Intel® TXN31111

Tri-rate 850 nm SFP Optical Transceivers

Datasheet

The LC Small Form Factor Pluggable (SFP) optical transceivers are high performance integrated modules for bi-directional communication over multimode optical fiber. This module is specifically designed for high-speed multi-rate operation. The Intel® TXN31111 transceiver is provided with the LC receptacle that is compatible with the industry standard LC connector. This optoelectronic transceiver module is Class 1 Laser Product compliant with FDA Radiation Performance Standards, 21 CFR Subchapter J and international standard IEC 825-1.

Applications

- Fibre Channel Switches
- Ethernet Stackable Switches
- Ethernet Enterprise Switches
- Fibre Channel Host Bus Adapters
- Ethernet Network Interface Cards
- iSCSI Host Bus Adapters

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 SFP MSA specification
- Hot pluggable
- 850 nm VCSEL emitter
- TTL Loss of Signal Output
- Transmitter Disable Input
- AC-coupled CML level Input/Output
- Single +3.3V Power Supply
- Class 1 Laser Product
- UL 60950

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Revision History

Revision 001 Revision Date: June 29, 2004	
Page #	**Description**
—	Initial Document Release

Revision 002 Revision Date: August 17, 2004	
Page #	**Description**
6	Updated the Transmitter Values for Max Field: • Single Ended, was 1100 • Differential, was 2200 • Output rise/fall time, was 115

6	Updated the Receiver Values:
	• Max.
	  • Total Jitter row was TBD
	• Min.
	  • Receiver Sensitivity was -22, -20
	  • LOS - Asserted was -30
	  • LOS - Hysteresis not defined
	• Typ.
	  • Receiver Sensitivity was -19, -17

1.0 Specifications

Table 1. Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	Notes
Operating Temperature	T_O	-20	85	°C	Note 1
Storage Temperature	T_S	-40	85	°C	–
Relative Humidity	R_H	5	95	%	–
Module Supply Voltage	$V_{CC}T$, R	-0.5	4	V	–
Data AC Voltage	TD+, TD-		2.6	V_{PP}	Differential
Control Input Voltage	V_I	-0.5	V_{CC} + 0.3	V	–
1. Performance and lifetime are not guaranteed at extremities.					

Table 2. Operating Condition Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit
Case Temperature	T_C	-10	–	70	°C
Module Supply Voltage	$V_{CC}T$, R	2.97	3.3	3.63	VDC
Data Rate	_	1.0625	–	2.5	Gb/s

1.1 Module Specifications – Electrical

Table 3. Power Supply Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units	Notes
Supply Current	I_{CC}	–	150	180	mA	T_C = 25 °C, V_{CC} = 3.3 V
	I_{CC}	–	–	200	mA	0° C < T_C < 70° C, 2.97 V < V_{CC} < 3.63 V
Supply Noise Rejection	–	100	–	–	mV	10 kHz to 4 MHz with supply filter
Inrush Current	–	–	–	30	mA	–
Time of De-Assertion of TX_OFF	–	–	–	500	µs	Stable Laser Power at >90% average output power
Time from Optical input assertion to Loss of Signal de-asserted	–	–	–	100	µs	–
Time from Optical input assertion to stable Rx output	–	–	–	50	µs	–

Table 4. Transmitter

Parameter	Symbol	Min.	Typ.	Max.	Units	Notes
CML Input (Single Ended)	–	200		1000	mVpp	AC Coupled Inputs
CML Input (Differential)	–	400		2000	mVpp	Peak to Peak Voltage
Input Impedance (differential)	Z_{IN}	85	100	115	Ω	–
TX_DISABLE input voltage - High	V_{IH}	2		V_{CC}+0.3	V	–
TX_DISABLE input voltage - Low	V_{IL}	0	–	0.8	V	–
TX_Fault Output Voltage - High	V_{OH}	2.0	–	V_{CC} + 0.3	V	I_{OH} = 40µA, 1 TTL Unit Load
TX_Fault Output Voltage - Low	V_{OL}	0	–	0.8	V	I_{OH} = -1.69 mA, 1 TTL Unit Load

