

# SN54AS821A, SN74AS821A 10-BIT BUS-INTERFACE FLIP-FLOPS WITH 3-STATE OUTPUTS

SDAS230A – DECEMBER 1983 – REVISED AUGUST 1995

- Functionally Equivalent to AMD's AM29821
- Provide Extra Data Width Necessary for Wider Address/Data Paths or Buses With Parity
- Outputs Have Undershoot-Protection Circuitry
- Power-Up High-Impedance State
- Buffered Control Inputs to Reduce dc Loading Effects
- Package Options Include Plastic Small-Outline (DW) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (NT) and Ceramic (JT) 300-mil DIPs

## description

These 10-bit flip-flops feature 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. They are particularly suitable for implementing wider buffer registers, I/O ports, bidirectional bus drivers with parity, and working registers.

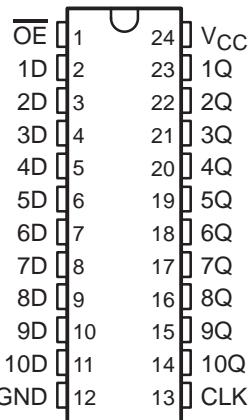
The ten flip-flops are edge-triggered D-type flip-flops. On the positive transition of the clock (CLK) input, the Q outputs are true to the data (D) input.

A buffered output-enable ( $\overline{OE}$ ) input can be used to place the ten outputs in either a normal logic state (high or low logic levels) or a high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased drive provide the capability to drive bus lines without interface or pullup components.

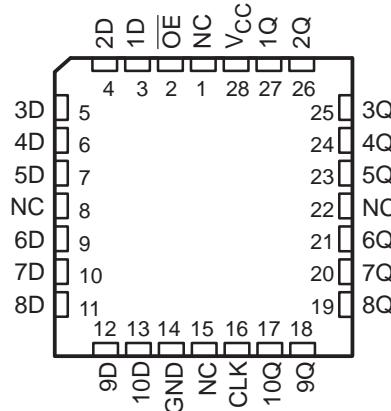
$\overline{OE}$  does not affect the internal operation of the flip-flops. Previously stored data can be retained or new data can be entered while the outputs are in the high-impedance state.

The SN54AS821A is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74AS821A is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

SN54AS821A . . . JT PACKAGE  
SN74AS821A . . . DW OR NT PACKAGE  
(TOP VIEW)



SN54AS821A . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

FUNCTION TABLE  
(each flip-flop)

| INPUTS          |            |   | OUTPUT<br>Q |
|-----------------|------------|---|-------------|
| $\overline{OE}$ | CLK        | D |             |
| L               | $\uparrow$ | H | H           |
| L               | $\uparrow$ | L | L           |
| L               | L          | X | $Q_0$       |
| H               | X          | X | Z           |

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.

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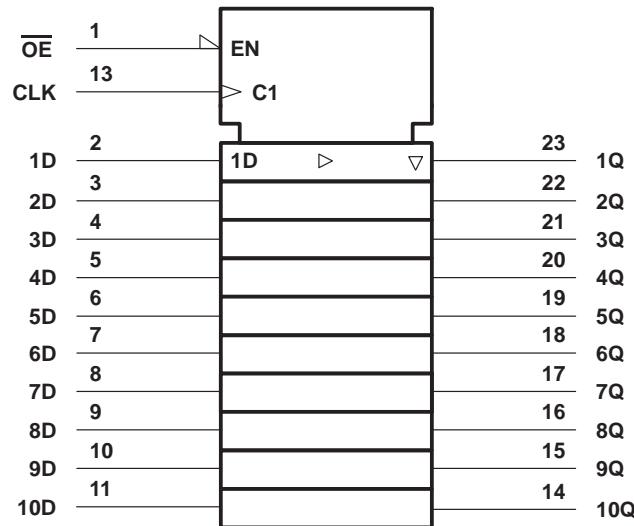


