

FAIRCHILD
SEMICONDUCTOR®

PHOTOTRANSISTOR OPTOCOUPLEDERS

H11AG1

H11AG2

H11AG3

DESCRIPTION

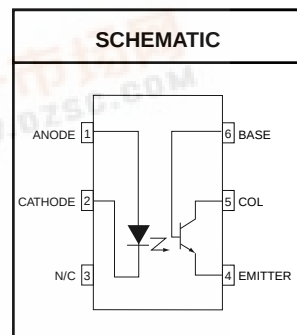
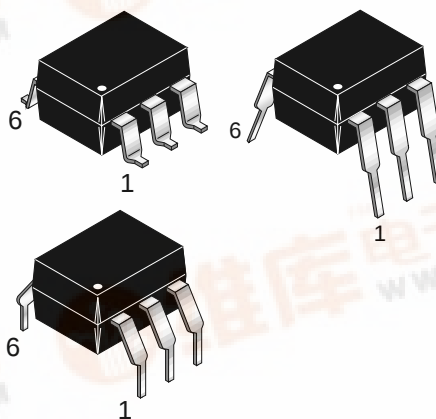
The H11AG series consists of a Gallium-Aluminum-Arsenide IRED emitting diode coupled with a silicon phototransistor in a dual in-line package. This device provides the unique feature of the high current transfer ratio at both low output voltage and low input current. This makes it ideal for use in low power logic circuits, telecommunications equipment and portable electronics isolation applications.

FEATURES

- High efficiency low degradation liquid epitaxial IRED
- Logic level compatible, input and output currents, with CMOS and LS/TTL
- High DC current transfer ratio at low input currents
- Underwriters Laboratory (UL) recognized File #E90700

APPLICATIONS

- CMOS driven solid state reliability
- Telephone ring detector
- Digital logic isolation



ABSOLUTE MAXIMUM RATINGS

Parameters	Symbol	Device	Value	Units
TOTAL DEVICE				
Storage Temperature	T_{STG}	All	-55 to +150	°C
Operating Temperature	T_{OPR}	All	-55 to +100	°C
Lead Solder Temperature	T_{SOL}	All	260 for 10 sec	°C
Total Device Power Dissipation @ 25°C (LED plus detector)	P_D	All	260	mW
Derate Linearly From 25°C			3.5	mW/°C
EMITTER				
Continuous Forward Current	I_F	All	50	mA
Reverse Voltage	V_R	All	6	V
Forward Current - Peak (1 μ s pulse, 300 pps)	$I_{F(pk)}$	All	3.0	A
LED Power Dissipation 25°C Ambient	P_D	All	75	mW
Derate Linearly From 25°C			1.0	mW/°C
DETECTOR				
Detector Power Dissipation @ 25°C	P_D	All	150	mW
Derate Linearly from 25°C			2.0	mW/°C
Continuous Collector Current		All	50	mA

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ELECTRICAL CHARACTERISTICS ($T_A = 0-70^\circ\text{C}$ Unless otherwise specified.)

INDIVIDUAL COMPONENT CHARACTERISTICS

Parameters	Test Conditions	Symbol	Device	Min	Typ	Max	Units
EMITTER							
Input Forward Voltage	$I_F = 1 \text{ mA}$	V_F	All			1.5	V
Reverse Leakage Current	$V_R = 5 \text{ V}, T_A = 25^\circ\text{C}$	I_R	All			10	μA
	$V_R = 5 \text{ V}, T_A = 70^\circ\text{C}$	I_R	All			100	μA
Capacitance	$V = 0, f = 1.0 \text{ MHz}$	C_J	All			100	pF
DETECTOR							
Breakdown Voltage Collector to Emitter	$I_C = 1.0 \text{ mA}, I_F = 0$	BV_{CEO}	All	30			V
Collector to Base	$I_C = 100 \mu\text{A}, I_F = 0$	BV_{CBO}	All	70			V
Emitter to Collector	$I_C = 100 \mu\text{A}, I_F = 0$	BV_{ECO}	All	7			V
Leakage Current Collector to Emitter	$V_{CE} = 10 \text{ V}, I_F = 0$	I_{CEO}	All		5	10	μA
Capacitance	$V_{CE} = 10 \text{ V}, f = 1 \text{ MHz}$	C_{CE}	All		2		pF

ISOLATION CHARACTERISTICS

Parameters	Test Conditions	Symbol	Min	Typ	Max	Units
Input-Output Isolation Voltage	$I_{I-O} \leq 1 \mu\text{A}, t = 1 \text{ min.}$	V_{ISO}	5300			Vac(rms)

TRANSFER CHARACTERISTICS ($T_A = 25^\circ\text{C}$ Unless otherwise specified.)

