



# ETU-LINK


Optical Communication System

## SFP28 Series

### SFP28

#### ES2Dxx3X-3LCD10

#### SFP28 DWDM 32G FC 10KM

- Hot-pluggable SFP28 form factor
- Supports 24.33Gb/s & 25.78Gb/s aggregate bit rate
- Supports 28.05Gb/s aggregate bit rate
- Transmitter: cooled 25Gb/s DWDM EML TOSA
- Compliant to ITU-T 694.1
- Receiver: 25Gb/s APD ROSA
- Internal CDR circuits on both receiver and transmitter channels
- 1.8W maximum power dissipation
- Maximum link length of 10Km over SMF
- Duplex LC receptacle
- Operating case temperature range: -40 to 85° C
- Single 3.3V power supply
- RoHS 2.0 compliant (2011/65/EU, lead free) 



## Applications

- CPRI Option 10
- 25G Ethernet
- 32G FC

## Description

This product is a 32G FC SFP28 transceiver designed for optical communication compliant with 25GE and 32G FC standard. Its high performance cooled DWDM EML transmitter and high sensitivity APD receiver provide superior performance for 25GE and 32G FC application up to 10km (with FEC) Links.

The product is designed with SFP28 form factor, which is the optical/electrical connection according to the SFP+ Multi-Source Agreement (MSA).

