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AFCT-57D3ANMZ

Digital Diagnostic SFP 25 km, 1310 nm DFB, 8.5/4.25/2.125 GBd
Fibre Channel Optical Transceiver with TX/RX Rate Select



Data Sheet



Description

Avago Technologies' AFCT-57D3ANMZ optical transceiver supports high-speed serial links over single-mode optical fiber at signaling rates up to 8.5 GBd. Compliant with Small Form Pluggable (SFP and SFP Plus) mechanical and electrical specifications for LC Duplex transceivers, ANSI Fibre Channel for FC-PI-4 and FC-PI-2 for gigabit applications. The part is electrically interoperable with SFP conformant devices.

The AFCT-57D3ANMZ supports both TX and RX Rate Select feature. It uses Rate Select to vary maximum transmitted RS(1) optical power for assisting interoperability with legacy 2G and 4G receivers. Fibre Channel FC-PI-4 has increased maximum received optical powers with each new data rate. As long as minimum link distances are chosen to avoid receiver overload, Rate Select enabled transceivers are not required. However, if link distances vary from 2 m to 25 km, the transmitter Rate Select RS(1) can be utilized to guarantee interoperability with low speed receivers.

The AFCT-57D3ANMZ has isolated signal and chassis SFP grounds to maximize flexibility in host system applications.

As an enhancement to the conventional SFP interface defined in SFF-8074i, the AFCT-57D3ANMZ supports SFF-8472 (digital diagnostic interface for optical transceivers). Using the 2-wire serial interface defined in the SFF-8472 MSA, the AFCT-57D3ANMZ provides real-time temperature, supply voltage, laser bias current, laser average output power and received input power. This information is in addition to conventional SFP base data. The digital diagnostic interface also adds the ability to disable the transmitter (TX_DISABLE), monitor for Transmitter Faults (TX_FAULT), and monitor for Receiver Loss of Signal (RX_LOS).

Related Products

- AFBR-57D9AMZ: 850 nm + 3.3 V LC SFP for 8.5/4.25/2.125 GBd Fibre Channel
- AFCT-57D9ATMZ: 1310nm DFB 10km +3.3v LC SFP for 8.5/4.25/2.125 GBd Fibre Channel

Features

- Compliant to Restriction on Hazardous Substances (RoHS) directive
- Diagnostic features per SFF-8472 "Diagnostic Monitoring Interface for Optical Transceivers"
- Real time monitoring of:
 - Transmitted optical power
 - Received optical power
 - Laser bias current
 - Temperature
 - Supply voltage
- Rate Select functionality per SFF-8431
- Wide temperature and supply voltage operation (-10 °C to 85 °C) (3.3 V ± 10%)
- SFP Plus mechanical Applications
- Transceiver specifications per SFP (SFF-8074i) Multi-Source Agreement and SFF-8472 (revision 11.0)
 - 8.5 GBd Fibre Channel operation for FC-PI-4 800-SM-LC-L
 - 4.25 GBd Fibre Channel operation for FC-PI-4 400-SM-LC-L
 - 2.125 GBd Fibre Channel operation for FC-PI-4 200-SM-LC-L
- Link lengths up to 25 km at 8.5/4.25/2.125 GBd with single-mode fiber
- LC Duplex optical connector interface conforming to ANSI TIA/EIA604-10 (FOCIS 10A)
- 1310 nm Distributed Feedback Laser (DFB) source technology
- IEC 60825-1 Class 1/CDRH Class 1 laser eye safe
- Enhanced EMI performance for high port density applications

Description, continued

Installation

The AFCT-57D3ANMZ can be installed in any SFF-8074i compliant Small Form Pluggable (SFP) port regardless of host equipment operating status. The AFCT-57D3ANMZ is hot-pluggable, allowing the module to be installed while the host system is operating and on-line. Upon insertion, the transceiver housing makes initial contact with the host board SFP cage, mitigating potential damage due to Electro-Static Discharge (ESD).

Digital Diagnostics

The AFCT-57D3ANMZ is compliant to the Diagnostic Monitoring Interface (DMI) defined in the document SFF-8472. These features allow the host to access, via I²C-bus, real-time diagnostic monitors of transmit optical power, received optical power, temperature, supply voltage, and laser operating current.

Predictive Failure Identification

The AFCT-57D3ANMZ predictive failure feature allows a host to identify potential link problems before system performance is impacted. Prior identification of link problems enables a host to service an application via “fail over” to a redundant link or replace a suspect device, maintaining system uptime in the process. For applications where ultra-high system uptime is required, a digital SFP provides a means to monitor two real-time laser metrics associated with observing laser degradation and predicting failure: average laser bias current (Tx_Bias) and average laser optical power (Tx_Power).

Compliance Prediction

Compliance prediction is the ability to determine if an optical transceiver is operating within its operating and environmental requirements. AFCT-57D3ANMZ devices provide real-time access to transceiver internal supply voltage and temperature, allowing a host to identify potential component compliance issues. Received optical power is also available to assess compliance of a cable plant and remote transmitter. When operating out of requirements, the link cannot guarantee error free transmission.

Fault Isolation

The fault isolation feature allows a host to quickly pinpoint the location of a link failure, minimizing downtime. For optical links, the ability to identify a fault at a local device, remote device or cable plant is crucial to speeding service of an installation. AFCT-57D3ANMZ real-time monitors of Tx_Bias, Tx_Power, Vcc, Temperature and Rx_Power can be used to assess local transceiver current operating conditions. In addition, status flags Tx_Disable and Rx Loss of Signal (LOS) are mirrored in memory and available via the two-wire serial interface.

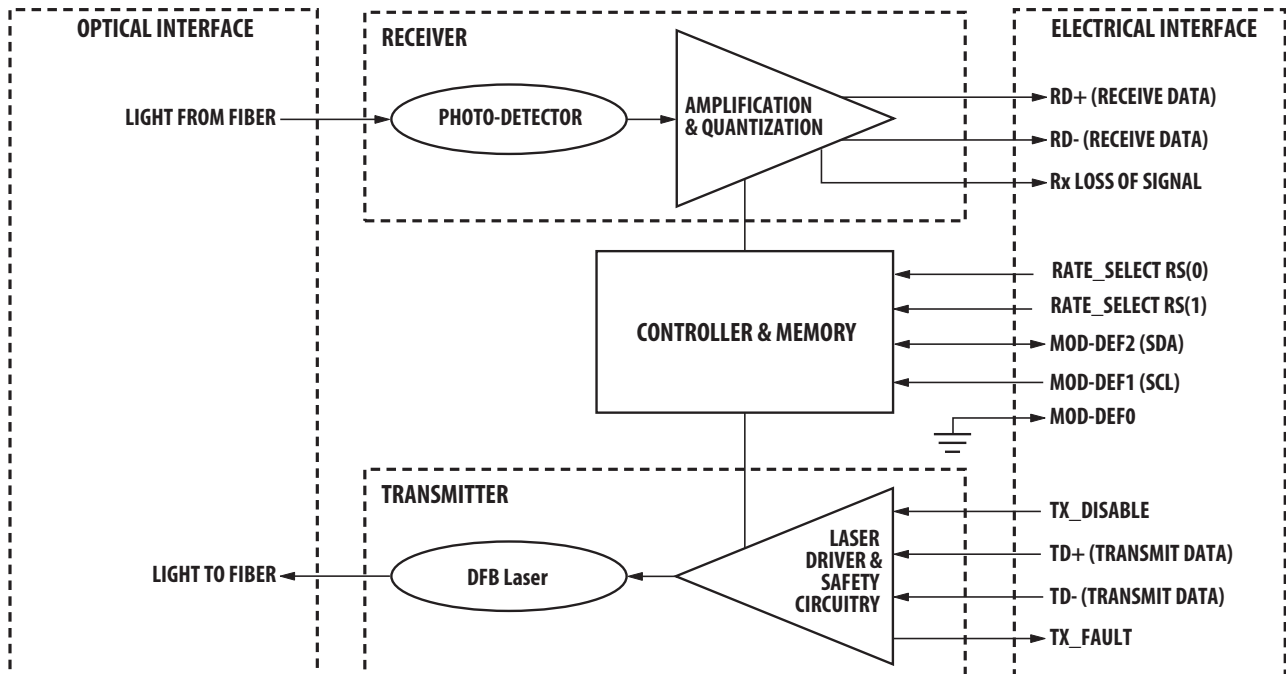


Figure 1. Transceiver functional diagram.

