

## ESCxx12-40D(I)

### 1.25Gbps CWDM SFP Optical Transceiver 40KM Reach

#### PRODUCT FEATURE

- Data-rate of 1.25Gbps operation
- 18 CWDM DFB wavelengths laser and PIN photodetector for 40km transmission
- Compliant with SFP MSA and SFF-8472 with duplex LC receptacle
- Digital Diagnostic Monitoring:
- Internal Calibration or External Calibration
- Compatible with SONET OC-24-LR-1
- Compatible with RoHS
- +3.3V single power supply
- Operating case temperature:
- Commercial Temperature: 0 to +70°C
- Industrial Temperature: -40 to +85°C



#### Applications

- Gigabit Ethernet
- Fiber Channel
- Switch to Switch interface
- Switched backplane applications
- Router/Server interface
- Other optical transmission systems

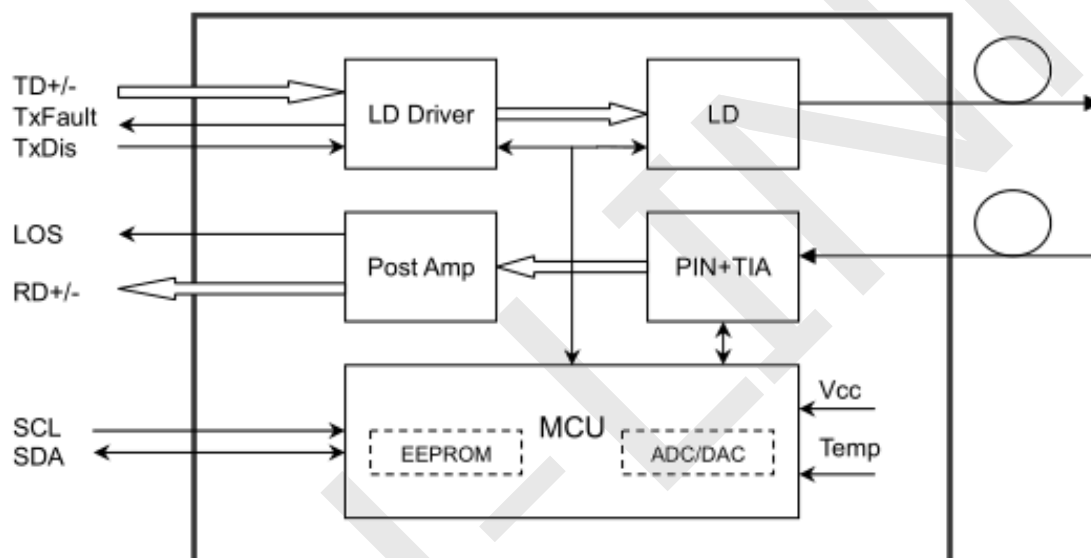
## Description

The SFP transceivers are high performance, cost effective modules supporting data-rate of 1.25Gbps and 40KM transmission distance with SMF.

The transceiver consists of three sections: an uncooled CWDM DFB laser transmitter, a PIN photodiode integrated with a trans-impedance preamplifier (TIA) and MCU control unit. All modules satisfy class I laser safety requirements.

The transceivers are compatible with SFP Multi-Source Agreement (MSA) and SFF-8472. For further information, please refer to SFP MSA.

## Module Block Diagram



## Ordering Information

| Part No.     | Data Rate(optical) | Laser | Fiber Type | Distance | Optical Interface | Temp     | DDMI |
|--------------|--------------------|-------|------------|----------|-------------------|----------|------|
| ESCxx12-40D  | 1.25Gbps           | DFB   | SMF        | 40km     | LC                | 0~70°C   | Y    |
| ESCxx12-40DI | 1.25Gbps           | DFB   | SMF        | 40km     | LC                | -40~85°C | Y    |

