



## QSFP-40GBASE-ER4-SKY

MSA Compliant 40GBase-ER4 QSFP+ Transceiver (SMF, 1270nm to 1330nm, 40km, LC, DOM)

### Product Description

This MSA compliant QSFP+ transceiver provides 40GBase-ER4 throughput up to 40km over single-mode fiber (SMF) using a wavelength of 1270nm to 1330nm via an LC connector. All of our transceivers are built to comply with Multi-Source Agreement (MSA) standards and are uniquely serialized and tested for data-traffic and application to ensure seamless network integration. Additional product features include Digital Optical Monitoring (DOM) support which allows 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-8436 Compliance
- Duplex LC Connector
- Commercial Temperature 0 to 70 Celsius
- Single-mode Fiber
- Hot Pluggable
- Excellent ESD Protection
- Metal with Lower EMI
- RoHS Compliant and Lead Free



### Applications:

- 40GBase Ethernet
- 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 |
|-----------------------------|--------|-----------------|------|------|------|
| Power Supply Voltage        | Vcc    | -0.5            |      | 3.6  | V    |
| Storage Temperature         | Tst    | -40             |      | 85   | °C   |
| Case Operating Temperature  | Top    | 0               |      | 70   | °C   |
| Humidity (non-condensing)   | Rh     | 0               |      | 95   | %    |
| Damage Threshold. Each lane |        | TH <sub>d</sub> | 3.8  |      | dBm  |

### Recommended Operating Conditions

| Parameter                  | Symbol | Min.  | Typ.    | Max.  | Unit |
|----------------------------|--------|-------|---------|-------|------|
| Supply Voltage             | Vcc    | 3.135 | 3.3     | 3.465 | V    |
| Operating Case Temperature | Tca    | -40   |         | 85    | °C   |
| Data Rate Per Lane         |        |       | 10.3125 | 11.2  | Gbps |
| Control Input Voltage High |        | 2     |         | Vcc   | V    |
| Control Input Voltage Low  |        | 0     |         | 0.8   | V    |
| Link Distance with G.652   | D      |       |         | 40    | km   |

## Electrical Characteristics

| Parameter                                              | Symbol  | Min.                   | Typ. | Max. | Unit     | Notes |
|--------------------------------------------------------|---------|------------------------|------|------|----------|-------|
| Power Consumption                                      |         |                        |      | 3.5  | W        |       |
| Supply Current                                         | Icc     |                        |      | 1.1  | A        |       |
| Transceiver Power-on Initialization Time               |         |                        |      | 2000 | ms       | 1     |
| Transmitter                                            |         |                        |      |      |          |       |
| Single-ended Input Voltage                             |         | -0.3                   |      | 4.0  | V        |       |
| AC Common Mode Input Voltage Tolerance                 |         | 15                     |      |      | mV       |       |
| Differential Input Voltage Swing Threshold             |         | 50                     |      |      | mVpp     |       |
| Differential Input Voltage Sing                        | Vin, pp | 190                    |      | 700  | mVpp     |       |
| Differential Input Impedance                           | Zin     | 90                     | 100  | 110  | Ohm      |       |
| Differential Input Return Loss                         |         | IEEE 802.3ba 86A.4.11  |      |      | dB       |       |
| J2 Jitter Tolerance                                    | Jt2     | 0.17                   |      |      | UI       |       |
| J9 Jitter Tolerance                                    | Jt9     | 0.29                   |      |      | UI       |       |
| Data Dependent Pulse Width Shrinkage (DDPWS) Tolerance |         | 0.07                   |      |      | UI       |       |
| Eye Mask Coordinates {X1, X2, Y1, Y2}                  |         | 0.11,0.31<br>95, 350   |      |      | UI<br>mV |       |
| Receiver                                               |         |                        |      |      |          |       |
| Single Ended Output Voltage                            |         | -0.3                   |      | 4.0  | V        |       |
| AC Common Mode Output Voltage                          |         |                        |      | 7.5  | mV       |       |
| Differential Output Voltage Swing                      | Vout,pp | 300                    |      | 850  | mVpp     |       |
| Differential Output Impedance                          | Zout    | 90                     | 100  | 110  | Ohm      |       |
| Termination Mismatch at 1MHz                           |         |                        |      | 5    | %        |       |
| Differential Output Return Loss                        |         | IEEE 802.3ba 86A.4.2.1 |      |      | dB       |       |
| Common Mode Output Return Loss                         |         | IEEE 802.3ba 86A.4.2.2 |      |      | dB       |       |
| Output Transition Time                                 |         | 28                     |      |      | ps       |       |
| J2 Jitter Output                                       | Jo2     |                        |      | 0.42 | UI       |       |
| J9 Jitter Output                                       | Jo9     |                        |      | 0.65 | UI       |       |
| Eye Mask Coordinates {X1, X2, Y1, Y2}                  |         | 0.29, 0.5<br>150, 420  |      |      | UI<br>mV |       |

