

## SNx4HC245 Octal Bus Transceivers With 3-State Outputs

### 1 Features

- Wide Operating Voltage Range of 2 V to 6 V
- High-Current 3-State Outputs Drive Bus Lines Directly or Up to 15 LSTTL Loads
- Low Power Consumption, 80- $\mu$ A Max  $I_{CC}$
- Typical  $t_{pd} = 12$  ns
- $\pm 6$ -mA Output Drive at 5 V
- Low Input Current of 1  $\mu$ A Max
- On Products Compliant to MIL-PRF-38535, All Parameters Are Tested Unless Otherwise Noted. On All Other Products, Production Processing Does Not Necessarily Include Testing of All Parameters.

### 2 Applications

- Servers
- PCs and Notebooks
- Network Switches
- Wearable Health and Fitness Devices
- Telecom Infrastructures
- Electronic Points of Sale

### 3 Description

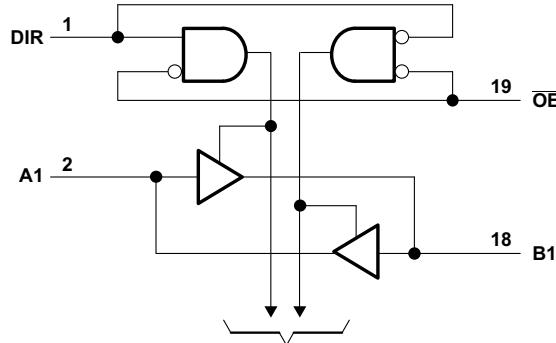
These octal bus transceivers are designed for asynchronous two-way communication between data buses. The control-function implementation minimizes external timing requirements.

The devices allow data transmission from the A bus to the B bus or from the B bus to the A bus, depending on the logic level at the direction-control (DIR) input. The output-enable ( $\overline{OE}$ ) input can be used to disable the device so that the buses are effectively isolated.

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

| PART NUMBER | PACKAGE        | BODY SIZE (NOM)           |
|-------------|----------------|---------------------------|
| SNx4HC245   | DB (SSOP, 20)  | 7.20 mm $\times$ 5.30 mm  |
|             | DW (SOIC, 20)  | 12.80 mm $\times$ 7.50 mm |
|             | N (PDIP, 20)   | 24.33 mm $\times$ 6.35 mm |
|             | NS (SO, 20)    | 12.60 mm $\times$ 5.30 mm |
|             | PW (TSSOP, 20) | 6.50 mm $\times$ 4.40 mm  |

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



To Seven Other Channels  
Logic Diagram (Positive Logic)



An IMPORTANT NOTICE at the end of this data sheet addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers. PRODUCTION DATA.

## 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.....  | <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.....                                | <b>5</b> | <b>12 Device and Documentation Support</b> .....                           | <b>13</b> |
| 6.5 Electrical Characteristics.....                         | <b>5</b> | 12.1 Related Links.....  | <b>13</b> |
| 6.6 Switching Characteristics, $C_L = 50 \text{ pF}$ .....  | <b>6</b> | 12.2 Receiving Notification of Documentation Updates.....                  | <b>13</b> |
| 6.7 Switching Characteristics, $C_L = 150 \text{ pF}$ ..... | <b>6</b> | 12.3 Support Resources.....  | <b>13</b> |
| 6.8 Operating Characteristics.....                          | <b>7</b> | 12.4 Trademarks.....   | <b>13</b> |
| 6.9 Typical Characteristics.....                            | <b>7</b> | 12.5 Electrostatic Discharge Caution.....                                  | <b>13</b> |
| <b>7 Parameter Measurement Information</b> .....            | <b>8</b> | 12.6 Glossary.....   | <b>13</b> |
| <b>8 Detailed Description</b> .....                         | <b>9</b> | <b>13 Mechanical, Packaging, and Orderable</b><br><b>Information</b> ..... | <b>13</b> |
| 8.1 Overview.....   | <b>9</b> |  |           |
| 8.2 Functional Block Diagram.....                           | <b>9</b> |  |           |

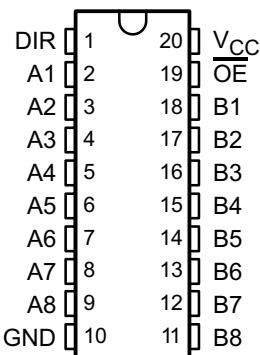
## 4 Revision History

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

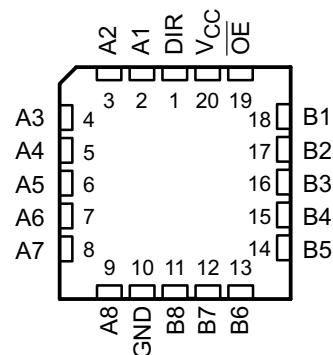
| <b>Changes from Revision E (September 2015) to Revision F (August 2022)</b>  | <b>Page</b> |
|--|-------------|
| • Updated the numbering, formatting, tables, figures and cross-references throughout the document to reflect modern datasheet standards..... | <b>1</b>    |

| <b>Changes from Revision D (August 2003) to Revision E (July 2015)</b>   | <b>Page</b> |
|--|-------------|
| • Added <i>Device Comparison</i> section, <i>Thermal Information</i> section, <i>ESD Ratings</i> section, <i>Application and Implementation</i> section, <i>Power Supply Recommendations</i> section, and <i>Layout</i> section..... | <b>1</b>    |
| • Added Military Disclaimer to Features list.....  | <b>1</b>    |
| • Updated FK package pinout drawing.....   | <b>3</b>    |

## 5 Pin Configuration and Functions



**Figure 5-1. DB, DGV, DW, N, J, W, or PW Package  
20-Pin SSOP, TVSOP, SOIC, PDIP CDIP, CFP, or  
TSSOP Top View**



**Figure 5-2. FK Package 20-Pin LCCC Top View**

| PIN |                 | TYPE <sup>(1)</sup> | DESCRIPTION     |
|-----|-----------------|---------------------|-----------------|
| NO. | NAME            |                     |                 |
| 1   | DIR             | I/O                 | Direction Pin   |
| 2   | A1              | I/O                 | A1 Input/Output |
| 3   | A2              | I/O                 | A2 Input/Output |
| 4   | A3              | I/O                 | A3 Input/Output |
| 5   | A4              | I/O                 | A4 Input/Output |
| 6   | A5              | I/O                 | A5 Input/Output |
| 7   | A6              | I/O                 | A6 Input/Output |
| 8   | A7              | I/O                 | A7 Input/Output |
| 9   | A8              | I/O                 | A8 Input/Output |
| 10  | GND             | —                   | Ground Pin      |
| 11  | B8              | I/O                 | B8 Input/Output |
| 12  | B7              | I/O                 | B7 Input/Output |
| 13  | B6              | I/O                 | B6 Input/Output |
| 14  | B5              | I/O                 | B5 Input/Output |
| 15  | B4              | I/O                 | B4 Input/Output |
| 16  | B3              | I/O                 | B3 Input/Output |
| 17  | B2              | I/O                 | B2 Input/Output |
| 18  | B1              | I/O                 | B1 Input/Output |
| 19  | OE              | I/O                 | Output Enable   |
| 20  | V <sub>CC</sub> | —                   | Power Pin       |

(1) Signal Types: I = Input, O = Output, I/O = Input or Output

## 6 Specifications

### 6.1 Absolute Maximum Ratings

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

|           |  |                             | MIN  | MAX      | UNIT |
|-----------|--|-----------------------------|------|----------|------|
| $V_{CC}$  | Supply voltage                             |                             | -0.5 | 7        | V    |
| $I_{IK}$  | Input clamp current <sup>(2)</sup>         | $V_I < 0$ or $V_I > V_{CC}$ |      | $\pm 20$ | mA   |
| $I_{OK}$  | Output clamp current <sup>(2)</sup>        | $V_O < 0$ or $V_O > V_{CC}$ |      | $\pm 20$ | mA   |
| $I_O$     | Continuous output current                  | $V_O = 0$ to $V_{CC}$       |      | $\pm 35$ | mA   |
|           | Continuous current through $V_{CC}$ or GND |                             |      | $\pm 70$ | mA   |
| $T_{stg}$ | Storage temperature                        |                             | -65  | 150      | °C   |
| $T_J$     | Junction Temperature                       |                             |      | 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 and output voltage ratings may be exceeded if the input and output current ratings are observed.

### 6.2 ESD Ratings

|             |  | VALUE      | UNIT |
|-------------|--|------------|------|
| $V_{(ESD)}$ | Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>              | $\pm 3000$ | V    |
|             | Charged-device model (CDM), per JEDEC specification JESD22-C101 <sup>(2)</sup> | $\pm 1000$ |      |

(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>

|                     |                                     | SN54HC245        |          |      | SN74HC245 |          |     | UNIT |
|---------------------|-------------------------------------|------------------|----------|------|-----------|----------|-----|------|
|                     |                                     | MIN              | NOM      | MAX  | MIN       | NOM      | MAX |      |
| $V_{CC}$            | Supply voltage                      | 2                | 5        | 6    | 2         | 5        | 6   | V    |
| $V_{IH}$            | High-level input voltage            | $V_{CC} = 2$ V   | 1.5      |      | 1.5       |          |     | V    |
|                     |                                     | $V_{CC} = 4.5$ V | 3.15     |      | 3.15      |          |     |      |
|                     |                                     | $V_{CC} = 6$ V   | 4.2      |      | 4.2       |          |     |      |
| $V_{IL}$            | Low-level input voltage             | $V_{CC} = 2$ V   |          | 0.5  |           | 0.5      |     | V    |
|                     |                                     | $V_{CC} = 4.5$ V |          | 1.35 |           | 1.35     |     |      |
|                     |                                     | $V_{CC} = 6$ V   |          | 1.8  |           | 1.8      |     |      |
| $V_I$               | Input voltage                       | 0                | $V_{CC}$ |      | 0         | $V_{CC}$ |     | V    |
| $V_O$               | Output voltage                      | 0                | $V_{CC}$ |      | 0         | $V_{CC}$ |     | V    |
| $\Delta t/\Delta v$ | Input transition rise and fall time | $V_{CC} = 2$ V   |          | 1000 |           | 1000     |     | ns   |
|                     |                                     | $V_{CC} = 4.5$ V |          | 500  |           | 500      |     |      |
|                     |                                     | $V_{CC} = 6$ V   |          | 400  |           | 400      |     |      |
| $T_A$               | Operating free-air temperature      | -55              |          | 125  | -40       |          | 85  | °C   |

(1) All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number [SCBA004](#).

## 6.4 Thermal Information

| THERMAL METRIC <sup>(1)</sup> |  | SNx4HC245    |              |             |             |               | UNIT |
|-------------------------------|--|--------------|--------------|-------------|-------------|---------------|------|
|                               |  | DB<br>(SSOP) | DW<br>(SOIC) | N<br>(PDIP) | NS<br>(SOP) | PW<br>(TSSOP) |      |
|                               |  | 20 PINS      |              |             |             |               |      |
| $R_{\theta JA}$               | Junction-to-ambient thermal resistance       | 92.1         | 77.0         | 57.0        | 74.1        | 99.7          | °C/W |
| $R_{\theta JC(\text{top})}$   | Junction-to-case (top) thermal resistance    | 53.9         | 41.5         | 48.6        | 40.6        | 34.0          | °C/W |
| $R_{\theta JB}$               | Junction-to-board thermal resistance         | 47.2         | 44.8         | 38.0        | 41.6        | 50.7          | °C/W |
| $\Psi_{JT}$                   | Junction-to-top characterization parameter   | 16.5         | 16.8         | 25.4        | 14.8        | 1.8           | °C/W |
| $\Psi_{JB}$                   | Junction-to-board characterization parameter | 46.8         | 44.3         | 37.8        | 41.2        | 50.1          | °C/W |

(1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC Package Thermal Metrics* application report, [SPRA953](#).

