



## SNx4HC32 Quadruple 2-Input Positive-OR Gates

### 1 Features

- Wide Operating Voltage Range: 2 V to 6 V
- Outputs Can Drive Up to 10 LSTTL Loads
- Low Power Consumption  $I_{CC}$ : 20  $\mu$ A (Maximum)
- Typical  $t_{pd}$ : 8 ns
- $\pm 4$ -mA Output Drive at 5 V
- Low Input Current: 1  $\mu$ A (Maximum)

### 2 Applications

- Education
- Toys
- Musical Instruments
- Medical Healthcare and Fitness
- Grid Infrastructure
- Electronic Point of Sale
- Test and Measurement
- Factory Automation and Control
- Building Automation

### 3 Description

The SNx4HC32 devices contain four independent 2-input OR gates. They perform the boolean function  $Y = \overline{A} \cdot \overline{B}$  or  $Y = A + B$  in positive logic.

**Device Information<sup>(1)</sup>**

| PART NUMBER | PACKAGE    | BODY SIZE (NOM)    |
|-------------|------------|--------------------|
| SN54HC32J   | CDIP (14)  | 19.94 mm × 7.62 mm |
| SN54HC32W   | CFP (14)   | 9.21 mm × 7.11 mm  |
| SN54HC32FK  | LCCC (20)  | 8.89 mm × 8.89 mm  |
| SN74HC32D   | SOIC (14)  | 4.90 mm × 3.91 mm  |
| SN74HC32DB  | SSOP (14)  | 6.20 mm × 5.30 mm  |
| SN74HC32N   | PDIP (14)  | 19.30 mm × 6.35 mm |
| SN74HC32NS  | SO (14)    | 10.30 mm × 5.30 mm |
| SN74HC32PW  | TSSOP (14) | 5.00 mm × 4.40 mm  |

(1) For all available packages, see the orderable addendum at the end of the data sheet.

### Logic Diagram (Positive Logic)



Copyright © 2016, Texas Instruments Incorporated



## Table of Contents

|                                                  |          |                                                                  |           |
|--------------------------------------------------|----------|------------------------------------------------------------------|-----------|
| <b>1 Features</b> .....                          | <b>1</b> | 8.3 Feature Description .....                                    | <b>9</b>  |
| <b>2 Applications</b> .....                      | <b>1</b> | 8.4 Device Functional Modes .....                                | <b>9</b>  |
| <b>3 Description</b> .....                       | <b>1</b> | <b>9 Application and Implementation</b> .....                    | <b>10</b> |
| <b>4 Revision History</b> .....                  | <b>2</b> | 9.1 Application Information .....                                | <b>10</b> |
| <b>5 Pin Configuration and Functions</b> .....   | <b>3</b> | 9.2 Typical Application .....                                    | <b>10</b> |
| <b>6 Specifications</b> .....                    | <b>4</b> | <b>10 Power Supply Recommendations</b> .....                     | <b>12</b> |
| 6.1 Absolute Maximum Ratings .....               | <b>4</b> | <b>11 Layout</b> .....                                           | <b>12</b> |
| 6.2 ESD Ratings: SN74HC32 .....                  | <b>4</b> | 11.1 Layout Guidelines .....                                     | <b>12</b> |
| 6.3 Recommended Operating Conditions .....       | <b>4</b> | 11.2 Layout Example .....                                        | <b>12</b> |
| 6.4 Thermal Information: SN54HC32 .....          | <b>5</b> | <b>12 Device and Documentation Support</b> .....                 | <b>13</b> |
| 6.5 Thermal Information: SN74HC32 .....          | <b>5</b> | 12.1 Documentation Support .....                                 | <b>13</b> |
| 6.6 Electrical Characteristics .....             | <b>5</b> | 12.2 Related Links .....                                         | <b>13</b> |
| 6.7 Switching Characteristics .....              | <b>6</b> | 12.3 Receiving Notification of Documentation Updates .....       | <b>13</b> |
| 6.8 Typical Characteristics .....                | <b>7</b> | 12.4 Community Resources .....                                   | <b>13</b> |
| <b>7 Parameter Measurement Information</b> ..... | <b>8</b> | 12.5 Trademarks .....                                            | <b>13</b> |
| <b>8 Detailed Description</b> .....              | <b>9</b> | 12.6 Electrostatic Discharge Caution .....                       | <b>13</b> |
| 8.1 Overview .....                               | <b>9</b> | 12.7 Glossary .....                                              | <b>13</b> |
| 8.2 Functional Block Diagram .....               | <b>9</b> | <b>13 Mechanical, Packaging, and Orderable Information</b> ..... | <b>13</b> |

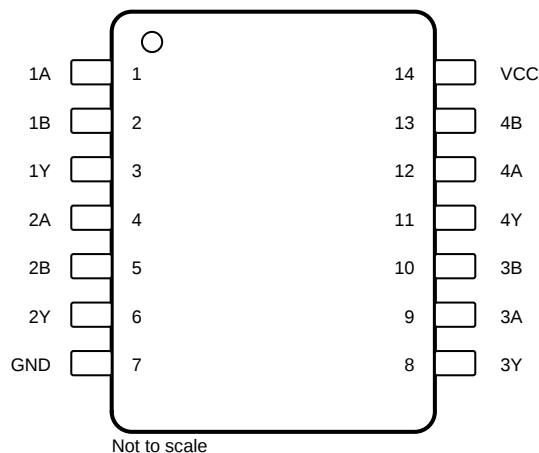
## 4 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

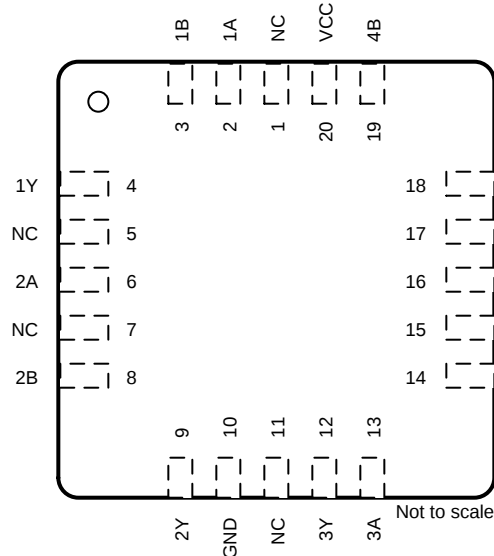
| Changes from Revision D (August 2003) to Revision E                                                                                                                                                                                                                                                                                                  | Page     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| • Added <i>ESD Ratings</i> table, <i>Feature Description</i> section, <i>Device Functional Modes</i> , <i>Application and Implementation</i> section, <i>Power Supply Recommendations</i> section, <i>Layout</i> section, <i>Device and Documentation Support</i> section, and <i>Mechanical, Packaging, and Orderable Information</i> section ..... | <b>1</b> |
| • Removed Ordering Information table .....                                                                                                                                                                                                                                                                                                           | <b>1</b> |
| • Updated values in the <i>Thermal Information</i> tables to align with JEDEC standards .....                                                                                                                                                                                                                                                        | <b>5</b> |

