



November 2015

FOD814 Series, FOD817 Series 4-Pin DIP Phototransistor Optocouplers

Features

- AC Input Response (FOD814)
- Current Transfer Ratio in Selected Groups:
 - FOD814: 20–300% FOD817: 50–600%
 - FOD814A: 50–150% FOD817A: 80–160%
 - FOD817B: 130–260%
 - FOD817C: 200–400%
 - FOD817D: 300–600%
- Minimum BV_{CEO} of 70 V Guaranteed
- Safety and Regulatory Approvals
 - UL1577, 5,000 VAC_{RMS} for 1 Minute
 - DIN EN/IEC60747-5-5

Applications

FOD814 Series

- AC Line Monitor
- Unknown Polarity DC Sensor
- Telephone Line Interface

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 FOD817 Series consists of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a 4-pin dual in-line package.

Functional Block Diagram

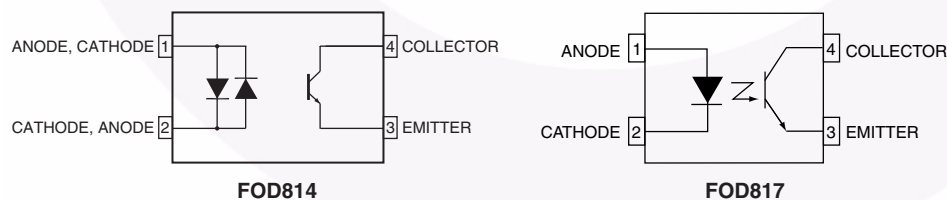


Figure 1. Schematic

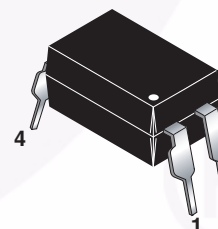


Figure 2. Package Outlines

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 _{RMS} | I–IV |
| | < 300 V _{RMS} | I–III |
| Climatic Classification | | 30/110/21 |
| Pollution Degree (DIN VDE 0110/1.89) | | 2 |
| Comparative Tracking Index | | 175 |

| Symbol | Parameter | Value | Unit |
|-----------------------|--|--------------------|-------------------|
| V _{PR} | Input-to-Output Test Voltage, Method A, V _{IORM} × 1.6 = V _{PR} , Type and Sample Test with t _m = 10 s, Partial Discharge < 5 pC | 1360 | V _{peak} |
| | Input-to-Output Test Voltage, Method B, V _{IORM} × 1.875 = V _{PR} , 100% Production Test with t _m = 1 s, Partial Discharge < 5 pC | 1560 | V _{peak} |
| V _{IORM} | Maximum Working Insulation Voltage | 850 | V _{peak} |
| V _{IOTM} | Highest Allowable Over-Voltage | 8000 | V _{peak} |
| | External Creepage | ≥ 7 | mm |
| | External Clearance | ≥ 7 | mm |
| | External Clearance (for Option W, 0.4" Lead Spacing) | ≥ 10 | mm |
| DTI | Distance Through Insulation (Insulation Thickness) | ≥ 0.4 | mm |
| T _S | Case Temperature ⁽¹⁾ | 175 | °C |
| I _{S,INPUT} | Input Current ⁽¹⁾ | 400 | mA |
| P _{S,OUTPUT} | Output Power ⁽¹⁾ | 700 | mW |
| R _{IO} | Insulation Resistance at T _S , V _{IO} = 500 V ⁽¹⁾ | > 10 ¹¹ | 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. $T_A = 25^\circ\text{C}$ Unless otherwise specified.

| Symbol | Parameter | Value | | Unit |
|------------------|-------------------------------------|--------------------|-------------|-------|
| | | FOD814 | FOD817 | |
| Total Device | | | | |
| T _{STG} | Storage Temperature | -55 to +150 | | °C |
| T _{OPR} | Operating Temperature | -55 to +105 | -55 to +110 | °C |
| T _J | Junction Temperature | -55 to +125 | | °C |
| T _{SOL} | Lead Solder Temperature | 260 for 10 seconds | | °C |
| θ _{JC} | Junction-to-Case Thermal Resistance | 210 | | °C/W |
| P _{TOT} | Total Device Power Dissipation | 200 | | mW |
| EMITTER | | | | |
| I _F | Continuous Forward Current | ±50 | 50 | mA |
| V _R | Reverse Voltage | | 6 | V |
| P _D | Power Dissipation | 70 | | mW |
| | Derate Above 100°C | 1.7 | | mW/°C |
| DETECTOR | | | | |
| V _{CEO} | Collector-Emitter Voltage | 70 | | V |
| V _{ECO} | Emitter-Collector Voltage | 6 | | V |
| I _C | Continuous Collector Current | 50 | | mA |
| P _C | Collector Power Dissipation | 150 | | mW |
| | Derate Above 90°C | 2.9 | | mW/°C |

