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April 2015

# H11AV1M, H11AV1AM 6-Pin DIP Phototransistor Optocouplers

## Features

- H11AV1M and H11AV1AM Feature 0.3" and 0.4" Input-Output Lead Spacing Respectively
- Safety and Regulatory Approvals:
  - UL1577, 4,170 VAC<sub>RMS</sub> for 1 Minute
  - DIN-EN/IEC60747-5-5, 850 V Peak Working Insulation Voltage

## Applications

- Power Supply Regulators
- Digital Logic Inputs
- Microprocessor Inputs

## Description

The general purpose optocouplers consist of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a 6-pin dual in-line white package.

## Schematic



Figure 1. Schematic

## Package Outlines



Figure 2. Package Outlines

H11AV1M, H11AV1AM — 6-Pin DIP Phototransistor Optocouplers

## Safety and Insulation Ratings

As per DIN EN/IEC 60747-5-5, 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.

Parameter		Characteristics
Installation Classifications per DIN VDE 0110/1.89 Table 1, For Rated Mains Voltage	< 150 V <sub>RMS</sub>	I–IV
	< 300 V <sub>RMS</sub>	I–IV
Climatic Classification		55/100/21
Pollution Degree (DIN VDE 0110/1.89)		2
Comparative Tracking Index		175

Symbol	Parameter	Value	Unit
V <sub>PR</sub>	Input-to-Output Test Voltage, Method A, V <sub>IORM</sub> × 1.6 = V <sub>PR</sub> , Type and Sample Test with t <sub>m</sub> = 10 s, Partial Discharge < 5 pC	1360	V <sub>peak</sub>
	Input-to-Output Test Voltage, Method B, V <sub>IORM</sub> × 1.875 = V <sub>PR</sub> , 100% Production Test with t <sub>m</sub> = 1 s, Partial Discharge < 5 pC	1594	V <sub>peak</sub>
V <sub>IORM</sub>	Maximum Working Insulation Voltage	850	V <sub>peak</sub>
V <sub>IOTM</sub>	Highest Allowable Over-Voltage	6000	V <sub>peak</sub>
	External Creepage	≥ 7	mm
	External Clearance	≥ 7	mm
	External Clearance (for Option TV, 0.4" Lead Spacing)	≥ 10	mm
DTI	Distance Through Insulation (Insulation Thickness)	≥ 0.5	mm
T <sub>S</sub>	Case Temperature <sup>(1)</sup>	175	°C
I <sub>S,INPUT</sub>	Input Current <sup>(1)</sup>	350	mA
P <sub>S,OUTPUT</sub>	Output Power <sup>(1)</sup>	800	mW
R <sub>IO</sub>	Insulation Resistance at T <sub>S</sub> , V <sub>IO</sub> = 500 V <sup>(1)</sup>	> 10 <sup>9</sup>	Ω

### Note:

1. Safety limit values – maximum values allowed in the event of a failure.

## 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	Parameter	Value	Unit
<b>TOTAL DEVICE</b>			
$T_{STG}$	Storage Temperature	-40 to +125	°C
$T_{OPR}$	Operating Temperature	-40 to +100	°C
$T_J$	Junction Temperature	-40 to +125	°C
$T_{SOL}$	Lead Solder Temperature	260 for 10 seconds	°C
$P_D$	Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$	270	mW
	Derate Above $25^\circ\text{C}$	2.94	mW/°C
<b>EMITTER</b>			
$I_F$	DC / Average Forward Input Current	60	mA
$V_R$	Reverse Input Voltage	6	V
$P_D$	LED Power Dissipation @ $T_A = 25^\circ\text{C}$	120	mW
	Derate Above $25^\circ\text{C}$	1.41	mW/°C
<b>DETECTOR</b>			
$V_{CEO}$	Collector-to-Emitter Voltage	70	V
$V_{CBO}$	Collector-to-Base Voltage	70	V
$V_{ECO}$	Emitter-to-Collector Voltage	7	V
$P_D$	Detector Power Dissipation @ $T_A = 25^\circ\text{C}$	150	mW
	Derate Above $25^\circ\text{C}$	1.76	mW/°C

## Electrical Characteristics

$T_A = 25^\circ\text{C}$  unless otherwise specified.

