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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%
  FOD814A: 50–150%
  FOD817: 50–600%
  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

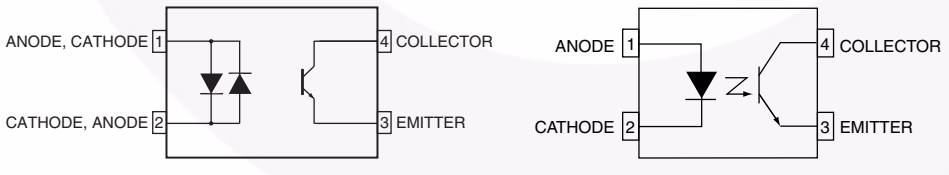



**Figure 1. Schematic**

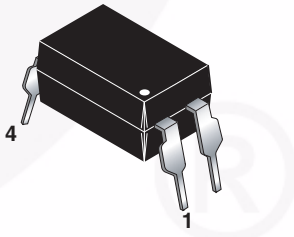



**Figure 2. Package Outlines**

## 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, $V_{IORM}$ x 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, $V_{IORM}$ x 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°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 |
| $\theta_{JC}$ | 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°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 | $I_F$ = ±1 mA, $V_{CE}$ = 5 V | 20 | | 300 | % |
| | | FOD814A | | 50 | | 150 | |
| | | FOD817 | $I_F$ = 5 mA, $V_{CE}$ = 5 V | 50 | | 600 | |
| | | FOD817A | | 80 | | 160 | |
| | | FOD817B | | 130 | | 260 | |
| | | FOD817C | | 200 | | 400 | |
| | | FOD817D | | 300 | | 600 | |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | FOD814 | $I_F$ = ±20 mA, $I_C$ = 1 mA | | 0.1 | 0.2 | V |
| | | FOD817 | $I_F$ = 20 mA, $I_C$ = 1 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 V, $I_C$ = 2 mA, $R_L$ = 100 Ω, -3 dB | 15 | 80 | | kHz |
| $t_r$ | Response Time (Rise) | FOD814, FOD817 | $V_{CE}$ = 2 V, $I_C$ = 2 mA, $R_L$ = 100 Ω[3] | | 4 | 18 | µs |
| $t_f$ | Response Time (Fall) | FOD814, FOD817 | | | 3 | 18 | µs |

**Notes:**

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

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

## Electrical Characteristics (Continued)

$T_A$ = 25°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 Hz, t = 1 minute, $I_{I-O} \leq 2$ µA | 5000 | | | $VAC_{RMS}$ |
| $R_{ISO}$ | Isolation Resistance | FOD814, FOD817 | $V_{I-O}$ = 500 $V_{DC}$ | $5x10^{10}$ | $1x10^{11}$ | | Ω |
| $C_{ISO}$ | Isolation Capacitance | FOD814, FOD817 | $V_{I-O}$ = 0, f = 1 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°C unless otherwise specified.

