

SN54BCT543, SN74BCT543 OCTAL REGISTERED TRANSCEIVERS WITH 3-STATE OUTPUTS

SCBS026C – NOVEMBER 1988 – REVISED APRIL 1994

- State-of-the-Art BiCMOS Design Significantly Reduces I_{CCZ}
- 3-State True Outputs
- Back-to-Back Registers for Storage
- ESD Protection Exceeds 2000 V Per MIL-STD-883C, Method 3015
- Package Options Include Plastic Small-Outline Packages (DW), Ceramic Chip Carriers (FK) and Flatpacks (W), and Plastic and Ceramic 300-mil DIPs (JT, NT)

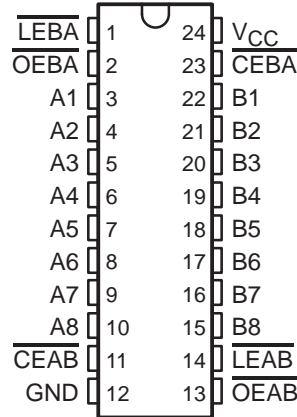
description

The 'BCT543 octal transceiver contains two sets of D-type latches for temporary storage of data flowing in either direction. Separate latch-enable (\overline{LEAB} or \overline{LEBA}) and output-enable (\overline{OEAB} or \overline{OEBA}) inputs are provided for each register to permit independent control in either direction of data flow.

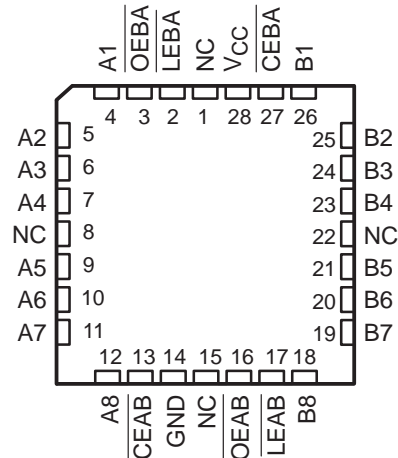
The A-to-B enable (\overline{CEAB}) input must be low in order to enter data from A or to output data from B. If \overline{CEAB} is low and \overline{LEAB} is low, the A-to-B latches are transparent; a subsequent low-to-high transition of \overline{LEAB} puts the A latches in the storage mode. With \overline{CEAB} and \overline{OEAB} both low, the 3-state B outputs are active and reflect the data present at the output of the A latches. Data flow from B to A is similar but requires using the \overline{CEBA} , \overline{LEBA} , and \overline{OEBA} inputs.

The SN54BCT543 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74BCT543 is characterized for operation from 0°C to 70°C .

SN54BCT543 . . . JT OR W PACKAGE
SN74BCT543 . . . DW OR NT PACKAGE
(TOP VIEW)



SN54BCT543 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

FUNCTION TABLE†

| INPUTS | | | | OUTPUT |
|-------------------|-------------------|-------------------|---|------------------|
| \overline{CEAB} | \overline{LEAB} | \overline{OEAB} | A | B |
| H | X | X | X | Z |
| X | X | H | X | Z |
| L | H | L | X | B_0^{\ddagger} |
| L | L | L | L | L |
| L | L | L | H | H |

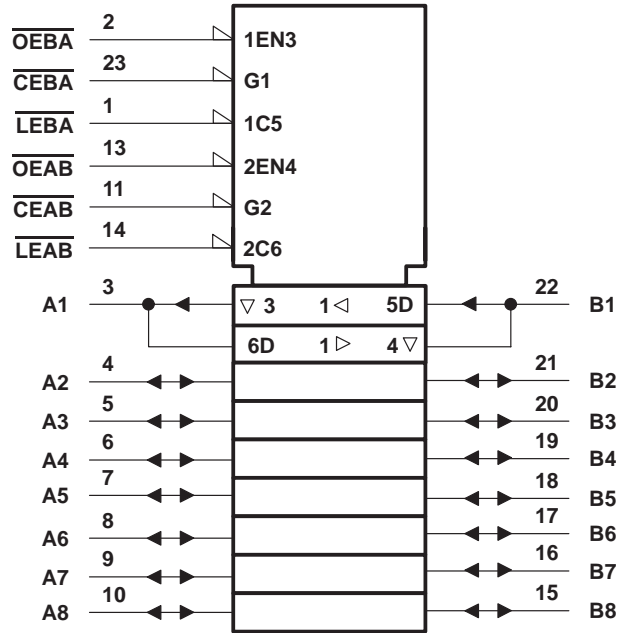
† A-to-B data flow is shown; B-to-A flow control is the same except that it uses \overline{CEBA} , \overline{LEBA} , and \overline{OEBA} .

