SO-SFP-10GE-T

SFP+ 10G-Base-T Transceiver

OVERVIEW

The SO-SFP-10GE-T copper transceiver module is a high performance integrated duplex data link for bidirectional communication over copper cable. It is specifically designed for high speed communication links that require 10 Gigabit Ethernet over Cat 6a/7 cable. This is the first SFP+ transceiver that offers 10 Gb/s communication over this type of media.

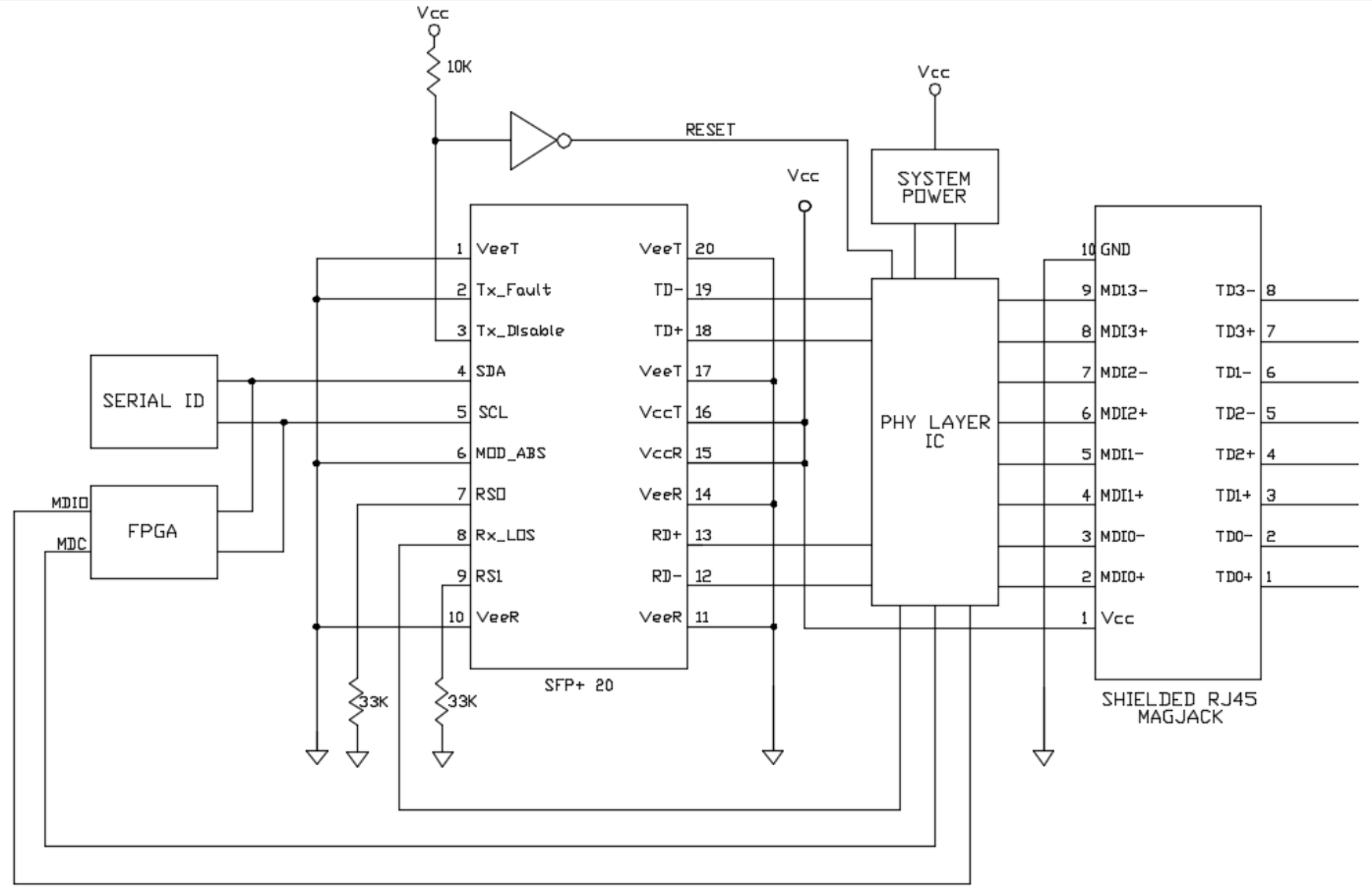
PRODUCT FEATURES

- Supports links up to 30m using Cat 6a/7 Cable
- SFF-8431 and SFF-8432 MSA compliant
- IEEE 802.3az compliant
- Low power consumption (2.5W MAX @ 30m)
- Fast retrain EMI cancellation algorithm
- Low EMI emissions
- I2C 2 wire serial interface for serial ID and phy registers
- Auto-negotiates with other 10GBase-T PHYs
- Supports 100/1000Base-T
- MDI/MDIX crossover
- Multiple loopback modes for testing and troubleshooting
- Built-in cable monitoring and link diagnostic features capable of cable length measurements and detection of opens/shorts
- Robust die cast housing
- Bail latch style ejector mechanism
- Unshielded and shielded cable support
- Write enabled EEPROM

ORDERING INFORMATION

Part Number	Description
SO-SFP-10GE-T	SFP+ 10G-Base-T Transceiver

BLOCK DIAGRAM



ELECTRICAL PIN DEFINITIONS

PIN	Logic	Symbol	Name/Description	Plug Sequence	Note
1		VeeT	Transmitter Ground	1	1
2	LVTTL-O	Tx_Fault	Transmitter Fault	3	
3	LVTTL-I	Tx_Disable	Transmitter Disable	3	
4	LVTT-I/O	SDA	2-wire Serial Interface Data Line	3	
5	LVTT-I/O	SCL	2-Wire Serial Interface Clock	3	
6		Mod_ABS	Module Absent, connect to VeeT or VeeR in the module	3	
7	LVTTL-I	RS0	Rate Select 0	3	