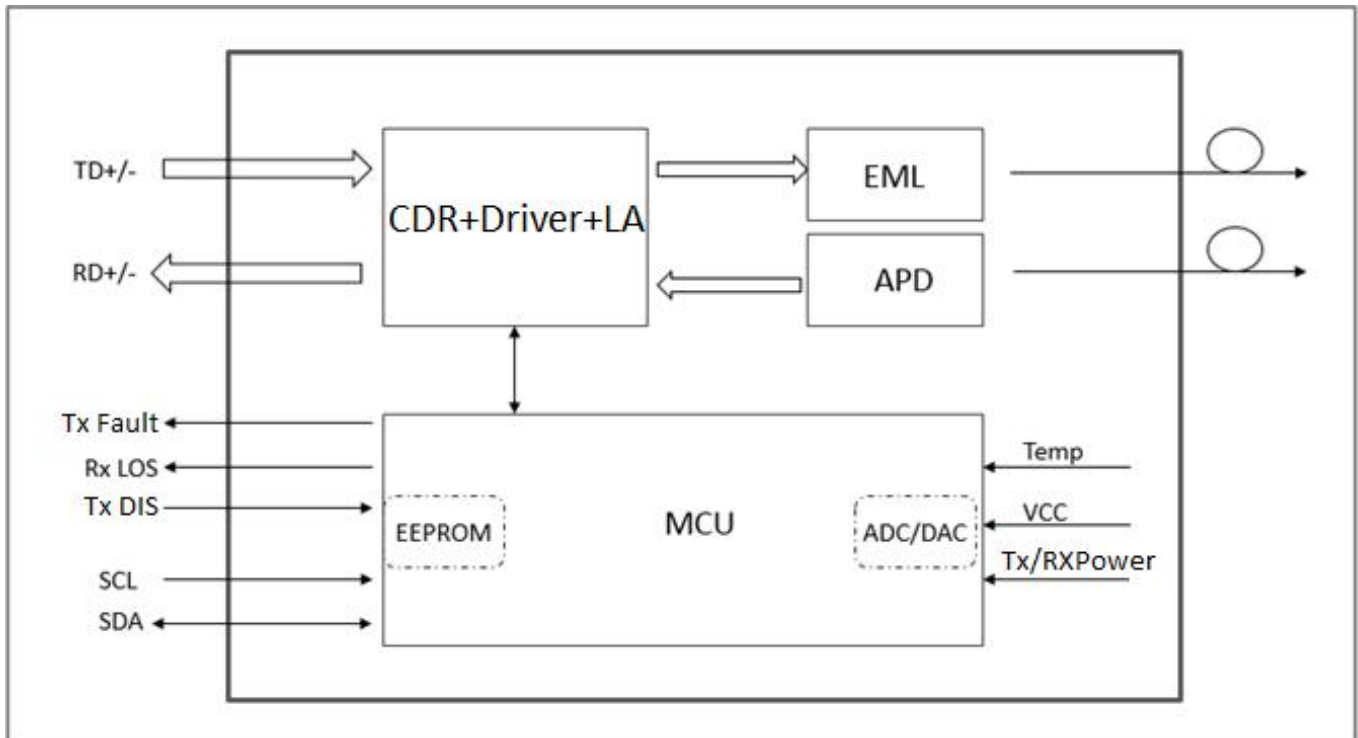


Figure 1. Module Block Diagram

The SFP28 is an Enhanced Small Form Factor Pluggable SFP+ transceiver, and can be contacted through I2C system.

## Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Supply Voltage	Vcc	-0.3	3.6	V
Input Voltage	Vin	-0.3	Vcc+0.3	V
Storage Temperature	Ts	-40	85	°C
Case Operating Temperature	Tc	-40	85	°C
Humidity (non-condensing)	Rh	0	85	%

## Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Unit
Supply Voltage	Vcc	3.13	3.3	3.47	V
Operating Case Temperature	Tc	-40		85	°C
Data Rate Per Lane	fd		24.33/25.78/ 28.05		Gb/s
Humidity	Rh	0		85	%
Power Dissipation	Pm			2	W
Fiber Bend Radius	Rb	3			cm

## Electrical Specifications

Parameter	Symbol	Min	Typical	Max	Unit
Differential Input Impedance	Zin	90	100	110	ohm
Differential Output Impedance	Zout	90	100	110	ohm
Differential Input Voltage Amplitude1	$\Delta V_{in}$	300		1100	mVp-p
Differential Output Voltage Amplitude2	$\Delta V_{out}$	500		800	mVp-p
Skew	Sw			300	ps
Bit Error Rate	BER			5E-5	
Input Logic Level High	V <sub>IH</sub>	2.0		Vcc	V
Input Logic Level Low	V <sub>IL</sub>	0		0.8	V
Output Logic Level High	V <sub>OH</sub>	Vcc-0.5		Vcc	V
Output Logic Level Low	V <sub>OL</sub>	0		0.4	V

### Note:

1. Differential input voltage amplitude is measured between TxnP and TxnN.
2. Differential output voltage amplitude is measured between RxnP and RxnN.

## Optical Characteristics

Parameter	Symbol	Min	Typical	Max	Unit
<b>Transmitter</b>					
Optical Wavelength	$\lambda_c$	per ITU-T 694.1			nm
Center Wavelength Deviation (End of Life)	d	±100			pm
Side-Mode Suppression Ratio	SMSR	30			dB
Average Launch Power	P <sub>out</sub>	-5		2	dBm
Optical Modulation Amplitude	OMA	-2			dBm
Extinction Ratio	ER	7			dB
Average Launch Power of OFF Transmitter	P <sub>off</sub>			-30	dB
Rin20OMA				-130	dB/HZ
Optical return loss tolerance	ORL			20	dB
<b>Receiver</b>					
Center Wavelength	$\lambda_c$	1260		1600	nm
Receiver Sensitivity in OMA2	RS <sub>oma</sub>			-11.4	dBm
Average Power at Receiver Input (each lane)	P <sub>in</sub>	-27		-5	dBm
Receiver Reflectance	RR			-26	dB
LOS Assert	LOSA	-30			dBm
LOS De-Assert	LOSD			-18	dBm
LOS Hysteresis	LOSH	0.5			dB

