

# AFCT-5760xNxZ and AFCT-5765xNxZ

Families of Small Form Factor Pluggable (SFP) Optical Transceivers  
for Single-Mode OC3/STM-1 with Optional DMI  
*Part of the Avago Technologies METRAK Family*



## Data Sheet



### Description

The AFCT-576xZ family of SFP optical transceivers for OC3 offers the customer a range of design options, including optional DMI (further described later), extended or industrial temperature ranges, and standard push-button or or bail delatch. The AFCT-5765Z family targets applications requiring DMI features, and the AFCT-5760Z family is streamlined for those applications where DMI features are not needed. Throughout this document, AFCT-576xZ will refer collectively to the entire product family encompassing this range of product features.

### Part Number Options

The AFCT-576xZ family consists of the following products:

#### With DMI

| Part Number   | Temperature | Design   |
|---------------|-------------|----------|
| AFCT-5765NLZ  | Extended*   | Standard |
| AFCT-5765NPZ  | Extended*   | Bail     |
| AFCT-5765ANLZ | Industrial* | Standard |
| AFCT-5765ANPZ | Industrial* | Bail     |

#### Without DMI

| Part Number   | Temperature | Design   |
|---------------|-------------|----------|
| AFCT-5760NLZ  | Extended*   | Standard |
| AFCT-5760NPZ  | Extended*   | Bail     |
| AFCT-5760ANLZ | Industrial* | Standard |
| AFCT-5760ANPZ | Industrial* | Bail     |

\* Extended Temperature Range is -10 to 85 degrees C  
Industrial Temperature Range is -40 to 85 degrees C

### Related Products

- AFCT-5755Z family of OC12 SFP transceivers with DMI
- AFCT-5745L/P family of OC48 SFP transceivers with DMI

### Features

- ROHS compliant
- Optional Digital Diagnostic Monitoring available
  - AFCT-5760Z family: without DMI
  - AFCT-5765Z family: with DMI
- Per SFF-8472, diagnostic features on AFCT-5765Z family enable Diagnostic Monitoring Interface for optical transceivers with real-time monitoring of:
  - Transmitted optical power
  - Received optical power
  - Laser bias current
  - Temperature
  - Supply voltage
- Compliant with SFF-8074i SFP transceiver specification
- Compliant with ITU-T G957 STM-1 L1.1 (40km) Optical Interface
- Compliant with Telcordia GR253 OC3 LR-1 (40km) Optical Interface
- Class 1 CDRH/IEC 825 eye safety compliant
- Operating case temperature range
  - 10 °C to +85 °C (Extended)
  - 40 °C to +85 °C (Industrial)
- Multirate operation from 125 Mb/s to 155 Mb/s
- LC duplex fiber connector
- Manufactured in an ISO 9001 compliant facility

### Applications

- ATM switches and routers
- SONET/SDH switch infrastructure
- Broadband aggregation applications
- Metro edge switching
- Metro and access multi-service platforms
- Suitable for Fast Ethernet applications

## General Features

The AFCT-576xZ family of SFP optical transceivers are high performance, cost effective modules for serial optical data communications applications ranging from 125-155 Mbps. They are designed to provide SONET/SDH compliant connections for 155 Mbps at short and intermediate reach links. This includes specifications for the signal coding, optical fiber and connector types, optical and electrical transmitter characteristics, optical and electrical receiver characteristics, jitter characteristics, and compliance testing methodology for the aforementioned. These transceivers are qualified in accordance with GR-468-CORE.

The transmitter section of the transceivers incorporate a 1300nm Fabry Perot (FP) laser. For each device the receiver section uses an MOVPE grown planar PIN photodetector for low dark current and excellent responsivity. A positive-ECL logic interface simplifies interface to external circuitry. The receiver section contains an InGaAs/InP photo detector and a preamplifier mounted in an optical subassembly. This optical subassembly is coupled to a postamplifier/decision circuit on a circuit board.

The AFCT-576xZ family of optical transceivers adds digital diagnostic monitoring to standard SFP functionality, enabling fault isolation, components monitoring and failure prediction capabilities.

## SFP MSA Compliance

The product package is compliant with the SFP MSA with the LC connector option. The SFP MSA includes specifications for mechanical packaging and performance as well as dc, ac and control signal timing and performance.

The power supply is 3.3 V dc.

The High Speed I/O (HSIO) signal interface is a Low Voltage Differential type. It is ac coupled and terminated internally to the module. The internal termination is a 100 Ohm differential load.

## Installation

The AFCT-576xZ can be installed in any SFF-8074i compliant Small Form Pluggable (SFP) port regardless of host equipment operating status. The module is hot-pluggable, allowing it to be installed while the host system is operating and online. Upon insertion, the transceiver housing makes initial contact with the host board SFP cage, mitigating potential damage due to electrostatic discharge (ESD).

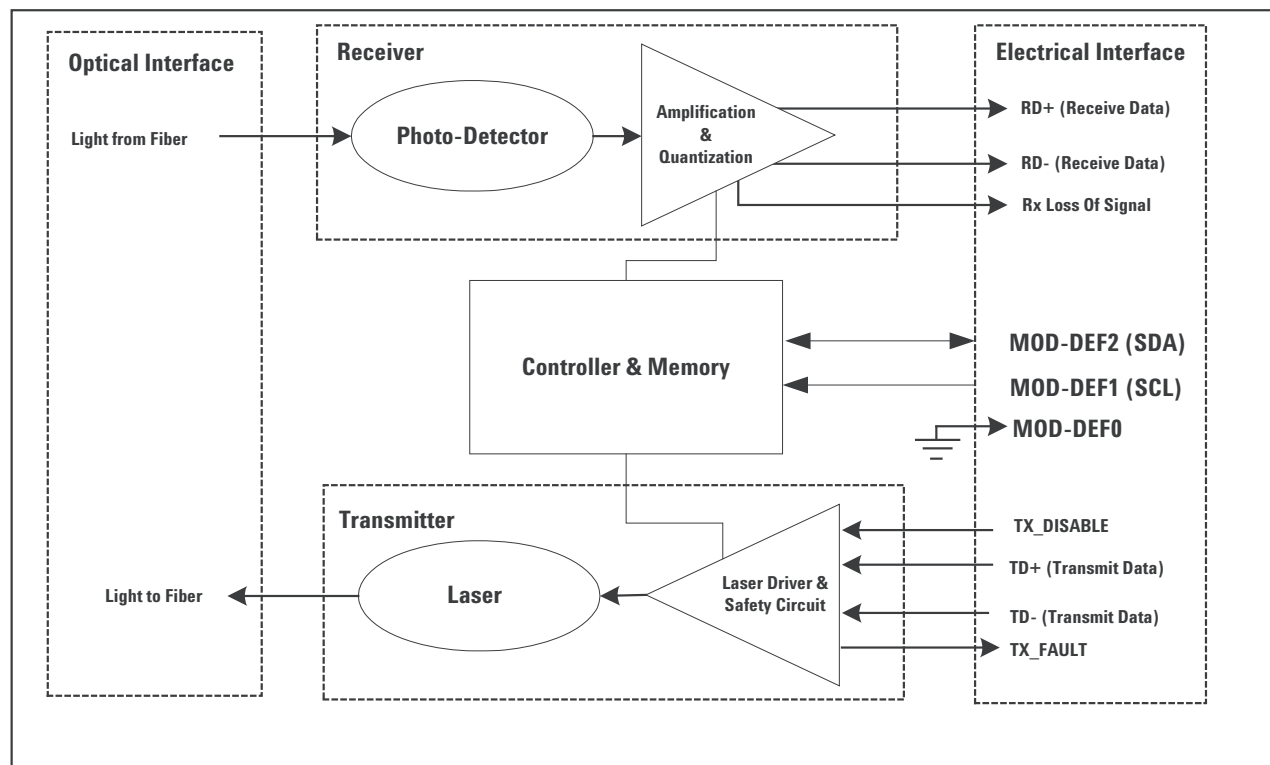


Figure 1. Transceiver Functional Diagram

## Transmitter Section

The transmitter section includes a 1310 nm Fabry-Perot laser and a transmitter driver circuit. The driver circuit maintains a constant optical power level provided that the data pattern is valid for NRZ code. Connection to the transmitter is provided via a LC optical connector.

