

10G SFP+ Transceiver

MTRS-2S60-01



Features

- 10Gb/s serial optical interface compliant to SONET OC-192/SDH STM-64 and 802.3ae
- Electrical interface compliant to SFF-8431 specifications for 10 Gigabit small form factor pluggable module “SFP+”
- 1550nm cooled EML transmitter with TEC, PIN receiver
- 2-wire interface for management specifications compliant with SFF-8472 digital diagnostic monitoring interface for optical transceivers
- Operating case temperature: 0°C~70°C

Applications

- SONET(OC-192)/SDH(STM-64) line card
- 10GBASE-ER (10.3125Gbps)
- 10GBASE-EW (9.953Gbps)

Compliance

- Compliant with IEEE 802.3ae-2002 10G Base-ER
- Compliant with SFF-8431 & SFF-8432 & SFF-8472

Description

The MTRS-2S60-01 is a very compact 10Gb/s optical transceiver module for serial optical communication applications at 10Gb/s. The MTRS-2S60-01 series converts a 10Gb/s serial electrical data stream to 10Gb/s optical output signal and a 10Gb/s optical input signal to 10Gb/s serial electrical data streams. The high speed 10Gb/s electrical interface is fully compliant with XFI specification (built in CDR on both TX and RX) and allows FR4 host PCB trace up to 200mm. The MTRS-2S60-01 is designed for use in a variety of 10Gb/s equipment SDH/SONET (9.95Gb/s), Ethernet LAN (10.3Gb/s) and FC (10.5Gb/s). The customer can adjust interface electrical level to select 9.95G~11.3G rate section. The high performance 1550nm DFB transmitter coupled with a high sensitivity PIN receiver provide superior performance for applications up to 40km SMF. The fully compliant SFP form factor provides high density applications, hot plug ability easy optical port upgrades and low EMI emission.

The SFP+ ER with CDR module electrical interface is compliant to XFI electrical specifications. The transmitter input and receiver output impedance is 100Ohms differential. Data lines are internally AC coupled. The module provides differential termination and reduce differential to common mode conversion for quality signal termination and low EMI.

Specification

Table1-Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Operating Case Temperature	Tc	-5	+75	°C
Supply Voltage	Vcc	0	+4	V
Relative Humidity	RH	+5	+85	%
Rx Input Average Power	Pmax	-	0	dBm

Table2-Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Unit
Operating Case Temperature	Tc	0	25	+70	°C
Power Supply Voltage	Vcc3	3.135	3.3	3.465	V
Power Supply Current	Icc3	-	-	545	mA
Power Consumption		-	-	1800	mW

Table3-Transmitter Operating Characteristic-Optical

Parameter	Symbol	Min	Typical	Max	Unit	Note
Operating Data Rate	DR	9.95	-	11.3	Gb/s	
Output Center Wavelength	λ_c	1530	1550	1565	nm	
Side Mode Suppression Ratio	SMSR	30		-	dB	
Average Output Power	Po	-1		+2	dBm	
Disabled Power	Poff	-		-30	dBm	
Extinction Ratio	ER	8.2		-	dB	
Eye Mask (@SONET/SDH)	-	5% (1000 consecutive snapshots at typical rate and room temperature)			%	
Generation Jitter 1 (20kHz - 80MHz)	-	-	-	0.3	Ulp-p	
Generation Jitter 2 (4MHz - 80MHz)	-	-	-	0.1	Ulp-p	
Relative Intensity Noise	RIN	-	-	-128	dB/Hz	
Operating Distance	-	-	40	-	km	
Transmitter and dispersion penalty	-	-	-	2	dB	
Spectral Width	-	-	-	0.5	nm	
Dispersion tolerance	Dt	-	-	800	Ps/nm	
Optical return loss tolerance	-			21	dB	

Table4-Receiver Operating Characteristic-Optical

Parameter	Symbol	Min	Typical	Max	Unit	Note
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Operating Data Rate	-	9.95	-	11.3	Gb/s	
Input Center Wavelength	Irc	1260		1605	nm	
Overload	Rovl	-1	-	-	dBm	
Minimum Sensitivity	Rsen	-	-	-16	dBm	
RX_LOS Assert Level	RLOSa	-28	-	-	dBm	Notes 1
RX_LOS Deassert Level	RLOSd	-	-	-18	dBm	
RX_LOS Hysteresis	RLOSh	0.5	-		dB	
Optical Return Loss	ORL	-	-	-27	dB	

Notes:

[1]When LOS assert, the RX shall not mask its data output. LOS output from LA, and LA connect to TIA using AC Coupling, so asserting LOS depend on receiving data.

