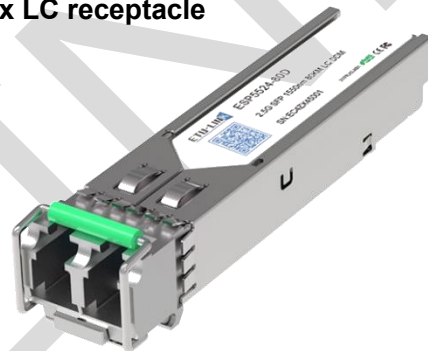


## ESP5524-80D(I)

2.67Gbps SFP Optical Transceiver, 80KM Reach

### PRODUCT FEATURES

- Data-rate of 2.67Gbps operation
- 1550nm DFB laser and APD photo detector for 80KM transmission
- Compliant with SFP MSA and SFF-8472 with duplex LC receptacle
- Digital Diagnostic Monitoring:
- Internal Calibration or External Calibration
- Compatible with SONET OC-48-LR-1
- Compatible with RoHS
- +3.3V single power supply
- Operating case temperature:  
Standard: 0 to +70°C  
Industrial: -40 to +85°C



### APPLICATIONS

- SDH STM-16 and SONET OC-48 system
- 2X Fiber Channel
- Switch to Switch interface
- Switched backplane applications
- Router/Server interface
- Other optical transmission systems

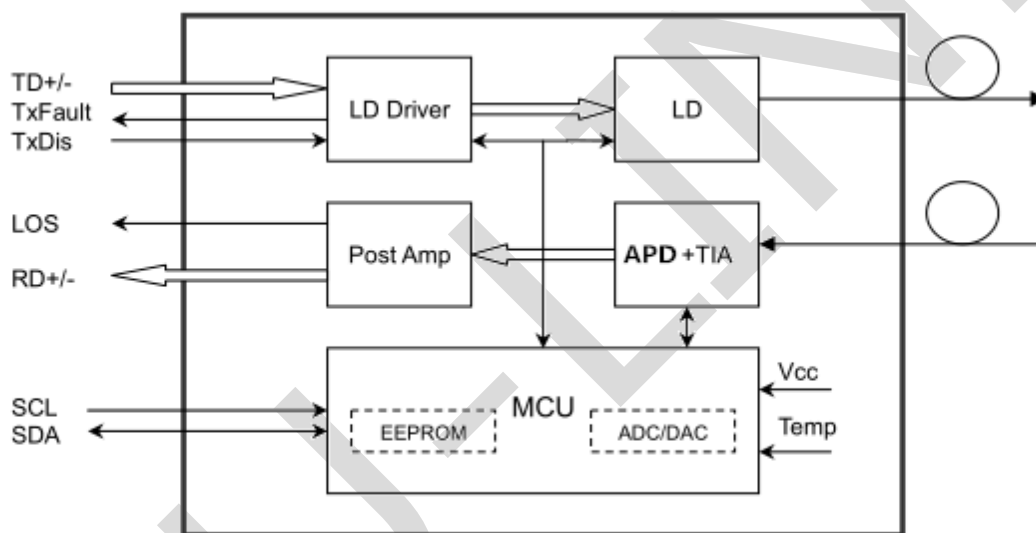
## DESCRIPTIONS

The SFP transceivers are high performance, cost effective modules supporting dual data-rate of 2.67Gbps and 80KM transmission distance with SMF.

The transceiver consists of three sections: a DFB laser transmitter, an APD 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 |
|--------------|--------------------|-------|------------|----------|-------------------|----------|------|
| ESP5524-80D  | 2.67Gbps           | DFB   | SMF        | 80KM     | LC                | 0~70°C   | Yes  |
| ESP5524-80DI | 2.67Gbps           | DFB   | SMF        | 80KM     | LC                | -40~85°C | Yes  |

## Absolute Maximum Ratings

| Parameter              | Symbol | Min  | Typ | Max | Unit | Ref. |
|------------------------|--------|------|-----|-----|------|------|
| Maximum Supply Voltage | Vcc    | -0.5 |     | 4.7 | V    |      |
| Storage Temperature    | TS     | -40  |     | 85  | °C   |      |

|                            |     |   |  |    |    |  |
|----------------------------|-----|---|--|----|----|--|
| Case Operating Temperature | TOP | 0 |  | 70 | °C |  |
|----------------------------|-----|---|--|----|----|--|

