

# Intel® TXN31011 Tri-rate LC SFF Optical Transceiver

#### **Datasheet**

The LC Small Form Factor (SFF) optical transceivers are high performance modules for bidirectional communication over multi-mode optical fiber. The Intel® TXN31011 Tri-rate LC SFF Optical Transceiver (hereafter called the TXN31011 Optical Transceiver) is specifically designed for high-speed multi-rate operation. The TXN31011 Optical Transceiver is provided with an LC receptacle that is compatible with the industry standard LC connector. The TXN31011 Optical Transceiver, with a single 3.3 V supply, provides double port densities by enabling twice the number of transceivers to fit onto the same board as compared to a 1x9 transceiver. The TXN31011 Optical Transceiver is Class 1 Laser Product compliant with FDA Radiation Performance Standards, 21 CFR Subchapter J.

### **Product Features**

- Compliant with 1x and 2x Fibre Channel (1.0625/2.125 Gbps) FC-PI standard
- Compliant with 1.25 Gbps Gigabit Ethernet standard
- Compliant with 2.5 Gbps Infiniband standard
- Compliant with SFF MSA specification
- 850 nm VCSEL emitter

- TTL Signal Detect Output termination
- Transmitter Disable Input
- AC-coupled CML level Input/Output
- Single +3.3 V Power Supply
- Class 1 Laser Product
- UL 60950 Approved

## **Applications**

- Fibre Channel Host Bus Adapters
- iSCSI Host Bus Adapters
- Ethernet Network Interface Cards

Order Number: 280050, Revision: 003 07 Feb 2005

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## **Revision History**

Date	Revision	Description
07 Feb 2005	003	Modified Table 3 "Electrical Characteristics" on page 5: added Power Dissipation values.
		Updated the Transceiver Electrical Characteristics Table by removing Inrush Current dataTable 3 "Electrical Characteristics" on page 5
		Updated the CML Maximum Values: Table 4 "Transmitter - Electrical" on page 6
		Single Ended, was 1100
		Differential, was 2200
		Updated the CML Maximum Values: Table 5 "Receiver - Electrical" on page 6
		Single Ended, was 600
		Differential, was 1200
		Output rise/fall time, was 140
		CML Minimum Values:
		Single Ended, was 300
		Differential, was 600
40.40004	4 002	Total Jitter (pk-pk):
19 Aug 2004		Typical, was <65
		Max, was 130
		Adjusted Note, was 500 Waveforms
		Updated the Transmitter - Optical Table: Table 7 "Transmitter - Optical" on page 7
		Note was Average Launch Power
		Total Jitter:
		Typical, was <65
		Max, was 130
		Note was 500 Waveforms
		Updated the Receiver - Optical Table: Table 7 "Transmitter - Optical" on page 7
		Reversed values for Typical
		Removed Jitter Row
		Removed extraneous information from CML Termination Section 3.1, "CML Termination" on page 9
20 Jul 2004	001	Initial release.



## 1.0 Specifications

#### **Table 1. Absolute Maximum Ratings**

Parameter	Symbol	Min.	Max.	Unit	Notes
Storage Temperature	T <sub>S</sub>	-40	85	°C	-
Relative Humidity	R <sub>H</sub>	5	95	%	-
Soldering Temperature	_	_	260	°C	10 seconds on leads only
Module Supply Voltage	V <sub>CC</sub> T, R	-0.5	4	V	-
Data AC Voltage	TD+, TD-	_	2.6	V <sub>PP</sub>	Differential
Control Input Voltage	V <sub>I</sub>	-0.5	V <sub>CC</sub> + 0.3	V	-

#### **Table 2. Recommended Operating Conditions**

Parameter	Symbol	Min.	Тур.	Max.	Unit
Case Temperature	T <sub>C</sub>	-10	_	70	°C
Module Supply Voltage	V <sub>CC</sub> T, R	2.97	3.3	3.63	VDC
Data Rate	-	1.0625	1	2.5	Gb/s

