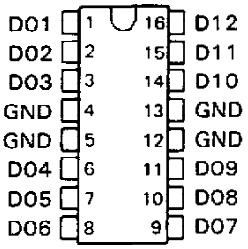
SN74S1050
12-BIT SCHOTTKY BARRIER DIODE BUS-TERMINATION ARRAY

SDLS015A D3228, JULY 1989–REVISED MARCH 1990

- Designed to Reduce Reflection Noise
- Repetitive Peak Forward Current . . . 200 mA
- 12-Bit Array Structure Suited for Bus-Oriented Systems
- ESD Protection Exceeds 10 kV Per MIL-STD-883C, Method 3015
- Package Options Include Plastic "Small Outline" Packages and Standard Plastic 300-mil DIPs

D OR N PACKAGE
(TOP VIEW)

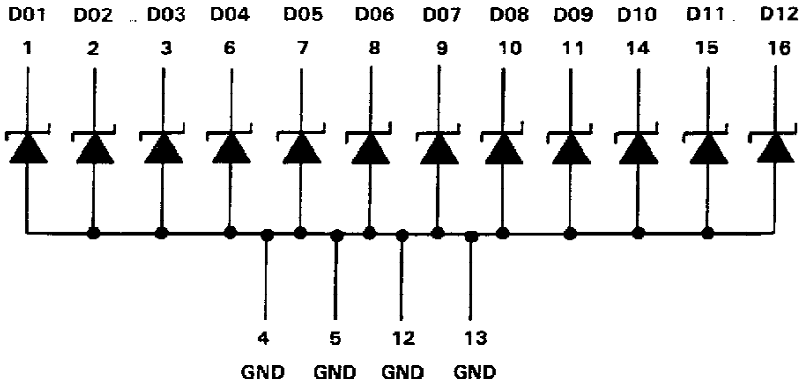


description

This Schottky barrier diode bus-termination array is designed to reduce reflection noise on memory bus lines. This device consists of a 12-bit high-speed Schottky diode array suitable for a clamp to GND.

The SN74S1050 is characterized for operation from 0°C to 70°C.

schematic diagram



TEXAS INSTRUMENTS
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Steady-state reverse voltage, V_R . . . . . 7 V
Continuous forward current, I_F: any D terminal from GND . . . . . 50 mA
total through all GND terminals . . . . . 170 mA
Repetitive peak forward current,‡ I_{FRM}: any D terminal from GND . . . . . 200 mA
total through all GND terminals . . . . . 1 A
Continuous total power dissipation at (or below) 25°C free-air temperature . . . . . 625 mW
Operating free-air temperature range . . . . . 0°C to 70°C
Storage temperature range . . . . . −65°C to 150°C

†Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
‡These values apply for $t_w \leq 100\ \mu s$, duty cycle ≤ 20%.

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

single-diode operation (see Note 1)

PARAMETER		TEST CONDITIONS		MIN	TYP§	MAX	UNIT
I_R	Static reverse current	V_R = 7 V				5	μA
V_F	Static forward voltage	I_F = 18 mA			0.75	0.95	V
		I_F = 50 mA			0.95	1.2	
V_{FM}	Peak forward voltage	I_F = 200 mA			1.45		V
C_T	Total capacitance	V_R = 0,	f = 1 MHz		5	10	pF
		V_R = 2 V,	f = 1 MHz		4	8	

NOTE 1: Test conditions and limits apply separately to each of the diodes. The diodes not under test are open-circuited during the measurement of these characteristics.

multiple-diode operation

PARAMETER		TEST CONDITIONS		MIN	TYP§	MAX	UNIT
I_X	Internal crosstalk current	Total I_F = 1 A,	See Note 2		0.6	2	mA
		Total I_F = 198 mA,	See Note 2		0.02	0.2	

§All typical values are at T_A = 25°C.
NOTE 2. I_X is measured under the following conditions with one diode static and all others switching:
Switching diodes: t_w = 100 μs, duty cycle = 20%; static diode: V_R = 5 V.
The static diode's input current is the internal crosstalk current I_X.

switching characteristics at 25°C free-air temperature (see Figures 1 and 2)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{rr}	Reverse recovery time	I_F = 10 mA, $I_{RM(REC)}$ = 10 mA, $i_{R(REC)}$ = 1 mA, R_L = 100 Ω		8	16	ns

