

# 4-Pin DIP Phototransistor Optocouplers

## FOD814, FOD817

### Introduction or Description

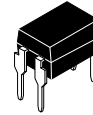
The FOD814 consists of two gallium arsenide infrared emitting diodes, connected in inverse parallel, driving a silicon phototransistor output in a 4-pin dual in-line package. The FOD817 Series consists of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a 4-pin dual in-line package.

### Features

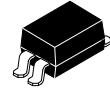
- AC Input Response (FOD814)
  - ◆ FOD814: 20–300%
  - ◆ FOD814A: 50–150%
  - ◆ FOD817: 50–600%
  - ◆ FOD817A: 80–160%
  - ◆ FOD817B: 130–260%
  - ◆ FOD817C: 200–400%
  - ◆ FOD817D: 300–600%
- Minimum  $BV_{CEO}$  of 70 V Guaranteed
- Safety and Regulatory Approvals
  - ◆ UL1577, 5,000 VAC<sub>RMS</sub> 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

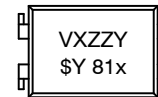


PDIP4  
CASE 646CD  
CASE 646CA



PDIP4 GW  
CASE 709AH

### 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
	x = 4 or 7

### ORDERING INFORMATION

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

# FOD814, FOD817

## FUNCTIONAL BLOCK DIAGRAM

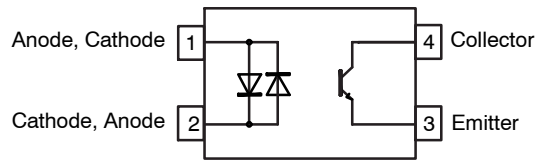


Figure 1. Schematic – FOD814

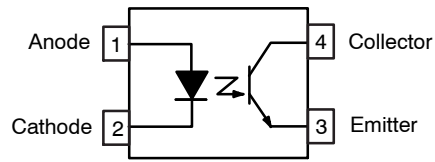


Figure 2. Schematic – FOD817

## SAFETY AND INSULATION RATINGS

Parameter		Characteristics
Installation Classifications per DIN VDE 0110/1.89 Table 1, For Rated Mains Voltage	< 150 V <sub>RMS</sub>	I–IV
	< 300 V <sub>RMS</sub>	I–III
Climatic Classification		30/110/21
Pollution Degree (DIN VDE 0110/1.89)		2
Comparative Tracking Index		175

Symbol	Parameter	Value	Unit
V <sub>PR</sub>	Input-to-Output Test Voltage, Method A, V <sub>IORM</sub> × 1.6 = V <sub>PR</sub> , Type and Sample Test with t <sub>m</sub> = 10 s, Partial Discharge < 5 pC	1360	V <sub>peak</sub>
	Input-to-Output Test Voltage, Method B, V <sub>IORM</sub> × 1.875 = V <sub>PR</sub> , 100% Production Test with t <sub>m</sub> = 1 s, Partial Discharge < 5 pC	1594	
V <sub>IORM</sub>	Maximum Working Insulation Voltage	850	
V <sub>IOTM</sub>	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 <sub>S</sub>	Case Temperature (Note 1)	175	°C
I <sub>S,INPUT</sub>	Input Current (Note 1)	400	mA
P <sub>S,OUTPUT</sub>	Output Power (Note 1)	700	mW
R <sub>IO</sub>	Insulation Resistance at T <sub>S</sub> , V <sub>IO</sub> = 500 V (Note 1)	> 10 <sup>11</sup>	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<sub>A</sub> = 25°C unless otherwise specified.

Symbol	Parameter	Value		Unit
		FOD814	FOD817	

### TOTAL DEVICE

T <sub>STG</sub>	Storage Temperature	–55 to +150		°C
T <sub>OPR</sub>	Operating Temperature	–55 to +105	–55 to +110	
T <sub>J</sub>	Junction Temperature	–55 to +125		
T <sub>SOL</sub>	Lead Solder Temperature	260 for 10 s		
θ <sub>JC</sub>	Junction–to–Case Thermal Resistance	210		°C/W
P <sub>TOT</sub>	Total Device Power Dissipation	200		mW

# FOD814, FOD817

**ABSOLUTE MAXIMUM RATINGS**  $T_A = 25^\circ\text{C}$  unless otherwise specified. (continued)

Symbol	Parameter	Value		Unit
		FOD814	FOD817	

## EMITTER

$I_F$	Continuous Forward Current	$\pm 50$	50	mA
$V_R$	Reverse Voltage		6	V
$P_D$	Power Dissipation	70		mW
	Derate Above $100^\circ\text{C}$	1.7		mW/ $^\circ\text{C}$

## 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 $90^\circ\text{C}$	2.9	mW/ $^\circ\text{C}$

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

## INDIVIDUAL COMPONENT CHARACTERISTICS

Symbol	Parameter	Device	Test Conditions	Min	Typ	Max	Unit
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### Emitter

