FAIRCHILD SEMICONDUCTOR®

October 2005

# H11AA1, H11AA3, H11AA2, H11AA4
# AC Input/Phototransistor Optocouplers

## Features

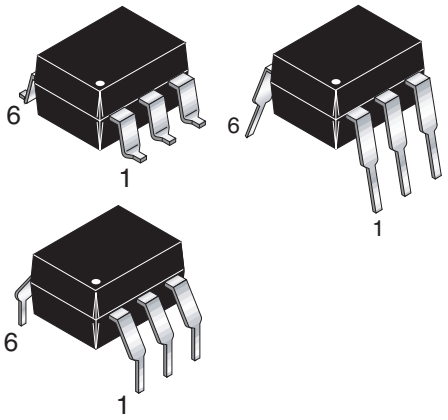
- Bi-polar emitter input
- Built-in reverse polarity input protection
- Underwriters Laboratory (UL) recognized – File #E90700
- VDE approved – File #E94766 (ordering option '300')

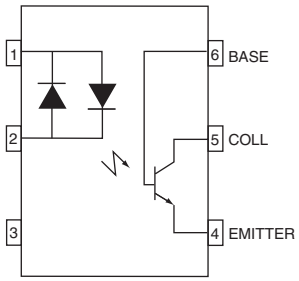
## Applications

- AC line monitor
- Unknown polarity DC sensor
- Telephone line interface

## Description

The H11AAX series consists of two gallium-arsenide infrared emitting diodes connected in inverse parallel driving a single silicon phototransistor output.




| Parameter | 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 | $P_D$ | All | 350 | mW |
| Derate Linearly From 25°C | | | 4.6 | mW/°C |
| **EMITTER** | | | | |
| Continuous Forward Current | $I_F$ | All | 100 | mA |
| Forward Current - Peak (1 µs pulse, 300 pps) | $I_{F(pk)}$ | All | ±1.0 | A |
| LED Power Dissipation | $P_D$ | All | 200 | mW |
| Derate Linearly From 25°C | | | 2.6 | mW/°C |
| **DETECTOR** | | | | |
| Detector Power Dissipation | $P_D$ | All | 300 | mW |
| Derate above 25°C | | | 4.0 | mW/°C |

## Electrical Characteristics ($T_A$ = 25°C Unless otherwise specified.)

### Individual Component Characteristics

| Parameter | Test Conditions | Symbol | Device | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **EMITTER** | | | | | | | |
| Input Forward Voltage | $I_F$ = ±10 mA | $V_F$ | All | | 1.2 | 1.5 | V |
| Capacitance | $V_F$ = 0 V, f = 1.0 MHz | $C_J$ | All | | 80 | | pF |
| **DETECTOR** | | | | | | | |
| Breakdown Voltage Collector to Emitter | $I_C$ = 1.0 mA, $I_F$ = 0 | $BV_{CEO}$ | All | 30 | | | V |
| Collector to Base | $I_C$ = 100 µA, $I_F$ = 0 | $BV_{CBO}$ | All | 70 | | | V |
| Emitter to Base | $I_E$ = 100 µA, $I_F$ = 0 | $BV_{EBO}$ | All | 5 | | | V |
| Emitter to Collector | $I_E$ = 100 µA, $I_F$ = 0 | $BV_{ECO}$ | All | 7 | | | V |
| Leakage Current Collector to Emitter | $V_{CE}$ = 10 V, $I_F$ = 0 | $I_{CEO}$ | H11AA1,3,4 | | | 50 | nA |
| | | | H11AA2 | | | 200 | |
| Capacitance Collector to Emitter | $V_{CE}$ = 0, f = 1 MHz | $C_{CE}$ | All | | 10 | | pF |
| Collector to Base | $V_{CE}$ = 0, f = 1 MHz | $C_{CB}$ | All | | 80 | | pF |
| Emitter to Base | $V_{CE}$ = 0, f = 1 MHz | $C_{EB}$ | All | | 15 | | pF |

## Transfer Characteristics ($T_A$ = 25°C Unless otherwise specified.)

| Characteristics | Test Conditions | Symbol | Device | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| Current Transfer Ratio, Collector to Emitter | $I_F$ = ±10 mA, $V_{CE}$ = 10 V | $CTR_{CE}$ | H11AA4 | 100 | | | % |
| | | | H11AA3 | 50 | | | |
| | | | H11AA1 | 20 | | | |
| | | | H11AA2 | 10 | | | |
| Current Transfer Ratio, Symmetry | $I_F$ = ±10 mA, $V_{CE}$ = 10 V (Figure.8) | | All | .33 | | 3.0 | |
| Saturation Voltage Collector to Emitter | $I_F$ = ±10 mA, $I_{CE}$ = 0.5 mA | $V_{CE(SAT)}$ | All | | | .40 | V |

