

# SN54HCT245, SN74HCT245 OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

SCLS020E – MARCH 1984 – REVISED AUGUST 2003

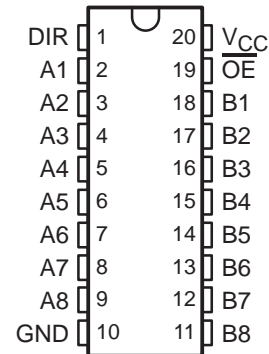
- Operating Voltage Range of 4.5 V to 5.5 V
- High-Current 3-State Outputs Drive Bus Lines Directly or Up To 15 LSTTL Loads
- Low Power Consumption, 80- $\mu$ A Max  $I_{CC}$
- Typical  $t_{pd} = 14$  ns
- $\pm 6$ -mA Output Drive at 5 V
- Low Input Current of 1  $\mu$ A Max
- Inputs Are TTL-Voltage Compatible

## description/ordering information

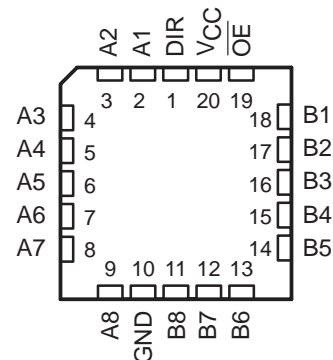
These octal bus transceivers are designed for asynchronous two-way communication between data buses. The control-function implementation minimizes external timing requirements.

The 'HCT245 devices allow data transmission from the A bus to the B bus or from the B bus to the A bus, depending upon 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.

### SN54HCT245 . . . J OR W PACKAGE SN74HCT245 . . . DB, DW, N, NS, OR PW PACKAGE (TOP VIEW)



### SN54HCT245 . . . FK PACKAGE (TOP VIEW)



## ORDERING INFORMATION

| T <sub>A</sub> | PACKAGE†   |               | ORDERABLE<br>PART NUMBER | TOP-SIDE<br>MARKING |
|----------------|------------|---------------|--------------------------|---------------------|
| –40°C to 85°C  | PDIP – N   | Tube of 20    | SN74HCT245N              | SN74HCT245N         |
|                | SOIC – DW  | Tube of 25    | SN74HCT245DW             | HCT245              |
|                |            | Reel of 2000  | SN74HCT245DWR            |                     |
|                | SOP – NS   | Reel of 2000  | SN74HCT245NSR            | HCT245              |
|                | SSOP – DB  | Reel of 2000  | SN74HCT245DBR            | HT245               |
|                | TSSOP – PW | Tube of 70    | SN74HCT245PW             | HT245               |
|                |            | Reel of 2000  | SN74HCT245PWR            |                     |
| Reel of 250    |            | SN74HCT245PWT |                          |                     |
| –55°C to 125°C | CDIP – J   | Tube of 20    | SNJ54HCT245J             | SNJ54HCT245J        |
|                | CFP – W    | Tube of 85    | SNJ54HCT245W             | SNJ54HCT245W        |
|                | LCCC – FK  | Tube of 55    | SNJ54HCT245FK            | SNJ54HCT245FK       |

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



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS  
INSTRUMENTS**

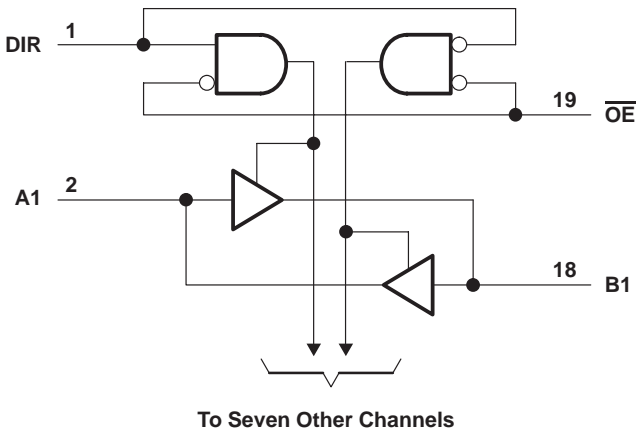
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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

