

# 10Gbps SFP+ Optical Transceiver, 10km Reach

## NM-289-S31

### 1. Applications

- 10GBASE-LR at 10.3125Gbps Ethernet
- 10GBASE-LW at 9.953Gbps Ethernet
- 10GE Storage, 8G Fiber Channel
- Other optical transmission systems



### 2. Features

- Data-rate of 10.3125Gbps operation
- 1310nm DFB laser and PIN photo detector
- Optical interface compliant to IEEE 802.3ae
- Compliant with SFP+ MSA and SFF-8472 with duplex LC receptacle
- Maximum link length of 10Km on 9/125um SMF
- All-metal housing for superior EMI performance
- +3.3V single power supply and Hot Pluggable
- Operating case temperature: 0 to +70°C
- Low power consumption

### 3. Description

NEM Engine's NM-289-S31 10Gb/s Enhanced Small Form Factor Pluggable SFP+ transceivers are designed for use in 10-Gigabit Ethernet links up to 10Km over Single Mode Fiber. They are compliant with SFF-8431, SFF-8432 and IEEE 802.3 aq 10GBASE-LRM. Digital diagnostics functions are available via a 2-wire serial interface, as specified in SFF-8472.

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## 4. standard

- Compliant with SFF-8431 and SFF-8432
- Compliant with SFF-8472 Rev 10.2
- Compliant with IEEE 802.3ae 10GBASE-LR and 10GBASE-LW
- RoHS Compliant

## 5. Performance Specifications

### 5.1. Absolute Maximum Ratings

These values represent the damage threshold of the module. Stress in excess of any of the individual Absolute Maximum Ratings can cause immediate catastrophic damage to the module even if all other parameters are within Recommended Operating Conditions.

*Table.1 Absolute maximum ratings*

Parameter	Symbol	Min	Max	Unit
Maximum Supply Voltage	Vcc	0	3.6	V
Storage Temperature	Ts	0	70	°C
RX Input Average Power	Pmax		0	dBm
Relative Humidity	RH	5	95	%

### 5.2. Recommended Operating Conditions

*Table.2 Recommended Operating Conditions*

Parameter	Symbol	Min	Typical	Max	Unit
Operating Case Temperature	Standard Tc	0	25	70	°C
Power Supply Voltage	Vcc	3.13	3.3	3.47	V
Power Supply Current	Icc			260	mA
Power Dissipation	PD		600	800	mW
Data Rate	DR		10.3125		Gbps
Transmission Distance	TD		10		km

### 5.3. Transmitter Specification

*Table.3 Transmitter Specification (Optical)*

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Average Output Power	Po	-8.2		0.5	dBm	
Laser OMA output power	POMA	-4.3			dBm	
Disable Power	Poff			-40	dBm	
Extinction Ratio	ER	3.5			dB	
Output Centre Wavelength	$\lambda_c$	1260	1310	1355	nm	
Side-Mode Suppression Ratio	SMSR	30			dB	
Spectral Width (-20dB)	$\Delta\lambda$			1	nm	
Optical Rise/Fall Time (20%~80%)	tr/tf	0.03			ns	
Transmitter Dispersion Penalty	TDP			3.2	dB	1
Generation Jitter (20KHZ-80MHZ)	GJ			0.3	Ulp-p	
Optical Return Loss	ORL			-12	dB	
Optical Eye Mask	MM	Compliant to IEEE802.3ae				1
Data Dependent Input Jitter	DDJ			0.1	UI	
Data Input Total Jitter	TJ			0.28	UI	

Note: 1. Measured at 10.3Gbps, PRBS2^31-1, NRZ

*Table.4 Transmitter Specification (Electrical)*

Parameter	Symbol	Min	Typical	Max	Unit
Data Input Swing Differential	$V_{IN}$	90		350	mV
common mode voltage tolerance		15			mV
Input Differential Impedance	$Z_{IN}$	90	100	110	$\Omega$
Transmit Disable Input	High	$V_{IH}$	2.0	$V_{cc}+0.3$	V
	Low	$V_{IL}$	0	0.8	V
Transmit Enable Output	High	$V_{OH}$	2.4	$V_{cc}+0.3$	V
	Low	$V_{OL}$	0	0.4	V

## 5.4. Receiver Specification

*Table.5 Receiver Specification (Optical)*

Parameter	Symbol	Min	Typical	Max	Unit	note
Centre Wavelength	$\lambda_c$	1270		1610	nm	
Receiver Sensitivity	Sen			-14	dBm	2
Receiver Overload	Psat	0.5			dBm	2
LOS De-Assert	LOSD			-12	dBm	
LOS Assert	LOSA	-30			dBm	
LOS Hysteresis		0.5		4	dB	
Stressed Sensitivity in OMA				-10.3	dBm	
Receiver Reflectance	Rrx			-12	dB	

