



## **X2-10GBASE-LR-OPC**

MSA and TAA 10GBase-LR X2 Transceiver (SMF, 1310nm, 10km, SC, DOM)

### **Features**

- X2 MSA 2.0 Compliance
- Duplex SC Connector
- Single-mode Fiber
- Commercial Temperature 0 to 70 Celsius
- Hot Pluggable
- Metal with Lower EMI
- Excellent ESD Protection
- RoHS Compliant and Lead Free



### **Applications:**

- 10GBase-LR Ethernet
- 8x/10x Fibre Channel
- Access, Datacenter and Enterprise
- Mobile Fronthaul CPRI/OBSAI

### **Product Description**

This MSA compliant X2 transceiver provides 10GBase-LR throughput up to 10km over single-mode fiber (SMF) using a wavelength of 1310nm via an SC connector. It can operate at temperatures between 0 and 70C. 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. This transceiver is Trade Agreements Act (TAA) compliant. We stand behind the quality of our products and proudly offer a limited lifetime warranty.

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

### Absolute Maximum Ratings

| Parameter                   | Symbol            | Min. | Typ. | Max. | Unit |
|-----------------------------|-------------------|------|------|------|------|
| Storage Ambient Temperature | T <sub>S</sub>    | -40  |      | 85   | °C   |
| Supply Voltage (5V)         | V <sub>S</sub>    | 0    |      | 6    | V    |
| Supply Voltage (3.3V)       | V <sub>3</sub>    | 0    |      | 4    | V    |
| Supply Voltage (APS)        | V <sub>APS</sub>  | 0    |      | 1.5  | V    |
| Optical Receiver Input      | P <sub>IMAX</sub> |      |      | 1.5  | dBm  |

### General Specifications

| Parameter                  | Symbol             | Min.  | Typ.    | Max.              | Unit |
|----------------------------|--------------------|-------|---------|-------------------|------|
| Data Rate                  | DR                 |       | 10.3125 |                   | GBd  |
| Bit Error Rate             | BER                |       |         | 10 <sup>-12</sup> |      |
| Total Power Consumption    | P                  |       |         | 3                 | W    |
| Supply Voltage (5V)        | V <sub>CC5</sub>   | 4.75  | 5       | 5.25              | V    |
| Supply Voltage (+3.3V)     | V <sub>CC3</sub>   | 3.14  | 3.3     | 3.47              | V    |
| Supply Voltage (APS)       | V <sub>CCAPS</sub> | 1.152 | 1.2     | 1.248             | V    |
| Supply Current (5V)        | I <sub>CC5</sub>   |       |         | 100               | mA   |
| Supply Current (+3.3V)     | I <sub>CC3</sub>   |       |         | 300               | mA   |
| Supply Current (APS)       | I <sub>CCAPS</sub> |       |         | 1000              | mA   |
| Case Operating Temperature | T <sub>C</sub>     | 0     |         | 70                | °C   |

### Link Distance

| Parameter | Fiber Type  | Distance Range (km) |
|-----------|-------------|---------------------|
| 10.3 GBd  | 9/125μm SMF | 10                  |

