

# 4-Pin DIP Photodarlington Output Optocoupler

## FOD852

### Description

The FOD852 consists of gallium arsenide infrared emitting diode driving a silicon photodarlington output (with integral base-emitter resistor) in a 4-pin dual in-line package.

### Features

- High Current Transfer Ratio: 1000% Minimum
- Safety and Regulatory Approvals
  - ◆ UL1577; 5,000 VAC<sub>RMS</sub> for 1 Minute
  - ◆ DIN EN/IEC60747-5-5
- These are Pb-Free Devices

### Applications

- Power Supply Regulators
- Digital Logic Inputs
- Microprocessor Inputs

### Functional Block Diagram

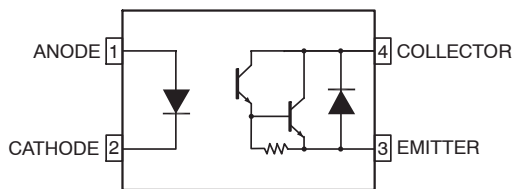
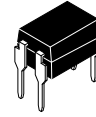
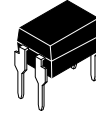


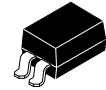
Figure 1. Schematic



PDIP4 4.6x6.5, 2.54P  
CASE 646CA

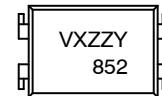


PDIP4 4.6x6.5, 2.54P  
CASE 646CD



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

### MARKING DIAGRAM



- V = DIN EN/IEC60747-5-5 Option (only appears on parts ordered with this option)
- X = One Digit Year Code
- ZZ = Two Digit Work Week
- Y = Assembly Package Code
- 852 = Specific Device Code

### ORDERING INFORMATION

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

**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 <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	1560	V <sub>peak</sub>
V <sub>IORM</sub>	Maximum Working Insulation Voltage	850	V <sub>peak</sub>
V <sub>IOTM</sub>	Highest Allowable Over-Voltage	6000	V <sub>peak</sub>
	External Creepage	≥7	mm
	External Clearance	≥7	mm
DTI	Distance Through Insulation (Insulation Thickness)	≥0.4	mm
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

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

**MAXIMUM RATINGS** (T<sub>A</sub> = 25 °C unless otherwise noted)

Symbol	Rating	Value	Unit
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**TOTAL DEVICE**

T <sub>STG</sub>	Storage Temperature	-55 to +125	°C
T <sub>OPR</sub>	Operating Temperature	-30 to +100	°C
T <sub>J</sub>	Junction Temperature	-55 to +100	°C
T <sub>SOL</sub>	Lead Solder Temperature	260 for 10 seconds	°C
P <sub>TOT</sub>	Total Device Power Dissipation	200	mW

**INPUT**

I <sub>F</sub>	Continuous Forward Current	50	mA
V <sub>R</sub>	Reverse Voltage	6	V
P <sub>D</sub>	LED Power Dissipation	70	mW

**OUTPUT**

V <sub>CEO</sub>	Collector-Emitter Voltage	300	V
V <sub>ECO</sub>	Emitter-Collector Voltage	0.1	V
I <sub>C</sub>	Continuous Collector Current	150	mA
P <sub>C</sub>	Collector Power Dissipation	150	mW

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.

# FOD852

## ELECTRICAL CHARACTERISTICS

( $T_A = 25\text{ }^\circ\text{C}$  unless otherwise noted)

### INDIVIDUAL COMPONENT CHARACTERISTICS

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
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#### INPUT

$V_F$	Forward Voltage	$I_F = 10\text{ mA}$	–	1.2	1.4	V
$I_R$	Reverse Current	$V_R = 4\text{ V}$	–	–	10	$\mu\text{A}$
$C_t$	Terminal Capacitance	$V = 0, f = 1\text{ kHz}$	–	30	250	pF

#### OUTPUT

$I_{CEO}$	Collector Dark Current	$V_{CE} = 200, I_F = 0$	–	–	200	nA
$BV_{CEO}$	Collector-Emitter Breakdown Voltage	$I_C = 0.1\text{ mA}, I_F = 0$	300	–	–	V
$BV_{ECO}$	Emitter-Collector Breakdown Voltage	$I_E = 10\text{ }\mu\text{A}, I_F = 0$	0.1	–	–	V