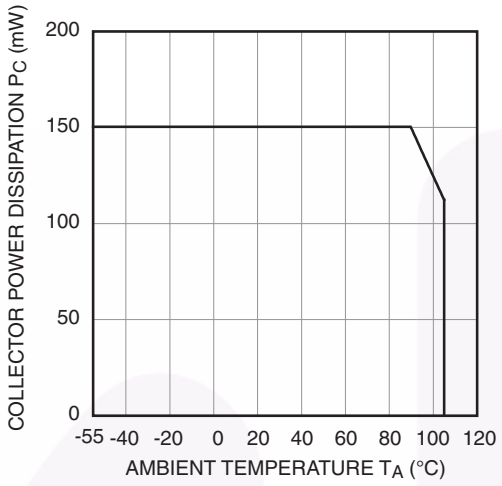



**Fig. 3 Collector Power Dissipation vs. Ambient Temperature (FOD814)**

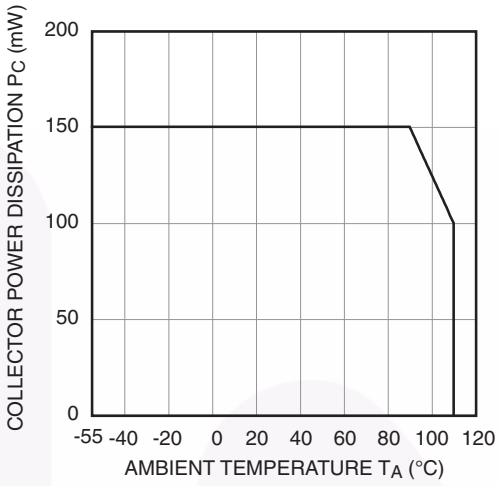



**Fig. 4 Collector Power Dissipation vs. Ambient Temperature (FOD817)**

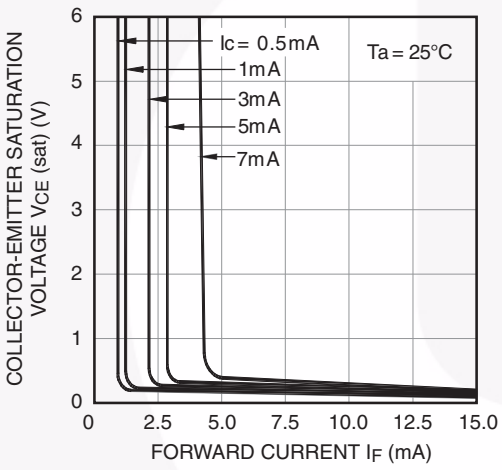



**Fig. 5 Collector-Emitter Saturation Voltage vs. Forward Current**

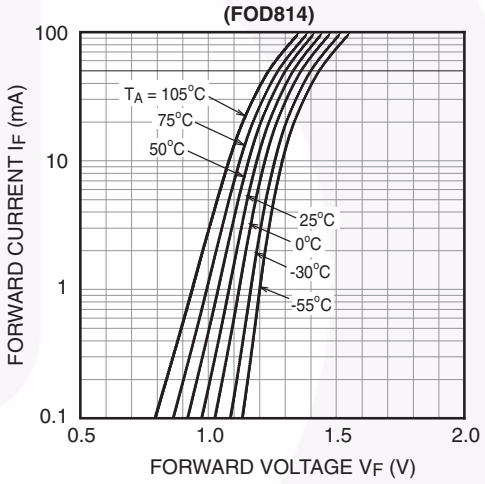



**Fig. 6 Forward Current vs. Forward Voltage**

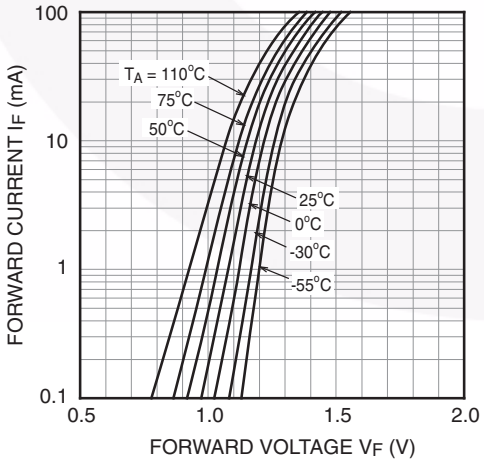



**Fig. 7 Forward Current vs. Forward Voltage (FOD817)**

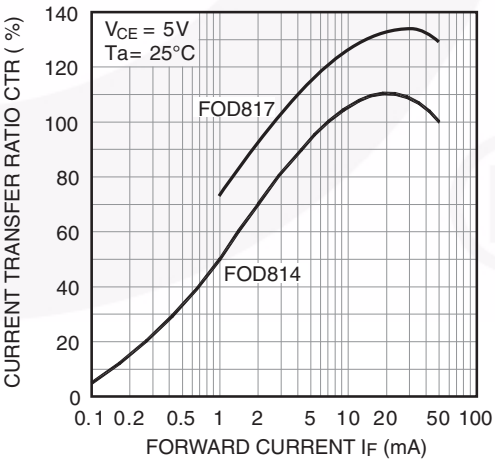



**Fig. 8 Current Transfer Ratio vs. Forward Current**

## Typical Electrical/Optical Characteristic Curves (Continued)

$T_A$ = 25°C unless otherwise specified.

