



## SFC49B40GE0D000

MSA 1000Base-CWDM SFP Transceiver (SMF, 1490nm, 200km, LC, DOM)

### Product Description

This MSA Compliant SFP transceiver provides 1000Base-CWDM throughput up to 200km over single-mode fiber (SMF) using a wavelength of 1490nm via an LC connector. It is built to MSA standards and is uniquely serialized and data-traffic and application tested to ensure that they will integrate into your network seamlessly. 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:

- SFF-8472 Compliance
- Operating Data Rate up to 1.25Gbps
- Duplex LC Connector
- Single-mode Fiber
- Commercial Temperature 0 to 70 Celsius
- CWDM DFB LD Transmitter
- Metal with Lower EMI
- Hot Pluggable
- RoHS Compliant and Lead Free
- Excellent ESD Protection



### Applications:

- Ethernet over CWDM
- Access, Metro and Enterprise
- 1x Fibre Channel

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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 |
|-----------------------------|------------------|------|-------|------|------|
| Maximum Supply Voltage      | V <sub>cc</sub>  | -0.5 |       | 3.6  | V    |
| Power Supply Voltage        | V <sub>cc</sub>  | 3.15 | 3.3   | 3.45 | V    |
| Power Supply Current        | I <sub>cc</sub>  |      |       | 300  | mA   |
| Storage Temperature         | T <sub>stg</sub> | -40  |       | 85   | °C   |
| Operating Case Temperature  | T <sub>c</sub>   | 0    |       | 70   | °C   |
| Operating Relative Humidity |                  |      |       | 95   | %    |
| Data Rate                   | GBE              |      | 1.25  |      | Gbps |
| Data Rate                   | FC               |      | 1.063 |      | Gbps |

### Notes:

1. Exceeding any one of these values may destroy the device immediately.

## Electrical Characteristics

| Parameter                     |         | Symbol           | Min. | Typ. | Max.                 | Unit  | Notes |
|-------------------------------|---------|------------------|------|------|----------------------|-------|-------|
| Transmitter                   |         |                  |      |      |                      |       |       |
| LVPECL Differential Inputs    |         | V <sub>IN</sub>  | 400  |      | 2000                 | mVp-p | 1     |
| Input Differential Impedance  |         | Z <sub>IN</sub>  | 85   | 100  | 115                  | Ω     | 2     |
| Tx_Disable                    | Disable |                  | 2    |      | V <sub>cc</sub> +0.3 | V     |       |
|                               | Enable  |                  | 0    |      | 0.8                  | V     |       |
| Tx_Fault                      | Fault   |                  | 2    |      | V <sub>cc</sub> +0.3 | V     |       |
|                               | Normal  |                  | 0    |      | 0.8                  | V     |       |
| Receiver                      |         |                  |      |      |                      |       |       |
| LVPECL Differential Outputs   |         | V <sub>OUT</sub> | 400  |      | 2000                 | mVp-p | 3     |
| Output Differential Impedance |         | Z <sub>OUT</sub> | 85   | 100  | 115                  | Ω     |       |
| Tx_Disable Assert Time        |         | T <sub>off</sub> |      |      | 10                   | us    |       |
| Rx_LOS                        | LOS     |                  | 2    |      | V <sub>cc</sub> +0.3 | V     |       |
|                               | Normal  |                  | 0    |      | 0.8                  | V     |       |
| MOD_DEF(0.2)                  |         | V <sub>OH</sub>  | 2.5  |      |                      | V     | 4     |
|                               |         | V <sub>OL</sub>  | 0    |      | 0.5                  | V     | 4     |

### Notes:

1. LVPECL Logic. Internally AC Coupled Inputs.
2. R<sub>IN</sub>>100kΩ @ DC.
3. LVPECL Logic. Internally AC Coupled Outputs.
4. With Serial ID.

