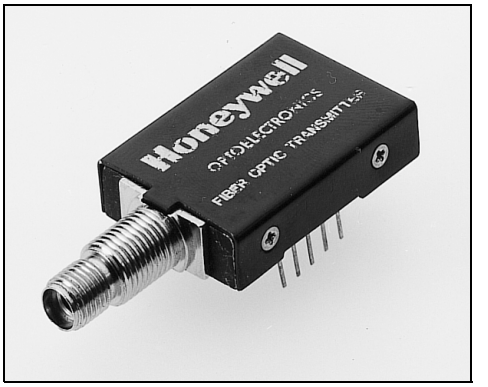
HFM2010

Fiber Optic Transmitter Module

FEATURES

- DC to 10 Mb/s NRZ
- Dynamic or static selection of power output
- "Cap Rock" LED couples to variety of fibers
- Operation on single +5 V supply



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DESCRIPTION

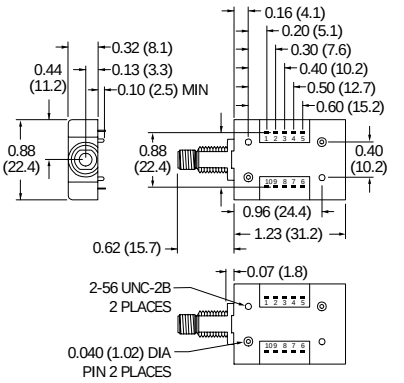
The HFM2010 transmitter module is an electrical to optical interface unit designed for point digital data transmission. The Low Profile Module provides both the electronics and the mechanical interface necessary to convert a TTL level input into an optically encoded output.

The HFM2010 module's bipolar MASTERSLICE IC and CAP ROCK LED produce an encoded three level optical signal that is independent of data format such that biphase (Manchester) encoded data, NRZ data or any other format can be transmitted. Internal voltage regulation allows adjustment-free operation over the full operating temperature range without external power supply filtering.

A unique feature of these modules allows the user to select power output to fit the application need. The module's binary encoded power output select inputs can be driven by open collector or standard TTL to dynamically select the power output, or they can be shorted to ground (or left open) to statically select power output.

Another unique module feature allows the user to select the type of optical receptacle to fit to the application. The module's mechanical interface is simple enough to allow custom designed receptacles as well as the standard SMA style. The "sweet spot" of light projected into either connector provides for easy alignment of a variety of glass and plastic fibers.

OUTLINE DIMENSIONS in inches (mm)



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Pinout

1. P_2 power output select
2. P_1 power output select
3. P_4 power output select
4. DS driver select
5. GND ground
6. GND ground
7. IHB inhibit
8. I Data input
9. ENB enable
10. V_{CC} power supply

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Fiber Optic Transmitter Module

APPLICATION (continued)

The Trilevel Transparent Code (TTC) optical signal is represented by three optical power levels:

a. LOW - zero power out
b. HI - maximum power out (P_H)
c. OFF - 1/2 maximum power out (P_O)

This three level optical signal is therefore analogous to a bipolar voltage signal (+, -, zero) in a conventional system.

The TTC encoder incorporated in the MASTERSLICE IC encodes a positive going input signal transition into a 50 ns wide LOW optical pulse and a negative going transition into a HI optical pulse. In addition, the encoder provides the appropriate width refresh pulse when the input is not transitioning. For TTL low input, HI refresh pulses are generated and output, and for TTL high input, LOW refresh pulses are output. The refresh pulses are required by the Receiver Module (HFM1011) to aid in decoding the trilevel optical signal back into the original TTL signal.

The TTL encoding scheme makes the HFM2010 to HFM1011 fiber optic link "transparent" to data format. Any input pulse width from DC to 100 ns will be reproduced at the link output. Narrower pulse widths require special versions (internal module capacitor changes) of the HFM2010 module.

The Data Input (pin 8) drives an internal gate that has 50 mV of hysteresis. Therefore, there is no limit to the rise/fall time of the input signal. An internal Schottky diode clamp on the Data Input limits negative overshoot to less than 1 V.

The Power Output Selection inputs (pins 1, 2, 3) are used to statically or dynamically select the power output (see POWER OUTPUT SELECTION TABLE). With none of the select inputs grounded, 100% of the average power output (P_O) is selected. Grounding any of the inputs reduces the optical power out and also the module power dissipation.

