

**MOTOROLA**  
**SEMICONDUCTOR**  
 TECHNICAL DATA

**Photo Detector**  
**Logic Output**

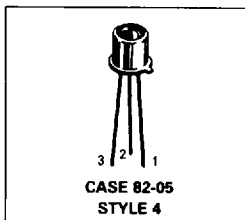
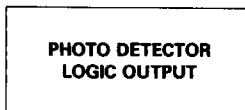
The MRD5009 incorporates a Schmitt Trigger which provides hysteresis for noise immunity and pulse shaping. The detector circuit is optimized for simplicity of operation and utilizes an open-collector output for application flexibility.

**Features:**

- Popular TO-18 Type Package for Easy Handling and Mounting
- High Coupling Efficiency
- Wide  $V_{CC}$  Range
- Ideally Suited for Use With MLED930 Emitter
- Usable to 125 kHz
- Hermetic Metal Package for Maximum Stability and Reliability

**Applications:**

- Industrial Processing and Control
- Shaft or Position Readers
- Optical Switching
- Remote Control
- Light Modulators
- Punched Card Readers
- Logic Circuits
- Light Demodulation/Detection
- Counters



**MAXIMUM RATINGS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Rating	Symbol	Value	Unit
Output Voltage Range	$V_O$	0-16	Volts
Supply Voltage Range	$V_{CC}$	0-16	Volts
Output Current	$I_O$	50	mA
Device Dissipation Derate above $25^\circ\text{C}^*$	$P_D$	250 2.27	mW mW/ $^\circ\text{C}$
Maximum Operating Temperature	$T_A$	-40 to +85	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-65 to +200	$^\circ\text{C}$
Lead Soldering Temperature (10 seconds maximum)	$T_L$	260	$^\circ\text{C}$

Characteristic	Symbol	Min	Typ	Max	Unit
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**DEVICE CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$ )

Operating Voltage	$V_{CC}$	3	—	15	Volts
Supply Current with Output High, Figure 4 ( $I_F = 0, V_{CC} = 5\text{ V}$ )	$I_{CC}(\text{off})$	—	1	5	mA
Output Current, High ( $I_F = 0, V_{CC} = V_O = 15\text{ V}, R_L = 270\ \Omega$ )	$I_{OH}$	—	—	100	$\mu\text{A}$

(continued)

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Characteristic	Symbol	Min	Typ	Max	Unit	
<b>COUPLED CHARACTERISTICS</b> ( $T_A = 0-70^\circ\text{C}$ )						
Light Required to Trigger (Tungsten Source, 2870 K)	$H_{(on)}$	—	0.50	—	$\text{mW}/\text{cm}^2$	
The following characteristics are measured with an MLED930 emitter at a separation distance of 8 mm (0.315 inches) with the lenses of the emitter and detector on a common axis within 0.1 mm and parallel within 5 degrees.						
Supply Current with Output Low, Figure 5 ( $I_F = I_{F(on)}$ , $V_{CC} = 5\text{ V}$ )	$I_{CC(on)}$	—	1.6	5	mA	
Output Voltage, Low ( $R_L = 270\ \Omega$ , $V_{CC} = 5\text{ V}$ , $I_F = I_{F(on)}$ )	$V_{OL}$	—	0.2	0.4	volts	
Threshold Current, ON ( $R_L = 270\ \Omega$ , $V_{CC} = 5\text{ V}$ )	$I_{F(on)}$	—	10	20	mA	
Threshold Current, OFF ( $R_L = 270\ \Omega$ , $V_{CC} = 5\text{ V}$ )	$I_{F(off)}$	1	7.5	—	mA	
Hysteresis Ratio, Figure 1 ( $R_L = 270\ \Omega$ , $V_{CC} = 5\text{ V}$ )	$\frac{I_{F(off)}}{I_{F(on)}}$	—	0.75	—		
<b>SWITCHING CHARACTERISTICS</b> ( $T_A = 25^\circ\text{C}$ )						
Turn-On Time	$R_L = 270\ \Omega$ , $V_{CC} = 5\text{ V}$ , $I_F = I_{F(on)}$	$t_{on}$	—	1.2	5	$\mu\text{s}$
Fall Time		$t_f$	—	0.1	—	
Turn-Off Time		$t_{off}$	—	1.2	5	
Rise Time		$t_r$	—	0.1	—	

