



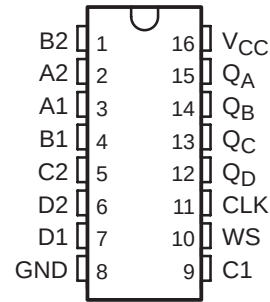
# THE DATASHEET OF SN74AS298ADRE4

# SN74AS298A QUADRUPLE 2-INPUT MULTIPLEXER WITH STORAGE

SDAS219B – DECEMBER 1983 – REVISED DECEMBER 1994

- Selects One of Two 4-Bit Data Sources and Synchronously Stores Data With System Clock
- Applications:
  - Dual Source for Operands and Constants in Arithmetic Processor; Can Release Processor Register Files for Acquiring New Data
  - Implements Separate Registers Capable of Parallel Exchange of Contents, Yet Retains External Load Capability
  - Has Universal-Type Register for Implementing Various Shift Patterns, Including Compound Left-Right Capability
- Package Options Include Plastic Small-Outline (D) Packages and Standard Plastic (N) 300-mil DIPs

D OR N PACKAGE  
(TOP VIEW)



## description

The SN74AS298A is a quadruple 2-input multiplexer with storage that provides essentially the equivalent functional capabilities of two separate MSI functions (SN74AS157 and 'AS175A) in a 16-pin package.

When the word-select (WS) input is low, word 1 (A1, B1, C1, D1) is applied to the flip-flops. A high input to WS causes the selection of word 2 (A2, B2, C2, D2). The selected word is clocked to the output terminals on the negative-going edge of the clock pulse.

The SN74AS298A is characterized for operation from 0°C to 70°C.

FUNCTION TABLE

| INPUTS |     | OUTPUTS <sup>†</sup> |     |     |     |
|--------|-----|----------------------|-----|-----|-----|
| WS     | CLK | QA                   | QB  | QC  | QD  |
| L      | ↓   | a1                   | b1  | c1  | d1  |
| H      | ↓   | a2                   | b2  | c2  | d2  |
| X      | H   | QA0                  | QB0 | QC0 | QD0 |

<sup>†</sup> a1, a2, etc. = the level of steady-state input at A1, A2, etc.

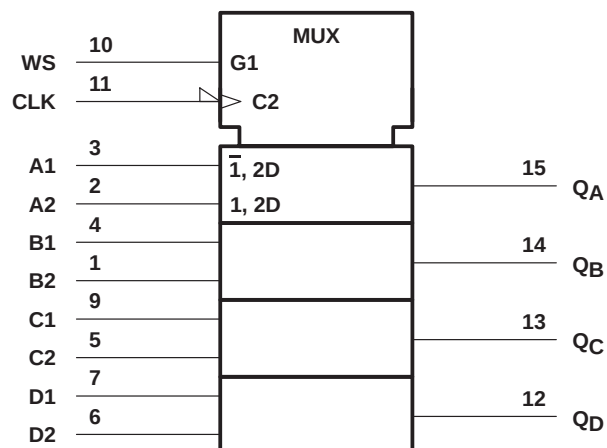
QA0, QB0, etc. = the level of QA, QB, etc. entered on the most recent ↓ transition of CLK

