



### 02312NPK-OPC

Huawei® 02312NPK Compatible TAA 400GBase-LR8 PAM4 QSFP-DD Transceiver (SMF, 1270nm to 1330nm, 10km, LC, DOM, CMIS 4.0)

#### Features

- Hot-pluggable QSFP-DD Type 2 form factor
- Supports 425Gb/s aggregate bit rate
- Power dissipation < 13W
- Single 3.3V power supply
- Single-mode Fiber
- Aligned with IEEE 802.3bs
- Operating case temperature: 0C to 70C



#### Applications:

- 400GBase Ethernet
- Access and Enterprise

#### Product Description

This Huawei® 02312NPK compatible QSFP-DD transceiver provides 400GBase-LR8 throughput up to 10km over single-mode fiber (SMF) using a wavelength of 1270nm to 1330nm via an LC connector. It is guaranteed to be 100% compatible with the equivalent Huawei® 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. 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.

TAA refers to the Trade Agreements Act (19 U.S.C. & 2501-2581), which is intended to foster fair and open international trade. TAA requires that the U.S. Government may acquire only "U.S.-made or designated country end products."



## Regulatory Compliance

- ESD to the Electrical PINs: compatible with MIL-STD-883E Method 3015.4
- ESD to the LC Receptacle: compatible with IEC 61000-4-3
- EMI/EMC compatible with FCC Part 15 Subpart B Rules, EN55022:2010
- Laser Eye Safety compatible with FDA 21CFR, EN60950-1& EN (IEC) 60825-1,2
- RoHS compliant with EU RoHS 2.0 directive 2015/863/EU

## Absolute Maximum Ratings

| Parameter                           | Symbol            | Min. | Max.                 | Unit | Notes |
|-------------------------------------|-------------------|------|----------------------|------|-------|
| Power Supply Voltage                | VCC               | -0.5 | 4.0                  | V    |       |
| Storage Temperature                 | Ts                | -40  | +85                  | °C   |       |
| Case Operating Temperature          | Top               | 0    | +70                  | °C   |       |
| Relative Humidity (non-condensing)  | RH                | 15   | 85                   | %    |       |
| Receiver Damage Threshold, per Lane | P <sub>Rdmg</sub> | 6.3  |                      | dBm  |       |
| Bit Rate (all wavelengths combined) | BR                |      | 425                  | Gb/s | 1     |
| Bit Error Ratio                     | BER               |      | 2.4x10 <sup>-4</sup> |      | 2     |
| Maximum Supported Distances         |                   |      |                      |      |       |
| Fiber Type                          |                   |      |                      |      |       |
| SMF per G.652                       | L <sub>max1</sub> |      | 10                   | km   |       |

