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# MPLS20-D6C-C2T1

## Features

- ◆ Single fiber bi-directional data links with 9.953Gbps downstream and 9.953/2.488Gbps upstream
- ◆ 1577nm continuous-mode EML laser transmitter and 1270nm burst-mode APD-TIA receiver
- ◆ 0 to 70°C operating case temperature
- ◆ +3.3V power supply
- ◆ SFP+ package with SC/UPC Receptacle connector
- ◆ 2-wire interface for integrated Digital Diagnostic Monitoring
- ◆ Digital Receiving Signal Strength Indication (RSSI)
- ◆ Low EMI and excellent ESD protection
- ◆ Class1 laser safety standard IEC-60825 compliant
- ◆ RoHS compliance

## Application

- ◆ XGSPON OLT (N2 class ODN)

## Standard

- ◆ Complies with SFF-8431/SFF-8432
- ◆ Complies with SFF-8472
- ◆ Complies with ITU-T G.987.2 & G.9807.1
- ◆ Complies with FCC 47 CFR Part 15, Class B
- ◆ Complies with FDA 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007

## Description

The MPLS20-D6C-C2T1 is an XGS-PON OLT optical transceiver designed for low cost point-to-multipoint (P2MP) Fiber to Home (FTTH), Business or Curb (FTTx) applications. It employs a 1577nm EML CW mode downstream transmitter operating at 9.95328Gb/s and a 1270nm APD/TIA burst mode upstream receiver operating at 9.95328Gb/s or 2.48832Gb/s. It is housed in a hot pluggable SFP+ package and is designed to operate over the commercial temperature range from 0 to 70°C.

## Specification

Absolute Maximum Ratings				
Parameter	Symbol	Min	Max	Unit
Storage temperature	T <sub>s</sub>	-40	+85	°C
Operating case temperature	T <sub>c</sub>	0	+70	°C
Storage Relative Humidity	RH <sub>S</sub>	5	95	%
Operating Relative Humidity	RH <sub>O</sub>	5	85	%
Power Supply Voltage	V <sub>CC</sub>	0	+3.6	V

Recommended Operating Conditions					
Parameter	Symbol	Min	Typical	Max	Unit
Operating Case Temperature	T <sub>c</sub>	0		+70	°C
Power Supply Voltage	V <sub>CC3</sub>	3.135	3.3	3.465	V
Supply Current	I <sub>CC3</sub>	-	-	800	mA
Power Consumption	P <sub>W</sub>	-	-	3	W
Data Rate		-	TX 9.953 RX 9.953/2.488	-	Gbps

Electrical Characteristics						
Parameter	Symbol	Min	Typical	Max	Unit	Notes
Transmitter Differential Data Input Swing	V <sub>INPP</sub>	120	-	800	mV	
Transmitter Differential Input Impedance	Z <sub>IN</sub>	80	100	120	Ω	
Receiver Differential Data Output Swing	V <sub>OUTPP</sub>	400	-	800	mV	
Receiver Differential Output Impedance	Z <sub>OUT</sub>	80	100	120	Ω	
TX Disable	V <sub>TDH</sub>	2.0	-	V <sub>CC</sub>	V	LVTTTL input
	V <sub>TDL</sub>	0	-	0.8		
TX Fault	V <sub>TFH</sub>	2.4	-	V <sub>CC</sub>	V	LVTTTL output
	V <sub>TFL</sub>	0	-	0.4		
RX Reset	V <sub>RSTH</sub>	2.0	-	V <sub>CC</sub>	V	LVTTTL input
	V <sub>RSTL</sub>	0	-	0.8		
RX_SD	V <sub>SDH</sub>	2.0	-	V <sub>CC</sub>	V	LVTTTL output
	V <sub>SDL</sub>	0	-	0.8		

