# THE DATASHEET OF

# FOD617DS

FAIRCHILD
SEMICONDUCTOR®

May 2006

# FOD814 Series, FOD617 Series, FOD817 Series 4-Pin High Operating Temperature Phototransistor Optocouplers

## Features

- AC input response (FOD814 only)
- Applicable to Pb-free IR reflow soldering
- Compact 4-pin package
- Current transfer ratio in selected groups:
  FOD617A: 40–80%
  FOD617B: 63–125%
  FOD617C: 100–200%
  FOD617D: 160–320%
  FOD814: 20–300%
  FOD814A: 50–150%
  FOD817: 50–600%
  FOD817A: 80–160%
  FOD817B: 130–260%
  FOD817C: 200–400%
  FOD817D: 300–600%
- C-UL, UL and VDE approved
- High input-output isolation voltage of 5000Vrms
- Minimum $BV_{CEO}$ of 70V guaranteed
- Higher operating temperatures (versus H11AXXX counterparts)

## Applications

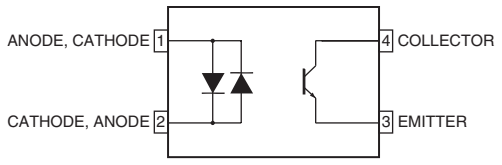
FOD814 Series
- AC line monitor
- Unknown polarity DC sensor
- Telephone line interface

FOD617 and FOD817 Series
- Power supply regulators
- Digital logic inputs
- Microprocessor inputs

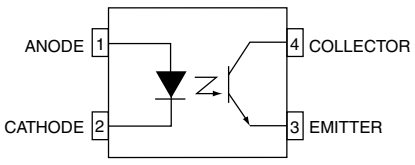
## Description

The FOD814 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 FOD617/817 Series consists of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a 4-pin dual in-line package.

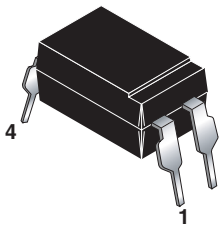
## Functional Block Diagram




**FOD814**




**FOD617/817**



## Absolute Maximum Ratings ($T_A$ = 25°C Unless otherwise specified.)

| Symbol | Parameter | Value | | Units |
|---|---|---|---|---|
| | | FOD814 | FOD617/817 | |
| **TOTAL DEVICE** | | | | |
| $T_{STG}$ | Storage Temperature | -55 to +150 | | °C |
| $T_{OPR}$ | Operating Temperature | -55 to +105 | -55 to +110 | °C |
| $T_{SOL}$ | Lead Solder Temperature | 260 for 10 sec | | °C |
| $P_{TOT}$ | Total Power Dissipation | 200 | | mW |
| **EMITTER** | | | | |
| $I_F$ | Continuous Forward Current | ±50 | 50 | mA |
| $V_R$ | Reverse Voltage | – | 6 | |
| $P_D$ | Power Dissipation<br>Derate above 100°C | 70<br>1.7 | | mW<br>mW/°C |
| **DETECTOR** | | | | |
| $V_{CEO}$ | Collector-Emitter Voltage | 70 | | V |
| $V_{ECO}$ | Emitter-Collector Voltage | 6 | 6 (FOD817)<br>7 (FOD617) | V |
| $I_C$ | Continuous Collector Current | 50 | | mA |
| $P_C$ | Collector Power Dissipation<br>Derate above 90°C | 150<br>2.9 | | mW<br>mW/°C |

