

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

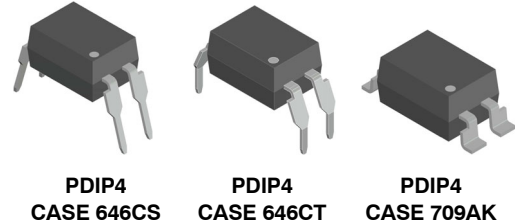
Typical Applications

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

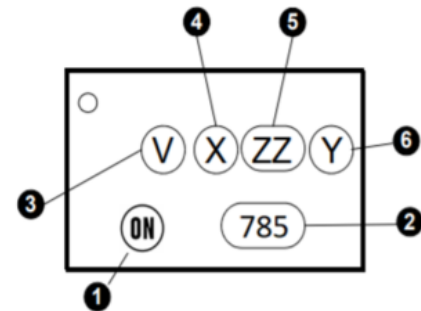


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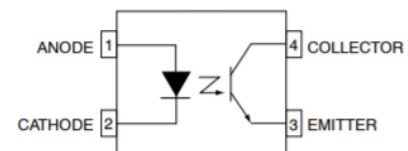


MARKING DIAGRAM



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.

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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

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
EMITTER						
V_F	Forward Voltage	$I_F = 20\text{ mA}$		1.2	1.4	V
I_R	Reverse Current	$V_R = 4.0\text{ V}$			10	μA
C_t	Terminal Capacitance	$V = 0, f = 1\text{ kHz}$		30		pF

DETECTOR

I_{CEO}	Collector Dark Current	$V_{CE} = 20\text{ V}, I_F = 0$			100	nA
BV_{CEO}	Collector–Emitter Breakdown Voltage	$I_C = 0.1\text{ mA}, I_F = 0$	80			V
BV_{ECO}	Emitter–Collector Breakdown Voltage	$I_E = 0.01\text{ mA}, I_F = 0$	6			V

DC TRANSFER CHARACTERISTICS

CTR (Note 2)	Current Transfer Ratio – FOD785	$I_F = 5\text{ mA}, V_{CE} = 5\text{ V}$	50		600	%
	– FOD785A		80		160	
	– FOD785B		130		260	
	– FOD785C		200		400	
	– FOD785D		300		600	
$V_{CE(SAT)}$	Saturation Voltage	$I_F = 20\text{ mA}, I_C = 1\text{ mA}$			0.2	V

AC TRANSFER CHARACTERISTICS

t_r	Rise Time	$I_C = 2\text{ mA}, V_{CE} = 2\text{ V}, R_L = 100\ \Omega$ (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) = $I_C / I_F \times 100\%$.

3. Refer to test circuit setup.

Table 5. ISOLATION CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{ISO}	Input–Output Isolation Voltage (Note 4)	$f = 60\text{ Hz}, t = 1\text{ minutes}, I_{I-O} \leq 2\ \mu\text{A}$	5000			$V_{AC_{RMS}}$
R_{ISO}	Isolation Resistance	$V_{I-O} = 500\text{ V}_{DC}$		1×10^{11}		Ω
C_{ISO}	Isolation Capacitance	$V_{I-O} = 0, f = 1\text{ MHz}$		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

