100BASE BX SFP transceiver modules with DDM function

MBPD-03XXX2X Series

Features

- 125/155Mbps data rate
- Single LC receptacle optical interface compliant
- Single +3.3V power supply
- Hot-pluggable
- Receiver Loss of Signal Output
- AC coupling of LVPECL signals
- Serial ID module on MOD (0-2)
- International Class 1 laser safety certified
- Transmitter disable input
- Operating temperature range:

Commercial:	-5 ºC ~+70 ºC
Extended commercial	-5 ºC ~+85 ºC
Industrial:	-40 ºC ~+85 ºC

Applications

- Fast Ethernet
- Switch to switch interface
- Switched backplane applications

Compliance

- Compliant with SFP MSA
- Compliant with IEEE802.3ah 100Base-BX
- Compliant with RoHS

Description

The MBPD-03XXX2X transceiver is a high performance, cost effective module that supports data-rate up to 125Mbps/155Mbps for 20km\40km\80km distance with SMF.

The transmitter section and the receiver section work independently in the transceiver. The receiver section contains an InGaAs PIN photo diode, a transimpedance amplifier and a post amplifier (with working data rate up to 125Mbps/155Mbps), functionally transmit received optical power to steady electrical data. The transmitter section contains a laser with back-facet monitor and a laser driver with APC function, transmit input electrical data to steady optical output signal.

This transceiver meets the Small Form Pluggable (SFP) industry standard package utilizing Single LC receptacle optical interface connector. An enhanced Digital Diagnostic Monitoring Interface compliant with SFF-8472 has been incorporated into the transceiver. It allows real time access to the transceiver operating parameters such as transceiver temperature, laser bias current, transmitted optical power, received optical power and transceiver supply voltage by reading a built-in memory with I^2C interface.

Specification

Absolute Maximum Ratings

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Storage Temperature	T_{STG}	-40		85	ºC	
Operating Relative Humidity	RH	5		95	%	
Supply Voltage	V_{CC}	-0.5		4	V	

Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Case temperature	T_{case}	-5	-	70	℃	Commercial
		-5	-	85	℃	Extended commercial
		-40	-	85	℃	Industrial
Supply Voltage	V_{CC}	3.135	3.3	3.465	V	Vcc±5%
Data Rate			125/155		Mbps	

Tested under recommended operating conditions, unless otherwise noted

Operating Characteristic-Electrical

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Power Supply Current	I_{CC}	-	-	300	mA	
Transmitter differential input voltage		500	-	2400	mV	
Receiver differential output voltage		370	-	2000	mV	
Tx fault /Loss of Signal output	V_{OH}	2	-	Vcc	V	LVTTL
	V_{OL}	0	-	0.8	V	LVTTL
Tx disable input	V_{OH}	2	-	Vcc	V	LVTTL
	V_{OL}	0	-	0.8	V	LVTTL

Transmitter Operating Characteristic-Optical

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Optical output power	P_O	-14	-	-8	dBm	For 20km
		-5	-	0	dBm	For 40km
		-5	-	0	dBm	For 80km
Operating Wavelength Range	I_C	1260	1310	1360	nm	
		1480	1490	1500	nm	
		1480	1550	1580	nm	
RMS Spectral Width	Δλ	-	-	7.7 3	nm	1260-1360nm,FP-LD
		-	-	4.6 3	nm	1480-1580nm,FP-LD
		-	-	0.88	nm	DFB-LD
Side Mode Suppression Ratio	SMSR	30	-	-	dB	
Extinction Ratio	E_R	6.6	-	-	dB	

Total transmitter Jitter	Tp-p	-	-	2.48	ns	
Relative Intensity Noise	RIN	-	-	-110	dB/H_Z	
Eye Diagram	Compliant with 802.3ah-2004 transmitter eye mask definition					
Transmitter and Dispersion Penalty	TDP	-	-	4.5	dB	
Optical Tx Output disable	P_{dis}	-	-	-45	dBm	

Receiver Operating Characteristic-Optical

Parameter	Symbol	Min	Typical	Max	Unit	Notes
Optical reflectance	OR	-	-	-12	dB	
Receiver Sensitivity	S	-	-	-31	dBm	Note1,For 20km
		-	-	-34	dBm	Note1,For 40km
		-	-	-34	dBm	Note1,For 80km
Optical Power Input Overload	P_{in-max}	-5	-	-	dBm	
LOS Optical Deassert	LOS_D	-	-	-34	dB	
LOS Optical Assert	LOS_A	-45	-	-	dB	

Note：

[1] Measured with a PRBS2^{23}-1 test pattern, @125Mb/s, EX=10dB, BER=1X10^{-12}.