Optical transmitter Characteristics						
Parameter	Symbol	Min	Typical	Max	Unit	Notes
Operating Wavelength Range	$\lambda_c$	1575	-	1580	nm	
Launched Power	$P_{OUT}$	+4	-	+7	dBm	
Spectral Width(-20dB)	$\Delta\lambda$	-	-	1	nm	
Side Mode Suppression Mode	SMSR	30	-	-	dB	
Extinction Ratio	ER	8.2	-	-	dB	PRBS 2 <sup>31</sup> -1 @9.953Gbps
Optical Output Power after TX Disable	$P_{OFF}$	-	-	-39	dBm	
Transmitter tolerance to reflected optical power		-15	-	-	dB	
Output Eye Diagram	Compliant with ITU-T G.987.2					
Optical receiver Characteristics						
Parameter	Symbol	Min	Typical	Max	Unit	Notes
Operating Wavelength Range	$\lambda_c$	1260	1270	1280	nm	
Receiver Sensitivity@9.953G	$P_{SEN1}$	-	-	-28	dBm	PRBS 2 <sup>31</sup> -1 @9.953Gbps BER<1x10 <sup>-3</sup> ER=8.2dB
Saturation Optical Power@9.953G	$P_{SAT1}$	-7	-	-	dBm	
Receiver Sensitivity@2.488G	$P_{SEN2}$	-	-	-29.5	dBm	PRBS 2 <sup>23</sup> -1 @2.488Gbps BER<1x10 <sup>-4</sup> ER=8.2dB
Saturation Optical Power@2.488G	$P_{SAT2}$	-9	-	-	dBm	
Immunity from Continuous Identical Digits	CID	72	-	-	Bit	
Receiver Reflectance		-	-	-20	dB	
Tolerance to the reflected optical power		-	-	12	dB	

Receiver Timing Characteristics						
Application	Parameter	Symbol	Min.	Typ.	Max.	Unit
XGSPON	Guard Time	Tg1	-	512	-	Bit
	Reset Pulse Width	Tr1	25.6	-	-	ns
	Data Recovery Time	Tsettle1	-	-	150	ns
	SD Assert Time	Ta1	-	-	100	ns
	SD De-assert Time	Td1	-	-	12.8	ns
XGPON	Guard Time	Tg2	-	64	-	Bit
	Reset Pulse Width	Tr2	25.6	-	-	ns
	Data Recovery Time	Tsettle2	-	-	25.6	ns
	SD Assert Time	Ta2	-	-	50	ns
	SD De-assert Time	Td2	-	-	12.8	ns