‡ Output level before the indicated steady-state input conditions were established.

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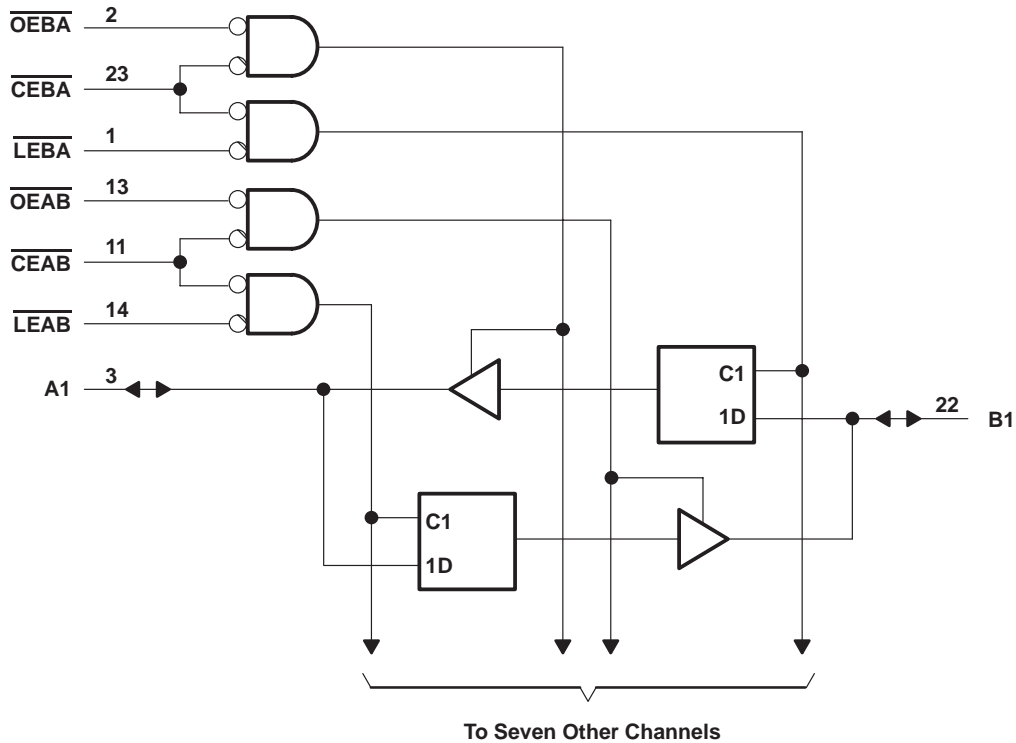
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logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



Pin numbers shown are for the DW, JT, NT, and W packages.

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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 7 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: SN54BCT543 | 96 mA |
| SN74BCT543 | 128 mA |
| Operating free-air temperature range: SN54BCT543 | – 55°C to 125°C |
| SN74BCT543 | 0°C to 70°C |
| Storage temperature range | – 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.

