

SFPD-MR-xx-xx-A



**Features**

- Available in all 100 GHz C-Band Wavelengths on the DWDM ITU Grid
- DWDM SFP MSA Compliant
- Cold Start Up Wavelength Compliance
- Low Power Dissipation <1.3W Maximum
- -5°C to 70°C Operating Case Temperature
- Multirate Functionality From 100M to 2.7Gbps
- SONET OC-48 /SDH STM-16 Compliant
- Pluggable Into Existing Standard SFP Cages
- Diagnostic Performance Monitoring of Transmit Power, Receive Power, Laser Bias, Module Temperature, Laser Temperature, APD Bias Voltage, TEC Current
- APD Based Receiver Sensitivity of -28dBm at OC-48
- Long Reach 80km, 120km and 200km Versions Available

**General Operation**

| Parameter                                 | Symbol          | Min.  | Typical | Max.  | Unit              |
|---|-----------------|-------|---------|-------|-------------------|
| Supply Voltage                            | V <sub>cc</sub> | 3.135 | 3.3     | 3.465 | V                 |
| Total Current (BOL)                       | I <sub>cc</sub> | -     | -       | 375   | mA                |
| Power Supply Noise Rejection <sup>a</sup> | PSR             | 100   | -       | -     | mV <sub>p-p</sub> |
| Operating Case Temperature                | T <sub>op</sub> | -5    | -       | 70    | °C                |
| Storage Temperature                       | T <sub>st</sub> | -40   | -       | 85    | °C                |
| Data Rate Multirate                       | MR              | 100   | -       | 2700  | Mbps              |

a) 20Hz to 155MHz

**Transmitter Specifications (Optical)**

| Parameter   | Symbol                  | Min | Typical | Max  | Unit                            |
|---|-------------------------|-----|---------|------|---------------------------------|
| Optical Power   | P <sub>OP</sub>         | 0   | 2       | 4    | dBm                             |
| Average Launch Power (Tx:Off)                         | P <sub>Off</sub>        | -   | -       | -45  | dBm                             |
| Extinction Ratio                                      | ER                      | 8.2 | -       | -    | dB                              |
| Eye Mask  |                         | -   | -       | -    | IEEE 802.3, SONET/SDH compliant |
| Optical Jitter Generation                             | J <sub>gen(pk-pk)</sub> | -   | -       | 0.07 | UI                              |
| Optical Rise Time <sup>b</sup>                        | t <sub>r</sub>          | -   | -       | 160  | ps                              |
| Optical Fall Time <sup>b</sup>                        | t <sub>f</sub>          | -   | -       | 160  | ps                              |
| Channel Spacing                                       | Δf                      | -   | 100     | -    | GHz                             |
| Deviation From Central Frequency, EOL                 |                         |     |         | ±12  | GHz                             |
| Spectral Width (20dB)                                 | Δλ                      | -   | -       | 0.3  | nm                              |
| Side Mode Suppression Ratio                           | SMSR                    | 30  | -       | -    | dB                              |
| Dispersion Penalty at specified distance <sup>c</sup> | dp                      | -   | -       | 2    | dB                              |
| Relative Intensity Noise                              | RIN                     | -   | -       | -135 | dB/Hz                           |
| Reflection Tolerance <sup>d</sup>                     | rp                      | -24 | -       | -    | dB                              |

b) 20%-80% values

c) Measured at BER of 10<sup>-12</sup>, PRBS of 2<sup>23</sup>-1, at eye center, OC-48. For SFPD-MR-08/E08-xx-A, measured at 80km (1600ps/nm); for SFPD-MR-12/E12-xx-A, measured at 120km (2400ps/nm); for SFPD-MR-20/E20-xx-A, measured at 200km (4000ps/nm).

