National Semiconductor

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# DP8308 8-Bit TRI-STATE® Bidirectional Transceiver (Non-Inverting)

## General Description

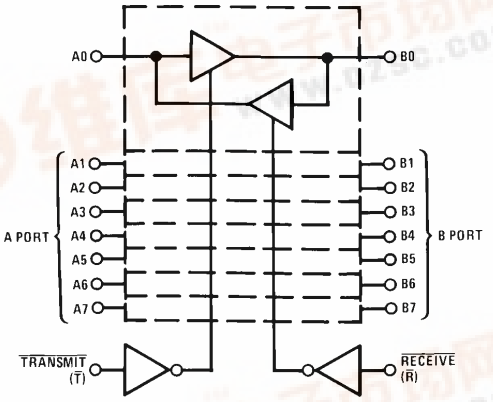
The DP8308 is a high speed Schottky 8-bit TRI-STATE bidirectional transceiver designed to provide bidirectional drive for bus oriented microprocessor and digital communications systems. It is capable of sinking 16 mA on the A ports and 48 mA on the B ports (bus ports). PNP inputs for low input current and an increased output high ($V_{OH}$) level allow compatibility with MOS, CMOS, and other technologies that have a higher threshold and less drive capabilities. In addition, it features glitch-free power up/down on the B port preventing erroneous glitches on the system bus in power up or down.

DP8308 is featured with $\overline{\text{Transmit}}$ ($\overline{\text{T}}$) and $\overline{\text{Receive}}$ ($\overline{\text{R}}$) control inputs.

## Features

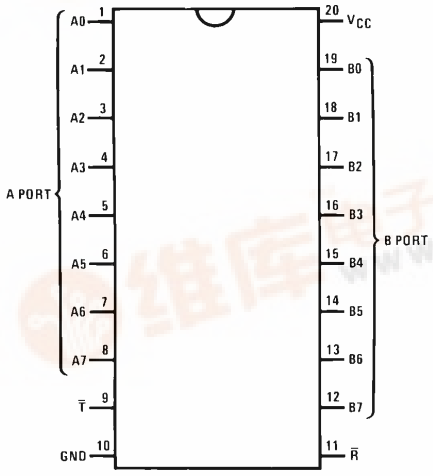
- 8-bit bidirectional data flow reduces system package count
- Bidirectional TRI-STATE inputs/outputs interface with bus oriented systems
- PNP inputs reduce input loading
- Output high voltage interfaces with TTL, MOS, and CMOS
- 48 mA/300 pF bus drive capability
- Pinouts simplify system interconnections
- Independent $\overline{\text{T}}$ and $\overline{\text{R}}$ controls for versatility
- Compact 20-pin dual-in-line package
- Bus port glitch free power up/down

## Logic and Connection Diagrams




TL/F/8795–1

**Dual-In-Line Package**




TL/F/8795–2

**Top View**

**Order Number DP8308N**
**See NS Package Number N20A**

## Logic Table

| Control Inputs | | Resulting Conditions | |
|---|---|---|---|
| $\overline{\text{Transmit}}$ | $\overline{\text{Receive}}$ | A Port | B Port |
| 1 | 0 | OUT | IN |
| 0 | 1 | IN | OUT |
| 1 | 1 | TRI-STATE | TRI-STATE |
| 0 | 0 | Both Active* | |

*This is not an intended logic condition and may cause oscillations.

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## Absolute Maximum Ratings (Note 1)

**If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.**

| | |
|---|---|
| Supply Voltage | 7V |
| Input Voltage | 5.5V |
| Output Voltage | 5.5V |
| Storage Temperature | −65°C to +150°C |
| Maximum Power Dissipation* at 25°C | |
| Cavity Package | 1667 mW |
| Molded Package | 1832 mW |
| Lead Temperature (soldering, 4 sec.) | 260°C |

*Derate cavity package 11.1 mW/°C above 25°C; derate molded package 14.7 mW/°C above 25°C.

