

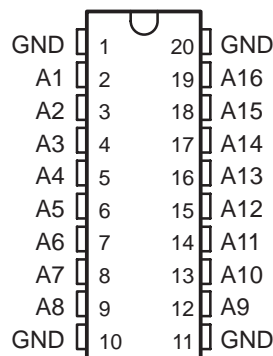
SN74F1016

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

DW PACKAGE
(TOP VIEW)

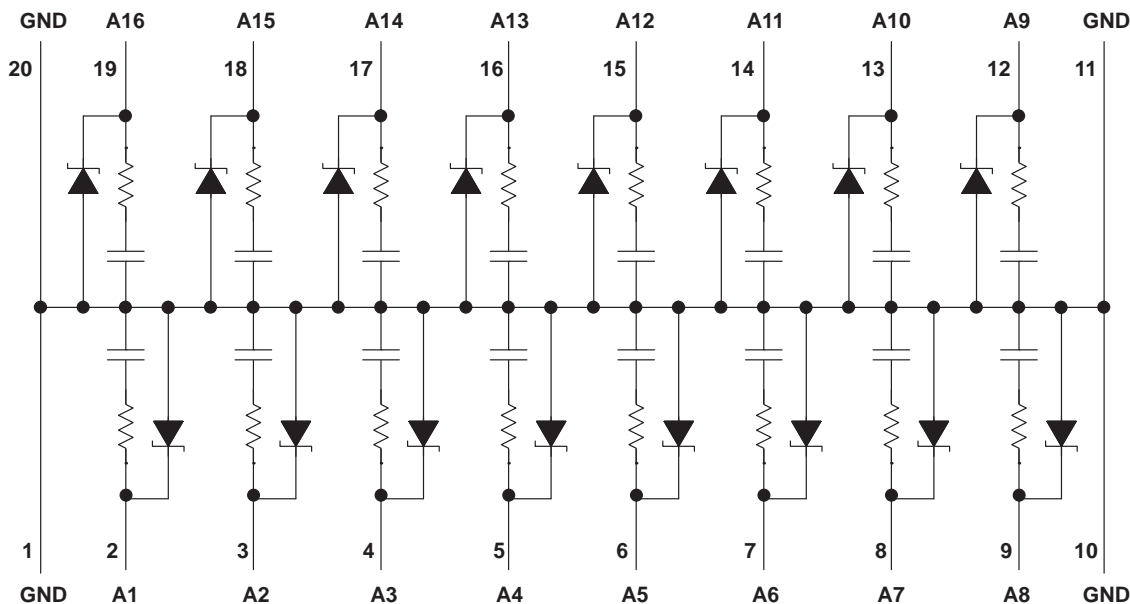


description

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.

schematic diagram



- Resistor = 50 Ω ± 10%
 Capacitor = 47 pF ± 10%, V_R = 2.5 V, f = 1 MHz
 Diode = Schottky

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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 | μA |
| 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 | μA |

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.