The transmitter has full IEC 825 and CDRH Class 1 eye safety.

## TX\_DISABLE

The transmitter output can be disabled by asserting pin 3, TX\_DISABLE. A high signal asserts this function while a low signal allows normal laser operation. The transmitter output can also be disabled and monitored via the 2-wire serial interface. In the event of a transceiver fault, such as the activation of the eye safety circuit, toggling of the TX\_DISABLE will reset the transmitter, as depicted in Figure 2.

## TX\_FAULT

A laser fault or a low  $V_{CC}$  condition will activate the transmitter fault 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 TX\_FAULT is not latched for Low  $V_{CC}$ . The transmitter fault condition can also be monitored via the two-wire serial interface (address A2, byte 110, bit 2). By default, TX\_FAULT is set to trigger on hardware faults only.

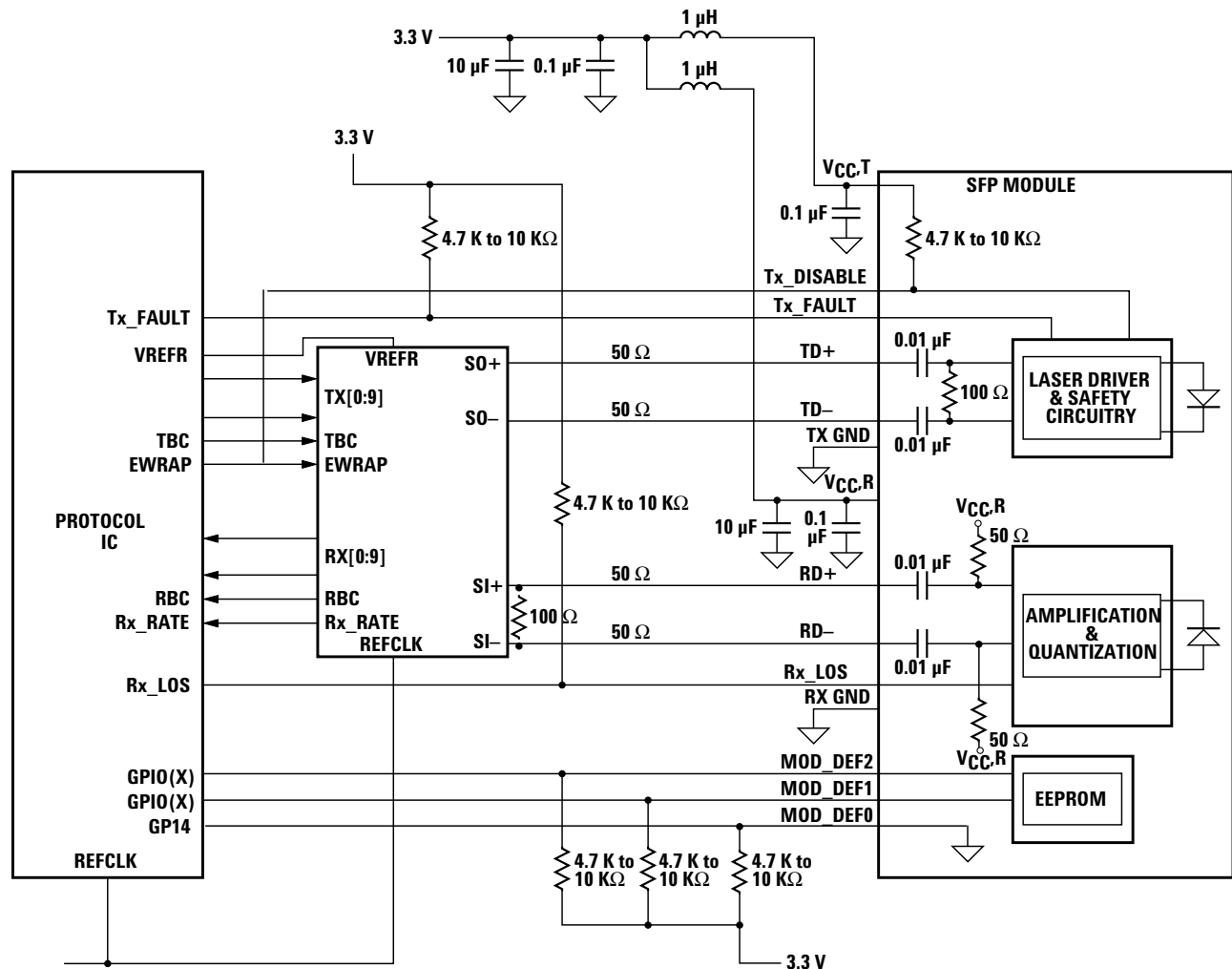


Figure 2. Typical Application Configuration

## Receiver Section

The receiver section for the AFCT-576xZ contains an InGaAs/InP photo detector and a preamplifier mounted in an optical subassembly. This optical subassembly is coupled to a post amplifier/decision circuit on a circuit board. The design of the optical subassembly provides better than 12 dB Optical Return Loss (ORL).

Connection to the receiver is provided via a LC optical connector.

## RX\_LOS

The receiver section contains a loss of signal (RX\_LOS) circuit to indicate when the optical input signal power is insufficient for SONET/SDH compliance. A high signal indicates loss of modulated signal, indicating link failure such as a broken fiber or a failed transmitter. RX\_LOS can be also be monitored via the two-wire serial (address A2, byte 110, bit 1).

## Functional Data I/O

Avago's AFCT-576xZ transceiver is designed to accept industry standard differential signals. The transceiver provides an AC-coupled, internally terminated data interface. Bias resistors and coupling capacitors have been included within the module to reduce the number of components required on the customer's board. Figure 2 illustrates the recommended interface circuit.

## Digital Diagnostic Interface and Serial Identification

The AFCT-576xZ family complies with the SFF-8074i specification, which defines the module's serial identification protocol to use the 2-wire serial CMOS EEPROM protocol of the ATMEL AT24C01A or similar. Standard SFP EEPROM bytes 0-255 are addressed per SFF-8074i at memory address 0xA0 (A0h).

As an enhancement to the conventional SFP interface defined in SFF-8074i, the AFCT-5765Z is also compliant to SFF-8472 (the digital diagnostic interface for SFP). This enhancement adds digital diagnostic monitoring to standard SFP functionality, enabling failure prediction, fault isolation, and component monitoring capabilities.

Using the 2-wire serial interface, the AFCT-5765Z provides real time access to transceiver internal supply voltage and temperature, transmitter output power, laser bias current and receiver average input power, allowing a host to predict system compliance issues. These five parameters are internally calibrated, per the MSA. New digital diagnostic information is accessed per SFF-8472 using EEPROM bytes 0-255 at memory address 0xA2 (A2h).

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).

Contents of the MSA-compliant serial ID memory are shown in Tables 3 to 7. The SFF-8074i and SFF-8472 specifications are available from the SFF Committee at <http://www.sffcommittee.org>.

The I2C accessible memory page address 0xB0 is used internally by SFP for the test and diagnostic purposes and it is reserved.

## Predictive Failure Identification

The diagnostic information allows the host system to identify potential link problems. Once identified, a fail-over technique can be used to isolate and replace suspect devices before system uptime is impacted.

## Compliance Prediction

The real-time diagnostic parameters can be monitored to alert the system when operating limits are exceeded and compliance cannot be ensured.

## Fault Isolation

The diagnostic information can allow the host to pinpoint the location of a link problem and accelerate system servicing and minimize downtime.

## Component Monitoring

As part of the host system monitoring, the real time diagnostic information can be combined with system level monitoring to ensure system reliability.

## Application Support

An Evaluation Kit and Reference Designs are available to assist in evaluation of the AFCT-576xZ SFPs. Please contact your local Field Sales representative for availability and ordering details.