$V_F$	Forward Voltage	FOD814	$I_F = \pm 20\text{ mA}$	–	1.2	1.4	V
		FOD817	$I_F = 20\text{ mA}$	–	1.2	1.4	
$I_R$	Reverse Current	FOD817	$V_R = 4.0\text{ V}$	–	–	10	$\mu\text{A}$
$C_t$	Terminal Capacitance	FOD814	$V = 0, f = 1\text{ kHz}$	–	50	250	pF
		FOD817		–	30	250	

### Detector

$I_{CEO}$	Collector Dark Current	FOD814	$V_{CE} = 20\text{ V}, I_F = 0$	–	–	100	nA
		FOD817		–	–	100	
$BV_{CEO}$	Collector–Emitter Breakdown Voltage	FOD814	$I_C = 0.1\text{ mA}, I_F = 0$	70	–	–	V
		FOD817		70	–	–	
$BV_{ECO}$	Emitter–Collector Breakdown Voltage	FOD814	$I_E = 10\text{ }\mu\text{A}, I_F = 0$	6	–	–	
		FOD817		6	–	–	

## DC TRANSFER CHARACTERISTICS

Symbol	Parameter	Device	Test Conditions	Min	Typ	Max	Unit
CTR	Current Transfer Ratio (Note 2)	FOD814	$I_F = \pm 1\text{ mA}, V_{CE} = 5\text{ V}$	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	

# FOD814, FOD817

**ELECTRICAL CHARACTERISTICS**  $T_A = 25^\circ\text{C}$  unless otherwise specified. (continued)

## AC TRANSFER CHARACTERISTICS

Symbol	Parameter	Device	Test Conditions	Min	Typ	Max	Unit
$f_C$	Cut-Off Frequency	FOD814	$V_{CE} = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ , $-3\text{ dB}$	15	80	–	kHz
$t_r$	Response Time (Rise)	FOD814, FOD817	$V_{CE} = 2\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ (Note 3)	–	4	18	$\mu\text{s}$
$t_f$	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	$f = 60\text{ Hz}$ , $t = 1\text{ min}$ , $I_{I-O} \leq 2\ \mu\text{A}$	5000	–	–	$V_{ACRMS}$
$R_{ISO}$	Isolation Resistance	FOD814, FOD817	$V_{I-O} = 500\text{ V}_{DC}$	$5 \times 10^{10}$	$1 \times 10^{11}$	–	$\Omega$
$C_{ISO}$	Isolation Capacitance	FOD814, FOD817	$V_{I-O} = 0$ , $f = 1\text{ MHz}$	–	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.

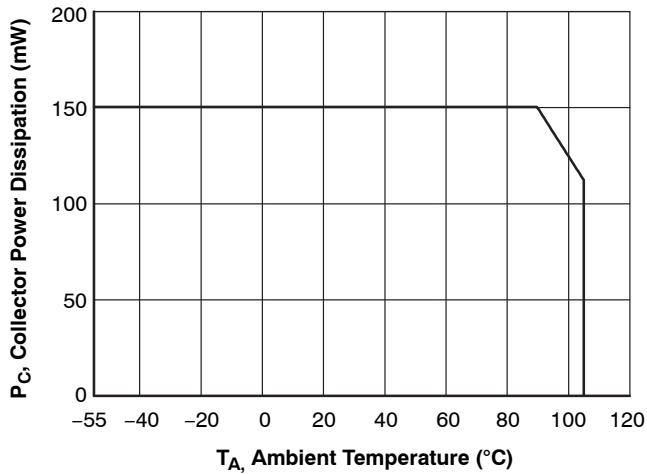
2. Current Transfer Ratio (CTR) =  $I_C / I_F \times 100\%$

3. For test circuit setup and waveforms, refer to page 5.

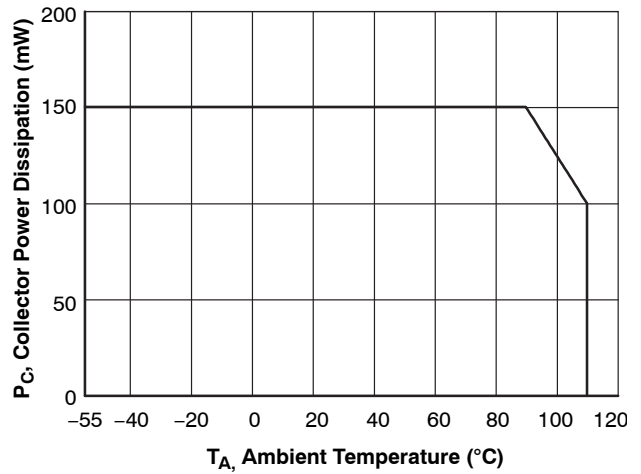
4. For this test, Pins 1 and 2 are common, and Pins 3 and 4 are common.

