

# SN74F1016

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

SDFS093 – NOVEMBER 1992 – REVISED DECEMBER 1993

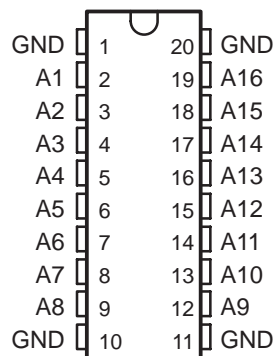
- Designed to Reduce Reflection Noise
- Repetitive Peak Forward Current . . . 300 mA
- 16-Bit Array Structure Suited for Bus-Oriented Systems

### description

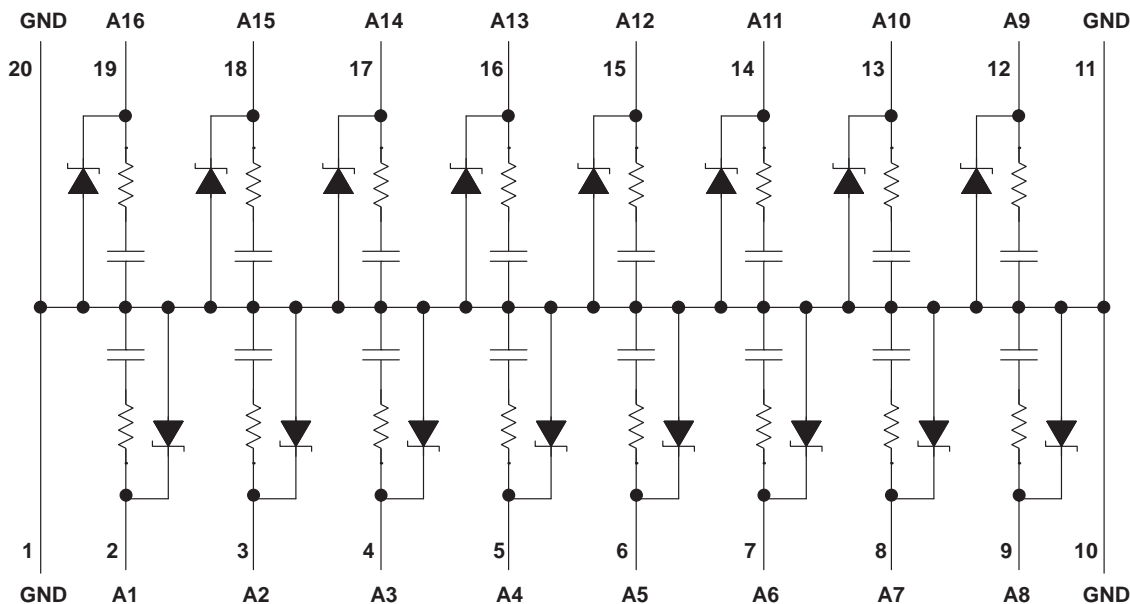
This bus-termination array is designed to reduce reflection noise and minimize ringing on high-performance bus lines. The SN74F1016 features a 16-bit R-C network and Schottky barrier diode array. These Schottky diodes provide clamp-to-ground functionality and serve to minimize overshoot and undershoot of high-speed switching buses.

The SN74F1016 is characterized for operation from 0°C to 70°C.

DW PACKAGE  
(TOP VIEW)



### schematic diagram



- Resistor = 50 Ω ± 10%  
 Capacitor = 47 pF ± 10%, V<sub>R</sub> = 2.5 V, f = 1 MHz  
 Diode = Schottky

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## 16-BIT SCHOTTKY BARRIER DIODE

### R-C BUS-TERMINATION ARRAY

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#### 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, $I_{FRM}^\ddagger$ : Any D terminal from GND	300 mA
Total through all GND terminals	1.2 A
Continuous total power dissipation at (or below) 25°C free-air temperature	500 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  $t_W \leq 100 \mu\text{s}$ , duty cycle  $\leq 20\%$ .

