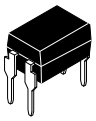
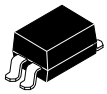
4-Pin DIP Phototransistor Optocouplers

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.

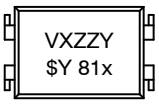
Features

- 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 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

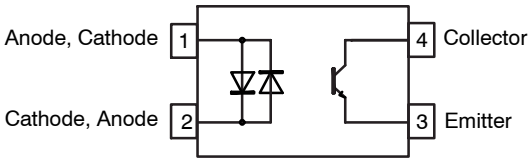

Figure 1. Schematic – FOD814

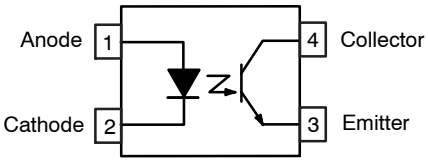

Figure 2. Schematic – FOD817

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		
θ_{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.

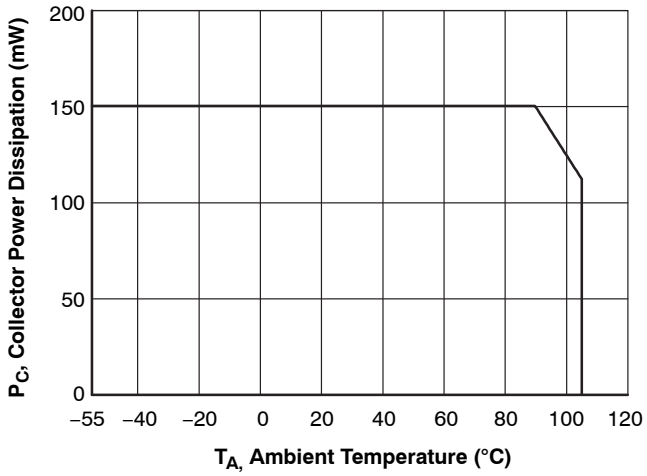

Figure 3. Collector Power Dissipation vs. Ambient Temperature (FOD814)

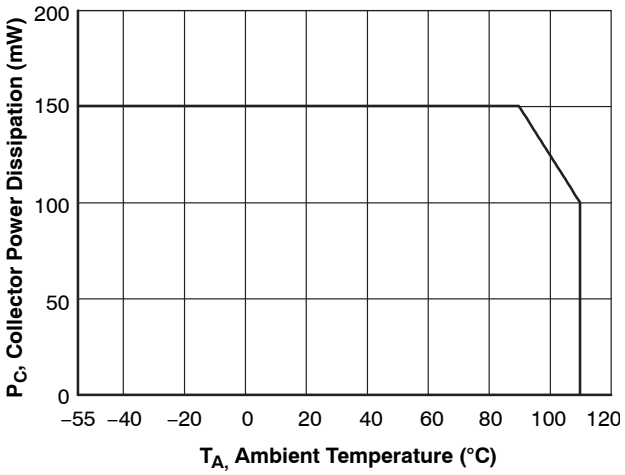

Figure 4. Collector Power Dissipation vs. Ambient Temperature (FOD817)