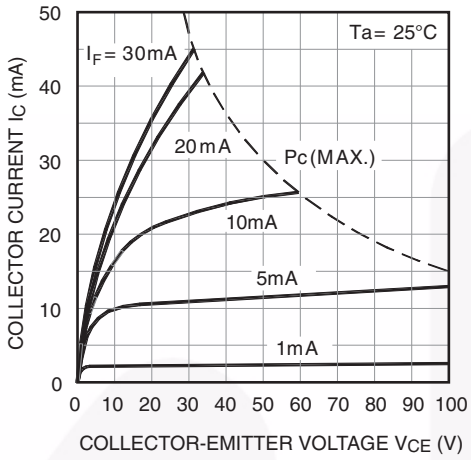



**Fig. 9 Collector Current vs. Collector-Emitter Voltage (FOD814)**

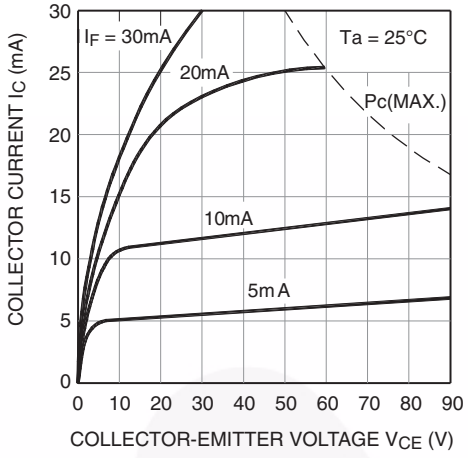



**Fig. 10 Collector Current vs. Collector-Emitter Voltage (FOD817)**

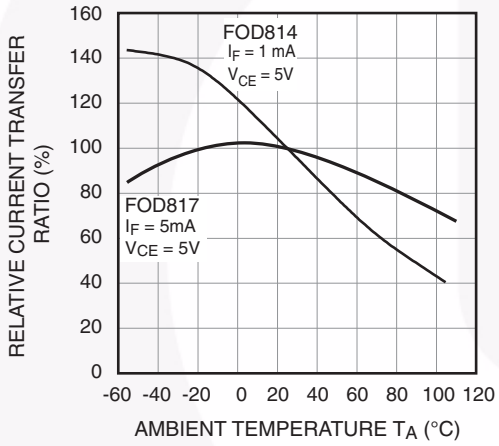



**Fig. 11 Relative Current Transfer Ratio vs. Ambient Temperature**

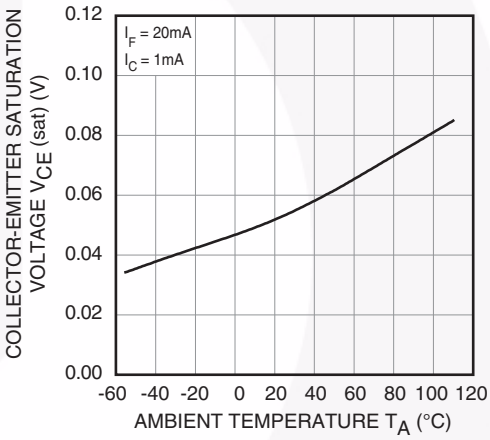



**Fig. 12 Collector-Emitter Saturation Voltage vs. Ambient Temperature**

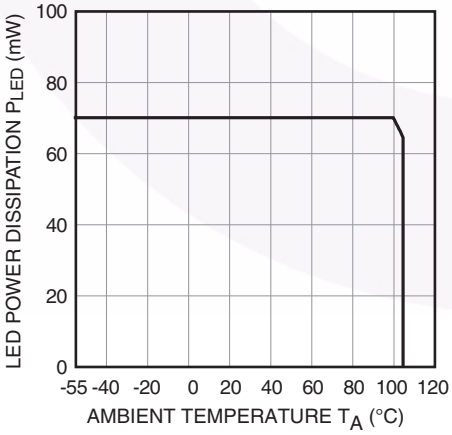



**Fig. 13 LED Power Dissipation vs. Ambient Temperature (FOD814)**

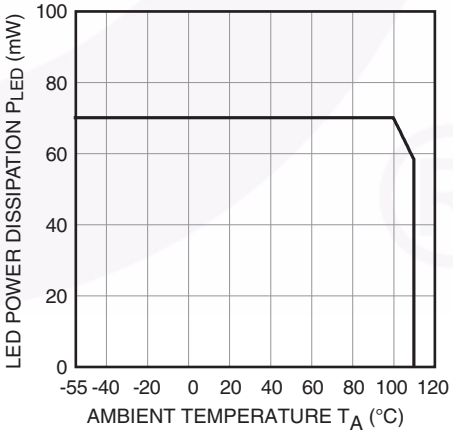



**Fig. 14 LED Power Dissipation vs. Ambient Temperature (FOD817)**

## Typical Electrical/Optical Characteristic Curves (Continued)

$T_A$ = 25°C unless otherwise specified.