Electrical Characteristics

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

Individual Component Characteristics

| Symbol | Parameter | Device | Test Conditions | Min. | Typ. | Max. | Unit |
|-------------------|-------------------------------------|--------|---|------|------|------|------|
| EMITTER | | | | | | | |
| V _F | Forward Voltage | FOD814 | I _F = ±20 mA | | 1.2 | 1.4 | V |
| | | FOD817 | I _F = 20 mA | | 1.2 | 1.4 | |
| I _R | Reverse Current | FOD817 | V _R = 4.0 V | | | 10 | μA |
| C _t | Terminal Capacitance | FOD814 | V = 0, f = 1 kHz | | 50 | 250 | pF |
| | | FOD817 | V = 0, f = 1 kHz | | 30 | 250 | |
| DETECTOR | | | | | | | |
| I _{CEO} | Collector Dark Current | FOD814 | V _{CE} = 20 V, I _F = 0 | | | 100 | nA |
| | | FOD817 | V _{CE} = 20 V, I _F = 0 | | | 100 | |
| BV _{CEO} | Collector-Emitter Breakdown Voltage | FOD814 | I _C = 0.1 mA, I _F = 0 | 70 | | | V |
| | | FOD817 | I _C = 0.1 mA, I _F = 0 | 70 | | | |
| BV _{ECO} | Emitter-Collector Breakdown Voltage | FOD814 | I _E = 10 μA, I _F = 0 | 6 | | | V |
| | | FOD817 | I _E = 10 μA, I _F = 0 | 6 | | | |

DC Transfer Characteristics

| Symbol | Parameter | Device | Test Conditions | Min. | Typ. | Max. | Unit |
|---------------|---------------------------------------|---------|--|------|------|------|------|
| CTR | Current Transfer Ratio ⁽²⁾ | FOD814 | $I_F = \pm 1\text{ mA}, V_{CE} = 5\text{ V}$ | 20 | | 300 | % |
| | | FOD814A | | 50 | | 150 | |
| | | FOD817 | $I_F = 5\text{ mA}, V_{CE} = 5\text{ V}$ | 50 | | 600 | |
| | | FOD817A | | 80 | | 160 | |
| | | FOD817B | | 130 | | 260 | |
| | | FOD817C | | 200 | | 400 | |
| | | FOD817D | | 300 | | 600 | |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | FOD814 | $I_F = \pm 20\text{ mA}, I_C = 1\text{ mA}$ | | 0.1 | 0.2 | V |
| | | FOD817 | $I_F = 20\text{ mA}, I_C = 1\text{ mA}$ | | 0.1 | 0.2 | |

AC Transfer Characteristics

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

Notes:

2. Current Transfer Ratio (CTR) = $I_C / I_F \times 100\%$.

3. For test circuit setup and waveforms, refer to page 7.

Electrical Characteristics (Continued) $T_A = 25^\circ\text{C}$ unless otherwise specified.**Isolation Characteristics**

| Symbol | Parameter | Device | Test Conditions | Min. | Typ. | Max. | Unit |
|------------------|---|-------------------|--|--------------------|--------------------|------|---------------------------|
| V_{ISO} | Input-Output Isolation Voltage ⁽⁴⁾ | FOD814, FOD817 | $f = 60\text{ Hz}$, $t = 1\text{ minute}$, $I_{\text{I-O}} \leq 2\text{ }\mu\text{A}$ | 5000 | | | VAC_{RMS} |
| R_{ISO} | Isolation Resistance | FOD814, FOD817 | $V_{\text{I-O}} = 500\text{ V}_{\text{DC}}$ | 5×10^{10} | 1×10^{11} | | Ω |
| C_{ISO} | Isolation Capacitance | FOD814, FOD817 | $V_{\text{I-O}} = 0$, $f = 1\text{ MHz}$ | | 0.6 | 1.0 | pf |

Note:

4. For this test, Pins 1 and 2 are common, and Pins 3 and 4 are common.

Typical Electrical/Optical Characteristic Curves

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

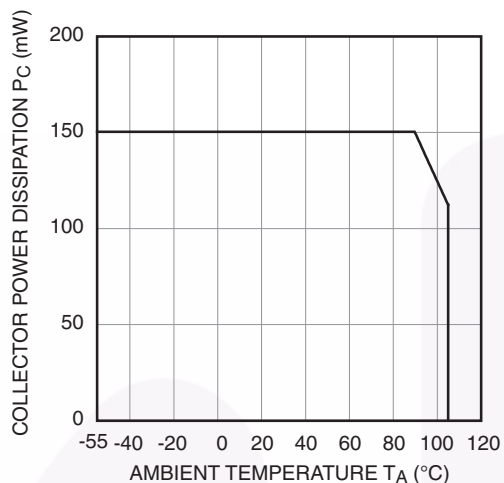


Fig. 3 Collector Power Dissipation vs. Ambient Temperature (FOD814)

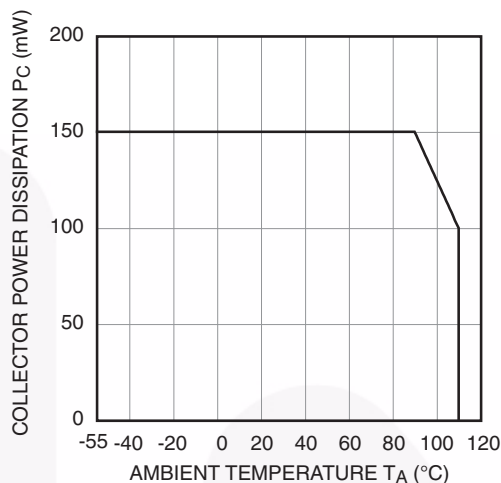


Fig. 4 Collector Power Dissipation vs. Ambient Temperature (FOD817)