# SN74AS298A

## QUADRUPLE 2-INPUT MULTIPLEXER WITH STORAGE

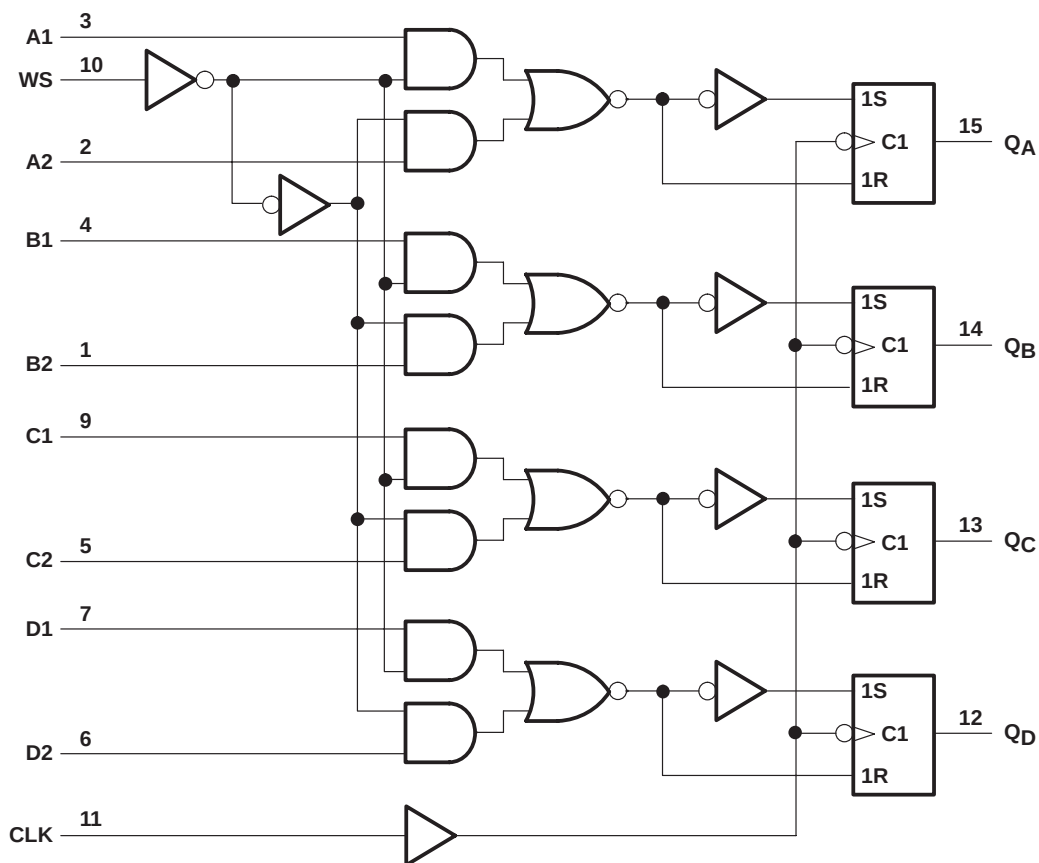
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logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



# SN74AS298A QUADRUPL 2-INPUT MULTIPLEXER WITH STORAGE

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

|                                             |               |
|---------------------------------------------|---------------|
| Supply voltage, $V_{CC}$                    | 7 V           |
| Input voltage, $V_I$                        | 7 V           |
| Operating free-air temperature range, $T_A$ | 0°C to 70°C   |
| Storage temperature range                   | 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.

## recommended operating conditions

|                                      | MIN | NOM | MAX | UNIT |
|--------------------------------------|-----|-----|-----|------|
| $V_{CC}$ Supply voltage              | 4.5 | 5   | 5.5 | V    |
| $V_{IH}$ High-level input voltage    | 2   |     |     | V    |
| $V_{IL}$ Low-level input voltage     |     |     | 0.8 | V    |
| $I_{OH}$ High-level output current   |     |     | -2  | mA   |
| $I_{OL}$ Low-level output current    |     |     | 20  | mA   |
| $T_A$ Operating free-air temperature | 0   |     | 70  | °C   |

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

| PARAMETER     | TEST CONDITIONS                             | MIN          | TYP <sup>‡</sup> | MAX   | UNIT    |
|---------------|---------------------------------------------|--------------|------------------|-------|---------|
| $V_{IK}$      | $V_{CC} = 4.5$ V, $I_I = -18$ mA            |              |                  | -1.2  | V       |
| $V_{OH}$      | $V_{CC} = 4.5$ V to 5.5 V, $I_{OH} = -2$ mA | $V_{CC} - 2$ |                  |       | V       |
| $V_{OL}$      | $V_{CC} = 4.5$ V, $I_{OL} = 20$ mA          |              | 0.35             | 0.5   | V       |
| $I_I$         | $V_{CC} = 5.5$ V, $V_I = 7$ V               |              |                  | 0.1   | mA      |
| $I_{IH}$      | WS                                          |              |                  | 40    | $\mu$ A |
|               | All others                                  |              |                  | 20    |         |
| $I_{IL}$      | WS                                          |              |                  | -0.75 | mA      |
|               | All others                                  |              |                  | -0.5  |         |
| $I_{OS}^{\S}$ | $V_{CC} = 5.5$ V, $V_O = 2.25$ V            | -30          |                  | -112  | mA      |
| $I_{CCH}$     | $V_{CC} = 5.5$ V                            |              | 21               | 33    | mA      |
| $I_{CCL}$     | $V_{CC} = 5.5$ V                            |              | 22               | 36    | mA      |

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

<sup>\S</sup> The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .

## timing requirements over recommended operating free-air temperature range (unless otherwise noted)

|                                             | MIN  | MAX | UNIT |
|---------------------------------------------|------|-----|------|
| $f_{\text{clock}}$ Clock frequency          | 0    | 62  | MHz  |
| $t_w$ Pulse duration, CLK high or low       | 8    |     | ns   |
| $t_{su}$ Setup time before CLK $\downarrow$ | Data | 4.5 | ns   |
|                                             | WS   | 13  |      |
| $t_h$ Hold time after CLK $\downarrow$      | Data | 3.5 | ns   |
|                                             | WS   | 1   |      |



# SN74AS298A

## QUADRUPLE 2-INPUT MULTIPLEXER WITH STORAGE

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switching characteristics over recommended ranges of supply voltage and operating free-air temperature,  $C_L = 50$  pF (unless otherwise noted) (see Figure 3)

| PARAMETER | FROM<br>(INPUT) | TO<br>(OUTPUT) | MIN | MAX | UNIT |
|-----------|-----------------|----------------|-----|-----|------|
| $f_{max}$ |                 |                | 62  |     | MHz  |
| $t_{PLH}$ | CLK             | Q              | 2   | 9   | ns   |
| $t_{PHL}$ |                 |                | 1   | 11  |      |

### APPLICATION INFORMATION

This versatile multiplexer can be connected to operate as a shift register that can shift  $n$  places in a single clock pulse. Figure 1 illustrates a BCD shift register that shifts an entire 4-bit BCD digit in one clock pulse.

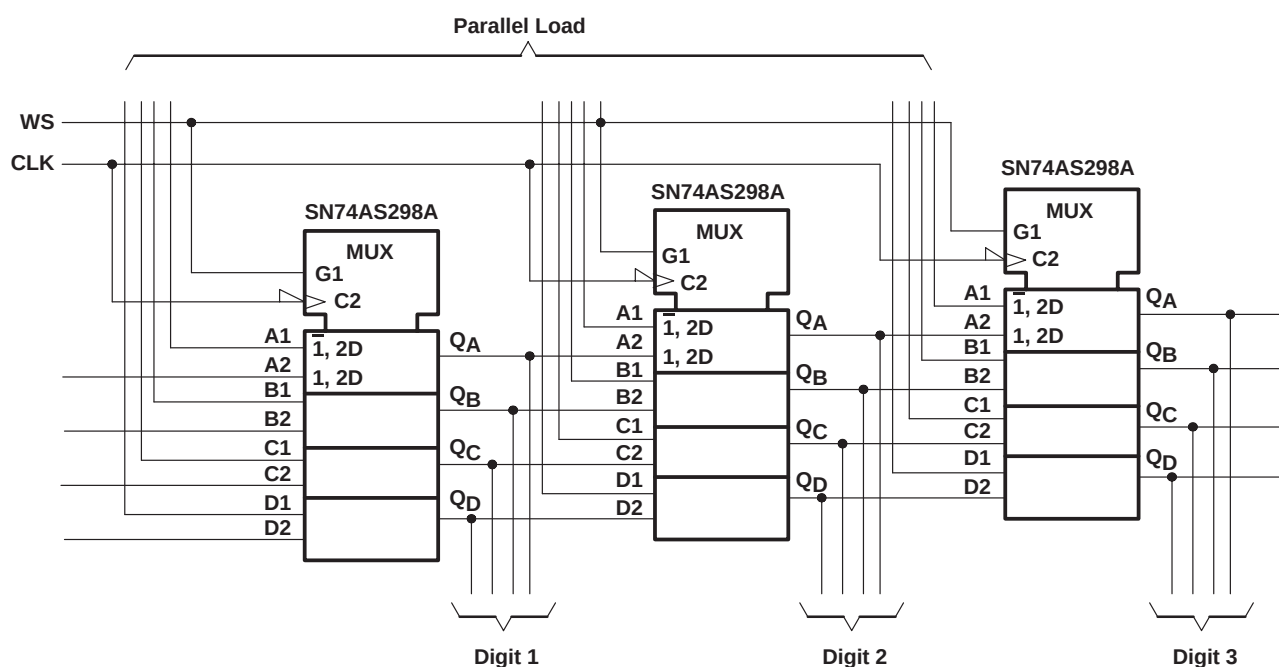


Figure 1. BCD Shift Register

When WS is high and the registers are clocked, the content of register 1 is transferred (shifted) to register 2, etc., effectively shifting the BCD digits one position. This application also retains a parallel-load capability, which means that new BCD data can be entered into the entire register with one clock pulse. This arrangement can be modified to perform the shifting of binary data for any number of bit locations.

