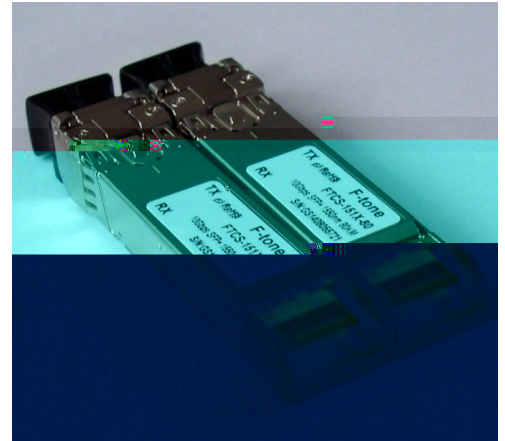


FTCS-M131X-02DXX 10Gbps 220m Multi Mode Datacom SFP+ Transceiver

Features

- ◆ Supports Up to 10.3Gbps bit rates
- ◆ Transmission distance up to 220m (OM1 fiber)
- ◆ Hot Pluggable SFP+ footprint
- ◆ 1310nm FP transmitter, PIN photo-detector
- ◆ Digital Status monitoring Interface
- ◆ Duplex LC connector
- ◆ RoHS compliant and Lead Free
- ◆ Metal enclosure for lower EMI
- ◆ Single 3.3V power supply
- ◆ Power dissipation < 1W
- ◆ Compliant with FC-PI-4 800-Mx-SN-I, SFF-8431 , SFF-8432 and SFF-8472
- ◆ Operating case temperature:
 - Standard : 0 to +70°C
 - Industrial : -40 to +85°C



Applications

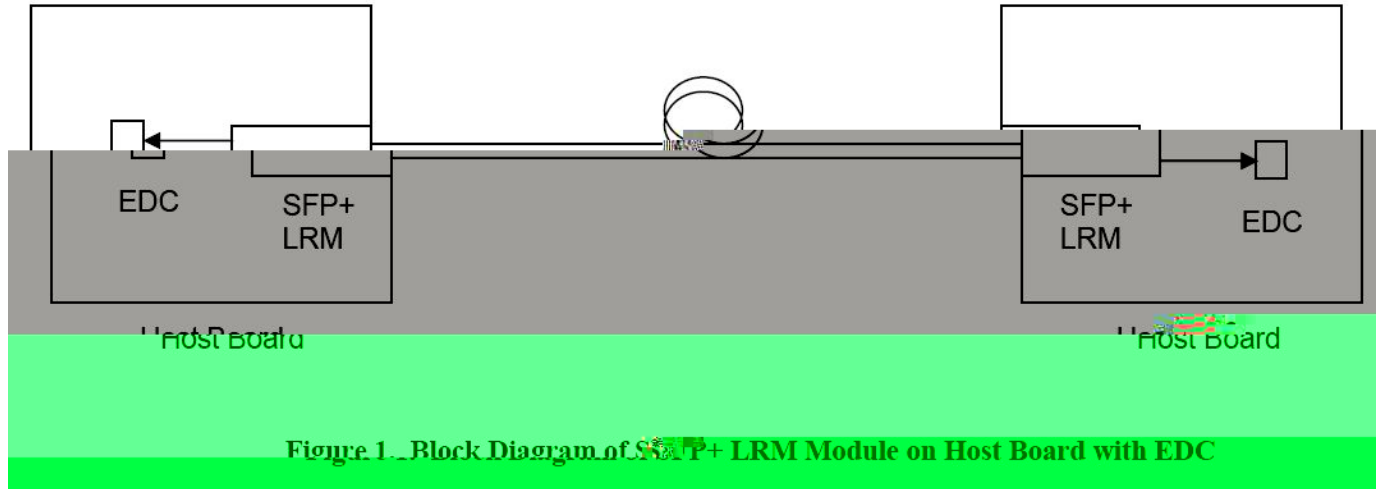
- ◆ 10GBASE-LRM 10G Ethernet
- ◆ Legacy FDDI multimode links

Product description

F-tone Networks' SFP+ LRM is an optical transceiver module for transmission at 1310nm over legacy multimode fiber. Supporting 10GBASE-LRM Ethernet standard make it ideally suited for 10G datacom. Its very low power consumption and its excellent EMI performance allow system design with high port density. The small form factor integrates a 1310nm Fabry-Perot (FP) laser in an LC package and a linear multimode PIN receiver. F-tone Networks' module is lead free, RoHS compliant and is designed and tested in accordance with industry safety standards.