## 5 Pin Configuration and Functions

**D, DB, J, N, NS, PW, W Package**  
**14-Pin SOIC, SSOP, CDIP, PDIP, SOP, TSSOP, CFP**  
**Top View**



**FK Package**  
**20-Pin LCCC**  
**Top View**



### Pin Functions

| PIN             |                        |                     | I/O | DESCRIPTION            |
|-----------------|------------------------|---------------------|-----|------------------------|
| NAME            | D, DB, J, N, NS, PW, W | FK                  |     |                        |
| 1A              | 1                      | 2                   | I   | Gate 1 input A         |
| 1B              | 2                      | 3                   | I   | Gate 1 input B         |
| 1Y              | 3                      | 4                   | O   | Gate 1 output          |
| 2A              | 4                      | 6                   | I   | Gate 2 input A         |
| 2B              | 5                      | 8                   | I   | Gate 2 input B         |
| 2Y              | 6                      | 9                   | O   | Gate 2 output          |
| 3A              | 9                      | 13                  | I   | Gate 3 input A         |
| 3B              | 10                     | 14                  | I   | Gate 3 input B         |
| 3Y              | 8                      | 12                  | O   | Gate 3 output          |
| 4A              | 12                     | 18                  | I   | Gate 4 input A         |
| 4B              | 13                     | 19                  | I   | Gate 4 input B         |
| 4Y              | 11                     | 16                  | O   | Gate 4 output          |
| GND             | 7                      | 10                  | —   | Ground                 |
| NC              | —                      | 1, 5, 7, 11, 15, 17 | —   | No internal connection |
| V <sub>CC</sub> | 14                     | 20                  | —   | Power supply           |

## 6 Specifications

### 6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

|                  |                                                   | MIN                                                    | MAX | UNIT   |
|------------------|---------------------------------------------------|--------------------------------------------------------|-----|--------|
| V <sub>CC</sub>  | Supply voltage range                              | −0.5                                                   | 7   | V      |
| I <sub>IK</sub>  | Input clamp current <sup>(2)</sup>                | V <sub>I</sub> < 0 or V <sub>I</sub> > V <sub>CC</sub> |     | ±20 mA |
| I <sub>OK</sub>  | Output clamp current <sup>(2)</sup>               | V <sub>O</sub> < 0 or V <sub>O</sub> > V <sub>CC</sub> |     | ±20 mA |
| I <sub>O</sub>   | Continuous output current                         | V <sub>O</sub> = 0 to V <sub>CC</sub>                  |     | ±25 mA |
|                  | Continuous current through V <sub>CC</sub> or GND |                                                        |     | ±50 mA |
| T <sub>J</sub>   | Operating virtual junction temperature            |                                                        |     | 150 °C |
| T <sub>stg</sub> | Storage temperature range                         | −65                                                    | 150 | °C     |

- (1) 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.
- (2) The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.

### 6.2 ESD Ratings: SN74HC32

|                    |                         | VALUE                                                                          | UNIT  |
|--------------------|-------------------------|--------------------------------------------------------------------------------|-------|
| V <sub>(ESD)</sub> | Electrostatic discharge | Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>              | ±2000 |
|                    |                         | Charged-device model (CDM), per JEDEC specification JESD22-C101 <sup>(2)</sup> | ±750  |

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
- (2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

### 6.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

|                 |                                    | MIN                     | NOM  | MAX             | UNIT |
|-----------------|------------------------------------|-------------------------|------|-----------------|------|
| V <sub>CC</sub> | Supply voltage                     | 2                       | 5    | 6               | V    |
| V <sub>IH</sub> | High-level input voltage           | V <sub>CC</sub> = 2 V   | 1.5  |                 | V    |
|                 |                                    | V <sub>CC</sub> = 4.5 V | 3.15 |                 |      |
|                 |                                    | V <sub>CC</sub> = 6 V   | 4.2  |                 |      |
| V <sub>IL</sub> | Low-level input voltage            | V <sub>CC</sub> = 2 V   |      | 0.5             | V    |
|                 |                                    | V <sub>CC</sub> = 4.5 V |      | 1.35            |      |
|                 |                                    | V <sub>CC</sub> = 6 V   |      | 1.8             |      |
| V <sub>I</sub>  | Input voltage                      | 0                       |      | V <sub>CC</sub> | V    |
| V <sub>O</sub>  | Output voltage                     | 0                       |      | V <sub>CC</sub> | V    |
| Δt/Δv           | Input transition rise or fall time | V <sub>CC</sub> = 2 V   |      | 1000            | ns   |
|                 |                                    | V <sub>CC</sub> = 4.5 V |      | 500             |      |
|                 |                                    | V <sub>CC</sub> = 6 V   |      | 400             |      |
| T <sub>A</sub>  | Operating free-air temperature     | SN54HC32                | −55  | 125             | °C   |
|                 |                                    | SN74HC32                | −40  | 85              |      |

- (1) All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. Refer to [Implications of Slow or Floating CMOS Inputs](#) application report.

## 6.4 Thermal Information: SN54HC32

| THERMAL METRIC <sup>(1)</sup> |                                              | SN54HC32 |         |           | UNIT |
|-------------------------------|----------------------------------------------|----------|---------|-----------|------|
|                               |                                              | CDIP (J) | CFP (W) | LCCC (FK) |      |
|                               |                                              | 14 PINS  | 14 PINS | 20 PINS   |      |
| $R_{\theta JA}$               | Junction-to-ambient thermal resistance       | —        | —       | —         | °C/W |
| $R_{\theta JC(top)}$          | Junction-to-case (top) thermal resistance    | 54.9     | 88.3    | 61        | °C/W |
| $R_{\theta JB}$               | Junction-to-board thermal resistance         | 80.1     | 156     | 59.6      | °C/W |
| $\psi_{JT}$                   | Junction-to-top characterization parameter   | —        | —       | —         | °C/W |
| $\psi_{JB}$                   | Junction-to-board characterization parameter | —        | —       | —         | °C/W |
| $R_{\theta JC(bot)}$          | Junction-to-case (bottom) thermal resistance | 25.1     | 15.2    | 11.7      | °C/W |

(1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.