Pin-out Definition

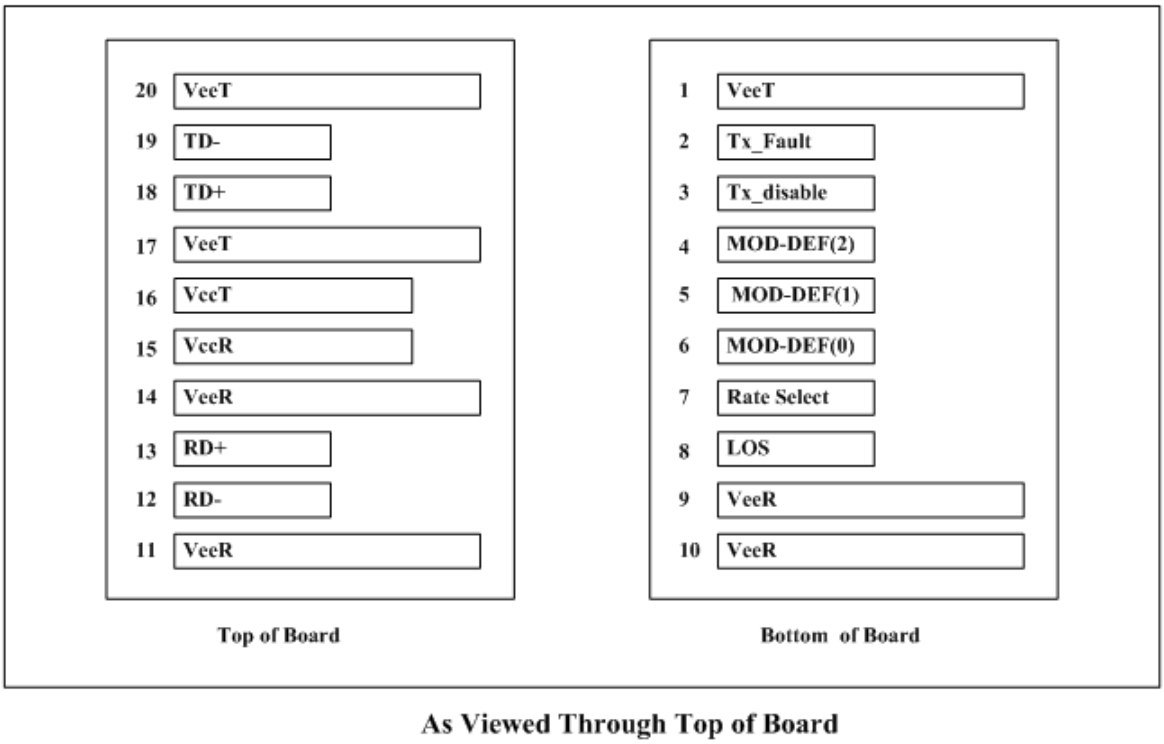

Figure1

Pin Assignment

Pin	Name	Function/Description	Engagement order	Notes
1	VeeT	Transmitter Ground	1	
2	TX Fault	Transmitter Fault Indication	3	Note1
3	TX Disable	Transmitter Disable-Module disables on high or open	3	Note2
4	MOD-DEF2	Module Definition 2-Two wire serial ID interface	3	Note3
5	MOD-DEF1	Module Definition 1-Two wire serial ID interface	3	Note3
6	MOD-DEF0	Module Definition 0-Two wire serial ID interface	3	Note3
7	Rate Select	Not Connected	3	
8	LOS	Loss of Signal	3	Note4
9	VeeR	Receiver Ground	1	
10	VeeR	Receiver Ground	1	
11	Veer	Receiver Ground	1	
12	RD-	Inverse Received Data out	3	Note5
13	RD+	Received Data out	3	Note5
14	VeeR	Receiver Ground	1	
15	VccR	Receiver Power —— +3.3V±5%	2	Note6
16	VccT	Transmitter Power —— +3.3 V±5%	2	Note6
17	VeeT	Transmitter Ground	1	
18	TD+	Transmitter Data In	3	Note7
19	TD-	Inverse Transmitter Data In	3	Note7
20	VeeT	Transmitter Ground	1	

Notes:

[1] TX Fault is open collector/drain output which should be pulled up externally with a 4.7K – 10KΩ resistor on the host board to supply <VccT+0.3V or VccR+0.3V. When high, this 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 input is used to shut down the laser output per the state table below. It is pulled up within the module with a 4.7 – 10K resistor.

Low (0 – 0.8V): Transmitter on

Between (0.8V and 2V): Undefined

High (2.0 – VccT): Transmitter Disabled

Open : Transmitter Disabled

[3] Mod-Def 0, 1, 2. These are the module definition pins. They should be pulled up with a 4.7 - 10K resistor on the hostboard to supply less than VccT+0.3V or VccR+0.3V.

Mod-Def 0 is grounded by the module to indicate that the module is present.

Mod-Def 1 is clock line of two wire serial interface for optional serial ID.

Mod-Def 2 is data line of two wire serial interface for optional serial ID.

[4] LOS (Loss of signal) is an open collector/drain output which should be pulled up externally with a 4.7 - 10K resistor on the host board to supply <VccT+0.3V or VccR+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] 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 thus not required on the host board.

[6] VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V±5% at the SFP connector pin. The in-rush current will typically be no more than 30mA above steady state supply current after 500ns.

[7] 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 host board.