## TYPICAL ELECTRICAL/OPTICAL CHARACTERISTICS CURVES

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



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



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

TYPICAL ELECTRICAL/OPTICAL CHARACTERISTICS CURVES

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

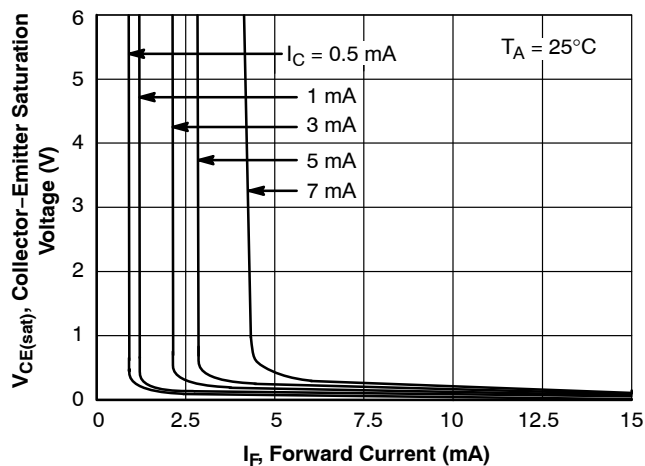


Figure 5. Collector-Emitter Saturation Voltage vs. Forward Current

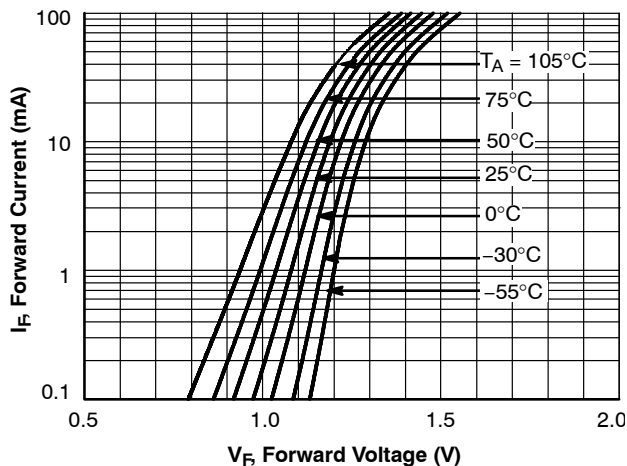


Figure 6. Forward Current vs. Forward Voltage (FOD814)

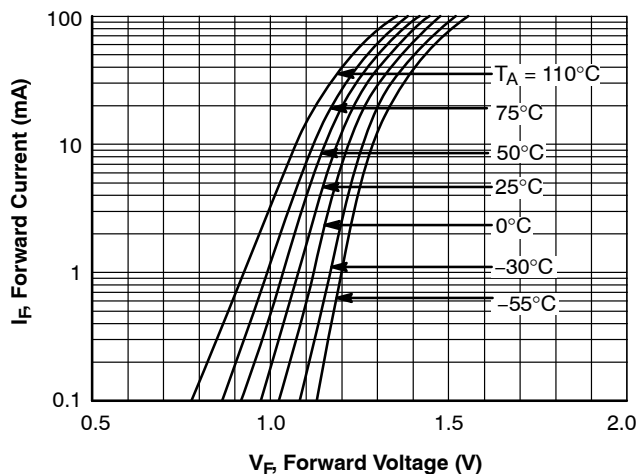


Figure 7. Forward Current vs. Forward Voltage (FOD817)

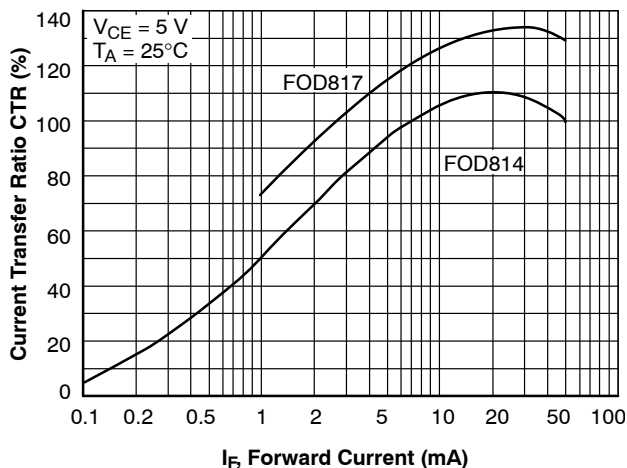


Figure 8. Current Transfer Ratio vs. Forward Current

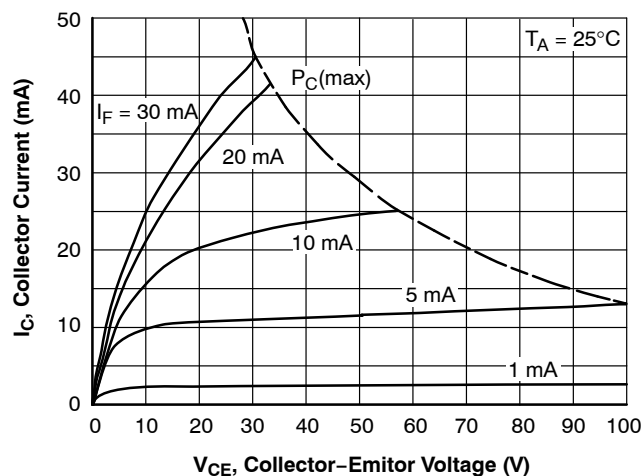


Figure 9. Collector Current vs. Collector-Emitter Voltage (FOD814)

