



## 3FE53441FC-SKY

Alcatel-Lucent Nokia® 3FE53441FC Compatible GPON OLT SFP C++ Transceiver (1490nmTx/1310nmRx, 2.5Gbps/1.25Gbps, 39dBm, SC, -40 to 85C)

### Product Description

This Alcatel-Lucent Nokia® 3FE53441FC compatible SFP transceiver provides 2.4Gbps/1.2Gbps-C++ throughput up to 60km over single-mode fiber (SMF) using a wavelength of 1490nmTx/1310nmRx via a SC connector. It is also capable of withstanding -40 to 85C environments and can operate at temperatures between -40C to +85C. It is guaranteed to be 100% compatible with the equivalent Alcatel-Lucent Nokia® transceiver. This easy to install, hot swappable transceiver has been programmed, uniquely serialized and data-traffic and application tested to ensure that it will initialize and perform identically. Digital optical monitoring (DOM) support is also present to allow access to real-time operating parameters. We stand behind the quality of our products and proudly offer a limited lifetime warranty.

Skylane's transceivers are RoHS compliant and lead-free.

### Features:

- Integrated Single Fiber Bi-Directional Optical Subassembly
- 1490nm Continuous DFB Laser Transmitter (with WDM)
- 1310nm Burst-Mode APD/TIA Receiver
- Low Power Consumption
- Single SC Receptacle Optical Interface Compliant
- 3.3V Single Power Supply
- LVTTTL Receiver Reset Control and Burst-Power-Detect Indication
- CML Compatible Data Input and Output
- RoHS Compliant and Lead-Free
- Operating Temperature: -40 to 85 Celsius



### Applications:

- GPON
- Access and Enterprise

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*For your product safety, please read the following information carefully before any manipulation of the transceiver:*



#### ESD

This transceiver is specified as ESD threshold 1kV for SFI pins and 2kV for all others electrical input pins, tested per MIL-STD-883G, Method 3015.4 / JESD22-A114-A (HBM). However, normal ESD precautions are still required during the handling of this module.



#### LASER SAFETY

This is a Class1 Laser Product according to IEC 60825-1:2007. This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated (June 24, 2007).

*The optical ports of the module need to be terminated with an optical connector or with a dust plug in order to avoid contamination.*

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## Absolute Maximum Ratings

| Parameter                   | Symbol           | Min. | Typ.    | Max.            | Unit | Notes |
|-----------------------------|------------------|------|---------|-----------------|------|-------|
| Operating Temperature Range | T <sub>c</sub>   | -40  |         | 85              | °C   |       |
| Storage Temperature Range   | T <sub>stg</sub> | -40  |         | 85              | °C   |       |
| Relative Humidity           | RH               | 5    |         | 95              | %    |       |
| Supply Voltage              | V <sub>cc</sub>  | 0    |         | 4.0             | V    |       |
| Pin Input Voltage           |                  | GND  |         | V <sub>cc</sub> | V    |       |
| Receiver Damage Threshold   |                  | +3   |         |                 | dBm  |       |
| Data Rate (Tx Side)         |                  |      | 2488.32 |                 | Mbps |       |
| Data Rate (Rx Side)         |                  |      | 1244.16 |                 | Mbps |       |

## Electrical Characteristics

| Parameter                             | Symbol          | Min.  | Typ. | Max.            | Unit | Notes |
|---------------------------------------|-----------------|-------|------|-----------------|------|-------|
| Power Supply Voltage                  | V <sub>cc</sub> | 3.135 | 3.3  | 3.465           | V    |       |
| Supply Current                        | I <sub>cc</sub> |       |      | 500             | mA   |       |
| LVPECL Differential Data Input Swing  |                 | 200   |      | 1600            | mV   | 1     |
| LVPECL Differential Data Output Swing |                 | 400   |      | 1600            | mV   | 1     |
| Differential Data Input Impedance     |                 |       | 100  |                 | Ω    | 1     |
| Input Signal Level (LVTTTL-H)         |                 | 2.0   |      | V <sub>cc</sub> | V    |       |
| Input Signal Level (LVTTTL-L)         |                 | 0     |      | 0.8             | V    |       |
| Output Signal Level (LVTTTL-H)        |                 | 2.4   |      | V <sub>cc</sub> | V    |       |
| Output Signal Level (LVTTTL-L)        |                 | 0     |      | 0.4             | V    |       |