## Notes:

1. Supports 400GBASE-LR8 per IEEE P802.3bs.
2. As defined by IEEE P802.3bs.

**Electrical Characteristics (EOL, T<sub>OP</sub> = 0 to +70°C, V<sub>CC</sub> = 3.135 to 3.465 Volts)**

| Parameter                                          | Symbol                     | Min.                             | Typ. | Max.  | Unit | Notes |
|----------------------------------------------------|----------------------------|----------------------------------|------|-------|------|-------|
| Supply Voltage                                     | V <sub>CC</sub>            | 3.135                            | 3.3  | 3.465 | V    |       |
| Supply Current                                     | I <sub>CC</sub>            |                                  |      | 3.83  | A    |       |
| Module total power                                 | P                          |                                  |      | 13    | W    | 1     |
| <b>Transmitter</b>                                 |                            |                                  |      |       |      |       |
| Signaling Rate, each Lane                          | V <sub>in</sub> , pp, diff | 26.5625 ± 100 ppm                |      |       | GBd  |       |
| Differential data input voltage per lane           | TP1a                       | 900                              |      |       | mVpp | 1     |
| Differential input return loss                     |                            | Per equation (83E-5) IEEE802.3bm |      |       | dB   |       |
| Differential to common mode input return loss      |                            | Per equation (83E-6) IEEE802.3bm |      |       | dB   |       |
| Differential termination mismatch                  |                            |                                  |      | 10    | %    |       |
| Module stress input test                           |                            | Per 120E.3.4.1 IEEE802.3bs       |      |       |      | 3     |
| Single-ended voltage tolerance range               |                            | -0.4                             |      | 3.3   | V    |       |
| DC common mode voltage                             |                            | -350                             |      | 2850  | mV   | 4     |
| <b>Receiver</b>                                    |                            |                                  |      |       |      |       |
| Signaling Rate, each lane                          |                            | 26.5625 ± 100 ppm                |      |       | GBd  |       |
| AC common-mode output voltage (RMS)                |                            |                                  |      | 17.5  | mV   |       |
| Differential output voltage                        |                            |                                  |      | 900   | mV   |       |
| Near-end ESMW (Eye symmetry mask width)            |                            | 0.265                            |      |       | UI   |       |
| Near-end Eye height, differential (min)            |                            | 70                               |      |       | mV   |       |
| Far-end ESMW (Eye symmetry mask width)             |                            | 0.2                              |      |       | UI   |       |
| Far-end Eye height, differential (min)             |                            | 30                               |      |       | mV   |       |
| Far-end pre-cursor ISI ratio                       |                            | -4.5                             |      | 2.5   | dB   |       |
| Differential output return loss                    |                            | Per equation 83E-2 IEEE802.3bm   |      |       |      |       |
| Common to differential mode conversion return loss |                            | Per equation 83E-3 IEEE802.3bm   |      |       |      |       |
| Differential termination mismatch                  |                            |                                  |      | 10    | %    |       |
| Transition time (min, 20% to 80%)                  |                            | 9.5                              |      |       | ps   |       |
| DC common mode voltage (min)                       |                            | -350                             |      | 2850  | mV   | 4     |

**Notes:**

1. Maximum total power value is specified across the full temperature and voltage range.
2. With the exception to 120E.3.1.2 that the pattern is PRBS31Q or scrambled idle.
3. Meets specified BER
4. DC common mode voltage generated by the host. Specification includes effects of ground offset voltage.

# Optical Characteristics (EOL, T<sub>OP</sub> = 0 to +70°C, V<sub>CC</sub> = 3.135 to 3.465 Volts)

Meets 400GBASE-LR8 as being defined by IEEE P802.3bs

| Parameter                                                                | Symbol | Min.                                                                                                                                                                         | Typ. | Max. | Unit  | Notes |
|--------------------------------------------------------------------------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|-------|-------|
| <b>Transmitter</b>                                                       |        |                                                                                                                                                                              |      |      |       |       |
| Signaling rate (each lane (range))                                       |        | 26.5625 ± 100 ppm                                                                                                                                                            |      |      | GBd   |       |
| Modulation Format                                                        |        | PAM4                                                                                                                                                                         |      |      |       |       |
