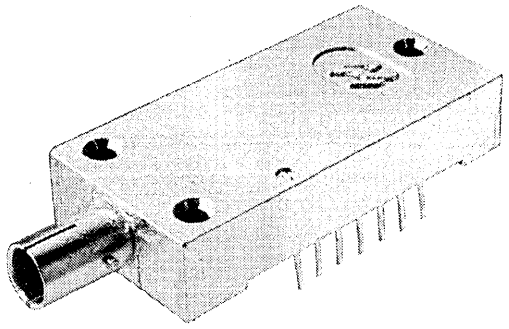
National Semiconductor

ADVANCE INFORMATION

FOT180B Fiber-Optic Transmitter

General Description

The FOT180B is a high-speed general-purpose electro-optical transmitter. It is designed for digital data transmission via optical fibers with data rates up to 20 MBits/s NRZ. The package includes the driver circuitry, optical light source, and connector. The bayonet-type connector on the package simplifies and ensures reliable optical coupling with minimal source to fiber alignment losses. The low-profile metal package is ideal for direct PC board mounting with 0.5″ board-to-board spacing. When used with the FOR100B fiber-optic receiver, the pair provides a complete optical data link with TTL compatible interfacing. Connectors are available from Amphenol™.



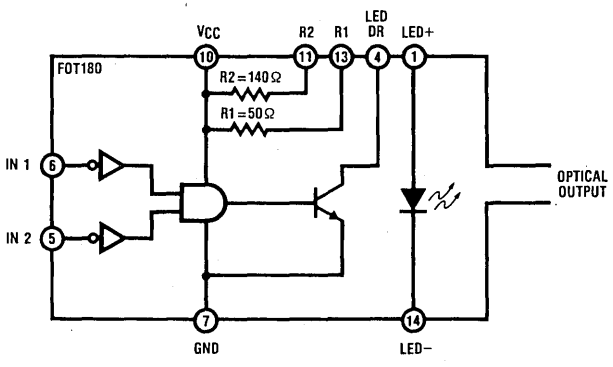
Features

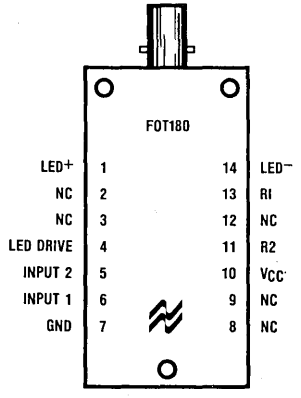
- Single +5 V supply
- DC to 20 Mbits/s NRZ data rate
- Pin selectable optical output power
- LED built-in
- CMOS/TTL compatibility
- Data and enable inputs
- Quickly demountable bayonet-type Amphenol optical connector
- 14-pin low profile package (0.3″) for direct PC board mounting
- Open collector output driver

Applications

- Data communication networks
- Secure communications
- Peripheral control/communication
- Industrial machine control
- T1 and T2 telecom digital links
- Optical modems
- Video transmission

Schematic and Connection Diagram





TOP VIEW
(The 3 mounting holes are tapped for 4—40 screws)

Order Number FOT180B
See NS Package FO14A

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Absolute Maximum Ratings

V_{CC}	Supply Voltage	7V
V_{IN}	Input Voltage	5.5V
I_{IN}	Input Current	−30 mA to +5 mA
I_F	LED Forward Current, DC	100 mA
T_A	Operating Temperature	−25°C to +85°C
T_{STG}	Storage Temperature	−25°C to +85°C
	Lead Temperature (Soldering, 10 seconds)	300°C

Electrical Characteristics $T_A = +25°C$.