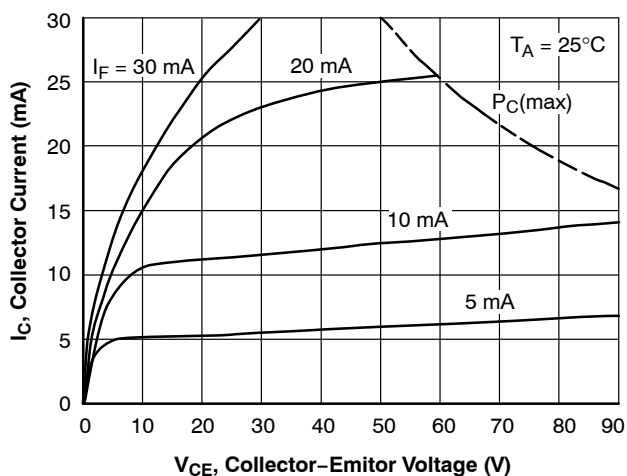


Figure 10. Collector Current vs. Collector-Emitter Voltage (FOD817)

# FOD814, FOD817

## TYPICAL ELECTRICAL/OPTICAL CHARACTERISTICS CURVES

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

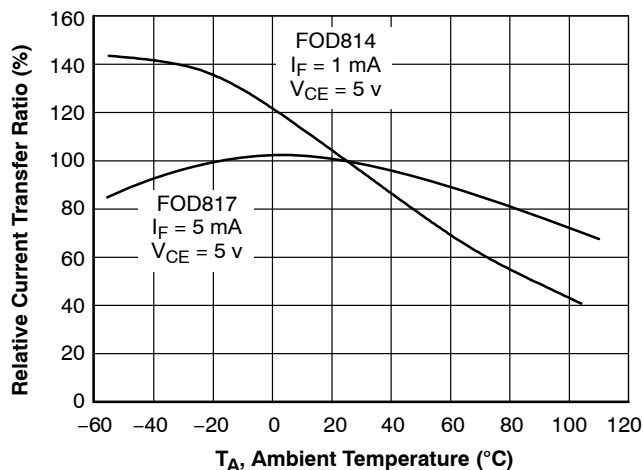


Figure 11. Relative Current Transfer Ratio vs. Ambient Temperature

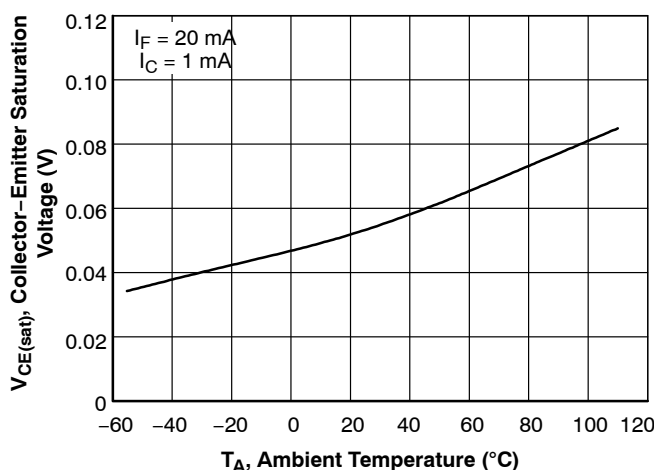


Figure 12. Collector-Emitter Saturation Voltage vs. Ambient Temperature

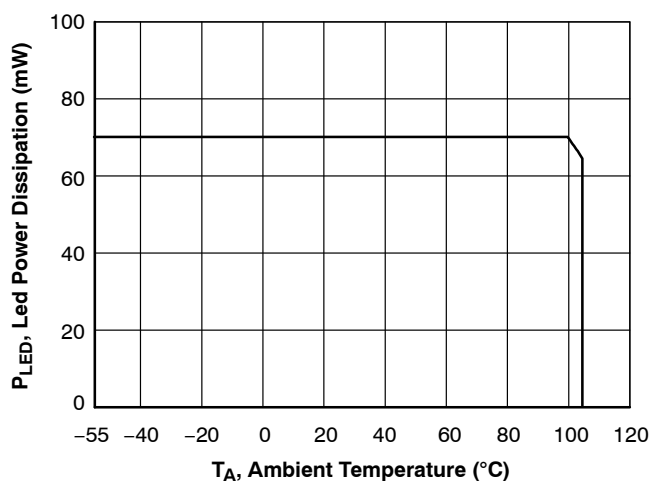


Figure 13. Led Power Dissipation vs. Ambient Temperature (FOD814)