8	LVTTL-O	Rx-LOS	Receiver Loss of Signal Indication	3	
9	LVTTL-I	RS1	Rate Select 1	3	
10		VeeR	Receiver Ground	1	1
11		VeeR	Receiver Ground	1	1
12	CML-O	RD-	Receiver Inverted Data Output	3	
13	CML-O	RD+	Receiver Non-Inverted Data Output	3	
14		VeeR	Receiver Ground	1	1

15		VccR	Receiver 3.3V Supply	2	
16		VccT	Transmitter 3.3V Supply	2	
17		VeeTTD+	Transmitter Ground	1	1
18	CML-I	TD+	Receiver Inverted Data Output	3	
19	CML-I	TD-	Transmitter Inverted Data Input	3	
20		VeeT	Module Transmitter Ground	1	1

Note 1: The module signal grounds should be isolated from the module case.

LATCH REQUIREMENTS

The SFP transceiver latch should be mechanically robust and designed to prevent unintentional unlatching during insertion or extraction of the transceiver cable. The transceiver is designed with a “Bail type ejector latch mechanism” that allows the SFP module to be easily released from the cage, when the adjacent SFP ports in both rows are also populated and regardless of whether the SFP module is placed in the lower or upper row. The latch shall also pass the “wiggle” RJ45 connector stress test.

Measurement	Min	Max	Units	Comments
SFP transceiver insertion	N/A	18	Newtons	Measure without the force from any cage kick-out springs. Module to be inserted into nominal cage.
SFP transceiver extraction	N/A	12.5	Newtons	Measure without the force from any cage kick-out springs. Module to be inserted into nominal cage.
SFP transceiver retention	90	170	Newtons	No functional damage to module below 90N.
Insertion/removal cycles, SFP transceiver	50	N/A	Cycles	No functional damage to module, cage or connector.