## 6.5 Electrical Characteristics

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

| PARAMETER |   | TEST CONDITIONS            | $V_{CC}$                       | $T_A = 25^\circ\text{C}$ |            |           | SN54HC245  | SN74HC245  | UNIT          |
|-----------|---|----------------------------|--------------------------------|--------------------------|------------|-----------|------------|------------|---------------|
|           |   |                            |                                | MIN                      | TYP        | MAX       | MIN        | MAX        |               |
| $V_{OH}$  | High-Level Output Voltage                       | $V_I = V_{IH}$ or $V_{IL}$ | $I_{OH} = -20\ \mu\text{A}$    | 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        |               |
|           |   |                            | $I_{OH} = -6\ \text{mA}$       | 4.5 V                    | 3.98       | 4.3       | 3.7        | 3.84       |               |
| $V_{OL}$  | Low-Level Output Voltage                        | $V_I = V_{IH}$ or $V_{IL}$ | $I_{OL} = 20\ \mu\text{A}$     | 6 V                      | 5.48       | 5.8       | 5.2        | 5.34       | V             |
|           |   |                            |                                | 2 V                      | 0.002      | 0.1       | 0.1        | 0.1        |               |
|           |   |                            |                                | 4.5 V                    | 0.001      | 0.1       | 0.1        | 0.1        |               |
|           |   |                            |                                | 6 V                      | 0.001      | 0.1       | 0.1        | 0.1        |               |
| $I_I$     | Input Current                                   | DIR or $\overline{OE}$     | $V_I = V_{CC}$ or 0            | 6 V                      | $\pm 0.1$  | $\pm 100$ | $\pm 1000$ | $\pm 1000$ | nA            |
|           | Off-State (High-Impedance State) Output Current | A or B                     | $V_O = V_{CC}$ or 0            | 6 V                      | $\pm 0.01$ | $\pm 0.5$ | $\pm 10$   | $\pm 5$    | $\mu\text{A}$ |
| $I_{CC}$  | Supply Current                                  |                            | $V_I = V_{CC}$ $I_O = 0$ or 0, | 6 V                      |            | 8         | 160        | 80         | $\mu\text{A}$ |
| $C_i$     | Input Capacitance                               | DIR or $\overline{OE}$     |                                | 2 V to 6 V               | 3          | 10        | 10         | 10         | pF            |

## 6.6 Switching Characteristics, $C_L = 50 \text{ pF}$

over recommended operating free-air temperature range (unless otherwise noted)  
 (see Figure 7-1)

| PARAMETER        | FROM<br>(INPUT) | TO<br>(OUTPUT) | V <sub>CC</sub> | T <sub>A</sub> = 25°C |     |     | SN54HC245 |     | SN74HC245 |     | UNIT |
|------------------|-----------------|----------------|-----------------|-----------------------|-----|-----|-----------|-----|-----------|-----|------|
|                  |                 |                |                 | MIN                   | TYP | MAX | MIN       | MAX | MIN       | MAX |      |
| t <sub>pd</sub>  | A or B          | B or A         | 2 V             |                       | 40  | 105 |           | 160 |           | 130 | ns   |
|                  |                 |                | 4.5 V           |                       | 15  | 21  |           | 32  |           | 26  |      |
|                  |                 |                | 6 V             |                       | 12  | 18  |           | 27  |           | 22  |      |
| t <sub>en</sub>  | OE              | A or B         | 2 V             |                       | 125 | 230 |           | 340 |           | 290 | ns   |
|                  |                 |                | 4.5 V           |                       | 23  | 46  |           | 68  |           | 58  |      |
|                  |                 |                | 6 V             |                       | 20  | 39  |           | 58  |           | 49  |      |
| t <sub>dis</sub> | OE              | A or B         | 2 V             |                       | 74  | 200 |           | 300 |           | 250 | ns   |
|                  |                 |                | 4.5 V           |                       | 25  | 40  |           | 60  |           | 50  |      |
|                  |                 |                | 6 V             |                       | 21  | 34  |           | 51  |           | 43  |      |
| t <sub>t</sub>   |                 | A or B         | 2 V             |                       | 20  | 60  |           | 90  |           | 75  | ns   |
|                  |                 |                | 4.5 V           |                       | 8   | 12  |           | 18  |           | 15  |      |
|                  |                 |                | 6 V             |                       | 6   | 10  |           | 15  |           | 13  |      |

## 6.7 Switching Characteristics, $C_L = 150 \text{ pF}$

over recommended operating free-air temperature range (unless otherwise noted)  
 (see Figure 7-1)

| PARAMETER       | FROM<br>(INPUT) | TO<br>(OUTPUT) | V <sub>CC</sub> | T <sub>A</sub> = 25°C |     |     | SN54HC245 |     | SN74HC245 |     | UNIT |
|-----------------|-----------------|----------------|-----------------|-----------------------|-----|-----|-----------|-----|-----------|-----|------|
|                 |                 |                |                 | MIN                   | TYP | MAX | MIN       | MAX | MIN       | MAX |      |
| t <sub>pd</sub> | A or B          | B or A         | 2 V             |                       | 54  | 135 |           | 200 |           | 170 | ns   |
|                 |                 |                | 4.5 V           |                       | 18  | 27  |           | 40  |           | 34  |      |
|                 |                 |                | 6 V             |                       | 15  | 23  |           | 34  |           | 29  |      |
| t <sub>en</sub> | OE              | A or B         | 2 V             |                       | 150 | 270 |           | 405 |           | 335 | ns   |
|                 |                 |                | 4.5 V           |                       | 31  | 54  |           | 81  |           | 67  |      |
|                 |                 |                | 6 V             |                       | 25  | 46  |           | 69  |           | 56  |      |
| t <sub>t</sub>  |                 | A or B         | 2 V             |                       | 45  | 210 |           | 315 |           | 265 | ns   |
|                 |                 |                | 4.5 V           |                       | 17  | 42  |           | 63  |           | 53  |      |
|                 |                 |                | 6 V             |                       | 13  | 36  |           | 53  |           | 45  |      |

## 6.8 Operating Characteristics

$T_A = 25^\circ\text{C}$

| PARAMETER |   | TEST CONDITIONS | TYP | UNIT |
|-----------|---|-----------------|-----|------|
| $C_{pd}$  | Power dissipation capacitance per transceiver | No load         | 40  | pF   |

## 6.9 Typical Characteristics

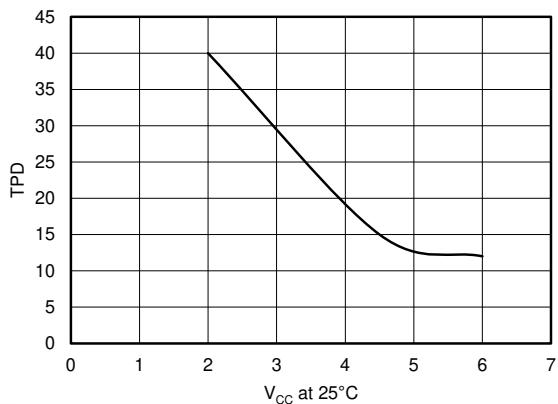


Figure 6-1. TPD vs  $V_{cc}$  at  $25^\circ\text{C}$

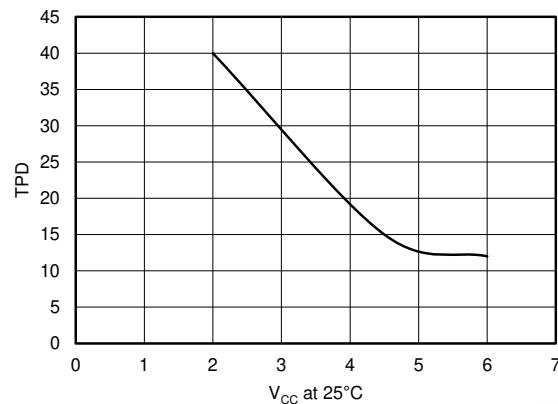
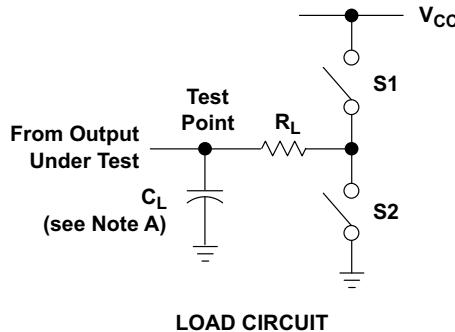


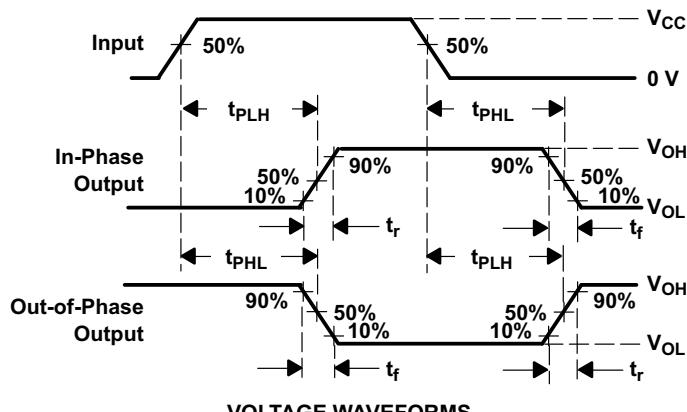
Figure 6-2. TPD vs  $V_{cc}$  at  $25^\circ\text{C}$

## 7 Parameter Measurement Information

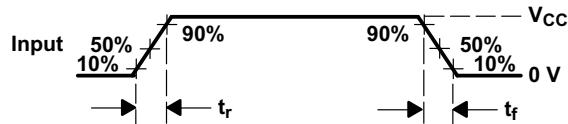
### 7.1



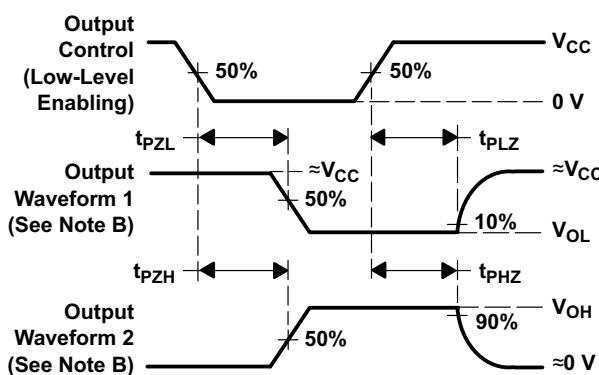
| PARAMETER         | $R_L$        | $C_L$                 | S1   | S2     |
|-------------------|--------------|-----------------------|------|--------|
| $t_{en}$          | 1 k $\Omega$ | 50 pF<br>or<br>150 pF | Open | Closed |
|                   |              | Closed                | Open |        |
| $t_{dis}$         | 1 k $\Omega$ | 50 pF                 | Open | Closed |
|                   |              | Closed                | Open |        |
| $t_{pd}$ or $t_t$ | --           | 50 pF<br>or<br>150 pF | Open | Open   |



VOLTAGE WAVEFORMS  
PROPAGATION DELAY AND OUTPUT TRANSITION TIMES



VOLTAGE WAVEFORM  
INPUT RISE AND FALL TIMES



VOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES FOR 3-STATE OUTPUTS

- $C_L$  includes probe and test-fixture capacitance.
- Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
- Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  1 MHz,  $Z_O = 50 \Omega$ ,  $t_r = 6$  ns,  $t_f = 6$  ns.
- The outputs are measured one at a time with one input transition per measurement.
- $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
- $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
- $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .

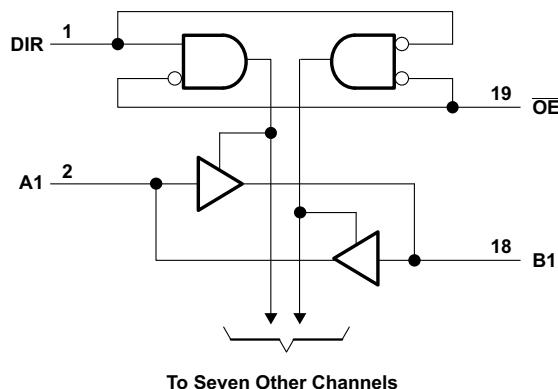
Figure 7-1. Load Circuit and Voltage Waveforms

## 8 Detailed Description

### 8.1 Overview

These octal bus transceivers are designed for asynchronous two-way communication between data buses. The control-function implementation minimizes external timing requirements. The SNx4HC245 devices allow data transmission from the A bus to the B bus or from the B bus to the A bus, depending on the logic level at the direction-control (DIR) input. The output-enable (OE) input can be used to disable the device so that the buses are effectively isolated. To ensure the high-impedance state during power up or power down, OE should be tied to VCC through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

### 8.2 Functional Block Diagram



**Logic Diagram (Positive Logic)**

### 8.3 Feature Description

The SNx4HC245 devices have a wide operating VCC range from 2 V to 6 V with slower edge rates to minimize output ringing.

### 8.4 Device Functional Modes

Table 8-1 lists the function modes of the SNx4HC245.

**Table 8-1. Function Table**

| INPUTS (1) |     | OPERATION       |
|------------|-----|-----------------|
| OE         | DIR |                 |
| L          | L   | B data to A bus |
| L          | H   | A data to B bus |
| H          | X   | Isolation       |

(1) H = High Voltage Level, L = Low Voltage Level, X = Don't Care

## 9 Application and Implementation

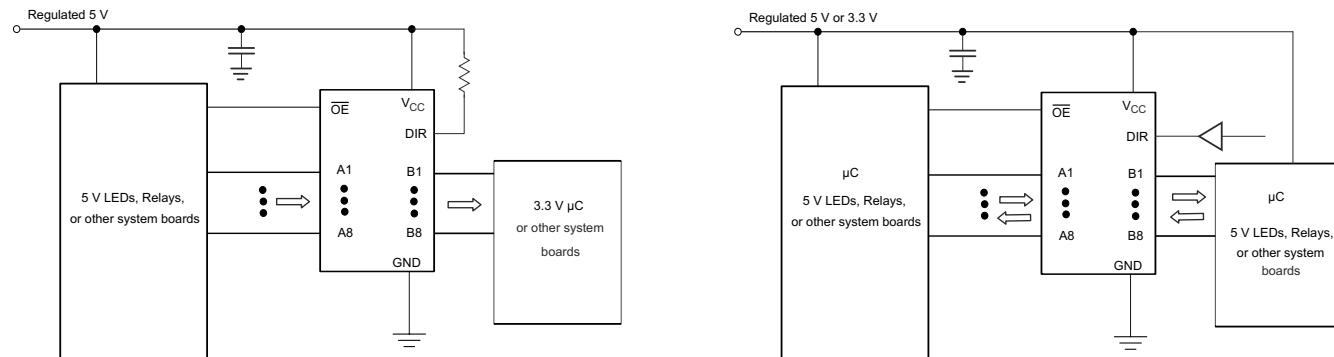
### Note

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, as well as validating and testing their design implementation to confirm system functionality.

### 9.1 Application Information

The SNx4HC245 is a low-drive CMOS device that can be used for a multitude of bus interface type applications where output ringing is a concern. The low drive and slow edge rates will minimize overshoot and undershoot on the outputs.

### 9.2 Typical Application



**Figure 9-1. Typical Application Schematic**

#### 9.2.1 Design Requirements

This device uses CMOS technology and has balanced output drive. Care should be taken to avoid bus contention because it can drive currents that would exceed maximum limits. Outputs can be combined to produce higher drive but the high drive will also create faster edges into light loads, so routing and load conditions should be considered to prevent ringing.

#### 9.2.2 Detailed Design Procedure

1. Recommended Input Conditions
  - Rise time and fall time specs: See ( $\Delta t/\Delta V$ ) in the [Section 6.3](#).
  - Specified high and low levels: See ( $V_{IH}$  and  $V_{IL}$ ) in the [Section 6.3](#).
2. Recommend Output Conditions
  - Load currents should not exceed 25 mA per output and 75 mA total for the part.
  - Outputs should not be pulled above  $V_{CC}$ .

### 9.2.3 Application Curve

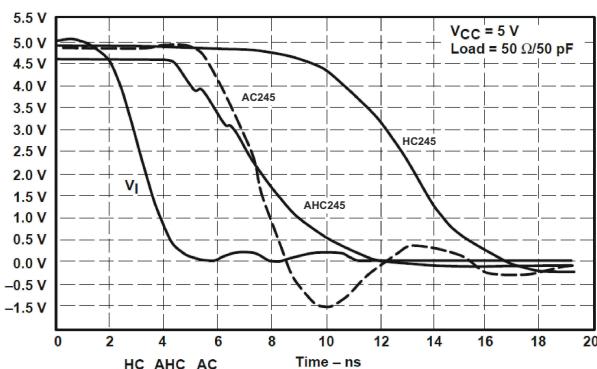


Figure 9-2. Switching Characteristics Comparison

## 10 Power Supply Recommendations

The power supply can be any voltage between the MIN and MAX supply voltage rating located in the [Section 6.3](#).

Each  $V_{CC}$  pin should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, 0.1  $\mu F$  is recommended; if there are multiple  $V_{CC}$  pins, then 0.01  $\mu F$  or 0.022  $\mu F$  is recommended for each power pin. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. A 0.1  $\mu F$  and a 1  $\mu F$  are commonly used in parallel. The bypass capacitor should be installed as close to the power pin as possible for best results.

## 11 Layout

### 11.1 Layout Guidelines

When using multiple-bit logic devices, inputs should never float.

In many cases, functions or parts of functions of digital logic devices are unused, for example, when only two inputs of a triple-input AND gate are used or only 3 of the 4 buffer gates are used. Such input pins should not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. [Figure 11-1](#) specifies the 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 should be applied to any particular unused input depends on the function of the device. Generally they will be tied to GND or  $V_{CC}$ , whichever makes more sense or is more convenient. It is generally acceptable to float outputs, unless the part is a transceiver. If the transceiver has an output enable pin, it will disable the output section of the part when asserted. This will not disable the input section of the IOs, so they cannot float when disabled.

### 11.2 Layout Example

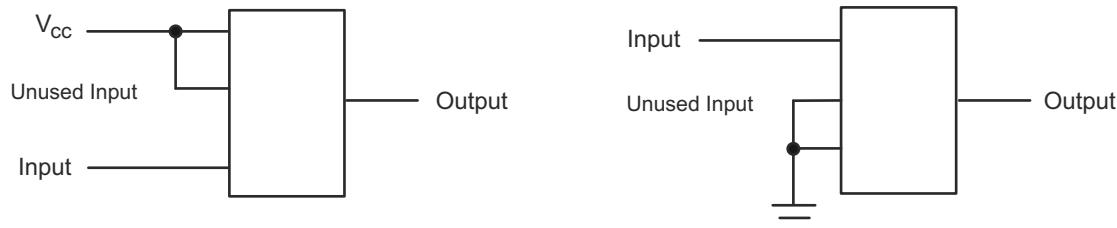


Figure 11-1. Layout Diagram

## 12 Device and Documentation Support

### 12.1 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 12-1. Related Links**

| PARTS     | PRODUCT FOLDER             | SAMPLE & BUY               | TECHNICAL DOCUMENTS        | TOOLS & SOFTWARE           | SUPPORT & COMMUNITY        |
|-----------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| SN54HC245 | <a href="#">Click here</a> |
| SN74HC245 | <a href="#">Click here</a> |

### 12.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](#). Click on *Subscribe to updates* 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.

### 12.3 Support Resources

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is 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](#).

### 12.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.

All trademarks are the property of their respective owners.

### 12.5 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

### 12.6 Glossary

[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 part number | Status<br>(1) | Material type<br>(2) | Package   Pins | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6)                |
|-----------------------|---------------|----------------------|----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|------------------------------------|
| 5962-8408501VRA       | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-8408501VR<br>A<br>SNV54HC245J |
| 5962-8408501VRA.A     | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-8408501VR<br>A<br>SNV54HC245J |
| 5962-8408501VSA       | Active        | Production           | CFP (W)   20   | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-8408501VS<br>A<br>SNV54HC245W |
| 5962-8408501VSA.A     | Active        | Production           | CFP (W)   20   | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-8408501VS<br>A<br>SNV54HC245W |
| 84085012A             | Active        | Production           | LCCC (FK)   20 | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 84085012A<br>SNJ54HC<br>245FK      |
| 8408501RA             | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 8408501RA<br>SNJ54HC245J           |
| 8408501SA             | Active        | Production           | CFP (W)   20   | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 8408501SA<br>SNJ54HC245W           |
| JM38510/65503BRA      | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>65503BRA               |
| JM38510/65503BRA.A    | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>65503BRA               |
| JM38510/65503BSA      | Active        | Production           | CFP (W)   20   | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>65503BSA               |
| JM38510/65503BSA.A    | Active        | Production           | CFP (W)   20   | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>65503BSA               |
| M38510/65503BRA       | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>65503BRA               |
| M38510/65503BSA       | Active        | Production           | CFP (W)   20   | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | JM38510/<br>65503BSA               |
| SN54HC245J            | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | SN54HC245J                         |
| SN54HC245J.A          | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | SN54HC245J                         |
| SN74HC245DBR          | Active        | Production           | SSOP (DB)   20 | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | HC245                              |

