

# H11AA814 Series, H11A617 Series, H11A817 Series 4-Pin Phototransistor Optocouplers

## Features

- AC input response (H11AA814 only)
- Compatible to Pb-free IR reflow soldering
- Compact 4-pin dual in-line package
- Current transfer ratio in selected groups:
 

|                     |                    |
|---------------------|--------------------|
| H11AA814: 20-300%   | H11A817: 50-600%   |
| H11AA814A: 50-150%  | H11A817A: 80-160%  |
| H11A617A: 40%-80%   | H11A817B: 130-260% |
| H11A617B: 63%-125%  | H11A817C: 200-400% |
| H11A617C: 100%-200% | H11A817D: 300-600% |
| H11A617D: 160%-320% |                    |
- C-UL, UL and VDE approved
- High input-output isolation voltage of 5000Vrms
- Minimum  $BV_{CEO}$  of 70V guaranteed

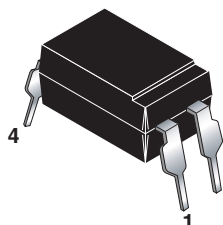
## Applications

- H11AA814 Series
  - AC line monitor
  - Unknown polarity DC sensor
  - Telephone line interface
- H11A617 and H11A817 Series
  - Power supply regulators
  - Digital logic inputs
  - Microprocessor inputs

## Description

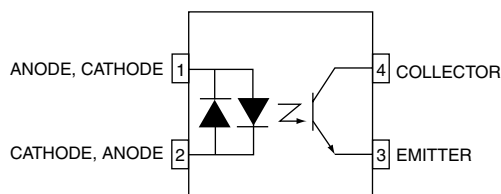
The H11AA814 consists of two gallium arsenide infrared emitting diodes, connected in inverse parallel, driving a silicon phototransistor output in a 4-pin dual in-line package. The H11A617/817 Series consists of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a 4-pin dual in-line package.

## Package

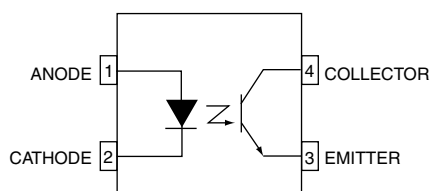


## Schematics

### H11AA814



### H11A617 & H11A817



**Absolute Maximum Ratings** ( $T_A = 25^\circ\text{C}$  Unless otherwise specified.)

| Symbol              | Parameter                                                                                     | Device*                       | Value          | Units                |
|---------------------|-----------------------------------------------------------------------------------------------|-------------------------------|----------------|----------------------|
| <b>TOTAL DEVICE</b> |                                                                                               |                               |                |                      |
| $T_{STG}$           | Storage Temperature                                                                           | All                           | -55 to +150    | $^\circ\text{C}$     |
| $T_{OPR}$           | Operating Temperature                                                                         | All                           | -55 to +100    | $^\circ\text{C}$     |
| $T_{SOL}$           | Lead Solder Temperature                                                                       | All                           | 260 for 10 sec | $^\circ\text{C}$     |
| $P_D$               | Total Device Power Dissipation (-55 $^\circ\text{C}$ to 50 $^\circ\text{C}$ )                 | All                           | 200            | mW                   |
| <b>EMITTER</b>      |                                                                                               |                               |                |                      |
| $I_F$               | Continuous Forward Current                                                                    | 814 Series<br>617, 817 Series | $\pm 50$<br>50 | mA                   |
| $V_R$               | Reverse Voltage                                                                               | 617 Series<br>817 Series      | 6<br>6         | V                    |
| $P_D$               | LED Power Dissipation (25 $^\circ\text{C}$ ambient)<br>No derating up to 100 $^\circ\text{C}$ | All                           | 70             | mW                   |
| <b>DETECTOR</b>     |                                                                                               |                               |                |                      |
| $V_{CEO}$           | Collector-Emitter Voltage                                                                     | All                           | 70             | V                    |
| $V_{ECO}$           | Emitter-Collector Voltage                                                                     | 814, 817 Series<br>617 Series | 6<br>7         | V                    |
| $I_C$               | Continuous Collector Current                                                                  | All                           | 50             | mA                   |
| $P_D$               | Detector Power Dissipation (25 $^\circ\text{C}$ ambient)<br>Derate above 90 $^\circ\text{C}$  | All                           | 150            | mW                   |
|                     |                                                                                               |                               | 2.9            | mW/ $^\circ\text{C}$ |