## Optical Characteristics

| Parameter                   | Symbol                    | Min. | Typ. | Max.   | Unit | Notes |
|-----------------------------|---------------------------|------|------|--------|------|-------|
| Link Budget                 |                           | 41   |      |        | dB   |       |
| Data Rate                   |                           |      | 1.25 |        | Gbps |       |
| Transmitter                 |                           |      |      |        |      |       |
| Center Wavelength           | $\lambda_C$               | 1484 | 1490 | 1497.5 | nm   |       |
| Spectral Width (RMS)        | $\Delta\lambda$           |      |      | 1      | nm   |       |
| Average Output Power        | POUT                      | 4    |      | 7      | dBm  | 1     |
| Side-Mode Suppression Ratio | SMSR                      | 30   |      |        | dB   |       |
| Extinction Ratio            | ER                        | 8.2  |      |        | dB   |       |
| Rise/Fall Time (20-80%)     | Tr/Tf                     |      |      | 0.26   | ns   |       |
| Total Jitter                | TJ                        |      |      | 0.43   | UI   | 2     |
| Output Optical Eye          | Compliant with IEEE 802.3 |      |      |        |      | 2     |
| POUT @ Tx_Disable Asserted  | POUT                      |      |      | -45    | dBm  |       |
| Receiver                    |                           |      |      |        |      |       |
| Center Wavelength           | $\lambda_C$               | 1260 |      | 1620   | nm   |       |
| Receiver Sensitivity        | Pmin                      |      |      | -37    | dBm  | 3     |
| Receiver Overload           | Pmax                      | -10  |      |        | dBm  |       |
| LOS De-Assert               | LOSD                      |      |      | -38    | dBm  |       |
| LOS Assert                  | LOSA                      | -50  |      |        | dBm  |       |
| LOS Hysteresis              | LOSH                      | 0.5  |      |        | dB   |       |

### Notes:

1. Output power is measured by coupling into a 9/125 $\mu$ m single-mode fiber.
2. Filtered. Measured with a PRBS 2<sup>7</sup>-1 test pattern @1250Mbps.
3. Minimum average optical power is measured at BER<1E<sup>-12</sup> with 2<sup>7</sup>-1 PRBS and ER=9dB.

## Pin Descriptions

| Pin | Symbol      | Name/Description                                          | Plug Sequence | Notes |
|-----|-------------|-----------------------------------------------------------|---------------|-------|
| 1   | VeeT        | Transmitter Ground.                                       | 1             | 5     |
| 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 Data.     | 3             | 3     |
| 5   | MOD-DEF1    | Module Definition 1. 2-Wire Serial ID Interface Clock.    | 3             | 3     |
| 6   | MOD-DEF0    | Module Definition 0. Grounded within the module.          | 3             | 3     |
| 7   | Rate Select | Not Connected. Function Not Available.                    | 3             |       |
| 8   | LOS         | Loss of Signal.                                           | 3             | 4     |
| 9   | VeeR        | Receiver Ground.                                          | 1             | 5     |
| 10  | VeeR        | Receiver Ground.                                          | 1             | 5     |
| 11  | VeeR        | Receiver Ground.                                          | 1             | 5     |
| 12  | RD-         | Inverted Received Data Out.                               | 3             | 6     |
| 13  | RD+         | Received Data Out.                                        | 3             | 7     |
| 14  | VeeR        | Receiver Ground.                                          | 1             | 5     |
| 15  | VccR        | Receiver Power. 3.3±5%.                                   | 2             | 7     |
| 16  | VccT        | Transmitter Power. 3.3±5%.                                | 2             | 7     |
| 17  | VeeT        | Transmitter Ground.                                       | 1             | 5     |
| 18  | TD+         | Transmit Data In.                                         | 3             | 8     |
| 19  | TD-         | Inverted Transmit Data In.                                | 3             | 8     |
| 20  | VeeT        | Transmitter Ground.                                       | 1             | 5     |

