

CMOS 8-Bit Priority Encoder

High-Voltage Types (20-Volt Rating)

■ CD4532B consists of combination logic that encodes the highest priority input (D7-D0) to a 3-bit binary code. The eight inputs, D7 through D0, each have an assigned priority; D7 is the highest priority and D0 is the lowest. The priority encoder is inhibited when the chip-enable input E_I is low. When E_I is high, the binary representation of the highest-priority input appears on output lines Q2-Q0, and the group select line GS is high to indicate that priority inputs are present. The enable-out (E_O) is high when no priority inputs are present. If any one input is high, E_O is low and all cascaded lower-order stages are disabled.

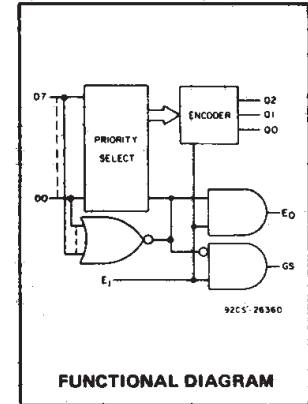
The CD4532B types are supplied in 16-lead hermetic dual-in-line ceramic packages (F3A suffix), 16-lead dual-in-line plastic packages (E suffix), 16-lead small-outline packages (M, M96, MT, and NSR suffixes), and 16-lead thin shrink small-outline packages (PW and PWR suffixes).

Features:

- Converts from 1 of 8 to binary
- Provides cascading feature to handle any number of inputs
- Group select indicates one or more priority inputs
- Standardized, symmetrical output characteristics
- 100% tested for quiescent current at 20 V
- Maximum input current of 1 μ A at 18 V over full package temperature range; 100 nA at 18 V and 25°C
- Noise margin (full package-temperature range):
 - 0.5 V at $V_{DD} = 5$ V
 - 1.5 V at $V_{DD} = 10$ V
 - 1.5 V at $V_{DD} = 15$ V
- 5-V, 10-V, and 15-V parametric ratings
- Meets all requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"

Applications:

- Priority encoder
- Binary or BCD encoder (keyboard encoding)
- Floating point arithmetic



RECOMMENDED OPERATING CONDITIONS

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

| Characteristic | Min. | Max. | Units |
|---|------|------|-------|
| Supply Voltage Range (for $T_A =$ Full Package Temp. Range) | 3 | 18 | V |

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 $V_{DD} + 0.5$ V

DC INPUT CURRENT, ANY ONE INPUT ± 10 mA

POWER DISSIPATION PER PACKAGE (P_D):

For $T_A = -55^\circ\text{C}$ to $+100^\circ\text{C}$ 500mW

For $T_A = +100^\circ\text{C}$ to $+125^\circ\text{C}$ Derate Linearity at 12mW/ $^\circ\text{C}$ to 200mW

DEVICE DISSIPATION PER OUTPUT TRANSISTOR

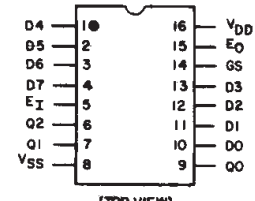
FOR $T_A =$ FULL PACKAGE-TEMPERATURE RANGE (All Package Types) 100mW

OPERATING-TEMPERATURE RANGE (T_A) -55°C to $+125^\circ\text{C}$

STORAGE TEMPERATURE RANGE (T_{stg}) -65°C to $+150^\circ\text{C}$

LEAD TEMPERATURE (DURING SOLDERING):

At distance 1/16 \pm 1/32 inch (1.59 \pm 0.79mm) from case for 10s max $+265^\circ\text{C}$



TERMINAL ASSIGNMENT

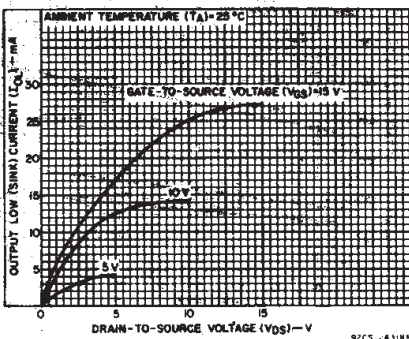


Fig. 1 – Typical output low (sink) current characteristics.

