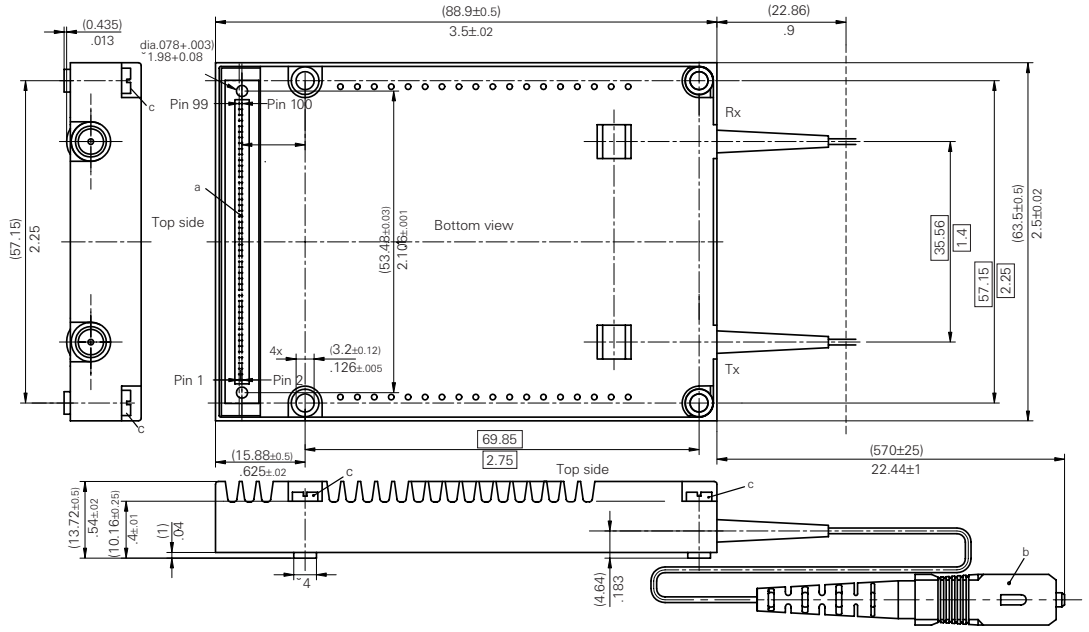
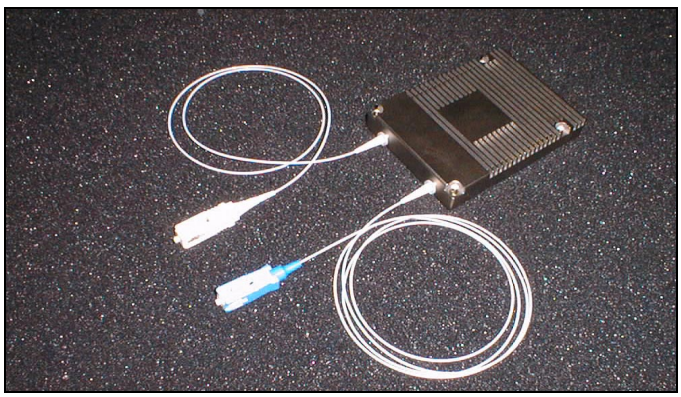
V23816-N1018-C13

Single Mode 1310 nm 16-Line Parallel 2.5 GBd Transceiver OC-48 SONET / SDH Telecom Links up to 2 km

Preliminary

Dimensions in (mm) inches





FEATURES

- **Compliant with existing standards**
- **Compact integrated transceiver unit with**
  - **FP laser diode transmitter**
  - **InGaAs PIN photodiode receiver**
  - **Pigtailed optical connections**
  - **Integrated Mux, Demux and Clock Recovery**
- **Class 1 FDA and IEC laser safety compliant**
- **Dual power supply (+3.3 V, +5 V)**
- **OC-48 optical transmit and receive at 2488.32 Mbit/s**
- **LVPECL (+3.3 V) Single Ended 16-line parallel interface at 155.52 Mbit/s**
- **External control for laser shutoff**
- **Loss of optical signal and Loss of synch indicators (Rx)**
- **Loss of lock indicator for TX high speed clock**
- **Laser bias monitor**

Absolute Maximum Ratings

Exceeding any one of these values may destroy the device immediately.