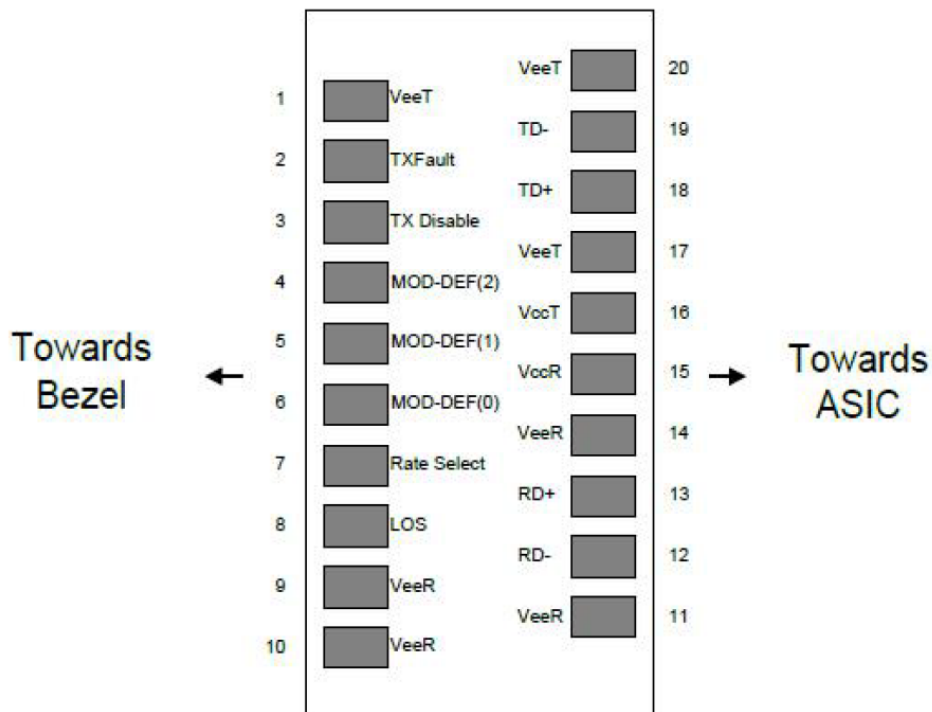
## Notes:

1. Tx\_Fault is an open collector/drain output which should be pulled up with a 4.7kΩ to 10kΩ resistor on the host board. Pull-up voltage is between 2.0V and VccT/R+0.3V. When “high,” 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 is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7kΩ to 10kΩ resistor. Its states are:
  - Low (0V-0.8V): Transmitter On
  - (>0.8V, <2.0V): Undefined
  - High (2.0V-3.465V): Transmitter Disabled
  - Open: Transmitter Disabled.
3. MOD-DEF0, 1, and 2. These are the module definition pins. They should be pulled up with a 4.7kΩ to 10kΩ resistor on the host board. The pull-up voltage shall be VccT or VccR.
  - 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 Serial ID.
  - MOD-DEF2 is the data line of the 2-Wire Serial Interface for Serial ID.
4. LOS (Loss of Signal) is an open collector/drain output which should be pulled up with a 4.7kΩ to 10kΩ

