

# SN74S1053

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

SDLS017A – SEPTEMBER 1990 – REVISED AUGUST 1997

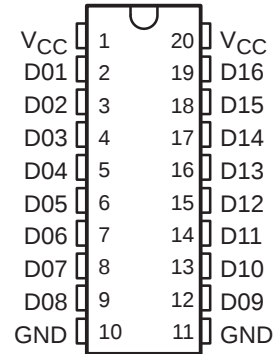
- Designed to Reduce Reflection Noise
- Repetitive Peak Forward Current to 200 mA
- 16-Bit Array Structure Suited for Bus-Oriented Systems
- Package Options Include Plastic Small-Outline Packages and Standard Plastic 300-mil DIPs

### description

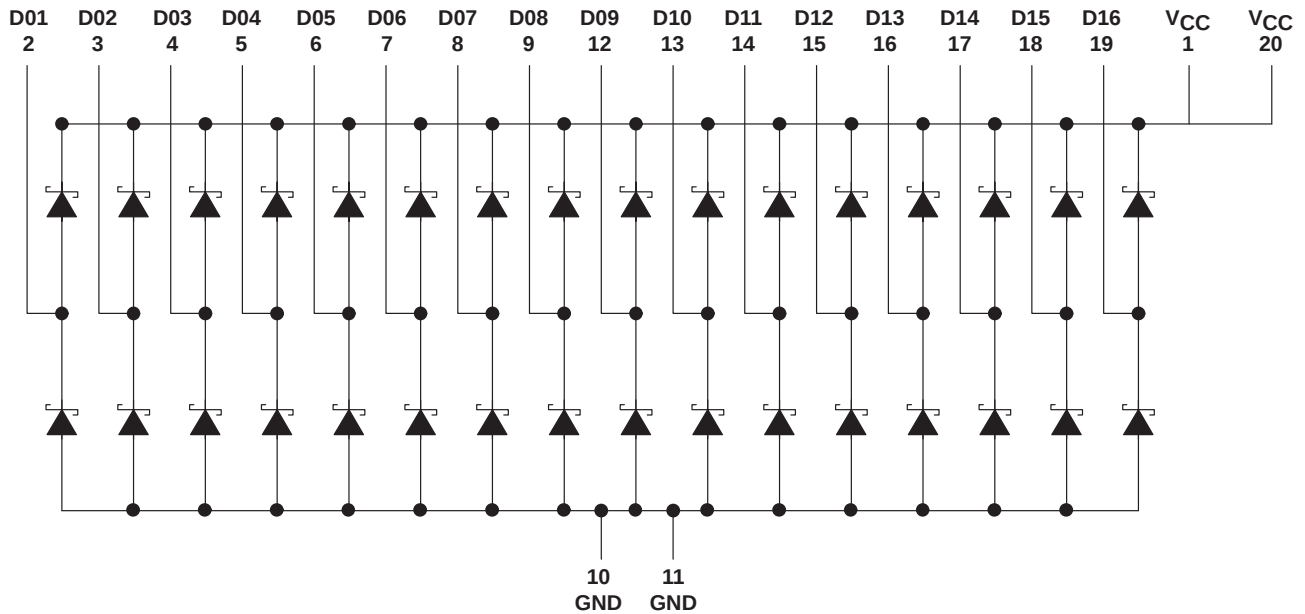
This Schottky barrier diode bus-termination array is designed to reduce reflection noise on memory bus lines. This device consists of a 16-bit high-speed Schottky diode array suitable for clamping to  $V_{CC}$  and/or GND.

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  
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## 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 | V       |
|                               |                                           |     | $I_F = 50 \text{ mA}$  | 1.05 |         |
|                               | From GND                                  |     | $I_F = 18 \text{ mA}$  | 0.75 |         |
|                               |                                           |     | $I_F = 50 \text{ mA}$  | 0.95 |         |
| $V_{FM}$ 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    | pF      |
|                               | $V_R = 2 \text{ V}$ , $f = 1 \text{ MHz}$ |     |                        | 4    |         |

<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  $I_X$ .

