

H11AG1M Phototransistor Optocoupler

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 (as low as 200 μ A)
- Underwriters Laboratory (UL) recognized File #E90700, Volume 2
- IEC 60747-5-2 approved (ordering option V)

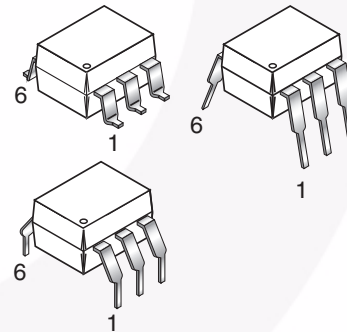
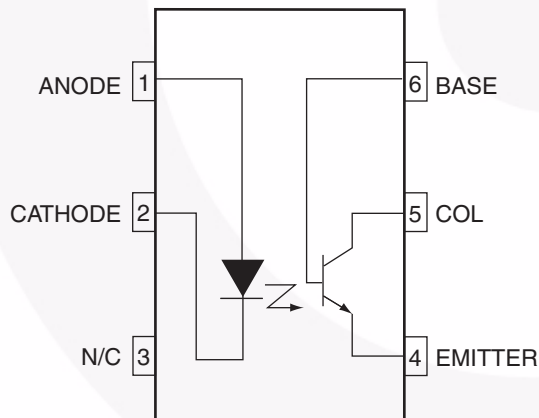
Applications

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

Description

The H11AG1M device 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.

Schematic



Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameters	Value	Units
TOTAL DEVICE			
T _{STG}	Storage Temperature	-55 to +150	°C
T _{OPR}	Operating Temperature	-40 to +100	°C
T _{SOL}	Lead Solder Temperature (Wave Solder)	260 for 10 sec	°C
P _D	Total Device Power Dissipation @ 25°C (LED plus detector) Derate Linearly From 25°C	260	mW
		3.5	mW/°C
EMITTER			
I _F	Continuous Forward Current	50	mA
V _R	Reverse Voltage	6	V
I _{F(pk)}	Forward Current – Peak (1µs pulse, 300pps)	3.0	A
P _D	LED Power Dissipation 25°C Ambient Derate Linearly From 25°C	75	mW
		1.0	mW/°C
DETECTOR			
P _D	Detector Power Dissipation @ 25°C Derate Linearly from 25°C	150	mW
		2.0	mW/°C
I _C	Continuous Collector Current	50	mA

Electrical Characteristics ($T_A = 25^\circ\text{C}$ unless otherwise specified.)**Individual Component Characteristics**

Symbol	Parameters	Test Conditions	Min.	Typ.*	Max.	Units
EMITTER						
V_F	Input Forward Voltage	$I_F = 1\text{mA}$		1.25	1.5	V
I_R	Reverse Leakage Current	$V_R = 5\text{V}, T_A = 25^\circ\text{C}$			10	μA
C_J	Capacitance	$V = 0, f = 1.0\text{MHz}$			100	pF
DETECTOR						
BV_{CEO}	Breakdown Voltage, Collector to Emitter	$I_C = 1.0\text{mA}, I_F = 0$	30			V
BV_{CBO}	Collector to Base	$I_C = 100\mu\text{A}, I_F = 0$	70			V
BV_{ECO}	Emitter to Collector	$I_C = 100\mu\text{A}, I_F = 0$	7			V
I_{CEO}	Leakage Current, Collector to Emitter	$V_{CE} = 10\text{V}, I_F = 0$		5	10	μA
C_{CE}	Capacitance	$V_{CE} = 10\text{V}, f = 1\text{MHz}$		10		pF

*Typical values at $T_A = 25^\circ\text{C}$.**Isolation Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.*	Max.	Units
V_{ISO}	Input-Output Isolation Voltage	$f = 60\text{Hz}, t = 1 \text{ sec.}$	7500			V_{ACPEAK}
R_{ISO}	Isolation Resistance	$V_{I-O} = 500\text{VDC}, T_A = 25^\circ\text{C}$	10^{11}			Ω

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

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

*Typical values at $T_A = 25^\circ\text{C}$

Safety and Insulation Ratings

As per IEC 60747-5-2, this optocoupler is suitable for “safe electrical insulation” only within the safety limit data. Compliance with the safety ratings shall be ensured by means of protective circuits.

