

DCxxx-SFP-LC.47dB

**Single-Mode CWDM 155M SDH/SONET or 100M FE
Duplex SFP Transceiver
RoHS6 Compliant**

Features

- ◆ Operating Data Rate up to 155Mbps
- ◆ 18-Wavelength CWDM DFB LD Transmitter from 1470nm to 1610nm, with step 20nm
- ◆ Single 3.3V Power Supply and TTL Logic Interface
- ◆ Hot-Pluggable SFP Footprint Duplex LC Connector Interface
- ◆ Compliant with Class 1 FDA and IEC60825-1 Laser Safety
- ◆ Operating Case Temperature Standard: 0°C~+70°C
- ◆ Compliant with SFP MSA
- ◆ Compliant with SFF-8472



Applications

- ◆ SDH/SONET
- ◆ ATM Switches and Routers
- ◆ Fast Ethernet
- ◆ Other Optical Link

Ordering Information

| Part No. | Data Rate | Fibre | Power Budget | Interface | Temperature | DDMI |
|---------------------------|-------------|-------|--------------|-----------|-------------|------|
| DCxxx-SFP-LC.47dB*(note1) | 155/100Mbps | SMF | 47dB | LC | Standard | YES |

Note1: xxx refers to CWDM Wavelength range 1470nm to 1610nm.

CWDM*^{Note2} Wavelength

| Band | PART NUMBER | Wavelength(nm) | | |
|-------------------------|--------------------|----------------|------|--------|
| | | Min. | Typ. | Max. |
| S-band Short Wavelength | DC1470-SFP-LC.47dB | 1464 | 1470 | 1477.5 |
| | DC1490-SFP-LC.47dB | 1484 | 1490 | 1497.5 |
| | DC1510-SFP-LC.47dB | 1504 | 1510 | 1517.5 |
| | DC1530-SFP-LC.47dB | 1524 | 1530 | 1537.5 |
| C-band Conventional | DC1550-SFP-LC.47dB | 1544 | 1550 | 1557.5 |
| L-band Long Wavelength | DC1570-SFP-LC.47dB | 1564 | 1570 | 1577.5 |
| | DC1590-SFP-LC.47dB | 1584 | 1590 | 1597.5 |
| | DC1610-SFP-LC.47dB | 1604 | 1610 | 1617.5 |

Note2: 8 Wavelengths from 1470 nm to 1610 nm, with 20 nm span.

Regulatory Compliance

| Feature | Standard | Performance |
|--|--|--|
| Electrostatic Discharge (ESD) to the Electrical Pins | MIL-STD-883G Method 3015.7 | Class 1C (>1000V) |
| Electrostatic Discharge to the Enclosure | EN 55024:1998+A1+A2 IEC-61000-4-2 GR-1089-CORE | Compliant with standards |
| Electromagnetic Interference (EMI) | FCC Part 15 Class B EN55022:2006 CISPR 22B :2006 VCCI Class B | Compliant with standards Noise frequency range: 30MHz to 6GHz. Good system EMI design practice required to achieve Class B margins. System margins are dependent on customer host board and chassis design. |
| Immunity | EN 55024:1998+A1+A2 IEC 61000-4-3 | Compliant with standards. 1KHz sine-wave, 80% AM, from 80MHz to 1GHz. No effect on transmitter/receiver performance is detectable between these limits. |
| Laser Eye Safety | FDA 21CFR 1040.10 and 1040.11 EN (IEC) 60825-1:2007 EN (IEC) 60825-2:2004+A1 | CDRH compliant and Class I laser product. TüV Certificate No. 50135086 |
| Component Recognition | UL and CUL EN60950-1:2006 | UL file E317337 TüV Certificate No. 50135086 |

| | | |
|-------|--|--------------------------------|
| | | (CB scheme) |
| RoHS6 | 2002/95/EC 4.1&4.2 2005/747/EC 5&7&13 | Compliant with standards*note3 |

Note3: In light of item 5 in RoHS exemption list of RoHS Directive 2002/95/EC, Item 5: Lead in glass of cathode ray tubes, electronic components and fluorescent tubes.