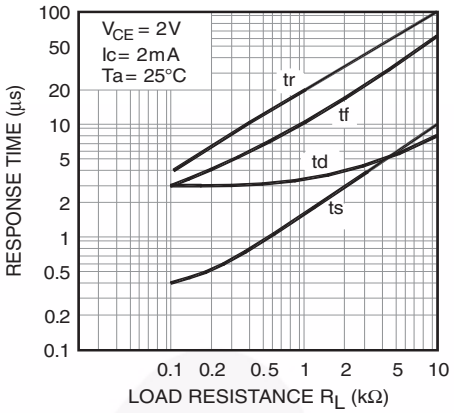



**Fig. 15 Response Time vs. Load Resistance**

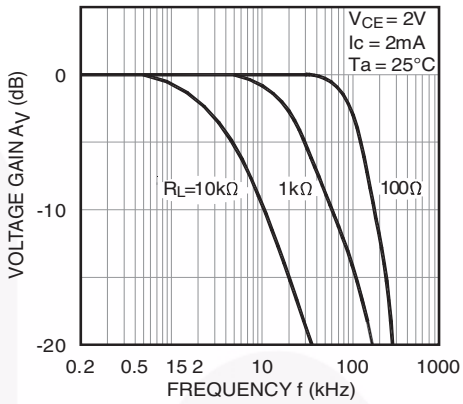



**Fig. 16 Frequency Response**

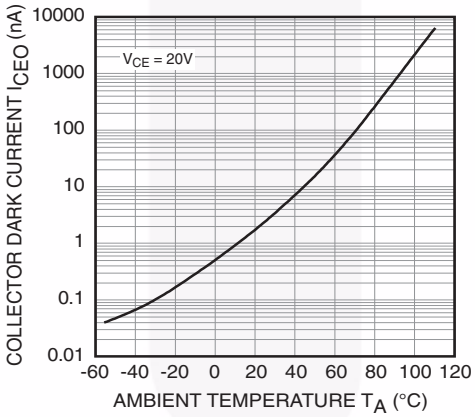



**Fig. 17 Collector Dark Current vs. Ambient Temperature**

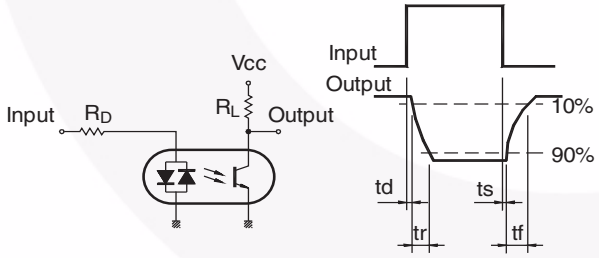



**Fig. 18 Test Circuit for Response Time**

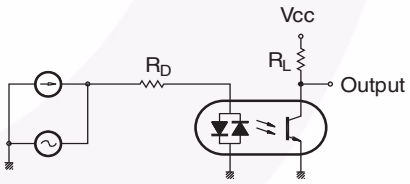
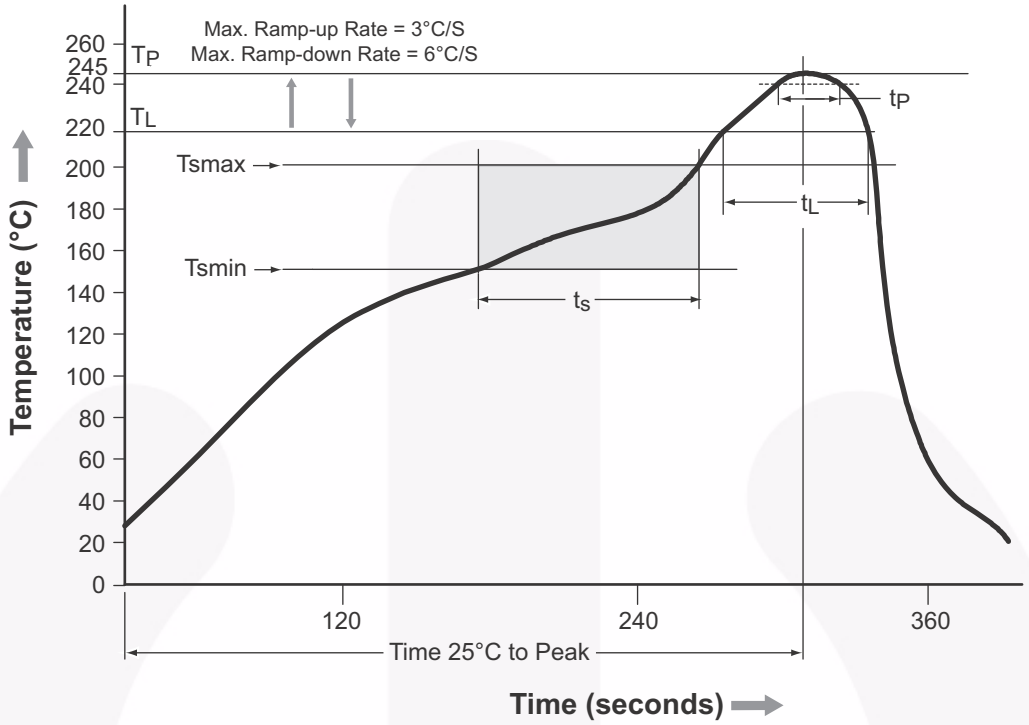



**Fig. 19 Test Circuit for Frequency Response**

## Reflow Profile




| Profile Feature | Pb-Free Assembly Profile |
