

CMOS Hex Buffer

High-Voltage Types (20-Volt Rating)
3-State Non-Inverting Type

■ CD4503B is a hex noninverting buffer with 3-state outputs having high sink- and source-current capability. Two disable controls are provided, one of which controls four buffers and the other controls the remaining two buffers.

The CD4503B types are supplied in 16-lead hermetic dual-in-line ceramic packages (F3A suffix), 16-lead dual-in-line plastic packages (E suffix), 16-lead small-outline packages (M, M96, MT, and NSR suffixes), and 16-lead thin shrink small-outline packages (PW and PWR suffixes).

Features:

- 1 TTL-load output drive capability
- 2 output-disable controls
- 3-state outputs
- Pin compatible with industry types MM80C97, MC14503, and 340097
- 5-V, 10-V, and 15-V parametric ratings
- Maximum input current of 1 μ A at 18 V over full package-temperature range; 100 nA at 18 V and 25°C
- Meets all requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"

Applications:

- 3-state hex buffer for interfacing IC's with data buses
- CMOS to TTL hex buffer

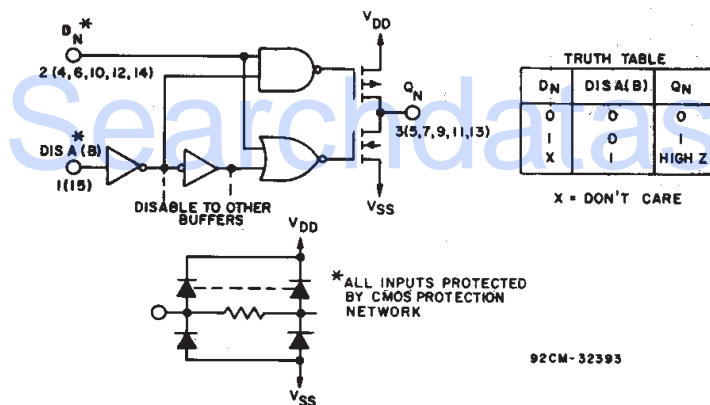
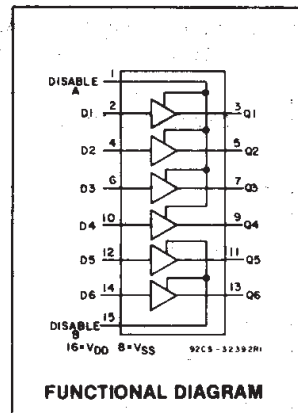


Fig. 1—Logic diagram of 1 to 6 identical buffers.

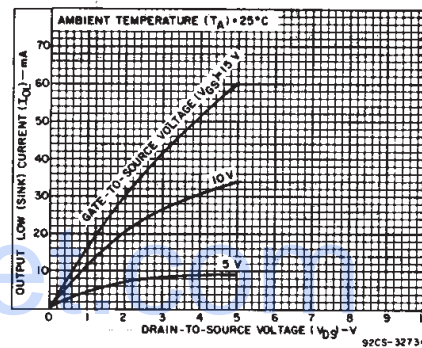


Fig. 2—Typical n-channel output low (sink) current characteristics.

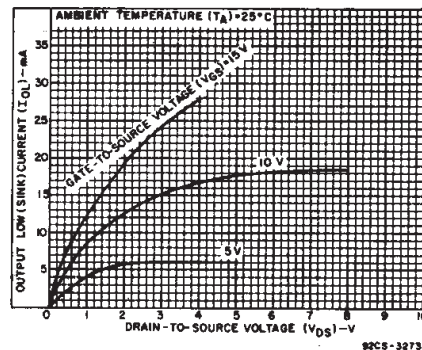


Fig. 3—Minimum n-channel output low (sink) current characteristics.