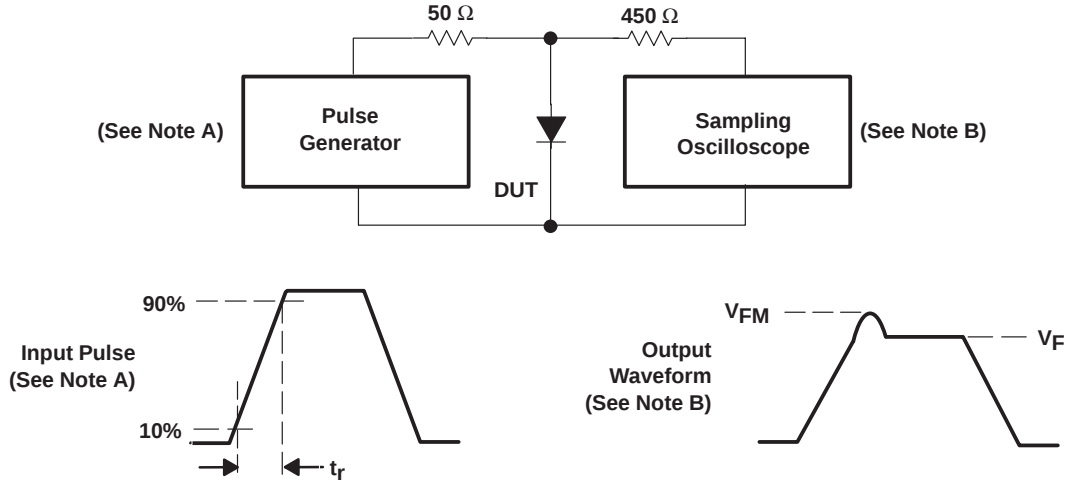
#### switching characteristics, $T_A = 25^\circ\text{C}$ (see Figures 1 and 2)

| 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   |



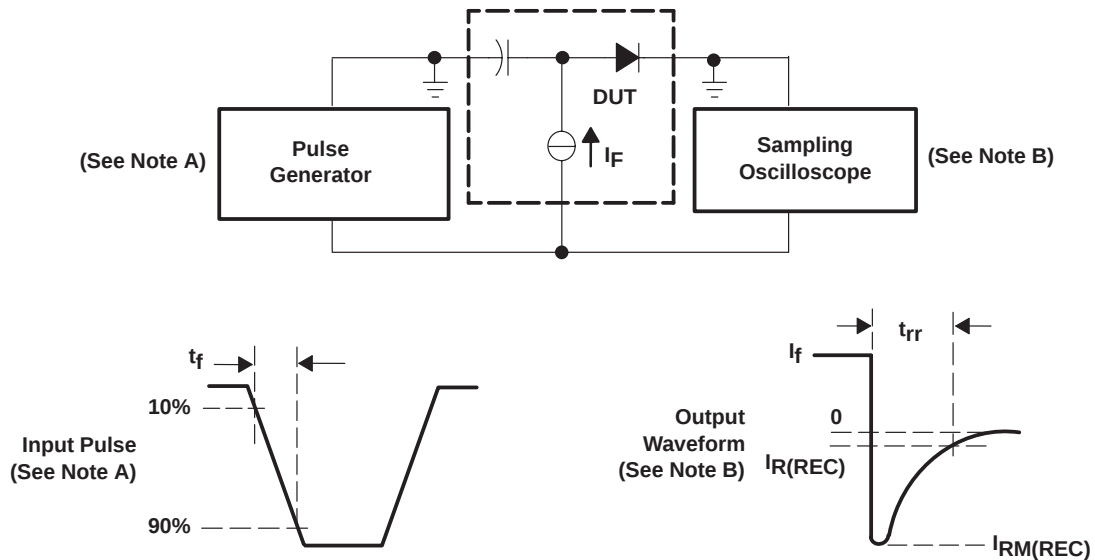
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## PARAMETER MEASUREMENT INFORMATION



- 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.