## Isolation Characteristics

| Characteristic | Test Conditions | Symbol | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Package Capacitance input/output | $V_{I-O}$ = 0, f = 1 MHz | $C_{I-O}$ | | 0.7 | | pF |
| Isolation Voltage | f = 60 Hz, t = 1 min. | $V_{ISO}$ | 5300 | | | VAC(RMS) |
| Isolation Resistance | $V_{I-O}$ = 500 VDC | $R_{ISO}$ | 1011 | | | Ω |

**Fig. 1 Input Voltage vs. Input Current**

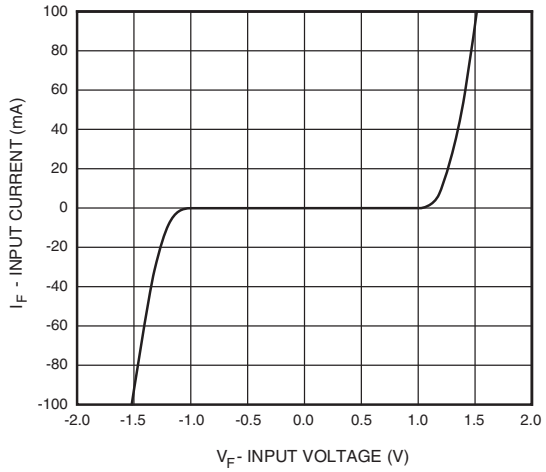



