

## High-Speed CMOS Logic Quad 2-Input NAND Schmitt Trigger

August 1997 - Revised March 2004

### Features

- Unlimited Input Rise and Fall Times
- Exceptionally High Noise Immunity
- Typical Propagation Delay: 10ns at  $V_{CC} = 5V$ ,  $C_L = 15pF$ ,  $T_A = 25^{\circ}C$
- Fanout (Over Temperature Range)
  - Standard Outputs . . . . . 10 LSTTL Loads
  - Bus Driver Outputs . . . . . 15 LSTTL Loads
- Wide Operating Temperature Range . . .  $-55^{\circ}C$  to  $125^{\circ}C$
- Balanced Propagation Delay and Transition Times
- Significant Power Reduction Compared to LSTTL Logic ICs
- HC Types
  - 2V to 6V Operation
  - High Noise Immunity:  $N_{IL} = 37\%$ ,  $N_{IH} = 51\%$  of  $V_{CC}$  at  $V_{CC} = 5V$
- HCT Types
  - 4.5V to 5.5V Operation
  - Direct LSTTL Input Logic Compatibility,  $V_{IL} = 0.8V$  (Max),  $V_{IH} = 2V$  (Min)
  - CMOS Input Compatibility,  $I_I \leq 1\mu A$  at  $V_{OL}$ ,  $V_{OH}$

### Description

The 'HC132 and 'HCT132 each contain four 2-input NAND Schmitt Triggers in one package. This logic device utilizes silicon gate CMOS technology to achieve operating speeds similar to LSTTL gates with the low power consumption of standard CMOS integrated circuits. All devices have the ability to drive 10 LSTTL loads. The HCT logic family is functionally pin compatible with the standard LS logic family.

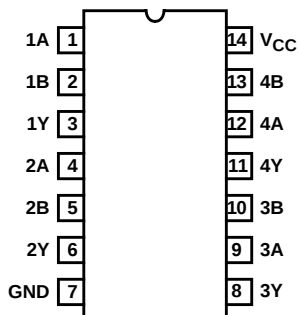
### Ordering Information

| PART NUMBER   | TEMP. RANGE<br>( $^{\circ}C$ ) | PACKAGE      |
|---------------|--------------------------------|--------------|
| CD54HC132F3A  | -55 to 125                     | 14 Ld CERDIP |
| CD54HCT132F3A | -55 to 125                     | 14 Ld CERDIP |
| CD74HC132E    | -55 to 125                     | 14 Ld PDIP   |
| CD74HC132M    | -55 to 125                     | 14 Ld SOIC   |
| CD74HC132MT   | -55 to 125                     | 14 Ld SOIC   |
| CD74HC132M96  | -55 to 125                     | 14 Ld SOIC   |
| CD74HCT132E   | -55 to 125                     | 14 Ld PDIP   |
| CD74HCT132M   | -55 to 125                     | 14 Ld SOIC   |
| CD74HCT132MT  | -55 to 125                     | 14 Ld SOIC   |
| CD74HCT132M96 | -55 to 125                     | 14 Ld SOIC   |

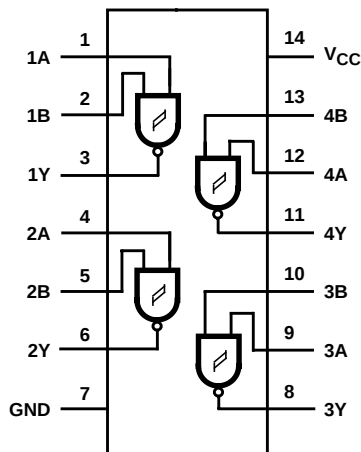
NOTE: When ordering, use the entire part number. The suffix 96 denotes tape and reel. The suffix T denotes a small-quantity reel of 250.