Note :2. Measured at BER 10<sup>-12</sup>, 10.3Gbps, PRBS2<sup>31</sup>-1, NRZ

*Table.6 Receiver Specification (Electrical)*

Parameter	Symbol	Min	Typical	Max	Unit	note
Data Output Swing Differential	Vout	300		850	mV	
Output Differential Impedance	Zon	90	100	110	$\Omega$	
LOS Output	High	VOH	2.4	V <sub>cc</sub> +0.3	V	
	Low	VOL	0	0.4	V	

## 5.5. Diagnostics Specification

*Table.7 Diagnostics Specification*

Parameter	Range	Unit	Accuracy	Calibration
Temperature	0 to 70	°C	±3°C	Internal / External
Voltage	3.0 to 3.6	V	±3%	Internal / External
Bias Current	0 to 100	mA	±10%	Internal / External
TX Power	-10 to 2	dBm	±3dB	Internal / External
RX Power	-22 to 2	dBm	±3dB	Internal / External

5.6. Pin Definitions

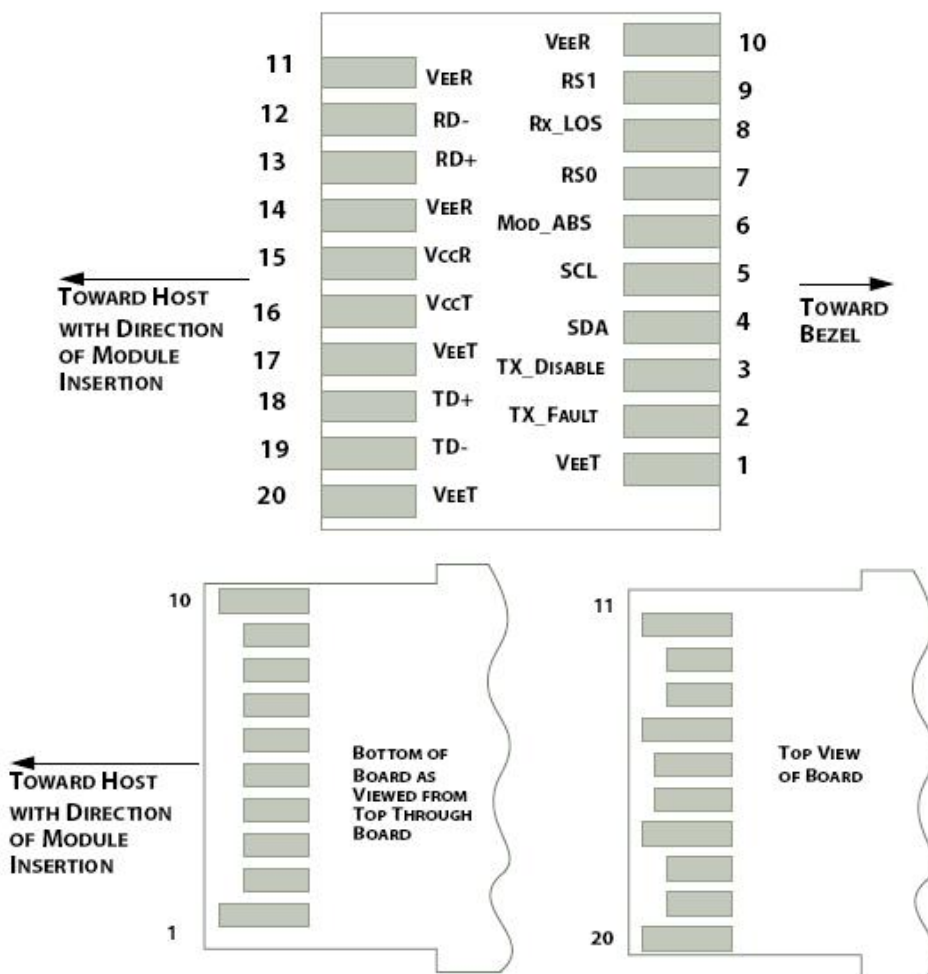


Table.8 Pin Definitions

PIN	Symbol	Description	Remarks
1	VEET	Transmitter ground (common with receiver ground)	Circuit ground is isolated from chassis ground
2	Tx_Fault	Transmitter Fault. Not supported	
3	Tx_Disable	Transmitter Disable. Laser output disable on high or open	Disabled: TDIS>2V or open Enabled: TDIS<0.8V
4	SDA	2-wire Serial Interface Data Line	Should Be pulled up with 4.7k – 10k ohm on host board to a voltage between 2V and 3.6V
5	SCL	2-wire Serial Interface Clock Line	
6	MOD_ABS	Module Absent. Grounded within the module.	
7	RS0	No connection required	
8	RX_LOS	Loss of Signal indication. Logic 0 indicates normal operation	LOS is open collector output
9	RS1	No connection required	
10	VEER	Receiver ground (common with transmitter ground)	Circuit ground is isolated from chassis ground