**Note:**

1. Hit Ratio =  $5 \times 10^{-5}$
2. Unstressed receiver OMA sensitivity.

## C-band $\lambda_c$ Wavelength Grid

ITU Channel Product Code	Frequency(THz)	Wavelength	ITU Channel Product Code	Frequency(THz)	Wavelength
			40	194.0	1545.32
18	191.8	1563.05	41	194.1	1544.53
19	191.9	1562.23	42	194.2	1543.73
20	192.0	1561.42	43	194.3	1542.94
21	192.1	1560.61	44	194.4	1542.14
22	192.2	1559.79	45	194.5	1541.35
23	192.3	1558.98	46	194.6	1540.56
24	192.4	1558.17	47	194.7	1539.77
25	192.5	1557.36	48	194.8	1538.98
26	192.6	1556.55	49	194.9	1538.19
27	192.7	1555.75	50	195.0	1537.40
28	192.8	1554.94	51	195.1	1536.61
29	192.9	1554.13	52	195.2	1535.82
30	193.0	1553.33	53	195.3	1535.04
31	193.1	1552.52	54	195.4	1534.25
32	193.2	1551.72	55	195.5	1533.47
33	193.3	1550.92	56	195.6	1532.68
34	193.4	1550.12	57	195.7	1531.90
35	193.5	1549.32	58	195.8	1531.12
36	193.6	1548.51	59	195.9	1530.33
37	193.7	1547.72	60	196.0	1529.55
38	193.8	1546.92	61	196.1	1528.77
39	193.9	1546.12			

**Table 1. Product ordering codes: the central wavelength is defined as per ITU-T 694.1**

## Pin Descriptions

Pin	Logic	Symbol	Name/Description	Note
1		VeeT	Module Transmitter Ground	1
2	LVTTL-O	TX_Fault	Module Transmitter Fault	2
3	LVTTL-I	TX_Dis	Transmitter Disable; Turns off transmitter laser output	
4	LVTTL-I/O	SDA	2-Wire Serial Interface Data Line	2
5	LVTTL-I	SCL	2-Wire Serial Interface Clock	2
6		MOD_ABS	Module Definition, Grounded in the module	
7	LVTTL-I	RS0	Receiver Rate Select	
8	LVTTL-O	RX_LOS	Receiver Loss of Signal Indication Active LOW	
9	LVTTL-I	RS1	Transmitter Rate Select (not used)	
10		VeeR	Module Receiver Ground	1
11		VeeR	Module Receiver Ground	1
12	CML-O	RD-	Receiver Inverted Data Output	
13	CML-O	RD+	Receiver Data Output	
14		VeeR	Module Receiver Ground	1
15		VccR	Module Receiver 3.3 V Supply	
16		VccT	Module Receiver 3.3 V Supply	
17		VeeT	Module Transmitter Ground	1
18	CML-I	TD+	Transmitter Non-Inverted Data Input	
19	CML-I	TD-	Transmitter Inverted Data Input	
20		VeeT	Module Transmitter Ground	1

### Note:

1. Module ground pins GND are isolated from the module case.
2. Shall be pulled up with 4.7K-10Kohms to a voltage between 3.15V and 3.45V on the host board.

