

## Professional high-speed optical transceiver

### OPN-SF1315-40SC / OPN-SF1315-40SCI / OPN-SF1315-40LC / OPN-SF1315-40LCI

1310 nm TX / 1550 nm RX , 3.3V / 622 Mbps Digital Diagnostic Single-Fiber SFP Transceiver

## PRODUCT FEATURES

- 1-Fiber Bi-Directional SFP Optical Transceiver
- Simplex SC Connector: OPN-SF1315-40SC
- Simplex LC Connector: OPN-SF1315-40LC
  - SFF-8472 Digital Diagnostic Function
    - 1310 nm LD Transmitter
    - 1550 nm Receiver
    - Distance Up to 40 km
- AC/AC Coupling according to MSA
  - Single +3.3 V Power Supply
  - RoHS Compliant
- 0 to 70°C Operation: OPN-SF1315-40LC
- -50 to 85°C Operation: OPN-SF1315-40LCI
- Class 1 Laser International Safety Standard IEC 60825Compliant

## APPLICATIONS

- SONET/SDH Equipment Interconnect
- Fibre Channel Links

## PRODUCT DESCRIPTION

The OPN-SF1315-40LC series is a small form factor pluggable modules for OC-12/STM-4 SONET/SDH and Fibre Channel single fiber communications by using 1310 nm transmitter and 1550 nm receiver. It is with the SFP 20-pin connector to allow hot plug capability. Digital diagnostic functions are available via an I<sup>2</sup>C. The transmitter section uses a multiple quantum well 1310 nm laser and is a class 1 laser compliant according to International Safety Standard IEC 60825. The receiver section uses an integrated 1550 nm detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

## ORDER INFORMATION

| P/No.            | Bit Rate (Mb/s) | Distance (km) | TX (nm) | RX (nm) | Package         | Temp (°C) | TX Power (dBm) | RX Sens. (dBm) | RoHS Compliant |
|------------------|-----------------|---------------|---------|---------|-----------------|-----------|----------------|----------------|----------------|
| OPN-SF1315-40SC  | 622             | 40            | 1310    | 1550    | SC SFP with DMI | 0 to 70   | 0 to -5        | -28            | Yes            |
| OPN-SF1315-40SCI | 622             | 40            | 1310    | 1550    | SC SFP with DMI | -50 to 85 | 0 to -5        | -28            | Yes            |
| OPN-SF1315-40LC  | 622             | 40            | 1310    | 1550    | LC SFP with DMI | 0 to 70   | 0 to -5        | -28            | Yes            |
| OPN-SF1315-40LCI | 622             | 40            | 1310    | 1550    | LC SFP with DMI | -50 to 85 | 0 to -5        | -28            | Yes            |

| Absolute Maximum Ratings   |        |     |     |       |                  |
|----------------------------|--------|-----|-----|-------|------------------|
| Parameter                  | Symbol | Min | Max | Units | Notes            |
| Storage Temperature        | Tstg   | -50 | 85  | °C    |                  |
| Operating Case Temperature | Topr   | 0   | 70  | °C    | OPN-SF1315-40LC  |
|                            |        | -50 | 85  |       | OPN-SF1315-40LCI |
| Power Supply Voltage       | Vcc    | 0   | 3.6 | V     |                  |
| Input Voltage              | ---    | GND | Vcc | V     |                  |
| Output Current             | Iout   | 0   | 30  | mA    |                  |

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| Recommended Operating Conditions |                         |          |     |          |                                               |
|----------------------------------|-------------------------|----------|-----|----------|-----------------------------------------------|
| Parameter                        | Symbol                  | Min      | Typ | Max      | Units / Notes                                 |
| Power Supply Voltage             | V <sub>CC</sub>         | 3.1      | 3.3 | 3.5      | V                                             |
| Power Supply Current             | I <sub>CC</sub> (TX+RX) |          | 200 | 300      | mA                                            |
| Operating Case Temperature       | T <sub>opr</sub>        | 0<br>-50 |     | 70<br>85 | °C / OPN-SF1315-40LC<br>°C / OPN-SF1315-40LCI |
| Data Rate                        |                         |          | 622 | 700      | Mb/s                                          |