## Wavelength Selection: C λc Wavelength

| Wavelength | xx | Clasp Color Code | Wavelength | xx | Clasp Color Code |
|------------|----|------------------|------------|----|------------------|
| 1270 nm    | 27 | Gray             | 1450 nm    | 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   |
| 1350 nm | 35 | Blue   | 1530 nm | 53 | Green  |
| 1370 nm | 37 | Green  | 1550 nm | 55 | Yellow |
| 1390 nm | 39 | Yellow | 1570 nm | 57 | Orange |
| 1410 nm | 41 | Orange | 1590 nm | 59 | Red    |
| 1430 nm | 43 | Red    | 1610 nm | 61 | Brown  |

## Absolute Maximum Ratings

It has to be noted that the operation in excess of any individual absolute maximum ratings might cause permanent damage to this module.

| Parameter                            | Symbol            | Min                   | Max | Unit | Notes |
|--------------------------------------|-------------------|-----------------------|-----|------|-------|
| Storage Temperature                  | T <sub>s</sub>    | -40                   | 85  | °C   |       |
| Operating Case Temperature           | T <sub>case</sub> | See order Information |     | °C   |       |
| Power Supply Voltage                 | V <sub>CC</sub>   | -0.5                  | 3.6 | V    |       |
| Relative Humidity (non-condensation) | RH                | 5                     | 95  | %    |       |

## Recommended Operating Conditions and Power Supply Requirements

| Parameter                  | Symbol          | Min   | Typical | Max             | Unit | Notes      |
|----------------------------|-----------------|-------|---------|-----------------|------|------------|
| Operating Case Temperature | T <sub>OP</sub> | 0     |         | 70              | °C   | Commercial |
|                            |                 | -40   |         | 85              |      | Industrial |
| Power Supply Voltage       | V <sub>CC</sub> | 3.135 | 3.3     | 3.465           | V    |            |
| Power Supply Current       | ICC             |       |         | 300             | mA   |            |
| Data Rate                  |                 |       | 1250    |                 | Mb/s |            |
| Control Input Voltage High |                 | 2     |         | V <sub>CC</sub> | V    |            |
| Control Input Voltage Low  |                 | 0     |         | 0.8             | V    |            |
| Link Distance (SMF)        | D               |       |         | 40              | km   | 9/125um    |

## Electrical Characteristics

High-Speed Signal: Compliant to CEI-11G-SR  
Low-Speed Signal: Compliant to SFF-8419

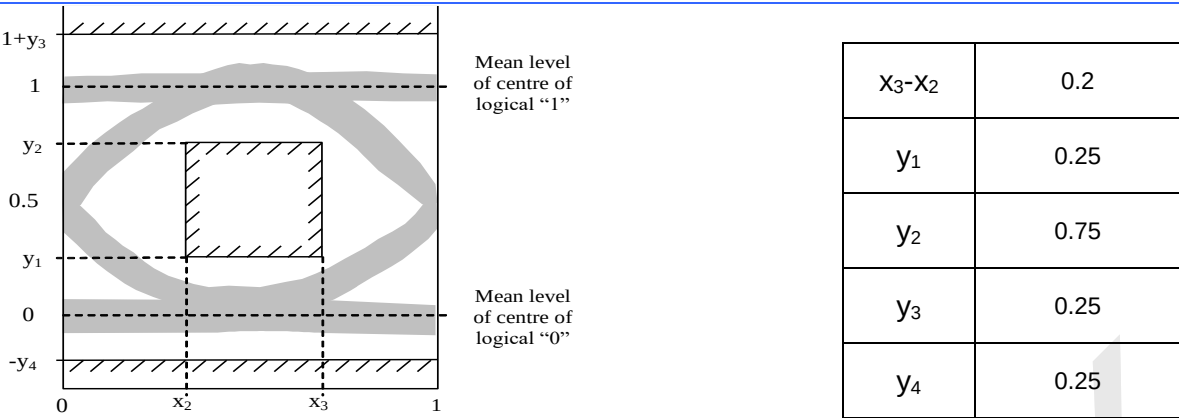
| Parameter                                    |                  | Symbol             | Min. | Typical | Max.                             | Unit | Notes |
|----------------------------------------------|------------------|--------------------|------|---------|----------------------------------|------|-------|
| <b>Transmitter (Module Input)</b>            |                  |                    |      |         |                                  |      |       |
| Differential Input Resistance                |                  | R <sub>Rdin</sub>  | 80   | 100     | 120                              | Ω    |       |
| Input Differential Voltage                   |                  | R <sub>Vdiff</sub> | 110  | -       | 1050                             | mVpp |       |
| Tx_Disable                                   | Normal Operation | V <sub>IL</sub>    | -0.3 | -       | 0.8                              | V    |       |
|                                              | Laser Disable    | V <sub>IH</sub>    | 2.0  | -       | V <sub>CC</sub> +0.3             | V    |       |
| <b>Receiver (Module Output)</b>              |                  |                    |      |         |                                  |      |       |
| Differential Resistance                      |                  | T <sub>Rd</sub>    | 80   | 100     | 120                              | Ohm  |       |
| Output Differential Voltage                  |                  | T <sub>Vdiff</sub> | 360  | -       | 770                              | mVpp |       |
| Differential Termination Resistance Mismatch |                  | T <sub>Rdm</sub>   | -    | -       | 5                                | %    |       |
| Rx los                                       | Normal Operation | V <sub>OL</sub>    | -0.3 | -       | 0.4                              | V    |       |
|                                              | Loss Signal      | V <sub>OH</sub>    | 2    |         | V <sub>CC</sub> H <sub>OST</sub> | V    |       |