Table 5. Receiver

Parameter	Symbol	Min.	Typ.	Max.	Units	Notes
CML Output (Single Ended)	–	275	350	600	mVpp	AC Couple Outlets
CML Output (Differential)	–	550	700	1200	mVpp	Peak to Peak Voltage
CML Output (Rise/Fall Time)	–			150	ps	20% - 80%
Output Impedance (Differential)	Z_{OUT}	85	100	115	Ω	–
TTL Signal Detect Output - Low	V_{IL}	0	–	0.8	V	I_{OH} = -1.69 mA, 1 TTL Unit Load
TTL Signal Detect Output - High	V_{OH}	2.0	–	V_{CC} + 0.3	V	I_{OL} = 40µA, 1 TTL Unit Load
MOD_DEF (0:2)	V_{OH}	2.5	–	V_{CC} + 0.3	V	With Serial ID
	V_{OL}	0	–	0.5	V	–
	NC	100 K	–	–	Ω	Measured to RGND/ TGND

1.2 Module Specifications – Optical

Table 6. Minimum Transmission Distance

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

Table 7. Transmitter

Parameter	Symbol	Min.	Typ.	Max.	Units	Notes
Optical Transmit Power	Popt	-8	-5	-4	dBm	–
Optical Center	l	830	850	860	nm	–
Spectral Width	△λ		–	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. 27 - 1 PRBS..
Output Rise/Fall Time	t_R, t_F	–	–	90	ps	20 - 80% values, measured unfiltered

Table 8. Receiver (Sheet 1 of 2)

Parameter	Symbol	Min.	Typ.	Max.	Units	Notes
Optical Input Wavelength	l	770		860	nm	–
Receiver Sensitivity	Pr	-19 -17	-22 -20	–	dBm	1.0625Gb/s 2.125Gb/s Test condition: 10^{-12} BER, 9dB ER input, 2^7 - 1 PRBS
Receiver Overload	–	0		–	dBm	–
Total Jitter	TJ			65	ps	pk-pk jitter measured by Agilent DCA. 100 waveforms measured at -12 dBm input signal.
Optical Return Loss	ORL	12	30	–	dB	–

Table 8. Receiver (Sheet 2 of 2)

Parameter	Symbol	Min.	Typ.	Max.	Units	Notes
LOS - Asserted	Pa	-29	–	–	dB	Measured on transition - low to high Signal Detect implemented; signal inverted
LOS - De-asserted	Pd	–	–	-17	dBm	Measured on transition - low to high Signal Detect implemented; signal inverted
LOS - Hysteresis	Pa - Pd	1	–	5	dB	–

2.0 Electrical Interface

Figure 1. Diagram of Host Board Connector Block Pin Numbers and Names

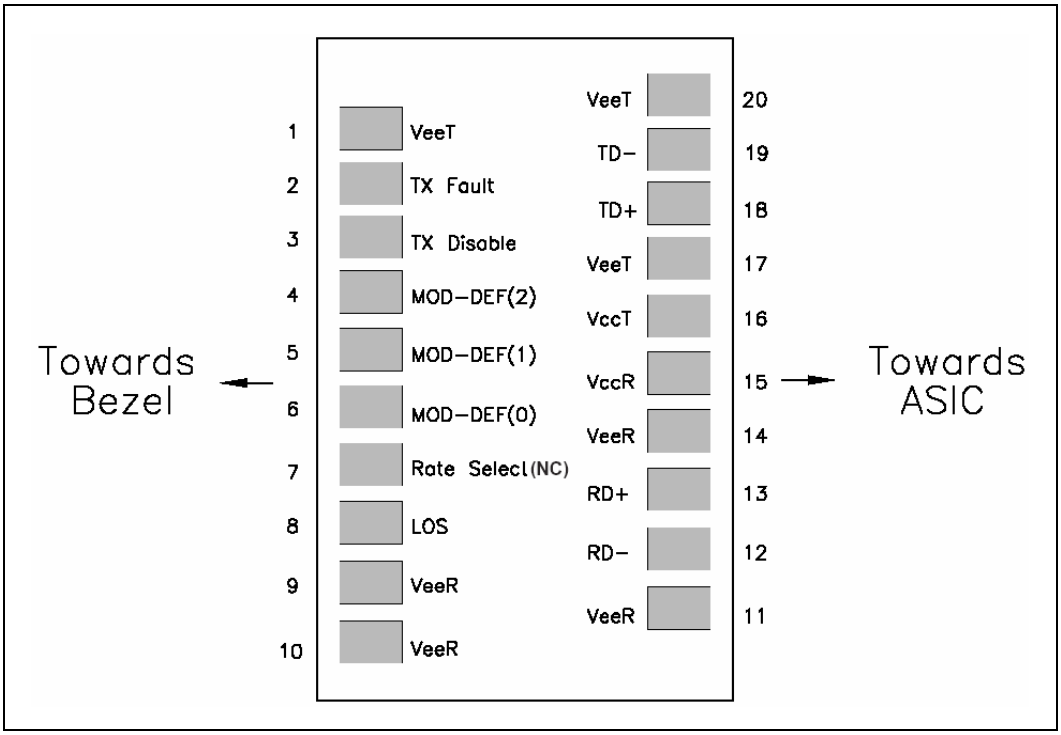


Table 9. Plug Sequence: Pin Engagement Sequence During Hot Plugging (Sheet 1 of 2)