| Transmitter Specifications (0°C < T <sub>opr</sub> < 70°C, 3.1V < V <sub>CC</sub> < 3.5V) |                                                                  |      |     |                      |       |                   |
|-------------------------------------------------------------------------------------------|------------------------------------------------------------------|------|-----|----------------------|-------|-------------------|
| Parameter                                                                                 | Symbol                                                           | Min  | Typ | Max                  | Units | Notes             |
| <b>Optical</b>                                                                            |                                                                  |      |     |                      |       |                   |
| Optical Transmit Power                                                                    | P <sub>o</sub>                                                   | -5   |     | 0                    | dBm   | 1                 |
| Output Center Wavelength                                                                  | λ                                                                | 1270 |     | 1355                 | nm    |                   |
| Output Spectrum Width                                                                     | Δλ                                                               | ---  |     | 2.5                  | nm    | -20 dB width      |
| Extinction Ratio                                                                          | E <sub>R</sub>                                                   | 10   |     |                      | dB    |                   |
| Output Eye                                                                                | Compliant with Bellcore GR-253-CORE and ITU recommendation G.957 |      |     |                      |       |                   |
| Optical Rise Time                                                                         | t <sub>r</sub>                                                   |      |     | 1.2                  | ns    | 10% to 90% Values |
| Optical Fall Time                                                                         | t <sub>f</sub>                                                   |      |     | 1.2                  | ns    | 10% to 90% Values |
| Relative Intensity Noise                                                                  | RIN                                                              |      |     | -116                 | dB/Hz |                   |
| Total Jitter                                                                              | TJ                                                               |      |     | 0.55                 | ns    | 2                 |
| <b>Electrical</b>                                                                         |                                                                  |      |     |                      |       |                   |
| Data Input Current – Low                                                                  | I <sub>IL</sub>                                                  | -350 |     |                      | μA    |                   |
| Data Input Current – High                                                                 | I <sub>IH</sub>                                                  |      |     | 350                  | μA    |                   |
| Differential Input Voltage                                                                | V <sub>IH</sub> - V <sub>IL</sub>                                | 0.5  |     | 2.4                  | V     | Peak-to-Peak      |
| TX Disable Input Voltage – Low                                                            | T <sub>DIS, L</sub>                                              | 0    |     | 0.5                  | V     | 3                 |
| TX Disable Input Voltage – High                                                           | T <sub>DIS, H</sub>                                              | 2.0  |     | V <sub>CC</sub>      | V     | 3                 |
| TX Disable Assert Time                                                                    | T <sub>ASSERT</sub>                                              |      |     | 10                   | μs    |                   |
| TX Disable Deassert Time                                                                  | T <sub>DEASSERT</sub>                                            |      |     | 1                    | ms    |                   |
| TX Fault Output Voltage -- Low                                                            | T <sub>FAULTL</sub>                                              | 0    |     | 0.5                  | V     | 4                 |
| TX Fault Output Voltage -- High                                                           | T <sub>FAULTH</sub>                                              | 2.0  |     | V <sub>CC</sub> +0.3 | V     | 4                 |

Notes: 1. Output power is power coupled into a 9/125 μm single mode fiber.

2. Measured with a 2<sup>23</sup>-1 PRBS

3. There is an internal 4.7K to 10K ohm pull-up resistor to V<sub>CC</sub>TX.

4. Open collector compatible, 4.7K to 10K ohm pull-up to V<sub>CC</sub> (Host Supply Voltage).

| Receiver Specifications (0°C < T <sub>opr</sub> < 70°C, 3.1 V < V <sub>CC</sub> < 3.5V) |                                   |      |     |                      |       |                         |
|-----------------------------------------------------------------------------------------|-----------------------------------|------|-----|----------------------|-------|-------------------------|
| Parameter                                                                               | Symbol                            | Min  | Typ | Max                  | Units | Notes                   |
| <b>Optical</b>                                                                          |                                   |      |     |                      |       |                         |
| Sensitivity                                                                             | ---                               | ---  | --- | -28                  | dBm   | 5                       |
| Maximum Input Power                                                                     | P <sub>in</sub>                   | -8   | --- | ---                  | dBm   |                         |
| Signal Detect – Asserted                                                                | P <sub>a</sub>                    | ---  | --- | -28                  | dBm   | Transition: low to high |
| Signal Detect – Deasserted                                                              | P <sub>d</sub>                    | -40  | --- | ---                  | dBm   | Transition: high to low |
| Signal detect – Hysteresis                                                              |                                   | 1.0  | --- |                      | dB    |                         |
| Wavelength of Operation                                                                 |                                   | 1480 |     | 1580                 | nm    | 6                       |
| Optical Return Loss                                                                     | ORL                               | 14   |     |                      | dB    |                         |
| <b>Electrical</b>                                                                       |                                   |      |     |                      |       |                         |
| Differential Output Voltage                                                             | V <sub>OH</sub> - V <sub>OL</sub> | 0.6  |     | 2.0                  | V     |                         |
| Output LOS Voltage -- Low                                                               | V <sub>OL</sub>                   | 0    |     | 0.5                  | V     | 7                       |
| Output LOS Voltage -- High                                                              | V <sub>OH</sub>                   | 2.0  |     | V <sub>CC</sub> +0.3 | V     | 7                       |
| Signal Detect Assert Time                                                               | A <sub>S</sub> MAX                |      |     | 100                  | μs    | OFF to ON               |
| Signal Detect Deassert Time                                                             | A <sub>N</sub> SMAX               |      |     | 300                  | μs    | ON to OFF               |