Component Monitoring

Component evaluation is a more casual use of the AFCT-57D3ANMZ real-time monitors of Tx_Bias, Tx_Power, Vcc, Temperature and Rx_Power. Potential uses are as debugging aids for system installation and design, and transceiver parametric evaluation for factory or field qualification. For example, temperature per module can be observed in high density applications to facilitate thermal evaluation of blades, PCI cards and systems.

Transmitter Section

The transmitter section includes the Transmitter Optical SubAssembly (TOSA) and laser driver circuitry. The TOSA, containing an 1310nm DFB (Distributed Feedback Laser) light source, is located at the optical interface and mates with the LC optical connector. The TOSA is driven by a laser driver IC which uses the incoming differential high speed logic signal to modulate the laser diode driver current. This Tx laser driver circuit regulates the optical power at a constant level provided the incoming data pattern is dc balanced (8B/10B code, for example).

Transmit Disable (Tx_Disable)

The AFCT-57D3ANMZ accepts a LVTTTL and CMOS compatible transmit disable control signal input (pin 3) which shuts down the transmitter optical output. A high signal implements this function while a low signal allows normal transceiver operation. In the event of a fault (e.g. eye safety circuit activated), cycling this control signal resets the module as depicted in Figure 4. An internal pull up resistor disables the transceiver transmitter until the host pulls the input low. Host systems should allow a 10 ms interval between successive assertions of this control signal. Tx_Disable can also be asserted via the two-wire serial interface (address A2h, byte 110, bit 6) and monitored (address A2h, byte 110, bit 7).

The contents of A2h, byte 110, bit 6 are logic OR'd with hardware Tx_Disable (pin 3) to control transmitter operation.

Transmit Fault (Tx_Fault)

A catastrophic laser fault will activate the transmitter signal, TX_FAULT, and disable the laser. This signal is an open collector output (pull-up required on the host board). A low signal indicates normal laser operation and a high signal indicates a fault. The TX_FAULT will be latched high when a laser fault occurs and is cleared by toggling the TX_DISABLE input or power cycling the transceiver. The transmitter fault condition can also be monitored via the two-wire serial interface (address A2, byte 110, bit 2).

Eye Safety Circuit

The AFCT-57D3ANMZ provides Class 1 (single fault tolerant) eye safety by design and has been tested for compliance with the requirements listed in Table 1. The eye safety circuit continuously monitors the optical output power level and will disable the transmitter upon detecting an unsafe condition beyond the scope of Class 1 certification. Such unsafe conditions can be due to inputs from the host board (Vcc fluctuation, unbalanced code) or a fault within the transceiver.

Fibre Channel Transmit Rate Select RS(1)

The AFCT-57D3ANMZ transceiver contains a parametric optimization circuit to ensure performance for 2.125 Gb/s, 4.25Gb/s and 8.5Gb/s data rates. When RS(1) is high, the transceiver transmit optical power is optimized for 8.5Gb/s performance as defined in FC-PI-4. When RS(1) is low (or open), the transceiver transmit optical power is optimized for 2.125Gb/s and 4.25Gb/s performance. RS(1) can also be asserted through the two-wire serial interface (address A2h, byte 118, bit 3) and monitored (address A2h, byte 110, bit 5).

The contents of A2h, byte 118, bit 3 are logic OR'd with hardware RS(1) (pin 9) to control transmitter operation.

Fibre Channel Receive Rate Select RS(0)

The AFCT-57D3ANMZ receiver is designed to ensure performance for 2.125 Gb/s, 4.25Gb/s and 8.5 Gb/s data rates. When RS(0) is High, the receiver chain is optimized for 8.5 Gb/s performance as defined in FC-PI-4. When RS(0) is Low (or open), the receiver chain is optimized for 2.125 Gb/s and 4.25 Gb/s performance.

RS(0) can also be asserted through the two-wire serial interface (address A2h, byte 110, bit 3) and monitored (address A2h, byte 110, bit 4). The contents of A2h, byte 110, bit 3 are logic OR'd with hardware RS(1) (pin 7) to control transmitter operation.

Receiver Section

The receiver section includes the Receiver Optical SubAssembly (ROSA) and the amplification/quantization circuitry. The ROSA, containing a PIN photodiode and custom transimpedance amplifier, is located at the optical interface and mates with the LC optical connector. The ROSA output is fed to a custom IC that provides post-amplification and quantization.

Receiver Loss of Signal (Rx_LOS)

The post-amplification IC also includes transition detection circuitry which monitors the ac level of incoming optical signals and provides a TTL/CMOS compatible status signal to the host (pin 8). An adequate optical input results in a low Rx_LOS output while a high Rx_LOS output indicates an unusable optical input. The Rx_LOS thresholds are factory set so that a high output indicates a definite optical fault has occurred. Rx_LOS can also be monitored via the two-wire serial interface (address A2h, byte 110, bit 1).

Functional Data I/O

The AFCT-57D3ANMZ interfaces with the host circuit board through twenty I/O pins (SFP electrical connector) identified by function in Table 2. The board layout for this interface is depicted in Figure 6.

The AFCT-57D3ANMZ high speed transmit and receive interfaces require SFP MSA compliant signal lines on the host board. To simplify board requirements, biasing resistors and ac coupling capacitors are incorporated into the SFP transceiver module (per SFF-8074i) and hence are not required on the host board. The Tx_Disable, Tx_Fault, and Rx_LOS lines require TTL lines on the host board (per SFF-8074i) if used. If an application chooses not to take advantage of the functionality of these pins, care must be taken to ground Tx_Disable (for normal operation).

Figure 2 depicts the recommended interface circuit to link the AFCT-57D3ANMZ to supporting physical layer ICs. Timing for MSA compliant control signals implemented in the transceiver are listed in Figure 4.

Application Support

An Evaluation Kit and Reference Designs are available to assist in evaluation of the AFCT-57D3ANMZ. Please contact your local Field Sales representative for availability and ordering details.

Caution

There are no user serviceable parts nor maintenance requirements for the AFCT-57D3ANMZ. All mechanical adjustments are made at the factory prior to shipment. Tampering with, modifying, misusing or improperly handling the AFCT-57D3ANMZ will void the product warranty. It may also result in improper operation and possibly overstress the laser source. Performance degradation or device failure may result. Connection of the AFCT-57D3ANMZ to a light source not compliant with ANSI FC-PI specifications, operating above maximum operating conditions or in a manner inconsistent with its design and function may result in exposure to hazardous light radiation and may constitute an act of modifying or manufacturing a laser product. Persons performing such an act are required by law to re-certify and re-identify the laser product under the provisions of U.S. 21 CFR (Subchapter J) and TUV.

Ordering Information

Please contact your local field sales engineer or one of Avago Technologies franchised distributors for ordering information. For technical information, please visit Avago Technologies' WEB page at www.avagotech.com or contact Avago Technologies Semicon-ductor Products Customer Response Center at 1-800-235-0312. For information related to SFF Committee documentation visit www.sffcommittee.org.

Regulatory Compliance

The AFCT-57D3ANMZ complies with all applicable laws and regulations as detailed in Table 1. Certification level is dependent on the overall configuration of the host equipment. The transceiver performance is offered as a figure of merit to assist the designer.

Electrostatic Discharge (ESD)

The AFCT-57D3ANMZ is compatible with ESD levels found in typical manufacturing and operating environments as described in Table 1. In the normal handling and operation of optical transceivers, ESD is of concern in two circumstances.

The first case is during handling of the transceiver prior to insertion into an SFP compliant cage. To protect the device, it's important to use normal ESD handling pre-cautions. These include use of grounded wrist straps, work-benches and floor wherever a transceiver is handled.