Another function that can be implemented is a register designed specifically for supporting multiplier or division operations (see Figure 2).

When WS is low and the register is clocked, the outputs of the arithmetic/logic units (ALUs) are shifted one place. When WS is high and the registers are clocked, the data is shifted two places.

### APPLICATION INFORMATION

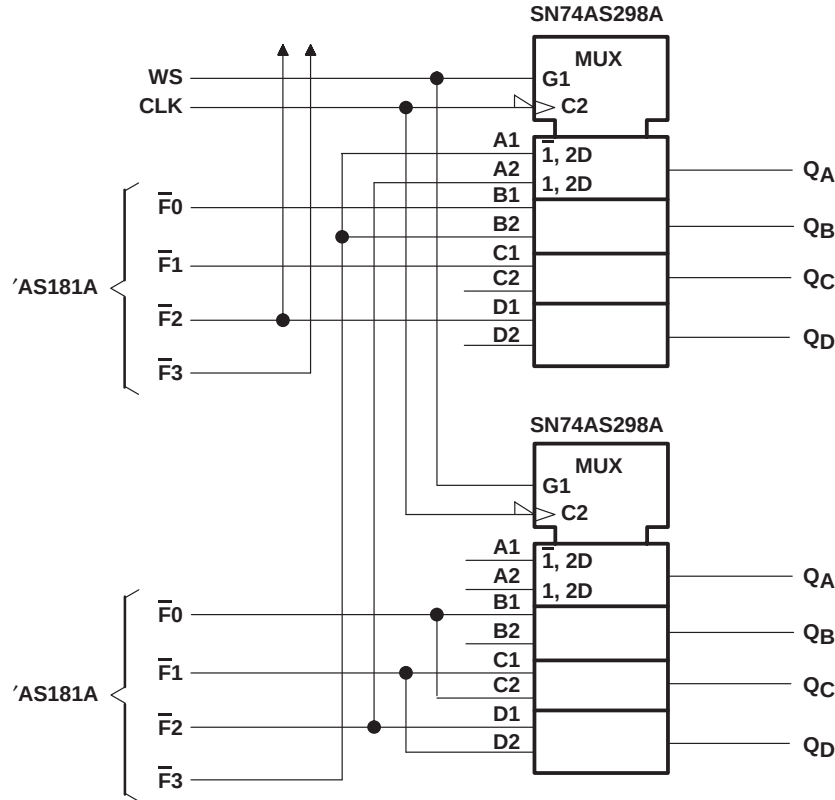


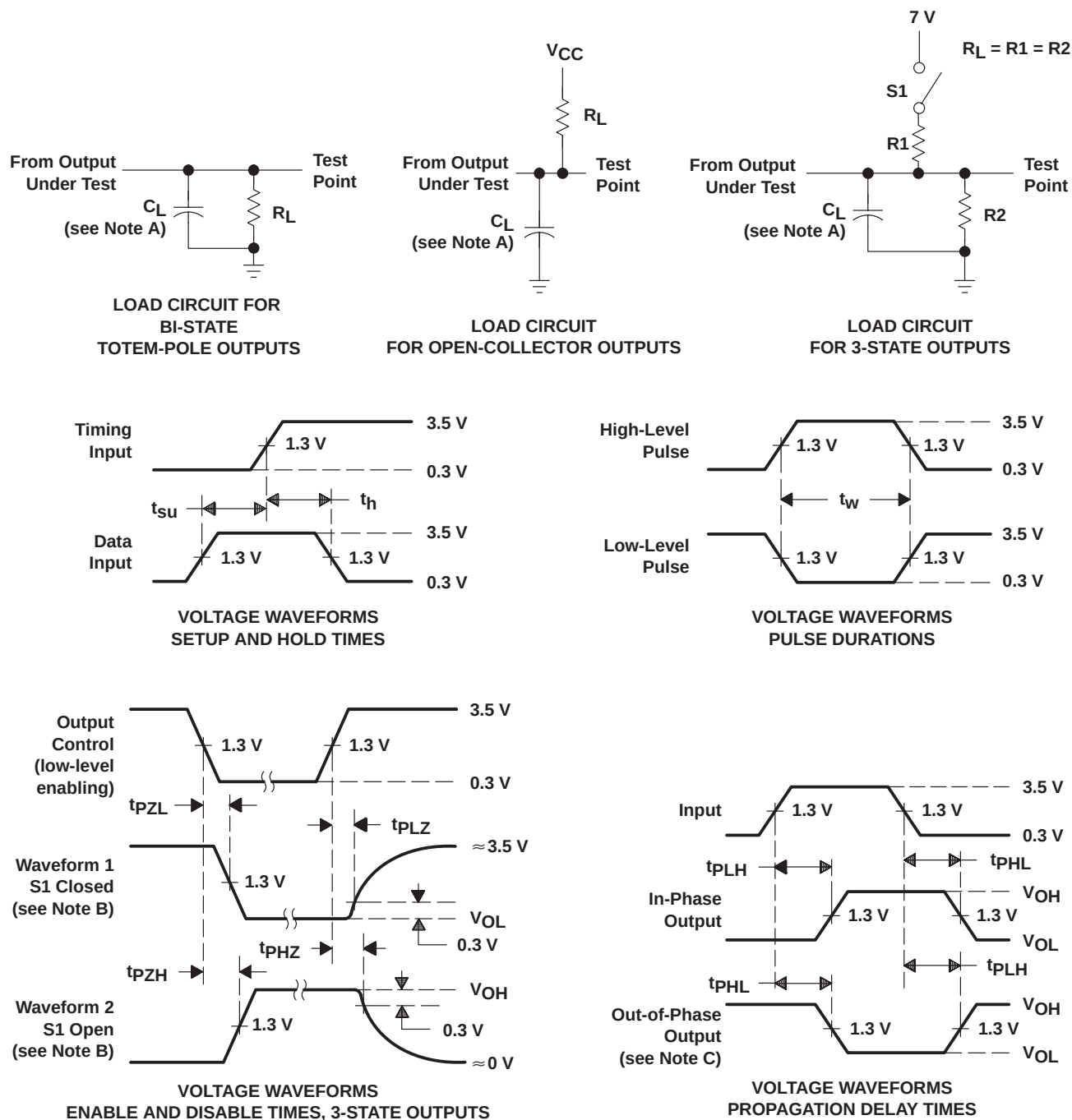
Figure 2. 1-Place/2-Place Shift Register

# SN74AS298A

## QUADRUPLE 2-INPUT MULTIPLEXER WITH STORAGE

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### PARAMETER MEASUREMENT INFORMATION SERIES 54ALS/74ALS AND 54AS/74AS DEVICES



- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.  
 C. When measuring propagation delay items of 3-state outputs, switch S1 is open.  
 D. All input pulses have the following characteristics: PRR  $\leq 1$  MHz,  $t_r = t_f = 2$  ns, duty cycle = 50%.  
 E. The outputs are measured one at a time with one transition per measurement.

Figure 3. Load Circuits and Voltage Waveforms

## PACKAGING INFORMATION

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2) | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| SN74AS298AD      | ACTIVE        | SOIC         | D                  | 16   | 40             | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | AS298A                  | <a href="#">Samples</a> |
| SN74AS298AN      | ACTIVE        | PDIP         | N                  | 16   | 25             | RoHS & Green    | NIPDAU                               | N / A for Pkg Type   | 0 to 70      | SN74AS298AN             | <a href="#">Samples</a> |

<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> **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.

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

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

<sup>(5)</sup> 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.

