# 54ABT244

***54ABT244 Octal Buffer/Line Driver with TRI-STATE Outputs***

Literature Number: SNOS041A

National Semiconductor

# 54ABT244

**OBSOLETE**
September 21, 2011

# Octal Buffer/Line Driver with TRI-STATE® Outputs

## General Description

The 'ABT244 is an octal buffer and line driver with TRI-STATE outputs designed to be employed as a memory and address driver, clock driver, or bus-oriented transmitter/receiver.

## Features

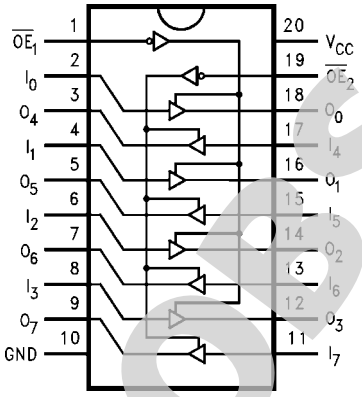
- Non-inverting buffers
- Output sink capability of 48 mA, source capability of 24 mA
- Output switching specified for both 50 pF and 250 pF loads
- Guaranteed simultaneous switching, noise level and dynamic threshold performance
- Guaranteed latchup protection
- High impedance glitch free bus loading during entire power up and power down cycle
- Nondestructive hot insertion capability
- Disable time less than enable time to avoid bus contention
- Standard Microcircuit Drawing (SMD) 5962-9214701

## Ordering Code

| Military | Package Number | Package Description |
|---|---|---|
| 54ABT244J-QML | J20A | 20-Lead Ceramic Dual-In-Line |
| 54ABT244W-QML | W20A | 20-Lead Cerpack |
| 54ABT244E-QML | E20A | 20-Lead Ceramic Leadless Chip Carrier, Type C |

## Connection Diagrams

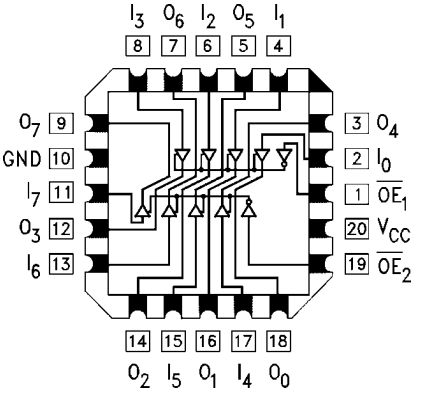
**Pin Assignment for DIP and Flatpak**




10020301

| Pin Names | Description |
|---|---|
| $\overline{OE}_1$, $\overline{OE}_2$ | Output Enable Input (Active Low) |
| $I_0$–$I_7$ | Inputs |
| $O_0$–$O_7$ | Outputs |

**Pin Assignment for LCC**




10020302

## Truth Table

| $\overline{OE}_1$ | $I_{0-3}$ | $O_{0-3}$ | $\overline{OE}_2$ | $I_{4-7}$ | $O_{4-7}$ |
|---|---|---|---|---|---|
| H | X | Z | H | X | Z |
| L | H | H | L | H | H |
| L | L | L | L | L | L |

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial
Z = High Impedance



TRI-STATE® is a registered trademark of National Semiconductor Corporation.

## Absolute Maximum Ratings (*Note 1*)

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

| | |
|---|---|
| Storage Temperature | −65°C to +150°C |
| Ambient Temperature under Bias | −55°C to +125°C |
| Junction Temperature under Bias | |
| Ceramic | −55°C to +175°C |
| $V_{CC}$ Pin Potential to Ground Pin | −0.5V to +7.0V |
| Input Voltage (*Note 2*) | −0.5V to +7.0V |
| Input Current (*Note 2*) | −30 mA to +5.0 mA |
| Voltage Applied to Any Output | |
| in the Disabled or | |
| Power-Off State | −0.5V to 5.5V |
| in the HIGH State | −0.5V to $V_{CC}$ |
| Current Applied to Output | |
| in LOW State (Max) | twice the rated $I_{OL}$ (mA) |
| DC Latchup Source Current | −500 mA |
| Over Voltage Latchup (I/O) | 10V |

## Recommended Operating Conditions

| | |
|---|---|
| Free Air Ambient Temperature | |
| Military | −55°C to +125°C |
| Supply Voltage | |
| Military | +4.5V to +5.5V |
| Minimum Input Edge Rate | (ΔV/Δt) |
| Data Input | 50 mV/ns |
| Enable Input | 20 mV/ns |