## 6.5 Thermal Information: SN74HC32

| THERMAL METRIC <sup>(1)</sup> |                                              | SN74HC32 |           |          |          |            | UNIT |
|-------------------------------|----------------------------------------------|----------|-----------|----------|----------|------------|------|
|                               |                                              | SOIC (D) | SSOP (DB) | PDIP (N) | SOP (NS) | TSSOP (PW) |      |
|                               |                                              | 14 PINS  | 14 PINS   | 14 PINS  | 14 PINS  | 14 PINS    |      |
| $R_{\theta JA}$               | Junction-to-ambient thermal resistance       | 90.1     | 105.4     | 54.9     | 88.8     | 119.6      | °C/W |
| $R_{\theta JC(top)}$          | Junction-to-case (top) thermal resistance    | 50.3     | 57.3      | 42.5     | 46.5     | 48.4       | °C/W |
| $R_{\theta JB}$               | Junction-to-board thermal resistance         | 44.4     | 52.7      | 34.7     | 47.6     | 61.3       | °C/W |
| $\psi_{JT}$                   | Junction-to-top characterization parameter   | 17.9     | 22.6      | 27.9     | 16.8     | 5.6        | °C/W |
| $\psi_{JB}$                   | Junction-to-board characterization parameter | 44.1     | 52.2      | 34.6     | 47.2     | 60.7       | °C/W |
| $R_{\theta JC(bot)}$          | Junction-to-case (bottom) thermal resistance | —        | —         | —        | —        | —          | °C/W |

(1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.

## 6.6 Electrical Characteristics

over operating free-air temperature range (unless otherwise noted)

| PARAMETER | TEST CONDITIONS                   |                                  |                    | MIN  | TYP   | MAX | UNIT |
|-----------|-----------------------------------|----------------------------------|--------------------|------|-------|-----|------|
| $V_{OH}$  | $V_I = V_{IH} \text{ or } V_{IL}$ | $I_{OH} = -20 \mu A$             | $V_{CC} = 2 V$     | 1.9  | 1.998 |     | V    |
|           |                                   |                                  | $V_{CC} = 4.5 V$   | 4.4  | 4.499 |     |      |
|           |                                   |                                  | $V_{CC} = 6 V$     | 5.9  | 5.999 |     |      |
|           |                                   | $I_{OH} = -4 mA, V_{CC} = 4.5 V$ | $T_A = 25^\circ C$ | 3.98 | 4.3   |     |      |
|           |                                   |                                  | SN54HC32           | 3.7  |       |     |      |
|           |                                   |                                  | SN74HC32           | 3.84 |       |     |      |
|           |                                   | $I_{OH} = -5.2 mA, V_{CC} = 6 V$ | $T_A = 25^\circ C$ | 5.48 | 5.8   |     |      |
|           |                                   |                                  | SN54HC32           | 5.2  |       |     |      |
|           |                                   |                                  | SN74HC32           | 5.34 |       |     |      |

## Electrical Characteristics (continued)

over operating free-air temperature range (unless otherwise noted)

| PARAMETER       |                                                                                  | TEST CONDITIONS                                 |                         |      | MIN   | TYP  | MAX | UNIT |
|-----------------|----------------------------------------------------------------------------------|-------------------------------------------------|-------------------------|------|-------|------|-----|------|
| V <sub>OL</sub> | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                              | I <sub>OL</sub> = 20 μA                         | V <sub>CC</sub> = 2 V   |      | 0.002 | 0.1  | V   |      |
|                 |                                                                                  |                                                 | V <sub>CC</sub> = 4.5 V |      | 0.001 | 0.1  |     |      |
|                 |                                                                                  |                                                 | V <sub>CC</sub> = 6 V   |      | 0.001 | 0.1  |     |      |
|                 |                                                                                  | I <sub>OL</sub> = 4 mA, V <sub>CC</sub> = 4.5 V | T <sub>A</sub> = 25°C   |      | 0.17  | 0.26 |     |      |
|                 |                                                                                  |                                                 | SN54HC32                |      |       | 0.4  |     |      |
|                 |                                                                                  |                                                 | SN74HC32                |      |       | 0.33 |     |      |
|                 |                                                                                  | I <sub>OL</sub> = 5.2 mA, V <sub>CC</sub> = 6 V | T <sub>A</sub> = 25°C   |      | 0.15  | 0.26 |     |      |
|                 |                                                                                  |                                                 | SN54HC32                |      |       | 0.4  |     |      |
|                 |                                                                                  |                                                 | SN74HC32                |      |       | 0.33 |     |      |
| I <sub>I</sub>  | V <sub>I</sub> = V <sub>CC</sub> or 0, V <sub>CC</sub> = 6 V                     | T <sub>A</sub> = 25°C                           |                         | ±0.1 | ±100  | nA   |     |      |
|                 |                                                                                  | SNx4HC32                                        |                         |      | ±1000 |      |     |      |
| I <sub>CC</sub> | V <sub>I</sub> = V <sub>CC</sub> or 0, I <sub>O</sub> = 0, V <sub>CC</sub> = 6 V | T <sub>A</sub> = 25°C                           |                         |      | 2     | μA   |     |      |
|                 |                                                                                  | SN54HC32                                        |                         |      | 40    |      |     |      |
|                 |                                                                                  | SN74HC32                                        |                         |      | 20    |      |     |      |
| C <sub>i</sub>  | V <sub>CC</sub> = 2 V to 6 V                                                     |                                                 |                         |      | 3     | 10   | pF  |      |
| C <sub>pd</sub> | Power dissipation capacitance per gate                                           | T <sub>A</sub> = 25°C, no load                  |                         |      |       | 20   |     | pF   |

## 6.7 Switching Characteristics

over operating free-air temperature range (unless otherwise noted; see [Figure 4](#))

| PARAMETER | TEST CONDITIONS                                                  |                  |                    | MIN | TYP | MAX | UNIT |
|-----------|------------------------------------------------------------------|------------------|--------------------|-----|-----|-----|------|
| $t_{pd}$  | $C_L = 50 \text{ pF}, \text{ from A or B (input) to Y (output)}$ | $V_{CC} = 2 V$   | $T_A = 25^\circ C$ |     | 50  | 100 | ns   |
|           |                                                                  |                  | SN54HC32           |     |     | 150 |      |
|           |                                                                  |                  | SN74HC32           |     |     | 125 |      |
|           |                                                                  | $V_{CC} = 4.5 V$ | $T_A = 25^\circ C$ |     | 10  | 20  |      |
|           |                                                                  |                  | SN54HC32           |     |     | 30  |      |
|           |                                                                  |                  | SN74HC32           |     |     | 25  |      |
|           |                                                                  | $V_{CC} = 6 V$   | $T_A = 25^\circ C$ |     | 8   | 17  |      |
|           |                                                                  |                  | SN54HC32           |     |     | 25  |      |
|           |                                                                  |                  | SN74HC32           |     |     | 21  |      |
| $t_t$     | $C_L = 50 \text{ pF}, \text{ to Y (output)}$                     | $V_{CC} = 2 V$   | $T_A = 25^\circ C$ |     | 38  | 75  | ns   |
|           |                                                                  |                  | SN54HC32           |     |     | 110 |      |
|           |                                                                  |                  | SN74HC32           |     |     | 95  |      |
|           |                                                                  | $V_{CC} = 4.5 V$ | $T_A = 25^\circ C$ |     | 8   | 15  |      |
|           |                                                                  |                  | SN54HC32           |     |     | 22  |      |
|           |                                                                  |                  | SN74HC32           |     |     | 19  |      |
|           |                                                                  | $V_{CC} = 6 V$   | $T_A = 25^\circ C$ |     | 6   | 13  |      |
|           |                                                                  |                  | SN54HC32           |     |     | 19  |      |
|           |                                                                  |                  | SN74HC32           |     |     | 16  |      |