d) 2dB degradation of receiver sensitivity

## SFPD-MR-xx-xx-A

## Transmitter Specifications (Electrical)

| Parameter                          | Symbol       | Min      | Typical | Max          | Unit     |
|------------------------------------|--------------|----------|---------|--------------|----------|
| Input Differential Impedence       | $R_{in}$     | 80       | 100     | 120          | $\Omega$ |
| PECL Single-Ended Data Input Swing | $V_{in,p-p}$ | 250      | -       | 1200         | mV       |
| TxFault_Fault                      | $V_{fault}$  | 2        | -       | $V_{cc}$     | V        |
| TxFault_Normal                     | $V_{normal}$ | $V_{ee}$ | -       | $V_{ee}+0.5$ | V        |
| TxDisable_Disable                  | $V_d$        | 2        | -       | $V_{cc}$     | V        |
| TxDisable_Enable                   | $V_{en}$     | $V_{ee}$ | -       | $V_{ee}+0.8$ | V        |

## Receiver Specifications (Optical)

| Parameter  | Symbol          | Min  | Typical | Max  | Unit |
|--|-----------------|------|---------|------|------|
| Receive Power Low <sup>e</sup>                                 | $R_{sens,low}$  | -    | -30     | -28  | dBm  |
| Receive Power at Specified Distance and 20dB OSNR <sup>e</sup> | $R_{sens,OSNR}$ | -    | -       | -24  | dBm  |
| Receive Power High   | $R_{sens,high}$ | -6   | -       | -    | dBm  |
| Damage Threshold For Receiver                                  | $P_{in,damage}$ | 4    | -       | -    | dBm  |
| Wavelength   | $\lambda$       | 1528 | -       | 1564 | nm   |
| Maximum Reflectance Of Receiver                                | $RX_r$          | -    | -       | -27  | dB   |
| LOS Assert   |                 | -40  | -       | -    | dBm  |
| LOS De-Assert  |                 | -    | -       | -28  | dBm  |
| LOS Hysteresis   |                 | 0.5  | -       | -    | dB   |

e) at  $10^{-12}$  BER, PRS 2<sup>23</sup>-1, OC-48

## Receiver Specifications (Electrical)

| Parameter                | Symbol        | Min | Typical | Max | Unit |
|--------------------------|---------------|-----|---------|-----|------|
| Single-Ended Data Output | $V_{out,p-p}$ | 185 | -       | 800 | mV   |
| Data Output Rise Time    | $t_r$         | -   | -       | 175 | ps   |
| Data Output Fall Time    | $t_f$         | -   | -       | 175 | ps   |

## Timing and Electrical

| Parameter  | Symbol              | Min      | Typical | Max           | Unit    |
|--|---------------------|----------|---------|---------------|---------|
| Tx Disable Negate Time   | $t_{on}$            | -        | -       | 20            | ms      |
| Tx Disable Assert Time   | $t_{off}$           | -        | -       | 20            | ms      |
| Time To Initialize After Reset of Tx_Fault/INT in Normal Operation | $t_{init}$          | -        | -       | 300           | ms      |
| Start-up Time  | $t_{startup}$       | -        | -       | 90            | secs    |
| Tx Fault/INT Assert Time   | $t_{fault}$         | -        | -       | 50            | ms      |
| Tx Disable To Reset  | $t_{reset}$         | 10       | -       | -             | $\mu$ s |
| LOS Assert Time  | $t_{loss_{on}}$     | -        | -       | 100           | $\mu$ s |
| LOS De-assert Time   | $t_{loss_{off}}$    | -        | -       | 100           | $\mu$ s |
| Serial ID Clock Rate   | $f_{serial\_clock}$ | -        | -       | 100           | kHz     |
| RX_LOS Voltage (High)  |                     | 2        | -       | -             | V       |
| RX_LOS Voltage (Low)   |                     | -        | -       | 0.8           | V       |
| LOS Output Voltage-Fault   | $V_{LOS\ fault}$    | 2        | -       | $V_{cc}$      | V       |
| LOS Output Voltage-Normal  | $V_{LOS\ normal}$   | $V_{ee}$ | -       | $V_{ee}+0.55$ | V       |
| MOD_DEF (0:2)-High   | $V_H$               | 2        | -       | $V_{cc}$      | V       |
| MOD_DEF (0:2)-Low  | $V_L$               | $V_{ee}$ | -       | $V_{ee}+0.5$  | V       |

