

# SN74S1053

## 16-BIT SCHOTTKY BARRIER DIODE BUS-TERMINATION ARRAY

SDLS017A – SEPTEMBER 1990 – REVISED AUGUST 1997

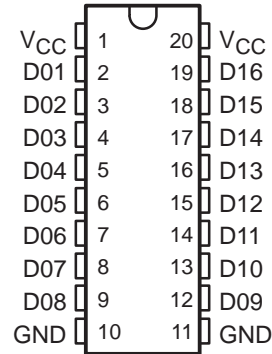
- Designed to Reduce Reflection Noise
- Repetitive Peak Forward Current to 200 mA
- 16-Bit Array Structure Suited for Bus-Oriented Systems
- Package Options Include Plastic Small-Outline Packages and Standard Plastic 300-mil DIPs

### description

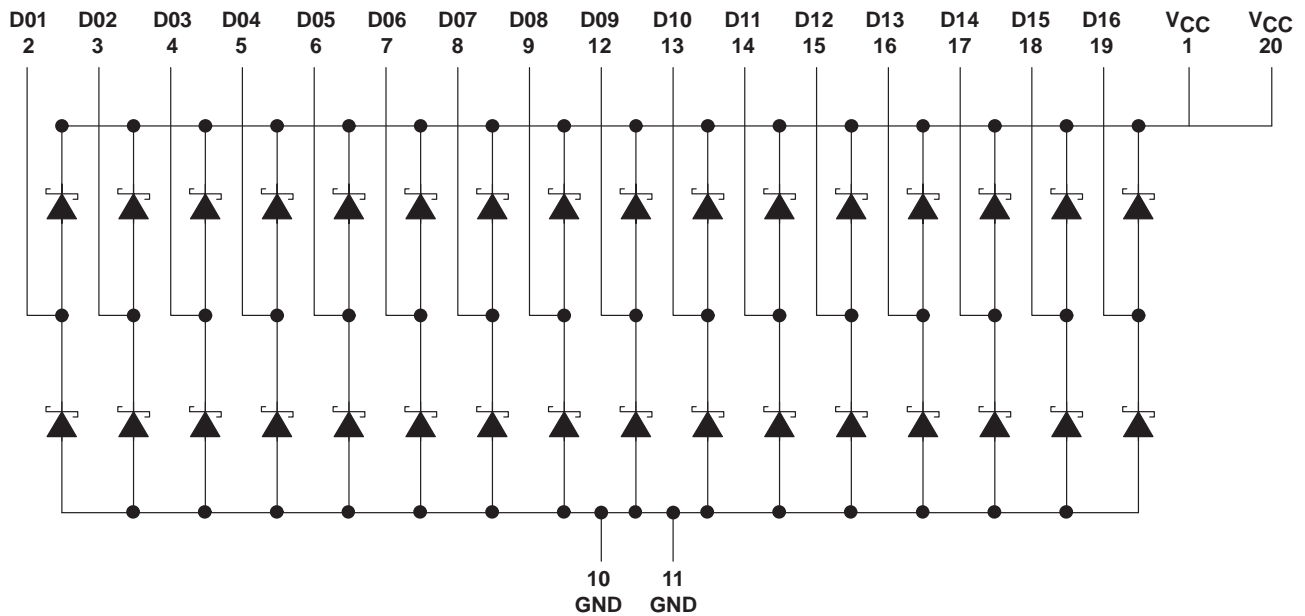
This Schottky barrier diode bus-termination array is designed to reduce reflection noise on memory bus lines. This device consists of a 16-bit high-speed Schottky diode array suitable for clamping to  $V_{CC}$  and/or GND.

The SN74S1053 is characterized for operation from 0°C to 70°C.

DW OR N PACKAGE  
(TOP VIEW)



### schematic diagrams



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS  
INSTRUMENTS**

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# SN74S1053

## 16-BIT SCHOTTKY BARRIER DIODE

### BUS-TERMINATION ARRAY

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#### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

Steady-state reverse voltage, $V_R$	7 V
Continuous forward current, $I_F$ : Any D terminal from GND or to $V_{CC}$	50 mA
Total through all GND or $V_{CC}$ terminals	170 mA
Repetitive peak forward current <sup>‡</sup> , $I_{FRM}$ : Any D terminal from GND or $V_{CC}$	200 mA
Total through all GND or $V_{CC}$ terminals	1.2 A
Continuous total power dissipation at (or below) 25°C free-air temperature (see Note 1)	625 mW
Operating free-air temperature range	0°C to 70°C
Storage temperature range, $T_{stg}$	–65°C to 150°C

<sup>†</sup> 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.