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

| Symbol            | Parameter                           | Test Conditions                             | Device                             | Min. | Typ.* | Max. | Unit |
|-------------------|-------------------------------------|---------------------------------------------|------------------------------------|------|-------|------|------|
| EMITTER           |                                     |                                             |                                    |      |       |      |      |
| V <sub>F</sub>    | Input Forward Voltage               | I <sub>F</sub> = 60mA                       | 617 Series                         |      | 1.35  | 1.65 | V    |
|                   |                                     | I <sub>F</sub> = 20mA                       | 817 Series                         |      | 1.2   | 1.5  |      |
|                   |                                     | I <sub>F</sub> = ±20mA                      | 814 Series                         |      | 1.2   | 1.5  |      |
| I <sub>R</sub>    | Reverse Leakage Current             | V <sub>R</sub> = 6.0V                       | 617 Series                         |      | .001  | 10   | μA   |
|                   |                                     | V <sub>R</sub> = 5.0V                       | 817 Series                         |      |       |      |      |
| DETECTOR          |                                     |                                             |                                    |      |       |      |      |
| BV <sub>CEO</sub> | Collector-Emitter Breakdown Voltage | I <sub>C</sub> = 0.1 mA, I <sub>F</sub> = 0 | ALL                                | 70   | 100   |      | V    |
| BV <sub>ECO</sub> | Emitter-Collector Breakdown Voltage | I <sub>E</sub> = 10 μA, I <sub>F</sub> = 0  | 814, 817 Series                    | 6    | 10    |      | V    |
|                   |                                     |                                             | 617 Series                         | 7    | 10    |      |      |
| I <sub>CEO</sub>  | Collector-Emitter Dark Current      | V <sub>CE</sub> = 10V, I <sub>F</sub> = 0   | H11AA814/A, 817 Series, H11A617C/D |      | 1     | 100  | nA   |
|                   |                                     |                                             | H11A617A/B                         |      |       | 50   |      |

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

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

| Symbol        | DC Characteristic                    | Test Conditions                                                                                                                        | Device                                          | Min     | Typ* | Max | Unit          |
|---------------|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|---------|------|-----|---------------|
| CTR           | Current Transfer Ratio               | $I_F = \pm 1\text{mA}$ , $V_{CE} = 5\text{V}^{(1)}$                                                                                    | H11AA814                                        | 20      |      | 300 | %             |
|               |                                      | $I_F = \pm 1\text{mA}$ , $V_{CE} = 5\text{V}^{(1)}$                                                                                    | H11AA814A                                       | 50      |      | 150 | %             |
|               |                                      | $I_F = 10\text{mA}$ , $V_{CE} = 5\text{V}^{(1)}$                                                                                       | H11A617A                                        | 40      |      | 80  | %             |
|               |                                      |                                                                                                                                        | H11A617B                                        | 63      |      | 125 | %             |
|               |                                      |                                                                                                                                        | H11A617C                                        | 100     |      | 200 | %             |
|               |                                      |                                                                                                                                        | H11A617D                                        | 160     |      | 320 | %             |
|               |                                      |                                                                                                                                        | $I_F = 5\text{mA}$ , $V_{CE} = 5\text{V}^{(1)}$ | H11A817 | 50   |     | 600           |
|               |                                      | H11A817A                                                                                                                               |                                                 | 80      |      | 160 | %             |
|               |                                      | H11A817B                                                                                                                               |                                                 | 130     |      | 260 | %             |
|               |                                      | H11A817C                                                                                                                               |                                                 | 200     |      | 400 | %             |
|               |                                      | H11A817D                                                                                                                               |                                                 | 300     |      | 600 | %             |
|               |                                      | $I_F = 1\text{mA}$ , $V_{CE} = 5\text{V}^{(1)}$                                                                                        | H11A617A                                        | 13      |      |     | %             |
|               |                                      |                                                                                                                                        | H11A617B                                        | 22      |      |     | %             |
|               |                                      |                                                                                                                                        | H11A617C                                        | 34      |      |     | %             |
|               |                                      |                                                                                                                                        | H11A617D                                        | 56      |      |     | %             |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | $I_C = 1\text{mA}$ , $I_F = \pm 20\text{mA}$<br>$I_C = 2.5\text{mA}$ , $I_F = 10\text{mA}$<br>$I_C = 1\text{mA}$ , $I_F = 20\text{mA}$ | 814 series                                      |         |      | 0.2 | V             |
|               |                                      |                                                                                                                                        | 617 series                                      |         |      | 0.4 |               |
|               |                                      |                                                                                                                                        | 817 series                                      |         |      | 0.2 |               |
|               |                                      |                                                                                                                                        | AC CHARACTERISTIC                               |         |      |     |               |
| $t_r$         | Rise Time                            | $I_C = 2\text{mA}$ , $V_{CE} = 2\text{ V}$ , $R_L = 100\Omega^{(2)}$                                                                   | ALL                                             |         | 4    | 18  | $\mu\text{s}$ |
| $t_f$         | Fall Time                            | $I_C = 2\text{mA}$ , $V_{CE} = 2\text{ V}$ , $R_L = 100\Omega^{(2)}$                                                                   | ALL                                             |         | 3    | 18  | $\mu\text{s}$ |