PIN No.	Name	Function	Plug Seq.	Notes
Pin 1	$V_{ee}T$	Transmitter Ground	1	–
Pin 2	TX_FAULT	Transmitter Fault Indication	3	Note 1
Pin 3	TX_DISABLE	Transmitter Disable	3	Note 2: Module Disables on high or open
Pin 4	MOD_DEF (2)	Module Definition 2	3	Note 3: Wire Serial ID interface
Pin 5	MOD_DEF (1)	Module Definition 1	3	Note 3: Wire Serial ID interface
Pin 6	MOD_DEF (0)	Module Definition 0	3	Note 3: Grounded Module
Pin 7	RATE SELECT	–	3	Note 4
Pin 8	LOS	Loss of Signal	3	Note 5
Pin 9	$V_{ee}R$	Receiver Ground	1	Note 6
Pin 10	$V_{ee}R$	Receiver Ground	1	Note 6
Pin 11	$V_{ee}R$	Receiver Ground	1	Note 6
Pin 12	RD-	Inverted Received Data out	3	Note 7
Pin 13	RD+	Non-Inverted Received Data out	3	Note 7
Pin 14	$V_{ee}R$	Receiver Ground	1	Note 6
Pin 15	$V_{cc}R$	Receiver Power	2	3.3 V +/- 10%, Note 8
Pin 16	$V_{cc}T$	Transmitter Power	2	3.3 V +/- 10%, Note 8
Pin 17	$V_{ee}T$	Transmitter Ground	1	Note 6
Pin 18	TD+	Non-inverted Data In	3	Note 9
Pin 19	TD-	Inverted Data In	3	Note 9
Pin 20	$V_{ee}T$	Transmitter Ground	1	Note 6

Table 9. Plug Sequence: Pin Engagement Sequence During Hot Plugging (Sheet 2 of 2)

PIN No.	Name	Function	Plug Seq.	Notes

NOTES:

1. TX FAULT: is an open collector/drain output which should be pulled up with a 4.7K - 10K Ω resistor on Host board. Pull up voltage between 2.0V and $V_{cc}T$, 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 4.7K - 10K Ω resistor. The states are:
   - Low (0 - 0.8V): Transmitter ON
   - (>0.8, <2.0V): Undefined
   - High (2.0 - 3.465V): Transmitter Disabled
3. MOD-DEF 0,1,2: These are the module definition pins. They should be pulled up with 4.7K - 10K Ω resistor on the host board. Pull up voltage between 2.0V and $V_{cc}T$, R+0.3V.
   - MOD-DEF 0 is grounded by the module to indicate that the module is present
   - MOD-DEF 1 is the clock line of two wire serial interface for serial ID.
   - MOD-DEF 2 is the data line of two wire serial interface serial ID.
4. RATE SELECT: This signal function is not implemented in this module. This module is rate agile--- it meets the specs for 1.0625Gb/s to 2.5Gb/s data rates without the use of a rate select pin.
5. LOS (Loss of Signal) has an internal 8K pull-up resistor to $V_{cc}R$. While LOS is defined per the SFP MSA, the actual signal implemented in this module is Signal Detect, or the inverse of LOS. When low, this output indicates the received optical signal power is below the worst-case receiver sensitivity. High indicates normal operation. In the low state, the output will be pulled to < 0.8V.
6. $V_{ee}R$ and $V_{ee}T$ may be internally connected within the SFP module.
7. RD-/+: These are the differential receiver outputs. They are AC coupled 100 Ω differential lines which should be terminated with 100 Ω (differential) at the user SerDes. The AC coupling is done inside the module and is thus not required on the host board.
8. $V_{cc}R$ and $V_{cc}T$: are the receiver and transmitter power supplies. They are defined as 3.3 V +/-10% at the SFP connector pin. Maximum supply current is 200 mA. Hot plugging of the SFP module will result in an inrush current of no more than 30 mA greater than the steady state value. $V_{cc}R$ and $V_{cc}T$ may be internally connected within the SFP module.
9. TD-/+: are the differential transmitter inputs. They are AC coupled differential lines with 100 Ω differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board.

