

# 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

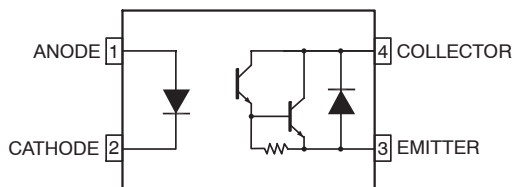
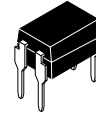
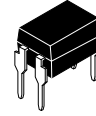


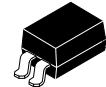
Figure 1. Schematic



PDIP4 4.6x6.5, 2.54P  
CASE 646CA

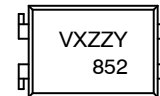


PDIP4 4.6x6.5, 2.54P  
CASE 646CD



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

**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.



**ELECTRICAL CHARACTERISTICS**(T<sub>A</sub> = 25 °C unless otherwise noted)**INDIVIDUAL COMPONENT CHARACTERISTICS**

| Symbol            | Parameter                           | Test Condition                              | Min | Typ | Max | Unit |
|-------------------|-------------------------------------|---------------------------------------------|-----|-----|-----|------|
| <b>INPUT</b>      |                                     |                                             |     |     |     |      |
| V <sub>F</sub>    | Forward Voltage                     | I <sub>F</sub> = 10 mA                      | –   | 1.2 | 1.4 | V    |
| I <sub>R</sub>    | Reverse Current                     | V <sub>R</sub> = 4 V                        | –   | –   | 10  | μA   |
| C <sub>t</sub>    | Terminal Capacitance                | V = 0, f = 1 kHz                            | –   | 30  | 250 | pF   |
| <b>OUTPUT</b>     |                                     |                                             |     |     |     |      |
| I <sub>CEO</sub>  | Collector Dark Current              | V <sub>CE</sub> = 200, I <sub>F</sub> = 0   | –   | –   | 200 | nA   |
| BV <sub>CEO</sub> | Collector-Emitter Breakdown Voltage | I <sub>C</sub> = 0.1 mA, I <sub>F</sub> = 0 | 300 | –   | –   | V    |
| BV <sub>ECO</sub> | Emitter-Collector Breakdown Voltage | I <sub>E</sub> = 10 μA, I <sub>F</sub> = 0  | 0.1 | –   | –   | V    |

**TRANSFER CHARACTERISTICS**

| Symbol               | DC Characteristics                   | Test Condition                                                               | Min   | Typ   | Max    | Unit |
|----------------------|--------------------------------------|------------------------------------------------------------------------------|-------|-------|--------|------|
| I <sub>C</sub>       | Collector Current                    | I <sub>F</sub> = 1 mA, V <sub>CE</sub> = 2 V                                 | 10    | 40    | 150    | mA   |
| CTR                  | Current Transfer Ratio (Note 2)      |                                                                              | 1,000 | 4,000 | 15,000 | %    |
| V <sub>CE(SAT)</sub> | Collector-Emitter Saturation Voltage | I <sub>F</sub> = 20 mA, I <sub>C</sub> = 100 mA                              | –     | –     | 1.2    | V    |
| f <sub>C</sub>       | Cut-Off Frequency                    | V <sub>CE</sub> = 2 V, I <sub>C</sub> = 20 mA, R <sub>L</sub> = 100 Ω, –3 dB | 1     | 7     | –      | kHz  |
| t <sub>R</sub>       | Response Time (Rise)                 | V <sub>CE</sub> = 2 V, I <sub>C</sub> = 20 mA, R <sub>L</sub> = 100 Ω        | –     | 100   | 300    | μs   |
| t <sub>F</sub>       | Response Time (Fall)                 |                                                                              | –     | 20    | 100    | μs   |

2. Current Transfer Ratio (CTR) = I<sub>C</sub> / I<sub>F</sub> x 100%.**ISOLATION CHARACTERISTICS**

| Symbol           | Characteristics                | Test Condition                                   | Min  | Typ              | Max | Unit               |
|------------------|--------------------------------|--------------------------------------------------|------|------------------|-----|--------------------|
| V <sub>ISO</sub> | Input-Output Isolation Voltage | f = 60 Hz, t = 1 minute, I <sub>I-O</sub> ≤ 2 μA | 5000 | –                | –   | VAC <sub>RMS</sub> |
| R <sub>ISO</sub> | Isolation Resistance           | V <sub>I-O</sub> = 500 V dc                      | –    | 10 <sup>12</sup> | –   | Ω                  |
| C <sub>ISO</sub> | Isolation Capacitance          | V <sub>I-O</sub> = 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.