## DC Electrical Characteristics

| Symbol | Parameter | | ABT244 Min | ABT244 Typ | ABT244 Max | Units | $V_{CC}$ | Conditions |
|---|---|---|---|---|---|---|---|---|
| $V_{IH}$ | Input HIGH Voltage | | 2.0 | | | V | | Recognized HIGH Signal |
| $V_{IL}$ | Input LOW Voltage | | | | 0.8 | V | | Recognized LOW Signal |
| $V_{CD}$ | Input Clamp Diode Voltage | | | | −1.2 | V | Min | $I_{IN}$ = −18 mA |
| $V_{OH}$ | Output HIGH Voltage | 54ABT | 2.5 | | | V | Min | $I_{OH}$ = −3 mA |
| | | 54ABT | 2.0 | | | V | Min | $I_{OH}$ = −24 mA |
| $V_{OL}$ | Output LOW Voltage | 54ABT | | | 0.55 | V | Min | $I_{OL}$ = 48 mA |
| $I_{IH}$ | Input HIGH Current | | | | 5 | μA | Max | $V_{IN}$ = 2.7V (*Note 4*) |
| | | | | | 5 | | | $V_{IN}$ = $V_{CC}$ |
| $I_{BVI}$ | Input HIGH Current Breakdown Test | | | | 7 | μA | Max | $V_{IN}$ = 7.0V |
| $I_{IL}$ | Input LOW Current | | | | −5 | μA | Max | $V_{IN}$ = 0.5V (*Note 4*) |
| | | | | | −5 | | | $V_{IN}$ = 0.0V |
| $V_{ID}$ | Input Leakage Test | | 4.75 | | | V | 0.0 | $I_{ID}$ = 1.9 μA<br>All Other Pins Grounded |
| $I_{OZH}$ | Output Leakage Current | | | | 50 | μA | 0 – 5.5V | $V_{OUT}$ = 2.7V; $\overline{OE}_n$ = 2.0V |
| $I_{OZL}$ | Output Leakage Current | | | | −50 | μA | 0 – 5.5V | $V_{OUT}$ = 0.5V; $\overline{OE}_n$ = 2.0V |
| $I_{OS}$ | Output Short-Circuit Current | | −100 | | −275 | mA | Max | $V_{OUT}$ = 0.0V |
| $I_{CEX}$ | Output High Leakage Current | | | | 50 | μA | Max | $V_{OUT}$ = $V_{CC}$ |
| $I_{ZZ}$ | Bus Drainage Test | | | | 100 | μA | 0.0 | $V_{OUT}$ = 5.5V; All Others GND |
| $I_{CCH}$ | Power Supply Current | | | | 50 | μA | Max | All Outputs HIGH |
| $I_{CCL}$ | Power Supply Current | | | | 30 | mA | Max | All Outputs LOW |
| $I_{CCZ}$ | Power Supply Current | | | | 50 | μA | Max | $\overline{OE}_n$ = $V_{CC}$;<br>All Others at $V_{CC}$ or Ground |
| $I_{CCT}$ | Additional $I_{CC}$/Input | Outputs Enabled | | | 2.5 | mA | Max | $V_I$ = $V_{CC}$ − 2.1V |
| | | Outputs TRI-STATE | | | 2.5 | mA | | Enable Input $V_I$ = $V_{CC}$ − 2.1V |
| | | Outputs TRI-STATE | | | 50 | μA | | Data Input $V_I$ = $V_{CC}$ − 2.1V |
| | | | | | | | | All Others at $V_{CC}$ or Ground |
| $I_{CCD}$ | Dynamic $I_{CC}$ (*Note 4*) | No Load | | | 0.1 | mA/ MHz | Max | Outputs Open<br>$\overline{OE}_n$ = GND, (*Note 3*)<br>One Bit Toggling, 50% Duty Cycle |

**Note 1:** Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

**Note 2:** Either voltage limit or current limit is sufficient to protect inputs.

**Note 3:** For 8 bits toggling, $I_{CCD}$ < 0.8 mA/MHz.

**Note 4:** Guaranteed, but not tested.

## AC Electrical Characteristics

| Symbol | Parameter | 54ABT $T_A$ = −55°C to +125°C, $V_{CC}$ = 4.5V–5.5V, $C_L$ = 50 pF | | Units | Fig. No. |
|---|---|---|---|---|---|
| | | Min | Max | | |
| $t_{PLH}$ | Propagation Delay | 1.0 | 5.3 | ns | *Figure 5* |
| $t_{PHL}$ | Data to Outputs | 1.0 | 5.0 | | |
| $t_{PZH}$ | Output Enable | 0.8 | 6.5 | ns | *Figure 4* |
| $t_{PZL}$ | Time | 1.2 | 7.9 | | |
| $t_{PHZ}$ | Output Disable | 1.2 | 7.6 | ns | *Figure 4* |
| $t_{PLZ}$ | Time | 1.0 | 7.9 | | |

## Capacitance

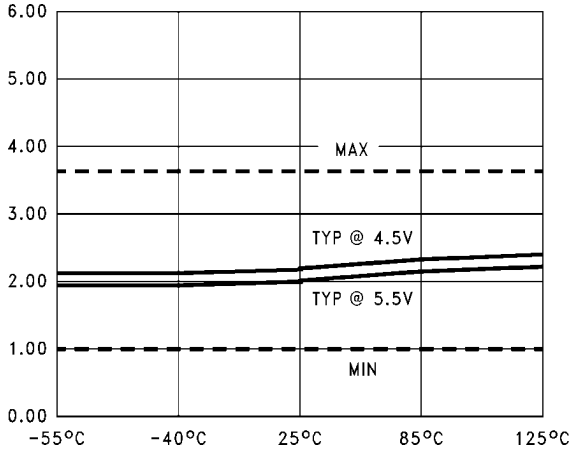
| Symbol | Parameter | Typ | Units | Conditions $T_A$ = 25°C |
|---|---|---|---|---|
| $C_{IN}$ | Input Capacitance | 5.0 | pF | $V_{CC}$ = 0V |
| $C_{OUT}$ (*Note 5*) | Output Capacitance | 9.0 | pF | $V_{CC}$ = 5.0V |

**Note 5:** $C_{OUT}$ is measured at frequency f = 1 MHz, per MIL-STD-883B, Method 3012.

## Typical Performance Curves

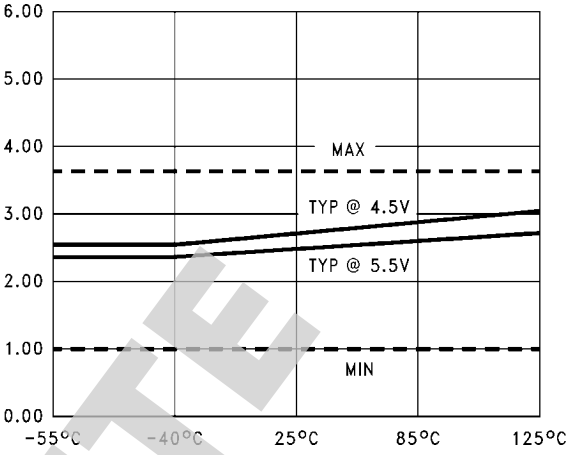
Dashed lines represent design characteristics; for specified guarantees refer to AC Characteristics Table.