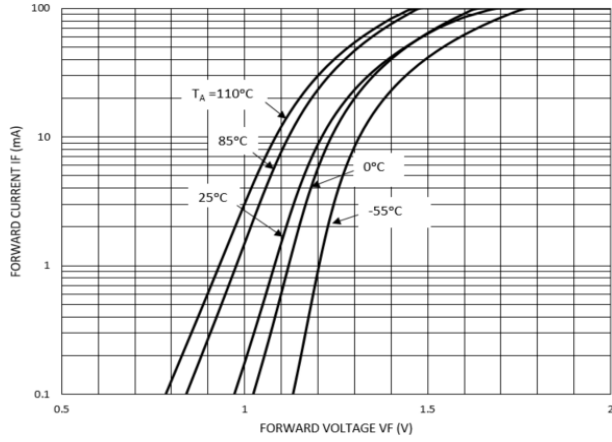


Figure 1. Forward Current vs. Forward Voltage

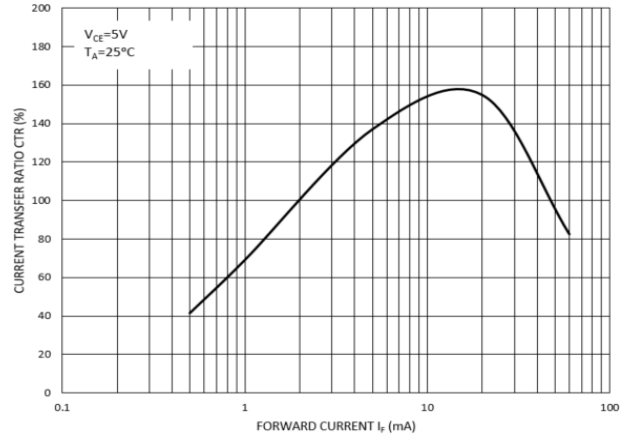


Figure 2. Current Transfer Ratio vs. Forward Current

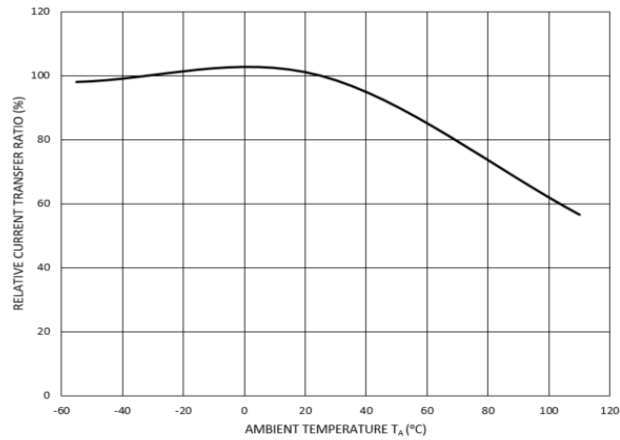


Figure 3. Relative Current Transfer Ratio vs. Ambient Temperature

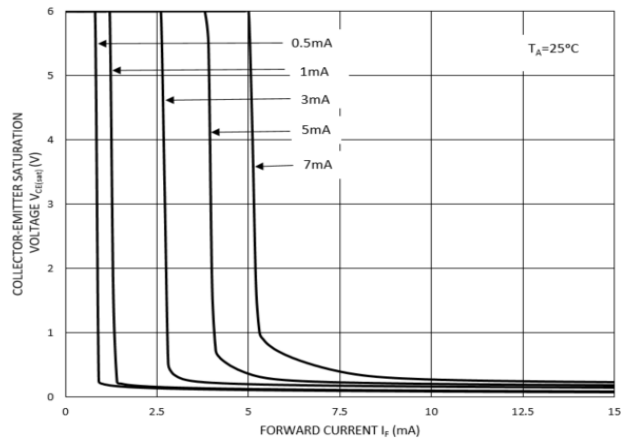


Figure 4. Collector-Emitter Saturation Voltage vs. Forward Current

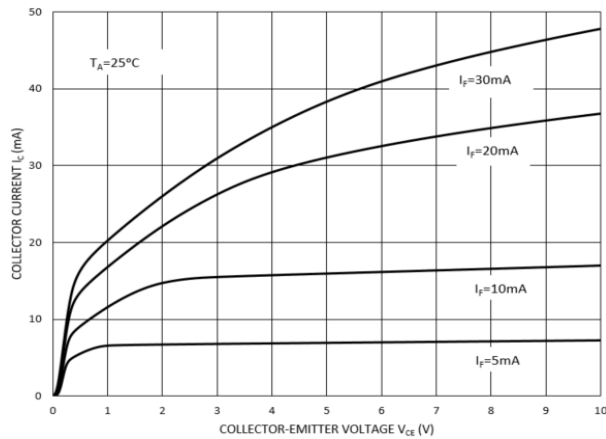


Figure 5. Collector Current vs. Collector-Emitter Voltage