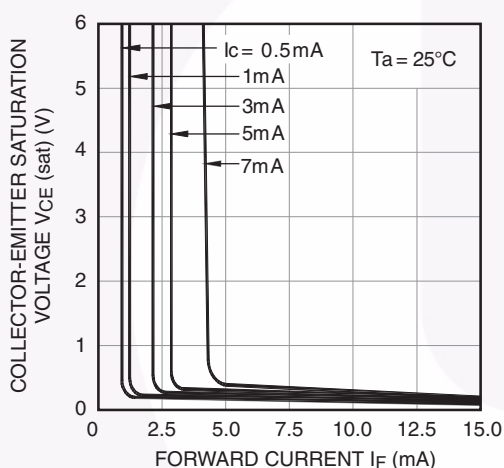


Fig. 5 Collector-Emitter Saturation Voltage vs. Forward Current

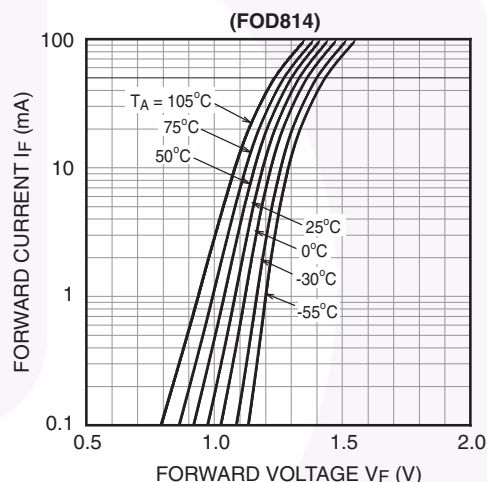


Fig. 6 Forward Current vs. Forward Voltage

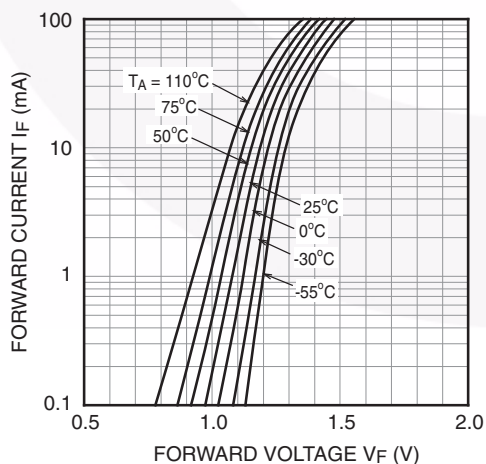


Fig. 7 Forward Current vs. Forward Voltage (FOD817)

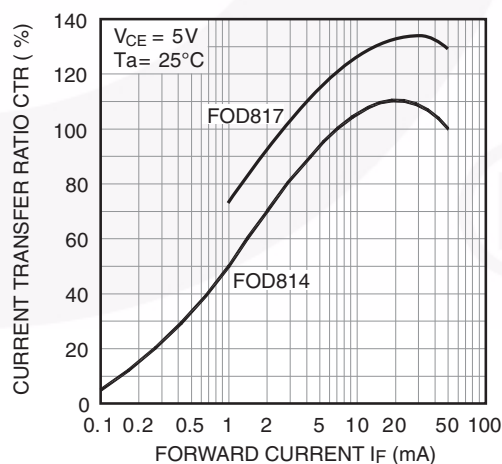


Fig. 8 Current Transfer Ratio vs. Forward Current

Typical Electrical/Optical Characteristic Curves (Continued)

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

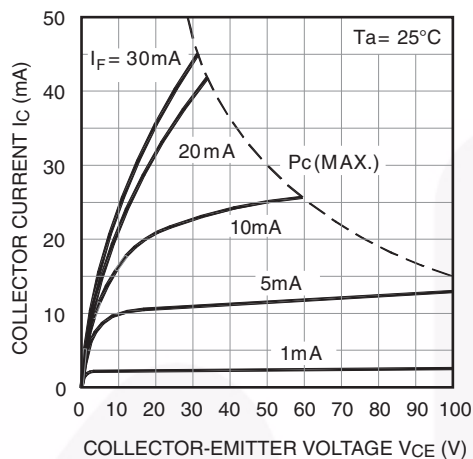


Fig. 9 Collector Current vs. Collector-Emitter Voltage (FOD814)

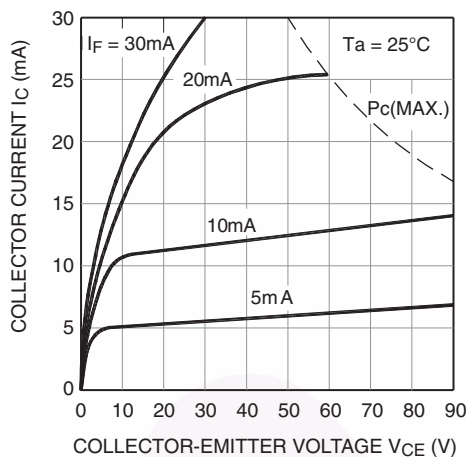


Fig. 10 Collector Current vs. Collector-Emitter Voltage (FOD817)