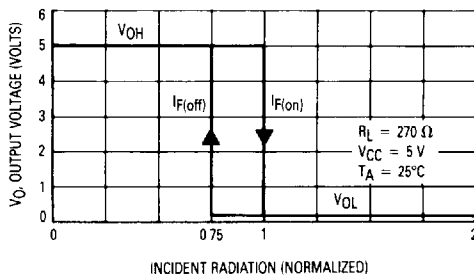


Figure 1. Transfer Characteristics

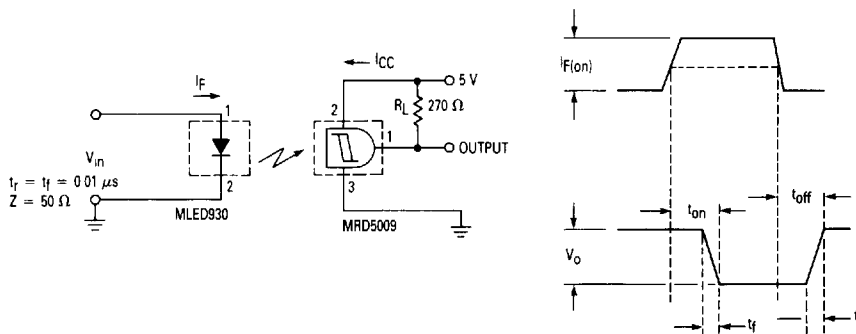
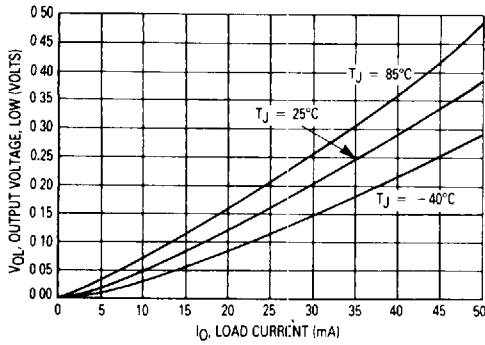
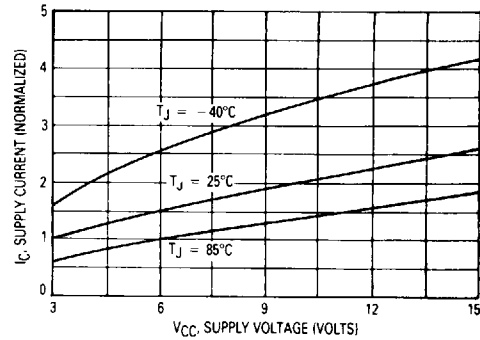


Figure 2. Switching Test Circuit

**TYPICAL CHARACTERISTICS**

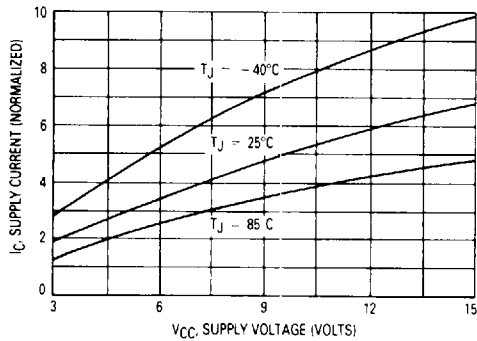


**Figure 3. Output Voltage, Low versus Load Current**

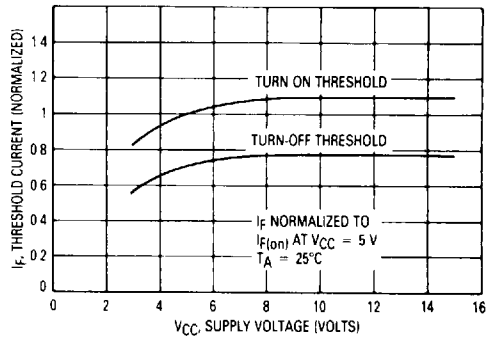


**Figure 4. Supply Current versus Supply Voltage — Output High**

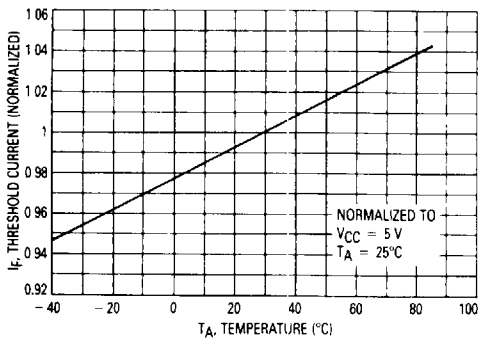
**TYPICAL COUPLED CHARACTERISTICS USING MLED930  
 EMITTER AND MRD5009 DIGITAL OUTPUT DETECTOR**



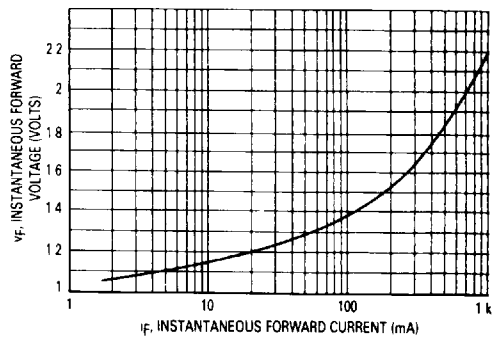
**Figure 5. Supply Current versus Supply Voltage — Output Low**



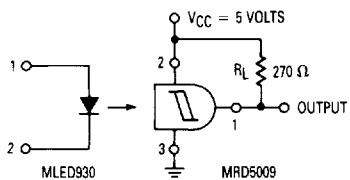
**Figure 6. Threshold Current versus Supply Voltage**



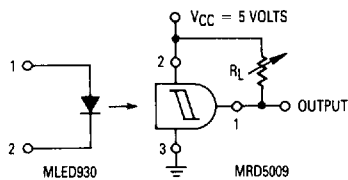
**Figure 7. Threshold Current versus Temperature**



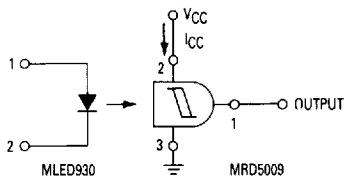
**Figure 8. MLED930 Forward Characteristics**



**Figure 9. Test Circuit for Threshold Current Measurements**



**Figure 10. Test Circuit for Output Voltage versus Load Current Measurements**



**Figure 11. Test Circuit for Supply Current versus Supply Voltage Measurements**