APPROVAL SHEET

Document No	**MT-E-PS-Q0325**
Product Name	**SFP SC Receptacle EPON OLT Transceiver**
Product Model	**SLE20-D6I-T1**
Version	**A0**
Issue Date	**2017-08-22**

Designed By	**Inspected By**	**Approved By**
Shaolong Yan	**Huaitang Xie**	**Jack Wu**

CHANGE RECORD

REV.	Description	Designed	Inspected	Approved	Issue Date
A0	Initial Released	Shaolong Yan	Huaitang Xie	Jack Wu	2017-08-22

SLE20-D6I-T1

Features

◆ Single fiber bi-directional data links TX 1.25Gbps/RX1.25Gbps application

◆ 1490nm continuous-mode DFB laser transmitter and 1310nm burst-mode APD-TIA receiver

◆ Compatible with SFP MSA, Hot-pluggable SFP footprint

◆ Small Form Factor Pluggable package with SC/UPC Connector

◆ -40 to 85°C operating temperature, -40～+85°C storage temperature

◆ Single 3.3V power supply

◆ Digital diagnostic monitoring interface

◆ Small size, it can be used in the optical access system of high density optical interface

◆ Low EMI and excellent ESD protection

◆ Class I laser safety standard IEC-60825 compliant

◆ RoHS6 Compliance

Applications

◆ Gigabit Ethernet Passive Optical Networks (GEPON)

Standards

◆ Complies with SFP Multi-Source Agreement (MSA) SFF-8074i

◆ Complies with IEEE 802.3ah

◆ 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

◆ Complies with SFF-8472

◆ Compatible with TR-NWT-000870 4.1 ESD sensitivity classification Class2.

◆ Compatible with Telcordia GR-468-CORE

General Description

It is based on the IEEE 802.3ah 1000BASE PX-20 specification for bidirectional communications over a single fiber and incorporates a high performance 1310nm burst mode APD Receiver and 1490nm CW mode DFB transmitter.

Specification

Absolute Maximum Ratings				
Parameter	Symbol	Min	Max	Unit
Storage Ambient Temperature	T_{STG}	-40	85	℃
Storage Humidity	H_S	5	90	%
Operating Humidity	H_O	5	85	%
Power Supply Voltage	V_{CC}	0	+3.6	V

Recommended Operating Conditions					
Parameter	Symbol	Min	Typical	Max	Unit
Operating Case Temperature	T_C	-40		85	℃
Power Supply Voltage	V_{CC}	3.135	3.3	3.465	V
Supply Current	I_{CC}			300	mA
Power Consumption	P_W			1.2	W
Data Rate			1.25		Gbps

Electrical Characteristics						
Parameter	Symbol	Min	Typical	Max	Unit	Notes
Transmitter Differential Input Voltage		300		2400	mV	
Receiver Differential Output Voltage		500		1200	mV	LVPECL, DC Coupled
Transmit Fault Alarm Voltage	V_{OH}	2.4		V_{CC}+0.3	V	LVTTL
	V_{OL}	0		0.4	V	LVTTL
Transmit Disable Voltage	V_{IH}	2		V_{CC}+0.3	V	LVTTL
	V_{IL}	0		0.8	V	LVTTL
Input Differential Impedance		90	100	110	Ω	
Transmit Disable Assert Time	T_{OFF}			10	us	
Loss Of Signal Voltage	V_{OH}	2.4		V_{CC}	V	LVTTL
	V_{OL}	0		0.4	V	LVTTL
Loss Of Signal Assert Time	T_D		0.5		us	
Loss Of Signal De-assert Time	T_A		0.5		us	

