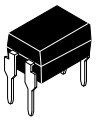
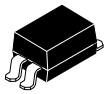
# 4-Pin DIP Phototransistor Optocouplers

# FOD814, FOD817



**PDIP4**
**CASE 646CD**
**CASE 646CA**



**PDIP4 GW**
**CASE 709AH**

### Introduction or 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.

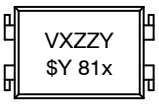
### Features

- 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
- This Device is Pb−Free

### Typical Applications

- FOD814 Series
  - AC Line Monitor
  - Unknown Polarity DC Sensor
  - Telephone Line Interface
- FOD817 Series
  - Power Supply Regulators
  - Digital Logic Inputs
  - Microprocessor Inputs

### MARKING DIAGRAM




| | |
|---|---|
| V | = VDE Mark |
| X | = One Digit Year Code |
| ZZ | = Two Digit Work Week |
| Y | = Assembly Package Code |
| $Y | = Logo |
| 81x | = Specific Device Code<br>x = 4 or 7 |

### ORDERING INFORMATION

See detailed ordering and shipping information on page 8 of this data sheet.

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## FUNCTIONAL BLOCK DIAGRAM

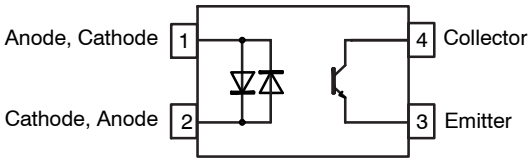


Figure 1. Schematic – FOD814

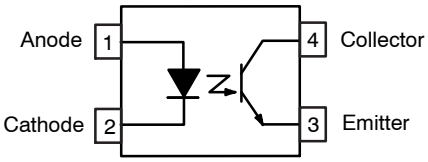


Figure 2. Schematic – FOD817

## SAFETY AND INSULATION RATINGS

| 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 | 1594 | |
| $V_{IORM}$ | Maximum Working Insulation Voltage | 850 | |
| $V_{IOTM}$ | Highest Allowable Over–Voltage | 8000 | |
| | External Creepage | ≥ 7 | mm |
| | External Clearance | ≥ 7 | |
| | External Clearance (for Option W, 0.4” Lead Spacing) | ≥ 10 | |
| DTI | Distance Through Insulation (Insulation Thickness) | ≥ 0.4 | |
| $T_S$ | Case Temperature (Note 1) | 175 | °C |
| $I_{S,INPUT}$ | Input Current (Note 1) | 400 | mA |
| $P_{S,OUTPUT}$ | Output Power (Note 1) | 700 | mW |
| $R_{IO}$ | Insulation Resistance at $T_S$, $V_{IO}$ = 500 V (Note 1) | > $10^{11}$ | Ω |

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.

1. Safety limit values – maximum values allowed in the event of a failure.

## ABSOLUTE MAXIMUM RATINGS $T_A$ = 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 | |
| $T_J$ | Junction Temperature | –55 to +125 | | |
| $T_{SOL}$ | Lead Solder Temperature | 260 for 10 s | | |
| $\theta_{JC}$ | Junction–to–Case Thermal Resistance | 210 | | °C/W |
| $P_{TOT}$ | Total Device Power Dissipation | 200 | | mW |



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**ABSOLUTE MAXIMUM RATINGS** $T_A$ = 25°C unless otherwise specified. (continued)

| Symbol | Parameter | Value | | Unit |
|---|---|---|---|---|
| | | FOD814 | FOD817 | |
| **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 | | |
| $I_C$ | Continuous Collector Current | 50 | | mA |
| $P_C$ | Collector Power Dissipation | 150 | | mW |
| | Derate Above 90°C | 2.9 | | mW/°C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

**ELECTRICAL CHARACTERISTICS** $T_A$ = 25°C unless otherwise specified.

**INDIVIDUAL COMPONENT CHARACTERISTICS**

| Symbol | Parameter | Device | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Emmiter** | | | | | | | |
| $V_F$ | 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 | | – | 30 | 250 | |
| **Detector** | | | | | | | |
| $I_{CEO}$ | Collector Dark Current | FOD814 | $V_{CE}$ = 20 V, $I_F$ = 0 | – | – | 100 | nA |
| | | FOD817 | | – | – | 100 | |
| $BV_{CEO}$ | Collector−Emitter Breakdown Voltage | FOD814 | $I_C$ = 0.1 mA, $I_F$ = 0 | 70 | – | – | V |
| | | FOD817 | | 70 | – | – | |
| $BV_{ECO}$ | Emitter−Collector Breakdown Voltage | FOD814 | $I_E$ = 10 μA, $I_F$ = 0 | 6 | – | – | |
| | | FOD817 | | 6 | – | – | |

