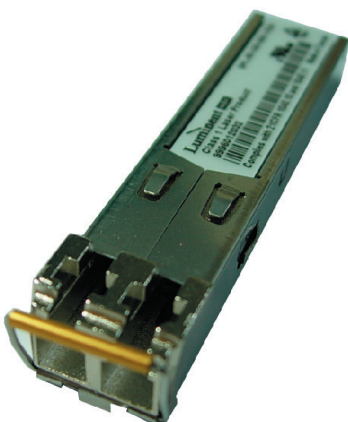


## SPL-53-MR-IR1



## Features

- Compatible with IEEE 802.3ah, 1000Base-BX10
- Compatible OC-48/STM-16 Standards
- GR 253/ STM G.957 compliant
- Single 3.3V Supply
- Simplex LC Connector
- Digital Diagnostic SFF-8472 Compliant
- SFP MSA SFF-8074i Compliant
- 13dB Minimum Power Budget
- 15km Minimum Reach
- Commercial temperature available (-Cxx)
- Industrial temperature available (-Txx)
- 1550nm DFB Laser
- Telcordia GR-468 Compliant
- Color code Bail Latch : Yellow
- RoHS compliant (lead free soldered)

## General Operation

| Parameter                    | Symbol    | Min.  | Typ.    | Max.  | Unit  |
|------------------------------|-----------|-------|---------|-------|-------|
| Supply Voltage               | $V_{cc}$  | 3.135 | 3.3     | 3.465 | V     |
| Total Current                | $I_{cc}$  | -     | -       | 300   | mA    |
| Power Supply Noise Rejection |           | 100   | -       | -     | mVp-p |
| Operating Temperature (-Cxx) | $T_{opr}$ | -5    | -       | 70    | °C    |
| Operating Temperature (-Txx) | $T_{opr}$ | -40   | -       | 85    | °C    |
| Storage Temperature          | $T_{stg}$ | -40   | -       | 85    | °C    |
| Data Rate OC-48              | DR        | -     | 2488.32 | -     | Mbps  |
| Data Rate FEC                | DR        | -     | 2700    | -     | Mbps  |
| Data Rate Gigabit Ethernet   | DR        | -     | 1250    | -     | Mbps  |
| Data Rate FC                 | DR        | -     | 1062.5  | -     | Mbps  |
| Data Rate 2xFC               | DR        | -     | 2125    | -     | Mbps  |

## Transmitter Specifications (Optical)

| Parameter                              | Symbol          | Min                          | Typical | Max  | Unit  |
|----------------------------------------|-----------------|------------------------------|---------|------|-------|
| Optical Power                          | $P_{op}$        | -5                           | -2.5    | 0    | dBm   |
| Optical Crosstalk                      | XT              | -                            | -       | -45  | dB    |
| Average Launch Power (Tx:Off)          | $P_{off}$       | -                            | -       | -45  | dBm   |
| Extinction Ratio                       | ER              | 8.2                          | -       | -    | dB    |
| Eye Mask                               |                 | SONET/IEEE 802.3ah Compliant |         |      |       |
| Optical Rise Time (20% to 80% values)  | $t_r$           | -                            | -       | 160  | ps    |
| Optical Fall Time (20% to 80% values)  | $t_f$           | -                            | -       | 160  | ps    |
| Mean Wavelength                        | $\lambda$       | 1480                         | 1550    | 1580 | nm    |
| Spectral Width (20dB)                  | $\Delta\lambda$ | -                            | -       | 1    | nm    |
| Side Mode Suppression Ratio            | SMSR            | 30                           | -       | -    | dB    |
| Dispersion penalty (15km) <sup>a</sup> | dp              | -                            | 0.5     | 1    |       |
| Relative Intensity Noise               | RIN             | -                            | -       | -120 | dB/Hz |
| Transmitter Reflectance                | -               | -                            | -       | -12  | dB    |
| Reflectance Tolerance                  | rp              | -24                          | -       | -    | dB    |

a) Measured at 2.7 Gb/s, BER of  $10^{-12}$ , PRBS of  $2^{23}-1$ , at eye center