| Lane wavelengths (range)                                                 |        | 1272.55 to 1274.54<br>1276.89 to 1278.89<br>1281.25 to 1283.27<br>1285.65 to 1287.68<br>1294.53 to 1296.59<br>1299.02 to 1301.09<br>1303.54 to 1305.63<br>1308.09 to 1310.19 |      |      | nm    |       |
| Side-mode suppression ratio (SMSR)                                       |        | 30                                                                                                                                                                           |      |      | dB    |       |
| Total average launch power                                               |        |                                                                                                                                                                              |      | 13.2 | dBm   |       |
| Average launch power, each lane                                          |        |                                                                                                                                                                              |      | 5.3  | dBm   | 1     |
| Average launch power, each lane                                          |        | -2.8                                                                                                                                                                         |      |      | dBm   | 2     |
| Outer Optical Modulation Amplitude (OMA <sub>outer</sub> ), each lane    |        | 0.2                                                                                                                                                                          |      | 5.7  | dBm   | 3     |
| Difference in launch power between any two lanes (OMA <sub>outer</sub> ) |        |                                                                                                                                                                              |      | 4    | dB    |       |
| Launch power in OMA <sub>outer</sub> minus TDECQ, each lane              |        | -1.1                                                                                                                                                                         |      |      | dBm   |       |
| Transmitter and dispersion eye closure for PAM4 (TDECQ), each lane       |        |                                                                                                                                                                              |      | 3.3  | dB    |       |
| Average launch power of OFF transmitter, each lane                       |        |                                                                                                                                                                              |      | -30  | dBm   |       |
| Extinction ratio                                                         |        | 3.5                                                                                                                                                                          |      |      | dB    |       |
| RIN <sub>15,1OMA</sub>                                                   |        |                                                                                                                                                                              |      | -132 | dB/Hz |       |
| Optical return loss tolerance                                            |        |                                                                                                                                                                              |      | 15.1 | dB    |       |
| Transmitter reflectance                                                  |        |                                                                                                                                                                              |      | -26  | dB    | 4     |
| <b>Receiver</b>                                                          |        |                                                                                                                                                                              |      |      |       |       |
| Signaling rate (each lane (range))                                       |        | 26.5625 ± 100 ppm                                                                                                                                                            |      |      | GBd   |       |
| Modulation Format                                                        |        | PAM4                                                                                                                                                                         |      |      |       |       |
| Lane wavelengths (range)                                                 |        | 1272.55 to 1274.54<br>1276.89 to 1278.89<br>1281.25 to 1283.27<br>1285.65 to 1287.68<br>1294.53 to 1296.59<br>1299.02 to 1301.09<br>1303.54 to 1305.63<br>1308.09 to 1310.19 |      |      | nm    |       |
| Damage threshold, each lane                                              |        | 6.3                                                                                                                                                                          |      |      | dBm   | 5     |
| Average receive power, each lane                                         |        |                                                                                                                                                                              |      | 5.3  | dBm   |       |
| Average receive power, each lane                                         |        | -9.1                                                                                                                                                                         |      |      | dBm   | 6     |
| Receive power (OMA <sub>outer</sub> ), each lane                         |        |                                                                                                                                                                              |      | 5.7  | dBm   |       |