PECL Supply Voltage (V_{CCPECL}) ..... 0 to 5.5 V
LVPECL Supply Voltage ($V_{CCLVPECL}$) ..... 0 to 5 V
LVPECL Data and Clock Input Levels ..... 0 to $V_{CCLVPECL}$
LVPECL Data and Clock Output Source Current ..... 50 mA
Operating Ambient Temperature[1] ..... 0 to 70°C
Storage Ambient Temperature ..... –40 to +85°C
Static Discharge Voltage, All Pins ..... 1000 V
Input Common Mode Noise on Supply Lines[2] ..... 50 mV p-p

Notes

1. Operating ambient temperature with 200 lfm airflow across the transceiver. In the case of convection cooling, the operating ambient temperature is specified to be 0 to +50°C.
2. 6 KHz to 2 MHz

DESCRIPTION

The Infineon single mode SONET/SDH transceiver is compliant with the Bellcore GR-253, ITU-T G.957 and ITU-T G.958 specifications. The transmitter section consists of a multiplexer, laser driver, Fabry Perot laser diode and pigtail single mode fiber. The receiver section consists of a multimode fiber pigtail, PIN photodiode / preamplifier, postamplifier, clock and data recovery unit and a demultiplexer. The 155 Mb/s parallel data interface frees the customer from the concerns of pcb layout at 2.5 Gb/s. The pluggable connector mates easily to the customer pcb, and allows the transceiver to be removed prior to any solder reflow or washing of the customer pcb.
The transceiver operates from a dual power supply (+3.3 V and +5 V). The transceiver electrical interface is via a 100 pin pluggable connector pair. The transmit and receive electrical signals each consist of 16 parallel single-ended data lines which are LVPECL (+3.3 V) compatible, and a differential LVPECL clock. Both the transmit input data and clock lines, and the receive outputs data and clock lines, are internally biased and terminated. All lines are DC coupled to the interface connector.

Functional Description

This transceiver is designed to transmit and receive serial 2.5 Gb/s data via singlemode fiber at 1310 nm wavelength.

The transmitter accepts 16 lines of parallel electrical data at 155.52 Mb/s and a synchronous transmit clock at 155.52 MHz. The data should be updated on the rising edge of the positive transmit clock (TxDI55P). The data is multiplexed into a serial data stream at 2488.32 Mbit/s. The data follows the SONET bit ordering, where the MSB (Bit 0) is transmitted first, and the LSB (Bit 15) is transmitted last. The laser driver circuit drives the modulation and bias currents of the laser diode. The 2488.32 Mbit/s optical data stream is transmitted at 1310 nm wavelength. The laser bias current is controlled by a power control circuit, which regulates the output power over temperature and aging. This is accomplished by using the output of a monitor PIN diode (mechanically built into the laser unit) as a feedback signal to prevent the laser power from exceeding the operating limits. The laser driver modulation current is temperature compensated to ensure a constant extinction ratio over temperature variations.
The laser can be switched off with a logical low signal on the Laser Shutoff input. The input is internally pulled high, so it can be driven with an open collector TTL interface. The laser bias current is monitored as an analog output voltage at the Bias Monitor output (IB) pin. The bias monitor can be used to monitor the aging of the laser.
The receiver accepts an input serial optical data stream at 2488.32 Mbit/s. The PIN/Preamp detects the incoming light and converts it to an electrical current, which is then amplified. The Clock and Data Recovery unit recovers the clock from the input data stream, and aligns the data so it is synchronous with the clock. The data is then demultiplexed directly to 16 lines of parallel data at 155.52 Mbit/s, with the MSB being Bit 0 and the LSB being Bit 15. The receiver also outputs a 155.52 MHz synchronous clock. The received data is updated on the falling edge of the positive receive clock (RxQI55P).

The Rx Alarm (FLAG) indicator will switch active low if there is a loss of optical input signal (LOS) or if the PLL in the clock recovery unit is unlocked (Lock). The FLAG output is an open collector TTL, and can be used to monitor the function of the receiver.

TECHNICAL DATA

The electro-optical characteristics described in the following tables are only valid for use under the recommended operating conditions.