### Pinout

CD54HC132, CD54HCT132  
(CERDIP)  
CD74HC132, CD74HCT132  
(PDIP, SOIC)  
TOP VIEW



## Functional Diagram

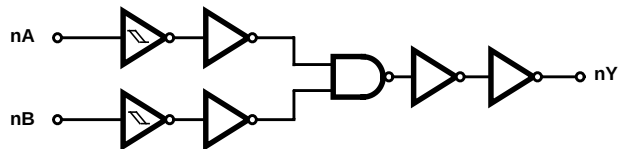


TRUTH TABLE

| INPUTS |    | OUTPUT |
|--------|----|--------|
| nA     | nB | nY     |
| L      | L  | H      |
| L      | H  | H      |
| H      | L  | H      |
| H      | H  | L      |

H = High Voltage Level, L = Low Voltage Level

## Logic Symbol



# CD54HC132, CD74HC132, CD54HCT132, CD74HCT132

## Absolute Maximum Ratings

DC Supply Voltage,  $V_{CC}$  ..... -0.5V to 7V  
 DC Input Diode Current,  $I_{IK}$   
 For  $V_I < -0.5V$  or  $V_I > V_{CC} + 0.5V$  .....  $\pm 20mA$   
 DC Output Diode Current,  $I_{OK}$   
 For  $V_O < -0.5V$  or  $V_O > V_{CC} + 0.5V$  .....  $\pm 20mA$   
 DC Output Source or Sink Current per Output Pin,  $I_O$   
 For  $V_O > -0.5V$  or  $V_O < V_{CC} + 0.5V$  .....  $\pm 25mA$   
 DC  $V_{CC}$  or Ground Current,  $I_{CC}$  or  $I_{GND}$  .....  $\pm 50mA$

## Thermal Information

Thermal Resistance (Typical, Note 1)  $\theta_{JA}$  ( $^{\circ}C/W$ )  
 E (PDIP) Package ..... 80  
 M (SOIC) Package ..... 86  
 Maximum Junction Temperature .....  $150^{\circ}C$   
 Maximum Storage Temperature Range .....  $-65^{\circ}C$  to  $150^{\circ}C$   
 Maximum Lead Temperature (Soldering 10s) .....  $300^{\circ}C$   
 (SOIC - Lead Tips Only)

## Operating Conditions

Temperature Range ( $T_A$ ) .....  $-55^{\circ}C$  to  $125^{\circ}C$   
 Supply Voltage Range,  $V_{CC}$   
 HC Types ..... 2V to 6V  
 HCT Types ..... 4.5V to 5.5V  
 DC Input or Output Voltage,  $V_I$ ,  $V_O$  ..... 0V to  $V_{CC}$

**CAUTION:** Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

### NOTE:

1. The package thermal impedance is calculated in accordance with JESD 51-7.

## DC Electrical Specifications

| PARAMETER                                  | SYMBOL          | TEST CONDITIONS                       |                     | V <sub>CC</sub> (V) | 25°C |     |      | -40°C TO 85°C |      | -55°C TO 125°C |      | UNITS |
|--------------------------------------------|-----------------|---------------------------------------|---------------------|---------------------|------|-----|------|---------------|------|----------------|------|-------|
|                                            |                 | V <sub>I</sub> (V)                    | I <sub>O</sub> (mA) |                     | MIN  | TYP | MAX  | MIN           | MAX  | MIN            | MAX  |       |
| HC TYPES                                   |                 |                                       |                     |                     |      |     |      |               |      |                |      |       |
| Input Switch Points<br>(Note 2)            | V <sub>T+</sub> | -                                     | -                   | 2                   | 0.7  | -   | 1.5  | 0.7           | 1.5  | 0.7            | 1.5  | V     |
|                                            |                 |                                       |                     | 4.5                 | 1.7  | -   | 3.15 | 1.7           | 3.15 | 1.7            | 3.15 | V     |
|                                            |                 |                                       |                     | 6                   | 2.1  | -   | 4.2  | 2.1           | 4.2  | 2.1            | 4.2  | V     |
|                                            | V <sub>T-</sub> | -                                     | -                   | 2                   | 0.3  | -   | 1    | 0.3           | 1    | 0.3            | 1    | V     |
|                                            |                 |                                       |                     | 4.5                 | 0.9  | -   | 2.2  | 0.9           | 2.2  | 0.9            | 2.2  | V     |
|                                            |                 |                                       |                     | 6                   | 1.2  | -   | 3    | 1.2           | 3    | 1.2            | 3    | V     |
|                                            | V <sub>H</sub>  |                                       |                     | 2                   | 0.2  | -   | 1    | 0.2           | 1    | 0.2            | 1    | V     |
|                                            |                 |                                       |                     | 4.5                 | 0.4  | -   | 1.4  | 0.4           | 1.4  | 0.4            | 1.4  | V     |
|                                            |                 |                                       |                     | 6                   | 0.6  | -   | 1.6  | 0.6           | 1.6  | 0.6            | 1.6  | V     |
| High Level Output<br>Voltage<br>CMOS Loads | V <sub>OH</sub> | V <sub>T+</sub> or<br>V <sub>T-</sub> | -0.02               | 2                   | 1.9  | -   | -    | 1.9           | -    | 1.9            | -    | V     |
|                                            |                 |                                       | -0.02               | 4.5                 | 4.4  | -   | -    | 4.4           | -    | 4.4            | -    | V     |
|                                            |                 |                                       | -0.02               | 6                   | 5.9  | -   | -    | 5.9           | -    | 5.9            | -    | V     |
| High Level Output<br>Voltage<br>TTL Loads  |                 |                                       | -4                  | 4.5                 | 3.98 | -   | -    | 3.84          | -    | 3.7            | -    | V     |
|                                            |                 |                                       | -5.2                | 6                   | 5.48 | -   | -    | 5.34          | -    | 5.2            | -    | V     |
| Low Level Output<br>Voltage<br>CMOS Loads  | V <sub>OL</sub> | V <sub>T+</sub> or<br>V <sub>T-</sub> | 0.02                | 2                   | -    | -   | 0.1  | -             | 0.1  | -              | 0.1  | V     |
|                                            |                 |                                       | 0.02                | 4.5                 | -    | -   | 0.1  | -             | 0.1  | -              | 0.1  | V     |
|                                            |                 |                                       | 0.02                | 6                   | -    | -   | 0.1  | -             | 0.1  | -              | 0.1  | V     |
| Low Level Output<br>Voltage<br>TTL Loads   |                 |                                       | 4                   | 4.5                 | -    | -   | 0.26 | -             | 0.33 | -              | 0.4  | V     |
|                                            |                 |                                       | 5.2                 | 6                   | -    | -   | 0.26 | -             | 0.33 | -              | 0.4  | V     |

