# TSSLS-NCNCE3 Optical Transceiver

1310nm SFP+ Single-mode Transceiver, With Diagnostic Monitoring
Duplex SFP+ 10km Transceiver

## Features

- Optical interface compliant to IEEE 802.3ae 10GBASE-LR
- Electrical interface compliant to SFF-8431
- Hot Pluggable
- Data rate up to 11.3Gbps
- 1310nm DFB transmitter, PIN photo-detector
- Low power consumption < 1.0W
- Distance up to 10km
- Specifications compliant with SFF 8472
- 2-wire interface with integrated Digital Diagnostic monitoring
- Operating case temperature: Standard: 0°C ~+70°C
  Industrial: -40°C ~+85°C
- RoHS6 compliant (lead free)

## Applications

- 10GBASE-LR at 10.3125Gbps
- 10GBASE-LW at 9.95Gbps

## Product Description

The TSSLS-NCNCE3 single mode transceiver is small form factor pluggable module for serial optical data communications such as IEEE 802.3ae 10GBASE-LR/LW. It is with the SFP+ 20-pin connector to allow hot plug capability.

This module is designed for single mode fiber and operates at a nominal wavelength of 1310 nm. The transmitter section uses a 1310nm multiple quantum well DFB laser.



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## Absolute Maximum Ratings

These values represent the damage threshold of the module. Stress in excess of any of the individual Absolute Maximum Ratings can cause immediate catastrophic damage to the module even if all other parameters are within Recommended Operating Conditions.

| Parameters | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|
| Power Supply Voltage | VCC | -0.5 | +3.6 | V |
| Storage Temperature | Tc | -40 | +85 | °C |
| Relative Humidity | RH | 0 | 85 | % |

## Recommended Operating Conditions

Recommended Operating Environment specifies parameters for which the electrical and optical characteristics hold unless otherwise noted.

| Parameter | Symbol | Min | Typical | Max | Unit |
|---|---|---|---|---|---|
| Power Supply Voltage | VCC | 3.15 | 3.30 | 3.45 | V |
| Operating Case Temperature (Standard) | Tca | 0 | - | 70 | °C |
| Operating Case Temperature (Industrial) | Tca | -40 | - | 85 | °C |

**Notes:**
[1] Supply current is shared between VCCTX and VCCRX.
[2] In-rush is defined as current level above steady state current requirements.

## Electrical Characteristics

| Parameter | Symbol | Min. | Typical | Max | Unit |
|---|---|---|---|---|---|
| **Transmitter** | | | | | |
| Data Rate | Mra | 1.0 | 10.3 | 11.3 | Gbps |
| Input differential impedance[1] | Rin | - | 100 | - | Ω |
| Differential Input Voltage swing | Vin | 150 | - | 1200 | mV |
| Transmit Disable Voltage | VD | 2.0 | - | VCC+0.3 | V |
| Transmit Enable Voltage[2] | Ven | Vee | - | Vee+0.8 | V |
| Transmit Disable Assert Time | Vn | - | - | 100 | us |
| **Receiver** | | | | | |
| Data Rate | Mra | - | 10.3 | 11.3 | Gbps |
| Output differential impedance[1] | Rout | - | 100 | - | Ω |
| Differential Output Swing[3] | Vout | 300 | - | 700 | mV |
| Loss of Signal –Asserted[4] | - | 2.0 | - | VCC+0.3 | V |
| Loss of Signal –Negated[4] | - | Vee | - | Vee+0.8 | V |

**Notes:**
[1] AC coupled.
[2] Or open circuit.

[3] Into 100 ohm differential termination.
[4] LOS is LVTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

## Transmitter Specifications – Optical

| Parameter | Symbol | Min | Typical | Max | Unit |
|---|---|---|---|---|---|
| Center Wavelength | λ | 1260 | 1310 | 1355 | nm |
| Average Optical Power[1] | Po | -8.2 | - | +0.5 | dBm |
| Side Mode Suppression Ratio | SMSR | 30 | - | - | dB |
| Average Launch Power of OFF Transmitter | Poff | - | - | -30 | dBm |
| Extinction Ratio | ER | 3.5 | - | - | dB |
| Optical Return Loss Tolerance | ORL | - | - | 12 | dB |
| Eye Mask | - | Compliant with IEEE 802.3 | | | |

## Receiver Specifications – Optical

| Parameter | Symbol | Min | Typical | Max | Unit |
|---|---|---|---|---|---|
| Center Wavelength | λ | 1260 | - | 1355 | nm |
| Receiver sensitivity in OMA[2] | Rsen1 | - | - | -12.6 | dBm |
| Receiver Overload | Pmax | 0.5 | | - | dBm |
| Receiver Reflectance | Rrx | - | - | -12 | dB |
| Receive electrical 3 dB upper cutoff | - | - | - | 12.3 | GHz |
| LOS Asserted | Lsa | -30 | - | - | dBm |
| LOS De-Asserted | Lda | - | - | -15 | dBm |
| LOS Hysteresis | Lh | 0.5 | - | - | dB |

**Notes:**
[1] Output power is coupled into a 9/125μm SMF.
[2] Average received power; BER less than 1E-12 and PRBS $2^{31-1}$ test pattern.