## SFPD-MR-xx-xx-A

 $\lambda$  Wavelength Ordering

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See table below for "XX" values

 $\lambda_c$  Wavelength Guide

| ITU Channel/Product Code | Frequency (THz) | Wavelength (nm) | ITU Channel/Product Code | Frequency (THz) | Wavelength (nm) |
|--------------------------|-----------------|-----------------|--------------------------|-----------------|-----------------|
| 15                       | 191.5           | 1565.495        | 39                       | 193.9           | 1546.119        |
| 16                       | 191.6           | 1564.678        | 40                       | 194.0           | 1545.322        |
| 17                       | 191.7           | 1563.863        | 41                       | 194.1           | 1544.526        |
| 18                       | 191.8           | 1563.047        | 42                       | 194.2           | 1543.730        |
| 19                       | 191.9           | 1562.233        | 43                       | 194.3           | 1542.936        |
| 20                       | 192.0           | 1561.419        | 44                       | 194.4           | 1542.142        |
| 21                       | 192.1           | 1560.606        | 45                       | 194.5           | 1541.349        |
| 22                       | 192.2           | 1559.794        | 46                       | 194.6           | 1540.557        |
| 23                       | 192.3           | 1558.983        | 47                       | 194.7           | 1539.766        |
| 24                       | 192.4           | 1558.173        | 48                       | 194.8           | 1538.976        |
| 25                       | 192.5           | 1557.363        | 49                       | 194.9           | 1538.186        |
| 26                       | 192.6           | 1556.555        | 50                       | 195.0           | 1537.397        |
| 27                       | 192.7           | 1555.747        | 51                       | 195.1           | 1536.609        |
| 28                       | 192.8           | 1554.940        | 52                       | 195.2           | 1535.822        |
| 29                       | 192.9           | 1554.134        | 53                       | 195.3           | 1535.036        |
| 30                       | 193.0           | 1553.329        | 54                       | 195.4           | 1534.250        |
| 31                       | 193.1           | 1552.524        | 55                       | 195.5           | 1533.465        |
| 32                       | 193.2           | 1551.721        | 56                       | 195.6           | 1532.681        |
| 33                       | 193.3           | 1550.918        | 57                       | 195.7           | 1531.898        |
| 34                       | 193.4           | 1550.116        | 58                       | 195.8           | 1531.116        |
| 35                       | 193.5           | 1549.315        | 59                       | 195.9           | 1530.334        |
| 36                       | 193.6           | 1548.515        | 60                       | 196.0           | 1529.553        |
| 37                       | 193.7           | 1547.715        | 61                       | 196.1           | 1528.773        |
| 38                       | 193.8           | 1546.917        |                          |                 |                 |

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| Diagnostics                  |                      |          |      |
|------------------------------|----------------------|----------|------|
| Parameter                    | Range                | Accuracy | Unit |
| Temperature                  | -5 to 70             | ± 3      | ° C  |
| Voltage                      | 0 to V <sub>CC</sub> | 0.1      | V    |
| Bias Current                 | 0 to 120             | 5        | mA   |
| TX Power                     | 0 to 4               | ±2       | dBm  |
| RX Power                     | -28 to -6            | ±2       | dBm  |
| TEC Current                  | -1200 to 1200        | ±60      | mA   |
| TEC Temperature <sup>f</sup> | 20 to 70             | ±0.25    | °C   |