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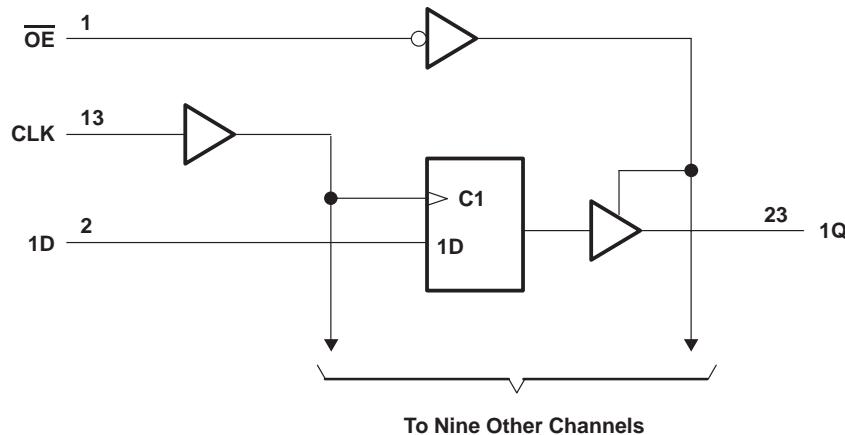
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## logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for the DW, JT, and NT packages.

## logic diagram (positive logic)



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

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

‡ 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.

**recommended operating conditions**

|                              |                                 | SN54AS821A |     |     | SN74AS821A |     |     | 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        | 2          |     |     | 2          |     |     | V    |
| V <sub>IL</sub>              | Low-level input voltage         |            |     | 0.8 |            |     | 0.8 | V    |
| I <sub>OH</sub>              | High-level output current       |            |     | -24 |            |     | -24 | mA   |
| I <sub>OL</sub>              | Low-level output current        |            |     | 32  |            |     | 48  | mA   |
| t <sub>w</sub> <sup>*</sup>  | Pulse duration, CLK high or low | 9          |     |     | 8          |     |     | ns   |
| t <sub>su</sub> <sup>*</sup> | Setup time, data before CLK↑    | 7          |     |     | 6          |     |     | ns   |
| t <sub>h</sub> <sup>*</sup>  | Hold time, data after CLK↑      | 0          |     |     | 0          |     |     | ns   |
| T <sub>A</sub>               | Operating free-air temperature  | -55        |     | 125 | 0          |     | 70  | °C   |

\* On products compliant to MIL-STD-883, Class B, this parameter is based on characterization data but is not production tested.

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

| PARAMETER                   | TEST CONDITIONS   | SN54AS821A                                      |                   |      | SN74AS821A          |                   |      | UNIT |
|-----------------------------|---|---|-------------------|------|---------------------|-------------------|------|------|
|                             |   | MIN   | TYPT <sup>†</sup> | MAX  | MIN                 | TYPT <sup>†</sup> | MAX  |      |
| V <sub>IK</sub>             | V <sub>CC</sub> = 4.5 V, I <sub>I</sub> = -18 mA          |   |                   | -1.2 |                     |                   | -1.2 | V    |
| V <sub>OH</sub>             | V <sub>CC</sub> = 4.5 V to 5.5 V, I <sub>OH</sub> = -2 mA | V <sub>CC</sub> - 2                             |                   |      | V <sub>CC</sub> - 2 |                   |      | V    |
|                             | V <sub>CC</sub> = 4.5 V                                   | I <sub>OH</sub> = -15 mA                        | 2.4               | 3.2  | 2.4                 | 3.2               |      |      |
| V <sub>OL</sub>             | V <sub>CC</sub> = 4.5 V                                   | I <sub>OH</sub> = -24 mA                        | 2                 |      | 2                   |                   |      | V    |
|                             |   | I <sub>OL</sub> = 32 mA                         | 0.25              | 0.5  |                     |                   | 0.35 |      |
| I <sub>OZH</sub>            | V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 2.7 V           |   |                   | 50   |                     |                   | 50   | µA   |
|                             | I <sub>OZL</sub>  | V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 0.4 V |                   | -50  |                     |                   | -50  | µA   |
| I <sub>I</sub>              | V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 7 V             |   |                   | 0.1  |                     |                   | 0.1  | mA   |
| I <sub>IH</sub>             | V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 2.7 V           |   |                   | 20   |                     |                   | 20   | µA   |
| I <sub>IL</sub>             | V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 0.4 V           |   |                   | -0.5 |                     |                   | -0.5 | mA   |
| I <sub>O</sub> <sup>‡</sup> | V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 2.25 V          | -30   | -112              | -30  | -112                |                   |      | mA   |
| I <sub>CC</sub>             | V <sub>CC</sub> = 5.5 V                                   | Outputs high                                    | 55                | 88   | 55                  | 88                |      | mA   |
|                             |   | Outputs low                                     | 68                | 109  | 68                  | 109               |      |      |
|                             |   | Outputs disabled                                | 70                | 113  | 70                  | 113               |      |      |

