# OptiCin

# Особенности:

- Industrial: -40℃ ~ +85℃
- EML лазер и APD фотоприемник
- до 80км на одномодовом кабеле
- возможность горячей замены
- двойной LC разъем
- встроенная функция диагностики DDMI
- соответствие спецификации MSA для SFP+ SFF-8431, SFF-8472

### Области применения:

- 10GBASE-ZR 10G Ethernet, STM-64/16

#### Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	С°С
Supply Voltage	V <sub>cc</sub>	-0.5	3.6	V

### **Recommended Operating Conditions**

je se						
Parameter		Symbol	Min.	Typical	Max.	Unit
Operating Case	T <sub>A</sub> SFP-Plus-ZR.80-I		-40		+85	С°
Temperature						
Power Supply Voltage	V <sub>cc</sub>		3.15	3.3	3.45	V
Power Supply Current	I <sub>CC</sub>				725	mA
Surge Current	I <sub>Surge</sub>				+30	mA
Baud Rate				9.953/		GBaud
				10 3125		

# **PERFORMANCE SPECIFICATIONS - ELECTRICAL**

Parameter	Symbol	Min.	Тур.	Max	Unit	Notes		
	TRANSMITTER							
CML Inputs(Differential )	Vin	150		1200	mVp	AC coupled inputs		
Input Impedance (Differential)	Zin	85	100	115	ohms	Rin > 100 kohms @ DC		
Tx_DISABLE Input Voltage - High		2		Vcc+0.3	V			
Tx_DISABLE Input Voltage - Low		0		0.8	V			
Tx_FAULT Output Voltage High		2		Vcc+0.3	V	lo = 400µA; Host Vcc		