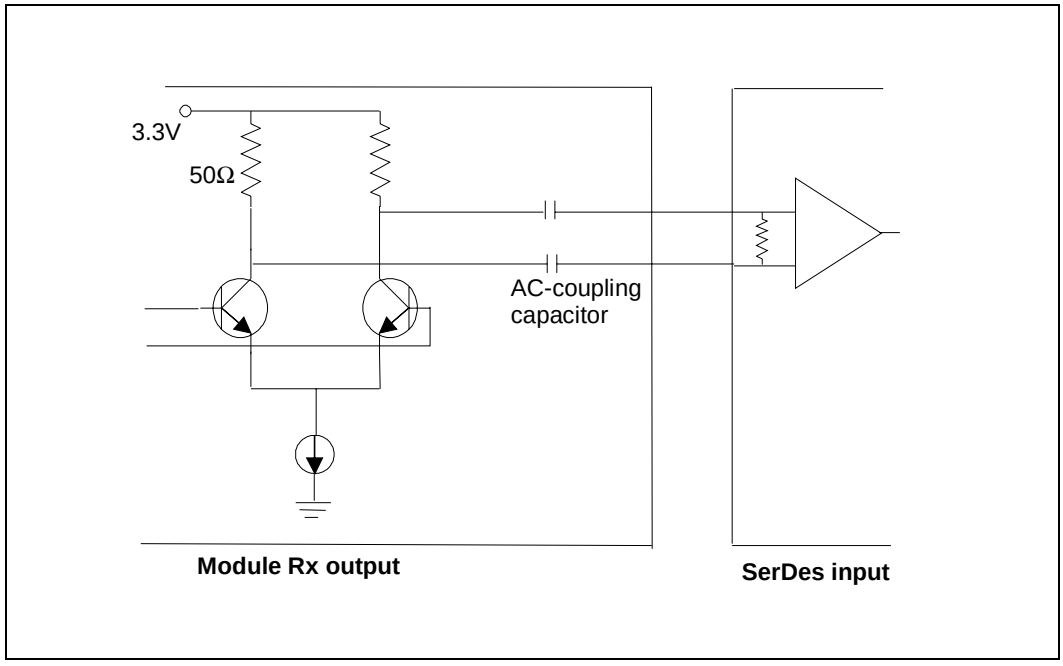
3.0 Termination

The SFP optical transceiver has two types of I/O interfaces. 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. Particularly on the CML I/Os, without the proper termination, jitter will increase significantly due to the reflection from the impedance mismatches.

3.1 CML Termination

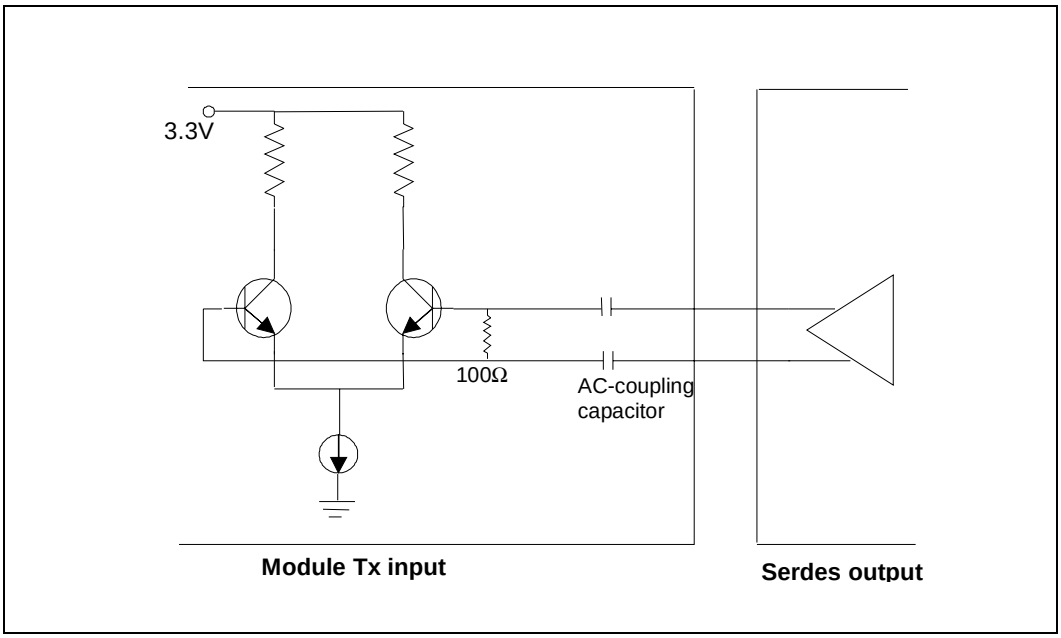
AC-coupling capacitors are built into the module. These AC-coupling capacitors help to prevent a direct current path from module power supply to the SerDes input. This may cause damage to the ESD diodes on SerDes.