### Individual Component Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>EMITTER</b>						
$V_F$	Input Forward Voltage ( $I_F = 10\text{ mA}$ )	$T_A = 25^\circ\text{C}$	0.80	1.18	1.50	V
		$T_A = -55^\circ\text{C}$	0.90	1.28	1.70	
		$T_A = 100^\circ\text{C}$	0.70	1.05	1.40	
$I_R$	Reverse Leakage Current	$V_R = 6.0\text{ V}$			10	$\mu\text{A}$
<b>DETECTOR</b>						
$BV_{CEO}$	Collector-to-Emitter Breakdown Voltage	$I_C = 1.0\text{ mA}, I_F = 0$	70	100		V
$BV_{CBO}$	Collector-to-Base Breakdown Voltage	$I_C = 100\text{ }\mu\text{A}, I_F = 0$	70	120		V
$BV_{ECO}$	Emitter-to-Collector Breakdown Voltage	$I_E = 100\text{ }\mu\text{A}, I_F = 0$	7	10		V
$I_{CEO}$	Collector-to-Emitter Dark Current	$V_{CE} = 10\text{ V}, I_F = 0$		1	50	nA
$I_{CBO}$	Collector-to-Base Dark Current	$V_{CB} = 10\text{ V}$		0.5		nA
$C_{CE}$	Capacitance	$V_{CE} = 0\text{ V}, f = 1\text{ MHz}$		8		pF

### Transfer Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>DC CHARACTERISTIC</b>						
CTR	Current Transfer Ratio, Collector-to-Emitter	$I_F = 10\text{ mA}, V_{CE} = 10\text{ V}$	100		300	%
$V_{CE(SAT)}$	Saturation Voltage, Collector-to-Emitter	$I_C = 2\text{ mA}, I_F = 20\text{ mA}$			0.4	V
<b>AC CHARACTERISTIC</b>						
$T_{ON}$	Non-Saturated Turn-on Time	$I_C = 2\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\text{ }\Omega$ (Figure 13)			15	$\mu\text{s}$
$T_{OFF}$	Non Saturated Turn-off Time	$I_C = 2\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\text{ }\Omega$ (Figure 13)			15	$\mu\text{s}$

### Isolation Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
$V_{ISO}$	Input-Output Isolation Voltage	$t = 1\text{ Minute}$	4170			$V_{AC_{RMS}}$
$C_{ISO}$	Isolation Capacitance	$V_{I-O} = 0\text{ V}, f = 1\text{ MHz}$		0.2		pF
$R_{ISO}$	Isolation Resistance	$V_{I-O} = \pm 500\text{ VDC}, T_A = 25^\circ\text{C}$	$10^{11}$			$\Omega$

Typical Performance Curves



Figure 3. LED Forward Voltage vs. Forward Current



Figure 4. Normalized CTR vs. Forward Current



Figure 5. Normalized CTR vs. Ambient Temperature

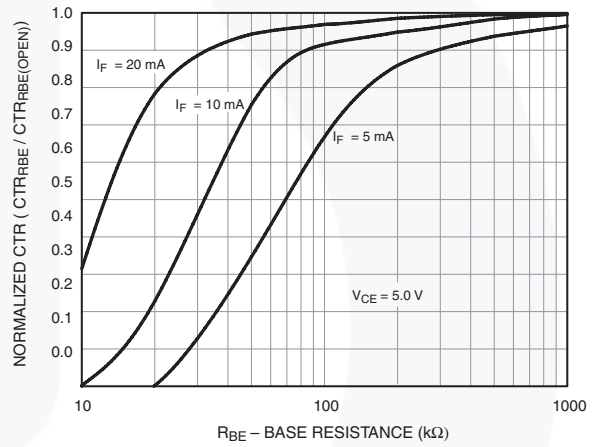


Figure 6. CTR vs. RBE (Unsaturated)



Figure 7. CTR vs. RBE (Saturated)

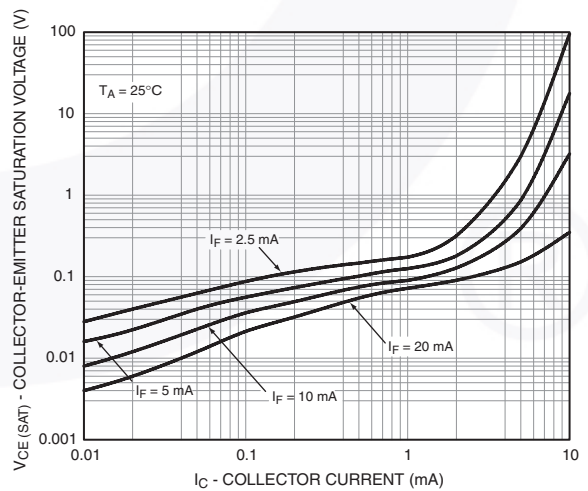


Figure 8. Collector-Emitter Saturation Voltage vs. Collector Current

Typical Performance Curves (Continued)