**Fig. 2 Normalized CTR vs. Forward Current**

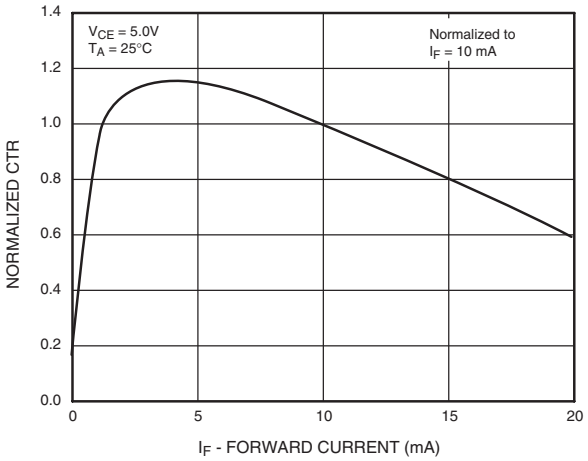



**Fig. 3 Normalized CTR vs. Ambient Temperature**

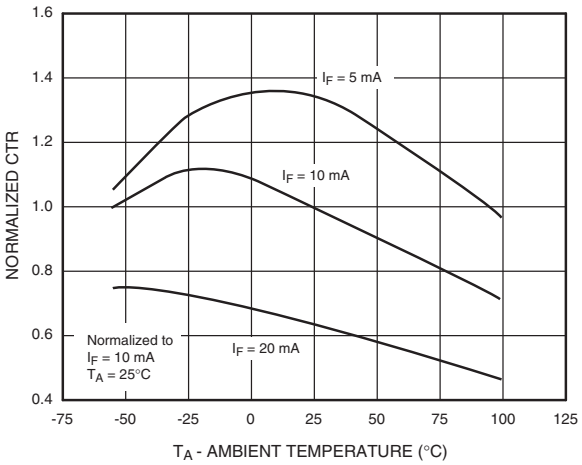



**Fig. 4 CTR vs. RBE (Unsaturated)**

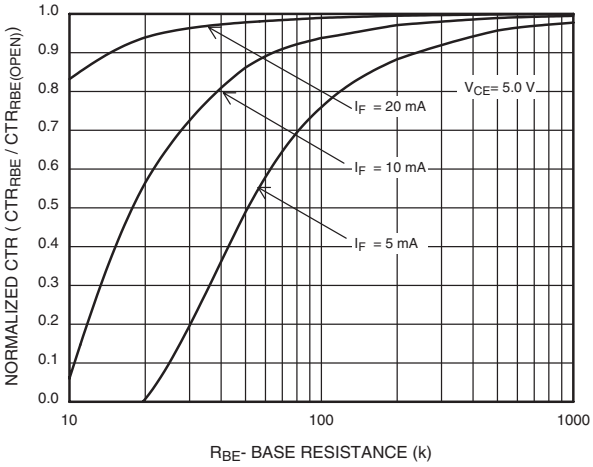



**Fig. 5 CTR vs. RBE (Saturated)**

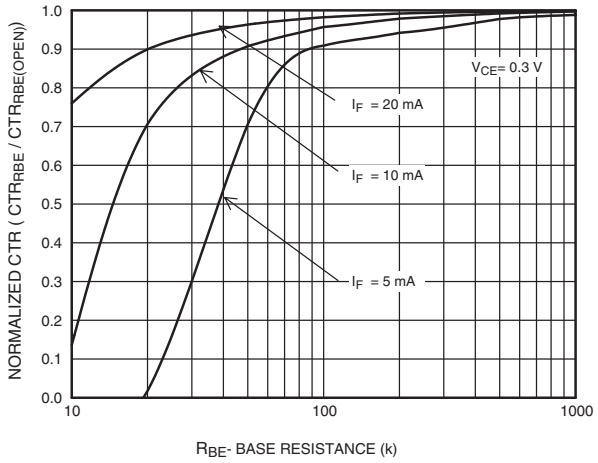



**Fig. 6 Collector-Emitter Saturation Voltage vs Collector Current**

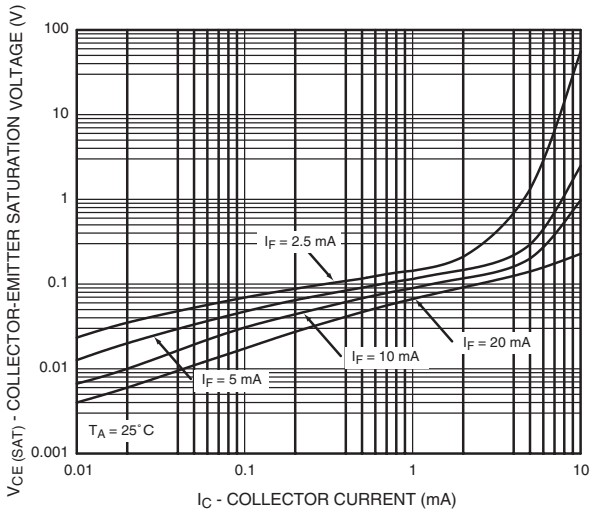