Block Diagram of Transceiver

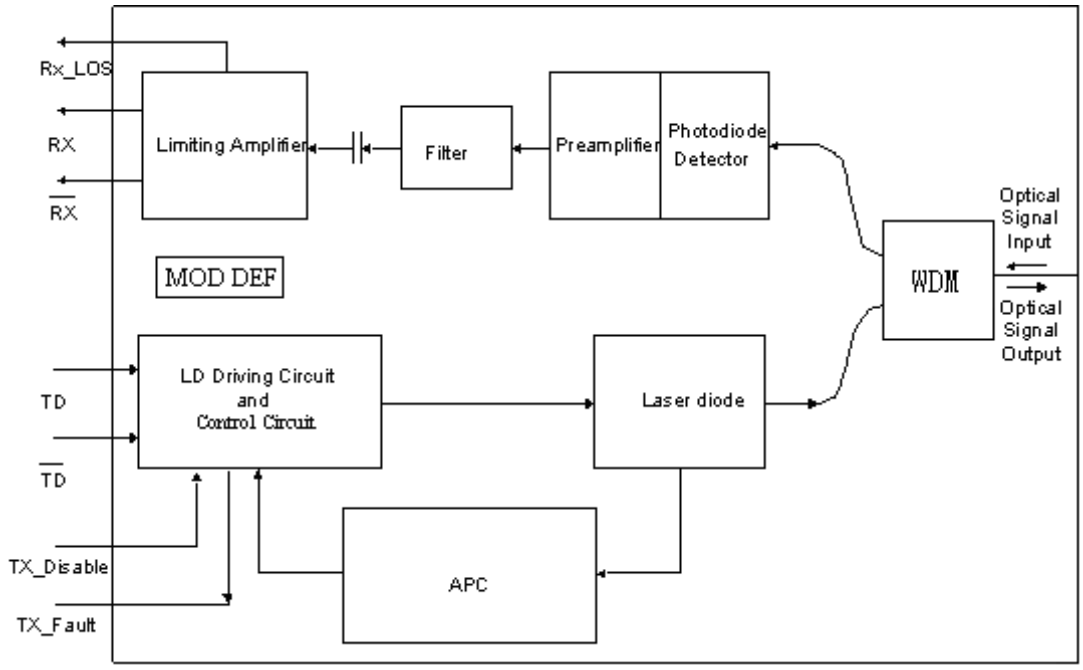

Figure2

Required Host Board Components

The MSA power supply noise rejection filter is required on the host PCB to meet data sheet performance. The MSA filter incorporates an inductor which should be rated 400mADC and 1Ωserial resistance or better. It should not be replaced with a ferrite. The required filter is illustrated in Figure 3. The MSA also specifies that 4.7K to 10KΩ pull-up resistors for TX_FAULT, LOS, and MOD_DEF0,1,2 are required on the host PCB. Figure is the suggested transceiver/host interface.