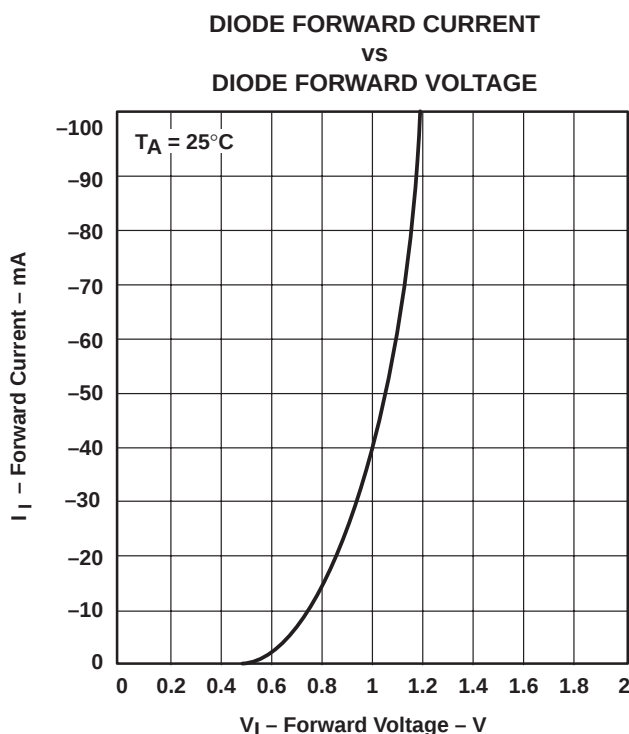


Figure 3. Typical Input Current vs Input Voltage  
(Lower Diode)

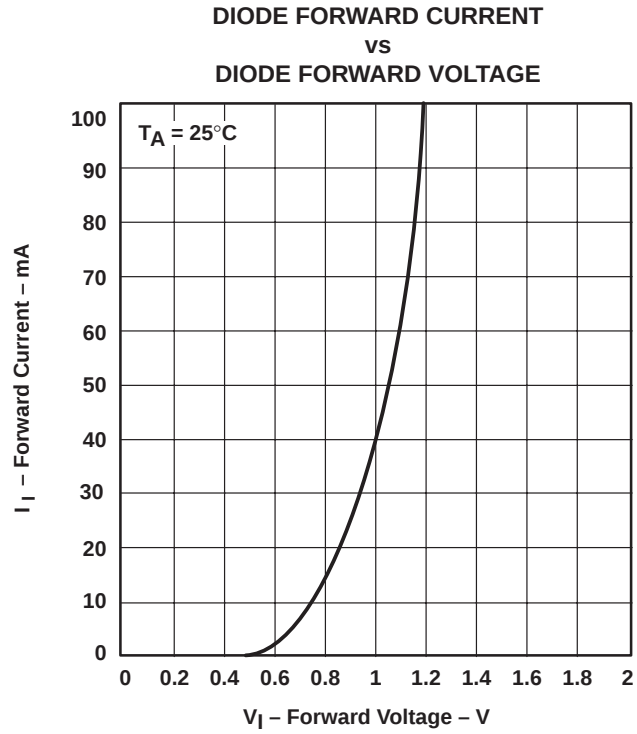
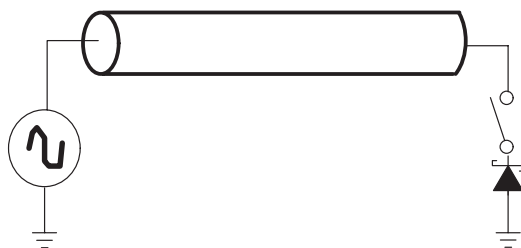


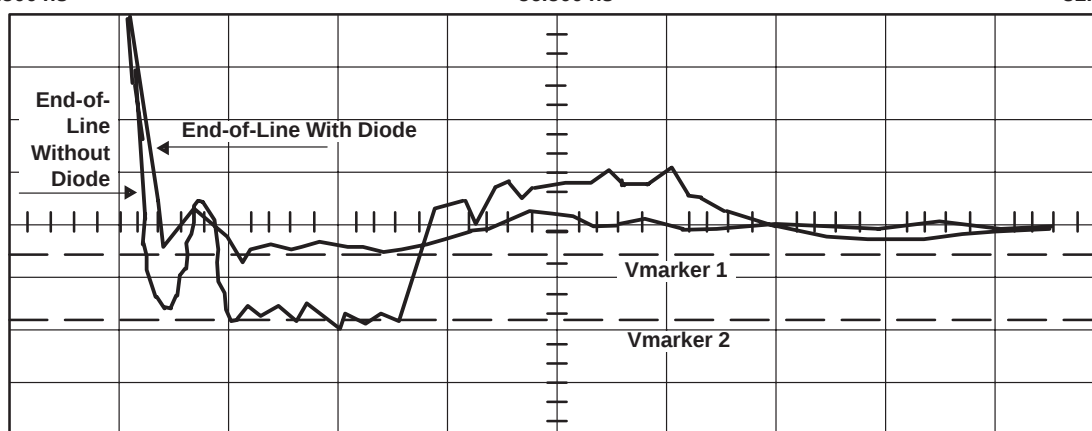
Figure 4. Typical Input Current vs Input Voltage  
(Upper Diode)

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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

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