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4-Pin DIP Phototransistor Optocouplers

FOD785 Series

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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

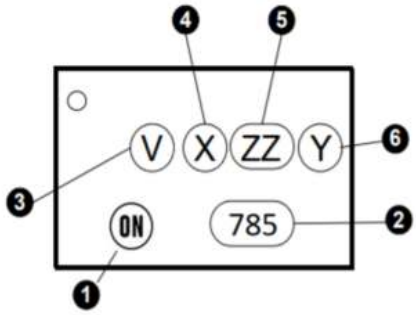
- Digital Logic Inputs
- Microprocessor Inputs
- Power Supply Monitor
- Twisted Pair Line Receiver
- Telephone Line Receiver

PDIP4
CASE 646CS

PDIP4
CASE 646CT

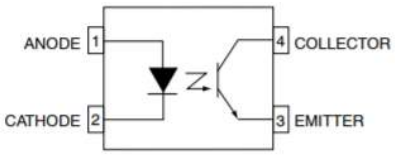
PDIP4
CASE 709AK

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.

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} 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_{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

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, $I_{I-O} \le 2$ μA	5000			VAC_{RMS}
R_{ISO}	Isolation Resistance	V_{I-O} = 500 V_{DC}		1×10^{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.

TYPICAL CHARACTERISTICS

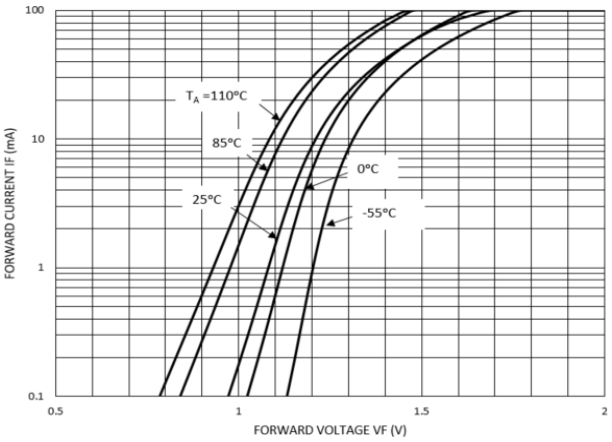


Figure 1. Forward Current vs. Forward Voltage

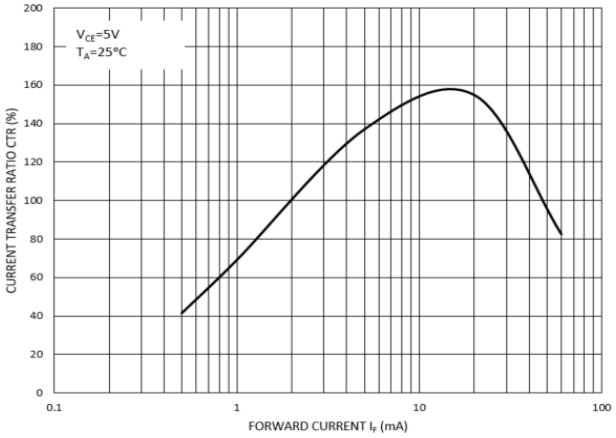


Figure 2. Current Transfer Ratio vs. Forward Current

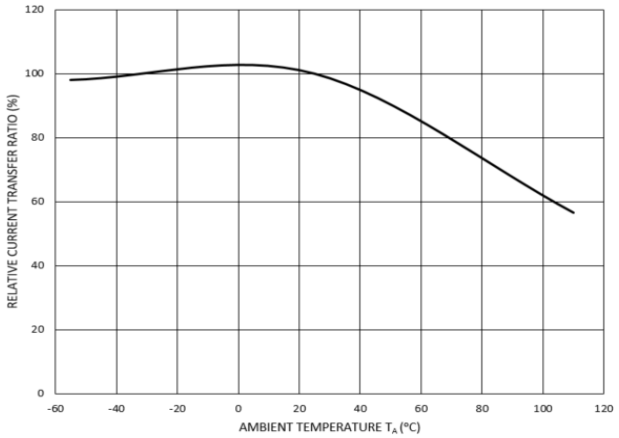


Figure 3. Relative Current Transfer Ratio vs. Ambient Temperature

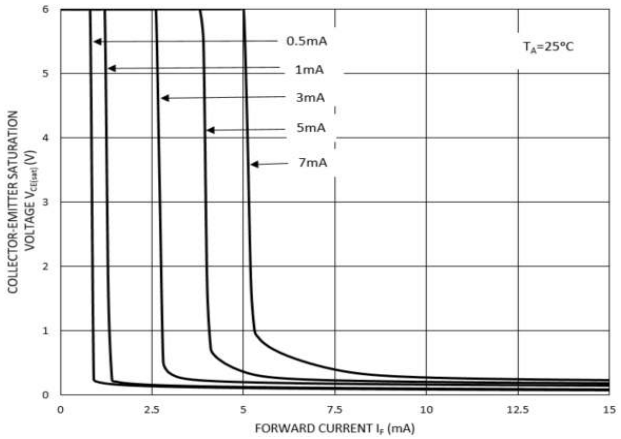


Figure 4. Collector−Emitter Saturation Voltage vs. Forward Current

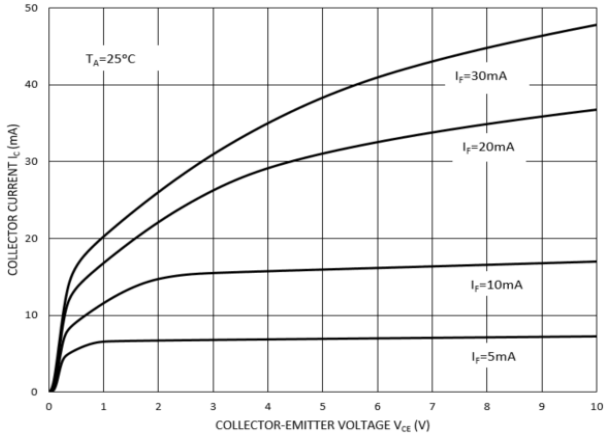