## Recommended Operating Conditions

| | Min | Max | Units |
|---|---|---|---|
| Supply Voltage ($V_{CC}$) | | | |
| DP7308 | 4.5 | 5.5 | V |
| DP8308 | 4.75 | 5.25 | V |
| Temperature ($T_A$) | | | |
| DP7308 | −55 | +125 | °C |
| DP8308 | 0 | +70 | °C |

## DC Electrical Characteristics (Notes 2 and 3)

| Symbol | Parameter | Conditions | | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| **A PORT (A0−A7)** | | | | | | | |
| $V_{IH}$ | Logical "1" Input Voltage | $\overline{T} = V_{IL}$, $\overline{R} = 2.0V$ | | 2.0 | | | V |
| $V_{IL}$ | Logical "0" Input Voltage | $\overline{T} = V_{IL}$, $\overline{R} = 2.0V$ | DP8308 | | | 0.8 | V |
| | | | DP7308 | | | 0.7 | V |
| $V_{OH}$ | Logical "1" Output Voltage | $\overline{T} = 2.0V$, $\overline{R} = V_{IL}$ | $I_{OH} = -0.4$ mA | $V_{CC}-1.15$ | $V_{CC}-0.7$ | | V |
| | | | $I_{OH} = -3$ mA | 2.7 | 3.95 | | V |
| $V_{OL}$ | Logical "0" Output Voltage | $\overline{T} = 2.0V$, $\overline{R} = V_{IL}$ | $I_{OL} = 16$ mA (8308) | | 0.35 | 0.5 | V |
| | | | $I_{OL} = 8$ mA (both) | | 0.3 | 0.4 | V |
| $I_{OS}$ | Output Short Circuit Current | $\overline{T} = 2.0V$, $\overline{R} = V_{IL}$, $V_O = 0V$, $V_{CC}$ = Max (Note 4) | | −10 | −38 | −75 | mA |
| $I_{IH}$ | Logical "1" Input Current | $\overline{T} = V_{IL}$, $\overline{R} = 2.0V$, $V_{IH} = 2.7V$ | | | 0.1 | 80 | μA |
| $I_I$ | Input Current at Maximum Input Voltage | $\overline{R} = \overline{T} = 2.0V$, $V_{CC}$ = Max, $V_{IH} = 5.25V$ | | | | 1 | mA |
| $I_{IL}$ | Logical "0" Input Current | $\overline{T} = V_{IL}$, $\overline{R} = 2.0V$, $V_{IN} = 0.4V$ | | | −70 | −200 | μA |
| $V_{CLAMP}$ | Input Clamp Voltage | $\overline{T} = \overline{R} = 2.0V$, $I_{IN} = -12$ mA | | | −0.7 | −1.5 | V |
| $I_{OD}$ | Output/Input TRI-STATE Current | $\overline{T} = \overline{R} = 2.0V$ | $V_{IN} = 0.4V$ | | | −200 | μA |
| | | | $V_{IN} = 4.0V$ | | | 80 | μA |
| **B PORT (B0−B7)** | | | | | | | |
| $V_{IH}$ | Logical "1" Input Voltage | $\overline{T} = 2.0V$, $\overline{R} = V_{IL}$ | | 2.0 | | | V |
| $V_{IL}$ | Logical "0" Input Voltage | $\overline{T} = 2.0V$, $\overline{R} = V_{IL}$ | DP8308 | | | 0.8 | V |
| | | | DP7308 | | | 0.7 | V |
| $V_{OH}$ | Logical "1" Output Voltage | $\overline{T} = V_{IL}$, $\overline{R} = 2.0V$ | $I_{OH} = -0.4$ mA | $V_{CC}-1.15$ | $V_{CC}-0.8$ | | V |
| | | | $I_{OH} = -5$ mA | 2.7 | 3.9 | | V |
| | | | $I_{OH} = -10$ mA | 2.4 | 3.6 | | V |
| $V_{OL}$ | Logical "0" Output Voltage | $\overline{T} = V_{IL}$, $\overline{R} = 2.0V$ | $I_{OL} = 20$ mA | | 0.3 | 0.4 | V |
| | | | $I_{OL} = 48$ mA | | 0.4 | 0.5 | V |
| $I_{OS}$ | Output Short Circuit Current | $\overline{T} = V_{IL}$, $\overline{R} = 2.0V$, $V_O = 0V$, $V_{CC}$ = Max (Note 4) | | −25 | −50 | −150 | mA |
| $I_{IH}$ | Logical "1" Input Current | $\overline{T} = 2.0V$, $\overline{R} = V_{IL}$, $V_{IH} = 2.7V$ | | | 0.1 | 80 | μA |
| $I_I$ | Input Current at Maximum Input Voltage | $\overline{T} = \overline{R} = 2.0V$, $V_{CC}$ = Max, $V_{IH} = 5.25V$ | | | | 1 | mA |
| $I_{IL}$ | Logical "0" Input Current | $\overline{T} = 2.0V$, $\overline{R} = V_{IL}$, $V_{IN} = 0.4V$ | | | −70 | −200 | μA |
| $V_{CLAMP}$ | Input Clamp Voltage | $\overline{T} = \overline{R} = 2.0V$, $I_{IN} = -12$ mA | | | −0.7 | −1.5 | V |
| $I_{OD}$ | Output/Input TRI-STATE Current | $\overline{T} = \overline{R} = 2.0V$ | $V_{IN} = 0.4V$ | | | −200 | μA |
| | | | $V_{IN} = 4.0V$ | | | +200 | μA |