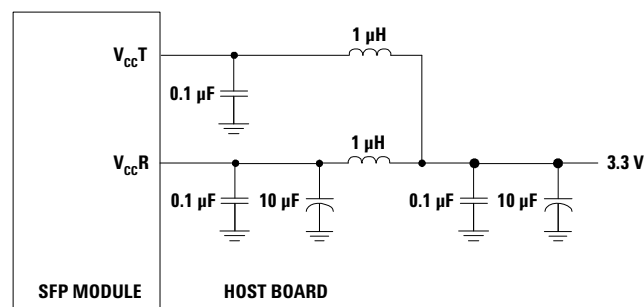


Figure 3. MSA required power supply filter

## Operating Temperature

The AFCT-576xZ family is available in either Extended (-10 to +85°C) or Industrial (-40 to +85°C) temperature ranges.

## Power Supply Noise

The AFCT-576xZ can withstand an injection of PSN on the V<sub>CC</sub> lines of 100 mV ac without a degradation in eye mask margin to 10% on the transmitter and a 1 dB sensitivity penalty on the receiver. This occurs when the product is used in conjunction with the MSA recommended power supply filter shown in Figure 3.

## Regulatory Compliance

The transceiver regulatory compliance is provided in Table 1 as a figure of merit to assist the designer. The overall equipment design will determine the certification level.

**Table 1. Regulatory Compliance**

| Feature                                                   | Test Method                                                                                                                                                            | Performance                                                                                                                               |
|-----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Electrostatic Discharge (ESD) to the Electrical Pins      | MIL-STD-883C Method 3015.4<br>JEDEC/EIA JESD22-A114-A                                                                                                                  | Class 2 (2000 Volts)                                                                                                                      |
| Electrostatic Discharge (ESD) to the Duplex LC Receptacle | Bellcore GR1089-CORE                                                                                                                                                   | 25 kV Air Discharge<br>10 Zaps at 8 kV (contact discharge) on the electrical faceplate on panel.                                          |
| Electromagnetic Interference (EMI)                        | FCC Class B                                                                                                                                                            | Applications with high SFP port counts are expected to be compliant; however, margins are dependent on customer board and chassis design. |
| Immunity                                                  | Variation of IEC 61000-4-3                                                                                                                                             | No measurable effect from a 10 V/m field swept from 80 to 1000 MHz applied to the transceiver without a chassis enclosure.                |
| Eye Safety                                                | US FDA CDRH AEL Class 1<br>EN (IEC) 60825-1, 2,<br>EN60950 Class 1                                                                                                     | CDRH Accession Number: 9521220-137T<br>UV Certificate Number: 933/21205741/040                                                            |
| Component Recognition                                     | Underwriter's Laboratories and Canadian Standards Association Joint Component Recognition for Information Technology Equipment Including Electrical Business Equipment | UL file # E173874                                                                                                                         |
| ROHS Compliance                                           |                                                                                                                                                                        | Reference to EU RoHS Directive 2002/95/EC                                                                                                 |

## Electrostatic Discharge (ESD)

There are two conditions in which immunity to ESD damage is important:

The first condition is static discharge to the transceiver during handling such as when the transceiver is inserted into the transceiver port. To protect the transceiver, it is important to use normal ESD handling precautions including the use of grounded wrist straps, work benches, and floor mats in ESD controlled areas. The ESD sensitivity of the AFCT-576xZ is compatible with typical industry production environments.

The second condition is static discharge to the exterior of the host equipment chassis after installation. To the extent that the duplex LC optical interface is exposed to the outside of the host equipment chassis, it may be subject to system-level ESD requirements. The ESD performance of the AFCT-576xZ exceeds typical industry standards. Table 1 documents ESD immunity to both of these conditions.

## Electromagnetic Interference (EMI)

Most equipment designs using the AFCT-576xZ SFPs are subject to the requirements of the FCC in the United States, CENELEC EN55022 (CISPR 22) in Europe and VCCI in Japan. The metal housing and shielded design of the transceiver minimize EMI and provide excellent EMI performance.

## EMI Immunity

The AFCT-576xZ transceivers have a shielded design to provide excellent immunity to radio frequency electromagnetic fields which may be present in some operating environments.

## Eye Safety

The AFCT-576xZ transceivers provide Class 1 eye safety by design. Avago Technologies has tested the transceiver design for regulatory compliance, under normal operating conditions and under a single fault condition. See Table 1.

## Flammability

The AFCT-576xZ family of SFPs is compliant to UL 94V-0.

## Customer Manufacturing Processes

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

## Caution

The AFCT-576xZ contains no user-serviceable parts. Tampering with or modifying the performance of the AFCT-576xZ will result in voided product warranty. It may also result in improper operation of the transceiver circuitry, and possible over-stress of the laser source. Device degradation or product failure may result. Connection of the AFCT-576xZ to a non-approved optical source, operating above the recommended absolute maximum conditions may be considered an act of modifying or manufacturing a laser product. The person(s) performing such an act is required by law to re-certify and re-identify the laser product under the provisions of U.S. 21 CF.

## Handling Precautions

The AFCT-576xZ can be damaged by current surges or overvoltage. Power supply transient precautions should be taken, and normal handling precautions for electrostatic sensitive devices should be taken.

## Optical Power Budget

The worst-case Optical Power Budget (OPB) in dB for a fiber-optic link is determined by the difference between the minimum transmitter output optical power (dBm avg) and the lowest receiver sensitivity (dBm avg). This OPB provides the necessary optical signal range to establish a working fiber-optic link. The OPB is allocated for the fiber-optic cable length and the corresponding link penalties. For proper link performance, all penalties that affect the link performance must be accounted for within the link optical power budget.

## Process Plug

This transceiver is supplied with a process plug for protection of the optical port within the LC connector receptacle. This process plug prevents contamination during handling, shipping and storage. It is made of a high-temperature, molded sealing material that can withstand +85 °C.

## LC SFP Cleaning Recommendations

In the event of contamination of the optical ports, the recommended cleaning process is the use of forced nitrogen. If contamination is thought to have remained, the optical ports can be cleaned using a NTT international Cletop stick type (diam. 1.25 mm) and HFE7100 cleaning fluid.

**Table 2. Pin description**

| Pin | Name        | Function/Description                                  | MSA Notes |
|-----|-------------|-------------------------------------------------------|-----------|
| 1   | VeeT        | Transmitter Ground                                    |           |
| 2   | TX Fault    | Transmitter Fault Indication                          | Note 1    |
| 3   | TX Disable  | Transmitter Disable - Module disables on high or open | Note 2    |
| 4   | MOD-DEF2    | Module Definition 2 - Two wire serial ID interface    | Note 3    |
| 5   | MOD-DEF1    | Module Definition 1 - Two wire serial ID interface    | Note 3    |
| 6   | MOD-DEF0    | Module Definition 0 - Grounded in module              | Note 3    |
| 7   | Rate Select | Not Connected                                         |           |
| 8   | LOS         | Loss of Signal                                        | Note 4    |
| 9   | VeeR        | Receiver Ground                                       |           |
| 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 $\pm 5\%$                      | Note 6    |
| 16  | VccT        | Transmitter Power - 3.3 V $\pm 5\%$                   | 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 should be pulled up with a 4.7K – 10K $\Omega$  resistor on the host board. Pull up voltage between 2.0 V and VccT, R+0.3 V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to < 0.8 V. By default, TX Fault is set to trigger only on hardware faults.
- TX Disable input is used to shut down the laser output per the state table below with an external 4.7 - 10 K $\Omega$  pull-up resistor.  
Low (0 - 0.8 V): Transmitter on  
Between (0.8 V and 2.0 V): Undefined  
High (2.0 - 3.465 V): Transmitter Disabled  
Open: Transmitter Disabled
- MOD-DEF 0,1,2. These are the module definition pins. They should be pulled up with a 4.7 - 10 K $\Omega$  resistor on the host board to a supply less than VccT +0.3 V or VccR+0.3 V.  
MOD-DEF 0 is grounded by the module to indicate that the module is present  
MOD-DEF 1 is clock line of two wire serial interface for optional serial ID  
MOD-DEF 2 is data line of two wire serial interface for optional serial ID
- LOS (Loss of Signal) is an open collector/drain output which should be pulled up externally with a 4.7K - 10 K $\Omega$  resistor on the host board to a supply < VccT,R+0.3 V. 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 < 0.8 V.
- RD-/+ : These are the differential receiver outputs. They are ac coupled 100 $\Omega$  differential lines which should be terminated with 100 $\Omega$  differential at the user SERDES. The ac coupling is done inside the module and is thus not required on the host board. The voltage swing on these lines will be between 250 and 2000 mV differential (160 - 1000 mV single ended) when properly terminated.
- VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.135 - 3.465 V at the SFP connector pin. The maximum supply current is 250 mA and the associated inrush current will be no more than 30 mA above steady state after 500 nanoseconds.
- TD-/+ : These are the differential transmitter inputs. They are ac coupled differential lines with 100 $\Omega$  differential termination inside the module. The ac coupling is done inside the module and is thus not required on the host board. The inputs will accept differential swings of 500 - 2400 mV (250 - 1200 mV single ended), though it is recommended that values between 500 and 1200 mV differential (250 - 600 mV single ended) be used for best EMI performance.