|                                                              |  |      |  |      |     |   |
|--------------------------------------------------------------|--|------|--|------|-----|---|
| Difference in receive power between any two lanes (OMAouter) |  |      |  | 4.5  | dBm |   |
| Receiver reflectance                                         |  |      |  | -26  | dB  |   |
| Receiver sensitivity (OMAouter), each lane                   |  |      |  | -7.1 | dBm | 7 |
| Stressed receiver sensitivity (OMAouter), each lane          |  |      |  | -4.7 | dBm | 8 |
| Conditions for Stress Receiver Sensitivity Test              |  |      |  |      |     |   |
| Stressed eye closure for PAM4 (SECQ), lane under test        |  | 3.3  |  |      | dB  | 9 |
| OMAouter of each aggressor lane                              |  | -0.2 |  |      | dBm | 9 |

**Notes:**

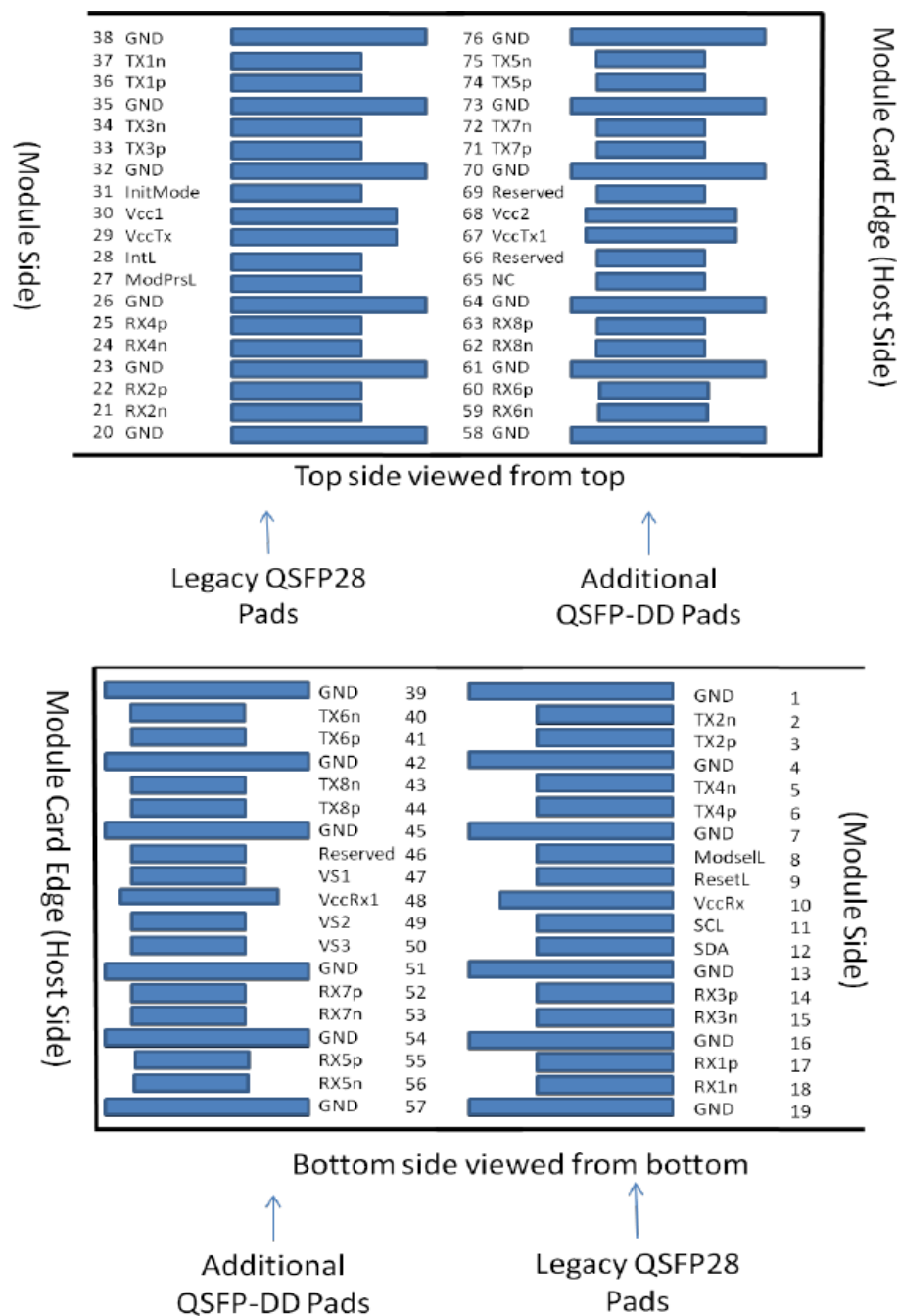
1. As the total average launch power limit has to be met, not all of the lanes can operate at the maximum average launch power, each lane.
2. Average launch power, each lane (min) is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant; however, a value above this does not ensure compliance.
3. Even if the TDECQ < 1 dB, the OMAouter (min) must exceed this value
4. Transmitter reflectance is defined looking into the transmitter
5. The receiver shall be able to tolerate, without damage, continuous exposure to an optical input signal having this average power level.
6. Average receive power, each lane (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant; however, a value above this does not ensure compliance.
7. Receiver sensitivity (OMAouter), each lane (max) is informative.
8. Measured with conformance test signal at TP3 (see 122.8.9) for the BER specified in 122.1.1.
9. These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