Figure 2. Circuit Diagram for CML Termination on Module Receiver Output



Most of the SerDes comes with the internal termination resistor. However, if there is no internal termination resistor, please check the SerDes specifications sheet for proper external termination.

Figure 3. Circuit Diagram for CML Termination on Module Transmitter Input



The module Tx input has an internal 100 Ω termination between two inputs. AC-coupling capacitors are also built into the module. Please make sure the SerDes output has the proper termination. If not, follow the suggestion of the SerDes datasheet for proper external termination.

4.0 SFP Timing Parameters

Table 10 shows timing parameters for SFP management.

Table 10. Timing parameters for SFP management

Parameter	Symbol	Min.	Max.	Unit	Conditions
TX_DISABLE assert time	t_off	–	10	µs	Time from rising edge of TX_DISABLE to when the optical output falls below 10% of nominal
TX_DISABLE negate time	t_on	–	1	ms	Time from falling edge of TX_DISABLE to when the modulated optical output rises above 90% of nominal
Time to initialize includes reset of TX_FAULT	t_init	–	300	ms	Time from power on or negation of TX_FAULT using TX_DISABLE
TX_FAULT Assert Time	t_fault	–	100	µs	Time from fault to TX_FAULT ON
TX Disable to reset	t_reset	10		µs	Time TX Disable must be held high to reset TX_FAULT
RX_LOS Assert time	t_loss_on	–	100	µs	Time from LOS state to RX_LOS assert
RX_LOS De-assert time	t_loss_off	–	100	µs	Time from non-LOS state to RX_LOS de-assert
Rate-Select Change time	t_ratesel	–	10	µs	Time from rising or falling edge of Rate Select input until receiver bandwidth is in conformance with appropriate specification
Serial ID Clock Rate	f_serial_clock	–	100	KHz	–

5.0 Serial Identification

Table 11 lists the definition from the different data stored in the SFP module EEPROM.

Table 11. Serial Identification Field Descriptions (Sheet 1 of 3)

Data Address	Field Size (Bytes)	Name of Field	Description of Field
Base of Fields			
0	1	Identifier	Type of serial identifier (see Table 12)
1	1	Ext. Identifier	Extended identifier of type of serial transceiver
2	1	Connector	Connector (see Table 13)
3-10	8	Transceiver	Optical Compatibility (see Table 15)
11	1	Encoding	Code for serial encoding algorithm (see Table 14)
12	1	BR, Nominal[1]	Nominal bit rate, units of 100Mbps
13	1	Reserved	–
14	1	Length (9µ) - km[2]	Link Length supported for 9/125 µm fiber, units of km
15	1	Length (9µ)[3]	Link Length supported for 9/125 µm fiber, units of 100 m
16	1	Length (50µ)[4]	Link Length supported for 50/125 µm fiber, units of 10 m
17	1	Length (62.5µ)[5]	Link Length supported for 62.5/125 µm fiber, units of 10 m
18	1	Length (Copper)[6]	Link Length supported for copper, units of meters
19	1	Reserved	–
20-35	16	Vendor name[7]	SFP vendor name (ASCII)
36	1	Reserved	–
37-39	3	Vendor OUI[8]	SFP vendor IEEE company ID
40-55	16	Vendor PN[9]	Part number provided by SFP vendor (ASCII)
56-59	4	Vendor rev[10]	Revision level for part number provided by vendor (ASCII)
60-62	3	Reserved	–
63	1	CC_BASE[11]	Check code for Base ID fields (address 0 to 62)
Extended ID Fields			
64-65	2	Options[12]	Indicates which optional SFP signals are implemented (see Table 16)
66	1	BR, Max[13]	Upper bit rate margin, units of %
67	1	BR, Min[14]	Lower bit rate margin, units of %
68-83	16	Vendor SN[15]	Serial number provided by vendor (ASCII)
84-91	8	Date Code [16]	Vendor's manufacturing date code (see Table 17)
92-94	3	Reserved	–
95	1	CC_EXT	Check code for the Extended ID fields (address 64 to 94)