### TRANSFER CHARACTERISTICS

Symbol	DC Characteristics	Test Condition	Min	Typ	Max	Unit
$I_C$	Collector Current	$I_F = 1\text{ mA}, V_{CE} = 2\text{ V}$	10	40	150	mA
CTR	Current Transfer Ratio (Note 2)		1,000	4,000	15,000	%
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	$I_F = 20\text{ mA}, I_C = 100\text{ mA}$	–	–	1.2	V
$f_C$	Cut-Off Frequency	$V_{CE} = 2\text{ V}, I_C = 20\text{ mA}, R_L = 100\text{ }\Omega, -3\text{ dB}$	1	7	–	kHz
$t_R$	Response Time (Rise)	$V_{CE} = 2\text{ V}, I_C = 20\text{ mA}, R_L = 100\text{ }\Omega$	–	100	300	$\mu\text{s}$
$t_F$	Response Time (Fall)		–	20	100	$\mu\text{s}$

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

### ISOLATION CHARACTERISTICS

Symbol	Characteristics	Test Condition	Min	Typ	Max	Unit
$V_{ISO}$	Input-Output Isolation Voltage	$f = 60\text{ Hz}, t = 1\text{ minute}, I_{I-O} \leq 2\text{ }\mu\text{A}$	5000	–	–	$V_{AC_{RMS}}$
$R_{ISO}$	Isolation Resistance	$V_{I-O} = 500\text{ V dc}$	–	$10^{12}$	–	$\Omega$
$C_{ISO}$	Isolation Capacitance	$V_{I-O} = 0, f = 1\text{ MHz}$	–	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.

