

ON Semiconductor

Is Now

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4-Pin DIP Phototransistor Optocouplers

FOD785 Series

Description

The FOD785 series is a general-purpose family of phototransistor optocoupler. It is offered in various CTR bins to meet the needs of most applications. It consists of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a compact 4-pin dual in-line package.

Features

- Wide Selection in Current Transfer Ratio (CTR):
 - FOD785: 50 – 600%
 - FOD785A: 80 – 160%
 - FOD785B: 130 – 260%
 - FOD785C: 200 – 400%
 - FOD785D: 300 – 600%
- Safety and Regulatory Approvals:
 - ◆ UL1577, 5,000 VACRMS for 1 Minute
 - ◆ DIN EN/IEC60747-5-5, 850 V Peak Working Insulation Voltage

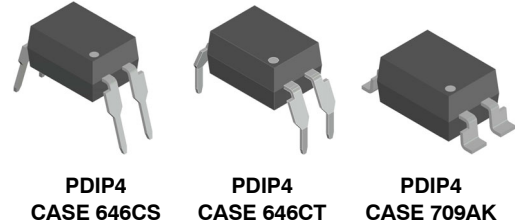
Typical Applications

- Digital Logic Inputs
- Microprocessor Inputs
- Power Supply Monitor
- Twisted Pair Line Receiver
- Telephone Line Receiver

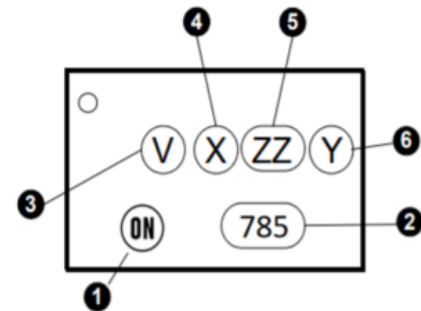


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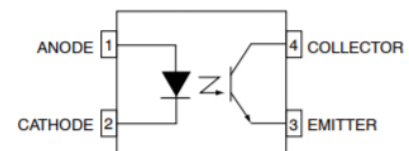


MARKING DIAGRAM



1. ON = Company Logo
2. 785 = Device Number
3. V = DIN EN/IEC60747-5-5 Option
4. X = One-Digit Year Code
5. ZZ = Two-Digit Work Week
6. Y = Assembly Package Code

PIN CONNECTIONS



ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

FOD785 Series

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.

Table 1. SAFETY AND INSULATION RATINGS

| Parameter | | Characteristics |
|---|------------------------|-----------------|
| Installation Classifications per DIN VDE 0110/1.89 Table 1, For Rated Mains Voltage | < 300 V _{RMS} | I-IV |
| | < 600 V _{RMS} | I-III |
| Climatic Classification | | 55/110/21 |
| Pollution Degree (DIN VDE 0110/1.89) | | 2 |
| Comparative Tracking Index | | 175 |

Table 2.

| Symbol | Parameter | Value | Unit |
|-----------------------|--|--------------------|-------------------|
| V _{PR} | Input-to-Output Test Voltage, Method A, V _{IORM} × 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} × 1.875 = V _{PR} , 100% Production Test with t _m = 1 s, Partial Discharge < 5 pC | 1594 | V _{peak} |
| V _{IORM} | Maximum Working Insulation Voltage | 850 | V _{peak} |
| V _{IOTM} | Highest Allowable Over-Voltage | 6000 | V _{peak} |
| | External Creepage | ≥ 7 | mm |
| | External Clearance | ≥ 7 | mm |
| | External Clearance (for Option W, 0.4" Lead Spacing) | ≥ 10 | mm |
| DTI | Distance Through Insulation (Insulation Thickness) | ≥ 0.4 | mm |
| T _S | Case Temperature (Note 1) | 175 | °C |
| I _{S,INPUT} | Input Current (Note 1) | 130 | mA |
| P _{S,OUTPUT} | Output Power (Note 1) | 265 | mW |
| R _{IO} | Insulation Resistance at T _S , V _{IO} = 500 V (Note 1) | > 10 ¹¹ | Ω |