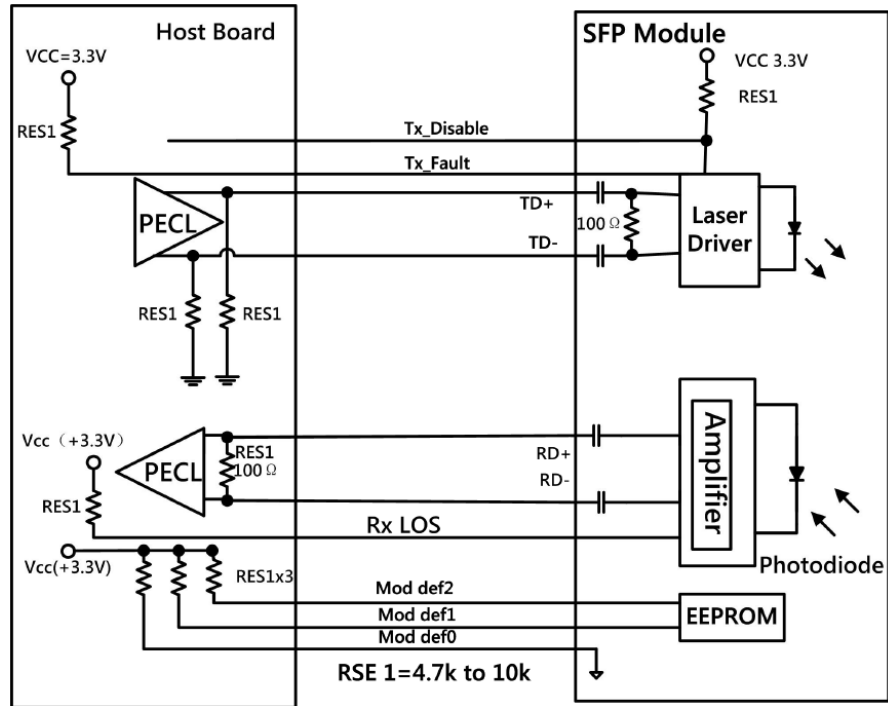
resistor. Pull-up voltage is between 2.0V and  $V_{ccT}/R+0.3V$ . When “high,” this output indicates that the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). “Low” indicates normal operation. In the “low” state, the output will be pulled to  $<0.8V$ .

5. VeeR and VeeT may be internally connected within the SFP module.
6. RD±. These are the differential receiver outputs. They are AC coupled 100 differential lines which should be terminated with 100 (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board. The voltage swing on these lines will be between 400mV to 2000mV differential (200mV to 1000mV, single-ended) when properly terminated.
7. VccR and VccT are the receiver and transmitter power supplies. They are defined as  $3.3V \pm 5\%$  at the SFP connector pin. Maximum supply current is 300mA. Recommended host board power supply filtering is shown below. Inductors with DC resistance of  $<1\Omega$  should be used in order to maintain the required voltage at the SFP input pin with 3.3V supply voltage. When the recommended supply-filtering network is used, hot plugging of the SFP transceiver module will result in an inrush current of no more than 30mA greater than the steady state value. VccR and VccT may be internally connected within the SFP transceiver module.
8. TD±. These are the differential transmitter inputs. They are AC coupled, differential lines with 100 differential terminations inside the module. The AC coupling is done inside the module and is thus not required on the host board. The inputs will accept differential swings of 400mV to 2000mV (200mV to 1000mV, single-ended).

## Electrical Pin-Out Details



## Recommended Circuit Schematic

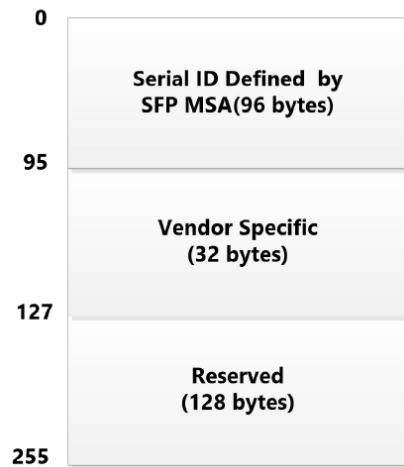


## EEPROM Information

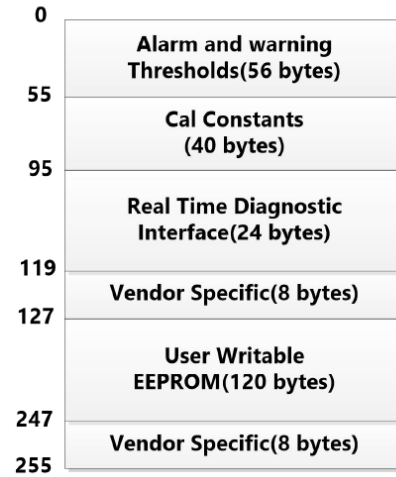
The serial interface uses the 2-wire serial CMOS EEPROM protocol defined for the ATMEL AT24c02/04 family of components. When the serial protocol is activated, the host generates the serial clock signal (SCL). The positive edge clocks data into those segments of the EEPROM that are not write-protected within the SFP+ transceiver. The negative edge clocks data from the SFP+ transceiver. The serial data signal (SDA) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially.