## 6.8 Typical Characteristics

$T_A = 25^\circ\text{C}$  and  $C_L = 50\text{ pF}$

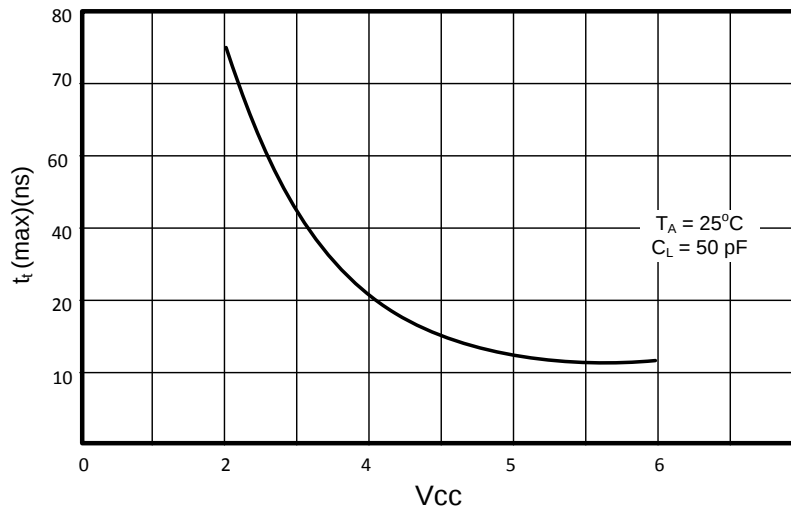
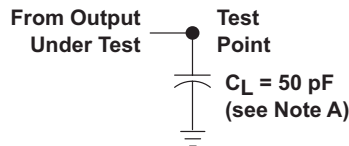
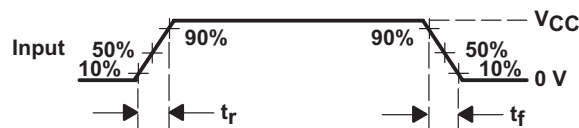


Figure 1.  $t_t$  vs  $V_{CC}$

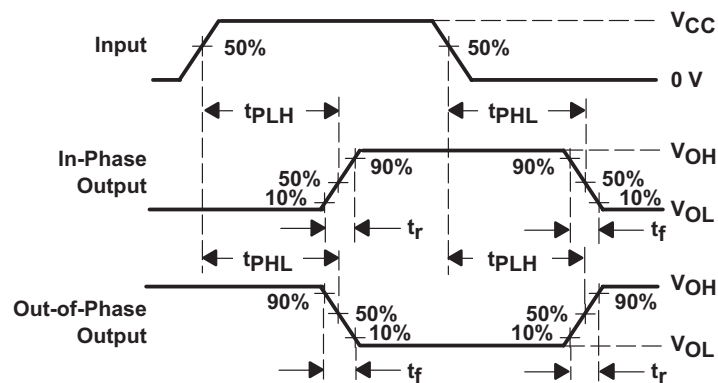
## 7 Parameter Measurement Information



**Figure 2. Load Current**



**Figure 3. Input Rise and Fall Times**



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

**Figure 4. Propagation Delay and Output Transition Times**

## 8 Detailed Description

### 8.1 Overview

The SNx4HC32 devices are quad 2-input OR gates. These devices are members of the High-Speed CMOS (HC) logic family. The HC family of logic is optimized to operate with a 5-V supply, is low noise without characteristic overshoot and undershoot, has low power consumption, small propagation delay, balanced propagation delay and transition times, and operates over a wide temperature range.

### 8.2 Functional Block Diagram



Copyright © 2016, Texas Instruments Incorporated

**Figure 5. Logic Diagram (Positive Logic)**

### 8.3 Feature Description

#### 8.3.1 Operating Voltage Range

The SNx4HC series of devices offer a wide operating voltage range from 2 V to 6 V.

#### 8.3.2 LSTTL Loads

The outputs of the SNx4HC series can drive up to 10 LSTTL loads.

#### 8.3.3 Low Power Consumption

The SNx4HC32 offers low power consumption of 20  $\mu$ A (maximum).

#### 8.3.4 Output Drive Capability

At 5 V, the outputs have  $\pm 4$  mA of output drive capability.

#### 8.3.5 Low Input Current Leakage

Inputs have low input current leakage of 1  $\mu$ A (maximum).

### 8.4 Device Functional Modes

[Table 1](#) lists the functional modes of SNx4HC32.

**Table 1. Function Table  
(Each Gate)**

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| H      | X | H      |
| X      | H | H      |
| L      | L | L      |

## 9 Application and Implementation

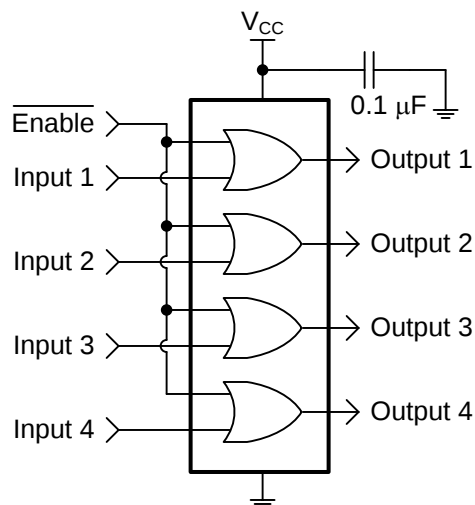
### NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

### 9.1 Application Information

The SNx4HC32 is an extremely versatile device with far more available applications than could be listed here. The application chosen as an example is using all four OR gates in a single package to provide a four channel output enable from a single active low enable signal (Enable). This circuit outputs a logic HIGH on all channels when disabled (Enable is HIGH), and passes the input signals when enabled (Enable is LOW).

### 9.2 Typical Application



Copyright © 2016, Texas Instruments Incorporated

Using a quad OR gate as a 4-channel active low enable with high output off state.

**Figure 6. Typical Application Schematic**

#### 9.2.1 Design Requirements

This device uses CMOS technology and has balanced output drive. Take care to avoid bus contention because it can drive currents that would exceed maximum limits. The high drive also creates fast edges into light loads, so routing and load conditions must be considered to prevent ringing.

The minimum output pulse time is approximately three times  $t_{pd}$  from [Switching Characteristics](#) for the selected  $V_{CC}$ , device, and temperature range.