**CD54HC132, CD74HC132, CD54HCT132, CD74HCT132**

**DC Electrical Specifications (Continued)**

| PARAMETER                                                      | SYMBOL                    | TEST CONDITIONS                    |                     | V <sub>CC</sub> (V) | 25°C |     |      | -40°C TO 85°C |      | -55°C TO 125°C |     | UNITS |
|----------------------------------------------------------------|---------------------------|------------------------------------|---------------------|---------------------|------|-----|------|---------------|------|----------------|-----|-------|
|                                                                |                           | V <sub>I</sub> (V)                 | I <sub>O</sub> (mA) |                     | MIN  | TYP | MAX  | MIN           | MAX  | MIN            | MAX |       |
| Input Leakage Current                                          | I <sub>I</sub>            | V <sub>CC</sub> or GND             | -                   | 6                   | -    | -   | ±0.1 | -             | ±1   | -              | ±1  | μA    |
| Quiescent Device Current                                       | I <sub>CC</sub>           | V <sub>CC</sub> or GND             | 0                   | 6                   | -    | -   | 2    | -             | 20   | -              | 40  | μA    |
| <b>HCT TYPES</b>                                               |                           |                                    |                     |                     |      |     |      |               |      |                |     |       |
| Input Switch Points (Note 2)                                   | V <sub>T+</sub>           | -                                  | -                   | 4.5                 | 1.2  | -   | 1.9  | 1.2           | 1.9  | 1.2            | 1.9 | V     |
|                                                                |                           |                                    |                     | 5.5                 | 1.4  | -   | 2.1  | 1.4           | 2.1  | 1.4            | 2.1 | V     |
|                                                                | V <sub>T-</sub>           | -                                  | -                   | 4.5                 | 0.5  | -   | 1.2  | 0.5           | 1.2  | 0.5            | 1.2 | V     |
|                                                                |                           |                                    |                     | 5.5                 | 0.6  | -   | 1.4  | 0.6           | 1.4  | 0.6            | 1.4 | V     |
|                                                                | V <sub>H</sub>            | -                                  | -                   | 4.5                 | 0.4  | -   | 1.4  | 0.4           | 1.4  | 0.4            | 1.4 | V     |
|                                                                |                           |                                    |                     | 5.5                 | 0.4  | -   | 1.5  | 0.4           | 1.5  | 0.4            | 1.5 | V     |
| High Level Output Voltage CMOS Loads                           | -                         | V <sub>T+</sub> or V <sub>T-</sub> | -0.02               | 4.5                 | 4.4  | -   | -    | 4.4           | -    | 4.4            | -   | V     |
| High Level Output Voltage TTL Loads                            | -                         |                                    | -4                  | 4.5                 | 3.98 | -   | -    | 3.84          | -    | 3.7            | -   | V     |
| Low Level Output Voltage CMOS Loads                            | V <sub>OL</sub>           | V <sub>T+</sub> or V <sub>T-</sub> | 0.02                | 4.5                 | -    | -   | 0.1  | -             | 0.1  | -              | 0.1 | V     |
| Low Level Output Voltage TTL Loads                             |                           |                                    | 4                   | 4.5                 | -    | -   | 0.26 | -             | 0.33 | -              | 0.4 | V     |
| Input Leakage Current                                          | I <sub>I</sub>            | V <sub>CC</sub> and GND            | -                   | 5.5                 | -    | -   | ±0.1 | -             | ±1   | -              | ±1  | μA    |
| Quiescent Device Current                                       | I <sub>CC</sub>           | V <sub>CC</sub> or GND             | 0                   | 5.5                 | -    | -   | 2    | -             | 20   | -              | 40  | μA    |
| Additional Quiescent Device Current Per Input Pin: 1 Unit Load | ΔI <sub>CC</sub> (Note 3) | V <sub>CC</sub> - 2.1              | -                   | 4.5 to 5.5          | -    | 100 | 360  | -             | 450  | -              | 490 | μA    |