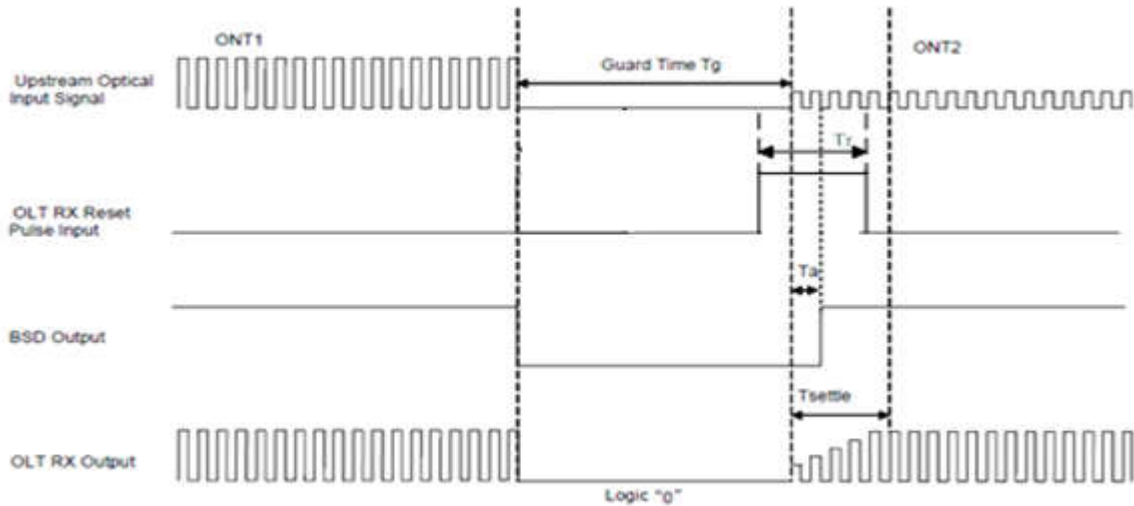


Figure 1 Timing Parameter Definitions in Burst Mode Sequence a

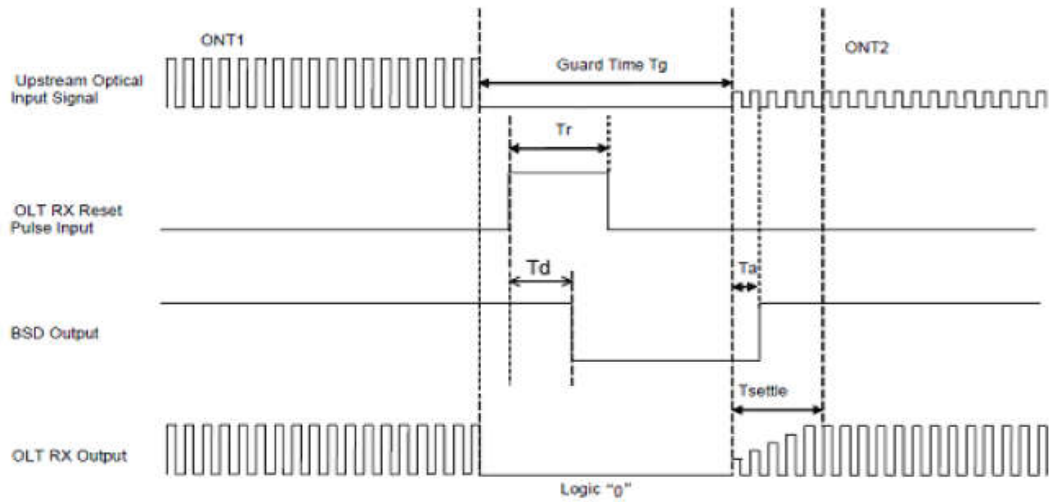


Figure 2 Timing Parameter Definitions in Burst Mode Sequence b

RSSI Characteristics						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
RSSI Trigger-Low		0	-	0.8	V	
RSSI Trigger-High		2.0	-	V <sub>CC</sub>	V	
RSSI Trigger Delay	T <sub>D</sub>	0	-	3000	ns	
Optical Signal During Time	T <sub>ONT</sub>	300	-	-	ns	
RSSI Trigger width	T <sub>W</sub>	300	-	T <sub>ONT</sub> - T <sub>D</sub>	ns	
I2C Access Prohibited Time	T <sub>p</sub>	500	-	-	μs	