| Orderable part number          | Status<br>(1) | Material type<br>(2) | Package   Pins  | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6)           |
|--------------------------------|---------------|----------------------|-----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|-------------------------------|
| SN74HC245DBR.A                 | Active        | Production           | SSOP (DB)   20  | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | HC245                         |
| SN74HC245DBRG4                 | Active        | Production           | SSOP (DB)   20  | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | HC245                         |
| <a href="#">SN74HC245DW</a>    | Obsolete      | Production           | SOIC (DW)   20  | -                     | -           | Call TI                              | Call TI                           | -40 to 85    | HC245                         |
| <a href="#">SN74HC245DWR</a>   | Active        | Production           | SOIC (DW)   20  | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | HC245                         |
| SN74HC245DWR.A                 | Active        | Production           | SOIC (DW)   20  | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | HC245                         |
| SN74HC245DWRE4                 | Active        | Production           | SOIC (DW)   20  | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | HC245                         |
| SN74HC245DWRG4                 | Active        | Production           | SOIC (DW)   20  | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | HC245                         |
| <a href="#">SN74HC245N</a>     | Active        | Production           | PDIP (N)   20   | 20   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -40 to 85    | SN74HC245N                    |
| SN74HC245N.A                   | Active        | Production           | PDIP (N)   20   | 20   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -40 to 85    | SN74HC245N                    |
| <a href="#">SN74HC245NSR</a>   | Active        | Production           | SOP (NS)   20   | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | HC245                         |
| SN74HC245NSR.A                 | Active        | Production           | SOP (NS)   20   | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | HC245                         |
| SN74HC245NSRE4                 | Active        | Production           | SOP (NS)   20   | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | HC245                         |
| <a href="#">SN74HC245PW</a>    | Obsolete      | Production           | TSSOP (PW)   20 | -                     | -           | Call TI                              | Call TI                           | -40 to 85    | HC245                         |
| <a href="#">SN74HC245PWR</a>   | Active        | Production           | TSSOP (PW)   20 | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | HC245                         |
| SN74HC245PWR.A                 | Active        | Production           | TSSOP (PW)   20 | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | HC245                         |
| <a href="#">SN74HC245PWRG4</a> | Active        | Production           | TSSOP (PW)   20 | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | HC245                         |
| SN74HC245PWRG4.A               | Active        | Production           | TSSOP (PW)   20 | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | HC245                         |
| <a href="#">SN74HC245PWT</a>   | Obsolete      | Production           | TSSOP (PW)   20 | -                     | -           | Call TI                              | Call TI                           | -40 to 85    | HC245                         |
| <a href="#">SNJ54HC245FK</a>   | Active        | Production           | LCCC (FK)   20  | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 84085012A<br>SNJ54HC<br>245FK |
| SNJ54HC245FK.A                 | Active        | Production           | LCCC (FK)   20  | 55   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 84085012A<br>SNJ54HC<br>245FK |
| <a href="#">SNJ54HC245J</a>    | Active        | Production           | CDIP (J)   20   | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 8408501RA<br>SNJ54HC245J      |
| SNJ54HC245J.A                  | Active        | Production           | CDIP (J)   20   | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 8408501RA<br>SNJ54HC245J      |
| <a href="#">SNJ54HC245W</a>    | Active        | Production           | CFP (W)   20    | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 8408501SA<br>SNJ54HC245W      |
| SNJ54HC245W.A                  | Active        | Production           | CFP (W)   20    | 25   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 8408501SA<br>SNJ54HC245W      |

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

**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 SN54HC245, SN54HC245-SP, SN74HC245 :**

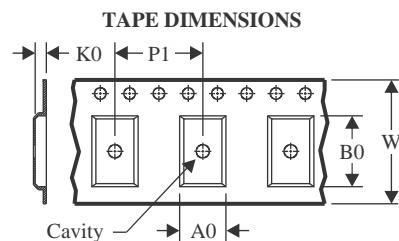
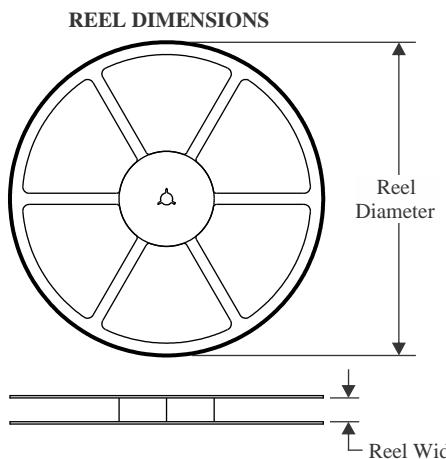
- Catalog : [SN74HC245](#), [SN54HC245](#)
- Military : [SN54HC245](#)
- Space : [SN54HC245-SP](#)

NOTE: Qualified Version Definitions:

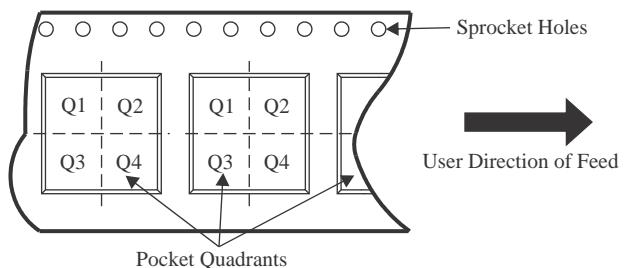
- Catalog - TI's standard catalog product

---

- Military - QML certified for Military and Defense Applications
- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

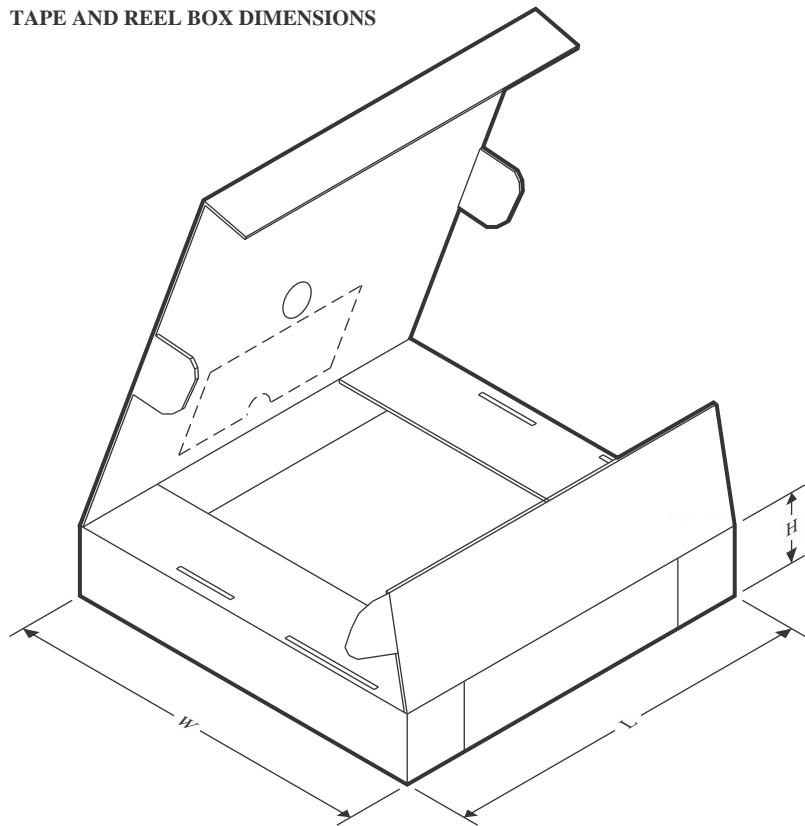
**TAPE AND REEL INFORMATION**


|    |   |
|----|---|
| A0 | Dimension designed to accommodate the component width     |
| B0 | Dimension designed to accommodate the component length    |
| K0 | Dimension designed to accommodate the component thickness |
| W  | Overall width of the carrier tape                         |
| P1 | Pitch between successive cavity centers                   |

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


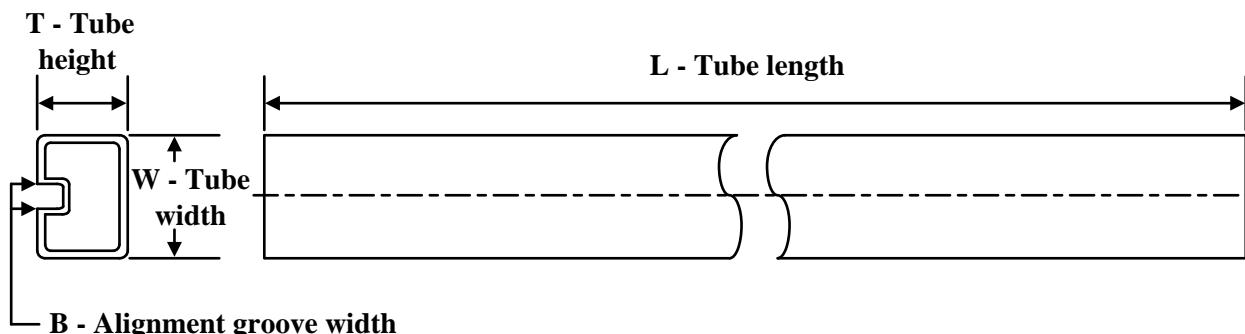
\*All dimensions are nominal

| Device         | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74HC245DBR   | SSOP         | DB              | 20   | 2000 | 330.0              | 16.4               | 8.2     | 7.5     | 2.5     | 12.0    | 16.0   | Q1            |
| SN74HC245DWR   | SOIC         | DW              | 20   | 2000 | 330.0              | 24.4               | 10.9    | 13.3    | 2.7     | 12.0    | 24.0   | Q1            |
| SN74HC245NSR   | SOP          | NS              | 20   | 2000 | 330.0              | 24.4               | 8.4     | 13.0    | 2.5     | 12.0    | 24.0   | Q1            |
| SN74HC245PWR   | TSSOP        | PW              | 20   | 2000 | 330.0              | 16.4               | 6.95    | 7.0     | 1.4     | 8.0     | 16.0   | Q1            |
| SN74HC245PWRG4 | TSSOP        | PW              | 20   | 2000 | 330.0              | 16.4               | 6.95    | 7.0     | 1.4     | 8.0     | 16.0   | Q1            |

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

| Device         | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74HC245DBR   | SSOP         | DB              | 20   | 2000 | 353.0       | 353.0      | 32.0        |
| SN74HC245DWR   | SOIC         | DW              | 20   | 2000 | 356.0       | 356.0      | 45.0        |
| SN74HC245NSR   | SOP          | NS              | 20   | 2000 | 356.0       | 356.0      | 45.0        |
| SN74HC245PWR   | TSSOP        | PW              | 20   | 2000 | 353.0       | 353.0      | 32.0        |
| SN74HC245PWRG4 | TSSOP        | PW              | 20   | 2000 | 353.0       | 353.0      | 32.0        |