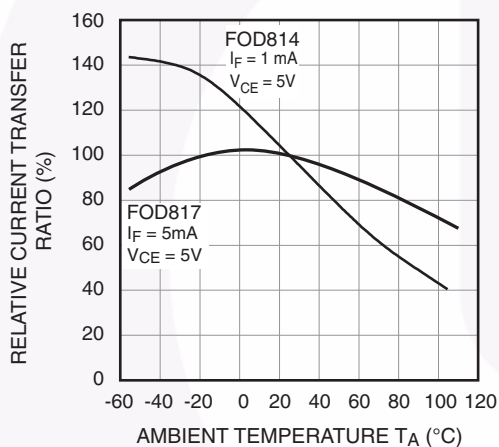


Fig. 11 Relative Current Transfer Ratio vs. Ambient Temperature

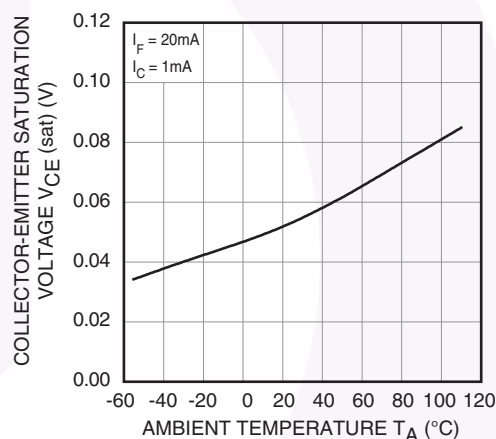


Fig. 12 Collector-Emitter Saturation Voltage vs. Ambient Temperature

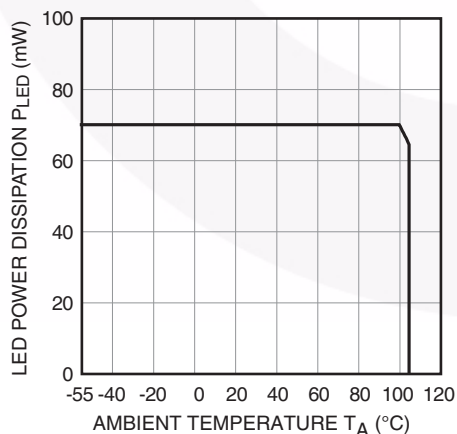


Fig. 13 LED Power Dissipation vs. Ambient Temperature (FOD814)

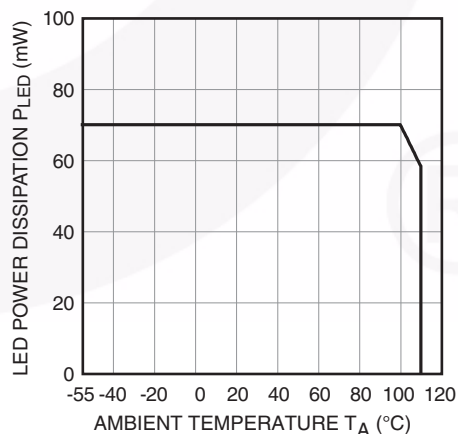


Fig. 14 LED Power Dissipation vs. Ambient Temperature (FOD817)

Typical Electrical/Optical Characteristic Curves (Continued)