Table 5- Electrical characteristics

Parameter	Symbol	Min	Typical	Max	Unit	Note
Input differential impedance	-		100		Ω	
Differential data input swing	V	180		700	mV	
Differential data output swing		300		850	mV	
Tx Fault, LOS Output Voltage	High	-	2.4		Vcc	V
	Low	-	Vee		Vee+ 0.4	V
Tx Disable, RS0,RS1	Low	VIL	Vee-0.3		Vee+ 0.8	V
	High	VIH	2		Vcc+0.3	V

DITITAL DIAGNOSTIC FUNCTIONS

The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF-8472 Rev10.4 with internal calibration mode. For external calibration mode please contact our sales stuff.

Table 6- Digital diagnostic specification table

Parameter	Symbol	Min.	Max	Unit	Notes
Temperature monitor absolute error	DMI_Temp	-3	3	degC	Over operating temp
Laser power monitor absolute error	DMI_TX	-2	2	dB	
RX power monitor absolute error	DMI_RX	-2	2	dB	-1dBm to -16dBm range
Supply voltage monitor absolute error	DMI_VCC	-3	3	%	
Bias current monitor	DMI_Ibias	-10%	10%	mA	

Pin-out Definition

The SFP+ modules are hot-pluggable. Hot pluggable refers to plugging in or unplugging a module while the host board is powered. The SFP+ host connector is a 0.8 mm pitch 20 position right angle improved connector specified by SFF-8431, or stacked connector with equivalent electrical performance. Host PCB contact assignment is shown in Figure 1 and contact definitions are given in Table7. SFP+ module contacts mates with the host in the order of ground, power, followed by signal as illustrated by Figure 2 and the contact sequence

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order listed in Table7.