TYPICAL ELECTRICAL/OPTICAL CHARACTERISTIC CURVES ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

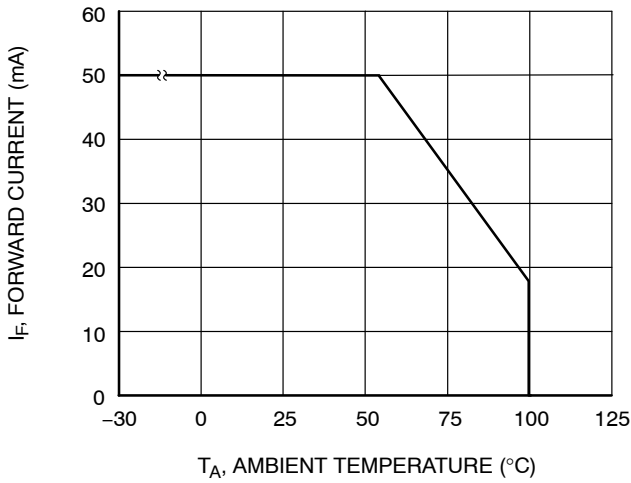


Figure 2. Forward Current vs. Ambient Temperature

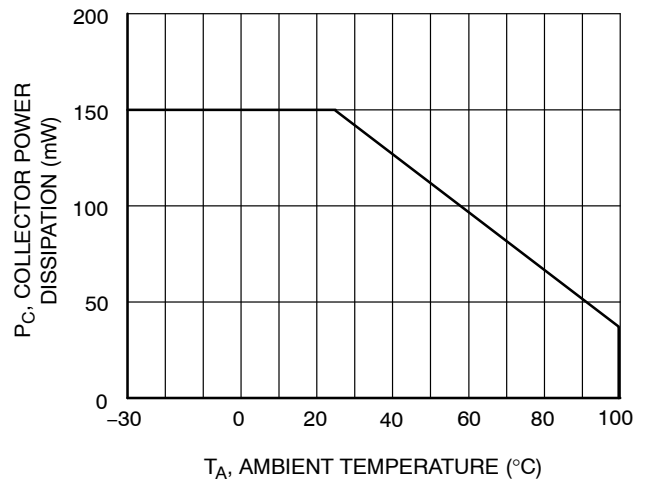


Figure 3. Collector Power Dissipation vs. Ambient Temperature

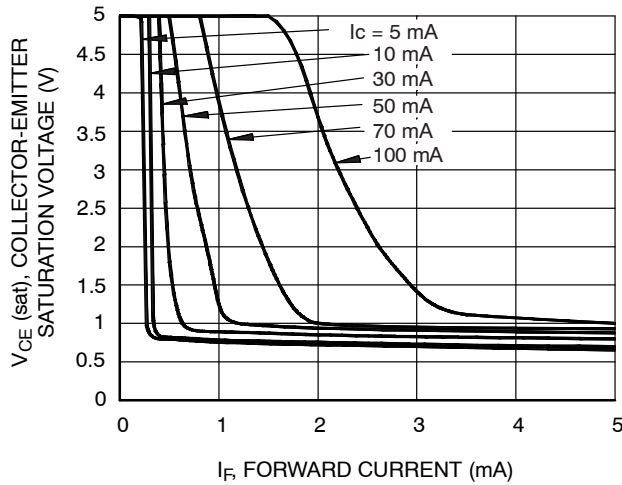


Figure 4. Collector-Emitted Saturation Voltage vs. Forward Current

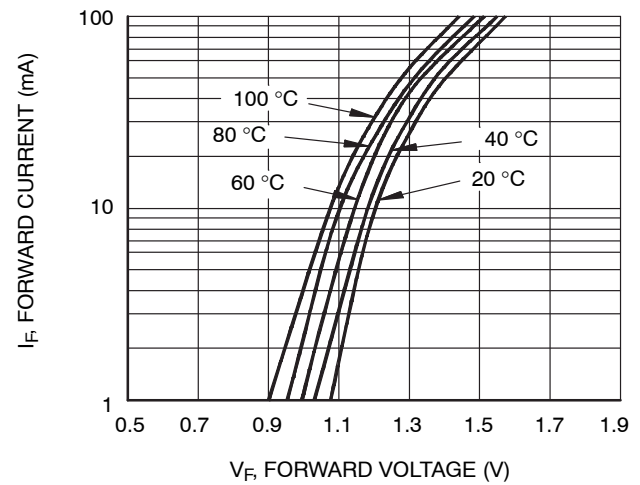


Figure 5. Forward Current vs. Forward Voltage

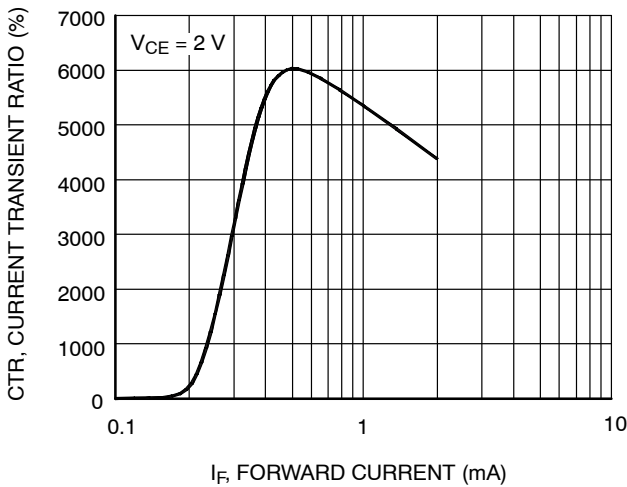


Figure 6. Current Transfer Ratio vs. Forward Current

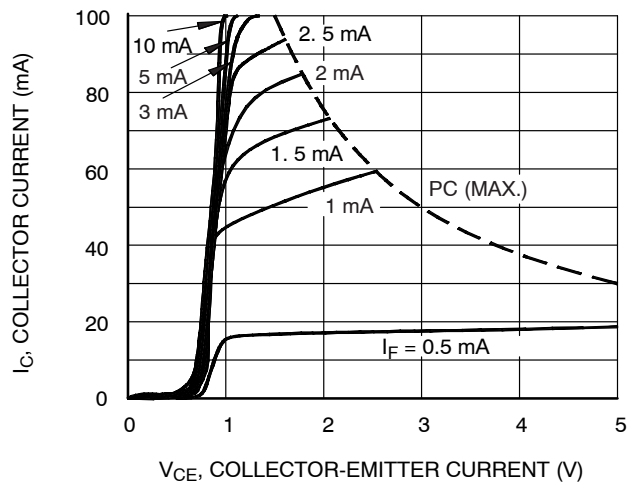


Figure 7. Collector Current vs. Collector-Emitter Voltage

TYPICAL ELECTRICAL/OPTICAL CHARACTERISTIC CURVES ( $T_A = 25\text{ }^\circ\text{C}$  unless otherwise noted) (continued)