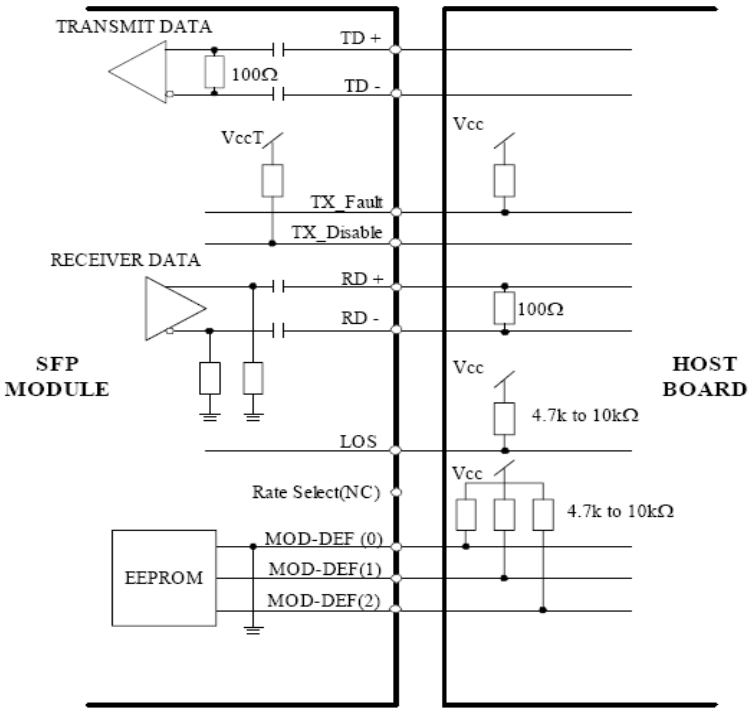

Figure3

Recommended Interface circuit

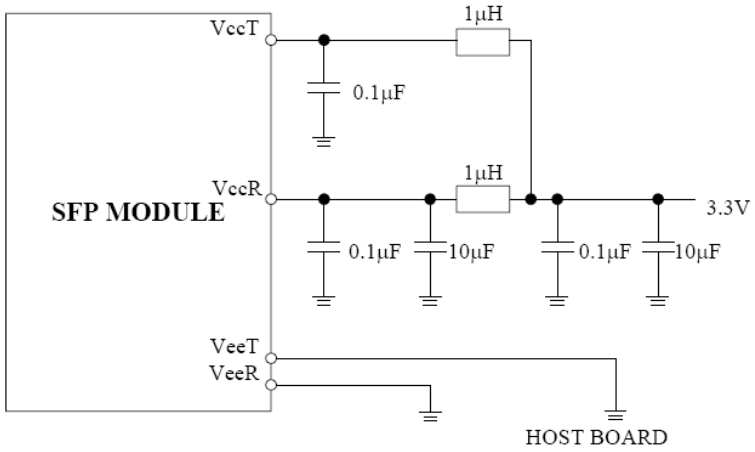

Figure4

PCB layout recommendation

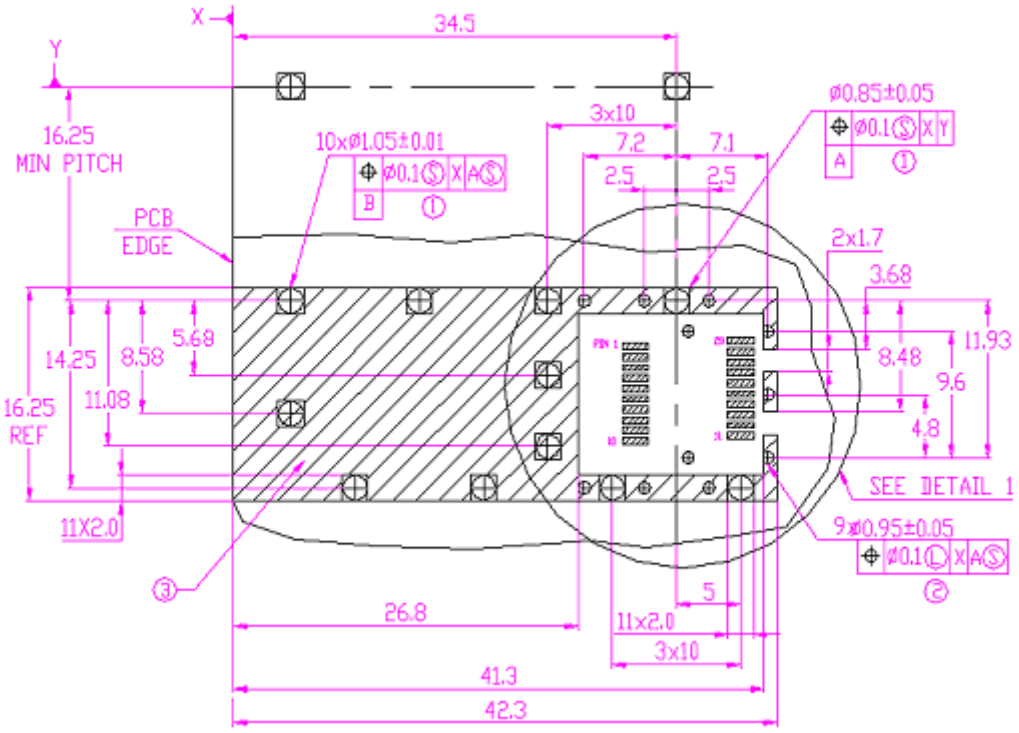

Figure5

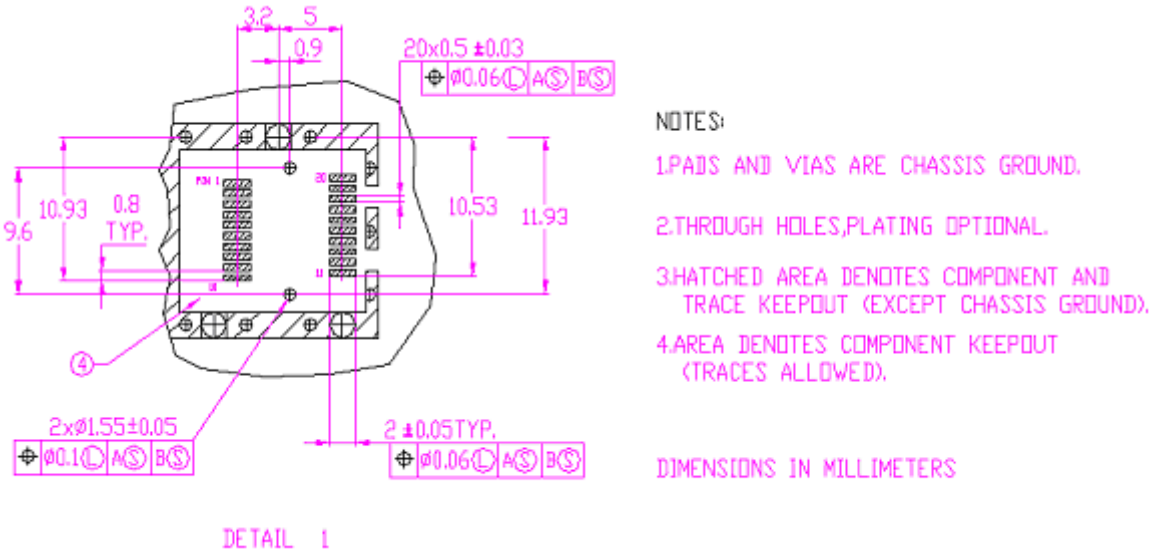

Figure6

Dimensions

(Unit: mm)