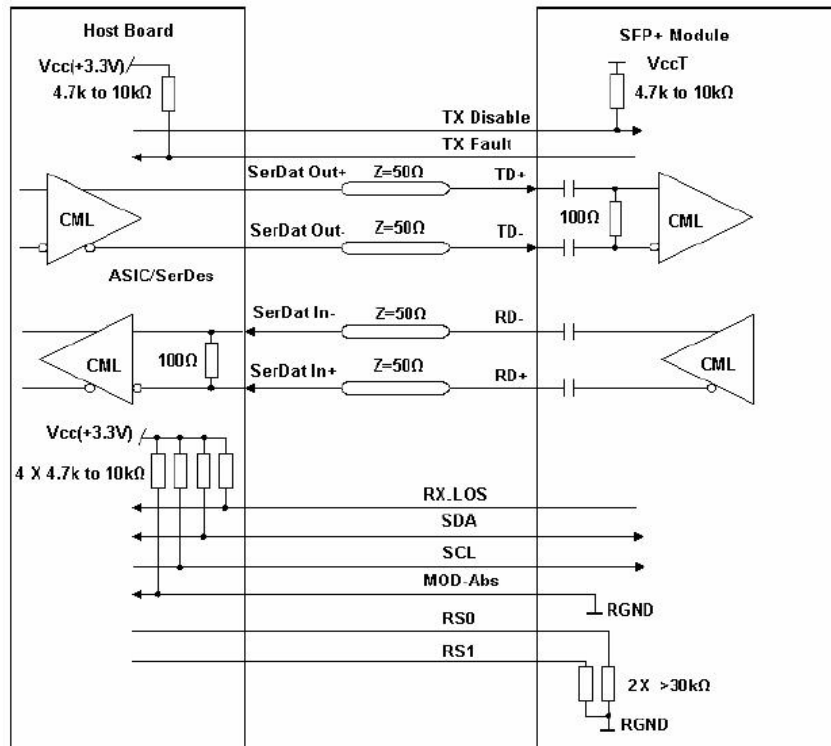
11	V <sub>EE</sub> R	Receiver ground (common with transmitter ground)	
12	RD-	Receiver Inverted DATA out. AC coupled	
13	RD+	Receiver Non-inverted DATA out. AC coupled	
14	V <sub>EE</sub> R	Receiver ground (common with transmitter ground)	Circuit ground is isolated from chassis ground
15	V <sub>CC</sub> R	Receiver power supply	
16	V <sub>CC</sub> T	Transmitter power supply	
17	V <sub>EE</sub> T	Transmitter ground (common with receiver ground)	Circuit ground is isolated from chassis ground
18	TD+	Transmitter Non-Inverted DATA in. AC coupled	
19	TD-	Transmitter Inverted DATA in. AC coupled	
20	V <sub>EE</sub> T	Transmitter ground (common with receiver ground)	Circuit ground is isolated from chassis ground

