

**MOTOROLA  
SEMICONDUCTOR  
TECHNICAL DATA**

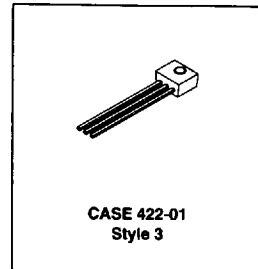
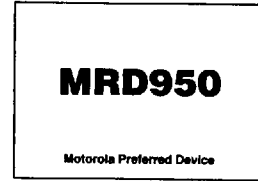
*Advance Information*  
**Digital Output Detector**

**Features:**

- Popular Low Cost Plastic Package
- High Coupling Efficiency
- Wide  $V_{CC}$  Range
- Ideally Suited for MLED91 Emitter
- Usable to 125 kHz
- Open Collector Output
- Compatible with 3 Volt Systems
- New Mold Technology Improves Performance Under Variable Environmental Conditions
- New Lens Design Offers Improved Optical Performance
- EIA 468-A Compliant Tape and Reel Option Available (MRD950RLRE)

**Applications:**

- IR Remote Control Receiver
- Shaft Encoders
- Position Sensors
- Interruptive Sensors



**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	$V_{CC}$	3 - 16	Volts
Output Current	$I_O$	50	mA
Device Dissipation Derate above $25^\circ\text{C}$ (1)	$P_D$	150 2.0	mW mW/ $^\circ\text{C}$
Maximum Operating Temperature	$T_A$	- 40 to +100	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	- 40 to +100	$^\circ\text{C}$
Lead Soldering Temperature (5 Seconds Maximum) (2)	$T_L$	260	$^\circ\text{C}$

\*Measured with device soldered into a typical PC board

**DEVICE CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$ )

Characteristic	Symbol	Min	Typ	Max	Unit
Operating Voltage	$V_{CC}$	3.0	—	16	Volts
Supply Current with Output High, Figure 4 ( $I_F = 0, V_{CC} = 5.0\text{ V}$ )	$I_{CC(off)}$	—	1.0	5.0	mA
Output Current, High ( $I_F = 0, V_{CC} = V_O = 15\text{ V}, R_L = 270\ \Omega$ )	$I_{OH}$	—	—	100	$\mu\text{A}$

(1) Measured with device soldered into a typical printed circuit board

(2) Maximum exposure time: five seconds. Minimum of 1/16 inch from the case. A heat sink should be applied in order to prevent the case temperature from exceeding  $100^\circ\text{C}$

This document contains information on a new product. Specifications and information herein are subject to change without notice.  
Preferred devices are Motorola recommended choices for future use and best overall value.

**COUPLED CHARACTERISTICS** ( $T_A = 0 - 70^\circ\text{C}$ )

Characteristic	Symbol	Min	Typ	Max	Unit
Light Required to Trigger (Tungsten Source, 2870 K)	$H_{(on)}$	—	0.50	—	mW/cm <sup>2</sup>

The following characteristics are measured with an MLED91 emitter at a separation distance of 4.0 mm (0.155 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 ( $I_F = I_{F(on)}$ , $V_{CC} = 5.0\text{ V}$ )	$I_{CC(on)}$	—	1.6	5.0	mA
Output Voltage, Low ( $R_L = 270\ \Omega$ , $V_{CC} = 5.0\text{ V}$ , $I_F = I_{F(on)}$ )	$V_{OL}$	—	0.2	0.4	Volts
Threshold Current, ON ( $R_L = 270\ \Omega$ , $V_{CC} = 5.0\text{ V}$ )	$I_{F(on)}$	—	10	20	mA
Threshold Current, OFF ( $R_L = 270\ \Omega$ , $V_{CC} = 5.0\text{ V}$ )	$I_{F(off)}$	1.0	7.5	—	mA
Hysteresis Ratio, Figure 1 ( $R_L = 270\ \Omega$ , $V_{CC} = 5.0\text{ V}$ )	$I_{F(off)}$ $I_{F(on)}$	—	0.75	—	—

**SWITCHING CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$ )

Turn-On Time	$R_L = 270\ \Omega$ $V_{CC} = 5.0\text{ V}$ $I_F = I_{F(on)}$	$t_{on}$	—	0.75	5.0	$\mu\text{s}$
Fall Time		$t_f$	—	0.1	—	
Turn-Off Time		$t_{off}$	—	2.0	5.0	
Rise Time		$t_r$	—	0.1	—	

