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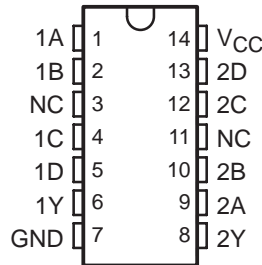
Jameco Part Number 1004610

# SN54HC21, SN74HC21 DUAL 4-INPUT POSITIVE-AND GATES

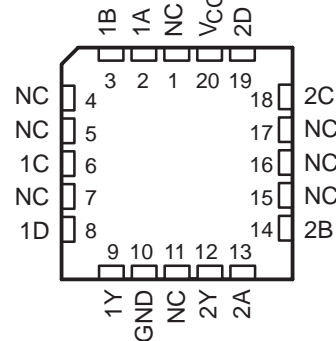
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- Wide Operating Voltage Range of 2 V to 6 V
- Outputs Can Drive Up To 10 LSTTL Loads
- Low Power Consumption, 20- $\mu$ A Max  $I_{CC}$
- Typical  $t_{pd} = 11$  ns
- $\pm 4$ -mA Output Drive at 5 V
- Low Input Current of 1  $\mu$ A Max

SN54HC21 . . . J OR W PACKAGE  
SN74HC21 . . . D, N, NS, OR PW PACKAGE  
(TOP VIEW)



SN54HC21 . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

## description/ordering information

These devices contain two independent 4-input AND gates. They perform the Boolean function  $Y = A \cdot B \cdot C \cdot D$  or  $Y = \overline{A + B + C + D}$  in positive logic.

## ORDERING INFORMATION

| TA             | PACKAGE†   |              | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|------------|--------------|-----------------------|------------------|
| -40°C to 85°C  | PDIP – N   | Tube of 25   | SN74HC21N             | SN74HC21N        |
|                | SOIC – D   | Tube of 50   | SN74HC21D             | HC21             |
|                |            | Reel of 2500 | SN74HC21DR            |                  |
|                |            | Reel of 250  | SN74HC21DT            |                  |
|                | SOP – NS   | Reel of 2000 | SN74HC21NSR           | HC21             |
|                | TSSOP – PW | Tube of 90   | SN74HC21PW            | HC21             |
| Reel of 2000   |            | SN74HC21PWR  |                       |                  |
| Reel of 250    |            | SN74HC21PWT  |                       |                  |
| -55°C to 125°C | CDIP – J   | Tube of 25   | SNJ54HC21J            | SNJ54HC21J       |
|                | CFP – W    | Tube of 150  | SNJ54HC21W            | SNJ54HC21W       |
|                | LCCC – FK  | Tube of 55   | SNJ54HC21FK           | SNJ54HC21FK      |

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).



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 **TEXAS  
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# SN54HC21, SN74HC21 DUAL 4-INPUT POSITIVE-AND GATES

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FUNCTION TABLE  
(each gate)

| INPUTS |   |   |   | OUTPUT<br>Y |
|--------|---|---|---|-------------|
| A      | B | C | D |             |
| H      | H | H | H | H           |
| L      | X | X | X | L           |
| X      | L | X | X | L           |
| X      | X | L | X | L           |
| X      | X | X | L | L           |

## logic diagram (positive logic)



Pin numbers shown are for the D, J, N, NS, PW, and W packages.

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

|   |                |
|---|----------------|
| Supply voltage range, $V_{CC}$  | -0.5 V to 7 V  |
| Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ ) (see Note 1)  | $\pm 20$ mA    |
| Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ ) (see Note 1) | $\pm 20$ mA    |
| Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )                  | $\pm 25$ mA    |
| Continuous current through $V_{CC}$ or GND                                  | $\pm 50$ mA    |
| Package thermal impedance, $\theta_{JA}$ (see Note 2):                      |                |
| D package   | 86°C/W         |
| N package   | 80°C/W         |
| NS package  | 76°C/W         |
| PW package  | 113°C/W        |
| Storage temperature range, $T_{stg}$  | -65°C to 150°C |

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.  
2. The package thermal impedance is calculated in accordance with JESD 51-7.