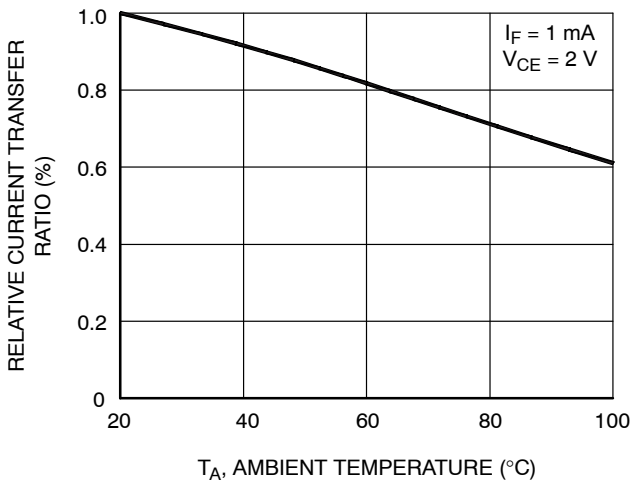


Figure 8. Relative Current Transfer Ratio vs. Ambient Temperature

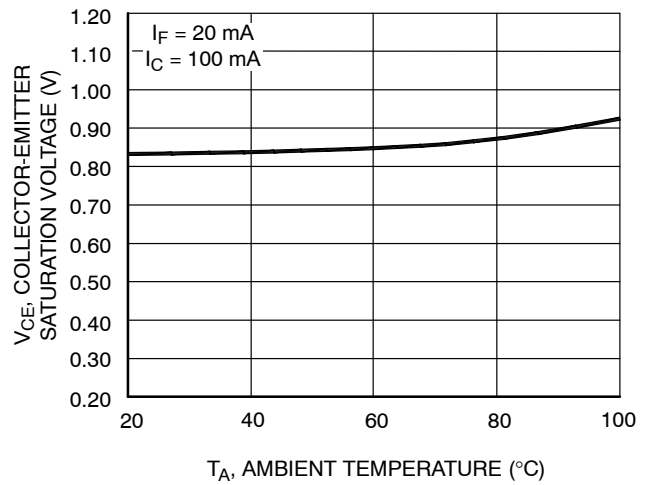


Figure 9. Collector-Emitter Saturation Voltage vs. Ambient Temperature

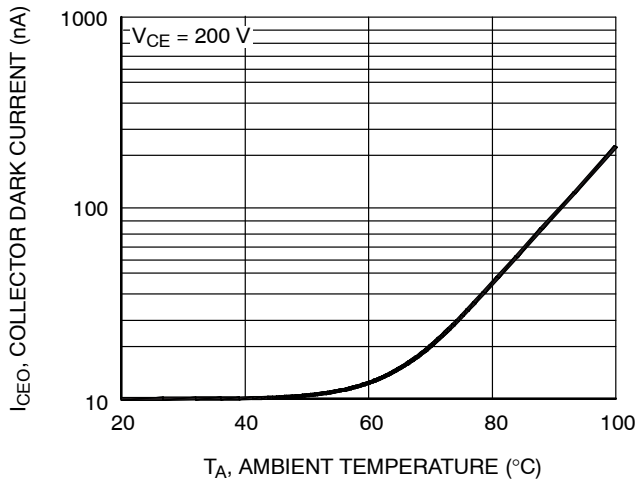


Figure 10. Collector Dark Current vs. Ambient Temperature