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TYPICAL ELECTRICAL/OPTICAL CHARACTERISTICS CURVES

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

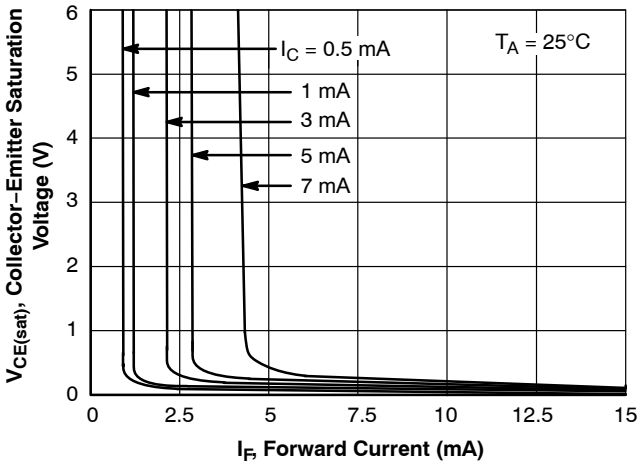

Figure 5. Collector−Emitter Saturation Voltage vs. Forward Current

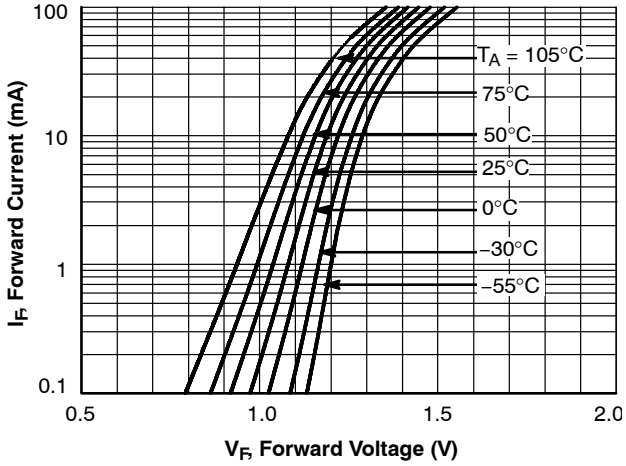

Figure 6. Forward Current vs. Forward Voltage (FOD814)

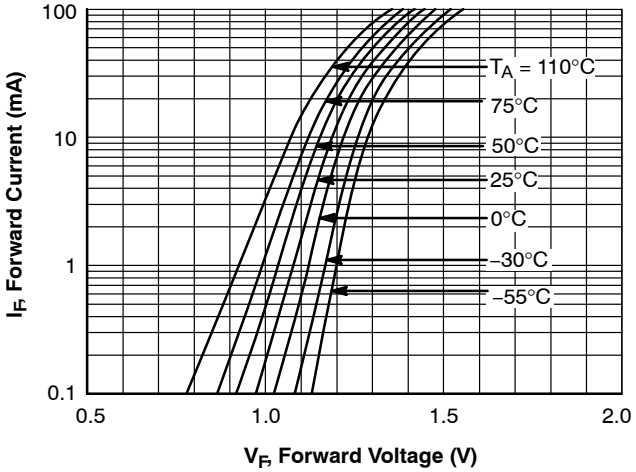

Figure 7. Forward Current vs. Forward Voltage (FOD817)