The F-tone Networks FTCS-M131X-02DXX SFP+ transceiver is a linear-interface transceiver that enables, in conjunction with an Electronic Dispersion Compensation (EDC) on the host board, an IEEE802.3aq 10GBASE-LRM compliant link. The host board EDC provides correction for the severe modal dispersion that may occur during propagation through multimode fiber links, including

legacy installed FDDI multimode fiber (see IEEE802.3aq for detailed information regarding fiber coverage).



Unlike the XFP MSA transceiver requirements, the SFP+ transceiver does not contain internal retiming circuitry, and thus some of the Transmitter Optical Characteristics stated in this data sheet require that the Host Board is compliant to the SFP+ MSA specifications. See Chapter 3 in Reference [1] for further details.

Absolute maximum rating

These values represent the damage threshold of the module. Stress in excess of any of the individual Absolute Maximum Ratings can cause immediate catastrophic damage to the module even if all other parameters are within Recommended Operating Conditions.

| Parameters | Symbol | Min. | Max. | Unit |
|----------------------------|-----------------|------|------|------|
| Power Supply Voltage | V _{CC} | 0 | +3.6 | V |
| Storage Temperature | T _c | -40 | +85 | °C |
| Operating Case Temperature | T _c | 0 | +70 | °C |
| Relative Humidity | RH | 5 | 95 | % |

Recommended operating environment

Recommended Operating Environment specifies parameters for which the electrical and optical characteristics hold unless otherwise noted.

| Parameter | Symbol | Min. | Typical | Max | Unit |
|----------------------------|-----------------|-------|---------|-------|------|
| Power Supply Voltage | V _{CC} | 3.135 | 3.300 | 3.465 | V |
| Operating Case Temperature | T _c | 0 | 25 | 70 | °C |

LOW Speed Characteristics

| Parameter | Symbol | Min. | Typical | Max | Unit |
|-------------------|--------|--------------|---------|--------------|------|
| Power Consumption | | | 0.8 | 1 | W |
| TX_Fault,RX_LOS | VOL | 0 | | 0.4 | V |
| | VOH | Host_Vcc-0.5 | | Host_Vcc+0.3 | V |
| TX_DIS | VIL | -0.3 | | 0.8 | V |
| | VIH | 2.0 | | VCCT+0.3 | V |
| RS0,RS1 | VIL | -0.3 | | 0.8 | V |
| | VIH | 2.0 | | VCCT+0.3 | V |

Electrical characteristics

| Parameter | Conditions | Symbol | Min. | Typical | Max | Unit |
|---------------------------------------|------------|--------------------|------|---------|---------|------|
| Nominal Data Rate | | VID | | 10.3125 | | Gbps |
| Supply Voltage | | Vcc | 3.14 | | 3.46 | V |
| Supply Current | | Icc | | 200 | 300 | mA |
| Power Dissipation | | P | | | 1 | W |
| Transmitter | | | | | | |
| Input differential impedance | 2 | R _{in} | | 100 | | |
| Single ended data input swing | 3 | V _{in,pp} | 90 | | 350 | mV |
| Transmit Disable Voltage | 4 | V _D | 2 | | Vcc | V |
| Transmit Enable Voltage | | V _{EN} | Vee | | Vee+0.8 | V |
| Receiver | | | | | | |
| Termination Mismatch at 1 MHz | | Z _M | | | 5 | % |
| Single Ended Output Voltage Tolerance | | | -0.3 | | 4.0 | V |
| Output AC Common Mode Voltage | | | | | 7.5 | mV |



| | | | | |
|------------------------------|---|-----------|--------------|------|
| Power Supply Noise Tolerance | 9 | VccT/VccR | per SFF-8431 | mVpp |
|------------------------------|---|-----------|--------------|------|

Notes:

1. Non-condensing.
2. Connected directly to TX data input pins. AC coupling from pins into laser driver IC.
3. Per SFF-8431 Rev 3.0
4. Into 100 ohms differential termination.
5. Measured with Module Compliance Test Board and OMA test pattern.
6. Crosstalk source rise/fall time (20%-80%) is 35 ps.
7. Defined with reference receiver with 14 T/2 spaced FFE taps and 5 T spaced DFE taps.
8. LOS is an open collector output. Should be pulled up with 4.7k – 10k on the host board. Normal operation is logic 0; loss of signal is logic 1. Maximum pull-up voltage is 5.5V.
9. As described in Section 2.8.1, SFF-8431 Rev 3.0.