FUNCTION TABLE

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

logic diagram (positive logic)



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

|   |                |
|---|----------------|
| Supply voltage range, $V_{CC}$  | −0.5 V to 7 V  |
| Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ ) (see Note 1)  | ±20 mA         |
| Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ ) (see Note 1) | ±20 mA         |
| Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )                  | ±35 mA         |
| Continuous current through $V_{CC}$ or GND                                  | ±70 mA         |
| Package thermal impedance, $\theta_{JA}$ (see Note 2):                      |                |
| DB package  | 70°C/W         |
| DW package  | 58°C/W         |
| N package   | 69°C/W         |
| NS package  | 60°C/W         |
| PW package  | 83°C/W         |
| Storage temperature range, $T_{stg}$  | −65°C to 150°C |

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

NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

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

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## recommended operating conditions (see Note 3)

|                 |                                 |                                  | SN54HCT245 |     |                 | SN74HCT245 |     |                 | UNIT |
|-----------------|---------------------------------|----------------------------------|------------|-----|-----------------|------------|-----|-----------------|------|
|                 |                                 |                                  | MIN        | NOM | MAX             | MIN        | NOM | MAX             |      |
| V <sub>CC</sub> | Supply voltage                  |                                  | 4.5        | 5   | 5.5             | 4.5        | 5   | 5.5             | V    |
| V <sub>IH</sub> | High-level input voltage        | V <sub>CC</sub> = 4.5 V to 5.5 V | 2          |     |                 | 2          |     |                 | V    |
| V <sub>IL</sub> | Low-level input voltage         | V <sub>CC</sub> = 4.5 V to 5.5 V |            |     | 0.8             |            |     | 0.8             | V    |
| V <sub>I</sub>  | Input voltage                   |                                  | 0          |     | V <sub>CC</sub> | 0          |     | V <sub>CC</sub> | V    |
| V <sub>O</sub>  | Output voltage                  |                                  | 0          |     | V <sub>CC</sub> | 0          |     | V <sub>CC</sub> | V    |
| Δt/Δv           | Input transition rise/fall time |                                  |            |     | 500             |            |     | 500             | ns   |
| T <sub>A</sub>  | Operating free-air temperature  |                                  | –55        |     | 125             | –40        |     | 85              | °C   |

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

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

| PARAMETER          |                               | TEST CONDITIONS   |                          | V <sub>CC</sub> | T <sub>A</sub> = 25°C |       |      | SN54HCT245 |     | SN74HCT245 |      | UNIT |
|--------------------|-------------------------------|---|--------------------------|-----------------|-----------------------|-------|------|------------|-----|------------|------|------|
|                    |                               |   |                          |                 | MIN                   | TYP   | MAX  | MIN        | MAX | MIN        | MAX  |      |
| V <sub>OH</sub>    |                               | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>               | I <sub>OH</sub> = –20 μA | 4.5 V           | 4.4                   | 4.499 |      | 4.4        |     | 4.4        |      | V    |
|                    |                               |   | I <sub>OH</sub> = –6 mA  |                 | 3.98                  | 4.3   |      | 3.7        |     | 3.84       |      |      |
| V <sub>OL</sub>    |                               | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>               | I <sub>OL</sub> = 20 μA  | 4.5 V           |                       | 0.001 | 0.1  |            | 0.1 |            | 0.1  | V    |
|                    |                               |   | I <sub>OL</sub> = 6 mA   |                 |                       | 0.17  | 0.26 |            | 0.4 |            | 0.33 |      |
| I <sub>I</sub>     | DIR or $\overline{\text{OE}}$ | V <sub>I</sub> = V <sub>CC</sub> or 0                             |                          | 5.5 V           | ±0.1                  | ±100  |      | ±1000      |     | ±1000      |      | nA   |
| I <sub>OZ</sub>    | A or B                        | V <sub>O</sub> = V <sub>CC</sub> or 0                             |                          | 5.5 V           | ±0.01                 | ±0.5  |      | ±10        |     | ±5         |      | μA   |
| I <sub>CC</sub>    |                               | V <sub>I</sub> = V <sub>CC</sub> or 0, I <sub>O</sub> = 0         |                          | 5.5 V           |                       |       | 8    | 160        |     | 80         |      | μA   |
| ΔI <sub>CC</sub> † |                               | One input at 0.5 V or 2.4 V, Other inputs at 0 or V <sub>CC</sub> |                          | 5.5 V           |                       | 1.4   | 2.4  | 3          |     | 2.9        |      | mA   |
| C <sub>i</sub> ‡   | DIR or $\overline{\text{OE}}$ |   |                          | 4.5 V to 5.5 V  |                       | 3     | 10   | 10         |     | 10         |      | pF   |