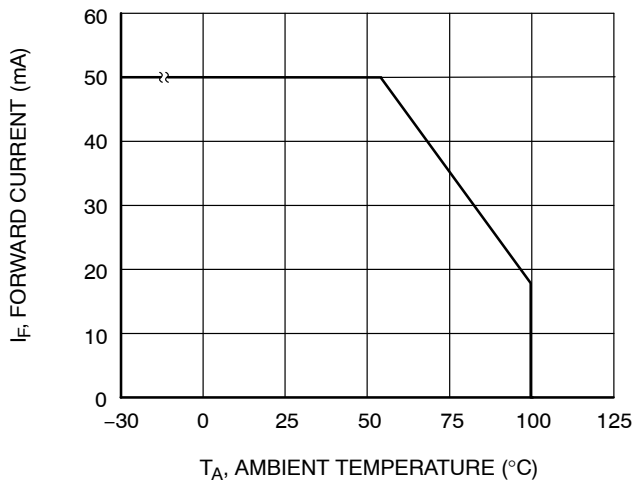
TYPICAL ELECTRICAL/OPTICAL CHARACTERISTIC CURVES ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Figure 2. Forward Current vs. Ambient Temperature

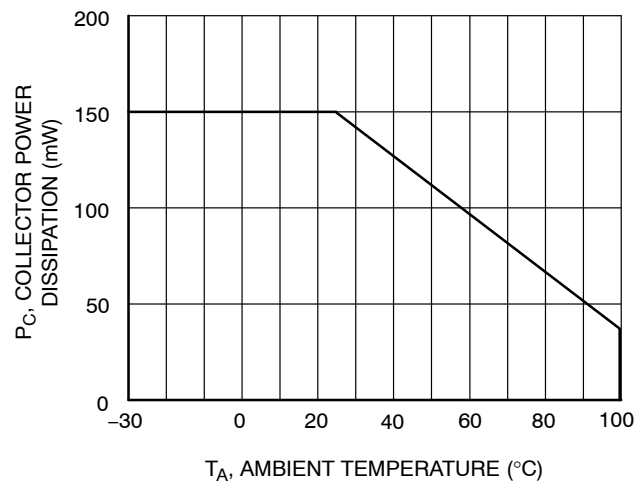


Figure 3. Collector Power Dissipation vs. Ambient Temperature

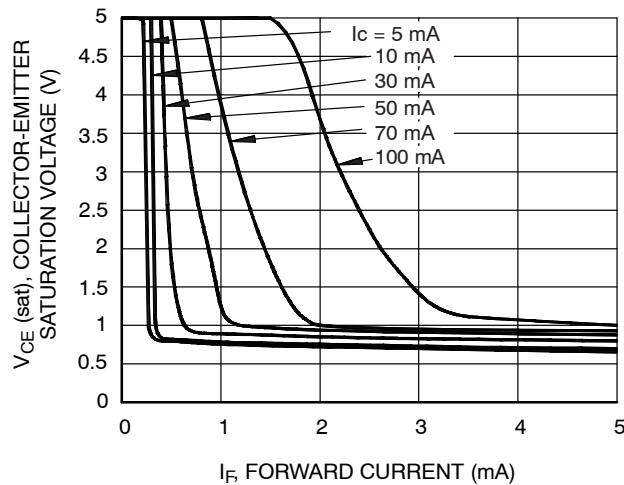