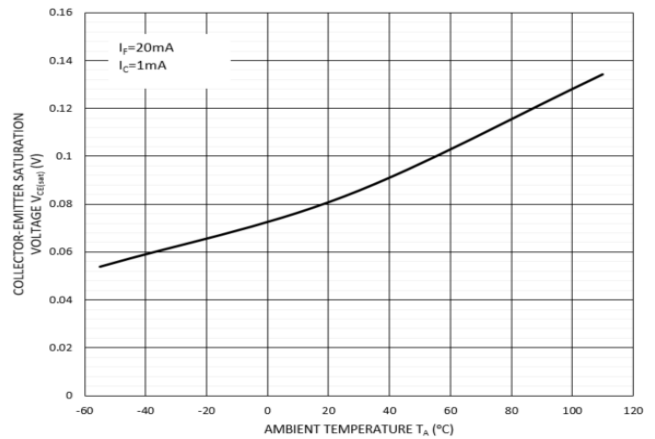


Figure 6. Collector-Emitter Saturation Voltage vs. Ambient Temperature

FOD785 Series

TYPICAL CHARACTERISTICS

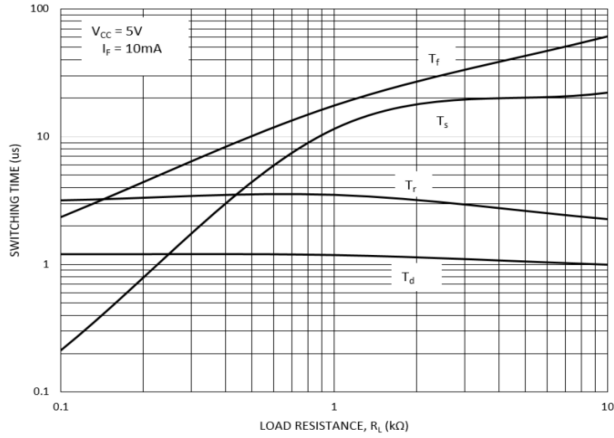


Figure 7. Switching Time vs. Load Resistance

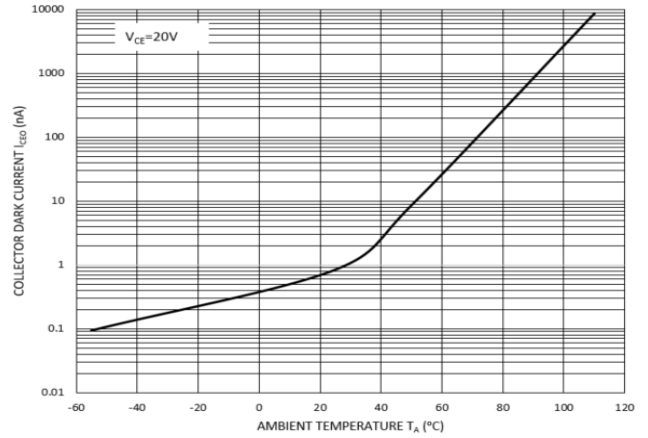


Figure 8. Switching Time vs. Ambient Temperature

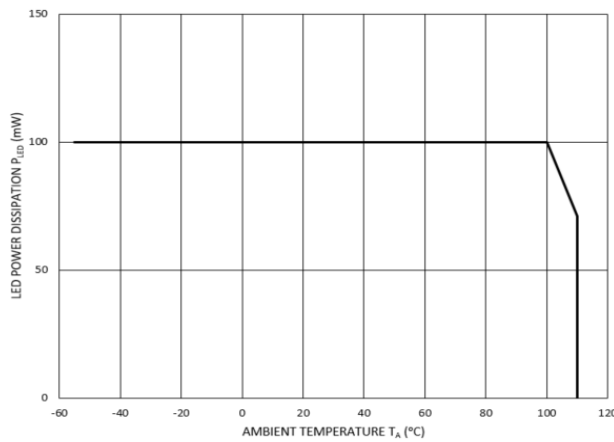


Figure 9. Max Allowable Power Dissipation (LED) vs. Ambient Temperature

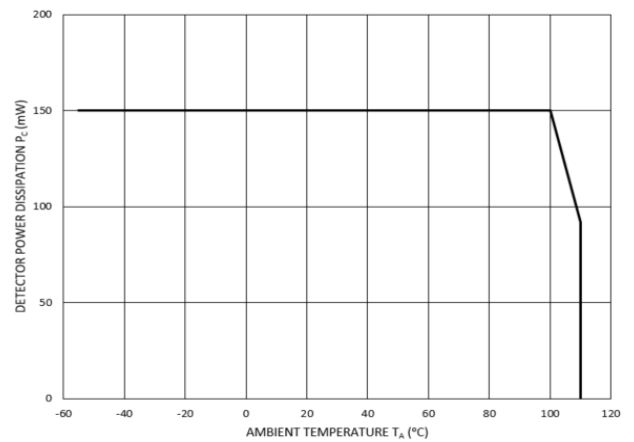


Figure 10. Max Allowable Power Dissipation (Detector) vs. Ambient Temperature