### Notes:

1. Power-on Initialization Time is the time from when the power supply voltages reach and remain above the minimum recommended operating supply voltages to the time when the module is fully functional.
2. The single ended input voltage tolerance is the allowable range of the instantaneous input signals.

## Optical Characteristics

| Parameter                                                                     | Symbol               | Min.                          | Typ. | Max.   | Unit  | Notes |
|-------------------------------------------------------------------------------|----------------------|-------------------------------|------|--------|-------|-------|
| Wavelength Assignment                                                         | L0                   | 12694.5                       | 1271 | 1277.5 | nm    |       |
|                                                                               | L1                   | 1284.5                        | 1291 | 1297.5 | nm    |       |
|                                                                               | L2                   | 1304.5                        | 1311 | 1317.5 | nm    |       |
|                                                                               | L3                   | 1324.5                        | 1331 | 1337.5 | nm    |       |
| Transmitter                                                                   |                      |                               |      |        |       |       |
| Side Mode Suppression Ratio                                                   | SMSR                 | 30                            |      |        | dB    |       |
| Total Average Launch Power                                                    | P <sub>T</sub>       |                               |      | 10.5   | dBm   |       |
| Average Launch Power, each Lane                                               | P <sub>AVG</sub>     | -3.7                          |      | 4.5    | dBm   |       |
| Optical Modulation Amplitude (OMA), each Lane                                 | P <sub>OMA</sub>     | .07                           |      | 5      | dBm   | 1     |
| Difference in Launch Power between and Two Lanes (OMA)                        | P <sub>tx,diff</sub> |                               |      | 4.7    | dB    |       |
| Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP), each Lane |                      | 1.5                           |      |        | dBm   |       |
| TDP, each Lane                                                                | TDP                  |                               |      | 2.6    | dB    |       |
| Extinction Ratio                                                              | ER                   | 5.5                           |      |        | dB    |       |
| Relative Intensity Noise                                                      | RIN                  |                               |      | -128   | dB/Hz |       |
| Optical Return Loss Tolerance                                                 | TOL                  |                               |      | 20     | dB    |       |
| Transmitter Reflectance                                                       | R <sub>T</sub>       |                               |      | -12    | dB    |       |
| Transmitter Eye Mask Definition {X1, X2, X3, Y1, Y2, Y3}                      |                      | {0.25,0.4,0.45,0.25,0.28,0.4} |      |        |       |       |
| Average Launch Power OFF Transmitter, each Lane                               | P <sub>off</sub>     |                               |      | -30    | dBm   |       |
| Receiver                                                                      |                      |                               |      |        |       |       |
| Damage Threshold, each Lane                                                   | TH <sub>d</sub>      | 3.8                           |      |        | dBm   | 2     |
| Average Receive Power, each Lane                                              |                      | -20.2                         |      | -1.5   | dBm   |       |
| Receiver Reflectance                                                          | R <sub>R</sub>       |                               |      | -26    | dB    |       |
| Receiver Power (OMA), each Lane                                               |                      |                               |      | -1     | dBm   |       |
| Receiver Sensitivity (OMA), each Lane                                         | SEN                  |                               |      | -18    | dBm   |       |
| Stressed Receiver Sensitivity (OMA), each Lane                                |                      |                               |      | -15.8  | dBm   | 3     |
| Difference in Receiver Power between and Two Lanes (OMA)                      | P <sub>rx,diff</sub> |                               |      | 7      | dB    |       |
| LOS Assert                                                                    | LOSA                 | -35                           |      |        | dBm   |       |
| LOS De-assert                                                                 | LOSD                 |                               |      | -20    | dBm   |       |
| LOS Hysteresis                                                                | LOSH                 | 0.5                           |      |        | dB    |       |
| Receiver Electrical 3 dB upper Cutoff Frequency, each Lane                    | F <sub>c</sub>       |                               |      | 12.3   | GHz   |       |
| Conditions of Stress Receiver Sensitivity Test (Note 4)                       |                      |                               |      |        |       |       |
| Vertical Eye Closure Penalty, each Lane                                       |                      |                               | 2.2  |        | dB    |       |
| Stressed Eye J2 Jitter, each Lane                                             |                      |                               | 0.3  |        | UI    |       |
| Stressed Eye J9 Jitter, each Lane                                             |                      |                               | 0.47 |        | UI    |       |