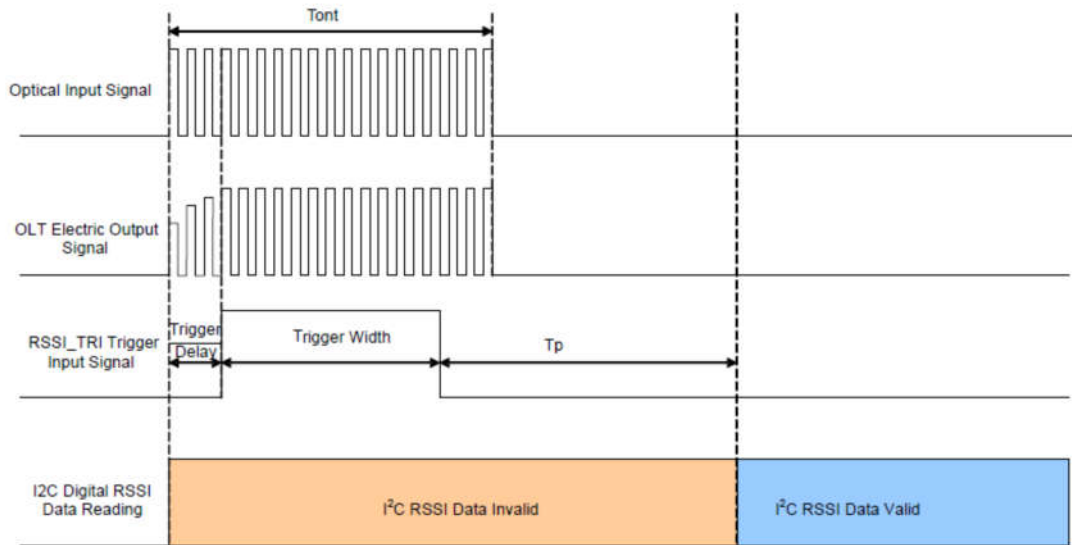


Figure 3 Timing Parameter Definitions in RSSI Trigger

### Digital Diagnostic Monitoring Information

Parameter	Accuracy	Calibration	Unit
Temperature	±3	Internal	°C
Voltage	±3%	Internal	V
Bias Current	±10%	Internal	mA
TX Power	±2	Internal	dBm
RX Power	±2	Internal	dBm

## Pin Definition

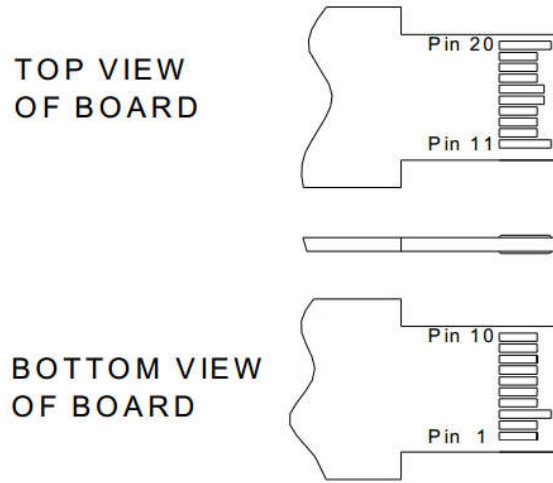


Figure 4 Pin out Drawing

Pin No	Name	Default Description	Note
1	NC		
2	NC		
3	GND	Module Ground	
4	SDA	2-Wire Serial Interface data line	LVTTTL
5	SCL	2-Wire Serial Interface clock line	LVTTTL
6	RD2.5G-	Inverted 2.488Gps RX Data Output	CML, DC coupled
7	RX_RESET	Burst Module Reset Signal, high active	LVTTTL Input
8	RX_SD	High: normal; Low: loss of signal	LVTTTL Output
9	TRIG/TXDIS	RSSI Trigger/TX_Disable	LVTTTL Input
10	RD2.5G+	Non-inverted 2.488Gps RX Data Output	CML, DC coupled
11	GND	Module Ground	
12	RD10G-	Inverted 9.953Gps RX Data Output	CML, DC coupled
13	RD10G+	Non-inverted 9.953Gps RX Data Output	CML, DC coupled
14	TX_Fault	Low: normal; High: transmitter fault	LVTTTL Output
15	VCC3_RX	Receiver 3.3V Power Supply	
16	VCC3_TX	Transmitter 3.3V Power Supply	
17	NC		

18	TD+	Non-Inverted Transmit Data input	CML, AC coupled
19	TD-	Inverted Transmit Data input	CML, AC coupled
20	GND	Module Ground	

