

## CMOS Hex Gate

Four Inverters, One 2-Input NOR Gate, One 2-Input NAND Gate

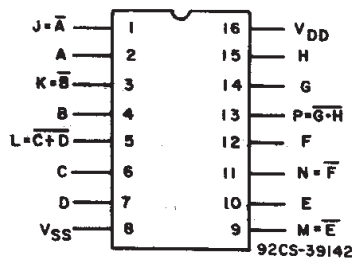
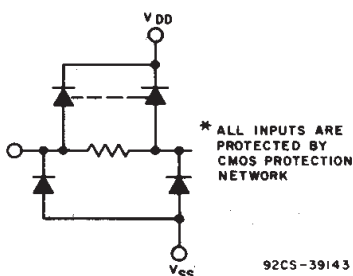
**Features:**

- Pin 7 NOR input positioned adjacent to  $V_{SS}$  for easy use of gate as an inverter
- Pin 15 NAND input positioned adjacent to  $V_{DD}$  for easy use of gate as an inverter
- Standard symmetrical output characteristics
- 100% tested for quiescent current at 20 V
- Maximum input current of 1  $\mu A$  at 18 V over full package-temperature range: 100 nA at 18 V and 25°C
- 5-V, 10-V, and 15-V parametric ratings
- Meets all requirements of JEDEC Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"

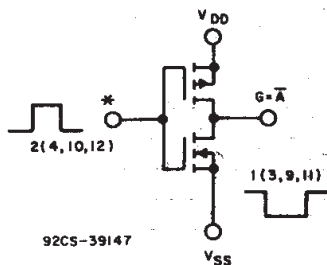
■ CD4572UB Hex Gate provides the system designer with direct implementation of inverter, NAND, and NOR functions and supplements the existing family of CMOS gates.

The CD4572UB devices meet all requirements of JEDEC Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices."

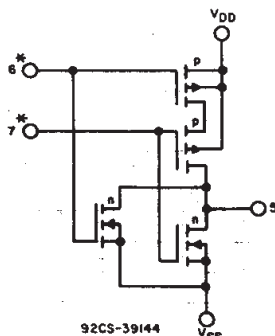
The CD4572UB types are supplied in 16-lead dual-in-line plastic packages (E suffix), 16-lead small-outline packages (M, M96, MT, and NSR suffixes), and 16-lead thin shrink small-outline packages (PW and PWR suffixes).



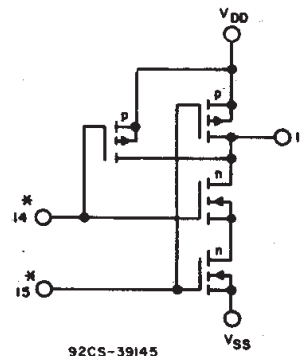
**TERMINAL ASSIGNMENT**



**Fig. 1 - Schematic diagram of one of four identical inverters.**



**Fig. 2 - Schematic diagram for the 2-input NOR gate.**



**Fig. 3 - Schematic diagram for the 2-input NAND gate.**

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## CD4572UB Types

### MAXIMUM RATINGS, Absolute-Maximum Values:

|  |                                      |
|--|--------------------------------------|
| DC SUPPLY-VOLTAGE RANGE, (V <sub>DD</sub> )<br>Voltages referenced to V <sub>SS</sub> Terminal | -0.5V to +20V                        |
| INPUT VOLTAGE RANGE, ALL INPUTS  | -0.5V to V <sub>DD</sub> +0.5V       |
| DC INPUT CURRENT, ANY ONE INPUT  | ±10mA                                |
| POWER DISSIPATION PER PACKAGE (P <sub>D</sub> ):   |                                      |
| For T <sub>A</sub> = -55°C to +100°C   | 500mW                                |
| For T <sub>A</sub> = +100°C to +125°C  | Derate Linearity at 12mW/°C to 200mW |
| DEVICE DISSIPATION PER OUTPUT TRANSISTOR   |                                      |
| FOR T <sub>A</sub> = FULL PACKAGE-TEMPERATURE RANGE (All Package Types)                        | 100mW                                |
| OPERATING-TEMPERATURE RANGE (T <sub>A</sub> )  | -55°C to +125°C                      |
| STORAGE TEMPERATURE RANGE (T <sub>stg</sub> )  | -65°C to +150°C                      |
| LEAD TEMPERATURE (DURING SOLDERING):   |                                      |
| At distance 1/16 ± 1/32 inch (1.59 ± 0.79mm) from case for 10s max                             | +265°C                               |

