MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

H21A1*
H21A2
H21A3
H22A1*
H22A2
H22A3

*Motorola Preferred Devices

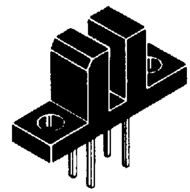
Slotted Optical Switches
Transistor Output

Each device consists of a gallium arsenide infrared emitting diode facing a silicon NPN phototransistor in a molded plastic housing. A slot in the housing between the emitter and the detector provides the means for mechanically interrupting the infrared beam. These devices are widely used as position sensors in a variety of applications.

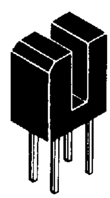
Features:
- Single Unit for Easy PCB Mounting
- Non-Contact Electrical Switching
- Long-Life Liquid Phase Epi Emitter
- 1 mm Detector Aperture Width

Applications:
Shaft encoders, non-contact switches, position sensing, paper handlers, coin handlers, and general purpose interruptive sensing.

SLOTTED OPTICAL SWITCHES TRANSISTOR OUTPUT



H21A1, 2 AND 3
CASE 354A-03
STYLE 1



H22A1, 2 AND 3
CASE 354-03
STYLE 1

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
INPUT LED			
Reverse Voltage	V_R	6	Volts
Forward Current — Continuous	I_F	60	mA
Input LED Power Dissipation @ T_A = 25°C Derate above 25°C	P_D	150 2	mW mW/°C
OUTPUT TRANSISTOR			
Collector-Emitter Voltage	V_{CEO}	30	Volts
Output Current — Continuous	I_C	100	mA
Output Transistor Power Dissipation @ T_A = 25°C Derate above 25°C	P_D	150 2	mW mW/°C
TOTAL DEVICE			
Ambient Operating Temperature Range	T_A	−40°C to 100°C	°C
Storage Temperature	T_{stg}	−40°C to 100°C	°C
Lead Soldering Temperature (5 seconds max)	—	260	°C
Total Device Power Dissipation @ T_A = 25°C Derate above 25°C	P_D	300 4	mW mW/°C

8

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic	Device	Symbol	Min	Typ	Max	Unit
INPUT LED						
Forward Voltage (I_F = 60 mA)		V_F	0 9	1.34	1.7	Volts
Reverse Leakage (V_R = 6 V)		I_R	—	1	10	μA
Capacitance (V = 0 V, f = 1 MHz)		C_J	—	24	50	pF
OUTPUT TRANSISTOR						
Dark Current (V_{CE} = 25 V)		I_{CEO}	—	15	100	nA
Collector-Emitter Breakdown Voltage (I_C = 1 mA)		$V_{(BR)CEO}$	30	45	—	Volts
Emitter-Collector Breakdown Voltage (I_E = 100 μA)		$V_{(BR)ECO}$	6	7.8	—	Volts
Capacitance (V_{CE} = 5 V, f = 1 MHz)		C_{CE}	—	2.5	—	pF
DC Current Gain (V_{CE} = 5 V, I_C = 2 mA)		h_{FE}	—	700	—	—
COUPLED						
Output Collector Current (I_F = 5 mA, V_{CE} = 5 V) Note 1	H21A1, H22A1	I_C	0.15	0.3	—	mA
	H21A2, H22A2		0 3	0.6	—	
	H21A3, H22A3		0.6	1	—	
Output Collector Current (I_F = 20 mA, V_{CE} = 5 V) Note 1	H21A1, H22A1	I_C	1	2	—	mA
	H21A2, H22A2		2	4	—	
	H21A3, H22A3		4	7	—	
Output Collector Current (I_F = 30 mA, V_{CE} = 5 V) Note 1	H21A1, H22A1	I_C	1 9	3.8	—	mA
	H21A2, H22A2		3	6	—	
	H21A3, H22A3		5.5	10	—	
Collector-Emitter Saturation Voltage (I_C = 1.8 mA, I_F = 30 mA) Note 1	H21A1, H22A1	$V_{CE(sat)}$	—	0.25	0.4	Volts
Collector-Emitter Saturation Voltage (I_C = 1.8 mA, I_F = 20 mA) Note 1	H21A2, H22A2	$V_{CE(sat)}$	—	0.25	0.4	Volts
	H21A3, H22A3		—	0.25	0.4	
Turn-On Time (I_F = 30 mA, V_{CC} = 5 V, R_L = 2.5 kΩ) Note 1		t_{on}	—	20	—	μs
Turn-Off Time (I_F = 30 mA, V_{CC} = 5 V, R_L = 2.5 kΩ) Note 1		t_{off}	—	80	—	μs

Notes 1 No actuator in sensing gap.
2. Stray radiation can alter values of characteristics. Adequate light shielding should be provided