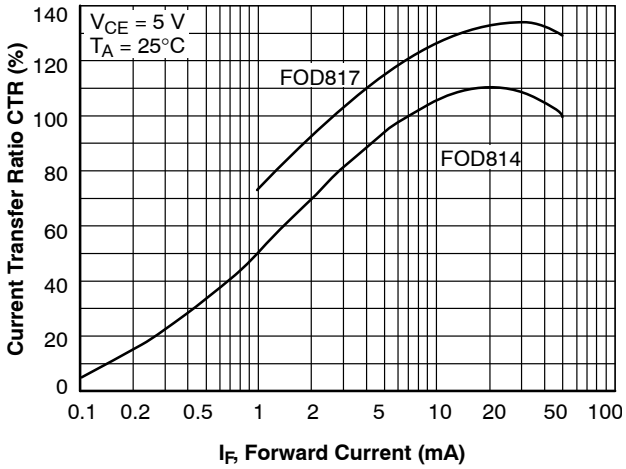

Figure 8. Current Transfer Ratio vs. Forward Current

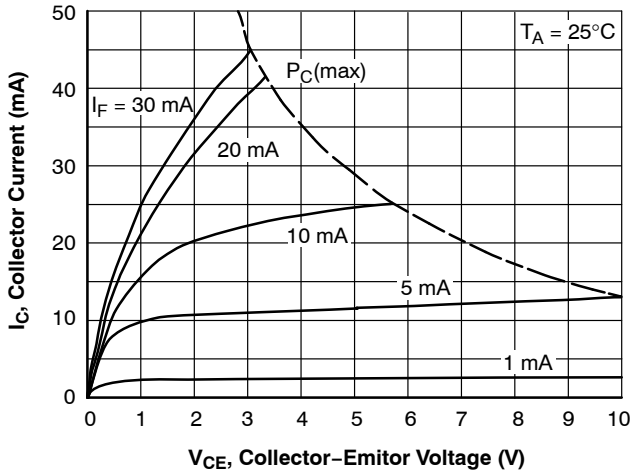

Figure 9. Collector Current vs. Collector−Emitor Voltage (FOD814)

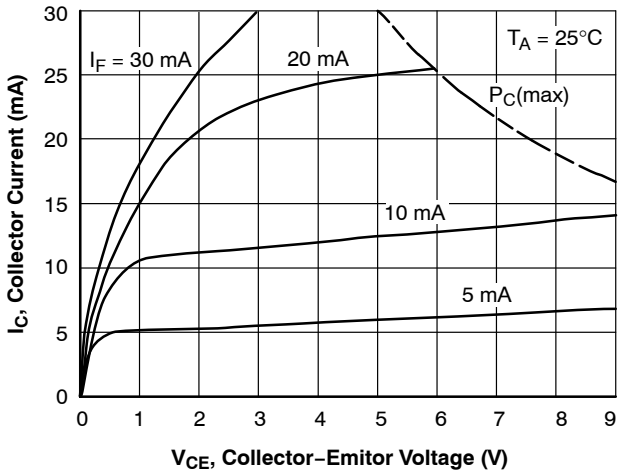

Figure 10. Collector Current vs. Collector−Emitor Voltage (FOD817)