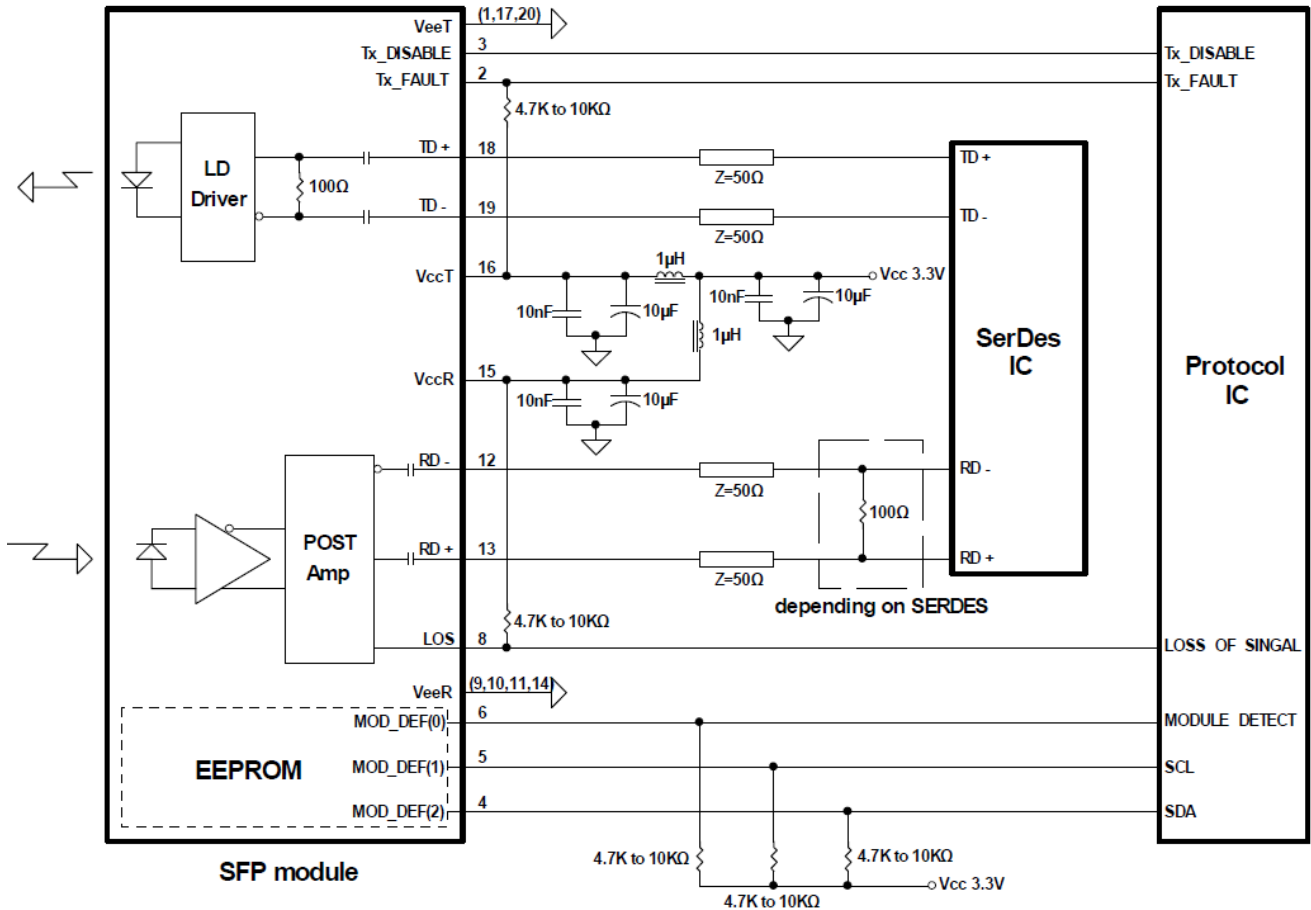
Notes: 5. Minimum sensitivity and saturation levels at BER 1E-10 for a 2<sup>23</sup>-1 PRBS.