Table 11. Serial Identification Field Descriptions (Sheet 2 of 3)

Data Address	Field Size (Bytes)	Name of Field	Description of Field
Vendor Specific ID Fields			
96-127	32	Read-only	Vendor specific data, read only
128-511	384	Reserved	Vendor specific
512-n	–	–	–

NOTES:

1. The nominal bit rate (BR, nominal) is specified in units of 100 Mbps per second, rounded off to the nearest 100 Mbps per second. The bit rate includes those bits necessary to encode and delimit the signal, as well as those bits carrying data information.
   A value of 0 indicates that the bit rate is not specified and must be determined from the transceiver technology. The actual information transfer rate depends on the encoding of the data, as defined by the encoding value.
2. In addition to EEPROM data from original GBIC definition, this value specifies the link length that is supported by the SFP while operating in compliance with the applicable standards using single mode fiber. The value is in units of kilometers. A value of 255 means that the SFP supports a link length greater than 254 km. A value of zero means that the SFP does not support single mode fiber or that the length information must be determined from the transceiver technology.
3. This value specifies the link length that is supported by the SFP while operating in compliance with the applicable standards using single mode fiber. The value is in units of 100 meters. A value of 255 means that the SFP supports a link length greater than 25.4 km. A value of zero indicates that the SFP does not support single mode fiber, or the length information must be determined from the transceiver technology.
4. This value specifies the link length that is supported by the SFP while operating in compliance with the applicable standards using 50 µm multimode fiber. The value is in units of 10 meters. A value of 255 means that the SFP supports a link length greater than 2.54 km. A value of zero indicates that the SFP does not support 50 µm multimode fiber, or the length information must be determined from the transceiver technology.

Table 11. Serial Identification Field Descriptions (Sheet 3 of 3)

Data Address	Field Size (Bytes)	Name of Field	Description of Field

5. The value specifies the link length that is supported by the SFP while operation in compliance with the applicable standards using 62.5 µm multi-mode fiber. The value is in units of 10 meters. A value of 255 means that the SFP supports a link length greater than 2.54 km. A value of zero indicates that the SFP does not support 62.5 µm multi-mode fiber or that the length information must be determined from the transceiver technology. It is common for SFPs to support both 50 µm and 62.5 µm fiber.
6. This value specifies the minimum link length that is supported by the SFP while operating in compliance with the applicable standards using copper cabling. The value is in units of 1 meters. A value of 255 means that the SFP supports a link length greater than 254 meters. A value of zero means that the SFP does not support copper cables or that the length information must be determined from the transceiver technology. Further information about the cable design, equalization, and connectors is usually required to guarantee meeting a particular length requirement.
7. The vendor name is a 16 character field that contains ASCII characters, left-aligned and padded on the right with ASCII spaces (20h). The vendor name shall be the full name of the corporation, a commonly accepted abbreviation of the name of the corporation, the SCSI company code for the corporation, or the stock exchange code for the corporation. At least one of the vendor name or the vendor OUI fields shall contain valid serial data.
8. The vendor organizationally unique identifier field (vendor OUI) is a 3-byte field that contains the IEEE Company Identifier for the vendor. A value of zero in the 3-byte field indicates that the Vendor OUI is unspecified.
9. The vendor part number (vendor PN) is a 16-byte field that contains ASCII characters, left-aligned and padded on the right with ASCII spaces (20h), defining the vendor part number or product name. A value of all zero in the 16-byte field indicates that the vendor PN is unspecified.
10. The vendor revision number (vendor rev) is a 4-byte field that contains ASCII characters, left-aligned and padded on the right with ASCII spaces (20h), defining the vendor's product revision number. A value of all zero in the 4-byte field indicates that the vendor PN is unspecified.
11. The check code is a one-byte code that can be used to verify that the first 64 bytes of serial information in the SFP is valid. The check code shall be the low order 8 bits of the sum of the contents of all the bytes from byte 0 to 62, inclusive
12. The bits in the option field specifies the options implemented in the SFP as described in Table 16.
13. The upper bit rate limit at which the SFP will still meet its specifications (BR, max) is specified in units of 1% above the nominal bit rate. A value of zero indicates that this field is not specified.
14. The lower bit rate limit at which the SFP will still meet its specifications (BR, min) is specified in units of 1% below the nominal bit rate. A value of zero indicates that this field is not specified.
15. The vendor serial number (vendor SN) is a 16-character field that contains ASCII characters, left aligned and padded on the right with ASCII spaces (20h), defining the vendor's serial number for the SFP. A value of all zero in the 16-byte field indicates that the vendor PN is unspecified.
16. The date code is an 8-byte field that contains the vendor's date code in ASCII characters. The date code is mandatory. The date code shall be in format specified in Table 17 below.