### 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 <sub>A</sub> =Full Package-Temperature Range) | 3      | 18   | V     |

### STATIC ELECTRICAL CHARACTERISTICS

| CHARACTERISTIC                                     | CONDITIONS            |                        |                        | LIMITS AT INDICATED TEMPERATURES (°C) |       |       |       |       |                   |      | UNITS |
|--|-----------------------|------------------------|------------------------|---------------------------------------|-------|-------|-------|-------|-------------------|------|-------|
|  | V <sub>O</sub><br>(V) | V <sub>IN</sub><br>(V) | V <sub>DD</sub><br>(V) | +25                                   |       |       |       |       |                   |      |       |
|  |                       |                        |                        | -55                                   | -40   | +85   | +125  | Min.  | Typ.              | Max. |       |
| Quiescent Device Current, I <sub>DD</sub> Max.     | —                     | 0, 5                   | 5                      | 0.25                                  | 0.25  | 7.5   | 7.5   | —     | 0.01              | 0.25 | μA    |
|  | —                     | 0, 10                  | 10                     | 0.5                                   | 0.5   | 15    | 15    | —     | 0.01              | 0.5  |       |
|  | —                     | 0, 15                  | 15                     | 1                                     | 1     | 30    | 30    | —     | 0.01              | 1    |       |
|  | —                     | 0, 20                  | 20                     | 5                                     | 5     | 150   | 150   | —     | 0.02              | 5    |       |
| Output Low (Sink) Current, I <sub>OL</sub> 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               | —    |       |
| Output High (Source) Current, I <sub>OH</sub> Min. | 4.6                   | 0, 5                   | 5                      | -0.64                                 | -0.61 | -0.42 | -0.36 | -0.51 | -1                | —    | mA    |
|  | 2.5                   | 0, 5                   | 5                      | -2                                    | -1.8  | -1.3  | -1.15 | -1.6  | -3.2              | —    |       |
|  | 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              | —    |       |
| Output Voltage: Low-Level, V <sub>OL</sub> 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 <sub>OH</sub> 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 <sub>IL</sub> Max.            | 0.5, 4.5              | —                      | 5                      | 1                                     |       |       |       | —     | —                 | 1    | V     |
|  | 1, 9                  | —                      | 10                     | 2                                     |       |       |       | —     | —                 | 2    |       |
|  | 1.5, 13.5             | —                      | 15                     | 2.5                                   |       |       |       | —     | —                 | 2.5  |       |
| Input High Voltage, V <sub>IH</sub> Min.           | 0.5, 4.5              | —                      | 5                      | 4                                     |       |       |       | 4     | —                 | —    | V     |
|  | 1, 9                  | —                      | 10                     | 8                                     |       |       |       | 8     | —                 | —    |       |
|  | 1.5, 13.5             | —                      | 15                     | 12.5                                  |       |       |       | 12.5  | —                 | —    |       |
| Input Current, I <sub>IN</sub> Max.                | —                     | 0, 18                  | 18                     | ±0.1                                  | ±0.1  | ±1    | ±1    | —     | ±10 <sup>-5</sup> | ±0.1 | μA    |

# CD4572UB Types

DYNAMIC ELECTRICAL CHARACTERISTICS at  $T_A=25^\circ\text{C}$ , Input  $t_r, t_f=20\text{ ns}$ ,  $C_L=50\text{ pF}$ ,  $R_L=200\text{ K}\Omega$

| CHARACTERISTIC         | SYMBOL             | TEST CONDITIONS | LIMITS |      |      | UNITS |
|------------------------|--------------------|-----------------|--------|------|------|-------|
|                        |                    | $V_{DD}$ (V)    | Min.   | Typ. | Max. |       |
| Propagation Delay Time | $t_{PHL}, t_{PLH}$ | 5               | —      | 100  | 200  | ns    |
|                        |                    | 10              | —      | 55   | 110  |       |
|                        |                    | 15              | —      | 40   | 85   |       |
| Transition Time        | $t_{THL}, t_{TLH}$ | 5               | —      | 100  | 200  |       |
|                        |                    | 10              | —      | 50   | 100  |       |
|                        |                    | 15              | —      | 40   | 80   |       |
| Input Capacitance      | $C_{IN}$           | Any Input       | —      | 10   | 15   | pF    |

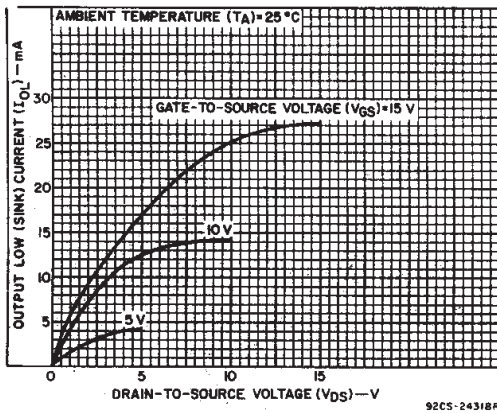


Fig. 4 - Typical output low (sink) current characteristics.