### Typical application Circuit

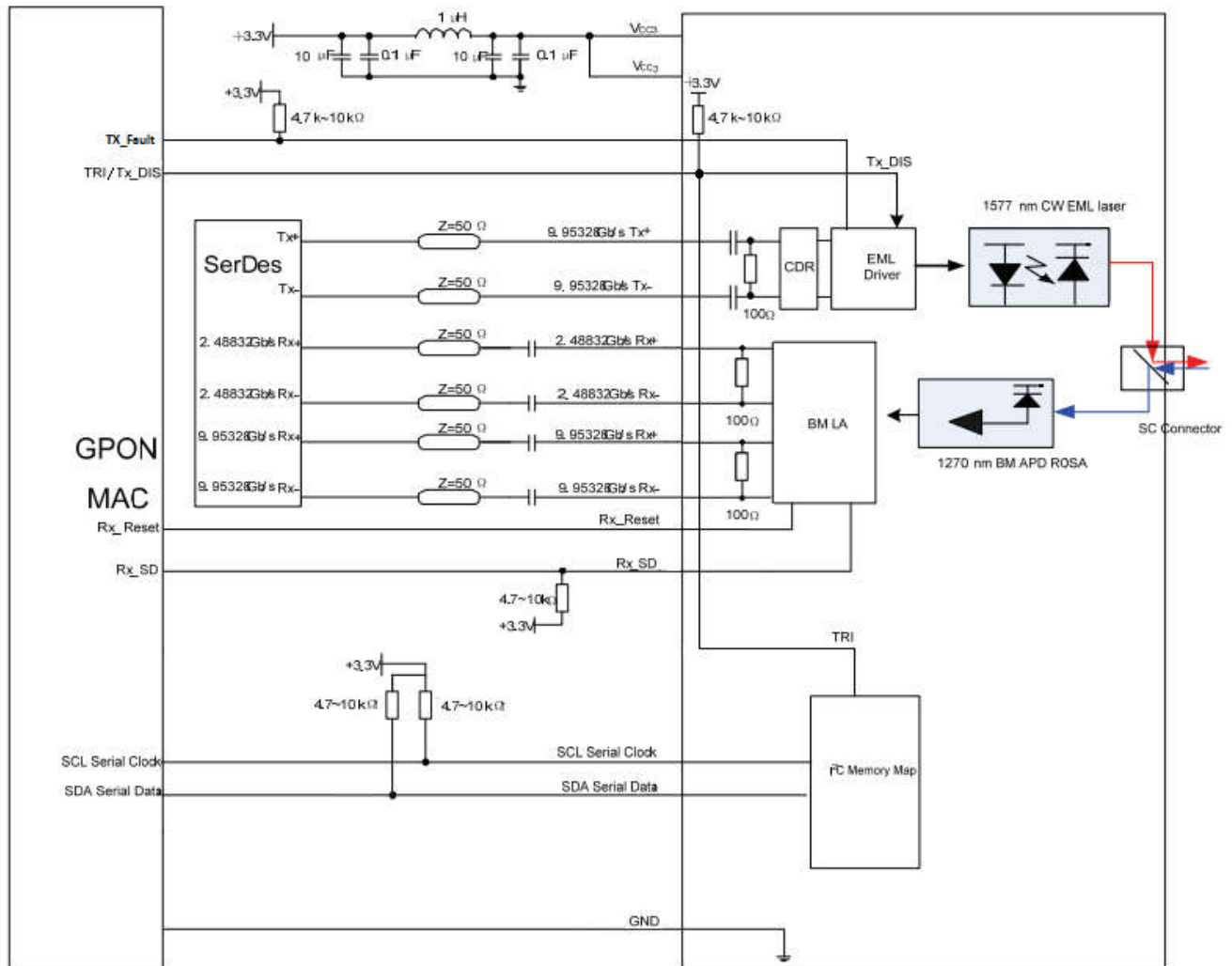


Figure 5 Typical Interface Circuit



## 2-Wire Serial Memory Map

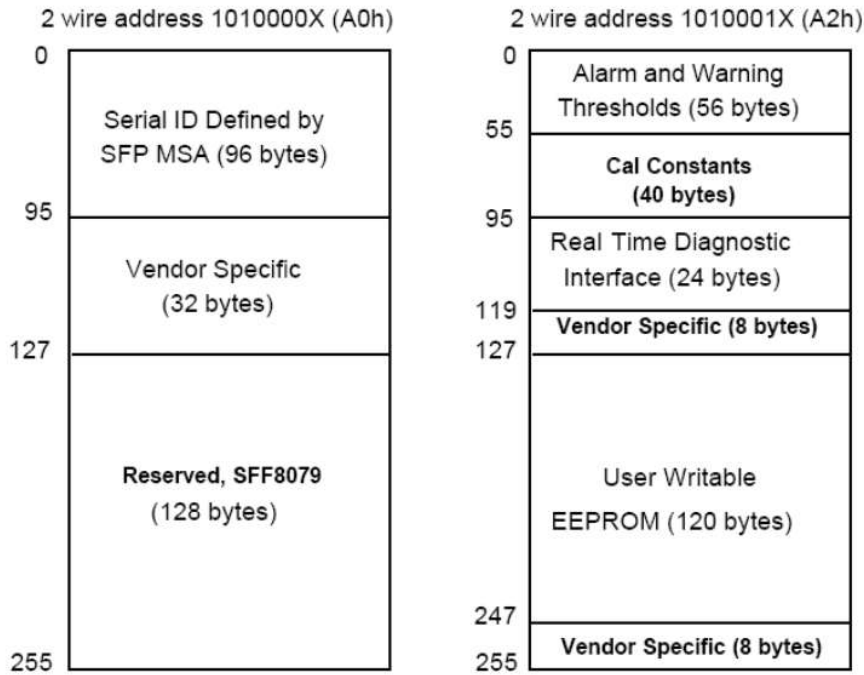


Figure 6 EEPROM Memory Map Specific Data Field Descriptions

## EEPROM serial ID memory contents (A0h)

Address	#Bytes	Name	HEX	Description
0	1	Identifier	03	SFP+
1	1	Ext. Identifier	04	Non Standard GBIC Interface
2	1	Connector	01	SC connector
3-10	8	Transceiver	47 13 01 00 00 01 00 40	Code for electronic compatibility or optical compatibility
11	1	Encoding	03	NRZ
12	1	BR, Nominal	64	10Gbps
13	1	Reserved	00	Reserved
14	1	Length(9μm)-km	14	20km
15	1	Length(9μm)-100m	C8	20km
16	1	Length (50μm OM2)-10m	00	Not Supported
17	1	Length (62.5μm OM1)-10m	00	Not Supported
18	1	Length (Copper)	00	Not Supported
19	1	Length (50μm OM3)-10m	00	Not Supported

20-35	16	Vendor name	4D 45 4E 54 45 43 48 4F 50 54 4F 20 20 20 20 20	“MENTECHOPTO”(ASCII character)
