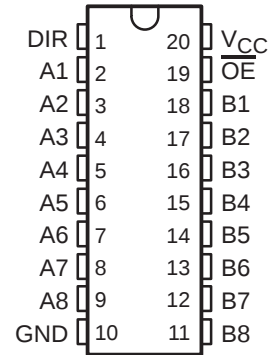


# SN54BCT640, SN74BCT640 OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

SCBS025C – SEPTEMBER 1988 – REVISED APRIL 1994

- State-of-the-Art BiCMOS Design Substantially Reduces Standby Current
- Outputs Have Undershoot-Protection Circuitry
- Power-Up High-Impedance State
- Buffered Control Inputs to Reduce DC Loading Effects
- ESD Protection Exceeds 2000 V Per MIL-STD-883C, Method 3015
- Package Options Include Plastic Small-Outline (DW) Packages, Ceramic Chip Carriers (FK) and Flatpacks (W), and Plastic and Ceramic 300-mil DIPs (J, N)

SN54BCT640 . . . J OR W PACKAGE  
SN74BCT640 . . . DW OR N PACKAGE  
(TOP VIEW)

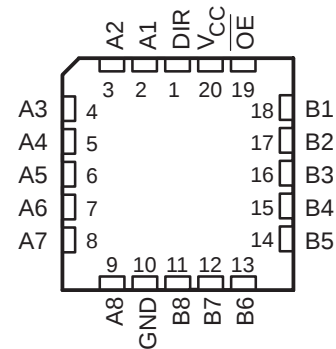


## description

The 'BCT640 bus transceiver is designed for asynchronous communication between data buses. These devices transmit data from the A bus to the B bus or from the B bus to the A bus depending upon the 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.

The SN54BCT640 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74BCT640 is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

SN54BCT640 . . . FK PACKAGE  
(TOP VIEW)

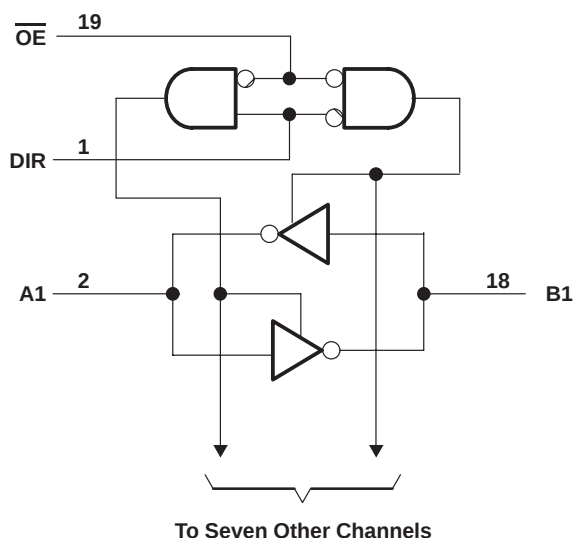
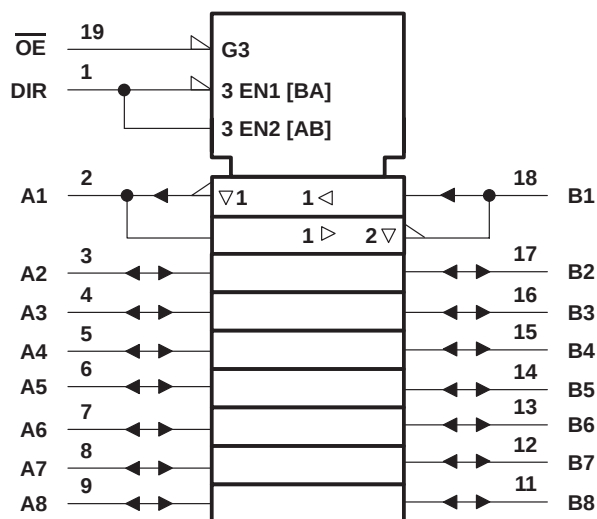


FUNCTION TABLE

| INPUTS          |     | OPERATION                    |
|-----------------|-----|------------------------------|
| $\overline{OE}$ | DIR |                              |
| L               | L   | $\overline{B}$ data to A bus |
| L               | H   | $\overline{A}$ data to B bus |
| H               | X   | Isolation                    |

