# FAIRCHILD

# PHOTOTRANSISTOR OPTOCOUPLERS

SEMICONDUCTOR®

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.

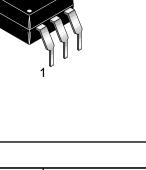
# FEATURES

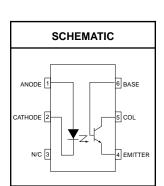
- High efficiency low degradation liquid epitaxial IRED
- Logic level compatible, input and output currents, with CMOS and LS/TTL
- High DC current transfer ratio at low input currents
- Underwriters Laboratory (UL) recognized File #E90700

# APPLICATIONS

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

ABSOLUTE MAXIMUM RATINGS					
Parameters	Symbol	Device	Value	Units	
TOTAL DEVICE	т	A.II.		°C	
Storage Temperature	T <sub>STG</sub>	All	-55 to +150		
Operating Temperature	T <sub>OPR</sub>	All	-55 to +100	°C	
Lead Solder Temperature	T <sub>SOL</sub>	All	260 for 10 sec	°C	
Total Device Power Dissipation @ 25°C (LED plus detector)	D	All	260	mW	
Derate Linearly From 25°C	P <sub>D</sub>	All	3.5	mW/°C	
EMITTER	1	All	50	0	
Continuous Forward Current	١ <sub>F</sub>	All	50	mA	
Reverse Voltage	V <sub>R</sub>	All	6	V	
Forward Current - Peak (1 µs pulse, 300 pps)	l <sub>F</sub> (pk)	All	3.0	А	
LED Power Dissipation 25°C Ambient	PD	A 11	75	mW	
Derate Linearly From 25°C		All	1.0	mW/°C	
DETECTOR					
Detector Power Dissipation @ 25°C	P		150	mW	
Derate Linearly from 25°C	P <sub>D</sub>	All	2.0	mW/°C	
Continuous Collector Current		All	50	mA	







SEMICONDUCTOR®

H11AG1

# H11AG2

## H11AG3

ELECTRICAL CHARACTERISTICS (T <sub>A</sub> = 0-70°C Unless otherwise specified.)							
INDIVIDUAL COMPC	INDIVIDUAL COMPONENT CHARACTERISTICS						
Parameters	Test Conditions	Symbol	Device	Min	Тур	Max	Units
EMITTER							
Input Forward Voltage	I <sub>F</sub> = 1 mA	V <sub>F</sub>	All			1.5	V
	V <sub>R</sub> = 5 V, T <sub>A</sub> = 25°C	I <sub>R</sub>	All			10	μA
Reverse Leakage Current	V <sub>R</sub> = 5 V, T <sub>A</sub> = 70°C	I <sub>R</sub>	All			100	μA
Capacitance	V = 0, f = 1.0 MHz	CJ	All			100	pF
DETECTOR							
Breakdown Voltage							
Collector to Emitter	I <sub>C</sub> = 1.0 mA, I <sub>F</sub> = 0	BV <sub>CEO</sub>	All	30			V
Collector to Base	$I_{C} = 100 \ \mu A, \ I_{F} = 0$	BV <sub>CBO</sub>	All	70			V
Emitter to Collector	I <sub>C</sub> = 100 μA, I <sub>F</sub> = 0	BV <sub>ECO</sub>	All	7			V
Leakage Current							
Collector to Emitter	$V_{CE} = 10 \text{ V}, I_{F} = 0$	I <sub>CEO</sub>	All		5	10	μA
Capacitance	V <sub>CE</sub> = 10 V, f = 1 MHz	C <sub>CE</sub>	All		2		pF

ISOLATION CHARACTERISTICS						
Parameters	Test Conditions	Symbol	Min	Тур	Max	Units
Input-Output Isolation Voltage	$I_{I-0} \le 1 \ \mu A, \ t = 1 \ min.$	V <sub>ISO</sub>	5300			Vac(rms)