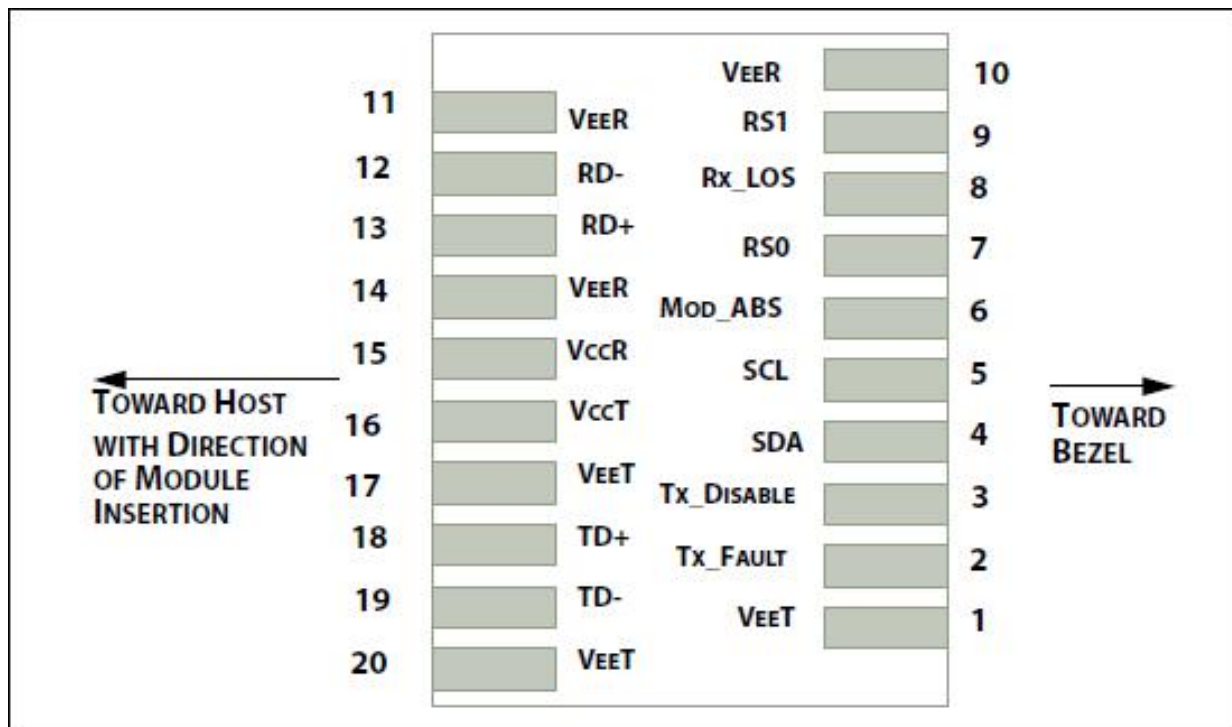


Figure 2. Electrical Pin-out Details

#### TX\_FAULT Pin

Tx\_Fault is a module output that when high, indicates that the module transmitter has detected a fault condition related to laser operation or safety. The Tx\_Fault output 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 kΩ to 10 kΩ.

#### TX\_DISABLE Pin

When Tx\_Disable is asserted high or left open, the SFP+ module transmitter output shall be turned off unless the module is a passive cable assembly. This contact shall be pulled up to VccT with a 4.7 kΩ to 10 kΩ resistor in modules and cable assemblies. Tx\_Disable is a module input contact.

#### RS0/RS1 Pin

RS0 and RS1 are module inputs and are pulled low to VeeT with > 30 kΩ resistors in the module. RS0 optionally selects the optical receive signaling rate coverage. RS1 optionally selects the optical transmit signaling rate coverage.

#### MOD\_ABS Pin

Mod\_ABS is connected to VeeT or VeeR in the SFP+ module. The host may pull this contact up to Vcc\_Host with a resistor in the range 4.7 kΩ to 10 kΩ. Mod\_ABS is asserted "High" when the SFP+ module is physically absent from a host slot. In the SFP MSA (INF-8074i) this contact has the same function but is called MOD\_DEF0.

#### RX\_LOS Pin

Rx\_LOS when high indicates an optical signal level below that specified in the relevant standard. Rx\_LOS is an open drain/collector output, but may also be used as an input by supervisory circuitry in the module. For a nominally 3.3 V Vcc\_Host using a resistive pull up to Vcc\_Host the resistor value shall be in the range 4.7 kΩ to 10 kΩ. For a nominally 2.5 V Vcc\_Host using a resistive pull up to Vcc\_Host the resistor value shall be in the range 4.7 kΩ to 7.2 kΩ.