**NOTES:**

- Hysteresis definition, characteristic and test setup see Test Circuits and Waveforms
- For dual-supply systems theoretical worst case (V<sub>I</sub> = 2.4V, V<sub>CC</sub> = 5.5V) specification is 1.8mA.

# **CD54HC132, CD74HC132, CD54HCT132, CD74HCT132**

**HCT Input Loading Table**

| INPUT  | UNIT LOADS |
|--------|------------|
| nA, nB | 0.6        |

NOTE: Unit Load is  $\Delta I_{CC}$  limit specified in DC Electrical Specifications table, e.g. 360 $\mu$ A max at 25°C.

**Switching Specifications** Input  $t_r$ ,  $t_f$  = 6ns

| PARAMETER                                     | SYMBOL                              | TEST CONDITIONS       | V <sub>CC</sub><br>(V) | 25°C |     |     | -40°C TO 85°C |     | -55°C TO 125°C |     | UNITS |
|-----------------------------------------------|-------------------------------------|-----------------------|------------------------|------|-----|-----|---------------|-----|----------------|-----|-------|
|                                               |                                     |                       |                        | MIN  | TYP | MAX | MIN           | MAX | MIN            | MAX |       |
| HC TYPES                                      |                                     |                       |                        |      |     |     |               |     |                |     |       |
| Propagation Delay<br>A, B to Y (Figure 1)     | t <sub>PLH</sub> , t <sub>PHL</sub> | C <sub>L</sub> = 50pF | 2                      | -    | -   | 125 | -             | 156 | -              | 188 | ns    |
|                                               |                                     |                       | 4.5                    | -    | -   | 25  | -             | 31  | -              | 38  | ns    |
|                                               |                                     |                       | 6                      | -    | -   | 21  | -             | 27  | -              | 32  | ns    |
| Propagation Delay<br>A, B to Y                | t <sub>TLH</sub> , t <sub>THL</sub> | C <sub>L</sub> = 15pF | 5                      | -    | 10  | -   | -             | -   | -              | -   | pF    |
| Transition Times (Figure 1)                   | t <sub>TLH</sub> , t <sub>THL</sub> | C <sub>L</sub> = 50pF | 2                      | -    | -   | 75  | -             | 95  | -              | 110 | ns    |
|                                               |                                     |                       | 4.5                    | -    | -   | 15  | -             | 19  | -              | 22  | ns    |
|                                               |                                     |                       | 6                      | -    | -   | 13  | -             | 16  | -              | 19  | ns    |
| Input Capacitance                             | C <sub>I</sub>                      | -                     | -                      | -    | -   | 10  | -             | 10  | -              | 10  | pF    |
| Power Dissipation Capacitance<br>(Notes 4, 5) | C <sub>PD</sub>                     | -                     | 5                      | -    | 30  | -   | -             | -   | -              | -   | pF    |
| HCT TYPES                                     |                                     |                       |                        |      |     |     |               |     |                |     |       |
| Propagation Delay<br>A, B to Y<br>(Figure 2)  | t <sub>PHL</sub> , t <sub>PHL</sub> | C <sub>L</sub> = 50pF | 4.5                    | -    | -   | 33  | -             | 41  | -              | 50  | ns    |
| Propagation Delay<br>A, B to Y                | t <sub>PLH</sub> , t <sub>PHL</sub> | C <sub>L</sub> = 15pF | 5                      | -    | 13  | -   | -             | -   | -              | -   | pF    |
| Transition Times (Figure 2)                   | t <sub>TLH</sub> , t <sub>THL</sub> | C <sub>L</sub> = 50pF | 4.5                    | -    | -   | 15  | -             | 19  | -              | 22  | ns    |
| Input Capacitance                             | C <sub>I</sub>                      | -                     | -                      | -    | -   | 10  | -             | 10  | -              | 10  | pF    |
| Power Dissipation Capacitance<br>(Notes 4, 5) | C <sub>PD</sub>                     | -                     | 5                      | -    | 30  | -   | -             | -   | -              | -   | pF    |