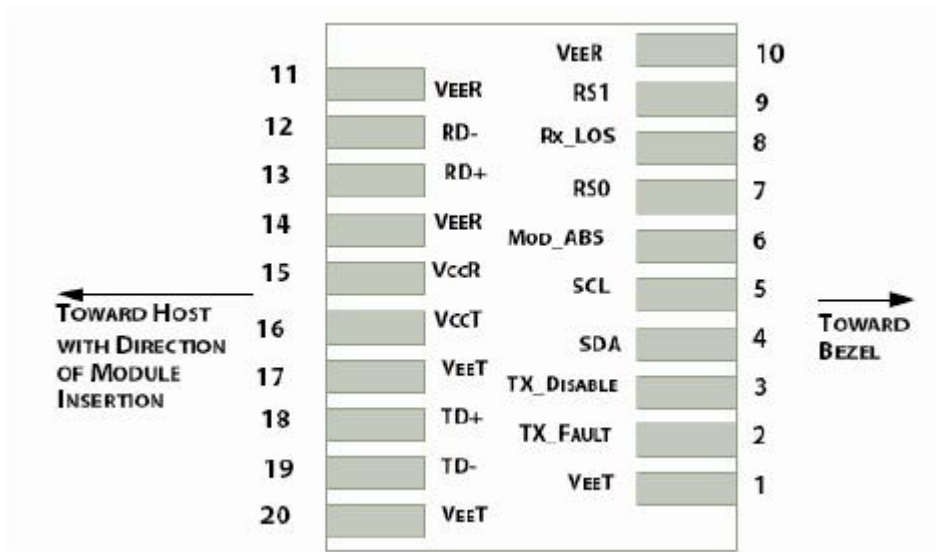


Figure1: Module Interface to Host

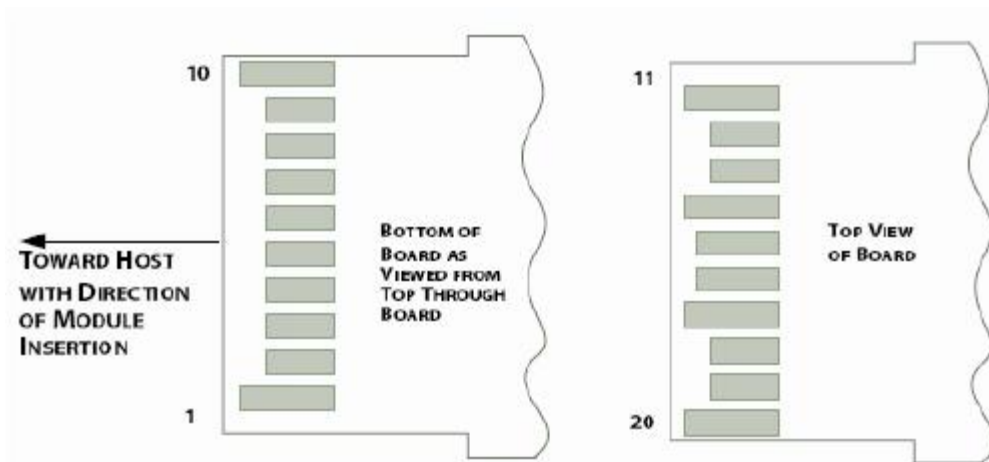


Figure2: Module Contact Assignment

Pin Assignment

Table 7-SFP+ Module PIN Definition					
PIN	Logic	Symbol	Name / Description	Power Sequence Order	Note
1		VeeT	Module Transmitter Ground	1st	1
2	LVTTL-O	TX_Fault	Module Transmitter Fault	3rd	2
3	LVTTL-I	TX_Dis	Transmitter Disable; Turns off transmitter laser output	3rd	
4	LVTTL-I/O	SDA	2-Wire Serial Interface Data Line	3rd	
5	LVTTL-I	SCL	2-Wire Serial Interface Clock	3rd	
6		MOD_ABS	Module Absent, connected to VeeT or VeeR in the module	3rd	2
7	LVTTL-I	RS0	Receiver Rate Select	3rd	
8	LVTTL-O	RX_LOS	Receiver Loss of Signal Indication Active High	3rd	2
9	LVTTL-I	RS1	Transmitter Rate Select	3rd	
10		VeeR	Module Receiver Ground	1st	1

11		VeeR	Module Receiver Ground	1st	1
12	CML-O	RD-	Receiver Inverted Data Output	3rd	
13	CML-O	RD+	Receiver Data Output	3rd	
14		VeeR	Module Receiver Ground	1st	1
15		VccR	Module Receiver 3.3 V Supply	2nd	
16		VccT	Module Receiver 3.3 V Supply	2nd	
17		VeeT	Module Transmitter Ground	1st	1
18	CML-I	TD+	Transmitter Non-Inverted Data Input	3rd	
19	CML-I	TD-	Transmitter Inverted Data Input	3rd	
20		VeeT	Module Transmitter Ground	1st	1

Notes:

[1]Module ground pins GND are isolated from the module case.

[2]Shall be pulled up with 4.7K-10Kohms to a voltage between 3.13V and 3.47V on the host board.