<sup>‡</sup> These values apply for  $t_W \leq 100 \mu s$ , duty cycle  $\leq 20\%$ .

NOTE 1: For operation above 25°C free-air temperature, derate linearly at the rate of 5 mW/°C.

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

##### single-diode operation (see Note 2)

PARAMETER	TEST CONDITIONS	MIN	TYP <sup>§</sup>	MAX	UNIT
$V_F$ Static forward voltage	To $V_{CC}$	$I_F = 18 \text{ mA}$	0.85	1.05	V
			1.05	1.3	
	From GND	$I_F = 18 \text{ mA}$	0.75	0.95	
			0.95	1.2	
$V_{FM}$ Peak forward voltage		$I_F = 200 \text{ mA}$	1.45		V
$I_R$ Static reverse current	To $V_{CC}$	$V_R = 7 \text{ V}$		5	$\mu A$
	From GND			5	
$C_t$ Total capacitance	$V_R = 0 \text{ V}$ , $f = 1 \text{ MHz}$		8	16	pF
	$V_R = 2 \text{ V}$ , $f = 1 \text{ MHz}$		4	8	

<sup>§</sup> All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

NOTE 2: 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 <sup>‡</sup>	MAX	UNIT
$I_X$ Internal crosstalk current	Total $I_F$ current = 1 A, See Note 3		0.8	2	mA
	Total $I_F$ current = 198 mA, See Note 3		0.02	0.2	

<sup>§</sup> All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

NOTE 3:  $I_X$  is measured under the following conditions with one diode static, and all others switching:

Switching diodes:  $t_W = 100 \mu s$ , duty cycle = 20%

Static diode:  $V_R = 5 \text{ V}$

The static diode input current is the internal crosstalk current  $I_X$ .

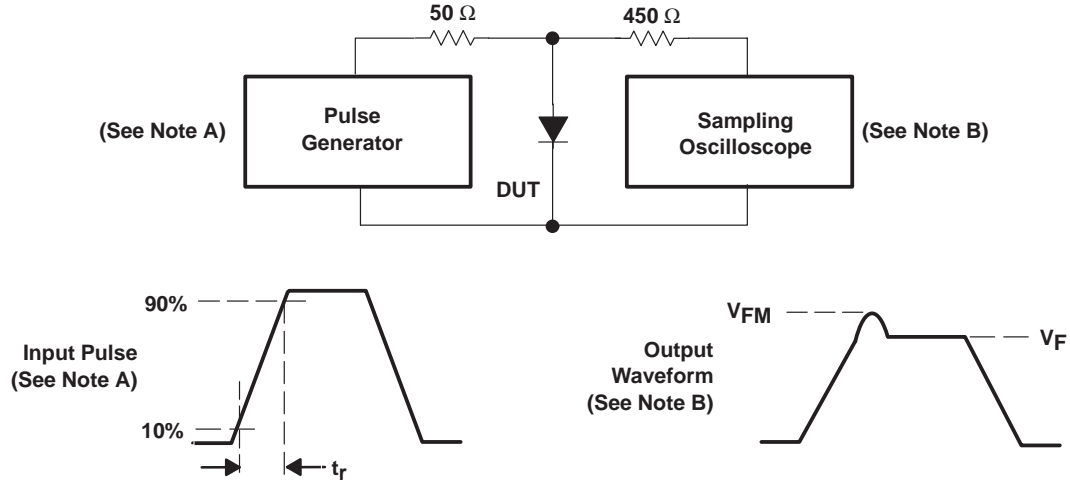
#### switching characteristics, $T_A = 25^\circ\text{C}$ (see Figures 1 and 2)