# SN54HC21, SN74HC21 DUAL 4-INPUT POSITIVE-AND GATES

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## recommended operating conditions (see Note 3)

|                 |                                 | SN54HC21                |     |                 | SN74HC21 |                 |     | UNIT |
|-----------------|---------------------------------|-------------------------|-----|-----------------|----------|-----------------|-----|------|
|                 |                                 | MIN                     | NOM | MAX             | MIN      | NOM             | MAX |      |
| V <sub>CC</sub> | Supply voltage                  | 2                       | 5   | 6               | 2        | 5               | 6   | V    |
| V <sub>IH</sub> | High-level input voltage        | V <sub>CC</sub> = 2 V   |     | 1.5             | 1.5      |                 | V   |      |
|                 |                                 | V <sub>CC</sub> = 4.5 V |     | 3.15            | 3.15     |                 |     |      |
|                 |                                 | V <sub>CC</sub> = 6 V   |     | 4.2             | 4.2      |                 |     |      |
| V <sub>IL</sub> | Low-level input voltage         | V <sub>CC</sub> = 2 V   |     |                 | 0.5      | 0.5             | V   |      |
|                 |                                 | V <sub>CC</sub> = 4.5 V |     |                 | 1.35     | 1.35            |     |      |
|                 |                                 | V <sub>CC</sub> = 6 V   |     |                 | 1.8      | 1.8             |     |      |
| V <sub>I</sub>  | Input voltage                   | 0                       |     | V <sub>CC</sub> | 0        | V <sub>CC</sub> | V   |      |
| V <sub>O</sub>  | Output voltage                  | 0                       |     | V <sub>CC</sub> | 0        | V <sub>CC</sub> | V   |      |
| Δt/Δv           | Input transition rise/fall time | V <sub>CC</sub> = 2 V   |     |                 | 1000     | 1000            | ns  |      |
|                 |                                 | V <sub>CC</sub> = 4.5 V |     |                 | 500      | 500             |     |      |
|                 |                                 | V <sub>CC</sub> = 6 V   |     |                 | 400      | 400             |     |      |
| T <sub>A</sub>  | Operating free-air temperature  | -55                     |     | 125             | -40      | 85              | °C  |      |

NOTE 3: All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

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

| PARAMETER       | TEST CONDITIONS   |                           | V <sub>CC</sub> | T <sub>A</sub> = 25°C |       |      | SN54HC21 |       | SN74HC21 |      | UNIT |
|-----------------|---|---------------------------|-----------------|-----------------------|-------|------|----------|-------|----------|------|------|
|                 |   |                           |                 | MIN                   | TYP   | MAX  | MIN      | MAX   | MIN      | MAX  |      |
| V <sub>OH</sub> | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>       | I <sub>OH</sub> = -20 μA  | 2 V             | 1.9                   | 1.998 |      | 1.9      | 1.9   | V        |      |      |
|                 |   |                           | 4.5 V           | 4.4                   | 4.499 |      | 4.4      | 4.4   |          |      |      |
|                 |   |                           | 6 V             | 5.9                   | 5.999 |      | 5.9      | 5.9   |          |      |      |
|                 |   | I <sub>OH</sub> = -4 mA   | 4.5 V           | 3.98                  | 4.3   |      | 3.7      | 3.84  |          |      |      |
|                 |   | I <sub>OH</sub> = -5.2 mA | 6 V             | 5.48                  | 5.8   |      | 5.2      | 5.34  |          |      |      |
| V <sub>OL</sub> | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>       | I <sub>OL</sub> = 20 μA   | 2 V             |                       | 0.002 | 0.1  |          | 0.1   | V        |      |      |
|                 |   |                           | 4.5 V           |                       | 0.001 | 0.1  |          | 0.1   |          | 0.1  |      |
|                 |   |                           | 6 V             |                       | 0.001 | 0.1  |          | 0.1   |          | 0.1  |      |
|                 |   | I <sub>OL</sub> = 4 mA    | 4.5 V           |                       | 0.17  | 0.26 |          | 0.4   |          | 0.33 |      |
|                 |   | I <sub>OL</sub> = 5.2 mA  | 6 V             |                       | 0.15  | 0.26 |          | 0.4   |          | 0.33 |      |
| I <sub>I</sub>  | V <sub>I</sub> = V <sub>CC</sub> or 0                     |                           | 6 V             |                       | ±0.1  | ±100 |          | ±1000 | ±1000    | nA   |      |
| I <sub>CC</sub> | V <sub>I</sub> = V <sub>CC</sub> or 0, I <sub>O</sub> = 0 |                           | 6 V             |                       |       | 2    |          | 40    | 20       | μA   |      |
| C <sub>i</sub>  |   |                           | 2 V to 6 V      |                       | 3     | 10   |          | 10    | 10       | pF   |      |