## Optical Characteristics

| Parameter                         | Symbol                                      | Min.                 | Typ. | Max.                 | Unit | Note |
|-----------------------------------|---------------------------------------------|----------------------|------|----------------------|------|------|
| Transmitter                       |                                             |                      |      |                      |      |      |
| Average Output Power              | POUT                                        | -5                   |      | 0                    | dBm  | 1    |
| Extinction Ratio                  | ER                                          | 8.2                  |      |                      | dB   |      |
| Center Wavelength                 | $\lambda_C$                                 | $1XX0-\Delta\lambda$ | 1XX0 | $1XX0+\Delta\lambda$ | nm   | 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) |                      |      |                      |      | 3    |
| Receiver                          |                                             |                      |      |                      |      |      |
| Input Optical Wavelength          | $\lambda_{IN}$                              | 1270                 |      | 1610                 | nm   |      |
| Receiver Sensitivity              | PIN                                         |                      |      | -25                  | dBm  | 4    |
| Input Saturation Power (Overload) | PSAT                                        | -9                   |      |                      | dBm  |      |
| Los Of Signal Assert              | PA                                          | -35                  |      |                      | dBm  |      |
| Los Of Signal De-assert           | PD                                          |                      |      | -28                  | dBm  | 5    |
| LOS Hysteresis                    | PA-PD                                       | 0.5                  | 2    | 6                    | dB   |      |

### Note:

1. Measure at 2<sup>17</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 Light source 1XX0 nm, ER=8.2dB; BER =<10<sup>-12</sup> @PRBS=2<sup>7</sup>-1 NRZ ,
5. When LOS de-asserted, the RX data+/- output is High-level (fixed)

Digital Diagnostic

| Parameter       | Range     | Accuracy | Unit | Calibration |
|-----------------|-----------|----------|------|-------------|
| Temperature     | -40 to 85 | ±3       | °C   | Internal    |
| Voltage         | 0 to Vcc  | ±3%      | V    | Internal    |
| Tx Bias Current | 0 to 100  | ±10%     | mA   | Internal    |
| Tx Output Power | -5 to 0   | ±3       | dB   | Internal    |
| Rx Input Power  | -25 to -3 | ±3       | dB   | Internal    |