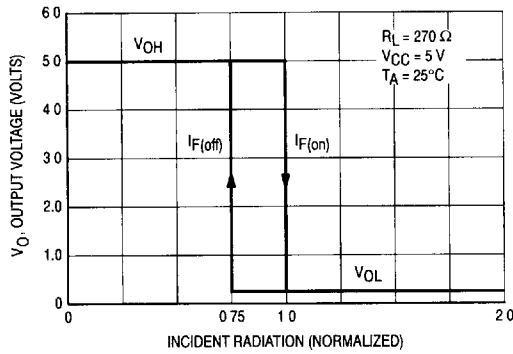


Figure 1. Transfer Characteristics

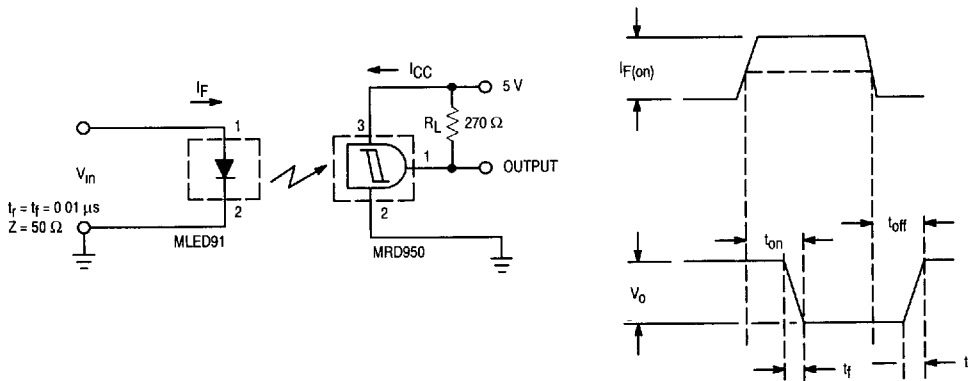
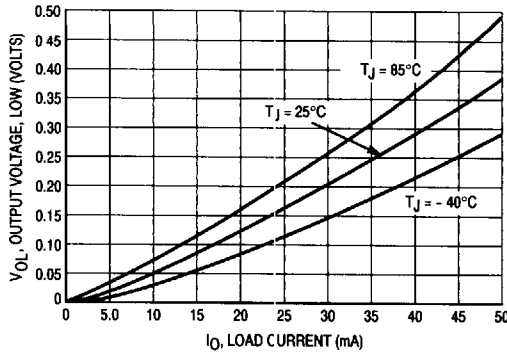
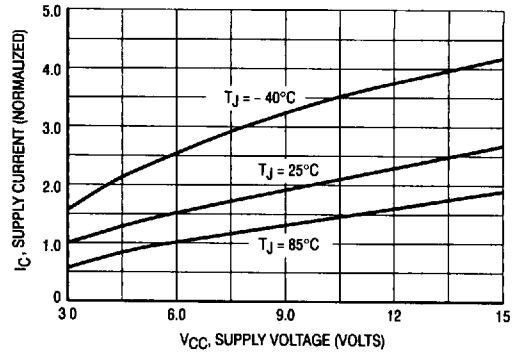