### Notes:

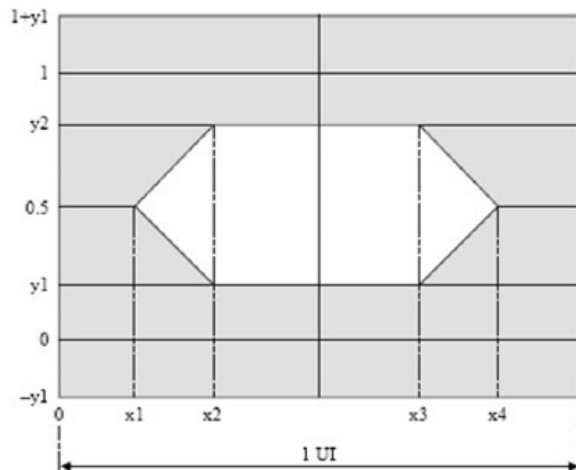
1. AC coupled internally.

## Optical Characteristics

| Parameter                                                                          |                   | Symbol                       | Min. | Typ.    | Max.    | Unit  | Notes |
|------------------------------------------------------------------------------------|-------------------|------------------------------|------|---------|---------|-------|-------|
| Transmitter                                                                        |                   |                              |      |         |         |       |       |
| Data Rate                                                                          |                   |                              |      | 2488.32 |         | Mbps  |       |
| Center Wavelength Range                                                            |                   | λC                           | 1480 | 1490    | 1500    | nm    | 1     |
| Spectral Width (-20dB)                                                             |                   | Δλ                           |      |         | 1       | nm    |       |
| Side-Mode Suppression Ratio                                                        |                   | SMSR                         | 30   |         |         | dB    |       |
| Launch Optical Power (BOL)                                                         |                   | PBOL                         | +5.0 |         | +9      | dBm   | 2     |
| Off Level Light                                                                    |                   |                              |      |         | -39     | dBm   | 3     |
| Extinction Ratio                                                                   |                   | ER                           | 8.2  |         |         | dB    | 4     |
| Total Jitter                                                                       |                   | TJ                           |      |         | 0.2     | UI    |       |
| Rise/Fall Time (20-80%)                                                            |                   | Tr/Tf                        |      |         | 250     | ps    | 5     |
| RIN <sub>15</sub> OMA                                                              |                   |                              |      |         | -115    | dB/Hz |       |
| Optical Return Loss Tolerance                                                      |                   |                              |      |         | 15      | dB    |       |
| Maximum Reflectance                                                                |                   |                              |      |         | -12     | dB    | 7     |
| Eye Diagram                                                                        |                   | Compliant with ITU-T G.984.2 |      |         |         |       | 4, 12 |
| Receiver                                                                           |                   |                              |      |         |         |       |       |
| Data Rate                                                                          |                   |                              |      | 1244.16 |         | Mbps  |       |
| Receiver Sensitivity (EOL)                                                         |                   | Rx_Sen                       |      |         | -33     | dBm   | 6     |
| Overload Input Optical Power                                                       |                   |                              | -14  |         |         | dBm   | 6     |
| CID Immunity                                                                       |                   |                              | 72   |         |         | Bits  |       |
| Center Wavelength Range                                                            |                   | λC                           | 1260 | 1310    | 1360    | nm    |       |
| PDL                                                                                |                   |                              |      |         | 0.5     | dB    | 9     |
| Reflected Optical Isolation                                                        |                   |                              | 32   |         |         | dB    | 10    |
| Reflected Overlay Optical Isolation                                                |                   |                              | 36   |         |         | dB    | 11    |
| Optical Cross-Talk                                                                 |                   |                              |      |         | -46     | dB    | 12    |
| Reflectance of Rx                                                                  |                   |                              |      |         | -20     | dB    | 9     |
| Differential Power Range                                                           |                   |                              |      |         | 15      | dB    |       |
| LOS Response Time Assert/De-Assert                                                 |                   |                              |      |         | 500/900 | ns    |       |
| Signal Detect (LVTTTL)                                                             | Optical De-Assert |                              | -45  |         |         | dBm   |       |
|                                                                                    | Optical Assert    |                              |      |         | -34     |       |       |
| Signal Detect Hysteresis                                                           |                   |                              | 0.5  |         | 6       | dB    |       |
| Measurement Accuracy of Received Burst Optical Power (Range from -10dBm to -34dBm) |                   |                              | -3   |         | +3      | dB    |       |
| Burst Optical Power Conversion Settling Time (Trigger Delay)                       |                   | BOPCS Time                   | 25   |         |         | ns    |       |
| Burst Optical Power Conversion Holding Time                                        |                   | Holding Time                 | 350  |         |         | ns    |       |
| Burst Optical Power Conversion Time                                                |                   |                              |      |         | 500     | us    |       |