<sup>†</sup> All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

<sup>‡</sup> The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I<sub>OS</sub>.

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WITH 3-STATE OUTPUTS**

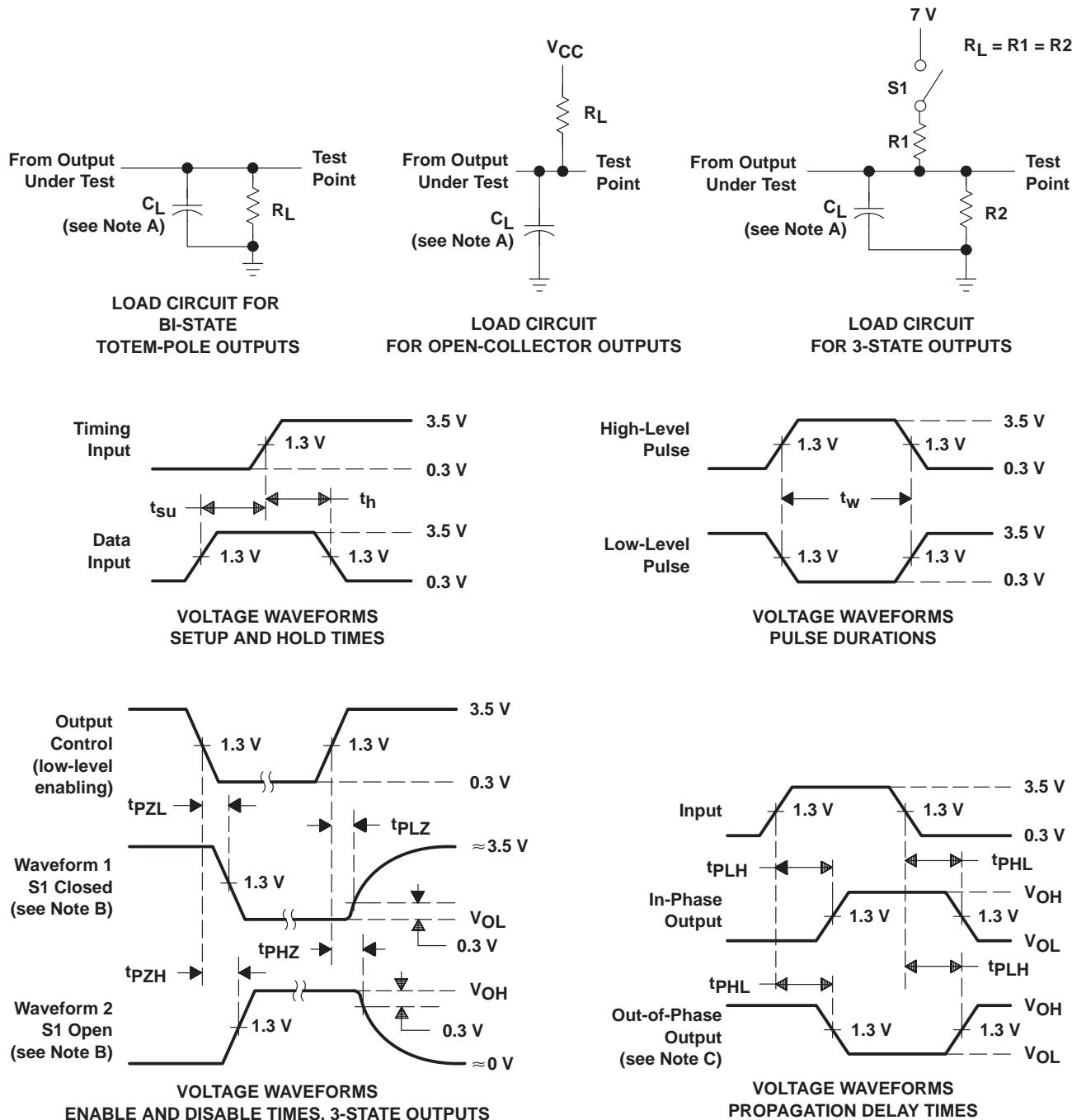
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**switching characteristics (see Figure 1)**