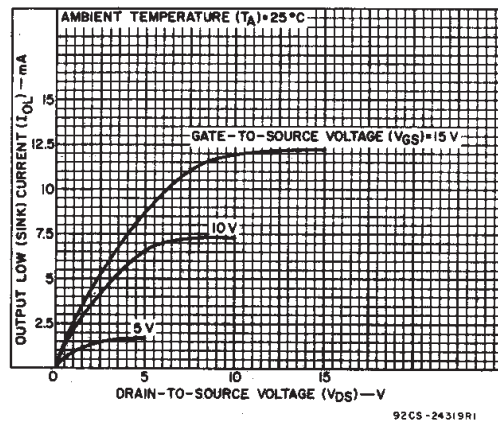


Fig. 5 - Minimum output low (sink) current characteristics.

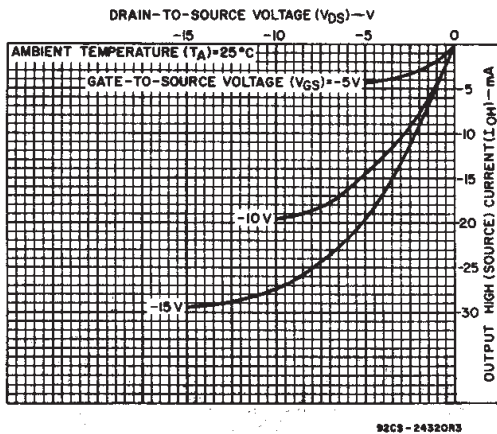


Fig. 6 - Typical output high (source) current characteristics.

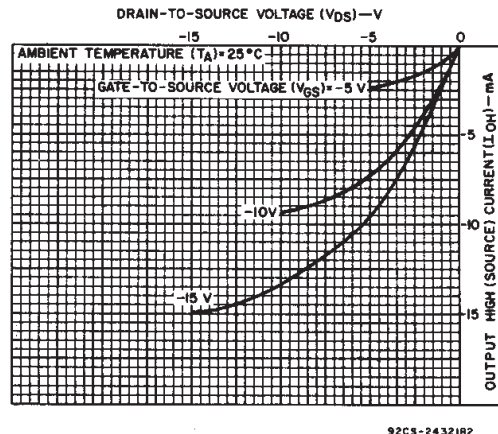


Fig. 7 - Minimum output high (source) current characteristics.

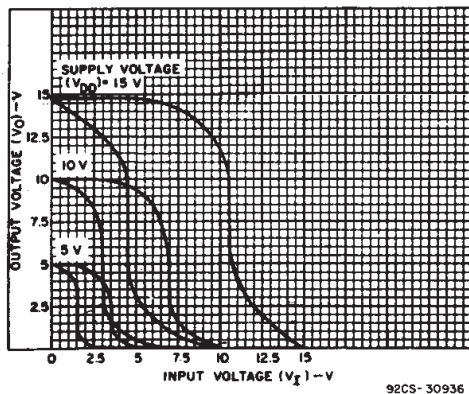


Fig. 8 - Minimum and maximum inverter voltage transfer characteristics.

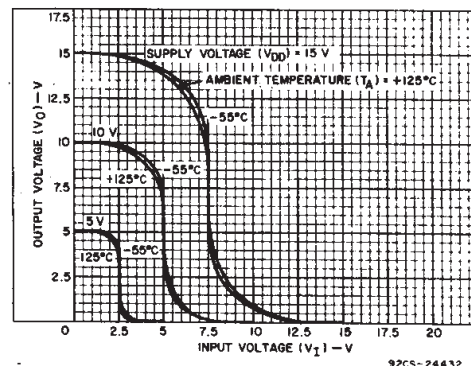


Fig. 9 - Typical inverter voltage transfer characteristics as a function of temperature.