In light of item 13 in RoHS exemption list of RoHS Directive 2005/747/EC, Item13: Lead and cadmium in optical and filter glass. The three exemptions are being concerned for our transceivers, because our transceivers use glass, which may contain Pb, for components such as lenses, windows, isolators, and other electronic components.

Product Description

The DCxxxx-SFP-LC.47dB series single mode transceiver is small form factor pluggable module for serial optical data communications such as SONET OC-3 / SDH STM-1 and Fast Ethernet. It is with the SFP 20-pin connector to allow hot plug capability. This module is designed for single mode fiber and operates at a nominal wavelength of CWDM. There are eighteen center wavelengths available from 1470nm to 1610nm, with each step 20nm.

The transmitter section uses a multiple quantum well CWDM DFB laser and is a class 1 laser compliant according to International Safety Standard IEC-60825. The receiver section uses an integrated InGaAs avalanche photodiode preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

The DCxxxx-SFP-LC.47dB series are designed to be compliant with SFF-8472.

Absolute Maximum Ratings

| Parameter | Symbol | Min. | Max. | Unit |
|-----------------------------|-----------------|------|------|------|
| Storage Temperature | T _s | -40 | +85 | °C |
| Supply Voltage | V _{cc} | -0.5 | 3.6 | V |
| Operating Relative Humidity | | - | 95 | % |

*Exceeding any one of these values may destroy the device permanently.

Recommended Operating Conditions

| Parameter | Symbol | Min. | Typical | Max. | Unit |
|----------------------------|-----------------|------|---------|------|------|
| Operating Case Temperature | T _A | 0 | - | +70 | °C |
| Power Supply Voltage | V _{cc} | 3.15 | 3.3 | 3.45 | V |
| Power Supply Current | I _{cc} | - | - | 300 | mA |
| Data Rate | OC-3/STM-1 | - | 155 | - | Mbps |
| | 100M | - | 100 | - | |

Performance Specifications - Electrical

| Parameter | Symbol | Min. | Typ. | Max | Unit | Notes |
|---------------------------------|---------|------|------|------|------|--|
| Transmitter | | | | | | |
| LVPECL Inputs(Differential) | Vin | 400 | | 2000 | mVpp | AC coupled inputs ^{*(note4)} |
| Input Impedance (Differential) | Zin | 85 | 100 | 115 | ohm | Rin > 100 kohm @ DC |
| TX_Dis | Disable | 2 | | Vcc | V | |
| | Enable | 0 | | 0.8 | | |
| TX_FAULT | Fault | 2 | | Vcc | V | |
| | Normal | 0 | | 0.8 | | |
| Receiver | | | | | | |
| LVPECL Outputs (Differential) | Vout | 370 | | 2000 | mVpp | AC coupled outputs ^{*(note4)} |
| Output Impedance (Differential) | Zout | 85 | 100 | 115 | ohm | |
| RX_LOS | LOS | 2 | | Vcc | V | |
| | Normal | 0 | | 0.8 | V | |
| MOD_DEF (0:2) | VoH | 2.5 | | | V | |
| | VoL | 0 | | 0.8 | V | |