# SN54HC21, SN74HC21 DUAL 4-INPUT POSITIVE-AND GATES

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switching characteristics over recommended operating free-air temperature range,  $C_L = 50 \text{ pF}$  (unless otherwise noted) (see Figure 1)

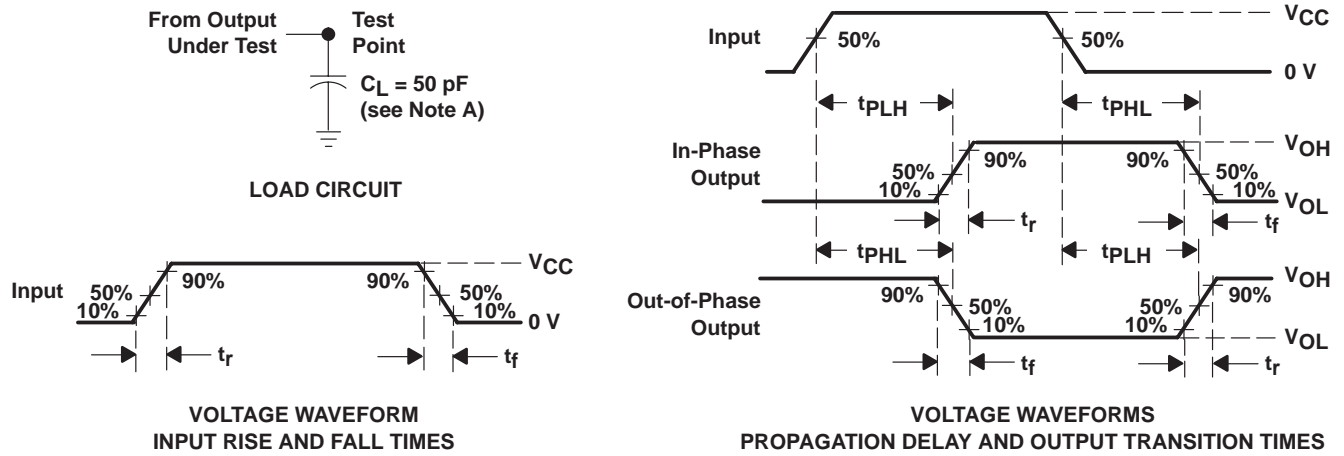
| PARAMETER | FROM (INPUT)  | TO (OUTPUT) | $V_{CC}$ | $T_A = 25^\circ\text{C}$ |     |     | SN54HC21 |     | SN74HC21 |     | UNIT |
|-----------|---------------|-------------|----------|--------------------------|-----|-----|----------|-----|----------|-----|------|
|           |               |             |          | MIN                      | TYP | MAX | MIN      | MAX | MIN      | MAX |      |
| $t_{pd}$  | A, B, C, or D | Y           | 2 V      |                          | 44  | 110 |          | 165 |          | 140 | ns   |
|           |               |             | 4.5 V    |                          | 14  | 22  |          | 33  |          | 28  |      |
|           |               |             | 6 V      |                          | 11  | 19  |          | 28  |          | 24  |      |
| $t_t$     |               | Y           | 2 V      |                          | 29  | 75  |          | 110 |          | 95  | ns   |
|           |               |             | 4.5 V    |                          | 10  | 15  |          | 22  |          | 19  |      |
|           |               |             | 6 V      |                          | 8   | 13  |          | 19  |          | 16  |      |

operating characteristics,  $T_A = 25^\circ\text{C}$

| PARAMETER                                       | TEST CONDITIONS | TYP | UNIT |
|---|-----------------|-----|------|
| $C_{pd}$ Power dissipation capacitance per gate | No load         | 25  | pF   |



PARAMETER MEASUREMENT INFORMATION



- NOTES: A.  $C_L$  includes probe and test-fixture capacitance.  
 B. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r = 6 \text{ ns}$ ,  $t_f = 6 \text{ ns}$ .  
 C. The outputs are measured one at a time with one input transition per measurement.  
 D.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .

