

## Datasheet

### SFP Bidirectional Transceiver

SFP-FD-BD35 and SFP-FD-BD53



#### Features

- Two wavelengths
  - 1310 nm FP laser (SFP-FD-BD35)
  - 1550 nm DFB laser (SFP-FD-BD53)
- 10 Mbps to 155 Mbps data rates
- 40 km reach
- Simplex LC connector
- 23.2 dB minimum power budget
- Single 3.3 V supply
- OC-3/STM-1 IEEE 802.3ah, 100BASE-BX10 compliances
- Digital Diagnostic SFF-8472 Compliance
- Bellcore GR-468 compliance
- SFP MSA SFF-8074i compliance
- Commercial and industrial temperature availability
- RoHS and China RoHS compliance
- UL Listing
- Color coded bail latch: Blue or Yellow
- Class 1 Laser

#### General Operating

| Parameter                    | Symbol    | Min   | Typical | Max   | Unit              |
|------------------------------|-----------|-------|---------|-------|-------------------|
| Supply Voltage               | $V_{CC}$  | 3.135 | 3.3     | 3.465 | V                 |
| Total Current                | $I_{CC}$  | -     | -       | 300   | mA                |
| Power Supply Noise Rejection | PSR       | 100   | -       | -     | mV <sub>p-p</sub> |
| Operating Temperature        | $T_{opr}$ | -5    | -       | 70    | °C                |
| Operating Temperature (TH)   | $T_{opr}$ | -40   | -       | 85    | °C                |
| Storage Temperature          | $T_{stg}$ | -40   | -       | 85    | °C                |
| Data Rate                    | DR        | 10    | -       | 155   | Mbps              |

#### Transmitter Specifications (Optical)

| Parameter                             | Symbol                           | Min  | Typical | Max  | Unit  |
|---------------------------------------|----------------------------------|------|---------|------|-------|
| Optical Power                         | $P_{op}$                         | -5   | -2.5    | 0    | dBm   |
| Optical Crosstalk                     | $\chi_T$                         | -    | -45     | -40  | dB    |
| Average Launch Power Of Off Tx        | $P_{off}$                        | -    | -       | -45  | dBm   |
| Extinction Ratio                      | ER                               | 6.6  | -       | -    | dB    |
| Eye Mask                              | IEEE 802.3Z, SONET/SDH compliant |      |         |      |       |
| Optical Rise Time (20% to 80% values) | $t_r$                            | -    | -       | 2    | ns    |
| Optical Fall Time (20% to 80% values) | $t_f$                            | -    | -       | 2    | ns    |
| Mean Wavelength:                      |                                  |      |         |      |       |
| SFP-FD-BD35                           | $\lambda$                        | 1260 | 1310    | 1360 | nm    |
| SFP-FD-BD53                           | $\lambda$                        | 1500 | 1550    | 1600 | nm    |
| RMS Width ( $\sigma$ ):               |                                  |      |         |      |       |
| SFP-FD-BD35                           | $\sigma$                         | -    | -       | 1    | nm    |
| SFP-FD-BD53                           | $\sigma$                         | -    | -       | 3    | nm    |
| Relative Intensity Noise              | RIN                              | -    | -       | -120 | dB/Hz |
| Optical Return Loss Tolerance         | ORLT                             | -    | -       | 12   | dB    |

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**Transmitter Specifications (Electical)**

| 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>a</sup> | $R_{sens,low}$  | -    | -30     | -28.2 | dBm  |
| Receive Power High             | $R_{sens,high}$ | -8   | -       | -     | dBm  |
| Damage Threshold For Receiver  | $P_{in,damage}$ | 4    | -       | -     | dBm  |
| Wavelength: SFP-FD-BX35        | $\lambda$       | 1480 | -       | 1580  | nm   |
| SFP-FD-BX53                    | $\lambda$       | 1260 | -       | 1360  | nm   |
| LOS Assert                     | -               | -45  | -       | -     | dBm  |
| LOS De-assert                  | -               | -    | -       | -28.2 | dBm  |
| LOS Hysteresis                 | -               | 0.5  | -       | -     | dB   |

 a) at  $10^{-12}$  BER, PRBS 2<sup>7</sup>-1

**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               | $t_r$         | -   | -       | 2   | ns   |
| Data Output Fall Time               | $t_f$         | -   | -       | 2   | ns   |