## Pin Descriptions

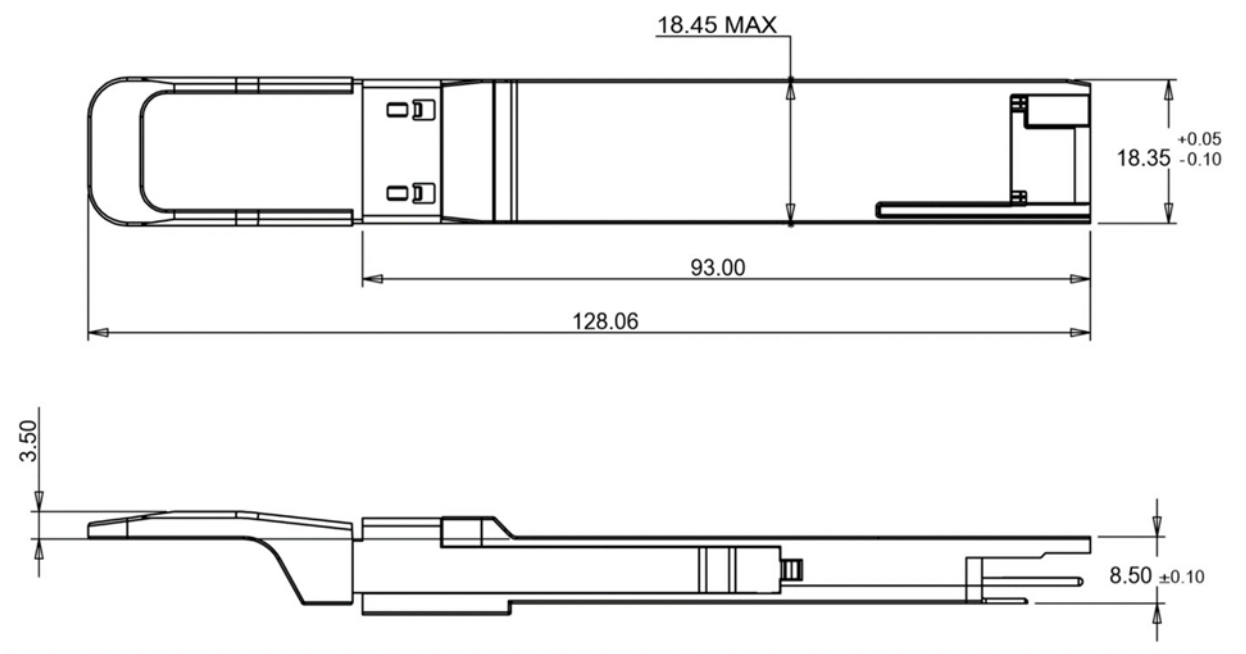
| Pin | Logic       | Symbol   | Name/Descriptions                                                                   | Plug Sequence |
|-----|-------------|----------|-------------------------------------------------------------------------------------|---------------|
| 1   |             | GND      | Ground                                                                              | 1B            |
| 2   | CML-I       | Tx2n     | Transmitter Inverted Data Input                                                     | 3B            |
| 3   | CML-I       | Tx2p     | Transmitter Non-Inverted Data Input                                                 | 3B            |
| 4   |             | GND      | Ground                                                                              | 1B            |
| 5   | CML-I       | Tx4n     | Transmitter Inverted Data Input                                                     | 3B            |
| 6   | CML-I       | Tx4p     | Transmitter Non-Inverted Data Input                                                 | 3B            |
| 7   |             | GND      | Ground                                                                              | 1B            |
| 8   | LVTTL-I     | ModSelL  | Module Select                                                                       | 3B            |
| 9   | LVTTL-I     | ResetL   | Module Reset                                                                        | 3B            |
| 10  |             | VccRx    | +3.3V Power Supply Receiver                                                         | 2B            |
| 11  | LVC MOS-I/O | SCL      | 2-wire serial interface clock                                                       | 3B            |
| 12  | LVC MOS-I/O | SDA      | 2-wire serial interface data                                                        | 3B            |
| 13  |             | GND      | Ground                                                                              | 1B            |
| 14  | CML-O       | Rx3p     | Receiver Non-Inverted Data Output                                                   | 3B            |
| 15  | CML-O       | Rx3n     | Receiver Inverted Data Output                                                       | 3B            |
| 16  | GND         | Ground   | 1B                                                                                  |               |
| 17  | CML-O       | Rx1p     | Receiver Non-Inverted Data Output                                                   | 3B            |
| 18  | CML-O       | Rx1n     | Receiver Inverted Data Output                                                       | 3B            |
| 19  |             | GND      | Ground                                                                              | 1B            |
| 20  |             | GND      | Ground                                                                              | 1B            |
| 21  | CML-O       | Rx2n     | Receiver Inverted Data Output                                                       | 3B            |
| 22  | CML-O       | Rx2p     | Receiver Non-Inverted Data Output                                                   | 3B            |
| 23  |             | GND      | Ground                                                                              | 1B            |
| 24  | CML-O       | Rx4n     | Receiver Inverted Data Output                                                       | 3B            |
| 25  | CML-O       | Rx4p     | Receiver Non-Inverted Data Output                                                   | 3B            |
| 26  |             | GND      | Ground                                                                              | 1B            |
| 27  | LVTTL-O     | ModPrsL  | Module Present                                                                      | 3B            |
| 28  | LVTTL-O     | IntL     | Interrupt                                                                           | 3B            |
| 29  |             | VccTx    | +3.3V Power supply transmitter                                                      | 2B            |
| 30  |             | Vcc1     | +3.3V Power supply                                                                  | 2B            |
| 31  | LVTTL-I     | InitMode | Initialization mode; In legacy QSFP applications, the InitMode pad is called LPMODE | 3B            |
| 32  |             | GND      | Ground                                                                              | 1B            |
| 33  | CML-I       | Tx3p     | Transmitter Non-Inverted Data Input                                                 | 3B            |
| 34  | CML-I       | Tx3n     | Transmitter Inverted Data Input                                                     | 3B            |
| 35  |             | GND      | Ground                                                                              | 1B            |
| 36  | CML-I       | Tx1p     | Transmitter Non-Inverted Data Input                                                 | 3B            |
| 37  | CML-I       | Tx1n     | Transmitter Inverted Data Input                                                     | 3B            |
| 38  |             | GND      | Ground                                                                              | 1B            |
| 39  |             | GND      | Ground                                                                              | 1A            |
| 40  | CML-I       | Tx6n     | Transmitter Inverted Data Input                                                     | 3A            |