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TYPICAL ELECTRICAL/OPTICAL CHARACTERISTICS CURVES

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

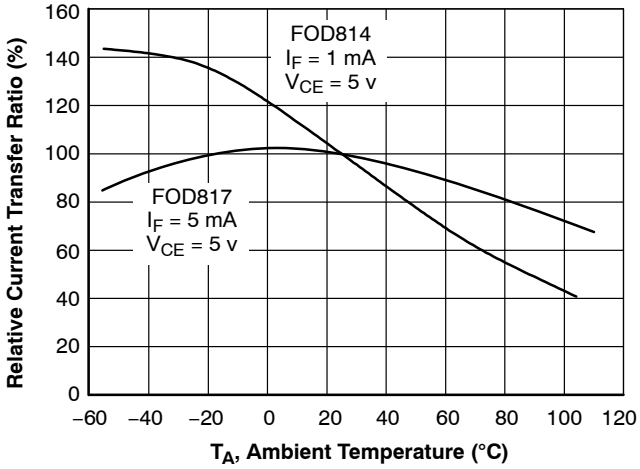

Figure 11. Relative Current Transfer Ratio vs. Ambient Temperature

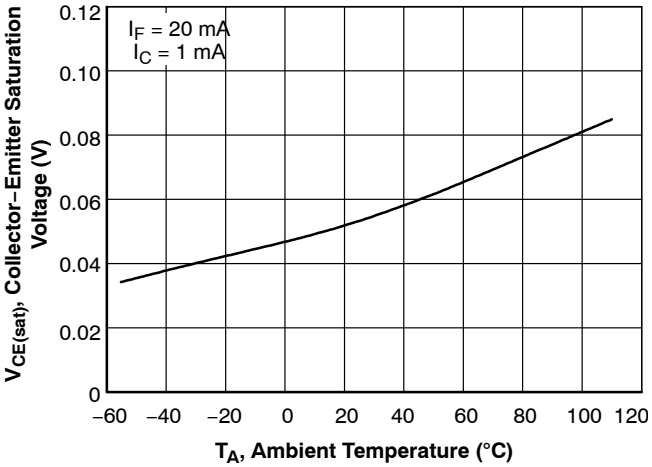

Figure 12. Collector−Emitter Saturation Voltage vs. Ambient Temperature

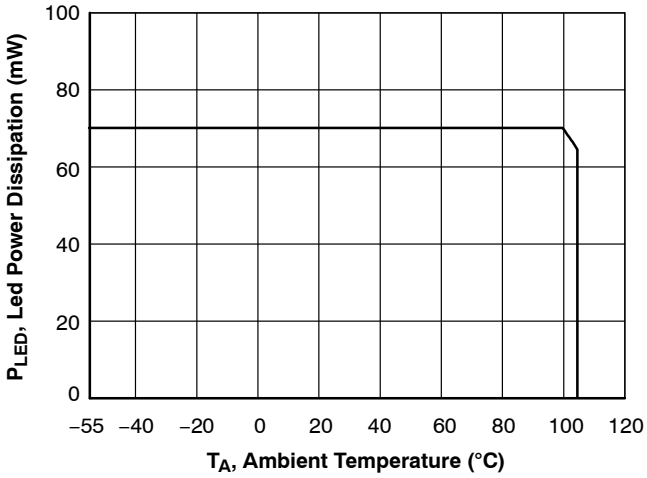

Figure 13. Led Power Dissipation vs. Ambient Temperature (FOD814)

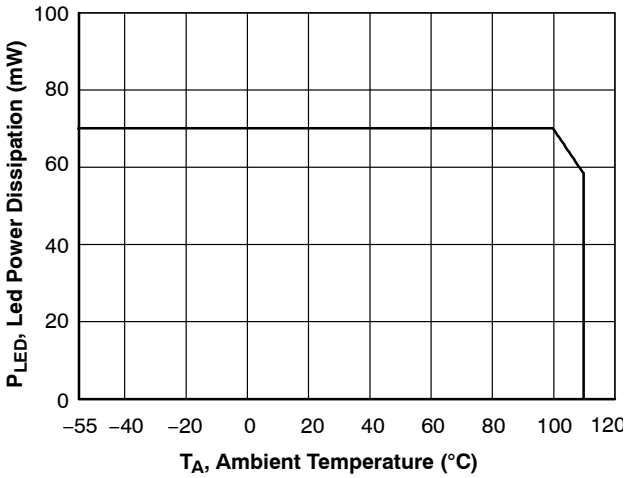

Figure 14. Led Power Dissipation vs. Ambient Temperature (FOD817)