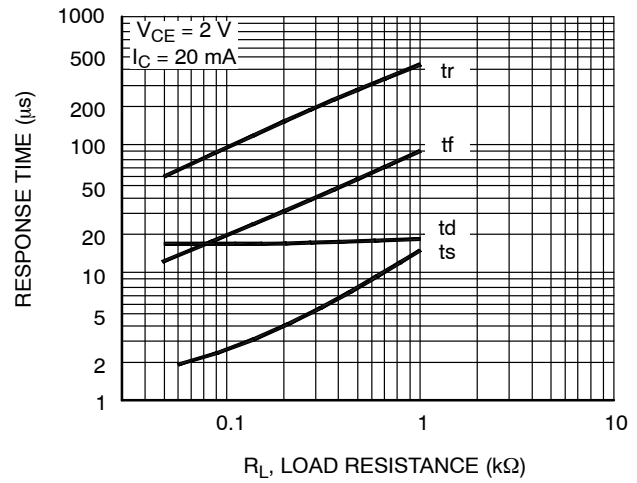


Figure 11. Response Time vs. Load Resistance

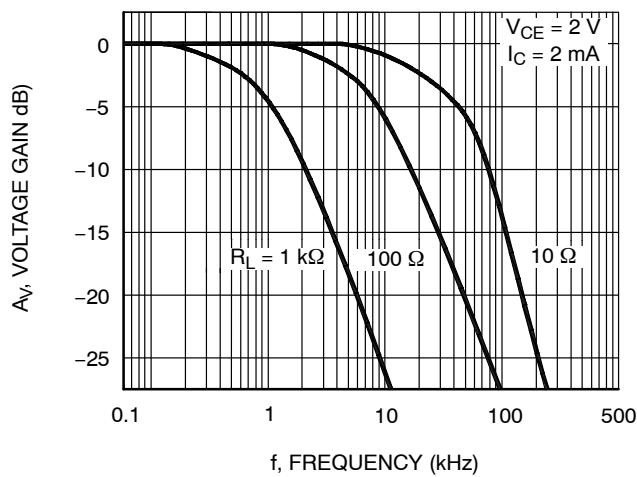


Figure 12. Frequency Response

# FOD852

## TEST CIRCUITS

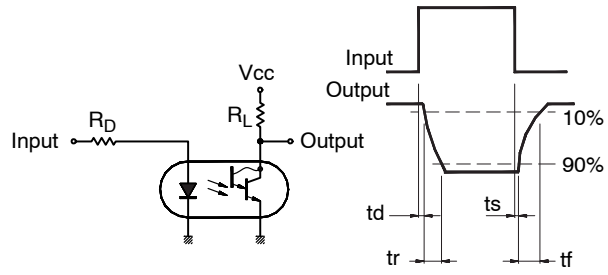


Figure 13. Test Circuit for Response Time

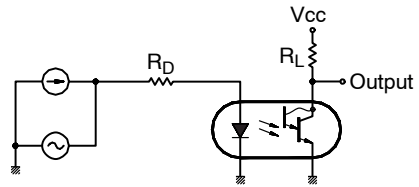
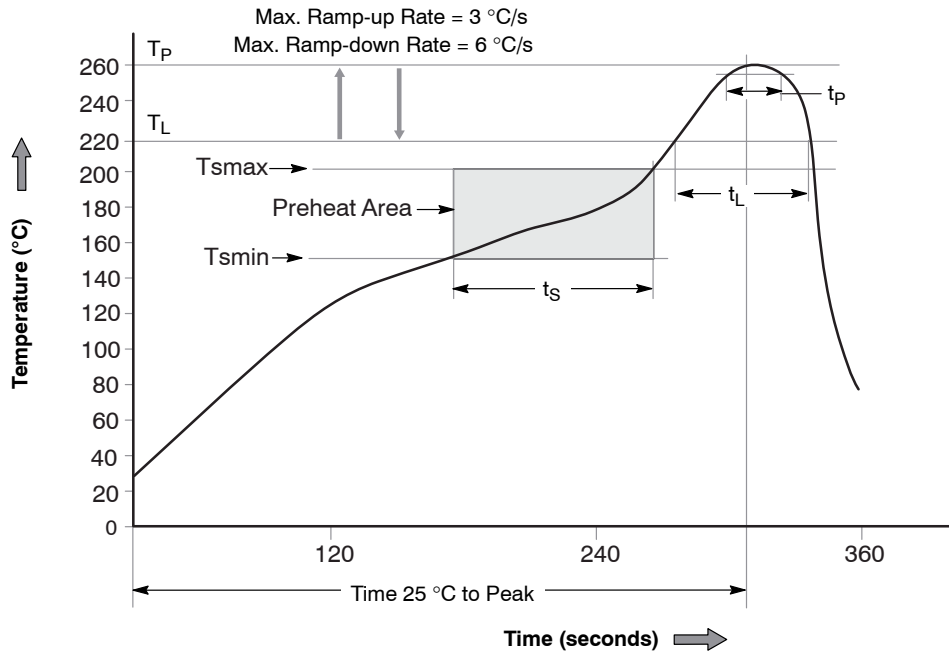


