

## 10G SFP+ Transceiver

### MTRS-02X13-G

#### Features

- Up to 10km transmission distance over SMF
- Support data rate up to 10.3125Gbps
- 1310nm DFB and PIN receiver
- SFI electrical interface
- 2-wire interface for integrated Digital Diagnostic monitoring
- SFP MSA package with duplex LC connector
- Hot pluggable
- Very low EMI and excellent ESD protection
- +3.3V power supply
- Power consumption less than 1W
- Operating case temperature: 0~+70°C

#### Applications

- High-speed storage area networks
- Computer cluster cross-connect
- Custom high-speed data pipes
- LTE optical repeater application

#### Compliance

- Compliant with IEEE 802.3ae-2002
- Compliant with MSA SFF-8472
- Compliant with MSA SFF-8431
- Compliant with MSA SFF-8432



#### Description

MTRS-02X13-G is a high performance, cost effective modules, which is supporting data rate up to 10.3125Gbps, and transmission distance up to 10km over single mode fiber. The transceiver consists of two sections: The transmitter section incorporates a 1310nm DFB TOSA and laser driver. The receiver section consists of a PIN photodiode integrated with a transimpedance amplifier (TIA) and limiting amplifier (LA). The module is hot pluggable into the 20-pin connector. The high-speed electrical interface is base on low voltage logic, with nominal 100 Ohms differential impedance and AC coupled in the module.

The optical output can be disabled by LVTTTL logic high-level input of TX\_DIS. Transmit Fault (Tx\_Fault) is provided to indicate that the module transmitter has detected a fault condition related to laser operation or safety. Loss of signal (RX\_LOS) output is provided to indicate the loss of an input optical signal of receiver. A serial EEPROM in the transceiver allows the user to access transceiver monitoring and configuration data via the 2-wire SFP Management Interface. as specified in SFF-8472.

## Absolute Maximum Ratings

**Table1-Absolute Maximum Ratings**

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	T <sub>s</sub>	-40	+85	°C
Supply Voltage	V <sub>CC3</sub>	0	3.6	V
Relative Humidity(Non-condensing )	RH	5	95	%
RX Input Average Power	P <sub>max</sub>	-	1.5	dBm

## Recommended Operating Conditions

**Table2- Recommended Operating Conditions**

Parameter	Symbol	Min.	Typical	Max.	Unit
Operating Case Temperature	T <sub>C</sub>	0	25	70	°C
Power Supply Voltage	V <sub>CC3</sub>	3.135	3.3	3.465	V
	I <sub>CC3</sub>	-	-	300	mA
Power Dissipation	P <sub>D</sub>	-	-	1	W
Maximum sustained peak Current	I <sub>CC</sub>	-	300	400	mA
Data Rate		-	-	10.3125	Gbps
Transmission Distance		-	-	10	Km

## Optical, Electrical Characteristic

Tested under recommended operating conditions, unless otherwise noted

**Table3- Transmitter Operating Characteristic-Optical, Electrical**

Parameter	Symbol	Min.	Typical	Max.	Unit	Note
Center Wavelength	λ <sub>C</sub>	1260	1310	1355	nm	
Spectral Width (-20dB)	P <sub>m</sub>	-	-	1	nm	
Side Mode Suppression Ratio	SMSR	30	-	-	dBm	
Laser Off Power	P <sub>off</sub>	-	-	-30	dBm	
Average Optical Power	P <sub>avg</sub>	-8.2	-	0.5	dBm	
Tx Optical Power in OMA		-5.2			dBm	Note1
Extinction Ratio	ER	3.5	-	-	dB	
Transmitter Dispersion Penalty	TDP	-	-	3.2	dB	
Relative intensity noise optical modulation amplitude	RIN <sub>12</sub> OMA	-	-	-128	dB/Hz	
Optical Return Loss Tolerance		-	-	12	dB	
Optical Eye Mask	Compliant with IEEE 802.3 10GBASE-LR Eye Mask and Margin >5%					Note2
Tx Input Diff. Voltage	V <sub>I</sub>	190	-	700	mV	

Tx Fault Output Voltage	VoL	-0.3	-	0.4	V	
	VoH	2.4	-	Vcc	V	
Tx Disable Input Voltage	ViL	-0.3	-	0.8	V	
	ViH	2.0	-	Vcc+0.3	V	

Notes:

[1] values are referenced to case temperature of +25 C and nominal power supply

[2] 1000 waveforms shall be acquired.