|---|---|
| Temperature Min. (Tsmin) | 150°C |
| Temperature Max. (Tsmax) | 200°C |
| Time ($t_S$) from (Tsmin 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

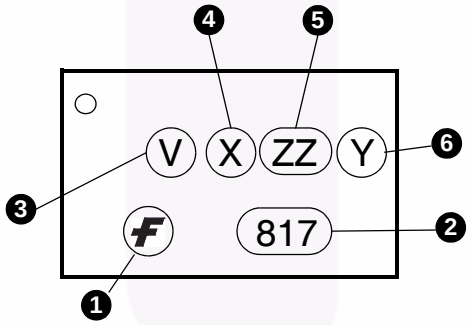



**Figure 21. Top Mark**

| 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<br>Y = Manufactured in Thailand<br>YA = Manufactured in China |

## Carrier Tape Specifications

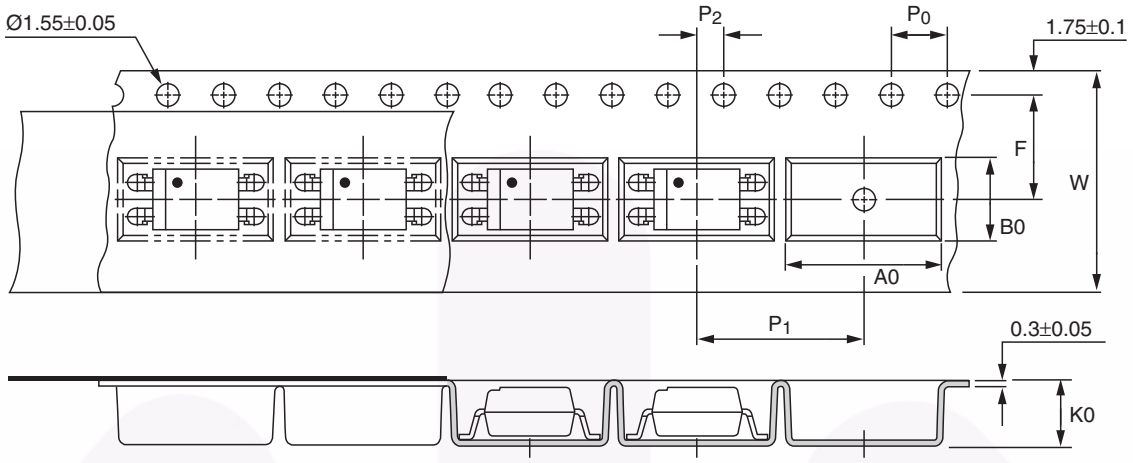
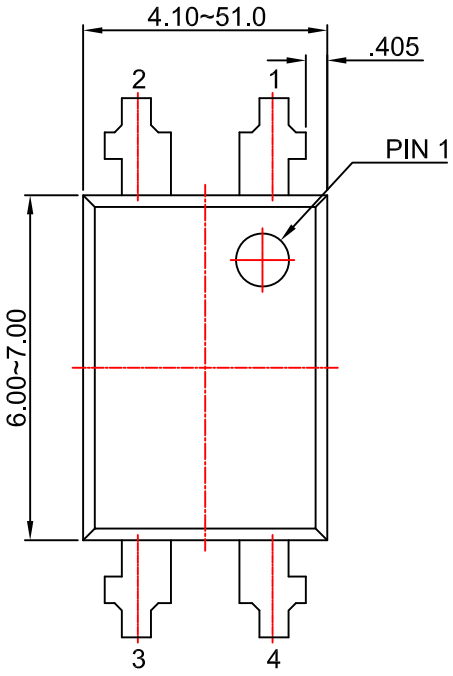