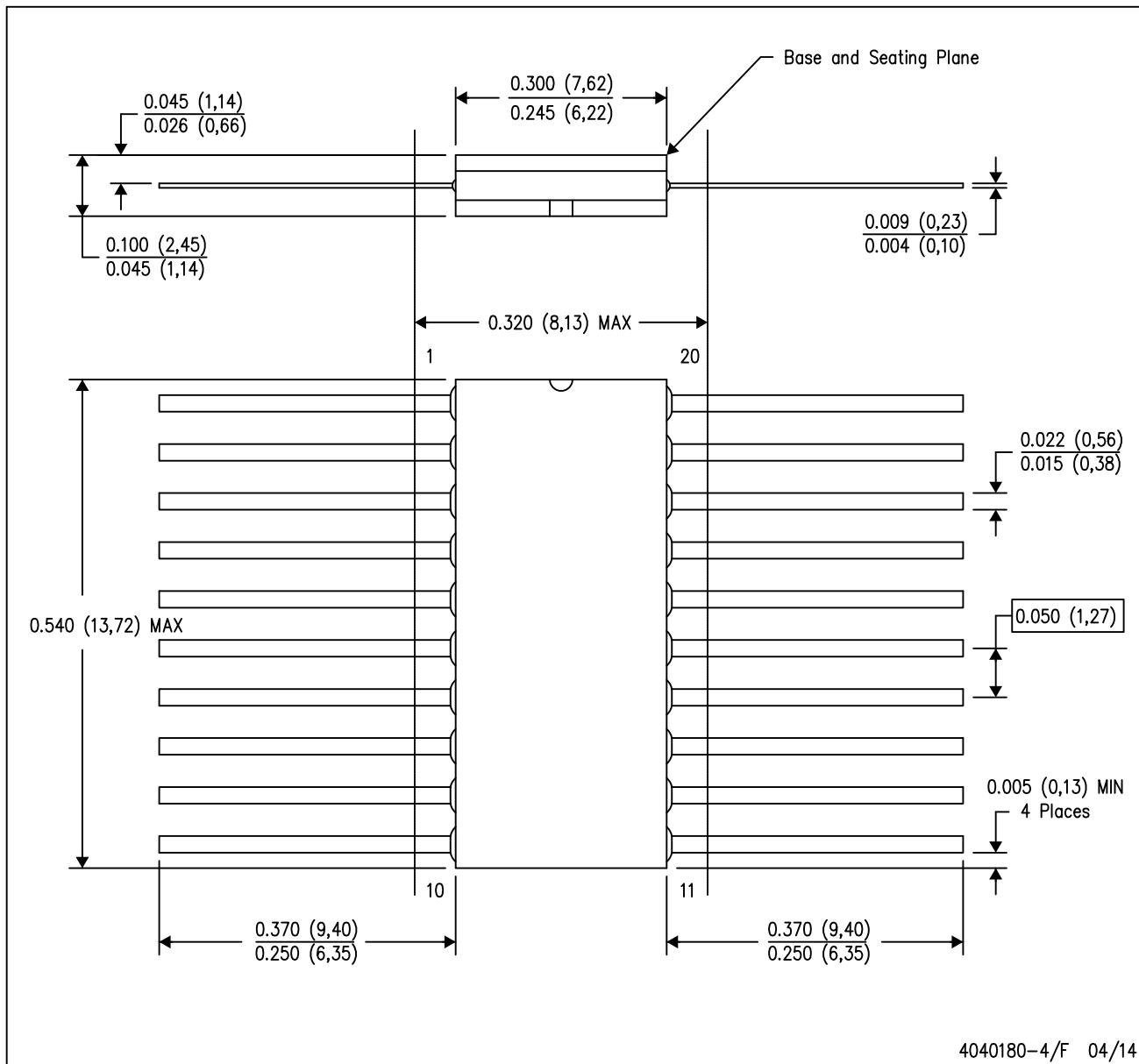
**TUBE**


\*All dimensions are nominal

| Device             | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T ( $\mu$ m) | B (mm) |
|--------------------|--------------|--------------|------|-----|--------|--------|--------------|--------|
| 5962-8408501VSA    | W            | CFP          | 20   | 25  | 506.98 | 26.16  | 6220         | NA     |
| 5962-8408501VSA.A  | W            | CFP          | 20   | 25  | 506.98 | 26.16  | 6220         | NA     |
| 84085012A          | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030         | NA     |
| 8408501SA          | W            | CFP          | 20   | 25  | 506.98 | 26.16  | 6220         | NA     |
| JM38510/65503BSA   | W            | CFP          | 20   | 25  | 506.98 | 26.16  | 6220         | NA     |
| JM38510/65503BSA.A | W            | CFP          | 20   | 25  | 506.98 | 26.16  | 6220         | NA     |
| M38510/65503BSA    | W            | CFP          | 20   | 25  | 506.98 | 26.16  | 6220         | NA     |
| SN74HC245N         | N            | PDIP         | 20   | 20  | 506    | 13.97  | 11230        | 4.32   |
| SN74HC245N.A       | N            | PDIP         | 20   | 20  | 506    | 13.97  | 11230        | 4.32   |
| SNJ54HC245FK       | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030         | NA     |
| SNJ54HC245FK.A     | FK           | LCCC         | 20   | 55  | 506.98 | 12.06  | 2030         | NA     |
| SNJ54HC245W        | W            | CFP          | 20   | 25  | 506.98 | 26.16  | 6220         | NA     |
| SNJ54HC245W.A      | W            | CFP          | 20   | 25  | 506.98 | 26.16  | 6220         | NA     |

W (R-GDFP-F20)

CERAMIC DUAL FLATPACK



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 ceramic lid using glass frit.
- D. Index point is provided on cap for terminal identification only.
- E. Falls within Mil-Std 1835 GDFP2-F20

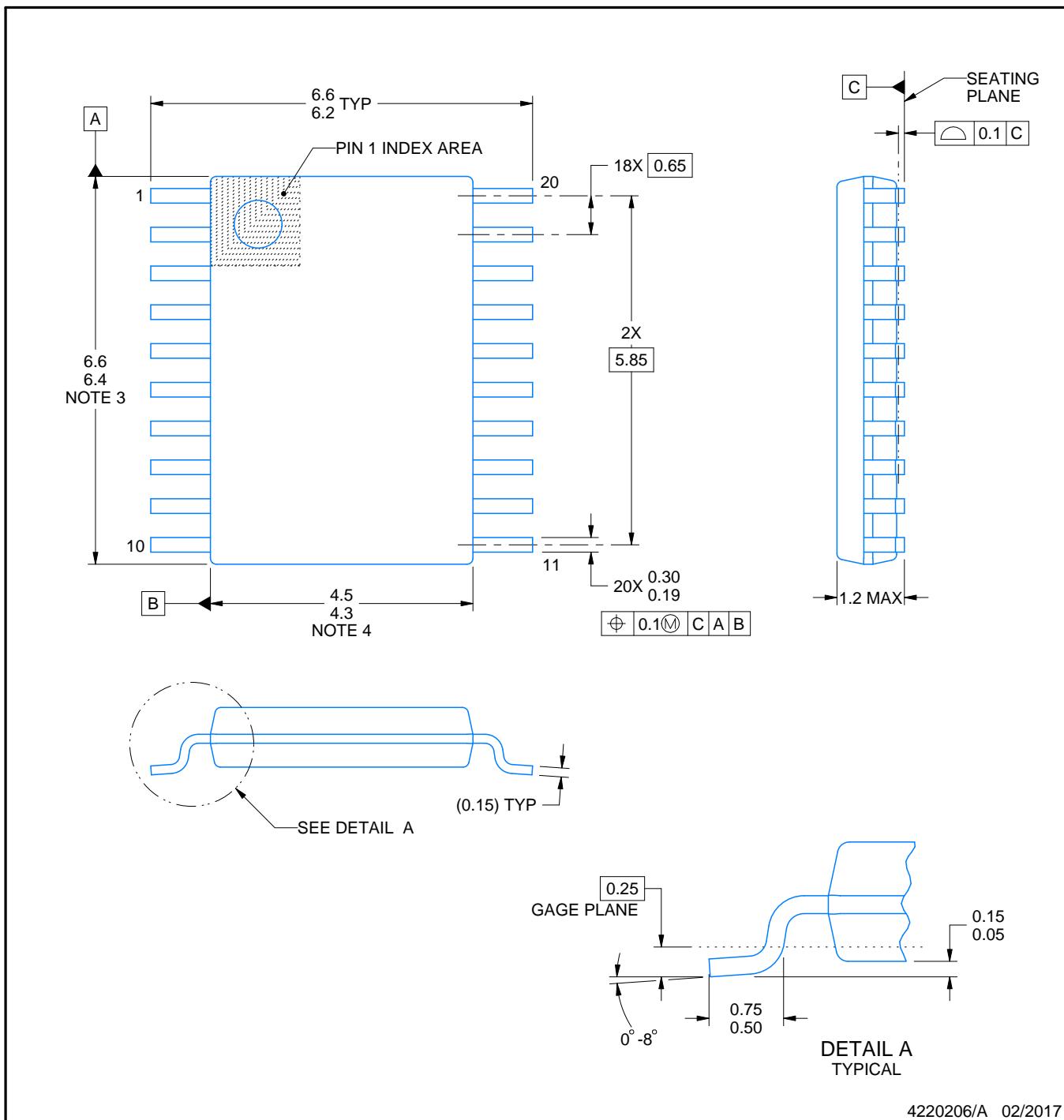
## PACKAGE OUTLINE

**PW0020A**



## **TSSOP - 1.2 mm max height**

## SMALL OUTLINE PACKAGE



## NOTES:

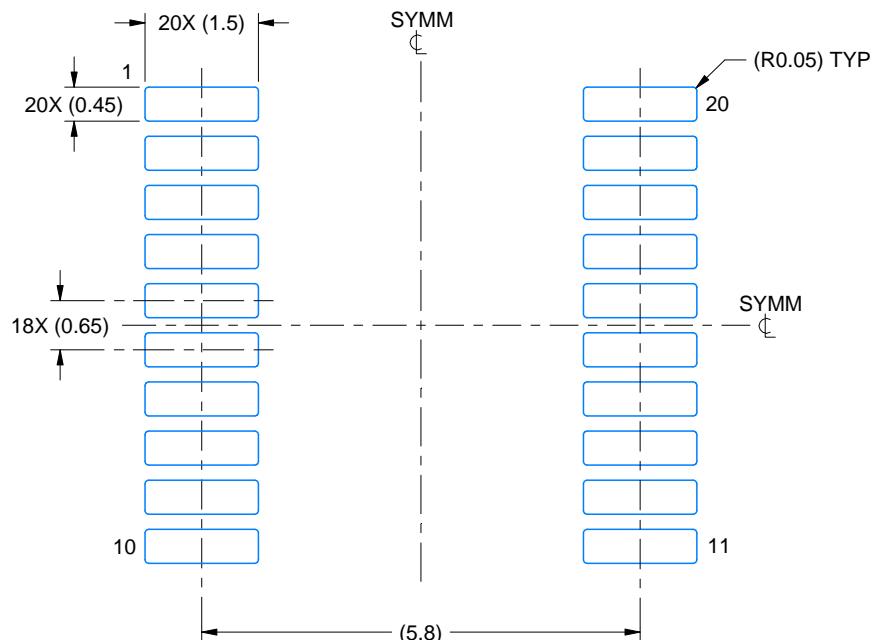
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

## EXAMPLE BOARD LAYOUT

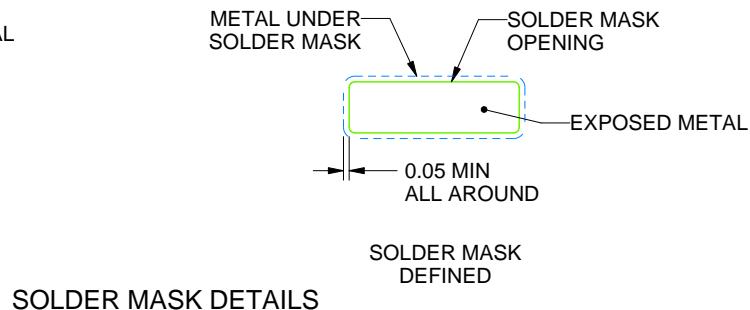
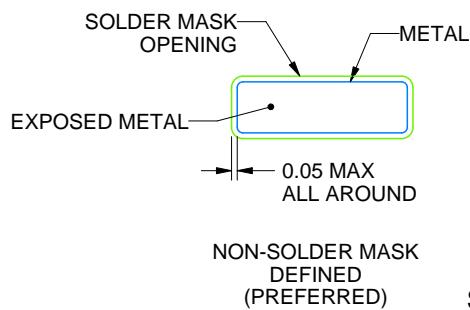
**PW0020A**