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

recommended operating conditions

| | | SN54BCT543 | | | SN74BCT543 | | | 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 | | | –12 | | | –15 | mA |
| I_{OL} | Low-level output current | | | 48 | | | 64 | mA |
| T_A | Operating free-air temperature | –55 | | 125 | 0 | | 70 | °C |



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

| PARAMETER | TEST CONDITIONS | | SN54BCT543 | | SN74BCT543 | | UNIT | |
|-----------|---------------------------|---------------------------|--|------|------------|-------|-------|---------------|
| | | | MIN | TYP† | MAX | MIN | | TYP† |
| V_{IK} | $V_{CC} = 4.5\text{ V}$, | $I_I = -18\text{ mA}$ | | | -1.2 | | -1.2 | V |
| V_{OH} | $V_{CC} = 4.5\text{ V}$ | $I_{OH} = -3\text{ mA}$ | 2.4 | 3.3 | | 2.4 | 3.3 | V |
| | | $I_{OH} = -12\text{ mA}$ | 2 | 3.2 | | | | |
| | | $I_{OH} = -15\text{ mA}$ | | | | 2 | 3.1 | |
| V_{OL} | $V_{CC} = 4.5\text{ V}$ | $I_{OL} = 48\text{ mA}$ | | 0.38 | 0.55 | | | V |
| | | $I_{OL} = 64\text{ mA}$ | | | | 0.42 | 0.55 | |
| I_I | $V_{CC} = 5.5\text{ V}$, | $V_I = 5.5\text{ V}$ | | | 0.4 | | 0.4 | mA |
| $I_{IH}‡$ | A or B port | $V_{CC} = 5.5\text{ V}$, | $V_I = 2.7\text{ V}$ | | | 70 | 70 | μA |
| | Control input | | | | | 20 | 20 | |
| $I_{IL}‡$ | A or B port | $V_{CC} = 5.5\text{ V}$, | $V_I = 0.5\text{ V}$ | | | -0.65 | -0.65 | mA |
| | Control input | | | | | -0.6 | -0.6 | |
| $I_{OS}§$ | | $V_{CC} = 5.5\text{ V}$, | $V_O = 0$ | -100 | -225 | -100 | -225 | mA |
| I_{CCL} | A or B port | $V_{CC} = 5.5\text{ V}$ | | 45 | 71 | 45 | 71 | mA |
| I_{CCH} | A or B port | $V_{CC} = 5.5\text{ V}$ | | 5 | 8 | 5 | 8 | mA |
| I_{CCZ} | A or B port | $V_{CC} = 5.5\text{ V}$ | | 9 | 15 | 9 | 15 | mA |
| C_i | Control input | $V_{CC} = 5\text{ V}$, | $V_I = 2.5\text{ V}$ or 0.5 V | | 6 | | 6 | pF |
| C_{io} | A or B port | $V_{CC} = 5\text{ V}$, | $V_O = 2.5\text{ V}$ or 0.5 V | | 16 | | 16 | pF |

† 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.

timing requirements over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

| | | $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$ | | SN54BCT543 | | SN74BCT543 | | UNIT |
|----------|--|---|-------------|------------|-----|------------|-----|------|
| | | MIN | MAX | MIN | MAX | MIN | MAX | |
| t_w | Pulse duration, \overline{LEAB} or \overline{LEBA} low | 7 | | 8 | | 7 | | ns |
| t_{su} | Setup time, data before \overline{LEAB} or $\overline{LEBA}\uparrow$ | | High or low | 4.5 | 5.5 | 4.5 | | ns |
| t_h | Hold time, data after \overline{LEAB} or $\overline{LEBA}\uparrow$ | | High or low | 1.5 | 1.5 | 1.5 | | ns |