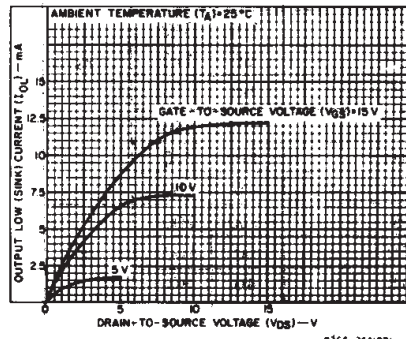


Fig. 2 – Minimum output low (sink) current characteristics.

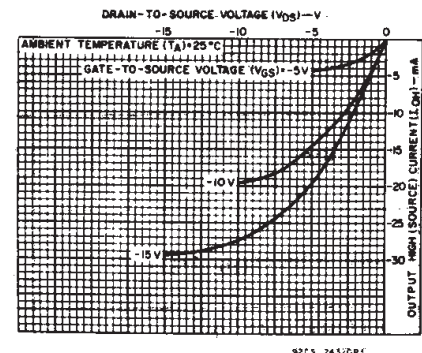


Fig. 3 – Typical output high (source) current characteristics.

3
COMMERCIAL CMOS
HIGH VOLTAGE ICs

CD4532B 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 | 5 | 5 | 150 | 150 | - | 0,04 | 5 | μA |
| | - | 0,10 | 10 | 10 | 10 | 300 | 300 | - | 0,04 | 10 | |
| | - | 0,15 | 15 | 20 | 20 | 600 | 600 | - | 0,04 | 20 | |
| | - | 0,20 | 20 | 100 | 100 | 3000 | 3000 | - | 0,08 | 100 | |
| Output Low (Sink) Current I _{OL} Min. | 0,4 | 0,5 | 5 | 0,64 | 0,61 | 0,42 | 0,36 | 0,51 | 1 | - | mA |
| | 0,5 | 0,10 | 10 | 1,6 | 1,5 | 1,1 | 0,9 | 1,3 | 2,6 | - | |
| | 1,5 | 0,15 | 15 | 4,2 | 4 | 2,8 | 2,4 | 3,4 | 6,8 | - | |
| | 4,6 | 0,5 | 5 | -0,64 | -0,61 | -0,42 | -0,36 | -0,51 | -1 | - | |
| Output High (Source) Current, I _{OH} Min. | 2,5 | 0,5 | 5 | -2 | -1,8 | -1,3 | -1,15 | -1,6 | -3,2 | - | mA |
| | 9,5 | 0,10 | 10 | -1,6 | -1,5 | -1,1 | -0,9 | -1,3 | -2,6 | - | |
| | 13,5 | 0,15 | 15 | -4,2 | -4 | -2,8 | -2,4 | -3,4 | -6,8 | - | |
| | 4,6 | 0,5 | 5 | -0,64 | -0,61 | -0,42 | -0,36 | -0,51 | -1 | - | |
| 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 | | | - | - | 1,5 | - | V |
| | 1,9 | - | 10 | 2,5 | | | - | - | 3 | - | |
| | 1,5, 13,5 | - | 15 | 3 | | | - | - | 4 | - | |
| Input High Voltage, V _{IH} Min.* | 0,5, 4,5 | - | 5 | 4 | | | 3,5 | - | - | - | V |
| | 1,9 | - | 10 | 7,5 | | | 7 | - | - | - | |
| | 1,5, 13,5 | - | 15 | 12 | | | 11 | - | - | - | |
| Input Current I _{IN} Max. | | 0,18 | 18 | ±0,1 | ±0,1 | ±1 | ±1 | - | ±10 ⁻⁵ | ±0,1 | μA |

*One input is tested at a time; other inputs should be at V_{DD} or V_{SS}. For testing all inputs at V_{IL} and V_{IH} levels, use 20%/80% V_{DD}.