Figure 4. Collector-Emitter Saturation Voltage vs. Forward Current

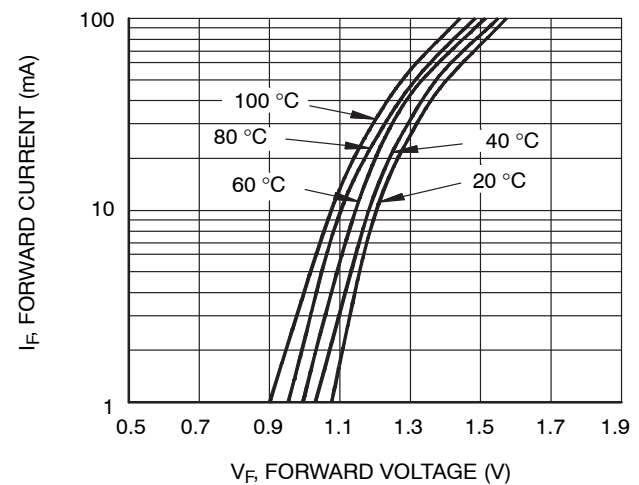


Figure 5. Forward Current vs. Forward Voltage

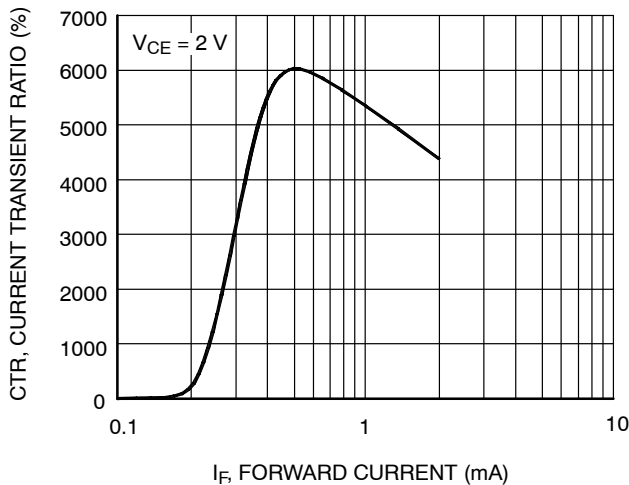


Figure 6. Current Transfer Ratio vs. Forward Current

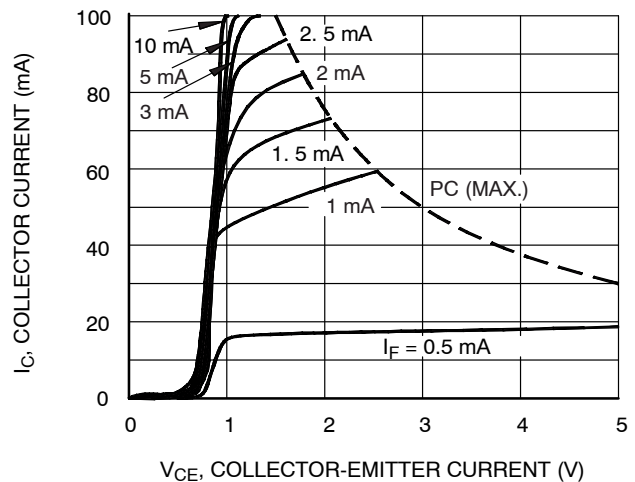
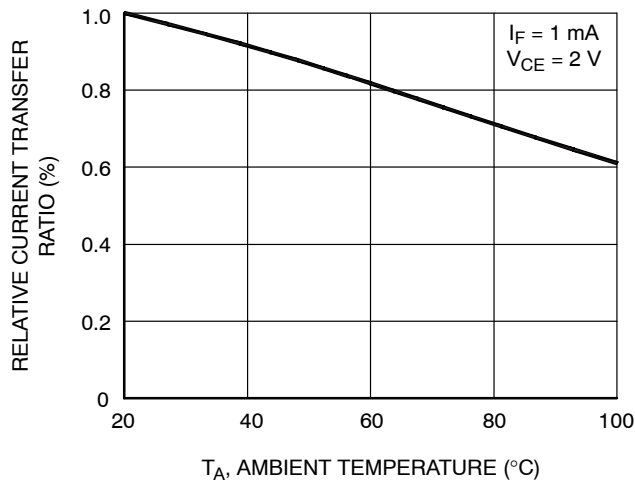
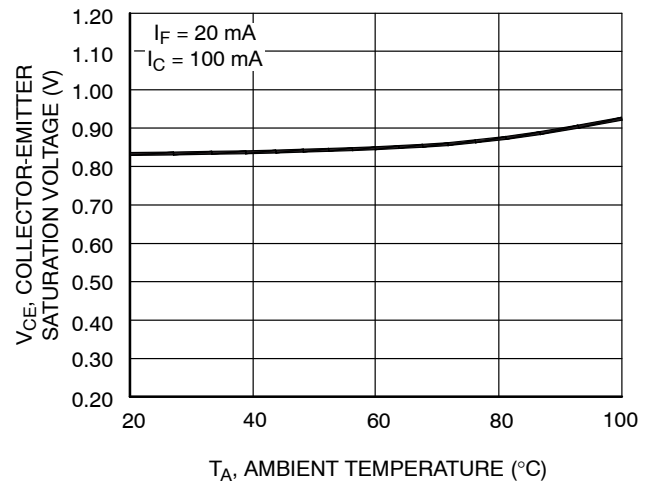