## Recommended Operating Conditions

| Parameter                  | Symbol          | Min. | Typical | Max. | Unit | Notes      |
|----------------------------|-----------------|------|---------|------|------|------------|
| Case Operating Temperature | Top             | 0    | -       | 70   | °C   | Commercial |
|                            |                 | -40  |         | 85   |      | Industrial |
| Power Supply Voltage       | V <sub>CC</sub> | 3.13 | 3.3     | 3.47 | V    |            |
| Power Supply Current       |                 |      |         | 1    | W    |            |
| Transmission Distance      | TD              | -    | -       | 80   | km   | Over SMF   |

## Electrical Characteristics

| Parameter                      | Symbol                 | Min.                 | Typ | Max.                  | Unit | Ref. |
|--------------------------------|------------------------|----------------------|-----|-----------------------|------|------|
| Supply Voltage                 | V <sub>CC</sub>        | 3.15                 | 3.3 | 3.6                   | V    |      |
| Supply Current                 | I <sub>CC</sub>        |                      | 185 | 250                   | mA   |      |
| <b>Transmitter</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</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. | Typ  | Max.  | Unit  | Ref. |
|-------------------------------------------|-------------|------|------|-------|-------|------|
| <b>Transmitter</b>                        |             |      |      |       |       |      |
| Output Opt. Pwr (End of Life)             | POUT        | 0.0  |      | 5.0   | dBm   | 1    |
| Optical Wavelength                        | $\lambda$   | 1520 | 1550 | 1580  | nm    |      |
| Wavelength Temperature Dependence         |             |      | 0.08 | 0.125 | nm/°C |      |
| Spectral Width (-20dB)                    | $\sigma$    |      |      | 3.0   | nm    |      |
| Optical Extinction Ratio                  | ER          | 10   |      |       | dB    |      |
| Sidemode Suppression ratio                | SMSRmin     | 30   |      |       | dB    |      |
| Optical Rise/Fall Time                    | tr/ tf      |      | 100  | 160   | ps    |      |
| RIN                                       | RIN         |      |      | -120  | dB/Hz |      |
| Transmitter Jitter (peak to peak)         |             |      |      | 100   | ps    |      |
| <b>Receiver</b>                           |             |      |      |       |       |      |
| Average Rx Sensitivity @ Gigabit Ethernet | RSSENS3     |      |      | -28.0 | dBm   | 2    |
| Maximum Input Power                       | PMAX        | -9.0 |      |       | dBm   |      |
| Optical Center Wavelength                 | $\lambda_C$ | 1260 |      | 1620  | nm    |      |
| LOS De -Assert                            | LOSD        |      |      | -30   | dBm   |      |
| LOS Assert                                | LOSA        | -40  |      |       | dBm   |      |
| LOS Hysteresis                            |             |      | 1.0  |       | dB    |      |
| Receiver Jitter Generation @2.488Gbps     |             |      |      | 160   | ps    | 3    |

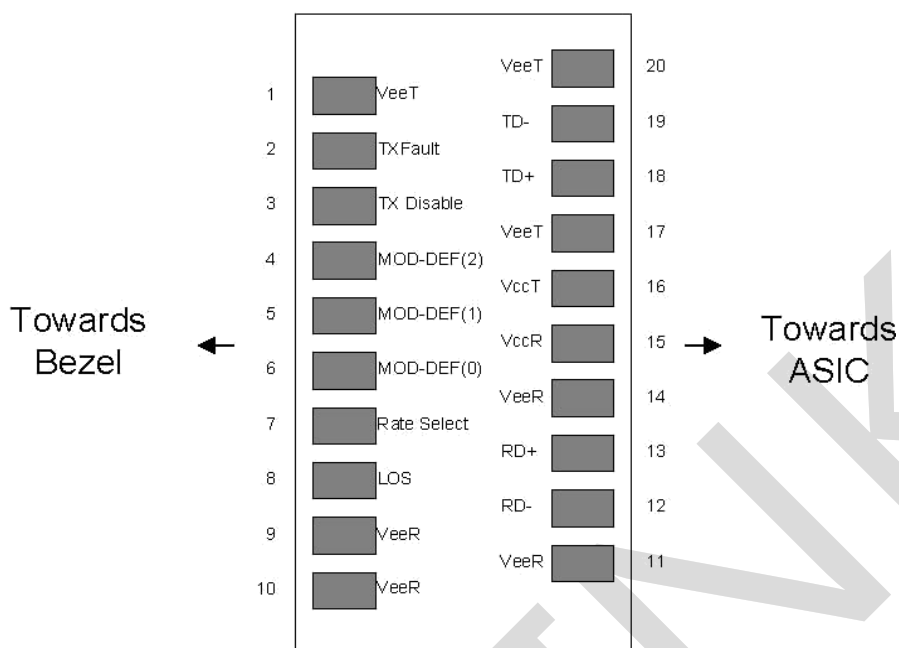
### Notes:

1. The optical power is launched into SMF.
2. PECL input, internally AC-coupled and terminated.
3. Measured with a PRBS 27-1 test pattern @2488Mbps, BER  $\leq 1 \times 10^{-12}$ . Internally AC-coupled.