† This is the increase in supply current for each input that is at one of the specified TTL voltage levels, rather than 0 V or V<sub>CC</sub>.

‡ Parameter C<sub>i</sub> does not apply to transceiver I/O ports.

## switching characteristics over recommended operating free-air temperature range, C<sub>L</sub> = 50 pF (unless otherwise noted) (see Figure 1)

| PARAMETER        | FROM (INPUT)           | TO (OUTPUT) | V <sub>CC</sub> | T <sub>A</sub> = 25°C |     |     | SN54HCT245 |     | SN74HCT245 |     | UNIT |
|------------------|------------------------|-------------|-----------------|-----------------------|-----|-----|------------|-----|------------|-----|------|
|                  |                        |             |                 | MIN                   | TYP | MAX | MIN        | MAX | MIN        | MAX |      |
| t <sub>pd</sub>  | A or B                 | B or A      | 4.5 V           |                       | 16  | 22  |            | 33  |            | 28  | ns   |
|                  |                        |             | 5.5 V           |                       | 14  | 20  |            | 30  |            | 25  |      |
| t <sub>en</sub>  | $\overline{\text{OE}}$ | A or B      | 4.5 V           |                       | 25  | 46  |            | 69  |            | 58  | ns   |
|                  |                        |             | 5.5 V           |                       | 22  | 41  |            | 62  |            | 52  |      |
| t <sub>dis</sub> | $\overline{\text{OE}}$ | A or B      | 4.5 V           |                       | 26  | 40  |            | 60  |            | 50  | ns   |
|                  |                        |             | 5.5 V           |                       | 23  | 36  |            | 54  |            | 45  |      |
| t <sub>t</sub>   |                        | A or B      | 4.5 V           |                       | 9   | 12  |            | 18  |            | 15  | ns   |
|                  |                        |             | 5.5 V           |                       | 8   | 11  |            | 16  |            | 14  |      |



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switching characteristics over recommended operating free-air temperature range,  $C_L = 150 \text{ pF}$   
(unless otherwise noted) (see Figure 1)

| PARAMETER | FROM<br>(INPUT) | TO<br>(OUTPUT) | $V_{CC}$ | $T_A = 25^\circ\text{C}$ |     |     | SN54HCT245 |     | SN74HCT245 |     | UNIT |
|-----------|-----------------|----------------|----------|--------------------------|-----|-----|------------|-----|------------|-----|------|
|           |                 |                |          | MIN                      | TYP | MAX | MIN        | MAX | MIN        | MAX |      |
| $t_{pd}$  | A or B          | B or A         | 4.5 V    |                          | 20  | 30  |            | 45  |            | 38  | ns   |
|           |                 |                | 5.5 V    |                          | 18  | 27  |            | 41  |            | 34  |      |
| $t_{en}$  | $\overline{OE}$ | A or B         | 4.5 V    |                          | 36  | 59  |            | 89  |            | 74  | ns   |
|           |                 |                | 5.5 V    |                          | 30  | 53  |            | 80  |            | 67  |      |
| $t_t$     |                 | A or B         | 4.5 V    |                          | 17  | 42  |            | 63  |            | 53  | ns   |
|           |                 |                | 5.5 V    |                          | 14  | 38  |            | 57  |            | 48  |      |