Block Diagram of Transceiver

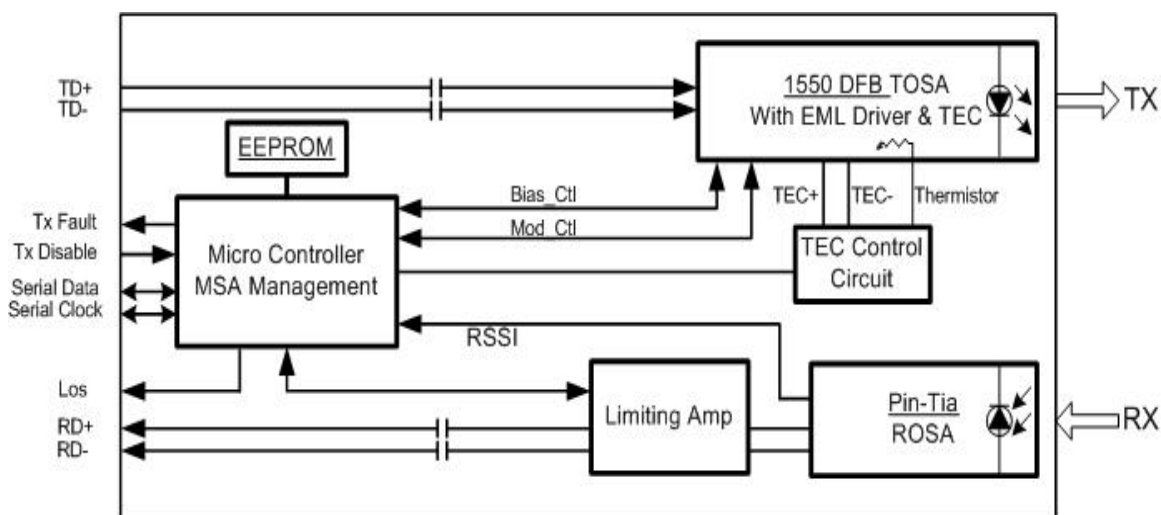


Figure3

Transmitter Section

The transmitter converts 10Gbit/s serial CML electrical data into serial optical data compliant with the 10GBASE-ER standard. An open collector compatible Transmit Disable (Tx_Dis) is provided. A logic "1," or no connection on this pin will disable the laser from transmitting. A logic "0" on this pin provides normal operation. The transmitter has an internal automatic power control loop (APC) to ensure constant optical power output across supply voltage and temperature variations. An open collector compatible Transmit Fault (Tx_Fault) is provided. TX_Fault is a module output contact that when high, indicates that the module transmitter has detected a fault condition related to laser operation or safety. The TX_Fault output contact is an open drain/collector and shall be pulled up to the Vcc_Host in the host with a resistor in the range 4.7-10 kΩ. TX_Disable is a module input contact. When TX_Disable is asserted high or left open, the SFP+ module transmitter output shall be turned off.

Receiver Section

The receiver converts 10Gbit/s serial optical data into serial CML electrical data. An open collector compatible

Loss of Signal is provided. Rx_LOS when high indicates an optical signal level below that specified in the relevant standard. The Rx_LOS contact is an open drain/collector output and shall be pulled up to Vcc_Host in the host with a resistor in the range 4.7-10 kΩ, or with an active termination. Power supply filtering is recommended for both the transmitter and receiver. The Rx_LOS signal is intended as a preliminary indication to the system in which the SFP+ is installed that the received signal strength is below the specified range.