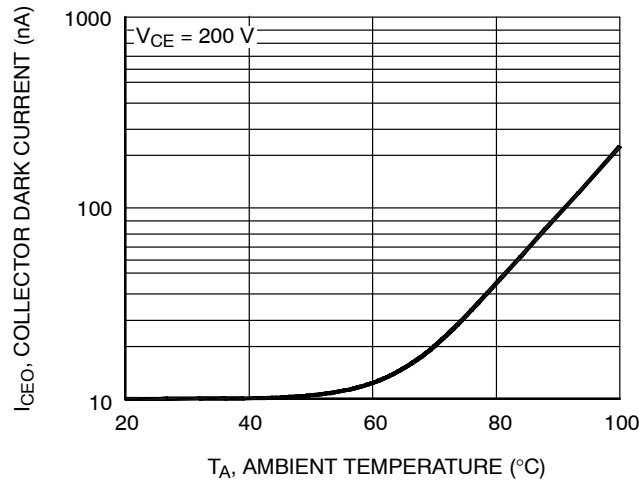
Figure 7. Collector Current vs. Collector-Emitter Voltage

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

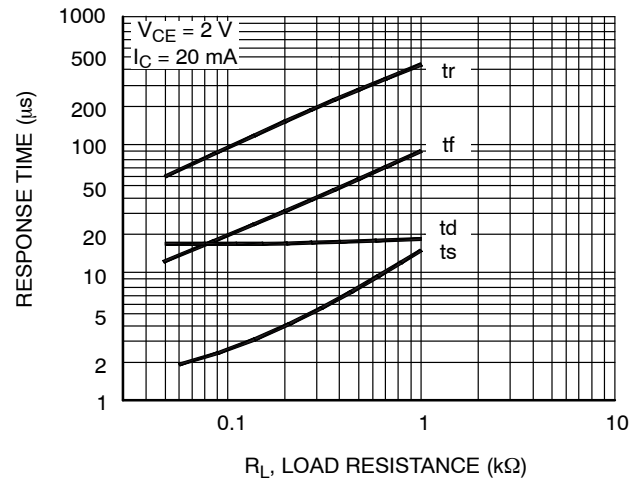
**Figure 8. Relative Current Transfer Ratio vs. Ambient Temperature**



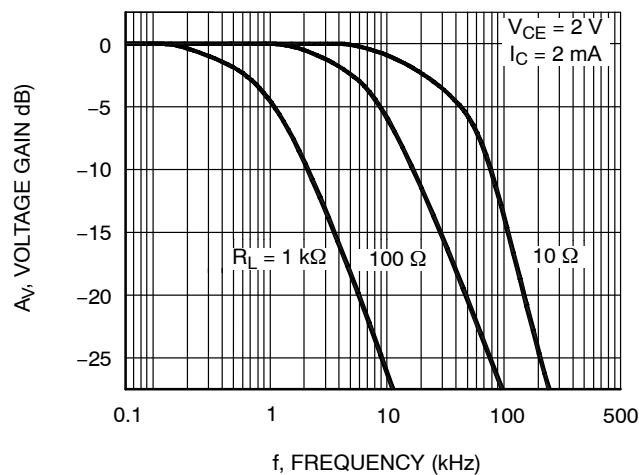
**Figure 9. Collector-Emitter Saturation Voltage vs. Ambient Temperature**