# Notes:

1. DFB-LD.
2. Coupled into 9/125 $\mu$ m SMF.
3. Measured without data input.
4. Measured with PRBS  $2^{23}-1$  test pattern @2.488Gbps.
5. Measured with the Bessel-Thompson filter off.
6. Measured with PRBS  $2^{23}-1$  test pattern @1.244Gbps with Tx on, ER=10dB, BER $\leq 10E^{-10}$ , preamble length is 25 Bytes, and reset length is 10 Bytes.
7.  $\lambda=1.49\mu$ m.
8. 1260~1360nm.
9. From 1480~1500nm relative to 1260~1360nm.
10. From 1539~1565nm relative to 1260~1360nm.
11. Result can be read out from rising edge of the trigger pulse.
12. Eye mask of diagram.



|           | 1244.16 Mbit/s | 2488.32 Mbit/s |
|-----------|----------------|----------------|
| $x1/x4$   | 0.28/0.72      | ---            |
| $x2/x3$   | 0.40/0.60      | ---            |
| $x3 - x2$ | ---            | 0.2            |
| $y1/y2$   | 0.20/0.80      | 0.25/0.75      |

## Pin Descriptions

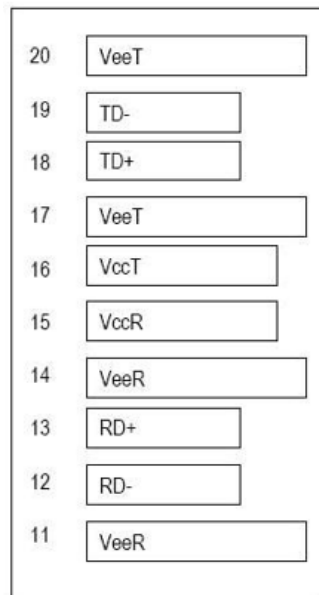
| Pin | Symbol     | Name/Description                                          | Plug Sequence | Notes |
|-----|------------|-----------------------------------------------------------|---------------|-------|
| 1   | VeeT       | Transmitter Ground.                                       | 1             |       |
| 2   | Tx_Fault   | Transmitter Fault Indication.                             | 3             | 1     |
| 3   | Tx_Disable | Transmitter Disable. Module disables on “high” or “open.” | 3             | 2     |
| 4   | MOD_DEF2   | Module Definition 2. 2-Wire Serial ID Interface.          | 3             | 3     |
| 5   | MOD_DEF1   | Module Definition 1. 2-Wire Serial ID Interface.          | 3             | 3     |
| 6   | MOD_DEF0   | Module Definition 0. 2-Wire Serial ID Interface.          | 3             | 3     |
| 7   | Reset      | Reset Signal Input.                                       | 3             | 8     |
| 8   | BPD        | Burst Power Detect (Active High).                         | 3             | 4     |
| 9   | Trigger    | Trigger Input of Burst Signal Packet Received.            | 3             | 9     |
| 10  | VeeR       | Receiver Ground.                                          | 1             |       |
| 11  | VeeR       | Receiver Ground.                                          | 1             |       |
| 12  | RD-        | Inverted Received Data Out.                               | 3             | 5     |
| 13  | RD+        | Received Data Out.                                        | 3             | 5     |
| 14  | VeeR       | Receiver Ground.                                          | 1             |       |
| 15  | VccR       | +3.3V $\pm$ 5% Receiver Power Supply.                     | 2             | 6     |
| 16  | VccT       | +3.3V $\pm$ 5% Transmitter Power Supply.                  | 2             | 6     |
| 17  | VeeT       | Transmitter Ground.                                       | 1             |       |
| 18  | TD+        | Transmitter Data In.                                      | 3             | 7     |
| 19  | TD-        | Inverted Transmitter Data In.                             | 3             | 7     |
| 20  | VeeT       | Transmitter Ground.                                       | 1             |       |