Recommended Interface Circuit

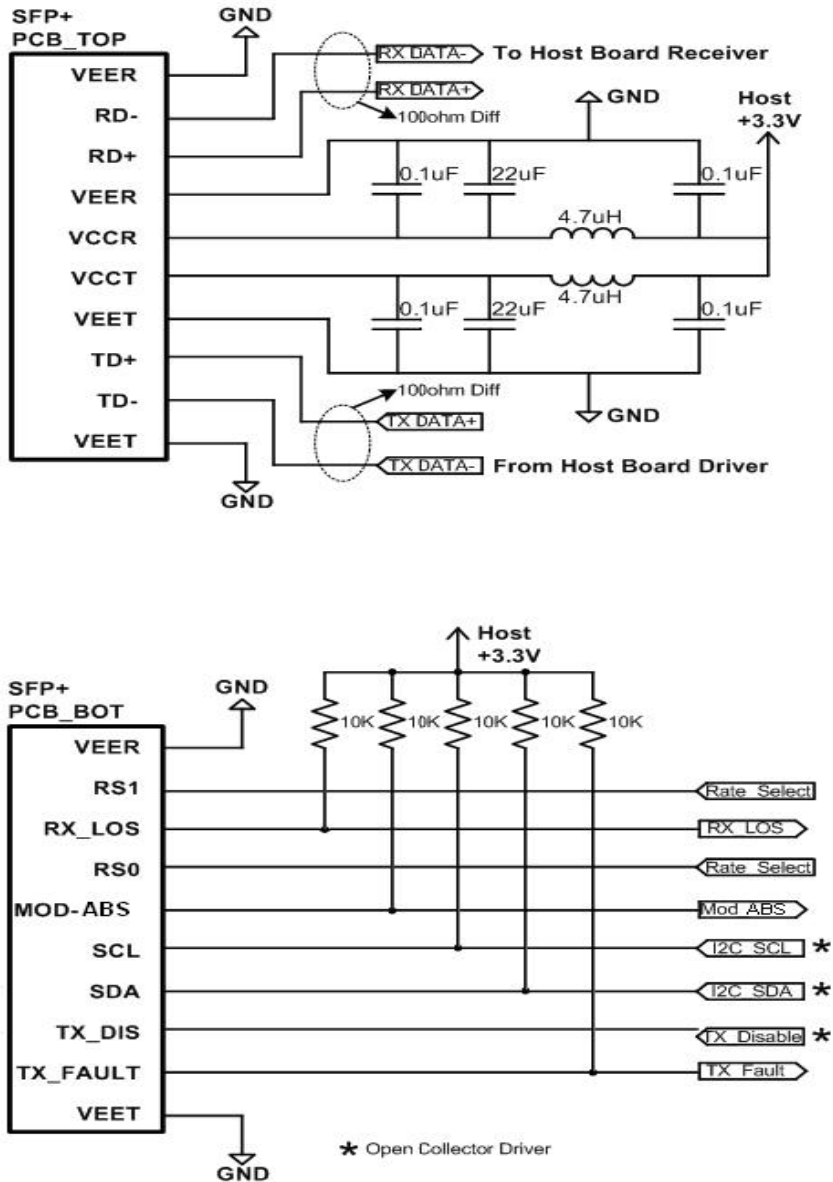


Figure4

Dimensions

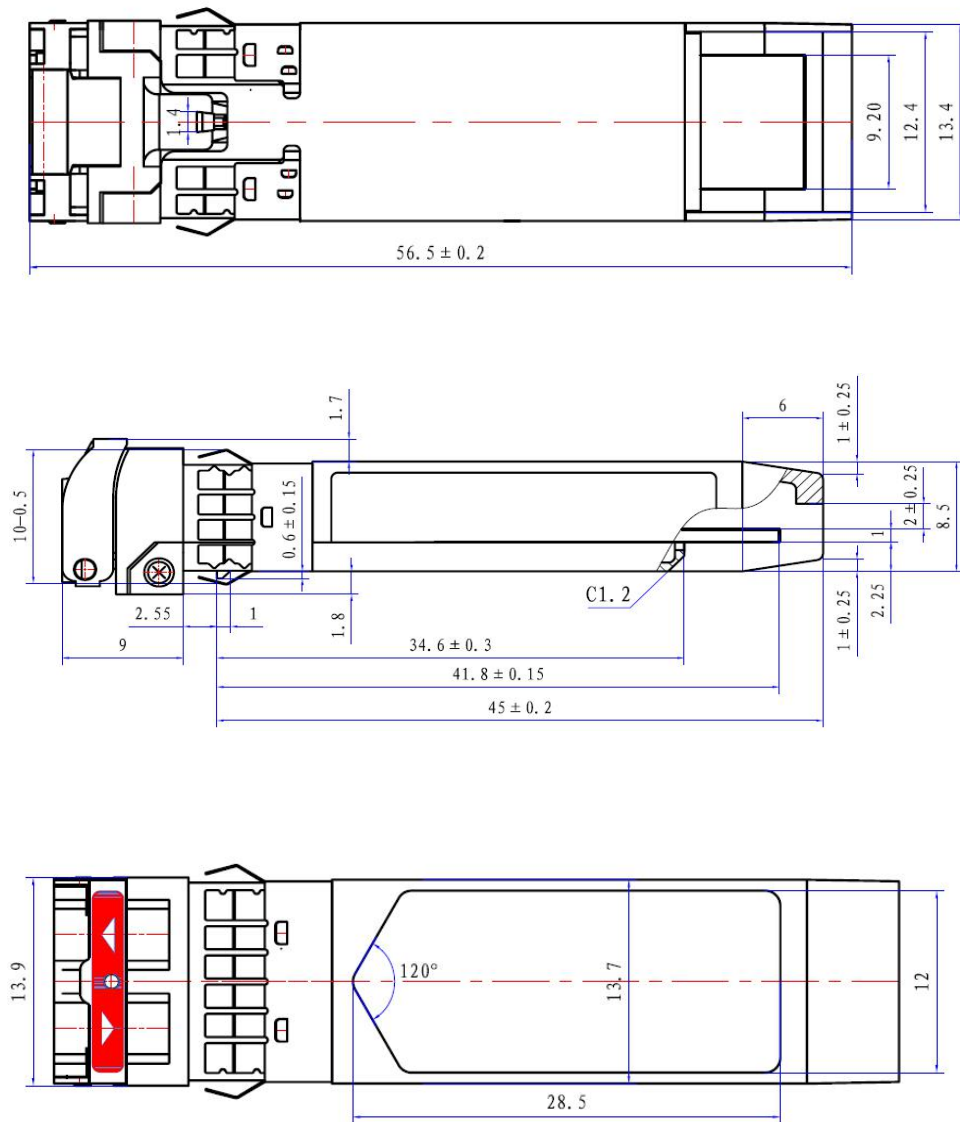
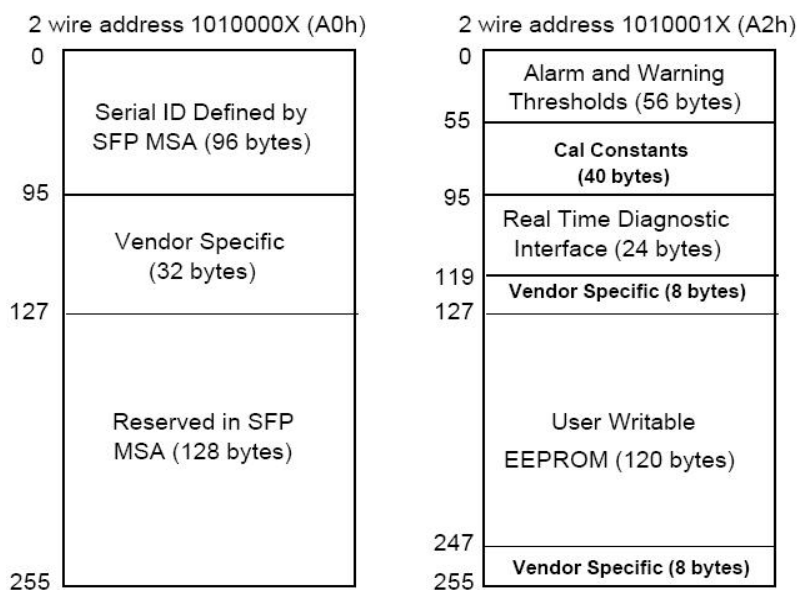