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switching characteristics (see Note 2)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $V_{CC} = 5\text{ V},$ $C_L = 50\text{ pF},$ $R_1 = 500\ \Omega,$ $R_2 = 500\ \Omega,$ $T_A = 25^\circ\text{C}$ | | | $V_{CC} = 4.5\text{ V to }5.5\text{ V},$ $C_L = 50\text{ pF},$ $R_1 = 500\ \Omega,$ $R_2 = 500\ \Omega,$ $T_A = \text{MIN to MAX}^\dagger$ | | | | UNIT |
|-----------|-----------------|----------------|---|-----|------|--|------|------------|------|------|
| | | | 'BCT543 | | | SN54BCT543 | | SN74BCT543 | | |
| | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| t_{PLH} | A or B | B or A | 2 | 5.7 | 7.5 | 2 | 9.9 | 2 | 8.8 | ns |
| t_{PHL} | | | 2 | 6.3 | 8.2 | 2 | 9.7 | 2 | 9.6 | |
| t_{PLH} | \overline{LE} | A or B | 2 | 8.2 | 10.3 | 2 | 13.9 | 2 | 12.9 | ns |
| t_{PHL} | | | 2 | 8.5 | 10.6 | 2 | 13.2 | 2 | 12.7 | |
| t_{PZH} | \overline{OE} | A or B | 1 | 6.8 | 8.6 | 1 | 11.4 | 1 | 10.7 | ns |
| t_{PZL} | | | 1 | 8.7 | 10.8 | 1 | 12.8 | 1 | 12.3 | |
| t_{PHZ} | \overline{OE} | A or B | 1 | 5.5 | 7.2 | 1 | 8.8 | 1 | 8.1 | ns |
| t_{PLZ} | | | 1 | 4.7 | 6.4 | 1 | 8.1 | 1 | 7.2 | |
| t_{PZH} | \overline{CE} | A or B | 1 | 7.6 | 9.8 | 1 | 12.8 | 1 | 12 | ns |
| t_{PZL} | | | 1 | 9.5 | 11.6 | 1 | 13.8 | 1 | 13.5 | |
| t_{PHZ} | CE | A or B | 1 | 5.8 | 7.5 | 1 | 9.3 | 1 | 8.5 | ns |
| t_{PLZ} | | | 1 | 4.8 | 6.7 | 1 | 8.4 | 1 | 7.6 | |

[†] 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 ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| 5962-9087001M3A | ACTIVE | LCCC | FK | 28 | 1 | TBD | POST-PLATE | N / A for Pkg Type |
| 5962-9087001MKA | ACTIVE | CFP | W | 24 | 1 | TBD | A42 | N / A for Pkg Type |
| 5962-9087001MLA | ACTIVE | CDIP | JT | 24 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| SN74BCT543DW | ACTIVE | SOIC | DW | 24 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74BCT543DWE4 | ACTIVE | SOIC | DW | 24 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74BCT543DWG4 | ACTIVE | SOIC | DW | 24 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74BCT543DWR | ACTIVE | SOIC | DW | 24 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74BCT543DWRE4 | ACTIVE | SOIC | DW | 24 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74BCT543DWRG4 | ACTIVE | SOIC | DW | 24 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74BCT543NT | ACTIVE | PDIP | NT | 24 | 15 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| SN74BCT543NTE4 | ACTIVE | PDIP | NT | 24 | 15 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| SNJ54BCT543FK | ACTIVE | LCCC | FK | 28 | 1 | TBD | POST-PLATE | N / A for Pkg Type |
| SNJ54BCT543JT | ACTIVE | CDIP | JT | 24 | 1 | TBD | A42 SNPB | N / A for Pkg Type |
| SNJ54BCT543W | ACTIVE | CFP | W | 24 | 1 | TBD | A42 | N / A for Pkg Type |

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

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

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

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

OBSELETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

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

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

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TAPE AND REEL INFORMATION



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 |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74BCT543DWR | SOIC | DW | 24 | 2000 | 330.0 | 24.4 | 10.75 | 15.7 | 2.7 | 12.0 | 24.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74BCT543DWR | SOIC | DW | 24 | 2000 | 346.0 | 346.0 | 41.0 |