**Isolation Characteristics**

| Symbol    | Characteristic                          | Test Conditions                                                              | Min.               | Typ.*     | Max. | Units    |
|-----------|-----------------------------------------|------------------------------------------------------------------------------|--------------------|-----------|------|----------|
| $V_{ISO}$ | Input-Output Isolation Voltage (note 3) | ( $f = 60\text{Hz}$ , $t = 1\text{min}$ )<br>( $I_{I-O} \leq 2\mu\text{A}$ ) | 5000               |           |      | Vac(rms) |
| $R_{ISO}$ | Isolation Resistance                    | ( $V_{I-O} = 500\text{VDC}$ )                                                | $5 \times 10^{10}$ | $10^{11}$ |      | $\Omega$ |
| $C_{ISO}$ | Isolation Capacitance                   | ( $V_{I-O} = 0$ , $f = 1\text{MHz}$ )                                        |                    | 0.6       | 1.0  | pf       |

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

1. Current Transfer Ratio (CTR) =  $I_C/I_F \times 100\%$ .
2. For test circuit setup and waveforms, refer to Figure 13.
3. For this test, Pins 1 and 2 are common, and Pins 3 and 4 are common.

## Typical Performance Curves

Fig. 1 Current Transfer Ratio vs. Forward Current

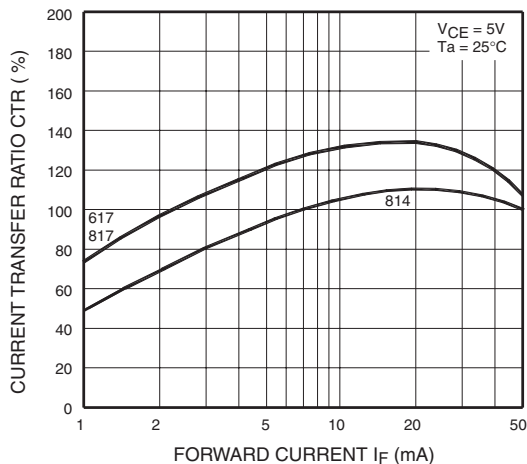


Fig. 2 Relative Current Transfer Ratio vs. Ambient Temperature

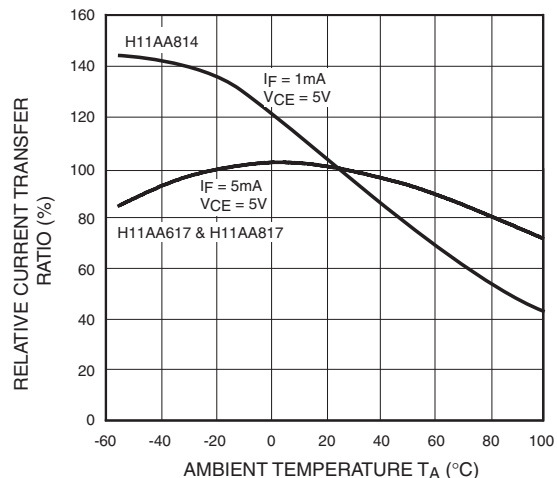


Fig. 3 Collector-Emitter Saturation Voltage vs. Ambient Temperature

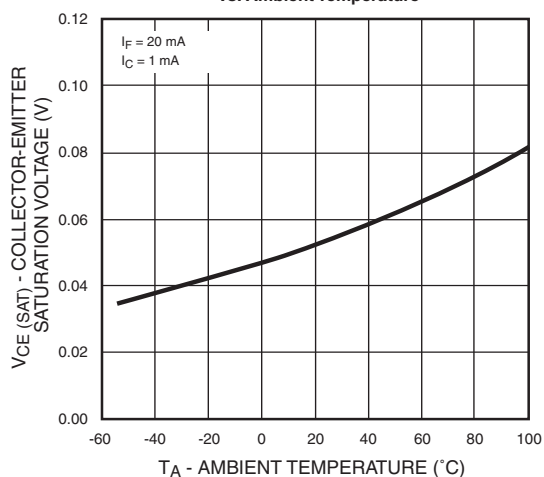


Fig. 4 Forward Current vs. Forward Voltage

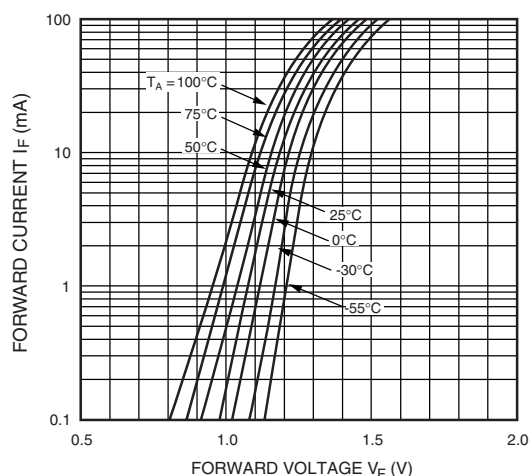


Fig. 5 Collector Current vs. Collector-Emitter Voltage (H11AA814)

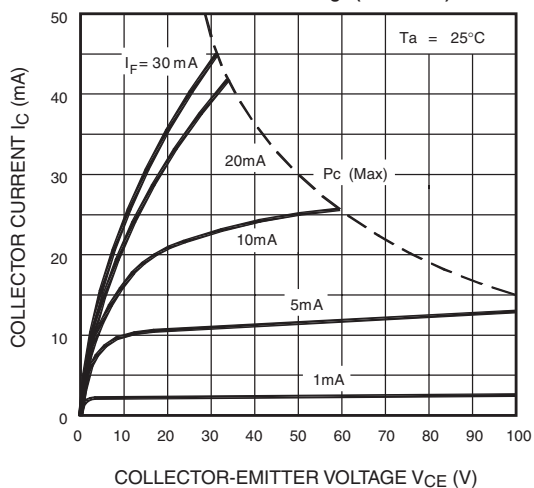
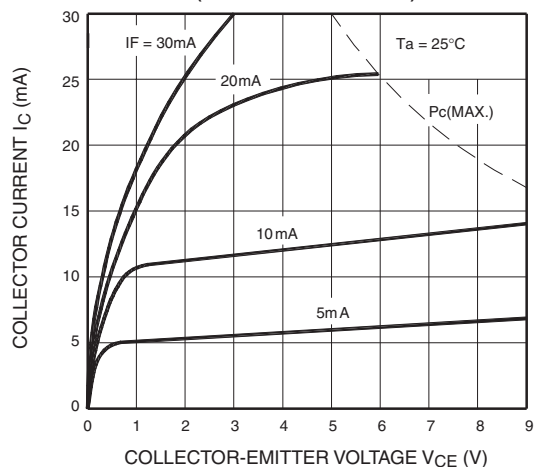


Fig. 6 Collector Current vs. Collector-Emitter Voltage (H11AA617 and H11A817)



## Typical Performance Curves (Continued)

Fig. 7 Collector Dark Current vs Ambient Temperature

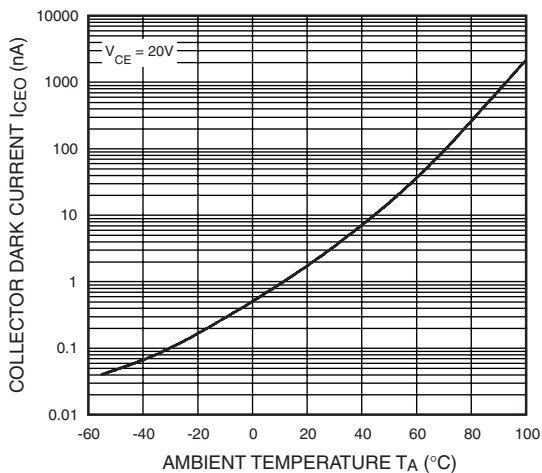


Fig. 8 Response Time vs. Load Resistance

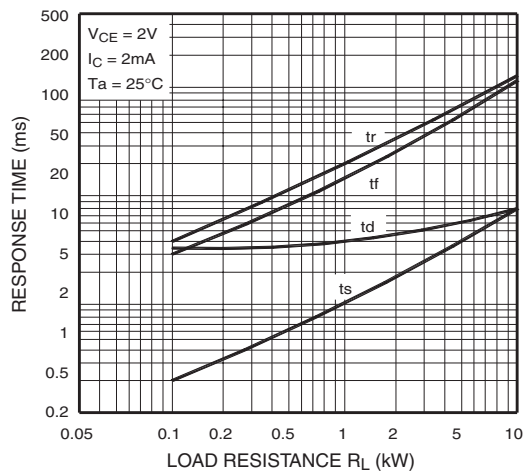


Fig. 9. Frequency Response (H11AA814)