**Notes:**

1. Even if the TDP<0.8 dB, the OMA min must exceed the minimum value specified here.
2. The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power.
3. Measured with conformance test signal at receiver input for BER=  $1 \times 10^{-12}$ .
4. Vertical eye closure penalty and stressed eye jitter are test conditions for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

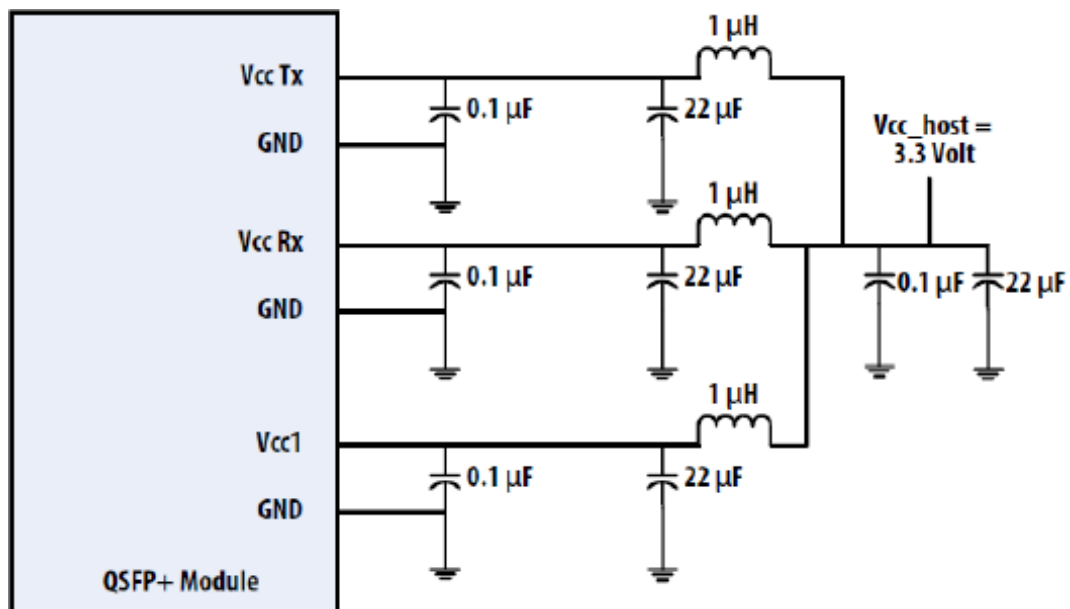
## Pin Descriptions

| Pin | Logic       | Symbol  | Name/Descriptions                                  | Ref. |
|-----|-------------|---------|----------------------------------------------------|------|
| 1   |             | GND     | Module Ground                                      | 1    |
| 2   | CML-I       | Tx2-    | Transmitter inverted data input                    |      |
| 3   | CML-I       | Tx2+    | Transmitter non-inverted data input                |      |
| 4   |             | GND     | Module Ground                                      | 1    |
| 5   | CML-I       | Tx4-    | Transmitter inverted data input                    |      |
| 6   | CML-I       | Tx4+    | Transmitter non-inverted data input                |      |
| 7   |             | GND     | Module Ground                                      | 1    |
| 8   | LVTTL-I     | MODSEIL | Module Select                                      | 2    |
| 9   | LVTTL-I     | ResetL  | Module Reset                                       | 2    |
| 10  |             | VCCRx   | +3.3v Receiver Power Supply                        |      |
| 11  | LVC MOS-I   | SCL     | 2-wire Serial interface clock                      | 2    |
| 12  | LVC MOS-I/O | SDA     | 2-wire Serial interface data                       | 2    |
| 13  |             | GND     | Module Ground                                      | 1    |
| 14  | CML-O       | RX3+    | Receiver non-inverted data output                  |      |
| 15  | CML-O       | RX3-    | Receiver inverted data output                      |      |
| 16  |             | GND     | Module Ground                                      | 1    |
| 17  | CML-O       | RX1+    | Receiver non-inverted data output                  |      |
| 18  | CML-O       | RX1-    | Receiver inverted data output                      |      |
| 19  |             | GND     | Module Ground                                      | 1    |
| 20  |             | GND     | Module Ground                                      | 1    |
| 21  | CML-O       | RX2-    | Receiver inverted data output                      |      |
| 22  | CML-O       | RX2+    | Receiver non-inverted data output                  |      |
| 23  |             | GND     | Module Ground                                      | 1    |
| 24  | CML-O       | RX4-    | Receiver inverted data output                      |      |
| 25  | CML-O       | RX4+    | Receiver non-inverted data output                  |      |
| 26  |             | GND     | Module Ground                                      | 1    |
| 27  | LVTTL-O     | ModPrsL | Module Present, internal pulled down to GND        |      |
| 28  | LVTTL-O     | IntL    | Interrupt output should be pulled up on host board | 2    |
| 29  |             | VCCTx   | +3.3v Transmitter Power Supply                     |      |
| 30  |             | VCC1    | +3.3v Power Supply                                 |      |
| 31  | LVTTL-I     | LPMODE  | Low Power Mode                                     | 2    |
| 32  |             | GND     | Module Ground                                      | 1    |
| 33  | CML-I       | Tx3+    | Transmitter non-inverted data input                |      |
| 34  | CML-I       | Tx3-    | Transmitter inverted data input                    |      |
| 35  |             | GND     | Module Ground                                      | 1    |
| 36  | CML-I       | Tx1+    | Transmitter non-inverted data input                |      |
| 37  | CML-I       | Tx1-    | Transmitter inverted data input                    |      |
| 38  |             | GND     | Module Ground                                      | 1    |