Figure 1. Load Circuit and Voltage Waveforms

**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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| 5962-88576012A   | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | N / A for Pkg Type           |
| 5962-8857601CA   | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                     | A42 SNPB         | N / A for Pkg Type           |
| SN54HC21J        | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                     | A42 SNPB         | N / A for Pkg Type           |
| SN74HC21D        | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74HC21DE4      | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74HC21DG4      | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74HC21DR       | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74HC21DRE4     | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74HC21DRG4     | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74HC21DT       | ACTIVE                | SOIC         | D               | 14   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74HC21DTE4     | ACTIVE                | SOIC         | D               | 14   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74HC21DTG4     | ACTIVE                | SOIC         | D               | 14   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74HC21N        | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| SN74HC21NE4      | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| SN74HC21NSR      | ACTIVE                | SO           | NS              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74HC21NSRE4    | ACTIVE                | SO           | NS              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74HC21NSRG4    | ACTIVE                | SO           | NS              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74HC21PW       | ACTIVE                | TSSOP        | PW              | 14   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74HC21PWE4     | ACTIVE                | TSSOP        | PW              | 14   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74HC21PWG4     | ACTIVE                | TSSOP        | PW              | 14   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74HC21PWR      | ACTIVE                | TSSOP        | PW              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74HC21PWRE4    | ACTIVE                | TSSOP        | PW              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74HC21PWRG4    | ACTIVE                | TSSOP        | PW              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74HC21PWT      | ACTIVE                | TSSOP        | PW              | 14   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74HC21PWTE4    | ACTIVE                | TSSOP        | PW              | 14   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74HC21PWTG4    | ACTIVE                | TSSOP        | PW              | 14   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |

| 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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| SNJ54HC21FK      | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | POST-PLATE       | N / A for Pkg Type           |
| SNJ54HC21J       | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                     | A42 SNPB         | N / A for Pkg Type           |

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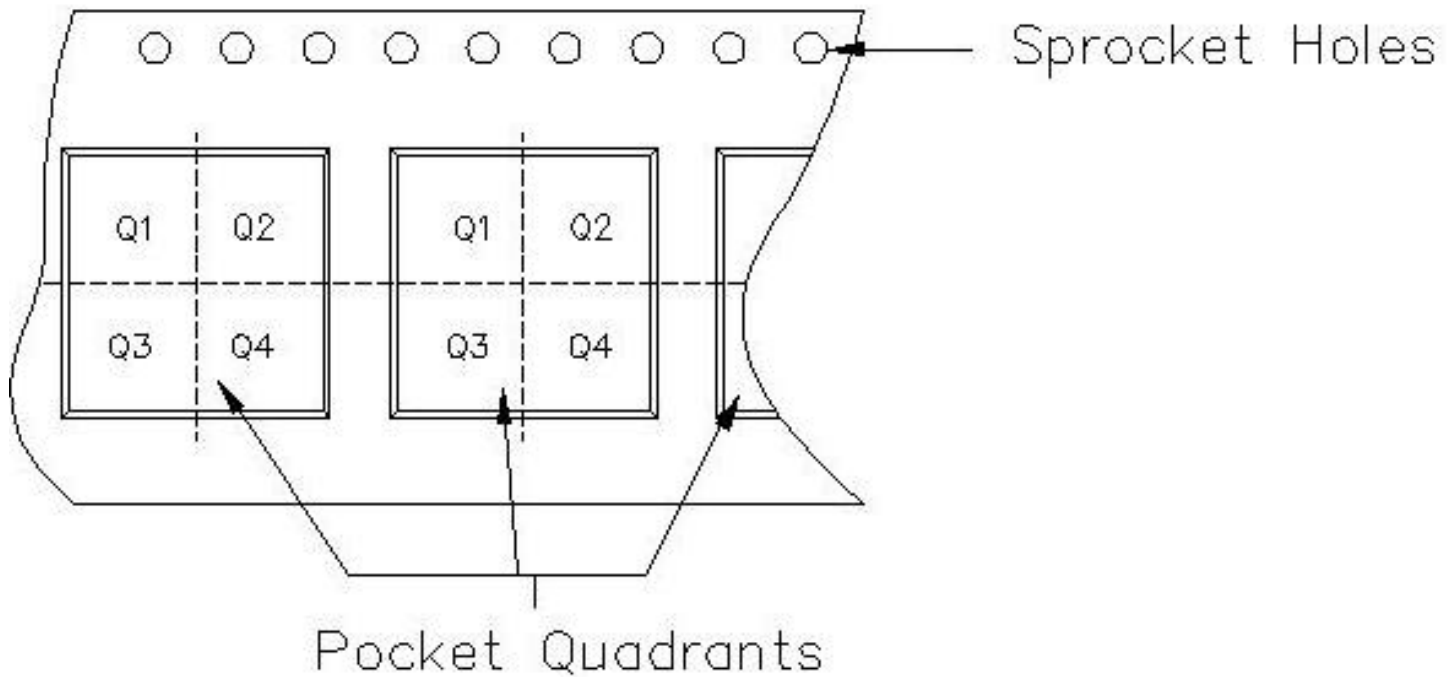
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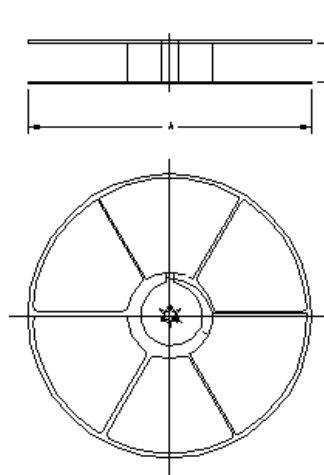
Carrier tape design is defined largely by the component length, width, and thickness.