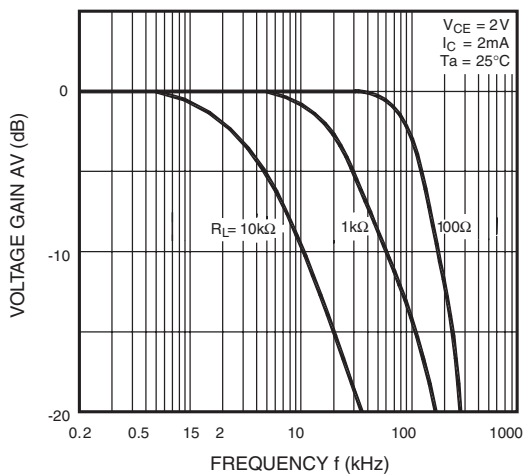


Fig. 10. Frequency Response (H11AA617 and H11AA817)

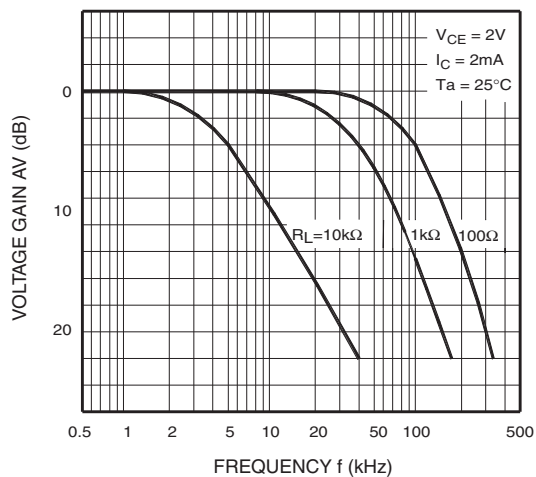


Fig. 11. LED Power Dissipation vs. Ambient Temperature

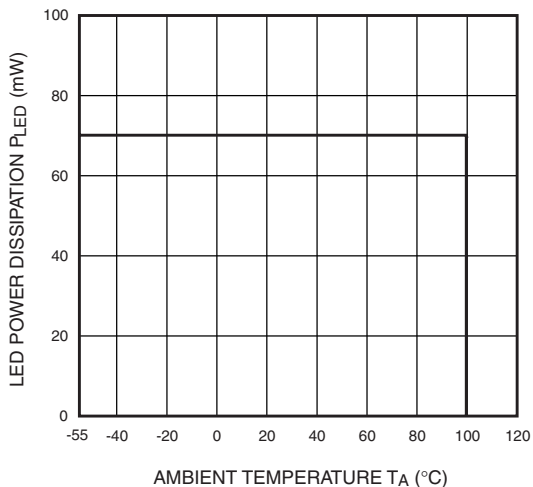
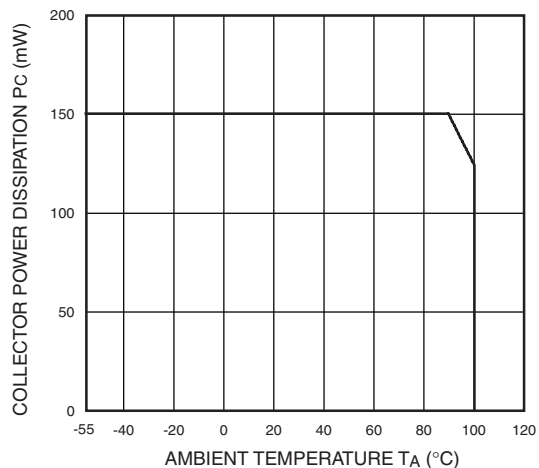