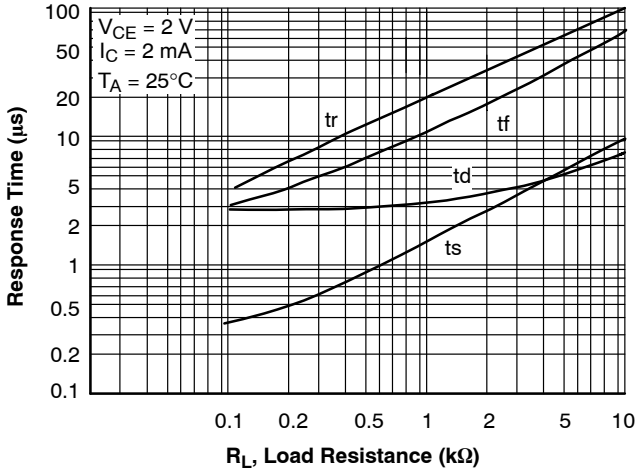

Figure 15. Response Time vs. Load Resistance

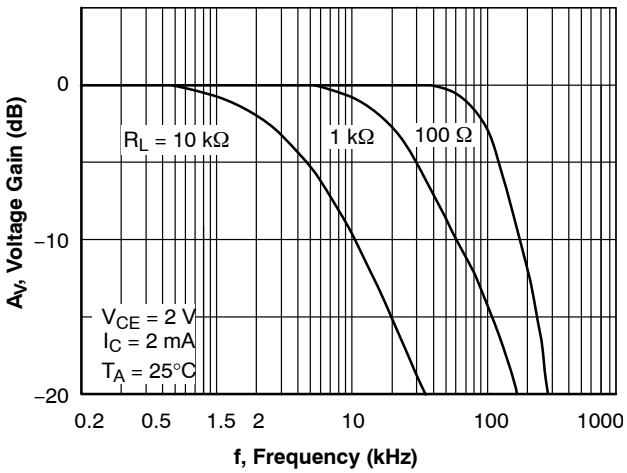

Figure 16. Frequency Response

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TYPICAL ELECTRICAL/OPTICAL CHARACTERISTICS CURVES

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

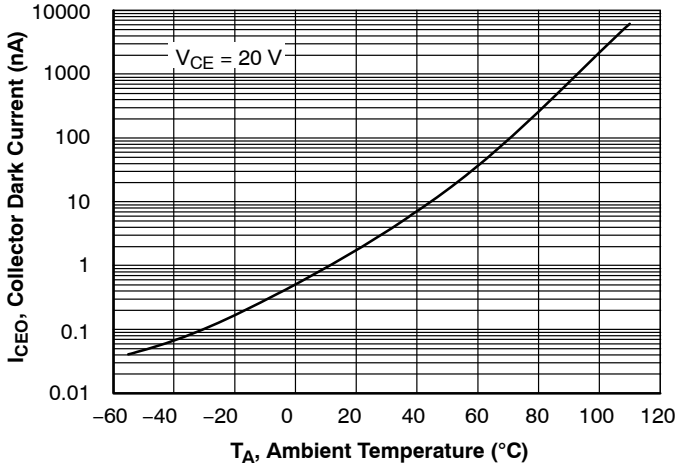

Figure 17. Collector Dark Current vs. Ambient Temperature

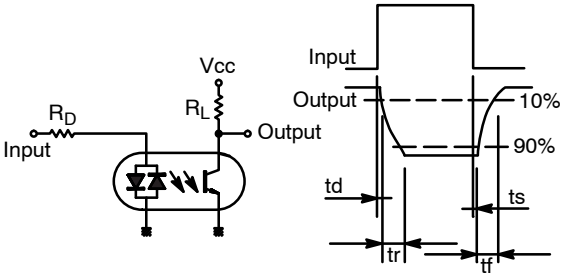

Figure 18. Test Circuit for Response Time