**Figure 22. Carrier Tape Specification**

| 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<br>$P_2$ | Distance of compartment | 7.5 ± 0.1 (0.295)<br>2 ± 0.1 (0.079) |
| $P_1$ | Distance of compartment to compartment | 12 ± 0.1 (0.472) |
| A0 | Compartment | 10.45 ± 0.1 (0.411) |
| B0 | | 5.30 ± 0.1 (0.209) |
| K0 | | 4.25 ± 0.1 (0.167) |



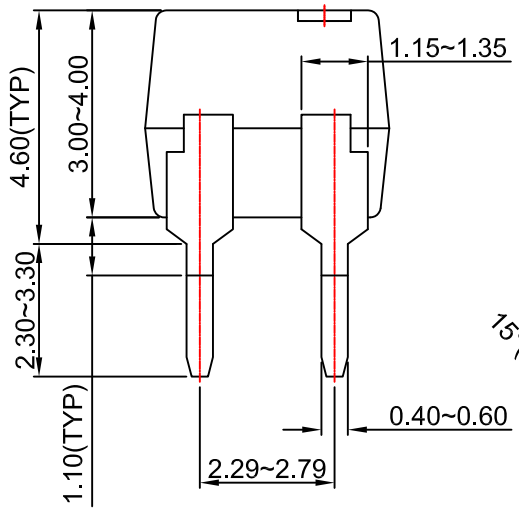

NOTES:

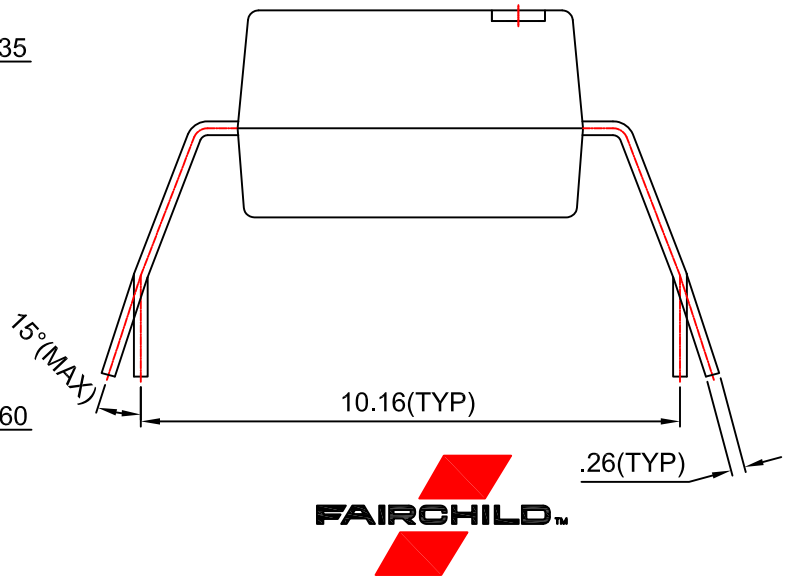
A) NO STANDARD APPLIES TO THIS PACKAGE.

B) ALL DIMENSIONS ARE IN MILLIMETERS.