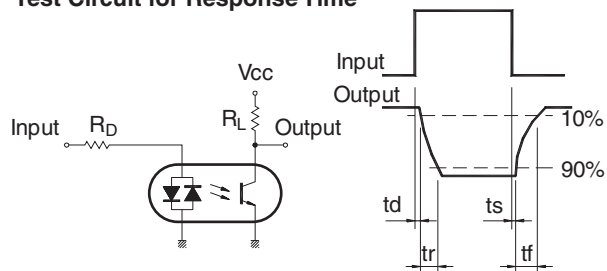
Fig. 12. Collector Power Dissipation vs. Ambient Temperature



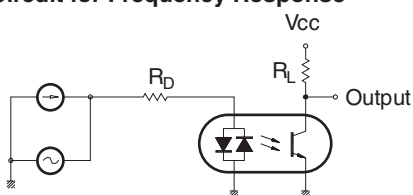
## Test Circuit

Figure 13. Test Circuit

### Test Circuit for Response Time

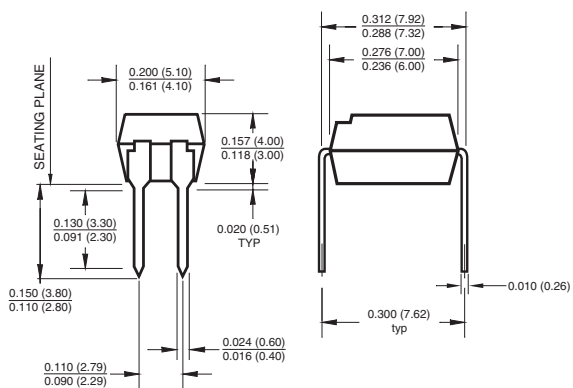


### Test Circuit for Frequency Response

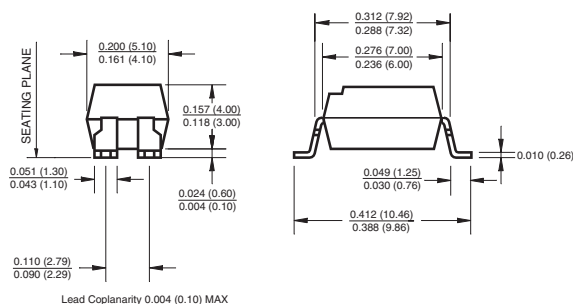


## Package Dimensions

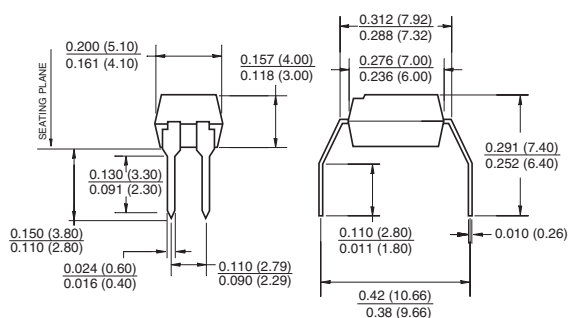
### Through Hole



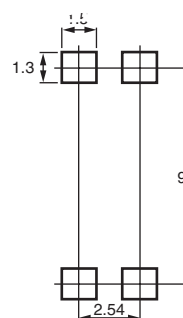
### Surface Mount



### 0.4" Lead Spacing



### Footprint Dimensions (Surface Mount)



#### Note:

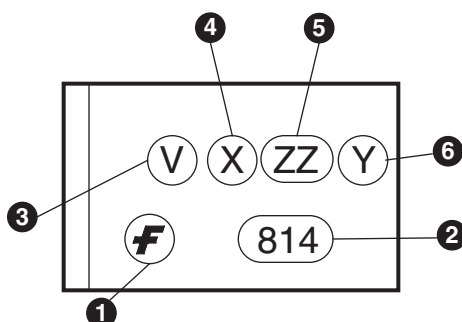
All dimensions are in inches (millimeters)

## Ordering Information

| Part Number Example | Description                              |
|---------------------|------------------------------------------|
| H11AA814S           | Surface Mount Lead Bend                  |
| H11AA814SD          | Surface Mount; Tape and reel             |
| H11AA814W           | 0.4" Lead Spacing                        |
| H11AA814300         | VDE Approved                             |
| H11AA814300W        | VDE Approved, 0.4" Lead Spacing          |
| H11AA8143S          | VDE Approved, Surface Mount              |
| H11AA8143SD         | VDE Approved, Surface Mount, Tape & Reel |