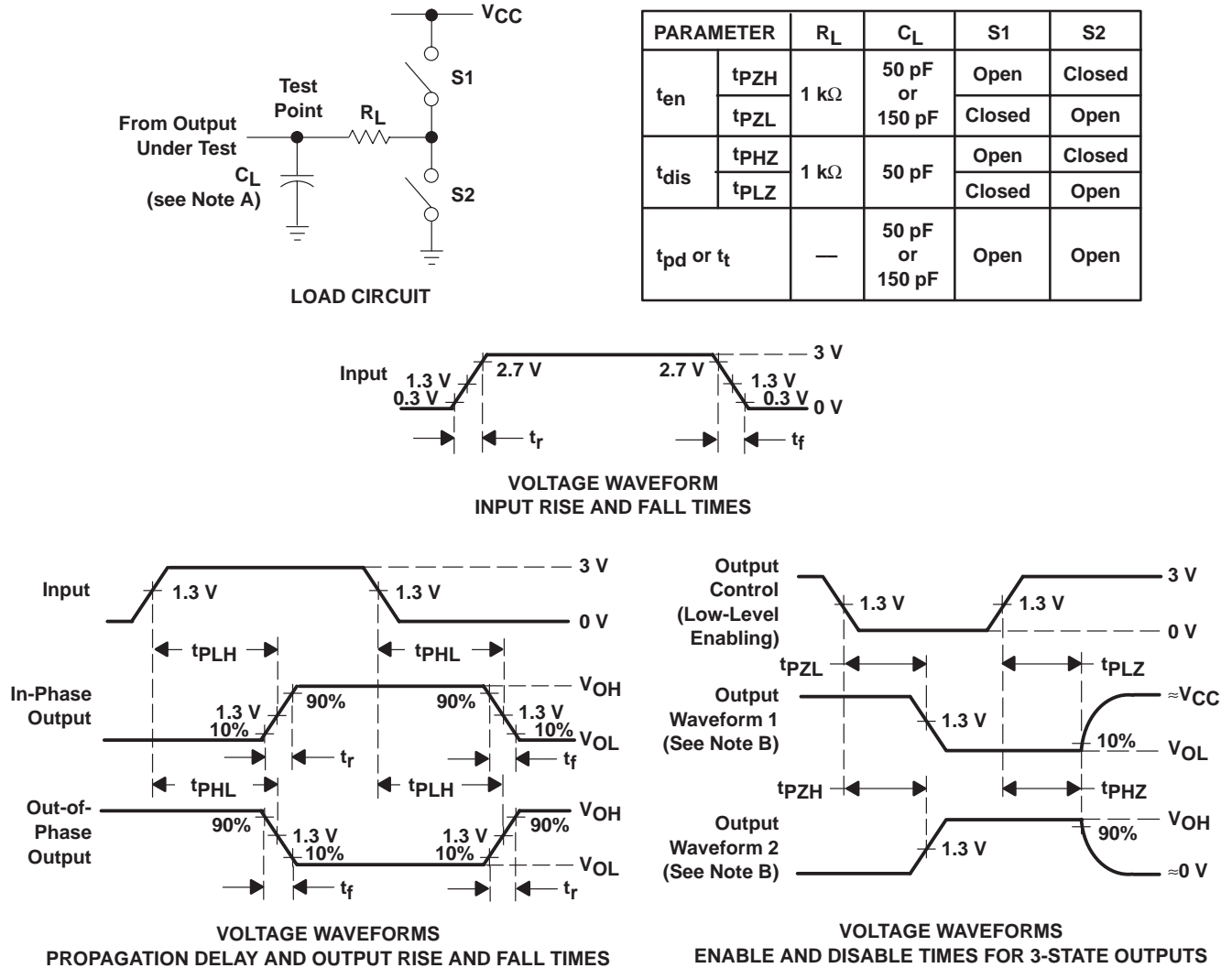
operating characteristics,  $T_A = 25^\circ\text{C}$

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



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## PARAMETER MEASUREMENT INFORMATION



- NOTES:
- A.  $C_L$  includes probe and test-fixture capacitance.
  - B. 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.
  - C. 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.
  - D. The outputs are measured one at a time with one input transition per measurement.
  - E.  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - F.  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - G.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .

Figure 1. Load Circuit and Voltage Waveforms

**PACKAGING INFORMATION**

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup>               |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|--|
| 5962-8550601VRA  | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | Call TI          | Level-NC-NC-NC                             |
| 5962-8550601VSA  | ACTIVE                | CFP          | W               | 20   | 1           | TBD                     | Call TI          | Level-NC-NC-NC                             |
| 85506012A        | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | Call TI          | Level-NC-NC-NC                             |
| 8550601RA        | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | Call TI          | Level-NC-NC-NC                             |
| JM38510/65553BRA | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | Call TI          | Level-NC-NC-NC                             |
| JM38510/65553BSA | ACTIVE                | CFP          | W               | 20   | 1           | TBD                     | Call TI          | Level-NC-NC-NC                             |
| SN54HCT245J      | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | Call TI          | Level-NC-NC-NC                             |
| SN74HCT245DBLE   | OBSOLETE              | SSOP         | DB              | 20   |             | TBD                     | Call TI          | Call TI                                    |
| SN74HCT245DBR    | ACTIVE                | SSOP         | DB              | 20   | 2000        | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-260C-1 YEAR/<br>Level-1-235C-UNLIM |
| SN74HCT245DW     | ACTIVE                | SOIC         | DW              | 20   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-250C-1 YEAR/<br>Level-1-235C-UNLIM |
| SN74HCT245DWR    | ACTIVE                | SOIC         | DW              | 20   | 2000        | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-250C-1 YEAR/<br>Level-1-235C-UNLIM |
| SN74HCT245N      | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC                             |
| SN74HCT245N3     | OBSOLETE              | PDIP         | N               | 20   |             | TBD                     | Call TI          | Call TI                                    |
| SN74HCT245NSR    | ACTIVE                | SO           | NS              | 20   | 2000        | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-260C-1 YEAR/<br>Level-1-235C-UNLIM |
| SN74HCT245PW     | ACTIVE                | TSSOP        | PW              | 20   | 70          | Pb-Free (RoHS)          | CU NIPDAU        | Level-1-250C-UNLIM                         |
| SN74HCT245PWLE   | OBSOLETE              | TSSOP        | PW              | 20   |             | TBD                     | Call TI          | Call TI                                    |
| SN74HCT245PWR    | ACTIVE                | TSSOP        | PW              | 20   | 2000        | Pb-Free (RoHS)          | CU NIPDAU        | Level-1-250C-UNLIM                         |
| SN74HCT245PWT    | ACTIVE                | TSSOP        | PW              | 20   | 250         | Pb-Free (RoHS)          | CU NIPDAU        | Level-1-250C-UNLIM                         |
| SNJ54HCT245FK    | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | Call TI          | Level-NC-NC-NC                             |
| SNJ54HCT245J     | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | Call TI          | Level-NC-NC-NC                             |
| SNJ54HCT245W     | ACTIVE                | CFP          | W               | 20   | 1           | TBD                     | Call TI          | Level-NC-NC-NC                             |

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) 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.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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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-F20)

CERAMIC DUAL FLATPACK



- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only.
  - Falls within Mil-Std 1835 GDFP2-F20

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

## LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



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

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

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



| PINS **<br>DIM      | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| A MAX               | 0.775<br>(19,69) | 0.775<br>(19,69) | 0.920<br>(23,37) | 1.060<br>(26,92) |
| A MIN               | 0.745<br>(18,92) | 0.745<br>(18,92) | 0.850<br>(21,59) | 0.940<br>(23,88) |
| MS-001<br>VARIATION | AA               | BB               | AC               | AD               |