## Optical Characteristics

| Parameter                                      | Symbol               | Min.                      | Typ. | Max.  | Unit  | Notes |
|------------------------------------------------|----------------------|---------------------------|------|-------|-------|-------|
| Transmitter                                    |                      |                           |      |       |       |       |
| Optical Wavelength                             | $\lambda$            | 1290                      |      | 1330  | nm    |       |
| Launch Power                                   | P <sub>OUT</sub>     | -8.2                      |      | 0.5   | dBm   |       |
| Launch Power in OMA minus TDP                  | P <sub>OUT_OMA</sub> | -5.2                      |      |       | dBm   |       |
| Launch Power of OFF Transmitter                | P <sub>OUT_OFF</sub> |                           |      | -30   | dBm   |       |
| Side Mode Suppression Ratio                    | SMSR                 | 30                        |      |       | dB    |       |
| Spectral Width (-20dB)                         | $\Delta \lambda$     |                           |      | 0.6   | nm    |       |
| Optical Extinction Ratio                       | ER                   | 3.5                       |      |       | dB    |       |
| Optical Modulation amplitude                   | OMA                  | -5.2                      |      |       | dBm   |       |
| Optical Return Loss Tolerance                  | ORL <sub>T</sub>     |                           |      | 12    | dB    |       |
| Relative Intensity Noise                       | RIN                  |                           |      | -128  | dB/Hz |       |
| Transmitter Dispersion Penalty                 | TDP                  |                           |      | 3.2   | dB    |       |
| Transmitter Reflectance                        | TR <sub>TX</sub>     |                           |      | -12   | dB    |       |
| Eye Mask Definition                            |                      | According to IEEE 802.3ae |      |       |       |       |
| Receiver                                       |                      |                           |      |       |       |       |
| Center Wavelength Range                        | $\lambda_c$          | 1260                      |      | 1600  | nm    |       |
| Optical Input Power                            | P <sub>IN</sub>      | -14.4                     |      | 0.5   | dBm   |       |
| Receiver Sensitivity in OMA                    | P <sub>IN_OMA</sub>  |                           |      | -12.6 | dBm   |       |
| Stressed Receiver Sensitivity                  | P <sub>IN_S</sub>    |                           |      | -10.3 | dBm   |       |
| Receiver Reflectance                           | TR <sub>RX</sub>     |                           |      | -12   | dB    |       |
| Loss of Signal Assert Level                    | P <sub>LOS_A</sub>   | -25                       |      |       | dBm   |       |
| Loss of Signal De-assert Level                 | P <sub>LOS_D</sub>   |                           |      | -16   | dBm   |       |
| Loss of Signal Hysteresis                      | P <sub>LOS_H</sub>   | 1                         |      |       | dBm   |       |
| Receiver electrical 3dB upper cutoff frequency | FR                   |                           |      | 12.3  | GHz   |       |

## Electrical Characteristics - DC

| Parameter                                                                  | Symbol          | Min.  | Typ. | Max.  | Unit       | Notes               |
|----------------------------------------------------------------------------|-----------------|-------|------|-------|------------|---------------------|
| <b>A. 1.2V COMS I/O DC Characteristics (PRTAD; LASI; RESET; TX_ON/OFF)</b> |                 |       |      |       |            |                     |
| External Pull-Up Resistor for Open Drain                                   | $R_{PU}$        | 10    |      | 22    | K $\Omega$ |                     |
| Output High Voltage                                                        | $V_{OH}$        | 1     |      |       | V          |                     |
| Output Low Voltage                                                         | $V_{OL}$        |       |      | 0.15  | V          |                     |
| Input High Voltage                                                         | $V_{IH}$        | 0.84  |      | 1.2   | V          |                     |
| Input Low Voltage                                                          | $V_{IL}$        |       |      | 0.36  | V          |                     |
| Input Pull-Down Current                                                    | IPD             | 20    | 120  | 120   | $\mu$ A    | VIN=1.2V            |
| <b>B. XAUI I/O DC Characteristics (TXLAN[0..3]; RXLANE[0..3])</b>          |                 |       |      |       |            |                     |
| Differential Input Amplitude (pk-pk)                                       | $V_{IN\_XAUI}$  | 200   |      | 2500  | mV         | AC Coupled          |
| Differential output Amplitude (pk-pk)                                      | $V_{OUT\_XAUI}$ | 800   |      | 1600  | mV         | AC Coupled          |
| <b>C. MDIO I/O DC Characteristics (MDIO; MDC)</b>                          |                 |       |      |       |            |                     |
| Output Low Voltage                                                         | $V_{OL}$        |       |      | 0.2   | V          | $I_{OL} = 100\mu$ A |
| Output Low Current                                                         | $I_{OL}$        |       |      | 4     | mA         |                     |
| Input High Voltage                                                         | $V_{IH}$        | 0.84  |      | 1.2   | V          |                     |
| Input Low Voltage                                                          | $V_{IL}$        |       |      | 0.36  | V          |                     |
| Pull-Up Supply Voltage                                                     | $V_{PU}$        | 1.152 | 1.2  | 1.248 | V          |                     |
| Input Capacitance                                                          | $C_{IN}$        |       |      | 10    | pF         |                     |
| Load Capacitance                                                           | $C_{LOAD}$      |       |      | 470   | pF         |                     |
| External Pull-Up Resistance                                                | RPU             | 200   |      |       | $\Omega$   |                     |

