SFP+ Optical Transceiver

THMPRL-7288-10B(I)

THMPRL-2788-10B(I)

FEATURES

- 10G uncooled 1330nm DML Transmitter and 1270nm PIN receiver for THMPRL-7288-10B(I)
- 10G uncooled 1270nm DML Transmitter and 1330nm PIN receiver for THMPRL-2788-10B(I)
- Support 1.06 to 10.7Gpbs application
- Up to 10km transmission at 10.3125Gbps on SMF
- SFP+ MSA package with BiDi LC connector
- Single +3.3V power supply
- <1.0W power consumption
- Operating case temperature
  0℃~+70℃ for THMPRL-7288-10B/THMPRL-2788-10B
  -40~+85℃ for THMPRL-7288-10BI/THMPRL-2788-10BI
- Compliant with MSA SFP+ Specification SFF-8431
- 2-wire interface with integrated Digital Diagnostic monitoring SFF-8472 Compliant
- Low EMI and excellent ESD protection
- RoHS-6 compliance

APPLICATIONS

- 10GBASE-LR 10Km BiDi.
- CPRI 1.22Gbps to 9.83Gbps

STANDARDS

- Complies with SFP MSA
- Compliant with IEEE 802.3ae
- Compliant with MSA SFP+ Specification SFF-8431
- Compliant with SFF-8472
- Compliant with section 158 of IEEE 802.3CP-2021

DESCRIPTION

The THMPRL-7288-10B(I)/ THMPRL-2788-10B(I) transceiver is small form factor pluggable SFP+ transceiver, which is designed for 1.06Gbps to 10.7Gbps optical fiber communication for 10km reach application.

The transceiver is built with uncooled 1330nm/1270nm DML laser and high sensitivity PIN receiver, which is class 1 laser compliant product according to international safety standard IEC-60825. Enhanced Digital Diagnostics functions are available via the 2-wire serial bus specified in the SFF-8472 Rev.11.0.

ABSOLUTE MAXIMUM RATINGS					
Parameter	**Symbol**	**Min**	**Max**	**Units**	**Notes**
Storage Temperature	T_{stg}	-40	+85	℃	Exceeding the Absolute Maximum Ratings may cause irreversible damage to the device. The device is not intended to be operated under the condition of simultaneous Absolute Maximum Ratings, a condition which may cause irreversible damage to the device.
Case Operating Temperature Range for THMPRL-7288-10B/THMPRL-2788-10B	T_{case}	0	+70	℃	
Case Operating Temperature Range for THMPRL-7288-10BI/THMPRL-2788-10BI		-40	+85	℃	
Relative Humidity - Storage	RH_s	0	95	%	
Relative Humidity - Operating	RH_o	0	85	%	
DC Supply Voltage	V_{CC}	0	3.6	V	

RECOMMENDED OPERATING CONDITION						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**	**Notes**
Operating Case Temperature	T_c	0		70	℃	C Grade
Operating Case Temperature		-40		+85	℃	I Grade
Power Supply Voltage	Vcc	3.13	3.3	3.47	V	
Power Supply Current	Icc			320	mA	
Bit Rate	BR	1.06	10.3125	10.7	Gbps	

TRANSMITTER ELECTRICAL CHARACTERISTICS							
Parameter		**Symbol**	**Min**	**Typ**	**Max**	**Unit**	**Notes**
Tx_Data Differential Input Voltage		V_{IH}-V_{IL}	180		1000	mV	CML Tx_DATA Electrical Signal
Input Differential Impedance		R_{in}	80	100	120	Ω	
Tx_Disable	Normal Operation	V_{OL}	0		0.8	V	
	Transmitter Fault	V_{OH}	2		Vcc	V	
Tx_Fault	Normal Operation	V_{OL}	0		0.4	V	
	Laser Disable	V_{OH}	2.4		Vcc	V	

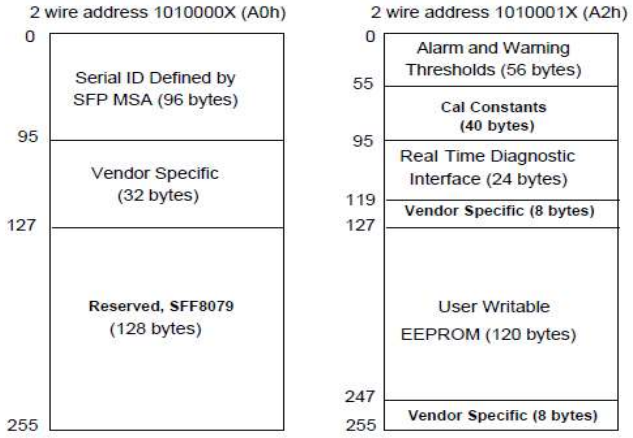
RECEIVER ELECTRICAL CHARACTERISTICS							
Parameter		**Symbol**	**Min**	**Typ**	**Max**	**Unit**	**Notes**
Rx_Data Differential Output Voltage		V_{IH}-V_{IL}	300		700	mV	CML Rx_DATA Electrical Signal
Output Differential Impedance		Z_O	80	100	120	Ω	
RX_LOS	Normal Operation	V_{OL}	0		0.4	V	
	Lose Signal	V_{OH}	2.4		Vcc	V	

