

## **ESCxx42-20D(I)**

### **4.25Gbps CWDM 20KM SFP Transceiver**

#### **PRODUCT FEATURES**

- Data-rate of 4.25Gbps operation
- 18 CWDM DFB wavelengths laser and PIN or APD photodetector for 20KM transmission
- Compliant with SFP MSA and SFF-8472 with duplex LC receptacle
- Digital Diagnostic Monitoring:
- Internal Calibration or External Calibration
- Compatible with RoHS
- +3.3V single power supply
- Case operating temperature range:  
Commercial: 0°C ~70°C  
Industrial: -40°C ~85°C

#### **APPLICATIONS**

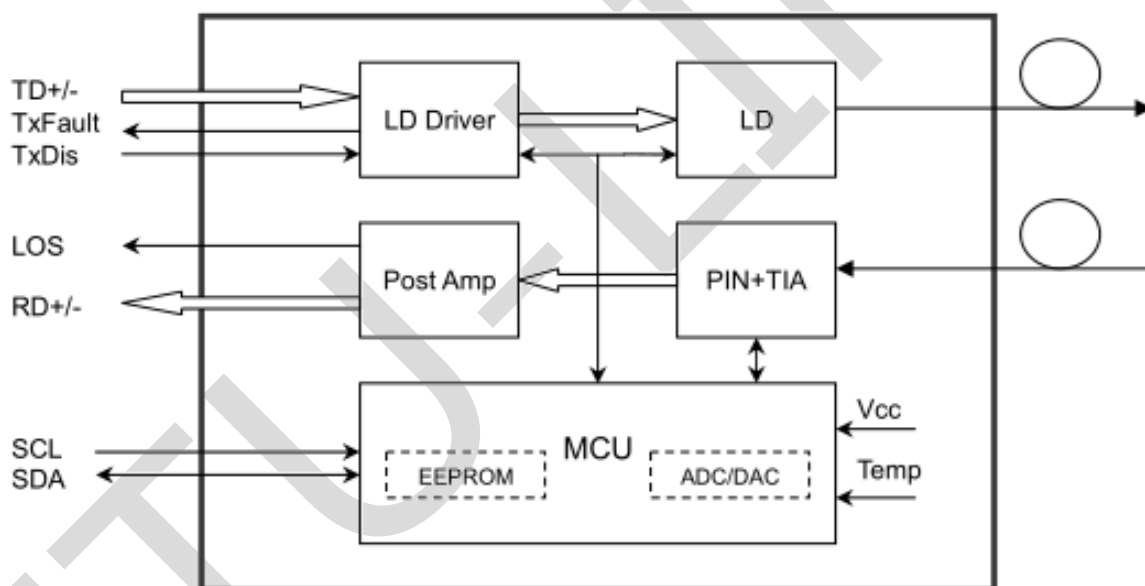
- 1000 Base-LX Ethernet
- 4xFC at 4.25Gbps
- 2xFC at 2.125Gbps
- 1xFC at 1.0625Gbps

## DESCRIPTIONS

ETU-LINK' s ESCxx42-20D(I) Small Form Factor Pluggable (SFP) transceivers are compatible with the Small Form Factor Pluggable Multi-Sourcing Agreement (MSA). The transceiver consists of five sections: the LD driver, the limiting amplifier, the digital diagnostic monitor, the DFB laser and the PIN .The module data link up to 20KM in 9/125um single mode fiber.

The optical output can be disabled by a TTL logic high-level input of Tx Disable, and the system also can disable the module via I2C. Tx Fault is provided to indicate that degradation of the laser. Loss of signal (LOS) output is provided to indicate the loss of an input optical signal of receiver or the link status with partner. The system can also get the LOS (or Link)/Disable/Fault information via I2C register access.

## Module Block Diagram



## Ordering Information

| Part No.     | Data Rate(optical) | Laser | Fiber Type | Distance | Optical Interface | Temp    | DDMI |
|--------------|--------------------|-------|------------|----------|-------------------|---------|------|
| ESCxx42-20D  | 4.25Gbps           | DFB   | SMF        | 20KM     | LC                | 0~70℃   | Y    |
| ESCxx42-20DI | 4.25Gbps           | DFB   | SMF        | 20KM     | LC                | -40~85℃ | Y    |