<b>TRANSFER CHARACTERISTICS</b> (T <sub>A</sub> = 25°C Unless otherwise specified.)							
DC Characteristics	Test Conditions	Symbol	Device	Min	Тур	Max	Units
		CTR	H11AG1	300			
	$I_{F} = 1 \text{ mA}, V_{CE} = 5 \text{ V}$		H11AG2	200			
			H11AG3	100			%
		CTR	H11AG1	100			
Current Transfer Ratio	I <sub>F</sub> = 1 mA, V <sub>CE</sub> = 0.6 V		H11AG2	50			
			H11AG3	20			
		OTD	H11AG1	100			
	I <sub>F</sub> = 0.2 mA, V <sub>CE</sub> = 1.5 V	CTR	H11AG2	50			
Saturation Voltage	I <sub>F</sub> = 2.0 mA, I <sub>C</sub> = 0.5 mA	V <sub>CE(SAT)</sub>	All			.40	V
AC Characteristics	Test Conditions	Symbol	Device	Min	Тур	Max	Units
Non-Saturated Switching Times							
Turn-On Time	$R_L$ = 100 $\Omega$ , $I_F$ = 1 mA, $V_{CC}$ = 5 V	t <sub>on</sub>	All		5		μS
Turn-Off Time	$R_L$ = 100 $\Omega,I_F$ = 1 mA, $V_{CC}$ = 5 V	t <sub>off</sub>	All		5		μS



H11AG1

H11AG2

### H11AG3

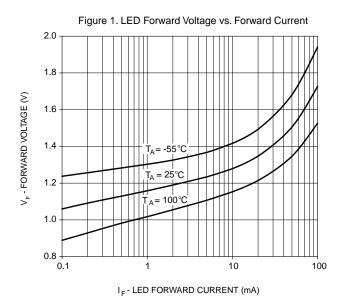
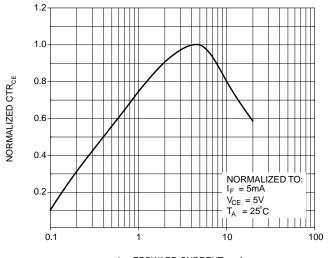


Figure 2. Normalized Current Transfer Ratio vs. Forward Current



I<sub>F</sub> - FORWARD CURRENT - mA

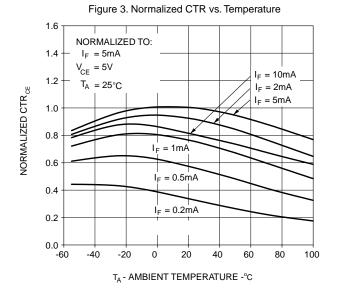
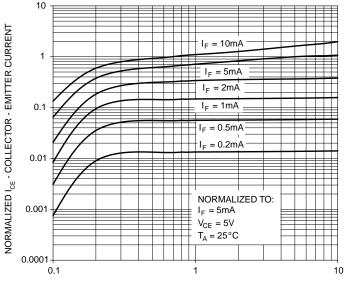