$t_{PLH}$ vs Temperature ($T_A$)
$C_L$ = 50 pF, 1 Output Switching



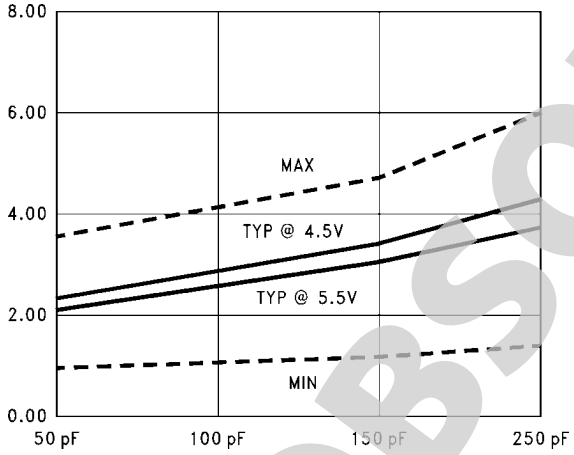

10020311

$t_{PHL}$ vs Temperature ($T_A$)
$C_L$ = 50 pF, 1 Output Switching



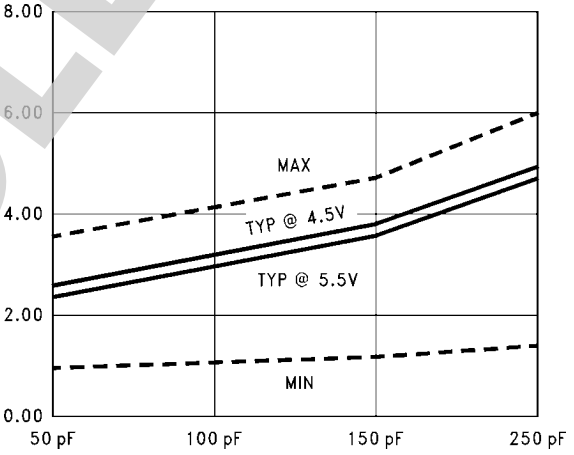

10020312

$t_{PLH}$ vs Load Capacitance
1 Output Switching, $T_A$ = 25°C



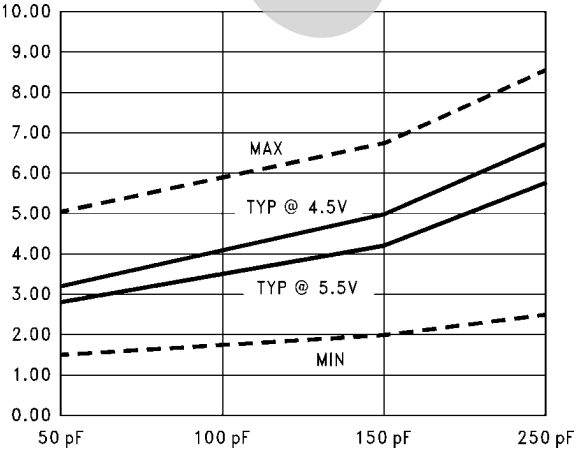

10020313

$t_{PHL}$ vs Load Capacitance
1 Output Switching, $T_A$ = 25°C



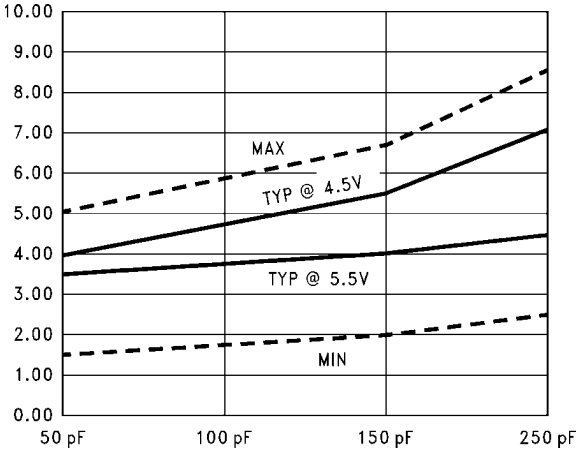

10020314

$t_{PLH}$ vs Load Capacitance
8 Outputs Switching, $T_A$ = 25°C



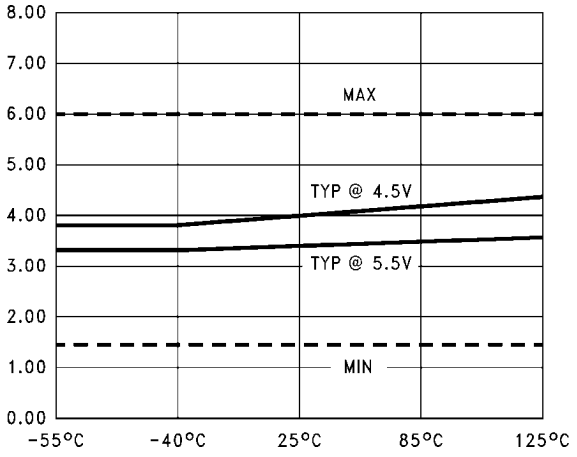

10020315

$t_{PHL}$ vs Load Capacitance
8 Outputs Switching, $T_A$ = 25°C



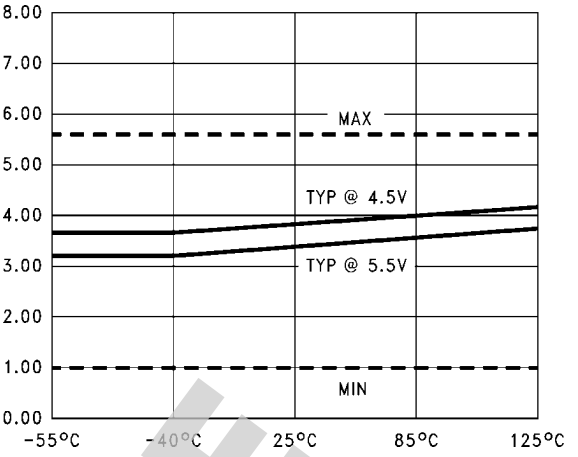

10020316

**$t_{PZL}$ vs Temperature ($T_A$)**
**$C_L$ = 50 pF, 1 Output Switching**



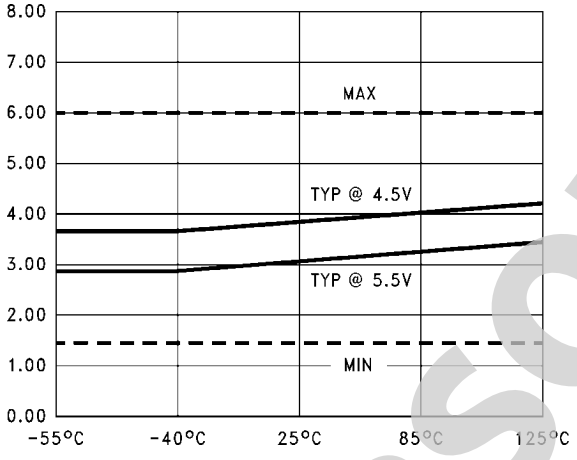