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

Table 3. ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|----------------------|--------------------------------|--------------------|-------|
| TOTAL PACKAGE | | | |
| T _{STG} | Storage Temperature | -55 to +125 | °C |
| T _{OPR} | Operating Temperature | -55 to +110 | °C |
| T _J | Junction Temperature | -55 to +125 | °C |
| T _{SOL} | Lead Solder Temperature | 260 for 10 seconds | °C |
| P _{TOT} | Total Device Power Dissipation | 200 | mW |
| EMITTER | | | |
| I _F | Continuous Forward Current | 50 | mA |
| V _R | Reverse Voltage | 6 | V |
| P _D | Power Dissipation | 100 | mW |
| | Derate Above 100°C | 2.9 | mW/°C |

FOD785 Series

Table 3. ABSOLUTE MAXIMUM RATINGS (continued)

| Symbol | Parameter | Value | Unit |
|------------------|------------------------------|-------|-------|
| DETECTOR | | | |
| V _{CEO} | Collector–Emitter Voltage | 80 | V |
| V _{ECO} | Emitter–Collector Voltage | 6 | V |
| I _C | Continuous Collector Current | 50 | mA |
| P _C | Collector Power Dissipation | 150 | mW |
| | Derate Above 100°C | 5.8 | 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

Table 4. ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise specified)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|----------------|----------------------|------------------------|-----|-----|-----|------|
| EMITTER | | | | | | |
| V _F | Forward Voltage | I _F = 20 mA | | 1.2 | 1.4 | V |
| I _R | Reverse Current | V _R = 4.0 V | | | 10 | μA |
| C _t | Terminal Capacitance | V = 0, f = 1 kHz | | 30 | | pF |

DETECTOR

| | | | | | | |
|-------------------|-------------------------------------|--|----|--|-----|----|
| I _{CEO} | Collector Dark Current | V _{CE} = 20 V, I _F = 0 | | | 100 | nA |
| BV _{CEO} | Collector–Emitter Breakdown Voltage | I _C = 0.1 mA, I _F = 0 | 80 | | | V |
| BV _{ECO} | Emitter–Collector Breakdown Voltage | I _E = 0.01 mA, I _F = 0 | 6 | | | V |

DC TRANSFER CHARACTERISTICS

| | | | | | | |
|----------------------|---------------------------------|---|-----|--|-----|---|
| CTR (Note 2) | Current Transfer Ratio – FOD785 | I _F = 5 mA, V _{CE} = 5 V | 50 | | 600 | % |
| | – FOD785A | | 80 | | 160 | |
| | – FOD785B | | 130 | | 260 | |
| | – FOD785C | | 200 | | 400 | |
| | – FOD785D | | 300 | | 600 | |
| V _{CE(SAT)} | Saturation Voltage | I _F = 20 mA, I _C = 1 mA | | | 0.2 | V |

AC TRANSFER CHARACTERISTICS

| | | | | | | |
|-----------------|-------------------|--|--|----|----|-----|
| t _r | Rise Time | I _C = 2 mA, V _{CE} = 2 V, R _L = 100 Ω (Note 3) | | | 18 | μs |
| t _f | Fall Time | | | | 18 | μs |
| F _{CO} | Cut–Off Frequency | | | 80 | | kHz |

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. Refer to test circuit setup.

Table 5. ISOLATION CHARACTERISTICS (T_A = 25°C unless otherwise specified)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|------------------|---|---|------|----------------------|-----|----------------------|
| V _{ISO} | Input–Output Isolation Voltage (Note 4) | f = 60 Hz, t = 1 minutes, I _{I-O} ≤ 2 μA | 5000 | | | V _{AC(RMS)} |
| R _{ISO} | Isolation Resistance | V _{I-O} = 500 V _{DC} | | 1 x 10 ¹¹ | | Ω |
| C _{ISO} | Isolation Capacitance | V _{I-O} = 0, f = 1 MHz | | 0.6 | 1.0 | pf |