## Electrical Characteristics - AC

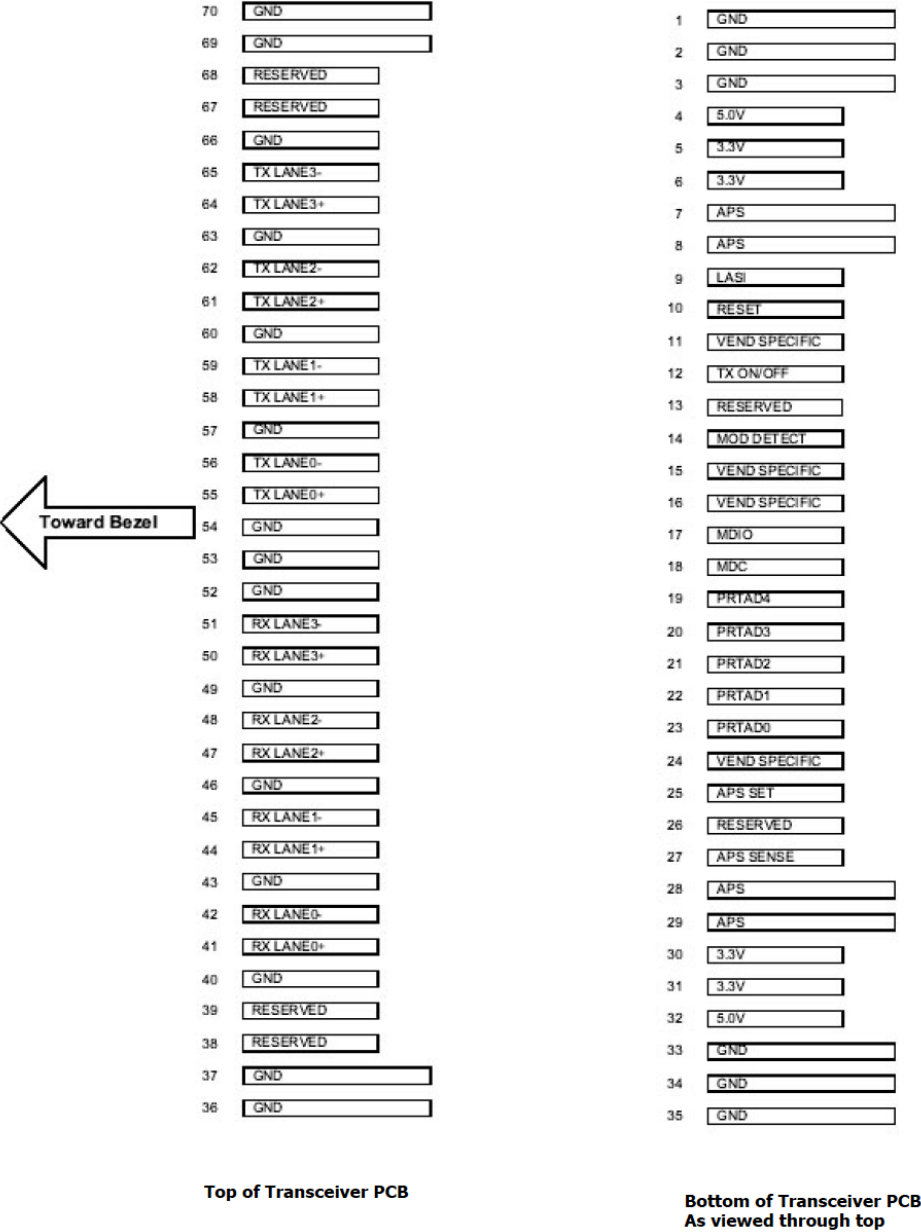
| Parameter                                        | Symbol                 | Min.                      | Typ.  | Max. | Unit             | Notes                                       |
|--------------------------------------------------|------------------------|---------------------------|-------|------|------------------|---------------------------------------------|
| A. XAUI Input AC Characteristics (TXLANE[0..3])  |                        |                           |       |      |                  |                                             |
| Baud Rate                                        | BR <sub>XAUI_IN</sub>  |                           | 3.125 |      | GBd              |                                             |
| Baud Rate Tolerance                              | BR <sub>TOL_XAUI</sub> | -100                      |       | 100  | ppm              |                                             |
| Differential Input Impedance                     | Z <sub>IN_XAUI</sub>   | 80                        | 100   | 120  | Ω                |                                             |
| Differential Return Loss                         | RL <sub>IN</sub>       | 10                        |       |      | dB               | 100MHz to 2.5 GHz                           |
| Input Differential Skew                          | T <sub>IN_SKEW</sub>   |                           |       | 75   | ps               | Crossing Point                              |
| Jitter Amplitude Tolerance                       | J <sub>XAUI_TOL</sub>  |                           |       | 0.65 | UI <sub>pp</sub> | IEEE 802.3ae                                |
| B. XAUI Output AC Characteristics (RXLANE[0..3]) |                        |                           |       |      |                  |                                             |
| Baud Rate                                        | BR <sub>XAUI_OUT</sub> |                           | 3.125 |      | GBd              |                                             |
| Baud Rate Variation                              | BR <sub>XAUI_VAR</sub> | -100                      |       | 100  | ppm              |                                             |