## SPL-53-MR-IR1

## Transmitter Specifications (Electrical)

| Parameter                          | Symbol        | Min      | Typical | Max            | Unit     |
|------------------------------------|---------------|----------|---------|----------------|----------|
| Input Differential Impedance       | $R_{in}$      | 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 |
|----------------------------------|------------------|------|---------|------|------|
| Receiver Power Low <sup>b</sup>  | $R_{sens, low}$  | -    | -20     | -18  | dBm  |
| Receiver Power High <sup>b</sup> | $R_{sens, high}$ | 0    | -       | -    | dBm  |
| Damage Threshold for Receiver    | $P_{in, damage}$ | -    | -       | 0    | dBm  |
| Wavelength                       | $\lambda$        | 1260 | -       | 1360 | nm   |
| LOS Assert                       | -                | -28  | -       | -    | dBm  |
| LOS De-Assert                    | -                | -    | -       | -18  | dBm  |
| LOS Hysteresis                   | -                | 0.5  | -       | -    | dB   |
| Receiver Reflectance             | -                | -    | -       | -12  | dB   |

<sup>b</sup> Measured at  $10^{-10}$  BER, 2.7 Gb/s,  $2^{23}-1$  PRBS, and  $10^{-12}$  BER, 1250 Mb/s,  $2^7-1$  PRBS

## Receiver Specifications (Electrical)

| Parameter                           | Symbol         | Min | Typical | Max | Unit |
|-------------------------------------|----------------|-----|---------|-----|------|
| PECL Single-Ended Data Output Swing | $V_{out, p-p}$ | 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                          | $t_{on}$            | -        | -       | 1              | ms      |
| Tx Disable Assert Time                          | $t_{off}$           | -        | -       | 10             | $\mu$ s |
| Time to Initialize, Including Reset of Tx Fault | $t_{init}$          | -        | -       | 300            | ms      |
| Tx Fault Assert Time                            | $t_{fault}$         | -        | -       | 100            | $\mu$ s |
| 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)                           | $RX\_LOS_H$         | 2        | -       | -              | V       |
| RX_LOS Voltage (Low)                            | $RX\_LOS_L$         | -        | -       | 0.8            | V       |
| LOS Output Voltage-Fault                        | $V_{LOS\ fault}$    | 2        | -       | $V_{cc}$       | V       |
| LOS Output Voltage-Normal                       | $V_{LOS\ normal}$   | $V_{ee}$ | -       | $V_{ee} + 0.5$ | 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       |

### Diagnostics

| Parameter          | Range         | Accuracy | Unit | Calibration | Bit value   | Formula                                                                                               |
|--------------------|---------------|----------|------|-------------|-------------|-------------------------------------------------------------------------------------------------------|
| Temperature (-Cxx) | -5 to 70      | ±3       | °C   | Internal    | 1/256 C     | $T_c(C) = T_{ad}(16 \text{ bit signed twos complement})/256$                                          |
| Temperature (-Txx) | -40 to 85     | ±3       | °C   | Internal    | 1/256 C     | $T_c(C) = T_{ad}(16 \text{ bit signed twos complement})/256$                                          |
| Voltage            | 0 to $V_{CC}$ | 0.1      | V    | Internal    | 100 $\mu$ V | $V(\text{Volts}) = V_{ad}(16 \text{ bit unsigned integer}) * 0.1$                                     |
| Bias current       | 0 to 120      | 5        | mA   | External    | 0.002mA     | $I(\text{mA}) = I_{slope} * I_{ad}(16 \text{ bit unsigned integer}) + I_{offset}$                     |
| TX Power           | -5 to 0       | ±2dB     | dBm  | External    | 0.1 $\mu$ W | $TX\_PWR(\mu W) = TX\_PWR_{slope} * TX\_PWR_{ad}(16 \text{ bit unsigned integer}) + TX\_PWR_{offset}$ |
| RX Power           | -18 to 0      | ±2dB     | dBm  | External    | 0.1 $\mu$ W | $RX\_PWR(\mu W) = A0 + A1 * x + A2 * x^2 + A3 * x^3 + A4 * x^4$                                       |