6. At least 30 dB optical isolation for the wavelength 1260 to 1360 nm.

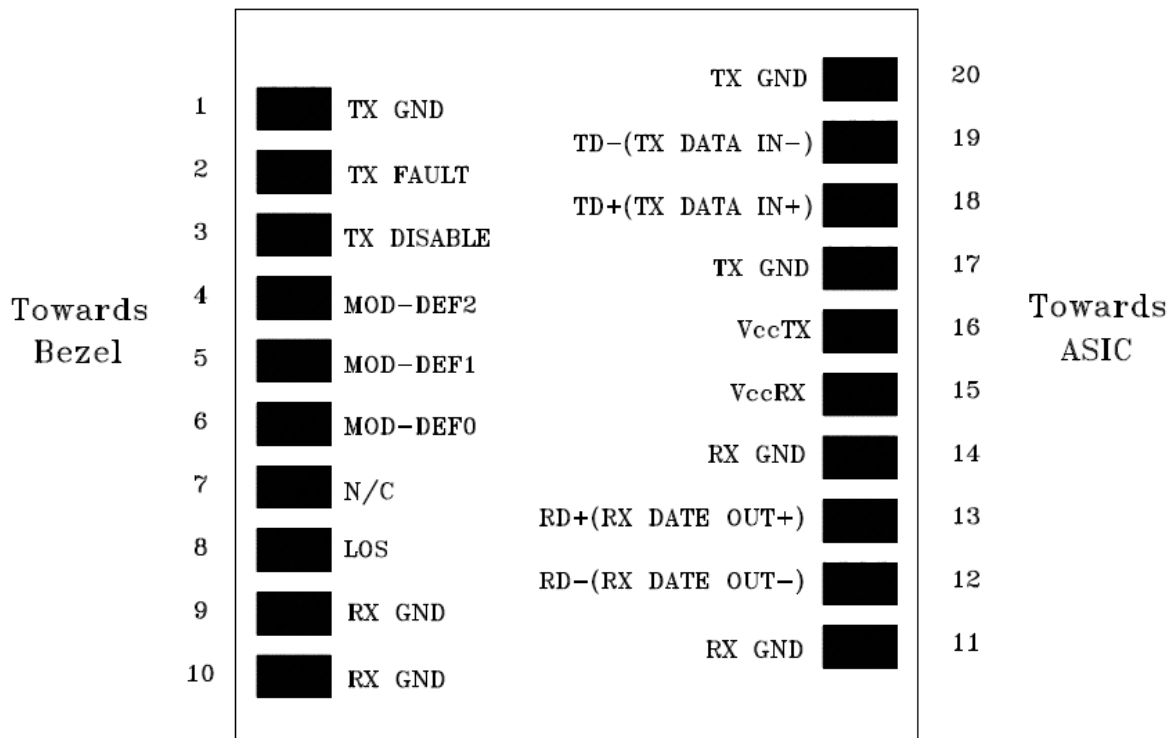
7. Open collector compatible, 4.7K to 10K ohm pull-up to V<sub>CC</sub> (Host Supply Voltage).

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### RECOMMENDED CIRCUIT SCHEMATIC



### CONNECTION DIAGRAM



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| PIN | Signal Name | Description                                             | PIN | Signal Name  | Description                 |
|-----|-------------|---------------------------------------------------------|-----|--------------|-----------------------------|
| 1   | TX GND      | Transmitter Ground                                      | 11  | RX GND       | Receiver Ground             |
| 2   | TX Fault    | Transmitter Fault Indication                            | 12  | RX DATA OUT- | Inverse Receiver Data Out   |
| 3   | TX Disable  | Transmitter Disable (Module disables on high or open)   | 13  | RX DATA OUT+ | Receiver Data Out           |
| 4   | MOD-DFE2    | Modulation Definition 2 – Two wires serial ID Interface | 14  | RX GND       | Receiver Ground             |
| 5   | MOD-DEF1    | Modulation Definition 1 – Two wires serial ID Interface | 15  | Vcc RX       | Receiver Power – 3.3V±5%    |
| 6   | MOD-DEF0    | Modulation Definition 0 – Ground in Module              | 16  | Vcc TX       | Transmitter Power – 3.3V±5% |
| 7   | N/C         | Not Connected                                           | 17  | TX GND       | Transmitter Ground          |
| 8   | LOS         | Loss of Signal                                          | 18  | TX DATA IN+  | Transmitter Data In         |
| 9   | RX GND      | Receiver Ground                                         | 19  | TX DATA IN-  | Inverse Transmitter Data In |
| 10  | RX GND      | Receiver Ground                                         | 20  | TX GND       | Transmitter Ground          |