5.1 Identifier

The identifier value specifies the physical device described by the serial information. This value shall be included in the serial data. Table 12 shows the defined identifier values.

Table 12. Identifier Values

Value	Description of Physical Device
00h	Unknown or unspecified
01h	GBIC
02h	Module/connector soldered to motherboard
03h	SFP transceiver
04-7Fh	Reserved
80-FFH	Vendor specific

5.2 Connector

The connector value indicates the external connector provided on the interface. This value shall be included in the serial data. Table 13 shows the defined connector values.

Table 13. Connector Values

Value	Description of Physical Device
00h	Unknown or unspecified
01h	SC
02h	Fibre Channel Style 1 copper connector
03h	Fibre Channel Style 2 copper connector
04h	BNC/TNC
05h	Fibre Channel Coaxial headers
06h	Fibre Jack
07h	LC
08h	MT-RJ
09h	MU
0Ah	SG
0Bh	Optical Pigtail
0C-1Fh	Reserved
20h	HSSDC II
21h	Copper Pigtail
22-7Fh	Reserved
80-FFh	Vendor specific
NOTE: 01h-05h are not SFP compatible, and are included for compatibility with GBIC standards.	

5.3 Encoding

The encoding value indicates the serial encoding mechanism that is the nominal design target of the particular module. Table 14 shows the defined encoding values.

Table 14. Encoding Codes

Value	Description of Physical Device
00h	Unspecified
01h	8B10B
02h	4B5B
03h	NRZ
04h	Manchester
05h-FFh	Reserved

5.4 Transceiver

Table 15 defines the method to interpret the Transceiver type for the SFP module and its associated compatibility options.

Table 15. Transceiver Codes (Sheet 1 of 2)

Data	Bit (Note 1)	Description of Transceiver
Reserved Standard Compliance Codes		
3	7-0	Reserved
4	7-4	Reserved
		SONET Compliance Codes
4	3	Reserved
4	2	OC-48 long reach
4	1	OC-48 intermediate reach
4	0	OC-48 short reach
5	7	Reserved
5	6	OC-12 single mode long reach
5	5	OC-12 single mode intermediate reach
5	4	OC-12 short mode intermediate reach
5	3	Reserved
5	2	OC-3, single mode long reach
5	1	OC-3, single mode intermediate reach
5	0	OC-3, single mode short reach

Data Addr	Bit (Note 1)	Description of Transceiver
Fiber Channel Link Length		
7	7	Very Long Distance (V)
7	6	Short Distance (S)
7	5	Intermediate Distance (S)
7	4	Long Distance (L)
Fiber Channel Transmit Technology		
7	3-2	Reserved
7	1	Longwave Laser (LC)
7	0	Electrical inter-enclosure (EL)
8	7	Electrical inter-enclosure (EL)
8	6	Shortwave Laser w/o OFC (SL)
8	5	Shortwave laser w/ OFC (SL)
8	4	Longwave laser (LL)
8	0-3	Reserved
Fibre Channel Transmission Media		
9	7	Twin Axel Pair (TW)

Table 15. Transceiver Codes (Sheet 2 of 2)

Data	Bit (Note 1)	Description of Transceiver
6	7-4	Reserved
6	3	1000BASE-T
6	2	1000BASE-CX
6	1	1000BASE-LX
6	0	1000BASE-SX

Data Addr	Bit (Note 1)	Description of Transceiver
9	6	Shielded twisted pair (TP)
9	5	Miniature coax (MI)
9	4	Video coax (TV)
9	3	Multi-mode, 62.5µ (M6)
9	2	Multi-mode, 50µ (M5)
9	1	Reserved
9	0	Single mode (SM)
Fibre Channel Speed		
10	7-5	Reserved
10	4	400 MBytes/Sec
10	3	Reserved
10	2	200 MBytes/Sec
10	1	Reserved
10	0	100 MBytes/Secc

NOTE: Bit 7 is the high order bit and is transmitted first in each byte.