36	1	Reserved	00	Reserved
37-39	3	Vendor OUI	00 00 00	No specific
40-55	16	Vendor PN	4D 50 4C 53 32 30 2D 44 36 43 2D 43 32 54 31 20	MPLS20-D6C-C2T1
56-59	4	Vendor rev	41 30 20 20	A0
60-61	2	Wavelength	06 29	1577nm
62	1	Reserved	00	Reserved
63	1	CC_BASE	Programmed by Factory	Check sum of bytes 0-62
64-65	2	Transceiver Options	00 1A	RX_SD, TX_Fault, TX_Disable
66	1	BR, max	00	
67	1	BR, min	00	
68-83	16	Vendor SN	Programmed by Factory	Serial number provided by vendor (ASCII)
84-91	8	Date Code	“YYMMDDLL”	Vendor's manufacturing date code (ASCII)
92	1	Diagnostic Monitoring Type	68	Internal Calibrated; Received power measurement type: Average Power
93	1	Enhanced Options	E0	Optional Alarm/warning implemented; Soft TX_DISABLE, TX_FAULT implemented
94	1	Compliance	08	Revision Implemented
95	1	CC_EXT	Programmed by Factory	Check sum of bytes 64-94
96-127	32	Vendor Specific		Vendor Specific EEPROM
128-255	128	Reserved	00	Reserved