**Table 3. EEPROM Serial ID Memory Contents - Address A0h**

| Byte #<br>Decimal | Dat<br>Hex | Notes                                  | Byte #<br>Decimal | Dat<br>Hex | Notes                               | Byte #<br>Decimal | Dat<br>Hex | Notes                                                       |
|-------------------|------------|----------------------------------------|-------------------|------------|-------------------------------------|-------------------|------------|-------------------------------------------------------------|
| 0                 | 03         | SFP physical device                    | 27                | 20         |                                     | 54                | 20         |                                                             |
| 1                 | 04         | SFP function defined by serial ID only | 28                | 20         |                                     | 55                | 20         |                                                             |
| 2                 | 07         | LC optical connector                   | 29                | 20         |                                     | 56                | 30         |                                                             |
| 3                 | 00         |                                        | 30                | 20         |                                     | 57                | 30         |                                                             |
| 4                 | 10         | SONET Reach Specifier                  | 31                | 20         |                                     | 58                | 31         |                                                             |
| 5                 | 04         | SONET Compliance Code                  | 32                | 20         |                                     | 59                | 30         |                                                             |
| 6                 | 00         |                                        | 33                | 20         |                                     | 60                | Table 4    |                                                             |
| 7                 | 00         |                                        | 34                | 20         |                                     | 61                | Table 4    |                                                             |
| 8                 | 00         |                                        | 35                | 20         |                                     | 62                | 00         |                                                             |
| 9                 | 00         |                                        | 36                | 00         |                                     | 63                |            | Checksum for Bytes 0-62 <sup>3</sup>                        |
| 10                | 00         |                                        | 37                | 00         | Hex Byte of Vendor OUI <sup>1</sup> | 64                | 00         |                                                             |
| 11                | 05         | SONET Scrambled                        | 38                | 17         | Hex Byte of Vendor OUI <sup>1</sup> | 65                | 1A         | Hardware SFP Tx_Disable, Tx_Fault & Rx_LOS                  |
| 12                | 02         | 155 Mbit/sec nominal bit rate          | 39                | 6A         | Hex Byte of Vendor OUI <sup>1</sup> | 66                | 00         | Upper Bit Rate Margin                                       |
| 13                | 00         |                                        | 40                | 41         | A                                   | 67                | 00         | Lower Bit Rate Margin                                       |
| 14                | 28         | Link length 9 μm in km                 | 41                | 46         | F                                   | 68-83             |            | Vendor Specific Serial Number ASCII characters <sup>4</sup> |
| 15                | FF         | Link length 9 μm in m                  | 42                | 43         | C                                   | 84-91             |            | Vendor Date Code ASCII characters <sup>5</sup>              |
| 16                | 00         |                                        | 43                | 54         | T                                   | 92                | Table 4    |                                                             |
| 17                | 00         |                                        | 44                | 2D         | -                                   | 93                | Table 4    |                                                             |
| 18                | 00         |                                        | 45                | 35         | 5                                   | 94                | Table 4    |                                                             |
| 19                | 00         |                                        | 46                | 37         | 7                                   | 95                |            | Checksum for Bytes 64-94 <sup>3</sup>                       |
| 20                | 41         | A                                      | 47                | 36         | 6                                   | 96-127            | 00         | Vendor specific EEPROM                                      |
| 21                | 56         | V                                      | 48                | Table 4    |                                     | 128-255           | 00         | Reserved                                                    |
| 22                | 41         | A                                      | 49                | Table 4    |                                     |                   |            |                                                             |
| 23                | 47         | G                                      | 50                | Table 4    |                                     |                   |            |                                                             |
| 24                | 4F         | O                                      | 51                | Table 4    |                                     |                   |            |                                                             |
| 25                | 20         |                                        | 52                | Table 4    |                                     |                   |            |                                                             |
| 26                | 20         |                                        | 53                | 20         |                                     |                   |            |                                                             |

**Notes:**

1. The IEEE Organizationally Unique Identifier (OUI) assigned to Avago is 00-17-6A (3 bytes of hex).
2. Laser wavelength is represented in 16 unsigned bits.
3. Addresses 63 and 95 are checksums calculated (per SFF-8472 and SFF-8074) and stored prior to product shipment.
4. Addresses 68-83 specify the ASCII serial number and will vary on a per unit basis.
5. Addresses 84-91 specify the ASCII date code and will vary on a per date code basis.

**Table 4. Individual Identifiers**

| AFCT-5760NLZ |     |        | AFCT-5760NPZ |        | AFCT-5760ANLZ |        | AFCT-5760ANPZ |        |
|--------------|-----|--------|--------------|--------|---------------|--------|---------------|--------|
| Byte #       | Hex | Notes  | Hex          | Notes  | Hex           | Notes  | Hex           | Notes  |
| 48           | 30  | 0      | 30           | 0      | 30            | 0      | 30            | 0      |
| 49           | 4E  | N      | 4E           | N      | 41            | A      | 41            | A      |
| 50           | 4C  | L      | 50           | P      | 4E            | N      | 4E            | N      |
| 51           | 5A  | Z      | 5A           | Z      | 4C            | L      | 50            | P      |
| 52           | 20  |        | 20           |        | 5A            | Z      | 5A            | Z      |
| 60           | 05  | 1310nm | 05           | 1310nm | 05            | 1310nm | 05            | 1310nm |
| 61           | 1E  |        | 1E           |        | 1E            |        | 1E            |        |
| 92           | 00  |        | 00           |        | 00            |        | 00            |        |
| 93           | 00  |        | 00           |        | 00            |        | 00            |        |
| 94           | 00  |        | 00           |        | 00            |        | 00            |        |

| AFCT-5765NLZ |     |        | AFCT-5765NPZ |        | AFCT-5765ANLZ |        | AFCT-5765ANPZ |        |
|--------------|-----|--------|--------------|--------|---------------|--------|---------------|--------|
| Byte #       | Hex | Notes  | Hex          | Notes  | Hex           | Notes  | Hex           | Notes  |
| 48           | 35  | 5      | 35           | 5      | 35            | 5      | 35            | 5      |
| 49           | 4E  | N      | 4E           | N      | 41            | A      | 41            | A      |
| 50           | 4C  | L      | 50           | P      | 4E            | N      | 4E            | N      |
| 51           | 5A  | Z      | 5A           | Z      | 4C            | L      | 50            | P      |
| 52           | 20  |        | 20           |        | 5A            | Z      | 5A            | Z      |
| 60           | 05  | 1310nm | 05           | 1310nm | 05            | 1310nm | 05            | 1310nm |
| 61           | 1E  |        | 1E           |        | 1E            |        | 1E            |        |
| 92           | 68  |        | 68           |        | 68            |        | 68            |        |
| 93           | F0  |        | F0           |        | F0            |        | F0            |        |
| 94           | 01  |        | 01           |        | 01            |        | 01            |        |