Performance Specifications - Optical
(CWDM DFB and APD, 47dB Power Budget at Least)

| Parameter | Symbol | Min. | Typical | Max. | Unit |
|--|---|---------------|-------------|-----------------|------|
| Data Rate | | | 100/155 | | Mbps |
| Transmitter | | | | | |
| Center Wavelength | λ_c | λ_c-6 | λ_c | $\lambda_c+7.5$ | nm |
| Spectral Width (-20dB) | $\Delta\lambda$ | | | 1 | nm |
| Average Output Power ^{*(note5)} | Pout | 2 | | 7 | dBm |
| Extinction Ratio ^{*(note6)} | ER | 10 | | | dB |
| Side Mode Suppression Ratio | SMSR | 30 | | | dB |
| Rise/Fall Time(20%~80%) | tr/tf | | | 2 | ns |
| Output Optical Eye ^{*(note6)} | IUT-T G.957 Compliant ^{*(note9)} | | | | |
| TX_Disable Assert Time | t_off | | | 10 | us |
| Receiver | | | | | |
| Center Wavelength | λ_c | 1100 | | 1650 | nm |
| Receiver Sensitivity ^{*(note7)} | Pmin | | | -45 | dBm |
| Receiver Overload | Pmax | -10 | | | dBm |
| Return Loss | | 14 | | | dB |
| Optical Path Penalty ^{*(note8)} | | | | 1 | dB |
| LOS De-Assert | LOSD | | | -46 | dBm |
| LOS Assert | LOSA | -50 | | | dBm |

| | | | | | |
|------------------------|--|-----|--|--|----|
| LOS Hysteresis*(note9) | | 0.5 | | | dB |
|------------------------|--|-----|--|--|----|

Note4: LVPECL logic, internally AC coupled.

Note5: Output is coupled into a 9/125µm single-mode fiber.

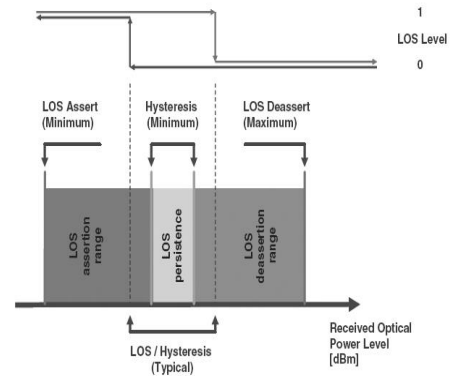
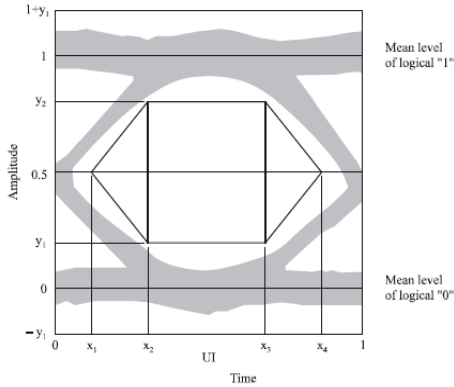
Note6: Filtered, measured with a PRBS 2²³-1 test pattern @155Mbps

Note7: Minimum average optical power measured at BER less than 1E-10, with a 2²³-1 PRBS and ER=9dB.

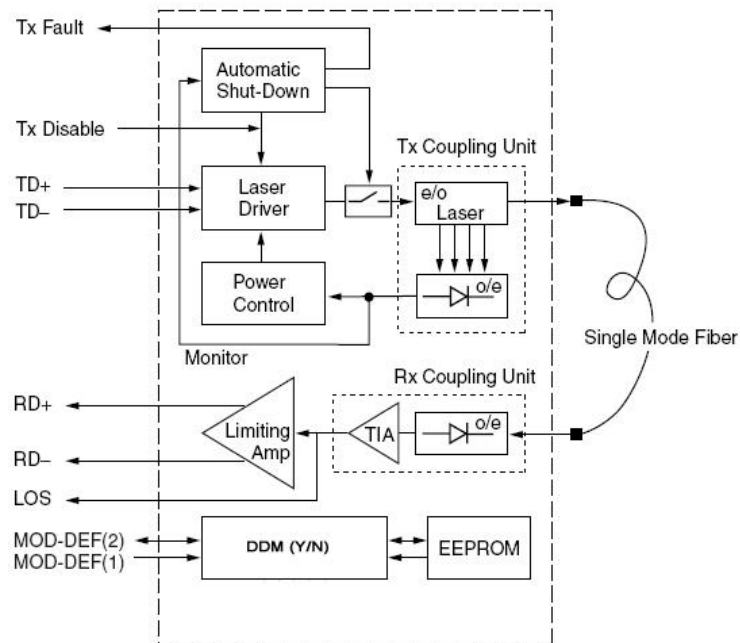
Note8: Measured with a PRBS 2²³-1 test pattern @155Mbps, BER ≤1×10⁻¹⁰.