## **TSSOP - 1.2 mm max height**

## SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



4220206/A 02/2017

#### NOTES: (continued)

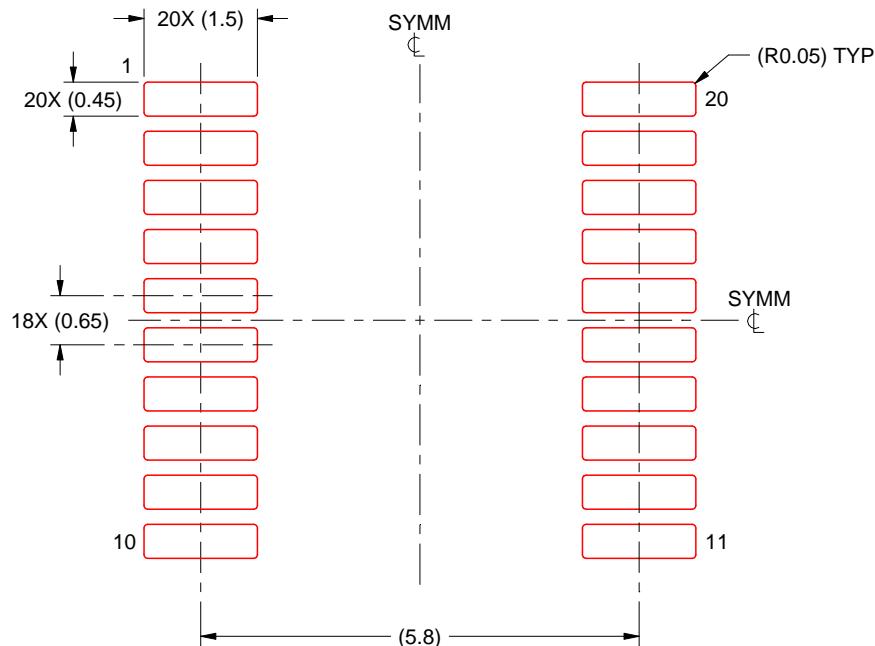
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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

4220206/A 02/2017

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

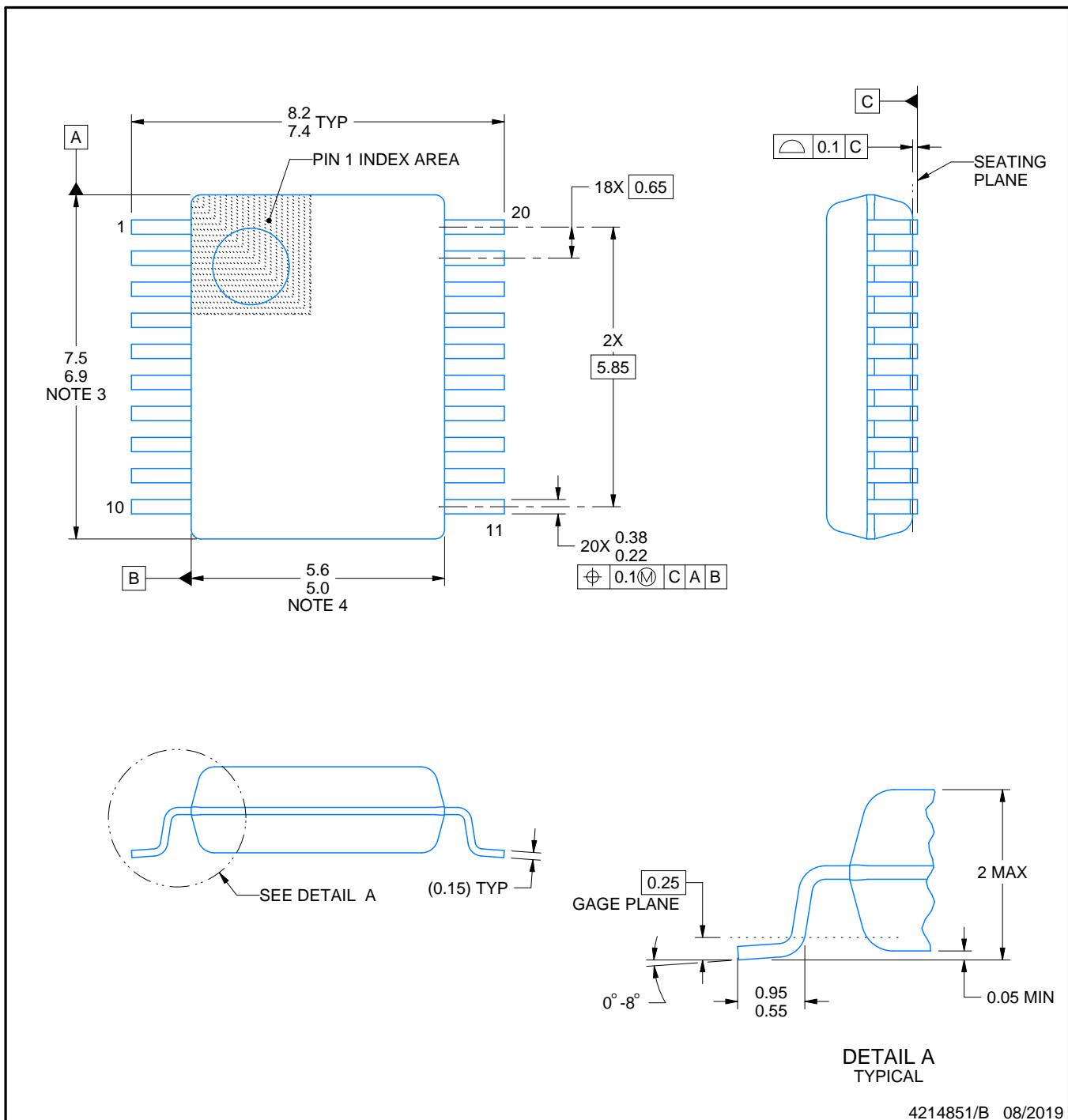
# PACKAGE OUTLINE

DB0020A



SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



## NOTES:

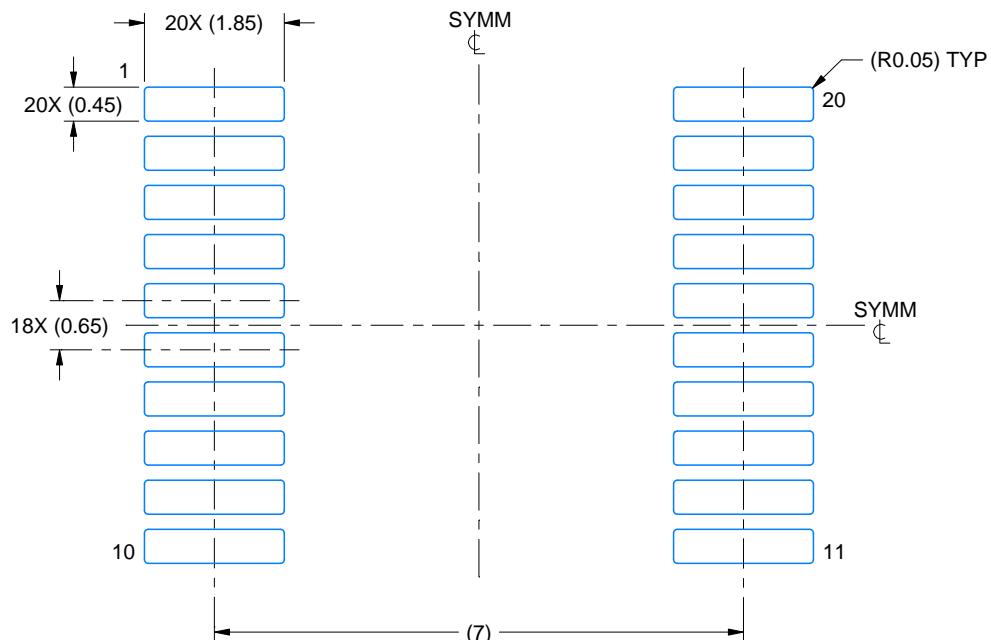
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-150.

# EXAMPLE BOARD LAYOUT

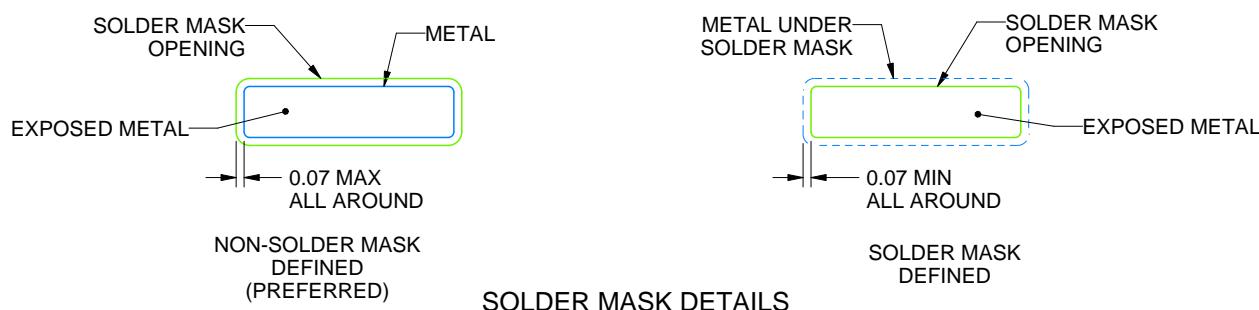
DB0020A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



4214851/B 08/2019

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

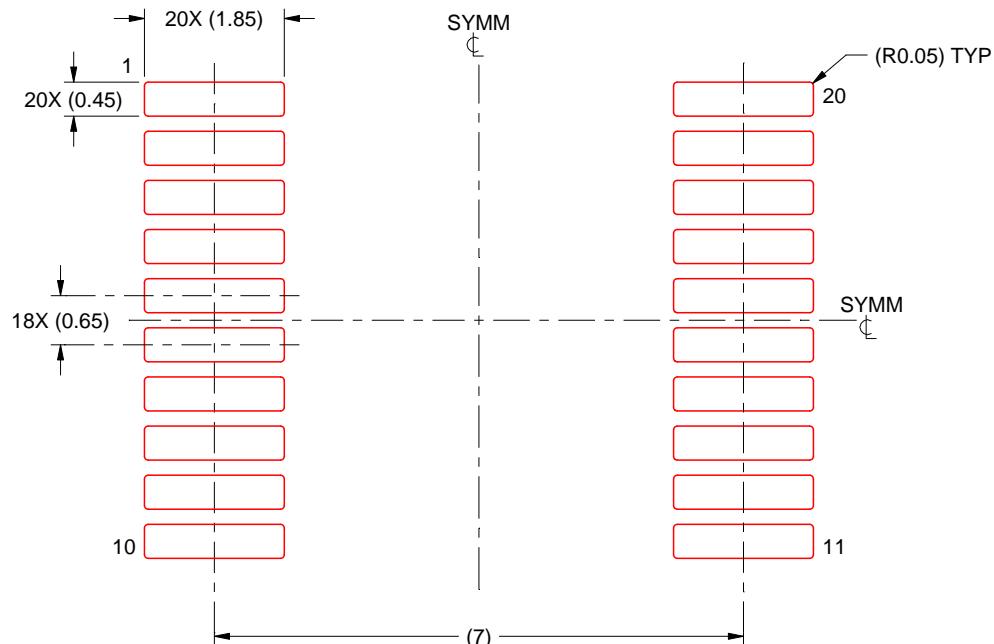
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DB0020A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