Figure 14. Test Circuit for Frequency Response

REFLOW PROFILE



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

Figure 15. Reflow Profile

# FOD852

## ORDERING INFORMATION

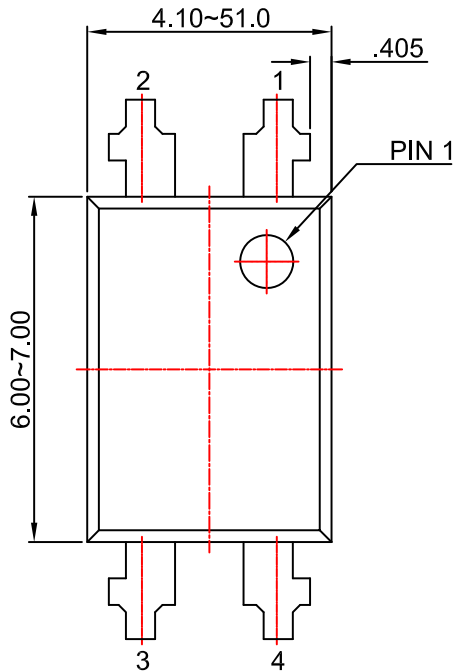
Part Number	Package Type	Shipping†
FOD852	DIP 4-Pin (Case 646CD)	2000 / Unit Box
FOD852S	SMT 4-Pin (Lead Bend) (Case 709AH)	2000 / Unit Box
FOD852SD	SMT 4-Pin (Lead Bend) (Case 709AH)	1000 / Tape & Reel
FOD852300	DIP 4-Pin, DIN EN/IEC60747-5-5 option (Case 646CD)	2000 / Unit Box
FOD8523S	SMT 4-Pin (Lead Bend), DIN EN/IEC60747-5-5 option (Case 709AH)	2000 / Unit Box
FOD8523SD	SMT 4-Pin (Lead Bend), DIN EN/IEC60747-5-5 option (Case 709AH)	1000 / Tape & Reel
FOD852300W	DIP 4-Pin, 0.4" Lead Spacing, DIN EN/IEC60747-5-5 option (Case 646CA)	2000 / Unit Box

†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](#).