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

NT (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

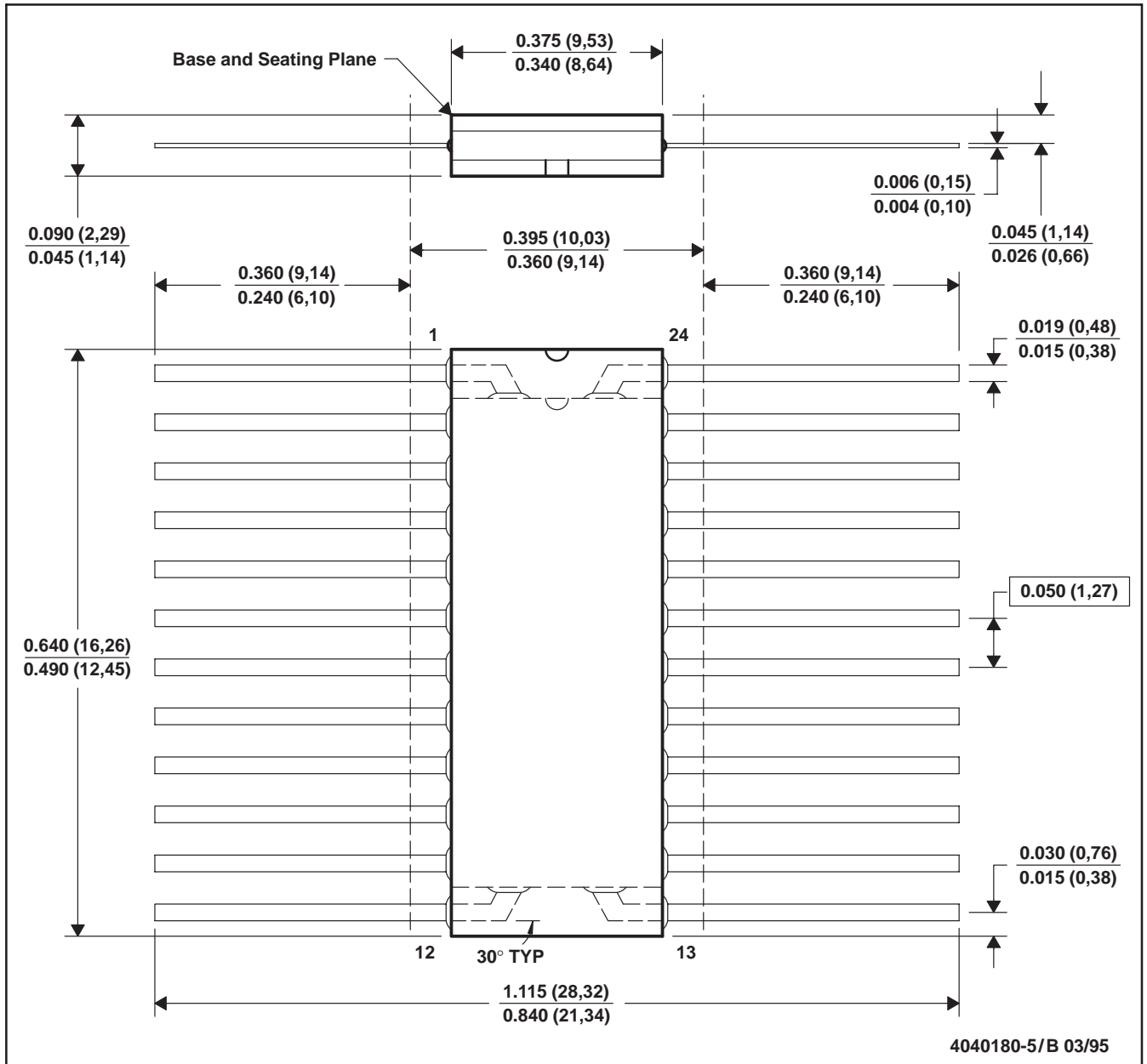
24 PINS SHOWN



NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.