DYNAMIC ELECTRICAL CHARACTERISTICS at T_A=25°C; C_L=50 pF, Input t_r, t_f= 20 ns, R_L=200 kΩ

| CHARACTERISTIC | TEST CONDITIONS V _{DD} VOLTS | LIMITS | | UNITS |
|---|---------------------------------------|--------|------|-------|
| | | TYP. | MAX. | |
| Propagation Delay Time t _{PHL} , t _{PLH} E _I to E _O , E _I to G _S | 5 | 110 | 220 | ns |
| | 10 | 55 | 110 | |
| | 15 | 45 | 85 | |
| E _I to Q _M , D _n to G _S | 5 | 170 | 340 | ns |
| | 10 | 85 | 170 | |
| | 15 | 65 | 125 | |
| D _n to Q _M | 5 | 220 | 440 | ns |
| | 10 | 110 | 220 | |
| | 15 | 85 | 160 | |
| Transition Time t _{THL} , t _{TLH} | 5 | 100 | 200 | ns |
| | 10 | 50 | 100 | |
| | 15 | 40 | 80 | |
| Input Capacitance C _{IN} | Any Input | 5 | 7,5 | pF |

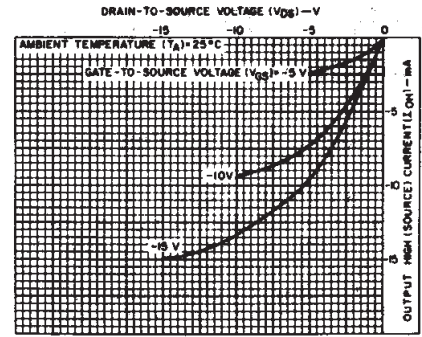


Fig. 4 - Minimum output high (source) current characteristics.

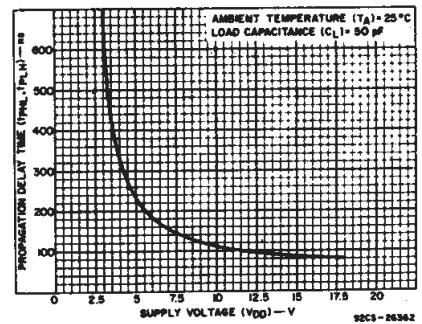


Fig. 5 - Typical propagation delay (D_n to Q_m) vs. supply voltage.

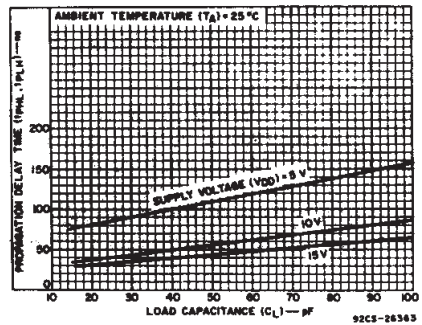


Fig. 6 - Typical propagation delay (E_I to G_S, E_I to E_O) vs. load capacitance.