#### 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	$V_R = 7 \text{ V}$			2	$\mu\text{A}$
$V_{FM}$ Peak forward voltage	$I_F = 200 \text{ mA}$		1.25		V
$C_t$ Total capacitance	$V_R = 0$			80	pF
	$V_R = 2 \text{ V}$			60	
	$V_R = 3 \text{ V}$			55	

† All typical values are at  $T_A = 25^\circ\text{C}$ .

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 GND current = 1.2 A, See Note 2		10	50	$\mu\text{A}$

NOTE 2:  $I_x$  is measured under the following conditions with one diode static, all others switching:

Switching diodes:  $t_W = 100 \mu\text{s}$ , duty cycle = 20%;

Static diode:  $V_R = 5 \text{ V}$ ; the static diode input current is the internal crosstalk current  $I_x$ .

#### switching characteristics, $T_A = 25^\circ\text{C}$

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	10	ns

#### undershoot characteristics

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
$V_{US}$ Undershoot voltage	$t_f = 2 \text{ ns}$ , $t_W = 50 \text{ ns}$ , $V_{IH} = 5 \text{ V}$ , $V_{IL} = 0$ , $Z_S = 25 \Omega$ , $Z_O = 50 \Omega$ , $L = 36\text{-inch coaxial cable}$		0.7	0.8	V



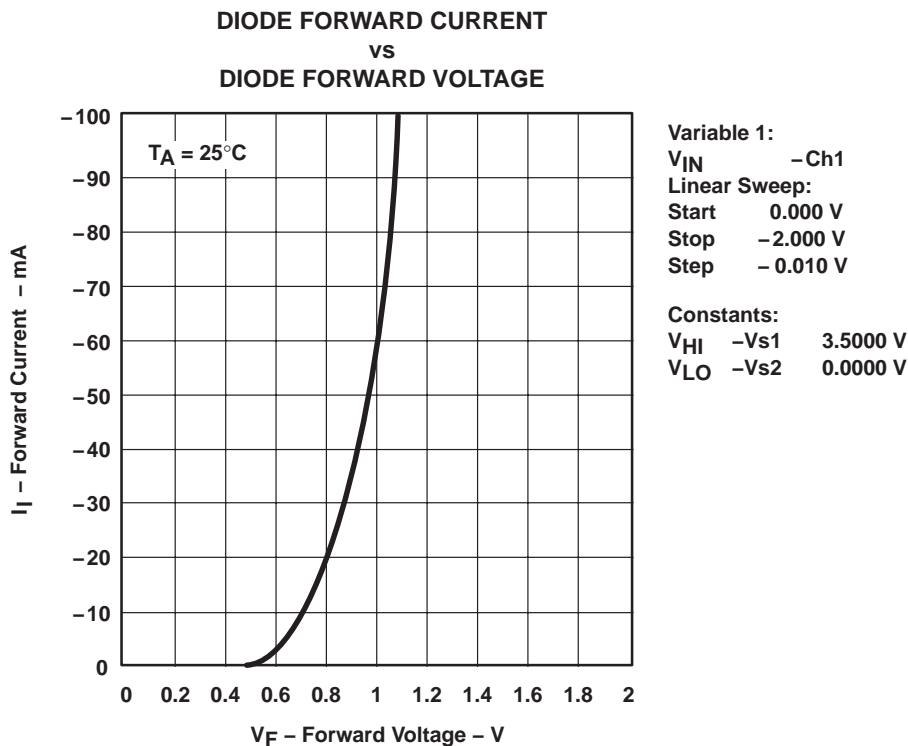
**APPLICATION INFORMATION**

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 SN74F1016 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 will reduce negative transients, but they 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 Figure 1. The diode conducts current whenever 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. A typical current voltage for the SN74F1016 is shown in Figure 1.