## EEPROM serial ID Memory contents (A2h)

### Alarm and Warning Thresholds

Address	Field Size(Byte)	Name of field	Description
00-01	2	Temp High Alarm	MSB at low address, 80℃
02-03	2	Temp Low Alarm	MSB at low address, -10℃
04-05	2	Temp High Warning	MSB at low address, 70℃
06-07	2	Temp Low Warning	MSB at low address, 0℃
08-09	2	3.3V Voltage High Alarm	MSB at low address, 3.6V
10-11	2	3.3V Voltage Low Alarm	MSB at low address, 3.0V
12-13	2	3.3V Voltage High Warning	MSB at low address, 3.47V
14-15	2	3.3V Voltage Low Warning	MSB at low address, 3.13V
16-17	2	Bias High Alarm	MSB at low address, 125mA
18-19	2	Bias Low Alarm	MSB at low address, 5mA
20-21	2	Bias High Warning	MSB at low address, 110mA
22-23	2	Bias Low Warning	MSB at low address, 10mA
24-25	2	TX Power High Alarm	MSB at low address, +8dBm
26-27	2	TX Power Low Alarm	MSB at low address, +3dBm
28-29	2	TX Power High Warning	MSB at low address, +7dBm
30-31	2	TX Power Low Warning	MSB at low address, +4dBm
32-33	2	RX Power High Alarm	MSB at low address, -5dBm
34-35	2	RX Power Low Alarm	MSB at low address, -31.5dBm
36-37	2	RX Power High Warning	MSB at low address, -7dBm
38-39	2	RX Power Low Warning	MSB at low address, -29.5dBm
40-41	2	TOSA Temp High Alarm	MSB at low address, 60℃
42-43	2	TOSA Temp Low Alarm	MSB at low address, 30℃
44-45	2	TOSA Temp High Warning	MSB at low address, 55℃
46-47	2	TOSA Temp Low Warning	MSB at low address, 40℃
48-55	8	Reserved	Reserved

**A/D Readout (Table A2H Byte 96~109)**

Address	Field Size (Byte)	Name of Field	Description	Unit
96-97	2	Temperature	Internally measured module temperature, MSB at low address	°C
98-99	2	3.3V Supply Voltage	Internally measured supply voltage, MSB at low address	V
100-101	2	TX Bias Current	Internally measured TX Bias Current, MSB at low address. Unit:4uA	mA
102-103	2	TX Power	Internally measured TX output power, MSB at low address. Unit:0.2uW	dBm
104-105	2	RX Power	Measured RX input power, MSB at low address. Unit: 0.1uW	dBm
106-107	2	TOSA Temperature	Internally measured TOSA temperature, MSB at low address	°C
108-109	2	Reserved		

**RSSI trigger/TX\_Disable selection (Table A2H Byte 118)**

Address	Bit	Name of Field	Description
118	7	RSSI Select	Writing "0" for XGSPON RSSI Monitor; Writing "1" for XGPON RSSI Monitor. Default power up value is "0".
118	6	RSSI/TX_Disable Select	When set to "0", PIN9 as TX_Disable input; When set to "1", PIN9 as RSSI input. Default power up value is "0".

## Product Security requirements

Items	Contents
Virus scanning	Don't contain malicious code or code vulnerabilities such as Trojans, viruses, worms, backdoors, etc.
Source code static scanning	Don't contain dead pointers, divide by 0, integer overflow, invalid shift operations, memory management, null pointer indirect references, boundary overflow checks, uninitialized variables, write constants, etc.
Source code security scanning	Don't contain memory leaks, out of bounds errors, arithmetic errors, suspicious code, logic errors, etc.