**Table 5. EEPROM Serial ID Memory Contents - Address A2h (AFCT-5765Z family only)**

| Byte<br>#Decimal | Notes                                      | Byte<br>#Decimal | Notes                                       | Byte<br>#Decimal | Notes                                         |
|------------------|--------------------------------------------|------------------|---------------------------------------------|------------------|-----------------------------------------------|
| 0                | Temp H Alarm MSB <sup>1</sup>              | 26               | Tx Pwr L Alarm MSB <sup>4</sup>             | 104              | Real Time Rx P <sub>AV</sub> MSB <sup>5</sup> |
| 1                | Temp H Alarm LSB <sup>1</sup>              | 27               | Tx Pwr L Alarm LSB <sup>4</sup>             | 105              | Real Time Rx P <sub>AV</sub> LSB <sup>5</sup> |
| 2                | Temp L Alarm MSB <sup>1</sup>              | 28               | Tx Pwr H Warning MSB <sup>4</sup>           | 106              | Reserved                                      |
| 3                | Temp L Alarm LSB <sup>1</sup>              | 29               | Tx Pwr H Warning LSB <sup>4</sup>           | 107              | Reserved                                      |
| 4                | Temp H Warning MSB <sup>1</sup>            | 30               | Tx Pwr L Warning MSB <sup>4</sup>           | 108              | Reserved                                      |
| 5                | Temp H Warning LSB <sup>1</sup>            | 31               | Tx Pwr L Warning LSB <sup>4</sup>           | 109              | Reserved                                      |
| 6                | Temp L Warning MSB <sup>1</sup>            | 32               | Rx Pwr H Alarm MSB <sup>5</sup>             | 110              | Status/Control - see Table 6                  |
| 7                | Temp L Warning LSB <sup>1</sup>            | 33               | Rx Pwr H Alarm LSB <sup>5</sup>             | 111              | Reserved                                      |
| 8                | V <sub>CC</sub> H Alarm MSB <sup>2</sup>   | 34               | Rx Pwr L Alarm MSB <sup>5</sup>             | 112              | Flag Bits - see Table 7                       |
| 9                | V <sub>CC</sub> H Alarm LSB <sup>2</sup>   | 35               | Rx Pwr L Alarm LSB <sup>5</sup>             | 113              | Flag Bit - see Table 7                        |
| 10               | V <sub>CC</sub> L Alarm MSB <sup>2</sup>   | 36               | Rx Pwr H Warning MSB <sup>5</sup>           | 114              | Reserved                                      |
| 11               | V <sub>CC</sub> L Alarm LSB <sup>2</sup>   | 37               | Rx Pwr H Warning LSB <sup>5</sup>           | 115              | Reserved                                      |
| 12               | V <sub>CC</sub> H Warning MSB <sup>2</sup> | 38               | Rx Pwr L Warning MSB <sup>5</sup>           | 116              | Flag Bits - see Table 7                       |
| 13               | V <sub>CC</sub> H Warning LSB <sup>2</sup> | 39               | Rx Pwr L Warning LSB <sup>5</sup>           | 117              | Flag Bits - see Table 7                       |
| 14               | V <sub>CC</sub> L Warning MSB <sup>2</sup> | 40-55            | Reserved                                    | 118              | Reserved                                      |
| 15               | V <sub>CC</sub> L Warning LSB <sup>2</sup> | 56-94            | External Calibration Constants <sup>6</sup> | 119              | Reserved                                      |
| 16               | Tx Bias H Alarm MSB <sup>3</sup>           | 95               | Checksum for Bytes 0-94 <sup>7</sup>        | 120-122          | Reserved                                      |
| 17               | Tx Bias H Alarm LSB <sup>3</sup>           | 96               | Real Time Temperature MSB <sup>1</sup>      | 123              |                                               |
| 18               | Tx Bias L Alarm MSB <sup>3</sup>           | 97               | Real Time Temperature LSB <sup>1</sup>      | 124              |                                               |
| 19               | Tx Bias L Alarm LSB <sup>3</sup>           | 98               | Real Time Vcc MSB <sup>2</sup>              | 125              |                                               |
| 20               | Tx Bias H Warning MSB <sup>3</sup>         | 99               | Real Time Vcc LSB <sup>2</sup>              | 126              |                                               |
| 21               | Tx Bias H Warning LSB <sup>3</sup>         | 100              | Real Time Tx Bias MSB <sup>3</sup>          | 127              | Reserved <sup>8</sup>                         |
| 22               | Tx Bias L Warning MSB <sup>3</sup>         | 101              | Real Time Tx Bias LSB <sup>3</sup>          | 128-247          | Customer Writable <sup>9</sup>                |
| 23               | Tx Bias L Warning LSB <sup>3</sup>         | 102              | Real Time Tx Power MSB <sup>4</sup>         | 248-254          | Vendor Specific                               |
| 24               | Tx Pwr H Alarm MSB <sup>4</sup>            | 103              | Real Time Tx Power LSB <sup>4</sup>         | 255              |                                               |
| 25               | Tx Pwr H Alarm LSB <sup>4</sup>            |                  |                                             |                  |                                               |

**Notes:**

1. Temperature (Temp) is decoded as a 16 bit signed twos complement integer in increments of 1/256 °C.
2. Supply voltage (V<sub>CC</sub>) is decoded as a 16 bit unsigned integer in increments of 100 µV.
3. Laser bias current (Tx Bias) is decoded as a 16 bit unsigned integer in increments of 2 µA.
4. Transmitted average optical power (Tx Pwr) is decoded as a 16 bit unsigned integer in increments of 0.1 µW.
5. Received average optical power (Rx Pwr) is decoded as a 16 bit unsigned integer in increments of 0.1 µW.
6. Bytes 55-94 are not intended from use with AFCT-5765xxxx, but have been set to default values per SFF-8472.
7. Bytes 95 is a checksum calculated (per SFF-8472) and stored prior to product shipment.
8. Byte 127 accepts a write but performs no action (reserved legacy byte).
9. Bytes 128-247 are write enabled (customer writable).
10. Byte 255 bits 2 and 3 control laser margining (per Table 7) when an enabling password is entered into bytes 123-126.

**Table 6. EEPROM Serial ID Memory Contents - Address A2h, Byte 110 (AFCT-5765Z family only)**

| Bit # | Status/Control Name  | Description                                                                              |
|-------|----------------------|------------------------------------------------------------------------------------------|
| 7     | Tx Disable State     | Digital state of SFP Tx Disable Input Pin (1 = Tx_Disable asserted)                      |
| 6     | Soft Tx Disable      | Read/write bit for changing digital state of SFP Tx_Disable function <sup>1</sup>        |
| 5     | Reserved             |                                                                                          |
| 4     | Rx Rate Select State | Digital state of SFP Rate Select Input Pin (1 = full bandwidth of 155 Mbit) <sup>2</sup> |
| 3     | Reserved             |                                                                                          |
| 2     | Tx Fault State       | Digital state of the SFP Tx Fault Output Pin (1 = Tx Fault asserted) <sup>3</sup>        |
| 1     | Rx LOS State         | Digital state of the SFP LOS Output Pin (1 = LOS asserted)                               |
| 0     | Data Ready (Bar)     | Indicates transceiver is powered and real time sense data is ready (0 = Ready)           |

**Notes:**

1. Bit 6 is logic OR'd with the SFP Tx\_Disable input pin 3 ... either asserted will disable the SFP transmitter.
2. AFCT-5765Z does not respond to state changes on Rate Select Input Pin. It is internally hardwired to full bandwidth.
3. By default, TX Fault is set to trigger only on hardware faults.