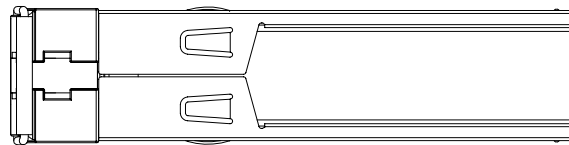
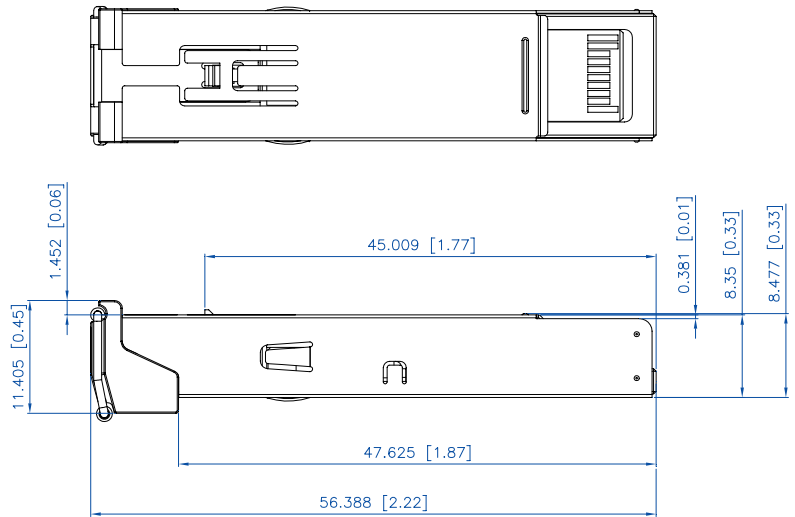
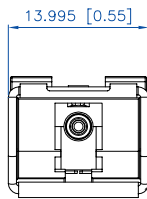
### Pinout Definitions

| Pin | Function   | Notes                  |
|-----|------------|------------------------|
| 1   | $V_{eeT}$  | TX GND                 |
| 2   | TX_FAULT   | 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   | $V_{eeR}$  | RX Ground              |
| 10  | $V_{eeR}$  | RX Ground              |
| 11  | $V_{eeR}$  | RX Ground              |
| 12  | RXD-       | RX Data Negative       |
| 13  | RXD+       | RX Data Positive       |
| 14  | $V_{eeR}$  | RX GND                 |
| 15  | $V_{CCR}$  | RX Power               |
| 16  | $V_{CCT}$  | TX Power               |
| 17  | $V_{eeT}$  | TX GND                 |
| 18  | TXD+       | TX Data Positive       |
| 19  | TXD-       | TX Data Negative       |
| 20  | $V_{eeT}$  | TX GND                 |