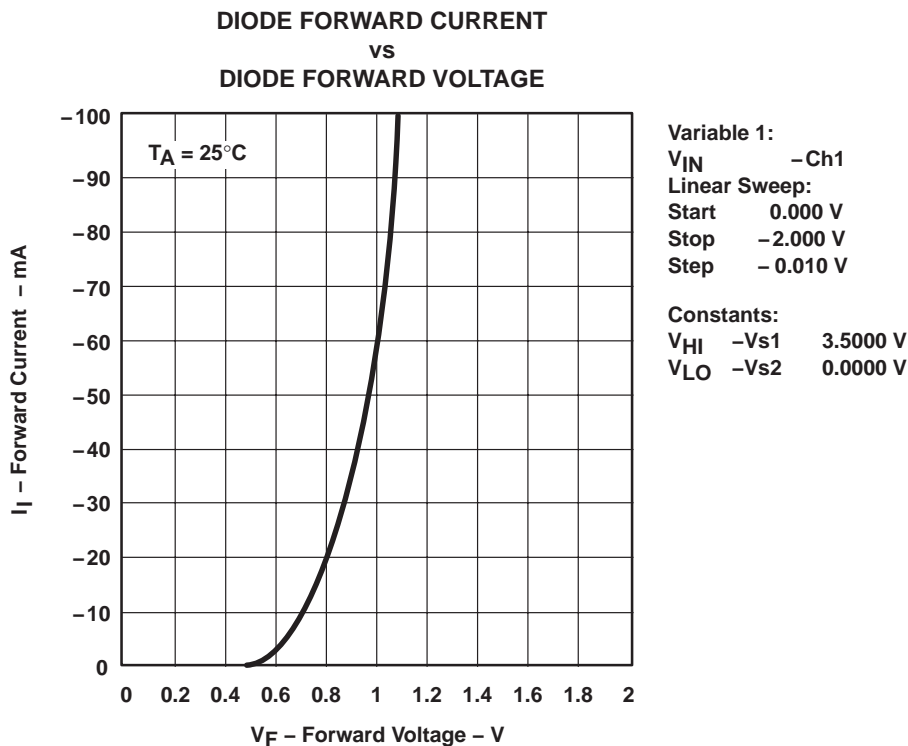
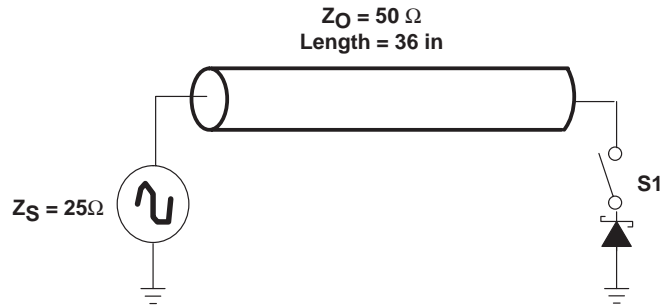


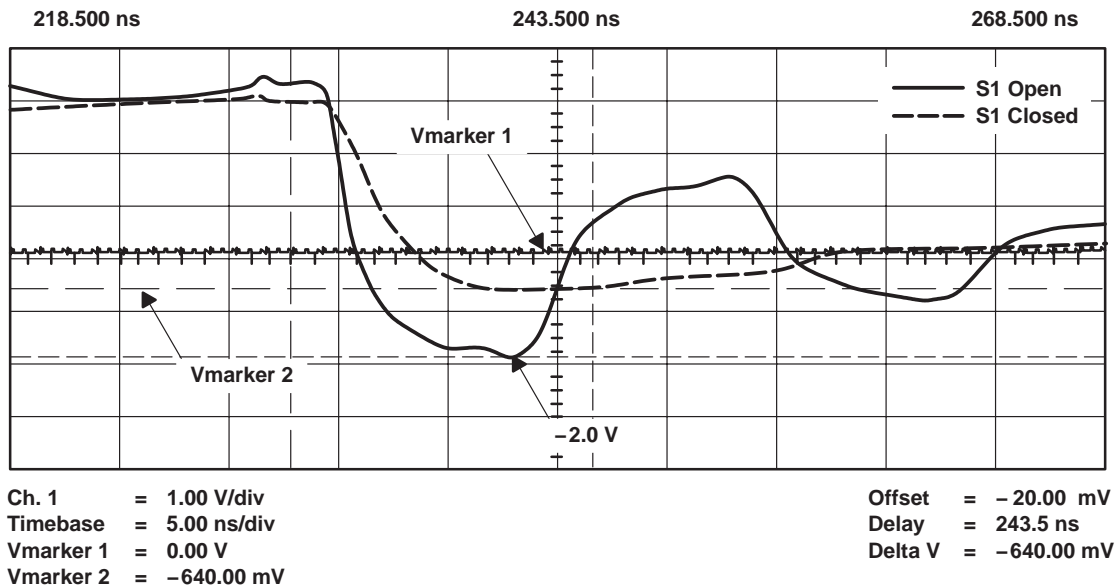
Figure 1

SN74F1016
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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/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| SN74F1016DW | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74F1016DWE4 | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74F1016DWE4 | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74F1016DWG4 | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74F1016DWG4 | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74F1016DWR | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74F1016DWR | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74F1016DWRE4 | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74F1016DWRE4 | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74F1016DWRG4 | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74F1016DWRG4 | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |

⁽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 - 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)