**NOTES:**

- $C_{PD}$  is used to determine the dynamic power consumption, per gate.
- $P_D = V_{CC}^2 f_i (C_{PD} + C_L)$  where  $f_i$  = input frequency,  $C_L$  = output load capacitance,  $V_{CC}$  = supply voltage.

## Test Circuits and Waveforms

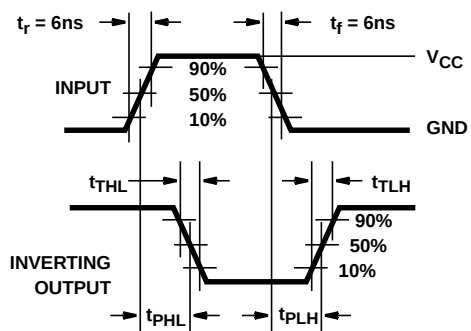


FIGURE 1. HC AND HCU TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

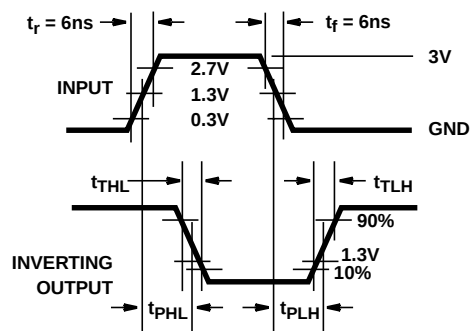


FIGURE 2. HCT TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

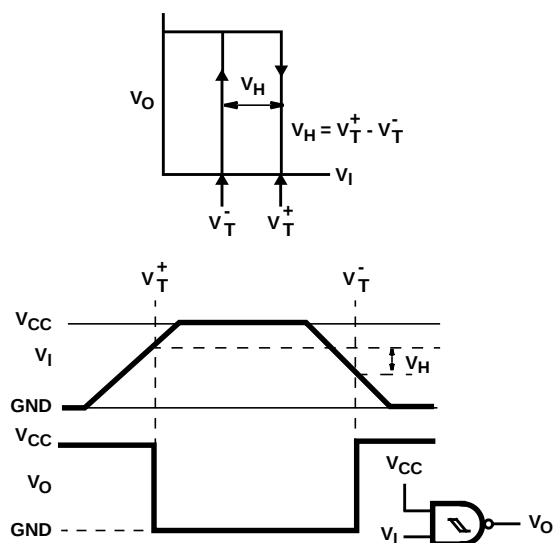


FIGURE 3. HYSTERESIS DEFINITION, CHARACTERISTIC, AND TEST SET-UP

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### Applications

|                    |                                                                          |
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| Automotive         | <a href="http://www.ti.com/automotive">www.ti.com/automotive</a>         |
| Broadband          | <a href="http://www.ti.com/broadband">www.ti.com/broadband</a>           |
| Digital Control    | <a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a> |
| Military           | <a href="http://www.ti.com/military">www.ti.com/military</a>             |
| Optical Networking | <a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a> |
| Security           | <a href="http://www.ti.com/security">www.ti.com/security</a>             |
| Telephony          | <a href="http://www.ti.com/telephony">www.ti.com/telephony</a>           |
| Video & Imaging    | <a href="http://www.ti.com/video">www.ti.com/video</a>                   |
| Wireless           | <a href="http://www.ti.com/wireless">www.ti.com/wireless</a>             |