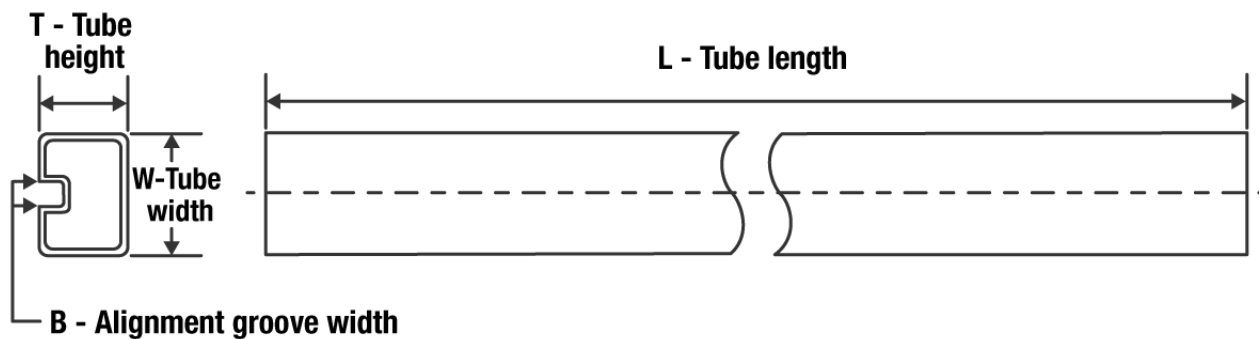
<sup>(6)</sup> Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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## TUBE