## DC Electrical Characteristics (Notes 2 and 3) (Continued)

| Symbol | Parameter | Conditions | | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| **CONTROL INPUTS $\overline{T}$, $\overline{R}$** | | | | | | | |
| $V_{IH}$ | Logical "1" Input Voltage | | | 2.0 | | | V |
| $V_{IL}$ | Logical "0" Input Voltage | | DP8308 | | | 0.8 | V |
| | | | DP7308 | | | 0.7 | V |
| $I_{IH}$ | Logical "1" Input Current | $V_{IH}$ = 2.7V | | | 0.5 | 20 | μA |
| $I_I$ | Maximum Input Current | $V_{CC}$ = Max, $V_{IH}$ = 5.25V | | | | 1.0 | mA |
| $I_{IL}$ | Logical "0" Input Current | $V_{IL}$ = 0.4V | $\overline{R}$ | | −0.1 | −0.25 | mA |
| | | | $\overline{T}$ | | −0.25 | −0.5 | mA |
| $V_{CLAMP}$ | Input Clamp Voltage | $I_{IN}$ = −12 mA | | | −0.8 | −1.5 | V |
| **POWER SUPPLY CURRENT** | | | | | | | |
| $I_{CC}$ | Power Supply Current | $\overline{T}$ = $\overline{R}$ = 2.0V, $V_{IN}$ = 0.4V, $V_{CC}$ = Max | | | 70 | 100 | mA |
| | | $\overline{T}$ = $V_{INA}$ = 0.4V, $\overline{R}$ = 2V, $V_{CC}$ = Max | | | 90 | 140 | mA |