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Units
Operating Ambient Temperature[1]	T_{AMB}	0		70	°C
Supply Voltage 5 V PECL	V_{CCPECL}	4.75	5.0	5.25	V
Supply Voltage 3.3 V LVPECL	$V_{CCLVPECL}$	3.04	3.3	3.46	
Supply Current 5 V PECL	I_{CCPECL}		350	Tbd	mA
Supply Current 3.3 V LVPECL	$I_{CCLVPECL}$		1270	Tbd	
Total Power Consumption	P_{TOT}		6.0	Tbd	W
Transmitter					
Data Input Bit Rate			155.52		Mbit/s
Clock Input Frequency			155.52		MHz
Clock Input Frequency Tolerance		–100		100	ppm
Clock Input Duty Cycle		40	50	60	%
Clock Input Jitter Tolerance, 10 Hz to 20 MHz	UI, rms			0.1	rms
	UI, p-p			1	p-p
Clock Input Return Loss, 10 MHz to 700 MHz		20			dB
Data Input Return Loss, 10 MHz to 700 MHz		15			dB
Clock and Data Input High Voltage[2]		V_{CC} LVPECL –1.165		V_{CC} LVPECL –0.88	V
Clock and Data Input Low Voltage[2]		V_{CC} LVPECL –2		V_{CC} LVPECL –1.475	
Clock Input Diffential Swing		0.3		1.3	V p-p
Data Input Single Ended Swing[3]		0.15		0.6	
Input Clock and Data Rise/Fall Time 10%–90%	t_R, t_F			1.5	ns

Recommended Operating Conditions - continued

Parameter	Min.	Typ.	Max.	Units
Laser Shutoff Delay Time			3	µs
Laser Bias Monitor Transfer Constant	19	20	21	mV/ mA
Laser Bias Monitor Output Current			10	mA
Transceiver				
Lock Detect Output High Voltage[5]	TTL open collector			V
Lock Detect Output Low Voltage			0.3	
Lock Detect Output Current (Sink)[5]			200	mA
Receiver				
Data Output Bit Rate		155.52		Mbit/s
Clock Output Frequency		155.52		MHz
Clock Output Duty Cycle	45	50	55	%
Clock and Data Output High Voltage[6]	V_{CC} LVPECL –1.15		V_{CC} LVPECL –0.65	V
Clock and Data Output Low Voltage[6]	V_{CC} LVPECL –2.2		V_{CC} LVPECL –1.75	
Clock Output Diffential Swing[7]	0.6		1.3	V p-p
Data Output Single Ended Swing[7]	0.3		0.8	
Output Clock & Data Rise/ Fall Time 10%–90%	0.5		1.5	ns
FLAG Output High Voltage[8]				V
FLAG Output Low Voltage			0.3	

Notes

1. Operating ambient temperature with 200 lfm airflow across the transceiver. In the case of convection cooling, the operating ambient temperature is specified to be 0 to +50°C.
2. Tx Clock and Tx Data inputs are DC coupled and internally biased and terminated.
3. Tx Clock input is differential LVPECL. Tx Data inputs are single ended LVPECL.
4. The Laser Shutoff input is pulled high internally to $V_{CCLVPECL}$ (+3.3 V) through a 1 K resistor.
5. The Tx Lock Detect output is open collector TTL.
6. Measured with 50 Ω to $V_{CCLVPECL}$ -2 V. The Rx Clock and Data outputs are DC coupled.
7. Rx Clock output is differential LVPECL. Rx Data outputs are single ended LVPECL.
8. The Rx FLAG output is open collector TTL.

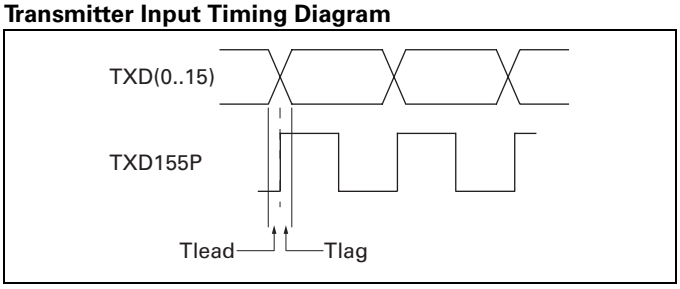
AC Electrical Characteristics

Transmitter	Symbol	Min.	Typ.	Max.	Units
Data Input Lead Time[1]	Tlead			1.0	ns
Data Input Lag Time[2]	Tlag			1.0	
Receiver					
Data Output Propogation Delay[3]	Tpd	–1		1	ns