f) Relative accuracy. Absolute accuracy is +/-3°C

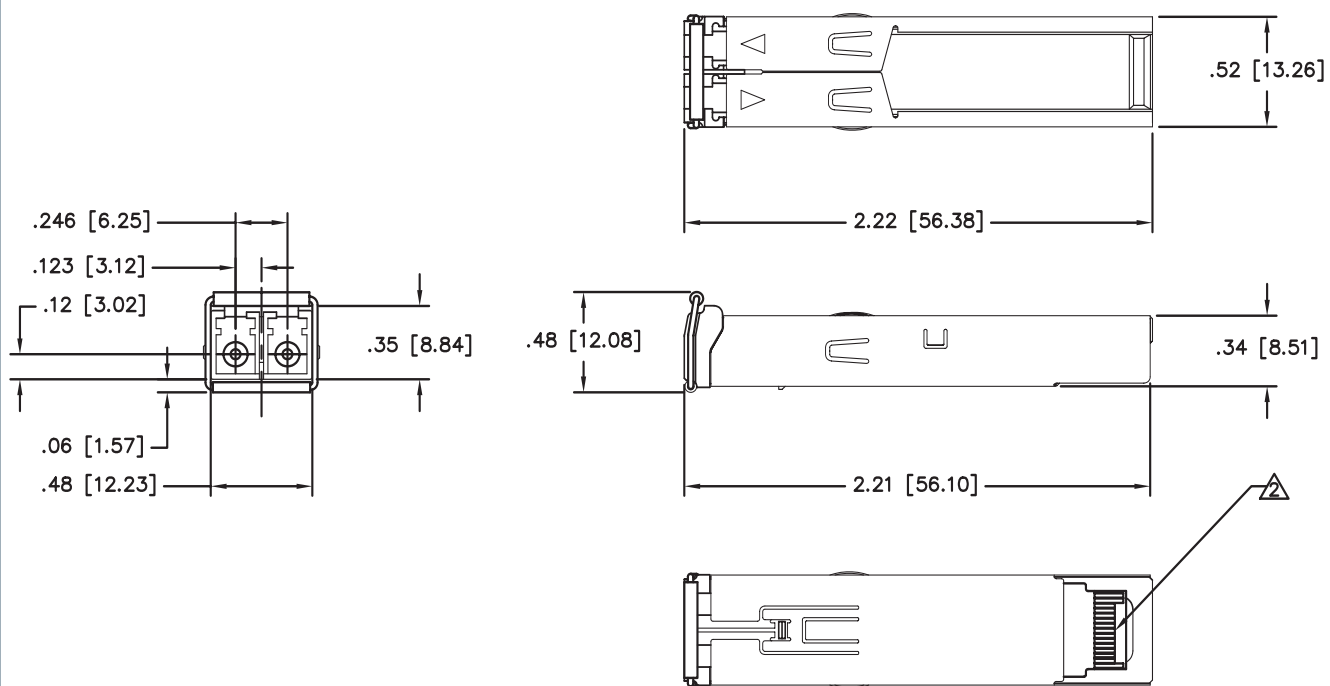
| EEPROM Serial ID |  |         |     |       |
|------------------|--|---------|-----|-------|
| Name of Field    | Description of Field                       | Address | Hex | ASCII |
| Vendor Name      | SFP Vendor Name(ASCII)                     | 20      | 4C  | L     |
|                  |  | 21      | 55  | U     |
|                  |  | 22      | 4D  | M     |
|                  |  | 23      | 49  | I     |
|                  |  | 24      | 4E  | N     |
|                  |  | 25      | 45  | E     |
|                  |  | 26      | 4E  | N     |
|                  |  | 27      | 54  | T     |
|                  |  | 28      | 4F  | O     |
|                  |  | 29      | 49  | I     |
|                  |  | 30      | 43  | C     |
| Vendor OUI       | IEEE Vendor OUI Code For LuminentOIC Inc.  | 37      | 00  |       |
|                  |  | 38      | 06  |       |
|                  |  | 39      | B5  |       |
| Vendor P/N       | Part Number in ASCII, e.g. SFPD-MR-xx-xx-A | 40      | 53  | S     |
|                  |  | 41      | 46  | F     |
|                  |  | 42      | 50  | P     |
|                  |  | 43      | 44  | D     |
|                  |  | 44      | 4D  | M     |
|                  |  | 45      | 52  | R     |
|                  |  | 46      | x   | x     |
|                  |  | 47      | x   | x     |
|                  |  | 48      | x   | x     |
|                  |  | 49      | x   | x     |
| 50               | 41   | A       |     |       |