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



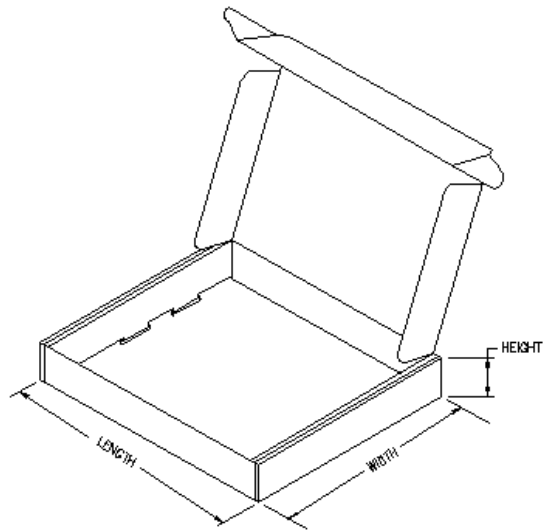
**TAPE AND REEL INFORMATION**

| Device      | Package | Pins | Site | Reel Diameter (mm) | Reel Width (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-------------|---------|------|------|--------------------|-----------------|---------|---------|---------|---------|--------|---------------|
| SN74HC21DR  | D       | 14   | MLA  | 330                | 16              | 6.5     | 9.0     | 2.1     | 8       | 16     | Q1            |
| SN74HC21NSR | NS      | 14   | MLA  | 330                | 16              | 8.2     | 10.5    | 2.5     | 12      | 16     | Q1            |
| SN74HC21PWR | PW      | 14   | MLA  | 330                | 12              | 7.0     | 5.6     | 1.6     | 8       | 12     | Q1            |



**TAPE AND REEL BOX INFORMATION**

| Device      | Package | Pins | Site | Length (mm) | Width (mm) | Height (mm) |
|-------------|---------|------|------|-------------|------------|-------------|
| SN74HC21DR  | D       | 14   | MLA  | 346.0       | 346.0      | 33.0        |
| SN74HC21NSR | NS      | 14   | MLA  | 346.0       | 346.0      | 33.0        |
| SN74HC21PWR | PW      | 14   | MLA  | 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<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:
- 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.

FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a metal lid.
  - D. The terminals are gold plated.
  - E. Falls within JEDEC MS-004

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-G14)

PLASTIC SMALL-OUTLINE PACKAGE



- 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 .006 (0,15) per end.
  - $\triangle D$  Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
  - E. Reference JEDEC MS-012 variation AB.

## 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

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 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

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