**DC TRANSFER CHARACTERISTICS**

| Symbol | Parameter | Device | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| CTR | Current Transfer Ratio (Note 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 | |



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**ELECTRICAL CHARACTERISTICS** $T_A$ = 25°C unless otherwise specified. (continued)

**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 (Note 3) | – | 4 | 18 | μs |
| $t_f$ | Response Time (Fall) | FOD814, FOD817 | | – | 3 | 18 | |

**ISOLATION CHARACTERISTICS**

| Symbol | Parameter | Device | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{ISO}$ | Input−Output Isolation Voltage (Note 4) | FOD814, FOD817 | f = 60 Hz, t = 1 min, $I_{I-O} \le 2$ 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 |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Current Transfer Ratio (CTR) = $I_C$ / $I_F$ x 100%
3. For test circuit setup and waveforms, refer to page 5.
4. For this test, Pins 1 and 2 are common, and Pins 3 and 4 are common.

## TYPICAL ELECTRICAL/OPTICAL CHARACTERISTICS CURVES

$T_A$ = 25°C unless otherwise specified.

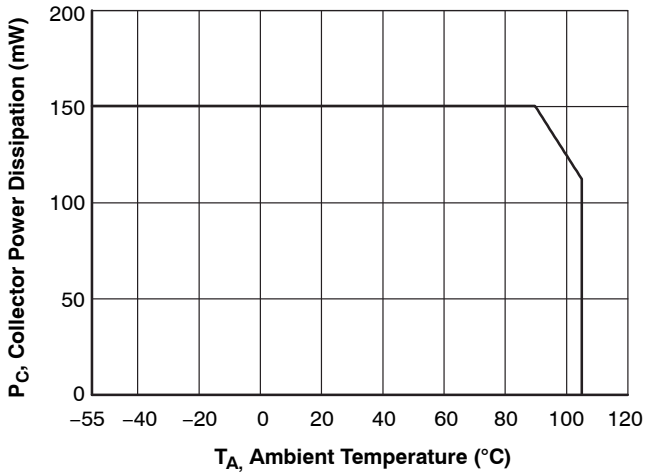


**Figure 3. Collector Power Dissipation vs. Ambient Temperature (FOD814)**

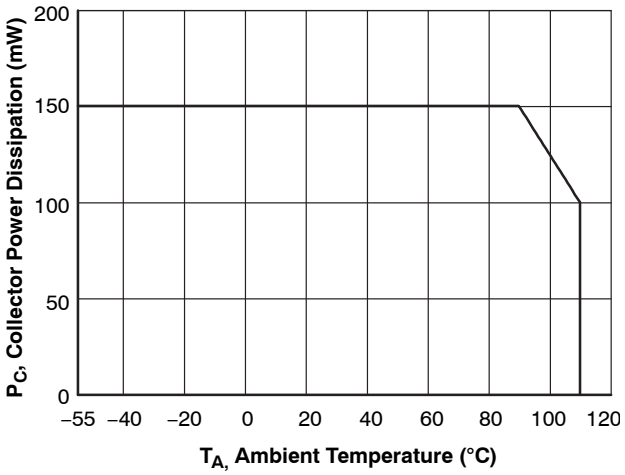


**Figure 4. Collector Power Dissipation vs. Ambient Temperature (FOD817)**



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## TYPICAL ELECTRICAL/OPTICAL CHARACTERISTICS CURVES

$T_A$ = 25°C unless otherwise specified. (continued)