### Notes:

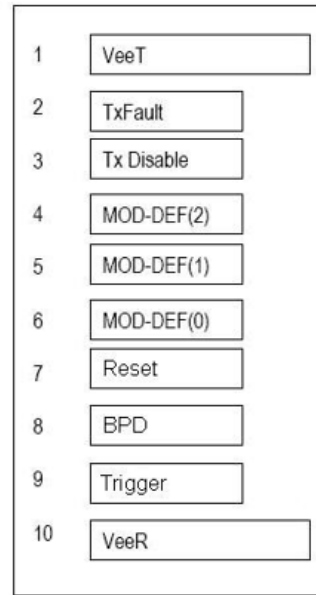
1. Tx\_Fault is open collector/drain output that should be pulled up externally with a 4.7k $\Omega$  to 10k $\Omega$  resistor on the host board to supply <VccT+0.3V or VccR+0.3V. When “high,” this output indicates a laser fault of some kind. “Low” indicates normal operation. In the low state, the output will be pulled to <0.8V.
2. Tx\_Disable input is used to shut down the laser output per the state table below. It is pulled up within the module with a 4.7k $\Omega$  to 10k $\Omega$  resistor:
  - Low (0V – 0.8V): Transmitter On
  - Between (0.8V and 2V): Undefined
  - High (2.0V – VccT): Transmitter Disabled
  - Open: Transmitter Disabled.
3. MOD\_DEF0, 1, & 2. These are the module definition pins. They should be pulled up with a 4.7k $\Omega$  to 10k $\Omega$  resistor on the host board to supply less than VccT+0.3V or VccR+0.3V.
  - MOD\_DEF0 is grounded by the module to indicate that the module is present.
  - MOD\_DEF1 is the clock line of the 2-wire serial interface for optional serial ID.
  - MOD\_DEF2 is the data line of the 2-wire serial interface for optional serial ID.
4. BPD (Burst Power Detect) is pulled up internally with a 10k $\Omega$  resistor to the VccR. When “low,” this output indicates that the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). “High” indicates normal operation. In the low state, the output will be pulled to <0.8V.

5. RD-/+. These are the differential receiver outputs. They are DC-coupled with 100 differential lines which should be terminated with 100Ω differential at the user SERDES. The DC coupling is done inside the module.
6. VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V±5% at the SFP connector pin. The in-rush current will typically be no more than 30mA above steady state supply current after 500ns.
7. TD-/+. These are the differential transmitter inputs. They are AC-coupled, differential lines with 100Ω differential termination inside the module. The AC coupling is done inside the module and is thus not required on host board.
8. Reset input compliant with LVTTL. It will be asserted “high” at the end of a burst packet.
9. Trigger input compliant with LVTTL. One positive pulse will issue a burst optical power conversion.