## 5.7. Timing Electrical Interface

*Table.9 Timing Electrical Interface*

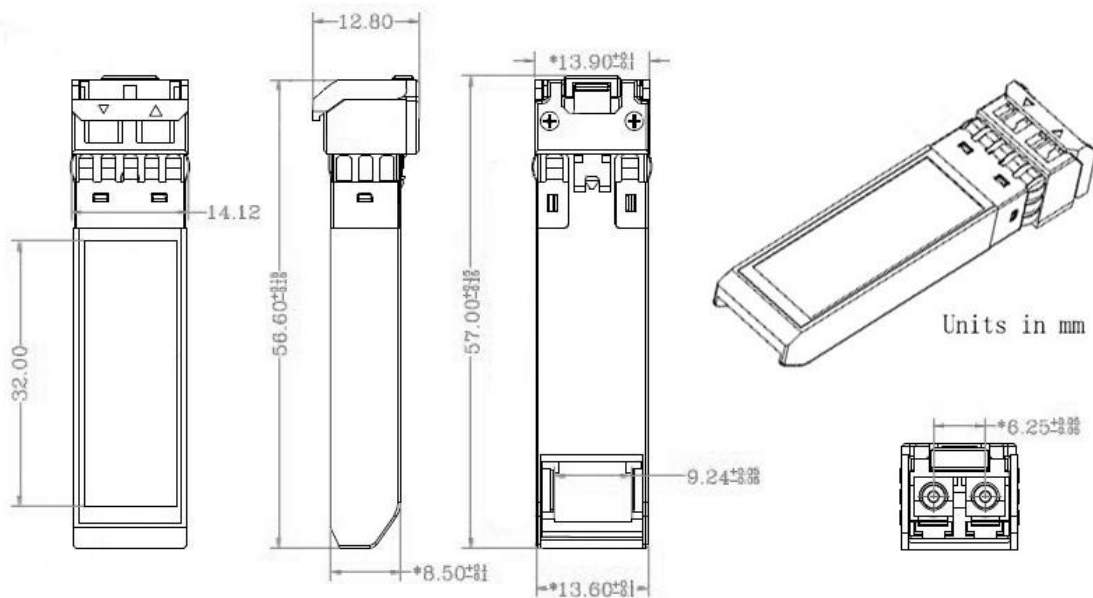
Parameter	Symbol	Min	Max	Units	Conditions
Tx_Disable Assert Time	t <sub>off</sub>		100	us	Rising edge of Tx_Disable to fall of output signal below 10% of nominal
Tx_Disable Negate Time	t <sub>on</sub>		2	ms	Tx_Disable negate time. Falling edge of Tx_Disable to rise of output signal above 90% of nominal. This only applies in normal operation, not during start up or fault recovery.
Time to initialize	t <sub>start_up</sub>		300	ms	From power supplies or hot plug or Tx disable negated during power up, or Tx_Fault recovery, until non-cooled power level I is fully operational.
Tx_Fault Assert Time	Tx_Fault		1	ms	From occurrence of fault to assertion of Tx_Fault
Tx_Fault to Reset	t <sub>reset</sub>	10		us	Time Tx_Disable must be held high to reset Tx_Fault
Rx_LOS Assert Time	t <sub>los_on</sub>		100	us	From occurrence of loss of signal to assertion of Rx_LOS
Rx_LOS De-Assert Time	t <sub>los_off</sub>		100	us	From occurrence of presence of signal to negation of Rx_LOS

**5.8. SFP+ Host Board Schematic**



**Diagram of SFP+ Host Board Schematic**

**5.9. Mechanical Dimensions**



**Diagram of Mechanical Dimensions**

## 6. Application Cautions

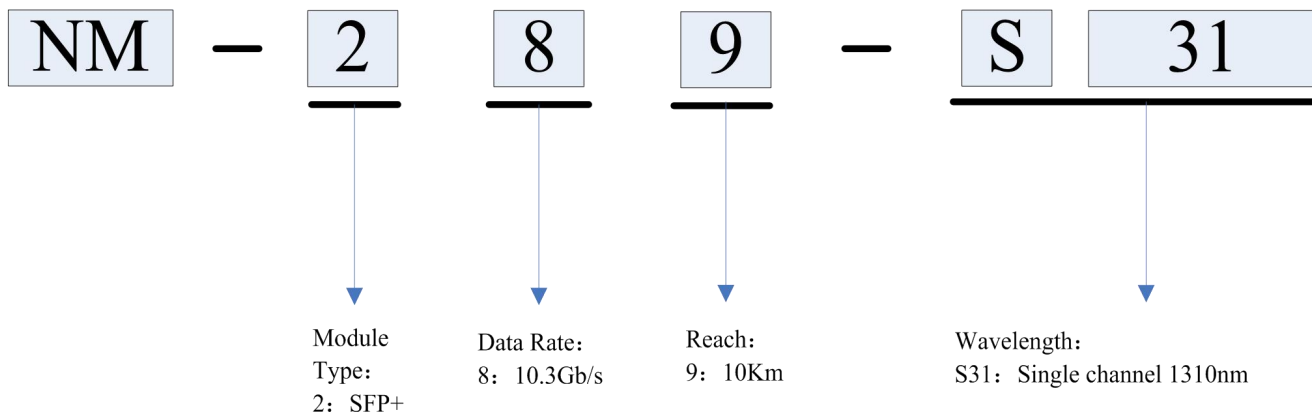
### 6.1. ESD

This transceiver is specified as ESD threshold 1kV for high speed pins and 2kV for all other electrical input pins, tested per MIL-STD-883, Method 3015.4 /JESD22-A114-A (HBM). However, normal ESD precautions are still required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.

### 6.2. LASER SAFTY

This is a Class 1 Laser Product according to IEC 60825-1:1993:+A1:1997+A2:2001. This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated (July 26, 2001)

## 7. Order Information



## Further Information

For further information, please contact NEME.

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