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

### Individual Component Characteristics

| Symbol | Parameter | Device | Test Conditions | Min. | Typ.* | Max. | Unit |
|---|---|---|---|---|---|---|---|
| **EMITTER** | | | | | | | |
| $V_F$ | Forward Voltage | FOD814 | $I_F$ = ±20mA | – | 1.2 | 1.4 | V |
| | | FOD617 | $I_F$ = 60mA | – | 1.35 | 1.65 | |
| | | FOD817 | $I_F$ = 20mA | – | 1.2 | 1.4 | |
| $I_R$ | Reverse Leakage Current | FOD617 | $V_R$ = 6.0V | – | 0.001 | 10 | µA |
| | | FOD817 | $V_R$ = 4.0V | – | – | 10 | |
| $C_t$ | Terminal Capacitance | FOD814 | V = 0, f = 1kHz | – | 50 | 250 | pF |
| | | FOD617 | V = 0, f = 1kHz | – | 30 | 250 | |
| | | FOD817 | V = 0, f = 1kHz | – | 30 | 250 | |
| **DETECTOR** | | | | | | | |
| $I_{CEO}$ | Collector Dark Current | FOD814 | $V_{CE}$ = 20V, $I_F$ = 0 | – | – | 100 | nA |
| | | FOD617C/D | $V_{CE}$ = 10V, $I_F$ = 0 | – | 1 | 100 | |
| | | FOD617A/B | $V_{CE}$ = 10V, $I_F$ = 0 | – | 1 | 50 | |
| | | FOD817 | $V_{CE}$ = 20V, $I_F$ = 0 | – | – | 100 | |
| $BV_{CEO}$ | Collector-Emitter Breakdown Voltage | FOD814 | $I_C$ = 0.1mA, $I_F$ = 0 | 70 | – | – | V |
| | | FOD617 | $I_C$ = 100µA, $I_F$ = 0 | 70 | – | – | |
| | | FOD817 | $I_C$ = 0.1mA, $I_F$ = 0 | 70 | – | – | |
| $BV_{ECO}$ | Emitter-Collector Breakdown Voltage | FOD814 | $I_E$ = 10µA, $I_F$ = 0 | 6 | – | – | V |
| | | FOD617 | $I_E$ = 10µA, $I_F$ = 0 | 7 | – | – | |
| | | FOD817 | $I_E$ = 10µA, $I_F$ = 0 | 6 | – | – | |

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

| Symbol | DC Characteristic | Device | Test Conditions | Min. | Typ.* | Max. | Unit |
|---|---|---|---|---|---|---|---|
| CTR | Current Transfer Ratio | FOD814 | $I_F$ = ±1mA, $V_{CE}$ = 5V(1) | 20 | – | 300 | % |
| | | FOD814A | | 50 | – | 150 | |
| | | FOD617A | $I_F$ = 10mA, $V_{CE}$ = 5V(1) | 40 | – | 80 | |
| | | FOD617B | | 63 | – | 125 | |
| | | FOD617C | | 100 | – | 200 | |
| | | FOD617D | | 160 | – | 320 | |
| | | FOD617A | $I_F$ = 1mA, $V_{CE}$ = 5V(1) | 13 | – | – | |
| | | FOD617B | | 22 | – | – | |
| | | FOD617C | | 34 | – | – | |
| | | FOD617D | | 56 | – | – | |
| | | FOD817 | $I_F$ = 5mA, $V_{CE}$ = 5V(1) | 50 | – | 600 | |
| | | FOD817A | | 80 | – | 160 | |
| | | FOD817B | | 130 | – | 260 | |
| | | FOD817C | | 200 | – | 400 | |
| | | FOD817D | | 300 | – | 600 | |
| $V_{CE\ (sat)}$ | Collector-Emitter Saturation Voltage | FOD814 | $I_F$ = ±20mA, $I_C$ = 1mA | – | 0.1 | 0.2 | V |
| | | FOD617 | $I_F$ = 10mA, $I_C$ = 2.5mA | – | – | 0.4 | |
| | | FOD817 | $I_F$ = 20mA, $I_C$ = 1mA | – | 0.1 | 0.2 | |

*Typical values at $T_A$ = 25°C

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

| Symbol | AC Characteristic | Device | Test Conditions | Min. | Typ.* | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $f_C$ | Cut-Off Frequency | FOD814 | $V_{CE}$ = 5V, $I_C$ = 2mA, $R_L$ = 100Ω, -3dB | 15 | 80 | – | kHz |
| $t_r$ | Response Time (Rise) | FOD814 | $V_{CE}$ = 2 V, $I_C$ = 2mA, $R_L$ = 100Ω(2) | – | 4 | 18 | µs |
| | | FOD617 | | | | | |
| | | FOD817 | | | | | |
| $t_f$ | Response Time (Fall) | FOD814 | | – | 3 | 18 | µs |
| | | FOD617 | | | | | |
| | | FOD817 | | | | | |