|    |       |          |                                     |    |
|----|-------|----------|-------------------------------------|----|
| 41 | CML-I | Tx6p     | Transmitter Non-Inverted Data Input | 3A |
| 42 |       | GND      | Ground                              | 1A |
| 43 | CML-I | Tx8n     | Transmitter Inverted Data Input     | 3A |
| 44 | CML-I | Tx8p     | Transmitter Non-Inverted Data Input | 3A |
| 45 |       | GND      | Ground                              | 1A |
| 46 |       | Reserved | For future use                      | 3A |
| 47 |       | VS1      | Module Vendor Specific 1            | 3A |
| 48 |       | VccRx1   | 3.3V Power Supply                   | 2A |
| 49 |       | VS2      | Module Vendor Specific 2            | 3A |
| 50 |       | VS3      | Module Vendor Specific 3            | 3A |
| 51 |       | GND      | Ground                              | 1A |
| 52 | CML-O | Rx7p     | Receiver Non-Inverted Data Output   | 3A |
| 53 | CML-O | Rx7n     | Receiver Inverted Data Output       | 3A |
| 54 |       | GND      | Ground                              | 1A |
| 55 | CML-O | Rx5p     | Receiver Non-Inverted Data Output   | 3A |
| 56 | CML-O | Rx5n     | Receiver Inverted Data Output       | 3A |
| 57 |       | GND      | Ground                              | 1A |
| 58 |       | GND      | Ground                              | 1A |
| 59 | CML-O | Rx6n     | Receiver Inverted Data Output       | 3A |
| 60 | CML-O | Rx6p     | Receiver Non-Inverted Data Output   | 3A |
| 61 |       | GND      | Ground                              | 1A |
| 62 | CML-O | Rx8n     | Receiver Inverted Data Output       | 3A |
| 63 | CML-O | Rx8p     | Receiver Non-Inverted Data Output   | 3A |
| 67 |       | GND      | Ground                              | 1A |
| 68 |       | NC       | No Connect                          | 3A |
| 69 |       | Reserved | For future use                      | 3A |
| 70 |       | VccTx1   | 3.3V Power Supply                   | 2A |
| 71 |       | Vcc2     | 3.3V Power Supply                   | 2A |
| 72 |       | Reserved | For Future Use                      | 3A |
| 73 |       | GND      | Ground                              | 1A |
| 74 | CML-I | Tx7p     | Transmitter Non-Inverted Data Input | 3A |
| 75 | CML-I | Tx7n     | Transmitter Inverted Data Input     | 3A |
| 76 |       | GND      | Ground                              | 1A |

MSA Compliant Connector



Mechanical Specifications



## **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.

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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.

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