MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

Photo Detector
Logic Output

MRD5009
Motorola Preferred Device

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

CASE 82-05
STYLE 4

7

MAXIMUM RATINGS (T_A = 25°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°C*	P_D	250 2.27	mW mW/°C
Maximum Operating Temperature	T_A	−40 to +85	°C
Storage Temperature Range	T_{stg}	−65 to +200	°C
Lead Soldering Temperature (10 seconds maximum)	T_L	260	°C

Characteristic	Symbol	Min	Typ	Max	Unit
DEVICE CHARACTERISTICS (T_A = 25°C)					
Operating Voltage	V_{CC}	3	—	15	Volts
Supply Current with Output High, Figure 4 (I_F = 0, V_{CC} = 5 V)	$I_{CC(off)}$	—	1	5	mA
Output Current, High (I_F = 0, V_{CC} = V_O = 15 V, R_L = 270 Ω)	I_{OH}	—	—	100	μA

(continued)

Characteristic	Symbol	Min	Typ	Max	Unit
COUPLED CHARACTERISTICS (T_A = 0–70°C)					
Light Required to Trigger (Tungsten Source, 2870 K)	$H_{(on)}$	—	0.50	—	mW/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 V)	$I_{CC(on)}$	—	1.6	5	mA
Output Voltage, Low (R_L = 270 Ω, V_{CC} = 5 V, I_F = $I_{F(on)}$)	V_{OL}	—	0 2	0 4	volts
Threshold Current, ON (R_L = 270 Ω, V_{CC} = 5 V)	$I_{F(on)}$	—	10	20	mA
Threshold Current, OFF (R_L = 270 Ω, V_{CC} = 5 V)	$I_{F(off)}$	1	7.5	—	mA
Hysteresis Ratio, Figure 1 (R_L = 270 Ω, V_{CC} = 5 V)	$\frac{I_{F(off)}}{I_{F(on)}}$	—	0 75	—	
SWITCHING CHARACTERISTICS (T_A = 25°C)					
Turn-On Time	R_L = 270 Ω, V_{CC} = 5 V, I_F = $I_{F(on)}$	t_{on}	—	1 2	5	μs
Fall Time		t_f	—	0 1	—	
Turn-Off Time		t_{off}	—	1 2	5	
Rise Time		t_r	—	0 1	—	

