

WDM SFP+ модули предназначены для создания каналов связи по одноволоконному SM кабелю на расстояние до 3км.

**Особенности:**

- 1270/1330нм DFB лазер
- возможность горячей замены
- LC разъем
- температурный диапазон от -5 до +70°C
- диагностика в соответствии со спецификацией MSA на SFP+

**Области применения:**

- 10GBASE-LR 10G Ethernet

**Absolute Maximum Ratings**

| Parameter           | Symbol   | Min. | Max. | Unit |
|---------------------|----------|------|------|------|
| Storage Temperature | $T_s$    | -40  | +85  | °C   |
| Supply Voltage      | $V_{CC}$ | -0.5 | 3.6  | V    |

**Recommended Operating Conditions**

| Parameter                  | Symbol      | Min.   | Typical | Max. | Unit  |
|----------------------------|-------------|--|---------|------|-------|
| Operating Case Temperature | $T_A$       | SFP-Plus-WDM-1270-1330.03<br>SFP-Plus-WDM-1330-1270.03 | -5      | +70  | °C    |
| Power Supply Voltage       | $V_{CC}$    | 3.15   | 3.3     | 3.45 | V     |
| Power Supply Current       | $I_{CC}$    |  |         | 300  | mA    |
| Surge Current              | $I_{Surge}$ |  |         | +30  | mA    |
| Baud Rate                  |             |  | 10.3125 | 10.5 | GBaud |

**PERFORMANCE SPECIFICATIONS - ELECTRICAL**

| Parameter                       | Symbol    | Min. | Typ. | Max          | Unit | Notes                                       |
|---------------------------------|-----------|------|------|--------------|------|---|
| <b>TRANSMITTER</b>              |           |      |      |              |      |   |
| CML Inputs(Differential)        | $V_{in}$  | 150  |      | 1200         | mVp  | AC coupled inputs                           |
| Input Impedance (Differential)  | $Z_{in}$  | 85   | 100  | 115          | ohms | $R_{in} > 100 \text{ kohms @ DC}$           |
| Tx_DISABLE Input Voltage - High |           | 2    |      | $V_{CC}+0.3$ | V    |   |
| Tx_DISABLE Input Voltage - Low  |           | 0    |      | 0.8          | V    |   |
| Tx_FAULT Output Voltage -- High |           | 2    |      | $V_{CC}+0.3$ | V    | $I_o = 400\mu\text{A}; \text{Host } V_{CC}$ |
| Tx_FAULT Output Voltage -- Low  |           | 0    |      | 0.5          | V    | $I_o = -4.0\text{mA}$                       |
| <b>RECEIVER</b>                 |           |      |      |              |      |   |
| CML Outputs (Differential)      | $V_{out}$ | 350  |      | 700          | mVpp | AC coupled outputs                          |

|                                 |                  |     |     |                      |      |  |
|---------------------------------|------------------|-----|-----|----------------------|------|--|
| Output Impedance (Differential) | Z <sub>out</sub> | 85  | 100 | 115                  | ohms |  |
| Rx_LOS Output Voltage - High    |                  | 2   |     | V <sub>CC</sub> +0.3 | V    | I <sub>o</sub> = 400µA; Host V <sub>CC</sub> |
| Rx_LOS Output Voltage - Low     |                  | 0   |     | 0.8                  | V    | I <sub>o</sub> = -4.0mA                      |
| MOD_DEF ( 0:2 )                 | VoH              | 2.5 |     |                      | V    | With Serial ID                               |
|                                 | VoL              | 0   |     | 0.5                  | V    |  |