Optical Transmitter Characteristics						
Parameter	**Symbol**	**Min**	**Typical**	**Max**	**Unit**	**Notes**
Launched Power (avg.)	P_{OUT}	+2		+7	dBm	
Operating Wavelength Range	λ_C	1480		1500	nm	
Spectral Width (-20dB)	$\Delta\lambda$			1	nm	
Side Mode Suppression Ratio	SMSR	30				
Extinction Ratio	ER	9			dB	PRBS 2^7-1 @1.25Gbit/s
Transmitter and Dispersion Penalty	TDP			2.3	dB	Transmit on 20km SMF
Optical Output Power after TX Disable	P_{DIS}			-39	dBm	
Output Eye Diagram	Compliant with IEEE 802.3ah					
Optical return loss tolerance				15	dB	
Transmitter Reflectance				-10	dB	
Optical Receiver Characteristics						
Parameter	**Symbol**	**Min**	**Typical**	**Max**	**Unit**	**Notes**
Wavelength Range	λ_C	1260		1360	nm	
Receiver Sensitivity	P_{SEN}			-30	dBm	PRBS 2^7-1@1.25Gbps, transmitter is operating, BER ≤1×10⁻¹⁰
Optical Power Input Overload	S_{AT}	-6			dBm	
Receiver Reflectance				-12	dB	
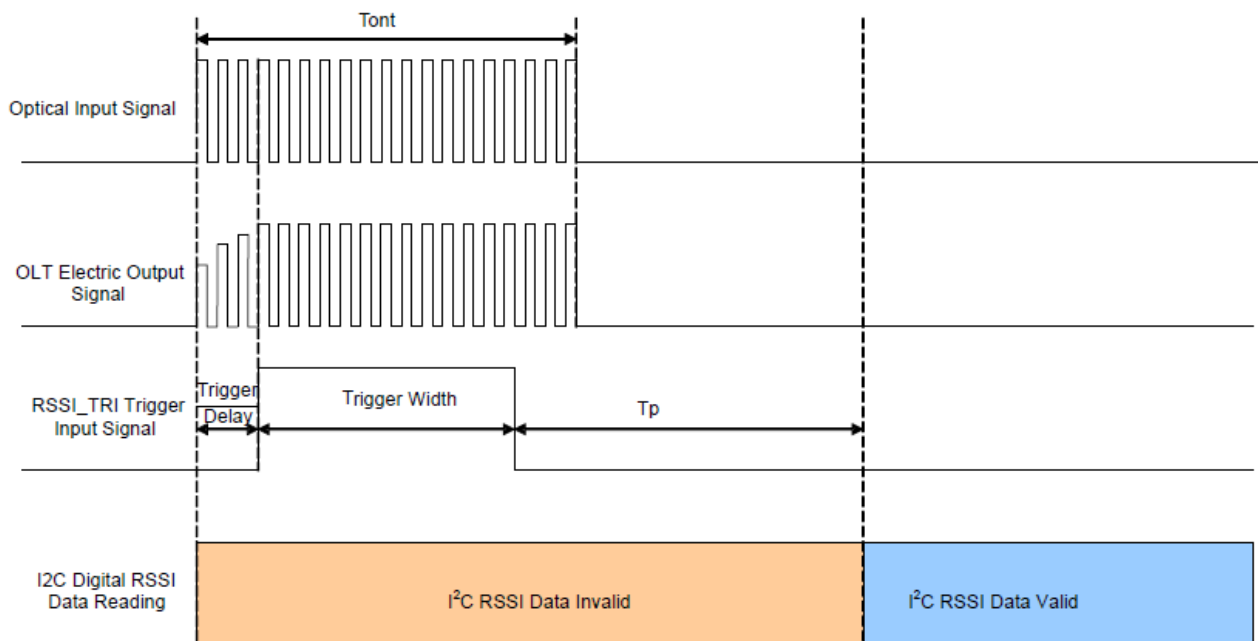
Figure 1 RSSI TIMING SEQUENCE

RSSI Characteristics						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
RSSI Trigger-Low		0		0.8	V	
RSSI Trigger-High		2.0		Vcc	V	
RSSI Trigger Delay	T_D	0		3000	ns	
Optical Signal During Time	T_{ONT}	300			ns	
RSSI Trigger width	T_W	300		$T_{ONT} - T_D$	ns	
I2C Access Prohibited Time	Tp			500	µs	

Digital Diagnostic Monitoring Information

Parameter	Accuracy	Calibration	Note
Temperature	±3°C	Internal	
Voltage	±3%	Internal	
Bias Current	±10%	Internal	
TX Power	±3dB	Internal	
RX Power	±3dB	Internal	-30 to -6dBm

Note: The digital diagnostic monitoring interface defines 256-byte memory map in EEPROM, which makes use of the 8 bit address 1010001X(A2h). Please refer to the SFF-8472 for the detail information.