## AC Electrical Characteristics $V_{CC}$ = 5V, $T_A$ = 25°C

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **A PORT DATA/MODE SPECIFICATIONS** | | | | | | |
| $t_{PDHLA}$ | Propagation Delay to a Logical "0" from B Port to A Port | $\overline{T}$ = 2.4V, $\overline{R}$ = 0.4V *(Figure A)*<br>R1 = 1k, R2 = 5k, C1 = 30 pF | | 14 | 18 | ns |
| $t_{PDLHA}$ | Propagation Delay to a Logical "1" from B Port to A Port | $\overline{T}$ = 2.4V, $\overline{R}$ = 0.4V *(Figure A)*<br>R1 = 1k, R2 = 5k, C1 = 30 pF | | 13 | 18 | ns |
| $t_{PLZA}$ | Propagation Delay from a Logical "0" to TRI-STATE from $\overline{R}$ to A Port | B0 to B7 = 0.4V, $\overline{T}$ = 2.4V *(Figure B)*<br>S3 = 1, R5 = 1k, C4 = 15 pF | | 11 | 15 | ns |
| $t_{PHZA}$ | Propagation Delay from a Logical "1" to TRI-STATE from $\overline{R}$ to A Port | B0 to B7 = 2.4V, $\overline{T}$ = 2.4V *(Figure B)*<br>S3 = 0, R5 = 1k, C4 = 15 pF | | 8 | 15 | ns |
| $t_{PZLA}$ | Propagation Delay from TRI-STATE to a Logical "0" from $\overline{R}$ to A Port | B0 to B7 = 0.4V, $\overline{T}$ = 2.4V *(Figure B)*<br>S3 = 1, R5 = 1k, C4 = 30 pF | | 24 | 35 | ns |
| $t_{PZHA}$ | Propagation Delay from TRI-STATE to a Logical "1" from $\overline{R}$ to A Port | B0 to B7 = 2.4V, $\overline{T}$ = 2.4V *(Figure B)*<br>S3 = 0, R5 = 5k, C4 = 30 pF | | 21 | 30 | ns |
| **B PORT DATA/MODE SPECIFICATIONS** | | | | | | |
| $t_{PDHLB}$ | Propagation Delay to a Logical "0" from A Port to B Port | $\overline{T}$ = 0.4V, $\overline{R}$ = 2.4V *(Figure A)*<br>R1 = 100Ω, R2 = 1k, C1 = 300 pF<br>R1 = 667Ω, R2 = 5k, C1 = 45 pF | | <br>18<br>11 | <br>23<br>18 | <br>ns<br>ns |
| $t_{PDLHB}$ | Propagation Delay to a Logical "1" from A Port to B Port | $\overline{T}$ = 0.4V, $\overline{R}$ = 2.4V *(Figure A)*<br>R1 = 100Ω, R2 = 1k, C1 = 300 pF<br>R1 = 667Ω, R2 = 5k, C1 = 45 pF | | <br>16<br>11 | <br>23<br>18 | <br>ns<br>ns |
| $t_{PLZB}$ | Propagation Delay from a Logical "0" to TRI-STATE from $\overline{T}$ to B Port | A0 to A7 = 0.4V, $\overline{R}$ = 2.4V *(Figure B)*<br>S3 = 1, R5 = 1k, C4 = 15 pF | | 13 | 18 | ns |
| $t_{PHZB}$ | Propagation Delay from a Logical "1" to TRI-STATE from $\overline{T}$ to B Port | A0 to A7 = 2.4V, $\overline{R}$ = 2.4V *(Figure B)*<br>S3 = 0, R5 = 1k, C4 = 15 pF | | 8 | 15 | ns |
| $t_{PZLB}$ | Propagation Delay from TRI-STATE to a Logical "0" from $\overline{T}$ to B Port | A0 to A7 = 0.4V, $\overline{R}$ = 2.4V *(Figure B)*<br>S3 = 1, R5 = 100Ω, C4 = 300 pF<br>S3 = 1, R5 = 667Ω, C4 = 45 pF | | <br>25<br>17 | <br>35<br>25 | <br>ns<br>ns |
| $t_{PZHB}$ | Propagation Delay from TRI-STATE to a Logical "1" from $\overline{T}$ to B Port | A0 to A7 = 2.4V, $\overline{R}$ = 2.4V *(Figure B)*<br>S3 = 0, R5 = 1k, C4 = 300 pF<br>S3 = 0, R5 = 5k, C4 = 45 pF | | <br>24<br>17 | <br>35<br>25 | <br>ns<br>ns |

## AC Electrical Characteristics (Continued)

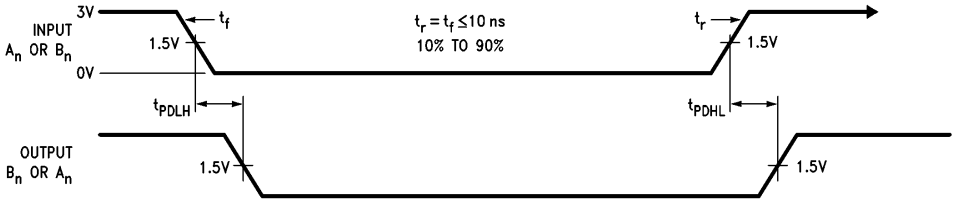
**Note 1:** "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

**Note 2:** Unless otherwise specified, min/max limits apply across the supply and temperature range listed in the table of Recommended Operating Conditions. All typical values given are for $V_{CC} = 5V$ and $T_A = 25°C$.