Figure 5. Collector Current vs. Collector−Emitter Voltage

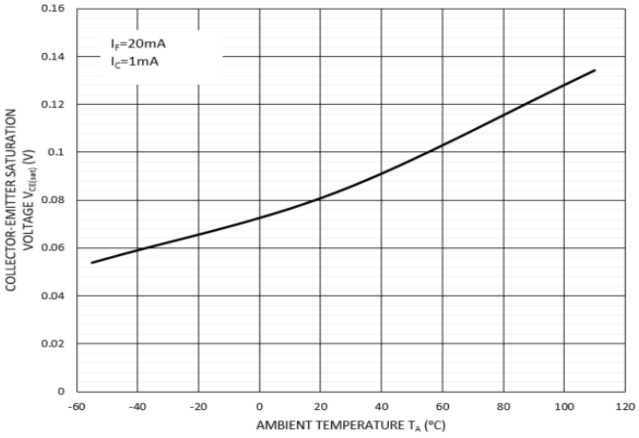


Figure 6. Collector−Emitter Saturation Voltage vs. Ambient Temperature

TYPICAL CHARACTERISTICS

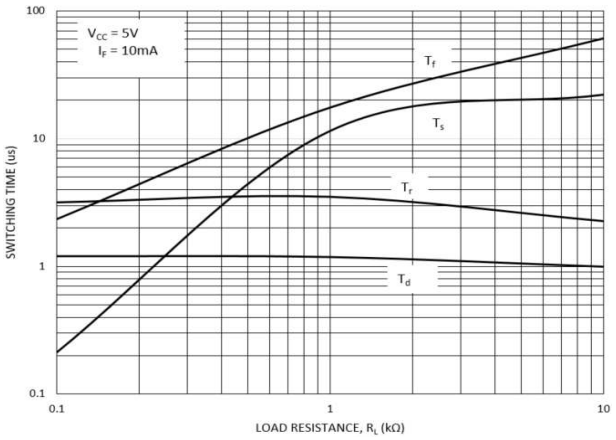


Figure 7. Switching Time vs. Load Resistance

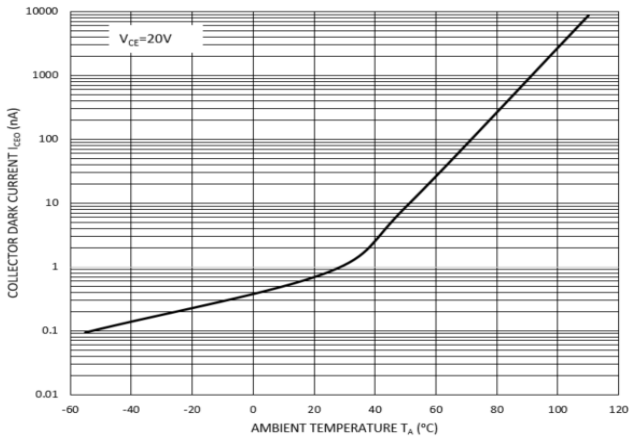


Figure 8. Switching Time vs. Load Resistance

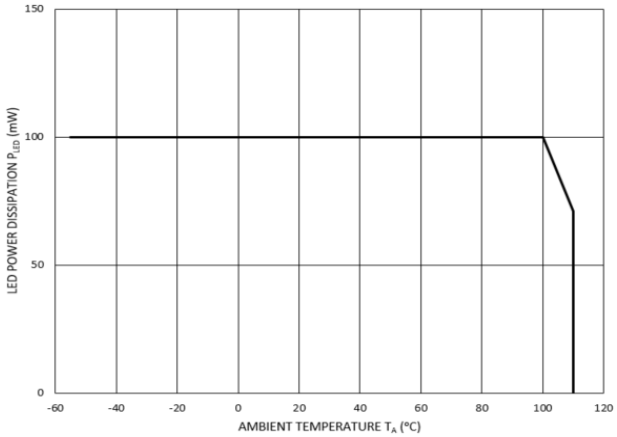


Figure 9. Max Allowable Power Dissipation (LED) vs. Ambient Temperature

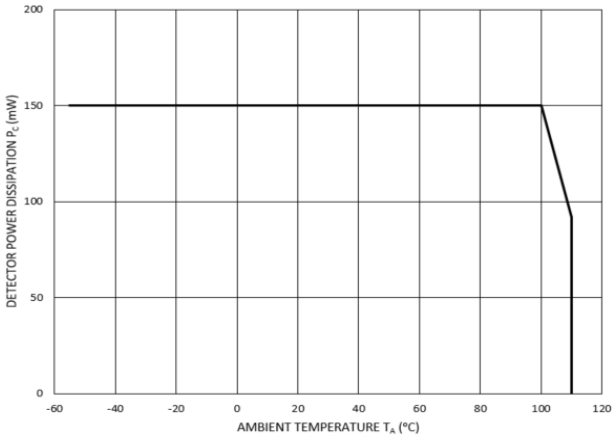


Figure 10. Max Allowable Power Dissipation (Detector) vs. Ambient Temperature

Test Circuit

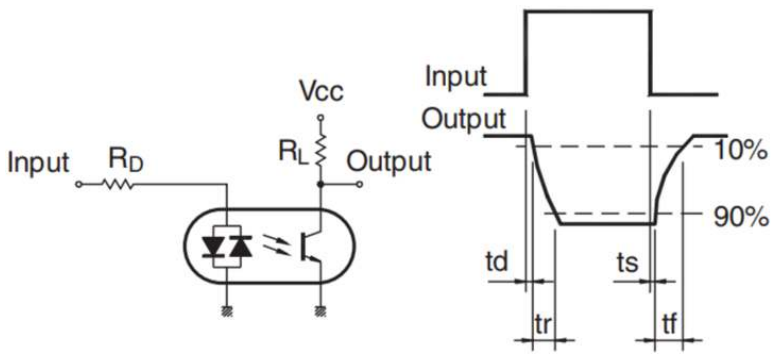