**Isolation Characteristics**

| Symbol | Characteristic | Device | Test Conditions | Min. | Typ.* | Max. | Units |
|---|---|---|---|---|---|---|---|
| $V_{ISO}$ | Input-Output Isolation Voltage(3) | FOD814 | f = 60Hz, t = 1 min, $I_{I-O} \leq 2\mu A$ | 5000 | | | Vac(rms) |
| | | FOD617 | | | | | |
| | | FOD817 | | | | | |
| $R_{ISO}$ | Isolation Resistance | FOD814 | $V_{I-O}$ = 500VDC | $5x10^{10}$ | $1x10^{11}$ | — | Ω |
| | | FOD617 | | | | | |
| | | FOD817 | | | | | |
| $C_{ISO}$ | Isolation Capacitance | FOD814 | $V_{I-O}$ = 0, f = 1 MHz | | 0.6 | 1.0 | pf |
| | | FOD617 | | | | | |
| | | FOD817 | | | | | |

*Typical values at $T_A$ = 25°C

**Notes:**
1. Current Transfer Ratio (CTR) = $I_C/I_F$ x 100%.
2. For test circuit setup and waveforms, refer to page 4.
3. For this test, Pins 1 and 2 are common, and Pins 3 and 4 are common.

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

**Fig. 1 Collector Power Dissipation vs. Ambient Temperature (FOD814)**

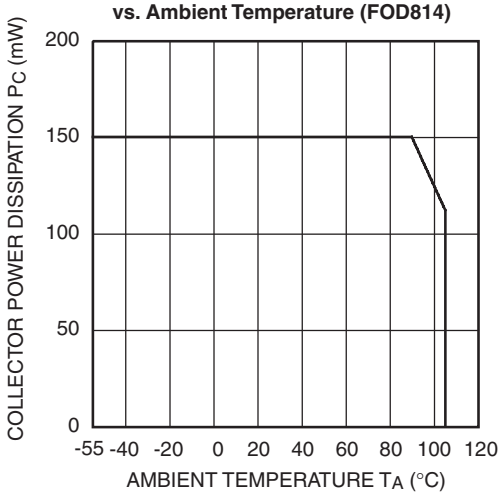



**Fig. 2 Collector Power Dissipation vs. Ambient Temperature (FOD617/817)**

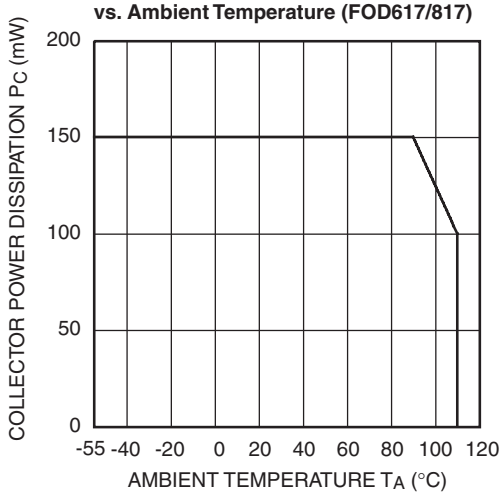



**Fig. 3 Collector-Emitter Saturation Voltage vs. Forward Current**

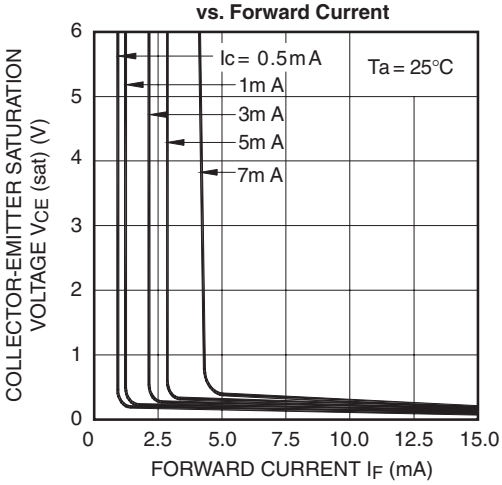



**Fig. 4 Forward Current vs. Forward Voltage (FOD814)**

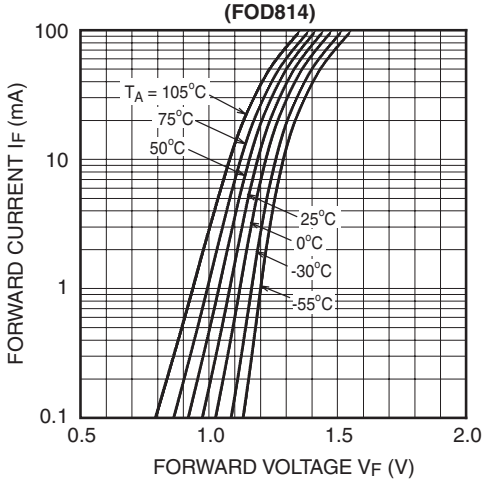



**Fig. 5 Forward Current vs. Forward Voltage (FOD617/817)**

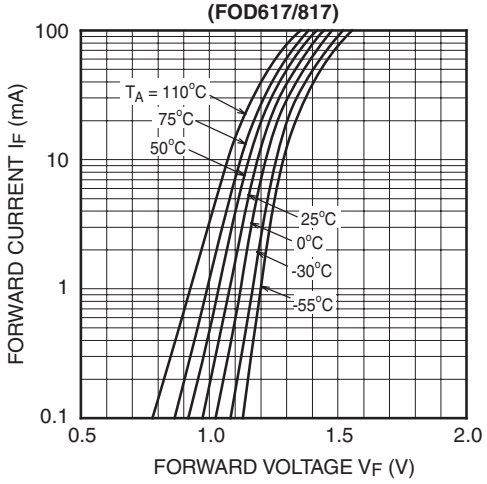
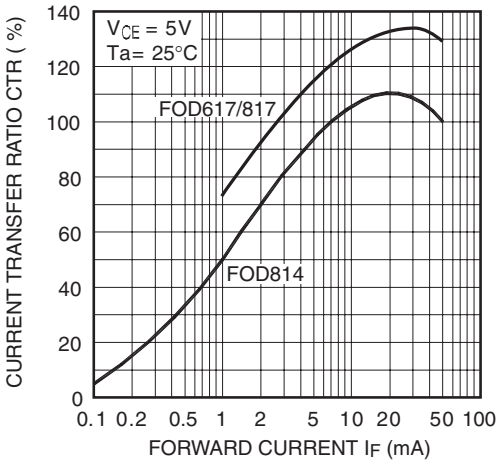