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

FOD785 Series

TYPICAL CHARACTERISTICS

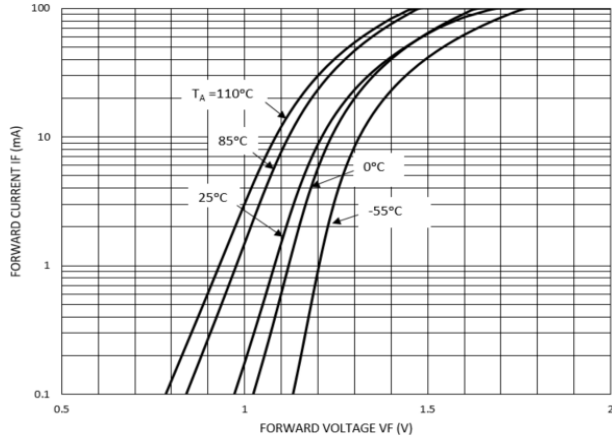


Figure 1. Forward Current vs. Forward Voltage

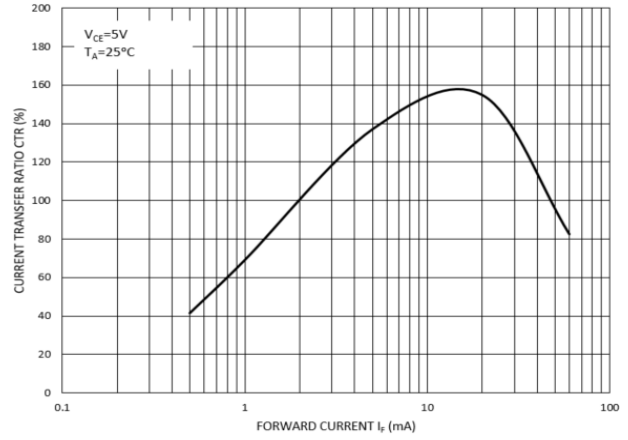


Figure 2. Current Transfer Ratio vs. Forward Current

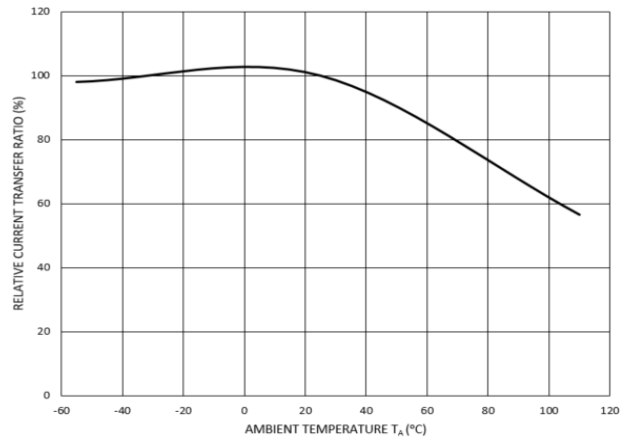


Figure 3. Relative Current Transfer Ratio vs. Ambient Temperature

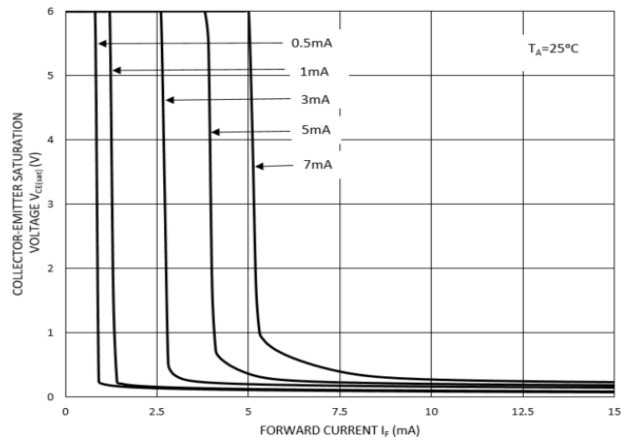


Figure 4. Collector-Emitter Saturation Voltage vs. Forward Current

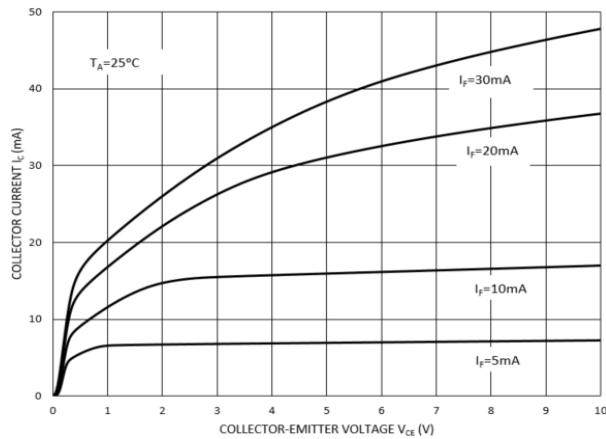


Figure 5. Collector Current vs. Collector-Emitter Voltage