Test Circuit

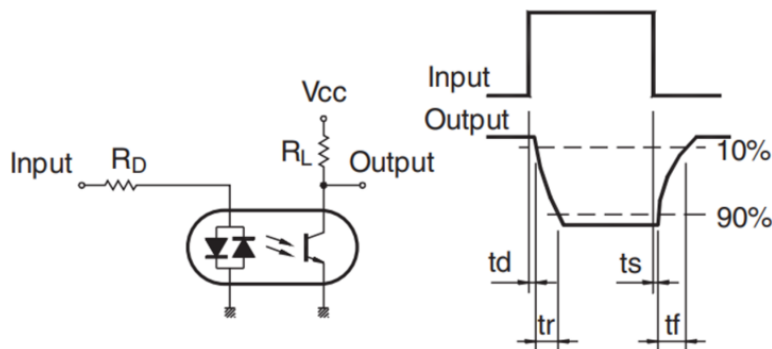


Figure 11. Test Circuit

FOD785 Series

Reflow Profile

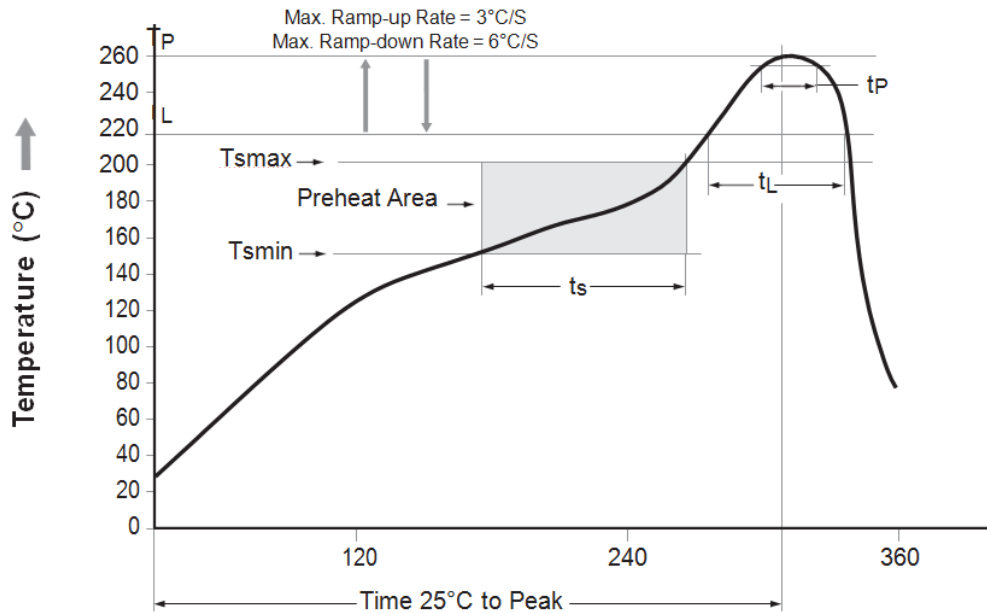


Figure 12. Reflow Profile

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.

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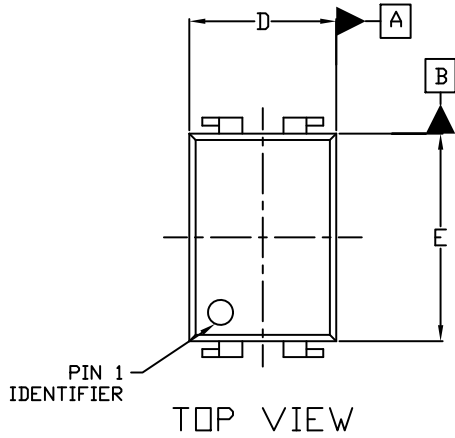
PACKAGE DIMENSIONS

PDIP4 6.50mm (STANDARD LEAD FORM)

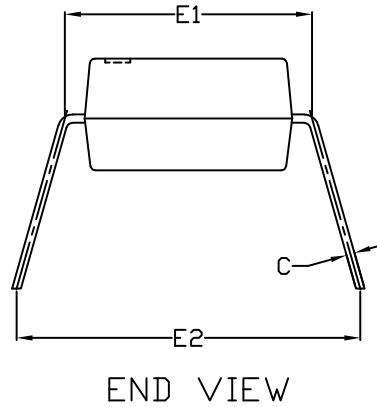
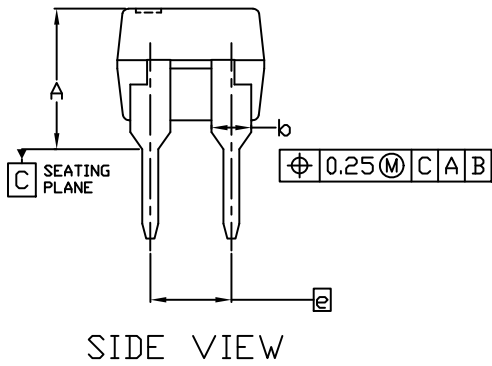
CASE 646CS
ISSUE O