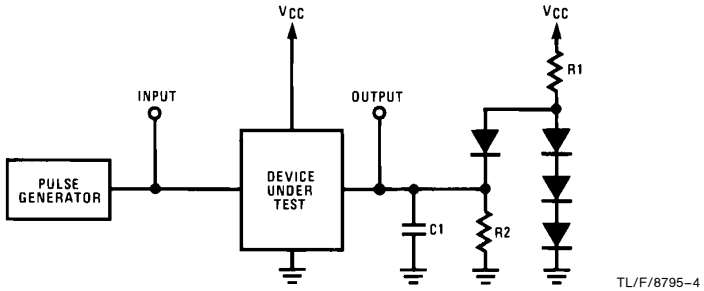
**Note 3:** All currents into device pins are positive; all currents out of device pins are negative. All voltages are referenced to ground unless otherwise specified.

**Note 4:** Only one output at a time should be shorted.

## Switching Time Waveforms and AC Test Circuits



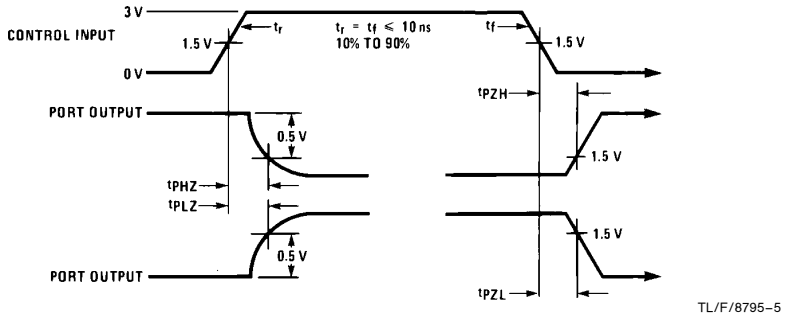

TL/F/8795–3



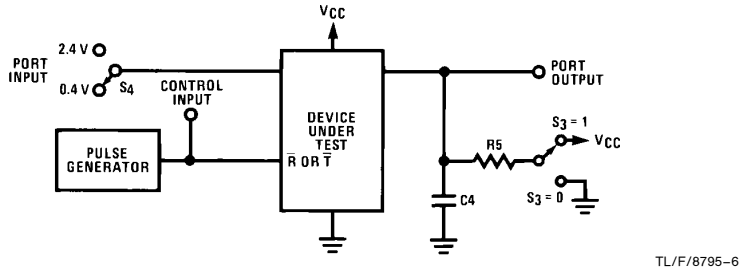

TL/F/8795–4

**Note:** C1 includes test fixture capacitance.

**FIGURE A. Propagation Delay from A Port to B Port or from B Port to A Port**



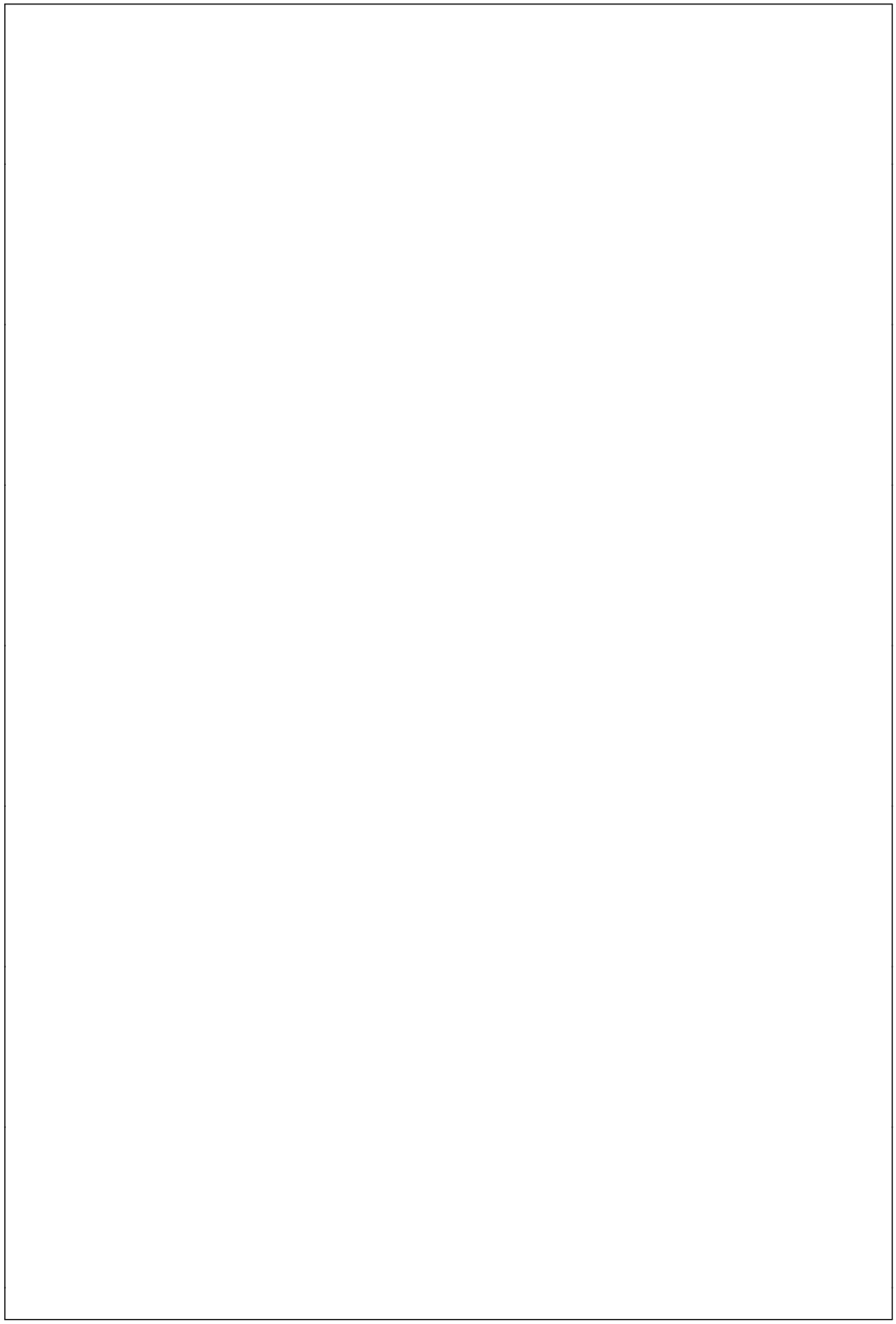