The second case to consider is static discharges to the exterior of the host equipment chassis after installation. If the optical interface is exposed to the exterior of host equipment cabinet, the transceiver may be subject to system level ESD requirements.

Electromagnetic Interference (EMI)

Equipment incorporating gigabit transceivers is typically subject to regulation by the FCC in the United States, CENELEC EN55022 (CISPR 22) in Europe and VCCI in Japan. The AFCT-57D3ANMZ's compliance to these standards is detailed in Table 1. The metal housing and shielded design of the AFCT-57D3ANMZ minimizes the EMI challenge facing the equipment designer.

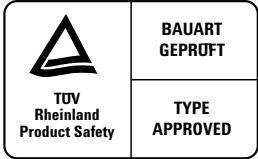
EMI Immunity (Susceptibility)

Due to its shielded design, the EMI immunity of the AFCT-57D3ANMZ exceeds typical industry standards.

Flammability

The AFCT-57D3ANMZ optical transceiver is made of metal and high strength, heat resistant, chemical resistant and UL 94 flame retardant plastic.

Table 1. Regulatory Compliance

| Feature | Test Method | Performance |
|---|--|--|
| Electrostatic Discharge (ESD) to the Electrical Pins | JEDEC A114 | Class 1 (> 2000 V) >1000 V for high speed signal pins TD±, RD± |
| Electrostatic Discharge (ESD) to the Duplex LC Receptacle | Variation of IEC 61000-4-2 | Typically, no damage occurs with 25 kV when the duplex LC connector receptacle is contacted by a Human Body Model probe. |
| | GR1089 | 10 contacts of 8 kV on the electrical faceplate with device inserted into a panel. |
| Electrostatic Discharge (ESD) to the Optical Connector | Variation of IEC 801-2 | Air discharge of 15 kV (min.) contact to connector without damage. |
| Electromagnetic Interference (EMI) | FCC Class B CENELEC EN55022 Class B (CISPR 22A) VCCI Class 1 | System margins are dependent on customer board and chassis design. |
| Immunity | IEC 61000-4-3 | Typically shows no measurable effect from a 10 V/m field swept from 80MHz to 1 GHz |
| Laser Eye Safety and Equipment Type Testing | US FDA CDRH AEL Class 1 US21 CFR, Subchapter J per Paragraphs 1002.10 and 1002.12 (IEC) EN 60950-1: 2006+A11+A1+A12+A2 (IEC) EN 60825-1: 2007 (IEC) EN 60825-2: 2004+A1+A2 | CDRH Accession No. 9521220-210 TUV file: E173874 |
|  | | |
| Component Recognition | Underwriters Laboratories and Canadian Standards Association Joint Component Recognition for Information Technology Equipment including Electrical Business Equipment | UL file: 4786550407 |
| RoHS Compliance | | Less than 1000 ppm of cadmium, lead, mercury, hexavalent chromium, polybrominated biphenyls, and polybrominated biphenyl ethers. |

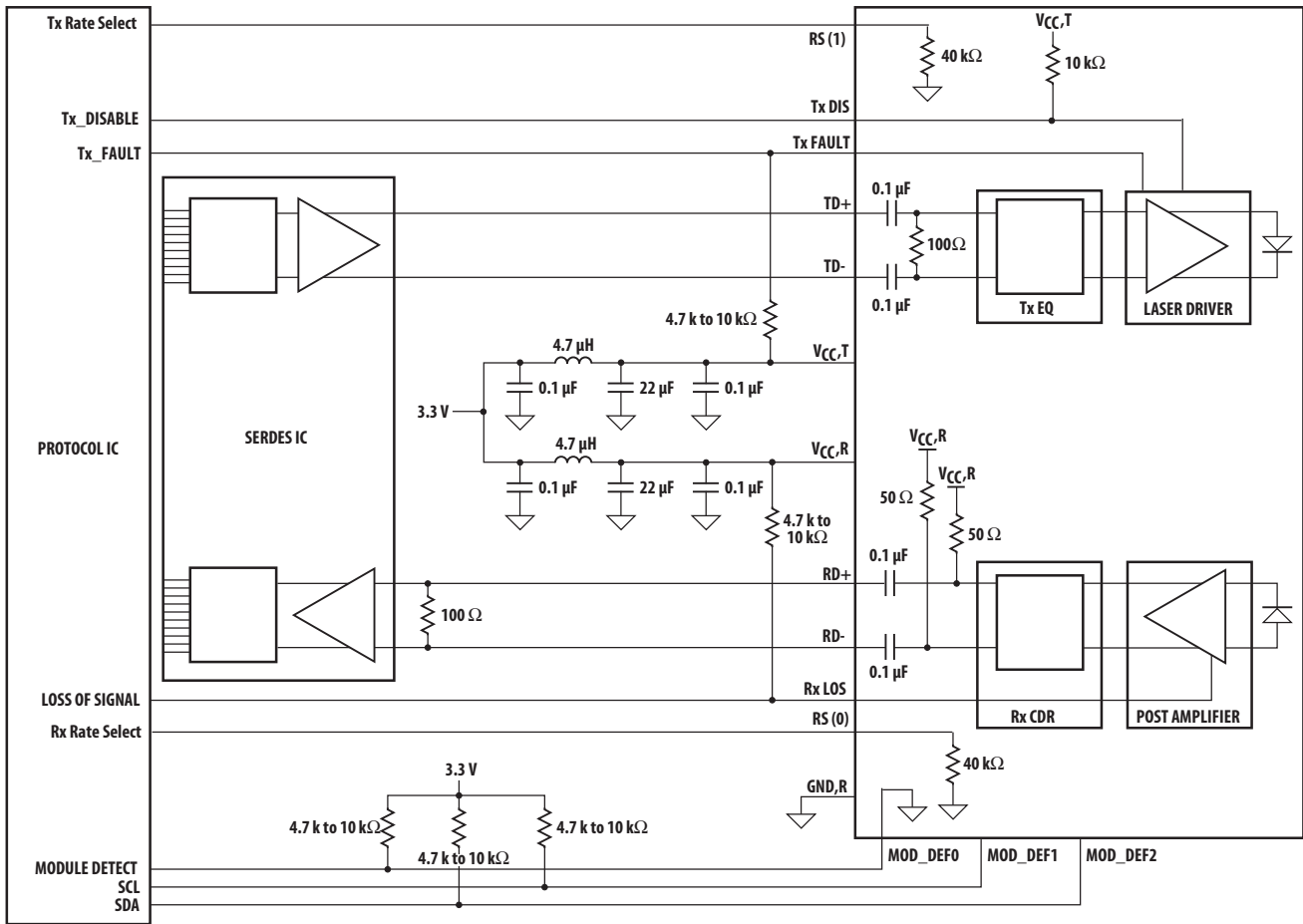
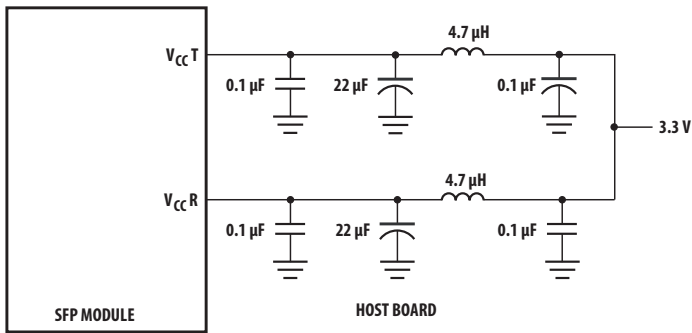


Figure 2. Typical application configuration



NOTE: INDUCTORS MUST HAVE LESS THAN 1Ω SERIES RESISTANCE TO LIMIT VOLTAGE DROP TO THE SFP MODULE.