**SFP-Plus-WDM-1270-1330.03 Optical and Electrical Characteristics**

| Parameter                              | Symbol                | Min. | Typical       | Max.                 | Unit  |
|--|-----------------------|------|---------------|----------------------|-------|
| 9µm Core Diameter SMF                  |                       |      | 3             |                      | km    |
| Data Rate                              |                       |      | 9.953/10.3125 |                      | Gbps  |
| <b>Transmitter</b>                     |                       |      |               |                      |       |
| Centre Wavelength                      | λ <sub>C</sub>        | 1260 | 1270          | 1280                 | nm    |
| Spectral Width (-20dB)                 | Δλ                    |      |               | 1                    | nm    |
| Average Output Power <sup>*note4</sup> | P <sub>out, AVG</sub> | -5   |               | 0                    | dBm   |
| Extinction Ratio                       | ER                    | 3.5  |               |                      | dB    |
| Side Mode Suppression Ratio            | SMSR                  | 30   |               |                      | dB    |
| Transmitter and Dispersion Penalty     | TDP                   |      |               | 2                    | dB    |
| Average Power of OFF Transmitter       |                       |      |               | -30                  | dBm   |
| Relative Intensity Noise               | RIN                   |      |               | -128                 | dB/Hz |
| Input Differential Impedance           | Z <sub>IN</sub>       | 90   | 100           | 110                  | Ω     |
| TX Disable                             | Disable               |      | 2.0           | V <sub>CC</sub> +0.3 | V     |
|  | Enable                |      | 0             | 0.8                  |       |
| TX Fault                               | Fault                 |      | 2.0           | V <sub>CC</sub> +0.3 | V     |
|  | Normal                |      | 0             | 0.8                  |       |
| TX Disable Assert Time                 | t <sub>off</sub>      |      |               | 10                   | us    |
| <b>Receiver</b>                        |                       |      |               |                      |       |
| Centre Wavelength                      | λ <sub>C</sub>        | 1320 |               | 1340                 | nm    |
| Sensitivity <sup>*note5</sup>          | PIN                   |      |               | -14                  | dBm   |
| Receiver Overload                      | P <sub>MAX</sub>      | 0.5  |               |                      | dBm   |
| Output Differential Impedance          | P <sub>IN</sub>       | 90   | 100           | 110                  | Ω     |
| LOS De-Assert                          | LOS <sub>D</sub>      |      |               | -18                  | dBm   |
| LOS Assert                             | LOS <sub>A</sub>      | -30  |               |                      | dBm   |
| LOS                                    | High                  |      | 2.0           | V <sub>CC</sub> +0.3 | V     |
|  | Low                   |      | 0             | 0.8                  |       |

**SFP-Plus-WDM-1330-1270.03 Optical and Electrical Characteristics**

| Parameter                              | Symbol                | Min. | Typical       | Max. | Unit |
|--|-----------------------|------|---------------|------|------|
| 9µm Core Diameter SMF                  |                       |      | 3             |      | km   |
| Data Rate                              |                       |      | 9.953/10.3125 |      | Gbps |
| <b>Transmitter</b>                     |                       |      |               |      |      |
| Centre Wavelength                      | λ <sub>C</sub>        | 1320 | 1330          | 1340 | nm   |
| Spectral Width (-20dB)                 | Δλ                    |      |               | 1    | nm   |
| Average Output Power <sup>*note4</sup> | P <sub>out, AVG</sub> | -5   |               | 0    | dBm  |

|                                    |         |                  |      |     |                      |       |
|------------------------------------|---------|------------------|------|-----|----------------------|-------|
| Extinction Ratio                   |         | ER               | 3.5  |     |                      | dB    |
| Side Mode Suppression Ratio        |         | SMSR             | 30   |     |                      | dB    |
| Transmitter and Dispersion Penalty |         | TDP              |      |     | 2                    | dB    |
| Average Power of OFF Transmitter   |         |                  |      |     | -30                  | dBm   |
| Relative Intensity Noise           |         | RIN              |      |     | -128                 | dB/Hz |
| Input Differential Impedance       |         | Z <sub>IN</sub>  | 90   | 100 | 110                  | Ω     |
| TX Disable                         | Disable |                  | 2.0  |     | V <sub>CC</sub> +0.3 | V     |
|                                    | Enable  |                  | 0    |     | 0.8                  | V     |
| TX Fault                           | Fault   |                  | 2.0  |     | V <sub>CC</sub> +0.3 | V     |
|                                    | Normal  |                  | 0    |     | 0.8                  | V     |
| TX Disable Assert Time             |         | t <sub>off</sub> |      |     | 10                   | us    |
| <b>Receiver</b>                    |         |                  |      |     |                      |       |
| Centre Wavelength                  |         | λ <sub>C</sub>   | 1260 |     | 1280                 | nm    |
| Sensitivity <sup>*note5</sup>      |         | PIN              |      |     | -14                  | dBm   |
| Receiver Overload                  |         | P <sub>MAX</sub> | 0.5  |     |                      | dBm   |
| Output Differential Impedance      |         | P <sub>IN</sub>  | 90   | 100 | 110                  | Ω     |
| LOS De-Assert                      |         | LOS <sub>D</sub> |      |     | -18                  | dBm   |
| LOS Assert                         |         | LOS <sub>A</sub> | -30  |     |                      | dBm   |
| LOS                                | High    |                  | 2.0  |     | V <sub>CC</sub> +0.3 | V     |
|                                    | Low     |                  | 0    |     | 0.8                  | V     |

\*Note4: Output is coupled into a 9/125um SMF.

\*Note5: Measured with worst ER, BER less than 1E-12 and PRBS 2<sup>31</sup>-1 at 10.3125Gbps.

### 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 Ω 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 – 10KΩ resistor. Pull up voltage between 2.0V and VccT, 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 100Ω differential lines which should be terminated with 100Ω (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.

Mechanical Specifications