10020317

**$t_{PLZ}$ vs Temperature ($T_A$)**
**$C_L$ = 50 pF, 1 Output Switching**



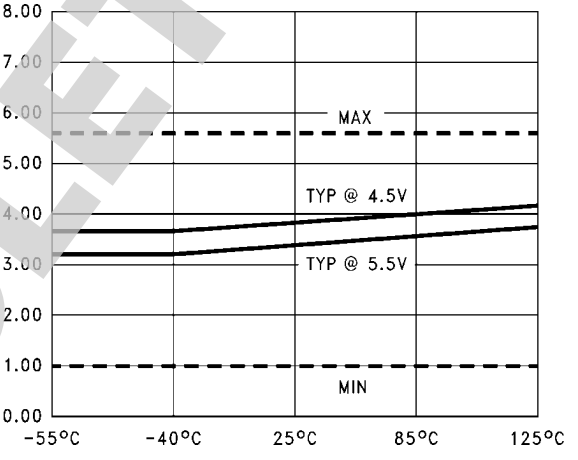

10020318

**$t_{PZH}$ vs Temperature ($T_A$)**
**$C_L$ = 50 pF, 1 Output Switching**



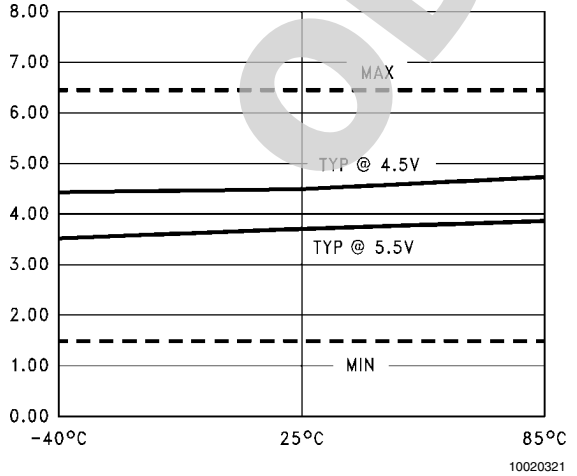

10020319

**$t_{PHZ}$ vs Temperature ($T_A$)**
**$C_L$ = 50 pF, 1 Output Switching**



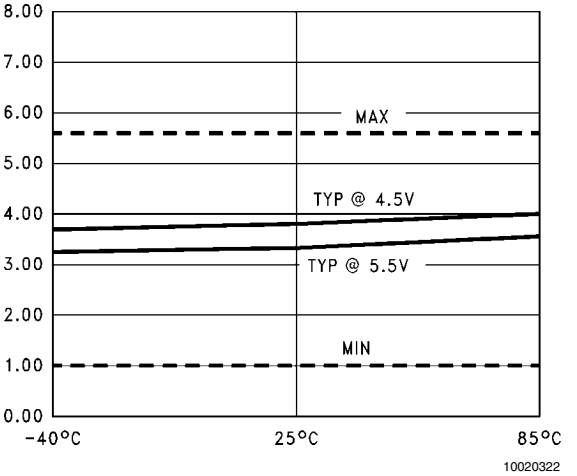

10020320

**$t_{PZH}$ vs Temperature ($T_A$)**
**$C_L$ = 50 pF, 8 Outputs Switching**




10020321

**$t_{PHZ}$ vs Temperature ($T_A$)**
**$C_L$ = 50 pF, 8 Outputs Switching**



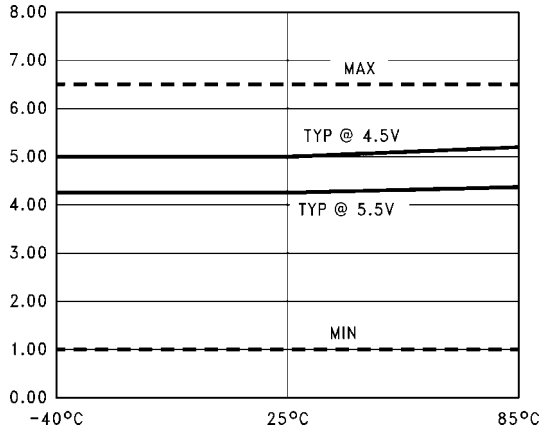

10020322





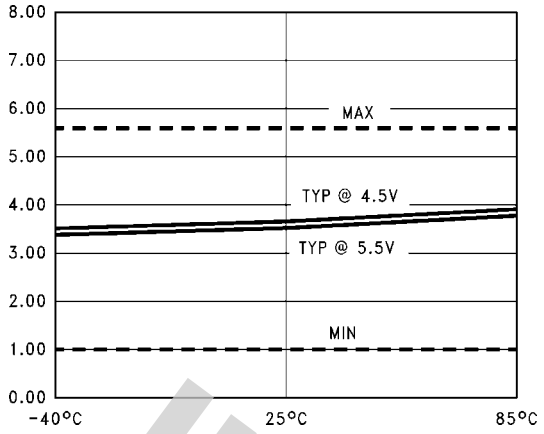
100203 Version 2 Revision 4 Print Date/Time: 2011/09/21 11:17:44