| XAUI Eye Mask (far-end)                          |                        | According to IEEE 802.3ae |       |      |                  |                                             |
| Output Differential Skew                         | T <sub>OUT_SKEW</sub>  |                           |       | 15   | ps               |                                             |
| Output Differential Impedance                    | Z <sub>OUT_XAUI</sub>  | 80                        | 100   | 120  | Ω                |                                             |
| Differential Output Return Loss                  | RL <sub>OUT</sub>      | 10                        |       |      | dB               | 100 MHz to 2.5 GHz                          |
| Total Jitter                                     | TJ <sub>XAUI</sub>     |                           |       | 0.35 | UI               | Near-end No pre-equalization<br>1 UI=320 ps |
| Deterministic Jitter                             | DJ <sub>XAUI</sub>     |                           |       | 0.17 | UI               |                                             |
| C. Power-On Reset Characteristics                |                        |                           |       |      |                  |                                             |
| Power-On Reset and TX_ONOFF Characteristics      |                        | According to X2 MSA Issue |       |      |                  |                                             |
| D. MDIO I/O AC Characteristics (MDIO; MDC)       |                        |                           |       |      |                  |                                             |
| MDIO Data Hold Time                              | T <sub>HOLD</sub>      | 10                        |       |      | ns               |                                             |
| MDIO Data Setup Time                             | T <sub>SU</sub>        | 10                        |       |      | ns               |                                             |
| Delay from MDC Rising Edge to MDIO Data Change   | T <sub>DELAY</sub>     |                           |       | 300  | ns               |                                             |
| MDC Clock Rate                                   | f <sub>MAX</sub>       |                           |       | 2.5  | MHz              |                                             |