**Table4- Receiver Operating Characteristic-Optical, Electrical**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Center Wavelength	$\lambda_r$	1260	1310	1355	nm	
Receiver Sensitivity	Psens	-	-	-14.4	dBm	Note1
Sensitivity(OMA)				-12.6	dBm	
Stressed Receiver Sensitivity(OMA)		-	-	-10.3	dBm	
Los Assert	LosA	-30	-	-	dBm	
Los Dessert	LosD	-	-	-16	dBm	
Los Hysteresis	LosH	0.5		-	dB	
Overload	Pin	0.5	-	-	dBm	
Receiver Reflectance		-	-	-12	dB	
Operating Data Rate		-	-	10.3125	Gbps	
Rx Output Diff Voltage	Vo	300	-	850	mV	
Rx Output Rise and Fall Time	Tr/Tf	28	34	-	ps	20% to 80%
LOS Output Voltage	VoL	-0.3	-	0.4	V	
	VoH	2.4	-	Vcc	V	

Notes:

[1] Receiver sensitivity is informative. Stressed receiver sensitivity shall be measured with conformance test signal for BER =  $1 \times 10^{-12}$ .

## Digital Diagnostic Functions

**Table5- Digital Diagnostic Functions**

Parameter	Symbol	Min.	Max.	Unit	Note
Temperature monitor absolute error	DMI_Temp	-3	3	°C	Over operating temp
Laser power monitor absolute error	DMI_TX	-2	2	dB	
RX power monitor absolute error	DMI_RX	-2	2	dB	Note1
Supply voltage monitor absolute error	DMI_VCC	-0.1	0.1	V	
Bias current monitor absolute error	DMI_Ibias	-10%	10%		

Notes:

[1] When no optics input receiver, the RX power monitor DDM=-40dBm

## Control and Status I/O Timing Characteristics

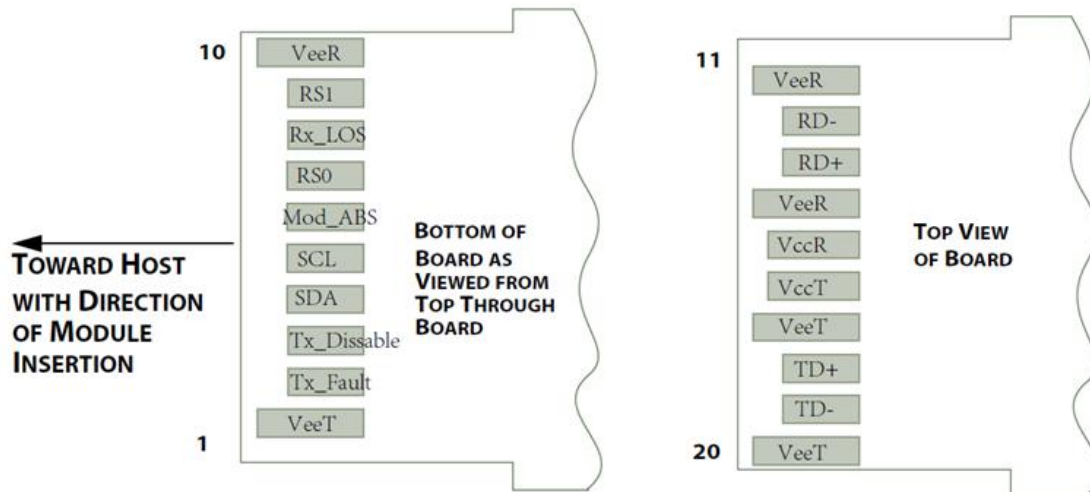
**Table6- Control and Status I/O Timing Characteristics**

Parameter	Symbol	Min.	Max.	Unit	Note
TX Disable Negate Time	t_on	-	2	ms	Note2
Time to initialize including reset of TX_Fault	t_init	-	300	ms	Note3
TX Fault Assert Time	t_fault_on	-	1	ms	Note4
TX Fault Reset Time	t_reset	10	-	µs	Note5
LOS Assert Time	t_loss_on	-	100	µs	Note6
LOS Deassert Time	t_loss_off	-	100	µs	Note7
TX Disable Assert Time	t_off	-	100	µs	Note1
Serial ID Clock Rate	f_serial_clock	-	100	kHz	

Notes:

- [1] Time from rising edge of TX Disable to when the optical output falls below 10% of nominal
- [2] Time from falling edge of TX Disable to when the modulated optical output rises above 90% of nominal
- [3] From power on or negation of TX Fault using TX Disable
- [4] Time from fault to TX fault on
- [5] Time from TX fault to TX nominal
- [6] Time from LOS state to RX LOS assert
- [7] Time from non-LOS state to RX LOS deassert.