Note9: Eye Pattern Mask

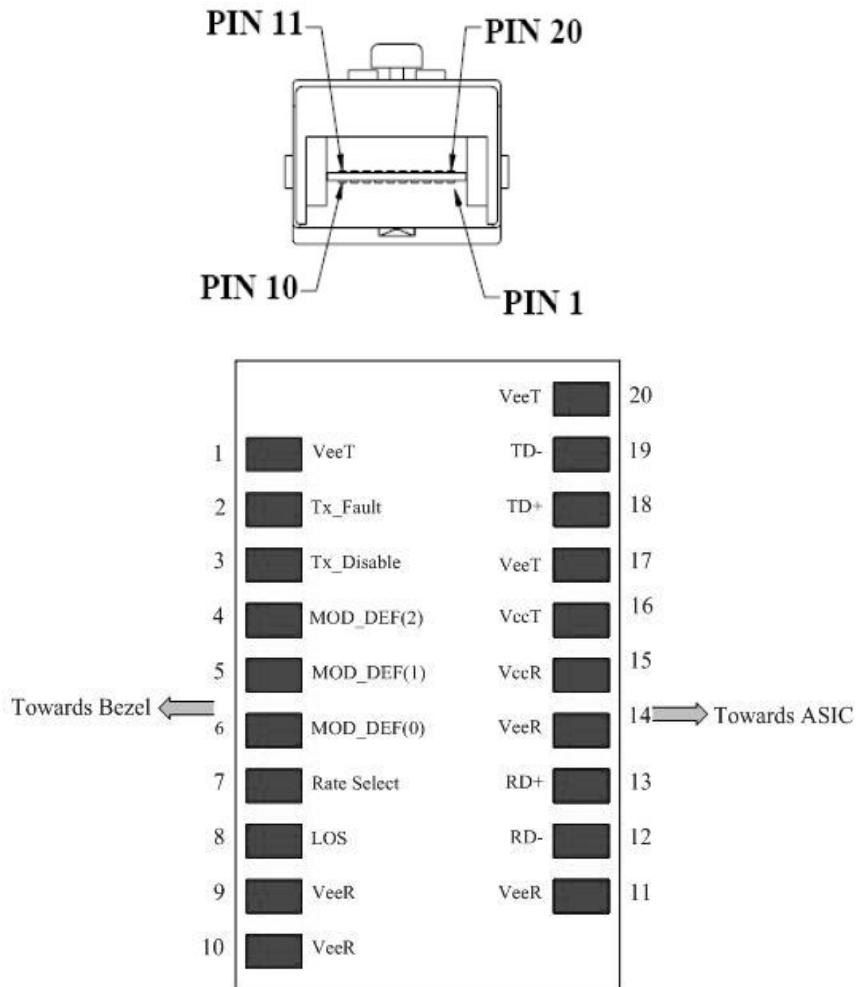
Note10: LOS Hysteresis



Functional Description of Transceiver



SFP Transceiver Electrical Pad Layout



Pin Function Definitions

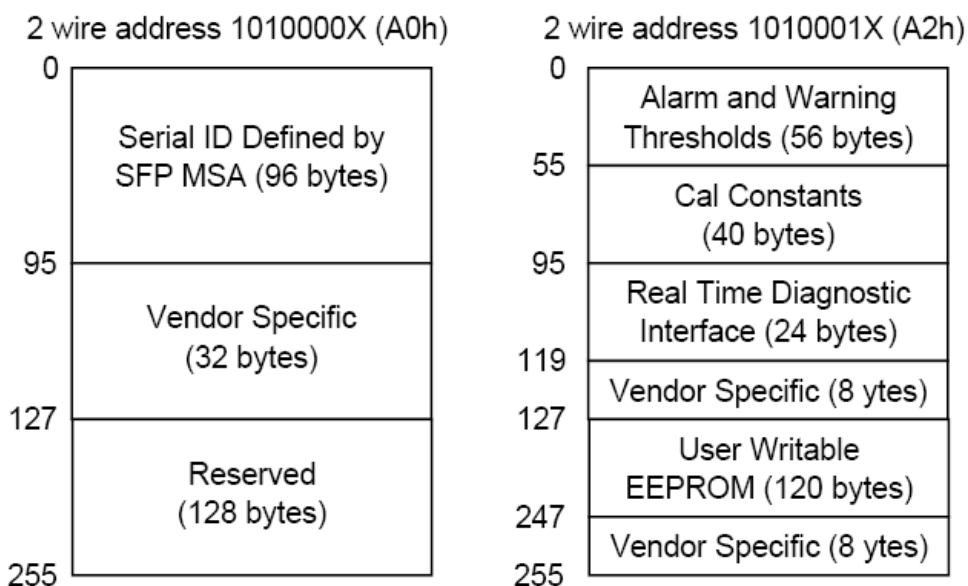
| Pin Num. | Name | Function Description |
|----------|-------------|---|
| 1 | VeeT | Transmitter Ground |
| 2 | TX Fault | Transmitter Fault Indication, open collector/drain output |
| 3 | TX Disable | Transmitter Disable |
| 4 | MOD-DEF2 | Module Definition 2, Data line for Serial ID. |
| 5 | MOD-DEF1 | Module Definition 1, Clock line for Serial ID. |
| 6 | MOD-DEF0 | Module Definition 0, Grounded within the module. |
| 7 | Rate Select | Not Connect, Function not available |
| 8 | LOS | Loss of Signal, open collector/drain output |
| 9 | VeeR | Receiver Ground |
| 10 | VeeR | Receiver Ground |
| 11 | VeeR | Receiver Ground |
| 12 | RD- | Inv. Received Data Out |
| 13 | RD+ | Received Data Out |
| 14 | VeeR | Receiver Ground |

| | | |
|----|------|-----------------------------|
| 15 | VccR | Receiver Power, 3.3 ± 5% |
| 16 | VccT | Transmitter Power, 3.3 ± 5% |
| 17 | VeeT | Transmitter Ground |
| 18 | TD+ | Transmit Data In |
| 19 | TD- | Inv. Transmit Data In |
| 20 | VeeT | Transmitter Ground |

EEPROM

The serial interface uses the 2-wire serial CMOS EEPROM protocol defined for the ATMEL AT24C02/04 family of components. When the serial protocol is activated, the host generates the serial clock signal (SCL). The positive edge clocks data into those segments of the EEPROM that are not write protected within the SFP transceiver. The negative edge clocks data from the SFP transceiver. The serial data signal (SDA) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially.

The Module provides diagnostic information about the present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Calibration and alarm/warning threshold data is written during device manufacture. Received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring all are implemented. If the module is defined as external calibrated, the diagnostic data are raw A/D values and must be converted to real world units using calibration constants stored in EEPROM locations 56 – 95 at wire serial bus address A2H. The digital diagnostic memory map specific data field define as following .For detail EEPROM information, please refer to the related document of SFF 8472 Rev 9.3.



EEPROM Serial ID Memory Contents

Accessing Serial ID Memory uses the 2 wire address 1010000X (A0H). Memory Contents of Serial ID are shown in Table 1.