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



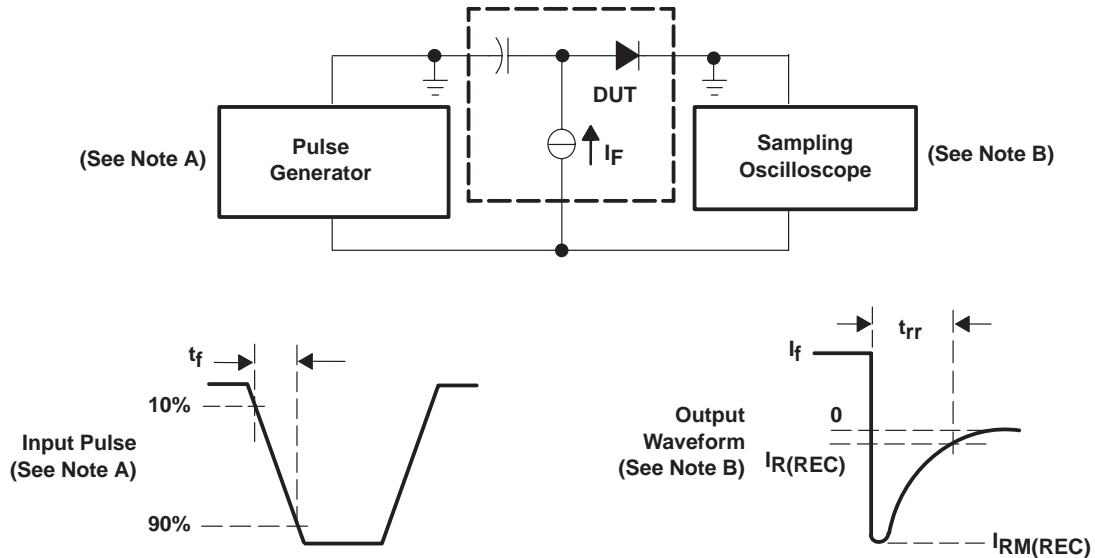
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## PARAMETER MEASUREMENT INFORMATION



- NOTES: A. The input pulse is supplied by a pulse generator having the following characteristics:  $t_r = 20$  ns,  $Z_O = 50$  Ω, freq = 500 Hz, duty cycle = 1%.  
B. The output waveform is monitored by an oscilloscope having the following characteristics:  $t_r \leq 350$  ps,  $R_i = 50$  Ω,  $C_i \leq 5$  pF.

**Figure 1. Forward Recovery Voltage**



- NOTES: A. The input pulse is supplied by a pulse generator having the following characteristics:  $t_f = 0.5$  ns,  $Z_O = 50$  Ω,  $t_w \geq 50$  ns, duty cycle = 1%.  
B. The output waveform is monitored by an oscilloscope having the following characteristics:  $t_r \leq 350$  ps,  $R_i = 50$  Ω,  $C_i \leq 5$  pF.

**Figure 2. Reverse Recovery Time**

# SN74S1053

## 16-BIT SCHOTTKY BARRIER DIODE

### BUS-TERMINATION ARRAY

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#### 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 devices. The SN74S1053 diode termination array helps 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 reduce negative transients, but they also can 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 when the voltage reaches a negative value large enough for the diode to turn on. Suppression of negative transients is tracked by the current-voltage characteristic curve for that diode. Typical current versus voltage curves for the SN74S1053 are shown in Figures 3 and 4.

To illustrate how the diode arrays act to reduce negative transients at the end of a transmission line, the test setup in Figure 5 was evaluated. The resulting waveforms with and without the diode are shown in Figure 6.

The maximum effectiveness of the diode arrays in suppressing negative transients occurs when the diode arrays are placed at the end of a line and/or the end of a long stub branching off a main transmission line. The diodes also can 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.