DC Characteristics	Test Conditions	Symbol	Device	Min	Typ	Max	Units
Current Transfer Ratio	$I_F = 1 \text{ mA}, V_{CE} = 5 \text{ V}$	CTR	H11AG1	300			%
			H11AG2	200			
			H11AG3	100			
	$I_F = 1 \text{ mA}, V_{CE} = 0.6 \text{ V}$	CTR	H11AG1	100			
			H11AG2	50			
			H11AG3	20			
	$I_F = 0.2 \text{ mA}, V_{CE} = 1.5 \text{ V}$	CTR	H11AG1	100			
			H11AG2	50			
Saturation Voltage	$I_F = 2.0 \text{ mA}, I_C = 0.5 \text{ mA}$	$V_{CE(SAT)}$	All			.40	V
AC Characteristics	Test Conditions	Symbol	Device	Min	Typ	Max	Units
Non-Saturated Switching Times							
Turn-On Time	$R_L = 100 \Omega, I_F = 1 \text{ mA}, V_{CC} = 5 \text{ V}$	t_{on}	All		5		μS
Turn-Off Time	$R_L = 100 \Omega, I_F = 1 \text{ mA}, V_{CC} = 5 \text{ V}$	t_{off}	All		5		μS

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Figure 1. LED Forward Voltage vs. Forward Current

