

**Особенности:**

- Industrial: -40°C~+85°C
- 1310nm FP лазер, 2км бюджет на SMF
- возможность горячей замены
- двойной LC разъем
- встроенная функция диагностики (DDMI) в соответствии с SFF-8472
- 10.3Gbps Data rate
- соответствие спецификации MSA для SFP+

**Области применения:**

- 10G Ethernet / Fiber Channel / STM-64

**Absolute Maximum Ratings**

| Parameter           | Symbol          | Min. | Max. | Unit |
|---------------------|-----------------|------|------|------|
| Storage Temperature | T <sub>s</sub>  | -40  | +85  | °C   |
| Supply Voltage      | V <sub>cc</sub> | -0.5 | 3.6  | V    |

**Recommended Operating Conditions**

| Parameter                  | Symbol                         | Min. | Typical | Max. | Unit  |
|----------------------------|--------------------------------|------|---------|------|-------|
| Operating Case Temperature | T <sub>A</sub> SFP-Plus-LC.2-I | -40  |         | 85   | °C    |
| Power Supply Voltage       | V <sub>cc</sub>                | 3.15 | 3.3     | 3.45 | V     |
| Power Supply Current       | I <sub>cc</sub>                |      |         | 300  | mA    |
| Surge Current              | I <sub>surge</sub>             |      |         | +30  | mA    |
| Baud Rate                  |                                |      | 10.3125 |      | GBaud |

**PERFORMANCE SPECIFICATIONS - ELECTRICAL**

| Parameter                       | Symbol          | Min. | Typ. | Max                  | Unit | Notes                                        |
|---------------------------------|-----------------|------|------|----------------------|------|----------------------------------------------|
| <b>TRANSMITTER</b>              |                 |      |      |                      |      |                                              |
| CML Inputs(Differential )       | V <sub>in</sub> | 150  |      | 1200                 | mVp  | AC coupled inputs                            |
| Input Impedance (Differential)  | Z <sub>in</sub> | 85   | 100  | 115                  | ohms | R <sub>in</sub> > 100 kohms @ DC             |
| Tx_DISABLE Input Voltage - High |                 | 2    |      | 3.45                 | V    |                                              |
| Tx_DISABLE Input Voltage - Low  |                 | 0    |      | 0.8                  | V    |                                              |
| Tx_FAULT Output Voltage -- High |                 | 2    |      | V <sub>cc</sub> +0.3 | V    | I <sub>o</sub> = 400µA; Host V <sub>cc</sub> |

|                                 |      |     |     |         |      |                      |
|---------------------------------|------|-----|-----|---------|------|----------------------|
| Tx_FAULT Output Voltage -- Low  |      | 0   |     | 0.5     | V    | Io = -4.0mA          |
| <b>RECEIVER</b>                 |      |     |     |         |      |                      |
| CML Outputs (Differential)      | Vout | 350 |     | 700     | mVpp | AC coupled outputs   |
| Output Impedance (Differential) | Zout | 85  | 100 | 115     | ohms |                      |
| Rx_LOS Output Voltage - High    |      | 2   |     | Vcc+0.3 | V    | Io = 400µA; Host Vcc |
| Rx_LOS Output Voltage - Low     |      | 0   |     | 0.8     | V    | Io = -4.0mA          |
| MOD_DEF ( 0:2 )                 | VoH  | 2.5 |     |         | V    | With Serial ID       |
|                                 | VoL  | 0   |     | 0.5     | V    |                      |