PARAMETER MEASUREMENT INFORMATION

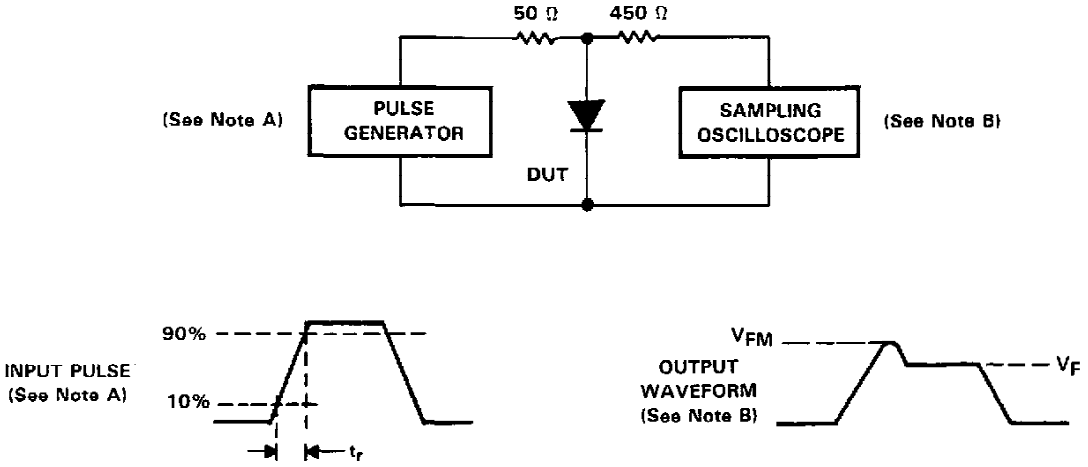


FIGURE 1. FORWARD RECOVERY VOLTAGE

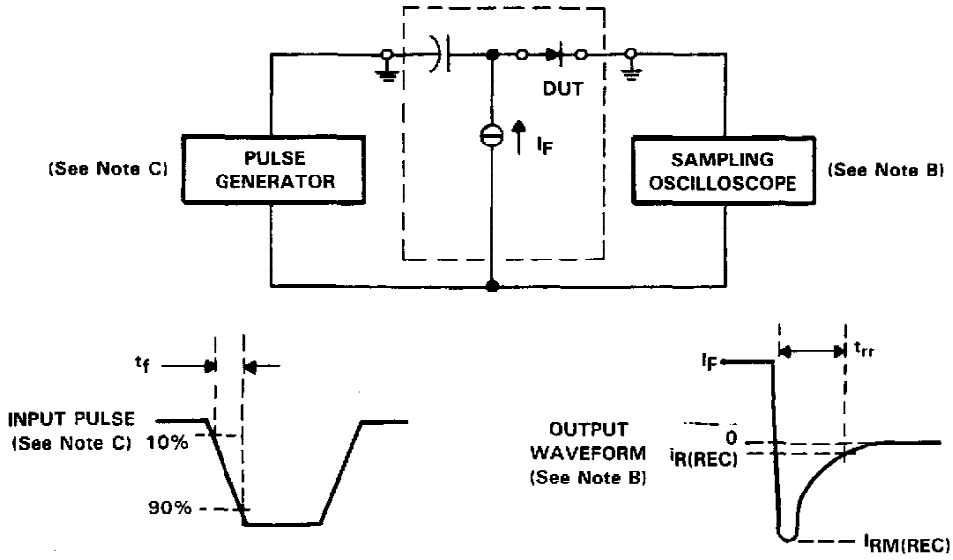


FIGURE 2. REVERSE RECOVERY TIME

NOTES: A. The input pulse is supplied by a pulse generator having the following characteristics: t_r = 20 ns, Z_{out} = 50 Ω, f = 500 Hz, duty cycle = 0.01.
B. The output waveform is monitored by an oscilloscope having the following characteristics: $t_r \leq 350$ ps, R_{in} = 50 Ω, $C_{in} = \leq 5$ pF.
C. The input pulse is supplied by a pulse generator having the following characteristics: t_f = 0.5 ns, Z_{out} = 50 Ω, $t_w = \geq 50$ ns, duty cycle ≤ 0.01.

APPLICATION INFORMATION

Large negative transients occurring at the inputs of memory devices (DRAMs, SRAMs, EPROMs, etc.), or on the CLOCK lines of many clocked devices can result in improper operation of the device. The SN74S1050 and SN74S1052 diode termination arrays help suppress negative transients caused by transmission line reflections, crosstalk, and switching noise.