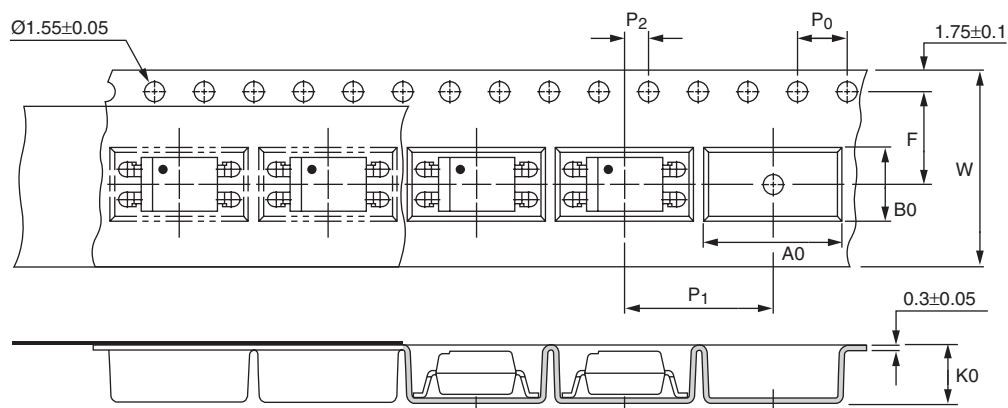
\*To specify the new construction version which needs 260°C max reflow peak temperature rating: add "NF098" to the end of the part number. The non-NF098 version is rated for 260°C peak reflow temperature only for parts marked with date code 0550 and later.

## 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                                                                    |
| 5           | Two digit work week ranging from '01' to '53'                                          |
| 6           | Assembly package code                                                                  |

## Carrier Tape Specifications

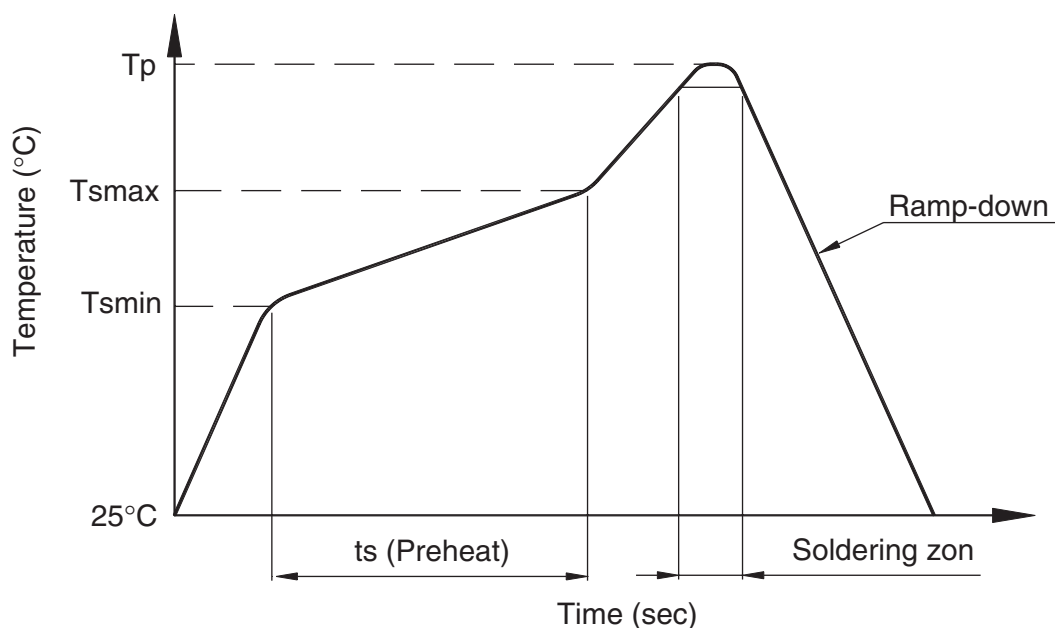


### Note:

All dimensions are in millimeters

| Description                            | Symbol | Dimensions in mm (inches) |
|----------------------------------------|--------|---------------------------|
| Tape wide                              | W      | $16 \pm 0.3$ (.63)        |
| Pitch of sprocket holes                | $P_0$  | $4 \pm 0.1$ (.15)         |
| Distance of compartment                | F      | $7.5 \pm 0.1$ (.295)      |
|                                        | $P_2$  | $2 \pm 0.1$ (.079)        |
| Distance of compartment to compartment | $P_1$  | $12 \pm 0.1$ (.472)       |
| Compartment                            | $A_0$  | $10.45 \pm 0.1$ (.411)    |
|                                        | $B_0$  | $5.30 \pm 0.1$ (.209)     |
|                                        | $K_0$  | $4.25 \pm 0.1$ (.167)     |