Figure 2. Switching Test Circuit

**TYPICAL CHARACTERISTICS**

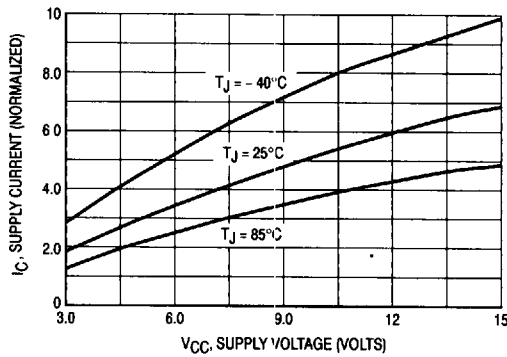


**Figure 3. Output Voltage, Low versus Load Current**

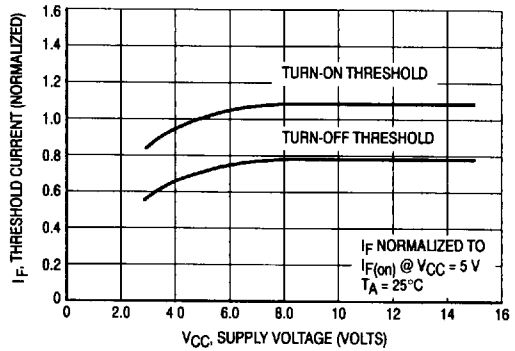


**Figure 4. Supply Current versus Supply Voltage — Output High**

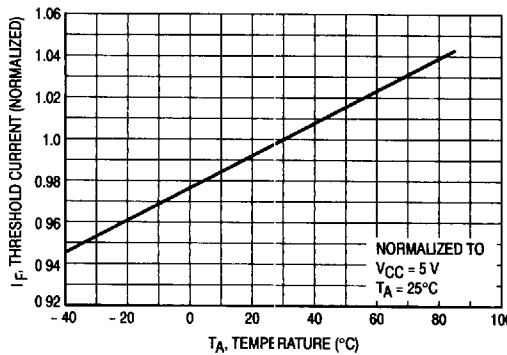
**TYPICAL COUPLED CHARACTERISTICS USING MLED91  
 EMITTER AND MRD950 DIGITAL OUTPUT DETECTOR**



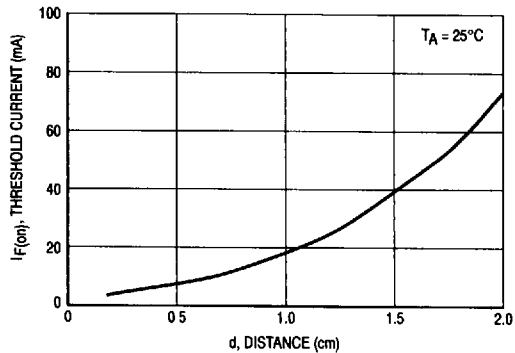
**Figure 5. Supply Current versus Supply Voltage — Output Low**



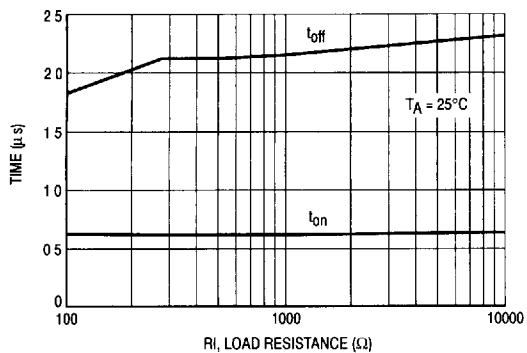
**Figure 6. Threshold Current versus Supply Voltage**



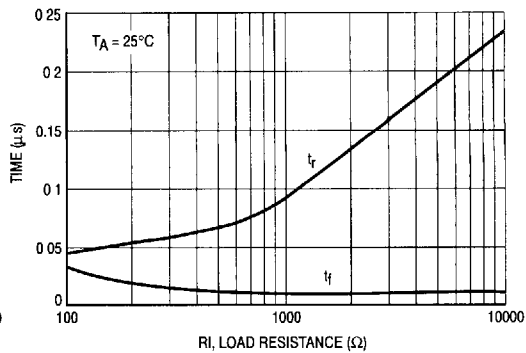
**Figure 7. Threshold Current versus Temperature**



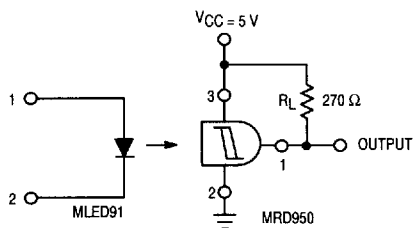
**Figure 8. Threshold Current versus Lens to Lens Separation Distance at 25°C**



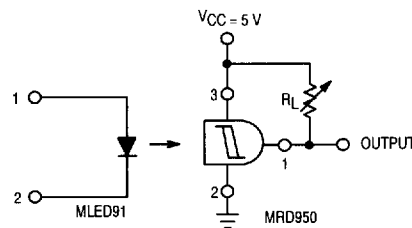
**Figure 9. MRD950 Switching Time versus Load Resistance**



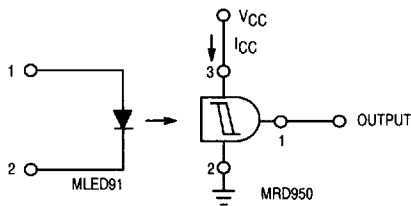
**Figure 10. MRD950 Rise Time and Fall Time versus Load Resistance**



**Figure 11. Test Circuit for Threshold Current Measurements**



**Figure 12. Test Circuit for Output Voltage versus Load Current Measurements**



**Figure 13. Test Circuit for Supply Current versus Supply Voltage Measurements**