ABSOLUTE MAXIMUM OPERATING CONDITIONS

Parameter	Symbol	Min	Max	Units	Notes
Storage temperature	Ts	-40	85	°C	
Case operating temperature	Tc	-5	85	°C	
Relative humidity	RH	5	95	%	
Supply voltage (3.3V)	Vcc		3.6	VDC	
Low speed input voltage		-0.5	Vcc+0.3	V	
Two-wire interface input voltage		-0.3	Vcc+0.5	V	

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min	Typ	Max	Units	Notes
Case operating temperature	Tc	-5		85	°C	
Supply voltage (3.3V)	Vcc	3.135	3.3	3.465	VDC	
Power (30m @ 25 °C ambient)			2.3	2.5	W	

REGULATORY REQUIREMENTS

The SFP transceiver installed into the host system requires meeting compliance requirements listed in this paragraph. In order to achieve this, the module must be evaluated in considering its use in the equipment designs. Unless otherwise specified, the transceiver module shall meet the current version, at the time of manufacturing, of the applicable EMI/EMC specifications for telecommunication network and information technology/multimedia equipment.

RADIATED EMISSION (RE)

10.0 KHz – 18.0 GHz is recommended frequency range for radiated emission testing. The 10G Base-T CuSFP transceiver shall meet the applicable FCC Part 15 emission requirements.

10G Base-T CuSFP transceiver minimum emission requirements are:

- Class B radiated emission requirements by using shielded cables at least 4dB margin.

ELECTROSTATIC DISCHARGE (ESD)

In addition, the CuSFP module or host platform shall not show susceptibility to conducted immunity when applied to the interface cable per the requirements of IEC 6100-4-2:

- Contact ESD only to the accessible portions of the module (i.e. front panel connector receptacle). 8 kV - Air Discharge and 4 kV – Contact discharge.
- Criteria B (see paragraph 6.7 for Criteria's definition) should be used as a measurable effect from ESD applied (25 discharges by polarity – both air/contact) to the system used with CuSFP modules

TRAFFIC GENERATION AND SUSCEPTIBILITY CRITERIA.

TRAFFIC GENERATION AND MONITORING.

A minimum 50% utilization will should be established for preliminary investigation when possible, with final evaluation being performed with a worst-case utilization.

SUSCEPTIBILITY CRITERIA

The disturbances will be applied to the system as a whole. Data losses will be reported according to the following performance criteria.

PERFORMANCE CRITERIA A

During the test and after the test, system with Cu SFP module shall continue to operate:

- Without degradation resulting in no greater than 1% of packets per second dropped,
- With zero requests for retry, beyond requests resulting from the 1% per second allowable data loss
- With no degradation in the data transmission rate, beyond requests resulting from the 1% per second allowable data loss
- Without protocol failure
- Without loss of link
- Without alarm signaling triggered.

Monitoring Method

The Traffic Generator will be monitored. The link, speed, retry rates, etc. during the test will be reviewed by equipment status logs after the test, and monitored by LED observation during the test.

PERFORMANCE CRITERIA B

Error rate, request for retry and speed of data transmission rate may be degraded during the application of the test. Degradation of the performance as described in criteria A is permitted provided that the normal operation of the EUT is self-recoverable to the condition immediately before the application of the test. In these cases, operator response is not permitted to re-initiate an operation.

Monitoring Method

The Traffic Generator will be monitored. The link, speed, retry rates, etc. during the test will be reviewed by equipment status logs after the test, and monitored by LED observation during the test.

PERFORMANCE CRITERIA C

Degradation of the performance as described in criteria A is permitted provided that the normal operation of the EUT is selfrecoverable to the condition immediately before the application of the test or can be restored after the test by the operator.

Monitoring Method:

The Traffic Generator will be monitored. The link, speed, retry rates, etc. during the test will be reviewed by equipment status logs after the test, and monitored by LED observation during the test.

FLAMMABILITY

The PCB of the SFP module shall be min. V-0 UL flame rated. Applicable standards: UL/CSA 60950 and IEC 60950.

ENVIRONMENTAL AND QUALITY REQUIREMENTS

ACCELERATED AGING

The SFP+ transceiver module shall be subjected to an accelerated aging test that exposes the module to 85C case temperature while being powered at 3.3V for 2000 hours.