Note
I_{CC} varies with P_O selected. Typical values are:
I_{CC} = (80 + (% x .9) mA, where % is given in the POWER OUTPUT SELECTION TABLE.

Example
For $P_1 = 1$, $P_2 = 1$, $P_4 = 0$, $I_{CC} = 80 + (50 \times .9) = 125$.

Notes
1. For PC board mounting, optical connector must overhang PC board edge to attach fiber cable.
2. For panel mounting, maximum recommended panel thickness is 0.156 in (3.96 mm).
3. Penetration greater than 0.09 (23) into tapped holes may damage module.

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Fiber Optic Transmitter Module

ELECTRO-OPTICAL CHARACTERISTICS (Values shown apply over ranges given in Recommended Operating Conditions unless otherwise stated. For TYP values V_{CC}=5.0 V and T_C=25°C)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	TEST CONDITIONS
High Level Input Current	I_{IH}		1	40	µW	V_I = 2.4 V
Low Level Input Current	I_{IL}		-1.2	-1.6	mA	V_I = 0.4 V
	$I_{P1,2,4}$		-2.3	-4.5	mA	$V_{P1,2,4}$ = 0.4 V
Supply Current (1)	I_{CC}		170	240	mA	$V_{P1,2,4} = V_{CC}$, V_I = 0.4 V
Power Output (average) HFM2010-2X4	P_O	100	140		µW	Data input = 5 MHz, square wave, measured out of 10 m of 100 µm core fiber, NA = 0.28, V_{CC} = 5.0 V, T_C = 25°C
P_O Temperature Coefficient	ΔP_O		-0.012		dB/°C	$V_{P1,2,4} = V_{CC}$, V_I = 0.4 V
Pulse Amplitude Symmetry (2) (=(P_H-P_O)/P_O)	K	0.8		1.2		
Peak Wavelength	λ_P	800	850	900	nm	T_C = 25°C
Propagation Delay (3)	t_{PLH}/t_{PHL}		13	23	ns	
Optical Pulse Width					ns	
	t_P Data	40	50	60		
	t_P Refresh	35	50	75		
Refresh Pulse Repetition Rate	f_R	0.7	1.1	2	MHz	

Notes

1. I_{CC} varies with P_O selected. Typical values are I_{CC}= (80 + (% x .9)) mA, where % is given in the POWER OUTPUT SELECTION TABLE. EXAMPLE: For P_1=1, P_2=2, P_4= 0, I_{CC}= 80 + (50 x .9) = 125 mA.
2. K= (P_H - P_O)/P_O is a measure of the difference in amplitude between a HIGH pulse and a LOW pulse.
3. The refresh pulse is interrrupted if Data Input (V_I) changes state during the refresh pulse. Min. propagation delay (typical reduction -3 ns) occurs for Data Input transitioning during the refresh pulse as shown in the OPTICAL ENCODING AND TIMING DIAGRAM.

ABSOLUTE MAXIMUM RATINGS

(25°C Free-Air Temperature unless otherwise noted)

Storage temperature	-65 to +150°C
Case operating temperature	-55 to +100°C
Lead solder temperature	260°C, 10 s
Supply voltage (V_{CC})	-0.5 to +7 V
Input voltage	
V_I, V_{ENB}, V_{IHB}	-0.5 to +5.5 V
V_{DS}	-0.5 to +0.9 V
V_{P1}, V_{P2}, V_{P4}	V_{CC}

Notes

1. The input voltage must be limited to 5.5 V max. even though V_{CC} may be 7.0 V.

ABSOLUTE MAXIMUM RATINGS (continued)

Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

HFM2010

Fiber Optic Transmitter Module

RECOMMENDED OPERATING CONDITIONS

Case operating temperature	-55 to +100°C
Supply voltage (V_{CC})	+4.5 to +5.5 V
Input voltage [1]	
V_{DS}	Open
V_{ENB}	V_I or V_{CC}
V_{INB}	GND
High level input voltage [2]	
V_{IH}	2.4 V to V_{CC}
V_{P1H}, V_{P2H}, V_{P4H}	
Low level input voltage [3]	
V_{IL}	0 to +0.5 V
V_{P1L}, V_{P2L}, V_{P4L}	
Data input pulse width at 1.5 V points	> 100 ns