## Host Board

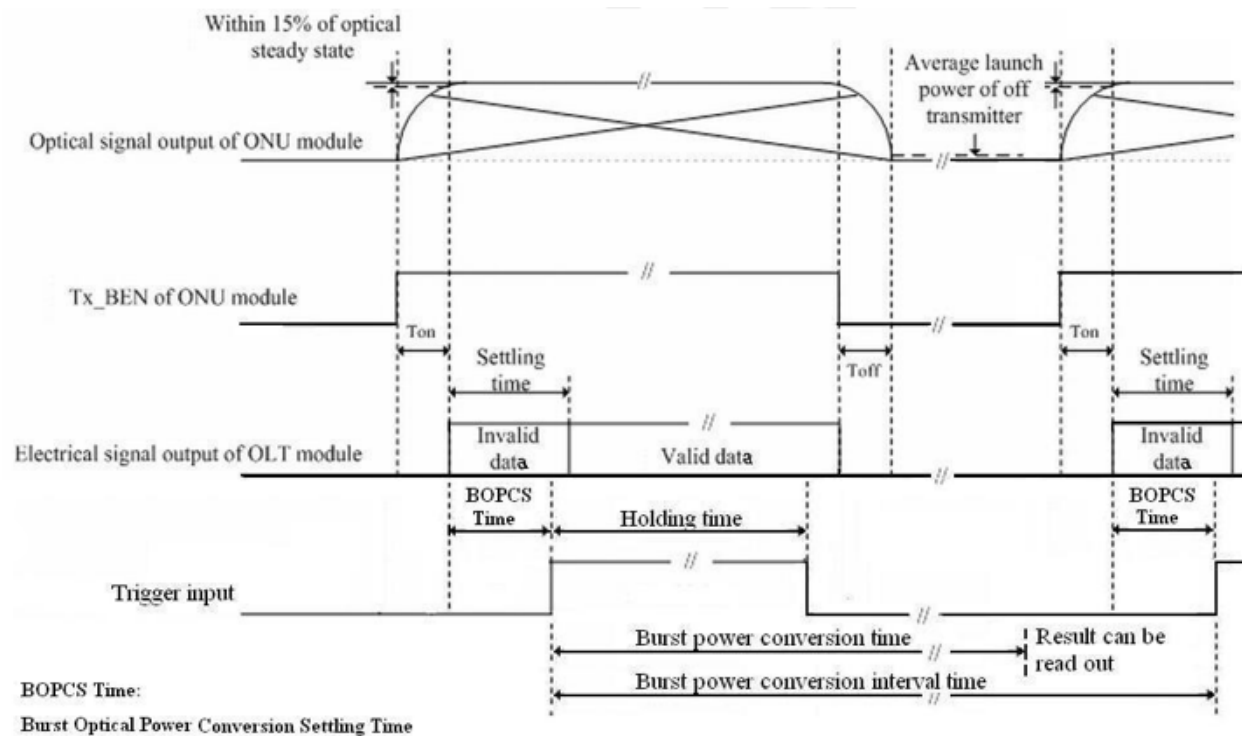


Top of Board

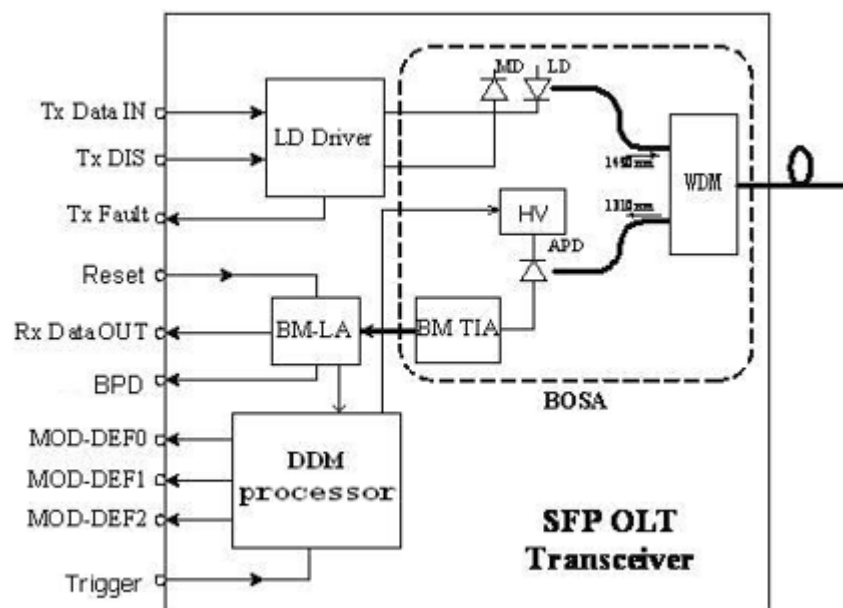


Bottom of Board (as viewed thru top of board)