Symbol	Parameter	Min.	Typ.	Max.	Unit
	Installation Classifications per DIN VDE 0110/1.89 Table 1				
	For Rated Main Voltage < 150Vrms		I-IV		
	For Rated Main voltage < 300Vrms		I-IV		
	Climatic Classification		55/100/21		
	Pollution Degree (DIN VDE 0110/1.89)		2		
CTI	Comparative Tracking Index	175			
V_{PR}	Input to Output Test Voltage, Method b, $V_{IORM} \times 1.875 = V_{PR}$, 100% Production Test with $t_m = 1$ sec, Partial Discharge < 5pC	1594			V_{peak}
	Input to Output Test Voltage, Method a, $V_{IORM} \times 1.5 = V_{PR}$, Type and Sample Test with $t_m = 60$ sec, Partial Discharge < 5pC	1275			V_{peak}
V_{IORM}	Max. Working Insulation Voltage	850			V_{peak}
V_{IOTM}	Highest Allowable Over Voltage	6000			V_{peak}
	External Creepage	7			mm
	External Clearance	7			mm
	Insulation Thickness	0.5			mm
RIO	Insulation Resistance at T_s , $V_{IO} = 500V$	10^9			Ω

Typical Performance Curves

Figure 1. LED Forward Voltage vs. Forward Current

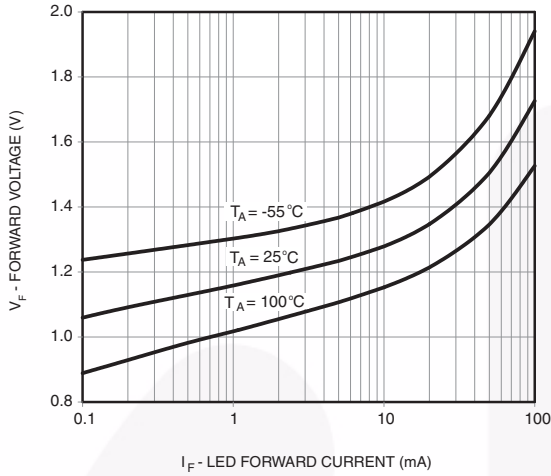


Figure 2. Normalized Current Transfer Ratio vs. Forward Current

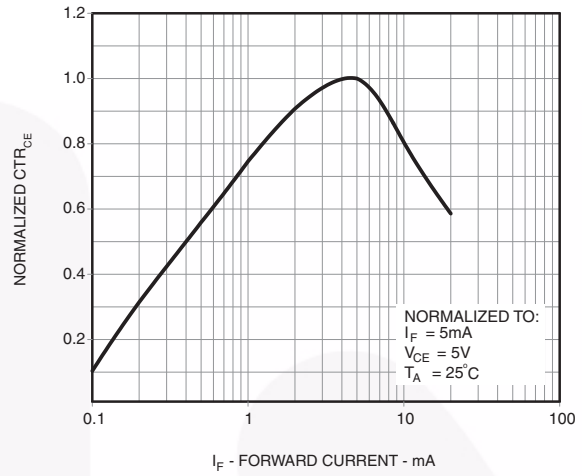


Figure 3. Normalized CTR vs. Temperature

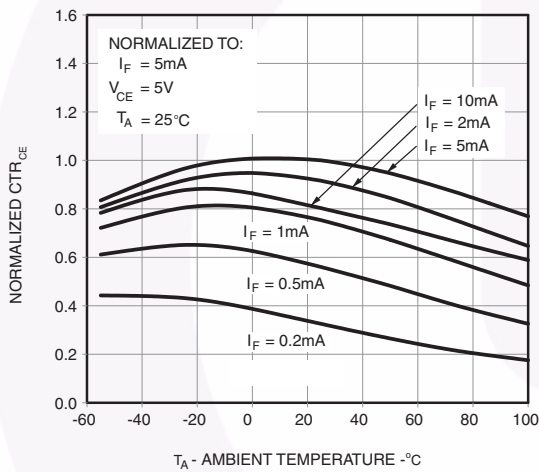


Figure 4. Normalized Collector vs. Collector - Emitter Voltage

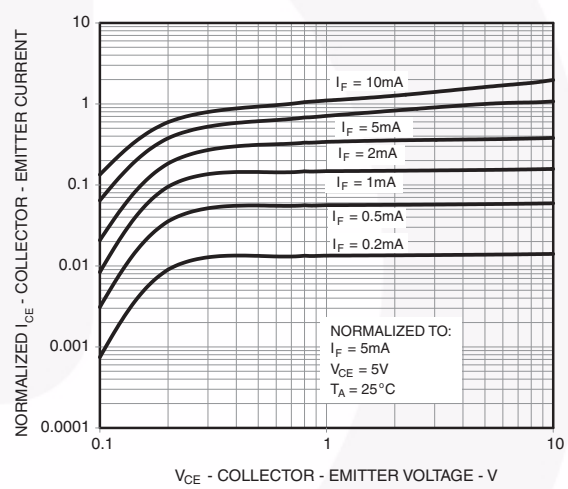


Figure 5. Normalized Collector Base Photocurrent Ratio vs. Forward Current

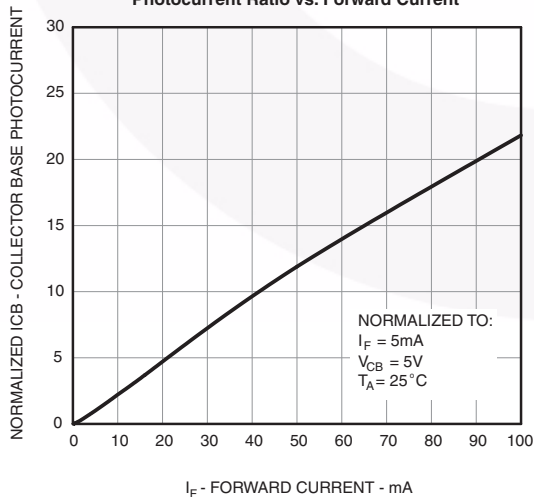
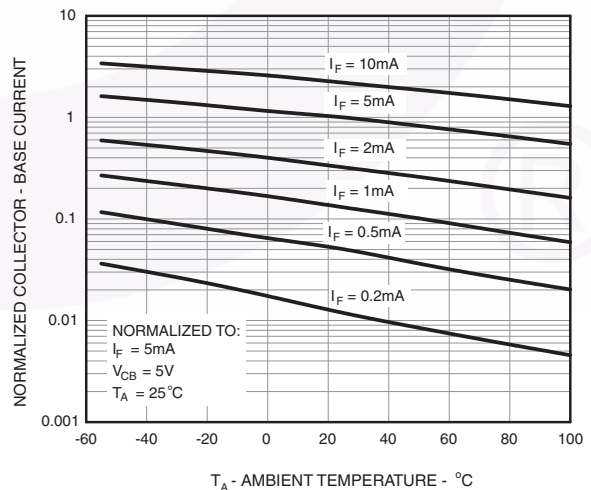
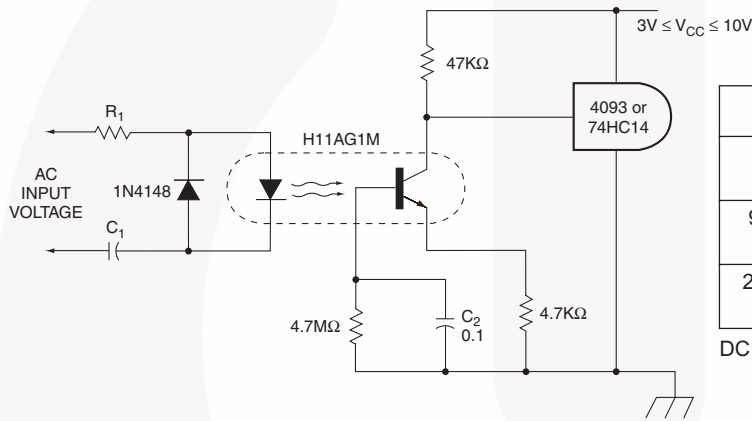
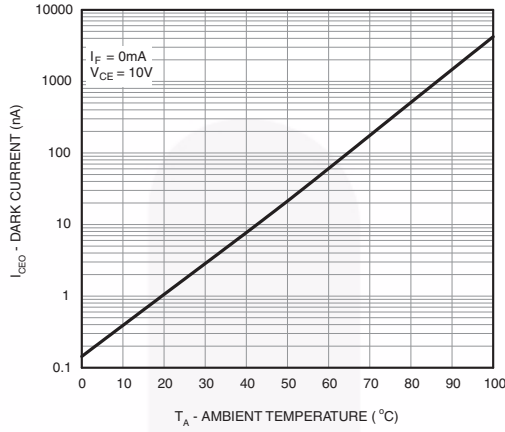