## Pin-out Definition



**Figure1**

**Table7- Pin Function Definitions**

Pin	Logic	Symbol	Name/Description	Note
1		VeeT	Module Transmitter Ground	Note1
2	LVTTL-O	TX_Fault	Module Transmitter Fault	Note2
3	LVTTL-I	TX_Disable	Transmitter Disable; Turns off transmitter laser output	Note3
4	LVTTL-I/O	SDA	2-wire Serial Interface Data Line (Same as MOD-DEF2 as defined in the INF-8074i)	Note4
5	LVTTL-I/O	SCL	2-wire Serial Interface Clock (Same as MOD-DEF1 as defined in the INF-8074i)	Note4
6		MOD_ABS	Module Absent, connected to VeeT or VeeR in the module	Note5
7	LVTTL-I	RS0	Not used	
8	LVTTL-O	RX_LOS	Receiver Loss of Signal Indication (In FC designated as RX_LOS, in SONET designated as LOS, and in Ethernet designated at Signal Detect)	Note2
9	LVTTL-I	RS1	Not used	
10		VeeR	Module Receiver Ground	Note1
11		VeeR	Module Receiver Ground	Note1
12	CML-O	RD-	Receiver Inverted Data Output	
13	CML-O	RD+	Receiver Non-Inverted Data Output	
14		VeeR	Module Receiver Ground	Note1
15		VccR	Module Receiver 3.3 V Supply	
16		VccT	Module Transmitter 3.3 V Supply	
17		VeeT	Module Transmitter Ground	Note1
18	CML-I	TD+	Transmitter Non-Inverted Data Input	
19	CML-I	TD-	Transmitter Inverted Data Input	
20		VeeT	Module Transmitter Ground	Note1

**Notes:**

- [1] The module signal ground pins, VeeR and VeeT, shall be isolated from the module case.
- [2] This pin is an open collector/drain output pin and shall be pulled up with 4.7k-10kohms to Host\_Vcc on the host board. Pull ups can be connected to multiple power supplies, however the host board design shall ensure that no module pin has voltage exceeding module VccT/R + 0.5 V.
- [3] This pin is an open collector/drain input pin and shall be pulled up with 4.7k-10kohms to VccT in the module.
- [4] See SFF-8431 4.2 2-wire Electrical Specifications .
- [5] This pin shall be pulled up with 4.7k-10kohms to Host\_Vcc on the host board.