RECOMMENDED OPERATING CONDITIONS (continued)

Notes

1. These three input input functions are not defined for Trilevel Transparent optical code. They are used only in the Bilevel code HFM2110 Transmitter Module. For proper module operation, connect as follows:
   Pin 9 to V_{CC} or Pin 8
   Pin 7 to GND
   Pin 4 leave open (do not connect).
2. The input voltage must be limited to 5.5 V max. even though V_{CC} may be 7.0 V.
3. For dynamic power output selection, drive these inputs with open collector or standard TTL. For static power select, either GND the input or leave open, an internal pull-up is provided. See POWER OUTPUT SELECTION TABLE for available range

OPTICAL ENCODING AND TIMING DIAGRAM

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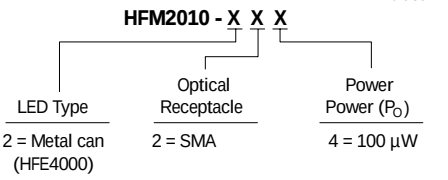
P_1	P_2	P_4	% of P_O
1	1	0	50.0
0	0	1	62.5
1	0	1	75.0
0	1	1	87.5
1	1	1	100.0

1 = V_{PH} or Open
0 = V_{PL} or GND

OPTICAL ENCODING AND TIMING DIAGRAM

FIBER025.SCH



Example: HFM 2010-224 contains a metal can (HFE4000) LED in an SMA receptacle with minimum P_O = 100 µW

BLOCK DIAGRAM

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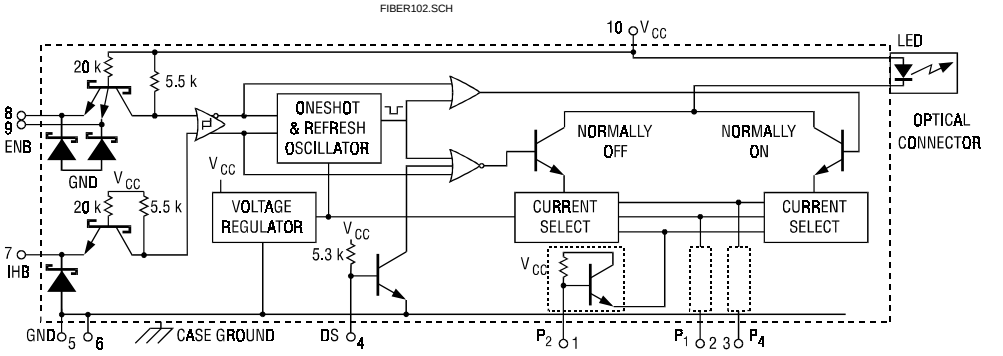

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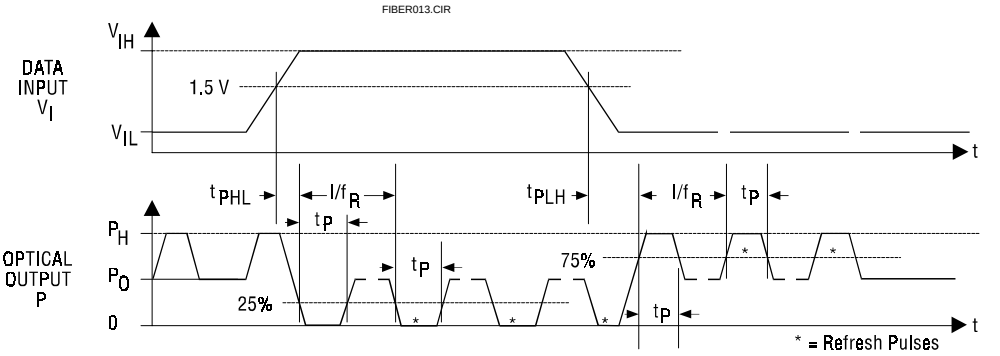
Fiber Optic Transmitter Module

OPTICAL ENCODING AND TIMING DIAGRAM



CAUTION

The inherent design of this component causes it to be sensitive to electrostatic discharge (ESD). To prevent ESD-induced damage and/or degradation to equipment, take normal ESD precautions when handling this product.

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