7

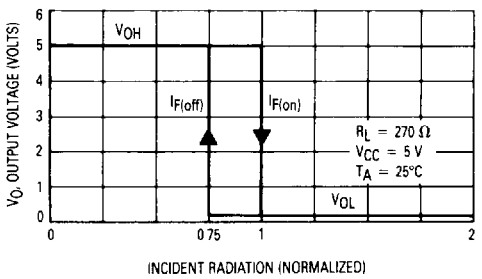

Figure 1. Transfer Characteristics

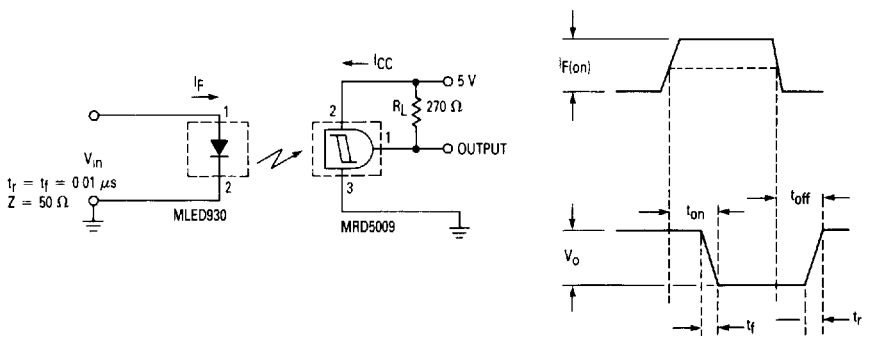

Figure 2. Switching Test Circuit

TYPICAL CHARACTERISTICS

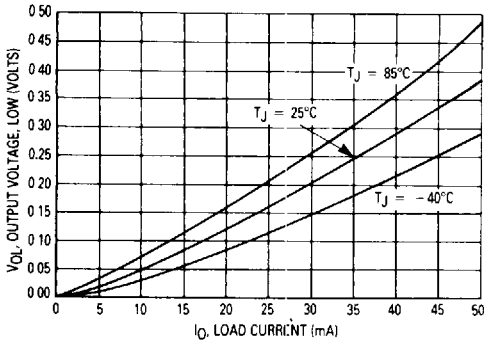

Figure 3. Output Voltage, Low versus Load Current

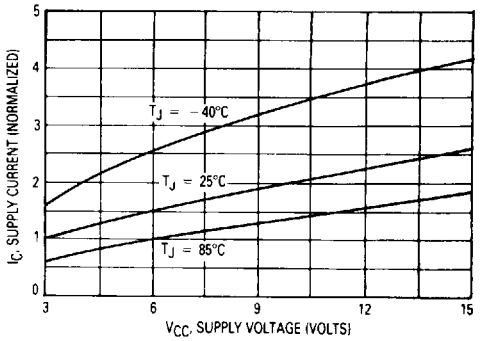

Figure 4. Supply Current versus Supply Voltage — Output High

TYPICAL COUPLED CHARACTERISTICS USING MLED930 EMITTER AND MRD5009 DIGITAL OUTPUT DETECTOR

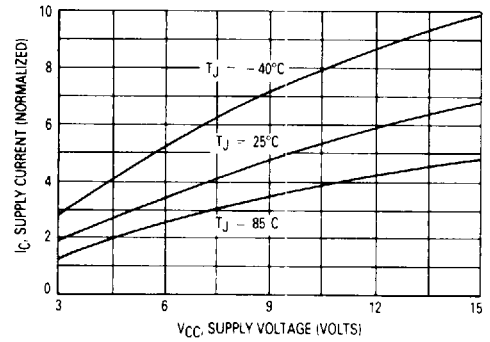

Figure 5. Supply Current versus Supply Voltage — Output Low

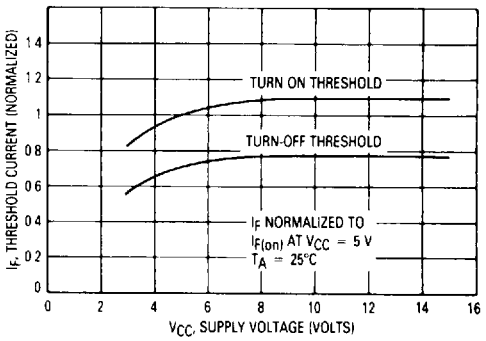

Figure 6. Threshold Current versus Supply Voltage

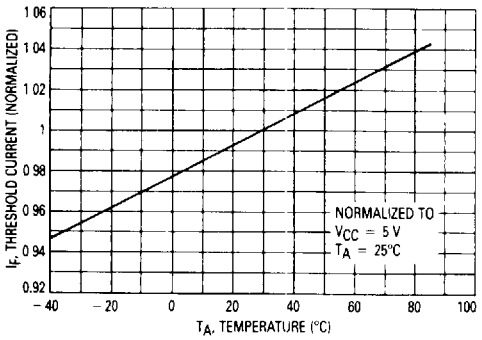

Figure 7. Threshold Current versus Temperature

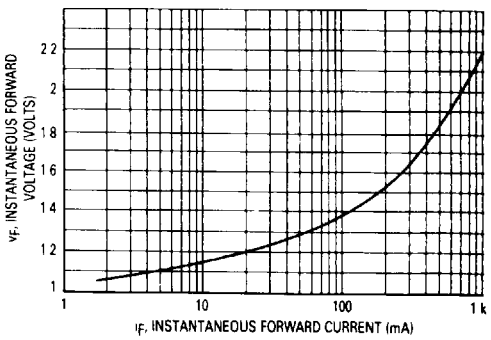

Figure 8. MLED930 Forward Characteristics

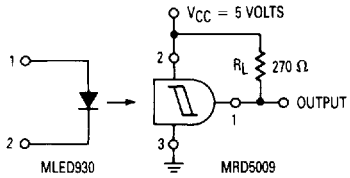

Figure 9. Test Circuit for Threshold Current Measurements

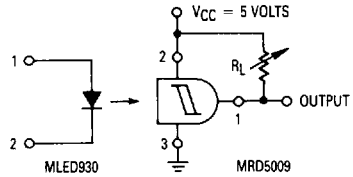

Figure 10. Test Circuit for Output Voltage versus Load Current Measurements

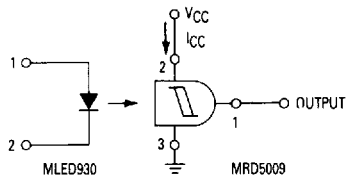

Figure 11. Test Circuit for Supply Current versus Supply Voltage Measurements

7