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Pin definition

Pin No	Symbol	Name/Description	Power Seq.	Note
1	$V_{EE}T$	Transmitter Ground	1st	
2	TX Fault	Transmitter Fault Indication	3rd	High: abnormal; Low: normal
3	TX Disable	Transmitter Disable	3rd	High: transmitter disable; Low: transmitter enable. Internally 4.7k-10kΩ pull-up.
4	MOD-DEF2	Module Definition 2	3rd	The data line of two wire serial interface
5	MOD-DEF1	Module Definition 1	3rd	The clock line of two wire serial interface
6	MOD-DEF0	Module Definition 0	3rd	Connected to Ground in the transceiver
7	RSSI Trigger	RSSI Trigger for Transceiver A/D Conversion	3rd	High: enable RSSI A/D conversion
8	RX_LOS	Loss of Signal	3rd	High: loss of signal; Low: signal detected;
9	$V_{EE}R$	Receiver Ground	1st	
10	$V_{EE}R$	Receiver Ground	1st	
11	$V_{EE}R$	Receiver Ground	1st	
12	RD-	Inv. Receiver Data Out	3rd	LVPECL logic output, DC coupled
13	RD+	Receiver Data Out	3rd	LVPECL logic output, DC coupled
14	$V_{EE}R$	Received Ground	1st	
15	$V_{CC}R$	Receiver Power	2nd	
16	$V_{CC}T$	Transmitter Power	2nd	
17	$V_{EE}T$	Transmitter Ground	1st	
18	TD+	Transmit Data In	3rd	LVPECL logic input, AC coupled
19	TD-	Inv. Transmit Data In	3rd	LVPECL logic input, AC coupled
20	$V_{EE}T$	Transmitter Ground	1st	

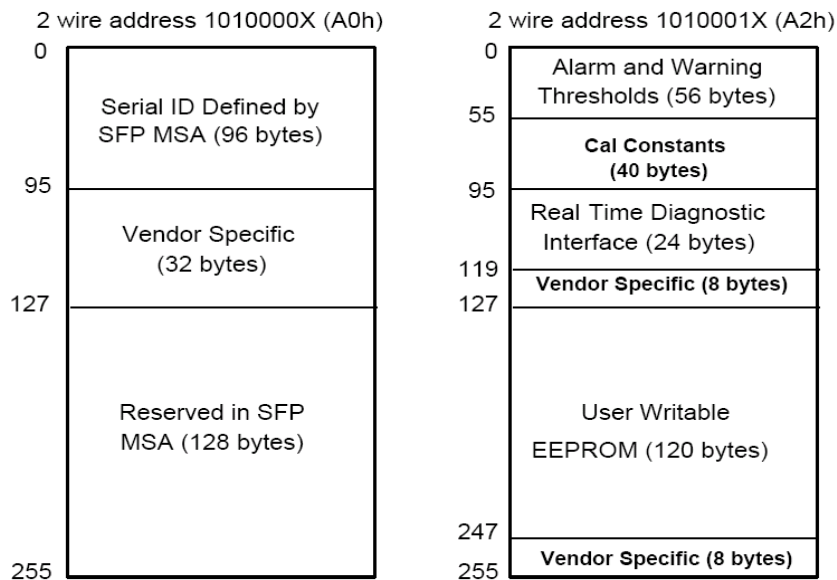## Typical application Circuit
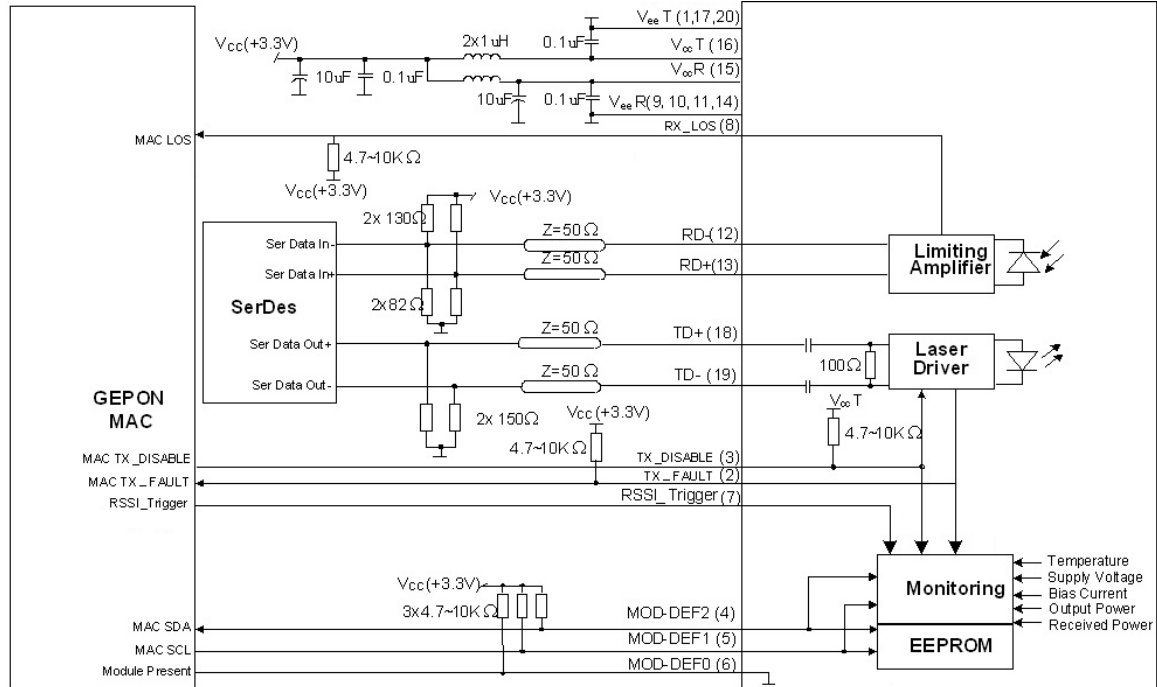
Figure 2 Typical Interface Circuit