## Pin Descriptions

| Pin# | Symbol        | I/O | Logic      | Description                                             | Pin# |
|------|---------------|-----|------------|---------------------------------------------------------|------|
| 1    | GND           | I   | Supply     | Electrical ground                                       | 1    |
| 2    | GND           | I   | Supply     | Electrical ground                                       | 2    |
| 3    | GND           | I   | Supply     | Electrical ground                                       | 3    |
| 4    | 5.0V          | I   | Supply     | Power                                                   | 4    |
| 5    | 3.3V          | I   | Supply     | Power                                                   | 5    |
| 6    | 3.3V          | I   | Supply     | Power                                                   | 6    |
| 7    | APS           | I   | Supply     | Adaptive Power Supply                                   | 7    |
| 8    | APS           | I   | Supply     | Adaptive Power Supply                                   | 8    |
| 9    | LASI          | O   | Open Drain | Link Alarm Status Interrupt. 10-22k ohm pull up on host | 9    |
| 10   | REST          | I   | 1.2V CMOS  | TX OFF when MDIO RESET                                  | 10   |
| 11   | VEND SPECIFIC |     |            | Vendor Specific Pin. Leave unconnected                  | 11   |
| 12   | TX ON/OFF     | I   | 1.2V CMOS  | Transmitter ON/OFF                                      | 12   |
| 13   | Reserved      |     |            | Reserved                                                | 13   |
| 14   | MOD DETECT    | O   |            | Pulled low inside module through 1k ohm                 | 14   |
| 15   | VEND SPECIFIC |     |            | Vendor Specific Pin. Leave unconnected                  | 15   |
| 16   | VEND SPECIFIC |     |            | Vendor Specific Pin. Leave unconnected                  | 16   |
| 17   | MDIO          | I/O | Open Drain | Management Data IO                                      | 17   |
| 18   | MDC           | I   | 1.2V CMOS  | Management data clock                                   | 18   |
| 19   | PRTAD4        | I   | 1.2V CMOS  | Port Address bit 4 (Low=0)                              | 19   |
| 20   | PRTAD3        | I   | 1.2V CMOS  | Port Address bit 3 (Low=0)                              | 20   |
| 21   | PRTAD2        | I   | 1.2V CMOS  | Port Address bit 2 (Low=0)                              | 21   |
| 22   | PRTAD1        | I   | 1.2V CMOS  | Port Address bit 1 (Low=0)                              | 22   |
| 23   | PRTAD0        | I   | 1.2V CMOS  | Port Address bit 0 (Low=0)                              | 23   |
| 24   | VEND SPECIFIC |     |            | Vendor Specific Pin. Leave unconnected                  | 24   |
| 25   | APS SET       | O   |            | Feedback output for APS                                 | 25   |
| 26   | RESERVED      |     |            | Reserved for Avalanche Photodiode use                   | 26   |
| 27   | APS SENSE     | O   | Analog     | APS Sense Connection                                    | 27   |
| 28   | APS           | I   | Supply     | Adaptive Power Supply                                   | 28   |
| 29   | APS           | I   | Supply     | Adaptive Power Supply                                   | 29   |
| 30   | 3.3V          | I   | Supply     | Power                                                   | 30   |
| 31   | 3.3V          | I   | Supply     | Power                                                   | 31   |
| 32   | 5.0V          |     | Supply     | Power                                                   | 32   |
| 33   | GND           | I   | Supply     | Electrical Ground                                       | 33   |
| 34   | GND           | I   | Supply     | Electrical Ground                                       | 34   |