## Recommended Interface Circuit

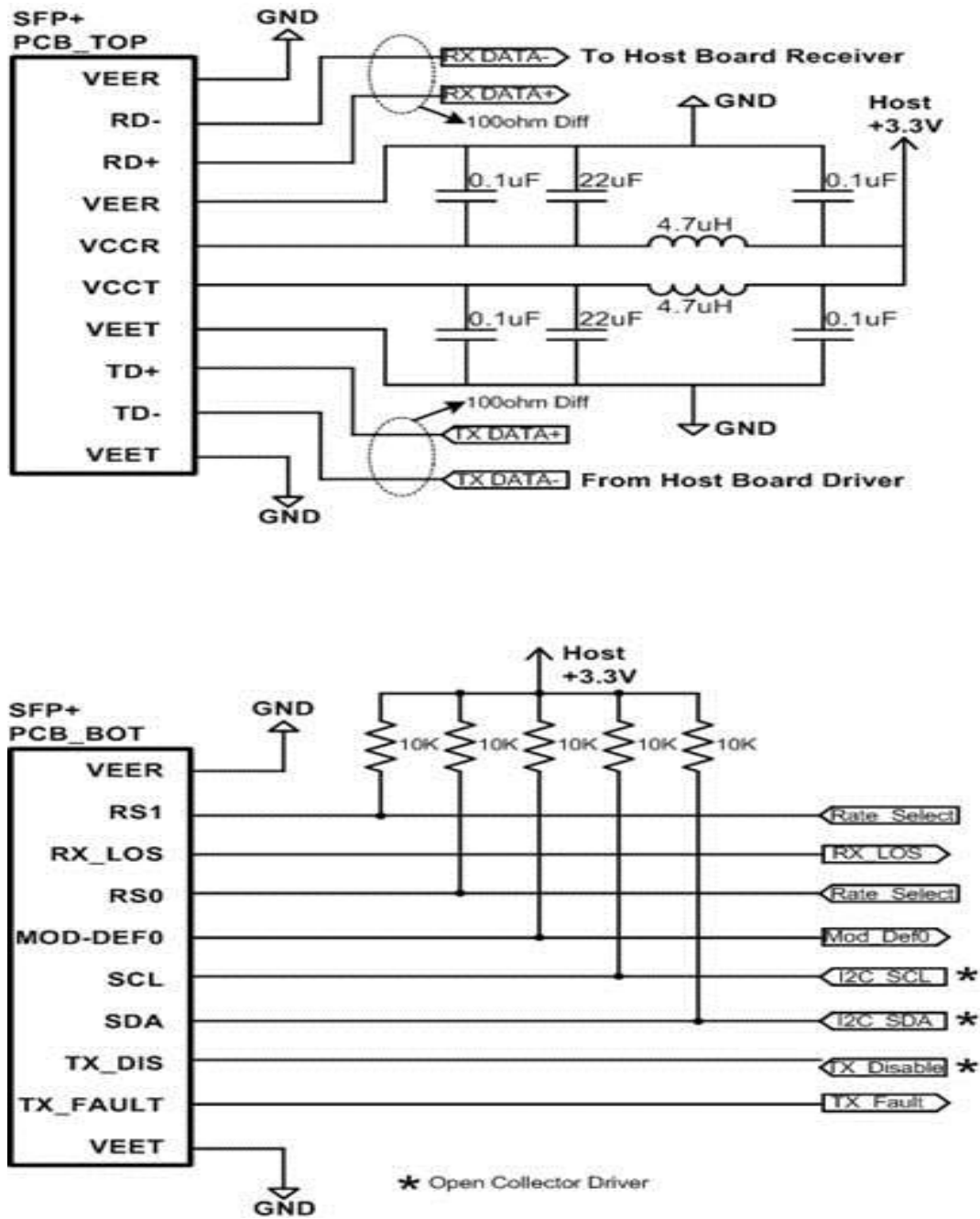


Figure 3. Recommended Interface Circuit



## Memory Organization

The transceivers provide serial ID memory contents and diagnostic information about the present operating conditions by the 2-wire serial interface (SCL, SDA).

The memory map specific data field defines as following.