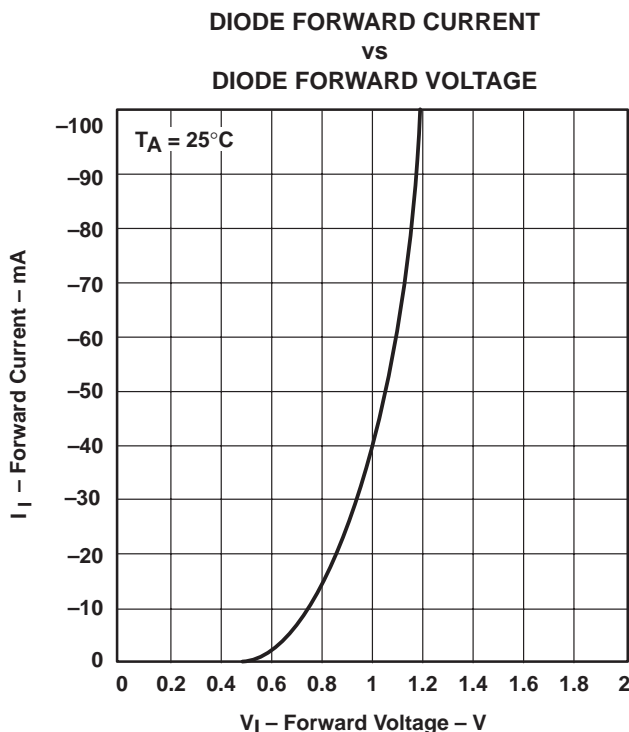
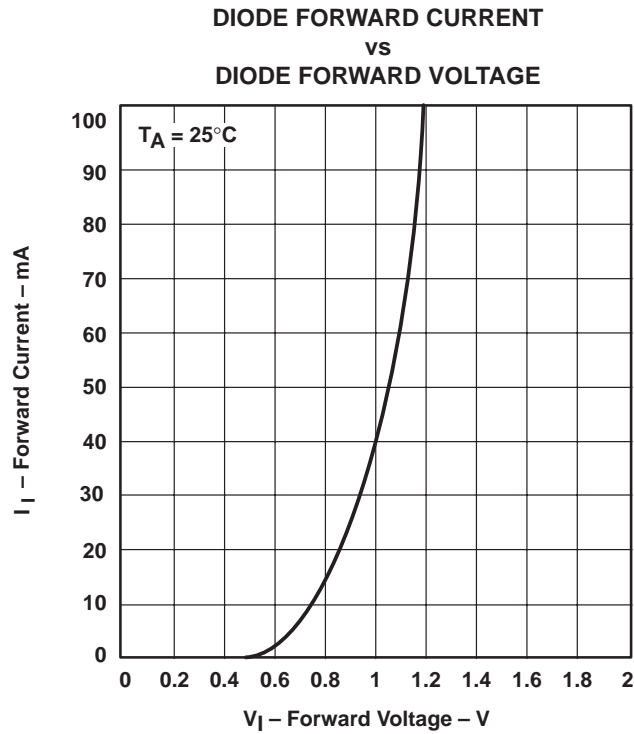


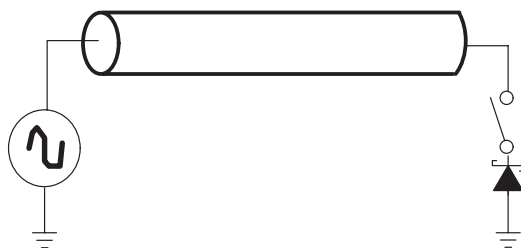
Figure 3. Typical Input Current vs Input Voltage  
(Lower Diode)



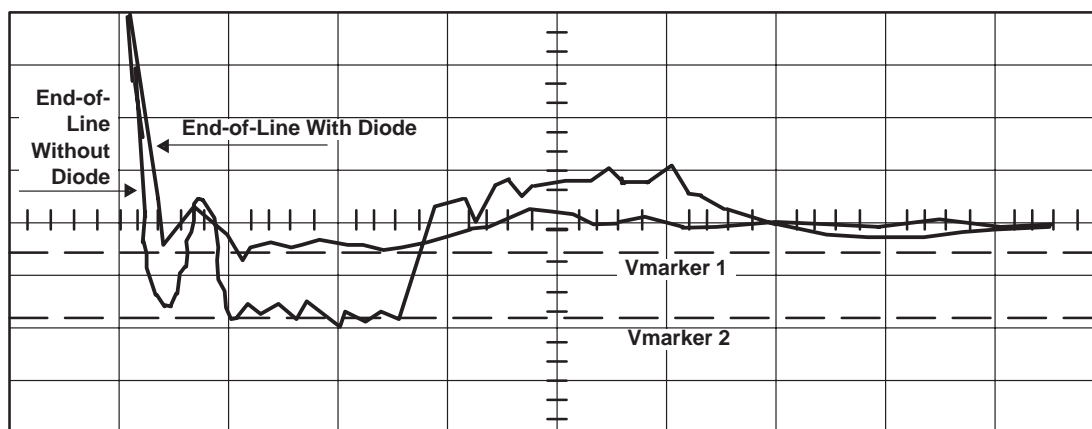
**Figure 4. Typical Input Current vs Input Voltage  
(Upper Diode)**

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**$Z_O = 50 \, \Omega$**   
**Length = 36 in.**



31.500 ns 56.500 ns 81.500 ns



Offset = 0.000 V  
Delay = 56.500 ns  
Delta V = -2.293 V

### Figure 6. Oscilloscope Display

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
SN74S1053DBR	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S1053DBRE4	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S1053DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S1053DWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S1053DWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S1053DWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S1053N	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74S1053NE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74S1053NSR	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S1053NSRG4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S1053PW	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S1053PWE4	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S1053PWR	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74S1053PWRE4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