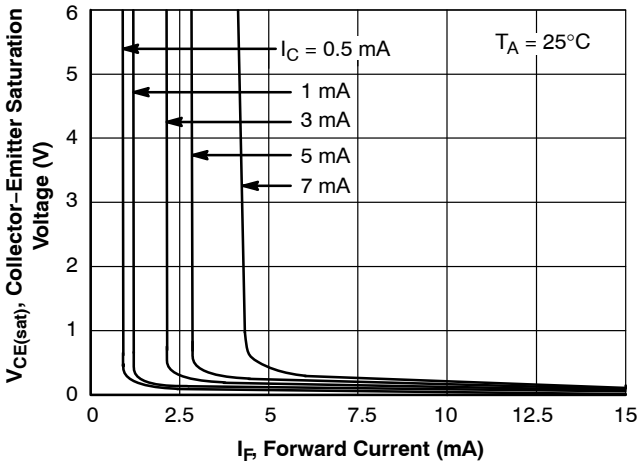


**Figure 5. Collector−Emitter Saturation Voltage vs. Forward Current**

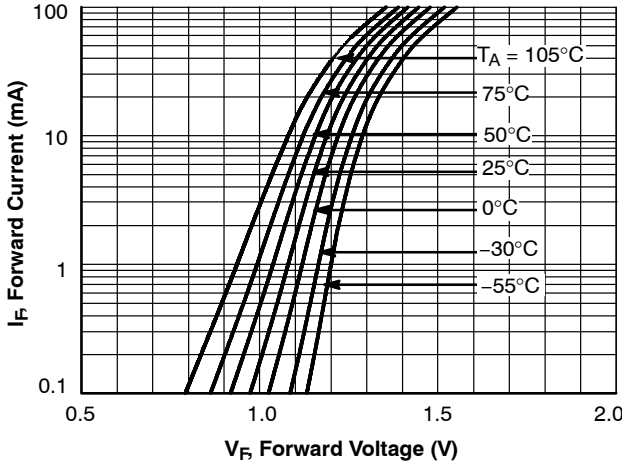


**Figure 6. Forward Current vs. Forward Voltage (FOD814)**

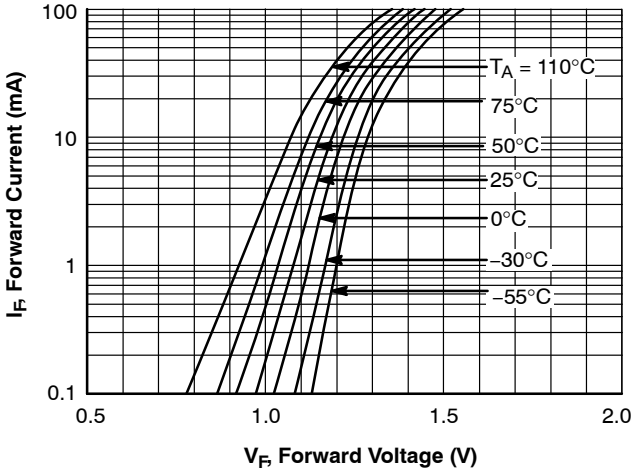


**Figure 7. Forward Current vs. Forward Voltage (FOD817)**

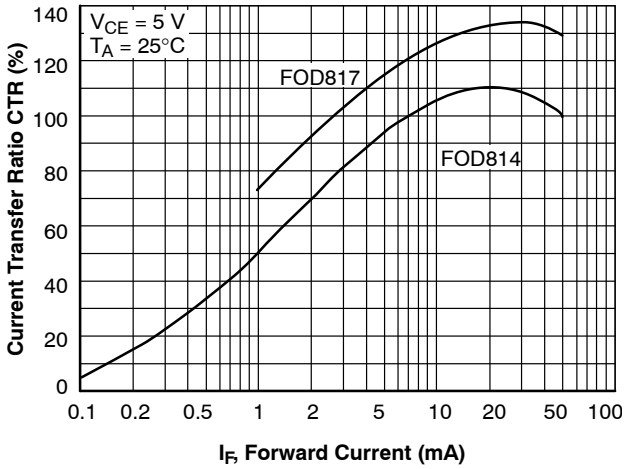


**Figure 8. Current Transfer Ratio vs. Forward Current**

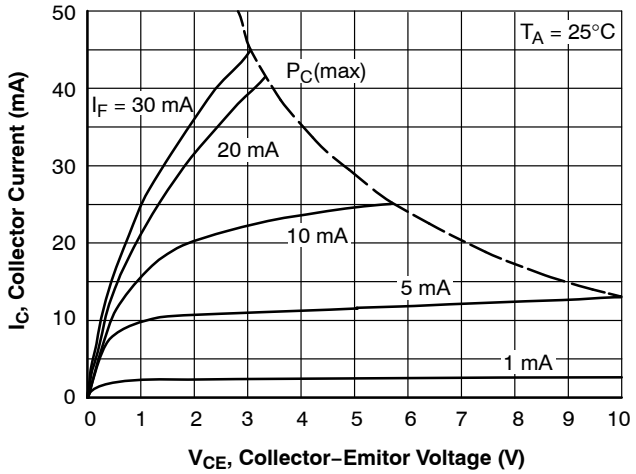


**Figure 9. Collector Current vs. Collector−Emitor Voltage (FOD814)**

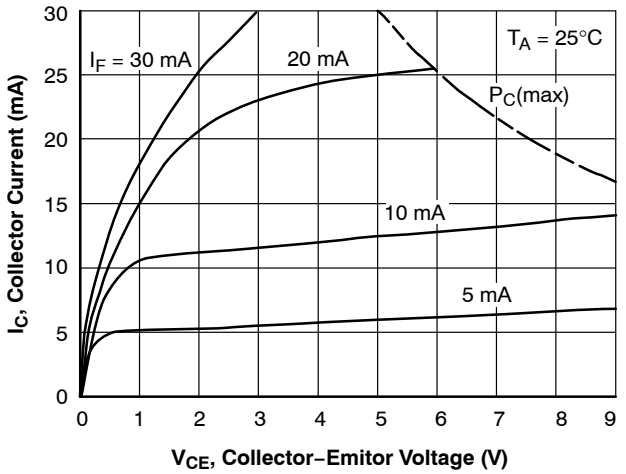


**Figure 10. Collector Current vs. Collector−Emitor Voltage (FOD817)**



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## TYPICAL ELECTRICAL/OPTICAL CHARACTERISTICS CURVES

$T_A$ = 25°C unless otherwise specified. (continued)