**Fig. 6 Current Transfer Ratio vs. Forward Current**



## Typical Electrical/Optical Characteristics (Continued) ($T_A$ = 25°C Unless otherwise specified.)

**Fig. 7 Collector Current vs. Collector-Emitter Voltage (FOD814)**

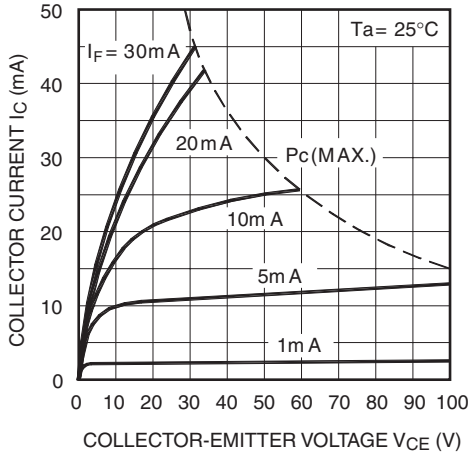



**Fig. 8 Collector Current vs. Collector-Emitter Voltage (FOD617/817)**

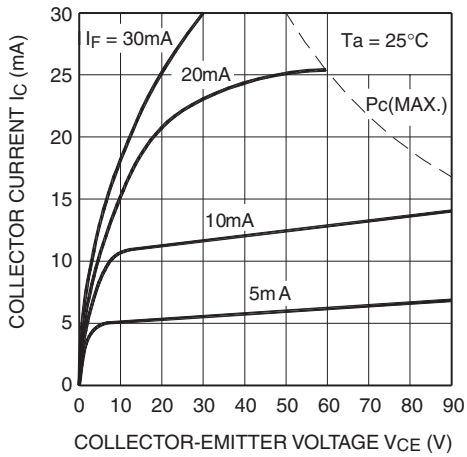



**Fig. 9 Relative Current Transfer Ratio vs. Ambient Temperature**

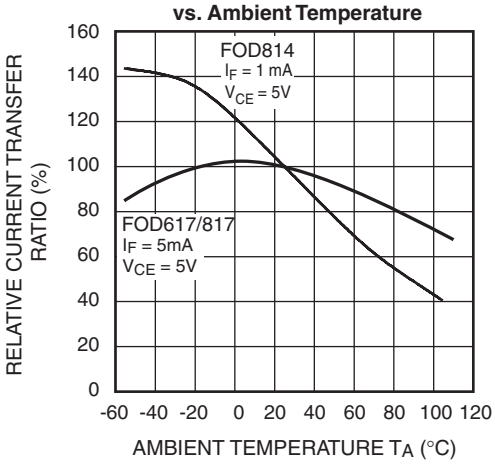



**Fig. 10 Collector-Emitter Saturation Voltage vs. Ambient Temperature**

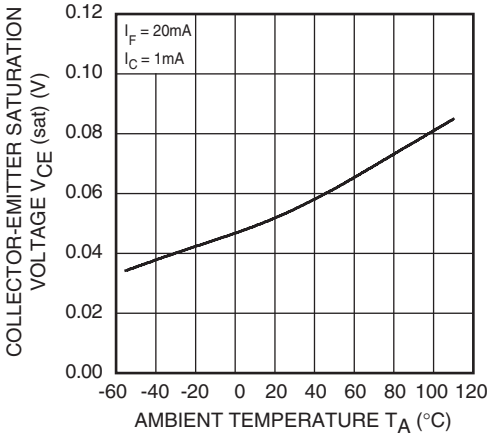



**Fig. 11 LED Power Dissipation vs. Ambient Temperature (FOD814)**

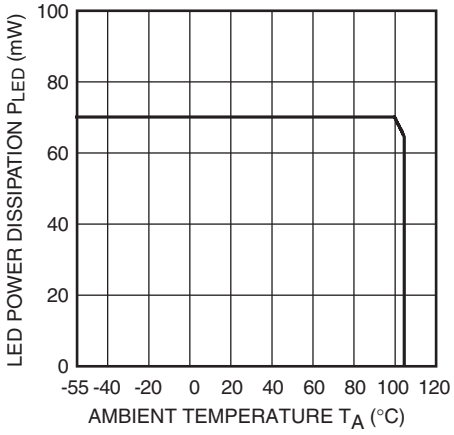
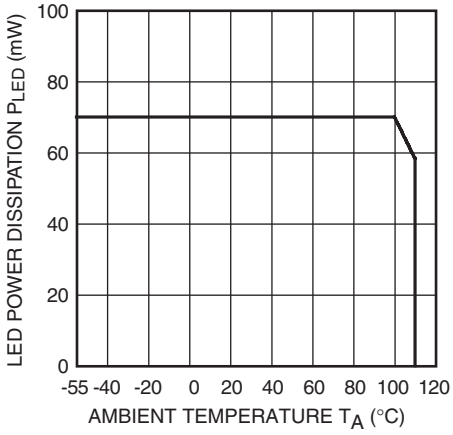