Figure 4. Normalized Collector vs. Collector - Emitter Voltage



V<sub>CE</sub> - COLLECTOR - EMITTER VOLTAGE - V



H11AG1

H11AG2

### H11AG3

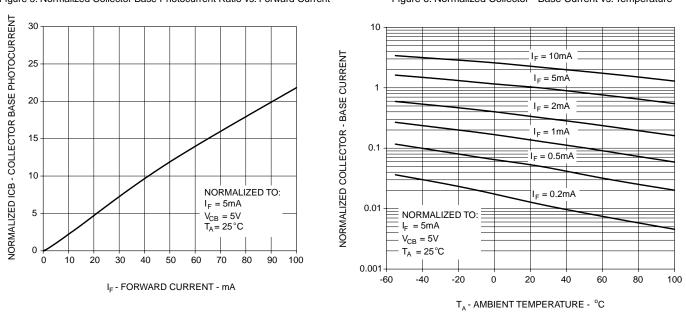


Figure 5. Normalized Collector Base Photocurrent Ratio vs. Forward Current

Figure 6. Normalized Collector - Base Current vs. Temperature

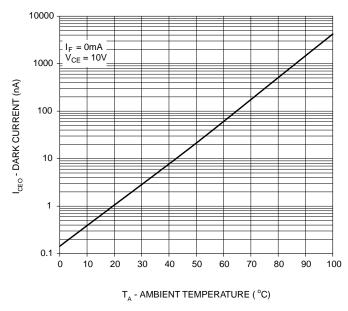


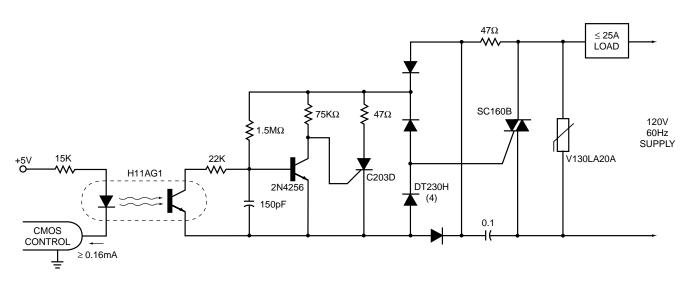
Figure 7. Collector-Emitter Dark Current vs. Ambient Temperature



H11AG1

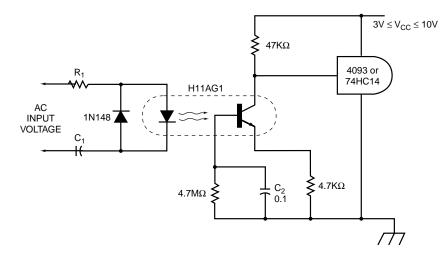
H11AG2

#### H11AG3





The H11AG1's superior performance at low input currents allows standard CMOS logic circuits to directly operate a 25A solid state relay. Circuit operation is as follows: power switching is provided by the SC160B, 25A triac. Its gate is controlled by the C203B via the DT230H rectifier bridge. The C203B turn-on is inhibited by the 2N4256 when line voltage is above 12V and/or the H11AG is off. False trigger and dv/dt protection are provided by the combination of the MOV<sup>®</sup> varistor and RC snubber network.



INPUT	R <sub>1</sub>	С <sub>1</sub>	Z	
40-90 VRMS	75 K	0.1 μF	4001/	
20 Hz	1/10 W	100 V	109K	
95-135 VRMS	180 K	12 ηF	00514	
60 Hz	1/10 W	200 V	285K	
200-280 VRMS	390 K	6.80 ηF	5501/	
50/60 Hz	1/4 W	400 V	550K	

DC component of input voltage is ignored due to C1



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.

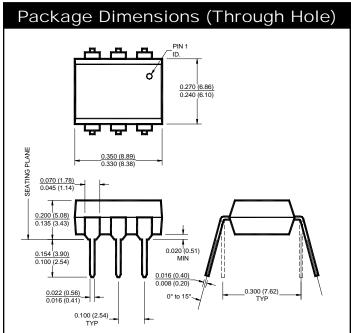


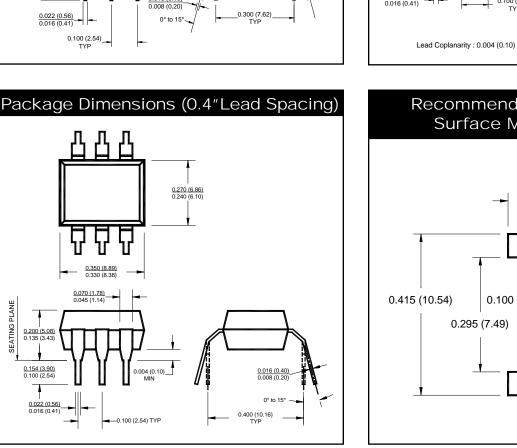
0.350 (8.89) 0.330 (8.38)

H11AG1

H11AG2

H11AG3





#### NOTE

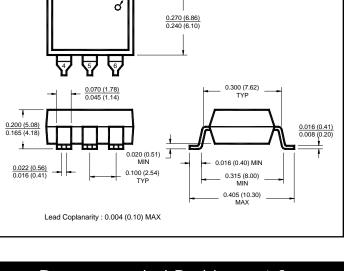
SEATING PLANE

0.200 (5.08)