MAXIMUM RATINGS, Absolute-Maximum Values:

DC SUPPLY-VOLTAGE RANGE, (V_{DD})

Voltages referenced to V_{SS} Terminal -0.5V to +20V

INPUT VOLTAGE RANGE, ALL INPUTS -0.5V to V_{DD} +0.5V

DC INPUT CURRENT, ANY ONE INPUT \pm 10mA

POWER DISSIPATION PER PACKAGE (P_D):

For T_A = -55°C to +100°C 500mW

For T_A = +100°C to +125°C Derate Linearly at 12mW/°C to 200mW

DEVICE DISSIPATION PER OUTPUT TRANSISTOR

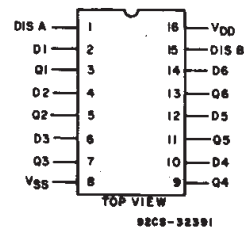
FOR T_A = FULL PACKAGE-TEMPERATURE RANGE (All Package Types) 100mW

OPERATING-TEMPERATURE RANGE (T_A) -55°C to +125°C

STORAGE TEMPERATURE RANGE (T_{stg}) -65°C to +150°C

LEAD TEMPERATURE (DURING SOLDERING):

At distance 1/16 \pm 1/32 inch (1.59 \pm 0.79mm) from case for 10s max +265°C



TERMINAL ASSIGNMENT

CD4503B Types

STATIC ELECTRICAL CHARACTERISTICS

| CHARACTERISTIC | CONDITIONS | | | LIMITS AT INDICATED TEMPERATURES (°C) | | | | | | | UNITS |
|---|-----------------------|------------------------|------------------------|---------------------------------------|-------|------|------|-------|-------------------|------|-------|
| | V _O (V) | V _{IN} (V) | V _{DD} (V) | -55 | -40 | +85 | +125 | +25 | | | |
| | | | | | | | | Min. | Typ. | Max. | |
| Quiescent Device Current, I _{DD} Max. | — | 0,5 | 5 | 1 | 1 | 30 | 30 | — | 0.02 | 1 | μA |
| | — | 0,10 | 10 | 2 | 2 | 60 | 60 | — | 0.02 | 2 | |
| Output Low (Sink) Current I _{OL} Min. | 0.4 | 0 | 5 | 2.6 | 2.5 | 1.4 | 1.3 | 2.1 | 2.3 | — | mA |
| | 0.5 | 0 | 10 | 6.5 | 6.4 | 3.9 | 3.8 | 5.5 | 6.2 | — | |
| | 1.5 | 0 | 15 | 19.2 | 18.9 | 11.4 | 11.2 | 16.1 | 23 | — | |
| Output High (Source) Current, I _{OH} Min. | 4.6 | 5 | 5 | -1.2 | -1.16 | -0.7 | -0.7 | -1.02 | -1.9 | — | mA |
| | 2.5 | 5 | 5 | -5.8 | -5.7 | -3.4 | -3 | -4.8 | -8.1 | — | |
| | 9.5 | 10 | 10 | -3.1 | -3 | -1.9 | -1.8 | -2.6 | -3.7 | — | |
| Output Voltage: Low-Level, V _{OL} Max. | — | 0,5 | 5 | 0.05 | | | | — | 0 | 0.05 | V |
| | — | 0,10 | 10 | 0.05 | | | | — | 0 | 0.05 | |
| | — | 0,15 | 15 | 0.05 | | | | — | 0 | 0.05 | |
| Output Voltage: High-Level, V _{OH} Min. | — | 0,5 | 5 | 4.95 | | | | 4.95 | 5 | — | V |
| | — | 0,10 | 10 | 9.95 | | | | 9.95 | 10 | — | |
| | — | 0,15 | 15 | 14.95 | | | | 14.95 | 15 | — | |
| Input Low Voltage, V _{IL} Max. | 0.5, 4.5 | — | 5 | 1.5 | | | | — | — | 1.5 | V |
| | 1.9 | — | 10 | 3 | | | | — | — | 3 | |
| | 1.5, 13.5 | — | 15 | 4 | | | | — | — | 4 | |
| Input High Voltage, V _{IH} Min. | 0.5, 4.5 | — | 5 | 3.5 | | | | 3.5 | — | — | V |
| | 1.9 | — | 10 | 7 | | | | 7 | — | — | |
| | 1.5, 13.5 | — | 15 | 11 | | | | 11 | — | — | |
| Input Current I _{IN} Max. | — | 0,18 | 18 | ±0.1 | ±0.1 | ±1 | ±1 | — | ±10 ⁻⁵ | ±0.1 | μA |
| 3-State Output Leakage Current, I _{OUT} Max. | 0,18 | 0,18 | 18 | ±0.4 | ±0.4 | ±12 | ±12 | — | ±10 ⁻⁴ | ±0.4 | |