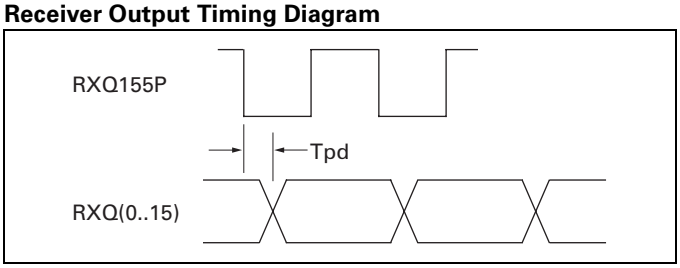
Notes

1. Transmitter input data leading the rising edge of transmit clock positive (TxDI55P).
2. Transmitter input data lagging the rising edge of transmit clock positive (TxDI55P).
3. Receiver output data propogation delay with respect to the falling edge of the positive receive output clock (RxQI55P).

Transmitter Input Timing Diagram



Receiver Output Timing Diagram



Transmitter Electro-Optical Characteristics

Transmitter	Symbol	Min.	Typ.	Max.	Units
Nominal Center Wavelength	λ_{NOM}		1310		nm
Center Wavelength Variation	λ_{MIN}-λ_{MAX}	1265		1360	
Spectral Bandwidth	$\Delta\lambda_{RMS}$			5	nm rms
Average Output Power[1]	P_{AVG}	-10	-7	-3	dBm
Extinction Ratio	ER	8.2			dB
Output Rise Time, 20%-80%	T_R			200	ps
Output Fall Time, 80%-20%	T_F			300	
Eye Diagram[2]	ED				
Jitter Generation[3]	J_{GEN}			0.01	UI rms
Reset Threshold for $V_{CCLVPECL}$[4]	V_{TH}	2.2		2.95	V
Power on delay for $V_{CCLVPECL}$[4]	T_{POD}		20		ms
Fault Delay[5]	T_{FAULT}		20		

Notes

1. The transmitter contains a control circuit which regulates the average optical output power. Nominal output power can be factory set to any value within the specified range.
2. The Eye Diagram is compliant with Bellcore GR-253 and ITU-T G.957 specifications.
3. Jitter Generation is compliant with GR-253 and ITU-T G.958 specifications, when measured using a high pass filter with 12 KHz cutoff frequency, and with a jitter level on the Tx Clock input which is less than the Jitter Tolerance levels specified in "Transmitter - Recommended Operating Conditions".
4. If the +3.3 V LVPECL Tx power supply drops below the specified level, the laser bias and modulation currents will be held disabled until the supply voltage rises above threshold, and after the Power On Delay Time period.
5. A fault, such as high laser bias current or high average power, which lasts longer than the specified Fault Delay time, will cause the transmitter to be disabled. Cycling of DC power is then required to reset the transceiver.

Receiver Electro-Optical Characteristics

Receiver	Symbol	Min.	Typ.	Max.	Units
Nominal Center Wavelength	λ_{NOM}		1310		nm
Sensitivity (Average Power)[1]	P_{IN}		–22	–18	dBm
Overload (Average Power)[1]	P_{OL}	0			
Optical Return Loss	RL_{RX}	27			dB
Jitter Tolerance[2]	J_{TOL}				
Jitter Transfer[3]	J_{XFR}				
Optical Path Penalty	P_{PEN}			1	dB
Clock Recovery Acquisition Lock Time	T_{LOCK}			16	µs
FLAG Output LOS Assert Level[4]	P_{ASSERT}	–28		–22	dBm
FLAG Output LOS Hysteresis	P_{HYST}		0.5	1	dB
FLAG Output LOS Assert Time	T_{ASSERT}		100		µs

Notes

1. Average Rx power for a $1x10^{-10}$ BER, and using a PRBS pattern of 2^{23}-1 length with 72 zeros and 72 ones inserted as per ITU-T G.958.
2. Jitter Tolerance for a 1 dB power penalty is defined to be 15 UI from 10 Hz to 600 Hz, 1.5 UI from 6 KHz to 100 KHz, and 0.15 UI from 1 MHz onwards, per ITU-T G.958.
3. Jitter Transfer is defined to be less than 0.1 dB up to 2 MHz, and dropping at -20 dB/Decade after that point, per ITU-T G.958.
4. The Rx FLAG output is an active low, open collector TTL output, which is set low if there is a loss of Rx optical signal input (LOS), or if the clock recovery unit is unable to lock onto the Rx data input. A decrease in optical input power below the assert level will cause the FLAG output to switch Low (ON).