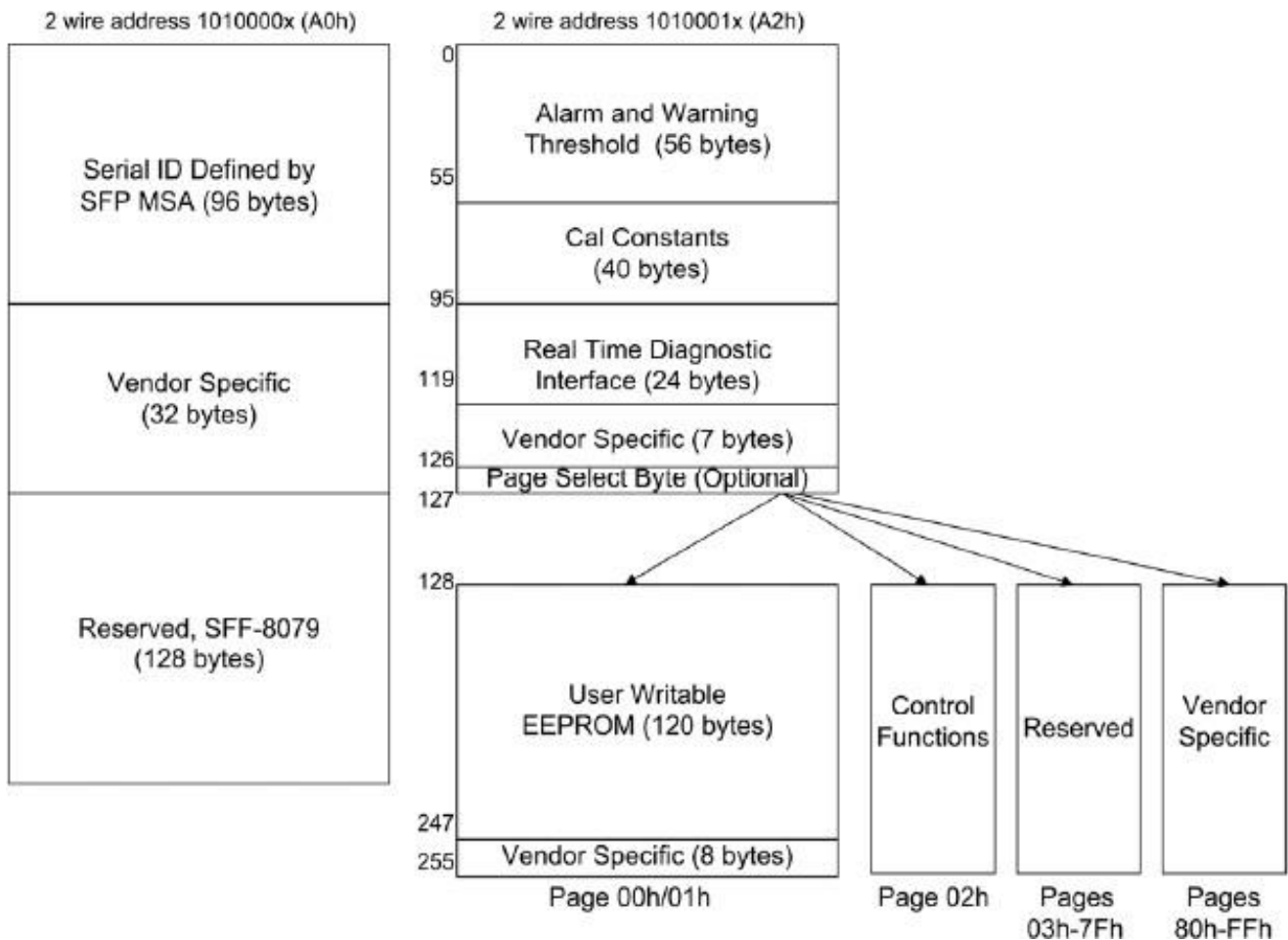


Figure 4. SFP28 Memory Map

## Timing and Electrical

<i>Parameter</i>	<i>Symbol</i>	<i>Min.</i>	<i>Max.</i>	<i>Unit</i>	<i>Conditions</i>
Tx_Disable assert time	t_off		100	μs	Rising edge of Tx_Disable to fall of output signal below 10% of nominal
Tx_Disable negate time	t_on		2	ms	Falling edge of Tx_Disable to rise of output signal above 90% of nominal. This only applies in normal operation, not during start up or fault recovery.
Time to initialize 2-wire interface	t_2w_start_up		300	ms	From power on or hot plug after the supply meeting <a href="#">Table 8</a> .
Time to initialize	t_start_up		300	ms	From power supplies meeting <a href="#">Table 8</a> or hot plug or Tx disable negated during power up, or Tx_Fault recovery, until non-cooled power level I part (or non-cooled power level II part already enabled at power level II for Tx_Fault recovery) is fully operational.
Time to initialize cooled module and time to power up a cooled module to Power Level II	t_start_up_cooled		90	s	From power supplies meeting <a href="#">Table 8</a> or hot plug, or Tx disable negated during power up or Tx_Fault recovery, until cooled power level I part (or cooled power level II part during fault recovery) is fully operational. Also, from stop bit low-to-high SDA transition enabling Power Level II until cooled module is fully operational
Time to Power Up to Level II	t_power_level2		300	ms	From stop bit low-to-high SDA transition enabling power level II until non-cooled module is fully operational
Time to Power Down from Level II	t_power_down		300	ms	From stop bit low-to-high SDA transition disabling power level II until module is within power level I requirements
Tx_Fault assert	Tx_Fault_on		1	ms	From occurrence of fault to assertion of Tx_Fault
Tx_Fault assert for cooled module	Tx_Fault_on_cooled		50	ms	From occurrence of fault to assertion of Tx_Fault
Tx_Fault Reset	t_reset	10		μs	Time Tx_Disable must be held high to reset Tx_Fault
RS0, RS1 rate select timing for FC	t_RS0_FC, t_RS1_FC		500	μs	From assertion till stable output
RS0, RS1 rate select timing non FC	t_RS0, t_RS1		24	ms	From assertion till stable output
Rx_LOS assert delay	t_los_on		100	μs	From occurrence of loss of signal to assertion of Rx_LOS
Rx_LOS negate delay	t_los_off		100	μs	From occurrence of presence of signal to negation of Rx_LOS