**Fig. 12 LED Power Dissipation vs. Ambient Temperature (FOD617/817)**



## Typical Electrical/Optical Characteristics (Continued) ($T_A$ = 25°C Unless otherwise specified.)

**Fig. 13 Response Time vs. Load Resistance**

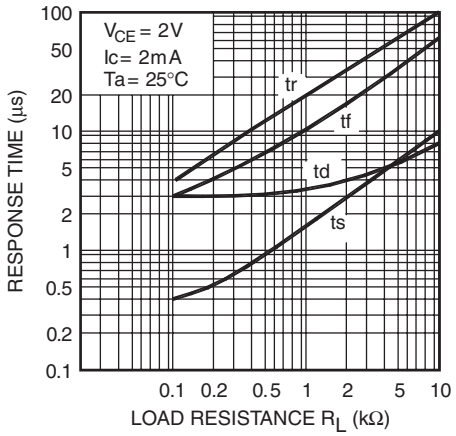



**Fig. 14 Frequency Response**

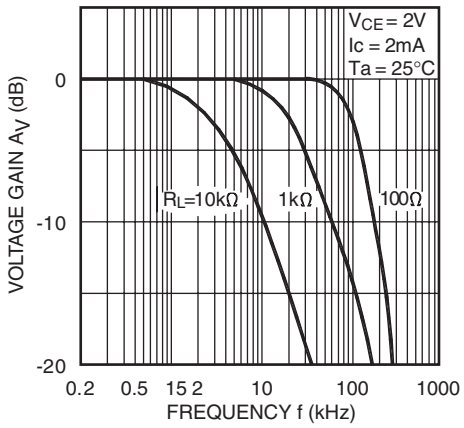
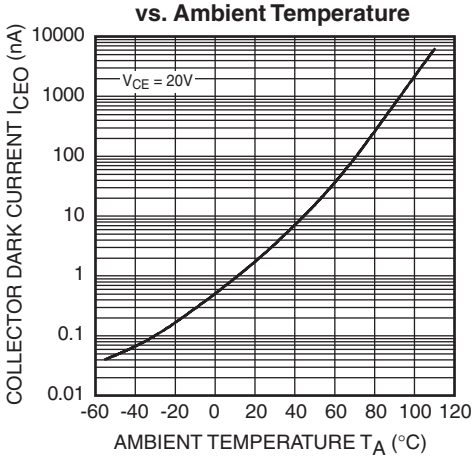
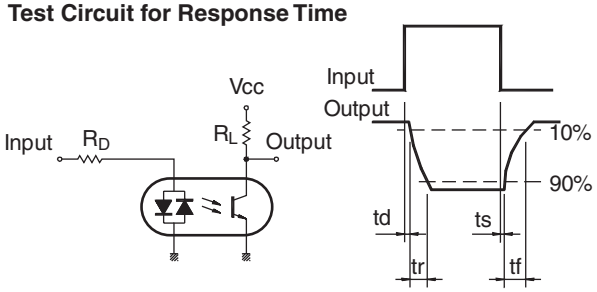


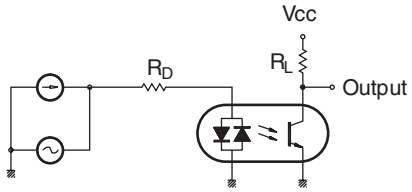

**Fig. 15 Collector Dark Current vs. Ambient Temperature**



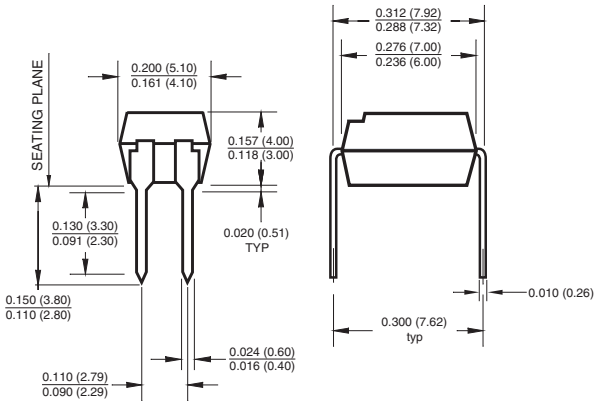

**Test Circuit for Response Time**



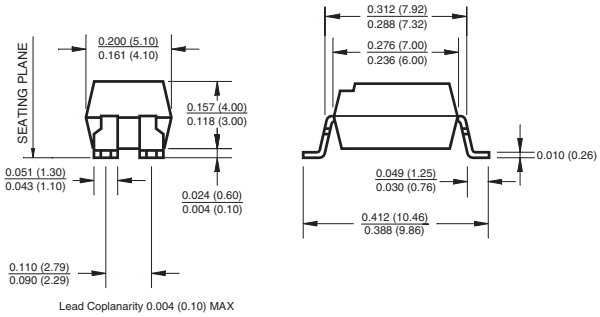

**Test Circuit for Frequency Response**



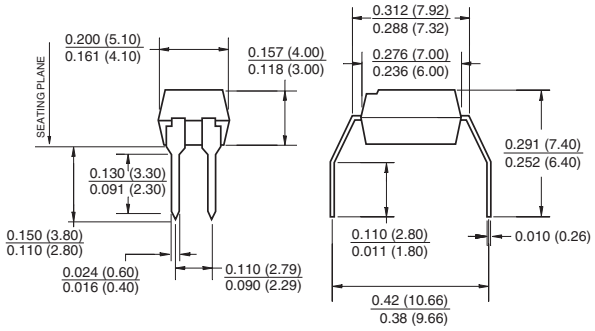
## Package Dimensions (Through Hole)