## Digital Diagnostics

| Parameter    | Range      | Unit | Accuracy | Calibration |
|--------------|------------|------|----------|-------------|
| Temperature  | -40 to +85 | °C   | ±3       | Internal    |
| Voltage      | 3.0 to 3.6 | V    | ±3%      | Internal    |
| Bias Current | 0 to 100   | mA   | ±10%     | Internal    |
| TX Power     | 0 to +5    | dBm  | ±3dB     | Internal    |
| RX Power     | -28 to -9  | dBm  | ±3dB     | Internal    |

## Pin Diagram



## Pin Definitions

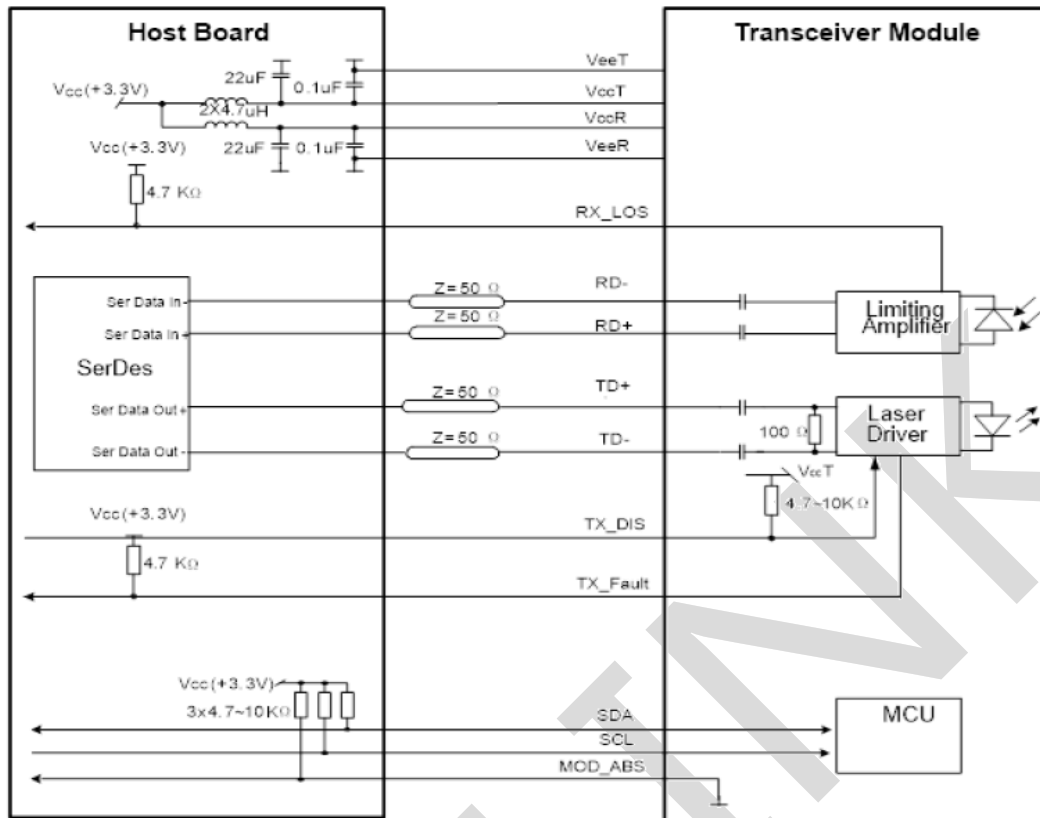
| Pin | Name        | Function                                                       | Notes |
|-----|-------------|----------------------------------------------------------------|-------|
| 1   | $V_{EET}$   | Transmitter Ground (Common with Receiver Ground)               | 1     |
| 2   | $T_{FAULT}$ | Transmitter Fault.                                             | 2     |
| 3   | $T_{DIS}$   | Transmitter Disable. Laser output disabled on high or open.    | 3     |
| 4   | MOD_DEF(2)  | Module Definition 2. Data line for Serial ID.                  | 4     |
| 5   | MOD_DEF(1)  | Module Definition 1. Clock line for Serial ID.                 | 4     |
| 6   | MOD_DEF(0)  | Module Definition 0. Grounded within the module.               | 4     |
| 7   | Rate Select | No connection required                                         |       |
| 8   | LOS         | Loss of Signal indication. Logic 0 indicates normal operation. | 5     |
| 9   | $V_{EER}$   | Receiver Ground (Common with Transmitter Ground)               | 1     |
| 10  | $V_{EER}$   | Receiver Ground (Common with Transmitter Ground)               | 1     |
| 11  | $V_{EER}$   | Receiver Ground (Common with Transmitter Ground)               | 1     |
| 12  | RD-         | Receiver Inverted DATA out. AC Coupled                         |       |
| 13  | RD+         | Receiver Non-inverted DATA out. AC Coupled                     |       |