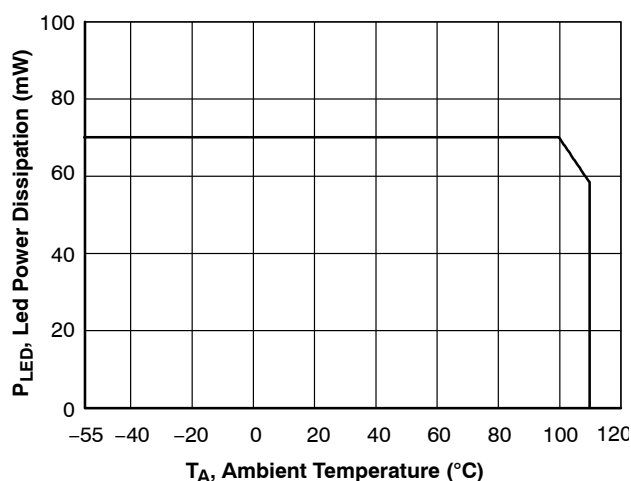


Figure 14. Led Power Dissipation vs. Ambient Temperature (FOD817)

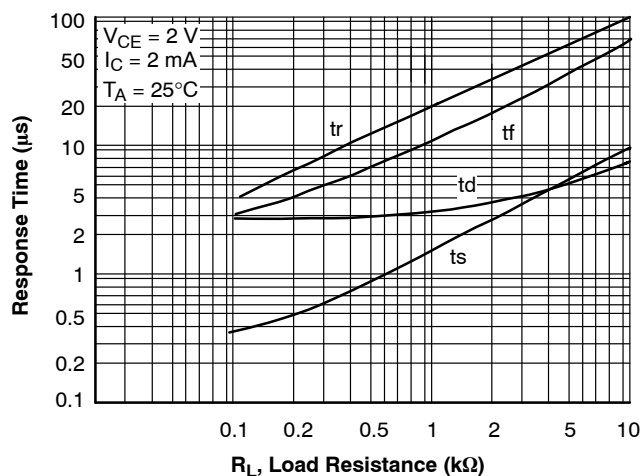


Figure 15. Response Time vs. Load Resistance

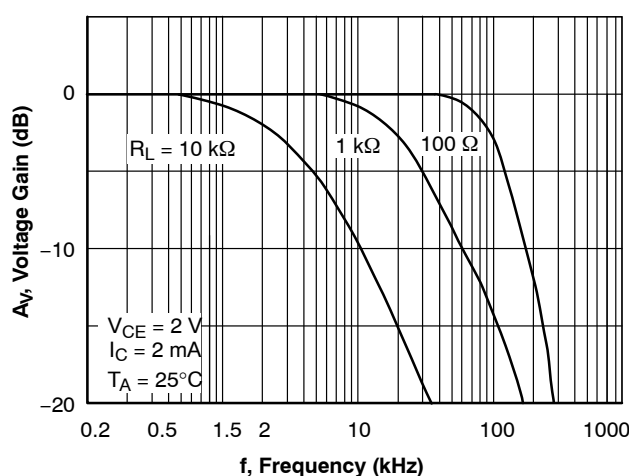


Figure 16. Frequency Response

TYPICAL ELECTRICAL/OPTICAL CHARACTERISTICS CURVES

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

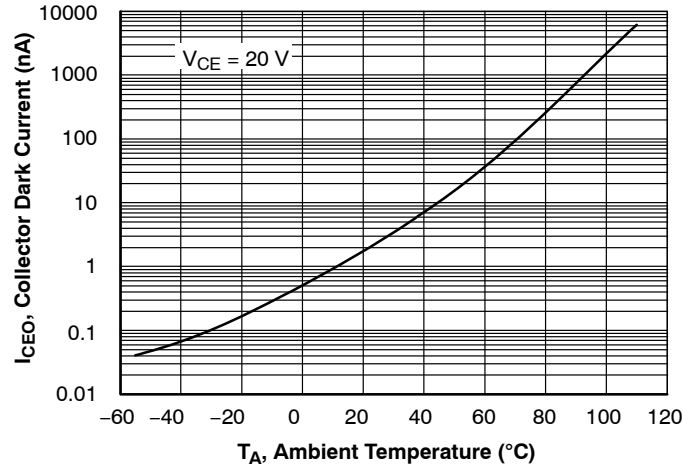


Figure 17. Collector Dark Current vs. Ambient Temperature

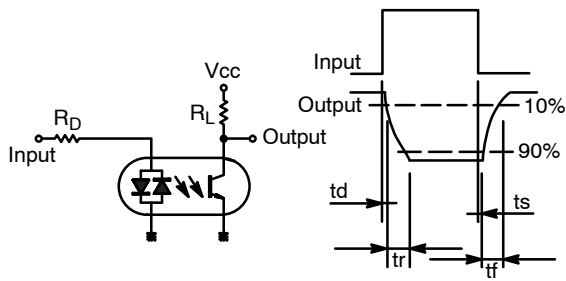


Figure 18. Test Circuit for Response Time

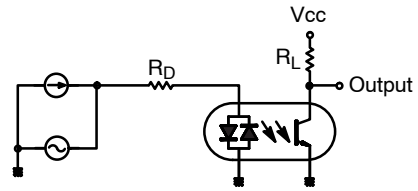


Figure 19. Test Circuit for Frequency Response

# FOD814, FOD817

## REFLOW PROFILE

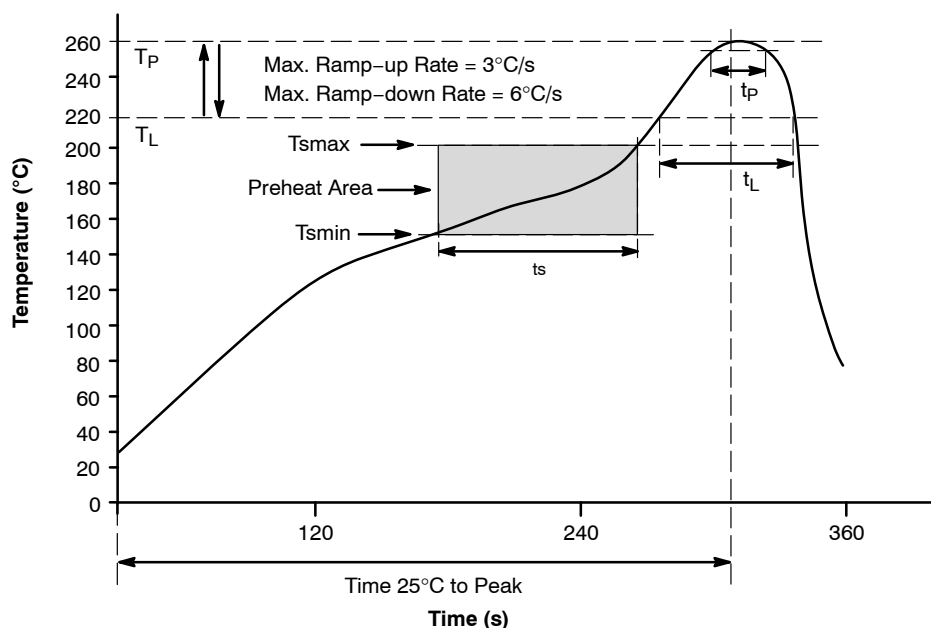


Figure 20. Reflow Profile

## REFLOW PROFILE

Profile Feature	Pb-Free Assembly Profile
Temperature Min. (T <sub>min</sub> )	150°C
Temperature Max. (T <sub>max</sub> )	200°C
Time (t <sub>s</sub> ) from (T <sub>min</sub> to T <sub>max</sub> )	60–120 s
Ramp-up Rate (t <sub>L</sub> to t <sub>P</sub> )	3°C/s max.
Liquidous Temperature (T <sub>L</sub> )	217°C
Time (t <sub>L</sub> ) Maintained Above (T <sub>L</sub> )	60–150 s
Peak Body Package Temperature	260°C +0°C / -5°C
Time (t <sub>P</sub> ) within 5°C of 260°C	30 s
Ramp-down Rate (T <sub>P</sub> to T <sub>L</sub> )	6°C/s max.
Time 25°C to Peak Temperature	8 min max.

## ORDERING INFORMATION

Part Number	Package	Shipping <sup>†</sup>
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	Tape and Reel (1,000 units per reel)

<sup>†</sup>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.