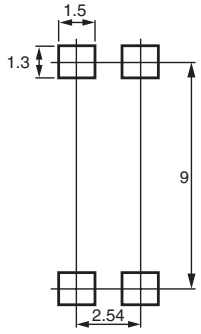

## Package Dimensions (Surface Mount)




## Package Dimensions (0.4" Lead Spacing)




## Footprint Dimensions (Surface Mount)



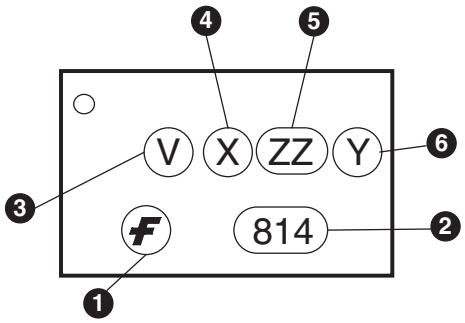

**Note:**

All dimensions are in inches (millimeters).

## Ordering Information

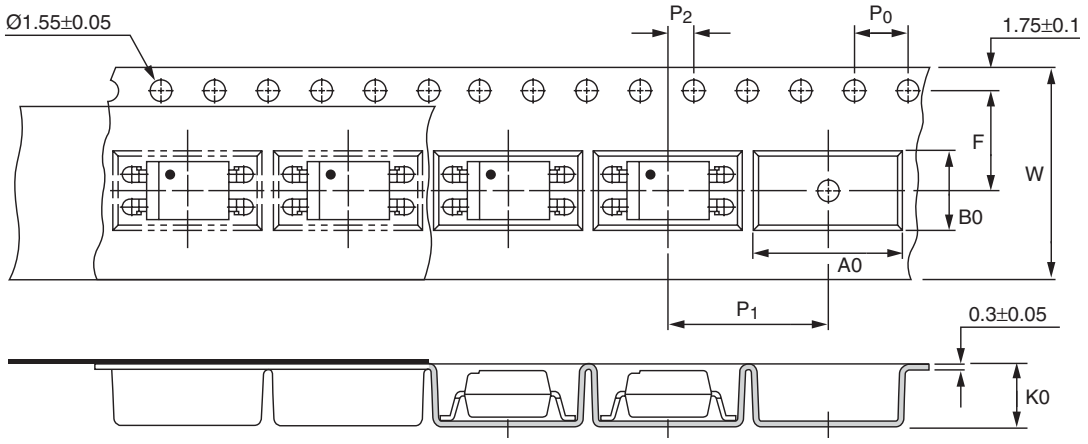
| Option | Part Number Example | Description |
|---|---|---|
| S | FOD814S | Surface Mount Lead Bend |
| SD | FOD814SD | Surface Mount; Tape and reel |
| W | FOD814W | 0.4" Lead Spacing |
| 300 | FOD814300 | VDE Approved |
| 300W | FOD814300W | VDE Approved, 0.4" Lead Spacing |
| 3S | FOD8143S | VDE Approved, Surface Mount |
| 3SD | FOD8143SD | VDE Approved, Surface Mount, Tape & Reel |