#### **Table 3. Electrical Characteristics**

Parameter	Symbol	Min.	Тур.	Max.	Units	Notes
	I <sub>CC</sub>	_	150	180	mA	Tc = 25 °C, $V_{CC}$ = 3.3 V
Supply Current	I <sub>CC</sub>	1	1	200	mA	0° C < T <sub>C</sub> < 70° C, 2.97 V < Vcc < 3.63 V
Power Dissipation	Pdiss	1	450	726	mW	0° C < TC < 70° C, 2.97 V < Vcc < 3.63 V
Supply Noise Rejection	_	100	1	1	mV	10 kHz to 4 MHz with supply filter
Time from de-assertion of TX_OFF	_	-	-	500	μs	Stable laser power at >90% average output power
Time from optical input assertion to Signal Detect asserted	_	_	_	100	μs	-
Time from optical input assertion to stable Rx output	_	_	_	50	μs	-



## 1.1 Specifications - Electrical

0C < Tc < 70C, 2.97 V < Vcc < 3.63 V

#### Table 4. Transmitter - Electrical

Parameter	Symbol	Min.	Тур.	Max.	Units	Notes
CML Input (Single Ended)	_	200	_	1000	mVpp	AC Coupled Input
CML Input (Differential)	_	400	_	2000	mVpp	AC Coupled Input
Input Impedance (differential)	Z <sub>IN</sub>	85	100	115	Ω	-
TX_DISABLE input voltage - High	V <sub>IH</sub>	2	-	Vcc + 0.3	V	-
TX_DISABLE input voltage - Low	V <sub>IL</sub>	0	-	0.8	V	-

#### Table 5. Receiver - Electrical

Parameter	Symbol	Min.	Тур.	Max.	Units	Notes
CML Output (Single Ended)	-	275	350	450	mVpp	AC Coupled Output, 50 Ω load
CML Output (Differential)	_	550	700	900	mVpp	AC Coupled Output
CML Output (Rise/Fall Time)	-	1	110	150	ps	-
Output Impedance (Differential)	Zout	110	120	130	Ω	-
Total Jitter (pk-pk)	TJ	_	_	65	Ps	See Note
TTL Signal Detect Output - Low	SDoutL	0	_	0.8	V	IOL = -1.2 mA, internal 8 k $\Omega$ load to V <sub>cc</sub>
TTL Signal Detect Output - High	SDoutH	2.0	-	Vcc + 0.3	V	ΙΟ = 30 μΑ

**NOTE:** Peak-to-peak jitter measured by Agilent\* DCA with 2.7 GHz plug-in. 2<sup>7</sup>-1 PRBS pattern. 100 waveforms at -12 dBm optical input power.

#### Table 6. Fiber Length

Parameter	Symbol	Min	Typ.	Max.	Units	Notes
50 μm/125 μm MMF	-	300 550	500 1000	-	m	BER < 1.0E -12 @ 2.125 Gbps BER < 1.0E -12 @ 1.0625 Gbps
62.5 μm/125 μm MMF	_	200 300	300 500	-	m	BER < 1.0E -12 @ 2.125 Gbps BER < 1.0E -12 @ 1.0625 Gbps



**Table 7. Transmitter - Optical** 

Parameter	Symbol	Min.	Тур.	Max.	Units	Notes
Optical Transmit Power	Popt	-8	-5	-4	dBm	Average Launch Power, Beginning of Life -4 to -6 dBm
Optical Center	I	830	850	860	nm	-
Spectral Width	Δλ	_	_	0.85	nm	RMS
Optical Modulation Amplitude	OMA	250	-	-	μW	pk-pk
Extinction Ratio	ER	9	_	_	dB	-
Relative Intensity Noise	RIN	_	_	-118	dB/Hz	-
Total Jitter	TJ	-	-	65	ps	pk-pk jitter measured by Agilent DCA. 100 Waveforms 2 <sup>7</sup> - 1 PRBS
Output Rise/Fall Time	t <sub>R,</sub> t <sub>F</sub>	1	ı	150	ps	20 - 80% values, measured unfiltered