Voltage LowRECEIVERCML Outputs (Differential)Vout350700mVppAC coupled outputCutput Impedance (Differential)Zout85100115ohmsRx_LOS Output Voltage - High2Vcc+0.3VIo = 400µA; Host VccRx_LOS Output Voltage - Low00.8VIo = -4.0mAMOD_DEF (0:2)Volt00.5VVith Serial IDMOD_DEF (0:2)Volt00.5VVith Serial IDOptical and Electrical Characteristics80kmMmData Rate9.953/ 10.3125GbpsGbpsCentre Wavelength AccAcc152815501565Spectral Width (-20dB) $\sigma$ -1+44Abr Extinction RatioER3.5dBTransmitter and Dispersion Penalty Tope700000.8Relative Intensity Noise Insel RIN-128dB/HzInput Differential ImpedanceZm90100110TX_EableDisable2.0<	Tx_FAULT Output		0			0.5	V	lo = -4	0mA
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$\begin{tabular}{ c c c c c c } \hline Output & Zout & 85 & 100 & 115 & ohms & & & & & & & & & & & & & & & & & & &$	CML Outputs	Vout	350			700	mVpp	AC co	upled
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$\begin{tabular}{ c c c c c c c }  c c c c c c c c c c c $		Zout	85	100		115	ohms		
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Voltage - HighVoltageVolta	· · · · · · · · · · · · · · · · · · ·		0					1 400	A 11 1
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Voltage - LowVolOOOMOD_DEF (0:2)VoH2.5VWith Serial IDOptical and Electrical CharacteristicsParameterSymbolMin.TypicalMax.Unit9µm Core Diameter SMF80KmData Rate9.953/ 10.3125GbpsTransmitterCentre Wavelength $\lambda_c$ 152815501565nmSpectral Width (-20dB) $\sigma$ 1nmAverage Output Power $P_{out}$ -1+44dBmExtinction RatioER3.5dBTransmitter and Dispersion PenaltyTDP2dBAverage Power of OFF Transmitter-300dBmSide Mode Suppression RatioSMSR30dBRelative Intensity NoiseRIN-128dB/HzInput Differential Impedance $Z_{IN}$ 90100110 $TX_Disable Assert Time$ t. off10usTX_FaultFault2.0Vcc+0.3VCentre Wavelength $\Lambda_c$ 12601600nmReceiver SensitivityPIN-24dBmOutput Differential Impedance $P_{MX}$ -8dBmLOS De-AssertLOS_b-36dBmLOS MerkerSide-24dBmOutput Differential Impedance $P_{MX}$ -8dBmLOS MerkerLOS_A-36dBmLOS MerkerLOS_A-36dBm			0			0.8			
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$\begin{tabular}{ c c c c c c c } \hline Parameter & Symbol Min. Typical Max. Unit \\ 9 \mbox{µm Core Diameter SMF} & 80 & km \\ \hline 9 \mbox{µm Core Diameter SMF} & 9.953/ \\ Data Rate & 9.953/ \\ 10.3125 & 0 & 0 \\ \hline 0.3125 & 0 & 0 \\ \hline 0 & 0.8 & 0 \\ \hline 0 & 0 & 0.8 \\ \hline 0 & 0 & 0 & 0.8 \\ \hline 0 & 0 & 0 & 0.8 \\ \hline 0 & 0 & 0 & 0 \\ \hline 0 $	Optical and Electric		-						
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$\begin{tabular}{ c c c c c c } \hline Transmitter \\ \hline Centre Wavelength & $\lambda_{\rm C}$ 1528 1550 1565 nm \\ Spectral Width (-20dB) & $\sigma$ & 1 nm \\ \hline Spectral Width (-20dB) & $\sigma$ & 1 nm \\ \hline Average Output Power & $P_{0ut}$ & $-1$ & $+4$ dBm \\ \hline Extinction Ratio & ER & $3.5$ & dB \\ \hline Transmitter and Dispersion Penalty & TDP & $2$ dB \\ \hline Average Power of OFF Transmitter & $-30$ dBm \\ \hline Side Mode Suppression Ratio & SMSR & $30$ & $dB$ \\ \hline Relative Intensity Noise & RIN & $-128$ dB/Hz \\ \hline Input Differential Impedance & $Z_{\rm IN}$ & $90$ 100 110 $\Omega$ \\ \hline TX Disable & $Disable$ & $2.0$ $Vcc+0.3$ $V$ \\ \hline Enable & $0$ 0.8$ \\ \hline TX_Fault & $Fault$ & $2.0$ $Vcc+0.3$ $V$ \\ \hline Normal & $0$ 0.8$ \\ \hline TX_Disable Assert Time & $t\_off$ & $10$ us \\ \hline Receiver \\ \hline Centre Wavelength $$\lambda_{\rm C}$ $1260$ $1600$ nm \\ \hline Receiver Sensitivity $$PIN$ $$-$24$ dBm \\ \hline Output Differential Impedance $$P_{\rm IN}$ $90$ 100 110 $\Omega$ \\ \hline Receiver Overload $$P_{\rm MAX}$ $$-$8$ $dBm \\ \hline LOS De-Assert $LOS_{\rm A}$ $-$36$ $dBm \\ \hline LOS $$High $$Z.0$ $V_{\rm Cc}$+0.3$ $V$ \\ \hline \end{tabular}$	Data	Rate							Gbps
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$\begin{array}{ c c c c c } \hline Spectral Width (-20dB) & \sigma & 1 & 1 & nm \\ \hline Average Output Power & P_{0ut} & -1 & +4 & dBm \\ \hline Average Output Power & ER & 3.5 & dB \\ \hline Transmitter and Dispersion Penalty & TDP & 2 & dB \\ \hline Average Power of OFF Transmitter & & -30 & dBm \\ \hline Average Power of OFF Transmitter & & -30 & dBm \\ \hline Average Power of OFF Transmitter & & -30 & dBm \\ \hline Side Mode Suppression Ratio & SMSR & 30 & -128 & dB/Hz \\ \hline Average Power of OFF Transmitter & & -128 & dB/Hz \\ \hline Average Power of OFF Transmitter & & 90 & 100 & 110 & \Omega \\ \hline Relative Intensity Noise & RIN & -128 & dB/Hz \\ \hline Input Differential Impedance & Z_{IN} & 90 & 100 & 110 & \Omega \\ \hline TX_Disable & Disable & 2.0 & Vcc+0.3 \\ \hline TX_Fault & Fault & 2.0 & Vcc+0.3 \\ \hline Normal & 0 & 0.8 \\ \hline TX_Disable Assert Time & t_off & 10 & us \\ \hline TX_Disable Assert Time & t_off & 100 & us \\ \hline Centre Wavelength & $\lambda_{C}$ & 1260 & 1600 & nm \\ \hline Receiver Sensitivity & PIN & -24 & dBm \\ \hline Output Differential Impedance & P_{IN} & 90 & 100 & 110 & \Omega \\ \hline Receiver Overload & P_{MAX} & -8 & dBm \\ \hline LOS De-Assert & LOS_D & -24 & dBm \\ \hline LOS Assert & LOS_A & -36 & -24 & dBm \\ \hline LOS & High & 2.0 & V_{cc}+0.3 & V \\ \hline \end{array}$			IT	1	ter	4500	4550	4505	
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$\begin{array}{c c c c c c c c } \hline Average Power of OFF Transmitter & & & & -30 & dBm \\ \hline Side Mode Suppression Ratio & SMSR & 30 & & & dB \\ \hline Relative Intensity Noise & RIN & & -128 & dB/Hz \\ \hline Input Differential Impedance & Z_{IN} & 90 & 100 & 110 & \Omega \\ \hline TX Disable & Disable & & 2.0 & Vcc+0.3 & V \\ \hline Enable & & 0 & 0.8 & & & & & \\ \hline TX_Fault & Fault & Fault & 2.0 & V_{cc}+0.3 & V \\ \hline Normal & & 0 & 0.8 & & & & \\ \hline TX_Disable Assert Time & t_off & & 10 & us \\ \hline Centre Wavelength & \lambda_c & 1260 & 1600 & nm \\ \hline Receiver Sensitivity & PIN & & -24 & dBm \\ \hline Output Differential Impedance & P_{IN} & 90 & 100 & 110 & \Omega \\ \hline Receiver Overload & P_{MAX} & -8 & & & & & \\ \hline LOS De-Assert & LOS_A & -36 & & & & & & \\ \hline LOS & High & 2.0 & V_{cc}+0.3 & V \\ \hline \end{array}$						3.5			
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LOS De-Assert LOS <sub>D</sub> -24 dBm   LOS Assert LOS <sub>A</sub> -36 dBm   LOS High 2.0 V <sub>cc</sub> +0.3 V							100		
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# **Pin Function Definitions**