**$t_{PZL}$ vs Temperature ($T_A$)**
**$C_L$ = 50 pF, 8 Outputs Switching**



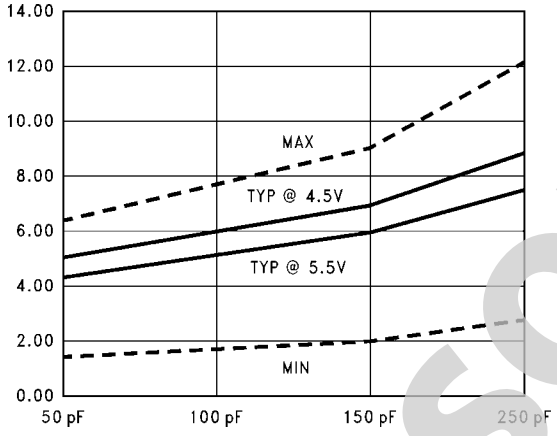

10020323

**$t_{PLZ}$ vs Temperature ($T_A$)**
**$C_L$ = 50 pF, 8 Outputs Switching**



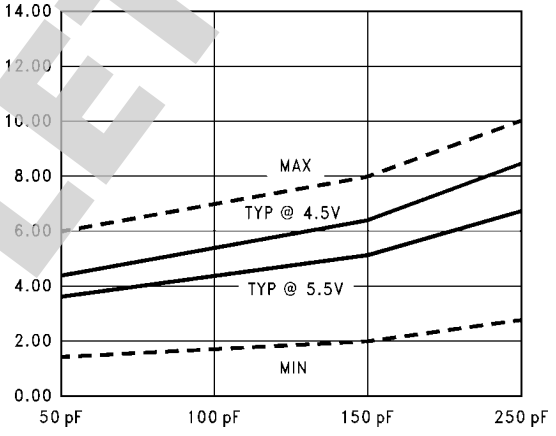

10020324

**$t_{PZL}$ vs Load Capacitance**
**8 Outputs Switching**
**$T_A$ = 25°C**



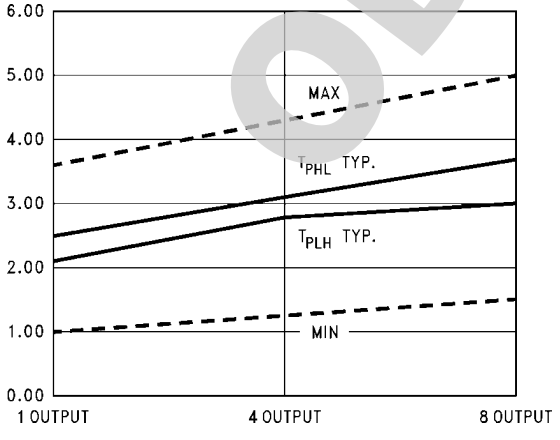

10020325

**$t_{PZH}$ vs Load Capacitance**
**8 Outputs Switching**
**$T_A$ = 25°C**



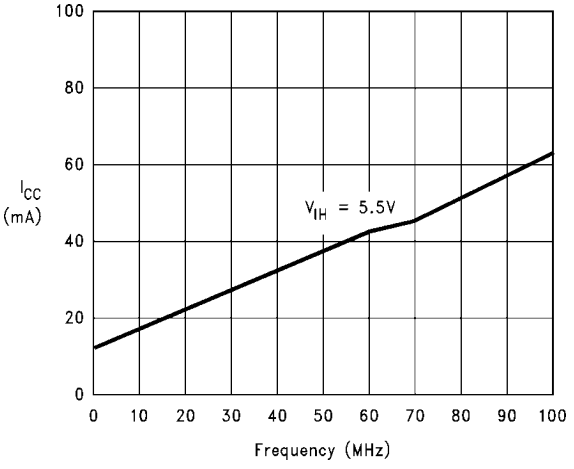

10020326

**$t_{PLH}$ and $t_{PHL}$ vs Number**
**Outputs Switching $V_{CC}$ = 5.0V,**
**$T_A$ = 25°C, $C_L$ = 50 pF**



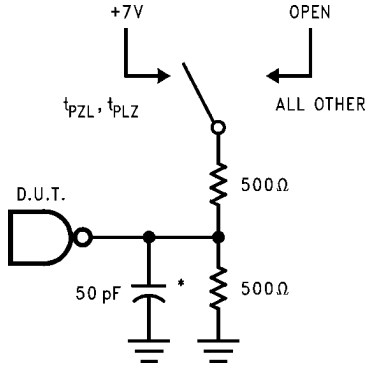