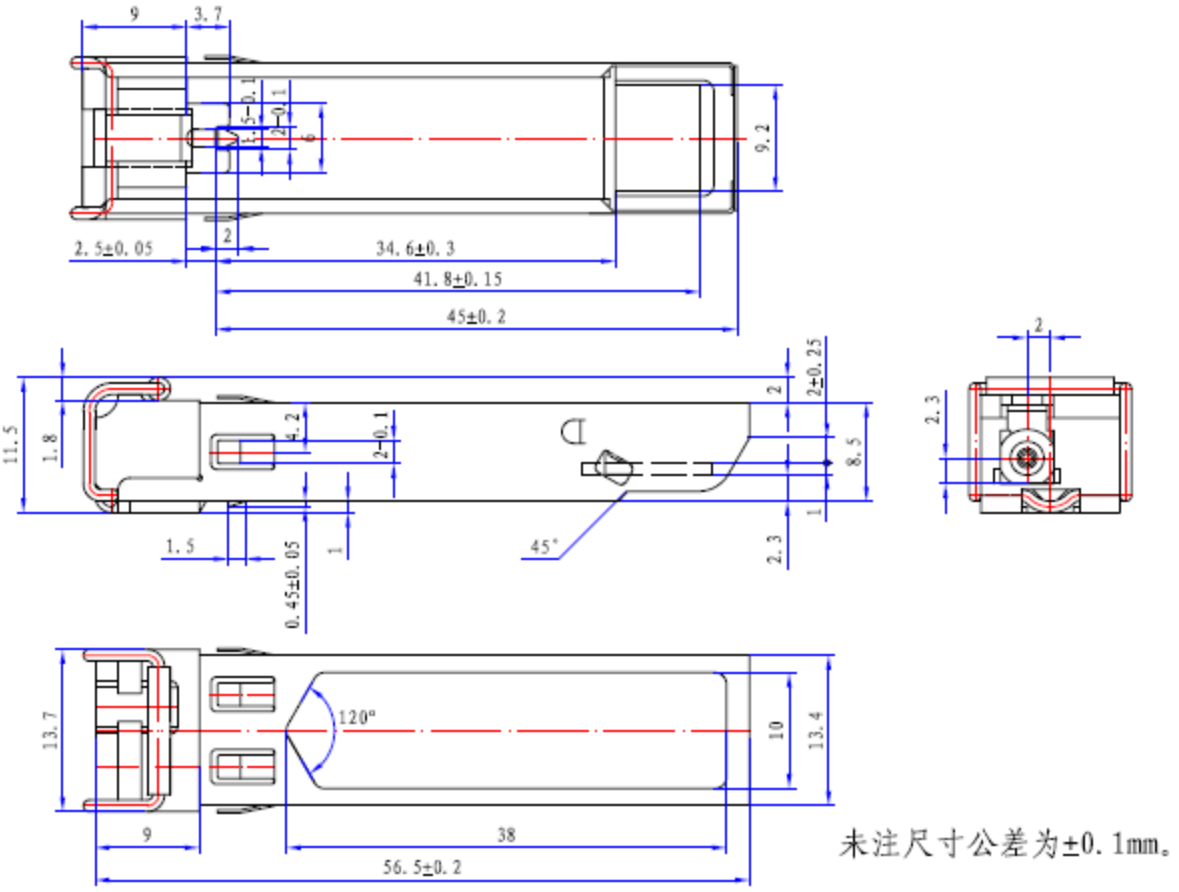

Figure7

Digital Diagnostic Memory Map

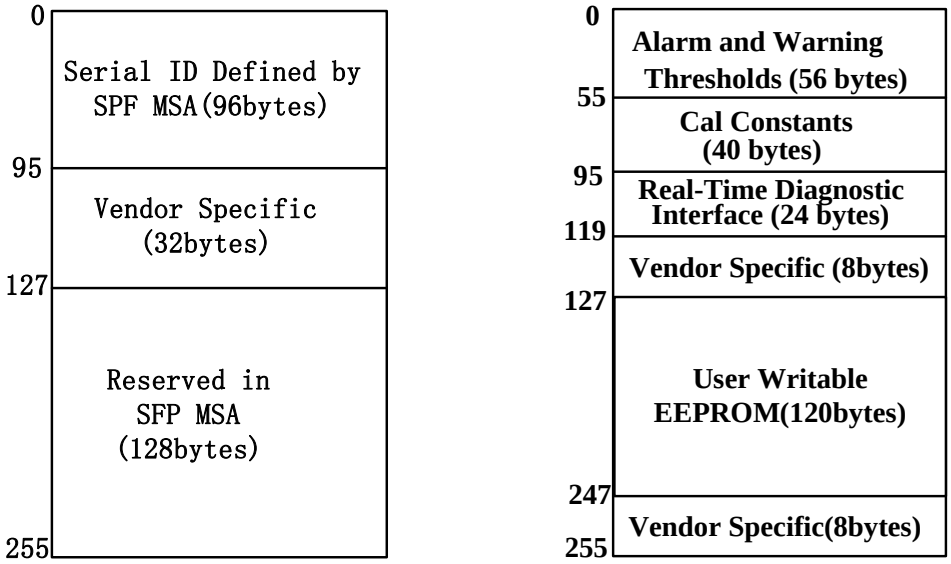

Figure8

EEPROM Serial ID Memory Contents

Accessing Serial ID Memory uses the 2 wire address 1010000X (A0). Memory Contents of Serial ID are shown in Table 1

Table 1 Serial ID Memory Contents

Data Address	Size (Bytes)	Name of Field	Contents(Hex)	Description
BASE ID FIELDS				
0	1	Identifier	03	SFP
1	1	Ext. Identifier	04	SFP function is defined by serial ID only
2	1	Connector	07	LC Connector
3-10	8	Transceiver	00 00 00 00 00 00 00 00	Transceiver Codes
11	1	Encoding	02	4B/5B
12	1	BR, Nominal	01	125Mbps
13	1	Reserved	00	
14	1	Length (9μm) km	14/28	20km/40km
15	1	Length (9μm) 100m	C8/00	20km/40km
16	1	Length (50μm) 10m	00	
17	1	Length(62.5μm)10m	00	
18	1	Length (Copper)	00	Not compliant
19	1	Reserved	00	
20-35	16	Vendor name	48 47 20 47 45 4E 55 49 4E 45 00 00 00 00 00 00	“HG GENUINE” (ASCII)
36	1	Reserved	00	
37-39	3	Vendor OUI	00 00 00	
40-55	16	Vendor PN	4D 42 50 44 2D 30 33 58 58 58 32 58 00 00 00 00	“MBPD-03XXX2X” (ASCII)
56-59	4	Vendor rev	20 20 20 20	
60-61	2	Wavelength	05 1E/06 0E	Transceiver wavelength
62	1	Reserved	00	
63	1	CC_BASE	Check Sum (Variable)	Check code for Base ID Fields
EXTENDED ID FIELDS				
64-65	2	Options	00 1A	TX_DISABLE, TX_FAULT and Loss of Signal implemented.
66	1	BR,max	00	
67	1	BR,min	00	
68-83	16	Vendor SN	30 30 34 39 34 39 30 35 20 20 20 20 20 20 20 20	Serial Number of transceiver (ASCII). For example “00494905”.
84-91	8	Date code	30 32 31 30 30 35 20 20	Manufactory date code. For example “021005”.

