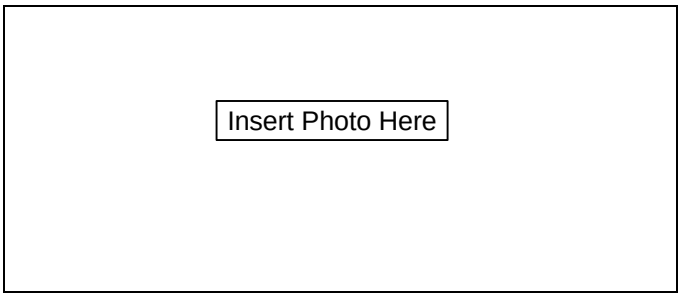
Modulated Reflective Sensor OTM930



FEATURES:

- **Modulated Sensor and Emitter Integrated in Industry Standard Package**
- **Only One External Resistor Required**
- **Senses Black Paper at Distance as Close as 0.10”**
- **Custom Cable Lengths and Terminating Connectors Available**

PRODUCT DESCRIPTION

The OTM930 is designed to provide excellent sensing performance in high ambient light conditions (up to 4000 lx). The OTM930 modulated reflective sensor provides exceptional sensing of non-reflective type materials, such as black paper, at close proximity (0.1”), as well as reflective targets as far away as 20 inches or further utilizing an outboard driver. The device features an 880nm infrared LED and a modulated photo integrated detector combined into an industry standard package. Only a single external resistor is required for operation. The detector consists of a built-in oscillator and an LED driver circuit, enabling optical synchronous detection under high ambient light conditions. The standard device includes a 16 inch cable with a seven (7) pin insulation displacement connector. Consult the factory for custom cable lengths, terminating requirements, or custom applications. OTM930 applications include document scanners, copiers, printers, and a wide range of other material handling equipment.

Absolute Maximum Ratings

General

Storage Temperature Range ---------- - 40°C to +100°C
Operating Temperature Range ---------- - 25°C to +60°C

Modulated Sensor / Driver

Supply Voltage ---------- -0.5 to +12 V
Output Voltage ---------- -0.5 to +12 V
Output Current ---------- 50 mA
Cathode Output Voltage ---------- -0.5 to +12 V
Cathode Pulsed Output Current ---------- 70 mA
Power Dissipation (Derate 3.3 mW/°C above 25°C) ---------- 250 mW

Infrared Emitter (880 nm)

Reverse Voltage ---------- 5 V
Peak Forward Current (t = 10 µs, Duty Cycle = 1/20) ---------- 1 A
Power Dissipation ---------- 100 mW

Product Specifications (T_A = 25°C unless noted)

Modulated Sensor / Driver

Parameter	Symbol	Min	Typ	Max	Units
Supply Voltage	V_{CC}	4.5		12	V
Sensor Current (O.C. output and O.C. cathode open)	I_{CC}		4	11	mA
Output Low Level Collector-Emitter Voltage (I_{OL}=16 mA)	V_{CE}		0.2	0.4	V
Cathode Low Level Collector-Emitter Voltage (I_{FM}=40mA)	V_{CE}			0.8	V

Infrared Emitter

Parameter	Symbol	Min	Typ	Max	Units
Forward Voltage (I_F = 50 mA)	V_F		1.40	1.55	V
Reverse Current (V_R = 5 V)	I_R			100	µA
Peak Wavelength (I_F = 20 mA)	λ_P		880		nm
Radiant Intensity (I_F = 100 mA, 0.01 sr)	I_E	20		40	mW/sr
Spectral Bandwidth at 50% (I_F = 20 mA)	$\Delta\lambda$		80		nm
Half Intensity Beam Angle	θ		20		Degrees