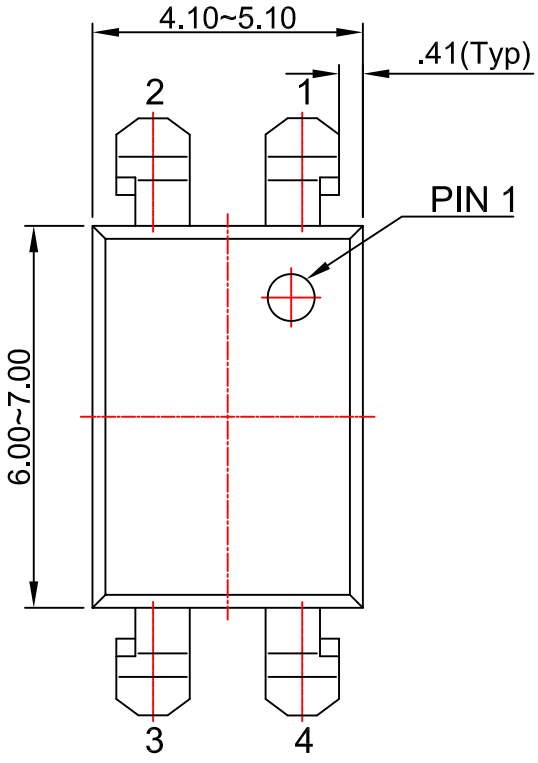
C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION

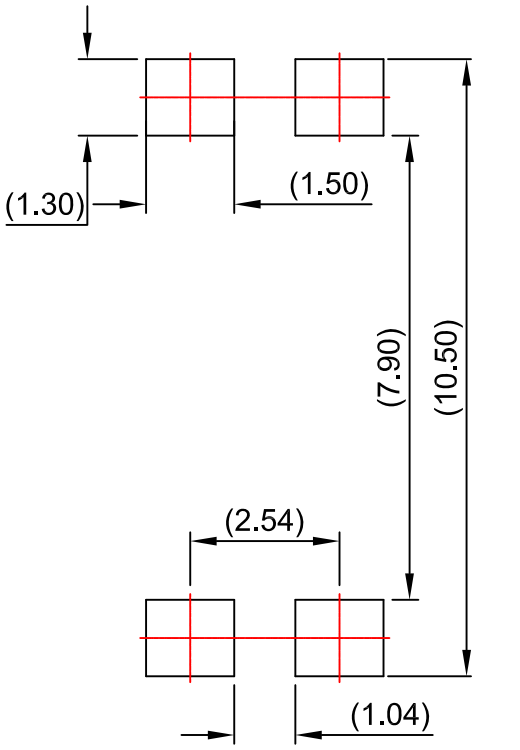
D) DRAWING FILENAME AND REVSION: MKT-N04Brev2.



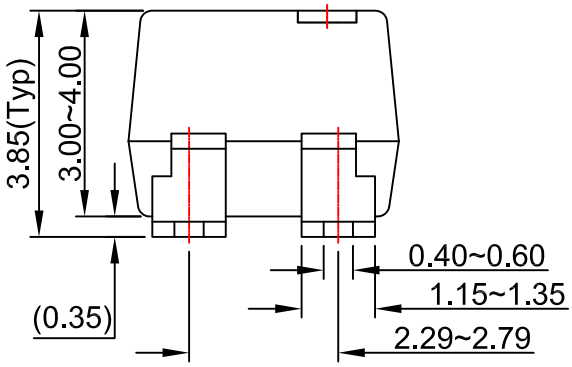



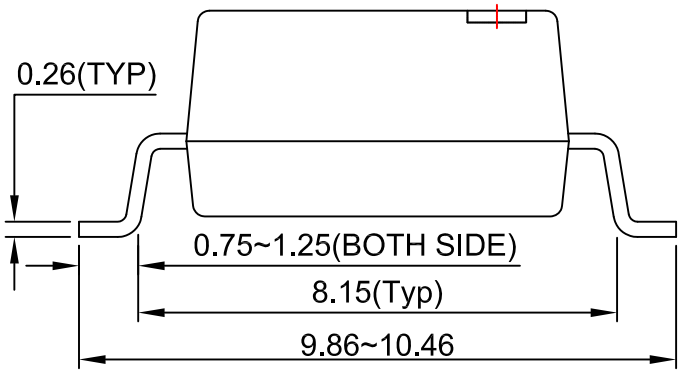

FAIRCHILD™




LAND PATTERN RECOMMENDATION




NOTES:

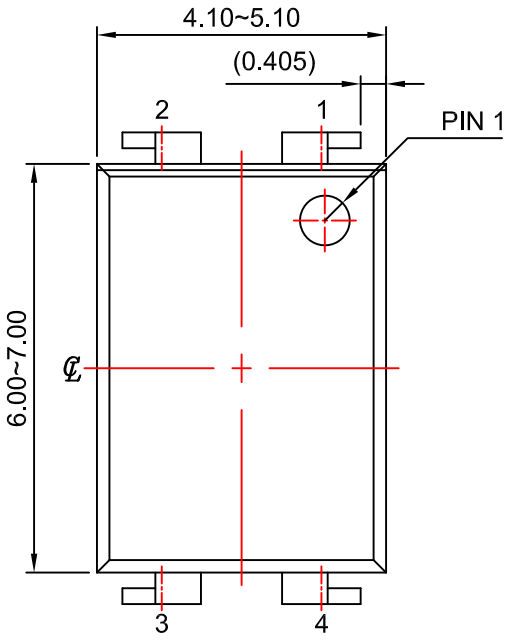
A) NO STANDARD APPLIES TO THIS PACKAGE.

B) ALL DIMENSIONS ARE IN MILLIMETERS.

C) DIMENSIONS ARE EXCLUSIVE OF BURRS,
MOLD FLASH, AND TIE BAR EXTRUSION

D) DRAWING FILENAME AND REVSION: MKT-N04Crev2.

FAIRCHILD




NOTES:

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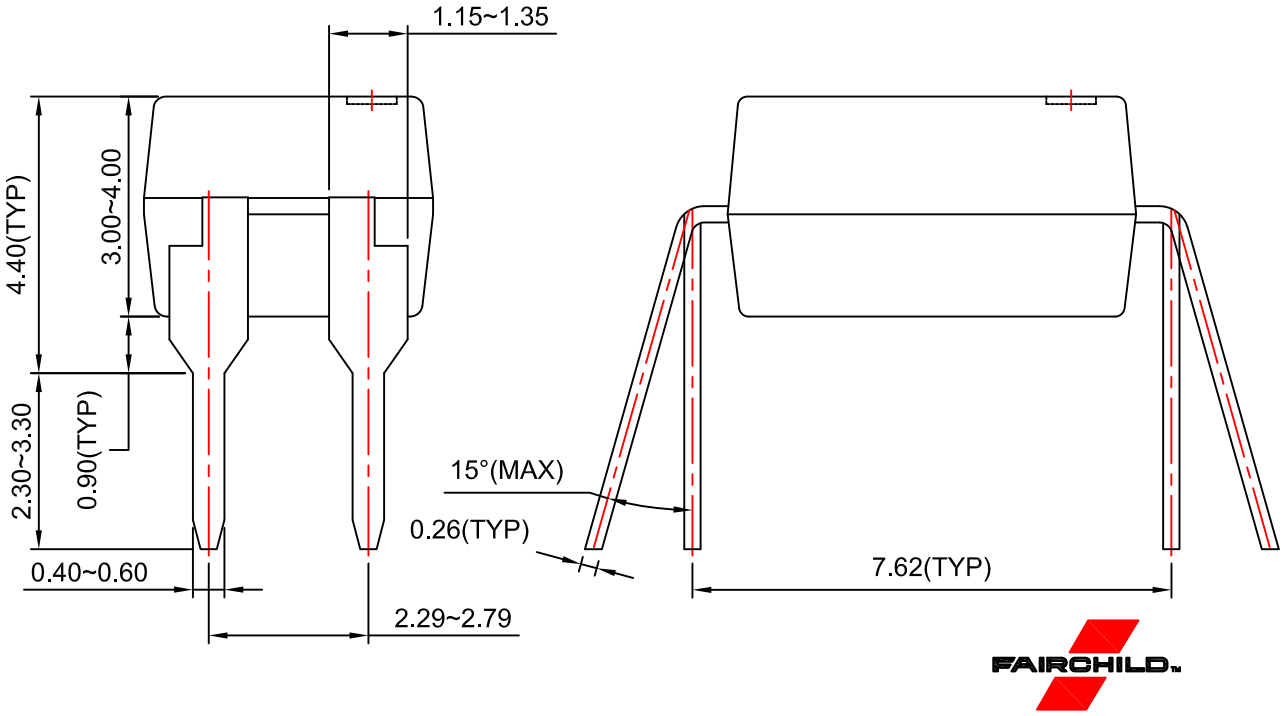

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