EEPROM Memory Map

2 wire address 1010000X (A0h)

0	
	Serial ID Defined by SFP MSA (96 bytes)
95	
	Vendor Specific (32 bytes)
127	
	Reserved in SFP MSA (128 bytes)
255	

2 wire address 1010001X (A2h)

0	
	Alarm and Warning Thresholds (56 bytes)
55	
	Cal Constants (40 bytes)
95	
	Real Time Diagnostic Interface (24 bytes)
119	
	Vendor Specific (8 bytes)
127	
	User Writable EEPROM (120 bytes)
247	
	Vendor Specific (8 bytes)
255	

Figure 3 EEPROM Memory Map Specific Data Field Descriptions

EEPROM Serial ID Memory Contents

The optical transceiver contains an EEPROM. It provides access to sophisticated identification information that describes the transceiver's capabilities, standard interfaces, manufacturer, and other information. When the serial protocol is activated, the host generates the serial clock signal (SCL, Mod Def 1). The positive edge clocks data into those segments of the EEPROM that are not writing protected within the SFP transceiver. The negative edge clocks data from the SFP transceiver. The serial data signal (SDA, Mod Def 2) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially.

The Module provides diagnostic information about the present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Calibration and alarm/warning threshold data is written during device manufacture. Received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring all are implemented. The diagnostic data are raw A/D values and must be converted to real world units using calibration constants stored in EEPROM locations 56 – 95 at wire serial bus address A2h. The digital diagnostic memory map specific data fields define as following.

EEPROM Serial ID Memory Contents (2-Wire Address A0h)

Address	Name of field	Hex	Description
BASE ID Fields			
00	Identifier	03	SFP transceiver
01	Ext. Identifier	04	Serial ID module supported for SFP
02	Connector	01	SC
03-05	Transceiver Codes	00 00 00	Not defined
06	Transceiver Codes	80	Not defined
07-10	Transceiver Codes	00 00 00	Not defined
11	Encoding	01	Encoding codes
12	BR, Nominal	0C	
13	Rate Identifier	00	Not defined
14	Length(9um)-km	14	
15	Length(9um)-m	C8	
16	Length(50um)	00	Transceiver transmit distance
17	Length(62.5um)	00	
18	Length(cable)	00	Not support cable
19	Length(OM3)	00	Not support OM3