## Package Outline

Dimensions are in millimeters. (Unit: mm)

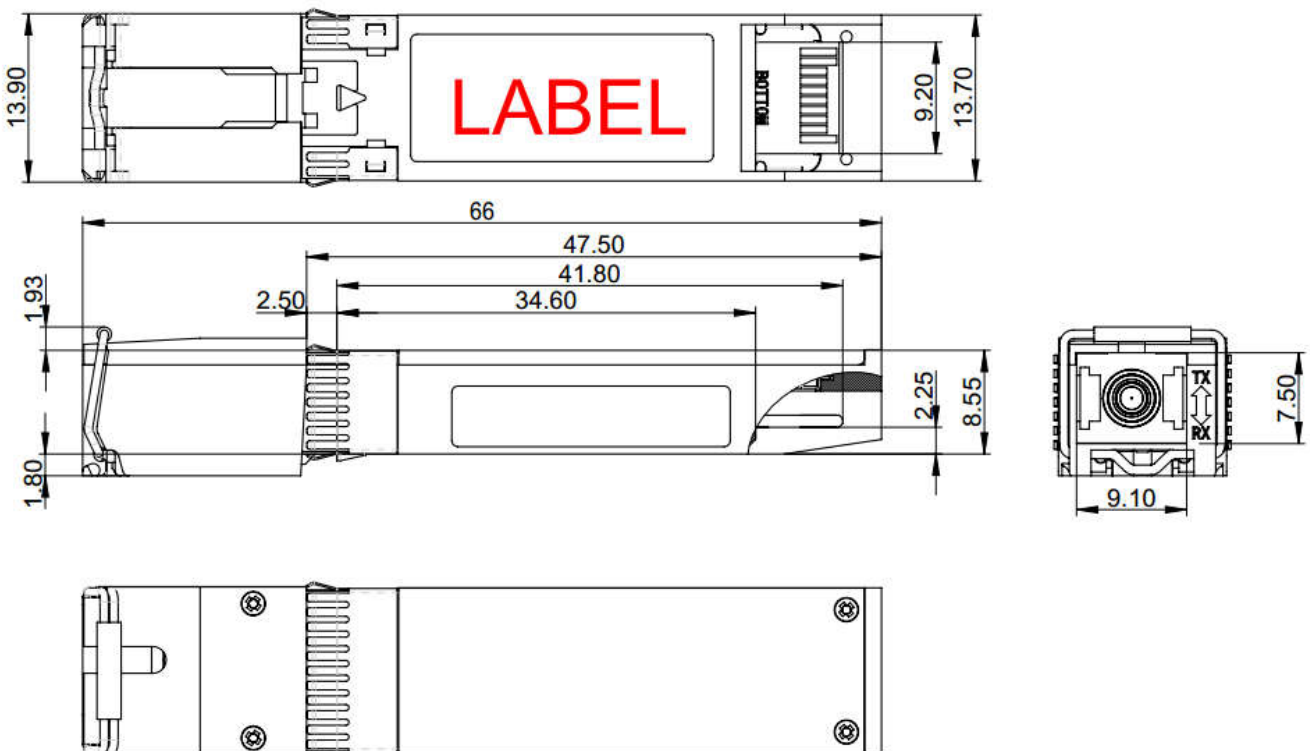


Figure7 Package Outline for MPLS20-D6C-C2T1

**Ordering information**

Part. No	Specifications								
	Package	Data Rate (Gbps)	Tx (nm)	Po (dBm)	Rx (nm)	Sen (dBm)	Temp (°C)	Reach (km)	DDM
MPLS20-D6C-C2T1	SFP+	TX 9.953 RX 9.953/2.488	1577	+4~+7	1270	<-28@9.953G <-29.5@2.488G	0~70	20	Y