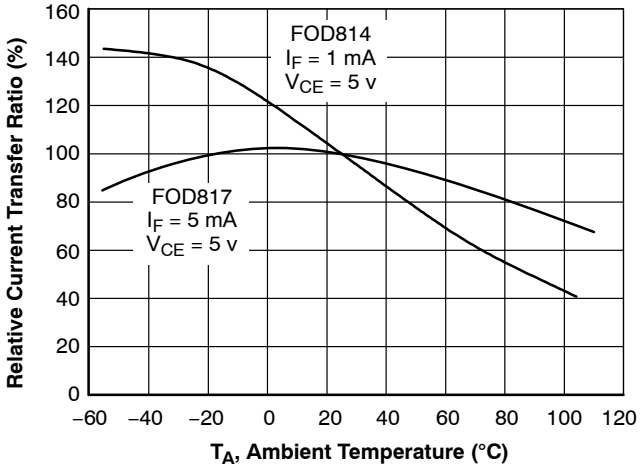


**Figure 11. Relative Current Transfer Ratio vs. Ambient Temperature**

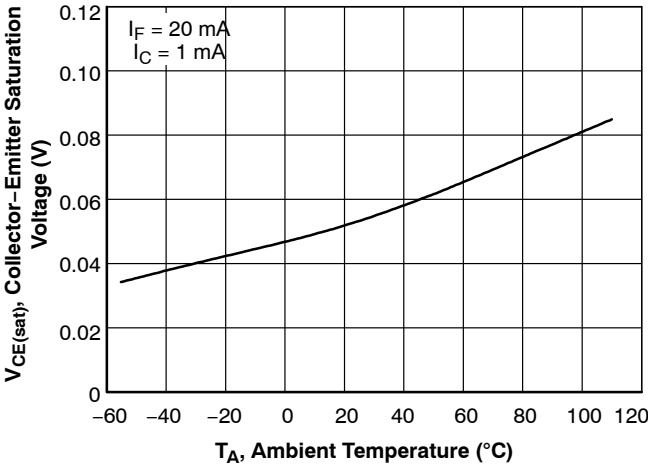


**Figure 12. Collector−Emitter Saturation Voltage vs. Ambient Temperature**

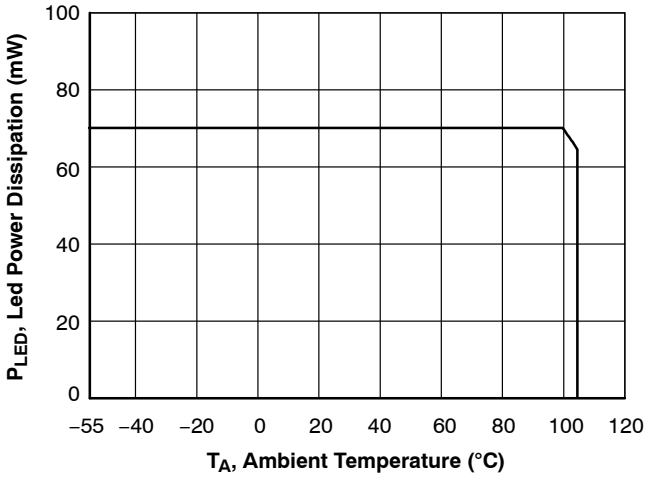


**Figure 13. Led Power Dissipation vs. Ambient Temperature (FOD814)**

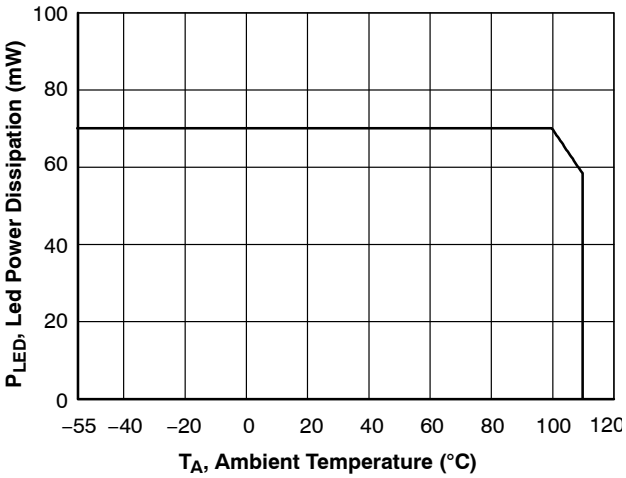