Failure criteria

The product is considered to have failed this test if any of the following occurred:

1. Failure of test unit to perform ping or traffic test.
2. Excessive corrosion of components.

RELATIVE HUMIDITY (NON-OPERATIONAL)

The SFP+ transceiver module shall be subjected to the temperature and humidity profile as per MIL STD 202G Method 103B,

Test description

The module shall be subjected to the temperature and humidity profile of 85C/85% RH for 1000 hours. The product shall be non-operational during this entire period.

Failure criteria

The product is considered to have failed this test if any of the following occurred:

1. Failure of test unit to perform ping or traffic test.
2. Excessive corrosion of components.

SHOCK AND VIBRATION

- 16 10G Base-T SFP+ copper transceivers shall be subject to mechanical shock test and vibration test.

- Mechanical shock test

  The mechanical shock test shall use the following specification:

  A half-sine wave shock shall be applied on the DUT, 5 times per direction for 6 directions.

  Peak acceleration of the input 1500G. Pulse width of half-sine wave 0.5ms.

- Vibration test

  The vibration test shall use the following specification:

  A random vibration input for a period of 4 min per cycle, 4 cycle per axis.

  The input acceleration level shall be 20G over the frequency band of 20 to 2000 Hz.

- Failure criteria: The product is considered to have failed this test if any of the following occurred:

  1. Failure of test unit to perform ping or traffic test;
  2. Excessive corrosion of components.

TEMPERATURE CYCLING

Thirty-two Modules shall be place in a temperature cycling chamber (16 operational and 16 non-operational). The temperature extremes shall be -5°C to +85°C. The dwell time at each temperature extreme shall be 10 minutes. The transition time between each temperature extreme shall be 8 minutes. 100 thermal cycles shall be complete. There shall be no evidence of any electrical or physical degradation to the samples, as a result of the thermal cycling.