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

4214851/B 08/2019

NOTES: (continued)

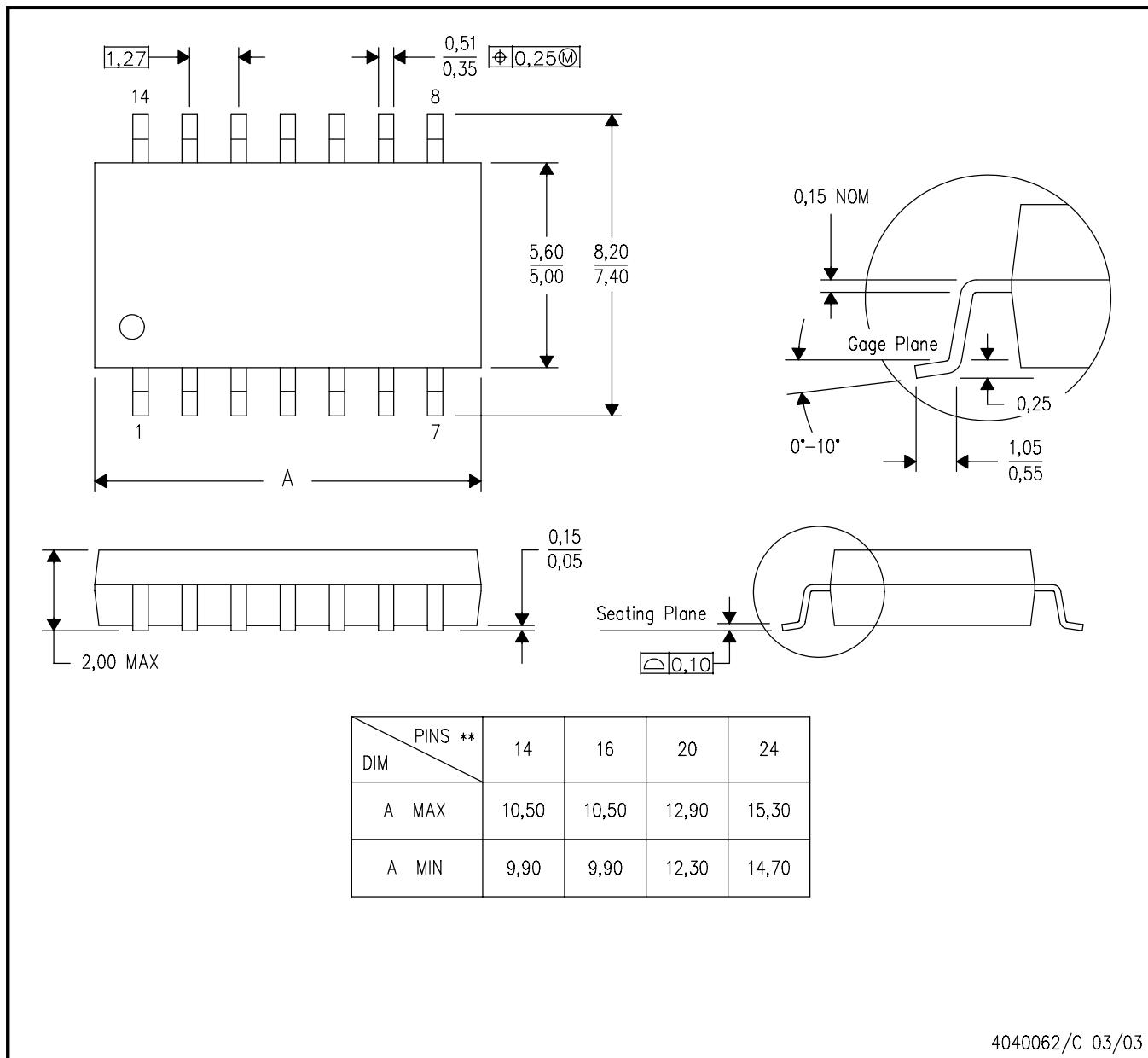
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

## MECHANICAL DATA

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

## PLASTIC SMALL-OUTLINE PACKAGE

**14-PINS SHOWN**



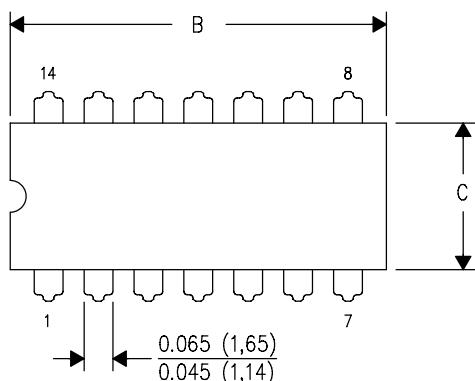
NOTES:

- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

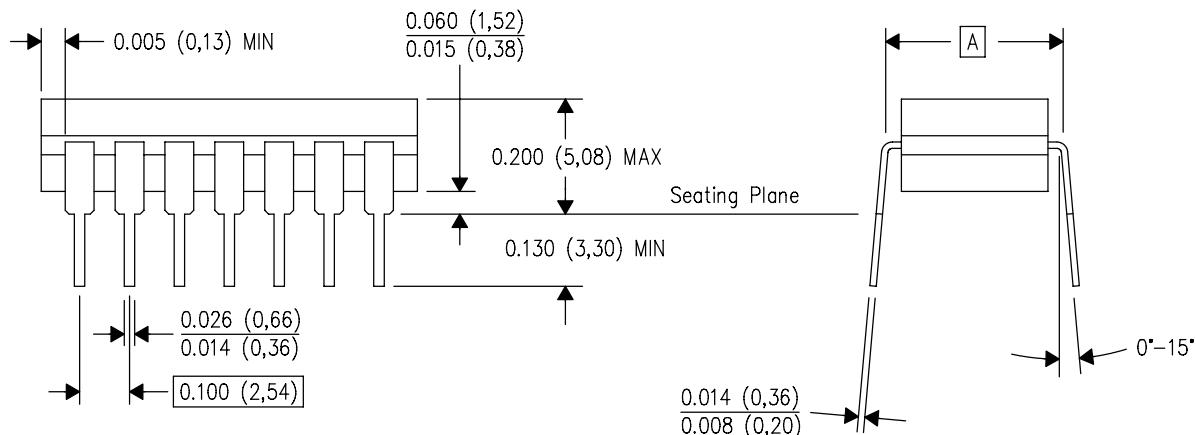
J (R-GDIP-T\*\*)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



| 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.

# GENERIC PACKAGE VIEW

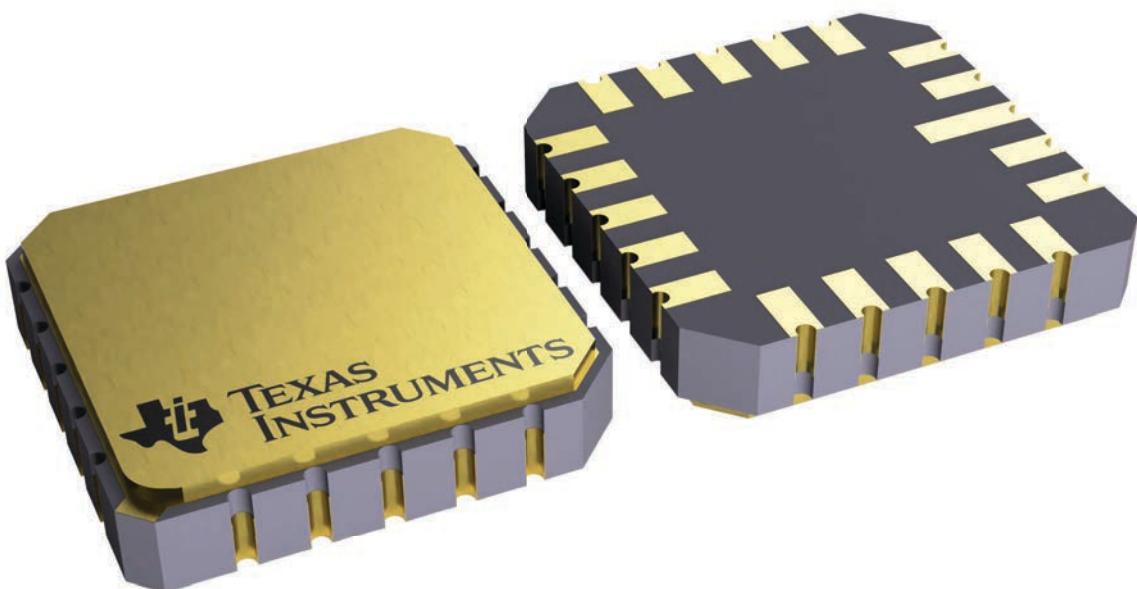
**FK 20**

**LCCC - 2.03 mm max height**

**8.89 x 8.89, 1.27 mm pitch**

**LEADLESS CERAMIC CHIP CARRIER**

This image is a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.