**Figure 14. Led Power Dissipation vs. Ambient Temperature (FOD817)**

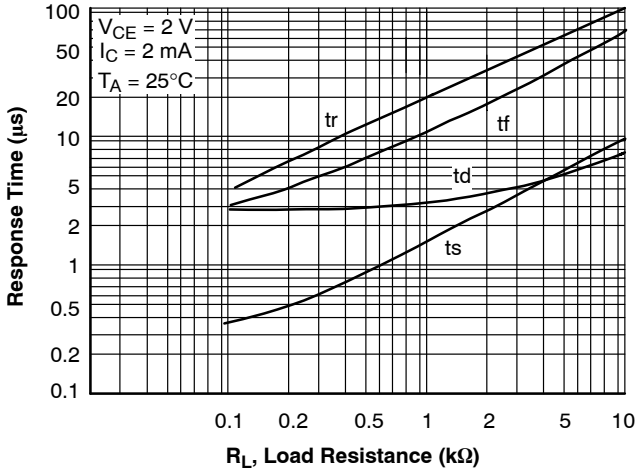


**Figure 15. Response Time vs. Load Resistance**

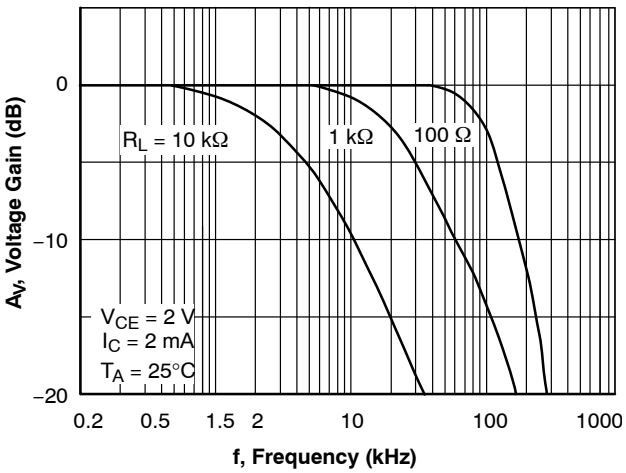


**Figure 16. Frequency Response**



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## TYPICAL ELECTRICAL/OPTICAL CHARACTERISTICS CURVES

$T_A$ = 25°C unless otherwise specified. (continued)