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# CD4572UB Types

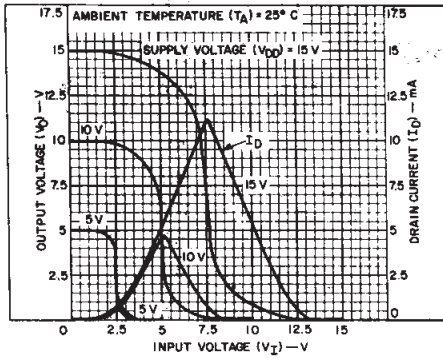


Fig. 10 - Typical inverter current and voltage transfer characteristics.

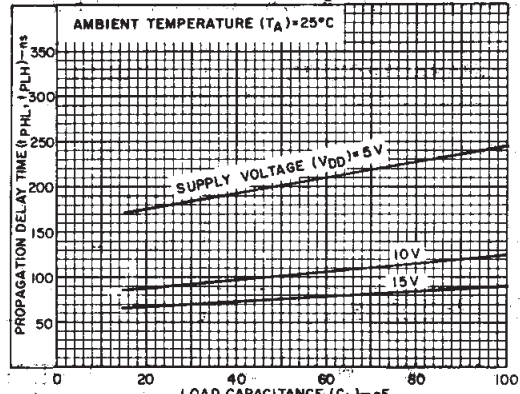


Fig. 11 - Typical propagation delay time as a function of load capacitance.

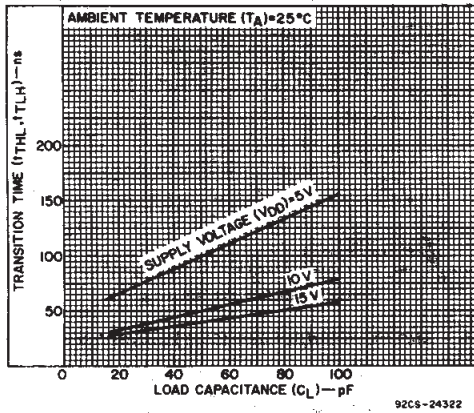


Fig. 12 - Typical transition time vs. load capacitance.

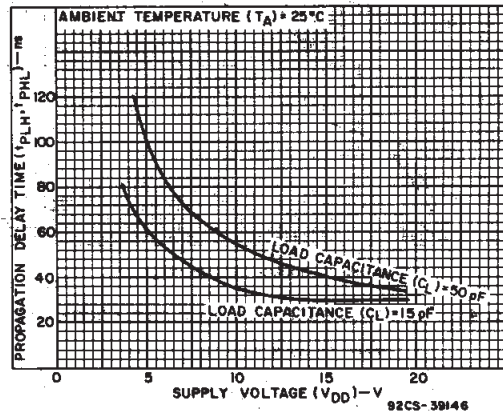


Fig. 13 - Typical propagation delay time vs. supply voltage.

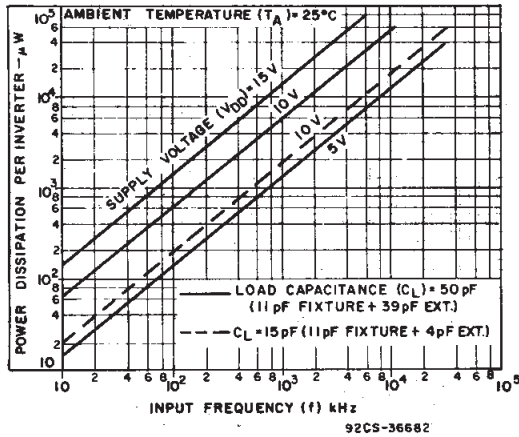


Fig. 14 - Typical dynamic power dissipation vs. frequency.

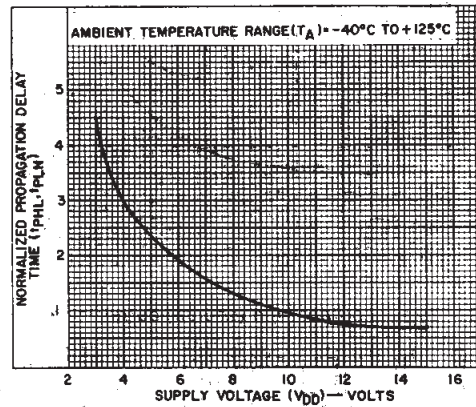


Fig. 15 - Variation of normalized propagation delay time ( $t_{PHL}$  and  $t_{PLN}$ ) with supply voltage.