Driver Specifications

Parameter		Conditions			Min.	Typ.	Max.	Units
V_{OL}	Output Low Voltage	$V_{CC} = 4.5V$, $V_{IN} = 0.8V$ (see Figure 1)		$I_{OL} = 40$ mA			0.5	V
				$I_{OL} = 70$ mA			0.7	
				$I_{OL} = 100$ mA			0.8	
V_{IH}	Input High Voltage	$V_{CC} = 4.5V$	Guaranteed input logic high for all inputs		2			
V_{IL}	Input Low Voltage		Guaranteed input logic low for all inputs				0.8	
I_{IH}	Input High Current	$V_{CC} = 5.5V$	$V_{IN} = 2.7V$	Input 1			30	μA
				Input 2			20	
I_{IL}	Input Low Current		$V_{IN} = 0.4V$	Input 1			−0.54	mA
				Input 2			−0.36	
I_{CC}	Supply Current			Input 2 = 0V			80	
R_1	Resistance				47.5	50	52.5	Ω
R_2	Resistance				133	140	147	

DC LED Specifications

Parameter		Conditions	Min.	Typ.	Max.	Unit
V_F	Forward Voltage	$I_F = 50$ mA		1.3		V
BV_R	Reverse Breakdown Voltage	$I_R = 100$ μA		5		
λ_{PK}	Peak Emission Wavelength	$I_F = 50$ mA		820		nm

Electrical Characteristics (Continued)

Transmitter Specifications Conditions: $V_{CC} = 5V$, $T_A = 25°C$.

Parameter		Conditions		Fiber Core Diameter	Min.	Typ.	Max.	Unit
P_O	Optical Power Output	(Notes 1 & 2) 100% Duty Cycle	Current limiting resistor = R1	200 μm, 0.4 NA		22		μW
				400 μm, 0.5 NA		110		
			Current limiting resistor = R2	200 μm, 0.4 NA		9		
				400 μm, 0.5 NA		45		
I_F	LED Current	Current limiting resistor = R1 (see Figure 2)				70		mA
		Current limiting resistor = R2 (see Figure 3)				26		
	Data Rate (NRZ)					20		Mb/s
	Optical Port (Fiber Core Diameter)					500		μm
NA	Exit Numerical Aperture					0.5		
t_r	Optical Rise Time	See Figure 2				15		ns
t_f	Optical Fall Time	See Figure 2				15		
t_{pd}	Propagation Delay: Electrical Input to Optical Output	See Figure 2				10		

Note 1: Optical power output (DC) is measured at the end of a one-meter long fiber using an EG & G Model 550 photometer that has been calibrated at 820 nm.

Note 2: The 200 μm fiber used is DuPont S120 Type 30; the 400 μm fiber used is DuPont PIFAX PIR140.

Applications Information

The FOT180B is a hybrid fiber-optic transmitter circuit. It includes the driver circuitry, LED, and two current-limiting resistors. The circuit layout allows the user to have access to the LED drive output pin, the two scaling resistors, and the LED. Access to both the anode and the cathode of the LED allows the user to implement various drive configurations to optimize system performance. Figure 4 shows the FOT180B set up in a series drive scheme using the internal 50 Ω resistor. The drive current can be calculated using the following equation:

$$I_D = \frac{V_{CC} - V_F - V_{OL}}{R}$$

where: I_D = LED drive current
V_{CC} = Supply voltage
V_F = ON-voltage of the LED
V_{OL} = LO-voltage of the open collector output
R = Current-limiting resistor

When input 2 is at logic "0", the LED ON/OFF condition is entirely controlled by input 1 at pin 6. This configuration allows the driver to control the LED and at the same time provide the necessary logic signal levels to interface with other TTL circuits. Also, series drive configurations tend to lower the power consumption in the LED driver. A characteristic of this method is a large current supply step when the LED turns ON and OFF (20 mA to 60 mA depending on the value of the current-limiting resistor). Figures 2 and 3 show the FOT180B set up in a different configuration. The LED is shunted across the drive output transistor instead of in series with it. In this shunt-driven mode the LED drive current is:

$$I_D = \frac{V_{CC} - V_F}{R}$$

where: I_D = LED drive current
V_F = ON-voltage of the LED
R = Current-limiting resistor

The step in supply current due to output switching is much smaller with this method, so the shunt drive configuration has a relatively constant supply current drain and less power supply line modulation.