Figure 3. Recommended power supply filter

Table 2. Pin Description

| Pin | Name | Function/Description | Notes |
|-----|------------|--|--------|
| 1 | VeeT | Transmitter Ground | |
| 2 | TX_FAULT | Transmitter Fault Indication – High indicates a fault condition | Note 1 |
| 3 | TX_DISABLE | Transmitter Disable – Module electrical input disables on high or open | Note 2 |
| 4 | MOD-DEF2 | Module Definition 2 – Two wire serial ID interface data line (SDA) | Note 3 |
| 5 | MOD-DEF1 | Module Definition 1 – Two wire serial ID interface clock line (SCL) | Note 3 |
| 6 | MOD-DEF0 | Module Definition 0 – Grounded in module (module present indicator) | Note 3 |
| 7 | RS(0) | Rx Rate Select Parametric Optimization | Note 9 |
| 8 | RX_LOS | Receiver Loss of Signal (LVTTL-O) | Note 4 |
| 9 | RS(1) | Tx Rate Select Parametric Optimization | Note 8 |
| 10 | VeeR | Receiver Ground | |
| 11 | VeeR | Receiver Ground | |
| 12 | RD- | Inverse Received Data Out | Note 5 |
| 13 | RD+ | Received Data Out | Note 5 |
| 14 | VeeR | Receiver Ground | |
| 15 | VccR | Receiver Power +3.3 V | Note 6 |
| 16 | VccT | Transmitter Power +3.3 V | Note 6 |
| 17 | VeeT | Transmitter Ground | |
| 18 | TD+ | Transmitter Data In | Note 7 |
| 19 | TD- | Inverse Transmitter Data In | Note 7 |
| 20 | VeeT | Transmitter Ground | |

Notes:

- TX_FAULT is an open collector/drain output, which must be pulled up with a 4.7 k – 10 kΩ resistor on the host board. When high, this output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.
- TX_DISABLE is an input that is used to shut down the transmitter optical output. It is internally pulled up (within the transceiver) with a 6.8 kΩ resistor.
Low (0 – 0.8V): Transmitter on
Between (0.8V and 2.0V): Undefined
High (2.0 – Vcc max) or OPEN: Transmitter Disabled
- The signals Mod-Def 0, 1, 2 designate the two wire serial interface pins. They must be pulled up with a 4.7 k – 10 kΩ resistor on the host board.
Mod-Def 0 is grounded by the module to indicate the module is present
Mod-Def 1 is serial clock line (SCL) of two wire serial interface
Mod-Def 2 is serial data line (SDA) of two wire serial interface
- RX_LOS (Rx Loss of Signal) is an open collector/drain output that must be pulled up with a 4.7 k – 10 kΩ resistor on the host board. When high, this output indicates the received optical power is below the worst case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.
- RD-/+ designate the differential receiver outputs. They are AC coupled 100 Ω differential lines which should be terminated with 100 Ω differential at the host SERDES input. AC coupling is done inside the transceiver and is not required on the host board. The voltage swing on these lines will be between 370 and 850 mV differential (185 - 425 mV single ended) when properly terminated.
- VccR and VccT are the receiver and transmitter power supplies. They are defined at the SFP connector pin. The maximum supply current is 300 mA and the associated in-rush current will typically be no more than 30 mA above steady state after 2 microseconds.
- TD-/+ designate the differential transmitter inputs. They are AC coupled differential lines with 100 Ω differential termination inside the module. The AC coupling is done inside the module and is not required on the host board. The inputs will accept differential swings of 180 - 1200 mV (90 - 600 mV single ended)
- RS(1) is an input used to control transmitter maximum optical power for multiple rates. It is internally pulled down with a >30kΩ resistor.
Low (0 - 0.8V) or OPEN: Low Bit Rate Compatibility per (2.125 Gb/s and 4.25 Gb/s)
Between (0.8V and 2.0V): Undefined
High (2.0 - Vcc): High Bit Rate Compatibility (8.5 Gb/s)
- Rate_Select is an input that is used to control transmit and receive high speed parametric optimization. It is internally pulled down (within the transceiver) with a >30kΩ resistor. Low (0 - 0.8V) or Open: Rate is set to 4.25 Gb/s and below optimization. Between (0.8V and 2.0V) Undefined
High (2.0 - Vcc max): Rate is set to 8.5 Gb/s optimization.

Table 3. Absolute Maximum Ratings

| Parameter | Symbol | Minimum | Maximum | Unit | Notes |
|----------------------------|---------------------|---------|----------------------|------|--------------|
| Storage Temperature | T _S | -40 | 85 | C | Note 1, 2 |
| Case Operating Temperature | T _C | -40 | 85 | C | Note 1, 2 |
| Relative Humidity | RH | 5 | 95 | % | Note 1, 4 |
| Supply Voltage | V _{CC,T,R} | -0.5 | 3.8 | V | Note 1, 2, 3 |
| Low Speed Input Voltage | V _{IN} | -0.5 | V _{CC} +0.5 | V | Note 1 |

Notes:

1. Absolute Maximum Ratings are those values beyond which damage to the device may occur if these limits are exceeded for other than a short period of time. See Reliability Data Sheet for specific reliability performance.
2. Between Absolute Maximum Ratings and the Recommended Operating Conditions functional performance is not intended, device reliability is not implied, and damage to the device may occur over an extended period of time.
3. The module supply voltages, V_{CC}T and V_{CC}R must not differ by more than 0.5 V or damage to the device may occur.
4. Exposure to a condensing environment is not allowed.

Table 4. Recommended Operating Conditions

| Parameter | Symbol | Minimum | Maximum | Unit | Notes |
|----------------------------|---------------------|---------|---------|------|-----------|
| Case Operating Temperature | T _C | -10 | 85 | °C | Note 1, 2 |
| Supply Voltage | V _{CC,T,R} | 2.97 | 3.63 | V | Note 2 |
| Data Rate | | 2.125 | 8.5 | Gb/s | Note 2 |

Notes:

1. The Ambient Operating Temperature limitations are based on the Case Operating Temperature limitations and are subject to the host system thermal design.
2. Recommended Operating Conditions are those values for which functional performance and device reliability is implied.

Table 5. Transceiver Electrical Characteristics(T_C = -10°C to 85°C, V_{CC}T, V_{CC}R = 3.3 V ±10%)

| Parameter | Symbol | Minimum | Typical | Maximum | Unit | Notes |
|---|-----------------|---------|---------|--------------------------|------|--------|
| AC Electrical Characteristics | | | | | | |
| Power Supply Noise Rejection (peak-peak) | PSNR | 100 | | | mV | Note 1 |
| DC Electrical Characteristics | | | | | | |
| Module Supply Current | I _{CC} | | | 350 mA @ 85°C | mA | |
| Low Speed Outputs: | V _{OH} | 2.0 | | V _{CC,T,R} +0.3 | V | Note 2 |
| Transmit Fault (TX_FAULT), Loss of Signal (RX_LOS), MOD-DEF 2 | V _{OL} | | | 0.8 | V | |
| Low Speed Inputs: | V _{IH} | 2.0 | | V _{CC} | V | Note 3 |
| Transmit Disable (TX_DIS), MOD-DEF 1, MOD-DEF2, RS(1) | V _{IL} | 0 | | 0.8 | V | |

Notes:

1. Filter per SFP specification is required on host board to remove 10 Hz to 2 MHz content.
2. Pulled up externally with a 4.7 k – 10 kΩ resistor on the host board to 3.3 V.
3. Mod-Def1 and Mod-Def2 must be pulled up externally with a 4.7 k – 10 kΩ resistor on the host board to 3.3 V.