## Product Selection

| Wavelength | xx | Clasp Color Code | Wavelength | xx | Clasp Color Code |
|------------|----|------------------|------------|----|------------------|
| 1270 nm    | 27 | Gray             | 1450nm     | 45 | Brown            |
| 1290 nm    | 29 | Gray             | 1470 nm    | 47 | Gray             |
| 1310 nm    | 31 | Gray             | 1490 nm    | 49 | Purple           |
| 1330 nm    | 33 | Purple           | 1510 nm    | 51 | Blue             |
| 1350nm     | 35 | Blue             | 1530nm     | 53 | Green            |
| 1370nm     | 37 | Green            | 1550nm     | 55 | Yellow           |
| 1390nm     | 39 | Yellow           | 1570nm     | 57 | Orange           |
| 1410nm     | 41 | Orange           | 1590nm     | 59 | Red              |
| 1430nm     | 43 | Red              | 1610nm     | 61 | Brown            |

## Absolute Maximum Ratings

| Parameter                 | Symbol | Min. | Typical | Max.    | Unit | Notes |
|---------------------------|--------|------|---------|---------|------|-------|
| Storage Temperature       | Ts     | -40  |         | 85      | °C   |       |
| Relative Humidity         | RH     | 5    |         | 95      | %    |       |
| Power Supply Voltage      | VCC    | -0.5 |         | 4       | V    |       |
| Signal Input Voltage      |        | -0.3 |         | Vcc+0.3 | V    |       |
| Receiver Damage Threshold |        | +6   |         |         | dBm  |       |

## Recommended Operating Conditions

| Parameter                    | Symbol            | Min. | Typical   | Max. | Unit  | Notes           |
|------------------------------|-------------------|------|-----------|------|-------|-----------------|
| Case Operating Temperature   | Top               | 0    | -         | 70   | °C    | Commercial      |
|                              |                   | -40  |           | 85   |       | Industrial      |
| Power Supply Voltage         | VCC               | 3.13 | 3.3       | 3.47 | V     |                 |
| Power Supply Current         | ICC               |      |           | 300  | mA    |                 |
| Power Supply Noise Rejection |                   |      |           | 100  | mVp-p | 100Hz to 1MHz   |
| Data Rate                    |                   |      | 4250/4250 |      | Mbps  | TX Rate/RX Rate |
| Transmission Distance        |                   |      |           | 20   | KM    |                 |
| Coupled Fiber                | Single mode fiber |      |           |      |       | 9/125um SMF     |

## Electrical Characteristics

| Parameter                         | Symbol                 | Min.                 | Typical | Max.                  | Unit | Notes |
|-----------------------------------|------------------------|----------------------|---------|-----------------------|------|-------|
| Supply Voltage                    | V <sub>cc</sub>        | 3.15                 | 3.3     | 3.6                   | V    |       |
| Supply Current                    | I <sub>cc</sub>        |                      | 250     | 300                   | mA   |       |
| <b>Transmitter (Module Input)</b> |                        |                      |         |                       |      |       |
| Input differential impedance      | R <sub>in</sub>        |                      | 100     |                       | Ω    | 1     |
| Single ended data input swing     | V <sub>in,pp</sub>     | 250                  |         | 1200                  | mV   |       |
| Transmit Disable Voltage          | V <sub>D</sub>         | V <sub>cc</sub> -1.3 |         | V <sub>cc</sub>       | V    |       |
| Transmit Enable Voltage           | V <sub>EN</sub>        | V <sub>ee</sub>      |         | V <sub>ee</sub> + 0.8 | V    | 2     |
| Transmit Disable Assert Time      |                        |                      |         | 10                    | us   |       |
| <b>Receiver (Module Output)</b>   |                        |                      |         |                       |      |       |
| Single ended data output swing    | V <sub>out,pp</sub>    | 250                  |         | 800                   | mV   | 3     |
| Data output rise time             | t <sub>r</sub>         |                      | 100     | 175                   | ps   | 4     |
| Data output fall time             | t <sub>f</sub>         |                      | 100     | 175                   | ps   | 4     |
| LOS Fault                         | V <sub>LOS fault</sub> | V <sub>cc</sub> -0.5 |         | V <sub>cc</sub> HOST  | V    | 5     |
| LOS Normal                        | V <sub>LOS norm</sub>  | V <sub>ee</sub>      |         | V <sub>ee</sub> +0.5  | V    | 5     |
| Power Supply Rejection            | PSR                    | 100                  |         |                       | mVpp | 6     |

### Notes:

1. Connected directly to TX data input pins. AC coupled thereafter.
2. Or open circuit.
3. into 100 ohms differential termination.
4. 20 – 80 %
5. Loss Of Signal is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.
6. Receiver sensitivity is compliant with power supply sinusoidal modulation of 20 Hz to 1.5 MHz up to specified value applied through the recommended power supply filtering network.