20-35	Vendor Name	4D 45 4E 54 45 43 48 4F 50 54 4F 20 20 20 20 20	"MENTECHOPTO"(ASCII character)
36	Reserved	00	Not defined
37-39	Vendor OUI	00 00 00	Not defined
40-55	Vendor P/N	53 4C 45 32 30 2D 44 36 49 2D 54 31	"SLE20-D6I-T1"(ASCII character)
56-59	Vendor P/N Rev.	41 30 20 20	"A0"(ASCII character)
60-61	Laser Wavelength	05 D2	1490nm
62	Reserved	00	Not defined
63	CC_BASE	xx	Check sum of bytes 0-62
Extended ID Fields			
64-65	Options	00 1A	TX_Disable、TX_Fault and RX_LOS are implemented
66	BR，max	00	Upper bit rate margin,20%
67	BR，min	00	Lower bit rate margin,20%
68-83	Vendor SN	xx…..xx	Vendor Serial Number in ASCII character
84-91	Date Code	Data Code	Vendor Date Code in ASCII character
92	Diagnostic Monitoring Type	58	Digital Diagnostic monitoring implemented "External calibrated " is implemented, RX measurement type is "Average Power"
93	Enhanced options	E0	Optional Alarm/warning flags, soft Tx_Disable control and monitoring, soft Tx_Fault monitoring are implemented
94	SFF-8472 compliant	03	SFF-8472 compliant with revision 10.2
95	CC-EXT	xx	Check sum of bytes 64-94
Vendor Specific ID Field			
96-127	Vendor Specific	00	Vendor specific EEPROM
128-255	Reserved	00	Reserved for future use

Digital Diagnostic Monitoring Interface：Alarm and Warning Thresholds

(2-Wire Address A2h)

Address	Field Size (Byte)	Bits	Name of Field	Description
00~01	2	ALL	Temp High Alarm	MSB at low address, 105°C

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02~03	2	ALL	Temp Low Alarm	MSB at low address, -45°C
04~05	2	ALL	Temp High Warning	MSB at low address, 100°C
06~07	2	ALL	Temp Low Warning	MSB at low address, -40°C
08~09	2	ALL	Voltage High Alarm	MSB at low address, 3.6V
10~11	2	ALL	Voltage Low Alarm	MSB at low address, 3.0V
12~13	2	ALL	Voltage High Warning	MSB at low address, 3.5V
14~15	2	ALL	Voltage Low Warning	MSB at low address, 3.1V
16~17	2	ALL	Bias High Alarm	MSB at low address, 90mA
18~19	2	ALL	Bias Low Alarm	MSB at low address, 1mA
20~21	2	ALL	Bias High Warning	MSB at low address, 70mA
22~23	2	ALL	Bias Low Warning	MSB at low address, 2mA
24~25	2	ALL	TX Power High Alarm	MSB at low address, 8dBm
26~27	2	ALL	TX Power Low Alarm	MSB at low address, 1dBm
28~29	2	ALL	TX Power High Warning	MSB at low address, 7dBm
30~31	2	ALL	TX Power Low Warning	MSB at low address,2dBm
32~33	2	ALL	RX Power High Alarm	MSB at low address, -5dBm
34~35	2	ALL	RX Power Low Alarm	MSB at low address, -31dBm
36~37	2	ALL	RX Power High Warning	MSB at low address, -6dBm
38~39	2	ALL	RX Power Low Warning	MSB at low address, -30dBm
40~55	16	ALL	Reserved	Reserved
56~59	4	ALL	Rx_PWR(4)	Single precision floating point calibration data - Rx optical power. Bit7 of byte 56 is MSB. Bit 0 of byte 59 is LSB. For "internally calibrated" devices, Rx_PWR(4) should be set to zero , and useless.
60~63	4	ALL	Rx_PWR(3)	Single precision floating point calibration data - Rx optical power. Bit 7 of byte 60 is MSB. Bit 0 of byte 63 is LSB. For "internally calibrated" devices, Rx_PWR(3) should be set to zero , and useless.
64~67	4	ALL	Rx_PWR(2)	Single precision floating point calibration data, Rx optical power. Bit 7 of byte 64 is MSB, bit 0 of byte 67 is LSB. For "internally calibrated" devices, Rx_PWR(2) should be set to zero, and useless.
68~71	4	ALL	Rx_PWR(1)	Single precision floating point calibration data, Rx optical power. Bit 7 of byte 68 is MSB, bit 0 of byte 71 is LSB. For "internally calibrated" devices, Rx_PWR(1) should be set to 1 , and useless.
72~75	4	ALL	Rx_PWR(0)	Single precision floating point calibration data, Rx optical power. Bit 7 of byte 72 is MSB, bit 0 of byte 75 is LSB. For "internally calibrated" devices, Rx_PWR(0) should be set to zero , and useless.