Table 6. Transmitter and Receiver Electrical Characteristics
($T_C = -10^\circ\text{C}$ to 85°C , $V_{CC,T}$, $V_{CC,R} = 3.3\text{ V} \pm 10\%$)

| Parameter | Symbol | Minimum | Typical | Maximum | Unit | Notes |
|---|--------|---------|---------|---------|------|--------|
| High Speed Data Input: Transmitter Differential Input Voltage (TD +/-) | V_I | 180 | | 1200 | mV | Note 1 |
| High Speed Data Output: Receiver Differential Output Voltage (RD +/-) | V_O | 370 | | 850 | mV | Note 2 |
| Receiver Total Jitter (8.5 Gb/s) | TJ | | | 0.71 | UI | Note 3 |
| Receiver Total Jitter (4.25 Gb/s) | TJ | | | 0.64 | UI | Note 3 |
| Receiver Total Jitter (2.125 Gb/s) | TJ | | | 0.64 | UI | Note 3 |

Notes:

- Internally AC coupled and terminated (100 Ohm differential).
- Internally AC coupled but requires an external load termination (100 Ohm differential).
- DJ is measured on an oscilloscope in average mode with 50% threshold and K28.5 pattern. TJ is the sum of RJ and DJ. RJ is calculated for 1×10^{-12} BER by multiplying the RMS jitter (measured on a single rise or fall edge) from the oscilloscope by 14. Per FC-PI-4 (Table 8 - SM jitter output, note 1), the actual RJ is allowed to increase above its limit if the actual DJ decreases below its limits, as long as the component output DJ and TJ remain within their specified FC-PI-4 maximum limits with the worst case specified component jitter input.

Table 7. Transmitter Optical Characteristics
($T_C = -10^\circ\text{C}$ to 85°C , $V_{CC,T}$, $V_{CC,R} = 3.3\text{ V} \pm 10\%$)

| Parameter | Symbol | Minimum | Typical | Maximum | Unit | Notes |
|--|-------------|-------------|---------|------------|--------------------------------|-----------------------------|
| Modulated Optical Output Power (OMA) (Peak-to-Peak) | Tx,OMA | 1000 708 | | | μW μW | for RS1-High for RS1-Low |
| Average Optical Output Power | P_{out} | | | +5 +1.5 | dBm dBm | Note 1,2,4 Note 1,2,5 |
| Center Wavelength | λ_C | 1260 | | 1360 | nm | |
| -20 dB Spectral Width | | | | 1.0 | nm | |
| Side Mode Suppression | | 30 | | | dB | |
| $R_{IN,12}$ (OMA) | R_{IN} | | | -128 | dB/Hz | |
| Transmitter Total Jitter (4.25 Gb/s) | TJ | | | 0.44 | UI | Note 3 |
| Transmitter Total Jitter (2.125 Gb/s) | TJ | | | 0.44 | UI | Note 3 |
| $P_{out,TX_DISABLE}$ Asserted | P_{OFF} | | | -35 | dBm | |

Notes:

- Max P_{out} is the lesser of Class 1 safety limits (CDRH and EN 60825) or receiver power, max.
- Into single-mode optical fiber.
- DJ is measured on an oscilloscope in average mode with 50% threshold and K28.5 pattern. TJ is the sum of RJ and DJ. RJ is calculated for 1×10^{-12} BER by multiplying the RMS jitter (measured on a single rise or fall edge) from the oscilloscope by 14. Per FC-PI-4 (Table 13 - MM jitter output, note 1), the actual RJ is allowed to increase above its limit if the actual DJ decreases below its limits, as long as the component output DJ and TJ remain within their specified FC-PI-4 maximum limits with the worst case specified component jitter input.
- Rate Select RS(1) in high state.
- Rate Select RS(1) in low state.

Table 8. Receiver Optical Characteristics
($T_C = -10^\circ\text{C}$ to 85°C , $V_{CC1}, V_{CC2} = 3.3\text{ V} \pm 10\%$)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Notes |
|--|-------------|------|------|------|---------------------|--------|
| Input Optical Power [Overdrive] | P_{IN} | | | +0.5 | dBm, avg | Note 1 |
| Input Optical Modulation Amplitude (Peak-to-Peak) 8.5 Gb/s [Sensitivity] | OMA | 42 | | | μW , OMA | Note 2 |
| Input Optical Modulation Amplitude (Peak-to-Peak) 4.25 Gb/s [Sensitivity] | OMA | 29 | | | μW , OMA | Note 2 |
| Input Optical Modulation Amplitude (Peak-to-Peak) 2.125 Gb/s [Sensitivity] | OMA | 15 | | | μW , OMA | Note 2 |
| Return Loss | | 12 | | | dB | |
| Loss of Signal – Assert | P_A | -30 | | | dBm, avg | Note 3 |
| Loss of Signal - De-Assert | P_D | | | -16 | dBm, OMA | Note 3 |
| Loss of Signal Hysteresis | $P_D - P_A$ | 0.5 | | | dB | |

Notes:

1. Maximum input optical power for 8.5Gb/s is +0.5dBm, for 4.25Gb/s is -1.0dBm and for 2.125Gb/s is -3.0dBm per ANSI T11 FC-PI-4.
2. Input Optical Modulation Amplitude (commonly known as sensitivity) requires a valid 8B/10B encoded input.
3. These average power values are specified with an Extinction Ratio of 6 dB. The loss of signal circuitry responds to valid 8B/10B encoded peak to peak input optical power (OMA), rather than average power.

Table 9. Transceiver DIAGNOSTIC Timing Characteristics
($T_C = -10^{\circ}\text{C}$ to 85°C , $V_{CCT}, V_{CCR} = 3.3\text{V} \pm 10\%$)

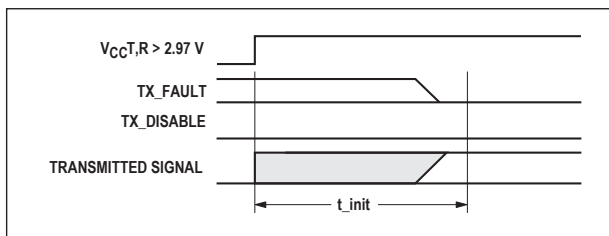
| Parameter | Symbol | Minimum | Maximum | Unit | Notes |
|--|-----------------|---------|---------|---------------|---------|
| Hardware TX_DISABLE Assert Time | t_off | | 10 | μs | Note 1 |
| Hardware TX_DISABLE Negate Time | t_on | | 1 | ms | Note 2 |
| Time to initialize, including reset of TX_FAULT | t_init | | 300 | ms | Note 3 |
| Hardware TX_FAULT Assert Time | t_fault | | 1000 | μs | Note 4 |
| Hardware TX_DISABLE to Reset | t_reset | 10 | | μs | Note 5 |
| Hardware RX_LOS Deassert Time | t_loss_on | | 100 | μs | Note 6 |
| Hardware RX_LOS Assert Time | t_loss_off | | 100 | μs | Note 7 |
| Hardware Rate Select Assert Time | t_rate_high | | 0.5 | ms | Note 17 |
| Hardware Rate Select Deassert Time | t_rate_low | | 0.5 | ms | Note 17 |
| Software TX_DISABLE Assert Time | t_off_soft | | 100 | ms | Note 8 |
| Software TX_DISABLE Negate Time | t_on_soft | | 100 | ms | Note 9 |
| Software Tx_FAULT Assert Time | t_fault_soft | | 100 | ms | Note 10 |
| Software Rx_LOS Assert Time | t_loss_on_soft | | 100 | ms | Note 11 |
| Software Rx_LOS Deassert Time | t_loss_off_soft | | 100 | ms | Note 12 |
| Analog parameter data ready | t_data | | 1000 | ms | Note 13 |
| Serial bus hardware ready | t_serial | | 300 | ms | Note 14 |
| Serial Bus Buffer Time | t_buf | 20 | | μs | Note 16 |
| Complete Single or Sequential Write up to 4 Byte | t_write | | 40 | ms | Note 15 |
| Complete Sequential Write of 5 – 8 Byte | t_write | | 80 | ms | Note 15 |
| Serial ID Clock Rate | f_serial_clock | | 400 | kHz | |

Notes:

