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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                   | $I_C = 2\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\text{ }\Omega$<br>(Figure 13) |      |      | 15   | $\mu\text{s}$ |
| $T_{OFF}$                | Non Saturated Turn-off Time                  | $I_C = 2\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\text{ }\Omega$<br>(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

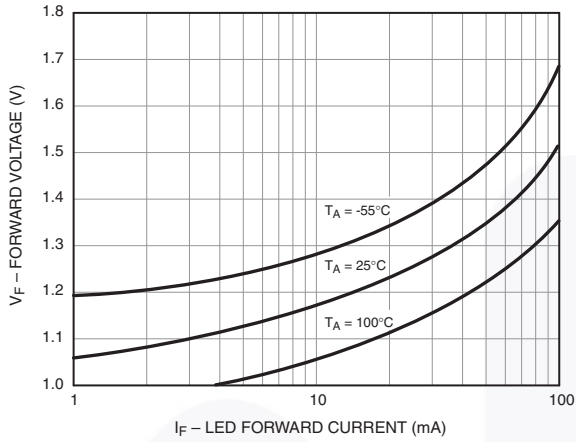


Figure 3. LED Forward Voltage vs. Forward Current

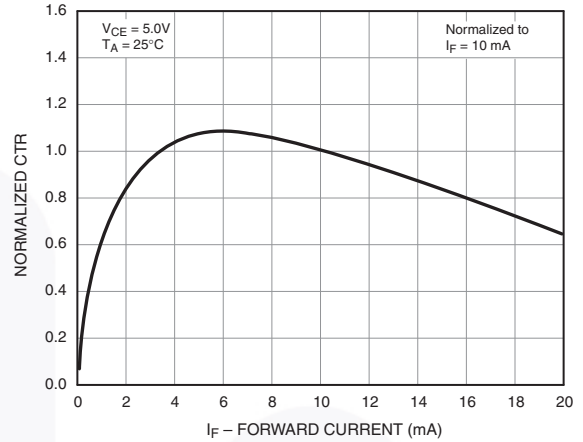


Figure 4. Normalized CTR vs. Forward Current

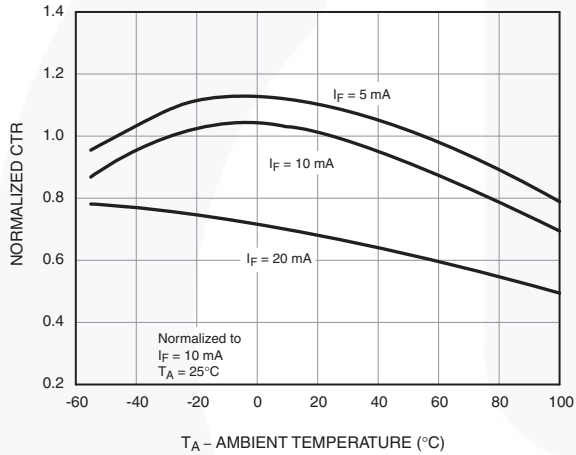


Figure 5. Normalized CTR vs. Ambient Temperature

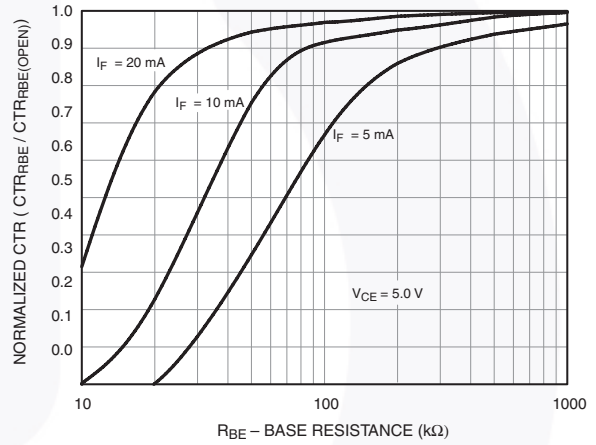


Figure 6. CTR vs. RBE (Unsaturated)

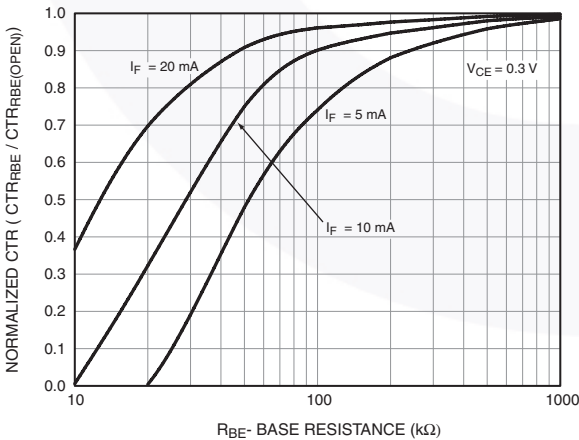


Figure 7. CTR vs. RBE (Saturated)