**Figure 10. Collector Dark Current vs. Ambient Temperature**



**Figure 11. Response Time vs. Load Resistance**



**Figure 12. Frequency Response**

## TEST CIRCUITS

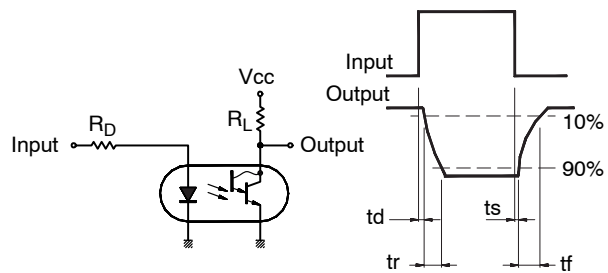


Figure 13. Test Circuit for Response Time

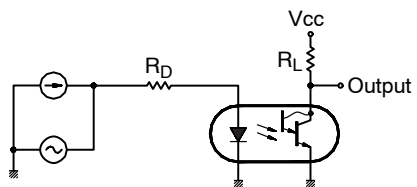
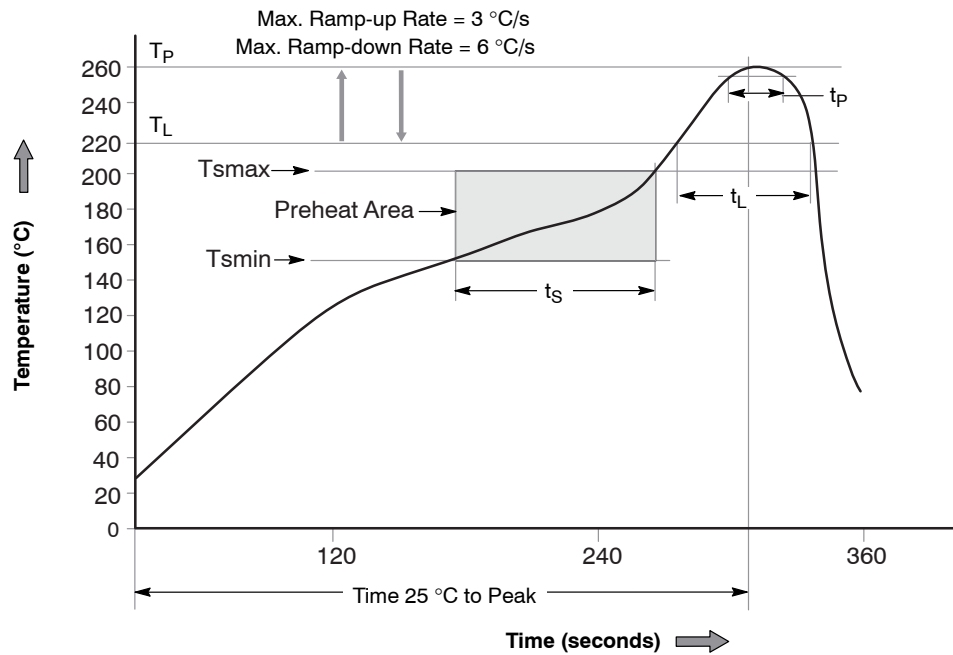


Figure 14. Test Circuit for Frequency Response

## REFLOW PROFILE



| Profile Feature                              | Pb-Free Assembly Profile |
|----------------------------------------------|--------------------------|
| Temperature Min. ( $T_{smín}$ )              | 150 °C                   |
| Temperature Max. ( $T_{smáx}$ )              | 200 °C                   |
| Time ( $t_s$ ) from $T_{smín}$ to $T_{smáx}$ | 60–120 seconds           |
| Ramp-up Rate ( $t_L$ to $t_p$ )              | 3 °C/seconds max.        |
| Liquidous Temperature ( $T_L$ )              | 217 °C                   |
| Time ( $t_L$ ) Maintained Above ( $T_L$ )    | 60–150 seconds           |
| Peak Body Package Temperature                | 260 °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 / 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    |

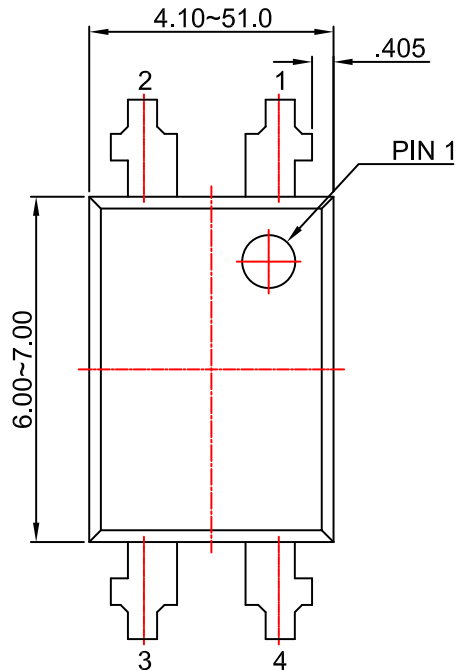
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, [BRD8011/D](#).