## SFPD-MR-xx-xx-A

| Pin | Function          | Notes                  |
|-----|-------------------|------------------------|
| 1   | V <sub>ee</sub> T | TX Ground              |
| 2   | TX_FAULT/INT      | Open Collector         |
| 3   | TX_DISABLE        | Internally Pulled High |
| 4   | MOD_DEF2          | Serial Data Input      |
| 5   | MOD_DEF1          | Serial Clock Input     |
| 6   | MOD_DEF0          | Internally Grounded    |
| 7   | NC                | Not Connected          |
| 8   | LOS               | Open Collector         |
| 9   | V <sub>ee</sub> R | RX Ground              |
| 10  | V <sub>ee</sub> R | RX Ground              |
| 11  | V <sub>ee</sub> R | RX Ground              |
| 12  | RXD-              | RX Data Negative       |
| 13  | RXD+              | RX Data Positive       |
| 14  | V <sub>ee</sub> R | RX Ground              |
| 15  | V <sub>cc</sub> R | RX Power               |
| 16  | V <sub>cc</sub> T | TX Power               |
| 17  | V <sub>ee</sub> T | TX Ground              |
| 18  | TXD+              | TX Data Positive       |
| 19  | TXD-              | TX Data Negative       |
| 20  | V <sub>ee</sub> T | TX Ground              |