General Specifications

| Parameter | Symbol | Min. | Typical | Max | Unit | Notes |
|-----------------------------|----------------------|------|---------|-------------------|--------|-------|
| Bit Rate | BR | | 10.3125 | | Gb/sec | 1 |
| Bit Error Ratio | BER | | | 10 ⁻¹² | | 2 |
| Maximum Supported Distances | | | | | | |
| Fiber Type | 1310nm OFL Bandwidth | | | | | |
| 62.5μm | "FDDI" 160MHz/km OM1 | Lmax | | 220 | m | 3 |
| | 200MHz/km | | | 220 | | |
| 50μm | 400MHz/km | Lmax | | 100 | m | 3 |
| | OM2 500MHz/km | | | 220 | | |
| | OM3 2000MHz/km | | | 220 | | |

Notes:

1. 10GBASE-LRM
2. Tested with a 231 – 1 PRBS
3. Operating range as defined by IEEE standards. Longer reach possible depending upon link implementation.



Optical characteristics

| Parameter | Symbol | Min. | Typical | Max | Unit | Notes |
|---|-------------------|------|---------|-------|-------|-------|
| Transmitter | | | | | | |
| Center Wavelength | t | 1260 | | 1355 | nm | |
| RMS spectral width | rms @1260nm | | | 2.4 | | 2 |
| | rms @ 1260nm-1300 | - | - | 2.4 | nm | |
| | rms @ 1300nm-1355 | | | 4 | | |
| Average Optical Power | Pavg | -6.5 | - | 0.5 | dBm | 1 |
| Extinction Ratio | ER | 3.5 | - | - | dB | |
| Optical Modulation Amplitude (OMA) | POMA | -4.5 | | +1.5 | dBm | |
| Peak Launch Power | PMAX | | | 3 | dBm | |
| Transmitter Waveform Dispersion Penalty | TWDP | | | 4.7 | dB | 3 |
| Average Launch power of OFF transmitter | POFF | | | -30 | dBm | |
| Uncorrelated Jitter [rms] | T _{xj} | | | 0.033 | UI | |
| Encircled Flux | <5μm | 30 | | | % | |
| | <11μm | 81 | | | | |
| Transmitter Reflectance | | | | -12 | dB | |
| Optical Return Loss Tolerance | | 20 | | | dB | |
| Relative Intensity Noise | Rin | | | -128 | dB/Hz | |
| Receiver | | | | | | |
| Comprehensive Stressed Receiver Sensitivity (OMA) @ 10.3125Gb/s | Precursor | - | - | -6.5 | dBm | 5 |
| | Symmetrical | | | -6 | dBm | |
| | Postcursor | | | -6.5 | dBm | |
| LOS Assert | LosA | -30 | - | | dBm | |
| LOS De-assert | LosD | | | -11 | dBm | |
| Overload | P _{MAX} | +1.5 | - | | dBm | 4 |
| Receiver Reflectance | | - | - | -12 | dB | |
| LOS Hysteresis | | 0.5 | | | dB | |

Notes:

1. Average power figures are informative only, per IEEE802.3aq
2. Maximum RMS spectral width as specified by Figure 3
3. Optical Eye Mask requires the host board to be SFF-8431 compliant. Optical eye mask per IEEE802.3aq.
4. TWDP figure requires the host board to be SFF-8431 compliant. TWDP is calculated using the Matlab code provided in clause 68.6.6.2 of IEEE802.3aq
5. Receiver overload specified in OMA and under the worst comprehensive stressed condition.
6. Conditions of stressed receiver tests per IEEE802.3aq. CSRS testing requires the host board to be SFF-8431 compliant.