<sup>(1)</sup> 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.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**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.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



PINS ** DIM	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	AA	BB	AC	AD



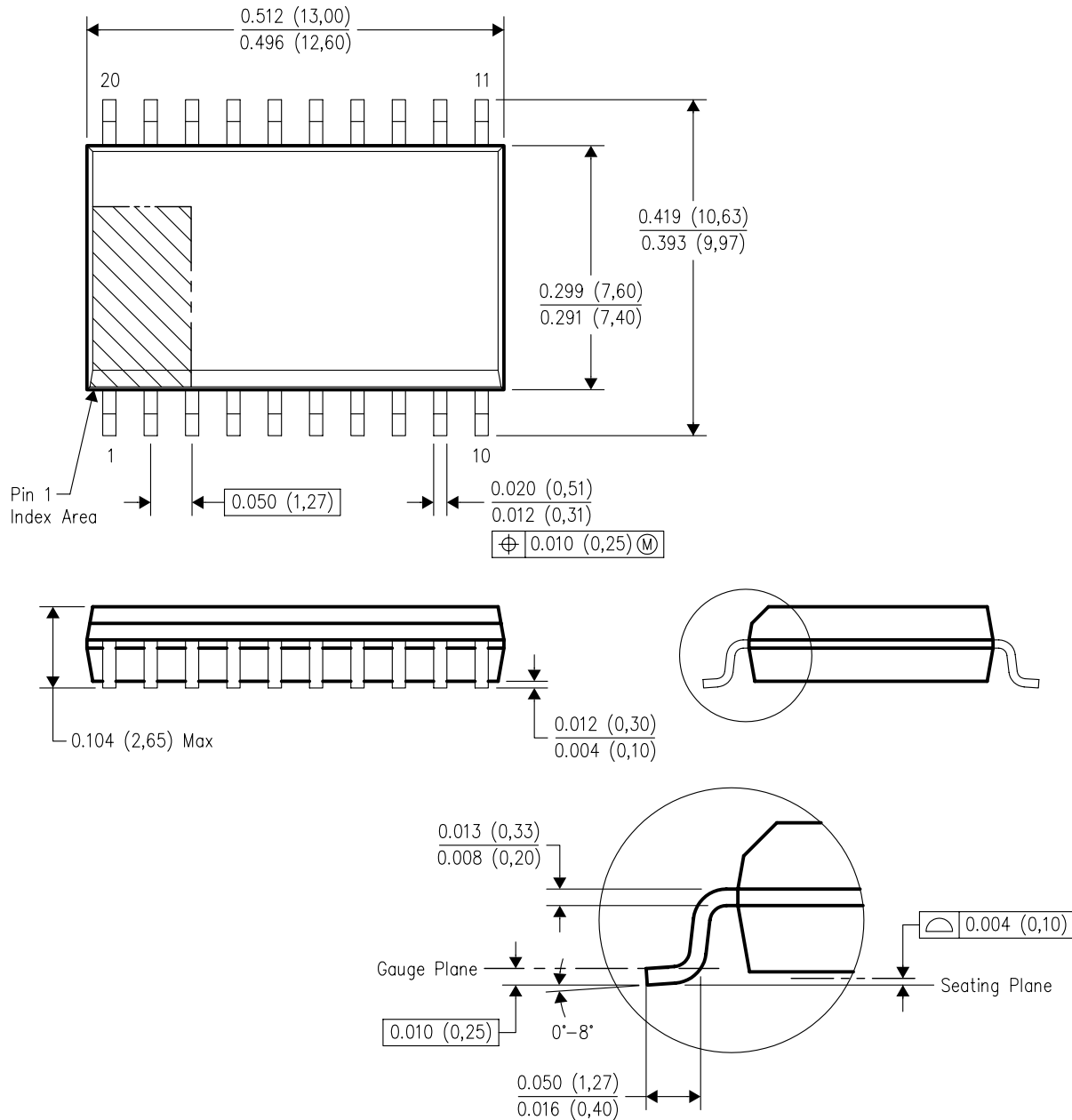
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NOTES:

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

DW (R-PDSO-G20)

## PLASTIC SMALL-OUTLINE PACKAGE



4040000-4/F 06/2004

- 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-013 variation AC.

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

## DB (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE

28 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-150

## PW (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-153

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