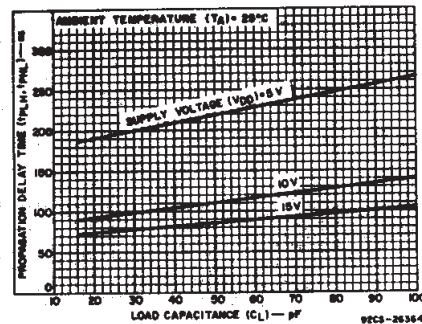
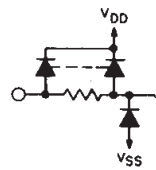
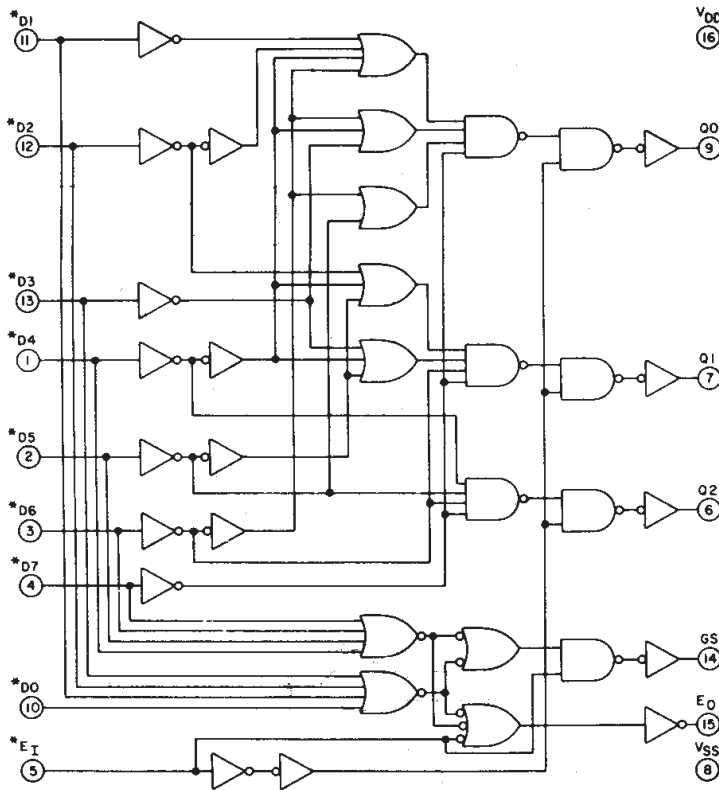


Fig. 7 - Typical propagation delay (D_n to Q_m) vs. load capacitance.

CD4532B Types



*ALL INPUTS PROTECTED BY CMOS PROTECTION NETWORK

Fig. 8 - CD4532 logic diagram.

TRUTH TABLE

| Input | | | | | | | | | Output | | | | |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| E _I | D ₇ | D ₆ | D ₅ | D ₄ | D ₃ | D ₂ | D ₁ | D ₀ | Q ₇ | Q ₆ | Q ₅ | Q ₄ | Q ₃ |
| 0 | X | X | X | X | X | X | X | X | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1 | 1 | X | X | X | X | X | X | X | 1 | 1 | 1 | 1 | 0 |
| 1 | 0 | 1 | X | X | X | X | X | X | 1 | 1 | 1 | 0 | 0 |
| 1 | 0 | 0 | 1 | X | X | X | X | X | 1 | 1 | 0 | 1 | 0 |
| 1 | 0 | 0 | 0 | 1 | X | X | X | X | 1 | 1 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 1 | X | X | X | 1 | 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 1 | X | X | 1 | 0 | 1 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | X | 1 | 0 | 0 | 1 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |

X = Don't Care

Logic 1 ≡ High

Logic 0 ≡ Low

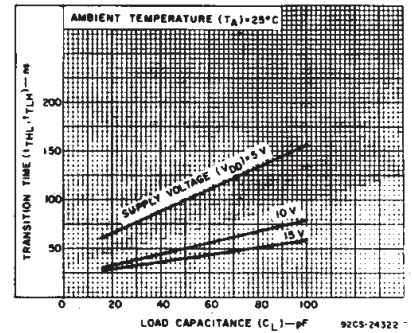


Fig. 9 - Typical transition time vs. load capacitance.

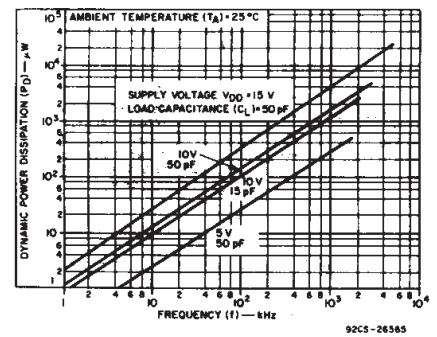


Fig. 10 - Typical dynamic power dissipation vs. frequency.