## Mechanical Dimensions

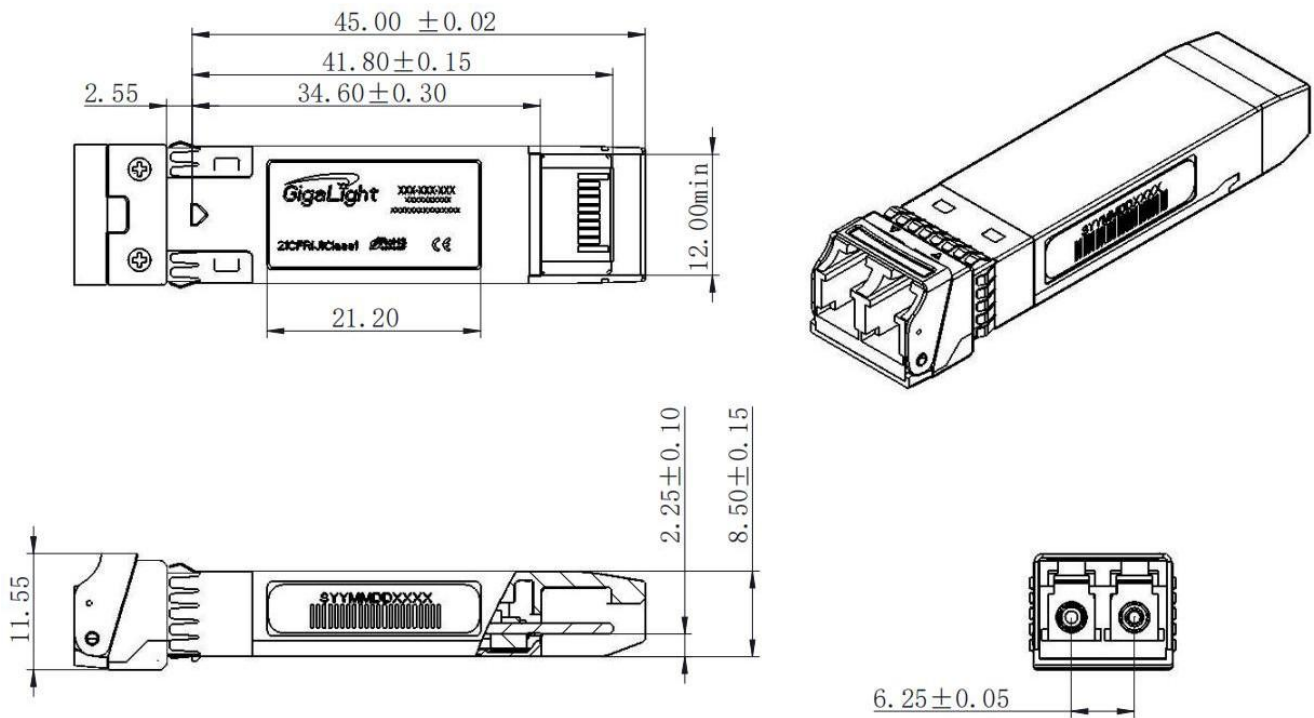


Figure 5. Mechanical Specifications

## Regulatory Compliance

Transceivers are Class 1 Laser Products. They are certified per the following standards:

Feature	Standard
Laser Safety	IEC 60825-1:2014 (Third Edition)
Environmental protection	2011/65/EU
CE EMC	EN55032: 2015 EN55035: 2017 EN61000-3-2:2014 EN61000-3-3:2013
FCC	FCC Part 15, Subpart B; ANSI C63.4-2014

## References

1. SFP28 MSA
2. Ethernet IEEE802.3cc
3. Directive 2011/65/EU of the European Parliament and of the Council, “on the restriction of the use of certain hazardous substances in electrical and electronic equipment,” July 1, 2011.

## CAUTION

Use of controls or adjustment or performance of procedures other than those specified herein may result in hazardous radiation exposure.

## Ordering information

Part Number	Product Description
ES2Dxx3X-3LCD10	CPRI Option 10, 25GE, 32G FC, SFP28 DWDM, 10km, -40°C ~ +85°C xx – DWDM Channel No(18~61).

## Important Notice

Performance figures, data and any illustrative material provided in this data sheet are typical and must be specifically confirmed in writing by before they become applicable to any particular order or contract. In accordance with the policy of continuous improvement specifications may change without notice.

The publication of information in this data sheet does not imply freedom from patent or other protective rights of or others. Further details are available from any sales representative.