## Block Diagram of Transceiver

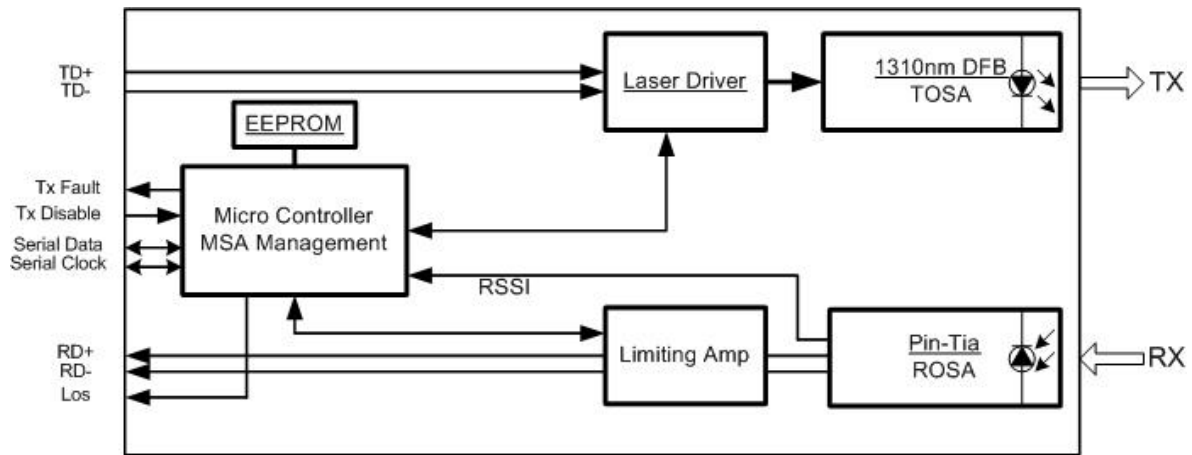


Figure2

### <Transmitter Section>:

The transmitter converts 10Gbit/s serial CML electrical data into serial optical data compliant with the 10GBASE-LR standard. An open collector compatible Transmit Disable (Tx\_Dis) input contact 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. This contact shall be pulled up to VccT with a 4.7 kΩ to 10 kΩ resistor. 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. contact shall be pulled up to the Vcc\_Host in the host with a resistor in the range 4.7-10 kΩ.

### <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 is a module output contact when high indicates an optical signal level below that specified in the relevant standard. Such an indication typically points to non-installed cables, broken cables, or a disabled, failing or a powered off transmitter at the far end of the cable. This contact 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.