76~77	2	ALL	Tx_I(Slope)	Fixed decimal (unsigned) calibration data, laser bias current. Bit 7 of byte 76 is MSB, bit 0 of byte 77 is LSB. For "internally calibrated" devices, Tx_I(Slope) should be set to 1, and useless.
78~79	2	ALL	Tx_I(Offset)	Fixed decimal (signed two's complement) calibration data, laser bias current. Bit 7 of byte 78 is MSB, bit 0 of byte 79 is LSB. For "internally calibrated" devices, Tx_I(Offset)should be set to zero , and useless.
80~81	2	ALL	Tx_PWR(Slope)	Fixed decimal (unsigned) calibration data, transmitter coupled output power. Bit 7 of byte 80 is MSB, bit 0 of byte 81 is LSB.For "internally calibrated" devices, Tx_PWR(Slope) should be set to 1 , and useless.
82~83	2	ALL	Tx_PWR(Offset)	Fixed decimal (signed two's complement) calibration data, transmitter coupled output power. Bit 7 of byte 82 is MSB, bit 0 of byte 83 is LSB. For "internally calibrated" devices, Tx_PWR(Offset) should be set to zero , and useless.
84~85	2	ALL	T (Slope)	Fixed decimal (unsigned) calibration data, internal module temperature. Bit 7 of byte 84 is MSB, bit 0 of byte 85 is LSB.For "internally calibrated" devices, T(Slope) should be set to 1, and useless.
86~87	2	ALL	T (Offset)	Fixed decimal (signed two's complement) calibration data, internal module temperature. Bit 7 of byte 86 is MSB, bit 0 of byte 87 is LSB. For "internally calibrated" devices,T(Offset) should be set to zero, and useless.
88~89	2	ALL	V (Slope)	Fixed decimal (unsigned) calibration data, internal module supply voltage. Bit 7 of byte 88 is MSB, bit 0 of byte 89 is LSB. For "internally calibrated" devices, V(Slope)should be set to 1 , and useless.
90~91	2	ALL	V (Offset)	Fixed decimal (signed two's complement) calibration data, internal module supply voltage. Bit 7 of byte 90 is MSB. Bit 0 of byte 91 is LSB. For "internally calibrated" devices, V(Offset) should be set to zero, and useless.
92~94	3	ALL	Reserved	Reserved
95	1	ALL	Checksum	Byte 95 contains the low order 8 bits of the sum of bytes 0 – 94.
96	1	ALL	Temperature MSB	Internally measured module temperature.

97	1	ALL	Temperature LSB	
98	1	ALL	Vcc MSB	Internally measured supply voltage in transceiver.
99	1	ALL	Vcc LSB	
100	1	ALL	TX Bias MSB	Internally measured TX Bias Current.
101	1	ALL	TX Bias LSB	
102	1	ALL	TX Power MSB	Measured TX output power.
103	1	ALL	TX Power LSB	
104	1	ALL	RX Power MSB	Measured RX input power.
105	1	ALL	RX Power LSB	
106~109	2	ALL	Reserved	Reserved
110	1	7	TX Disable State	Digital state of the TX Disable Input Pin. Updated within 100ms of change on pin.
		6	Soft TX Disable	Read/write bit that allows software disable of laser. Writing '1' disables laser.
		5	Reserved	Reserved
		4	Reserved	Reserved
		3	Reserved	Reserved
		2	TX Fault	Tx Fail Status: 1=TX Fail; 0=TX Normal
		1	Reserved	Reserved
		0	Reserved	Reserved
111	1	ALL	Reserved	Reserved
112	1	7	Temp High Alarm	Set when internal temperature exceeds high alarm level.
		6	Temp Low Alarm	Set when internal temperature is below low alarm level.
		5	Vcc High Alarm	Set when internal supply voltage exceeds high alarm level.
		4	Vcc Low Alarm	Set when internal supply voltage is below low alarm level.
		3	TX Bias High Alarm	Set when TX Bias current exceeds high alarm level.
		2	TX Bias Low Alarm	Set when TX Bias current is below low alarm level.
		1	TX Power High Alarm	Set when TX output power exceeds high alarm level.
		0	TX Power Low Alarm	Set when TX output power is below low alarm level.
113	1	7	RX Power High Alarm	Set when Received Power exceeds high alarm level.
		6	RX Power Low Alarm	Set when Received Power is below low alarm level.
		5	Reserved	Reserved
		4	Reserved	Reserved
		3	Reserved	Reserved
		2	Reserved	Reserved