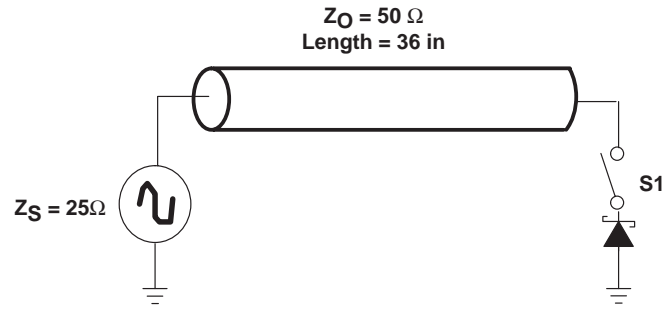
The maximum effectiveness of the diode arrays in suppressing negative transients occurs when they are placed at the end of a line and/or the end of a long stub branching off a main transmission line. The diodes can also be used to reduce the negative transients that occur due to discontinuities in the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



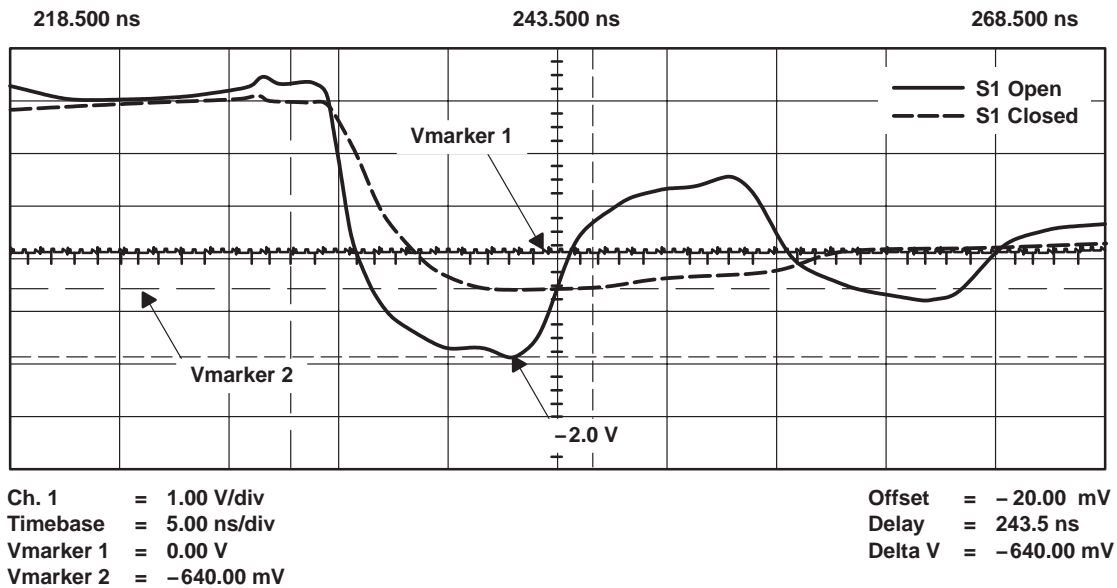
**Figure 1**

**SN74F1016**  
**16-BIT SCHOTTKY BARRIER DIODE**  
**R-C BUS-TERMINATION ARRAY**

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(a) UNDERSHOOT TEST SETUP



(b) SCOPE DISPLAY

Figure 2. Undershoot Test Setup and Scope Display

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74F1016DWR	ACTIVE	SOIC	DW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	F1016	Samples

(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.

**OBSELETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

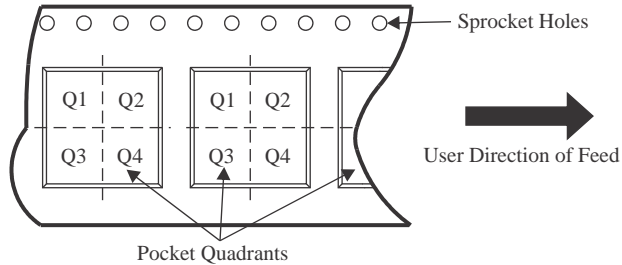
(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74F1016DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74F1016DWR	SOIC	DW	20	2000	350.0	350.0	43.0

# DW0020A



# PACKAGE OUTLINE

## SOIC - 2.65 mm max height

SOIC



4220724/A 05/2016

### NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm per side.
5. Reference JEDEC registration MS-013.



# EXAMPLE BOARD LAYOUT

DW0020A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE  
SCALE:6X



SOLDER MASK DETAILS

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NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DW0020A

SOIC - 2.65 mm max height

SOIC



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:6X

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NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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