**Timing and Electrical**

| Parameter                                       | Symbol              | Min      | Typical | Max          | Unit    |
|---|---------------------|----------|---------|--------------|---------|
| Tx Disable Negate Time                          | $t_{on}$            | -        | -       | 25           | 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                                 | $t_{loss_{on}}$     | -        | -       | 300          | $\mu$ 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       |

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### Digital Diagnostics

| Parameter        | Range         | Accuracy | Unit | Calibration | Bit Value | Formula   |
|------------------|---------------|----------|------|-------------|-----------|---|
| Temperature      | -5 to 70      | ± 3      | ° C  | Internal    | 1/256 C   | $T_c(C) = T_{ad}(16 \text{ bit signed twos complement})/256$  |
| Temperature (TH) | -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    | 100µV     | $V(\text{Volts}) = V_{ad}(16 \text{ bit unsigned integer}) * 0.1$                                     |
| Bias Current     | 0 to 120      | 5        | mA   | External    | -         | $I(\text{mA}) = I_{slope} * I_{ad}(16 \text{ bit unsigned integer}) + I_{offset}$                     |
| TX Power         | -5 to 0       | ±3 dB    | dBm  | External    | -         | $TX\_PWR(\mu W) = TX\_PWR_{slope} * TX\_PWR_{ad}(16 \text{ bit unsigned integer}) + TX\_PWR_{offset}$ |
| RX Power         | -28.2 to -8   | ±3 dB    | dBm  | External    | -         | $RX\_PWR(\mu W) = A_0 + A_1 * x + A_2 * x^2 + A_3 * x^3 + A_4 * x^4$                                  |

| 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                 |

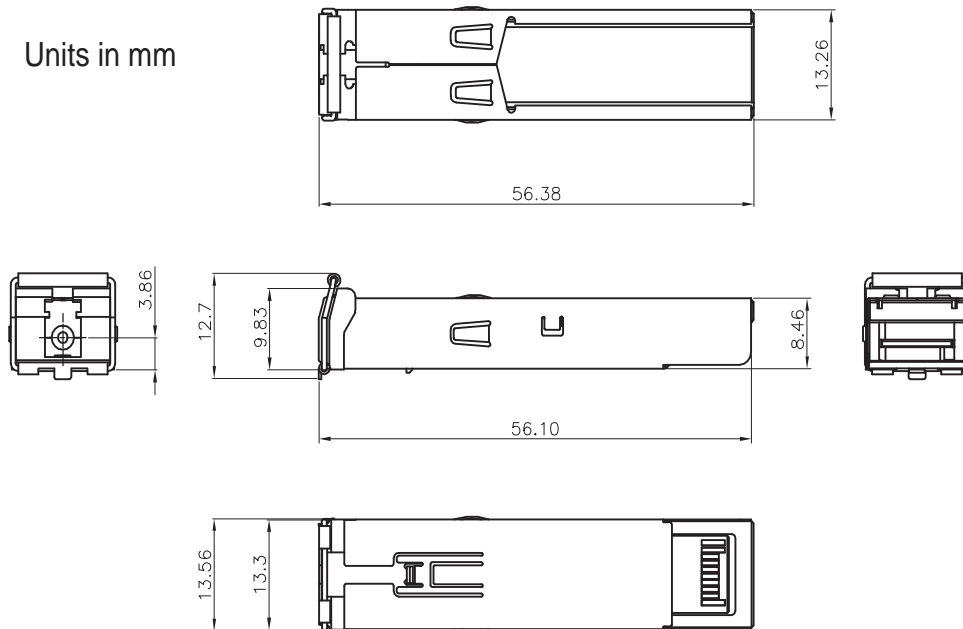
### Ordering Information

| Model         | Description   | Data Rate (Mbps)   | Wavelength (nm) | Connector Type | Bail Latch Color | Distance Range (km) |
|---------------|---|--------------------|-----------------|----------------|------------------|---------------------|
| SFP-FD-BD35   | SFP Bidirectional Transceiver                           | 100Base-BX and OC3 | 1310/1550       | LC             | Blue             | 0-40                |
| SFP-FD-BD53   | SFP Bidirectional Transceiver                           | 100Base-BX and OC3 | 1550/1310       | LC             | Yellow           | 0-40                |
| SFP-FD-BD35TH | SFP Bidirectional Transceiver<br>(Temperature Hardened) | 100Base-BX and OC3 | 1310/1550       | LC             | Blue             | 0-40                |
| SFP-FD-BD53TH | SFP Bidirectional Transceiver<br>(Temperature Hardened) | 100Base-BX and OC3 | 1550/1310       | LC             | Yellow           | 0-40                |

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## Outline Drawing

Units in mm



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