W (R-GDFP-F24)

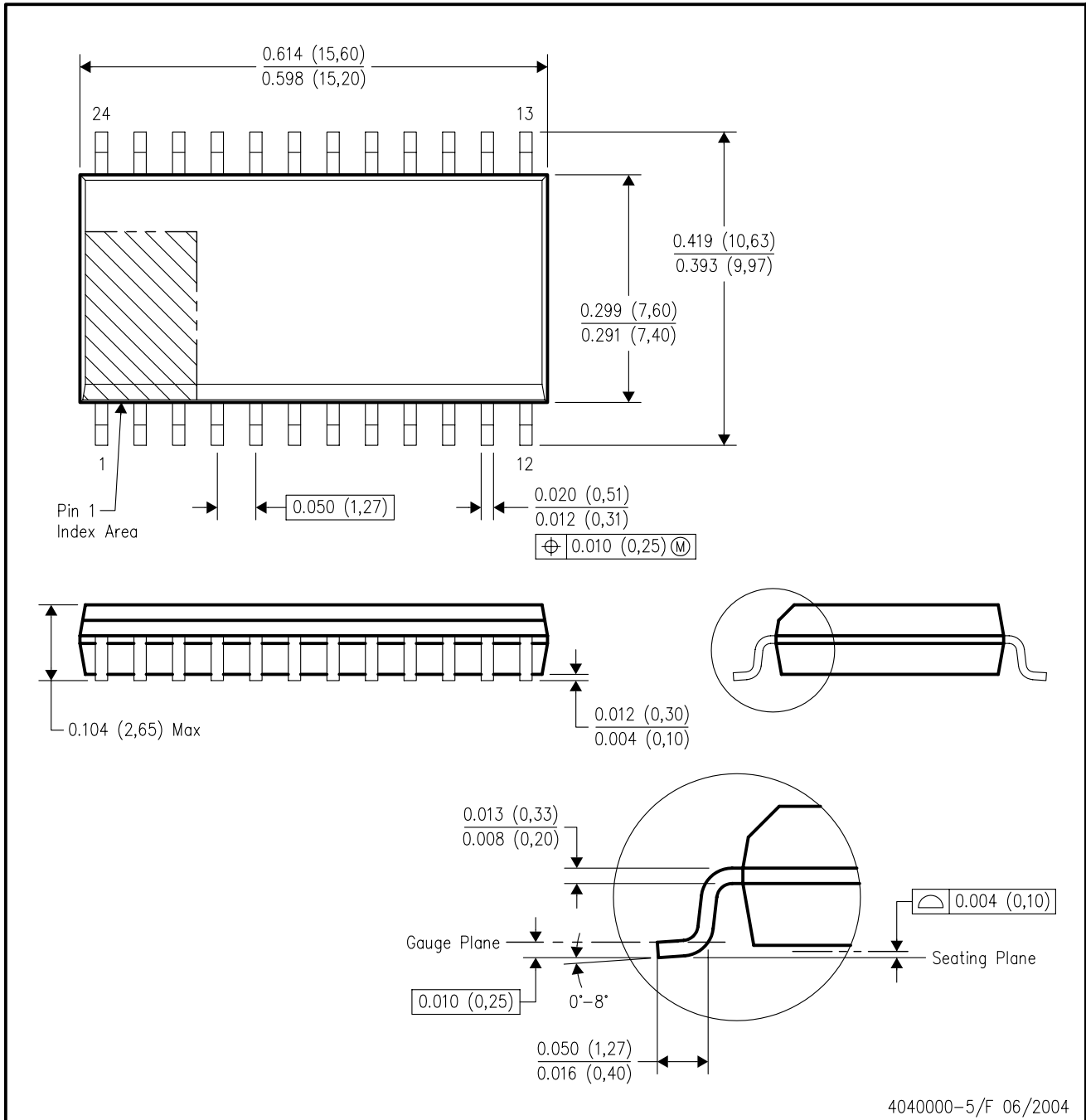
CERAMIC DUAL FLATPACK



- 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. Falls within MIL-STD-1835 GDFP2-F24 and JEDEC MO-070AD
 E. Index point is provided on cap for terminal identification only.

DW (R-PDSO-G24)

PLASTIC SMALL-OUTLINE PACKAGE



- 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 AD.

JT (R-GDIP-T**)

CERAMIC DUAL-IN-LINE

24 LEADS SHOWN



4040110/C 08/96

- 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.
 E. Falls within MIL STD 1835 GDIP3-T24, GDIP4-T28, and JEDEC MO-058 AA, MO-058 AB

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