Regulatory Compliance

Feature	Standard	Comments
Electrostatic Discharge (ESD) to the Electrical Pins	MIL-STD 883C Method 3015.4	Class 1 (>1000 V)
Immunity: Electrostatic Discharge (ESD) to the Connector	EN 61000-4-2 IEC 1000-4-2	Discharges of ±15kV with an air discharge probe on the receptacle cause no damage.
Immunity: Radio Frequency Electromagnetic Field	EN 61000-4-3 IEC 1000-4-3	With a field strength of 10 V/m rms, noise frequency ranges from 10 MHz to 1 GHz. No effect on transceiver performance between the specification limits.
Emission: Electromagnetic Interference (EMI)	FCC Class B EN 55022 Class B CISPR 22	Noise frequency range: 30 MHz to 1 GHz

Pin Description of Interface Connector

Pin#	Pin Name	I/O	Level/ Logic	Description
1	Tx GND	I	Supply	
2	Tx GND	I	Supply	
3	TxD0	I	LVPECL	155 Mb/s Data Input, MSB
4	Tx GND	I	Supply	
5	Tx GND	I	Supply	
6	TxD1	I	LVPECL	155 Mb/s Data Input
7	TxD2	I	LVPECL	155 Mb/s Data Input
8	Tx GND	I	Supply	
9	Tx GND	I	Supply	
10	TxD3	I	LVPECL	155 Mb/s Data Input
11	TxD4	I	LVPECL	155 Mb/s Data Input
12	Tx GND	I	Supply	
13	Tx GND	I	Supply	
14	TxD5	I	LVPECL	155 Mb/s Data Input
15	TxD6	I	LVPECL	155 Mb/s Data Input
16	Tx GND	I	Supply	
17	Tx GND	I	Supply	
18	TxD7	I	LVPECL	155 Mb/s Data Input
19	TxD8	I	LVPECL	155 Mb/s Data Input
20	Tx GND	I	Supply	
21	Tx GND	I	Supply	
22	TxD9	I	LVPECL	155 Mb/s Data Input
23	TxD10	I	LVPECL	155 Mb/s Data Input
24	Tx GND	I	Supply	
25	Tx GND	I	Supply	
26	TxD11	I	LVPECL	155 Mb/s Data Input
27	TxD12	I	LVPECL	155 Mb/s Data Input
28	Tx GND	I	Supply	
29	Tx GND	I	Supply	
30	TxD13	I	LVPECL	155 Mb/s Data Input
31	TxD14	I	LVPECL	155 Mb/s Data Input
32	Tx GND	I	Supply	
33	Tx GND	I	Supply	
34	TxD15	I	LVPECL	155 Mb/s Data Input
35	TxD155P	I	LVPECL	155 MHz Clock Input Positive
36	Tx GND	I	Supply	
37	TxD155N	I	LVPECL	155 MHz Clock Input Negative
38	Tx GND	I	Supply	
39	Tx GND	I	Supply	
40	155M_OOL	O	TTL Open Collector	Active Low status signal to indicate lock condition of 155 MHz Clock Regenerator PLL. Low=Unlocked
41	MUX +3.3	I	Supply	Supply for Tx MUX
42	Tx +3.3	I	Supply	Supply for Tx LVPECL
43	MUX +3.3	I	Supply	Supply for Tx MUX
44	Tx +3.3	I	Supply	Supply for Tx LVPECL
45	VO_{ref}	O	Reference	$\frac{(V_{OH}+V_{OL})}{2} \pm 12V$
46	Laser shutoff	I	TTL (w/ Pullup)	Active Low control signal to turn off laser. Low = Laser Disable
47	IB	O	Analog	Analog voltage proportional to laser bias current. 20 mV / mA
48	Tx GND	I	Supply	
49	Tx GND	I	Supply	
50	Tx +5	I	Supply	Supply for Tx PECL
51	Rx GND	I	Supply	Supply for Rx
52	Tx GND	I	Supply	Supply for Tx
53	Rx GND	I	Supply	Supply for Rx
54	Rx GND	I	Supply	Supply for Rx
55	DEMUX +3.3	I	Supply	Supply for Rx DEMUX
56	Rx +5	I	Supply	Supply for Rx LVPECL
57	DEMUX +3.3	I	Supply	Supply for Rx DEMUX
58	Rx +5	I	Supply	Supply for Rx PECL
59	Rx +3.3	I	Supply	Supply for Rx LVPECL
60	Rx GND	I	Supply	Supply for Rx
61	Rx +3.3	I	Supply	Supply for Rx LVPECL
62	Rx GND	I	Supply	
63	Rx GND	I	Supply	
64	FLAG	O	TTL Open Collector	Active low status signal to indicate Rx loss of signal or loss of synchronization. Low = Rx Fault
65	Rx Q15	O	LVPECL	155 Mb/s Data Output, LSB
66	Rx GND	I	Supply	
67	Rx GND	I	Supply	
68	Rx Q14	O	LVPECL	155 Mb/s Data Output
69	Rx Q13	O	LVPECL	155 Mb/s Data Output
70	Rx GND	I	Supply	
71	Rx GND	I	Supply	
72	Rx Q12	O	LVPECL	155 Mb/s Data Output
73	Rx Q11	O	LVPECL	155 Mb/s Data Output
74	Rx GND	I	Supply	
75	Rx GND	I	Supply	
76	Rx Q10	O	LVPECL	155 Mb/s Data Output
77	Rx Q9	O	LVPECL	155 Mb/s Data Output
78	Rx GND	I	Supply	
79	Rx GND	I	Supply	
80	Rx Q8	O	LVPECL	155 Mb/s Data Output
81	Rx Q7	O	LVPECL	155 Mb/s Data Output
82	Rx GND	I	Supply	
83	Rx GND	I	Supply	
84	Rx Q6	O	LVPECL	155 Mb/s Data Output
85	Rx Q5	O	LVPECL	155 Mb/s Data Output
86	Rx GND	I	Supply	
87	Rx GND	I	Supply	
88	Rx Q4	O	LVPECL	155 Mb/s Data Output
89	Rx Q3	O	LVPECL	155 Mb/s Data Output