**Table 7. EEPROM Serial ID Memory Contents - Address A2h, Bytes 112, 113, 116, 117 (AFCT-5765Z family only)**

| 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 alarm threshold.           |
|      | 5     | V <sub>CC</sub> High Alarm   | Set when transceiver internal supply voltage exceeds high alarm threshold.   |
|      | 4     | V <sub>CC</sub> 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 P_Avg optical power exceeds high alarm threshold.          |
|      | 6     | Rx Power Low Alarm           | Set when received P_Avg 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     | V <sub>CC</sub> High Warning | Set when transceiver internal supply voltage exceeds high warning threshold. |
|      | 4     | V <sub>CC</sub> 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 P_Avg optical power exceeds high warning threshold.        |
|      | 9     | Rx Power Low Warning         | Set when received P_Avg optical power exceeds low warning threshold.         |
|      | 0-5   | Reserved                     |                                                                              |

## Optical Parameters

### Absolute Maximum Ratings

Absolute maximum ratings are those values beyond which functional performance is not intended, device reliability is not implied, and damage to the device may occur.

| Parameter                           | Symbol             | Minimum | Maximum         | Unit | Notes |
|-------------------------------------|--------------------|---------|-----------------|------|-------|
| Storage Temperature (non-operating) | T <sub>S</sub>     | -40     | +85             | ° C  |       |
| Relative Humidity                   | RH                 | 0       | 85              | %    |       |
| Supply Voltage                      | V <sub>CC</sub>    | -0.5    | 3.63            | V    |       |
| Input Voltage on any Pin            | V <sub>I</sub>     | -0.5    | V <sub>CC</sub> | V    |       |
| Receiver Optical Input              | P <sub>INABS</sub> |         | 0               | dBm  |       |

### Recommended Multirate Operating Conditions

Typical operating conditions are those values for which functional performance and device reliability is implied.

| Parameter                  | Symbol          | Minimum | Typical | Maximum | Unit | Notes |
|----------------------------|-----------------|---------|---------|---------|------|-------|
| Case Operating Temperature |                 |         |         |         |      |       |
| AFCT-576xNLZ/NPZ           | T <sub>C</sub>  | -10     |         | +85     | ° C  |       |
| AFCT-576xANLZ/ANPZ         | T <sub>C</sub>  | -40     |         | +85     | ° C  |       |
| Supply Voltage             | V <sub>CC</sub> | 3.1     | 3.3     | 3.5     | V    |       |

### Transceiver Electrical Characteristics for multirate operations at Fast Ethernet (125 Mbit/s) and OC-3 (155 Mbit/s) \*6

| Parameter                                    | Symbol            | Minimum | Typical | Maximum | Unit | Notes |
|----------------------------------------------|-------------------|---------|---------|---------|------|-------|
| Module supply current                        | I <sub>CC</sub> T |         |         | 250     | mA   | 1     |
| Power Dissipation                            | P <sub>DISS</sub> |         |         | 875     | mW   |       |
| <b>AC Electrical Characteristics</b>         |                   |         |         |         |      |       |
| Power Supply Noise Rejection                 | PSNR              | 100     |         |         | mV   | 2     |
| In-rush Current                              |                   |         |         | 30      | mA   |       |
| <b>DC Electrical Characteristics</b>         |                   |         |         |         |      |       |
| <b>Signal Outputs:</b>                       |                   |         |         |         |      |       |
| Transmit Fault (TX_FAULT)                    | V <sub>OH</sub>   | 2.0     |         | 3.5     | V    |       |
| Loss of Signal (LOS)                         | V <sub>OL</sub>   | 0       |         | 0.8     | V    | 3     |
| <b>Signal Inputs:</b>                        |                   |         |         |         |      |       |
| Transmitter Disable (TX_DISABLE)             | V <sub>IH</sub>   | 2.0     |         | 3.5     | V    |       |
| MOD-DEF1, 2                                  | V <sub>IL</sub>   | 0       |         | 0.8     | V    | 6     |
| <b>Data Input:</b>                           |                   |         |         |         |      |       |
| Transmitter Single Ended Input Voltage (TD±) | V <sub>I</sub>    | 250     |         | 1200    | mV   | 4     |
| <b>Data Output:</b>                          |                   |         |         |         |      |       |
| Receiver Single Ended Output Voltage (RD±)   | V <sub>O</sub>    | 250     |         | 1000    | mV   | 5     |

#### Notes:

- MSA gives max current at 300 mA.
- MSA filter is required on host board 10 Hz to 2 MHz.
- LVTTL, External 4.7-10 KΩ pull up resistor required on host board to voltage less than V<sub>CC</sub> + 0.3 V.
- Internally ac coupled and terminated (100 Ω differential).
- Internally ac coupled and load termination located at the user SERDES.
- Minimum input to MOD-DEF1,2 is 0.7\*V<sub>CC</sub>

### Transmitter Optical Characteristics for multirate operations at Fast Ethernet (125 Mbit/s) and OC-3 (155 Mbit/s)

| Parameter            | Symbol           | Minimum | Typical* | Maximum | Unit | Notes |
|----------------------|------------------|---------|----------|---------|------|-------|
| Optical Output Power | P <sub>OUT</sub> | -5      |          | 0       | dBm  | 1     |
| Center Wavelength    | $\lambda_C$      | 1270    |          | 1360    | nm   |       |
| Spectral Width - RMS | $\sigma$         |         |          | 3       | nm   | 2     |
| Optical Rise Time    | t <sub>r</sub>   |         |          | 2.5     | ns   | 3     |
| Optical Fall Time    | t <sub>f</sub>   |         |          | 2.5     | ns   | 3     |
| Tx disable OFF power | P <sub>OFF</sub> |         |          | -45     | dBm  |       |
| Extinction Ratio     | Er               | 10      |          |         | dB   |       |
| Eye Mask Margin      | EMM              | 30      |          |         | %    | 4     |
| Jitter Generation    | pk to pk         |         |          | 70      | mUI  | 5     |
|                      | RMS              |         |          | 7       | mUI  | 5     |

\*Typicals indicated expected values for room temperature measurements +25 °C

#### Notes:

1. The output power is coupled into a 1 m single mode fiber. Minimum output optical level is at end of life
2. The relationship between FWHM and RMS values for spectral width can be derived from the Gaussian shaped spectrum which results in RMS=FWHM/2.35
3. These are unfiltered 20-80% values.
4. 30% margin to eye mask in Telcordia GR-253-CORE and ITU-T G.957
5. Jitter measurements taken with Avago OMNIBER 718 in accordance with GR253

### Receiver Optical Characteristics for multirate operations at Fast Ethernet (125 Mbit/s) and OC-3 (155 Mbit/s)

| Parameter                  | Symbol             | Minimum | Typical | Maximum | Unit | Notes |
|----------------------------|--------------------|---------|---------|---------|------|-------|
| Receiver Sensitivity       | P <sub>INMIN</sub> |         |         | -34     | dBm  | 1     |
| Receiver Overload          | P <sub>INMAX</sub> | 0       |         |         | dBm  |       |
| Input Operating Wavelength | $\lambda$          | 1261    |         | 1360    | nm   |       |
| LOS Deassert               | P <sub>LOSD</sub>  |         |         | -34.5   | dBm  |       |
| LOS Assert                 | P <sub>LOSA</sub>  | -45     |         |         | dBm  |       |
| LOS Hysteresis             | P <sub>H</sub>     | 0.5     |         | 4       | dB   |       |

#### Notes:

1. The receiver is guaranteed to provide output data with a Bit Error Rate better than or equal to  $1 \times 10^{-10}$  measured with TX powered and carrying data.

## Transceiver Digital Diagnostic Monitor (Real Time Sense) Characteristics (AFCT-5765Z family only)

| Parameter                                         | Symbol           | Min. | Typ. | Max. | Unit | Reference |
|---------------------------------------------------|------------------|------|------|------|------|-----------|
| Transceiver Internal Temperature Accuracy         | T <sub>INT</sub> | -3.0 |      | +3.0 | °C   | 1         |
| Transceiver Internal Supply Voltage Accuracy      | V <sub>INT</sub> | -3.0 |      | +3.0 | %    | 2         |
| Transmitter Laser dc Bias Current Accuracy        | I <sub>INT</sub> | -10  |      | +10  | %    | 3         |
| Transmitted Average Optical Output Power Accuracy | P <sub>T</sub>   | -3.0 |      | +3.0 | dB   |           |
| Received Average Optical Input Power Accuracy     | P <sub>R</sub>   | -3.0 |      | +3.0 | dB   |           |

### Notes:

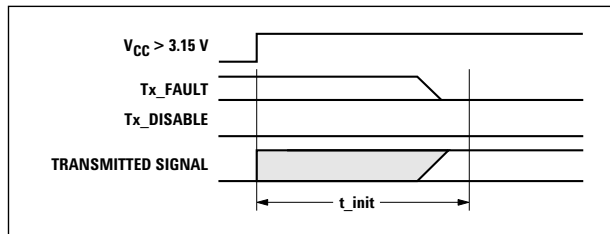
1. Temperature was measured internal to the transceiver. Valid from = -10 °C to +85 °C or from -40°C to +85°C.  
For calibration to an external temperature, please contact Avago Technologies.
2. Reference voltage is 3.3 V.
3. Valid from 0 to 50 mA, avg.