## Recommended Interface Circuit

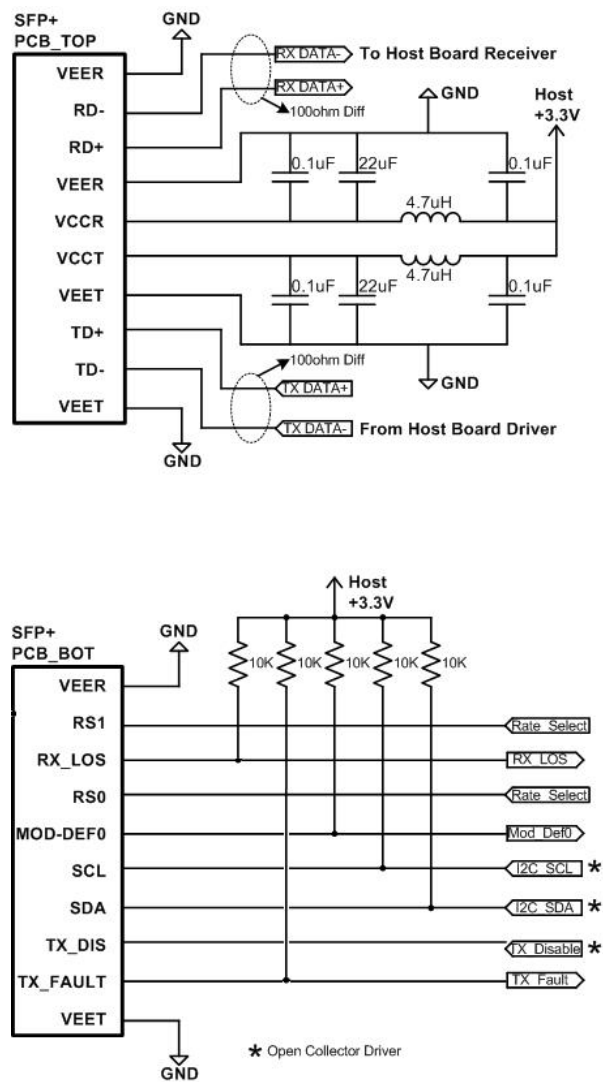
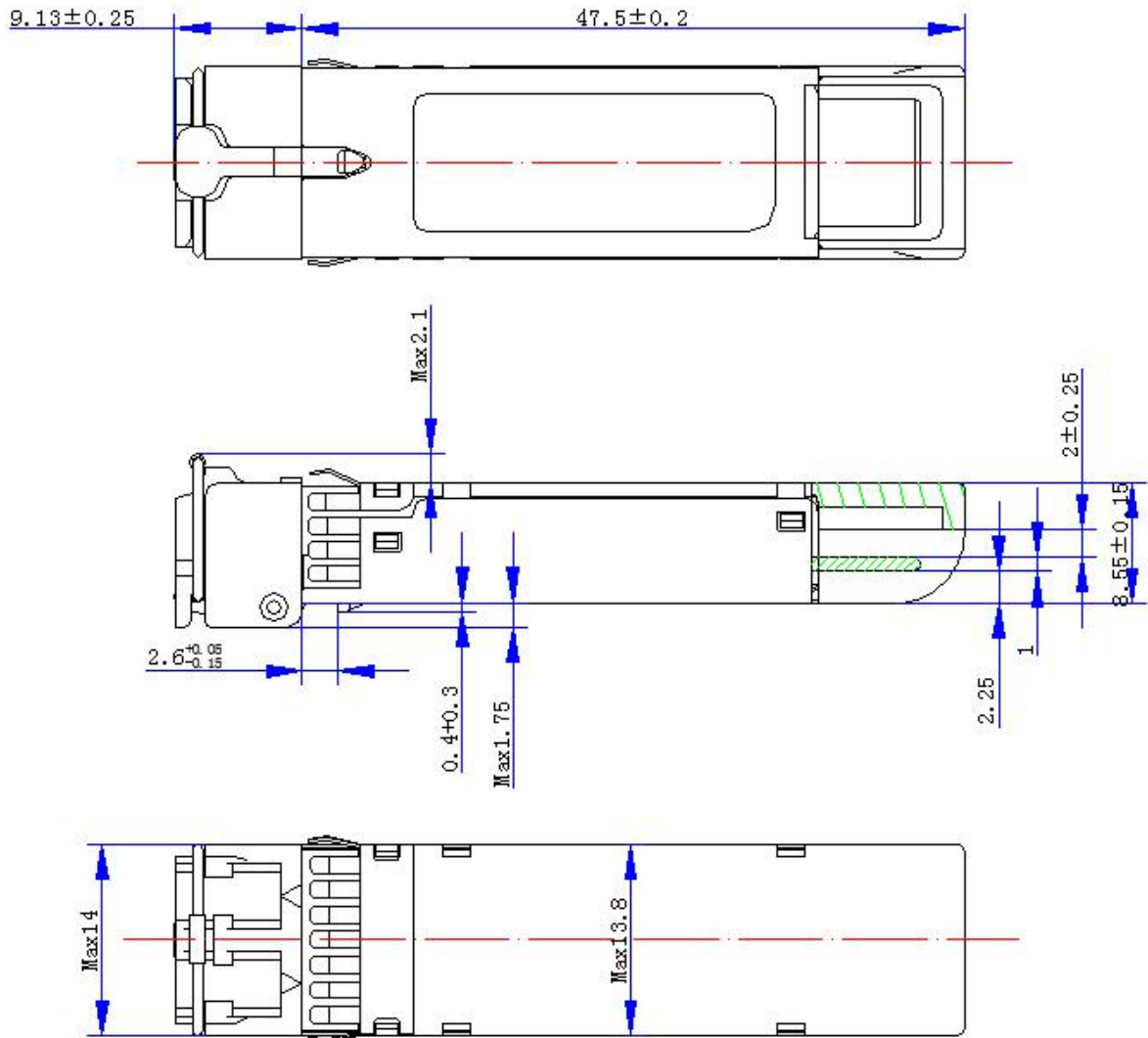


Figure3

## Dimensions



**Figure4**

Tolerance:  $\pm 0.1$  mm, unless otherwise specified.



## Digital Diagnostic Memory Map

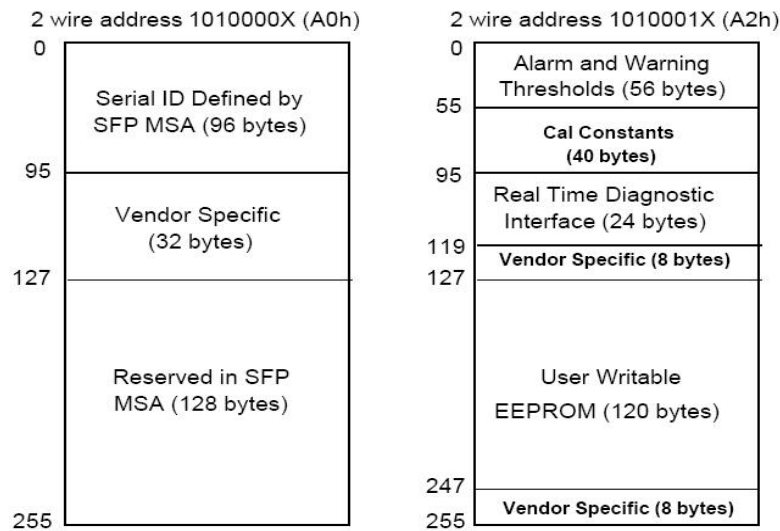


Figure5

Table8-EEPROM Information (A0h)