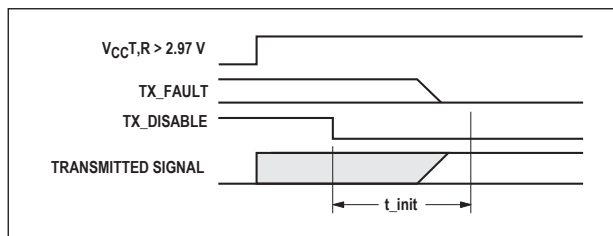
1. Time from rising edge of TX_DISABLE to when the optical output falls below 10% of nominal.
2. Time from falling edge of TX_DISABLE to when the modulated optical output rises above 90% of nominal.
3. Time from power on or falling edge of Tx_Disable to when the modulated optical output rises above 90% of nominal.
4. From power on or negation of TX_FAULT using TX_DISABLE.
5. Time TX_DISABLE must be held high to reset the laser fault shutdown circuitry.
6. Time from loss of optical signal to Rx_LOS Assertion.
7. Time from valid optical signal to Rx_LOS De-Assertion.
8. Time from two-wire interface assertion of TX_DISABLE (A2h, byte 110, bit 6) to when the optical output falls below 10% of nominal. Measured from falling clock edge after stop bit of write transaction.
9. Time from two-wire interface de-assertion of TX_DISABLE (A2h, byte 110, bit 6) to when the modulated optical output rises above 90% of nominal.
10. Time from fault to two-wire interface TX_FAULT (A2h, byte 110, bit 2) asserted.
11. Time for two-wire interface assertion of Rx_LOS (A2h, byte 110, bit 1) from loss of optical signal.
12. Time for two-wire interface de-assertion of Rx_LOS (A2h, byte 110, bit 1) from presence of valid optical signal.
13. From power on to data ready bit asserted (A2h, byte 110, bit 0). Data ready indicates analog monitoring circuitry is functional.
14. Time from power on until module is ready for data transmission over the serial bus (reads or writes over A0h and A2h).
15. Operation of the Two Wire Serial Interface at rates beyond 100 kHz requires the use of clock stretching techniques.
16. Time between STOP and START Commands.
17. Time from rising or falling edge of Rate Select input until transceiver is in conformance with appropriate specification.

Table 10. Transceiver Digital Diagnostic Monitor (Real Time Sense) Characteristics
 ($T_C = -10^\circ\text{C}$ to 85°C , $V_{CC,T}$, $V_{CC,R} = 3.3\text{V} \pm 10\%$)

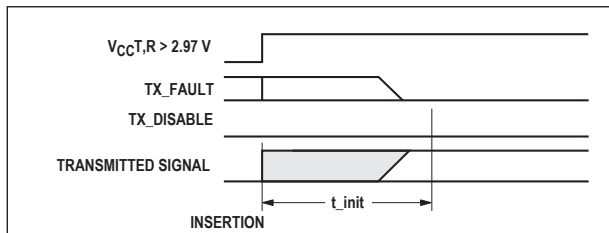
| Parameter | Symbol | Min. | Units | Notes |
|---|-----------|-----------|------------------|--|
| Transceiver Internal Temperature Accuracy | T_{INT} | ± 3.0 | $^\circ\text{C}$ | Temperature is measured internal to the transceiver. Valid from -10°C to 85°C case temperature. |
| Transceiver Internal Supply Voltage Accuracy | V_{INT} | ± 0.1 | V | Supply voltage is measured internal to the transceiver and can, with less accuracy, be correlated to voltage at the SFP Vcc pin. Valid over $3.3\text{V} \pm 10\%$. |
| Transmitter Laser DC Bias Current Accuracy | I_{INT} | ± 10 | % | I_{INT} is better than $\pm 10\%$ of the nominal value. |
| Transmitted Average Optical Output Power Accuracy | P_T | ± 3.0 | dB | Coupled into single-mode fiber. Valid from $250\ \mu\text{W}$ to $2500\ \mu\text{W}$, avg. |
| Received Average Optical Input Power Accuracy | P_R | ± 3.0 | dB | Coupled from single-mode fiber. Valid from $12\ \mu\text{W}$ to $1122\ \mu\text{W}$, avg. |



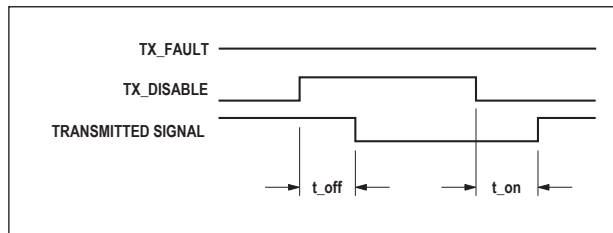
t-init: TX DISABLE NEGATED



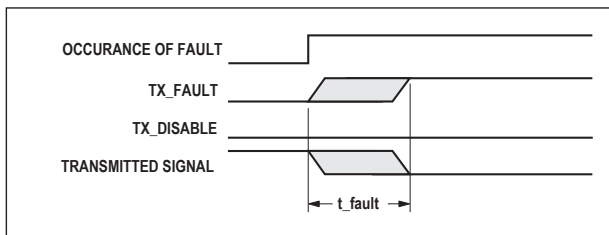
t-init: TX DISABLE ASSERTED



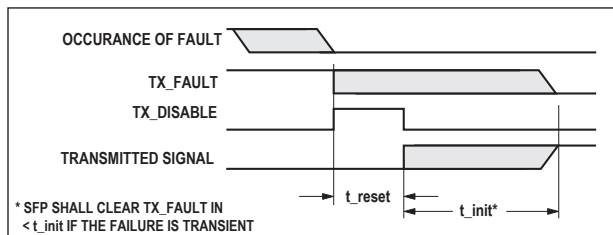
t-init: TX DISABLE NEGATED, MODULE HOT PLUGGED



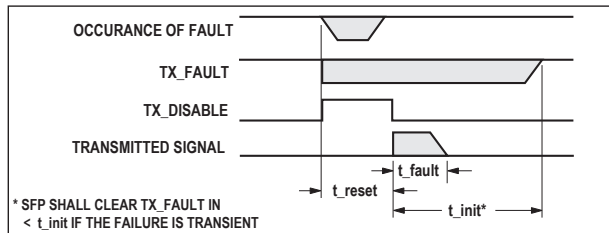
t-off & t-on: TX DISABLE ASSERTED THEN NEGATED



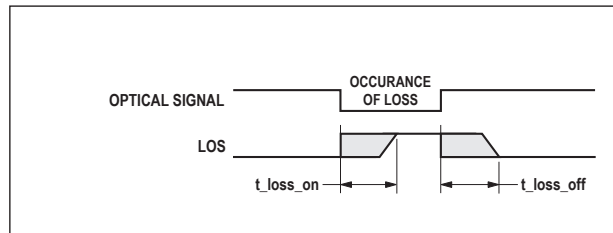
t-fault: TX FAULT ASSERTED, TX SIGNAL NOT RECOVERED



t-reset: TX DISABLE ASSERTED THEN NEGATED, TX SIGNAL RECOVERED



t-fault: TX DISABLE ASSERTED THEN NEGATED, TX SIGNAL NOT RECOVERED



t-loss-on & t-loss-off

Figure 4. Transceiver timing diagrams (module installed except where noted).

Table 11. EEPROM Serial ID Memory Contents – Conventional SFP Memory (Address A0h)