## SCBS025C – SEPTEMBER 1988 – REVISED APRIL 1994

**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 voltage range: Control inputs (see Note 1)                              | ..... | – 0.5 V to 7 V      |
| I/O ports (see Note 1)                                                        | ..... | – 0.5 V to 5.5 V    |
| Voltage range applied to any output in the disabled or power-off state, $V_O$ | ..... | – 0.5 V to 5.5 V    |
| Voltage range applied to any output in the high state, $V_O$                  | ..... | – 0.5 V to $V_{CC}$ |
| Input clamp current, $I_{IK}$                                                 | ..... | –30 mA              |
| Current into any output in the low state: SN54BCT640                          | ..... | 96 mA               |
| SN74BCT640                                                                    | ..... | 128 mA              |
| Operating free-air temperature range: SN54BCT640                              | ..... | – 55°C to 125°C     |
| SN74BCT640                                                                    | ..... | 0°C to 70°C         |
| Storage temperature range                                                     | ..... | – 65°C to 150°C     |

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

# SN54BCT640, SN74BCT640 OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

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## recommended operating conditions

|          |                                | SN54BCT640 |     |     | SN74BCT640 |     |     | UNIT |
|----------|--------------------------------|------------|-----|-----|------------|-----|-----|------|
|          |                                | MIN        | NOM | MAX | MIN        | NOM | MAX |      |
| $V_{CC}$ | Supply voltage                 | 4.5        | 5   | 5.5 | 4.5        | 5   | 5.5 | V    |
| $V_{IH}$ | High-level input voltage       | 2          |     |     | 2          |     |     | V    |
| $V_{IL}$ | Low-level input voltage        |            |     | 0.8 |            |     | 0.8 | V    |
| $I_{IK}$ | Input clamp current            |            |     | –18 |            |     | –18 | mA   |
| $I_{OH}$ | High-level output current      | A port     |     | –3  | A port     |     | –3  | mA   |
|          |                                | B port     |     | –12 | B port     |     | –15 |      |
| $I_{OL}$ | Low-level output current       | A port     |     | 20  | A port     |     | 24  | mA   |
|          |                                | B port     |     | 48  | B port     |     | 64  |      |
| $T_A$    | Operating free-air temperature | –55        |     | 125 | 0          |     | 70  | °C   |