Figure5

Digital Diagnostic Memory Map



EEPROM definitions

Serial ID Memory Contents(A0h)

Data Address	Size (Bytes)	Name of Field	Hex	Description
0	1	Identifier	03	SFP Plus
1	1	Ext.Identifier	04	GBIC/SFP Function is defined
2	1	Connector	07	LC Connector
3-10	8	Transceiver	80 00 00 00 00 00 00 00	10GBASE-ER
11	1	Encoding	05	SONET Scrambled
12	1	BR, Nomina	63	9.95Gbps
13	1	Rate Identifier	06	Rx & Tx Rate_select
14	1	Length(SMF, km)	28	40km
15	1	Length(SMF)	FF	40km
16	1	Length(50um)	00	not support
17	1	Length(62.5um)	00	not support
18	1	Length(Copper)	00	not support
19	1	Length(OM3)	00	not support

20-35	16	Vendor name	48 47 20 47 45 4E 55 49 4E 45 20 20 20 20 20	"HG GENUINE" Vendor Name(ASCII)
36	1	Transceiver	00	Unallocated
37-39	3	Vendor OUI	00 00 00	SFP vendor IEEE company ID
40-55	16	Vendor PN	4D 54 52 53 2D 32 53 36 30 2D 30 31 20 20 20 20	MTRS-2S60-01 (ASCII)
56-59	4	Vendor rev	31 2E 30 20	"1.0" (ASCII)
60-61	2	Wavelength	06 0E	1550 nm
62	1	Unallocated	00	
63	1	CC_BASE	CC	Check code (0 to 62)
64-65	2	Options	06	A cooled LD, Power Level 2, a conventional limiting output
			3A	Rate Select,TxDisable, TxFault ,LOS implemented
66	1	BR, max	00	Upper bit rate margin, units of %
67	1	BR, min	00	Lower bit rate margin, units of %
68-83	16	Vender SN	SN(Variable)	Serial number provided by vendor (ASCII)
84-91	8	Date code	DC(Variable)	Vendor's manufacturing date code
92	1	Diagnostic Monitoring Type	68	Digital diagnostic monitoring, Internally calibrated
93	1	Enhanced	F0	Alarm/Warning flags,