I2C SERIAL LOGIC						
Parameter	**Symbol**	**State**	**Min**	**Typ**	**Max**	**Unit**
I^2C Serial Data	SDA_H	HIGH	2.0		Vcc	V
	SDA_L	LOW	0		0.8	V
I^2C Serial Clock	SCL_H	HIGH	2.0		Vcc	V
	SCL_L	LOW	0		0.8	V

Optical Characteristics						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**	**Notes**
Upstream Signaling Speed	Stx	1.06	10.3125	10.7	Gbps	
Centre Wavelength	λ_C	λ_C-12	λ_C	λ_C+12	nm	λ_C=1270,1330nm
Side Mode Suppression Ratio	SMSR	30			dB	
Spectral Width -20dB	$\triangle\lambda$			1	nm	
Average Output Power	P_{out}	-8		0.5	dBm	
Launch power in OMA minus TDP	P_{OMA}	-6.2			dBm	
Extinction Ratio	ER	3.5			dB	PRBS 2^{31} –1 @10.3125Gbps
Transmitter and Dispersion Penalty	TDP			3.2	dB	PRBS 2^{31} –1 @10.3125Gbps 10Km SMF
Optical Return Loss Tolerance	ORLT			12	dB	
Transmitter Reflectance				-12	dB	
Relative Intensity Noise	RIN			-128	dB/Hz	
Eye Diagram		Compliant with IEEE 802.3CP-2021				PRBS 2^{31} –1 @10.3125Gbps

Downstream CW Mode Receiver Optical Specifications						
Parameter	**Symbol**	**Min**	**Typ**	**Max**	**Unit**	**Notes**
Downstream Signaling Speed	Stx	1.06	10.3125	10.7	Gbps	
Wavelength	λ_C	λ_C-12	λ_C	λ_C+12	nm	λ_C=1270,1330nm
Receiver Sensitivity	P_{OMA_SENS}			-14.4	dBm	PRBS 2^{31} –1 @10.3125Gbps, BER≤10^{-12}.
Receiver Sensitivity(OMA)	P_{OMA_SENS}			-12.6	dBm	PRBS 2^{31} –1 @10.3125Gbps, BER≤10^{-12}.
Receiver Overload	P_{IN-OL}	0.5			dBm	PRBS 2^{31} –1 @10.3125Gbps, BER≤10^{-12}. ER=4dB
LOS Assert		-35			dBm	
LOS Deassert				-15	dBm	
Signal-Detected Hysteresis		0.5		6	dB	
Receiver Reflectance				-12	dB	

EEPROM INFORMATION



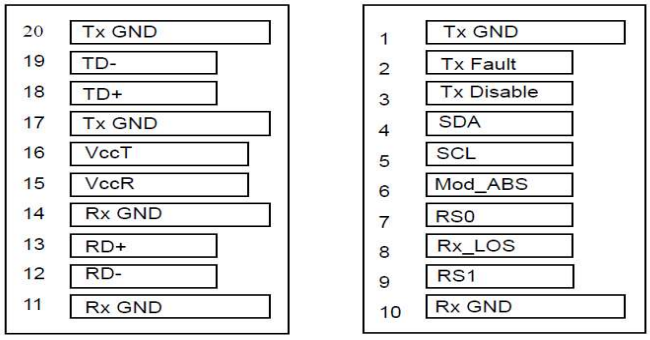
2x10 SFF PIN ASSIGNMENT

Pin	Symbol	Description	Note
1	Tx GND	Module Transmitter Ground	
2	Tx Fault	Module Transmitter Fault	1
3	Tx Disable	Transmitter Disable; Turns off transmitter laser output	2
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 VEET or VEER in the module	1
7	RS0	Rate Select 0, NOT implement	3
8	Rx_LOS	Receiver Loss of Signal Indication	1
9	RS1	Rate Select 1, NOT implement	3
10	Rx GND	Module Receiver Ground	
11	Rx GND	Module Receiver Ground	
12	RD-	Receiver Inverted Data Output	
13	RD+	Receiver Non-Inverted Data Output	
14	Rx GND	Module Receiver Ground	
15	VccR	Module Receiver 3.3 V Supply	
16	VccT	Module Transmitter 3.3 V Supply	
17	Tx GND	Module Transmitter Ground	
18	TD+	Transmitter Non-Inverted Data Input	
19	TD-	Transmitter Inverted Data Input	
20	Tx GND	Module Transmitter Ground	