Figure 6. Normalized Collector - Base Current vs. Temperature



Typical Performance Curves (Continued)

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



Input	R1	C1	Z
40-90 VRMS 20Hz	75K 1/10W	0.1µF 100V	109K
95-135 VRMS 60Hz	180K 1/10W	12 ηF 200 V	285K
200-280 VRMS 50/60Hz	390K 1/4W	6.80 ηF 400 V	550K

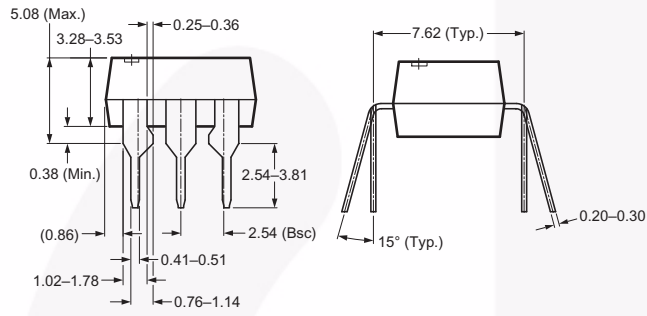
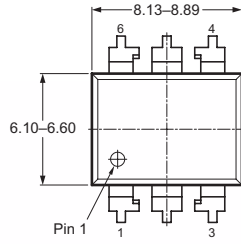
DC component of input voltage is ignored due to C1

Figure 8. Telephone Ring Detector/A.C. Line CMOS Input Isolator

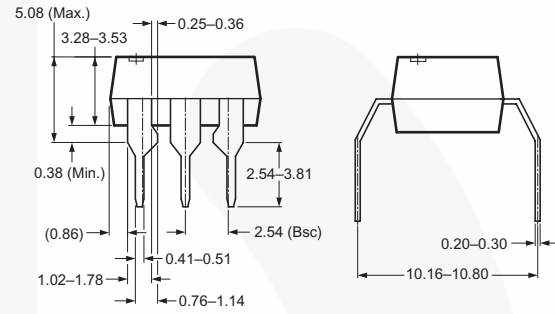
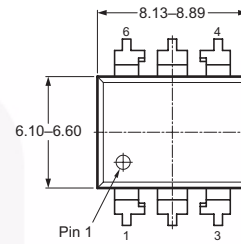
The H11AG1M uses less input power than the neon bulb traditionally used to monitor telephone and line voltages. Additionally, response time can be tailored to ignore telephone dial tap, switching transients and other undesired signals by modifying the value of C2. The high impedance to line voltage also can simply board layout spacing requirements.

Package Dimensions

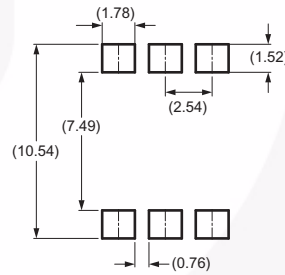
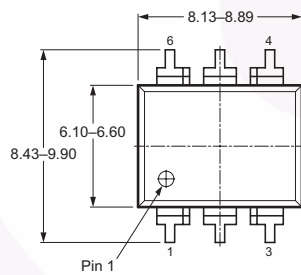
Through Hole



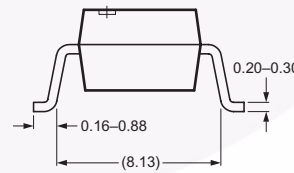
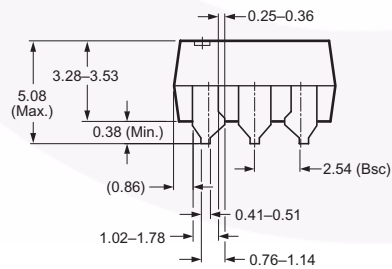
0.4" Lead Spacing



Surface Mount



Recommended Pad Layout

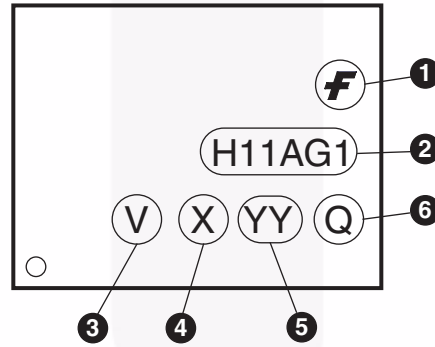


Note:
All dimensions in mm.