Digital Diagnostic Functions

The following digital diagnostic characteristics are defined over the Recommended Operating Environment unless otherwise specified. It is compliant to SFF8472 Rev9.2 with internal calibration mode. For external calibration mode please contact our sales staff.

| Parameter | Symbol | Min. | Max | Unit | Notes |
|-------------------------------|-----------|-------|-------|------|-----------------------|
| Accuracy | | | | | |
| Transceiver Temperature | DMI_Temp | -3 | +3 | degC | Over operating temp |
| TX Output optical power | DMI_TX | -3 | +3 | dBm | |
| RX Input optical power | DMI_RX | -3 | +3 | dBm | -3dBm to -12dBm range |
| Transceiver Supply voltage | DMI_VCC | -0.08 | +0.08 | V | Full operating range |
| Bias current monitor | DMI_Ibias | -10% | 10% | mA | |
| Dynamic Range Accuracy | | | | | |
| Transceiver Temperature | DMI_Temp | -5 | 70 | degC | |
| TX Output optical power | DMI_TX | -9 | -1 | dBm | |
| RX Input optical power | DMI_RX | -18 | 0 | dBm | |
| Transceiver Supply voltage | DMI_VCC | 3.0 | 3.6 | V | |
| Bias current monitor | DMI_Ibias | 0 | 70 | mA | |