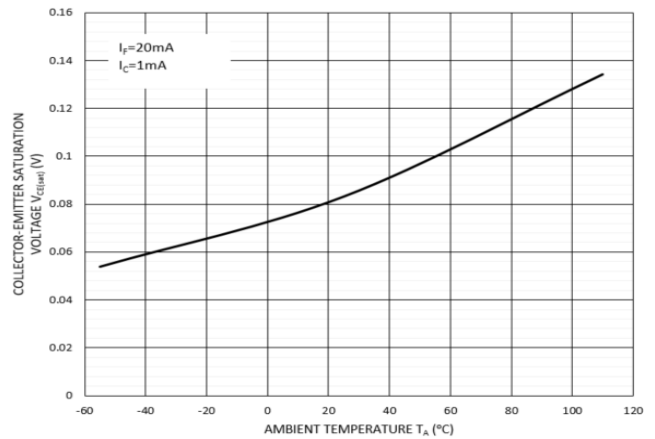


Figure 6. Collector-Emitter Saturation Voltage vs. Ambient Temperature

FOD785 Series

TYPICAL CHARACTERISTICS

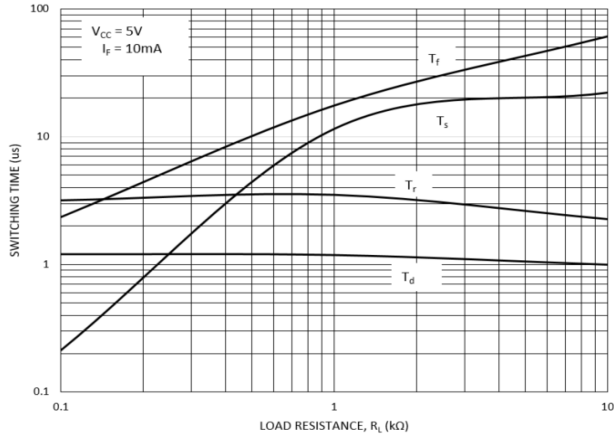


Figure 7. Switching Time vs. Load Resistance

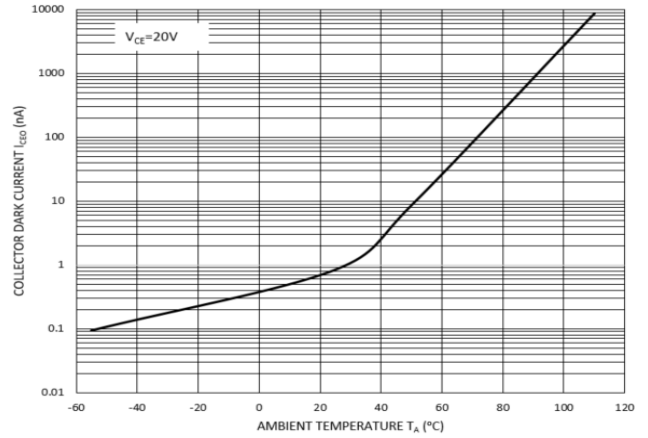


Figure 8. Switching Time vs. Ambient Temperature

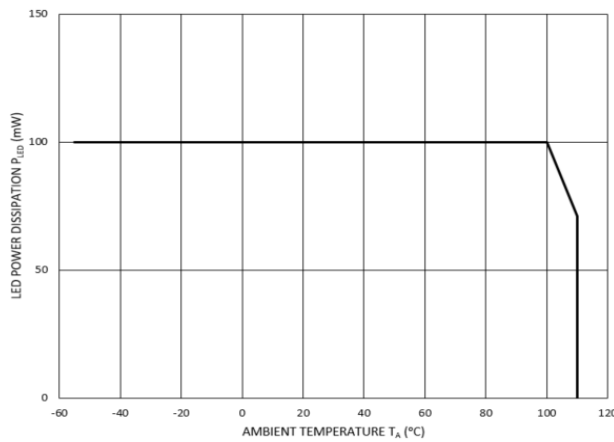


Figure 9. Max Allowable Power Dissipation (LED) vs. Ambient Temperature

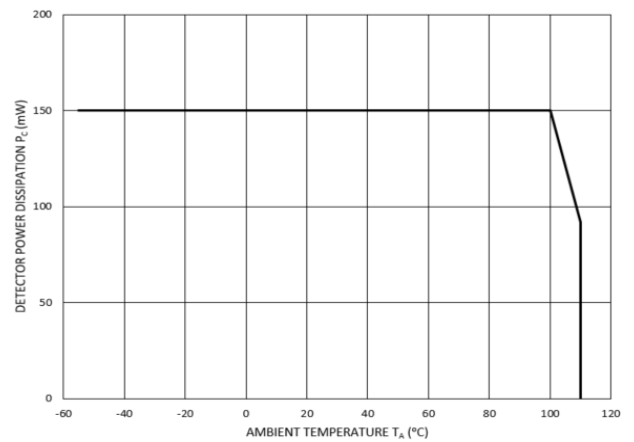


Figure 10. Max Allowable Power Dissipation (Detector) vs. Ambient Temperature