92	1	Diagnostic Monitoring Type	58/68	Digital diagnostic monitoring implemented, “externally calibrated” /“internally calibrated” is implemented. RX measurement type is “Average Power”.
93	1	Enhanced Options	B0	Optional Alarm/Warning flags implemented for all monitored quantities, Optional Soft TX_FAULT monitoring implemented, Optional Soft RX_LOS monitoring implemented.
94	1	SFF_8472 Compliance	03	Includes functionality described in Rev 9.5 SFF-8472.
95	1	CC_EXT	Check Sum (Variable)	Check sum for Extended ID Field.
VENDOR SPECIFIC ID FIELDS				
96-127	32	Vendor Specific	Read only	Depends on customer information
128-255	128	Reserved	Read only	Filled by zero

Diagnostic Monitor Functions

Diagnostic Monitor Functions interface uses the 2 wire address 1010001X (A2). Memory contents of Diagnostic Monitor Functions are shown in Table 2.

Table 2 Memory contents of Diagnostic Monitor Function

Data Address	Field Size (bytes)	Name	Contents and Description
Alarm and Warning Thresholds			
00-01	2	Temperature High Alarm	On select
02-03	2	Temperature Low Alarm	On select
04-05	2	Temperature High Warning	On select
06-07	2	Temperature Low Warning	On select
08-09	2	Vcc High Alarm	Set to 3.6 V
10-11	2	Vcc Low Alarm	Set to 3.0 V
12-13	2	Vcc High Warning	Set to 3.5 V
14-15	2	Vcc Low Warning	Set to 3.1 V
16-17	2	Bias High Alarm	
18-19	2	Bias Low Alarm	
20-21	2	Bias High Warning	
22-23	2	Bias Low Warning	
24-25	2	TX Power High Alarm	Manufacture measurement plus 2dB
26-27	2	TX Power Low Alarm	Manufacture measurement minus 2dB
28-29	2	TX Power High Warning	Manufacture measurement plus 1dB
30-31	2	TX Power Low Warning	Manufacture measurement minus 1 dB
32-33	2	RX Power High Alarm	Maximum input optical power

34-35	2	RX Power Low Alarm	Minimum input optical power
36-37	2	RX Power High Warning	Maximum input power minus 3dB
38-39	2	RX Power Low Warning	Manufacture measurement plus 3dB
40-55	16	Reserved	
Calibration Constants			
56-59	4	RX Power Calibration Data4	Single precision floating-point numbers (various values at each device)
60-63	4	RX Power Calibration Data3	
64-67	4	RX Power Calibration Data2	Single precision floating-point numbers (various values at each device)
68-71	4	RX Power Calibration Data1	
72-75	4	RX Power Calibration Data0	
76-77	2	Bias Calibration Data1	00 01 (fixed)
78-79	2	Bias Calibration Data0	00 00 (fixed)
80-81	2	TX Power Calibration Data1	00 01 (fixed)
82-83	2	TX Power Calibration Data0	00 00 (fixed)
84-85	2	Temperature Calibration Data1	00 01 (fixed)
86-87	2	Temperature Calibration Data0	00 00 (fixed)
88-89	2	VCC Calibration Data1	00 01 (fixed)
90-91	2	VCC Calibration Data0	00 00 (fixed)
92-94	3	Reserved	00 00 00 (fixed)
95	1	Check Sum	Checksum of bytes 0-94
Real Time Diagnostic Monitor Interface			
96-97	2	Measured Temperature	Yield a 16-bit A/D value (see Table 2.1)
98-99	2	Measured Vcc	Yield a 16-bit A/D value (see Table 2.1)
100-101	2	Measured Bias	Yield a 16-bit A/D value (see Table 2.1)
102-103	2	Measured TX Power	Yield a 16-bit A/D value (see Table 2.1)
104-105	2	Measured RX Power	Yield a 16-bit A/D value (see Table 2.1)
106-109	4	Reserved	
110	1	Logic Status	See Table 2.2
111	1	AD Conversion Updates	See Table 2.2
112-119	8	Alarm and Warning Flags	See Table 2.3
Vendor Specific			
120-127	8	Vendor Specific	Don't Access
128-247	120	User writable EEPROM	
248-255	8	Vendor Specific	Don't Access

The measured values located at bytes 96-105(in the 2 wire address 0xA2) are raw A/D values (16-bit integers) of transceiver temperature, supply voltage, laser bias current, laser optical output power and received power. All the measured values are "Externally Calibrated", and then it is necessary to convert raw A/D values to real world units by the manner as shown in Table 2.1.

Table 2.1 Real Time Diagnostic Monitor Values

Byte	Name	Description
96	Temperature MSB	Internally measured transceiver temperature. Compliant with External Calibration of SFF-8472.
97	Temperature LSB	
98	V_{CC} MSB	Internally measured supply voltage. Compliant with External Calibration of SFF-8472.
99	V_{CC} LSB	
100	Laser Bias MSB	Measured Laser bias current. Compliant with External Calibration of SFF-8472.
101	Laser Bias LSB	
102	Tx Power MSB	Measured Tx power. Compliant with External Calibration of SFF-8472.
103	Tx Power LSB	
104	Rx Power MSB	Measured Tx power. Compliant with External Calibration of SFF-8472.
105	Rx Power LSB	

This transceiver implements two optional status bytes, “Logic States” at byte 110(0xA2)” and “A/D Updated” at byte 111(0xA2) as shown in Table 2.2. “A/D Updated” status bits allow the user to verify if an update from the analog-digital conversion has occurred of the measured values, temperature, V_{CC}, laser bias, Tx power and Rx power. The user writes the byte to 0x00. Once a conversion is completed for a given value, its bit will change to ‘1’