Addr.	Field Size (Bytes)	Name of Field	Hex	Description
0	1	Identifer	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	20 00 00 00 00 00 00 00	Transceiver Codes
11	1	Encoding	06	64B/66B
12	1	BR, Nominal	67	10300Mb/s
13	1	Rate Identifier	00	Unspecified
14	1	Length (9um) km	0A	Transceiver transmit distance,10km
15	1	Length (9um) 100m	64	Transceiver transmit distance,10km
16	1	Length (50um)10m	00	Transceiver transmit distance
17	1	Length (62.5um) 10m	00	Transceiver transmit distance
18	1	Length (Copper)	00	Not compliant
19	1	Length (50um OM3)	00	Not compliant
20-35	16	Vendor name	48 47 20 47 45 4E 55 49 4E 45 20 20 20 20 20 20	"HG GENUINE" Vendor Name(ASCII)
36	1	Reserved	00	
37-39	3	Vendor OUI	00 00 00	
40-55	16	Vendor PN	4D 54 52 53 2D 30 32 58 31 33 2D 47 20 20 20 20	"MTRS-02X13-G"Part No.(ASCII)
56-59	4	Vendor rev	31 2E 30 20	"1.0" (ASCII)

60-61	2	Wavelength	05 1E	Transceiver wavelength
62	1	Reserved	00	
63	1	CC_BASE	DA	Check code for Base ID Fields
64-65	2	Options	00 1A	TX_DISABLE, TX_FAULT and Loss of Signal implemented.
66	1	BR,MAX	00	Not Specified
67	1	BR,MIN	00	Not Specified
68-83	16	Vendor SN	SN(Variable)	Serial Number of transceiver(ASCII).
84-91	8	Date code	DC(Variable)	Manufactory Date Code.
92	1	Diagnostic Monitoring Type	68	Digital diagnostic monitoring implemented, “Internally calibrated” is implemented
93	1	Enhanced Options	F0	Optional Alarm/Warning flags implemented for all monitored quantities, Optional Soft TX_Disable control and monitoring implemented, Optional Soft TX_FAULT monitoring implemented, Optional Soft RX_LOS monitoring implemented
94	1	SFF_8472 Compliance	04	Includes functionality described in Rev10.4 SFF-8472
95	1	CC_EXT	CS(Variable)	Check sum for Extended ID Field.
96-127	32	Vendor Specific	Read only	Depends on customer information Filled by zero
128-255	128	Reserved	Read only	Filled by zero

**Table9- DM Alarm & warning threshold(A2h)**

Addr.	Field Size (Bytes)	Name of Field	Description
00-01	2	Low temperature warning	0°C
02-03	2	High temperature warning	70°C
04-05	2	Low voltage warning	3.135V
06-07	2	High voltage warning	3.465V
08-09	2	Low Ibias warning	3mA
10-11	2	High Ibias warning	80mA
12-13	2	Low Tx power warning	-8.2dBm
14-15	2	High Tx power warning	0.5dBm
16-17	2	Low Rx power warning	-14.4dBm
18-19	2	High Rx power warning	0.5dBm
20-21	2	Low temperature alarm	-10°C

22-23	2	High temperature alarm	80℃
24-25	2	Low voltage alarm	2.97V
26-27	2	High voltage alarm	3.63V
28-29	2	Low Ibias alarm	2mA
30-31	2	High Ibias alarm	90mA
32-33	2	Low Tx power alarm	-10.2dBm
34-35	2	High Tx power alarm	2.5dBm
36-37	2	Low Rx power alarm	-16.4dBm
38-39	2	High Rx power alarm	2.5dBm

## Ordering Information

**Table10- Ordering Information**

Part No.	Specification								
	Pack	Rate	Tx	Pout	Rx	S	Top	Reach	Others
MTRS-02X13-G	SFP+	10G	1310nm DFB	-8.2~+0.5dBm	PIN	<-14.4dBm	0~70℃	10km	DDM/RoHS

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