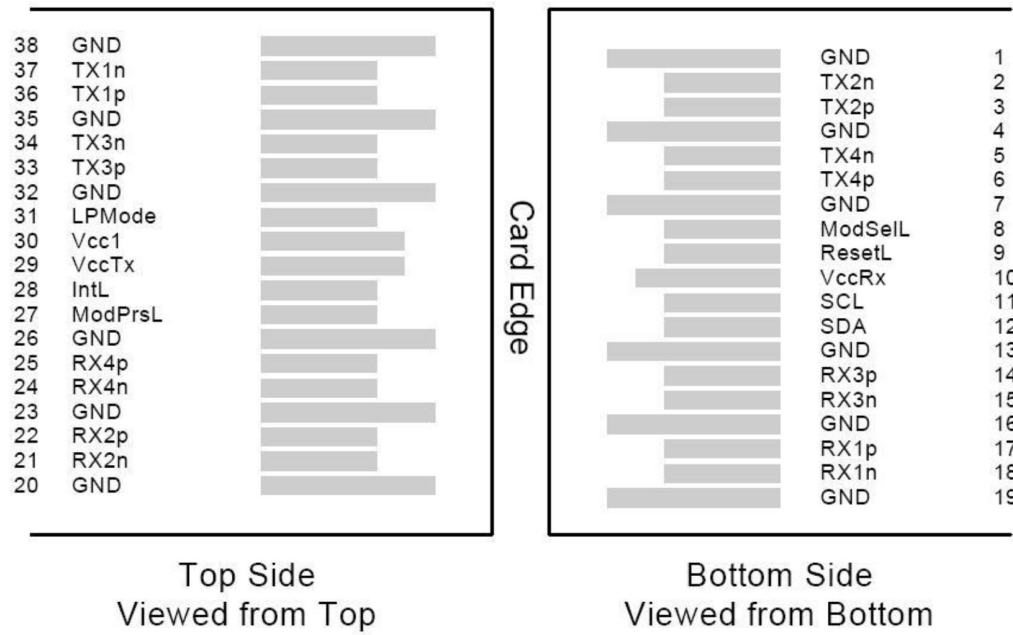
**Notes:**

1. GND is the symbol for signal and supply (power) common for QSFP+ modules. All are common within the QSFP+ module and all module voltages are referenced to this potential unless otherwise noted. Connect these directly to the host board signal common ground plane.
2. VccRx, Vcc1 and Vxx Tx are the receiving and transmission power suppliers and shall be applied concurrently. Recommend host board power supply filtering is shown in image below. VccRx, Vcc1 and Vcc Tx may be internally connected within the QSFP+ transceiver module in any combination. The connector pins are each rated for a maximum current of 500mA

### Recommended Power Supply Filter



Electrical Pin-out Details



Digital Diagnostic Functions

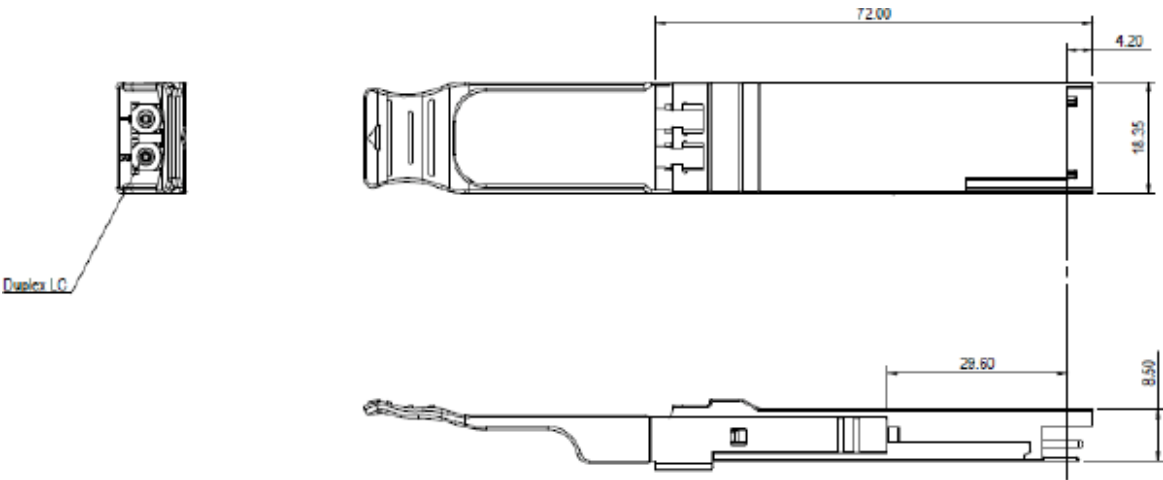
The following digital diagnostic characteristics are defined over the normal operating conditions unless otherwise specified.

| Parameter                               | Symbol       | Min. | Max. | Unit | Notes                            |
|-----------------------------------------|--------------|------|------|------|----------------------------------|
| Temperature monitor absolute error      | DMI_Temp     | -3   | +3   | °C   | Over operating temperature range |
| Supply voltage monitor absolute error   | DMI_VCC      | -0.1 | 0.1  | V    | Over full operating range        |
| Channel RX power monitor absolute error | DMI_RX_Ch    | -2   | 2    | dB   | 1                                |
| Channel Bias current monitor            | DMI_Ibias_Ch | -10% | 10%  | mA   |                                  |
| Channel TX power monitor absolute error | DMI_TX_Ch    | -2   | 2    | dB   | 1                                |

Notes:

1. Due to measurement accuracy of different single mode fibers, there could be an additional +/-1 dB fluctuation, or a +/- 3 dB total accuracy.

Mechanical Specifications



# 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.