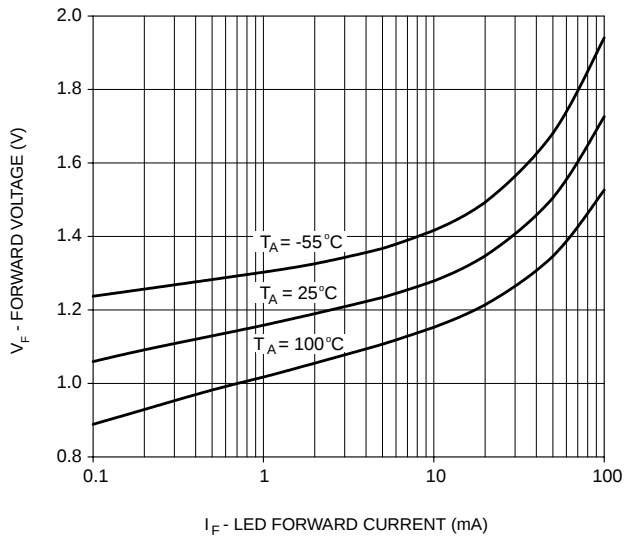


Figure 2. Normalized Current Transfer Ratio vs. Forward Current

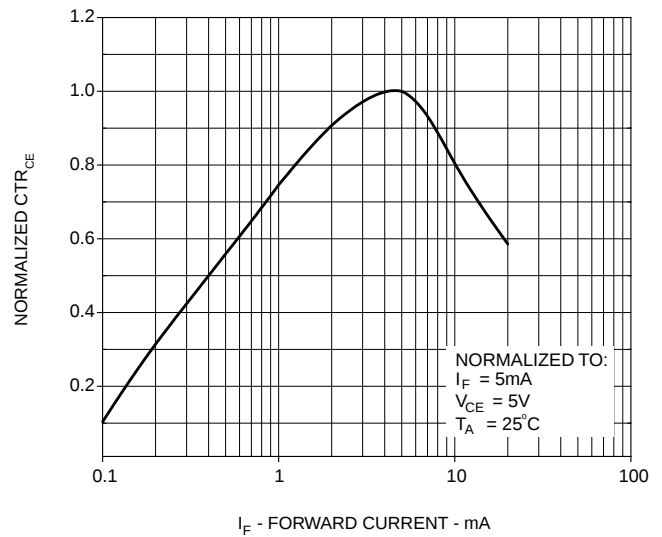


Figure 3. Normalized CTR vs. Temperature

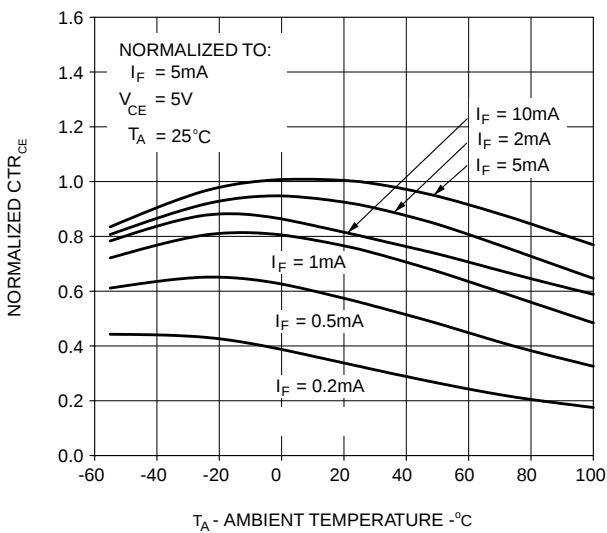
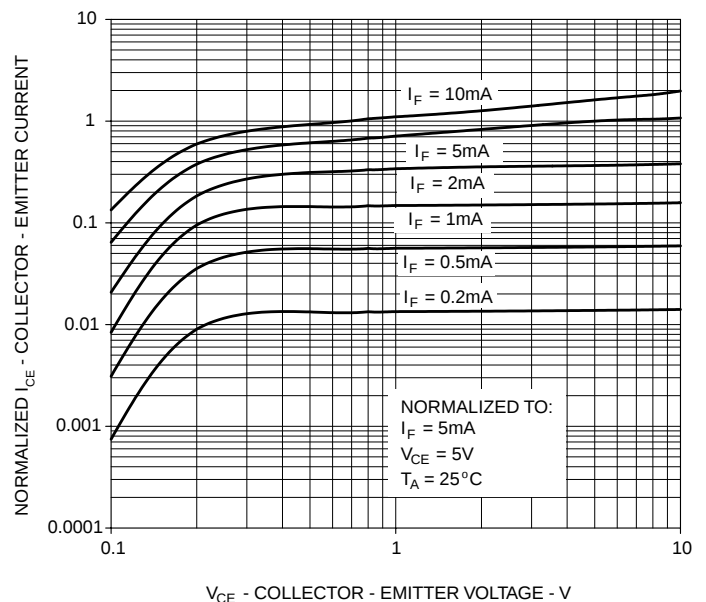


Figure 4. Normalized Collector vs. Collector - Emitter Voltage



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Figure 5. Normalized Collector Base Photocurrent Ratio vs. Forward Current