**Fig. 7 Switching Speed vs. Load Resistor**

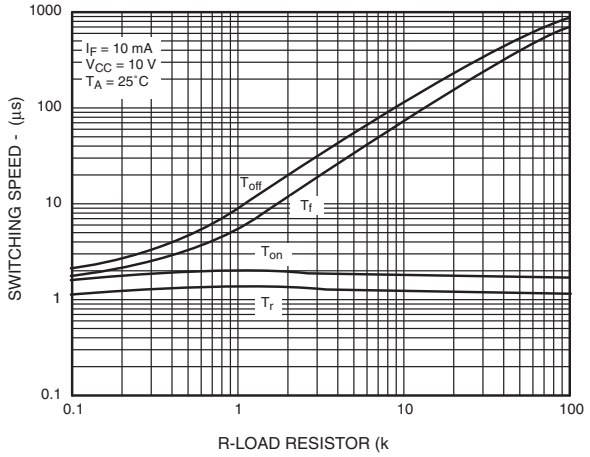



**Fig. 8 Normalized $t_{on}$ vs. $R_{BE}$**

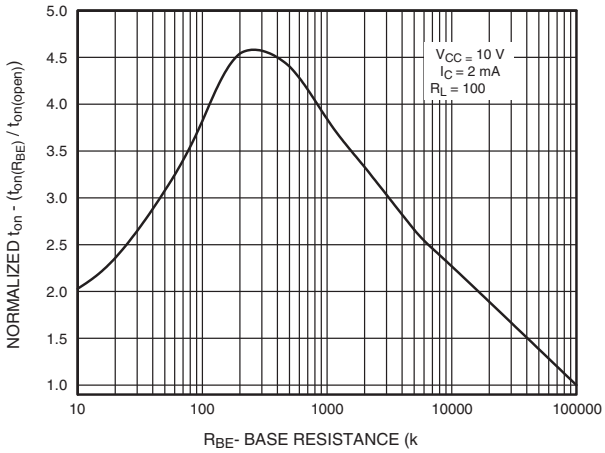



**Fig. 9 Normalized $t_{off}$ vs. $R_{BE}$**

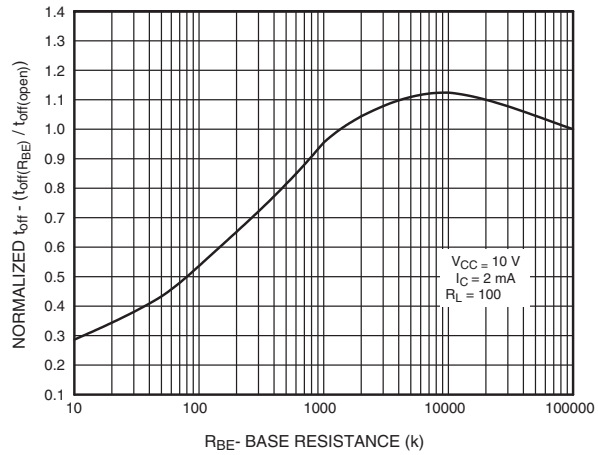



**Fig. 10 Dark Current vs. Ambient Temperature**

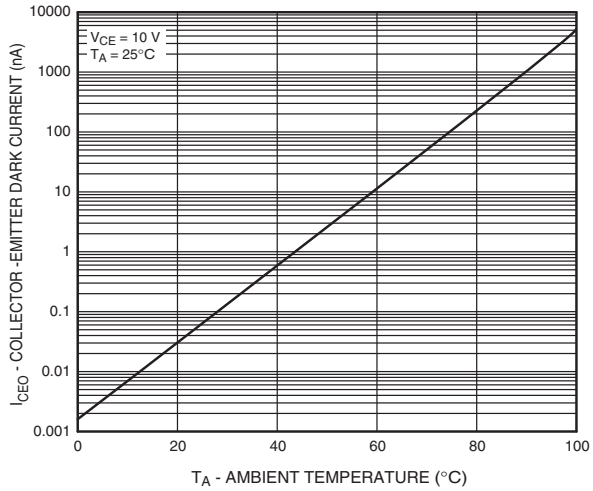
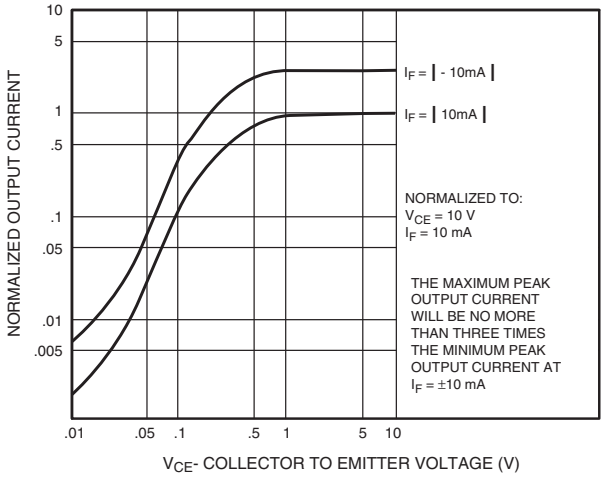
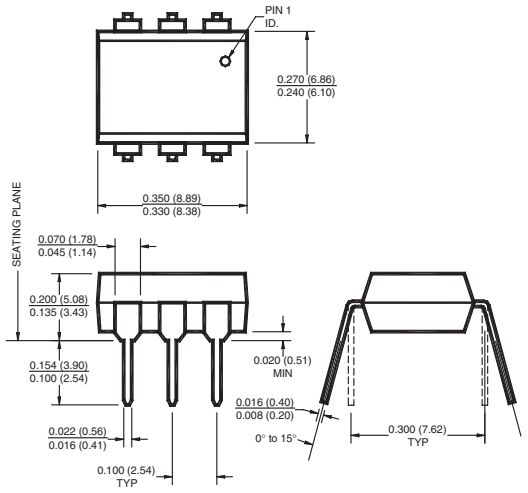