Pin#	Pin Name	I/O	Level/ Logic	Description
90	Rx GND	I	Supply	
91	Rx GND	I	Supply	
92	Rx Q2	O	LVPECL	155 Mb/s Data Output
93	Rx Q1	O	LVPECL	155 Mb/s Data Output
94	Rx GND	I	Supply	
95	Rx GND	I	Supply	
96	Rx Q0	O	LVPECL	155 Mb/s Data Output, MSB
97	Rx Q155P	O	LVPECL	155 MHz Clock Output Positive
98	Rx GND	I	Supply	
99	Rx Q155N	O	LVPECL	155 MHz Clock Output Negative
100	Rx GND	I	Supply	

Mating connector information

The suggested mating connector is Samtec FTMH-150-03-L-DV-EP-P.

LASER SAFETY

This single mode SONET/SDH transceiver is a Class 1 laser product. It complies with IEC 825-1 and FDA 21 CFR 1040.10 and 1040.11. The transceiver must be operated under recommended operating conditions.

Caution

The use of optical instruments with this product will increase eye hazard!

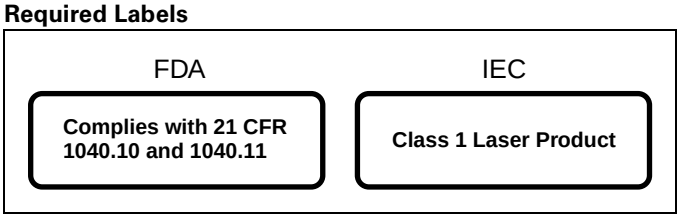
Note

Failure to adhere to the above restrictions could result in a modification that is considered an act of "manufacturing," and will require, under law, recertification of the modified product with the U.S. Food and Drug Administration (ref. 21 CFR 1040.10 (i)).

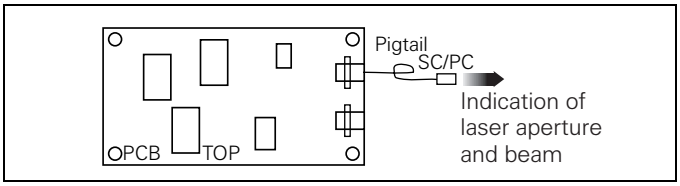
Laser Data

Wavelength	1310 nm
Total output power (as defined by IEC: 50 mm aperture at 10 cm distance)	4 mW
Total output power (as defined by FDA: 7 mm aperture at 20 cm distance)	195 µW
Beam divergence	5°

Required Labels



Laser Emission



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