**Optical and Electrical Characteristics**

| Parameter                        | Symbol           | Min.        | Typical  | Max.         | Unit |
|----------------------------------|------------------|-------------|----------|--------------|------|
| 9µm Core Diameter SMF            |                  |             | <b>2</b> |              | Km   |
| Data Rate                        |                  |             | 10.3     |              | Gbps |
| <b>Transmitter</b>               |                  |             |          |              |      |
| Centre Wavelength                | $\lambda_C$      | 1270        | 1310     | 1355         | nm   |
| Spectral Width (RMS)             | $\sigma$         |             |          | 3            | nm   |
| Average Output Power             | P <sub>out</sub> | <b>-6.0</b> |          | -1           | dBm  |
| Extinction Ratio                 | ER               | 3.5         |          |              | dB   |
| Average Power of OFF Transmitter |                  |             |          | -30          | dBm  |
| Side Mode Suppression Ratio      | SMSR             | 30          |          |              | dB   |
| Input Differential Impedance     | Z <sub>IN</sub>  | 90          | 100      | 110          | Ω    |
| TX Disable                       | Disable          |             | 2.0      | Vcc+0.3      | V    |
|                                  | Enable           |             | 0        | 0.8          |      |
| TX_Fault                         | Fault            |             | 2.0      | Vcc+0.3      | V    |
|                                  | Normal           |             | 0        | 0.8          |      |
| TX_Disable Assert Time           | t <sub>off</sub> |             |          | 10           | us   |
| <b>Receiver</b>                  |                  |             |          |              |      |
| Centre Wavelength                | $\lambda_C$      | 1260        |          | 1565         | nm   |
| Receiver Sensitivity             | PIN              |             |          | <b>-14.4</b> | dBm  |
| Output Differential Impedance    | P <sub>IN</sub>  | 90          | 100      | 110          | Ω    |
| Receiver Overload                | P <sub>MAX</sub> | 0.5         |          |              | dBm  |
| Optical Return Loss              | ORL              |             |          | -12          | dB   |
| LOS De-Assert                    | LOS <sub>D</sub> |             |          | -15          | dBm  |
| LOS Assert                       | LOS <sub>A</sub> | -25         |          |              | dBm  |
| LOS                              | High             |             | 2.0      | Vcc+0.3      | V    |
|                                  | Low              |             | 0        | 0.8          |      |

## Pin Function Definitions

| Pin Num. | Name       | FUNCTION                     | Plug | Notes                                                                                                      |
|----------|------------|------------------------------|------|------------------------------------------------------------------------------------------------------------|
| 1        | VeeT       | Transmitter Ground           | 1    |                                                                                                            |
| 2        | TX Fault   | Transmitter Fault Indication | 3    | Note 1                                                                                                     |
| 3        | TX Disable | Transmitter Disable          | 3    | Note 2, Module disables on high or open                                                                    |
| 4        | SDA        | Module Definition 2          | 3    | Note 3, Data line for Serial ID.                                                                           |
| 5        | SCL        | Module Definition 1          | 3    | Note 3, Clock line for Serial ID.                                                                          |
| 6        | MOD-ABS    | Module Definition 0          | 3    | Note 3                                                                                                     |
| 7        | RS0        | RX Rate Select (LVTTTL).     | 3    | This pin has an internal 30k pull down to ground. A signal on this pin will not affect module performance. |
| 8        | LOS        | Loss of Signal               | 3    | Note 4                                                                                                     |
| 9        | RS1        | TX Rate Select (LVTTTL).     | 1    | This pin has an internal 30k pull down to ground. A signal on this pin will not affect module performance. |
| 10       | VeeR       | Receiver Ground              | 1    | Note 5                                                                                                     |
| 11       | VeeR       | Receiver Ground              | 1    | Note 5                                                                                                     |
| 12       | RD-        | Inv. Received Data Out       | 3    | Note 6                                                                                                     |
| 13       | RD+        | Received Data Out            | 3    | Note 7                                                                                                     |
| 14       | VeeR       | Receiver Ground              | 1    | Note 5                                                                                                     |
| 15       | VccR       | Receiver Power               | 2    | 3.3 ± 5%, Note 7                                                                                           |
| 16       | VccT       | Transmitter Power            | 2    | 3.3 ± 5%, Note 7                                                                                           |
| 17       | VeeT       | Transmitter Ground           | 1    | Note 5                                                                                                     |
| 18       | TD+        | Transmit Data In             | 3    | Note 8                                                                                                     |
| 19       | TD-        | Inv. Transmit Data In        | 3    | Note 8                                                                                                     |
| 20       | VeeT       | Transmitter Ground           | 1    | Note 5                                                                                                     |

**Notes:**

1) TX Fault is an open collector/drain output, which should be pulled up with a 4.7K – 10KΩ resistor on the host board. Pull up voltage between 2.0V and VccT, R+0.3V. When

high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to  $< 0.8V$ .