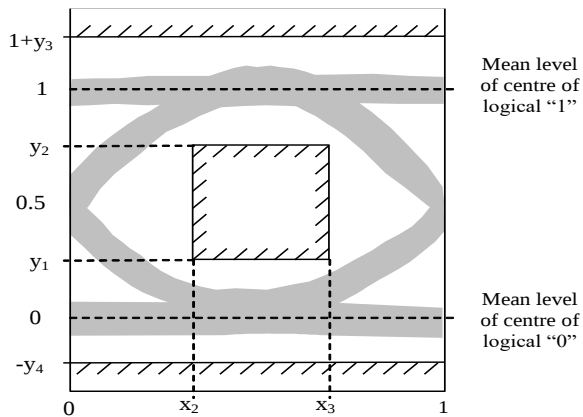
## Optical and Characteristics

| Parameter                         | Symbol                                      | Min.                    | Typical | Max.                    | Unit | Notes                 |
|-----------------------------------|---------------------------------------------|-------------------------|---------|-------------------------|------|-----------------------|
| Transmitter                       |                                             |                         |         |                         |      |                       |
| Average Output Power              | POUT                                        | 1                       |         | 5                       | dBm  | Note (1)              |
| Extinction Ratio                  | ER                                          | 8.2                     |         |                         | dB   |                       |
| Center Wavelength                 | $\lambda_C$                                 | (1XX0)- $\Delta\lambda$ | 1XX0    | (1XX0)+ $\Delta\lambda$ | nm   | DFB Laser<br>Note (2) |
| Side Mode Suppression Ratio       | SMSR                                        | 30                      |         |                         | dB   |                       |
| Spectrum Bandwidth(-20dB)         | $\sigma$                                    |                         |         | 1                       | nm   |                       |
| Transmitter OFF Output Power      | POff                                        |                         |         | -45                     | dBm  |                       |
| Differential Line Input Impedance | RIN                                         | 90                      | 100     | 110                     | Ohm  |                       |
| Output Eye Mask                   | Compliant with G.957 (class 1 laser safety) |                         |         |                         |      | Note (3)              |
| Receiver                          |                                             |                         |         |                         |      |                       |
| Input Optical Wavelength          | $\lambda_{IN}$                              | 1270                    |         | 1610                    | nm   | PIN                   |
| Receiver Sensitivity              | PIN                                         |                         |         | -18                     | dBm  | Note (4)              |

|                                   |       |     |   |     |     |          |
|-----------------------------------|-------|-----|---|-----|-----|----------|
| Input Saturation Power (Overload) | PSAT  | -3  |   |     | dBm |          |
| Los Of Signal Assert              | PA    | -35 |   |     | dBm |          |
| Los Of Signal De-assert           | PD    |     |   | -26 | dBm | Note (5) |
| LOS Hysteresis                    | PA-PD | 0.5 | 2 | 6   | dB  |          |

**Notes:**

1. Measure at 2<sup>23</sup>-1 NRZ PRBS pattern
2. "XX" is: 27,29,31,33,35,37,39,41,43,45,47,49,51,53,55,57,59 and 61; "Δλ" is 7.5
3. Transmitter eye mask definition
4. Measured with a PRBS 2<sup>23</sup>-1 test pattern @4250Mbps, BER ≤1×10<sup>-12</sup>
5. Internally AC-coupled.