## Low Speed Characteristics

| Parameter | Symbol | Min | Typical | Max | Unit |
|---|---|---|---|---|---|
| TX_Fault, RX_LOS | VOL | 0 | - | 0.4 | V |
| | VOH | Host_VCC-0.5 | - | Host_VCC+0.3 | V |
| TX_DIS | VIL | -0.3 | - | 0.8 | V |
| | VIH | 2.0 | - | VCCT+0.3 | V |
| RS0, RS1 | VIL | -0.3 | - | 0.8 | V |
| | VIH | 2.0 | - | VCCT+0.3 | V |



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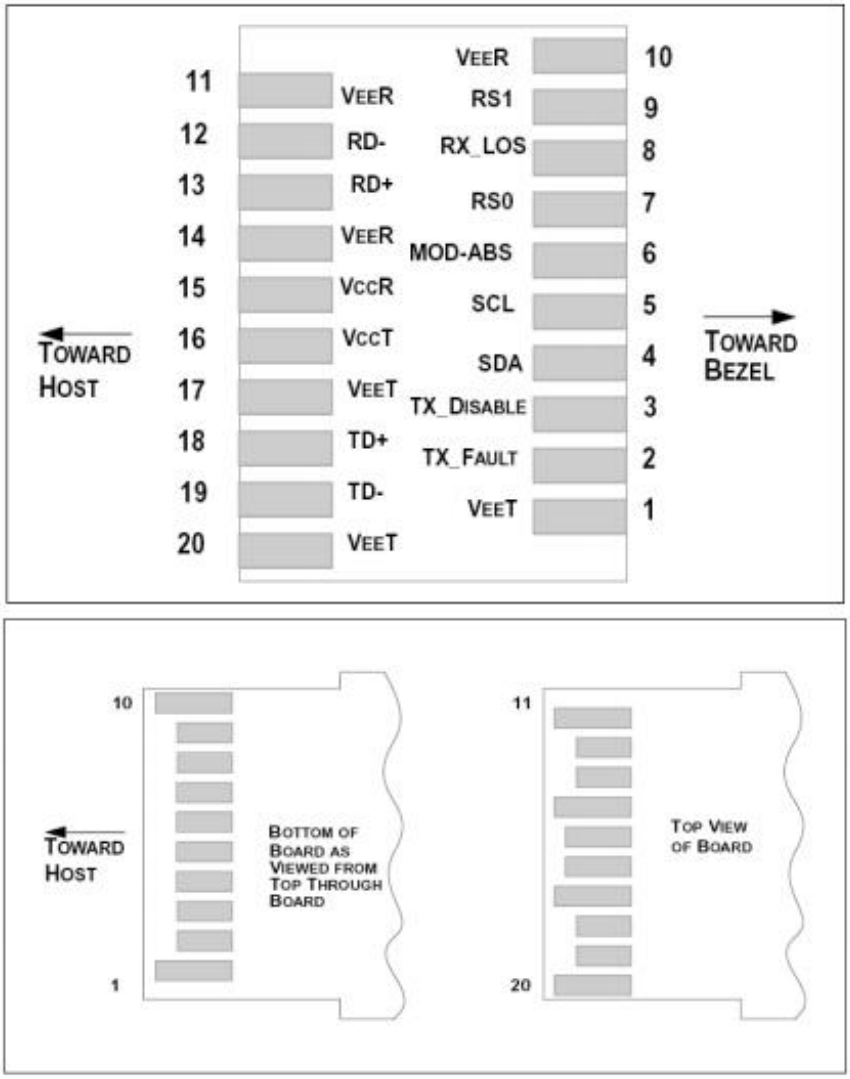
## SFP+ Transceiver Electrical Pad Layout




## Pin definition

| Pin | Symbol | Name/Description |
|---|---|---|
| 1 | VEET [1] | Transmitter Ground |
| 2 | Tx_FAULT [2] | Transmitter Fault |
| 3 | Tx_DIS [3] | Transmitter Disable. Laser output disabled on high or open |
| 4 | SDA [2] | 2-wire Serial Interface Data Line |
| 5 | SCL [2] | 2-wire Serial Interface Clock Line |
| 6 | MOD_ABS [4] | Module Absent. Grounded within the module |
| 7 | RS0 [5] | Rate Select 0 |
| 8 | RX_LOS [2] | Loss of Signal indication. Logic 0 indicates normal operation |
| 9 | RS1 [5] | Rate Select 1 |
| 10 | VEER [1] | Receiver Ground |

| | | |
|---|---|---|
| 11 | VEER [1] | Receiver Ground |
| 12 | RD- | Receiver Inverted DATA out. AC Coupled |
| 13 | RD+ | Receiver DATA out. AC Coupled |
| 14 | VEER [1] | Receiver Ground |
| 15 | VCCR | Receiver Power Supply |
| 16 | VCCT | Transmitter Power Supply |
| 17 | VEET [1] | Transmitter Ground |
| 18 | TD+ | Transmitter DATA in. AC Coupled |
| 19 | TD- | Transmitter Inverted DATA in. AC Coupled |
| 20 | VEET [1] | Transmitter Ground |

**Notes:**

[1] Module circuit ground is isolated from module chassis ground within the module.