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

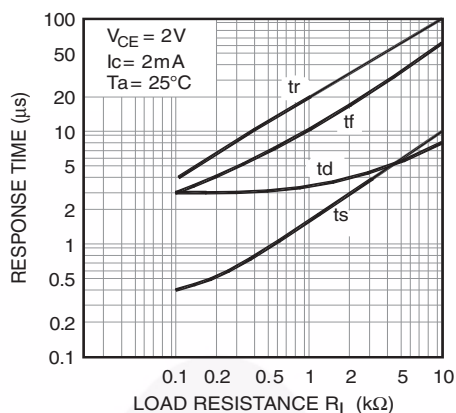


Fig. 15 Response Time vs. Load Resistance

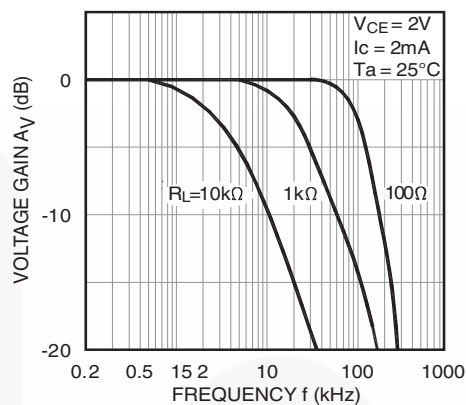


Fig. 16 Frequency Response

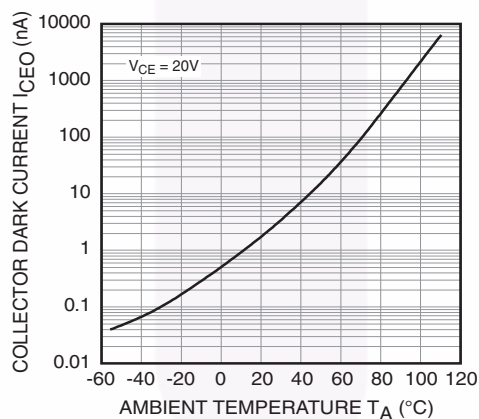


Fig. 17 Collector Dark Current vs. Ambient Temperature

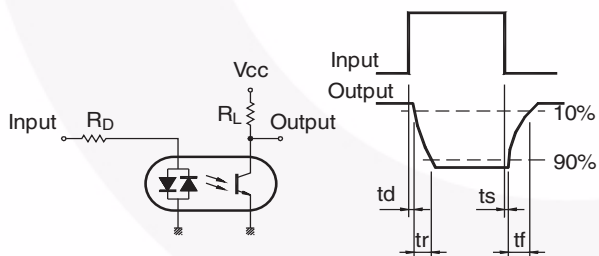


Fig. 18 Test Circuit for Response Time

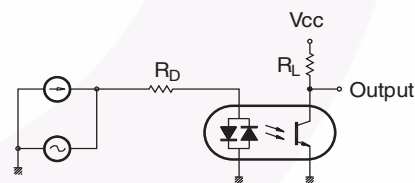
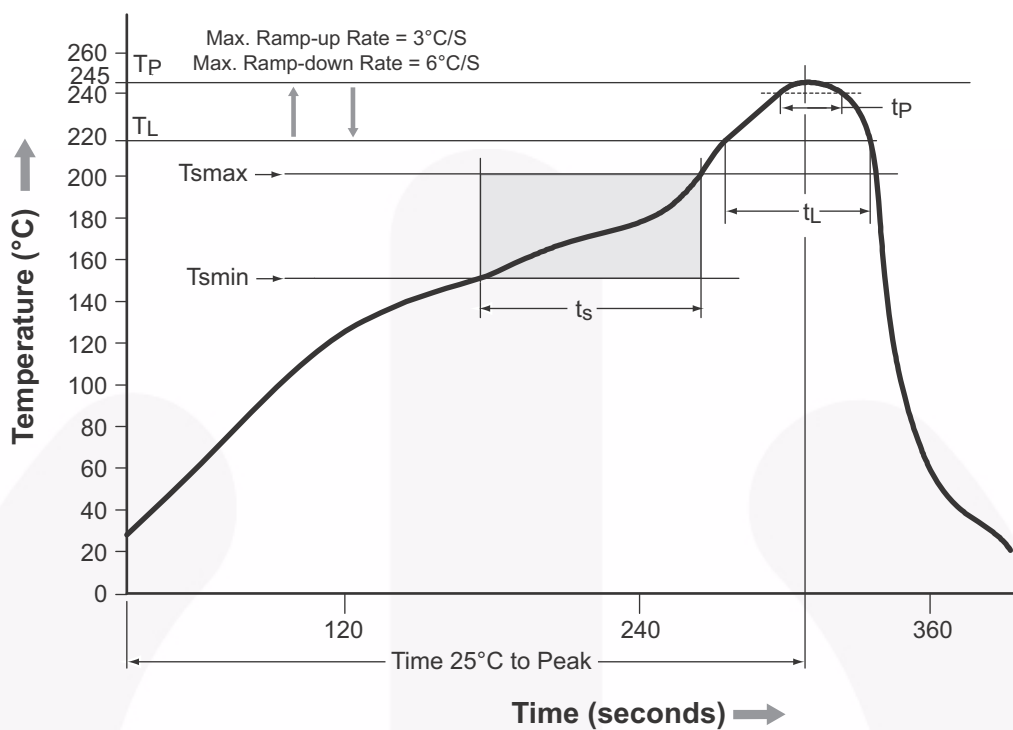


Fig. 19 Test Circuit for Frequency Response

Reflow Profile



| Profile Feature | Pb-Free Assembly Profile |
|---|--------------------------|
| Temperature Min. (Tmin) | 150°C |
| Temperature Max. (Tsmax) | 200°C |
| Time (t_s) from (Tmin to Tsmax) | 60–120 seconds |
| Ramp-up Rate (t_L to t_P) | 3°C/second max. |
| Liquidous Temperature (T_L) | 217°C |
| Time (t_L) Maintained Above (T_L) | 60–150 seconds |
| Peak Body Package Temperature | 245°C +0°C / -5°C |
| Time (t_P) within 5°C of 260°C | 30 seconds |
| Ramp-down Rate (T_P to T_L) | 6°C/second max. |
| Time 25°C to Peak Temperature | 8 minutes max. |

Figure 20. Reflow Profile

Ordering Information

| Part Number | Package | Packing Method |
|-------------|--|--------------------------------------|
| FOD817X | DIP 4-Pin | Tube (100 units per tube) |
| FOD817XS | SMT 4-Pin (Lead Bend) | Tube (100 units per tube) |
| FOD817XSD | SMT 4-Pin (Lead Bend) | Tape and Reel (1,000 units per reel) |
| FOD817X300 | DIP 4-Pin, DIN EN/IEC60747-5-5 option | Tube (100 units per tube) |
| FOD817X3S | SMT 4-Pin (Lead Bend), DIN EN/IEC60747-5-5 option | Tube (100 units per tube) |
| FOD817X3SD | SMT 4-Pin (Lead Bend), DIN EN/IEC60747-5-5 option | Tape and Reel (1,000 units per reel) |
| FOD817X300W | DIP 4-Pin, 0.4" Lead Spacing, DIN EN/IEC60747-5-5 option | Tube (100 units per tube) |

Note:

The product orderable part number system listed in this table also applies to the FOD814 products.