0.154 (3.90) 0.100 (2.54)

0.022 (0.56) 0.016 (0.41)

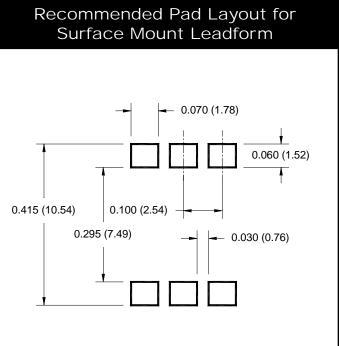
All dimensions are in inches (millimeters)



Package Dimensions (Surface Mount)

PIN 1

ID.



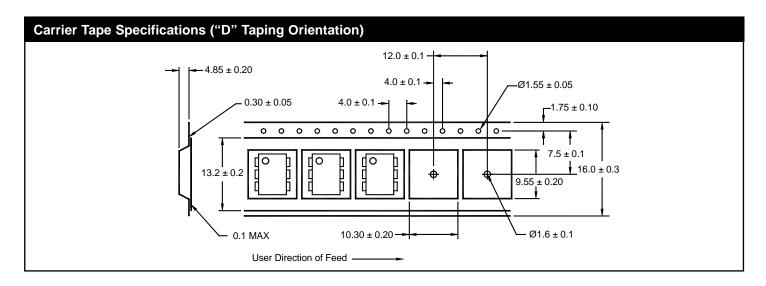


H11AG1

# H11AG2

## H11AG3

Option	Order Entry Identifier	Description
S	.S	Surface Mount Lead Bend
SD	.SD	Surface Mount; Tape and reel
W	.W	0.4" Lead Spacing
300	.300	VDE 0884
300W	.300W	VDE 0884, 0.4" Lead Spacing
3S	.3S	VDE 0884, Surface Mount
3SD	.3SD	VDE 0884, Surface Mount, Tape & Reel

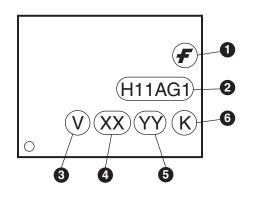


### NOTE

All dimensions are millimeters

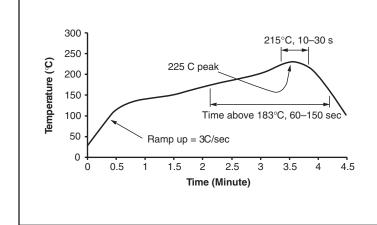


# **MARKING INFORMATION**



Definiti	Definitions				
1	Fairchild logo				
2	Device number				
3	VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table)				
4	Two digit year code, e.g., '03'				
5	Two digit work week ranging from '01' to '53'				
6	Assembly package code				

#### Reflow Profile (Black Package, No Suffix)



- Peak reflow temperature: 225°C (package surface temperature)
  Time of temperature higher than 183°C for 60–150 seconds
  One time soldering reflow is recommended

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CoolFET™	FRFET™	MicroFET™	PowerTrench <sup>®</sup>	SuperSOT™-6
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DOME™	GTO™່	MICROWIRE™	QS™	SyncFET™
EcoSPARK™	HiSeC™	MSX™	QT Optoelectronics <sup>™</sup>	TinyLogic®
E <sup>2</sup> CMOS™	I²C™	MSXPro™	Quiet Series <sup>™</sup>	TINYOPTO™
EnSigna™	<i>i-Lo</i> ™	OCX™	RapidConfigure™	TruTranslation™
FACT™	ImpliedDisconnect <sup>™</sup>	OCXPro™	RapidConnect™	UHC™
FACT Quiet Serie		<b>OPTOLOGIC<sup>®</sup></b>	µSerDes™	UltraFET <sup>®</sup>
Across the board The Power Frand Programmable A		OPTOPLANAR™ PACMAN™ POP™	SILENT SWITCHER <sup>®</sup> SMART START™ SPM™	VCX™

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No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
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