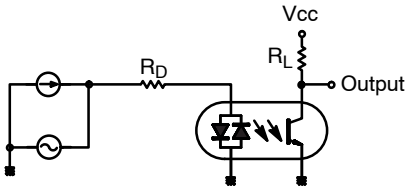

Figure 19. Test Circuit for Frequency Response

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REFLOW PROFILE

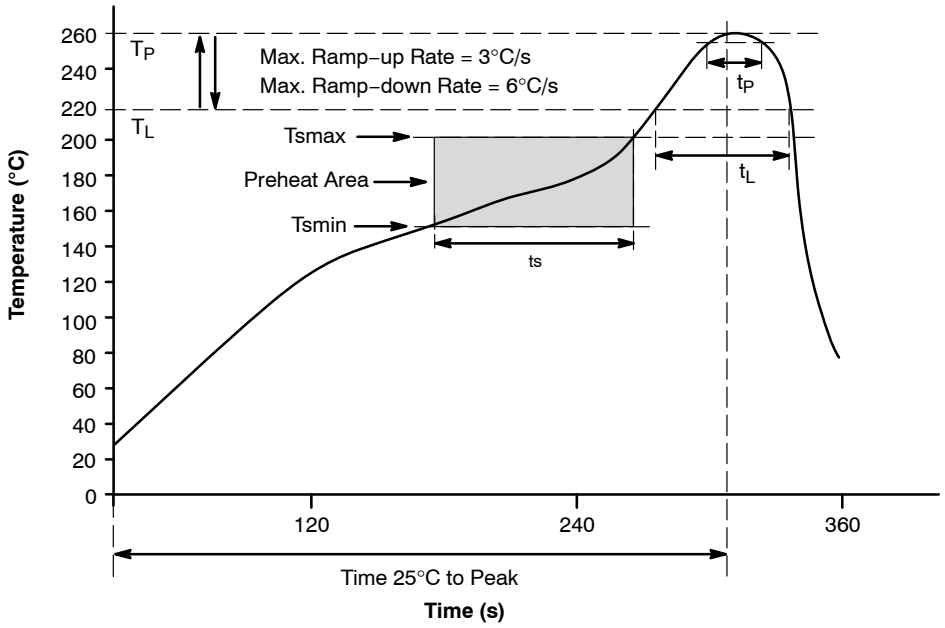

Figure 20. Reflow Profile

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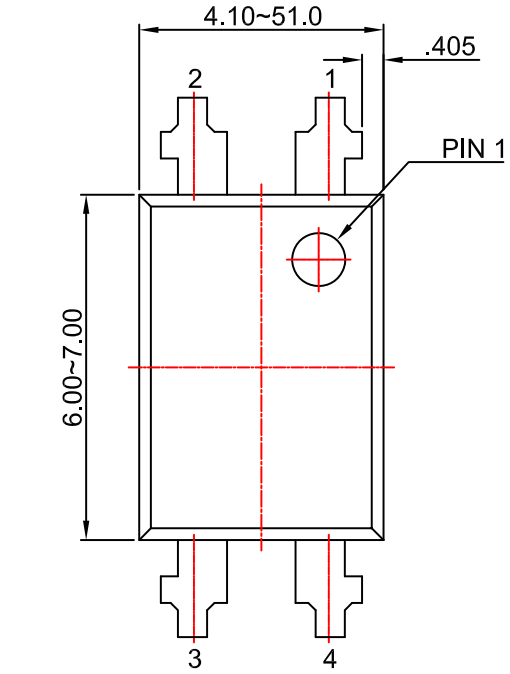
PDIP4 4.6x6.5, 2.54P
CASE 646CA
ISSUE O

DATE 31 JUL 2016



NOTES:

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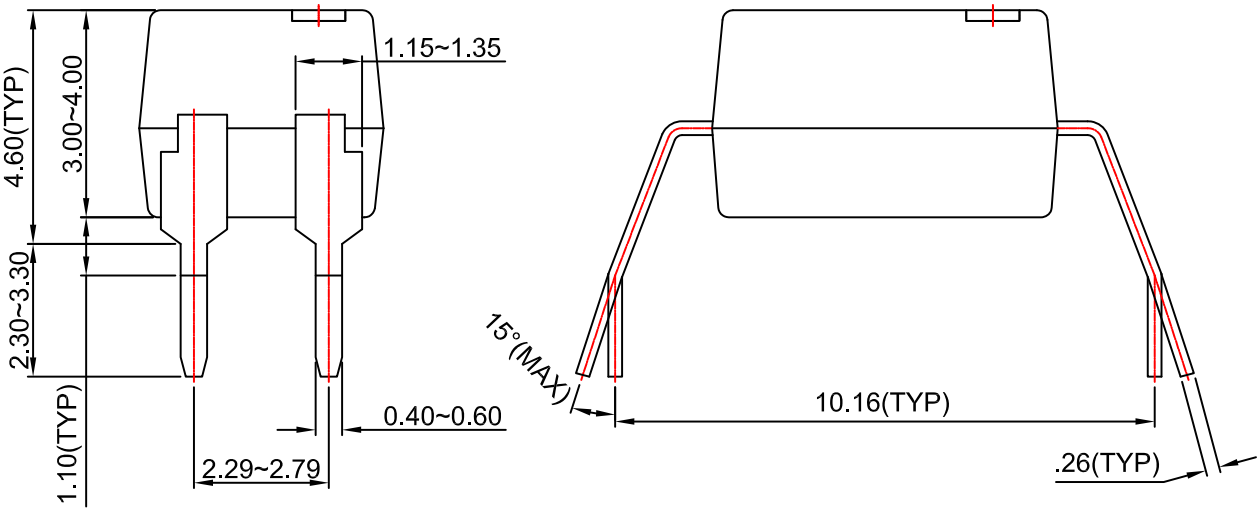
B) ALL DIMENSIONS ARE IN MILLIMETERS.

