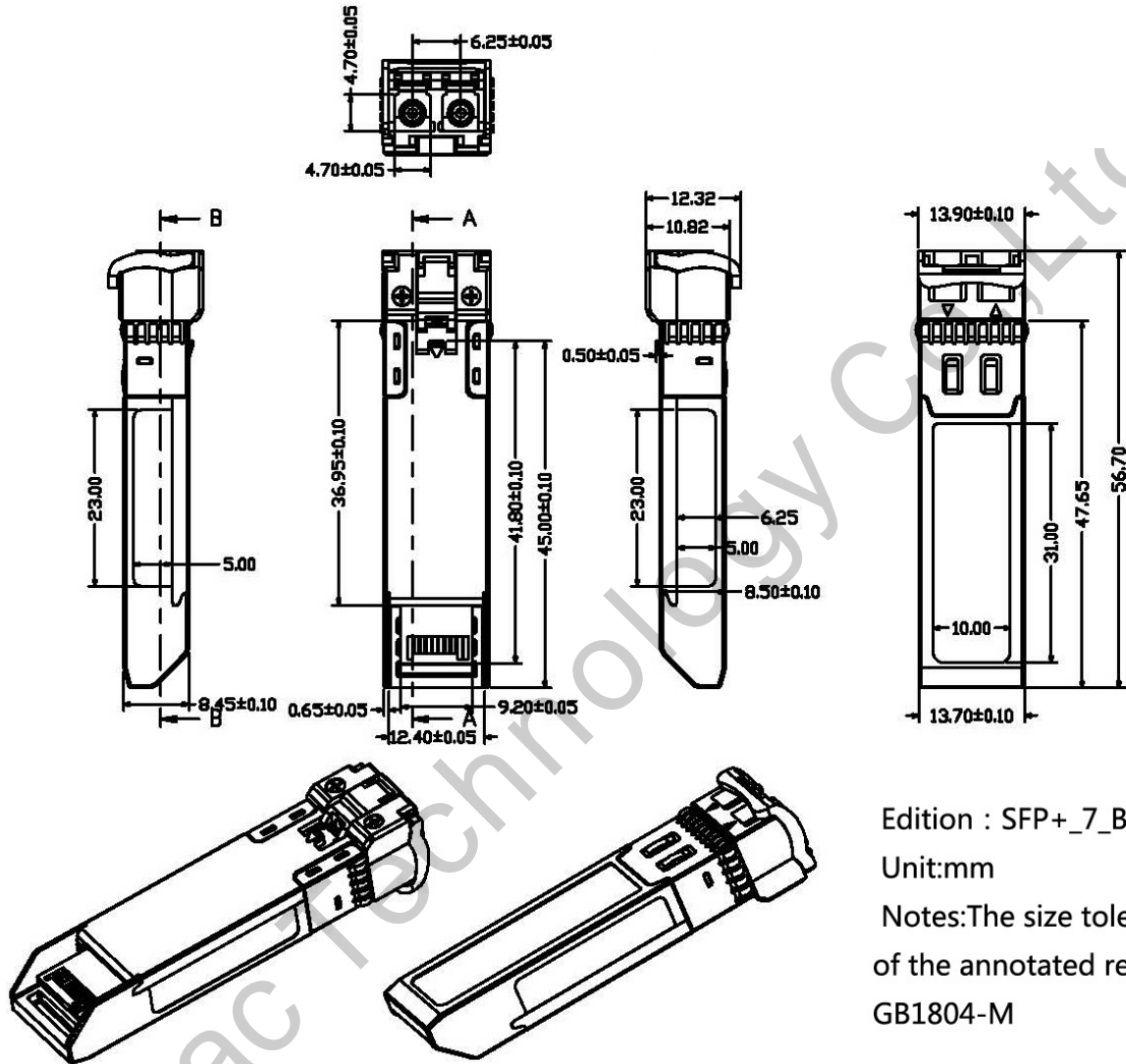
Data Addr	Field Size (Byte)	Name Of filed	Description of field	Coded value	Hex
0	2	Temp High Alarm	Temp High Alarm	90.00°C	5A
1					00
2	2	Temp Low Alarm	Temp Low Alarm	-10.00°C	F6
3					00
4	2	Temp High Warning	Temp High Warning	85.00°C	55
5					00
6	2	Temp Low Warning	Temp Low Warning	-5.00°C	FB
7					00
8	2	Voltage High Alarm	Voltage High Alarm	3.60V	8C
9					A0
10	2	Voltage Low Alarm	Voltage Low Alarm	2.90V	71
11					48
12	2	Voltage High Warning	Voltage High Warning	3.50V	88
13					B8
14	2	Voltage Low Warning	Voltage Low Warning	3.00V	75
15					30
16	2	Bias High Alarm	Bias High Alarm	90.00mA	AF
17					C8