## Transceiver Timing Characteristics

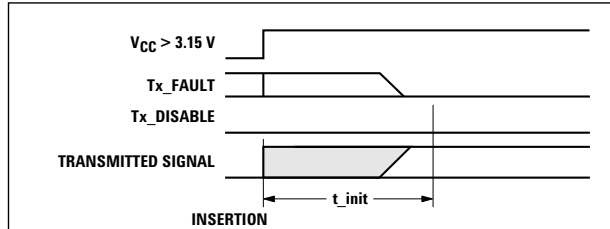
| Parameter                                       | Symbol                     | Minimum | Maximum | Unit | Notes   |
|-------------------------------------------------|----------------------------|---------|---------|------|---------|
| Hardware TX_DISABLE Assert Time                 | t <sub>off</sub>           |         | 10      | ms   | Note 1  |
| Hardware TX_DISABLE Negate Time                 | t <sub>on</sub>            |         | 1       | ms   | Note 2  |
| Time to initialize, including reset of TX_FAULT | t <sub>init</sub>          |         | 300     | ms   | Note 3  |
| Hardware TX_FAULT Assert Time                   | t <sub>fault</sub>         |         | 100     | ms   | Note 4  |
| Hardware TX_DISABLE to Reset                    | t <sub>reset</sub>         | 10      |         | ms   | Note 5  |
| Hardware RX_LOS Assert Time                     | t <sub>loss_on</sub>       |         | 100     | ms   | Note 6  |
| Hardware RX_LOS De-Assert Time                  | t <sub>loss_off</sub>      |         | 100     | ms   | Note 7  |
| Software TX_DISABLE Assert Time                 | t <sub>off_soft</sub>      |         | 100     | ms   | Note 8  |
| Software TX_DISABLE Negate Time                 | t <sub>on_soft</sub>       |         | 100     | ms   | Note 9  |
| Software Tx_FAULT Assert Time                   | t <sub>fault_soft</sub>    |         | 100     | ms   | Note 10 |
| Software Rx_LOS Assert Time                     | t <sub>loss_on_soft</sub>  |         | 100     | ms   | Note 11 |
| Software Rx_LOS De-Assert Time                  | t <sub>loss_off_soft</sub> |         | 100     | ms   | Note 12 |
| Analog parameter data ready                     | t <sub>data</sub>          |         | 1000    | ms   | Note 13 |
| Serial bus hardware ready                       | t <sub>serial</sub>        |         | 300     | ms   | Note 14 |
| Write Cycle Time                                | t <sub>write</sub>         |         | 10      | ms   | Note 15 |
| Serial ID Clock Rate                            | f <sub>serial_clock</sub>  |         | 400     | kHz  |         |

### Notes:

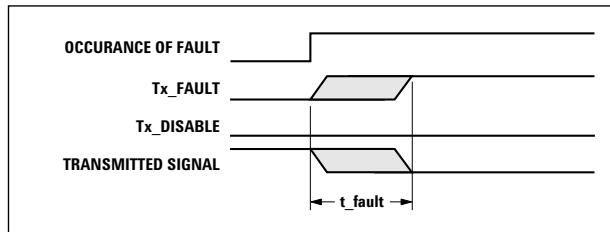
1. Time from rising edge of TX\_DISABLE to when the optical output falls below 10% of nominal.
2. Time from falling edge of TX\_DISABLE to when the modulated optical output rises above 90% of nominal.
3. Time from power on or falling edge of Tx\_Disable to when the modulated optical output rises above 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. Time from stop bit to completion of a 1-8 byte write command.



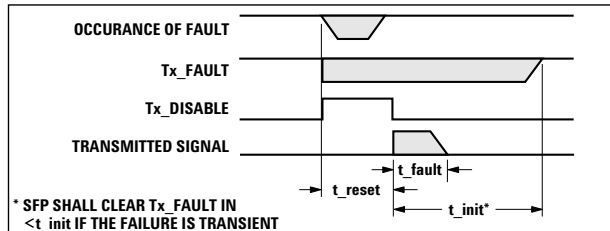
t-init: TX DISABLE NEGATED



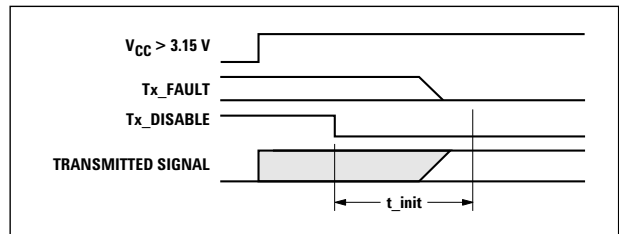
t-init: TX DISABLE NEGATED, MODULE HOT PLUGGED



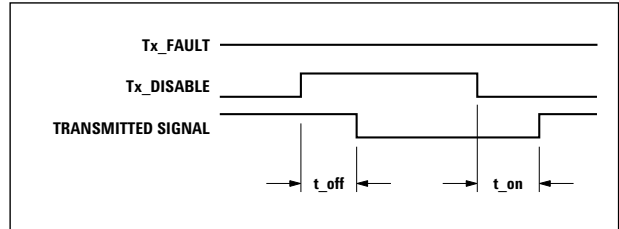
t-fault: TX FAULT ASSERTED, TX SIGNAL NOT RECOVERED



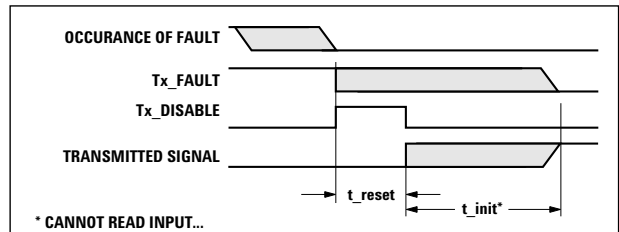
t-fault: TX DISABLE ASSERTED THEN NEGATED, TX SIGNAL NOT RECOVERED