### Lead Free Recommended IR Reflow Condition



| Profile Feature                                                               | Pb-Sn solder assembly         | Lead Free assembly            |
|-------------------------------------------------------------------------------|-------------------------------|-------------------------------|
| Preheat condition<br>(T <sub>smin</sub> -T <sub>smax</sub> / t <sub>s</sub> ) | 100°C ~ 150°C<br>60 ~ 120 sec | 150°C ~ 200°C<br>60 ~ 120 sec |
| Melt soldering zone                                                           | 183°C<br>60 ~ 120 sec         | 217°C<br>30 ~ 90 sec          |
| Peak temperature (T <sub>p</sub> )                                            | 240 +0/-5°C                   | 260 +0/-5°C                   |
| Ramp-down rate                                                                | 6°C/sec max.                  | 6°C/sec max.                  |

### Recommended Wave Soldering condition

| Profile Feature                    | For all solder assembly |
|------------------------------------|-------------------------|
| Peak temperature (T <sub>p</sub> ) | Max 260°C for 10 sec    |

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| ActiveArray <sup>™</sup>                         | GlobalOptoisolator <sup>™</sup> | OCXPro <sup>™</sup>             | SMART START <sup>™</sup>     | UltraFET <sup>®</sup> |
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| Build it Now <sup>™</sup>                        | HiSeC <sup>™</sup>              | OPTOPLANAR <sup>™</sup>         | Stealth <sup>™</sup>         | Wire <sup>™</sup>     |
| CoolFET <sup>™</sup>                             | I <sup>2</sup> C <sup>™</sup>   | PACMAN <sup>™</sup>             | SuperFET <sup>™</sup>        |                       |
| CROSSVOLT <sup>™</sup>                           | i-Lo <sup>™</sup>               | POP <sup>™</sup>                | SuperSOT <sup>™</sup> -3     |                       |
| DOME <sup>™</sup>                                | ImpliedDisconnect <sup>™</sup>  | Power247 <sup>™</sup>           | SuperSOT <sup>™</sup> -6     |                       |
| EcoSPARK <sup>™</sup>                            | IntelliMAX <sup>™</sup>         | PowerEdge <sup>™</sup>          | SuperSOT <sup>™</sup> -8     |                       |
| E <sup>2</sup> C <sup>™</sup>                    | ISOPLANAR <sup>™</sup>          | PowerSaver <sup>™</sup>         | SyncFET <sup>™</sup>         |                       |
| EnSigna <sup>™</sup>                             | LittleFET <sup>™</sup>          | PowerTrench <sup>®</sup>        | TCM <sup>™</sup>             |                       |
| FACT <sup>™</sup>                                | MICROCOUPLER <sup>™</sup>       | QFET <sup>®</sup>               | TinyBoost <sup>™</sup>       |                       |
| FAST <sup>®</sup>                                | MicroFET <sup>™</sup>           | QS <sup>™</sup>                 | TinyBuck <sup>™</sup>        |                       |
| FAST <sup>™</sup>                                | MicroPak <sup>™</sup>           | QT Optoelectronics <sup>™</sup> | TinyPWM <sup>™</sup>         |                       |
| FPS <sup>™</sup>                                 | MICROWIRE <sup>™</sup>          | Quiet Series <sup>™</sup>       | TinyPower <sup>™</sup>       |                       |
| FRFET <sup>™</sup>                               | MSX <sup>™</sup>                | RapidConfigure <sup>™</sup>     | TinyLogic <sup>®</sup>       |                       |
|                                                  | MSXPro <sup>™</sup>             | RapidConnect <sup>™</sup>       | TINYOPTO <sup>™</sup>        |                       |
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| The Power Franchise <sup>®</sup>                 |                                 | ScalarPump <sup>™</sup>         | UHC <sup>™</sup>             |                       |
| Programmable Active Droop <sup>™</sup>           |                                 |                                 |                              |                       |

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

## PRODUCT STATUS DEFINITIONS

### Definition of Terms

| Datasheet Identification | Product Status         | Definition                                                                                                                                                                                                   |
|--------------------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Advance Information      | Formative or In Design | This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.                                                                           |
| Preliminary              | First Production       | This datasheet contains preliminary data, and 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. |
| No Identification Needed | Full Production        | This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.                                                       |
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