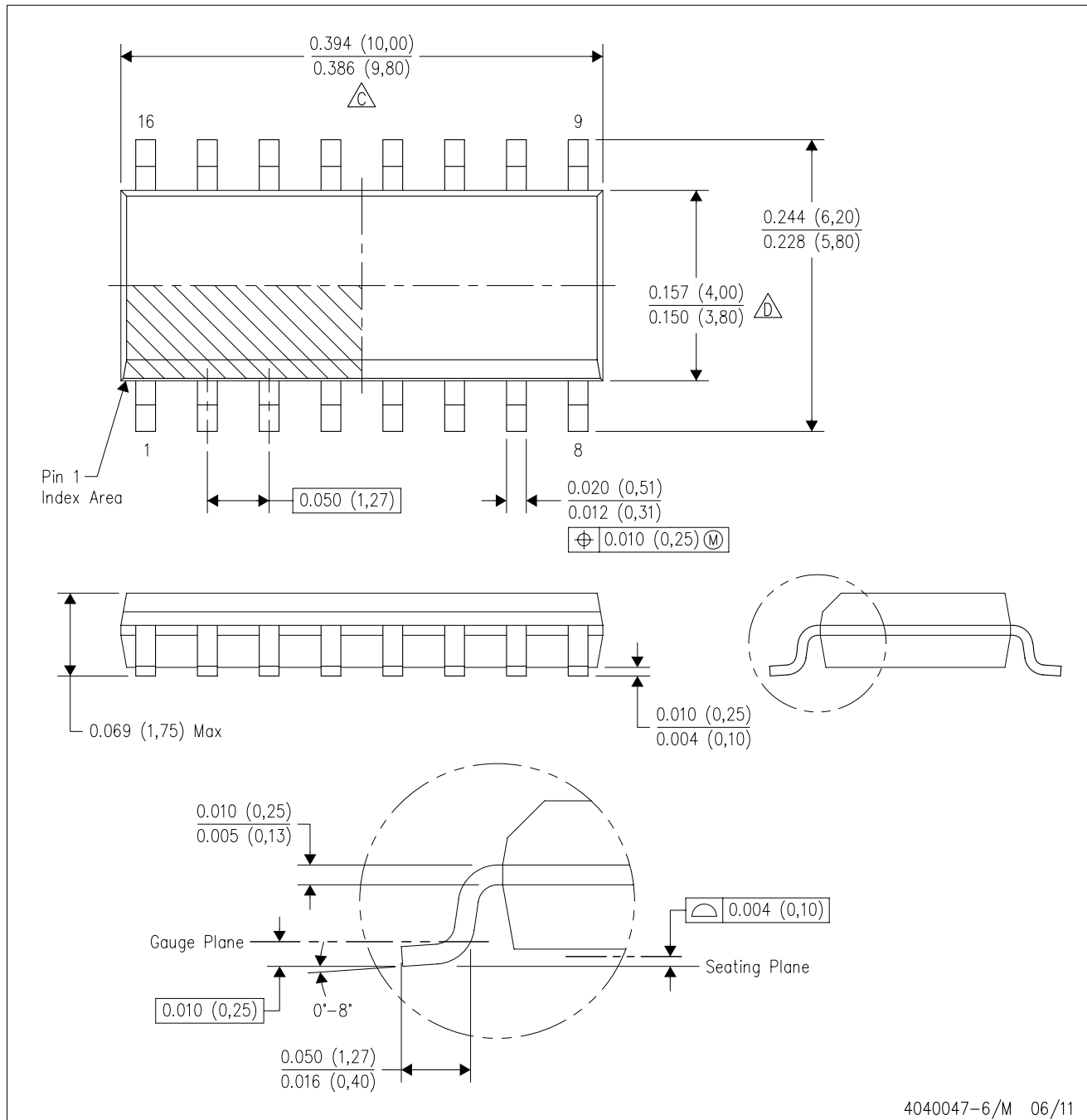


\*All dimensions are nominal

| Device      | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|-------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| SN74AS298AD | D            | SOIC         | 16   | 40  | 507    | 8      | 3940   | 4.32   |
| SN74AS298AN | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SN74AS298AN | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE

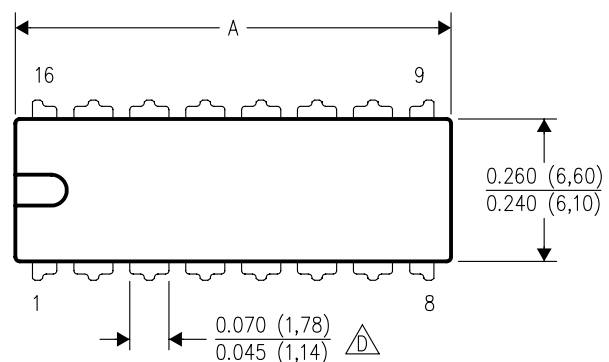


- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - $\triangle C$  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
  - $\triangle D$  Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