Diode terminations have several advantages when compared to resistor termination schemes. Split resistor or Thevenin equivalent termination can cause a substantial increase in power consumption. The use of a single resistor to Ground to terminate a line usually results in degradation of the output high level, resulting in reduced noise immunity. Series damping resistors placed on the outputs of the driver will reduce negative transients, but can also increase propagation delays down the line, as a series resistor reduces the output drive capability of the driving device. Diode terminations have none of these drawbacks.

The operation of the diode arrays in reducing negative transients is explained in the following figures. The diode conducts current whenever the voltage reaches a negative value large enough for the diode to turn on. Suppression of negative transients by the diode tracks the current-voltage characteristic curve for the diode. A typical current-voltage curve for the SN74S1050/S1052 is shown in Figure 3.

To illustrate how the diode arrays act to reduce negative transients at the end of a transmission line, the test setup in Figure 4 was evaluated. The resulting waveforms with and without the diode are shown in Figure 5.

The maximum effectiveness of the diode in suppressing negative transients occurs when they are placed at the end of a line and/or the end of a long stub branching off a main transmission line. The diodes can also be used to reduce the negative transients that occur due to discontinuities in the middle of a line. An example of this is a slot in a backplane that is provided for an add-on card.

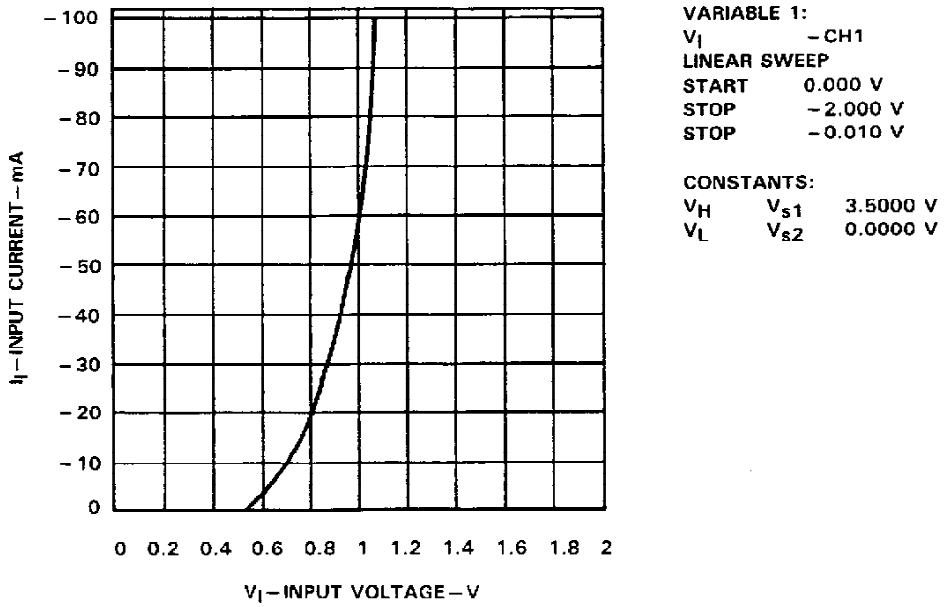


FIGURE 3. TYPICAL CURRENT-VOLTAGE CURVE

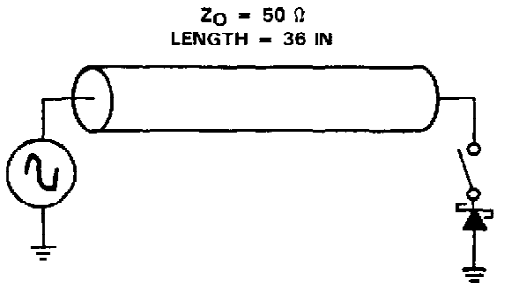


FIGURE 4. DIODE TEST SETUP

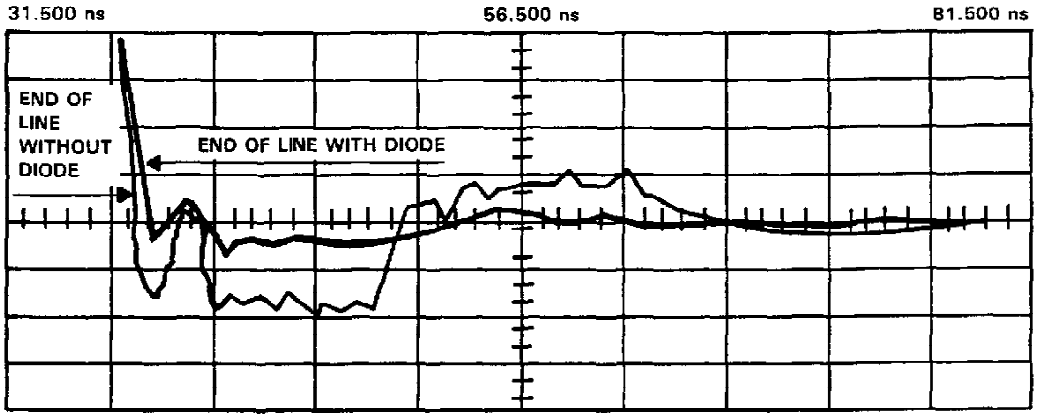


FIGURE 5. SCOPE DISPLAY

IMPORTANT NOTICE