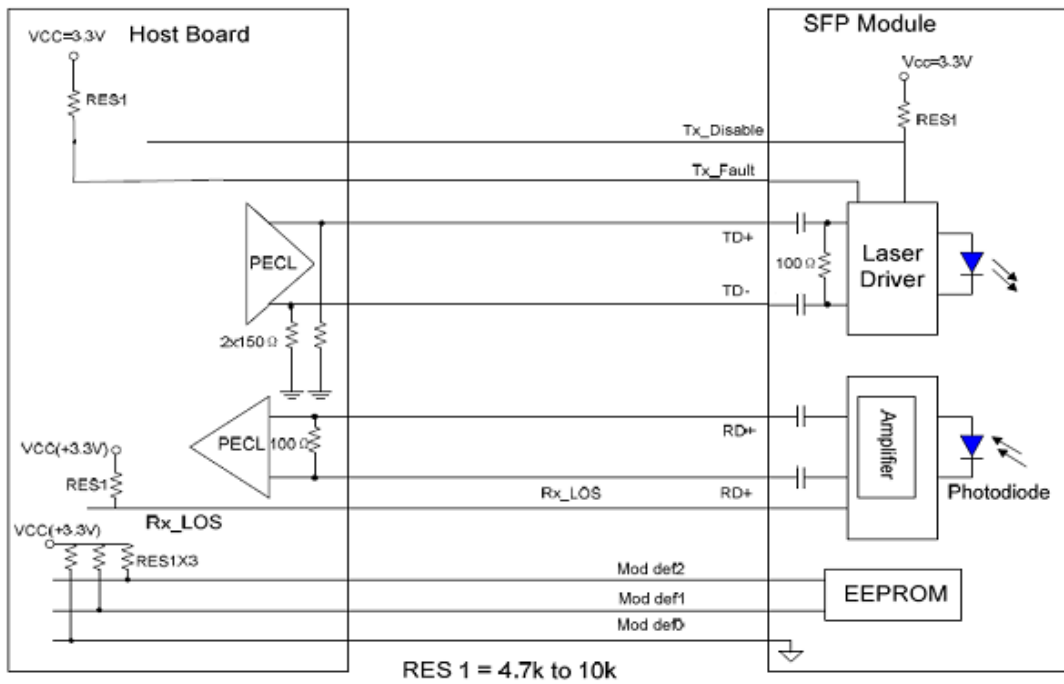
Table 1 Serial ID Memory Contents

| Addr. | Size (Bytes) | Name of Field | Hex | Description |
|---------------------------|--------------|-------------------|---|--|
| BASE ID FIELDS | | | | |
| 0 | 1 | Identifier | 03 | SFP |
| 1 | 1 | Ext. Identifier | 04 | SFP function is defined by serial ID only |
| 2 | 1 | Connector | 07 | LC Connector |
| 3-10 | 8 | Transceiver | XX XX XX XX XX XX XX XX XX ^(note10) | OC 3, Single mode, long reach |
| 11 | 1 | Encoding | 03 | NRZ |
| 12 | 1 | BR, Nominal | 01 | 155Mbps |
| 13 | 1 | Reserved | 00 | |
| 14 | 1 | Length (9µm)km | XX | Transceiver transmit distance |
| 15 | 1 | Length(9µm)100m | FF | |
| 16 | 1 | Length (50µm) 10m | 00 | |
| 17 | 1 | Length(62.5µm)10m | 00 | |
| 18 | 1 | Length (Copper) | 00 | Not compliant |
| 19 | 1 | Reserved | 00 | |
| 20-35 | 16 | Vendor name | Data Controls ^(note10) | Vendor name |
| 36 | 1 | Reserved | 00 | |
| 37-39 | 3 | Vendor OUI | 68F125 ^(note10) | |
| 40-55 | 16 | Vendor PN | DCxxxxSFPLC47dB ^(note10) | PN |
| 56-59 | 4 | Vendor rev | XX XX XX XX ^(note10) | |
| 60-61 | 2 | Wavelength | XX XX ^(note10) | Wavelength |
| 62 | 1 | Reserved | 00 | |
| 63 | 1 | CC_BASE | Check Sum (Variable) | Check code for Base ID Fields |
| EXTENDED ID FIELDS | | | | |
| 64-65 | 2 | Options | 00 1A | TX_DISABLE, TX_FAULT and Loss of Signal implemented. |
| 66 | 1 | BR, max | 00 | |
| 67 | 1 | BR, min | 00 | |
| 68-83 | 16 | Vendor SN | XX XX XX XX XX XX XX XX XX 20 20 20 20 20 20 20 20 20 ^(note10) | Serial Number of transceiver (ASCII). For example "B000822". |
| 84-91 | 8 | Date code | XX XX XX XX XX XX XX XX XX ^(note10) | Manufactory date code. For example "080405". |