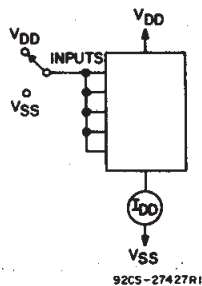


Fig. 16 - Quiescent device current test circuit.

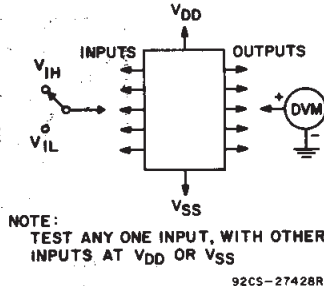


Fig. 17 - Noise immunity test circuit.

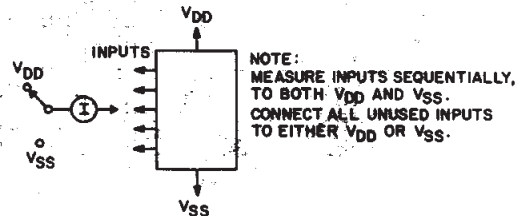


Fig. 18 - Input leakage current test circuit.

# CD4572UB Types

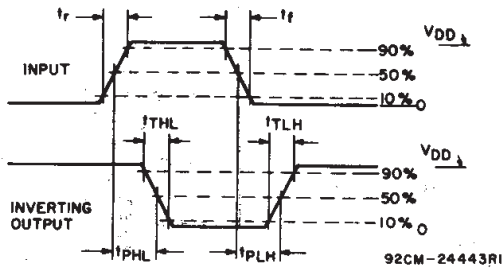
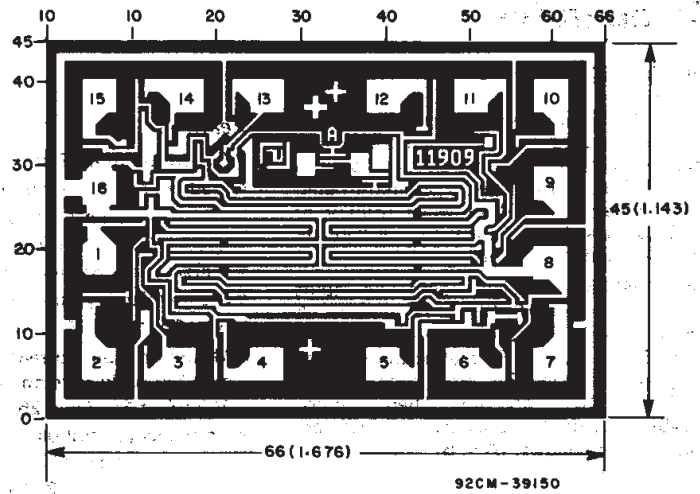


Fig. 19 - Transition times and propagation delay times, combination logic.



Dimensions and pad layout for CD4572UBH.

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<br>(1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan<br>(2)         | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|-----------------|------|-------------|-------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| CD4572UBE        | ACTIVE        | PDIP         | N               | 16   | 25          | Pb-Free (RoHS)          | CU NIPDAU               | N / A for Pkg Type   | -55 to 125   | CD4572UBE               | <a href="#">Samples</a> |
| CD4572UBEE4      | ACTIVE        | PDIP         | N               | 16   | 25          | Pb-Free (RoHS)          | CU NIPDAU               | N / A for Pkg Type   | -55 to 125   | CD4572UBE               | <a href="#">Samples</a> |
| CD4572UBM        | ACTIVE        | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -55 to 125   | CD4572UBM               | <a href="#">Samples</a> |
| CD4572UBME4      | ACTIVE        | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -55 to 125   | CD4572UBM               | <a href="#">Samples</a> |
| CD4572UBMG4      | ACTIVE        | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -55 to 125   | CD4572UBM               | <a href="#">Samples</a> |
| CD4572UBNSR      | ACTIVE        | SO           | NS              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -55 to 125   | CD4572UB                | <a href="#">Samples</a> |
| CD4572UBPWR      | ACTIVE        | TSSOP        | PW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -55 to 125   | CM572UB                 | <a href="#">Samples</a> |
| CD4572UBPWRE4    | ACTIVE        | TSSOP        | PW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -55 to 125   | CM572UB                 | <a href="#">Samples</a> |

(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.

(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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## 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 |
|-------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| CD4572UBNSR | SO           | NS              | 16   | 2000 | 330.0              | 16.4               | 8.2     | 10.5    | 2.5     | 12.0    | 16.0   | Q1            |
| CD4572UBPWR | 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) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| CD4572UBNSR | SO           | NS              | 16   | 2000 | 367.0       | 367.0      | 38.0        |
| CD4572UBPWR | TSSOP        | PW              | 16   | 2000 | 367.0       | 367.0      | 35.0        |

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.
  - $\triangle C$  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - $\triangle D$  The 20 pin end lead shoulder width is a vendor option, either half or full width.