# MECHANICAL CASE OUTLINE

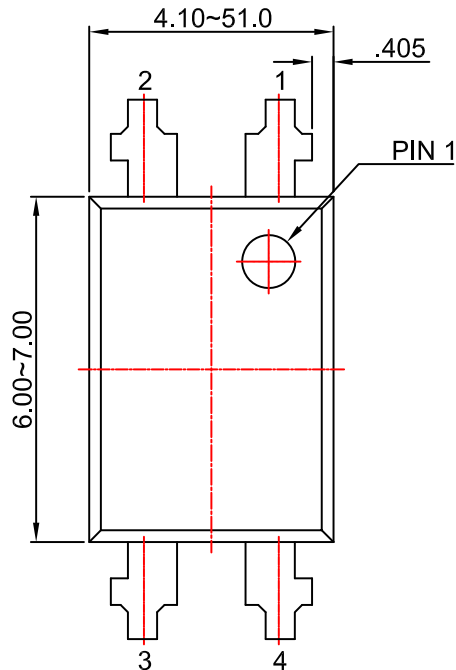
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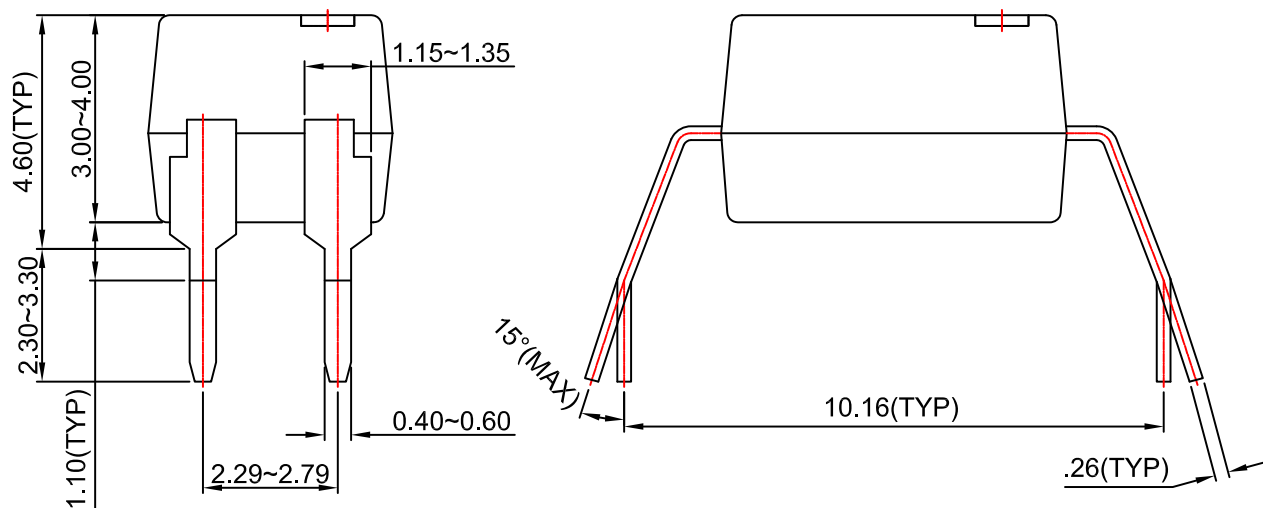
PDIP4 4.6x6.5, 2.54P  
CASE 646CA  
ISSUE O