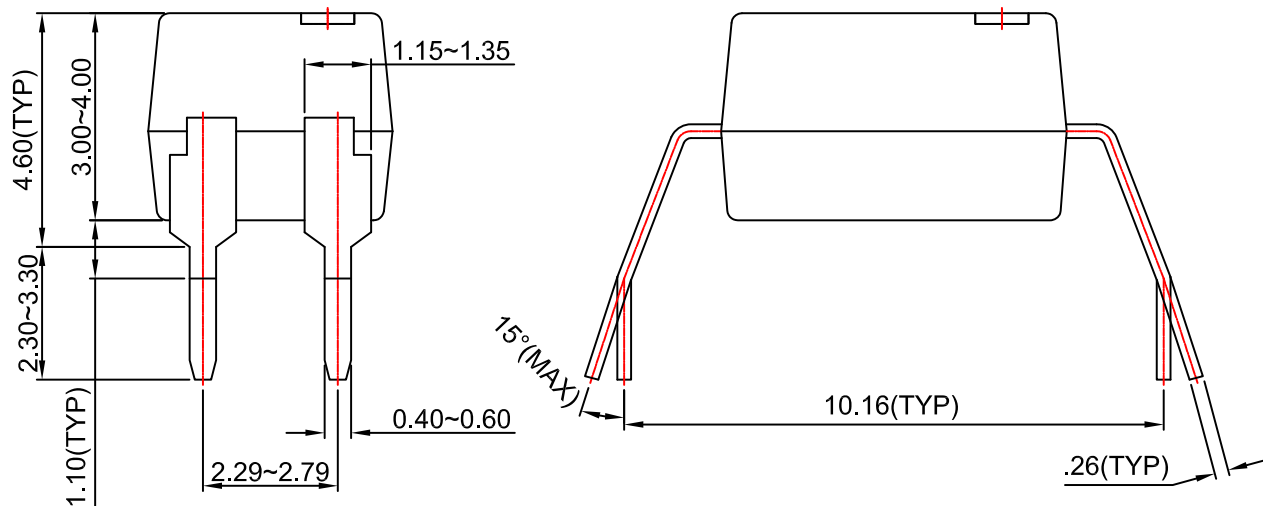
**PDIP4 4.6x6.5, 2.54P**  
CASE 646CA  
ISSUE O