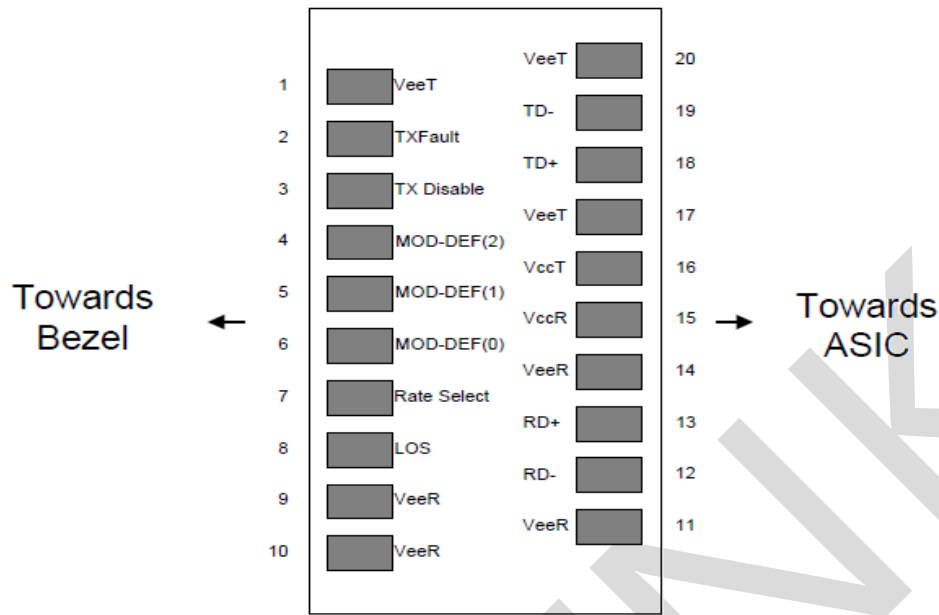


|                                |      |
|--------------------------------|------|
| x <sub>3</sub> -x <sub>2</sub> | 0.2  |
| y <sub>1</sub>                 | 0.25 |
| y <sub>2</sub>                 | 0.75 |
| y <sub>3</sub>                 | 0.25 |
| y <sub>4</sub>                 | 0.25 |

## Digital Diagnostics

| Parameter       | Range      | Accuracy | Unit | Calibration |
|-----------------|------------|----------|------|-------------|
| Temperature     | -40 to 85  | ±3       | °C   | Internal    |
| Voltage         | 0 to 3.6   | ±3%      | V    | Internal    |
| Tx Bias Current | 0 to 100   | ±10%     | mA   | Internal    |
| Tx Output Power | 1 to 5     | ±3       | dB   | Internal    |
| Rx Input Power  | -18 to 0.5 | ±3       | dB   | Internal    |

## Pin Diagram



## Pin Definitions

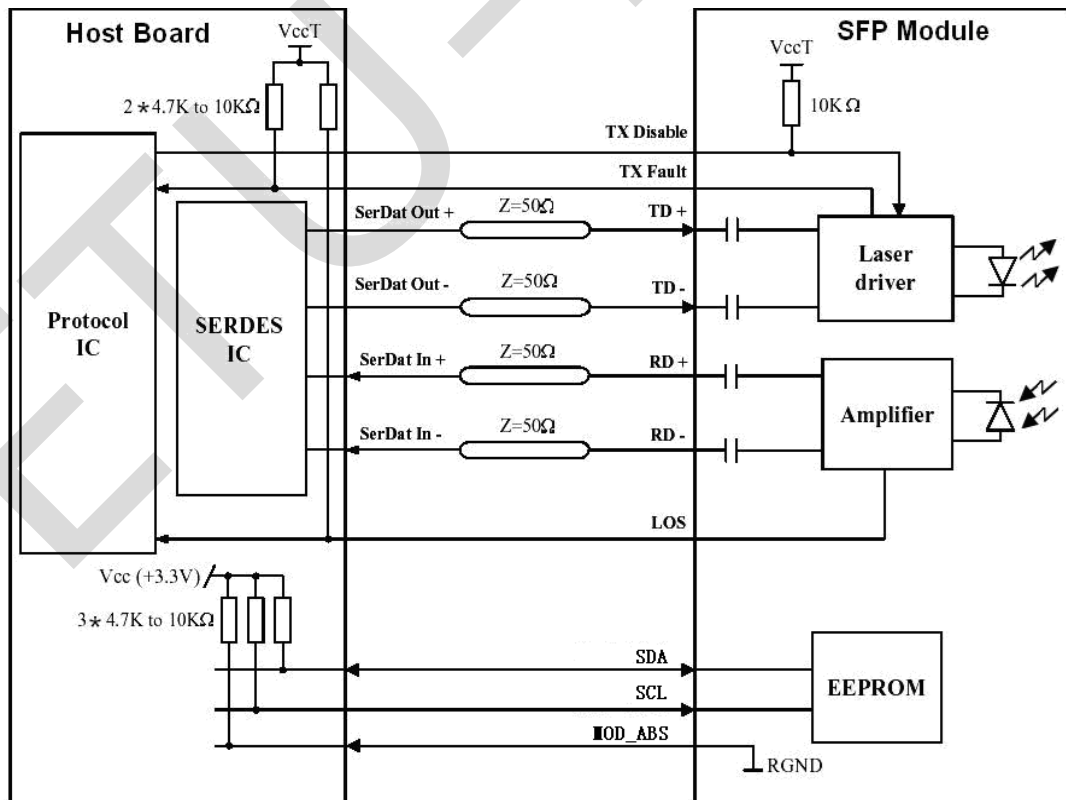
| PIN # | Name        | Function                                                       | Notes |
|-------|-------------|----------------------------------------------------------------|-------|
| 1     | VEET        | Transmitter Ground (Common with Receiver Ground)               | 1     |
| 2     | TFAULT      | Transmitter Fault.                                             |       |
| 3     | TDIS        | Transmitter Disable. Laser output disabled on high or open.    | 2     |
| 4     | MOD_DEF(2)  | Module Definition 2. Data line for Serial ID.                  | 3     |
| 5     | MOD_DEF(1)  | Module Definition 1. Clock line for Serial ID.                 | 3     |
| 6     | MOD_DEF(0)  | Module Definition 0. Grounded within the module.               | 3     |
| 7     | Rate Select | No connection required                                         | 4     |
| 8     | LOS         | Loss of Signal indication. Logic 0 indicates normal operation. | 5     |
| 9     | VEER        | Receiver Ground (Common with Transmitter Ground)               | 1     |
| 10    | VEER        | Receiver Ground (Common with Transmitter Ground)               | 1     |
| 11    | VEER        | Receiver Ground (Common with Transmitter Ground)               | 1     |
| 12    | RD-         | Receiver Inverted DATA out. AC Coupled                         |       |
| 13    | RD+         | Receiver Non-inverted DATA out. AC Coupled                     |       |
| 14    | VEER        | Receiver Ground (Common with Transmitter Ground)               | 1     |
| 15    | VCCR        | Receiver Power Supply                                          |       |