18	2	Bias Low Alarm	Bias Low Alarm	5.00mA	09
19					C4
20	2	Bias High Warning	Bias High Warning	80.00mA	9C
21					40
22	2	Bias Low Warning	Bias Low Warning	10.00mA	13
23					88
24	2	TX Power High Alarm	TX Power High Alarm	2.00dBm	3D
25					E8
26	2	TX Power Low Alarm	TX Power Low Alarm	-8.00dBm	06
27					30
28	2	TX Power High Warning	TX Power High Warning	1.00dBm	31
29					2D
30	2	TX Power Low Warning	TX Power Low Warning	-7.00dBm	07
31					CB
32	2	RX Power High Alarm	RX Power High Alarm	2.00dBm	3D
33					E8
34	2	RX Power Low Alarm	RX Power Low Alarm	-18.01dBm	00
35					9E
36	2	RX Power High Warning	RX Power High Warning	1.00dBm	31
37					2D
38	2	RX Power Low Warning	RX Power Low Warning	-16.00dBm	00
39					FB
40	16	Unallocated	Reserved for future monitored quantities	Reserved	00
41					00
42					00
43					00
44					00
45					00
46					00
47					00
48					00
49					00
50					00
51					00
52					00
53					00
54					00
55					00

56	4	Rx_PWR(4)	Single precision floating point calibration data - Rx optical power.	0.00	00		
57					00		
58					00		
59					00		
60	4	Rx_PWR(3)		Single precision floating point calibration data - Rx optical power.	0.00	00	
61						00	
62						00	
63						00	
64	4	Rx_PWR(2)			Single precision floating point calibration data - Rx optical power.	0.00	00
65							00
66							00
67							00
68	4	Rx_PWR(1)	Single precision floating point calibration data - Rx optical power.			1.00	3F
69							80
70							00
71							00
72	4	Rx_PWR(0)		Single precision floating point calibration data - Rx optical power.		0.00	00
73							00
74							00
75							00
76	2	Tx_I(Slope)			Fixed decimal (unsigned) calibration data, laser bias current.	1	01
77		00					
78	2	Tx_I(Offset)			Fixed decimal (signed two's complement) calibration data, laser bias current.	0	00
79		00					
80	2	Tx_PWR(Slope)	Fixed decimal (unsigned) calibration data, transmitter coupled output power.		1	01	
81		00					
82	2	Tx_PWR(Offset)	Fixed decimal (signed two's complement) calibration data, transmitter coupled output power.		0	00	
83		00					
84	2	T (Slope)	Fixed decimal (unsigned) calibration data, internal module temperature.	1	01		
85		00					
86	2	T (Offset)	Fixed decimal (signed two's complement) calibration data, internal module temperature.	0	00		
87		00					
88	2	V (Slope)	Fixed decimal (unsigned) calibration data, internal module supply voltage.	1	01		
89		00					
90	2	V (Offset)	Fixed decimal (signed two's complement) calibration data, internal module supply voltage.	0	00		
91		00					
92	3	Unallocated	Reserved	Reserved	00		
93					00		

94					00
95	1	Checksum	Byte 95 contains the low order 8 bits of the sum of bytes 0 – 94.	00	00

### Mechanical



Edition : SFP+\_7\_B

Unit:mm

Notes:The size tolerance of the annotated reference GB1804-M

Figure 5, Mechanical Diagram (Rev SFP+\_7\_b)

### Regulatory Compliance

Feature	Standard	Performance
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883G Method 3015.7	Class 1C (>1000 V)
Electrostatic Discharge to the enclosure	EN 55024:1998+A1+A2 IEC-61000-4-2 GR-1089-CORE	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN55022:2006 CISPR 22B :2006 VCCI Class B	Compatible with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design.

Immunity	EN 55024:1998+A1+A2 IEC 61000-4-3	Compatible with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/receiver performance is detectable between these limits.
Laser Eye Safety	FDA 21CFR 1040.10 and 1040.11 EN (IEC) 60825-1:2007 EN (IEC) 60825-2:2004+A1	CDRH compliant and Class I laser product. TüV Certificate No. 50135086
Component Recognition	UL and CUL EN60950-1:2006	UL file E317337 TüV Certificate No. 50135086 (CB scheme )
RoHS6	2002/95/EC 4.1&4.2 2005/747/EC 5&7&13	Compliant with standards <sup>*note2</sup>

Note1: For update of the equipment and strict control of raw materials, Gigac has the ability to supply the customized products since Jan 1, 2007, which meet the requirements of RoHS6 (Restrictions on use of certain Hazardous Substances) of European Union.

In light of item 5 in RoHS exemption list of RoHS Directive 2002/95/EC, Item 5: Lead in glass of cathode ray tubes, electronic components and fluorescent tubes.

In light of item 13 in RoHS exemption list of RoHS Directive 2005/747/EC, Item13: Lead and cadmium in optical and filter glass. The three exemptions are being concerned for Gigac's transceivers, because Gigac's transceivers use glass, which may contain Pb, for components such as lenses, windows, isolators, and other electronic components.

### Notice

Gigac reserves the right to make changes to or discontinue any optical link product or service identified in this publication, without notice, in order to improve design and/or performance. Applications that are described herein for any of the optical link products are for illustrative purposes only. Gigac makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

### Revision history

Version	Initiated	Reviewed	Revision History	Release Date
A0	Simon	Smith	Initialization	2009-10-23
A1	Code	Smith	Updated output power value.	2011-01-08
A2	Code	smith	Update case temp. symbol.	2013-03-28
A3	HOU	Denny	Add the extended temperature range	2014-06-24
A4	Code	Denny	Update package size, adjust the data manual typesetting format	2015-03-18
A5	Code	Denny	Fixed some description;add Monitoring Specification	2015-04-13

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