DATE 31 JUL 2016




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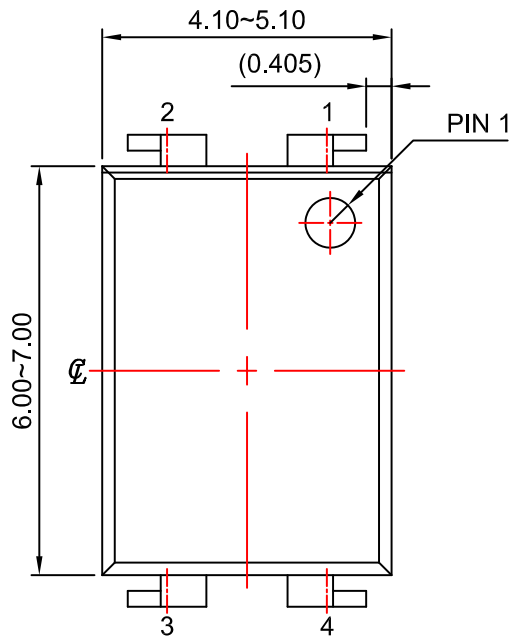
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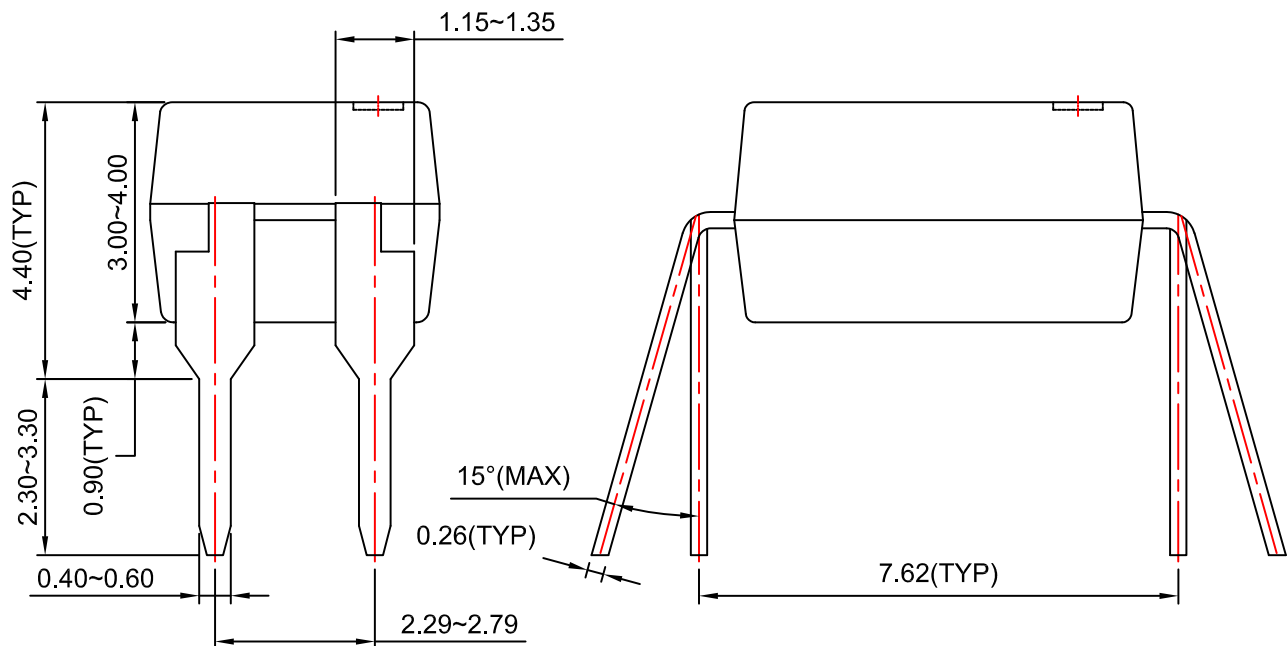
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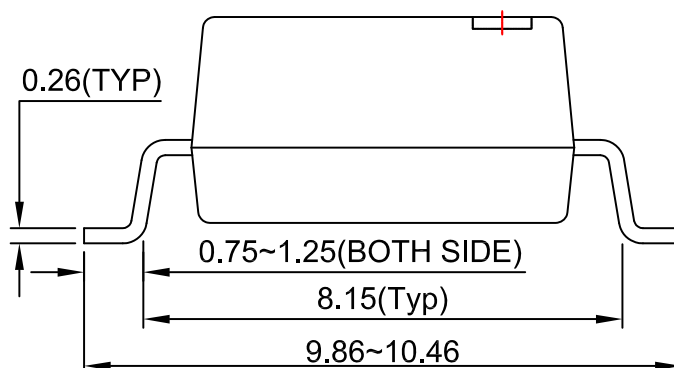
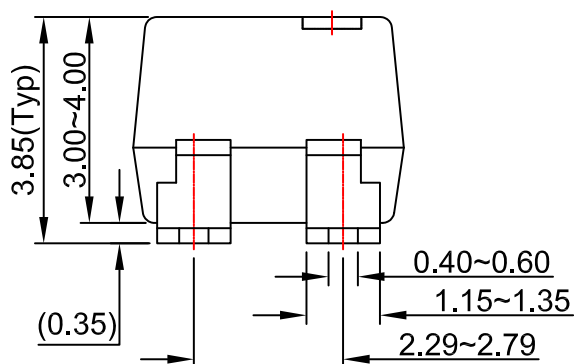
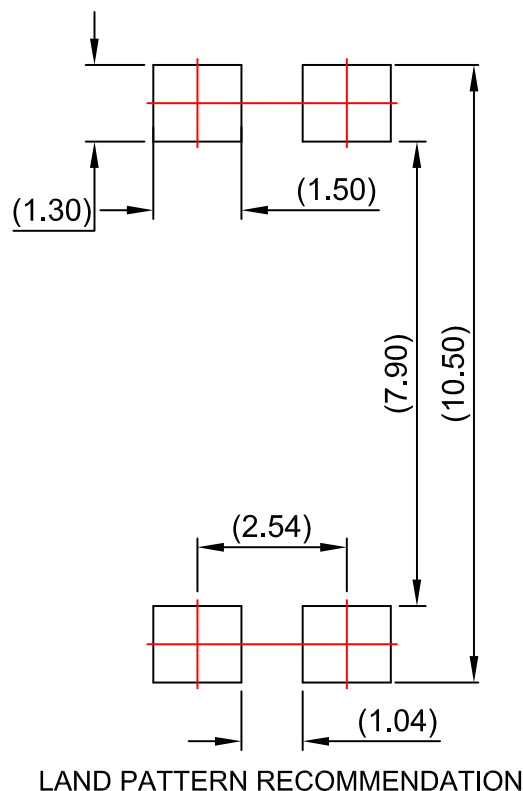
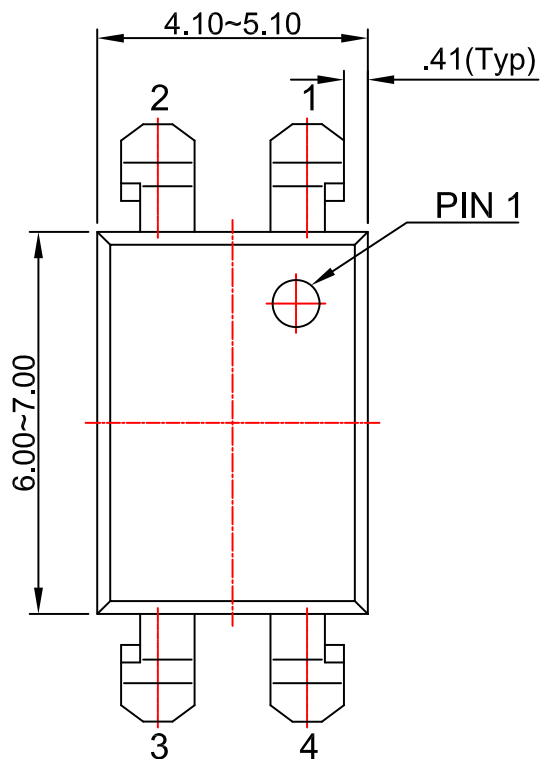
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