TL/F/8795–5



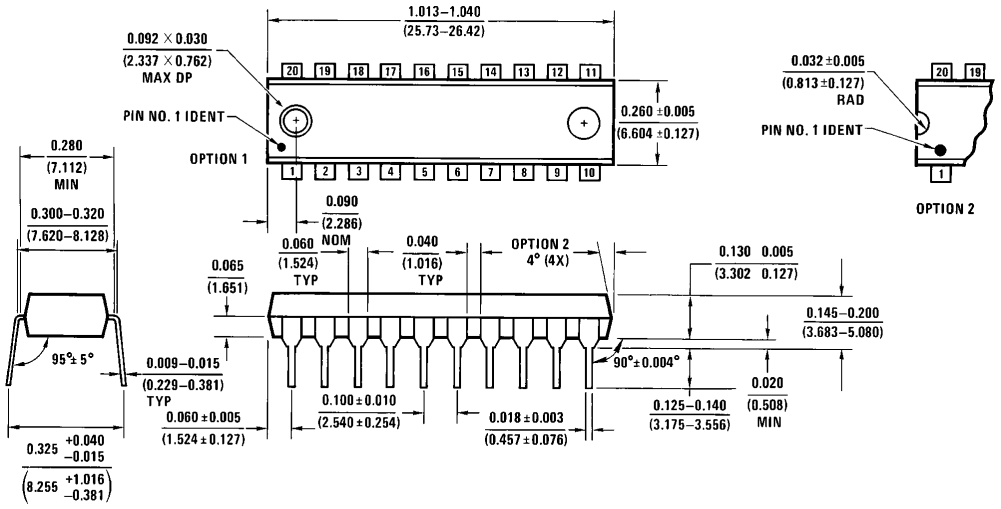

TL/F/8795–6

**Note:** C4 includes test fixture capacitance. Port input is in a fixed logical condition. See AC Table.

**FIGURE B. Propagation Delay to/from TRI-STATE from $\overline{R}$ to A Port and $\overline{T}$ to B Port**



## Physical Dimensions inches (millimeters)




**Molded Dual-In-Line Package (N)**
**Order Number DP8308N**
**NS Package Number N20A**

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