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

| PARAMETER         |                | TEST CONDITIONS                                    |                          | SN54BCT640 |      |       | SN74BCT640 |      |       | UNIT          |
|-------------------|----------------|----------------------------------------------------|--------------------------|------------|------|-------|------------|------|-------|---------------|
|                   |                |                                                    |                          | MIN        | TYP† | MAX   | MIN        | TYP† | MAX   |               |
| $V_{IK}$          |                | $V_{CC} = 4.5\text{ V}$ ,<br>$I_I = -18\text{ mA}$ |                          |            |      | –1.2  |            |      | –1.2  | V             |
| $V_{OH}$          | A port         | $V_{CC} = 4.5\text{ V}$                            | $I_{OH} = -1\text{ mA}$  | 2.5        | 3.4  |       | 2.5        | 3.4  |       | V             |
|                   |                |                                                    | $I_{OH} = -3\text{ mA}$  | 2.4        | 3.3  |       | 2.4        | 3.3  |       |               |
|                   | B port         | $V_{CC} = 4.5\text{ V}$                            | $I_{OH} = -3\text{ mA}$  | 2.4        | 3.3  |       | 2.4        | 3.3  |       |               |
|                   |                |                                                    | $I_{OH} = -12\text{ mA}$ | 2          | 3.2  |       |            |      |       |               |
|                   |                |                                                    | $I_{OH} = -15\text{ mA}$ |            |      |       | 2          | 3.1  |       |               |
| $V_{OL}$          | A port         | $V_{CC} = 4.5\text{ V}$                            | $I_{OL} = 20\text{ mA}$  |            | 0.3  | 0.5   |            |      |       | V             |
|                   |                |                                                    | $I_{OL} = 24\text{ mA}$  |            |      |       |            | 0.35 | 0.5   |               |
|                   | B port         | $V_{CC} = 4.5\text{ V}$                            | $I_{OL} = 48\text{ mA}$  |            | 0.38 | 0.55  |            |      |       |               |
|                   |                |                                                    | $I_{OL} = 64\text{ mA}$  |            |      |       |            | 0.42 | 0.55  |               |
| $I_I$             | A or B port    | $V_{CC} = 5.5\text{ V}$ ,<br>$V_I = 5.5\text{ V}$  |                          |            |      | 1     |            |      | 1     | mA            |
|                   | Control inputs |                                                    |                          |            |      | 0.1   |            |      | 0.1   |               |
| $I_{IH}^\ddagger$ | A or B port    | $V_{CC} = 5.5\text{ V}$ ,<br>$V_I = 2.7\text{ V}$  |                          |            |      | 70    |            |      | 70    | $\mu\text{A}$ |
|                   | Control inputs |                                                    |                          |            |      | 20    |            |      | 20    |               |
| $I_{IL}^\ddagger$ | A or B port    | $V_{CC} = 5.5\text{ V}$ ,<br>$V_I = 0.5\text{ V}$  |                          |            |      | –0.6  |            |      | –0.6  | mA            |
|                   | Control inputs |                                                    |                          |            |      | –0.65 |            |      | –0.65 |               |
| $I_{OS}^\S$       | A port         | $V_{CC} = 5.5\text{ V}$ ,<br>$V_O = 0$             |                          | –60        |      | –150  | –60        |      | –150  | mA            |
|                   | B port         |                                                    |                          | –100       |      | –225  | –100       |      | –225  |               |
| $I_{CCL}$         | A to B         | $V_{CC} = 5.5\text{ V}$                            |                          |            | 53   | 84    |            | 53   | 94    | mA            |
| $I_{CCH}$         | A to B         | $V_{CC} = 5.5\text{ V}$                            |                          |            | 23   | 37    |            | 23   | 41    | mA            |
| $I_{CCZ}$         |                | $V_{CC} = 5.5\text{ V}$                            |                          |            | 4    | 10    |            | 4    | 11    | mA            |

† All typical values are at  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

‡ For I/O ports, the parameters  $I_{IH}$  and  $I_{IL}$  include the off-state output current.

§ Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

# SN54BCT640, SN74BCT640

## OCTAL BUS TRANSCEIVERS

### WITH 3-STATE OUTPUTS

SCBS025C – SEPTEMBER 1988 – REVISED APRIL 1994

#### switching characteristics (see Note 2)

| PARAMETER        | FROM<br>(INPUT)        | TO<br>(OUTPUT) | V <sub>CC</sub> = 5 V,<br>C <sub>L</sub> = 50 pF,<br>R1 = 500 Ω,<br>R2 = 500 Ω,<br>T <sub>A</sub> = 25°C |     |     | V <sub>CC</sub> = 4.5 V to 5.5 V,<br>C <sub>L</sub> = 50 pF,<br>R1 = 500 Ω,<br>R2 = 500 Ω,<br>T <sub>A</sub> = MIN to MAX† |      |            |      | UNIT |
|------------------|------------------------|----------------|----------------------------------------------------------------------------------------------------------|-----|-----|----------------------------------------------------------------------------------------------------------------------------|------|------------|------|------|
|                  |                        |                | 'BCT640                                                                                                  |     |     | SN54BCT640                                                                                                                 |      | SN74BCT640 |      |      |
|                  |                        |                | MIN                                                                                                      | TYP | MAX | MIN                                                                                                                        | MAX  | MIN        | MAX  |      |
| t <sub>PLH</sub> | A or B                 | B or A         | 0.5                                                                                                      | 3.6 | 5.6 | 0.5                                                                                                                        | 7    | 0.5        | 6.5  | ns   |
| t <sub>PHL</sub> |                        |                | 0.5                                                                                                      | 1.9 | 3.4 | 0.5                                                                                                                        | 3.8  | 0.5        | 3.7  |      |
| t <sub>PZH</sub> | $\overline{\text{OE}}$ | A or B         | 3.1                                                                                                      | 6.4 | 8.9 | 2.6                                                                                                                        | 10.5 | 2.6        | 10.2 | ns   |
| t <sub>PZL</sub> |                        |                | 4.1                                                                                                      | 6.9 | 9.5 | 3.5                                                                                                                        | 12.3 | 3.5        | 10.7 |      |
| t <sub>PHZ</sub> | $\overline{\text{OE}}$ | A or B         | 1.9                                                                                                      | 5   | 7.9 | 1.4                                                                                                                        | 12.2 | 1.4        | 10.2 | ns   |
| t <sub>PLZ</sub> |                        |                | 1.8                                                                                                      | 4.3 | 6.8 | 1.5                                                                                                                        | 8.3  | 1.5        | 7.8  |      |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.