"X" denotes the Current Transfer Ratio (CTR) options

Marking Information

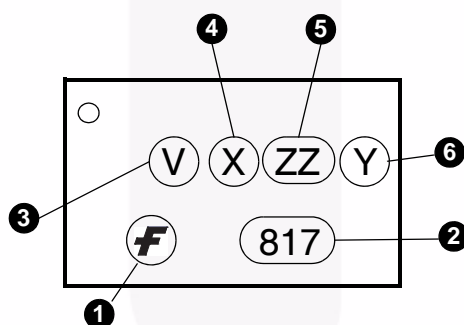


Figure 21. Top Mark

| Definitions | |
|-------------|---|
| 1 | Fairchild Logo |
| 2 | Device Number |
| 3 | DIN EN/IEC60747-5-5 Option (only appears on parts ordered with this option) |
| 4 | One-Digit Year Code, e.g., '5' |
| 5 | Two-Digit Work Week, Ranging from '01' to '53' |
| 6 | Assembly Package Code Y = Manufactured in Thailand YA = Manufactured in China |

Carrier Tape Specifications

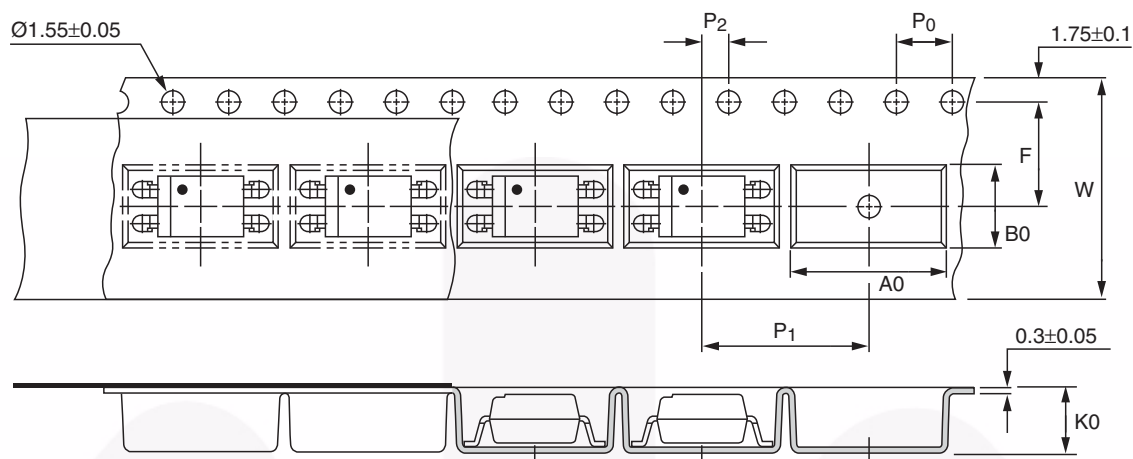
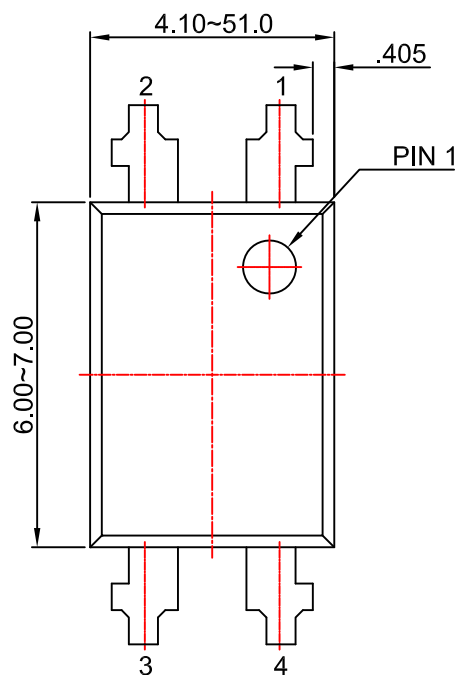