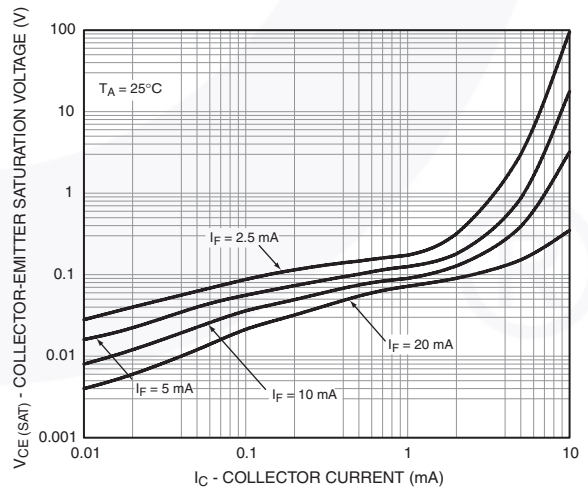


Figure 8. Collector-Emitter Saturation Voltage vs. Collector Current

Typical Performance Curves (Continued)

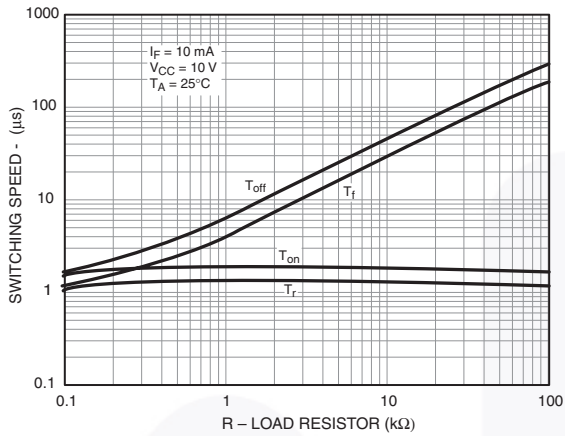


Figure 9. Switching Speed vs. Load Resistor



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

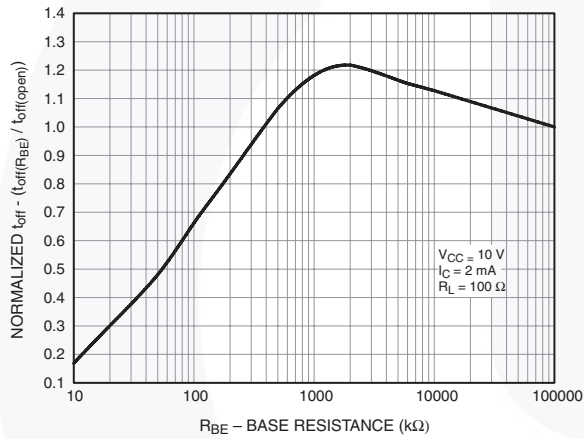


Figure 11. Normalized  $t_{off}$  vs.  $R_{BE}$



Figure 12. Dark Current vs. Ambient Temperature

Switching Time Test Circuit and Waveform

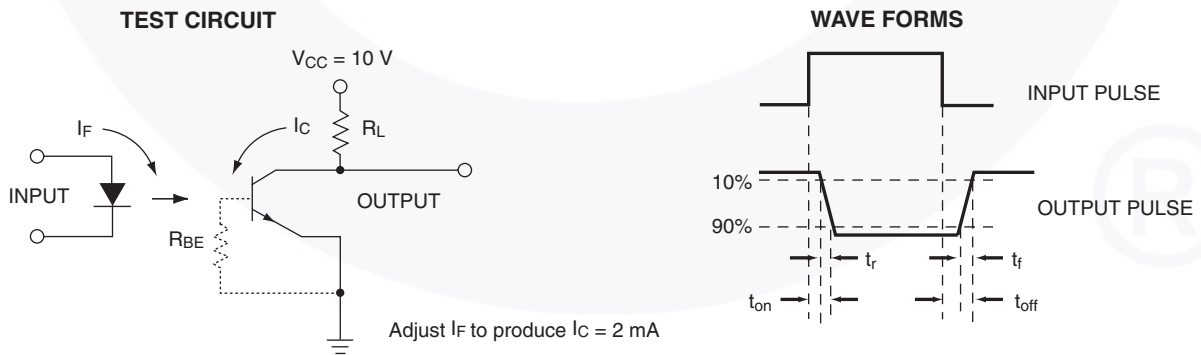


Figure 13. Switching Time Test Circuit and Waveform

### 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

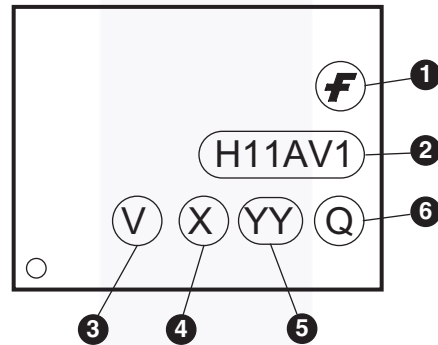


Figure 15. Top Mark

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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