Pin Assignment

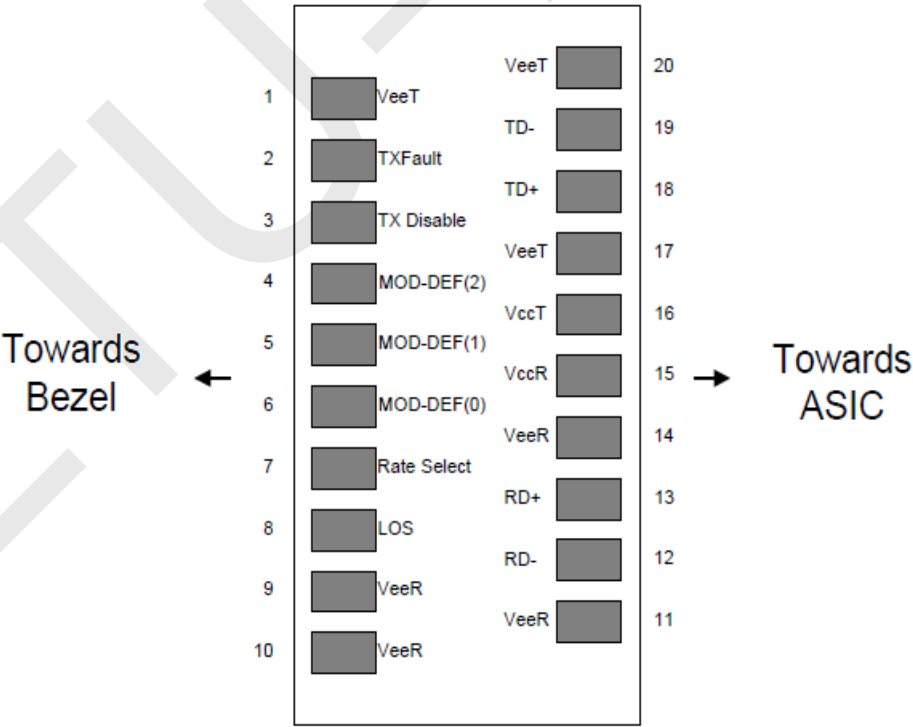


Figure1. Diagram of host board connector block pin numbers and names

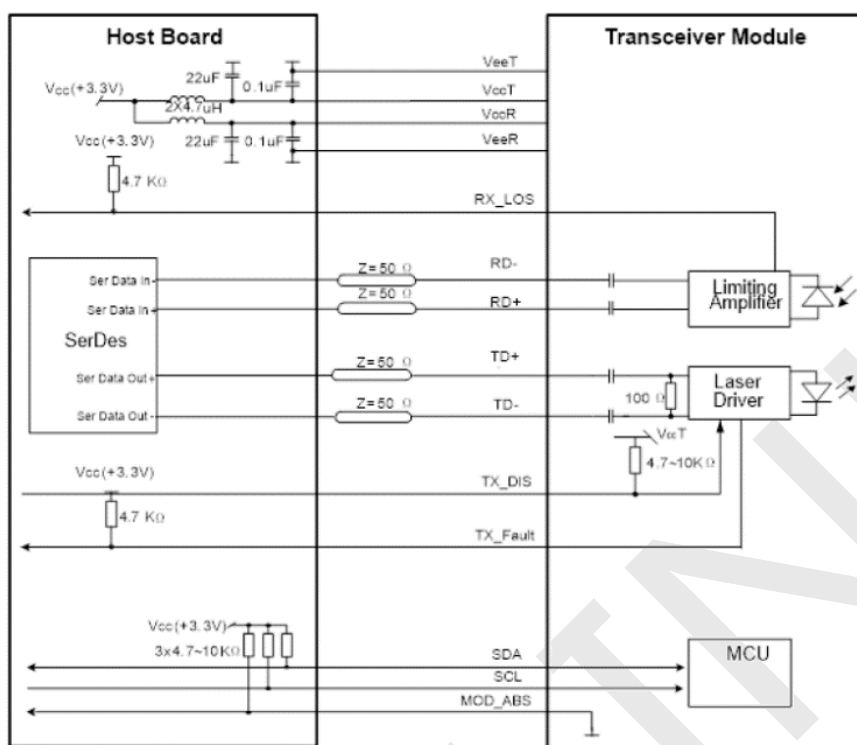
## Pin Description

| PIN | Name        | Name/Description                                               | Notes |
|-----|-------------|----------------------------------------------------------------|-------|
| 1   | VEET        | Transmitter Ground (Common with Receiver Ground)               | 1     |
| 2   | TXFAULT     | Transmitter Fault.                                             |       |
| 3   | TXDIS       | 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     |