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**PACKAGING INFORMATION**

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| 5962-8984501CA   | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                     | A42 SNPB         | N / A for Pkg Type           |
| CD54HC132F3A     | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                     | A42 SNPB         | N / A for Pkg Type           |
| CD54HCT132F      | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                     | A42 SNPB         | N / A for Pkg Type           |
| CD54HCT132F3A    | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                     | A42 SNPB         | N / A for Pkg Type           |
| CD74HC132E       | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| CD74HC132EE4     | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| CD74HC132M       | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC132M96     | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC132M96E4   | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC132M96G4   | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC132ME4     | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC132MG4     | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC132MT      | ACTIVE                | SOIC         | D               | 14   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC132MTE4    | ACTIVE                | SOIC         | D               | 14   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HC132MTG4    | ACTIVE                | SOIC         | D               | 14   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HCT132E      | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| CD74HCT132EE4    | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| CD74HCT132M      | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HCT132M96    | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HCT132M96E4  | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HCT132M96G4  | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HCT132ME4    | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HCT132MG4    | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HCT132MT     | ACTIVE                | SOIC         | D               | 14   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HCT132MTE4   | ACTIVE                | SOIC         | D               | 14   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| CD74HCT132MTG4   | ACTIVE                | SOIC         | D               | 14   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |

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<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> 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.

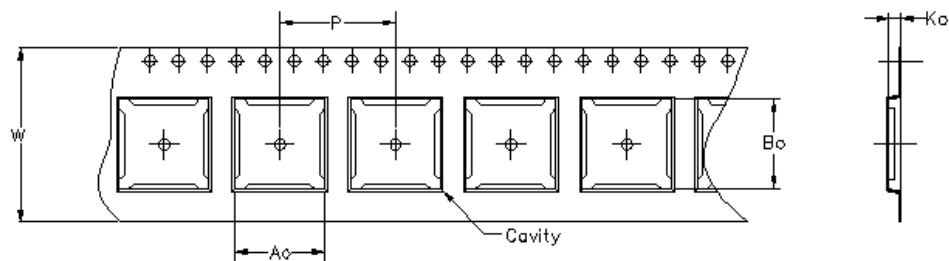
**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**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)

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

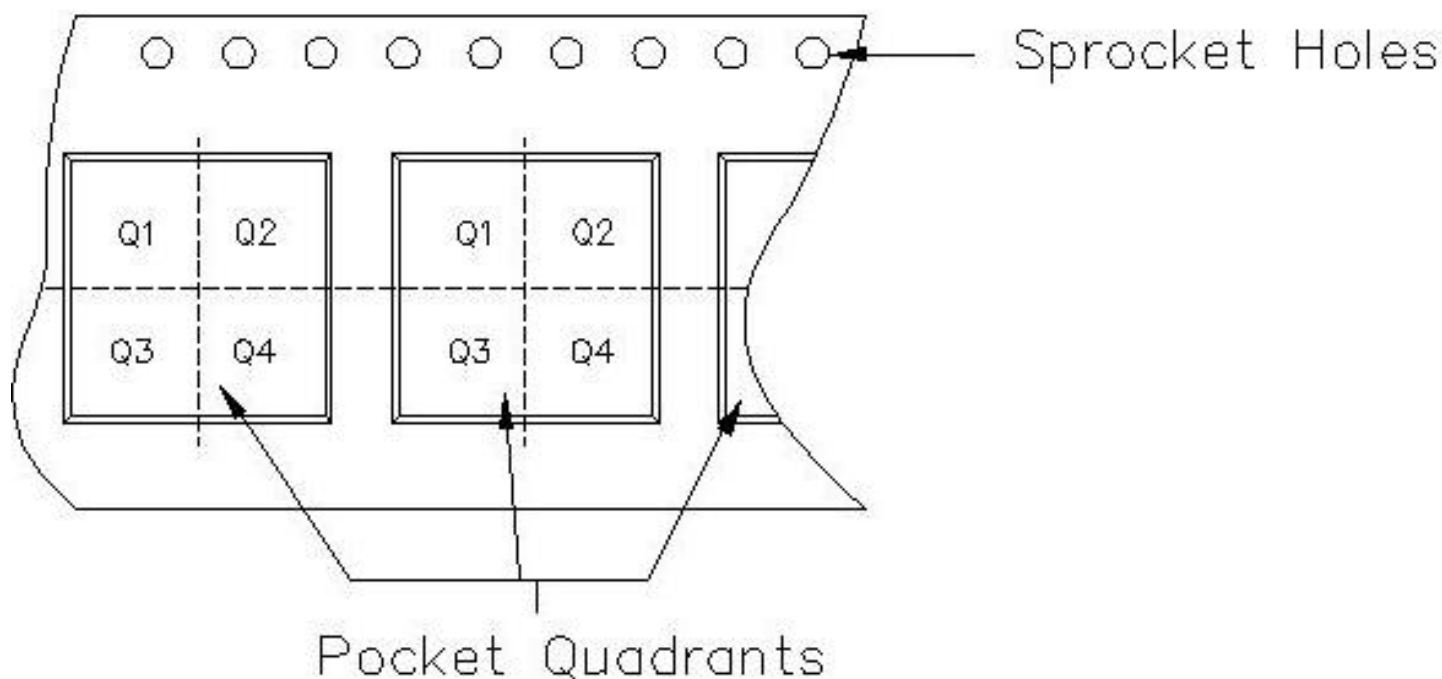
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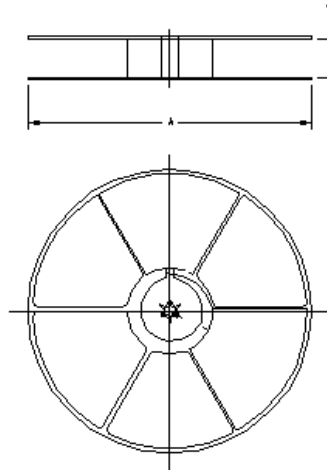
Carrier tape design is defined largely by the component length, width, and thickness.