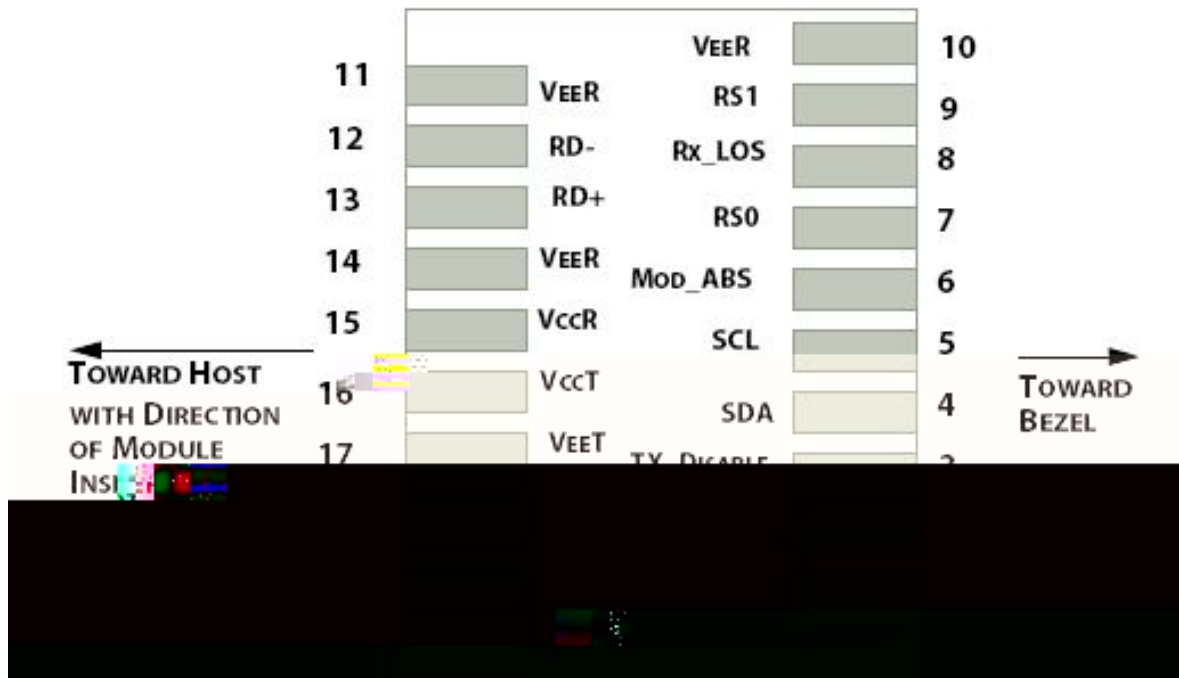


Figure 2: Interface to Host PCB

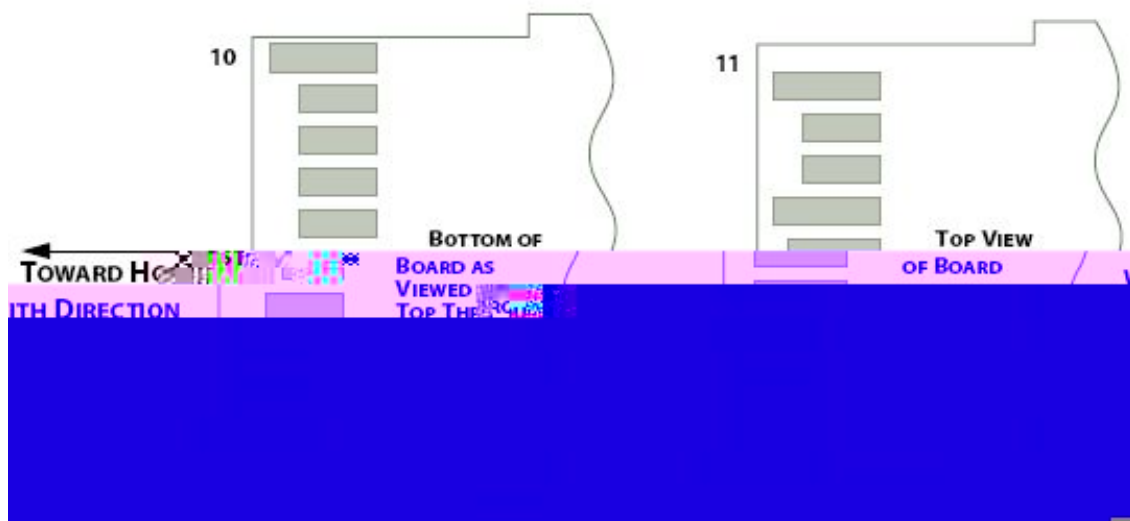


Figure 3: Module Contact Assignment

Pin definition

| Pin | Symbol | Name/Description |
|-----|----------|--------------------|
| 1 | VEET [1] | Transmitter Ground |



| | | |
|----|--------------|---|
| 2 | Tx_FAULT [2] | Transmitter Fault |
| 3 | Tx_DIS [3] | Transmitter Disable. Laser output disabled on high or open |
| 4 | SDA [2] | 2-wire Serial Interface Data Line |
| 5 | SCL [2] | 2-wire Serial Interface Clock Line |
| 6 | MOD_ABS [4] | Module Absent. Grounded within the module |
| 7 | RS0 [5] | Rate Select 0 |
| 8 | RX_LOS [2] | Loss of Signal indication. Logic 0 indicates normal operation |
| 9 | RS1 [5] | Rate Select 1 |
| 10 | VEER [1] | Receiver Ground |
| 11 | VEER [1] | Receiver Ground |
| 12 | RD- | Receiver Inverted DATA out. AC Coupled |
| 13 | RD+ | Receiver DATA out. AC Coupled |
| 14 | VEER [1] | Receiver Ground |
| 15 | VCCR | Receiver Power Supply |
| 16 | VCCT | Transmitter Power Supply |
| 17 | VEET [1] | Transmitter Ground |
| 18 | TD+ | Transmitter DATA in. AC Coupled |
| 19 | TD- | Transmitter Inverted DATA in. AC Coupled |
| 20 | VEET [1] | Transmitter Ground |

Notes:

[1] Module circuit ground is isolated from module chassis ground within the module.

[2].should be pulled up with 4.7k – 10k ohms on host board to a voltage between 3.15V and 3.6V.

[3]Tx_Disable is an input contact with a 4.7 k to 10 k pullup to VccT inside the module.

[4]Mod_ABS is connected to VeeT or VeeR in the SFP+ module. The host may pull this contact up to Vcc_Host with a resistor in the range 4.7 k to 10 k .Mod_ABS is asserted "High" when the SFP+ module is physically absent from a host slot.

[5] RS0 and RS1 are module inputs and are pulled low to VeeT with > 30 k resistors in the module.