#### 9.2.2 Detailed Design Procedure

##### Logic

- All four input channels are to be enabled or disabled simultaneously
- The enable signal is active low (LOW = enabled, HIGH = disabled)
- All four outputs are to output logic HIGH while disabled

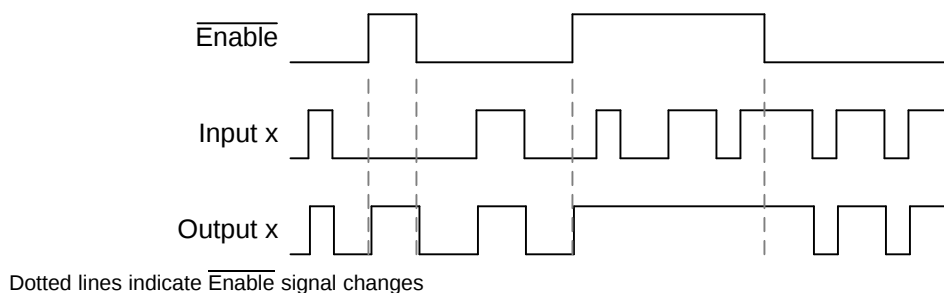
##### Inputs

- Each input must follow requirements specified in [Absolute Maximum Ratings](#):
  - Avoid exceeding input voltages

## Typical Application (continued)

- If input voltages ratings must be exceeded, ensure that the maximum input current ratings are not exceeded.
- Ensure that the input signals have edge rates that are equal to or faster than that listed in [Recommended Operating Conditions](#). Slower signals can cause incorrect behavior and possibly damage to the part.
- Each output must also follow requirements in [Absolute Maximum Ratings](#):
  - Avoid bus contention by only connecting outputs together when inputs are tied together directly.
  - Avoid forcing output voltages outside those specified in [Absolute Maximum Ratings](#).
  - If output voltage ratings must be exceeded, ensure that the maximum output current ratings are not exceeded.
  - Ensure that the total current output does not exceed the continuous current through  $V_{CC}$  or GND listed in [Absolute Maximum Ratings](#).

### 9.2.3 Application Curves



**Figure 7. Application Timing Diagram**

## 10 Power Supply Recommendations

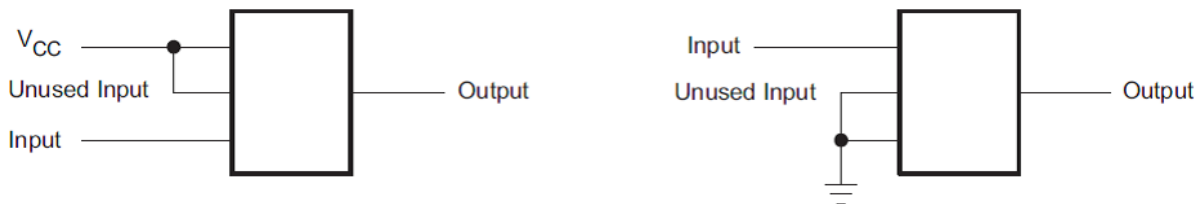
The power supply can be any voltage between the minimum and maximum supply voltage rating located in [Recommended Operating Conditions](#). Each  $V_{CC}$  pin must have a good bypass capacitor to prevent power disturbance. For devices with a single supply, TI recommends a 0.1- $\mu$ F bypass capacitor. If there are multiple  $V_{CC}$  pins, TI recommends a 0.01- $\mu$ F or 0.022- $\mu$ F bypass capacitors for each power pin. It is acceptable to parallel multiple bypass capacitors to reject different frequencies of noise. Two bypass capacitors of value 0.1- $\mu$ F and 1- $\mu$ F are commonly used in parallel. For best results, install the bypass capacitor(s) as close to the power pin as possible.

## 11 Layout

### 11.1 Layout Guidelines

When using multiple bit logic devices, inputs must not float. In many cases, functions or parts of functions of digital logic devices are unused. Some examples are when only two inputs of a triple-input AND gate are used, or when only 3 of the 4-buffer gates are used. Such input pins must not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. Specified in [Absolute Maximum Ratings](#) are rules that must be observed under all circumstances. All unused inputs of digital logic devices must be connected to a high or low bias to prevent them from floating. The logic level that must be applied to any particular unused input depends on the function of the device. Generally they are tied to GND or  $V_{CC}$ , whichever makes more sense or is more convenient. It is acceptable to float outputs unless the part is a transceiver. If the transceiver has an output enable pin, it disables the outputs section of the part when asserted. This does not disable the input section of the I/Os so they also cannot float when disabled.

### 11.2 Layout Example



**Figure 8. Layout Recommendation**

## 12 Device and Documentation Support

### 12.1 Documentation Support

#### 12.1.1 Related Documentation

For related documentation see the following:

- [Implications of Slow or Floating CMOS Inputs](#) (SCBA004)

### 12.2 Related Links

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to sample or buy.

**Table 2. Related Links**

| PARTS    | PRODUCT FOLDER             | SAMPLE & BUY               | TECHNICAL DOCUMENTS        | TOOLS & SOFTWARE           | SUPPORT & COMMUNITY        |
|----------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| SN54HC32 | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> |
| SN74HC32 | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> |

### 12.3 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

### 12.4 Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

**TI E2E™ Online Community** *TI's Engineer-to-Engineer (E2E) Community*. Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

**Design Support** *TI's Design Support* Quickly find helpful E2E forums along with design support tools and contact information for technical support.

### 12.5 Trademarks

E2E is a trademark of Texas Instruments.  
All other trademarks are the property of their respective owners.