## Compatibility Test

In order to ensure the product compatibility, our products will be tested on the switch before shipment. Our modules can compatible with many mainstream brand switches, such as Cisco, Juniper, Extreme, Brocade, IBM, H3C, HP, Huawei, D-Link, Mikrotik, ZTE, TP-Link...

Our test equipment: VOLKTEK MEN-4110, HP 2530-8G, CRS226-24G-25+RM, Catalyst 2960G Series, Catalyst 3850 XS 10G SFP+, Catalyst 3750-E Series, HUAWEI S5700Series, H3C S3100V2 Series, Juniper-EX4200, etc.



**Cisco Catalyst 3850**



**HUAWEI S5700**



**H3C S3100V2**



**HP J9264AR**



**Juniper EX 4200**



**Alcatel 6850E-U24X**



**Mikrotik CR5226-24G-25+RM**



**Cisco Catalyst 2960G**



**Volktek MEN-4110**

## Product Production Process

# Quality Assurance

Continuous introduction of new equipment, produced by strict standards, strict quality inspection, to guarantee the high quality standard of each product.



**Standardized  
Production Line**



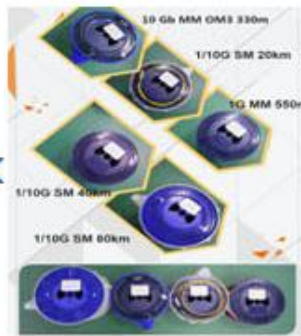
**Professional  
Welding**



**Assembling**



**Aging Testing**



**Distance Testing**



**Cleaning end face**



**Product Initial Test**



**Switch Testing**



**Product Final Test**

## Packaging

ETU-Link provides two kinds of packaging, 10pcs/Tray and individual package.



Company: ETU-Link Technology Co., LTD

Address: Right side of 3rd floor, No. 102 building, Longguan expressway, Dalang street,  
Longhua District, Shenzhen city, Guangdong Province, China 518109

Tel: +86-755 2328 4603

Addresses and phone number also have been listed at [www.etulinktechnology.com](http://www.etulinktechnology.com).

Please e-mail us at [sales@etulinktechnology.com](mailto:sales@etulinktechnology.com) or call us for assistance.