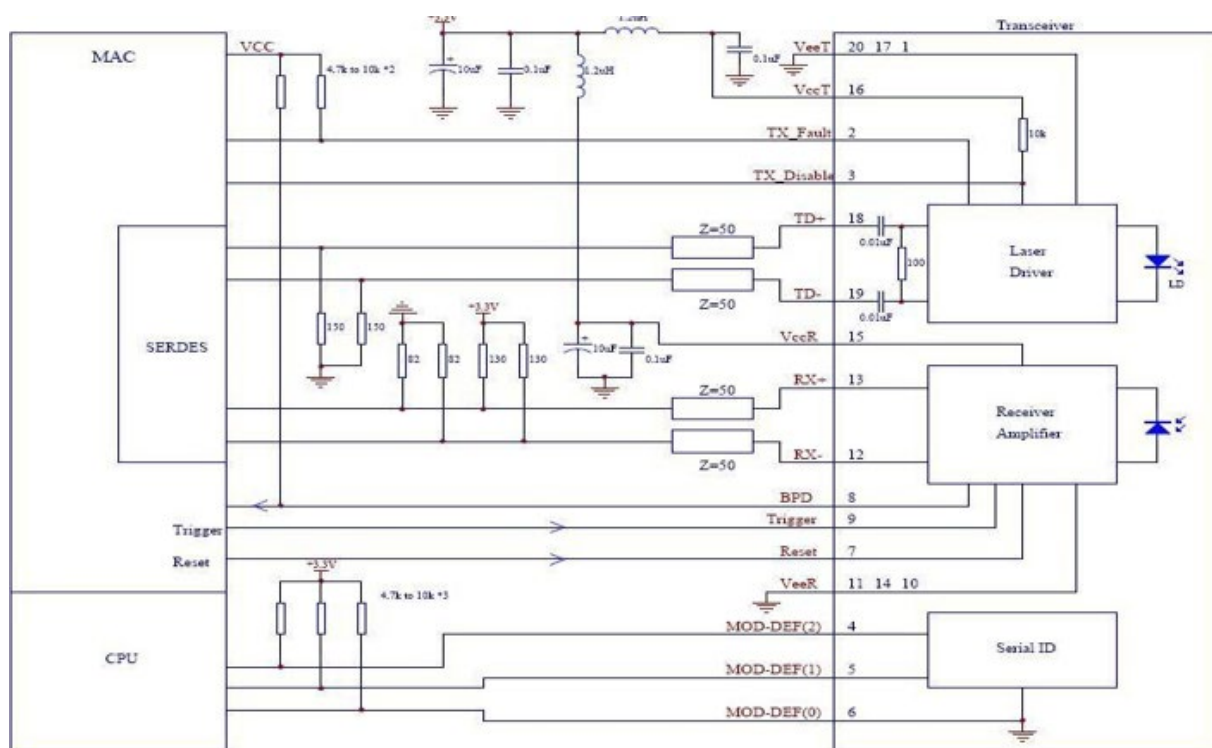
## Trigger Sequence



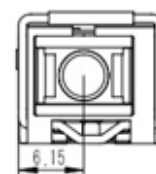
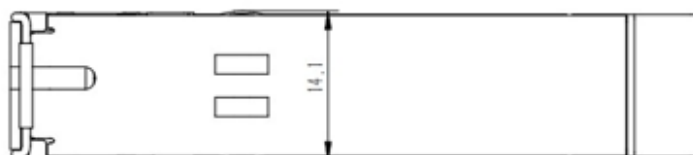
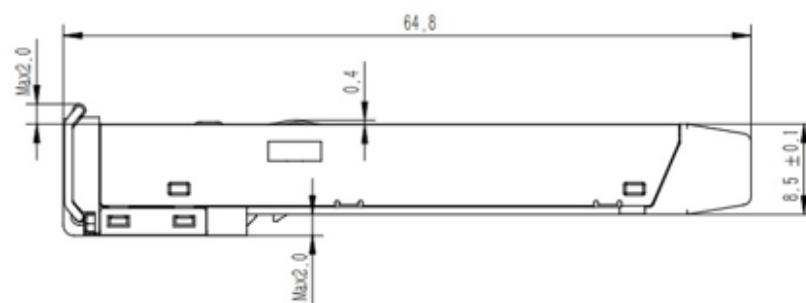
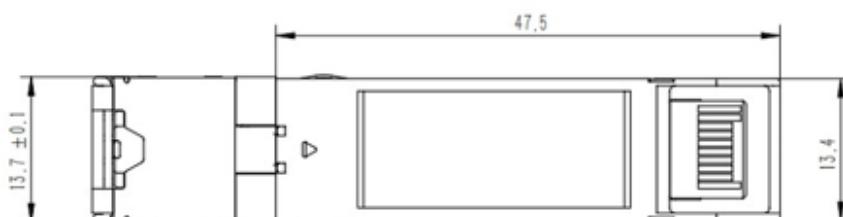
## Block Diagram



## Recommended Circuit Schematic



## Mechanical Specifications



Unit, mm  
Unspecified Tolerance, ± 0.1mm

# About Skylane Optics

Skylane is a leading provider of transceivers for optical communication.

We offer an extensive portfolio for the enterprise, access, datacenter and metropolitan fiber optical market as well as for smart home applications and home networks.

We cover the European, South American and North American market with a strong partner network and have offices in Belgium, Brazil, Sweden and USA.

Our offerings are characterized by high quality and performance. In combination with our strong technical support, we enable our customers to build cost optimized network solutions.

We offer an extensive range of high-quality products including transceivers (Optical and copper), Active Optical Cable (AOC), Direct Attach Cable (DAC), Mux/Demux, Coding Box.