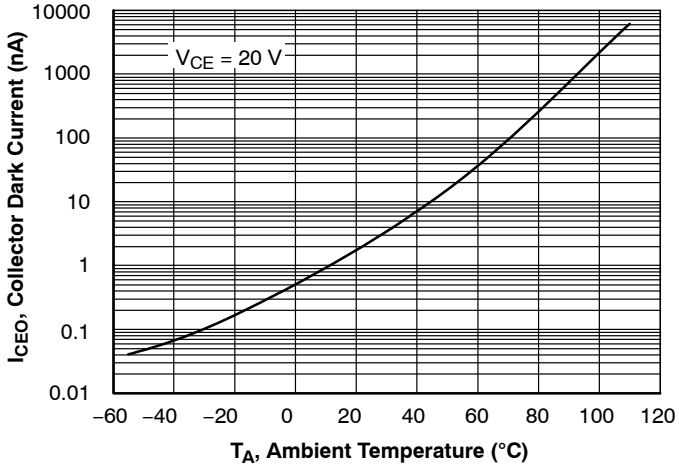


**Figure 17. Collector Dark Current vs. Ambient Temperature**

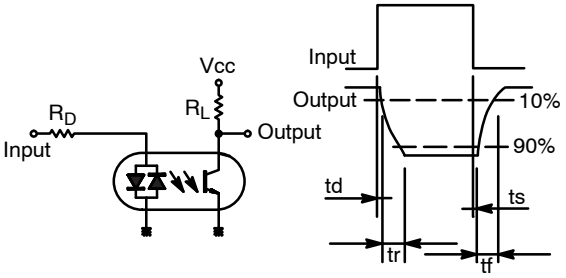


**Figure 18. Test Circuit for Response Time**

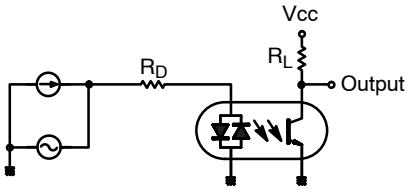


**Figure 19. Test Circuit for Frequency Response**



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## REFLOW PROFILE

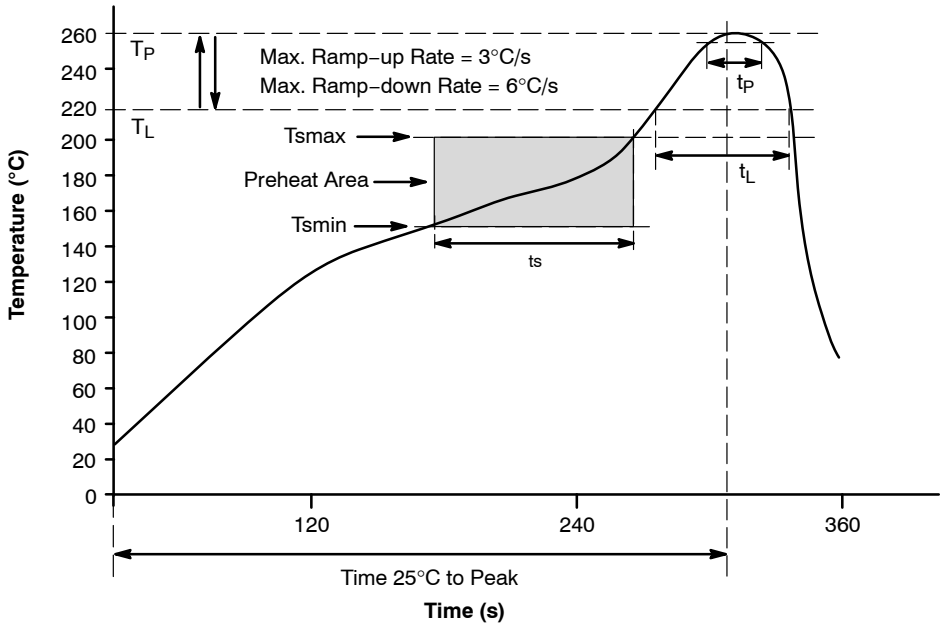


**Figure 20. Reflow Profile**

### 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 s |
| Ramp−up Rate ($t_L$ to $t_P$) | 3°C/s max. |
| Liquidous Temperature ($T_L$) | 217°C |
| Time ($t_L$) Maintained Above ($T_L$) | 60−150 s |
| Peak Body Package Temperature | 260°C +0°C / −5°C |
| Time ($t_P$) within 5°C of 260°C | 30 s |
| Ramp−down Rate ($T_P$ to $T_L$) | 6°C/s max. |
| Time 25°C to Peak Temperature | 8 min max. |

### ORDERING INFORMATION

| Part Number | Package | Shipping† |
|---|---|---|
| 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) |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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.



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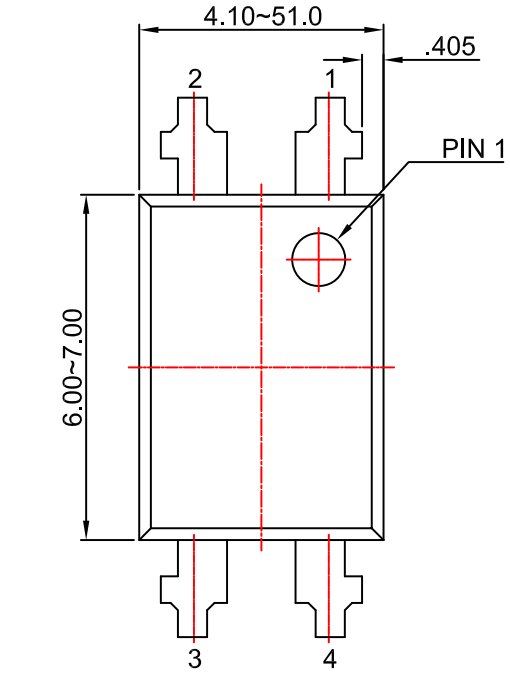
**PDIP4 4.6x6.5, 2.54P**
CASE 646CA
ISSUE O