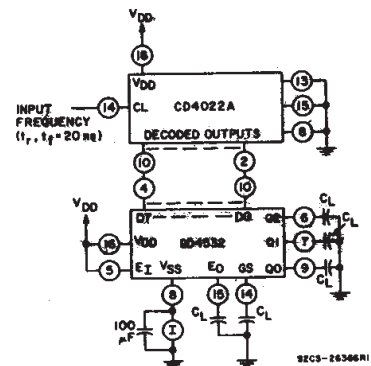


Fig. 11 - Dynamic power dissipation test circuit.

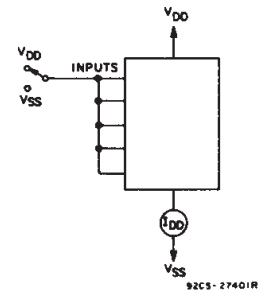


Fig. 12 - Quiescent device current test circuit.

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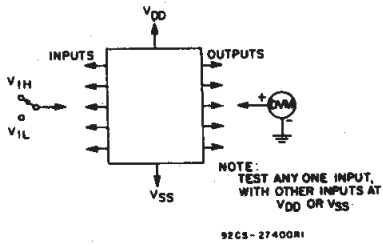


Fig. 13 - Input voltage test circuit.

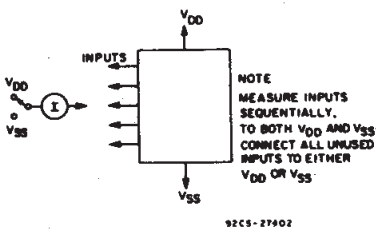
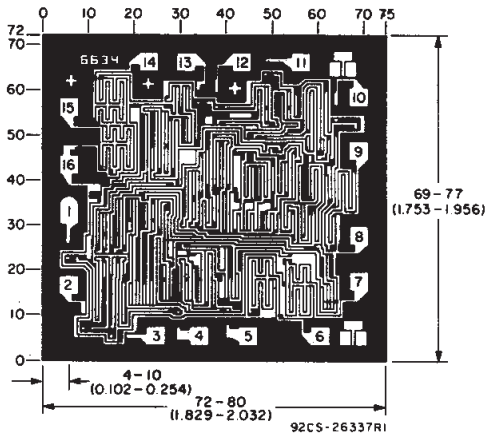


Fig. 14 - Input current test circuit.



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

Dimensions and pad layout for CD4532BH.

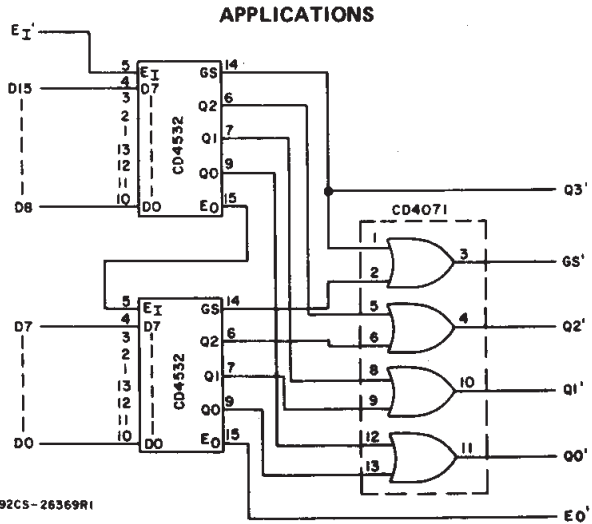
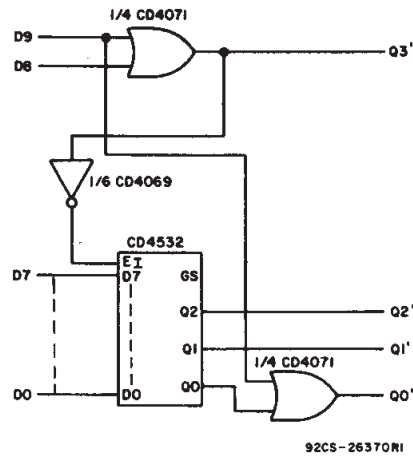


Fig. 15 - 16-level priority encoder.