### Module Definition

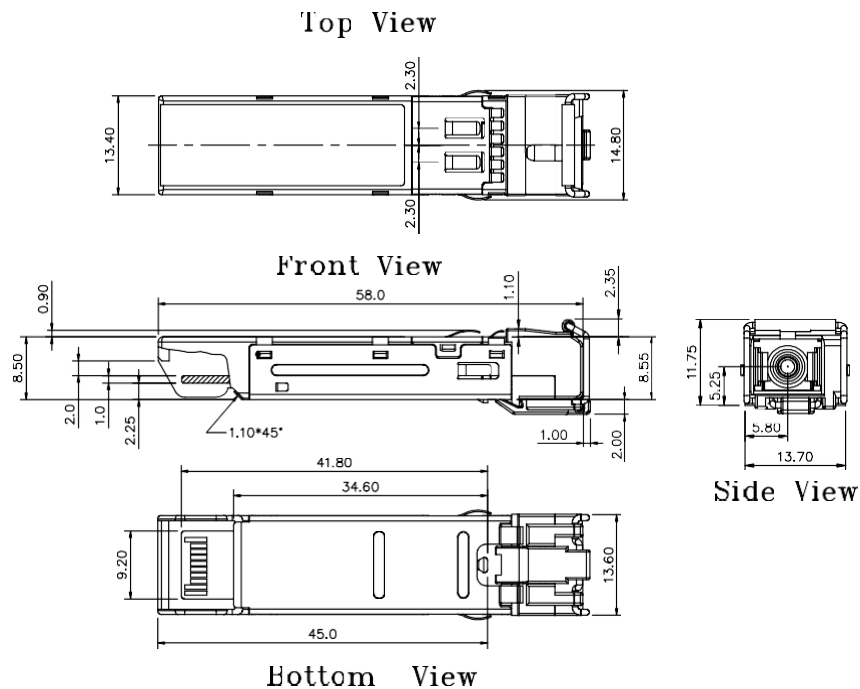
| Module Definition | MOD-DEF2<br>PIN 4 | MOD-DEF1<br>PIN 5 | MOD-DEF0<br>PIN 6 | Interpretation by Host            |
|-------------------|-------------------|-------------------|-------------------|-----------------------------------|
| 4                 | SDA               | SCL               | LV-TTL Low        | Serial module definition protocol |

Module Definition 4 specifies a serial definition protocol. For this definition, upon power up, MOD-DEF(1:2) appear as no connector (NC) and MOD-DEF(0) is TTL LOW. When the host system detects this condition, it activates the serial protocol. The protocol uses the 2-wire serial CMOS E<sup>2</sup>PROM protocol of the ATMEL AT24C01A/02/04 family of components.

### PACKAGE DIAGRAM

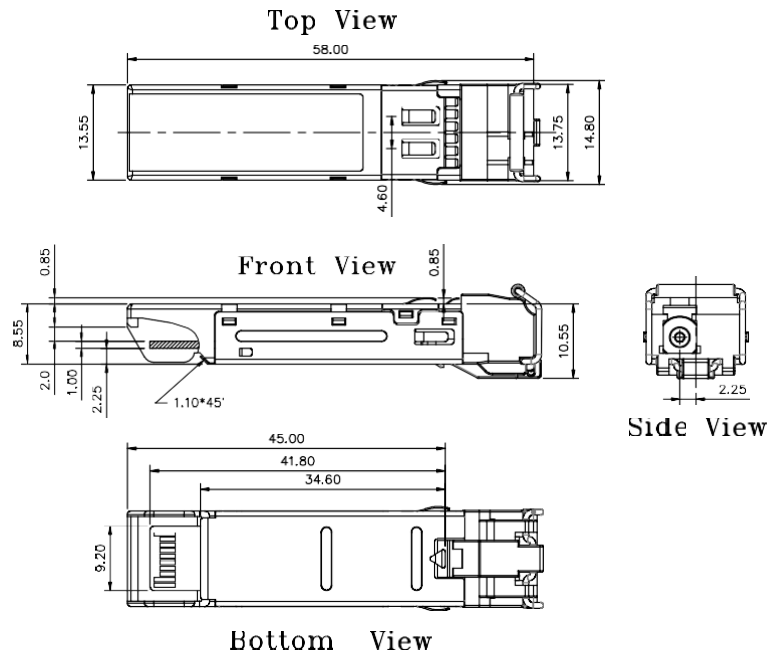
Units in mm

#### A) SC SFP



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### B) LC SFP



Note: Specifications subject to change without notice.