### 12.6 Electrostatic Discharge Caution



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

### 12.7 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

## 13 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

**PACKAGING INFORMATION**

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5)           | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|-------------------------|----------------------|--------------|-----------------------------------|-------------------------|
| 5962-8404501VCA  | ACTIVE        | CDIP         | J                  | 14   | 1              | TBD                        | A42                     | N / A for Pkg Type   | -55 to 125   | 5962-8404501VC<br>A<br>SNV54HC32J | <a href="#">Samples</a> |
| 5962-8404501VDA  | ACTIVE        | CFP          | W                  | 14   | 1              | TBD                        | A42                     | N / A for Pkg Type   | -55 to 125   | 5962-8404501VD<br>A<br>SNV54HC32W | <a href="#">Samples</a> |
| 84045012A        | ACTIVE        | LCCC         | FK                 | 20   | 1              | TBD                        | POST-PLATE              | N / A for Pkg Type   | -55 to 125   | 84045012A<br>SNJ54HC<br>32FK      | <a href="#">Samples</a> |
| 8404501CA        | ACTIVE        | CDIP         | J                  | 14   | 1              | TBD                        | A42                     | N / A for Pkg Type   | -55 to 125   | 8404501CA<br>SNJ54HC32J           | <a href="#">Samples</a> |
| 8404501DA        | ACTIVE        | CFP          | W                  | 14   | 1              | TBD                        | A42                     | N / A for Pkg Type   | -55 to 125   | 8404501DA<br>SNJ54HC32W           | <a href="#">Samples</a> |
| JM38510/65201B2A | ACTIVE        | LCCC         | FK                 | 20   | 1              | TBD                        | POST-PLATE              | N / A for Pkg Type   | -55 to 125   | JM38510/<br>65201B2A              | <a href="#">Samples</a> |
| JM38510/65201BCA | ACTIVE        | CDIP         | J                  | 14   | 1              | TBD                        | A42                     | N / A for Pkg Type   | -55 to 125   | JM38510/<br>65201BCA              | <a href="#">Samples</a> |
| JM38510/65201BDA | ACTIVE        | CFP          | W                  | 14   | 1              | TBD                        | A42                     | N / A for Pkg Type   | -55 to 125   | JM38510/<br>65201BDA              | <a href="#">Samples</a> |
| M38510/65201B2A  | ACTIVE        | LCCC         | FK                 | 20   | 1              | TBD                        | POST-PLATE              | N / A for Pkg Type   | -55 to 125   | JM38510/<br>65201B2A              | <a href="#">Samples</a> |
| M38510/65201BCA  | ACTIVE        | CDIP         | J                  | 14   | 1              | TBD                        | A42                     | N / A for Pkg Type   | -55 to 125   | JM38510/<br>65201BCA              | <a href="#">Samples</a> |
| M38510/65201BDA  | ACTIVE        | CFP          | W                  | 14   | 1              | TBD                        | A42                     | N / A for Pkg Type   | -55 to 125   | JM38510/<br>65201BDA              | <a href="#">Samples</a> |
| SN54HC32J        | ACTIVE        | CDIP         | J                  | 14   | 1              | TBD                        | A42                     | N / A for Pkg Type   | -55 to 125   | SN54HC32J                         | <a href="#">Samples</a> |
| SN74HC32D        | ACTIVE        | SOIC         | D                  | 14   | 50             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | HC32                              | <a href="#">Samples</a> |
| SN74HC32DBLE     | OBSOLETE      | SSOP         | DB                 | 14   |                | TBD                        | Call TI                 | Call TI              | -40 to 85    |                                   |                         |
| SN74HC32DBR      | ACTIVE        | SSOP         | DB                 | 14   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | HC32                              | <a href="#">Samples</a> |
| SN74HC32DE4      | ACTIVE        | SOIC         | D                  | 14   | 50             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | HC32                              | <a href="#">Samples</a> |

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| SN74HC32DG4      | ACTIVE        | SOIC         | D                  | 14   | 50             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | HC32                    | <a href="#">Samples</a> |
| SN74HC32DR       | ACTIVE        | SOIC         | D                  | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU   CU SN       | Level-1-260C-UNLIM   | -40 to 85    | HC32                    | <a href="#">Samples</a> |
| SN74HC32DRE4     | ACTIVE        | SOIC         | D                  | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | HC32                    | <a href="#">Samples</a> |
| SN74HC32DRG4     | ACTIVE        | SOIC         | D                  | 14   | 2500           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | HC32                    | <a href="#">Samples</a> |
| SN74HC32DT       | ACTIVE        | SOIC         | D                  | 14   | 250            | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | HC32                    | <a href="#">Samples</a> |
| SN74HC32N        | ACTIVE        | PDIP         | N                  | 14   | 25             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | -40 to 85    | SN74HC32N               | <a href="#">Samples</a> |
| SN74HC32N3       | OBSOLETE      | PDIP         | N                  | 14   |                | TBD                        | Call TI                 | Call TI              | -40 to 85    |                         |                         |
| SN74HC32NE4      | ACTIVE        | PDIP         | N                  | 14   | 25             | Pb-Free<br>(RoHS)          | CU NIPDAU               | N / A for Pkg Type   | -40 to 85    | SN74HC32N               | <a href="#">Samples</a> |
| SN74HC32NSR      | ACTIVE        | SO           | NS                 | 14   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | HC32                    | <a href="#">Samples</a> |
| SN74HC32PW       | ACTIVE        | TSSOP        | PW                 | 14   | 90             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | HC32                    | <a href="#">Samples</a> |
| SN74HC32PWE4     | ACTIVE        | TSSOP        | PW                 | 14   | 90             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | HC32                    | <a href="#">Samples</a> |
| SN74HC32PWG4     | ACTIVE        | TSSOP        | PW                 | 14   | 90             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | HC32                    | <a href="#">Samples</a> |
| SN74HC32PWLE     | OBSOLETE      | TSSOP        | PW                 | 14   |                | TBD                        | Call TI                 | Call TI              | -40 to 85    |                         |                         |
| SN74HC32PWR      | ACTIVE        | TSSOP        | PW                 | 14   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU   CU SN       | Level-1-260C-UNLIM   | -40 to 85    | HC32                    | <a href="#">Samples</a> |
| SN74HC32PWRE4    | ACTIVE        | TSSOP        | PW                 | 14   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | HC32                    | <a href="#">Samples</a> |
| SN74HC32PWRG4    | ACTIVE        | TSSOP        | PW                 | 14   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | HC32                    | <a href="#">Samples</a> |
| SN74HC32PWT      | ACTIVE        | TSSOP        | PW                 | 14   | 250            | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | HC32                    | <a href="#">Samples</a> |
| SN74HC32PWTG4    | ACTIVE        | TSSOP        | PW                 | 14   | 250            | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | HC32                    | <a href="#">Samples</a> |
| SNJ54HC32FK      | ACTIVE        | LCCC         | FK                 | 20   | 1              | TBD                        | POST-PLATE              | N / A for Pkg Type   | -55 to 125   | 84045012A<br>SNJ54HC    | <a href="#">Samples</a> |

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2) | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|--------------------|------|----------------|-----------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
|                  |               |              |                    |      |                |                 |                         |                      |              | 32FK                    |                         |
| SNJ54HC32J       | ACTIVE        | CDIP         | J                  | 14   | 1              | TBD             | A42                     | N / A for Pkg Type   | -55 to 125   | 8404501CA<br>SNJ54HC32J | <a href="#">Samples</a> |
| SNJ54HC32W       | ACTIVE        | CFP          | W                  | 14   | 1              | TBD             | A42                     | N / A for Pkg Type   | -55 to 125   | 8404501DA<br>SNJ54HC32W | <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.