RECOMMENDED OPERATING CONDITIONS

For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges:

| CHARACTERISTIC | LIMITS | | UNITS |
|--|--------|------|-------|
| | Min. | Max. | |
| Supply-Voltage Range (For T _A = Full Package-Temperature Range) | 3 | 18 | V |

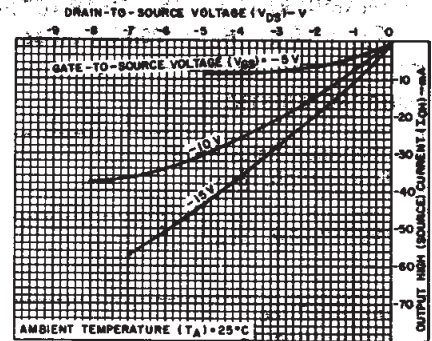


Fig. 4—Typical p-channel output high (source) current characteristics.

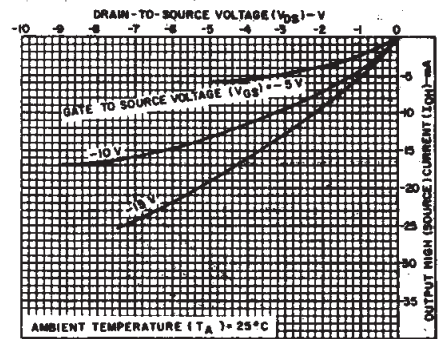


Fig. 5—Minimum p-channel output high (source) current characteristics.

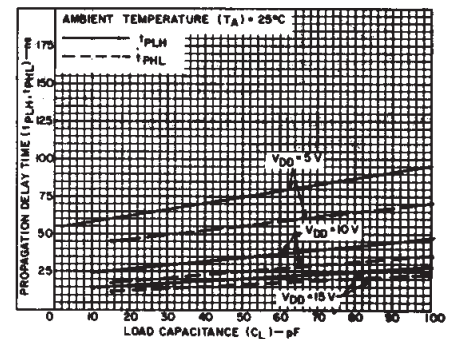


Fig. 6—Typical propagation delay time as a function of load capacitance.

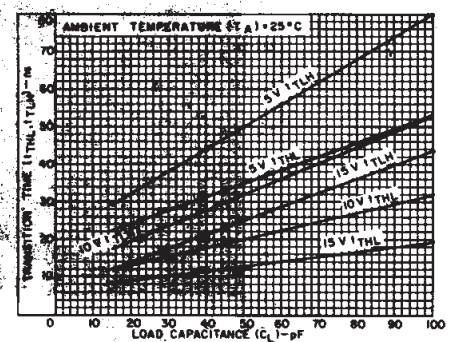


Fig. 7—Typical transition time as a function of load capacitance.

3
COMMERCIAL CMOS
HIGH VOLTAGE ICs

CD4503B Types

DYNAMIC ELECTRICAL CHARACTERISTICS at $T_A = 25^\circ\text{C}$; Input $t_r, t_f = 20\text{ ns}$, $C_L = 50\text{ pF}$, $R_L = 200\text{ k}\Omega$ unless otherwise specified.

| CHARACTERISTIC | V_{DD} (V) | LIMITS | | UNITS |
|--|--------------|--------|------|-------|
| | | Typ. | Max. | |
| Propagation Delay Time: Low-to-High, t_{PLH} | 5 | 75 | 150 | ns |
| | 10 | 35 | 70 | |
| | 15 | 25 | 50 | |
| High-to-Low, t_{PHL} | 5 | 55 | 110 | ns |
| | 10 | 25 | 50 | |
| | 15 | 17 | 35 | |
| Transition Time: Low-to-High, t_{TLH} | 5 | 50 | 90 | ns |
| | 10 | 30 | 45 | |
| | 15 | 25 | 35 | |
| High-to-Low, t_{THL} | 5 | 35 | 70 | ns |
| | 10 | 20 | 40 | |
| | 15 | 13 | 25 | |
| 3-State Propagation Delay Time: $R_L = 1\text{ k}\Omega$ t_{PHZ}, t_{PZH} | 5 | 70 | 140 | ns |
| | 10 | 30 | 60 | |
| | 15 | 25 | 50 | |
| t_{PZL}, t_{PLZ} | 5 | 90 | 180 | ns |
| | 10 | 40 | 80 | |
| | 15 | 35 | 70 | |