Test Circuit

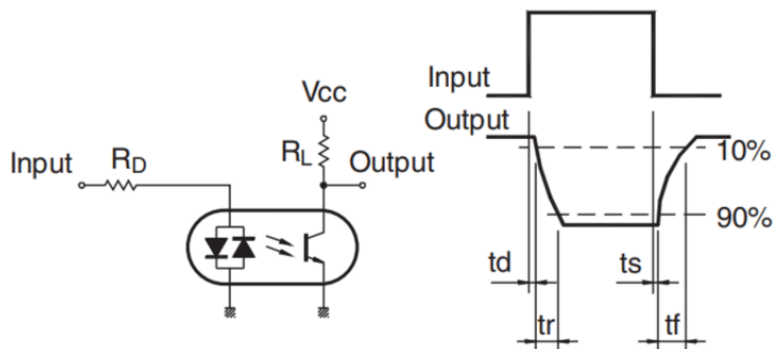


Figure 11. Test Circuit

FOD785 Series

Reflow Profile

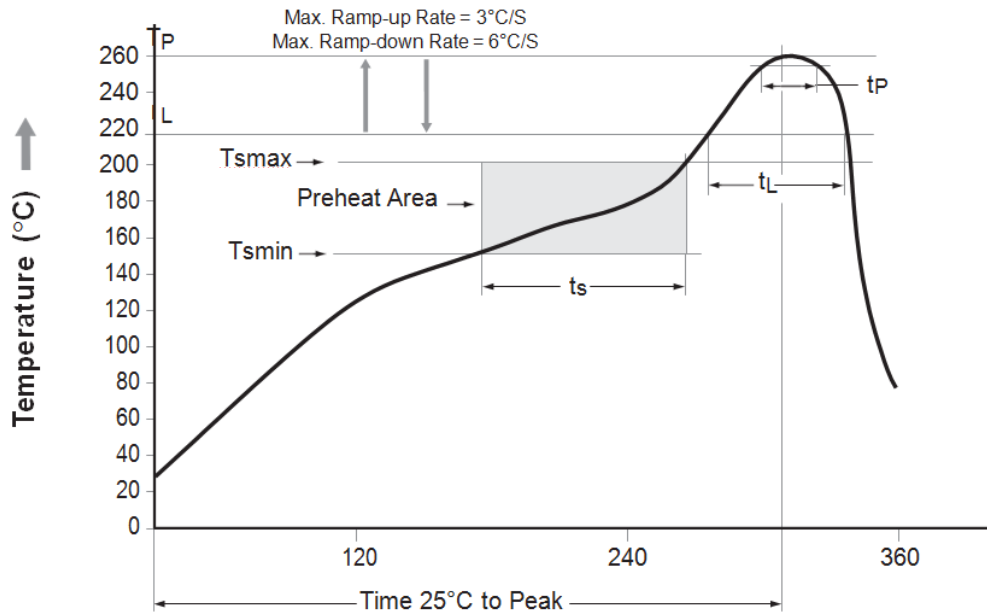


Figure 12. Reflow Profile

Table 6.

| Profile Feature | Pb-Free Assembly Profile |
|---|--------------------------|
| Temperature Min. (T _{min}) | 150°C |
| Temperature Max. (T _{max}) | 200°C |
| Time (t _s) from (T _{min} to T _{max}) | 60–120 seconds |
| Ramp-up Rate (t _L to t _p) | 3°C/second 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 / second max. |
| Time 25°C to Peak Temperature | 8 minutes max. |