10020327

**$I_{CC}$ vs Frequency,**
**Average, $T_A$ = 25°C,**
**All Outputs Unloaded/Unterminated**




10020328

## AC Loading




*Includes jig and probe capacitance

**FIGURE 1. Standard AC Test Load**

| Amplitude | Rep. Rate | $t_w$ | $t_r$ | $t_f$ |
|---|---|---|---|---|
| 3.0V | 1 MHz | 500 ns | 2.5 ns | 2.5 ns |

**FIGURE 3. Test Input Signal Requirements**

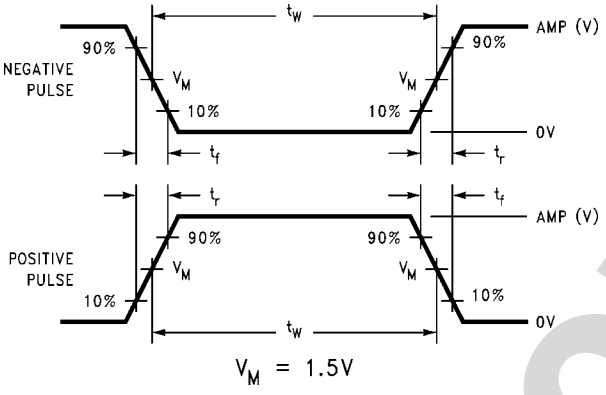



**FIGURE 2. Test Input Signal Levels**

## AC Waveforms

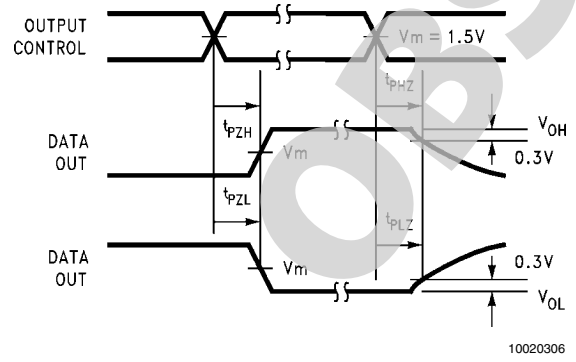



**FIGURE 4. TRI-STATE Output HIGH and LOW Enable and Disable Times**

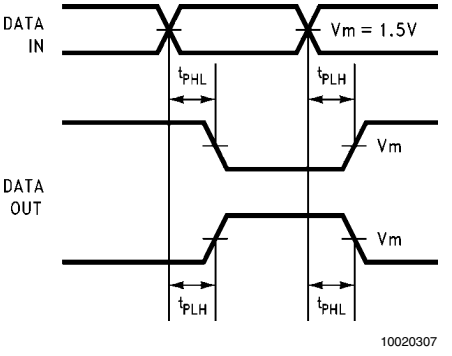
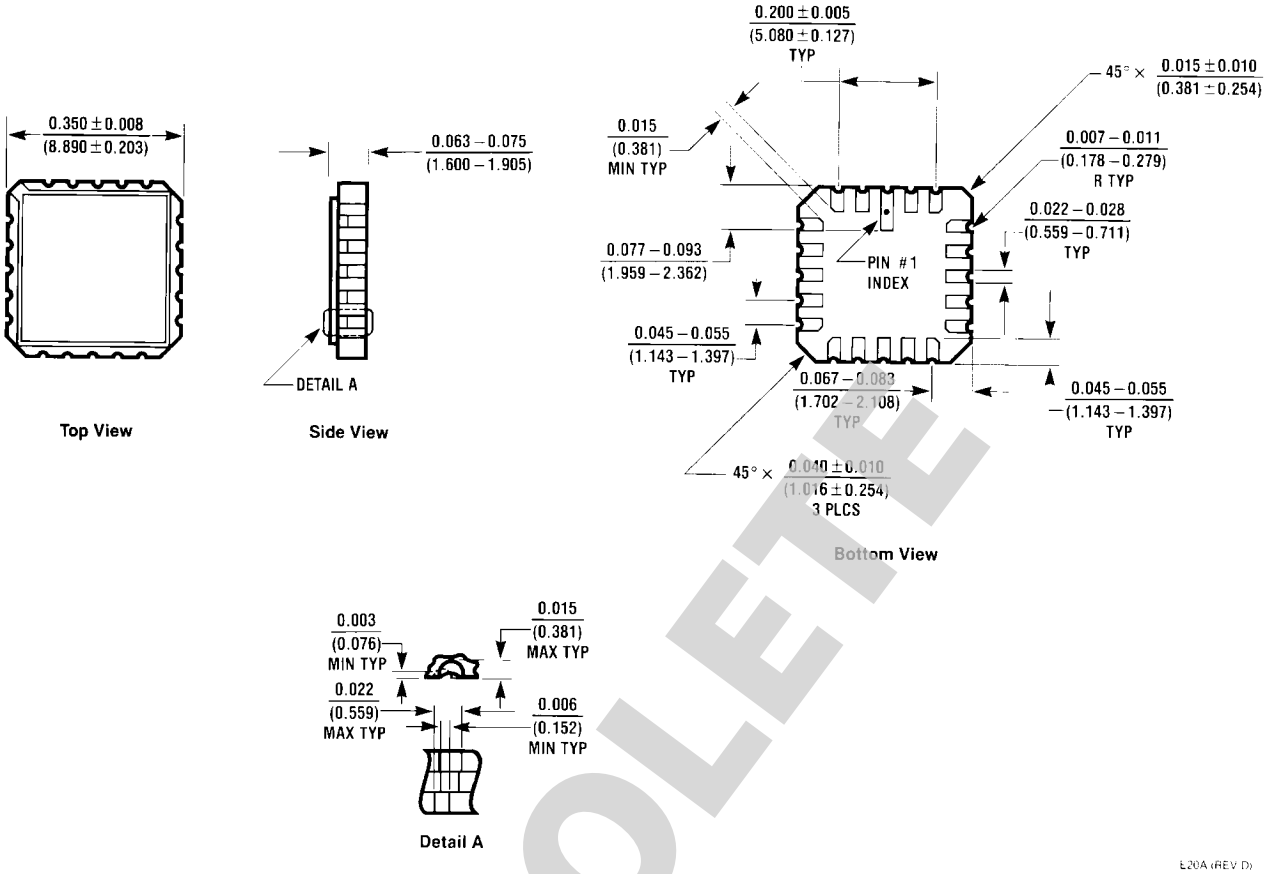