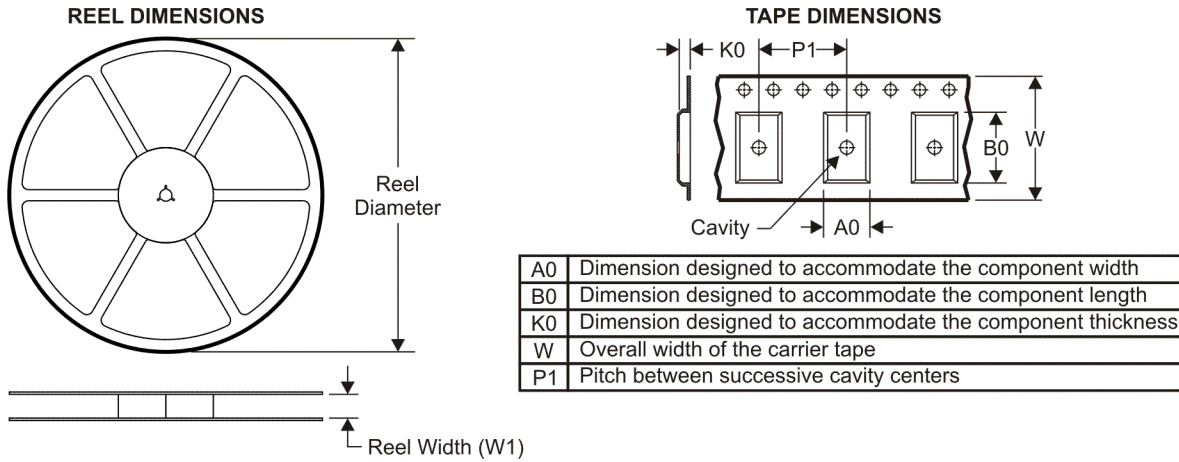
⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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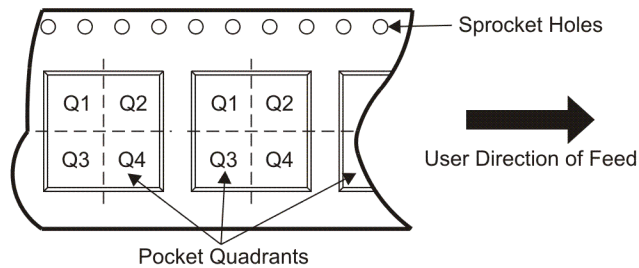
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TAPE AND REEL INFORMATION



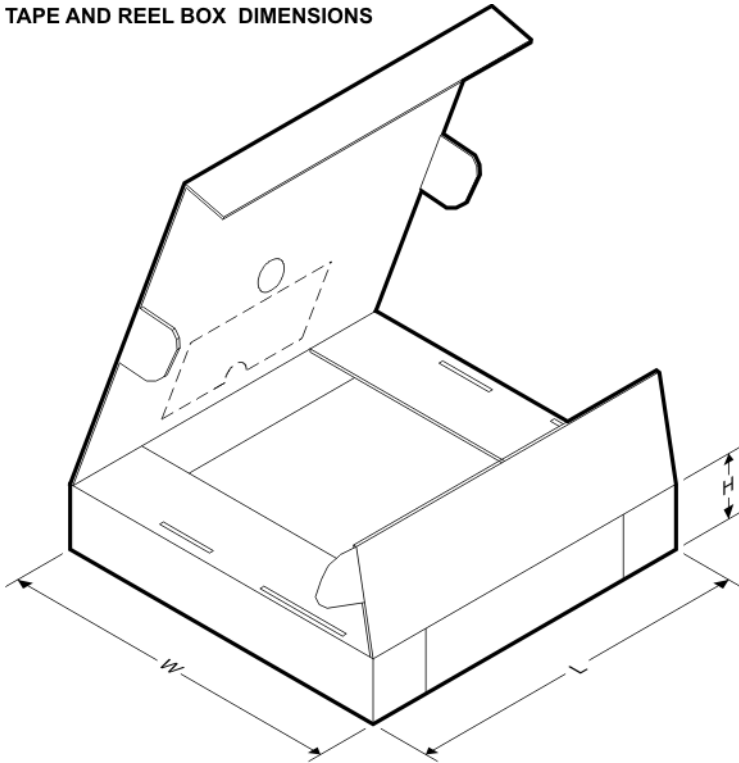
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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 | 13.1 | 2.65 | 12.0 | 24.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS

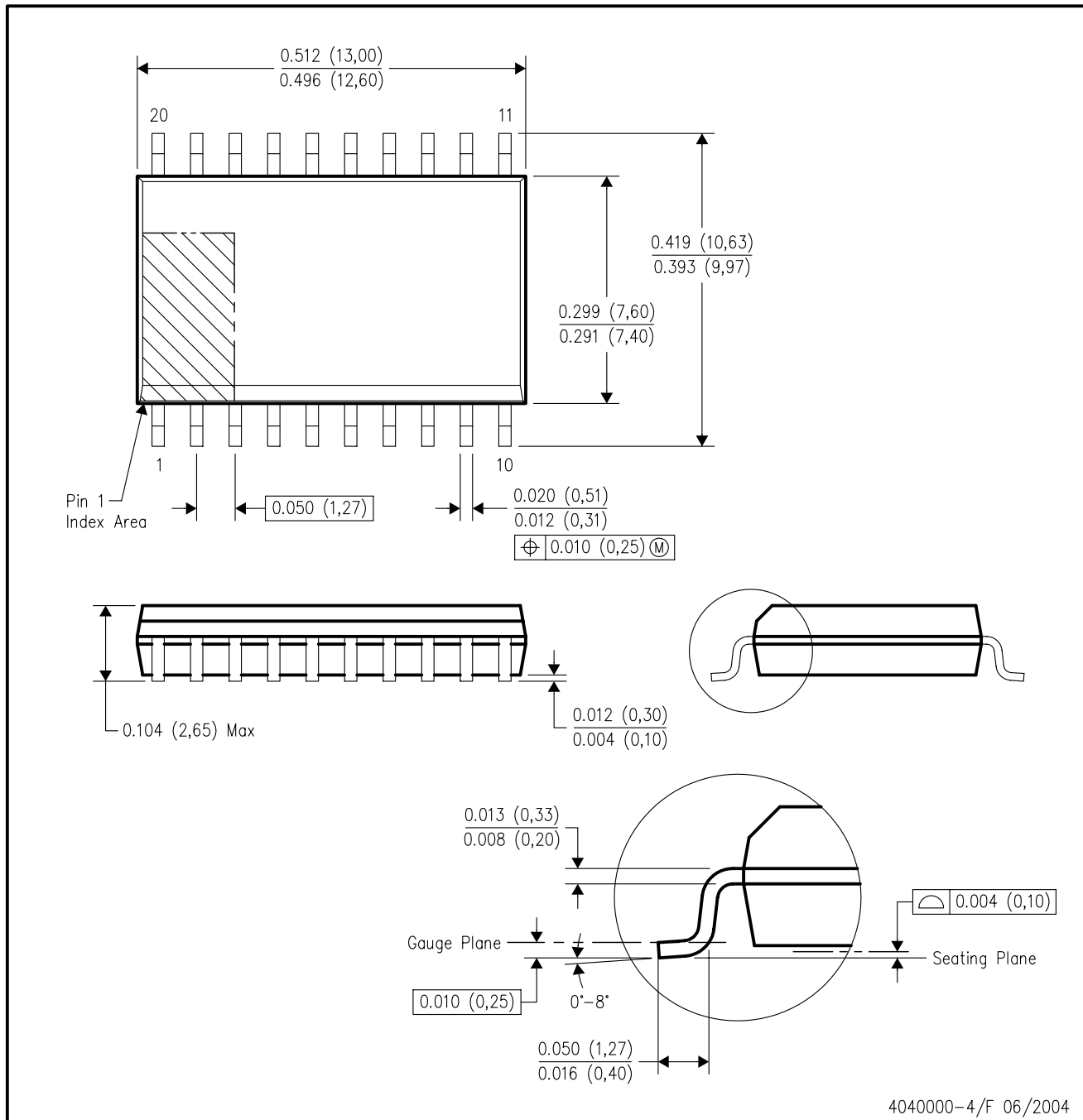


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|--------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74F1016DWR | SOIC | DW | 20 | 2000 | 346.0 | 346.0 | 41.0 |

DW (R-PDSO-G20)

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-013 variation AC.

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