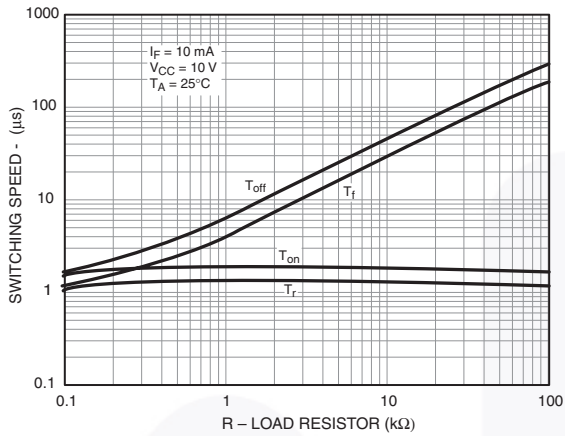


Figure 9. Switching Speed vs. Load Resistor



Figure 10. Normalized  $t_{on}$  vs.  $R_{BE}$

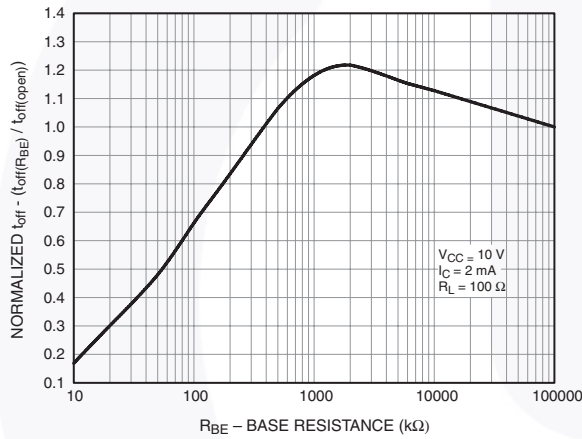


Figure 11. Normalized  $t_{off}$  vs.  $R_{BE}$



Figure 12. Dark Current vs. Ambient Temperature

Switching Time Test Circuit and Waveform

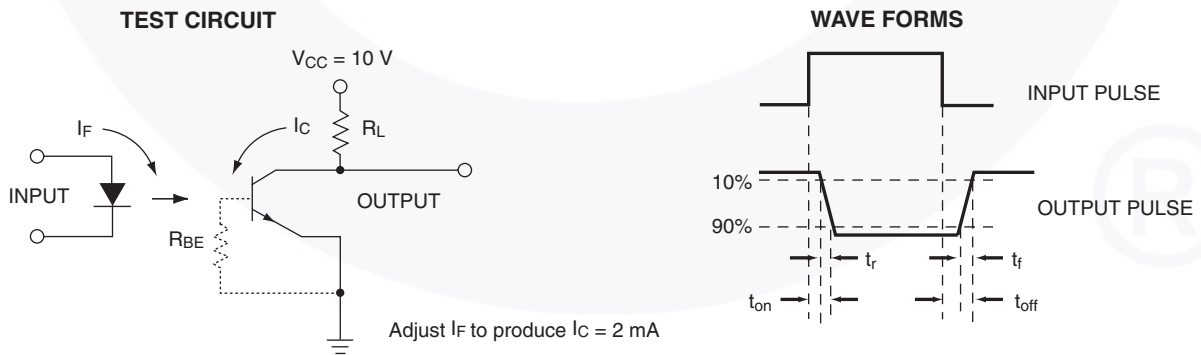


Figure 13. Switching Time Test Circuit and Waveform

### Reflow Profile



Figure 14. Reflow Profile



### Ordering Information

Part Number	Package	Packing Method
H11AV1M	DIP 6-Pin	Tube (50 Units)
H11AV1SM	SMT 6-Pin (Lead Bend)	Tube (50 Units)
H11AV1SR2M	SMT 6-Pin (Lead Bend)	Tape and Reel (1000 Units)
H11AV1VM	DIP 6-Pin, DIN EN/IEC60747-5-5 Option	Tube (50 Units)
H11AV1SVM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tube (50 Units)
H11AV1SR2VM	SMT 6-Pin (Lead Bend), DIN EN/IEC60747-5-5 Option	Tape and Reel (1000 Units)
H11AV1AM	DIP 6-Pin, 0.4" Lead Spacing	Tube (50 Units)
H11AV1AVM	DIP 6-Pin, 0.4" Lead Spacing, DIN EN/IEC60747-5-5 Option	Tube (50 Units)

### Marking Information

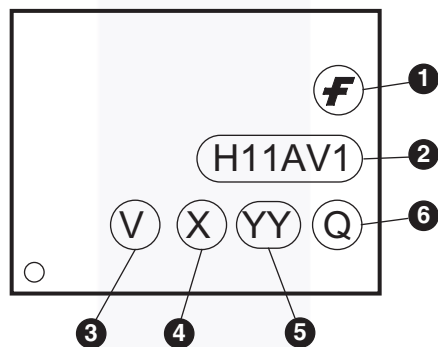


Figure 15. Top Mark

Table 1. Top Mark Definitions

1	Fairchild Logo
2	Device Number
3	DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option)
4	One-Digit Year Code, e.g., "5"
5	Digit Work Week, Ranging from "01" to "53"
6	Assembly Package Code



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