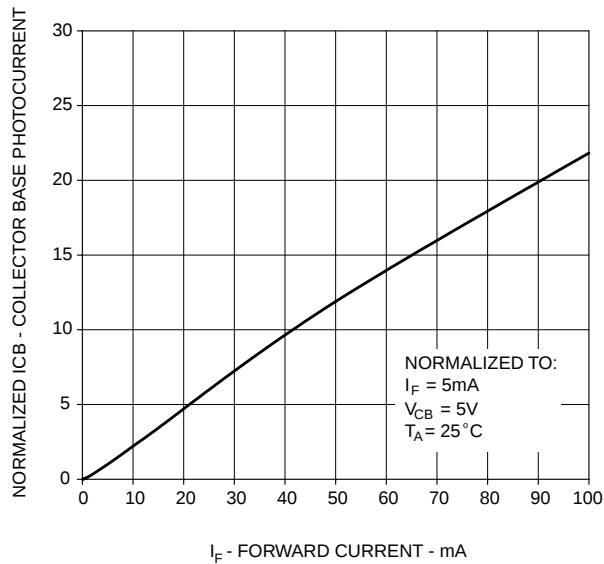


Figure 6. Normalized Collector - Base Current vs. Temperature

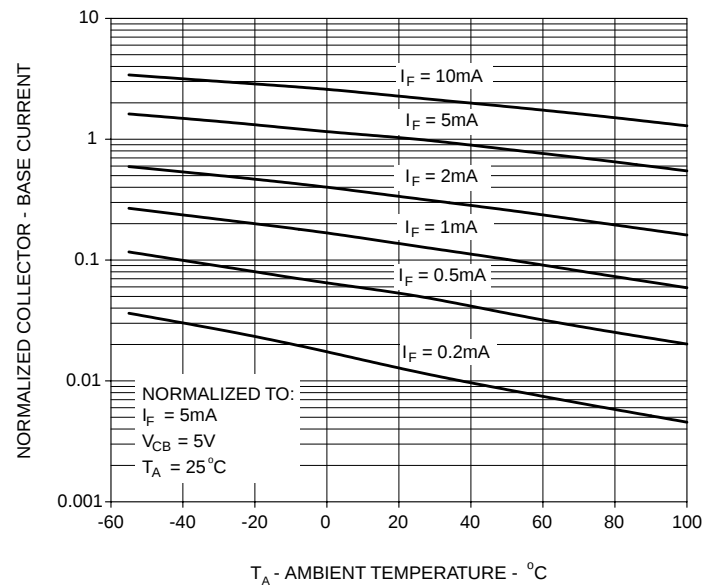
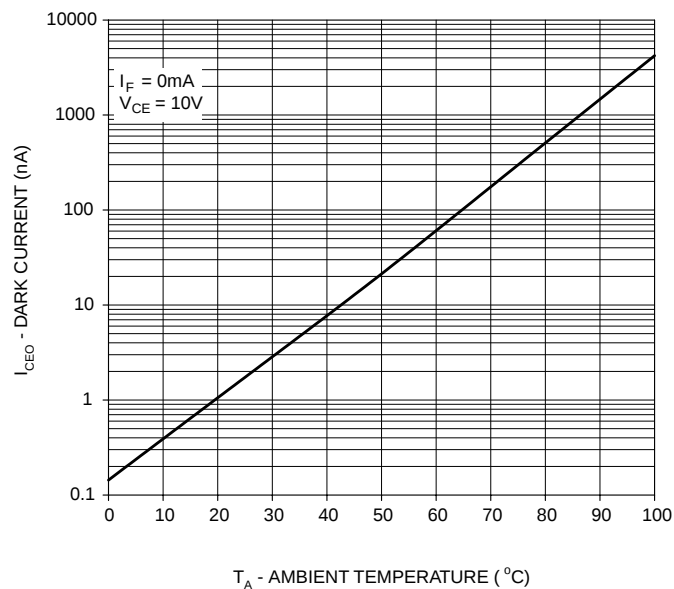


Figure 7. Collector-Emitter Dark Current vs. Ambient Temperature





INPUT	R ₁	C ₁	Z
40-90 VRMS 20 Hz	75 K 1/10 W	0.1 μF 100 V	109K
95-135 VRMS 60 Hz	180 K 1/10 W	12 ηF 200 V	285K
200-280 VRMS 50/60 Hz	390 K 1/4 W	6.80 ηF 400 V	550K

DC component of input voltage is ignored due to C1

Figure 9. Telephone Ring Detector/A.C. Line CMOS Input Isolator

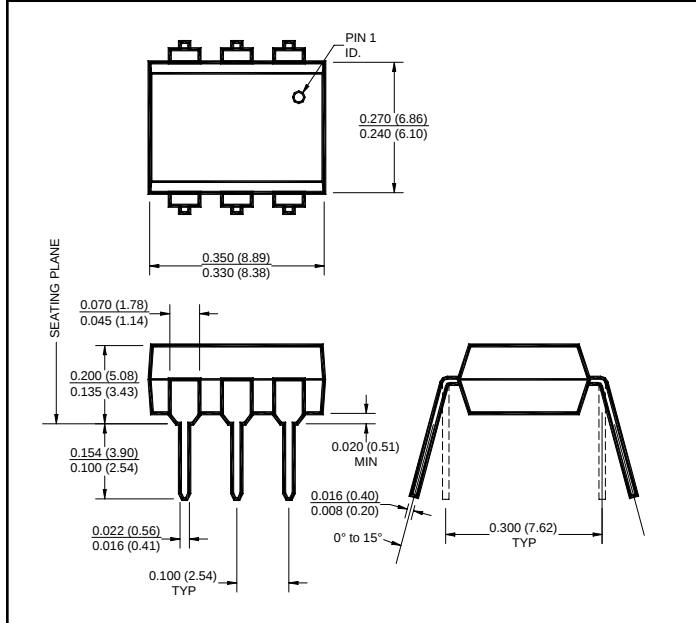
The H11AG1 uses less input power than the neon bulb traditionally used to monitor telephone and line voltages. Additionally, response time can be tailored to ignore telephone dial tap, switching transients and other undesired signals by modifying the value of C2. The high impedance to line voltage also can simply board layout spacing requirements.