  - E. Reference JEDEC MS-012 variation AC.

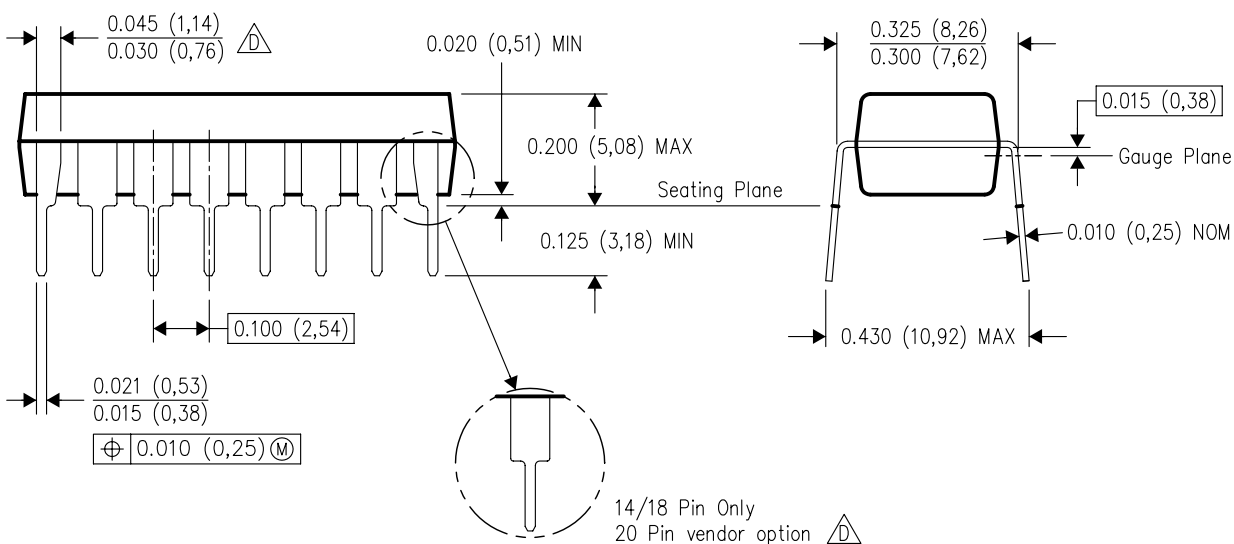
N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



| PINS **<br>DIM      | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| A MAX               | 0.775<br>(19,69) | 0.775<br>(19,69) | 0.920<br>(23,37) | 1.060<br>(26,92) |
| A MIN               | 0.745<br>(18,92) | 0.745<br>(18,92) | 0.850<br>(21,59) | 0.940<br>(23,88) |
| MS-001<br>VARIATION | 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.
-  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.

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