Ordering Information

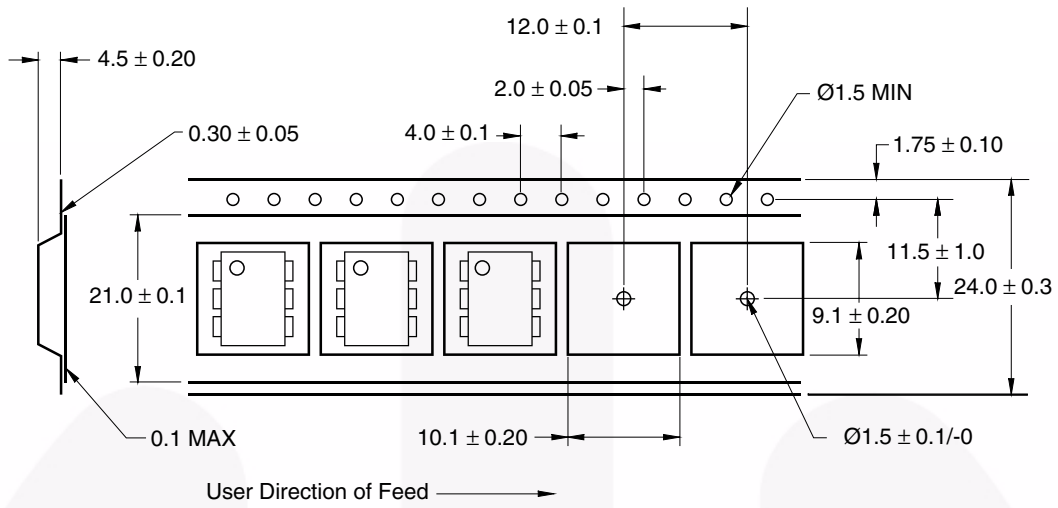
Suffix	Example	Option
No Suffix	H11AG1M	Standard Through Hole Device (50 units per tube)
S	H11AG1SM	Surface Mount Lead Bend
SR2	H11AG1SR2M	Surface Mount; Tape and Reel (1,000 units per reel)
T	H11AG1TM	0.4" Lead Spacing
V	H11AG1VM	VDE 0884
TV	H11AG1TVM	VDE 0884, 0.4" Lead Spacing
SV	H11AG1SVM	VDE 0884, Surface Mount
SR2V	H11AG1SR2VM	VDE 0884, Surface Mount, Tape & Reel (1,000 units per reel)

Marking Information



Definitions	
1	Fairchild logo
2	Device number
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)
4	One digit year code, e.g., '7'
5	Two digit work week ranging from '01' to '53'
6	Assembly package code

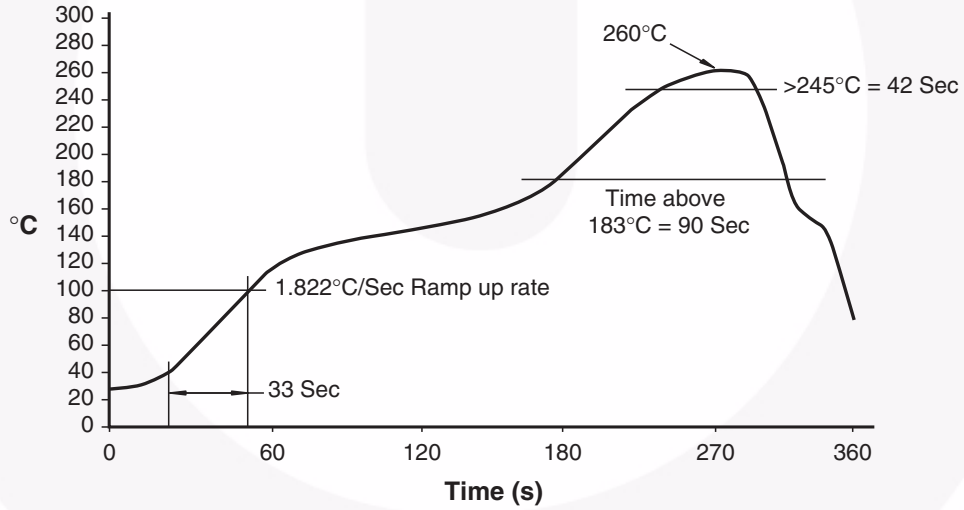
Tape Dimensions



Note:

All dimensions are in inches (millimeters)






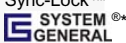
Reflow Soldering Profile





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Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
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