DATE 31 JUL 2016

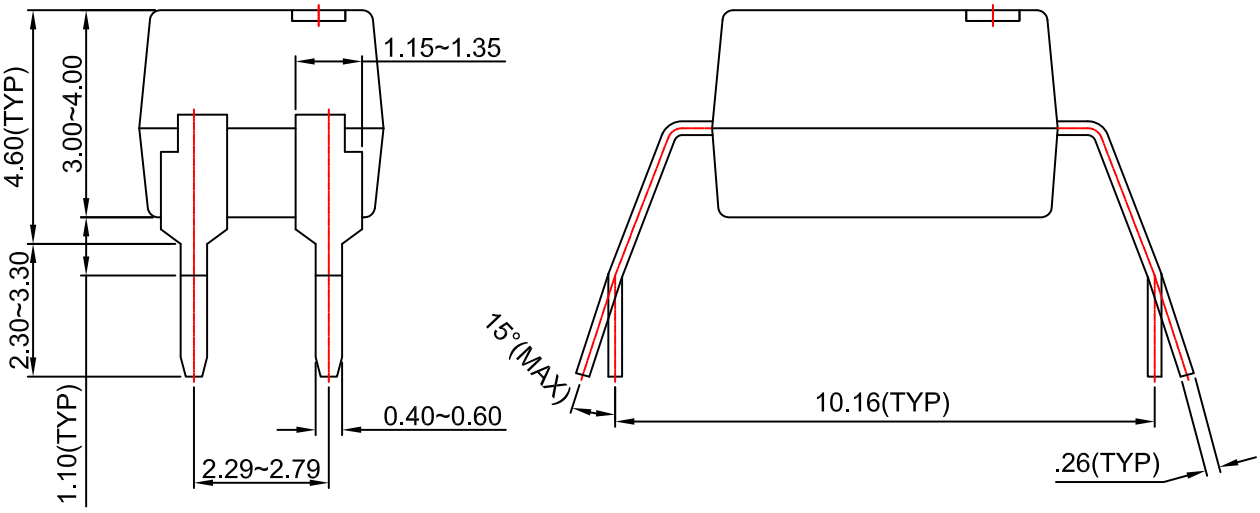



NOTES:

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

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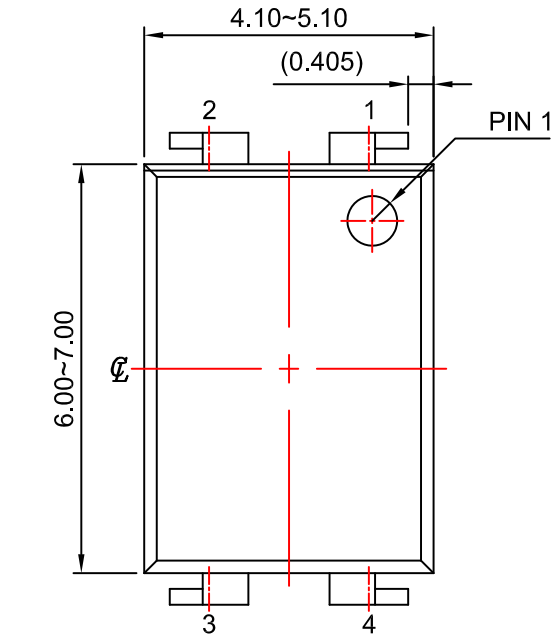
**PDIP4 4.6x6.5, 2.54P**
CASE 646CD
ISSUE O