| PARAMETER | FROM<br>(INPUT) | TO<br>(OUTPUT) | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ ,<br>$C_L = 50\text{ pF}$ ,<br>$R1 = 500\text{ }\Omega$ ,<br>$R2 = 500\text{ }\Omega$ ,<br>$T_A = \text{MIN to MAX}^\dagger$ |     |            |     | UNIT |  |
|-----------|-----------------|----------------|--|-----|------------|-----|------|--|
|           |                 |                | SN54AS821A   |     | SN74AS821A |     |      |  |
|           |                 |                | MIN  | MAX | MIN        | MAX |      |  |
| $t_{PLH}$ | CLK             | Any Q          | 3.5  | 9   | 3.5        | 7.5 | ns   |  |
| $t_{PHL}$ |                 |                | 3.5  | 14  | 3.5        | 13  |      |  |
| $t_{PZH}$ | $\overline{OE}$ | Any Q          | 4  | 12  | 3          | 11  | ns   |  |
| $t_{PZL}$ |                 |                | 4  | 13  | 4          | 12  |      |  |
| $t_{PHZ}$ | $\overline{OE}$ | Any Q          | 1  | 10  | 1          | 8   | ns   |  |
| $t_{PLZ}$ |                 |                | 1  | 10  | 1          | 8   |      |  |

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

PARAMETER MEASUREMENT INFORMATION  
 SERIES 54ALS/74ALS AND 54AS/74AS DEVICES



NOTES: A.  $C_L$  includes probe and jig 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. When measuring propagation delay items of 3-state outputs, switch S1 is open.  
 D. All input pulses have the following characteristics:  $PRR \leq 1 \text{ MHz}$ ,  $t_r = t_f = 2 \text{ ns}$ , duty cycle = 50%.  
 E. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms

**PACKAGING INFORMATION**

| Orderable Device | Status<br>(1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan<br>(2)  | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5)          | Samples   |
|------------------|---------------|--------------|-----------------|------|-------------|------------------|--------------------------------------|----------------------|--------------|----------------------------------|---|
| 5962-9078001MLA  | ACTIVE        | CDIP         | JT              | 24   | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-9078001MLA<br>SNJ54AS821AJT | <span style="background-color: red; color: white; padding: 2px;">Samples</span> |
| SN54AS821AJT     | ACTIVE        | CDIP         | JT              | 24   | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | SN54AS821AJT                     | <span style="background-color: red; color: white; padding: 2px;">Samples</span> |
| SNJ54AS821AJT    | ACTIVE        | CDIP         | JT              | 24   | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-9078001MLA<br>SNJ54AS821AJT | <span style="background-color: red; color: white; padding: 2px;">Samples</span> |

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

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

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

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

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

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

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices 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.