TRUTH TABLE

| Input | | | | | | | | | | Output | | | | |
|-------|----|----|----|----|----|----|----|----|----|--------|-----|-----|-----|-----|
| D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | GS | Q3' | Q2' | Q1' | Q0' |
| 1 | X | X | X | X | X | X | X | X | X | 0 | 1 | 0 | 0 | 1 |
| 0 | 1 | X | X | X | X | X | X | X | X | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 1 | X | X | X | X | X | X | X | 1 | 0 | 1 | 1 | 1 |
| 0 | 0 | 0 | 1 | X | X | X | X | X | X | 1 | 0 | 1 | 1 | 0 |
| 0 | 0 | 0 | 0 | 1 | X | X | X | X | X | 1 | 0 | 1 | 0 | 1 |
| 0 | 0 | 0 | 0 | 0 | 1 | X | X | X | X | 1 | 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | X | X | X | 1 | 0 | 0 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | X | X | 1 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | X | 1 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |

X = Don't Care

Logic 1 \equiv High

Logic 0 \equiv Low

Fig. 16 - 0-to-9 keyboard encoder.

PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| CD4532BE | ACTIVE | PDIP | N | 16 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | N / A for Pkg Type | -55 to 125 | CD4532BE | Samples |
| CD4532BEE4 | ACTIVE | PDIP | N | 16 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | N / A for Pkg Type | -55 to 125 | CD4532BE | Samples |
| CD4532BF3A | ACTIVE | CDIP | J | 16 | 1 | TBD | A42 | N / A for Pkg Type | -55 to 125 | CD4532BF3A | Samples |
| CD4532BM | ACTIVE | SOIC | D | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CD4532BM | Samples |
| CD4532BM96 | ACTIVE | SOIC | D | 16 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CD4532BM | Samples |
| CD4532BM96E4 | ACTIVE | SOIC | D | 16 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CD4532BM | Samples |
| CD4532BMG4 | ACTIVE | SOIC | D | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CD4532BM | Samples |
| CD4532BNSR | ACTIVE | SO | NS | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CD4532B | Samples |
| CD4532BPWR | ACTIVE | TSSOP | PW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -55 to 125 | CM532B | 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.

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

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OTHER QUALIFIED VERSIONS OF CD4532B, CD4532B-MIL :

- Catalog: [CD4532B](#)
- Military: [CD4532B-MIL](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

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 |
|------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| CD4532BM96 | SOIC | D | 16 | 2500 | 330.0 | 16.4 | 6.5 | 10.3 | 2.1 | 8.0 | 16.0 | Q1 |
| CD4532BNSR | SO | NS | 16 | 2000 | 330.0 | 16.4 | 8.2 | 10.5 | 2.5 | 12.0 | 16.0 | Q1 |
| CD4532BPWR | TSSOP | PW | 16 | 2000 | 330.0 | 12.4 | 6.9 | 5.6 | 1.6 | 8.0 | 12.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|------------|--------------|-----------------|------|------|-------------|------------|-------------|
| CD4532BM96 | SOIC | D | 16 | 2500 | 333.2 | 345.9 | 28.6 |
| CD4532BNSR | SO | NS | 16 | 2000 | 367.0 | 367.0 | 38.0 |
| CD4532BPWR | TSSOP | PW | 16 | 2000 | 367.0 | 367.0 | 35.0 |

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.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



4220204/A 02/2017

NOTES:

1. All linear dimensions are in millimeters. Any 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 0.25 mm per side.
5. Reference JEDEC registration MO-153.

EXAMPLE BOARD LAYOUT

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



SOLDER MASK DETAILS

4220204/A 02/2017

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

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

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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.

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.

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:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package is hermetically sealed with a ceramic lid using glass frit.
 - Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - 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.

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