Table 2.2 Logic Status and AD Conversion Updates

Byte	Bit	Name	Description
110	7	Tx Disable State	Optional digital State of the Tx Disable input pin.
110	6	Soft Tx Disable Control	Not supported (set to 0).
110	5	Reserved	Set to 0.
110	4	Rx Rate Select State	Not supported (set to 1).
110	3	Soft Rate Select Control	Not supported (set to 0).
110	2	Tx Fault	Optional digital state of the Tx Fault output pin.
110	1	LOS	Optional digital state of the LOS output pin.
110	0	Power on Logic	Bit will be 0 when the analog monitoring is active.
111	7	Temp A/D Valid	Indicates A/D value in Bytes 96/97 is valid.
111	6	Vcc A/D Valid	Indicates A/D value in Bytes 98/99 is valid.
111	5	Laser Bias A/D Valid	Indicates A/D value in Bytes 100/101 is valid.
111	4	Tx Power A/D Valid	Indicates A/D value in Bytes 102/103 is valid.
111	3	Rx Power A/D Valid	Indicates A/D value in Bytes 104/105 is valid.
111	2	Reserved	Set to 0.
111	1	Reserved	Set to 0.
111	0	Reserved	Set to 0.

Each of the measured values has a corresponding high alarm, low alarm, high warning and low warning threshold level at location 00-39(x0A2) written as the data format of a corresponding valued shown in Table 2.3.Alarm and warning flags at bytes 112-119(0xA2) are defined as follows.

[1] Alarm flags indicate conditions likely to result (or have resulted) in link failure and cause for immediate action.

[2] Warning flags indicate conditions outside the guaranteed operating specification of transceiver but not

necessarily causes of immediate link failures.

Table 2.3 Alarm and Warning Flags

Byte	Bit(s)	Name	Description
112	7	Temperature High Alarm	Set when temperature monitor value exceeds high alarm level.
112	6	Temperature Low Alarm	Set when temperature monitor value exceeds low alarm level.
112	5	Vcc High Alarm	Set when Vcc monitor value exceeds high alarm level.
112	4	Vcc Low Alarm	Set when Vcc monitor value exceeds Low alarm level.
112	3	Laser Bias High Alarm	Set when laser bias monitor value exceeds high alarm level.
112	2	Laser Bias Low Alarm	Set when laser bias monitor value exceeds low alarm level.
112	1	Tx Power High Alarm	Set when Tx power monitor value exceeds high alarm level
112	0	Tx Power Low Alarm	Set when Tx power monitor value exceeds low alarm level.
113	7	Rx Power High Alarm	Set when Rx power monitor value exceeds high alarm level
113	6	Rx Power Low Alarm	Set when Rx power monitor value exceeds low alarm level
113	5-0	Reserved	All bits set to 0.
114	7-0	Reserved	All bits set to 0.
115	7-0	Reserved	All bits set to 0.
116	7	Temperature High warning	Set when temperature monitor value exceeds high warning level.
116	6	Temperature Low warning	Set when temperature monitor value exceeds low warning level.
116	5	Vcc High warning	Set when Vcc monitor value exceeds high warning level.
116	4	Vcc Low warning	Set when Vcc monitor value exceeds Low warning level.
116	3	Laser Bias High warning	Set when laser bias monitor value exceeds high warning level.
116	2	Laser Bias Low warning	Set when laser bias monitor value exceeds low warning level.
116	1	Tx Power High warning	Set when Tx power monitor value exceeds high warning level
116	0	Tx Power Low warning	Set when Tx power monitor value exceeds low warning level.
117	7	Rx Power High warning	Set when Rx power monitor value exceeds high warning level
117	6	Rx Power Low warning	Set when Rx power monitor value exceeds low warning level
117	5-0	Reserved	All bits set to 0.
118	7-0	Reserved	All bits set to 0.
119	7-0	Reserved	All bits set to 0.

Internal Calibration

Measurements stored in data address byte 96~ 105 are calibrated over transceiver operating temperature and supply voltage and are interpreted as defined in SFF-8472 Rev9.5. Alarm and warning threshold values should be interpreted in the same manner as real time 16 bit data.

External Calibration

Measurements are raw A/D values and must be converted to real world units using calibration constants stored in EEPROM locations 56 – 95 at 2 wire serial bus address A2h. Calibration is valid over transceiver operating temperature and voltage.

Alarm and warning threshold values should be interpreted in the same manner as real time 16 bit data.

After calibration per the equations given below for each variable as described in SFF-8472 Rev9.5, the results are

consistent with the accuracy and resolution goals for internally calibrated devices.

Internally measured transceiver temperature. Temperature, **T** (^{o}C), is given by

T = TSLOPE * TAD + TOFFSET

Where **TAD** is 16-bit signed 2's complement A/D value at bytes 96-97, **TSLOPE** is unsigned fixed-point value at bytes 84-85 and **TOFFSET** is signed 2's complement value with LSB equal to 1/256 deg-C at bytes 86-87. The result, **T**, is 16-bit signed 2's complement value with LSB equal to 1/256 OC, yielding a total range of -128 OC to +128 OC.

Internally measured supply voltage: Voltage, **V** (μV), is given by

V = VSLOPE * VAD + VOFFSET

Where **VAD** is 16-bit unsigned A/D value at bytes 98-99, **VSLOPE** is unsigned fixed-point value at bytes 88-89 and **VOFFSET** is signed 2's complement value with LSB equal to 100 μV at bytes 90-91. The result, **V**, is 16-bit unsigned value with LSB equal to 100 μV, yielding a total range of 0-6.55V.

Measured transmitter laser bias current: Current (μA), **I**, is given by

I = ISLOPE* IAD + IOFFSET

Where **IAD** is 16-bit unsigned A/D value at bytes 100-101, **ISLOPE** is unsigned fixed-point value at bytes 76-77 and **IOFFSET** is signed 2's complement value with LSB equal to 2 μA at bytes 78-79. The result, **I**, is 16-bit unsigned value with LSB equal to 2 μA, yielding a total range of 0-131mA.