		Options		SoftTxDisable, Soft TxFault, Soft RxLOS implemented
94	1	SFF-8472 Compliance	04	Includes functionality described in Rev10.4 SFF-8472
95	1	CC_EXT	Checksum(Variable)	Check code (64 to 94)
96-127	32	Vendor Specific	Read only	Vendor Specific EEPROM
128-255	128	Reserved	Read only	Filled by 0xFF

Diagnostic Monitor Functions(A2)

Data Address	Field Size (bytes)	Name	Contents and Description
Alarm and Warning Thresholds			
00-01	2	Temperature High Alarm	Set to 80°C
02-03	2	Temperature Low Alarm	Set to -10°C
04-05	2	Temperature High Warning	Set to 70°C
06-07	2	Temperature Low Warning	Set to 0°C
08-09	2	Vcc High Alarm	Set to 3.63 V
10-11	2	Vcc Low Alarm	Set to 2.97V
12-13	2	Vcc High Warning	Set to 3.465V
14-15	2	Vcc Low Warning	Set to 3.135V
16-17	2	Bias High Alarm	Set to 97.5mA
18-19	2	Bias Low Alarm	Set to 32.5mA
20-21	2	Bias High Warning	Set to 91mA
22-23	2	Bias Low Warning	Set to 39mA
24-25	2	TX Power High Alarm	Set to 5dB
26-27	2	TX Power Low Alarm	Set to -4dB
28-29	2	TX Power High Warning	Set to 3dB

30-31	2	TX Power Low Warning	Set to -2dB
32-33	2	RX Power High Alarm	Set to 0dB
34-35	2	RX Power Low Alarm	Set to -17dB
36-37	2	RX Power High Warning	Set to -2dB
38-39	2	RX Power Low Warning	Set to -15 dB
40-55	16	Reserved	Set to FF
Calibration Constants			
56-59	4	RX Power Calibration Data4	00 00 00 00
60-63	4	RX Power Calibration Data3	00 00 00 00
64-67	4	RX Power Calibration Data2	00 00 00 00
68-71	4	RX Power Calibration Data1	3F 80 00 00
72-75	4	RX Power Calibration Data0	00 00 00 00
76-77	2	Bias Calibration Data1	01 00
78-79	2	Bias Calibration Data0	00 00
80-81	2	TX Power Calibration Data1	01 00
82-83	2	TX Power Calibration Data0	00 00
84-85	2	Temperature Calibration Data1	01 00
86-87	2	Temperature Calibration Data0	00 00
88-89	2	VCC Calibration Data1	01 00
90-91	2	VCC Calibration Data0	00 00
92-94	3	Reserved	FF FF FF
95	1	Check Sum	Checksum of bytes 0-94
96-97	2	Measured Temperature	Internally measured module temperature
98-99	2	Measured Vcc	Internally measured supply voltage in transceiver
100-101	2	Measured Bias	Internally measured TX Bias Current
102-103	2	Measured TX Power	Measured TX output power

104-105	2	Measured RX Power	Measured RX input power.	
106-109	4	Unallocated	Reserved for future diagnostic definitions	
110	7	Tx Disable State	supported	
	6	Soft TX Disable Select	supported	
	5	RS State	Not supported	
	4	Rate Select State	Not supported	
	3	Soft Rate Select Select	Not supported	
	2	1	TX Fault State	Optional digital state of the Tx Fault output pin.
	1		Rx_LOS State	Optional digital state of the LOS output pin.
	0		Data_Ready_Bar State	Indicates transceiver has achieved power up and data is ready. Bit remains high until data is ready to be read at which time the device sets the bit low.
111	1	Reserved	Reserved for SFF-8079	
112-119	8	Alarm and Warning Flags	Compliant with SFF-8472	
Vendor Specific				
120-127	8	Vendor Specific	Vendor specific memory addresses	
128-247	120	User writable EEPROM		
248-255	8	Vendor Specific	Vendor specific control functions	

Ordering Information

Part No.	Specification								
	Pack	Rate	Tx	Pout	Rx	S	Top	Reach	Others
MTRS-2S60-01	SFP+	10G	1550nm DFB	-1~2dBm	PIN-TIA	≤-16dBm	0~70℃	40km	DDM/RoHS

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