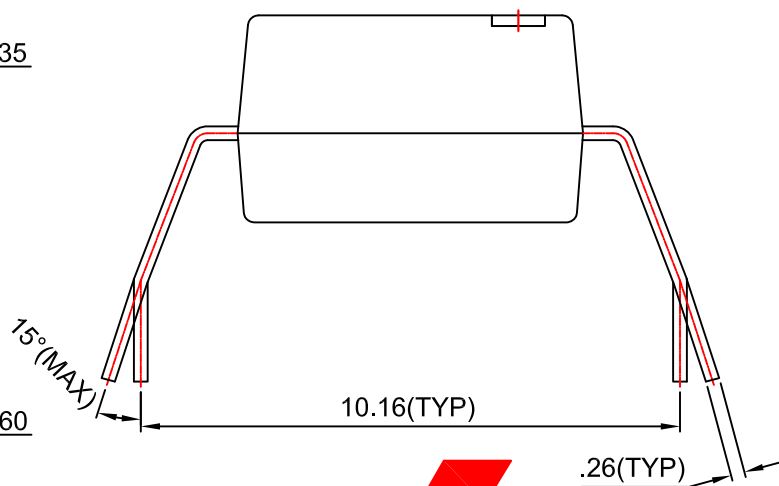
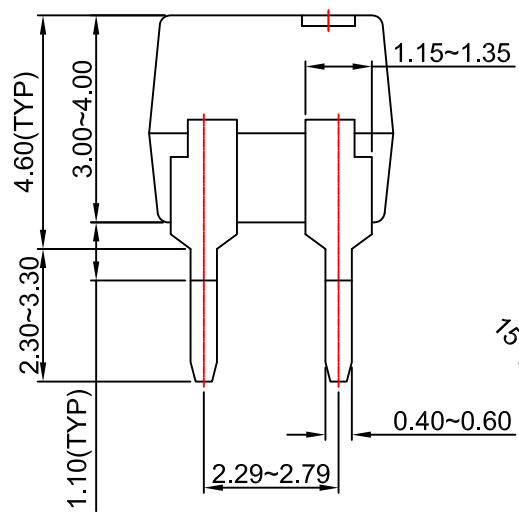
Figure 22. Carrier Tape Specification

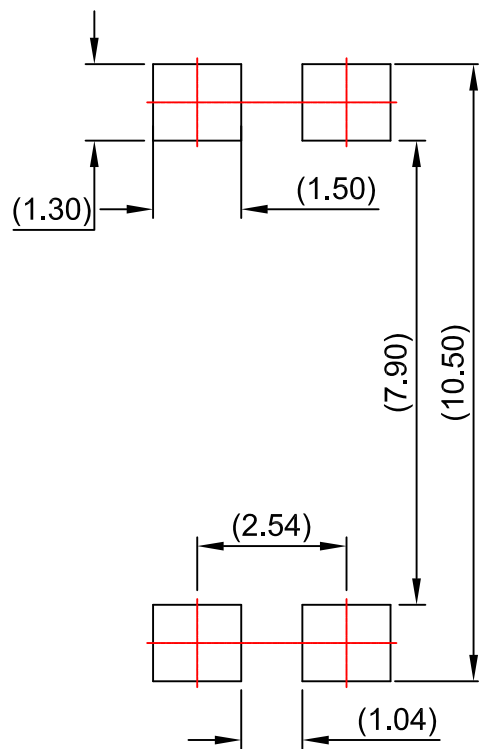
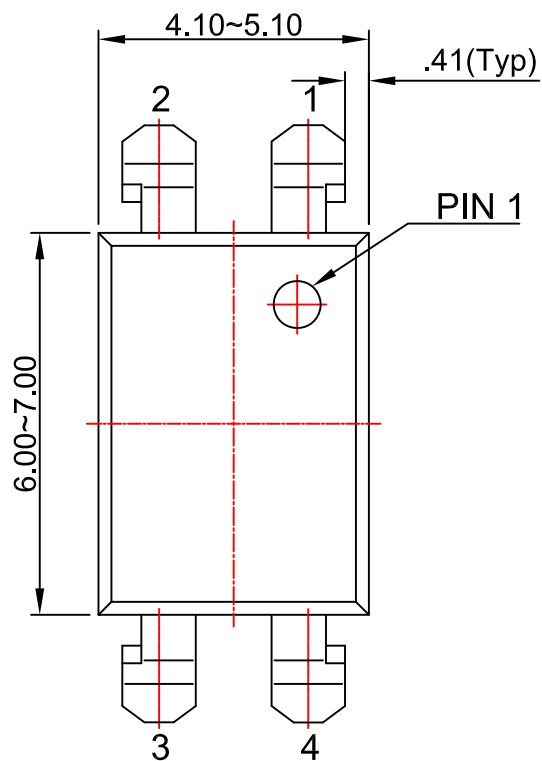
| Symbol | Description | Dimensions in mm (inches) |
|----------------|--|---------------------------|
| W | Tape wide | 16 ± 0.3 (0.63) |
| P ₀ | Pitch of sprocket holes | 4 ± 0.1 (0.15) |
| F | Distance of compartment | 7.5 ± 0.1 (0.295) |
| P ₂ | | 2 ± 0.1 (0.079) |
| P ₁ | Distance of compartment to compartment | 12 ± 0.1 (0.472) |
| A ₀ | Compartment | 10.45 ± 0.1 (0.411) |
| B ₀ | | 5.30 ± 0.1 (0.209) |
| K ₀ | | 4.25 ± 0.1 (0.167) |