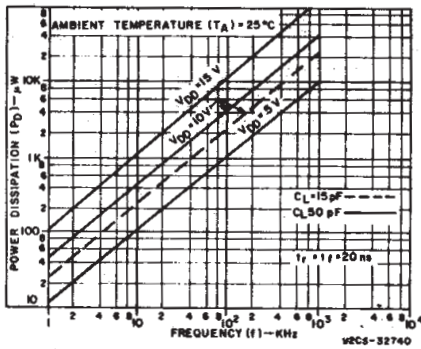


Fig. 8—Typical power dissipation as a function of frequency.

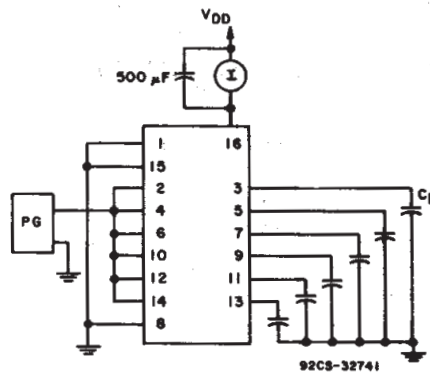


Fig. 9—Dynamic power dissipation test circuit.

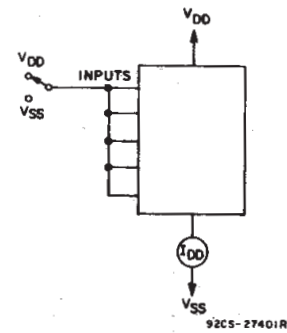


Fig. 10—Quiescent device current test circuit.

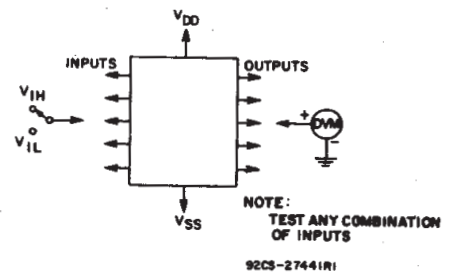


Fig. 11—Input voltage test circuit.

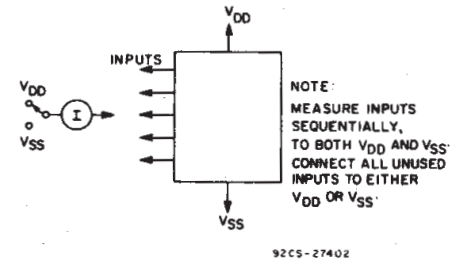
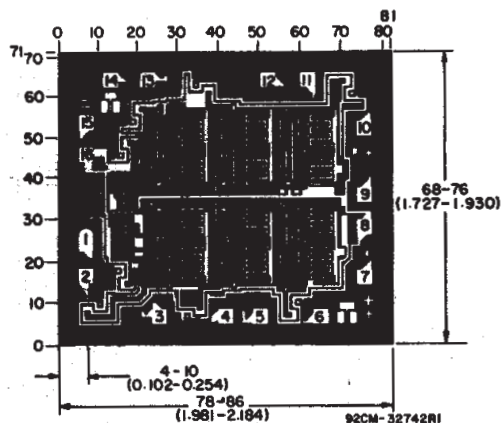


Fig. 12—Input current test circuit.



Dimensions and pad layout for CD4503BH

Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated. Grid graduations are in mils (10^{-3} inch).