Measured coupled TX optical output power: Power, **TX_P** (μW), is given by

TX_P = TX_PSLOPE * TX_PAD + TX_POFFSET

Where **TX_PAD** is 16-bit unsigned A/D value at bytes 102-103, **TX_PSLOPE** is unsigned fixed-point value at bytes 80-81 and **TX_POFFSET** is signed 2's complement value with LSB equal to 0.1 μW at bytes 82-83. The result, **TX_P**, is 16-bit unsigned value with LSB equal to 0.1 μW, yielding a total range of 0-6.5mW.

Measured received optical power: Power, **RX_P** (μW), is given by

$RX\_P = R4 * RX\_PAD^4 + R3 * RX\_PAD^3 + R2 * RX\_PAD^2 + R1 * RX\_PAD + R0$

Where RAD is 16-bit unsigned A/D value at bytes 104-105 and R4, R3, R2, R1 and R0 are single precision floating-point values at bytes 56-75. The maximum value for R4, R3, R2, R1 and R0 is 1e8. The result, **RX_P**, is 16-bit unsigned value with LSB equal to 0.1 μW, yielding a total range of 0-6.5mW.

Digital Diagnostic Monitor Accuracy

Parameter	unit	Accuracy
Tx Optical Output Power	dB	+/- 3
Rx Received Optical Power	dB	+/- 3
Tx Bias Current	%	+/- 10
Supply Voltage	%	+/- 3
Temperature	℃	+/- 3

Regulatory Compliance

Feature	Test Method	Performance
RoHS5	BS EN 1122: 2001 US EPA METHOD 3050B US EPA METHOD 3052 US EPA METHOD 3060A	Hg<1000ppm PBB<1000ppm PBDE<1000ppm Cd<100ppm
RoHS6	BS EN 1122: 2001 US EPA METHOD 3050B US EPA METHOD 3052 US EPA METHOD 3060A	Pb <1000ppm Cr6+ <1000ppm Hg <1000ppm PBB <1000ppm PBDE <1000ppm Cd <100ppm
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD-883E Method 3015.7	Class 1 (>1.5kV) – Human Body Model
Electrostatic Discharge (ESD) Immunity	IEC61000-4-2	Class 2(>4.0kV)
Electromagnetic Interference (EMI)	CISPR22 ITE Class B FCC Class B CENELEC EN55022 VCCI Class 1	Compliant with standard
Immunity	IEC61000-4-3 Class 2	Typically show no measurable effect from a 3 V/m field swept from 80 to 1000MHz applied to the transceiver without a chassis enclosure.

Ordering Information

Part No.	Specification									Application
	Pack	Rate	Tx	Pout	Rx	S	Top	Reach	Others	
MBPD-0335S2	SFP	125Mbps/155Mbps	1310nm FP	-14～-8dBm	1550nm PIN	＜-31dBm	-5～70℃	20km	DDM with External Calibration /RoHS	100Base-BX
MBPD-0353S2	SFP	125Mbps/155Mbps	1550nm FP	-14～-8dBm	1310nm PIN	＜-31dBm	-5～70℃	20km	DDM with External Calibration /RoHS	100Base-BX
MBPD-0335M2	SFP	125Mbps/155Mbps	1310nm FP	-5～0dBm	1550nm PIN	＜-34dBm	-5～70℃	40km	DDM with External Calibration /RoHS	100Base-BX
MBPD-0353M2D	SFP	125Mbps/155Mbps	1550nm DFB	-5～0dBm	1310nm PIN	＜-34dBm	-5～70℃	40km	DDM with External Calibration /RoHS	100Base-BX
MBPD-0345L2D	SFP	125Mbps/155Mbps	1490nm DFB	-5～0dBm	1550nm PIN	＜-34dBm	-5～70℃	80km	DDM with External Calibration /RoHS	100Base-BX
MBPD-0354L2D	SFP	125Mbps/155Mbps	1550nmDFB	-5～0dBm	1490nm PIN	＜-34dBm	-5～70℃	80km	DDM with External Calibration /RoHS	100Base-BX
MBPD-0335S2I	SFP	125Mbps/155Mbps	1310nm FP	-14～-8dBm	1550nm PIN	＜-31dBm	-40～85℃	20km	DDM with External Calibration /RoHS	100Base-BX
MBPD-0353S2I	SFP	125Mbps/155Mbps	1550nm FP	-14～-8dBm	1310nm PIN	＜-31dBm	-40～85℃	20km	DDM with External Calibration /RoHS	100Base-BX
MBPD-0335S2N	SFP	125Mbps/155Mbps	1310nm FP	-14～-8dBm	1550nm PIN	＜-31dBm	-5～70℃	20km	DDM with Internal Calibration / RoHS	100Base-BX
MBPD-0353S2N	SFP	125Mbps/155Mbps	1550nm FP	-14～-8dBm	1310nm PIN	＜-31dBm	-5～70℃	20km	DDM with Internal Calibration / RoHS	100Base-BX
MBPD-0335S2NI	SFP	125Mbps/155Mbps	1310nm FP	-14～-8dBm	1550nm PIN	＜-31dBm	-40～85℃	20km	DDM with Internal Calibration / RoHS	100Base-BX
MBPD-0353S2NI	SFP	125Mbps/155Mbps	1550nm FP	-14～-8dBm	1310nm PIN	＜-31dBm	-40～85℃	20km	DDM with Internal Calibration / RoHS	100Base-BX

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