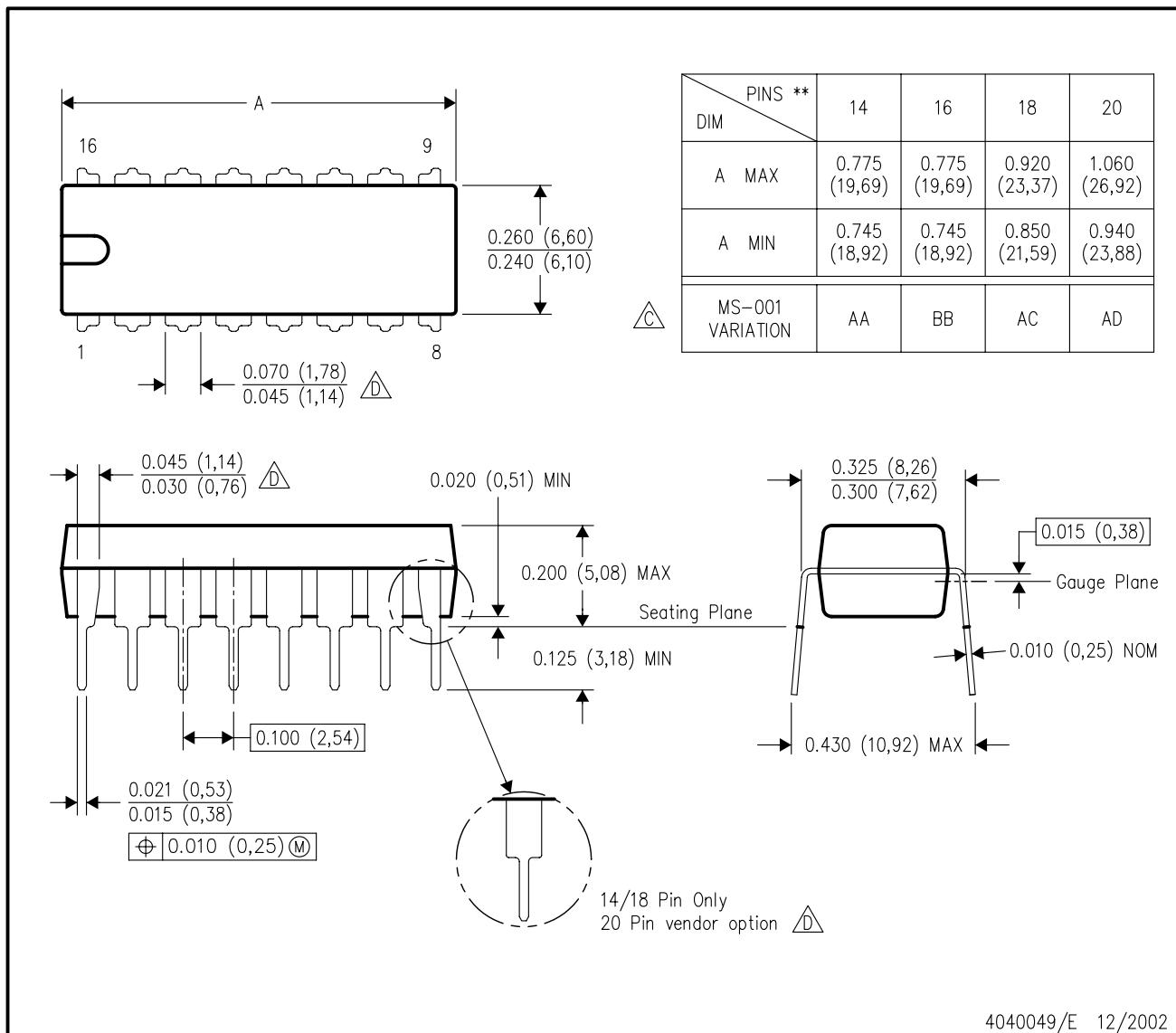


4229370VA\

## N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



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.

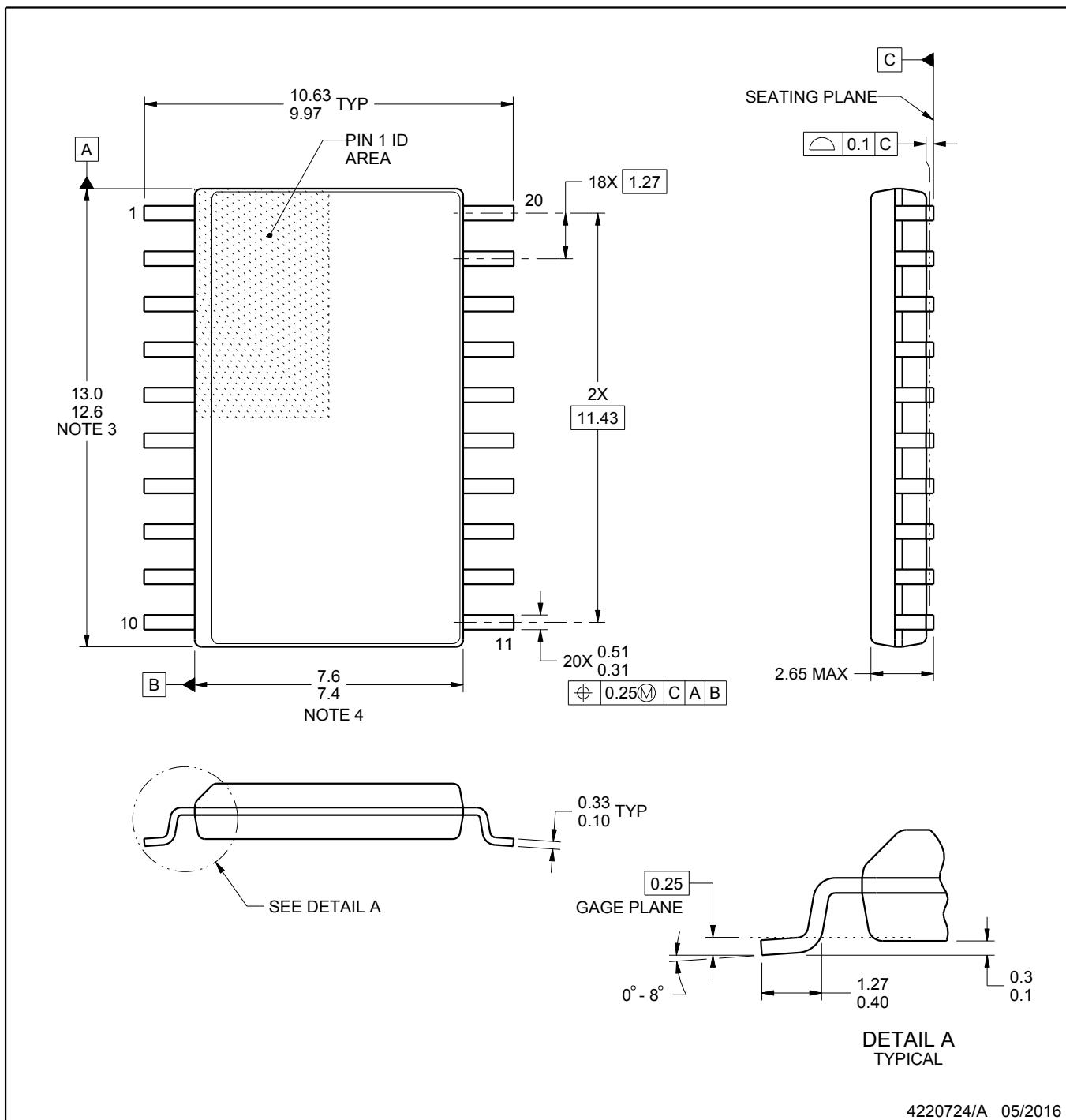
# PACKAGE OUTLINE

DW0020A



SOIC - 2.65 mm max height

SOIC



4220724/A 05/2016

## NOTES:

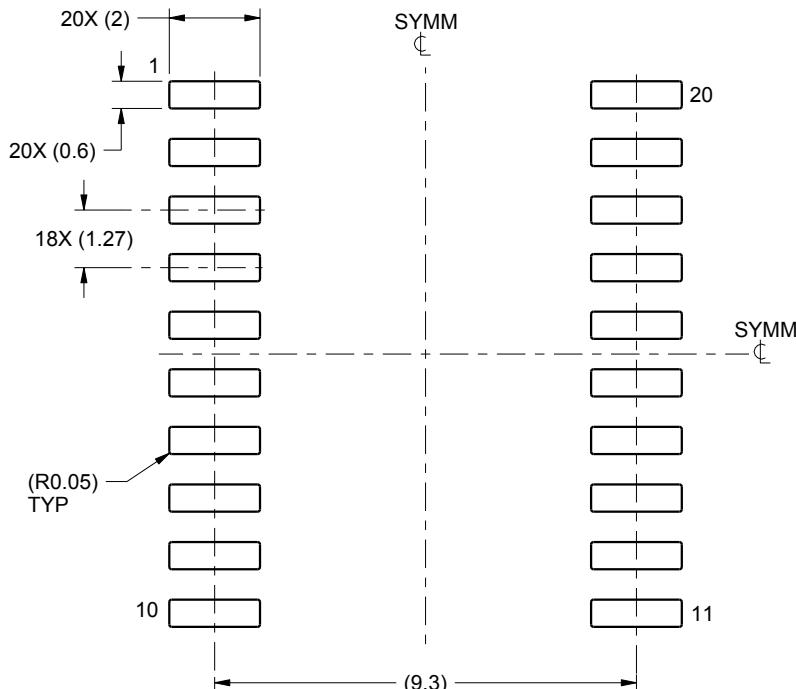
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm per side.
5. Reference JEDEC registration MS-013.

# EXAMPLE BOARD LAYOUT

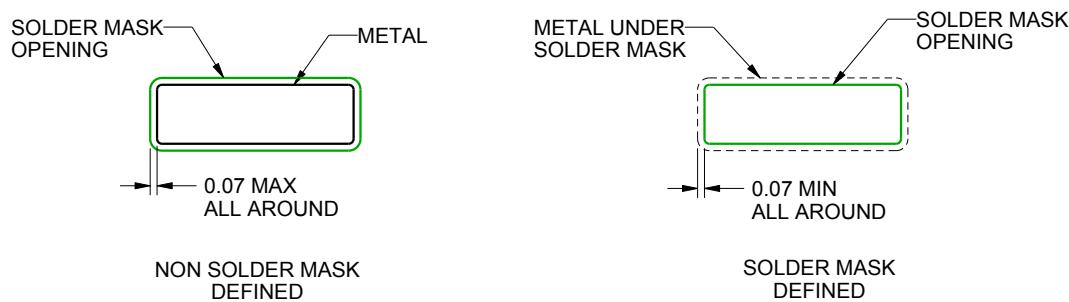
DW0020A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE  
SCALE:6X



SOLDER MASK DETAILS

4220724/A 05/2016

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

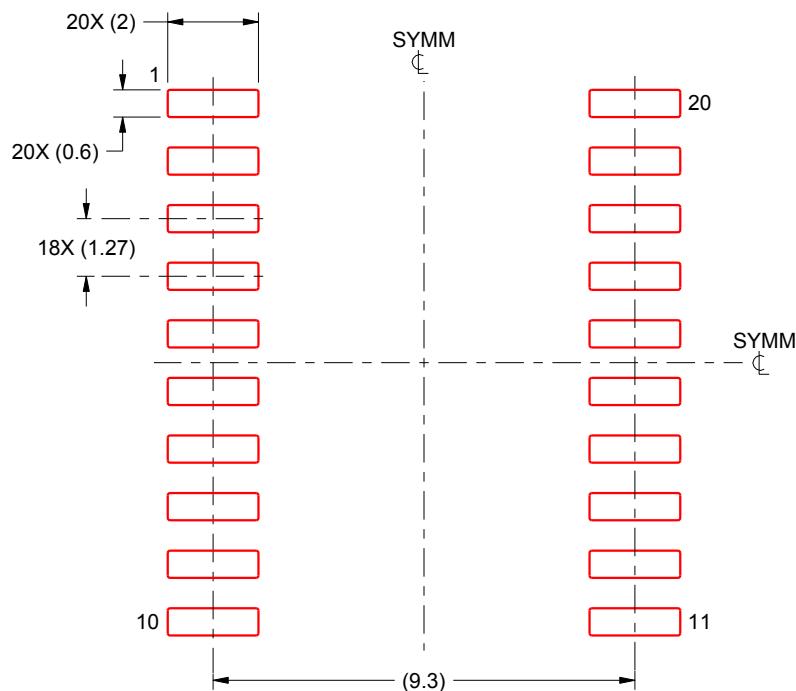
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DW0020A

SOIC - 2.65 mm max height

SOIC



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:6X

4220724/A 05/2016

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you fully indemnify TI and its representatives against any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#), [TI's General Quality Guidelines](#), or other applicable terms available either on [ti.com](#) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products. Unless TI explicitly designates a product as custom or customer-specified, TI products are standard, catalog, general purpose devices.

TI objects to and rejects any additional or different terms you may propose.

Copyright © 2026, Texas Instruments Incorporated

Last updated 10/2025