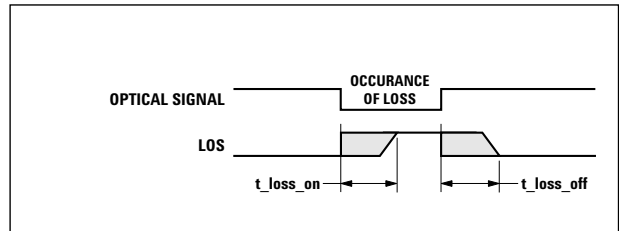
t-init: TX DISABLE ASSERTED



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

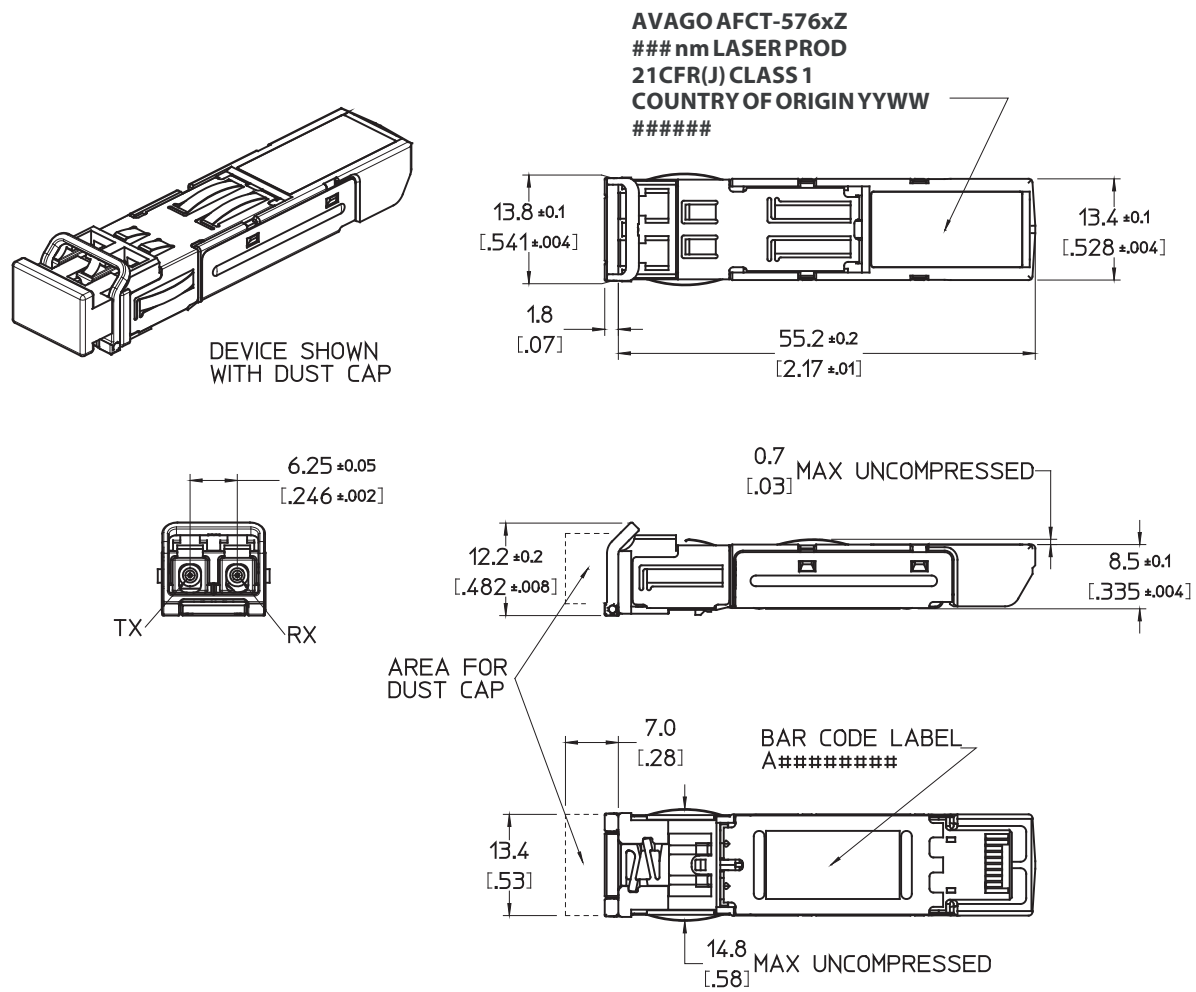


t-reset: TX DISABLE ASSERTED THEN NEGATED, TX SIGNAL RECOVERED



t-loss-on & t-loss-off

Figure 5. Timing Diagrams



Notes:

1. Bail delatch is colored BLUE for SONET/Single-Mode Identification.

**Figure 6. Module Drawing**



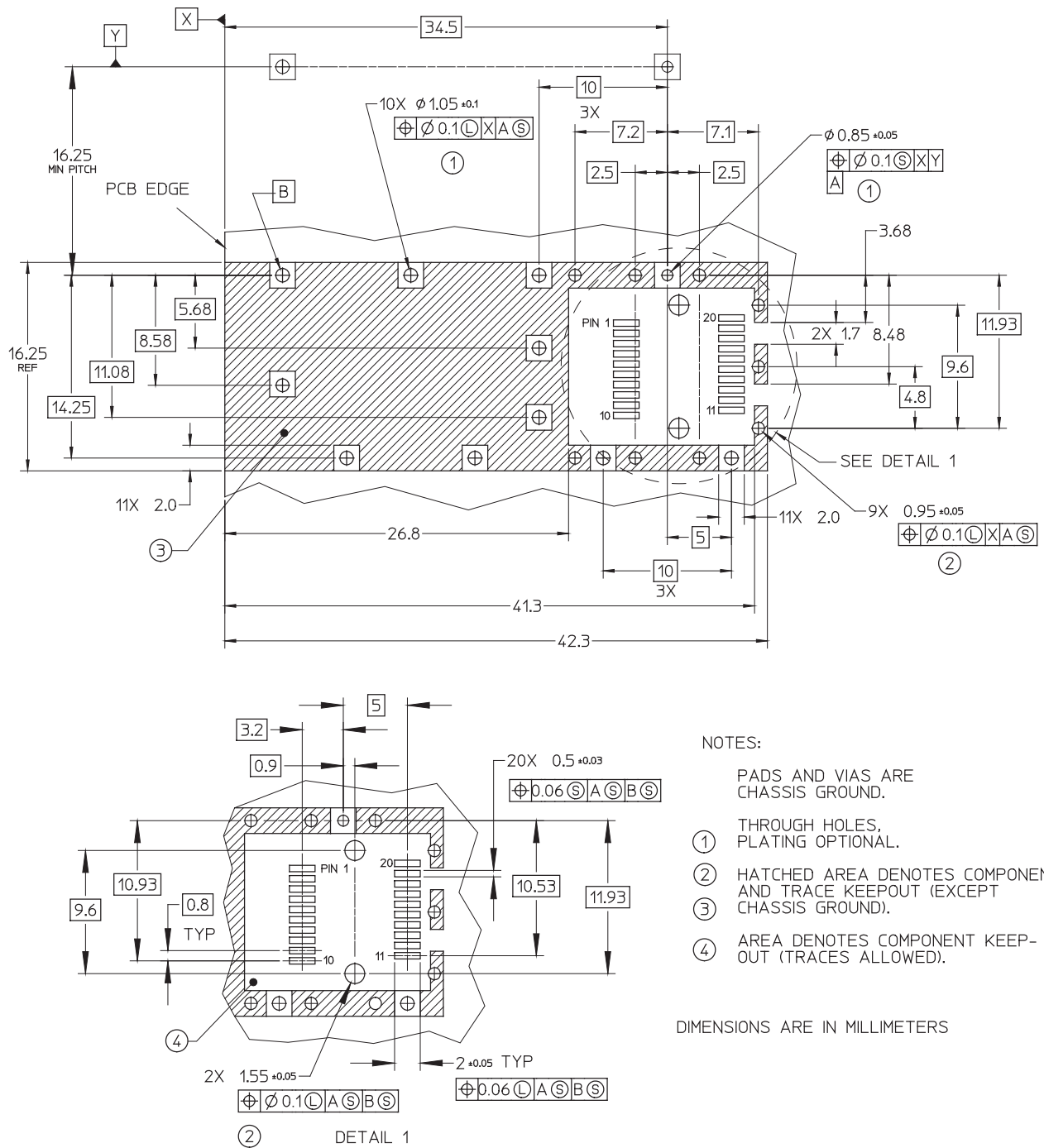


Figure 8. SFP host board mechanical layout

## 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](http://www.avagotech.com) or contact one of Avago Technologies' regional Technical Response Centers. For information related to SFF Committee documentation, visit [www.sffcommittee.org](http://www.sffcommittee.org).

### 1300nm FP Laser (Operating Case Temperature -10 to +85 °C)

#### ***With DMI***

AFCT-5765NLZ standard de-latch

AFCT-5765NPZ bail de-latch

#### ***Without DMI***

AFCT-5760NLZ standard de-latch

AFCT-5760NPZ bail de-latch

### 1300nm FP Laser (Operating Case Temperature -40 to +85 °C)

#### ***With DMI***

AFCT-5765ANLZ standard de-latch

AFCT-5765ANPZ bail de-latch

#### ***Without DMI***

AFCT-5760ANLZ standard de-latch

AFCT-5760ANPZ bail de-latch

## EEPROM Content and / or Label Options

AFCT-5760XXXX-YYY

AFCT-5765XXXX-YYY

Where "XXXX" refers to product option  
"YYY" is customer specific

For product information and a complete list of distributors, please go to our web site: [www.avagotech.com](http://www.avagotech.com)

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AV02-0140EN - September 12, 2012





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- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



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