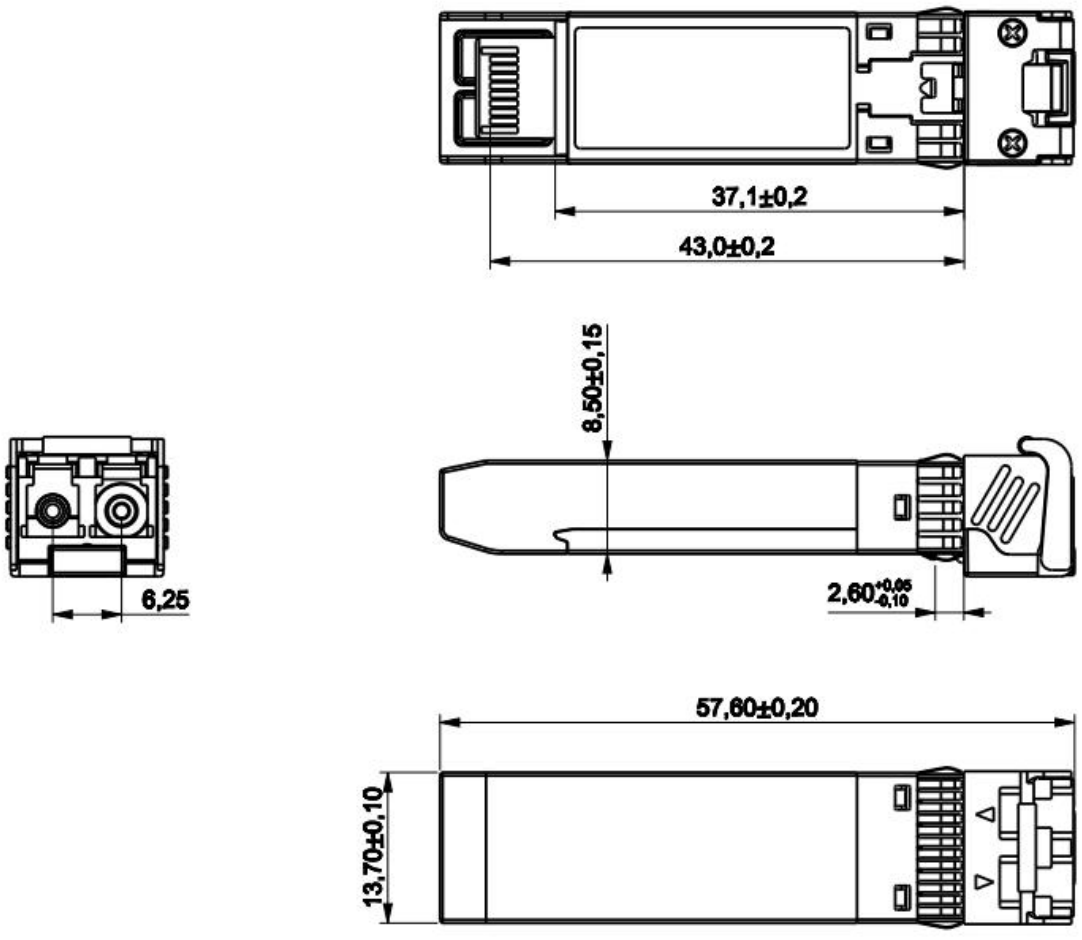
[2] Should be pulled up with 4.7k – 10k ohms on host board to a voltage between 3.15Vand 3.6V.

[3] Tx_Disable is an input contact with a 4.7 kΩ to 10 kΩ pullup to VCCT inside the module.

[4] 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 to10 kΩ.Mod_ABS is asserted "High" when the SFP+ module is physically absent from a host slot.

[5] RS0 and RS1 are module inputs and are pulled low to VeeT with > 30 kΩ resistors in the module.

## Mechanical



## Ordering Information

| Part Number | Product Description |
|---|---|
| TSSLS-NCNCE3C | 10G SFP+ 1310nm 10km Transceiver 0°C ~ +70°C |
| TSSLS-NCNCE3T | 10G SFP+ 1310nm 10km Transceiver -40°C ~ +85°C |

## Important Notice

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