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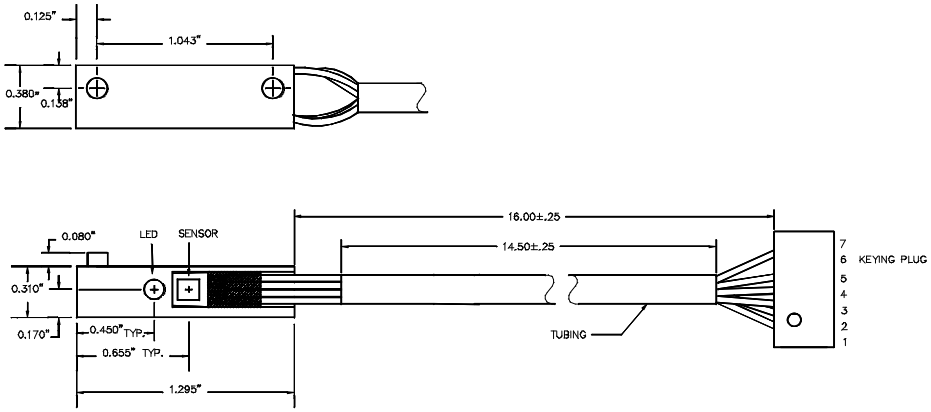
Coupled Characteristics

Parameter		Symbol	Min	Typ	Max	Units
Coplanarity to reflective surface				± 10		degree
Minimum Sensing Distance (I_F = 10 mA)		d_{min}			0.1	inch
Maximum Sensing Distance[1]	I_{FM} = 10 mA	d_{max}	1.3	1.4		inches
	I_{FM} = 30 mA		2.3	2.6		
	I_{FM} = 50 mA		3.0	3.2		
	I_{FM} = 70 mA		3.3	3.6		
	I_{FM} = 500 mA		5.0	5.5		
Maximum Sensing Distance[2]	I_{FM} = 10 mA	d_{max}	8	8.9		inches
	I_{FM} = 30 mA		12	13.8		
	I_{FM} = 50 mA		17	19.1		
	I_{FM} = 70 mA		18	21		
	I_{FM} = 500 mA		30	40		
Hysteresis			0.45	0.65	0.95	
Frequency Response		f	0.5	1.25		kHz
Allowable Ambient Light		E_X	2000	4000		lx

[1] Reflecting surface is 3" diameter Eastman Kodak neutral white test card having a 90% diffused reflectance.
[2] Reflecting surface is 3" diameter 3M 8810 Reflective Marking Film.

Dimensional Outline



Application Information

The following table defines the pin functions of the OTM930:

Pin Number	Function
1	GND
2	V_{CC}
3	Infrared LED Anode (+)
4	Open Collector LED Cathode Driver (Current Sink)
5	Infrared LED Cathode (-)
6	No Connection / Key Plug
7	Open Collector Output

The OTM930 provides open collector outputs for both the infrared LED driver circuitry and the logic state switched output. With the open collector output connected to V_{CC} with a pull up resistor, the voltage will be high in the absence of the reflected light and low with the presence of reflected light (logic inverted output). The output transistor should be pulled up as close to the decision circuitry as possible to avoid interference problems. The open collector LED drive requires a single resistor to set the LED forward current properly for the desired sensing distance. To determine this resistance value use Equation 1 and refer to Figure 1 (Standard Configuration):

$$R = \frac{V_{CC} - V_F - V_{CE}}{I_{FM}} \quad (1)$$

Where V_{CC} is the supply voltage, V_F is the LED forward voltage drop (~ 1.4 V), V_{CE} is the cathode transistor drop (~ 0.8 V), and I_{FM} is the modulated LED forward current.

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For extended distance sensing the circuit can utilize an outboard LED drive transistor to safely drive the forward current of the LED as high as 1A. Refer to Figure 2 (Outboard Driver) for details. Be sure to use a PNP transistor that can adequately handle the increased collector current and can be driven (I_{BB}) without exceeding the LED drive transistor collector current.

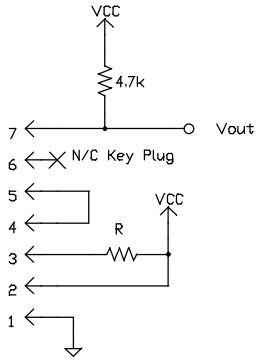

FIGURE 1
If < 70 mA

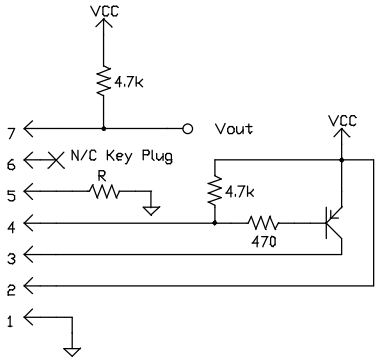

FIGURE 2
70 mA < If < 1 A