| Byte # Decimal | Data Hex | Notes | Byte # Decimal | Data Hex | Notes |
|-------------------|-------------|--|-------------------|-------------|---|
| 0 | 03 | SFP physical device | 36 | 00 | |
| 1 | 04 | SFP function defined by serial ID only | 37 | 00 | Hex Byte of Vendor OUI [2] |
| 2 | 07 | LC optical connector | 38 | 17 | Hex Byte of Vendor OUI [2] |
| 3 | 00 | | 39 | 6A | Hex Byte of Vendor OUI [2] |
| 4 | 00 | | 40 | 41 | "A" - Vendor Part Number ASCII character |
| 5 | 00 | | 41 | 46 | "F" - Vendor Part Number ASCII character |
| 6 | 00 | | 42 | 43 | "C" - Vendor Part Number ASCII character |
| 7 | 12 | Long distance (per FC-PI-4), Longwave Laser (LC) | 43 | 54 | "T" - Vendor Part Number ASCII character |
| 8 | 00 | | 44 | 2D | "-" - Vendor Part Number ASCII character |
| 9 | 01 | Single-mode (SM) | 45 | 35 | "5" - Vendor Part Number ASCII character |
| 10 | 54 | 200, 400 & 800 Mbytes/sec FC-PI-4 speed ^[1] | 46 | 37 | "7" - Vendor Part Number ASCII character |
| 11 | 01 | Compatible with 8B/10B encoded data | 47 | 44 | "D" - Vendor Part Number ASCII character |
| 12 | 55 | 8500 MBit/sec nominal bit rate (8.5 Gbit/s) | 48 | 33 | "3" - Vendor Part Number ASCII character |
| 13 | 06 | 8GFC Rx & Tx Rate_Select | 49 | 41 | "A" - Vendor Part Number ASCII character |
| 14 | 19 | 25km of single-mode fiber | 50 | 4E | "N" - Vendor Part Number ASCII character |
| 15 | FA | 25km of single-mode fiber | 51 | 4D | "M" - Vendor Part Number ASCII character |
| 16 | 00 | | 52 | 5A | "Z" - Vendor Part Number ASCII character |
| 17 | 00 | | 53 | 20 | " " - Vendor Part Number ASCII character |
| 18 | 00 | | 54 | 20 | " " - Vendor Part Number ASCII character |
| 19 | 00 | | 55 | 20 | " " - Vendor Part Number ASCII character |
| 20 | 41 | "A" - Vendor Name ASCII character | 56-59 | | Vendor Revision Number |
| 21 | 56 | "V" - Vendor Name ASCII character | 60 | 05 | Hex Byte of Laser Wavelength [3] |
| 22 | 41 | "A" - Vendor Name ASCII character | 61 | 1E | Hex Byte of Laser Wavelength [3] |
| 23 | 47 | "G" - Vendor Name ASCII character | 62 | 00 | |
| 24 | 4F | "O" - Vendor Name ASCII character | 63 | | Checksum for Bytes 0-62 [4] |
| 25 | 20 | " " - Vendor Name ASCII character | 64 | 00 | Receiver limiting output. 1 Watt power class. |
| 26 | 20 | " " - Vendor Name ASCII character | 65 | 3A | Hardware SFP TX_DISABLE, TX_FAULT, RX_LOS & RATE_SELECT |
| 27 | 20 | " " - Vendor Name ASCII character | 66 | 00 | |
| 28 | 20 | " " - Vendor Name ASCII character | 67 | 00 | |
| 29 | 20 | " " - Vendor Name ASCII character | 68-83 | | Vendor Serial Number ASCII characters [5] |
| 30 | 20 | " " - Vendor Name ASCII character | 84-91 | | Vendor Date Code ASCII characters [6] |
| 31 | 20 | " " - Vendor Name ASCII character | 92 | 68 | Digital Diagnostics, Internal Cal, Rx Pwr Avg |
| 32 | 20 | " " - Vendor Name ASCII character | 93 | FA | A/W, Soft TX_DISABLE, TX_FAULT, RX_LOS & RATE_SELECT |
| 33 | 20 | " " - Vendor Name ASCII character | 94 | 05 | SFF-8472 Compliance to revision 11.0 |
| 34 | 20 | " " - Vendor Name ASCII character | 95 | | Checksum for Bytes 64-94 [5] |
| 35 | 20 | " " - Vendor Name ASCII character | 96 - 255 | 00 | |

Notes:

1. FC-PI speed 800 MBytes/sec is a serial bit rate of 8.5 Gbit/sec. 200 MBytes/sec is a serial bit rate of 2.125 Gbit/sec. 400 MBytes/sec is a serial bit rate of 4.25 Gbit/sec.
2. The IEEE Organizationally Unique Identifier (OUI) assigned to Avago Technologies is 00-17-6A (3 bytes of hex).
3. Laser wavelength is represented in 16 unsigned bits. The hex representation of 1310 (nm) is 051E.
4. Addresses 63 and 95 are checksums calculated (per SFF-8472 and SFF-8074) and stored prior to product shipment.
5. Addresses 68-83 specify the AFCT-57D3ANMZ ASCII serial number and will vary on a per unit basis.
6. Addresses 84-91 specify the AFCT-57D3ANMZ ASCII date code and will vary on a per date code basis.

Table 12. EEPROM Serial ID Memory Contents – Enhanced Feature Set Memory (Address A2h)

| Byte # Decimal | Notes | Byte # Decimal | Notes | Byte # Decimal | Notes |
|-------------------|--------------------------------------|-------------------|---|-------------------|-------------------------------------|
| 0 | Temp H Alarm MSB ^[1] | 26 | Tx Pwr L Alarm MSB ^[4] | 104 | Real Time Rx Pwr MSB ^[5] |
| 1 | Temp H Alarm LSB ^[1] | 27 | Tx Pwr L Alarm LSB ^[4] | 105 | Real Time Rx Pwr LSB ^[5] |
| 2 | Temp L Alarm MSB ^[1] | 28 | Tx Pwr H Warning MSB ^[4] | 106 | Reserved |
| 3 | Temp L Alarm LSB ^[1] | 29 | Tx Pwr H Warning LSB ^[4] | 107 | Reserved |
| 4 | Temp H Warning MSB ^[1] | 30 | Tx Pwr L Warning MSB ^[4] | 108 | Reserved |
| 5 | Temp H Warning LSB ^[1] | 31 | Tx Pwr L Warning LSB ^[4] | 109 | Reserved |
| 6 | Temp L Warning MSB ^[1] | 32 | Rx Pwr H Alarm MSB ^[5] | 110 | Status/Control - See Table 13 |
| 7 | Temp L Warning LSB ^[1] | 33 | Rx Pwr H Alarm LSB ^[5] | 111 | Reserved |
| 8 | Vcc H Alarm MSB ^[2] | 34 | Rx Pwr L Alarm MSB ^[5] | 112 | Flag Bits - See Table 14 |
| 9 | Vcc H Alarm LSB ^[2] | 35 | Rx Pwr L Alarm LSB ^[5] | 113 | Flag Bits - See Table 14 |
| 10 | Vcc L Alarm MSB ^[2] | 36 | Rx Pwr H Warning MSB ^[5] | 114 | Reserved |
| 11 | Vcc L Alarm LSB ^[2] | 37 | Rx Pwr H Warning LSB ^[5] | 115 | Reserved |
| 12 | Vcc H Warning MSB ^[2] | 38 | Rx Pwr L Warning MSB ^[5] | 116 | Flag Bits - See Table 14 |
| 13 | Vcc H Warning LSB ^[2] | 39 | Rx Pwr L Warning LSB ^[5] | 117 | Flag Bits - See Table 14 |
| 14 | Vcc L Warning MSB ^[2] | 40-55 | Reserved | 118 | Status/Control - See Table 15 |
| 15 | Vcc L Warning LSB ^[2] | 56-94 | External Calibration Constants ^[6] | 119-127 | Reserved |
| 16 | Tx Bias H Alarm MSB ^[3] | 95 | Checksum for Bytes 0-94 ^[7] | 128-247 | Customer Writeable |
| 17 | Tx Bias H Alarm LSB ^[3] | 96 | Real Time Temperature MSB ^[1] | 248-255 | Vendor Specific |
| 18 | Tx Bias L Alarm MSB ^[3] | 97 | Real Time Temperature LSB ^[1] | | |
| 19 | Tx Bias L Alarm LSB ^[3] | 98 | Real Time Vcc MSB ^[2] | | |
| 20 | Tx Bias H Warning MSB ^[3] | 99 | Real Time Vcc LS ^[2] | | |
| 21 | Tx Bias H Warning LSB ^[3] | 100 | Real Time Tx Bias MSB ^[3] | | |
| 22 | Tx Bias L Warning MSB ^[3] | 101 | Real Time Tx Bias LSB ^[3] | | |
| 23 | Tx Bias L Warning LSB ^[3] | 102 | Real Time Tx Power MSB ^[4] | | |
| 24 | Tx Pwr H Alarm MSB ^[4] | 103 | Real Time Tx Power LSB ^[4] | | |
| 25 | Tx Pwr H Alarm LSB ^[4] | | | | |

Notes:

1. Temperature (Temp) is decoded as a 16 bit signed twos complement integer in increments of 1/256°C.
2. Supply Voltage (Vcc) is decoded as a 16 bit unsigned integer in increments of 100 μ V.
3. Laser bias current (Tx Bias) is decoded as a 16 bit unsigned integer in increments of 2 μ A.
4. Transmitted average optical power (Tx Pwr) is decoded as a 16 bit unsigned integer in increments of 0.1 μ W.
5. Received average optical power (Rx Pwr) is decoded as a 16 bit unsigned integer in increments of 0.1 μ W.
6. Bytes 56-94 are not intended for use with AFCT-57D3ANMZ, but have been set to default values per SFF-8472.
7. Byte 95 is a checksum calculated (per SFF-8472) and stored prior to product shipment.