		1	Reserved	Reserved
		0	Reserved	Reserved
114	1	ALL	Reserved	Reserved
115	1	ALL	Reserved	Reserved
116	1	7	Temp High Warning	Set when internal temperature exceeds high warning level.
		6	Temp Low Warning	Set when internal temperature is below low warning level.
		5	Vcc High Warning	Set when internal supply voltage exceeds high warning level.
		4	Vcc Low Warning	Set when internal supply voltage is below low warning level.
		3	TX Bias High Warning	Set when TX Bias current exceeds high warning level.
		2	TX Bias Low Warning	Set when TX Bias current is below low warning level.
		1	TX Power High Warning	Set when TX output power exceeds high warning level.
		0	TX Power Low Warning	Set when TX output power is below low warning level.
117	1	7	RX Power High Warning	Set when Received Power exceeds high warning level.
		6	RX Power Low Warning	Set when Received Power is below low warning level.
		5	Reserved	Reserved
		4	Reserved	Reserved
		3	Reserved	Reserved
		2	Reserved	Reserved
		1	Reserved	Reserved
		0	Reserved	Reserved
118	1	ALL	Reserved	Reserved
119	1	ALL	Reserved	Reserved
120-127	8	ALL	Vendor Specific	Vendor Specific
128-247	120	ALL	User EEPROM	User writable EEPROM
248-255	8	ALL	Vendor Specific	Vendor Specific

Package Outline
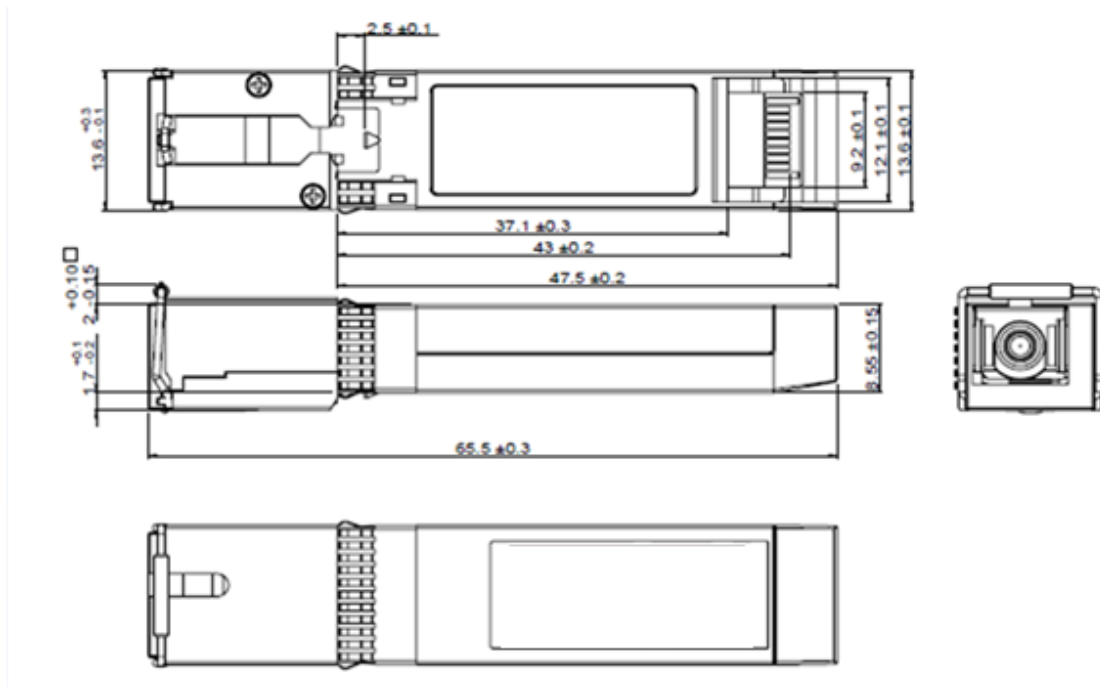
Figure 6 Package Outline

Ordering information

PART NO.	Specifications									DDM
	Package	Type	Rate	Tx	Po	Rx	Sen	Temp	Reach	
			(Gbps)	(nm)	(dBm)	(nm)	(dBm)	(℃)	(km)	
SLE20-D6I-T1	SFP	EPON OLT	1.25 TX/ 1.25 RX	1490	2~7	1310	<-30	-40~85	20	Y