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## PACKAGE OPTION ADDENDUM

4-Feb-2021

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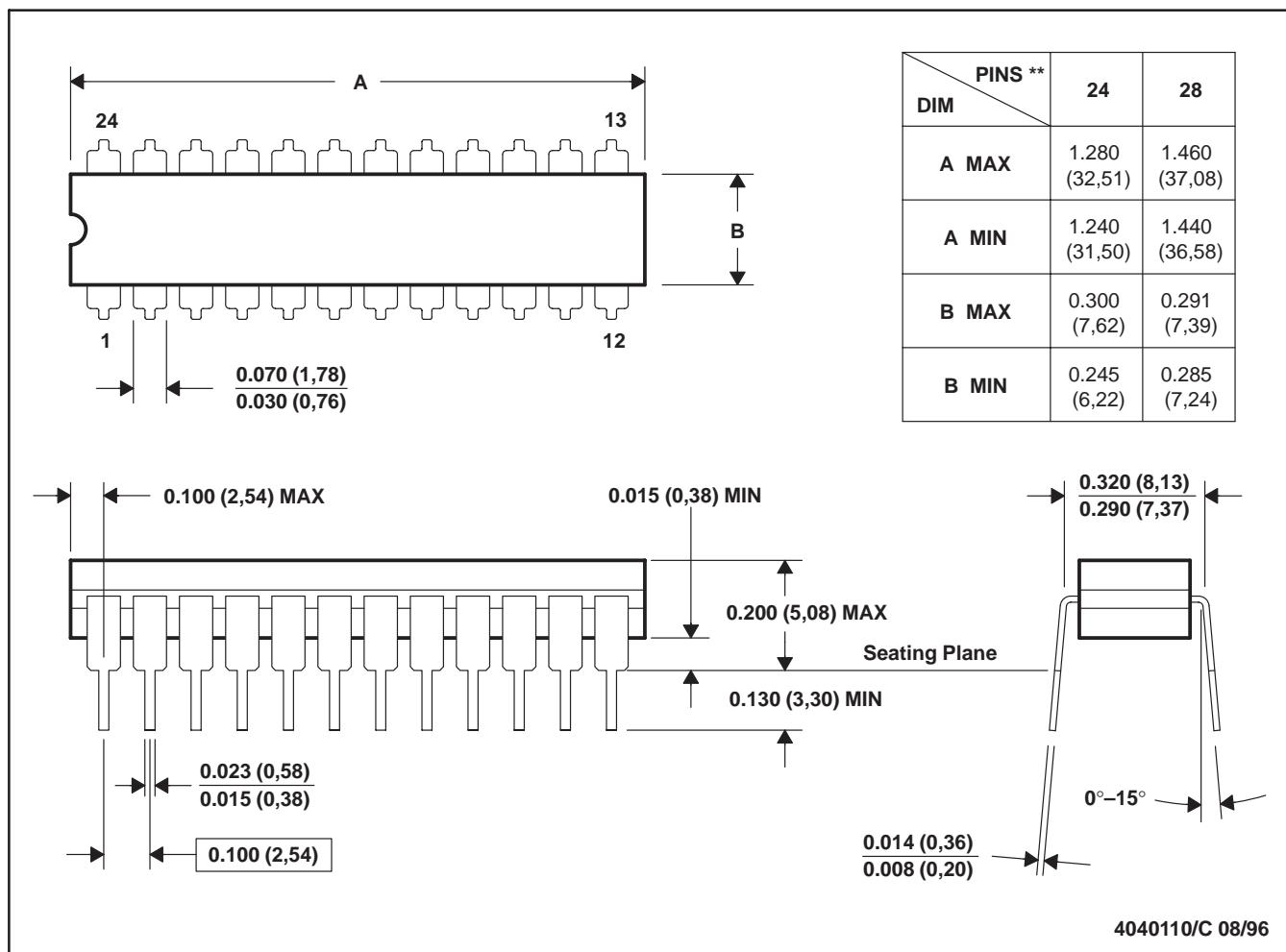
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## JT (R-GDIP-T\*\*)

24 LEADS SHOWN

## CERAMIC DUAL-IN-LINE



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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