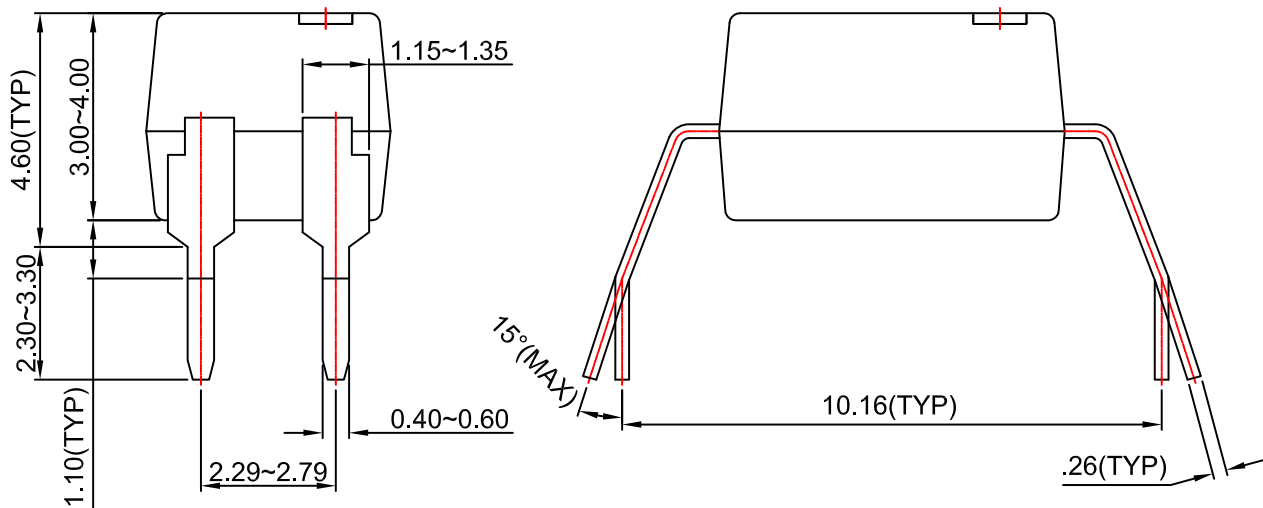
**PDIP4 4.6x6.5, 2.54P**  
CASE 646CA  
ISSUE O

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

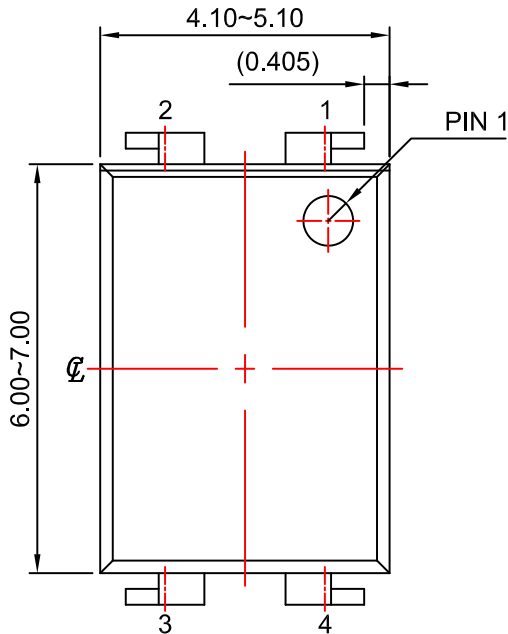


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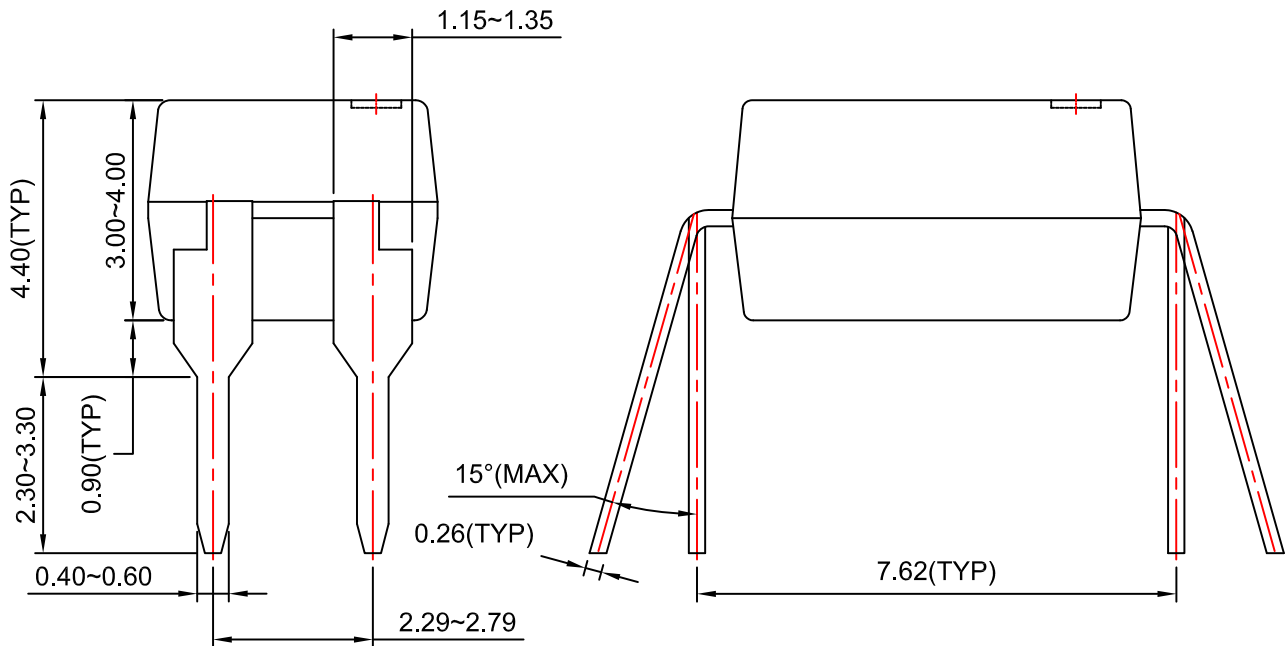
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CASE 646CD  
ISSUE O