TYPICAL CHARACTERISTICS

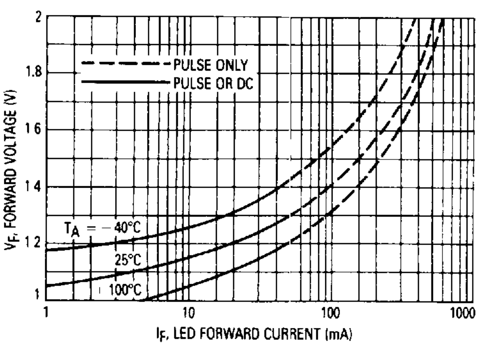


Figure 1. LED Forward Voltage versus Forward Current

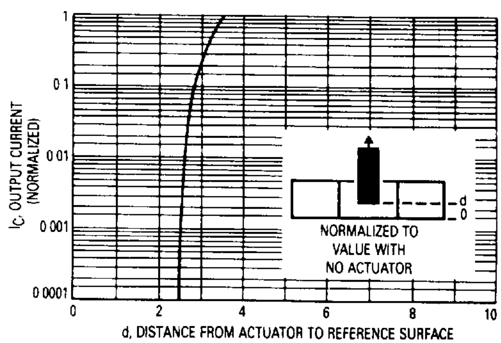


Figure 2. Output Current versus Actuator Position

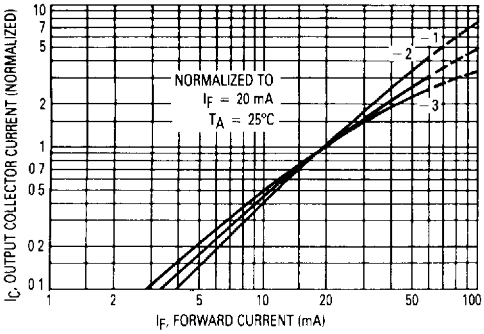


Figure 3. Output Current versus Input Current

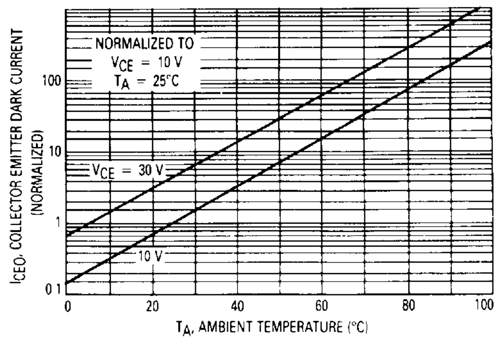


Figure 4. Dark Current versus Ambient Temperature

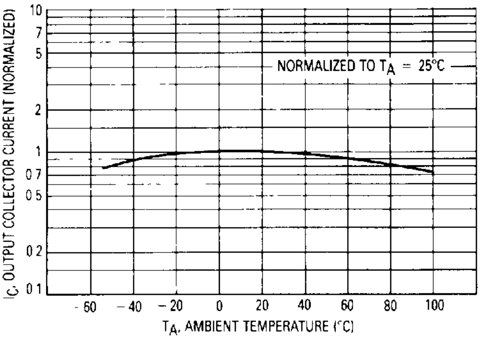


Figure 5. Output Current versus Ambient Temperature

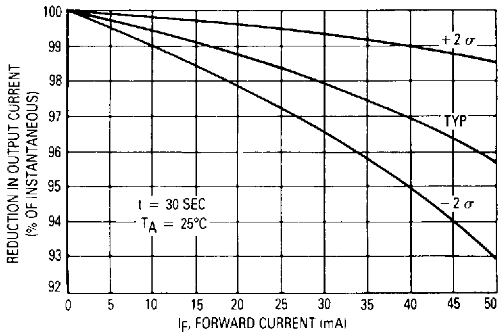


Figure 6. Reduction in Output Current Due to LED Heating versus Forward Current

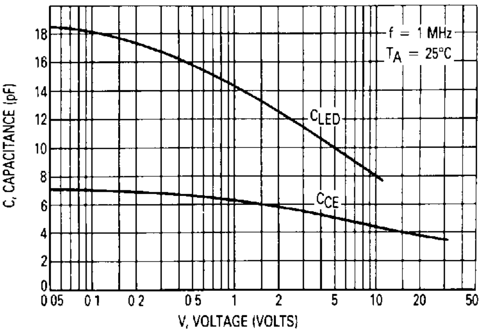


Figure 7. Capacitances versus Voltage

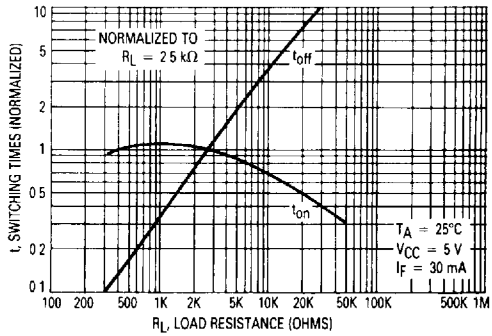


Figure 8. Switching Times versus Load Resistance

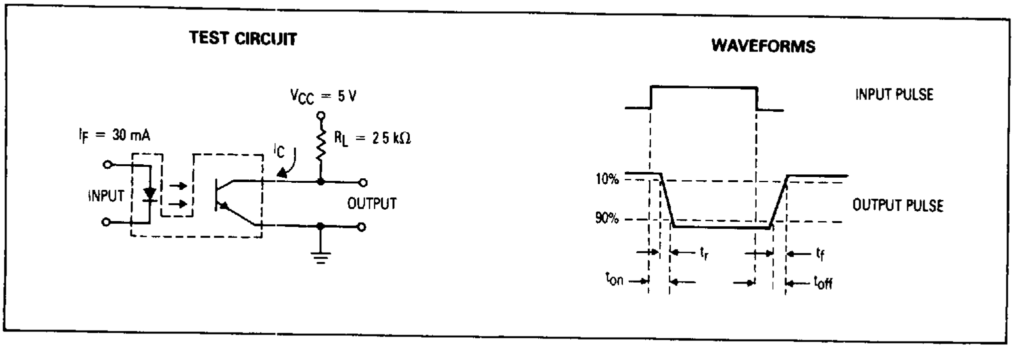


Figure 9. Switching Times

8