2) TX disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a  $4.7 - 10 K \Omega$  resistor. Its states are:

Low ( $0 - 0.8V$ ): Transmitter on

( $>0.8, < 2.0V$ ): Undefined

High ( $2.0 - 3.465V$ ): Transmitter Disabled

Open: Transmitter Disabled

3) Modulation Absent, connected to VEET or VEER in the module.

4) LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a  $4.7K - 10K\Omega$  resistor. Pull up voltage between  $2.0V$  and  $V_{ccT}, R+0.3V$ . 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  $< 0.8V$ .

5) VeeR and VeeT may be internally connected within the SFP+ module.

6) 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  $370$  and  $2000$  mV differential ( $185 - 1000$  mV single ended) when properly terminated.

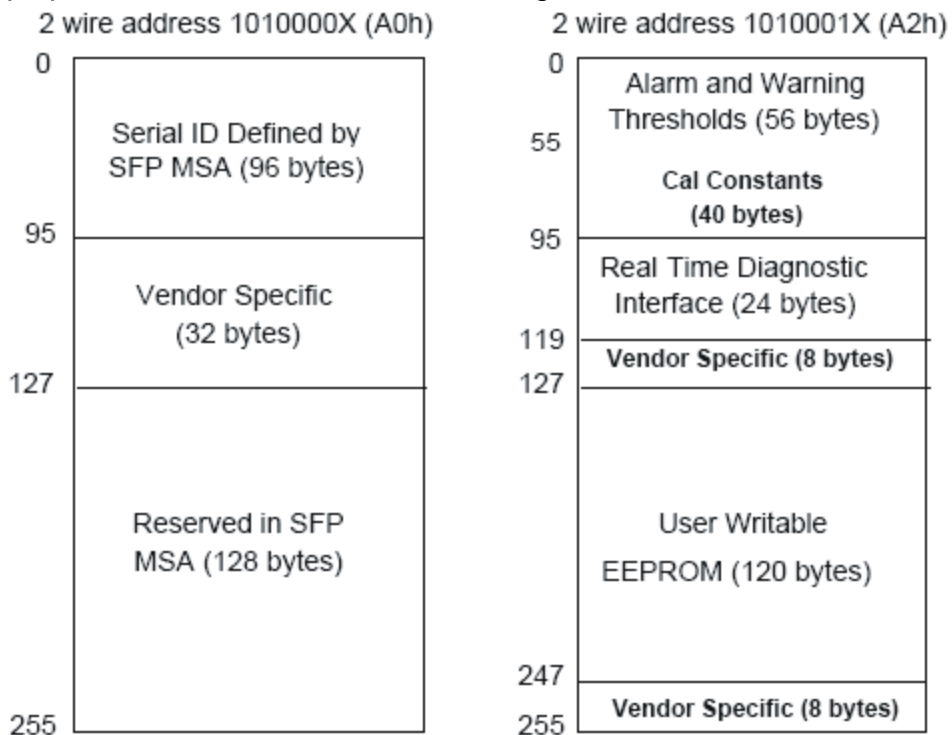
7) VccR and VccT are the receiver and transmitter power supplies. They are defined as  $3.3V \pm 5\%$  at the SFP+ connector pin. Maximum supply current is  $300mA$ . Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than  $1$  ohm should be used in order to maintain the required voltage at the SFP+ input pin with  $3.3V$  supply voltage. When the recommended supply-filtering network is used, hot plugging of the SFP+ transceiver module will result in an inrush current of no more than  $30mA$  greater than the steady state value. VccR and VccT may be internally connected within the SFP+ transceiver module.

8) 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 ( $250 - 1200mV$  single-ended), though it is recommended that values between  $500$  and  $1200$  mV differential ( $250 - 600mV$  single-ended) be used for best EMI performance.

**EEPROM**

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

The Module provides diagnostic information about the present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Calibration and alarm/warning threshold data is written during device manufacture. Received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring all are implemented. The diagnostic data are raw A/D values and must be converted to real world units using calibration constants stored in EEPROM locations 56 – 95 at wire serial bus address A2h. The digital diagnostic memory map specific data field define as following.



Mechanical Specifications