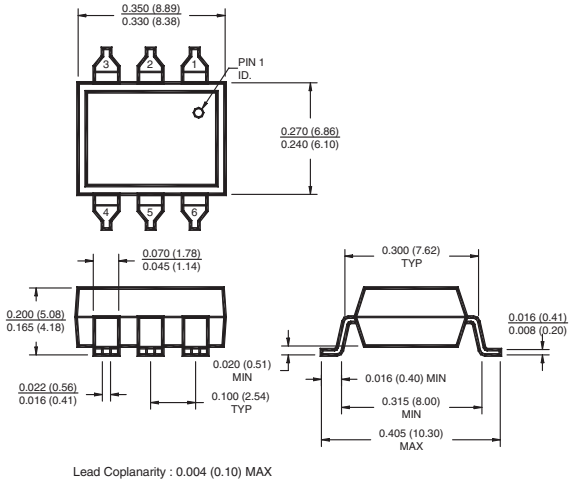

**Fig. 11 Output Symmetry Characteristics**



## Package Dimensions (Through Hole)

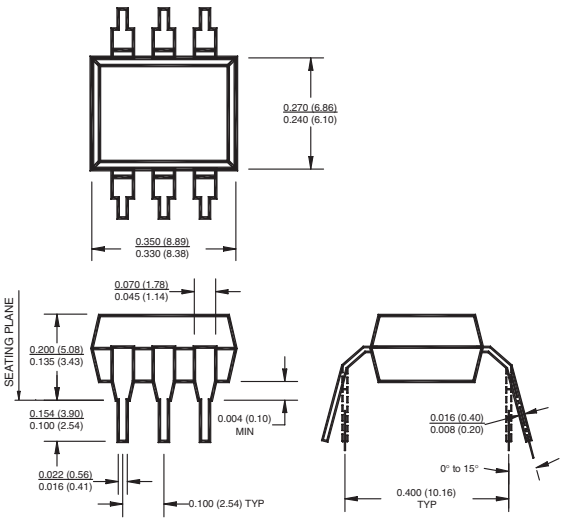



## Package Dimensions (Surface Mount)

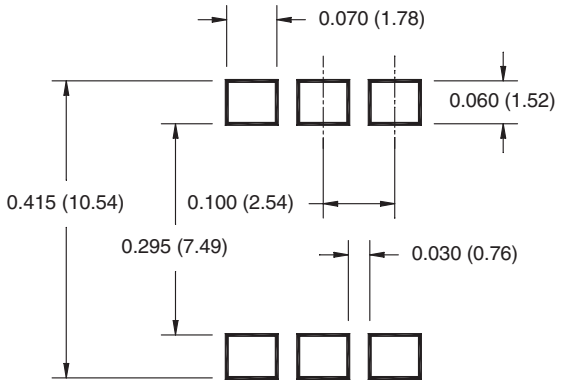



Lead Coplanarity : 0.004 (0.10) MAX

## Package Dimensions (0.4"Lead Spacing)




## Recommended Pad Layout for Surface Mount Leadform



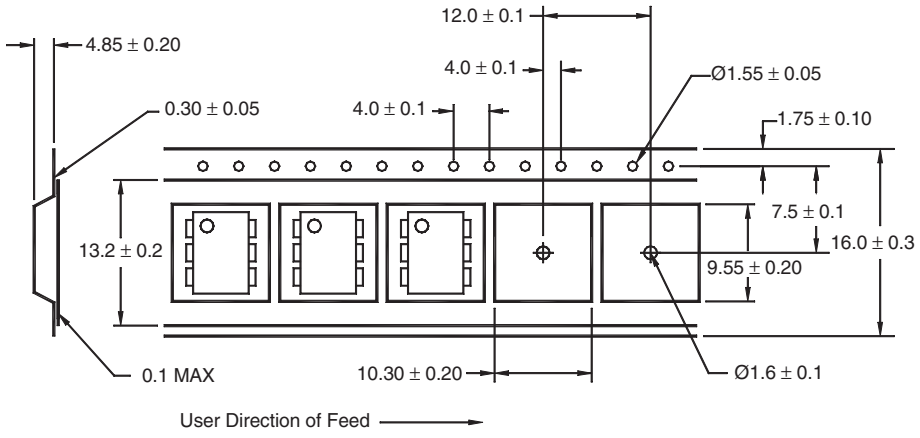

**Note**

All dimensions are in inches (millimeters)

## Ordering Information

| 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 and Reel |

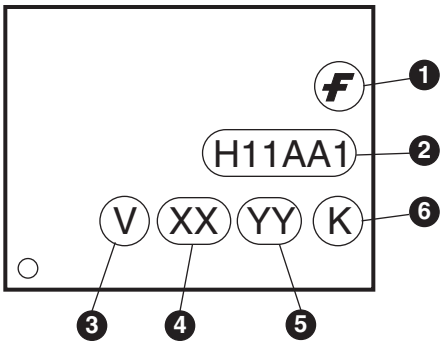
## Carrier Tape Specifications (“D” Taping Orientation)




**Note**

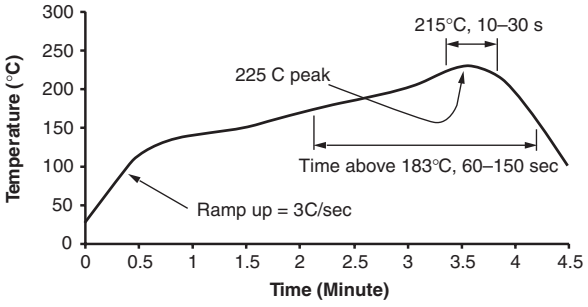
All dimensions are in millimeters

## 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 | 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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