Texas Instruments (TI) reserves the right to make changes to its products or to discontinue any semiconductor product or service without notice, and advises its customers to obtain the latest version of relevant information to verify, before placing orders, that the information being relied on is current.

TI warrants performance of its semiconductor products and related software to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

Certain applications using semiconductor products may involve potential risks of death, personal injury, or severe property or environmental damage ("Critical Applications").

TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, INTENDED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT APPLICATIONS, DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS.

Inclusion of TI products in such applications is understood to be fully at the risk of the customer. Use of TI products in such applications requires the written approval of an appropriate TI officer. Questions concerning potential risk applications should be directed to TI through a local SC sales office.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards should be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein. Nor does TI warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
SN74S1050D	ACTIVE	SOIC	D	16	40	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74S1050DR	ACTIVE	SOIC	D	16	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74S1050N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

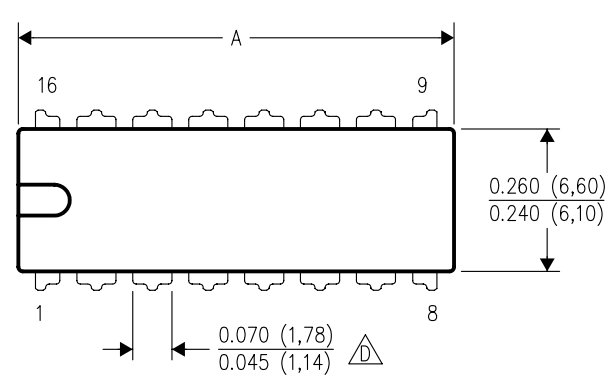
(2) Eco Plan - May not be currently available - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
None: Not yet available Lead (Pb-Free).
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Green (RoHS & no Sb/Br): TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDECindustry standard classifications, and peak solder temperature.

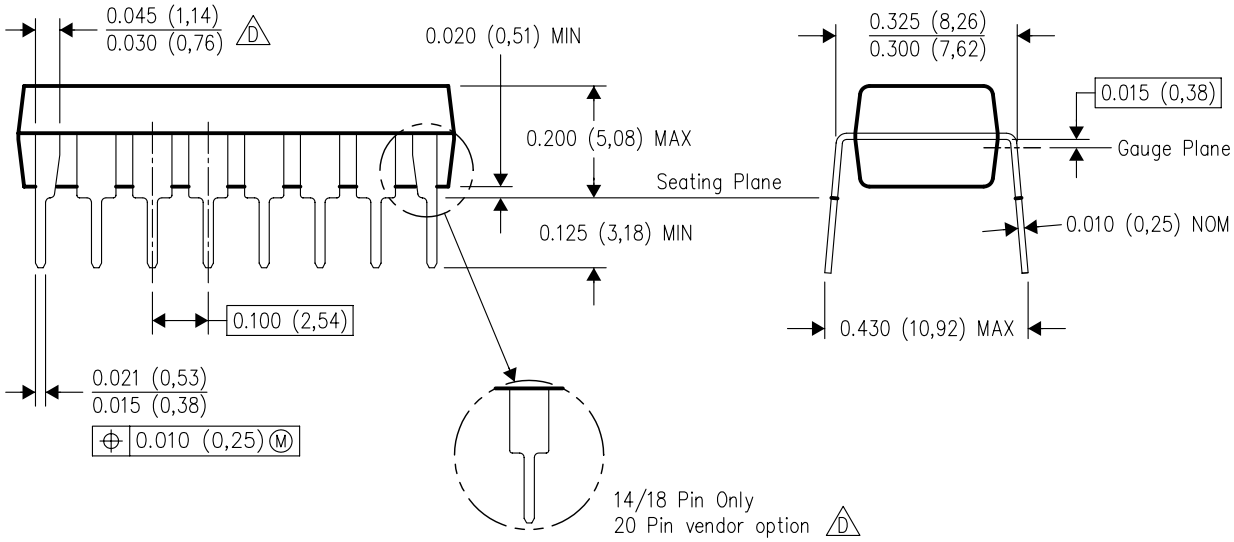
N (R–PDIP–T**)

PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN



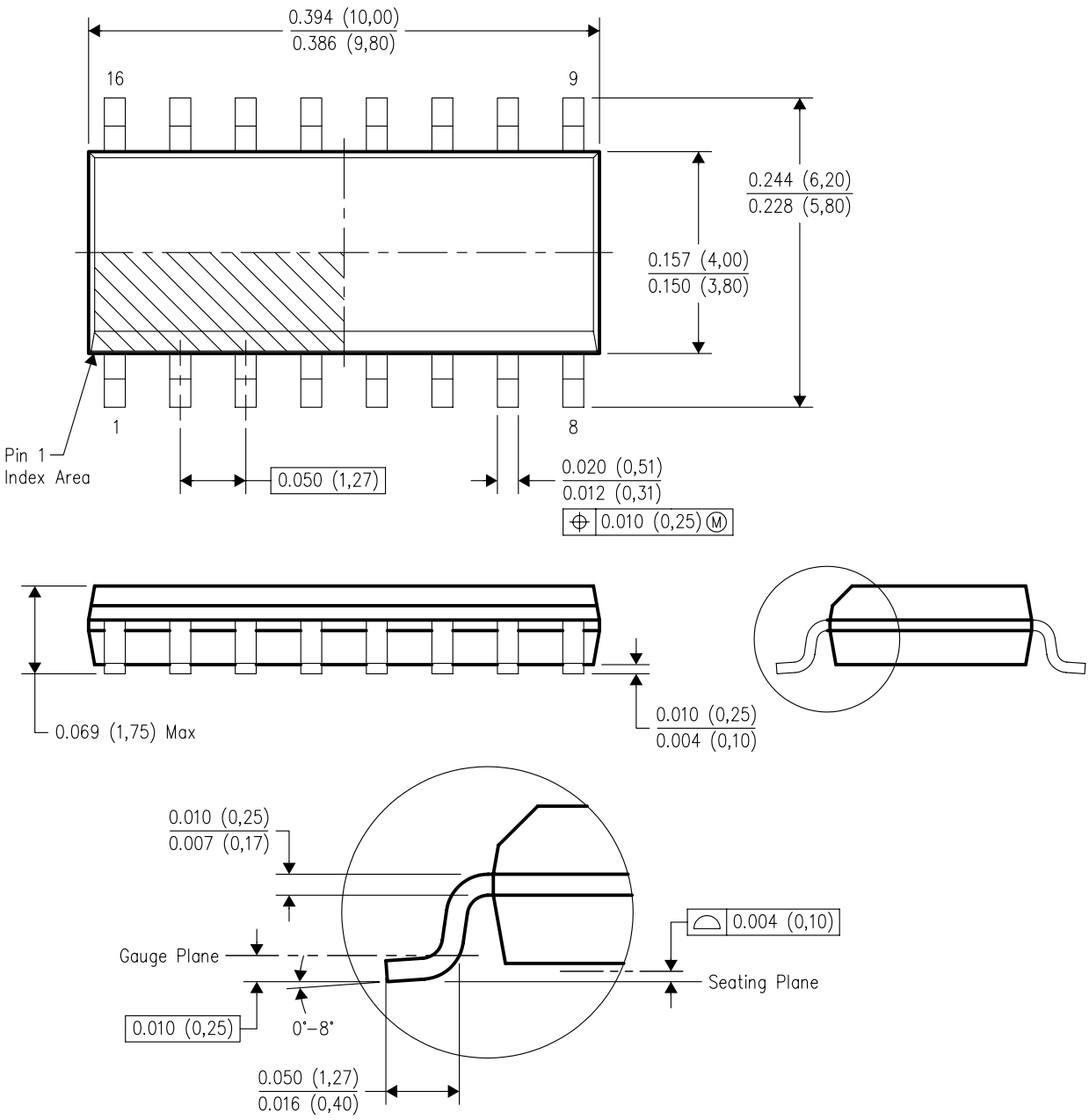
DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS–001 VARIATION (C)	AA	BB	AC	AD



4040049/E 12/2002

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001, except 18 and 20 pin minimum body length (Dim A).
D. The 20 pin end lead shoulder width is a vendor option, either half or full width.

D (R–PDSO–G16) PLASTIC SMALL–OUTLINE PACKAGE



NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MS–012 variation AC.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		**Applications**	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265