DC Test Circuit

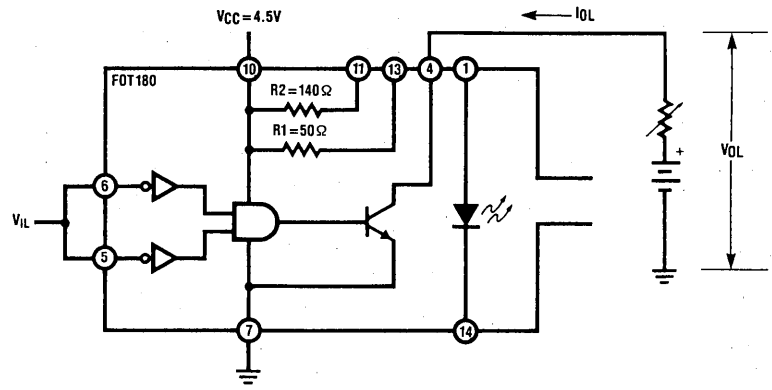
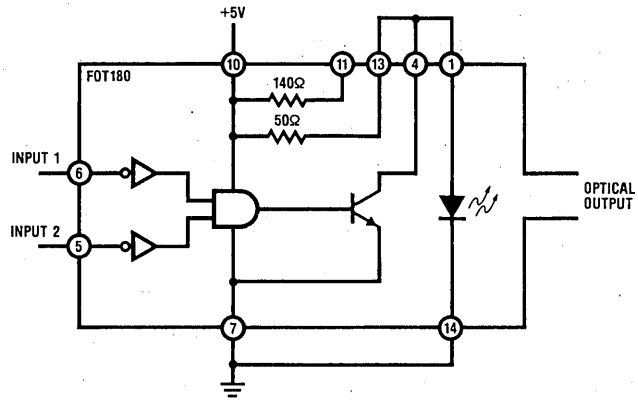


Figure 1. V_{IL}, V_{OL}

Typical Applications



Input 1	Input 2	Optical
0	0	OFF
0	1	ON
1	0	OFF
1	1	OFF

Figure 2. High Current, Shunt Drive

Typical Applications continued

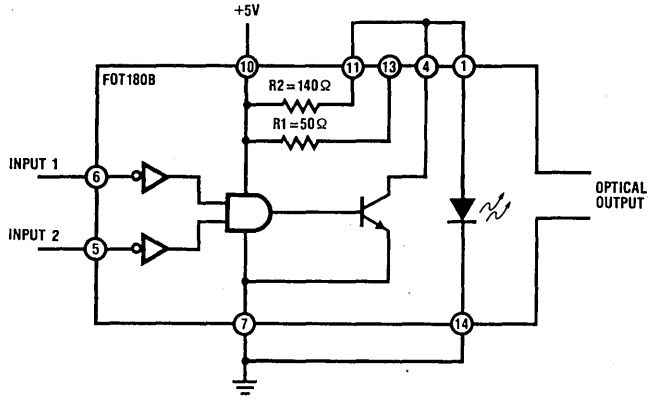
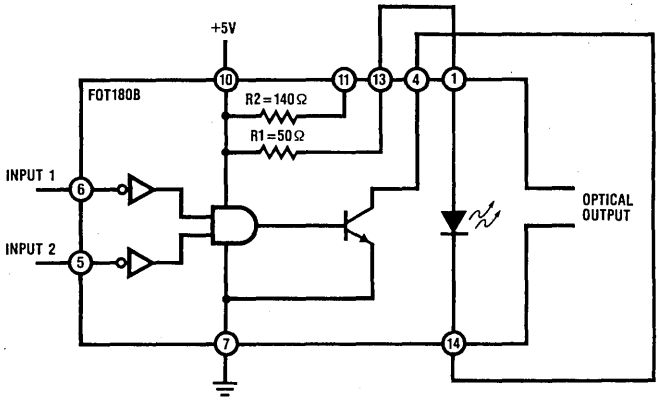


Figure 3. Low Current, Shunt Drive



Input 1	Input 2	Optical
0	0	ON
0	1	OFF
1	0	OFF
1	1	OFF

Figure 4. High Current, Series Drive

Ordering Information

Bayonet Connector	Part No.	Fiber Diameter
	905-143-5001	125 microns
	905-143-5002	140 microns
	905-143-5003	200 microns
	905-143-5004	230 microns
	905-143-5005	400 microns
	905-143-5006	600 microns
Order from Amphenol Division, Bunker Ramo Corp., Denbury, Connecticut	905-143-5007	1 millimeter