Figure 11. Test Circuit

Reflow Profile

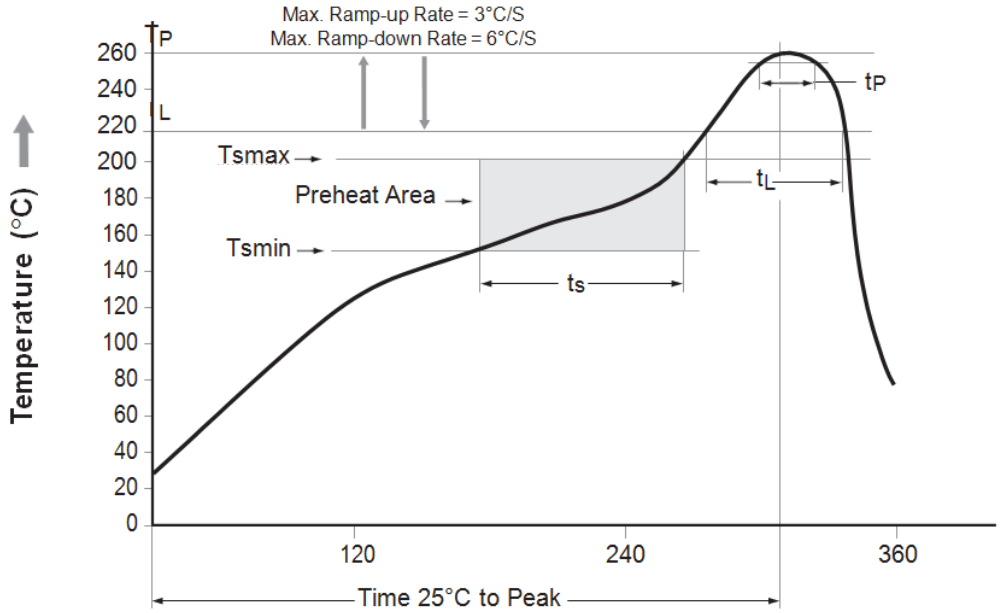


Figure 12. Reflow Profile

Table 6.

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 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.

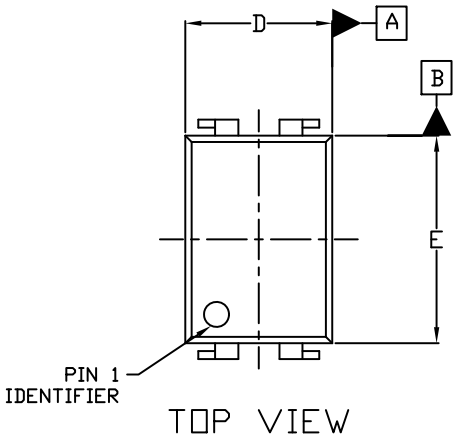
PACKAGE DIMENSIONS

PDIP4 6.50mm (STANDARD LEAD FORM)
CASE 646CS
ISSUE O

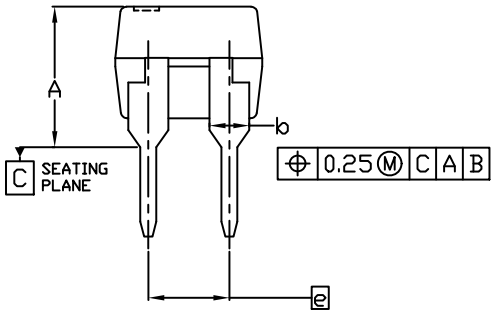
NOTES:

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.

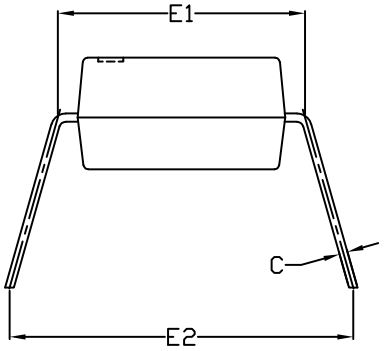
DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	4.20	4.50	4.80
b	1.35	1.45	1.55
c		0.25 REF	
D	4.28	4.58	4.88
E	6.20	6.50	6.80
E1		7.62 REF	
E2	7.62	---	9.50
e		2.54 BSC	