H11AG1

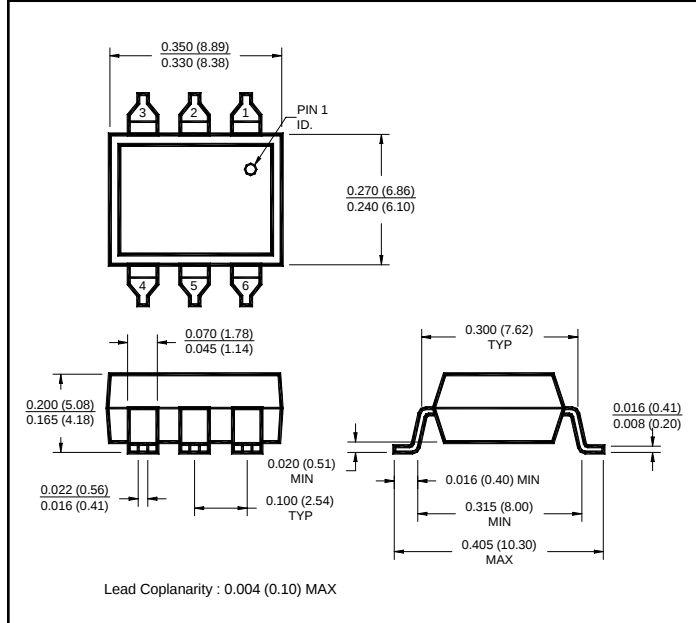
H11AG2

H11AG3

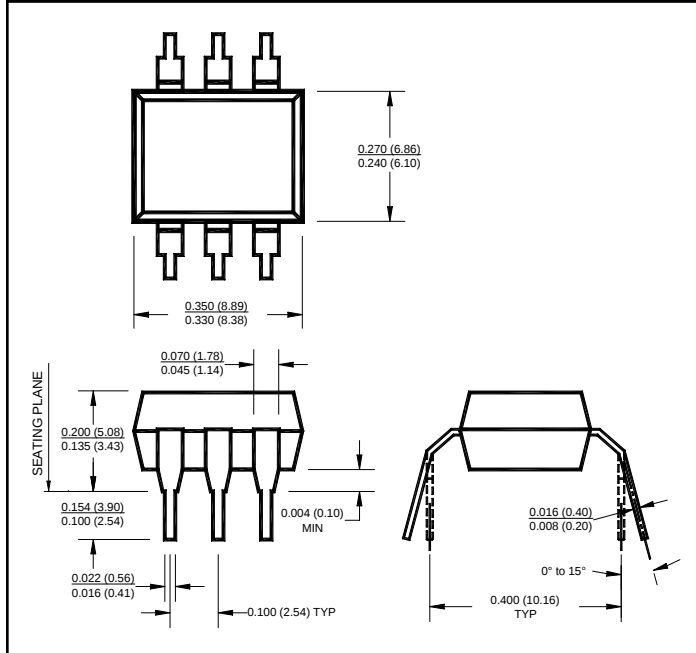
Package Dimensions (Through Hole)



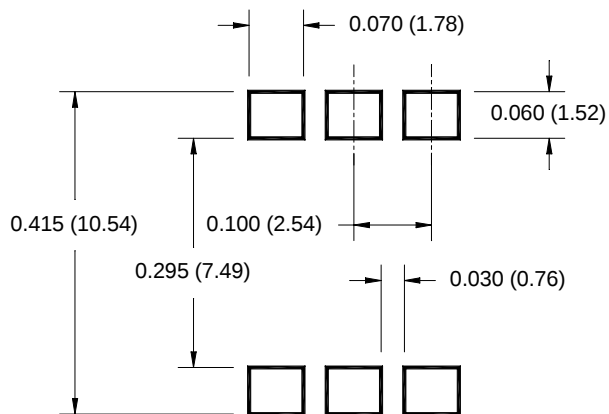
Package Dimensions (Surface Mount)



Package Dimensions (0.4" Lead Spacing)



Recommended Pad Layout for Surface Mount Leadform



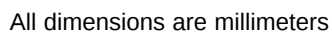
NOTE

All dimensions are in inches (millimeters)



H11AG3

Carrier Tape Specifications (“D” Taping Orientation)





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