|    |            |   |        |                            |    |
|----|------------|---|--------|----------------------------|----|
| 35 | GND        | I | Supply | Electrical Ground          | 35 |
| 36 | GND        | I | Supply | Electrical Ground          | 36 |
| 37 | GND        | I | Supply | Electrical Ground          | 37 |
| 38 | RESERVED   |   |        | Reserved                   | 38 |
| 39 | RESERVED   |   |        | Reserved                   | 39 |
| 40 | GND        | I | Supply | Electrical ground          | 40 |
| 41 | RX LANE 0+ | O | AC     | Module XAUI Output Lane 0+ | 41 |
| 42 | RX LANE 0- | O | AC     | Module XAUI Output Lane 0- | 42 |
| 43 | GND        | I | Supply | Electrical ground          | 43 |
| 44 | RX LANE 1+ | O | AC     | Module XAUI Output Lane 1+ | 44 |
| 45 | RX LANE 1- | O | AC     | Module XAUI Output Lane 1- | 45 |
| 46 | GND        | I | Supply | Electrical ground          | 46 |
| 47 | RX LANE 2+ | O | AC     | Module XAUI Output Lane 2+ | 47 |
| 48 | RX LANE 2- | O | AC     | Module XAUI Output Lane 2- | 48 |
| 49 | GND        | I | Supply | Electrical ground          | 49 |
| 50 | RX LANE 3+ | O | AC     | Module XAUI Output Lane 3+ | 50 |
| 51 | RX LANE 3- | O | AC     | Module XAUI Output Lane 3- | 51 |
| 52 | GND        | I | Supply | Electrical ground          | 52 |
| 53 | GND        | I | Supply | Electrical ground          | 53 |
| 54 | GND        | I | Supply | Electrical ground          | 54 |
| 55 | TX LANE 0+ | O | AC     | Module XAUI Input Lane 0+  | 55 |
| 56 | TX LANE 0- | O | AC     | Module XAUI Input Lane 0-  | 56 |
| 57 | GND        | I | Supply | Electrical ground          | 57 |
| 58 | TX LANE 1+ | O | AC     | Module XAUI Input Lane 1+  | 58 |
| 59 | TX LANE 1- | O | AC     | Module XAUI Input Lane 1-  | 59 |
| 60 | GND        | I | Supply | Electrical ground          | 60 |
| 61 | TX LANE 2+ | O | AC     | Module XAUI Input Lane 2+  | 61 |
| 62 | TX LANE 2- | O | AC     | Module XAUI Input Lane 2-  | 62 |
| 63 | GND        | I | Supply | Electrical ground          | 63 |
| 64 | TX LANE 3+ | O | AC     | Module XAUI Input Lane 3+  | 64 |
| 65 | TX LANE 3- | O | AC     | Module XAUI Input Lane 3-  | 65 |
| 66 | GND        | I | Supply | Electrical ground          | 66 |
| 67 | RESERVED   |   |        | Reserved                   | 67 |
| 68 | RESERVED   |   |        | Reserved                   | 68 |
| 69 | GND        | I | Supply | Electrical Ground          | 69 |
| 70 | GND        | I | Supply | Electrical Ground          | 70 |