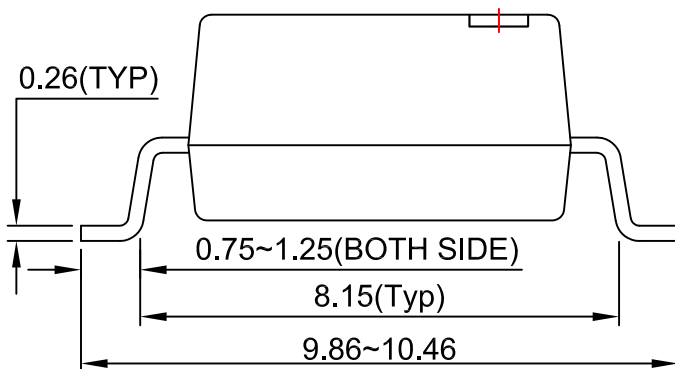
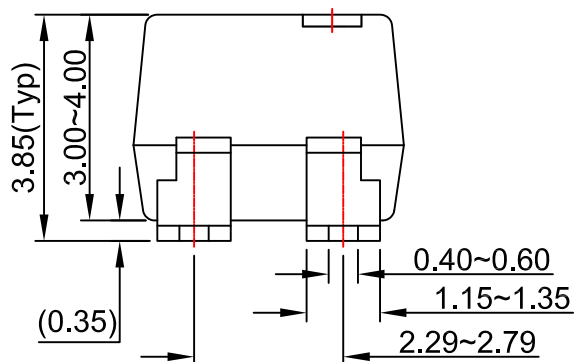
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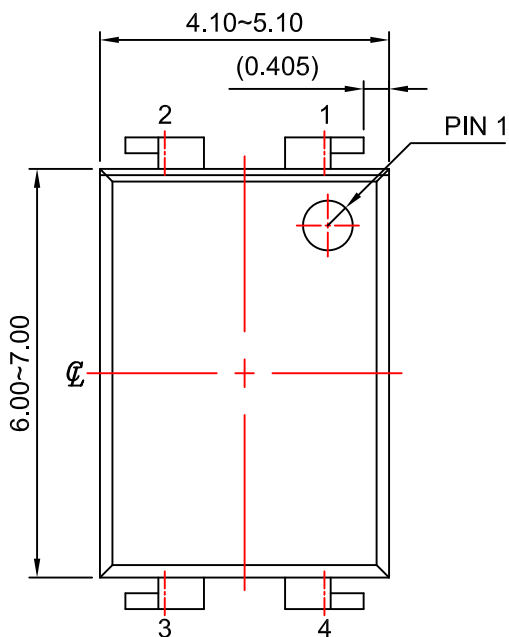
LAND PATTERN RECOMMENDATION



NOTES:

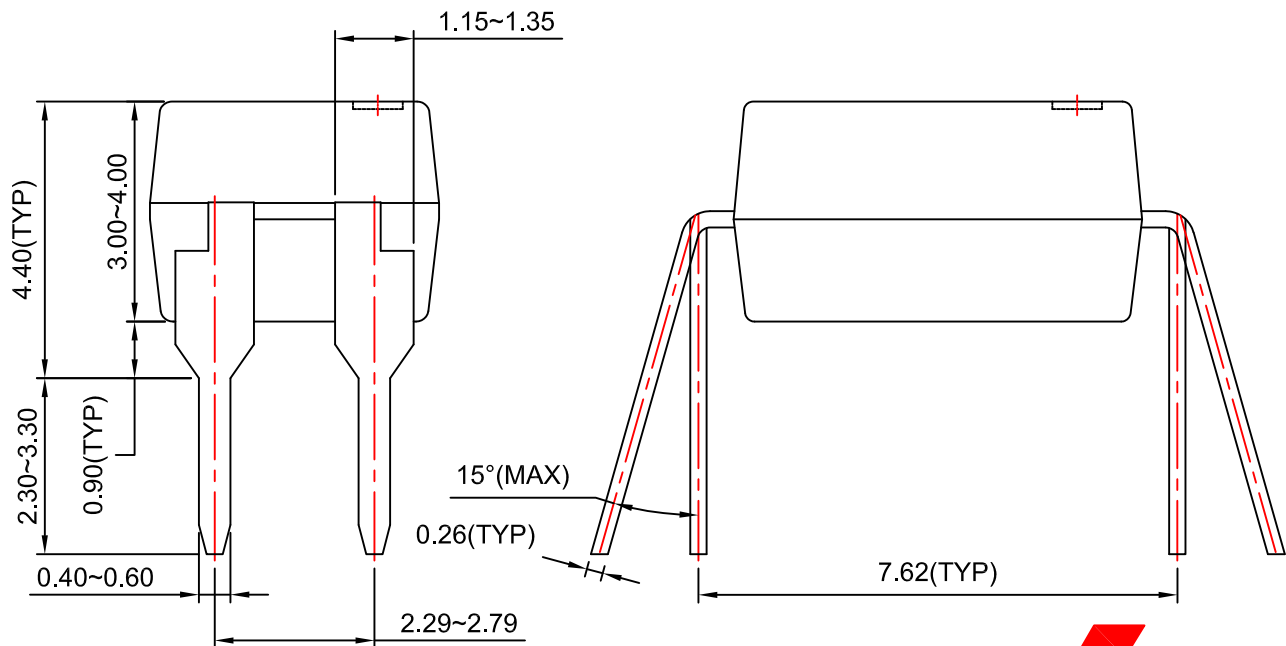
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Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS

Definition of Terms

| Datasheet Identification | Product Status | Definition |
|--------------------------|-----------------------|---|
| Advance Information | Formative / In Design | Datasheet contains the design specifications for product development. Specifications may change in any manner without notice. |
| Preliminary | First Production | Datasheet contains preliminary data; 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 | Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design. |
| Obsolete | Not In Production | Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only. |

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