Table 7. ORDERING INFORMATION

| Part Number | Package | Packing Method [†] |
|-------------|--|--------------------------------------|
| FOD785 | DIP 4-Pin | Tube (100 units per tube) |
| FOD785S | SMT 4-Pin (Lead Bend) | Tube (100 units per tube) |
| FOD785SD | SMT 4-Pin (Lead Bend) | Tape and Reel (1,500 units per reel) |
| FOD785300 | DIP 4-Pin, DIN EN/IEC60747-5-5 option | Tube (100 units per tube) |
| FOD7853S | SMT 4-Pin (Lead Bend), DIN EN/IEC60747-5-5 option | Tube (100 units per tube) |
| FOD7853SD | SMT 4-Pin (Lead Bend), DIN EN/IEC60747-5-5 option | Tape and Reel (1,500 units per reel) |
| FOD785300W | 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 Specification Brochure, BRD8011/D.

NOTE: The product orderable part number system listed in this table also applies to the FOD785A, FOD785B, FOD785C, and FOD785D products.

FOD785 Series

PACKAGE DIMENSIONS

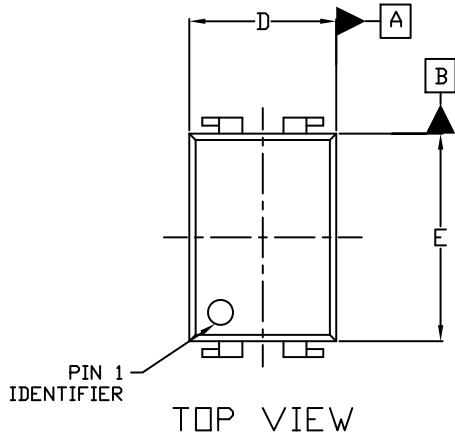
PDIP4 6.50mm (STANDARD LEAD FORM)

CASE 646CS

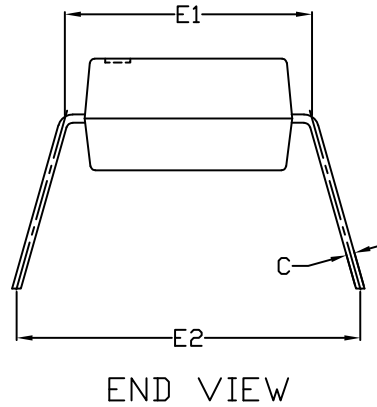
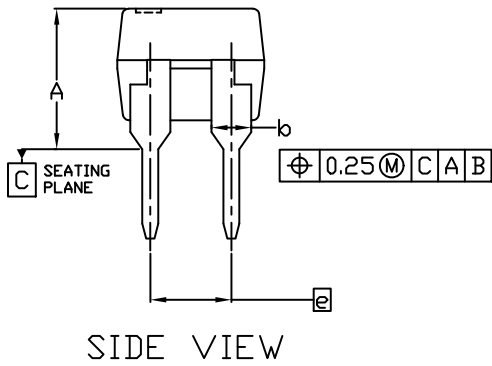
ISSUE O

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.



| DIM | MILLIMETERS | | |
|-----|-------------|------|------|
| | MIN. | NOM. | MAX. |
| A | 4.20 | 4.50 | 4.80 |
| b | 1.35 | 1.45 | 1.55 |
| c | 0.25 REF | | |
| D | 4.28 | 4.58 | 4.88 |
| E | 6.20 | 6.50 | 6.80 |
| E1 | 7.62 REF | | |
| E2 | 7.62 | --- | 9.50 |
| e | 2.54 BSC | | |



FOD785 Series

PACKAGE DIMENSIONS

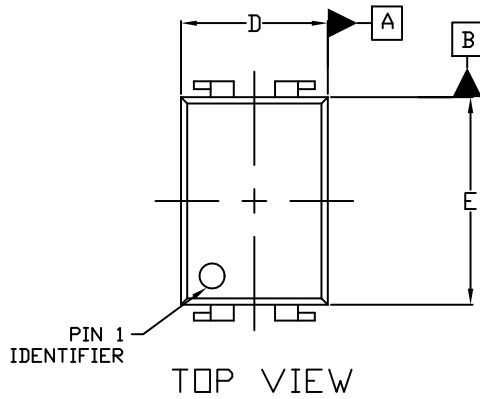
PDIP4 6.50mm (M LEAD FORM)