**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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| 5962-9075201M2A  | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | Call TI          | Level-NC-NC-NC               |
| 5962-9075201MRA  | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | Call TI          | Level-NC-NC-NC               |
| 5962-9075201MSA  | ACTIVE                | CFP          | W               | 20   | 1           | TBD                     | Call TI          | Level-NC-NC-NC               |
| SN74BCT640DW     | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT640DWE4   | ACTIVE                | SOIC         | DW              | 20   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT640DWR    | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT640DWRE4  | ACTIVE                | SOIC         | DW              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT640N      | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| SN74BCT640NE4    | ACTIVE                | PDIP         | N               | 20   | 20          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC               |
| SN74BCT640NSR    | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74BCT640NSRE4  | ACTIVE                | SO           | NS              | 20   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SNJ54BCT640FK    | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | Call TI          | Level-NC-NC-NC               |
| SNJ54BCT640J     | ACTIVE                | CDIP         | J               | 20   | 1           | TBD                     | Call TI          | Level-NC-NC-NC               |
| SNJ54BCT640W     | 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)        |

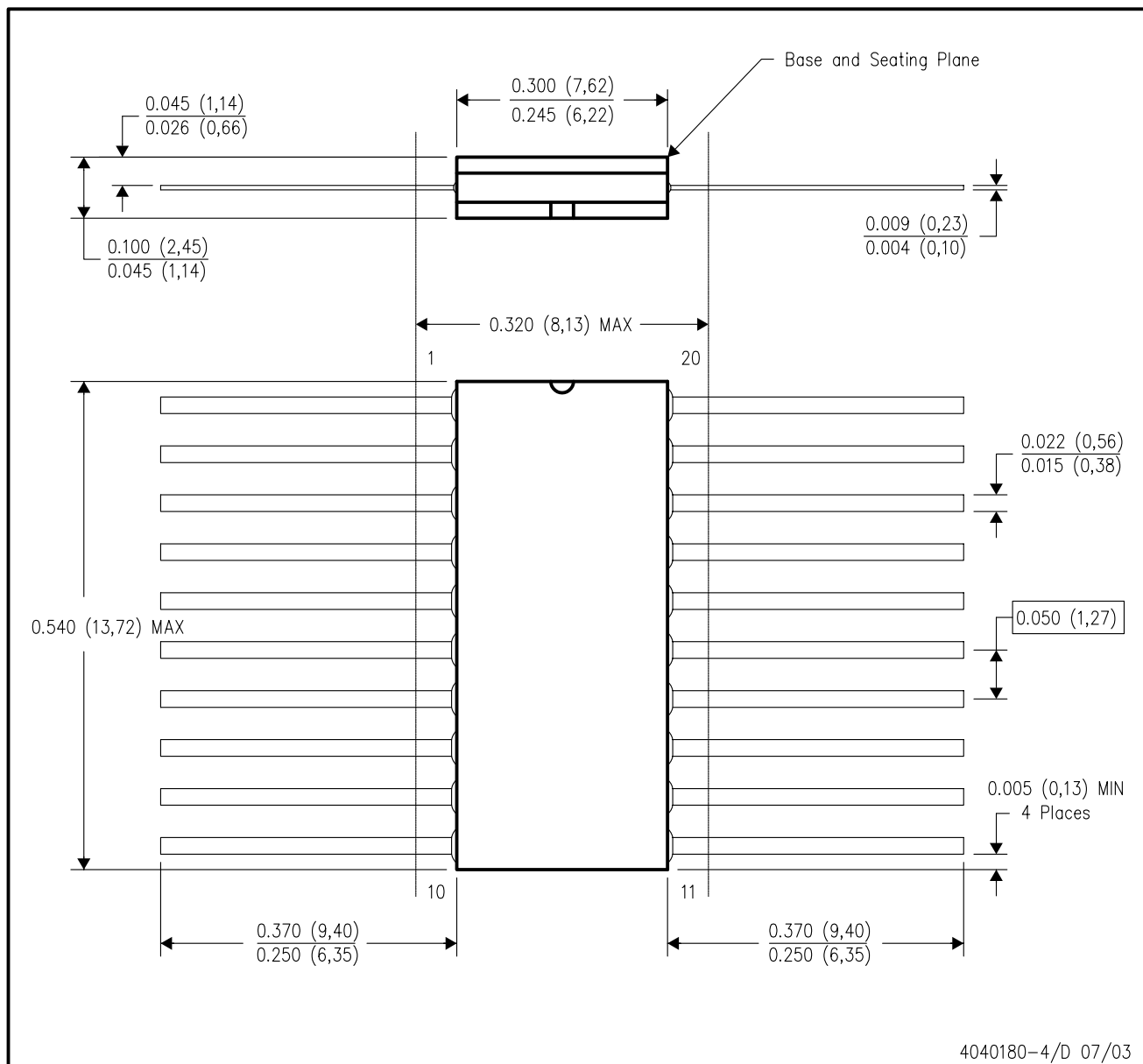


4040083/F 03/03

- 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

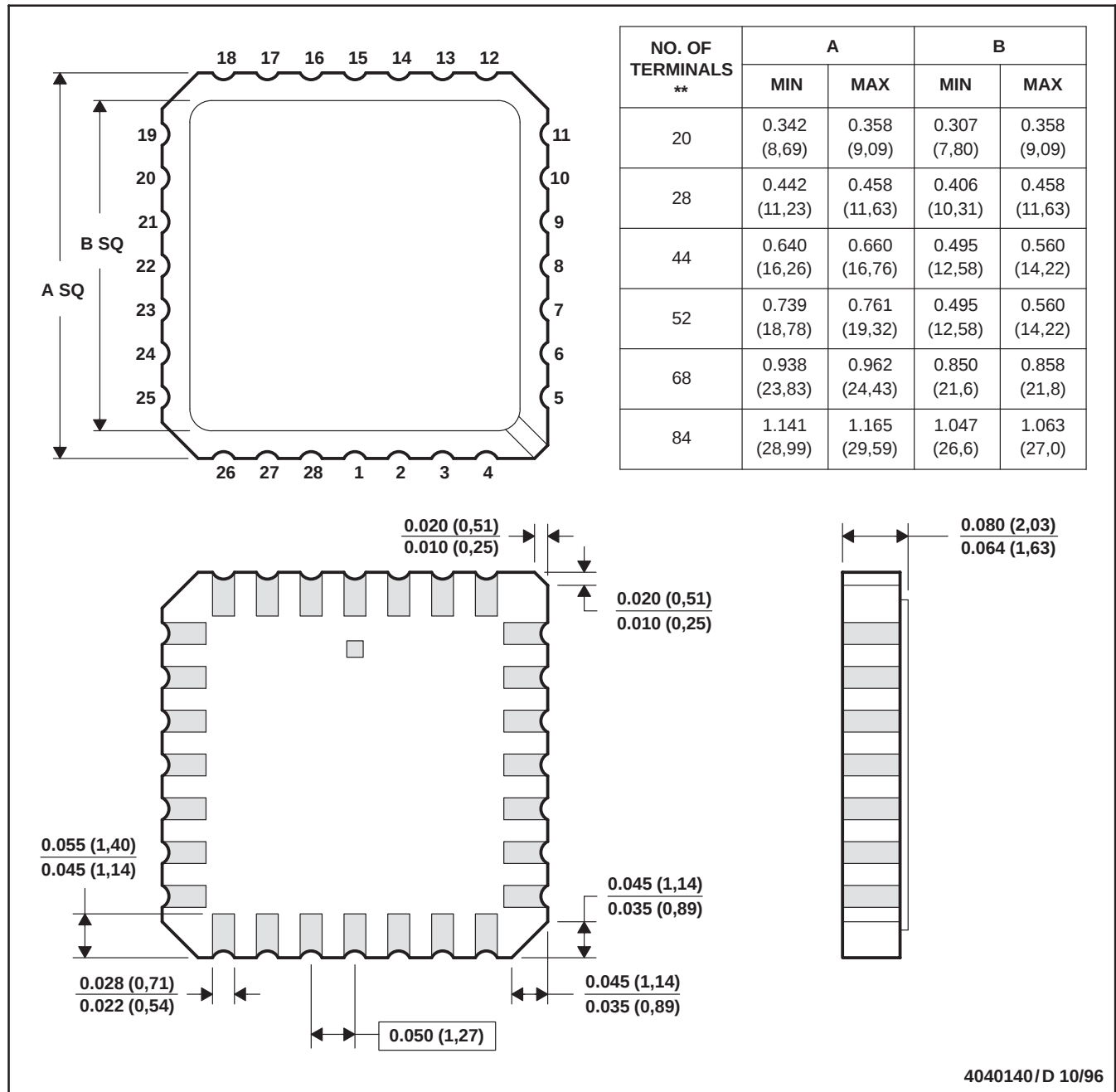


- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only.
  - Falls within Mil-Std 1835 GDFP2-F20

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

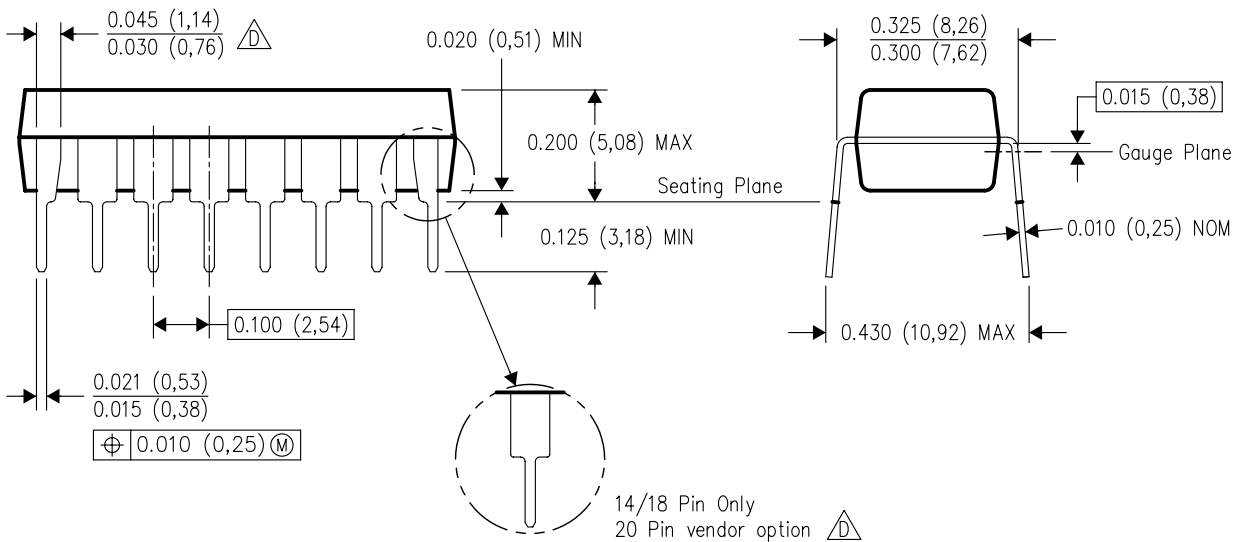
## N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