## 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 |

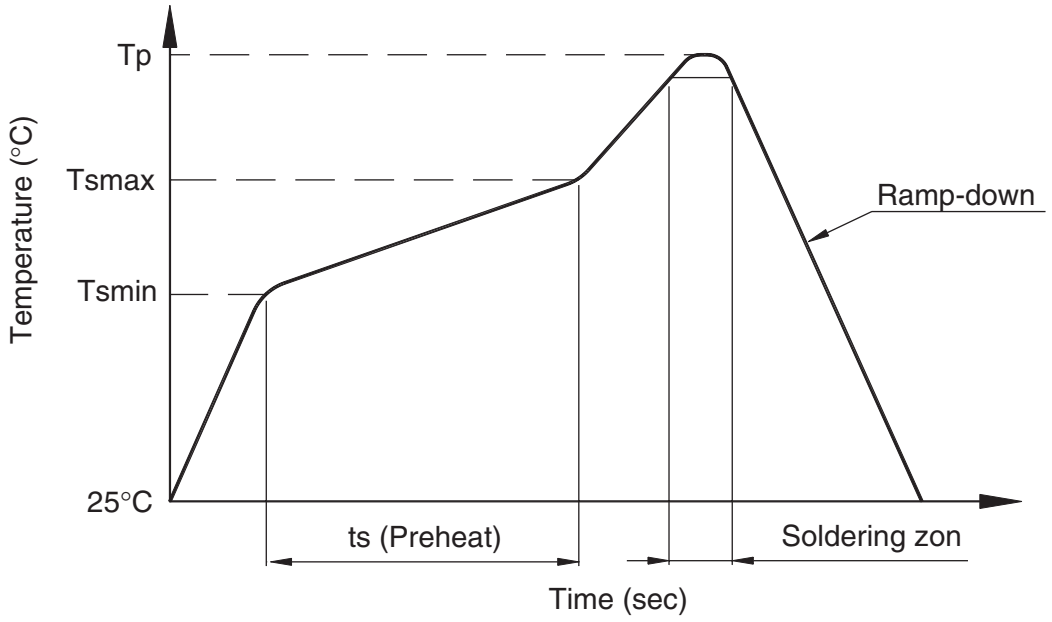
## Carrier Tape Specifications




**Note:**
All dimensions are in millimeters.

| Description | Symbol | Dimensions in mm (inches) |
|---|---|---|
| Tape wide | W | 16 ± 0.3 (.63) |
| Pitch of sprocket holes | $P_0$ | 4 ± 0.1 (.15) |
| Distance of compartment | F<br>$P_2$ | 7.5 ± 0.1 (.295)<br>2 ± 0.1 (.079) |
| Distance of compartment to compartment | $P_1$ | 12 ± 0.1 (.472) |
| Compartment | A0 | 10.45 ± 0.1 (.411) |
| | B0 | 5.30 ± 0.1 (.209) |
| | K0 | 4.25 ± 0.1 (.167) |

## Lead Free Recommended IR Reflow Condition




| Profile Feature | Pb-Sn solder assembly | Lead Free assembly |
|---|---|---|
| Preheat condition<br>(Tsmin-Tsmax / ts) | 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 (Tp) | 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 (Tp) | Max 260°C for 10 sec |

## TRADEMARKS

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| | | | | |
|---|---|---|---|---|
| ACEx™ | FAST® | ISOPLANAR™ | PowerEdge™ | SuperFET™ |
| ActiveArray™ | FASTr™ | LittleFET™ | PowerSaver™ | SuperSOT™-3 |
| Bottomless™ | FPS™ | MICROCOUPLER™ | PowerTrench® | SuperSOT™-6 |
| Build it Now™ | FRFET™ | MicroFET™ | QFET® | SuperSOT™-8 |
| CoolFET™ | GlobalOptoisolator™ | MicroPak™ | QS™ | SyncFET™ |
| *CROSSVOLT*™ | GTO™ | MICROWIRE™ | QT Optoelectronics™ | TCM™ |
| DOME™ | HiSeC™ | MSX™ | Quiet Series™ | TinyLogic® |
| EcoSPARK™ | $I^2C$™ | MSXPro™ | RapidConfigure™ | TINYOPTO™ |
| $E^2CMOS$™ | *i-Lo*™ | OCX™ | RapidConnect™ | TruTranslation™ |
| EnSigna™ | ImpliedDisconnect™ | OCXPro™ | µSerDes™ | UHC™ |
| FACT™ | IntelliMAX™ | OPTOLOGIC® | ScalarPump™ | UniFET™ |
| FACT Quiet Series™ | | OPTOPLANAR™ | SILENT SWITCHER® | UltraFET® |
| Across the board. Around the world.™ | | PACMAN™ | SMART START™ | VCX™ |
| The Power Franchise® | | POP™ | SPM™ | Wire™ |
| Programmable Active Droop™ | | Power247™ | Stealth™ | |

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As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.

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 in order 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 in order to improve design. |
| Obsolete | Not In Production | This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only. |

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