4040049/E 12/2002

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.
  - 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.
  - 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.

PW (R-PDSO-G16)

PLASTIC SMALL OUTLINE

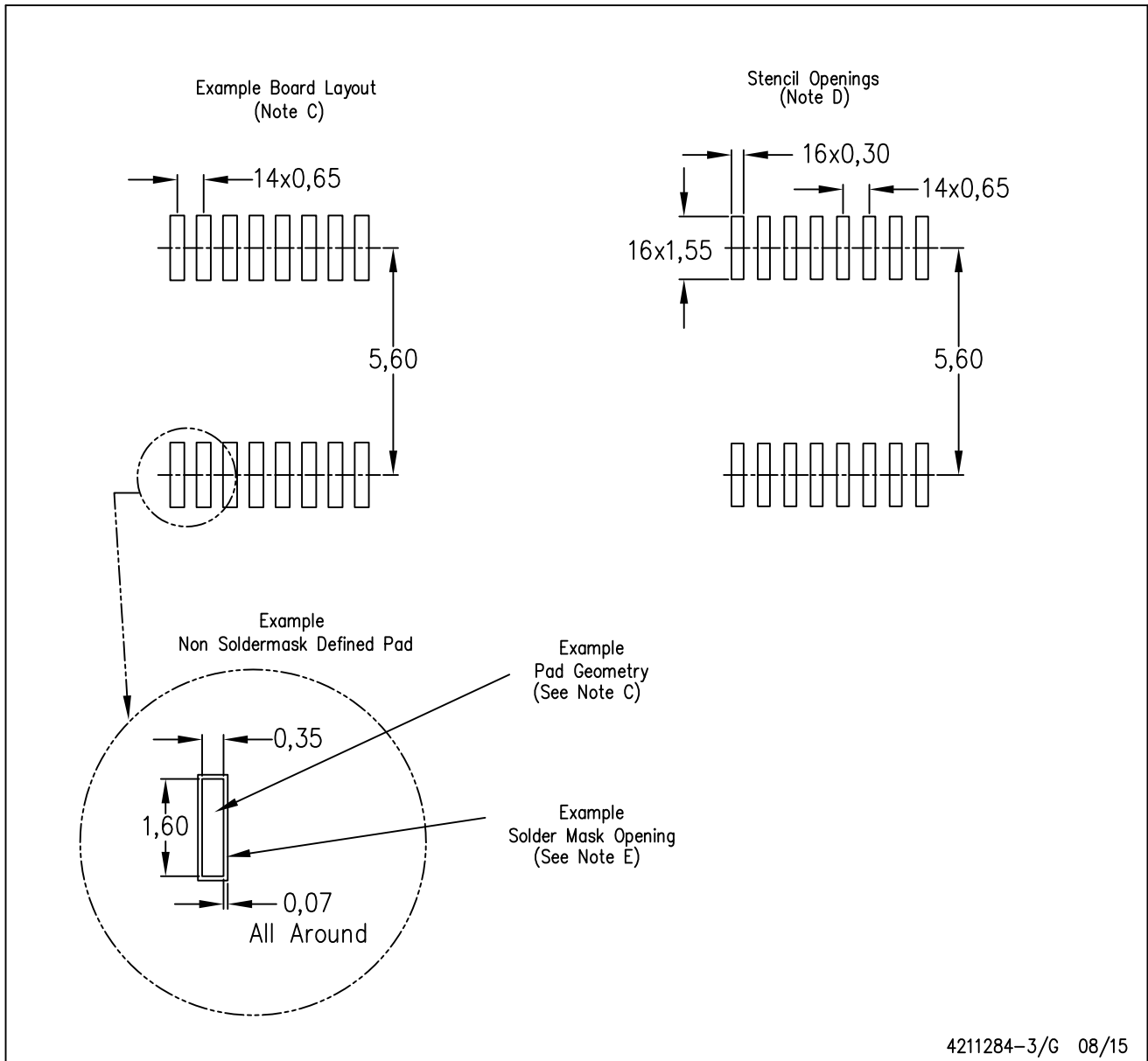


4040064-4/G 02/11

- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  -  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
  -  Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
  - E. Falls within JEDEC MO-153

PW (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.



## 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.

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