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



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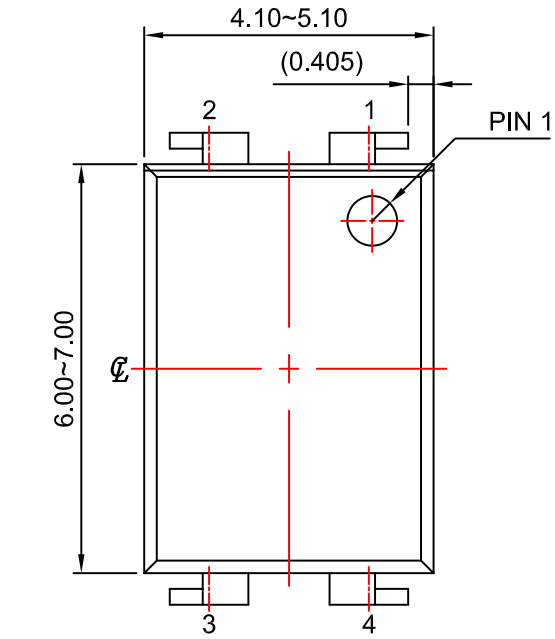
PDIP4 4.6x6.5, 2.54P
CASE 646CD
ISSUE O

DATE 31 JUL 2016



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B) ALL DIMENSIONS ARE IN MILLIMETERS.

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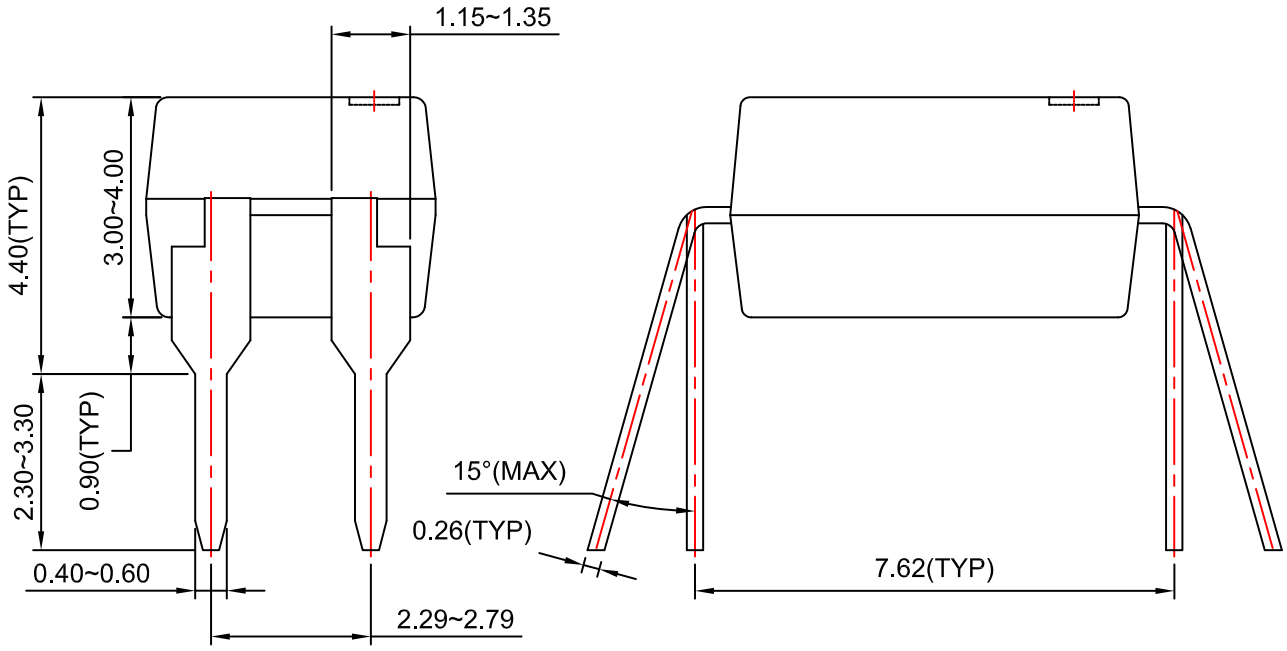