#### Table 8. Receiver - Optical

Parameter	Symbol	Min.	Тур.	Max.	Units	Notes
Optical Input Wavelength	1	770		860	nm	_
		-19	-22			1.0625Gb/s
	_	-17	-20			2.125Gb/s
Receiver Sensitivity	Pr			_	dBm	Test condition: 10 <sup>-12</sup> BER, 9dB ER input, 2 <sup>7</sup> - 1 PRBS.
Receiver Overload	_	0	_	_	dBm	-
Optical Return Loss	ORL	12	30	_	dB	-
Signal Detect - Asserted	Pa	_	_	-17	dB	Measured on transition - low to high
Signal Detect - De-asserted	Pd	-29	_	_	dBm	Measured on transition - high to low
Signal Detect - Hysteresis	Pa - Pd	1	-	5	dB	_

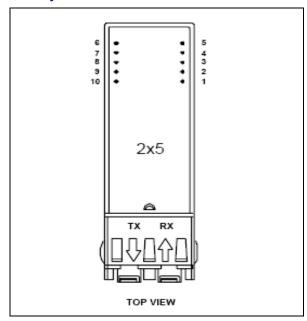


## 2.0 Electrical Interface

Table 9. Pin Assignment

Pin No.	Description	Interface Type
1	Receiver Ground	Signal ground
2	Receiver +3.3 V Power	Power
3	Signal Detect	TTL output
4	Receiver Data Inverted	CML output
5	Receiver Data	CML output
6	Transmitter +3.3 V Power	Power
7	Transmitter Ground	Signal ground
8	Transmit Disable	TTL input
9	Transmit Data	CML input
10	Transmit Data Inverted	CML input

Figure 1. Pin Layout





## 3.0 Termination

The TXN31011 Optical Transceiver has the following two types of I/O interfaces:

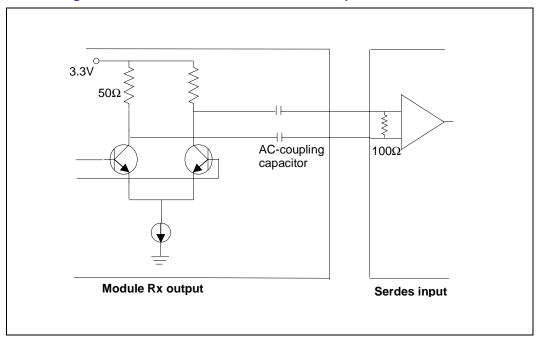
- CML Interface
- TTL Interface

The high speed I/Os use the CML interface, while the control signals use the TTL interface. Proper termination is critical to ensure good signal integrity. Without the proper termination (particularly on the CML I/Os), jitter increases significantly due to reflection from the impedance mismatches.

#### 3.1 CML Termination

AC-coupling capacitors are built into the TXN31011 Optical Transceiver.

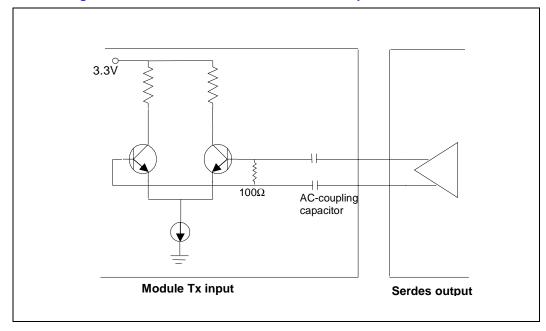
Figure 2. Circuit Diagram for CML Termination on Receiver Output



Most of the SerDes comes with the internal termination resistor. Please check the SerDes specification sheet for proper external termination.