## SPL-53-MR-IR1

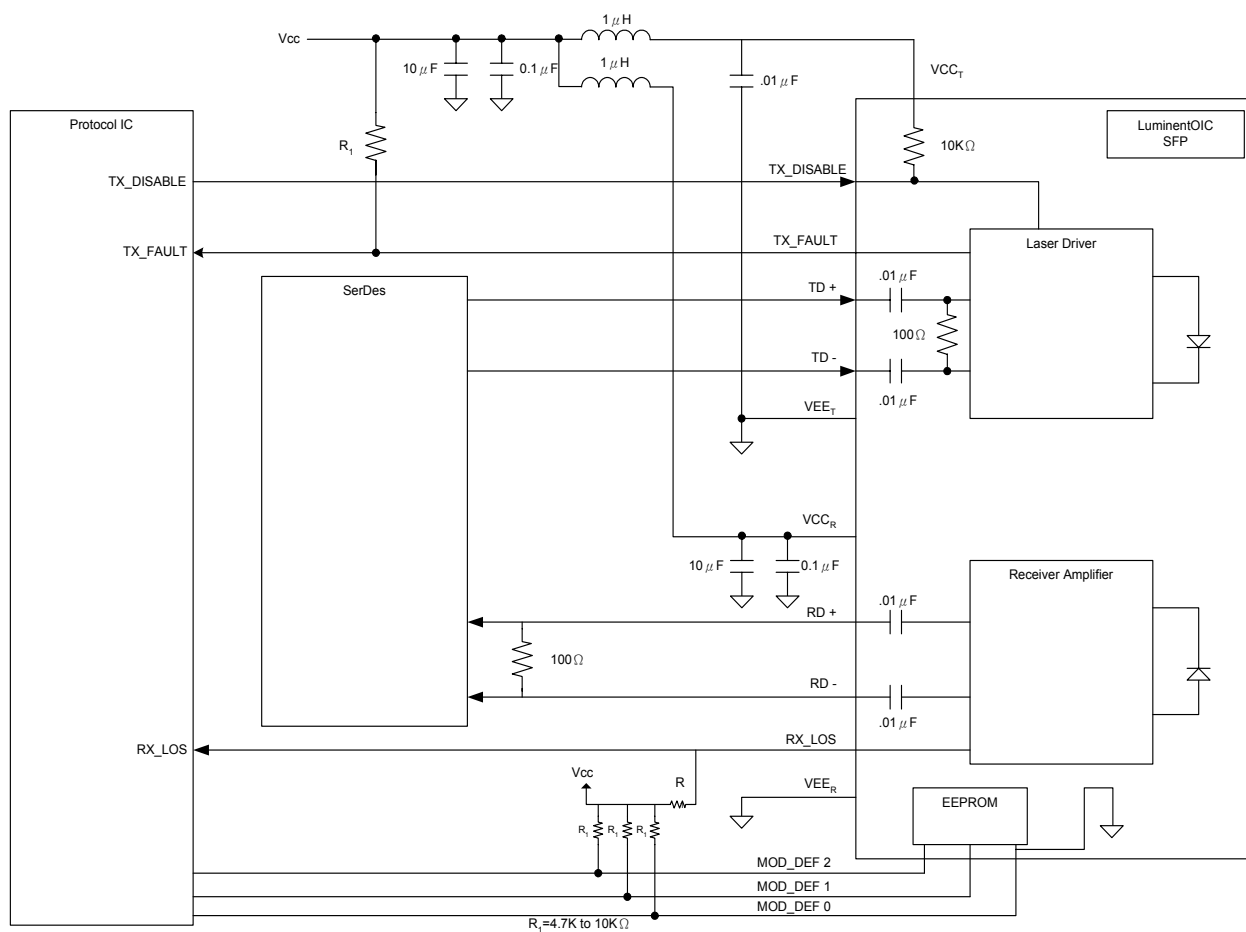
| EEPROM Serial ID |                                                 |         |     |       |
|------------------|-------------------------------------------------|---------|-----|-------|
| Name of Field    | Description of Field                            | Address | Hex | ASCII |
| Vendor Name      | 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 PN        | Part number in ASCII, e.g.<br>SPL-53-MR-IR1-CDA | 40      | 53  | S     |
|                  |                                                 | 41      | 50  | P     |
|                  |                                                 | 42      | 4C  | L     |
|                  |                                                 | 43      | 35  | 5     |
|                  |                                                 | 44      | 33  | 3     |
|                  |                                                 | 45      | 4D  | M     |
|                  |                                                 | 46      | 52  | R     |
|                  |                                                 | 47      | 49  | I     |
|                  |                                                 | 48      | 52  | R     |
|                  |                                                 | 49      | 31  | 1     |
|                  |                                                 | 50      | 43  | C     |
|                  |                                                 | 51      | 44  | D     |
|                  |                                                 | 52      | 41  | A     |

**Mechanicals**



**Units in mm (inches)**

## Suggested Transceiver Interface



## SPL-53-MR-IR1

## Ordering Information

## Available Options:

SPL-53-MR-IR1-CDA  
SPL-53-MR-IR1-CNA  
SPL-53-MR-IR1-TDA  
SPL-53-MR-IR1-TNA

## Part numbering Definition:

SPL - 53 - MR - IR1 - Temperature Diagnostic Revision

- SPL = LC connector
- 53 = Tx 1550nm/Rx 1310nm
- MR = Multi Rate
- IR1 = Reach 15 km
- Operating Temperature
  - C = Commercial temperature (-5 to 70°C)
  - T = Industrial temperature (-40 to 85°C)
- D = Digital Diagnostic (SFF-8472)
  - N = No Diagnostic
- Design Revision
  - A = RoHS compliant (lead free soldered)

## 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.

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