Table 16 defines the method to interpret and the optional SFP signals that are implemented in the module.

Table 16. Option Values

Value	Bit	Description of Physical Device
64	7-0	Reserved
65	7-6	Reserved
65	5	RATE_SELECT is implemented if a bit is set then active control of the rate select pin in required to change rates. If a bit is not set, no control of pin is required. In all cases, compliance with multiple rate standards should be determined by Transceiver Codes in Bytes 4,5,6, and 10. (See Table 15)
65	4	TX_DISABLE is implemented and disables the serial output
65	3	TX_FAULT signal implemented. (Reset defined in section III)
65	2	Loss of signal is defined per the SFP MSA. Signal Detect is implemented, signal inverted **NOTE:** This is not standard SFP behavior.
65	1	Loss of signal implemented, signal as defined in Table 8
65	0	Reserved

Table 17 defines the method to interpret the manufacturing date stored in the Date Code section of the EEPROM.

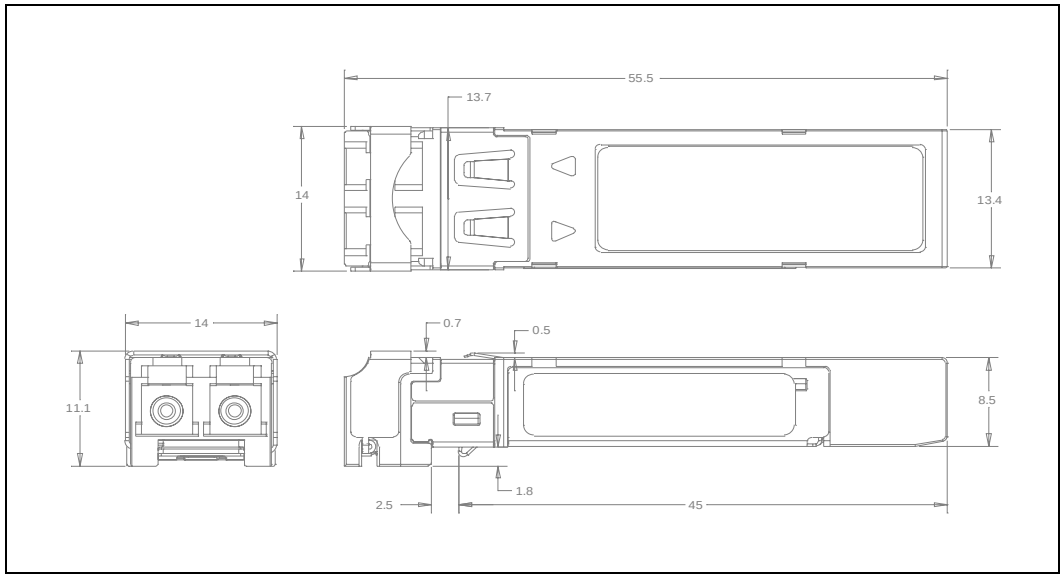
Table 17. Date Code

Data Address	Description of Field
84-85	ASCII code, two low order digits of year. (00 = 2000).
86-87	ASCII code, digits of month (01 = Jan through 12 = Dec)
88-89	ASCII code, day of month (01-31)
90-91	ASCII code, vendor specific lot code, may be blank

6.0 Mechanical Specification

Mechanical specifications of Intel® Small Form Factor Pluggable (SFP) transceivers are shown below. Dimensions comply with SFP Multi-Source Agreement (MSA). All dimensions are in millimeters.

Figure 4. SFP Mechanical Specifications



7.0 Regulatory Compliance

The Intel® TXN31111 transceiver meets the relevant regulations described in Table 18.

Table 18. 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

8.0 Safety

The Intel® TXN31111 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.

9.0 Ordering Information

When ordering, please specify the complete part number as defined in Table 19.

Table 19. Ordering Information

Part Number	Description
Intel® TXN31111D000xxx	Tri-rate 2/1 Gbps Fibre Channel and Gigabit Ethernet SFP module with digital diagnostics feature[1]
Intel® TXN311110000xxx	Tri-rate 2/1 Gbps Fibre Channel and Gigabit Ethernet SFP module[1]
1. The last 3 characters of the part number ("xxx") are used to designated customer-specific customizations. The Intel standard part has "000" as the last three characters	