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

---

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**OTHER QUALIFIED VERSIONS OF SN54HC32, SN54HC32-SP, SN74HC32 :**

- Catalog: [SN74HC32](#), [SN54HC32](#)
- Military: [SN54HC32](#)
- Space: [SN54HC32-SP](#)

**NOTE: Qualified Version Definitions:**

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications
- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

**TAPE AND REEL INFORMATION**


\*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 |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74HC32DBR   | SSOP         | DB              | 14   | 2000 | 330.0              | 16.4               | 8.2     | 6.6     | 2.5     | 12.0    | 16.0   | Q1            |
| SN74HC32DR    | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| SN74HC32DR    | SOIC         | D               | 14   | 2500 | 330.0              | 16.8               | 6.5     | 9.5     | 2.3     | 8.0     | 16.0   | Q1            |
| SN74HC32DR    | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| SN74HC32DRG4  | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| SN74HC32DRG4  | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| SN74HC32DT    | SOIC         | D               | 14   | 250  | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| SN74HC32PWR   | TSSOP        | PW              | 14   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| SN74HC32PWR   | TSSOP        | PW              | 14   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| SN74HC32PWRG4 | TSSOP        | PW              | 14   | 2000 | 330.0              | 12.4               | 6.9     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| SN74HC32PWT   | TSSOP        | PW              | 14   | 250  | 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) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74HC32DBR   | SSOP         | DB              | 14   | 2000 | 367.0       | 367.0      | 38.0        |
| SN74HC32DR    | SOIC         | D               | 14   | 2500 | 333.2       | 345.9      | 28.6        |
| SN74HC32DR    | SOIC         | D               | 14   | 2500 | 364.0       | 364.0      | 27.0        |
| SN74HC32DR    | SOIC         | D               | 14   | 2500 | 367.0       | 367.0      | 38.0        |
| SN74HC32DRG4  | SOIC         | D               | 14   | 2500 | 333.2       | 345.9      | 28.6        |
| SN74HC32DRG4  | SOIC         | D               | 14   | 2500 | 367.0       | 367.0      | 38.0        |
| SN74HC32DT    | SOIC         | D               | 14   | 250  | 367.0       | 367.0      | 38.0        |
| SN74HC32PWR   | TSSOP        | PW              | 14   | 2000 | 364.0       | 364.0      | 27.0        |
| SN74HC32PWR   | TSSOP        | PW              | 14   | 2000 | 367.0       | 367.0      | 35.0        |
| SN74HC32PWRG4 | TSSOP        | PW              | 14   | 2000 | 367.0       | 367.0      | 35.0        |
| SN74HC32PWT   | TSSOP        | PW              | 14   | 250  | 367.0       | 367.0      | 35.0        |

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

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



| NO. OF<br>TERMINALS<br>** | A                |                  | B                |                  |
|---------------------------|------------------|------------------|------------------|------------------|
|                           | MIN              | MAX              | MIN              | MAX              |
| 20                        | 0.342<br>(8,69)  | 0.358<br>(9,09)  | 0.307<br>(7,80)  | 0.358<br>(9,09)  |
| 28                        | 0.442<br>(11,23) | 0.458<br>(11,63) | 0.406<br>(10,31) | 0.458<br>(11,63) |
| 44                        | 0.640<br>(16,26) | 0.660<br>(16,76) | 0.495<br>(12,58) | 0.560<br>(14,22) |
| 52                        | 0.740<br>(18,78) | 0.761<br>(19,32) | 0.495<br>(12,58) | 0.560<br>(14,22) |
| 68                        | 0.938<br>(23,83) | 0.962<br>(24,43) | 0.850<br>(21,6)  | 0.858<br>(21,8)  |
| 84                        | 1.141<br>(28,99) | 1.165<br>(29,59) | 1.047<br>(26,6)  | 1.063<br>(27,0)  |



4040140/D 01/11

- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a metal lid.
  - Falls within JEDEC MS-004

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



| DIM \ PINS ** | 14    | 16    | 20    | 24    |
|---------------|-------|-------|-------|-------|
| A MAX         | 10,50 | 10,50 | 12,90 | 15,30 |
| A MIN         | 9,90  | 9,90  | 12,30 | 14,70 |

4040062/C 03/03

- 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



| 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)        |

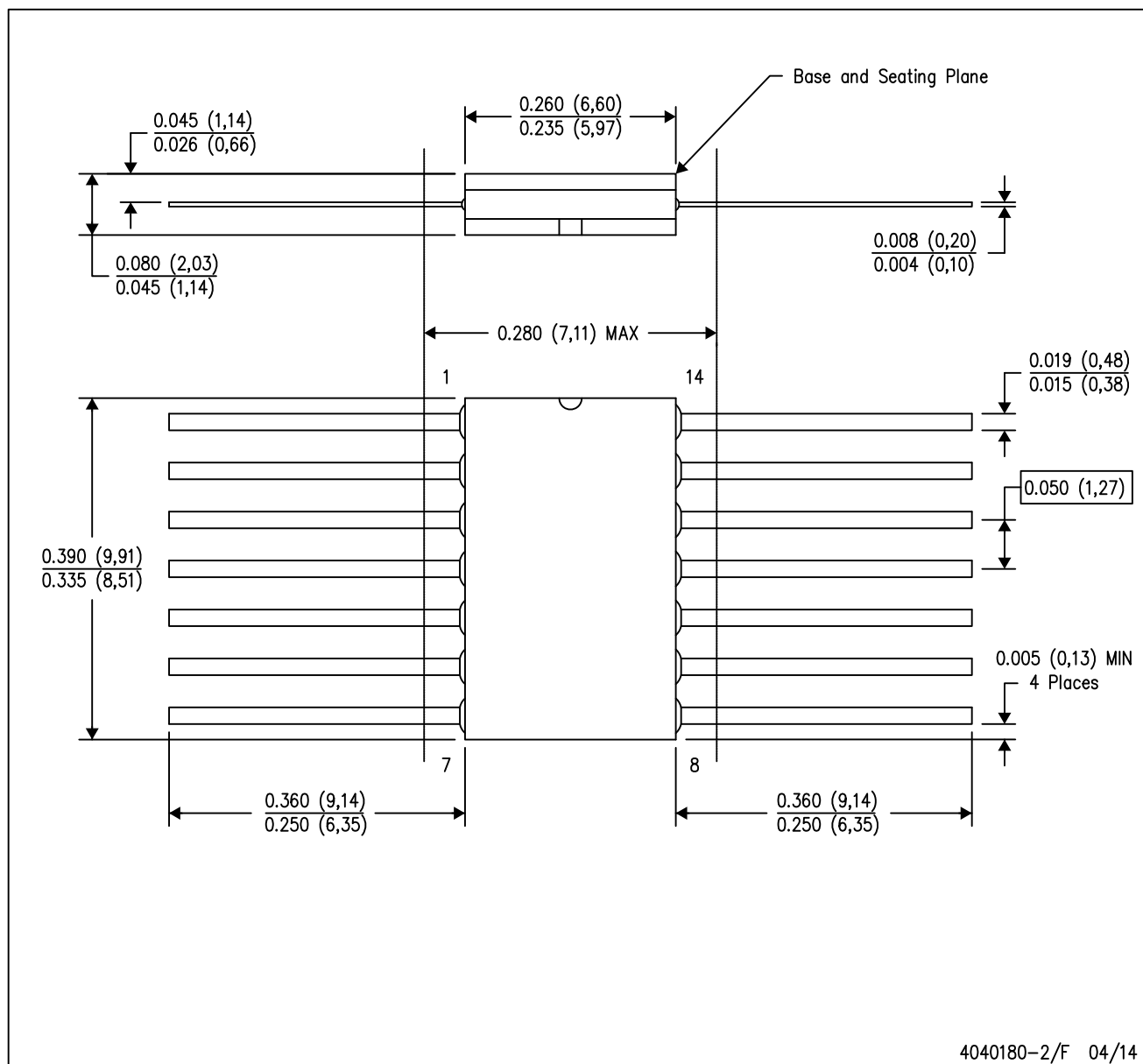


4040083/F 03/03

- 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.