| Pin | Name      | Function                                         | Notes |
|-----|-----------|--------------------------------------------------|-------|
| 14  | $V_{EER}$ | Receiver Ground (Common with Transmitter Ground) | 1     |
| 15  | $V_{CCR}$ | Receiver Power Supply                            |       |
| 16  | $V_{CCT}$ | Transmitter Power Supply                         |       |
| 17  | $V_{EET}$ | 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  | $V_{EET}$ | Transmitter Ground (Common with Receiver Ground) | 1     |

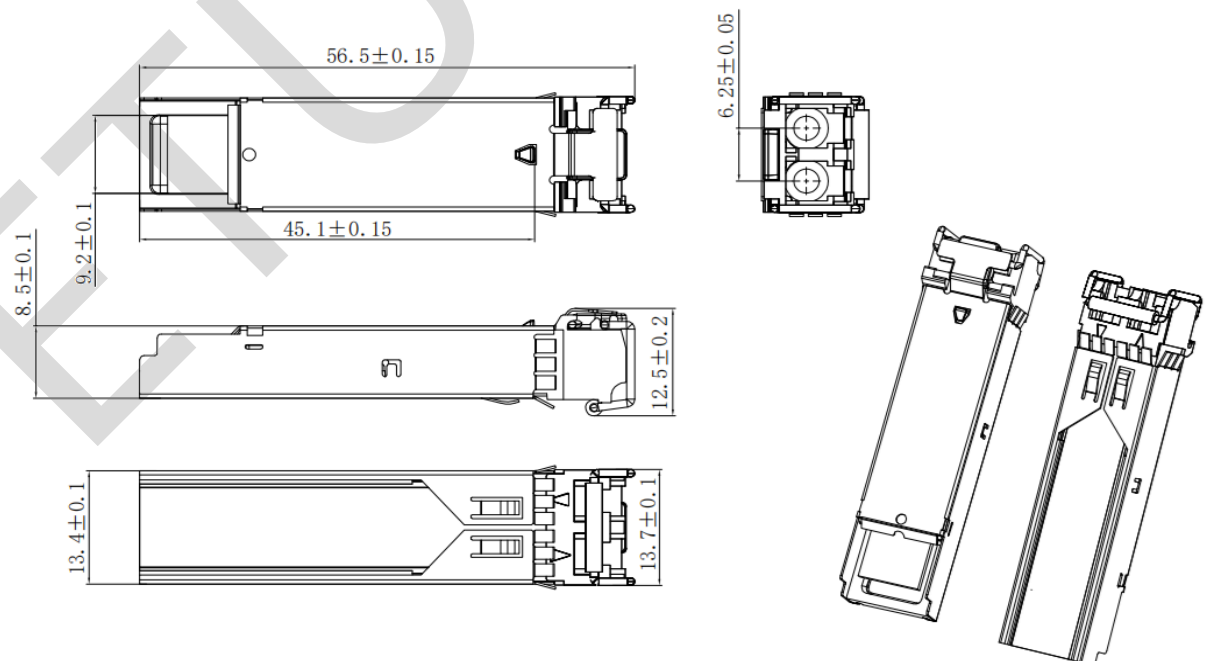
**Notes:**

1. Circuit ground is internally isolated from chassis ground.
2.  $T_{FAULT}$  is an open collector/drain output, which should be pulled up with a 4.7k – 10k Ohms resistor on the host board if intended for use. Pull up voltage should be between 2.0V to  $V_{CC} + 0.3V$ . A high output indicates a transmitter fault caused by either the TX bias current or the TX output power exceeding the preset alarm thresholds. A low output indicates normal operation. In the low state, the output is pulled to <0.8V.
3. Laser output disabled on  $T_{DIS} > 2.0V$  or open, enabled on  $T_{DIS} < 0.8V$ .
4. 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.
5. LOS is open collector output. It should be pulled up with 4.7k – 10 kohms 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         | May 8, 2015      | Preliminary datasheet |
| 2.0         | October 11, 2018 | Product upgrades      |
| 3.0         | July 29, 2024    | Format change         |

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