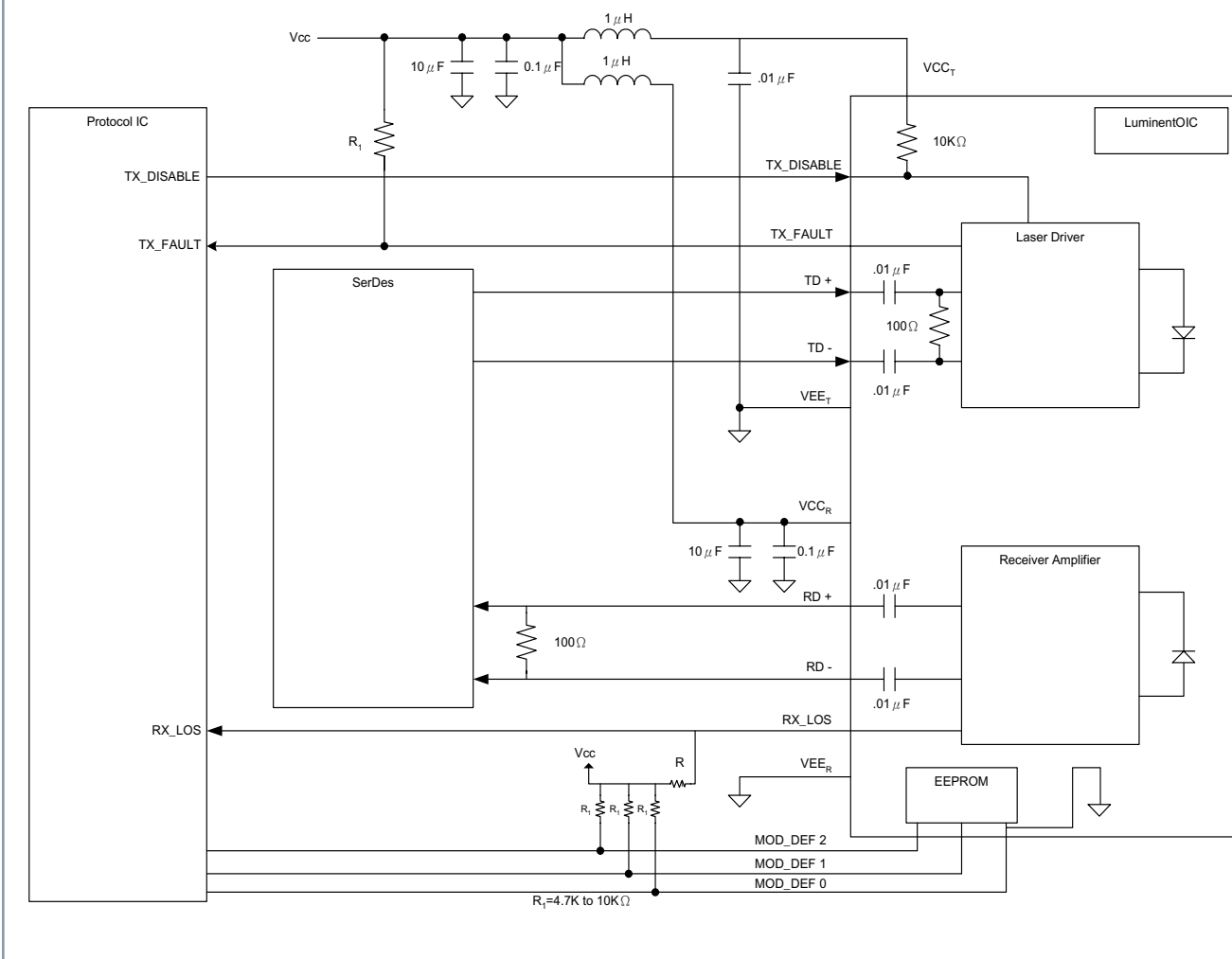
SFPD-MR-xx-xx-A

Outline Drawing



SFPD-MR-xx-xx-A

Suggested Transceiver Interface

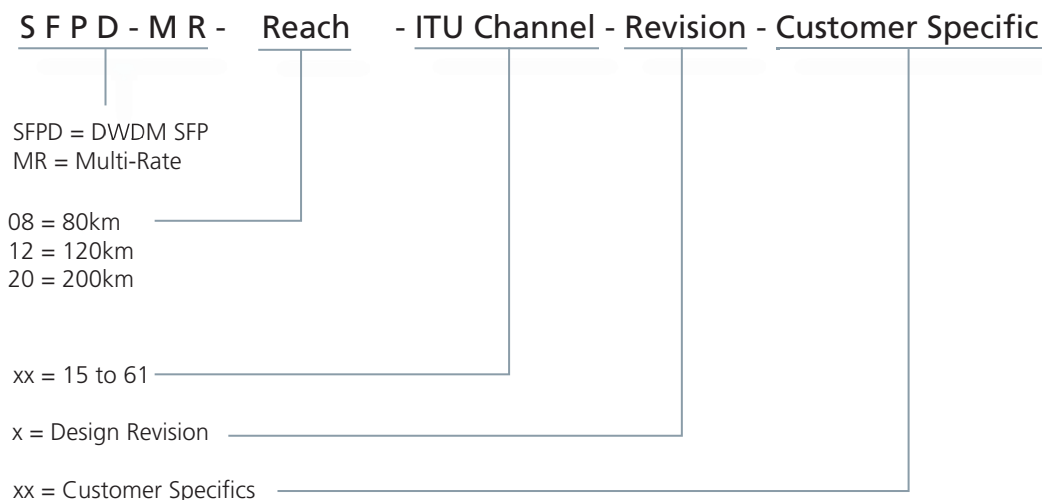


Ordering Information

Available Options:

- SFPD-MR-08-xx-A
- SFPD-MR-12-xx-A
- SFPD-MR-20-xx-A

Part Numbering Definition:



Warnings:

**Handling Precautions:** This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.

**Laser Safety:** Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.

Legal Notes:

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