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

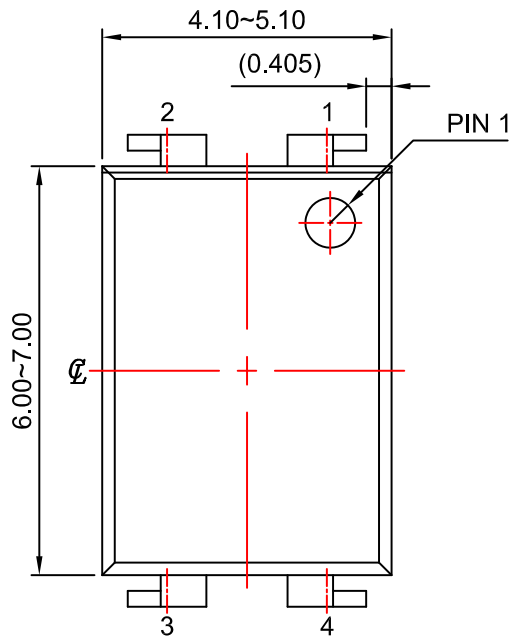


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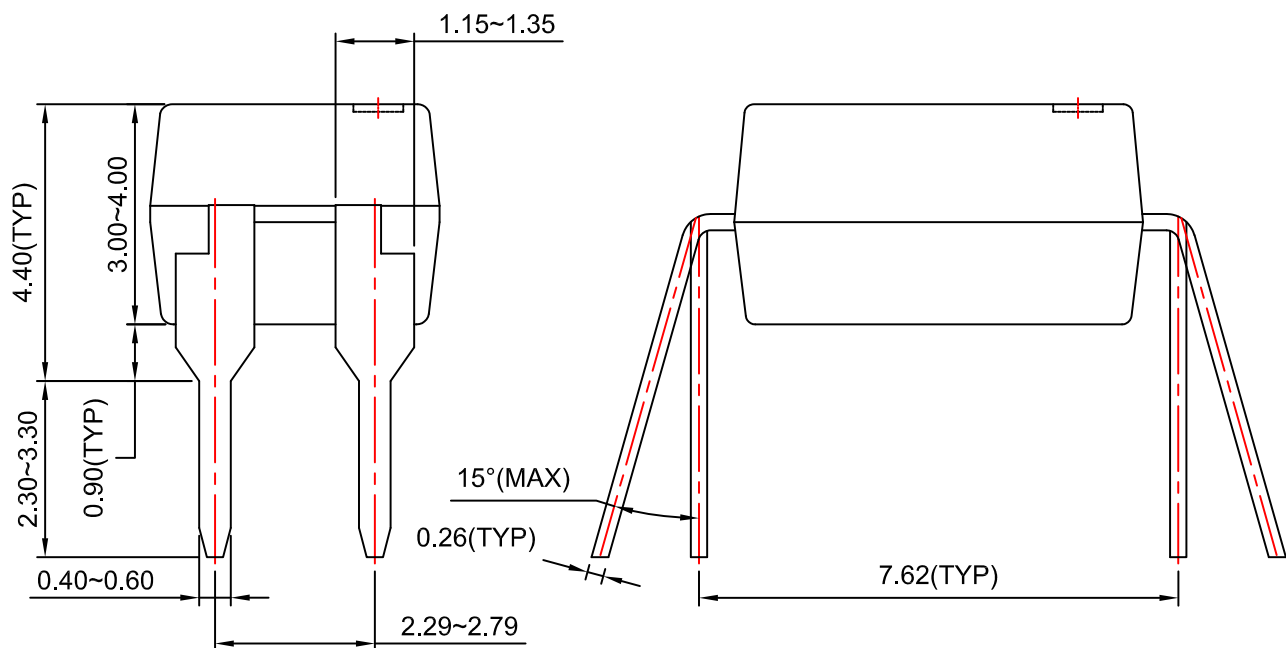
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CASE 646CD  
ISSUE O

DATE 31 JUL 2016



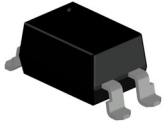
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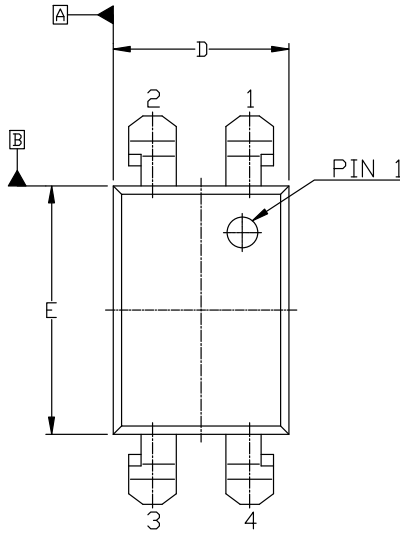
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**PDIP4 4.60x6.50x3.85, 2.54P**  
**CASE 709AH**  
**ISSUE B**

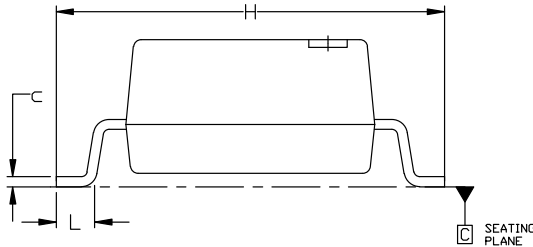
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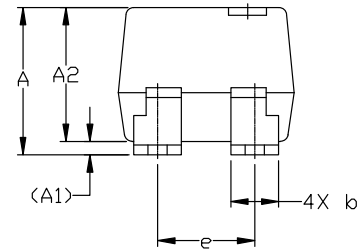
TOP VIEW

NOTES:

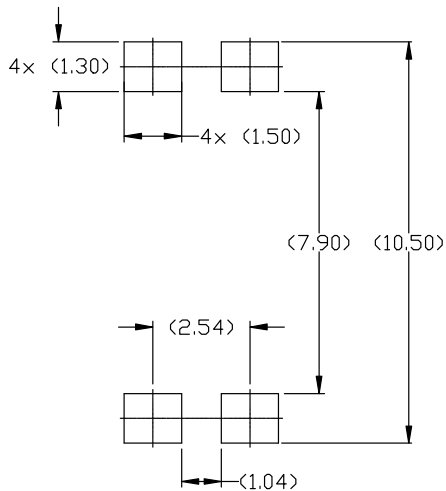
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2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSION.
4. DRAWING FILENAME AND REVISION: MKT-N04Crev2.



END VIEW



SIDE VIEW



LAND PATTERN RECOMMENDATION

| 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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