W (R-GDFP-F14)

CERAMIC DUAL FLATPACK



D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



4040047-5/M 06/11

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 AB.

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. 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.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



4040064-3/G 02/11

PW (R-PDSO-G14)

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.

## 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               |



14/18 Pin Only  
20 Pin vendor option

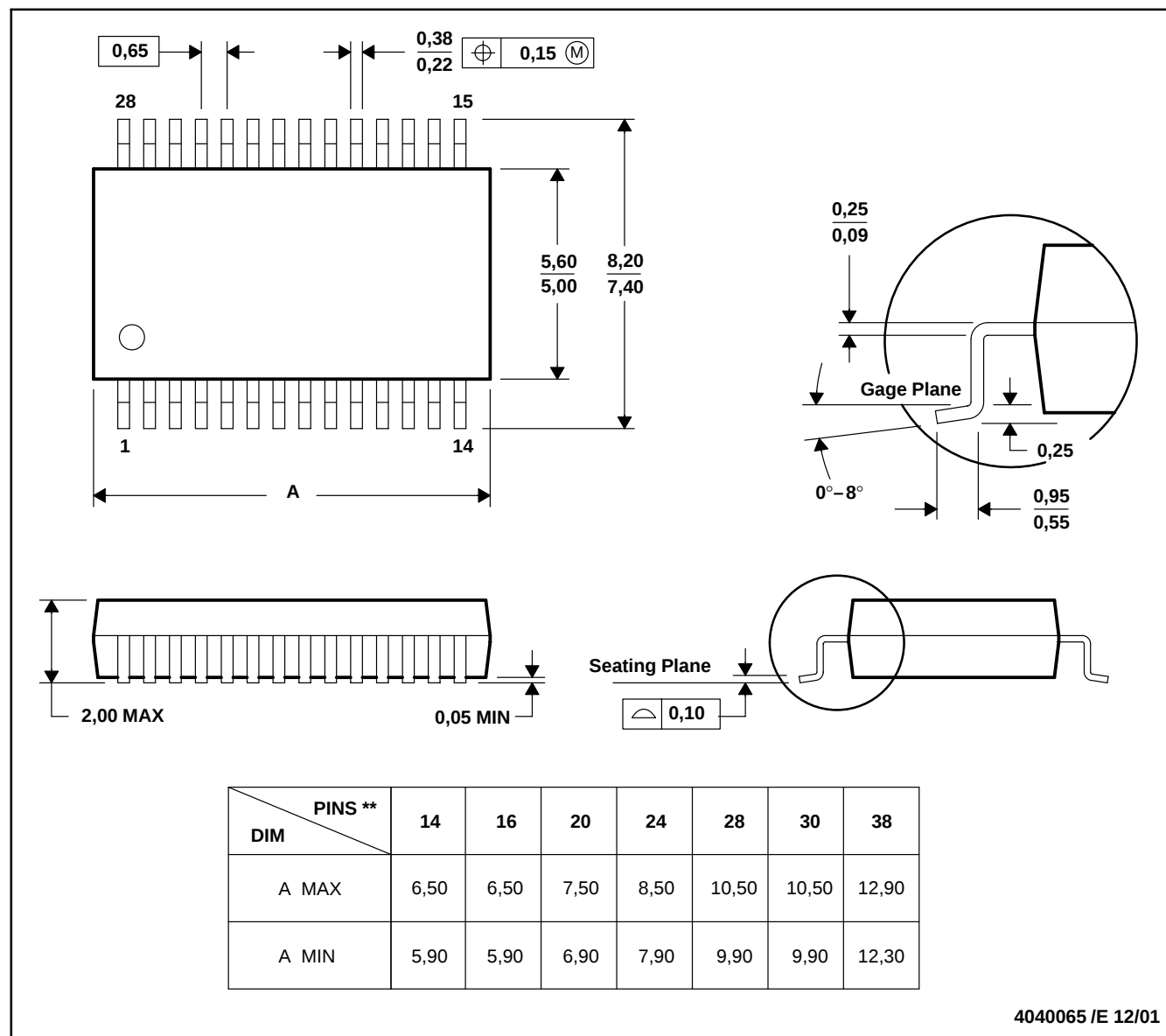
4040049/E 12/2002

- 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.

## DB (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE

28 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.  
 D. Falls within JEDEC MO-150

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

### Products

|                              |                                                                                      |
|------------------------------|--------------------------------------------------------------------------------------|
| Audio                        | <a href="http://www.ti.com/audio">www.ti.com/audio</a>                               |
| Amplifiers                   | <a href="http://amplifier.ti.com">amplifier.ti.com</a>                               |
| Data Converters              | <a href="http://dataconverter.ti.com">dataconverter.ti.com</a>                       |
| DLP® Products                | <a href="http://www.dlp.com">www.dlp.com</a>                                         |
| DSP                          | <a href="http://dsp.ti.com">dsp.ti.com</a>                                           |
| Clocks and Timers            | <a href="http://www.ti.com/clocks">www.ti.com/clocks</a>                             |
| Interface                    | <a href="http://interface.ti.com">interface.ti.com</a>                               |
| Logic                        | <a href="http://logic.ti.com">logic.ti.com</a>                                       |
| Power Mgmt                   | <a href="http://power.ti.com">power.ti.com</a>                                       |
| Microcontrollers             | <a href="http://microcontroller.ti.com">microcontroller.ti.com</a>                   |
| RFID                         | <a href="http://www.ti-rfid.com">www.ti-rfid.com</a>                                 |
| OMAP Applications Processors | <a href="http://www.ti.com/omap">www.ti.com/omap</a>                                 |
| Wireless Connectivity        | <a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a> |

### Applications

|                               |                                                                                          |
|-------------------------------|------------------------------------------------------------------------------------------|
| Automotive and Transportation | <a href="http://www.ti.com/automotive">www.ti.com/automotive</a>                         |
| Communications and Telecom    | <a href="http://www.ti.com/communications">www.ti.com/communications</a>                 |
| Computers and Peripherals     | <a href="http://www.ti.com/computers">www.ti.com/computers</a>                           |
| Consumer Electronics          | <a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>                   |
| Energy and Lighting           | <a href="http://www.ti.com/energy">www.ti.com/energy</a>                                 |
| Industrial                    | <a href="http://www.ti.com/industrial">www.ti.com/industrial</a>                         |
| Medical                       | <a href="http://www.ti.com/medical">www.ti.com/medical</a>                               |
| Security                      | <a href="http://www.ti.com/security">www.ti.com/security</a>                             |
| Space, Avionics and Defense   | <a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a> |
| Video and Imaging             | <a href="http://www.ti.com/video">www.ti.com/video</a>                                   |

### TI E2E Community

[e2e.ti.com](http://e2e.ti.com)