TOP VIEW



SIDE VIEW



END VIEW

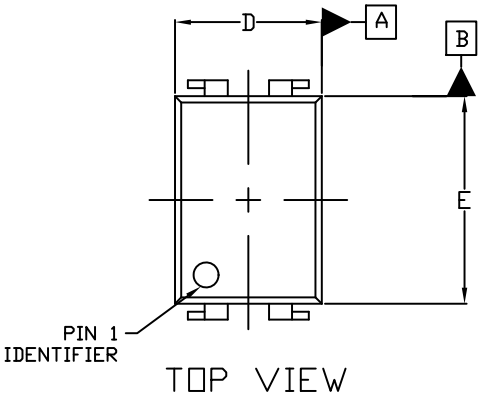
PACKAGE DIMENSIONS

PDIP4 6.50mm (M LEAD FORM)
CASE 646CT
ISSUE O

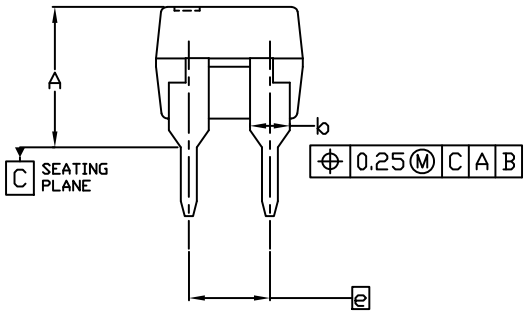
NOTES:

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.

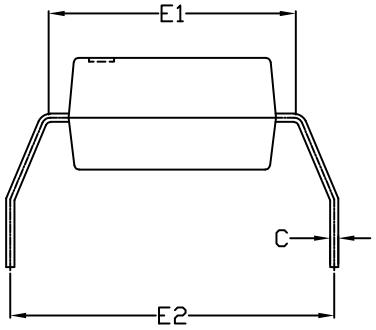
DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	4.20	4.50	4.80
b	1.35	1.45	1.55
c	0.25 REF		
D	6.20	6.50	6.80
D1	7.62 REF		
D2	10.16 REF		
E	4.28	4.58	4.88
e	2.54 BSC		



TOP VIEW



SIDE VIEW

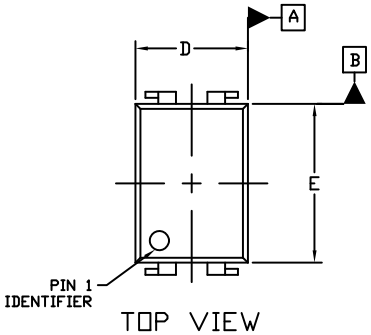


END VIEW

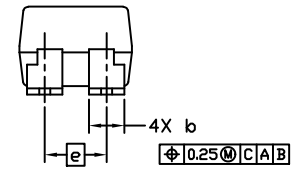
FOD785 Series

PACKAGE DIMENSIONS

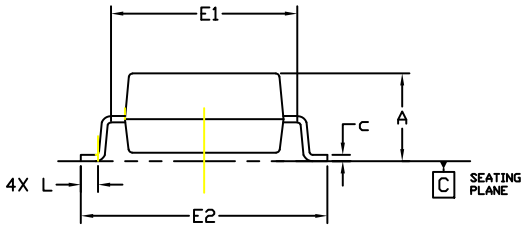
PDIP4 6.50mm (GULL WING)
CASE 709AK
ISSUE O



TOP VIEW



SIDE VIEW

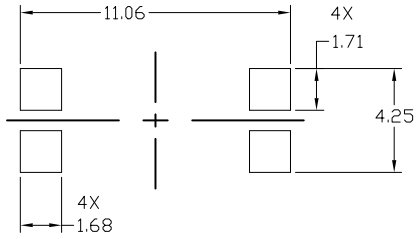


END VIEW

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.

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, SOLDERRM/D.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
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Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:
Phone: 00421 33 790 2910
For additional information, please contact your local Sales Representative

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