CASE 646CT

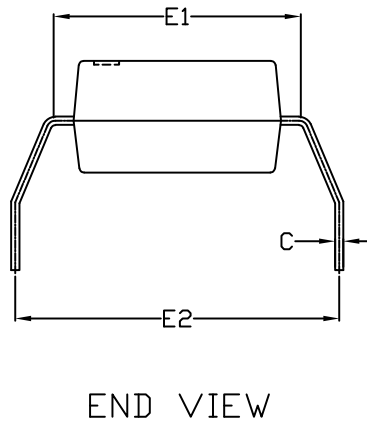
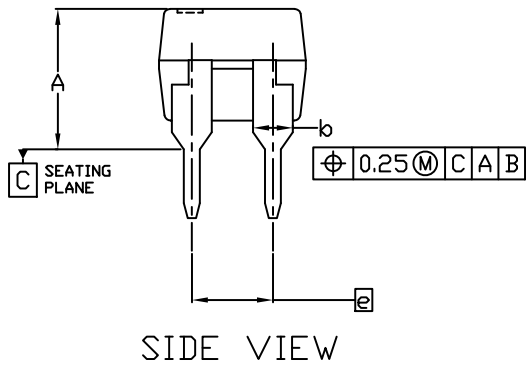
ISSUE O

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1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.



| DIM | MILLIMETERS | | |
|-----|-------------|------|------|
| | MIN. | NOM. | MAX. |
| A | 4.20 | 4.50 | 4.80 |
| b | 1.35 | 1.45 | 1.55 |
| c | 0.25 REF | | |
| D | 6.20 | 6.50 | 6.80 |
| D1 | 7.62 REF | | |
| D2 | 10.16 REF | | |
| E | 4.28 | 4.58 | 4.88 |
| e | 2.54 BSC | | |



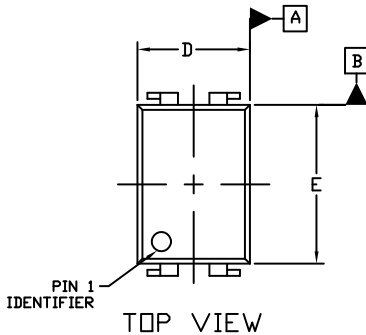
FOD785 Series

PACKAGE DIMENSIONS

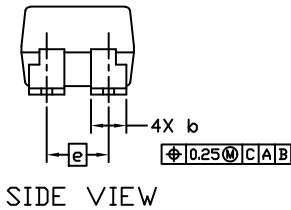
PDIP4 6.50mm (GULL WING) CASE 709AK ISSUE O

NOTES:

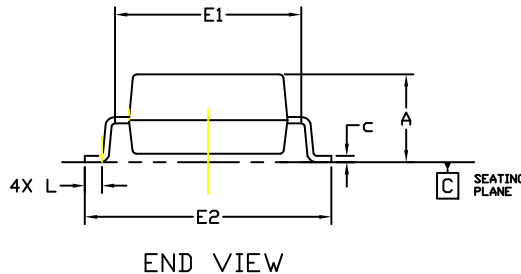
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
4. FOOT LENGTH, DIMENSION L, IS MEASURED AS THE FLAT PORTION OF THE LEAD FOOT.



TOP VIEW

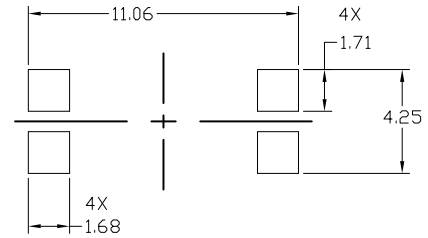


SIDE VIEW



END VIEW

| DIM | MILLIMETERS | | |
|-----|-------------|------|-------|
| | MIN. | NOM. | MAX. |
| A | 3.30 | 3.60 | 3.90 |
| b | 1.35 | 1.45 | 1.55 |
| c | 0.25 REF | | |
| D | 4.28 | 4.58 | 4.88 |
| E | 6.20 | 6.50 | 6.80 |
| E1 | 7.62 REF | | |
| E2 | --- | --- | 10.30 |
| e | 2.54 BSC | | |
| L | 0.60 | --- | --- |



RECOMMENDED MOUNTING FOOTPRINT*

- * 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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