|    |      |                                                  |   |
|----|------|--------------------------------------------------|---|
| 16 | VCCT | Transmitter Power Supply                         |   |
| 17 | VEET | Transmitter Ground (Common with Receiver Ground) | 1 |
| 18 | TD+  | Transmitter Non-Inverted DATA in. AC Coupled.    |   |
| 19 | TD-  | Transmitter Inverted DATA in. AC Coupled.        |   |
| 20 | VEET | Transmitter Ground (Common with Receiver Ground) | 1 |

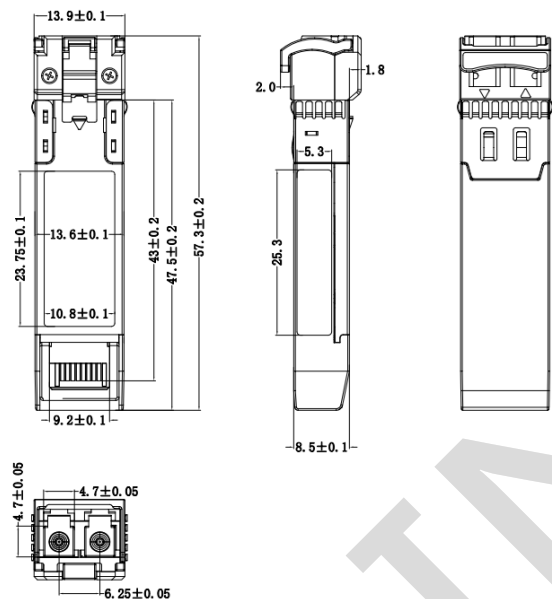
**Notes:**

1. Circuit ground is internally isolated from chassis ground.
2. Laser output disabled on  $T_{DIS} > 2.0V$  or open, enabled on  $T_{DIS} < 0.8V$ .
3. Should be pulled up with 4.7k - 10kohms on host board to a voltage between 2.0V and 3.6V. MOD\_DEF (0) pulls line low to indicate module is plugged in.
4. This is an optional input used to control the receiver bandwidth for compatibility with multiple data rates (most likely Fiber Channel 1x and 2x Rates). If implemented, the input will be internally pulled down with  $> 30k\Omega$  resistor. The input states are:
  5. Low (0 - 0.8V): Reduced Bandwidth
  6. ( $> 0.8, < 2.0V$ ): Undefined
  7. High (2.0 - 3.465V): Full Bandwidth
  8. Open: Reduced Bandwidth
9. LOS is open collector output should be pulled up with 4.7k - 10kohms on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

## Recommended Interface Circuit



Mechanical Diagram



Revision History

| Version No. | Date               | Description           |
|-------------|--------------------|-----------------------|
| 1.0         | February 18, 2016  | Preliminary datasheet |
| 2.0         | September 28, 2018 | Product upgrades      |
| 3.0         | Aug 25, 2024       | Format change         |

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