DATE 31 JUL 2016



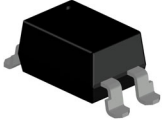
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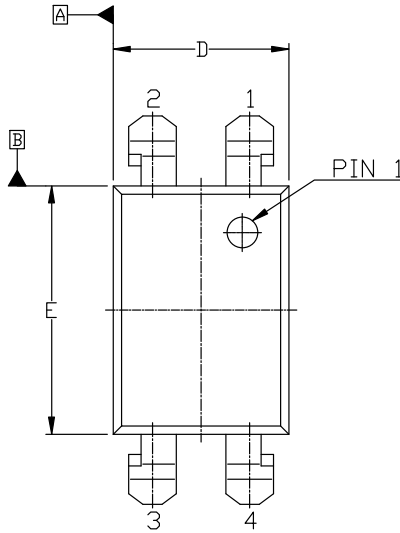
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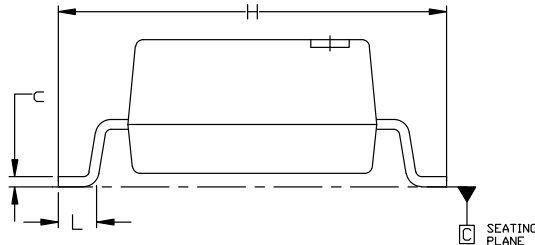


**PDIP4 4.60x6.50x3.85, 2.54P**  
**CASE 709AH**  
**ISSUE B**

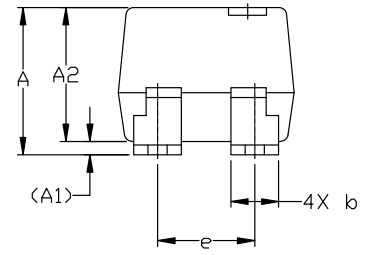
DATE 06 JUL 2023



TOP VIEW



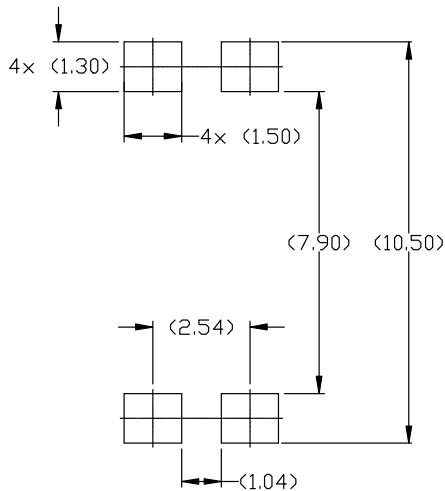
END VIEW



SIDE 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.



LAND PATTERN RECOMMENDATION

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

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

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