DATE 31 JUL 2016

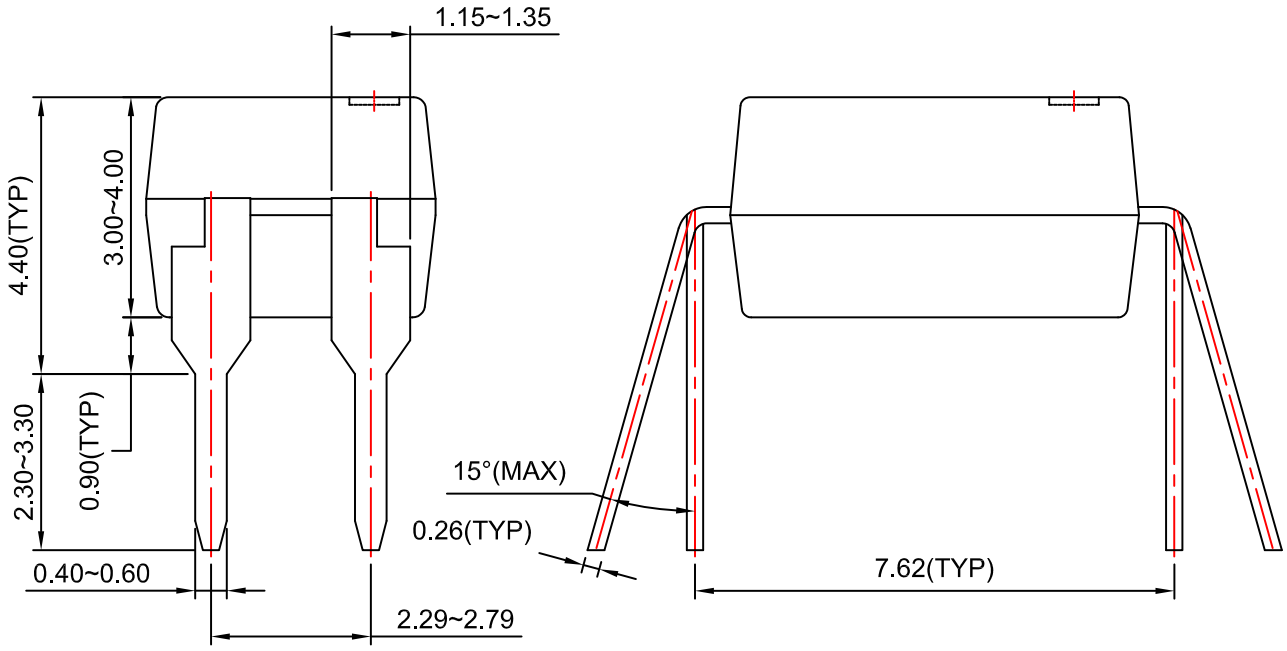



NOTES:

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




| | | | |
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| **DESCRIPTION:** | **PDIP4 4.6X6.5, 2.54P** | | **PAGE 1 OF 1** |

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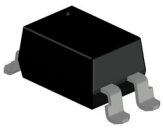
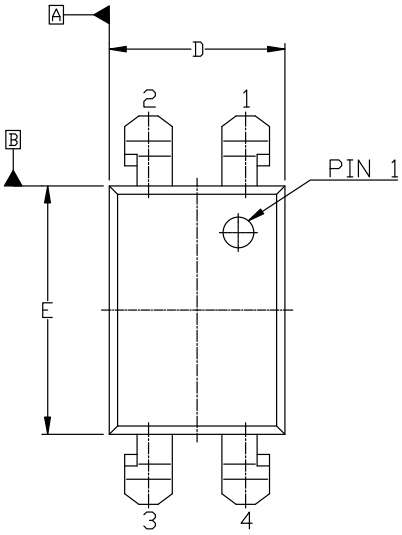


**PDIP4 4.60x6.50x3.85, 2.54P**
CASE 709AH
ISSUE B

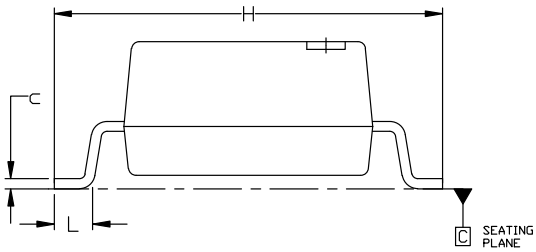
DATE 06 JUL 2023



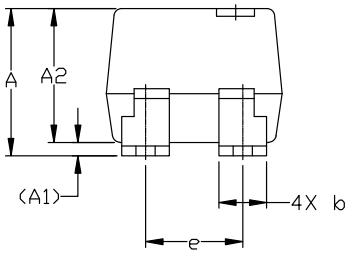

TOP VIEW

NOTES:

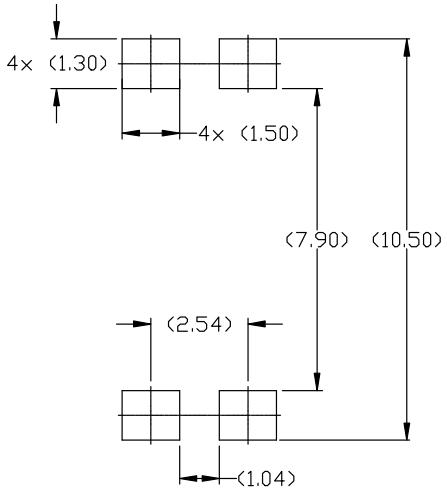
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION.
4. DRAWING FILENAME AND REVISION: MKT-N04Crev2.




END VIEW




SIDE VIEW




LAND PATTERN RECOMMENDATION

* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

| DIM | MILLIMETERS | | |
|---|---|---|---|
| | MIN. | NOM. | MAX. |
| A | | 3.85 (TYP) | |
| A1 | | 0.35 (REF) | |
| A2 | 3.00 | 3.50 | 4.00 |
| b | 1.15 | 1.25 | 1.35 |
| c | | 0.26 (REF) | |
| D | 4.10 | 4.60 | 5.10 |
| E | 6.00 | 6.50 | 7.00 |
| e | 2.29 | 2.54 | 2.79 |
| H | 9.86 | 10.16 | 10.46 |
| L | 0.75 | --- | 1.25 |

| | | |
|---|---|---|
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