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DESCRIPTION:	**PDIP4 4.6X6.5, 2.54P**		**PAGE 1 OF 1**

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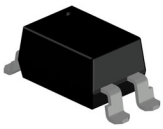
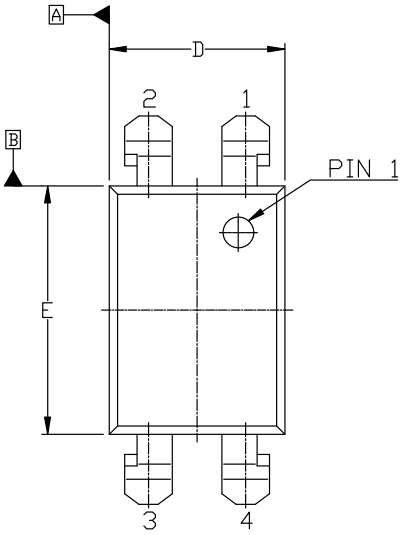


PDIP4 4.60x6.50x3.85, 2.54P
CASE 709AH
ISSUE B

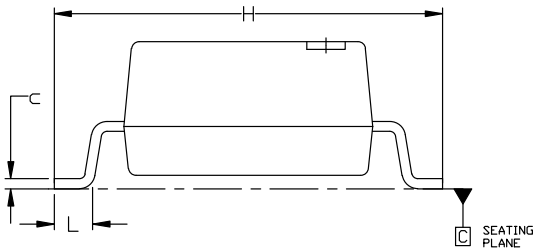
DATE 06 JUL 2023



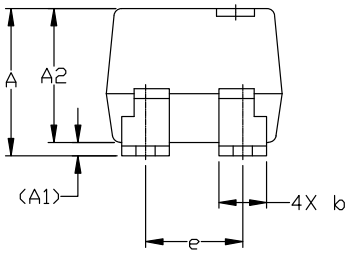
TOP VIEW

NOTES:

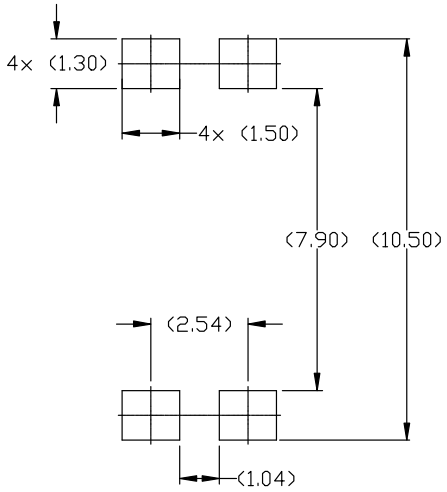
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION.
4. DRAWING FILENAME AND REVISION: MKT-N04Crev2.



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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