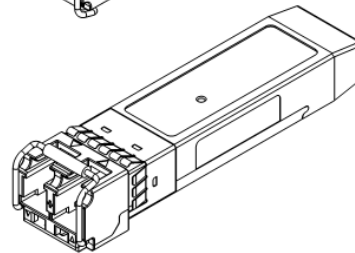
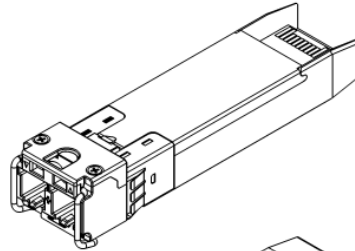
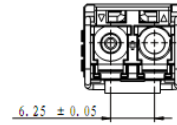
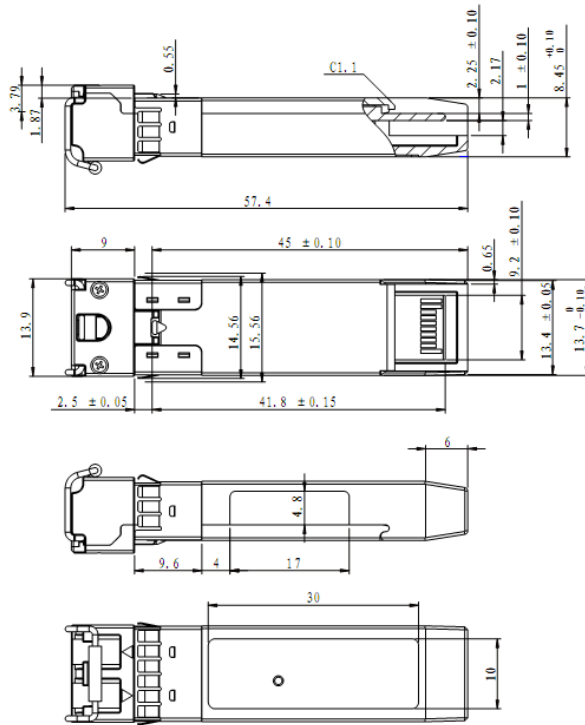
| | | | | |
|----------------------------------|-----|----------------------------|------------------------|---|
| 92 | 1 | Diagnostic Monitoring Type | XX ^(note10) | Digital diagnostic monitoring implemented |
| 93 | 1 | Enhanced Options | XX ^(note10) | Optional flags |
| 94 | 1 | SFF_8472 Compliance | 01 | 01 for diagnostics (Rev9.3 SFF-8472). |
| 95 | 1 | CC_EXT | Check Sum (Variable) | Check sum for Extended ID Field. |
| VENDOR SPECIFIC ID FIELDS | | | | |
| 96-127 | 32 | Vendor Specific | Read only | Depends on customer information |
| 128-255 | 128 | Reserved | Read only | |

Note10: The "XX" byte should be filled in according to practical case. For more information, please refer to the related document of SFP Multi-Source Agreement (MSA).

Recommend Circuit Schematic



Mechanical Specifications



Contact

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