Pin	Name	FUNCTION Plug Notes				
Num.	Hume	I ONOTION	Tug	Notes		
1	VeeT	Transmitter	1			
	VCCT	Ground				
2	TX Fault	Transmitter Fault	3	Note 1		
		Indication	0			
3	TX Disable	Transmitter	3	Note 2, Module disables on high or		
		Disable	Ū	open		
4	SDA	Module Definition	3	Note 3, Data line for Serial ID.		
		2	-			
5	SCL	Module Definition	3	Note 3, Clock line for Serial ID.		
	001	1	Ū			
6	MOD-ABS	Module Definition	3	Note 3		
		0				
7	RS0	RX Rate Select	3	This pin has an internal 30k pull		
		(LVTTL).		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	1	This pin has an internal 30k pull		
		(LVTTL).		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	3	Note 6		
		Data Out	-			
13	RD+	Received Data	3	Note 7		
		Out				
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	1	Note 5		
		Ground				
18	TD+	Transmit Data In	3	Note 8		
19	TD-	Inv. Transmit Data	3	Note 8		
		In				
20	VeeT	Transmitter	1	Note 5		
		Ground				

Notes:

### SFP+ модуль. Модель SFP-Plus-ZR.80-I



1) 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 2.0V 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  $4.7 - 10 \text{ K} \Omega$  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 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  $100\Omega$  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.

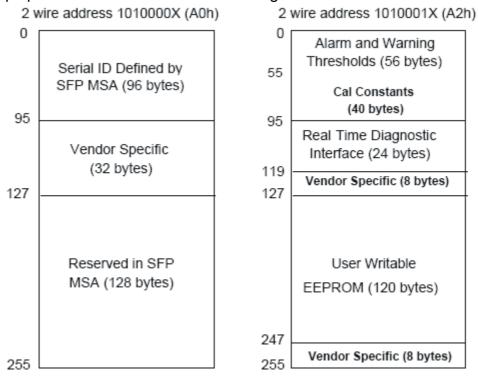
8) TD-/+: These are the differential transmitter inputs. They are AC-coupled, differential lines with 100 $\Omega$  differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board. The inputs will accept differential swings of 150 – 1200 mV (75 – 600mV single-ended).



#### 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 bidirectional 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** 

# OptiCin

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