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PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| CD4503BE | ACTIVE | PDIP | N | 16 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| CD4503BEE4 | ACTIVE | PDIP | N | 16 | 25 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| CD4503BF | ACTIVE | CDIP | J | 16 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| CD4503BF3A | ACTIVE | CDIP | J | 16 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| CD4503BM | ACTIVE | SOIC | D | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| CD4503BM96 | ACTIVE | SOIC | D | 16 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| CD4503BM96E4 | ACTIVE | SOIC | D | 16 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| CD4503BM96G4 | ACTIVE | SOIC | D | 16 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| CD4503BME4 | ACTIVE | SOIC | D | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| CD4503BMG4 | ACTIVE | SOIC | D | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| CD4503BMT | ACTIVE | SOIC | D | 16 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| CD4503BMTE4 | ACTIVE | SOIC | D | 16 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| CD4503BMTG4 | ACTIVE | SOIC | D | 16 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| CD4503BNSR | ACTIVE | SO | NS | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| CD4503BNSRE4 | ACTIVE | SO | NS | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| CD4503BNSRG4 | ACTIVE | SO | NS | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| CD4503BPW | ACTIVE | TSSOP | PW | 16 | 90 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| CD4503BPWE4 | ACTIVE | TSSOP | PW | 16 | 90 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| CD4503BPWG4 | ACTIVE | TSSOP | PW | 16 | 90 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| CD4503BPWR | ACTIVE | TSSOP | PW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| CD4503BPWRE4 | ACTIVE | TSSOP | PW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| CD4503BPWRG4 | ACTIVE | TSSOP | PW | 16 | 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.

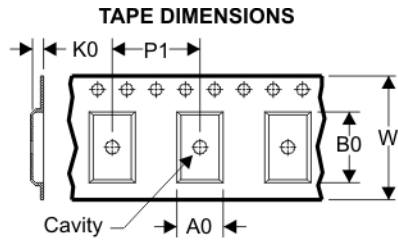
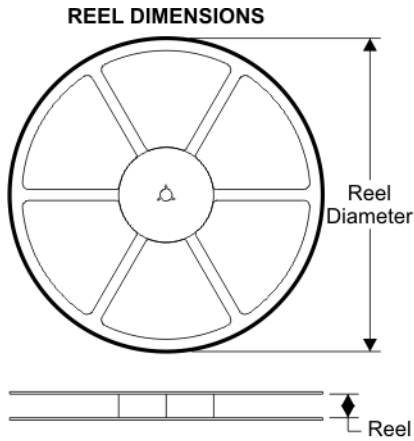
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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TAPE AND REEL BOX INFORMATION



| | |
|----|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



| Device | Package | Pins | Site | Reel Diameter (mm) | Reel Width (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|------------|---------|------|---------|--------------------|-----------------|---------|---------|---------|---------|--------|---------------|
| CD4503BM96 | D | 16 | SITE 27 | 330 | 16 | 6.5 | 10.3 | 2.1 | 8 | 16 | Q1 |
| CD4503BNSR | NS | 16 | SITE 41 | 330 | 16 | 8.2 | 10.5 | 2.5 | 12 | 16 | Q1 |
| CD4503BPWR | PW | 16 | SITE 41 | 330 | 12 | 7.0 | 5.6 | 1.6 | 8 | 12 | Q1 |

TAPE AND REEL BOX DIMENSIONS



| Device | Package | Pins | Site | Length (mm) | Width (mm) | Height (mm) |
|------------|---------|------|---------|-------------|------------|-------------|
| CD4503BM96 | D | 16 | SITE 27 | 342.9 | 336.6 | 28.58 |
| CD4503BNSR | NS | 16 | SITE 41 | 346.0 | 346.0 | 33.0 |
| CD4503BPWR | PW | 16 | SITE 41 | 346.0 | 346.0 | 29.0 |

J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



| DIM \ PINS ** | 14 | 16 | 18 | 20 |
|---------------|------------------------|------------------------|------------------------|------------------------|
| A | 0.300 (7,62) BSC | 0.300 (7,62) BSC | 0.300 (7,62) BSC | 0.300 (7,62) BSC |
| B MAX | 0.785 (19,94) | .840 (21,34) | 0.960 (24,38) | 1.060 (26,92) |
| B MIN | — | — | — | — |
| C MAX | 0.300 (7,62) | 0.300 (7,62) | 0.310 (7,87) | 0.300 (7,62) |
| C MIN | 0.245 (6,22) | 0.245 (6,22) | 0.220 (5,59) | 0.245 (6,22) |



4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package is hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- 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.

D (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
 - D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
 - E. Reference JEDEC MS-012 variation AC.

MECHANICAL DATA

NS (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.

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- 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