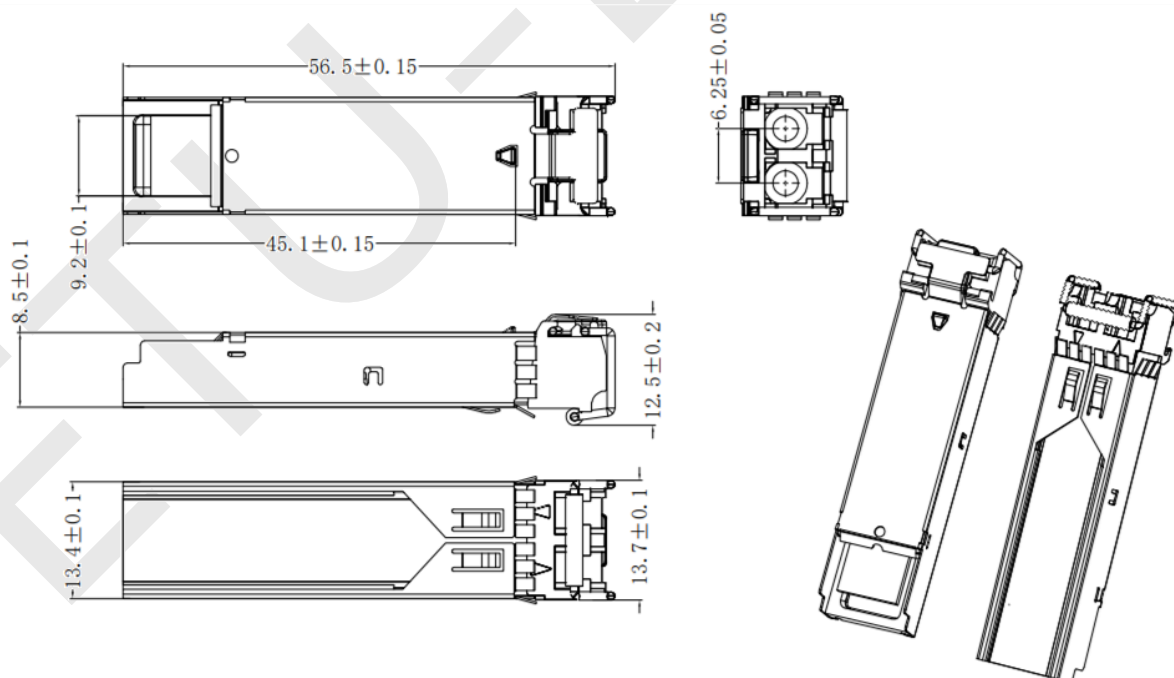
### Notes:

1. Circuit ground is internally isolated from chassis ground.
2. Laser output disabled on TDIS >2.0V or open, enabled on TDIS <0.8V.
3. Should be pulled up with 4.7k-10k ohms 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 > 30kΩ resistor. The input states are:
  - 1) Low (0 – 0.8V): Reduced Bandwidth
  - 2) (>0.8, < 2.0V): Undefined
  - 3) High (2.0 – 3.465V): Full Bandwidth
  - 4) Open: Reduced Bandwidth
5. LOS is open collector output should be pulled up with 4.7k-10k ohms 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 Dimensions



## Revision History

| Version No. | Date              | Description           |
|-------------|-------------------|-----------------------|
| 1.0         | February 12, 2014 | Preliminary datasheet |
| 2.0         | October 02, 2017  | Product upgrades      |
| 3.0         | July 27, 2024     | Format change         |

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