Figure 3. Circuit Diagram for CML Termination on Transmitter Input



The TXN31011 Optical Transceiver Tx input has an internal  $100~\Omega$  termination between two inputs. AC-coupling capacitors are also built into the TXN31011 Optical Transceiver.

*Note:* Make sure the SerDes output has the proper termination. If not, follow the suggestion of the SerDes Datasheet for proper external termination.



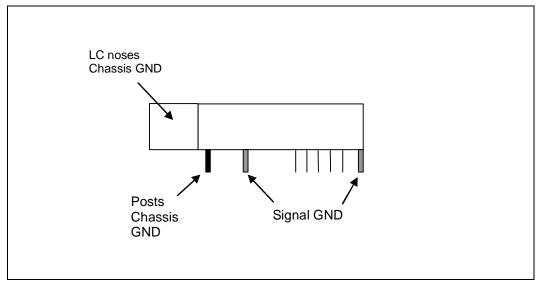
## 4.0 EMI and Grounding Scheme

Proper grounding is critical to ensure good EMI performance. There are two types of ground on the TXN31011 Optical Transceiver housing as follows (see Figure 4):

- · Chassis ground
- · Signal ground

The LC nose and the front posts form the chassis ground. This ground is used to connect to the Bezel/Chassis. In addition, there are four taps on the body of the TXN31011 Optical Transceiver, and these taps are used to connect the signal ground. Separating the signal ground from the chassis ground allows the chassis to take the static discharge. If both grounds are connected together, the static charge can move directly to the signal ground. This sometimes affects proper operation of ICs on the motherboard. The signal ground on the TXN31011 Optical Transceiver housing is connected to the ground plane of PCB inside the TXN31011 Optical Transceiver.

#### Figure 4. Proper Grounding

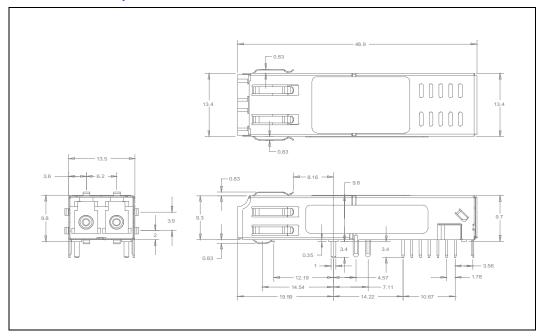




## 5.0 Mechanical Specification

Figure 5 illustrates the TXN31011 Optical Transceiver mechanical specifications. Dimensions comply with the SFF Multi-Source Agreement (MSA). All dimensions are in millimeters.

#### Figure 5. SFF Mechanical Specifications





## 6.0 Regulatory Compliance

The TXN31011 Optical Transceiver meets the relevant regulations described in Table 10.

#### **Table 10. Regulatory Compliance**

Regulatory Requirement	Applicable Standards	Performance
Electrostatic Discharge (ESD)	EN 61000-4-2 (Human Body Model)	Discharge to the pins: ± 500 V 15 kV air discharge and 8 kV contact discharge to the faceplate
Radio Frequency Immunity (RFI)	EN 61000-4-3	10 V/m from 10 kHz to 10 GHz
Electromagnetic Interference (EMI)	FCC Class B EN 55022 Class B	6 dB margin

## 7.0 Safety

The TXN31011 Optical Transceiver meets the fire resistance requirements of Telcordia\* GR-63 Section 4.2. The device also complies with FDA 21, CFR 1040.10 and 1040.11, and IEC 825-1.

## 8.0 Ordering Information

When ordering, please specify the complete TXN31011 Optical Transceiver part number as defined in Table 11.

#### **Table 11. Ordering Information**

Part Number	Description
Intel® TXN310110000xxx <sup>1</sup>	Tri-rate 2/1 GFC, 1 GE 850 nm SFF optical transceiver
The last 3 characters of the part number ("xxx") are used to designate customer-specific customizations.  The Intel standard part has "000" as the last three characters.	