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

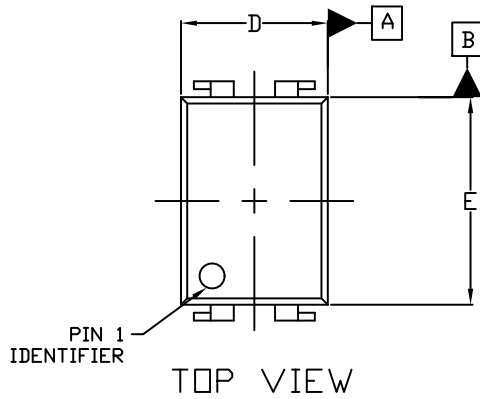
PDIP4 6.50mm (M LEAD FORM)

CASE 646CT

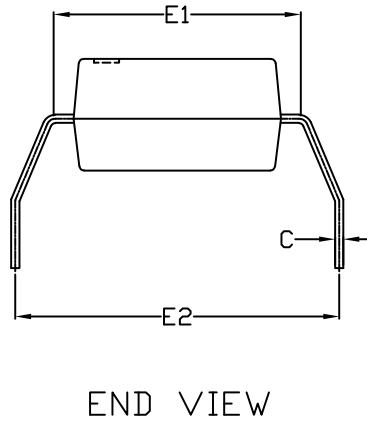
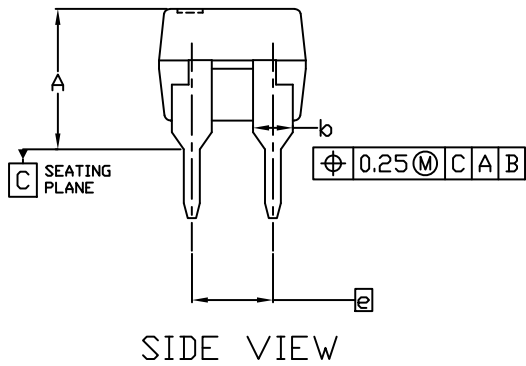
ISSUE O

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		



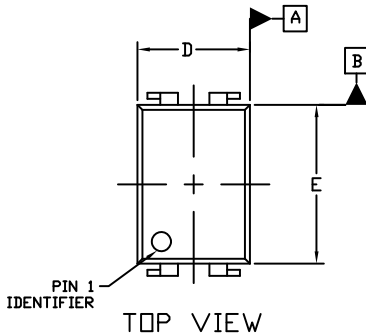
FOD785 Series

PACKAGE DIMENSIONS

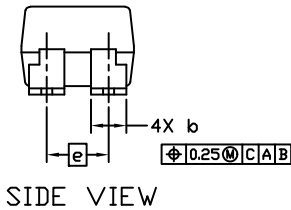
PDIP4 6.50mm (GULL WING) CASE 709AK ISSUE O

NOTES:

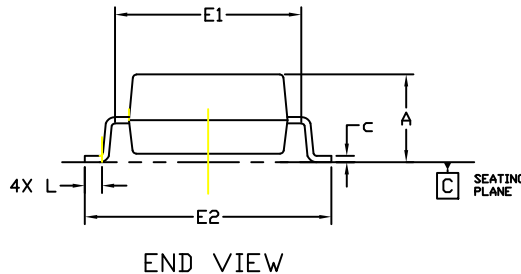
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
4. FOOT LENGTH, DIMENSION L, IS MEASURED AS THE FLAT PORTION OF THE LEAD FOOT.



TOP VIEW

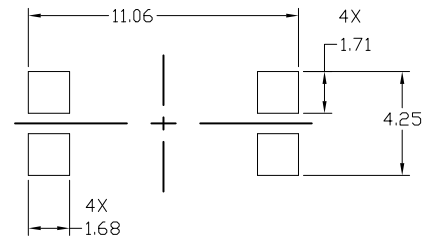


SIDE VIEW




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, SLDERRM/D.

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