Table 13. EEPROM Serial ID Memory Contents – Soft Commands (Address A2h, Byte 110)

| Bit # | Status/Control Name | Description | Notes |
|-------|-------------------------|--|-----------|
| 7 | TX_DISABLE State | Digital state of TX_DISABLE Input Pin (1 = TX_DISABLE asserted) | Note 1 |
| 6 | Soft TX_DISABLE Control | Read/write bit for changing digital state of TX_DISABLE function | Note 1, 2 |
| 5 | RS(1) State | Digital state of TX Rate_Select Input Pin RS(1) (1 = Rate High asserted) | |
| 4 | RS(0) State | Digital state of RX Rate_Select Input Pin RS(0) (1 = Rate High asserted) | |
| 3 | Soft RS(0) Control | Read/write bit for changing digital state of Rx Rate_Select RS(0) function | Note 3 |
| 2 | TX_FAULT State | Digital state of TX_FAULT Output Pin (1 = TX_FAULT asserted) | Note 1 |
| 1 | RX_LOS State | Digital state of SFP RX_LOS Output Pin (1 = RX_LOS asserted) | Note 1 |
| 0 | Data Ready (Bar) | Indicates transceiver is powered and real time sense data is ready (0 = Data Ready) | |

Notes:

1. The response time for soft commands of the AFCT-57D3ANMZ is 100 ms as specified by MSA SFF-8472.
2. Bit 6 is logic OR'd with the SFP TX_DISABLE input pin 3 either asserted will disable the SFP transmitter.
3. Bit 3 is logic OR'd with the SFP RS(0) RX Rate_Select input pin 7 either asserted will set receiver to Rate = High.

Table 14. EEPROM Serial ID Memory Contents – Alarms and Warnings (Address A2h, Bytes 112, 113, 116, 117)

| Byte | Bit | Flag Bit Name | Description |
|------|-----|-----------------------|---|
| 112 | 7 | Temp High Alarm | Set when transceiver internal temperature exceeds high alarm threshold |
| | 6 | Temp Low Alarm | Set when transceiver internal temperature exceeds low alarm threshold |
| | 5 | Vcc High Alarm | Set when transceiver internal supply voltage exceeds high alarm threshold |
| | 4 | Vcc Low Alarm | Set when transceiver internal supply voltage exceeds low alarm threshold |
| | 3 | Tx Bias High Alarm | Set when transceiver laser bias current exceeds high alarm threshold |
| | 2 | Tx Bias Low Alarm | Set when transceiver laser bias current exceeds low alarm threshold |
| | 1 | Tx Power High Alarm | Set when transmitted average optical power exceeds high alarm threshold |
| | 0 | Tx Power Low Alarm | Set when transmitted average optical power exceeds low alarm threshold |
| 113 | 7 | Rx Power High Alarm | Set when received average optical power exceeds high alarm threshold |
| | 6 | Rx Power Low Alarm | Set when received average optical power exceeds low alarm threshold |
| | 0-5 | Reserved | |
| 116 | 7 | Temp High Warning | Set when transceiver internal temperature exceeds high warning threshold |
| | 6 | Temp Low Warning | Set when transceiver internal temperature exceeds low warning threshold |
| | 5 | Vcc High Warning | Set when transceiver internal supply voltage exceeds high warning threshold |
| | 4 | Vcc Low Warning | Set when transceiver internal supply voltage exceeds low warning threshold |
| | 3 | Tx Bias High Warning | Set when transceiver laser bias current exceeds high warning threshold |
| | 2 | Tx Bias Low Warning | Set when transceiver laser bias current exceeds low warning threshold |
| | 1 | Tx Power High Warning | Set when transmitted average optical power exceeds high warning threshold |
| | 0 | Tx Power Low Warning | Set when transmitted average optical power exceeds low warning threshold |
| 117 | 7 | Rx Power High Warning | Set when received average optical power exceeds high warning threshold |
| | 6 | Rx Power Low Warning | Set when received average optical power exceeds low warning threshold |
| | 0-5 | Reserved | |

Table 15. EEPROM Expanded Serial ID Memory Contents - Soft Command (Address A2h, Byte 118)

| Bit # | Status/Control Name | Description | Notes |
|-------|---------------------|--|-------|
| 7-4 | Reserved | | |
| 3 | Soft RS(1) Control | Read/write bit for changing digital state of RS(1) Tx Rate Select function | 1, 2 |
| 2 | Reserved | | |
| 1 | Power Level State | Always set to zero. Value of zero indicates Power Level 1 operation (1 W max.) | |
| 0 | Power Level Select | Unused | |

Notes:

1. AFCT-57D3ANMZ Tx optical power is optimized for 2.125 Gb/s and 4.25 Gb/s performance when RS(1) is low and for 8.5 Gb/s performance when high.
2. Bit 3 is logic OR'd with the SFP RS(1) TX Rate_Select input pin 9. Either asserted will set transmitter to Rate = High.

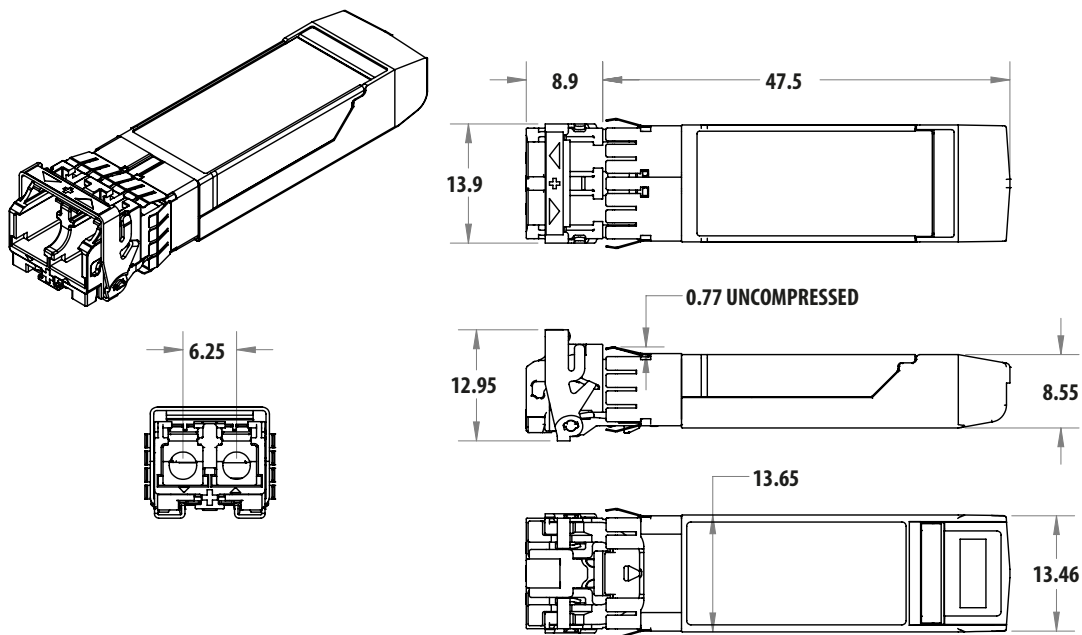


Figure 5. Module drawing.

Customer Manufacturing Processes

This module is pluggable and is not designed for aqueous wash, IR reflow, or wave soldering processes.

For product information and a complete list of distributors, please go to our website: www.avagotech.com

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