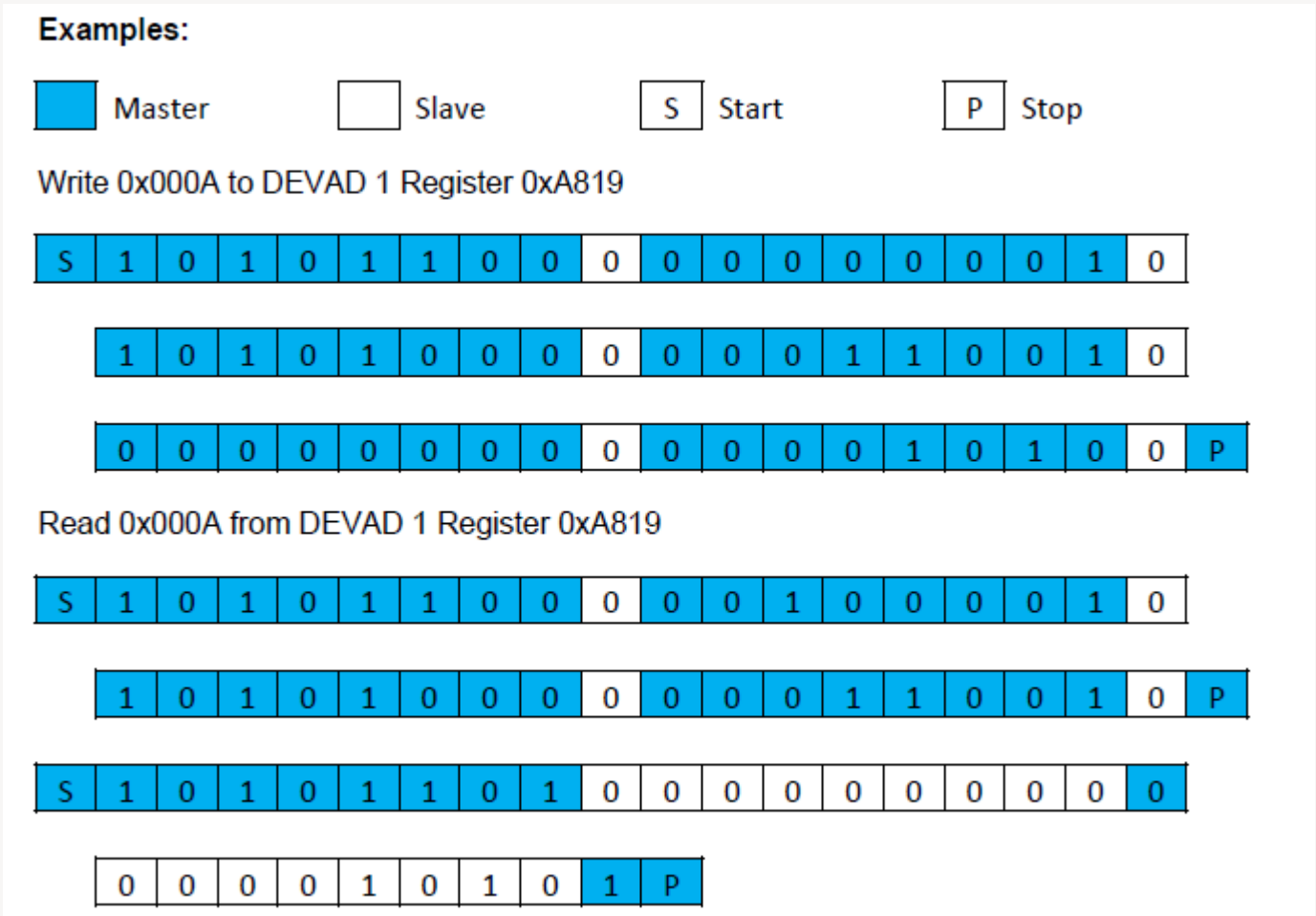
PROTOCOL FOR I2C TO MDIO BRIDGE

The Transceiver contains a Bridge device to allow the Host I2C interface to communicate with the PHY's MDIO interface. In order for this to work the following protocol must be used. The I2C Slave Address for the Bridge is 0x56 + R/W Bit or 0xAC for a write and 0xAD for a read.