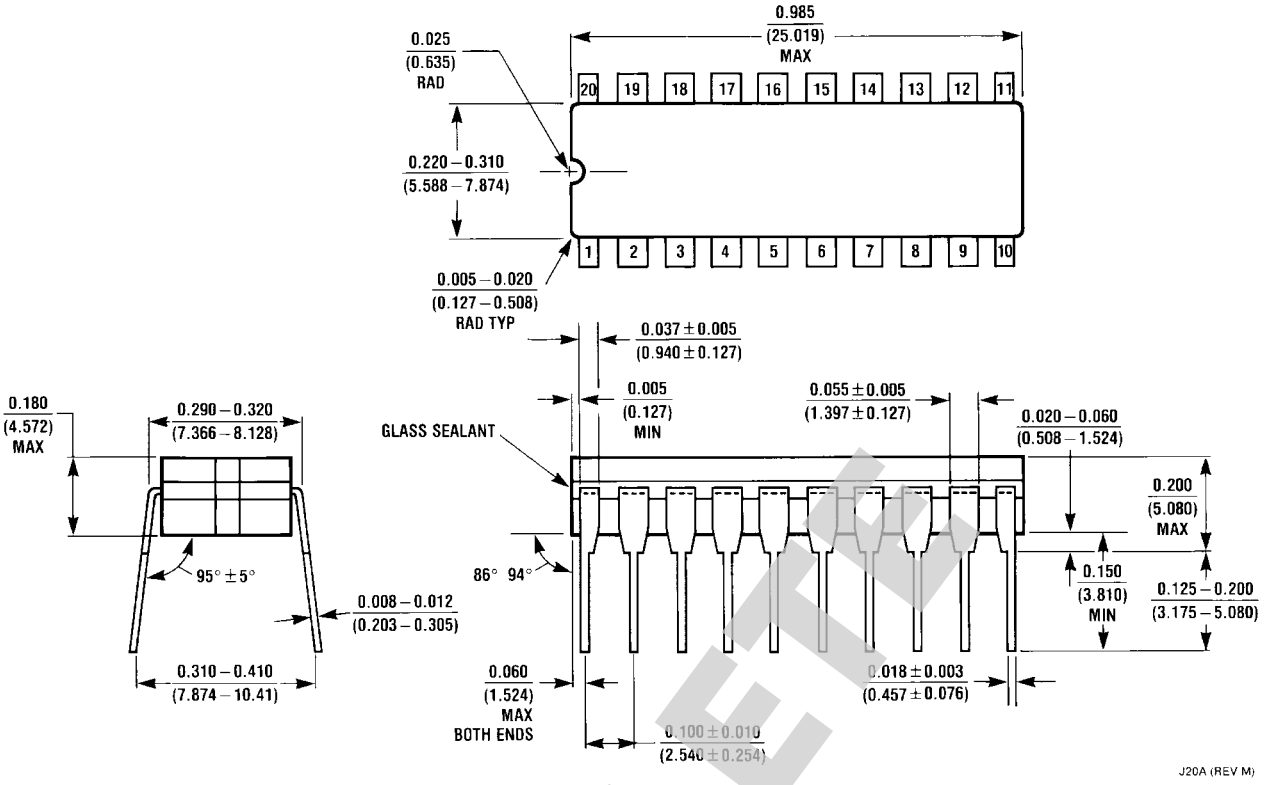

**FIGURE 5. Propagation Delay Waveforms for Inverting and Non-Inverting Functions**

## Physical Dimensions inches (millimeters) unless otherwise noted

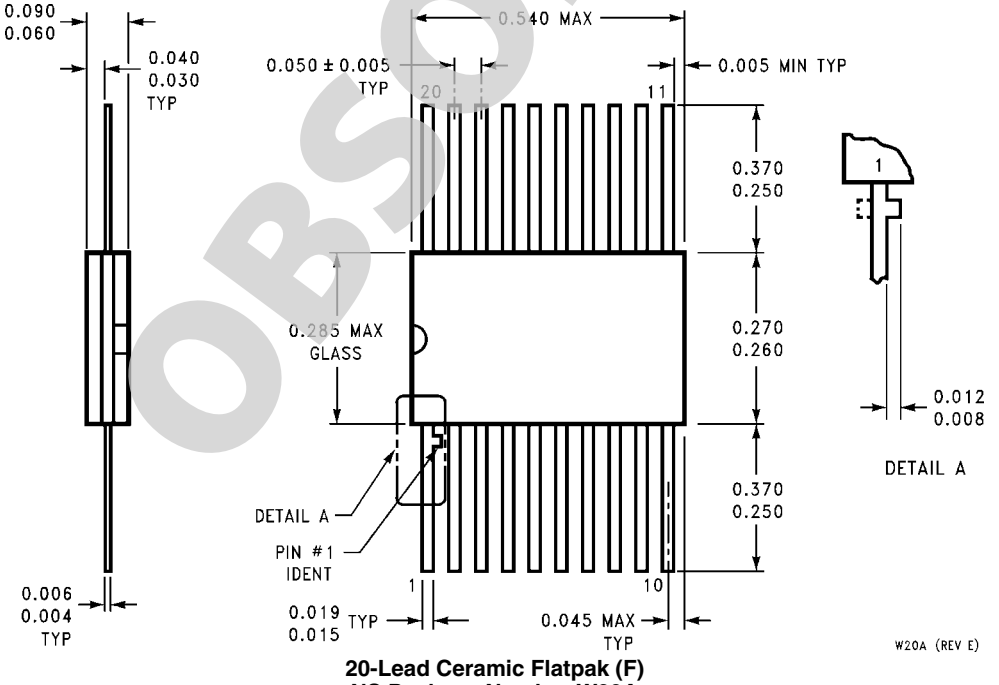



E20A (REV D)

**20-Terminal Ceramic Chip Carrier (L)**
**NS Package Number E20A**




**20-Lead Ceramic Dual-In-Line (D)**
**NS Package Number J20A**




**20-Lead Ceramic Flatpak (F)**
**NS Package Number W20A**

# Notes

**For more National Semiconductor product information and proven design tools, visit the following Web sites at: www.national.com**

| Products | | Design Support | |
|---|---|---|---|
| Amplifiers | www.national.com/amplifiers | WEBENCH® Tools | www.national.com/webench |
| Audio | www.national.com/audio | App Notes | www.national.com/appnotes |
| Clock and Timing | www.national.com/timing | Reference Designs | www.national.com/refdesigns |
| Data Converters | www.national.com/adc | Samples | www.national.com/samples |
| Interface | www.national.com/interface | Eval Boards | www.national.com/evalboards |
| LVDS | www.national.com/lvds | Packaging | www.national.com/packaging |
| Power Management | www.national.com/power | Green Compliance | www.national.com/quality/green |
| Switching Regulators | www.national.com/switchers | Distributors | www.national.com/contacts |
| LDOs | www.national.com/ldo | Quality and Reliability | www.national.com/quality |
| LED Lighting | www.national.com/led | Feedback/Support | www.national.com/feedback |
| Voltage References | www.national.com/vref | Design Made Easy | www.national.com/easy |
| PowerWise® Solutions | www.national.com/powerwise | Applications & Markets | www.national.com/solutions |
| Serial Digital Interface (SDI) | www.national.com/sdi | Mil/Aero | www.national.com/milaero |
| Temperature Sensors | www.national.com/tempsensors | SolarMagic™ | www.national.com/solarmagic |
| PLL/VCO | www.national.com/wireless | PowerWise® Design University | www.national.com/training |





LIFE SUPPORT POLICY

**NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS PRIOR WRITTEN APPROVAL OF THE CHIEF EXECUTIVE OFFICER AND GENERAL COUNSEL OF NATIONAL SEMICONDUCTOR CORPORATION.** As used herein:

Life support devices or systems are devices which (a) are intended for surgical implant into the body, or (b) support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in a significant injury to the user. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system or to affect its safety or effectiveness.



For the most current product information visit us at www.national.com

www.national.com

**National Semiconductor Americas Technical Support Center**
Email: support@nsc.com
Tel: 1-800-272-9959

**National Semiconductor Europe Technical Support Center**
Email: europe.support@nsc.com

**National Semiconductor Asia Pacific Technical Support Center**
Email: ap.support@nsc.com

**National Semiconductor Japan Technical Support Center**
Email: jpn.feedback@nsc.com

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

| **Products** | | **Applications** | |
|---|---|---|---|
| Audio | www.ti.com/audio | Communications and Telecom | www.ti.com/communications |
| Amplifiers | amplifier.ti.com | Computers and Peripherals | www.ti.com/computers |
| Data Converters | dataconverter.ti.com | Consumer Electronics | www.ti.com/consumer-apps |
| DLP® Products | www.dlp.com | Energy and Lighting | www.ti.com/energy |
| DSP | dsp.ti.com | Industrial | www.ti.com/industrial |
| Clocks and Timers | www.ti.com/clocks | Medical | www.ti.com/medical |
| Interface | interface.ti.com | Security | www.ti.com/security |
| Logic | logic.ti.com | Space, Avionics and Defense | www.ti.com/space-avionics-defense |
| Power Mgmt | power.ti.com | Transportation and Automotive | www.ti.com/automotive |
| Microcontrollers | microcontroller.ti.com | Video and Imaging | www.ti.com/video |
| RFID | www.ti-rfid.com | | |
| OMAP Mobile Processors | www.ti.com/omap | | |
| Wireless Connectivity | www.ti.com/wirelessconnectivity | | |
| | **TI E2E Community Home Page** | | e2e.ti.com |

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265