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

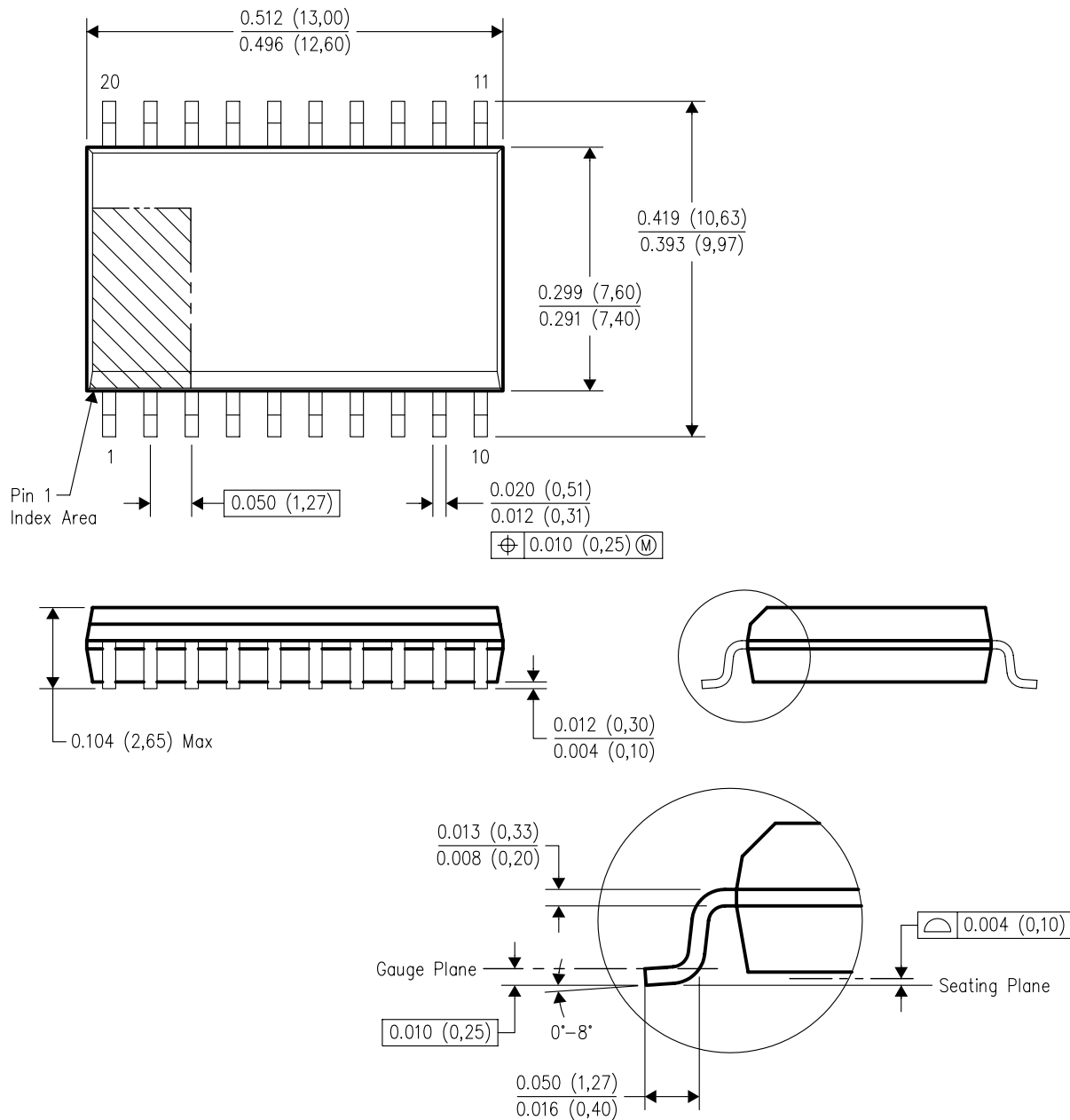


4040049/E 12/2002

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - D. 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:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - Falls within JEDEC MS-013 variation AC.

# MECHANICAL DATA

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

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



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

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| Microcontrollers | <a href="http://microcontroller.ti.com">microcontroller.ti.com</a> | Security            | <a href="http://www.ti.com/security">www.ti.com/security</a>             |
|                  |                                                                    | Telephony           | <a href="http://www.ti.com/telephony">www.ti.com/telephony</a>           |
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