The module provides diagnostic information about the present operation conditions. The transceiver generates this diagnostic data by digitization of the internal analog signals. Calibration and alarm/warning threshold data is written during device manufacture. Received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring, and temperature monitoring are all implemented. If the module is defined as externally calibrated, the diagnostic data are raw A/D values and must be converted to real-world units using calibration constants stored in EEPROM locations 56-95 at the wire serial bus address A2h. The digital diagnostic memory map-specific data field is defined as the following. For detailed EEPROM information, please refer to SFF-8472 Rev. 10.2.

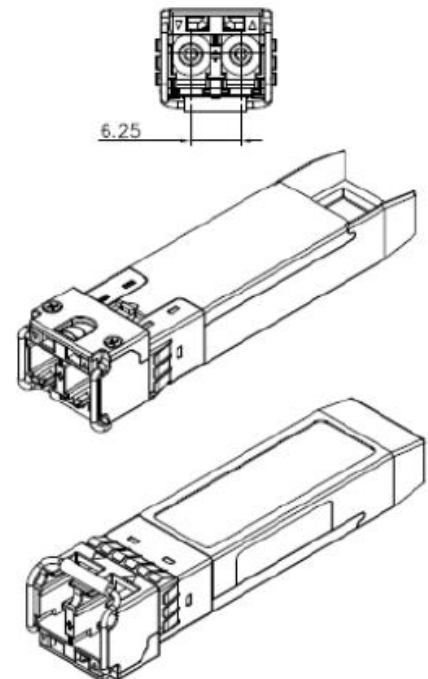
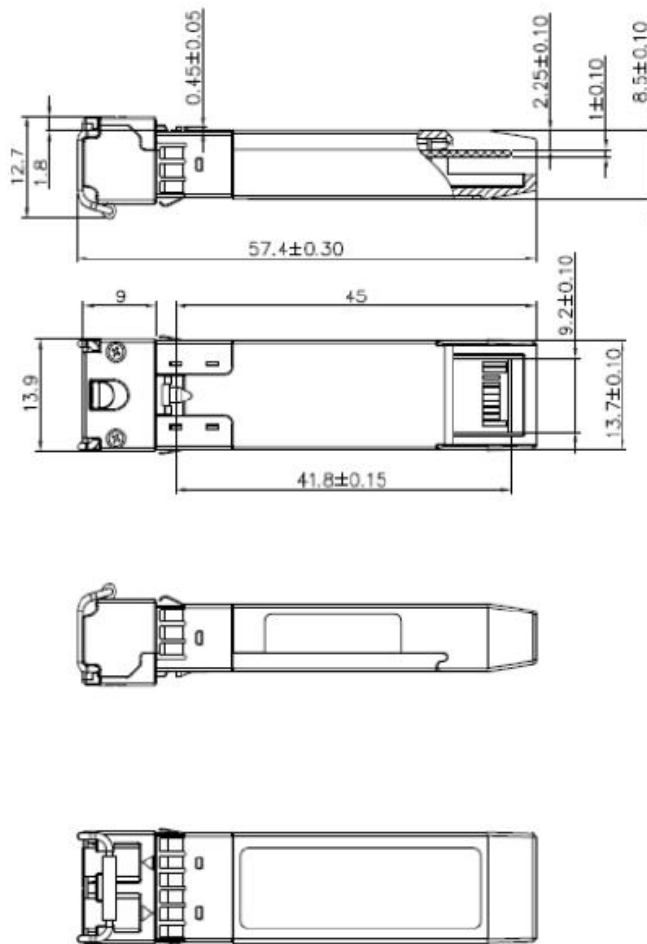
2 wire address 1010000X(A0h)



2 wire address 1010000X (A2h)



## Mechanical Specifications



Unremarked tolerances  $\pm 0.2\text{mm}$

# 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.