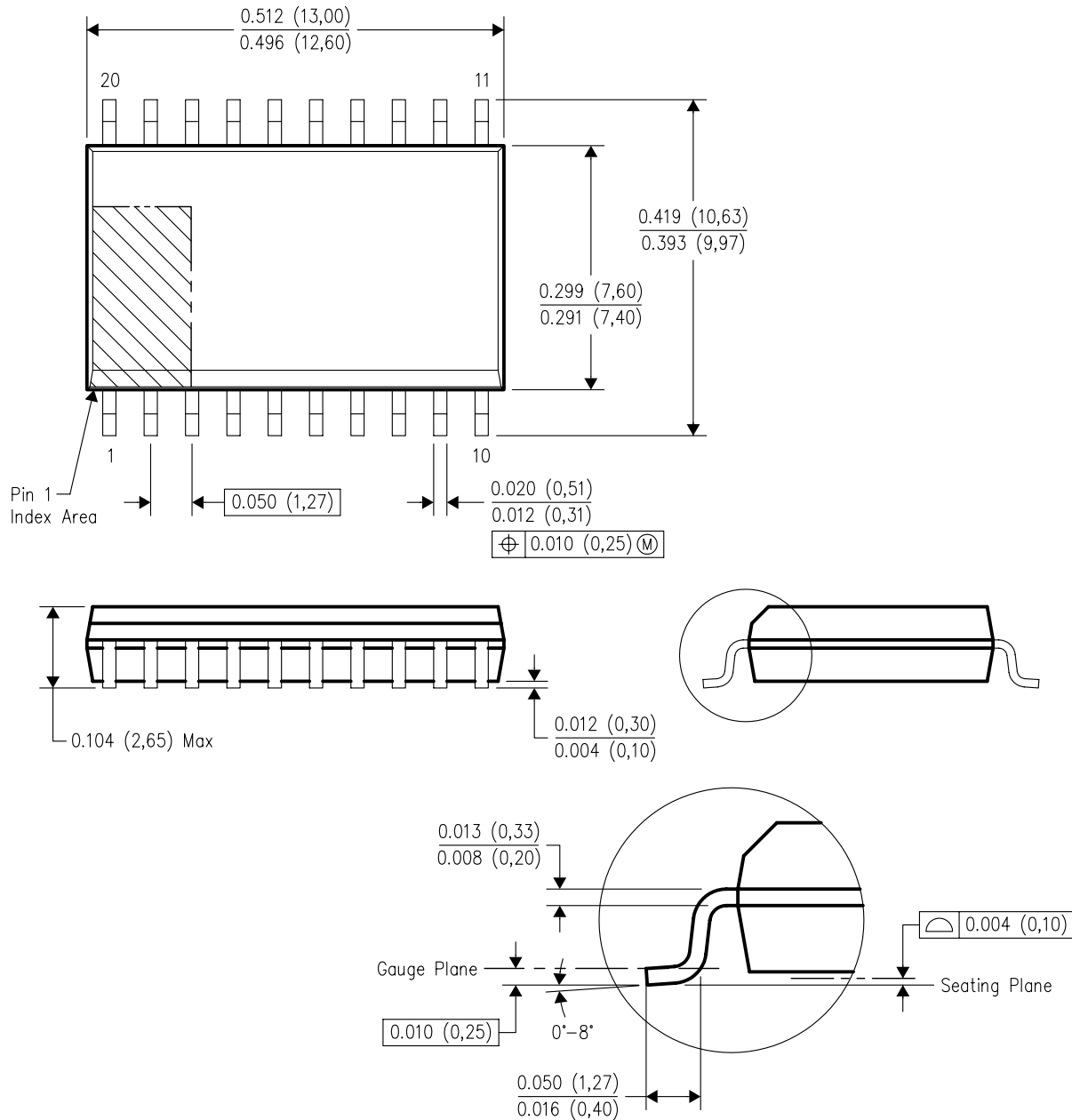


4040049/E 12/2002

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  -  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  -  The 20 pin end lead shoulder width is a vendor option, either half or full width.

DW (R-PDSO-G20)

## PLASTIC SMALL-OUTLINE PACKAGE



4040000-4/F 06/2004

- NOTES: A. All linear dimensions are in inches (millimeters).  
B. This drawing is subject to change without notice.  
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).  
D. Falls within JEDEC MS-013 variation AC.

# 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.

## 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

## PW (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.  
 D. Falls within JEDEC MO-153

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