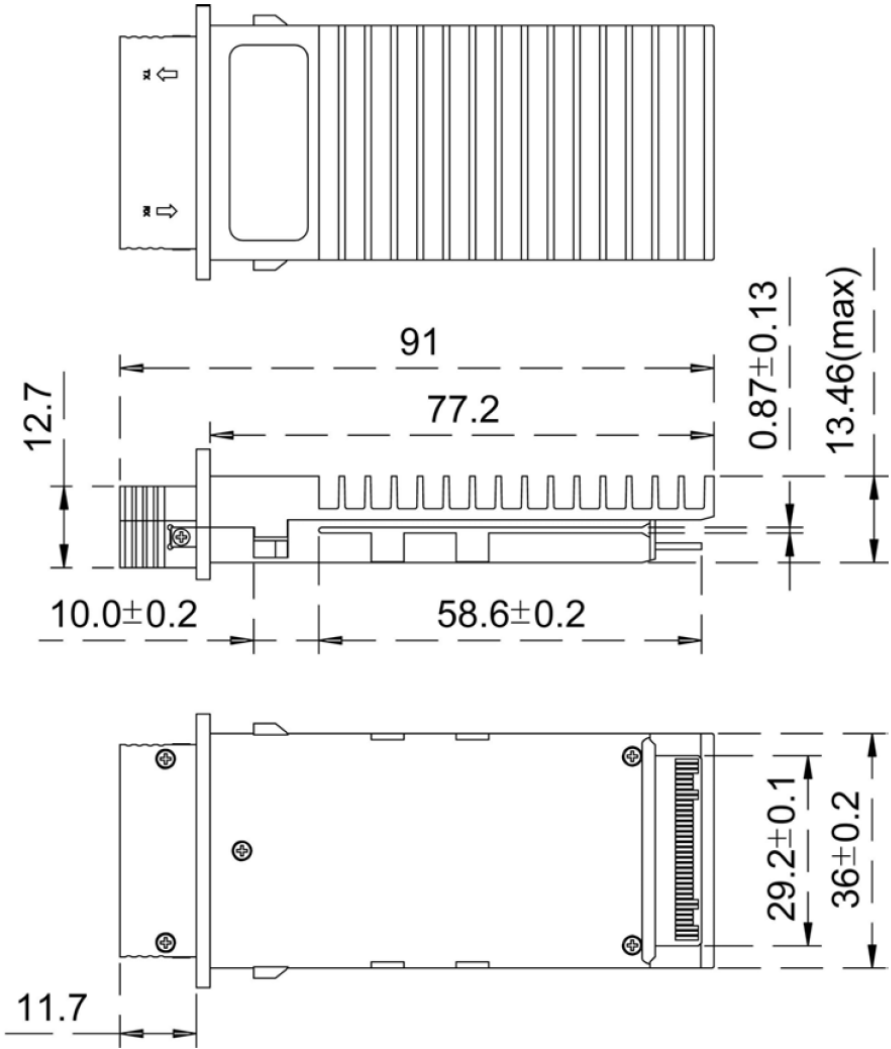
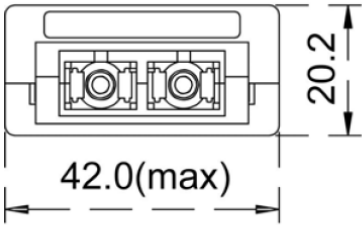
Electrical Pad Layout



Digital Diagnostic

| Parameter           | Symbol           | Min. | Typ. | Max. | Unit | Notes |
|---------------------|------------------|------|------|------|------|-------|
| Temperature Monitor | T <sub>MON</sub> | -5   |      | 5    | °C   |       |
| Laser Bias Monitor  | I <sub>MON</sub> | -10  |      | 10   | %    |       |
| TX Power Monitor    | P <sub>TX</sub>  | -3   |      | 3    | dBm  |       |
| RX Power Monitor    | P <sub>RX</sub>  | -3   |      | 3    | dBm  |       |

Mechanical Specifications



Unit:millimeter

## **OptioConnect**

### **Innovation for the Future of High-Speed Networking**

#### **Who We Are**

OptioConnect is reshaping the landscape of communication and high-speed networking through intelligent technology. With a core focus on cutting edge technology, we deliver smarter fiber optic solutions for enterprise networks, data centers, and next-gen telecom infrastructures.

#### **What We Do**

At OptioConnect, we fuse advanced engineering with intelligent automation to drive the future of networking. Our AI-integrated solutions are designed to optimize performance and streamline operations with:

- Superior Performance
- Network and traffic optimization
- Intelligent energy management
- Seamless OEM compatibility
- Scalable cost-efficiency

#### **Smarter Networks by Design**

Innovation isn't just a goal—it's our process. We embed AI and machine learning across our R&D and product lines, enabling adaptive performance, automated tuning, and faster deployment cycles. The result? Networks that don't just work—they learn, evolve, and outperform.

#### **Our Team**

Our engineers, data scientists, and network architects bring decades of experience and a future-focused mindset. We provide hands-on support with intelligent insights that turn complex challenges into simple solutions.

#### **Our Mission**

To deliver AI-enhanced connectivity that reduces cost, increases speed, and maximizes efficiency—empowering our partners to operate at the forefront of a rapidly evolving digital world.

#### **Let's Connect**

Discover how OptioConnect's intelligent infrastructure solutions can power your network's next leap forward.

[www.optioconnect.com](http://www.optioconnect.com) | [info@optioconnect.com](mailto:info@optioconnect.com)