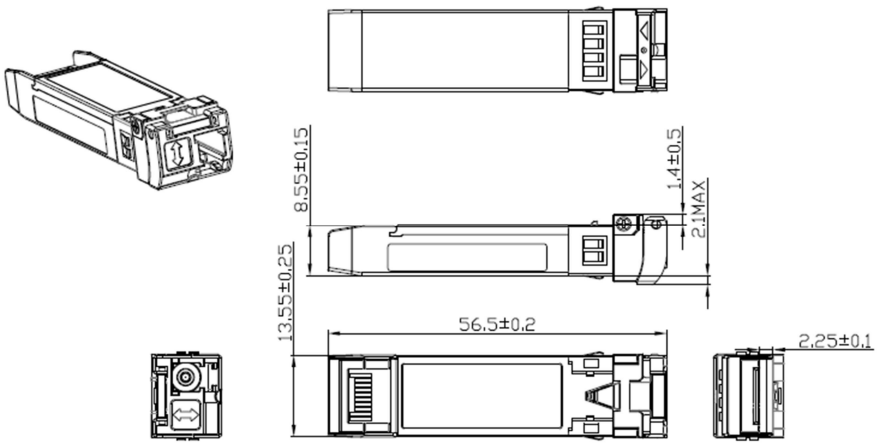
NOTE:

1. The pins shall be pulled up with 4.7K-10Kohms to a voltage between 3.14V and 3.46Von host board.
2. The pin is pulled up to VCCT with a 4.7K-10KΩ resistor in the module.
3. The pins are pulled low to Tx GND with a >30kΩ resistor in the module.

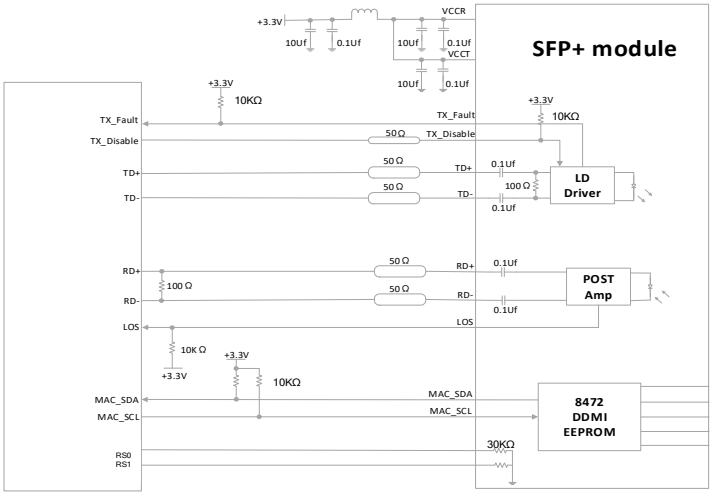
Pin Descriptions



Mechanical Specifications (Unit:mm)



ELECTRICAL INTERFACE



Order Information					
Part Number	Specifications				
	Application	Data Rate	Laser Source	Fiber Type	Temperature
THMPRL-7288-10B	10Gbase 10km BiDi SFP	10.3125G	1330nm/DML	SMF	0~70℃
THMPRL-2788-10B	10Gbase 10km BiDi SFP	10.3125G	1270nm/DML	SMF	0~70℃
THMPRL-7288-10BI	10Gbase 10km BiDi SFP	10.3125G	1330nm/DML	SMF	-40~85℃
THMPRL-2788-10BI	10Gbase 10km BiDi SFP	10.3125G	1270nm/DML	SMF	-40~85℃

Revision Record

Version.	Date of Issue	Description	Prepared by	Checked by	Approved by
V1.0	2018-07-26	New document	Rick.Zhou	Frank.Zeng	Frank.Zeng
V1.1	2019-03-18	Update Receiver Sensitivity	Wei.Liao	Rick.Zhou	Frank.Zeng
V1.2	2020-11-20	Update Mechanical Specifications	Wei.Liao	Rick.Zhou	Frank.Zeng
V1.3	2023-04-23	Revised to comply with IEEE802.3CP-2021 protocol standards.	Song.Luo	Rick.Zhou	Mark.Li HongBin.Zhang