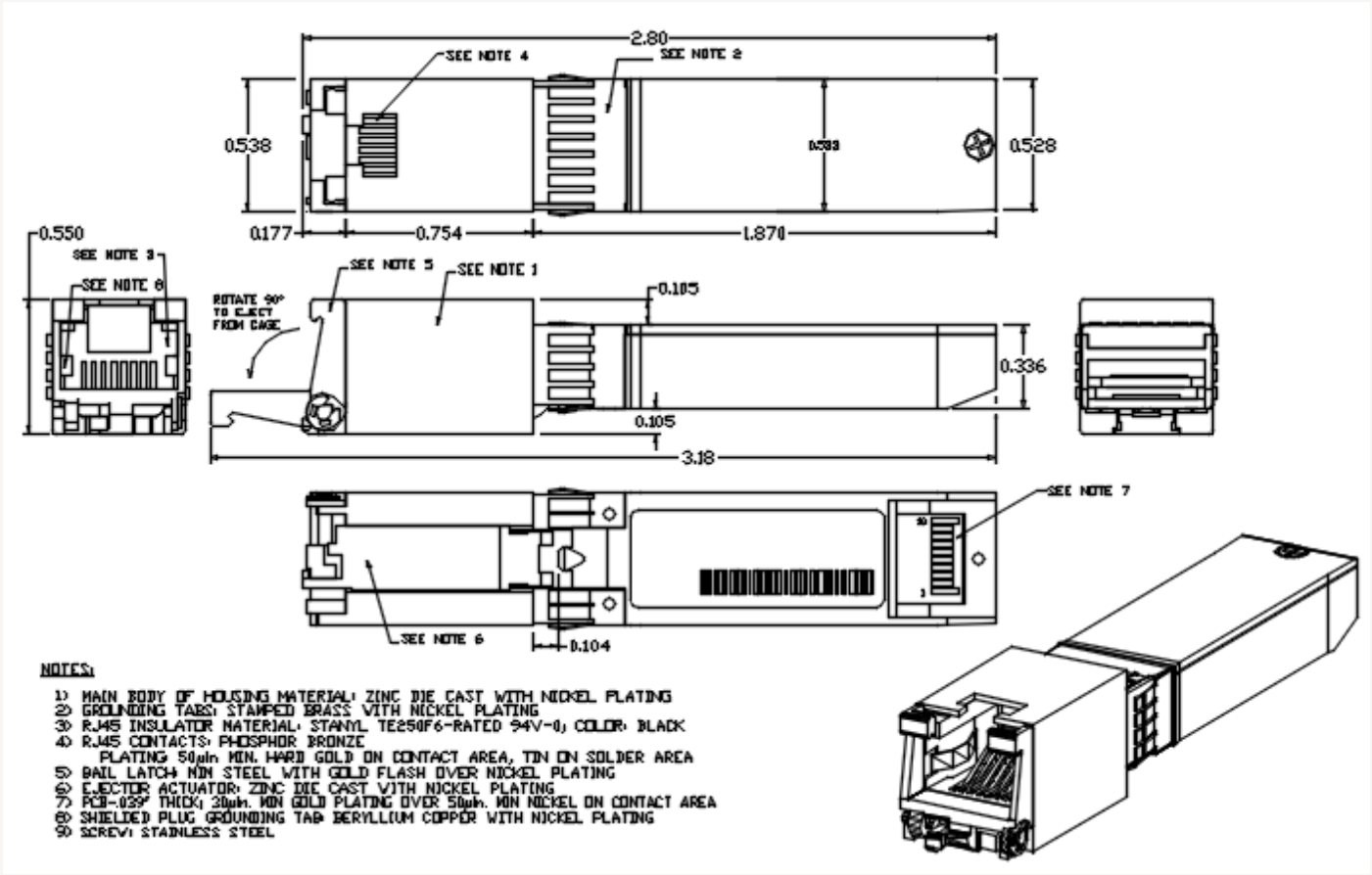
To write to a PHY register the I2C Master needs to send a 6 Byte I2C frame. The first Byte is the I2C Slave Address with R/W Bit = 0 or 0xAC. The second Byte contains the 5 Bit MDIO Device Address in Bits 4:0 with Bits 7:5 = 0. The next 2 Bytes are the 16 Bit Register Address with the MSB first, and the last 2 Bytes are the 16 Bit Data with the MSB first.

To read from a PHY register the I2C Master needs to first send a 4 Byte I2C frame. The first Byte is the I2C Slave Address with R/W Bit = 0 or 0xAC. The second Byte contains the 5 Bit MDIO Device Address in Bits 4:0 with Bit 5 = 1 and Bits 7:6 = 0. The next 2 Bytes are the 16 Bit Register Address
with the MSB first. Then the I2C Master starts a second frame by sending the I2C Slave Address with R/W Bit = 1 or 0xAD. The I2C Master will then receive 2 Bytes containing the 16 Bit Data with the MSB first from the Slave.

Examples:



MECHANICAL DRAWING



NOTES:

1) MAIN BODY OF HOUSING MATERIAL: ZINC DIE CAST WITH NICKEL PLATING
2) GROUNDING TABS: STAMPED BRASS WITH NICKEL PLATING
3) RJ45 INSULATOR MATERIAL: STANYL TE250F6-RATED 94V-0; COLOR: BLACK
4) RJ45 CONTACTS: PHOSPHOR BRONZE
   PLATING 50µin MIN. HARD GOLD ON CONTACT AREA, TIN ON SOLDER AREA
5) BAIL LATCH: MIN STEEL WITH GOLD FLASH OVER NICKEL PLATING
6) EJECTOR ACTUATOR: ZINC DIE CAST WITH NICKEL PLATING
7) PCB-.039" THICK; 30µin. MIN GOLD PLATING OVER 50µin. MIN NICKEL ON CONTACT AREA
8) SHIELDED PLUG GROUNDING TAB BERYLLIUM COPPER WITH NICKEL PLATING
9) SCREW: STAINLESS STEEL