|                                                                    |
|--------------------------------------------------------------------|
| $A_0$ = Dimension designed to accommodate the component width.     |
| $B_0$ = Dimension designed to accommodate the component length.    |
| $K_0$ = Dimension designed to accommodate the component thickness. |
| $W$ = Overall width of the carrier tape.                           |
| $P$ = Pitch between successive cavity centers.                     |



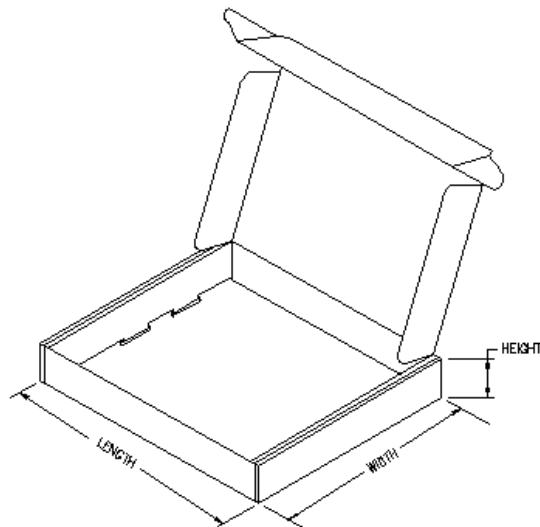
## TAPE AND REEL INFORMATION

| Device        | Package | Pins | Site | Reel<br>Diameter<br>(mm) | Reel<br>Width<br>(mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1<br>(mm) | W<br>(mm) | Pin1<br>Quadrant |
|---------------|---------|------|------|--------------------------|-----------------------|---------|---------|---------|------------|-----------|------------------|
| CD74HC132M96  | D       | 14   | MLA  | 330                      | 16                    | 6.5     | 9.0     | 2.1     | 8          | 16        | Q1               |
| CD74HCT132M96 | D       | 14   | MLA  | 330                      | 16                    | 6.5     | 9.0     | 2.1     | 8          | 16        | Q1               |



## TAPE AND REEL BOX INFORMATION

| Device        | Package | Pins | Site | Length (mm) | Width (mm) | Height (mm) |
|---------------|---------|------|------|-------------|------------|-------------|
| CD74HC132M96  | D       | 14   | MLA  | 342.9       | 336.6      | 28.58       |
| CD74HCT132M96 | D       | 14   | MLA  | 342.9       | 336.6      | 28.58       |



J (R-GDIP-T\*\*)

14 LEADS SHOWN

# CERAMIC DUAL IN-LINE PACKAGE



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

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



| PINS **             | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| DIM                 |                  |                  |                  |                  |
| 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.

## D (R-PDSO-G14)

## PLASTIC SMALL-OUTLINE PACKAGE



4040047-3/H 11/2006

## 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 AB.

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