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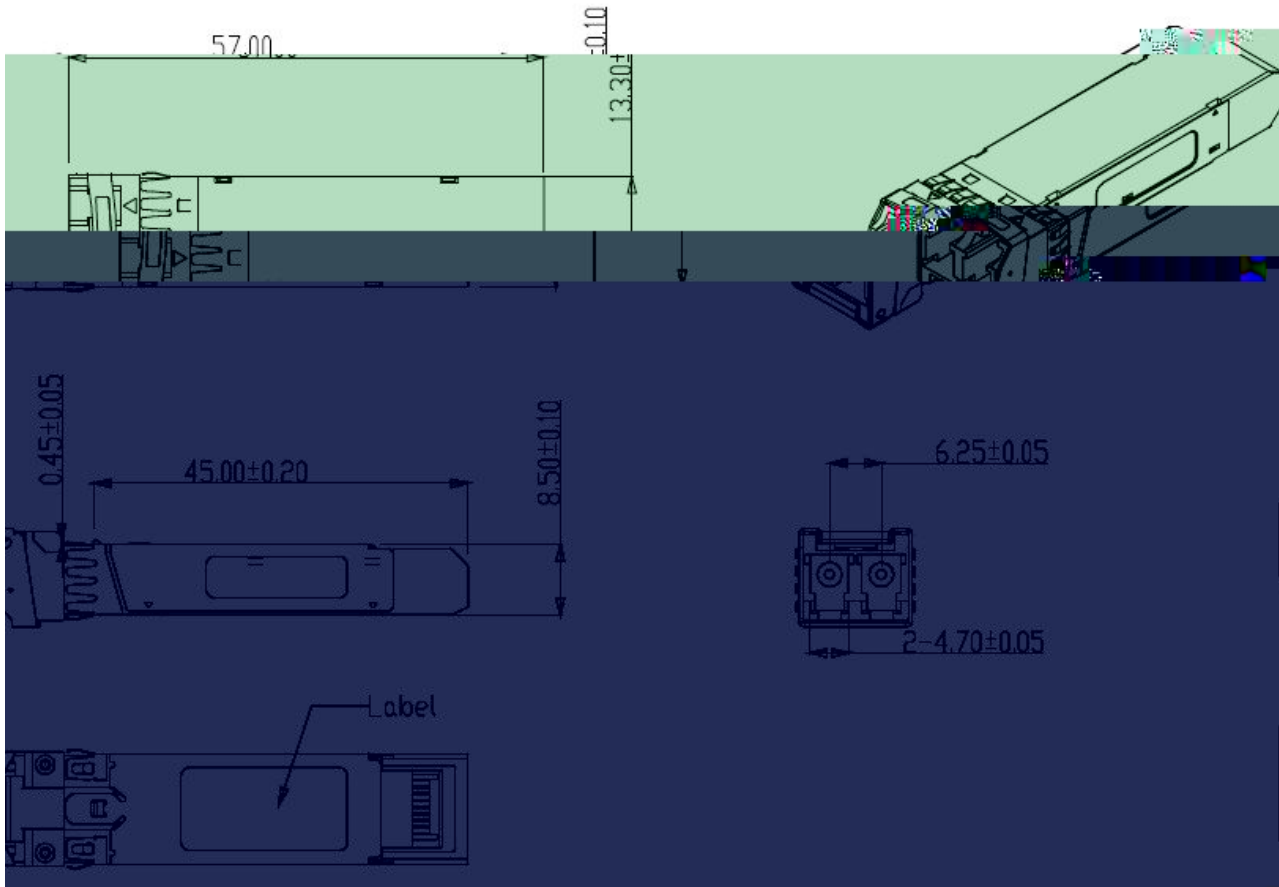


Figure6. Mechanical Specifications

Regulatory Compliance

F-tone Networks SFP+ transceiver is designed to be Class I Laser safety compliant and is certified per the following standards:

| Feature | Agency | Standard |
|--------------------------|--------|---|
| Laser Safety | FDA | CDRH 21 CFR 1040 and Laser Notice No. 50 |
| Product Safety | UL | UL and CUL EN60950-2:2007 |
| Environmental protection | SGS | RoHS Directive 2002/95/EC |
| EMC | WALTEK | EN 55022:2006+A1:2007 EN 55024:1998+A1+A2:2003 |

Ordering information

| Part Number | Product Description |
|-----------------|--|
| FTCS-M131X-02D | 1310nm, 10.3125Gpbs, Multi Mode 220m, 0°C ~ +70°C |
| FTCS-M131X-02DI | 1310nm, 10.3125Gpbs, Multi Mode 220m, -40 to +85°C |

References

1. "Specifications for Enhanced Small Form Factor Pluggable Module SFP+", SFF-8431, Rev 4.1, July 6, 2009.
2. "Improved Pluggable Formfactor", SFF-8432, Rev 4.2, Apr 18, 2007
3. IEEE802.3aq
4. "Diagnostic Monitoring Interface for Optical Transceivers" SFF-8472, Rev 10.3, Dec 1, 2007

Important Notice

Performance figures, data and any illustrative material provided in this data sheet are typical and must be specifically confirmed in writing by F-tone Networks before they become applicable to any particular order or contract. In accordance with the F-tone Networks policy of continuous improvement specifications may change without notice.

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