

# 54AC/74AC540 Octal Buffer/Line Driver with TRI-STATE® Outputs

## General Description

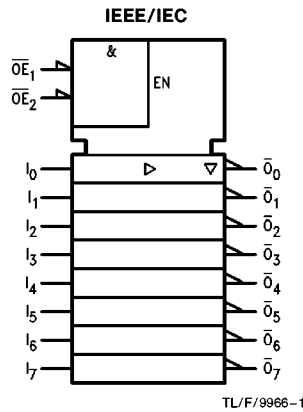
The 'AC540 is an octal buffer/line drivers designed to be employed as memory and address drivers, clock drivers and bus oriented transmitter/receivers.

These devices are similar in function to the 'AC240 while providing flow-through architecture (inputs on opposite side from outputs). This pinout arrangement makes these devices especially useful as output ports for microprocessors, allowing ease of layout and greater PC board density.

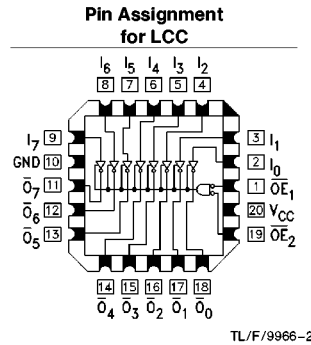
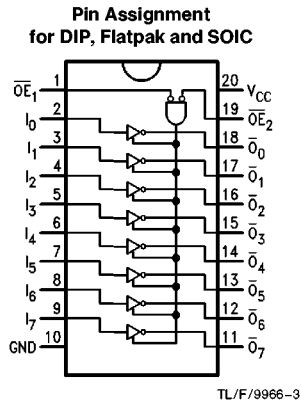
## Features

- $I_{CC}$  and  $I_{OZ}$  reduced by 50%
- TRI-STATE inverting outputs
- Inputs and outputs opposite side of package, allowing easier interface to microprocessors
- Output source/sink 24 mA
- Standard Military Drawing 54AC540: 5962-8769501

## Logic Symbol



## Connection Diagrams



## Truth Table

Inputs			Outputs
$\overline{OE}_1$	$\overline{OE}_2$	I	
L	L	H	L
H	X	X	Z
X	H	X	Z
L	L	L	H

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

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

54AC/74AC540 Octal Buffer/Line Driver with TRI-STATE Outputs

## Absolute Maximum Rating (Note 1)

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

Supply Voltage ( $V_{CC}$ )	-0.5V to +7.0V
DC Input Diode Current ( $I_{IK}$ )	
$V_I = -0.5V$	-20 mA
$V_I = V_{CC} + 0.5V$	+20 mA
DC Input Voltage ( $V_I$ )	-0.5V to $V_{CC} + 0.5V$
DC Output Diode Current ( $I_{OK}$ )	
$V_O = -0.5V$	-20 mA
$V_O = V_{CC} + 0.5V$	+20 mA
DC Output Voltage ( $V_O$ )	-0.5V to $V_{CC} + 0.5V$
DC Output Source or Sink Current ( $I_O$ )	±50 mA
DC $V_{CC}$ or Ground Current per Output Pin ( $I_{CC}$ or $I_{GND}$ )	±50 mA
Storage Temperature ( $T_{STG}$ )	-65°C to +150°C
Junction Temperature ( $T_J$ )	
CDIP	175°C
PDIP	140°C

**Note 1:** Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. National does not recommend operation of FACT™ circuits outside databook specifications.

## Recommended Operating Conditions

Supply Voltage ( $V_{CC}$ )	'AC	2.0V to 6.0V
Input Voltage ( $V_I$ )		0V to $V_{CC}$
Output Voltage ( $V_O$ )		0V to $V_{CC}$
Operating Temperature ( $T_A$ )		
74AC		-40°C to +85°C
54AC		-55°C to +125°C
Minimum Input Edge Rate ( $\Delta V/\Delta t$ )		
'AC Devices		
$V_{IN}$ from 30% to 70% of $V_{CC}$		
$V_{CC}$ @ 3.3V, 4.5V, 5.5V		125 mV/ns

## DC Characteristics for 'AC Family Devices

Symbol	Parameter	$V_{CC}$ (V)	74AC		54AC		74AC		Units	Conditions
			$T_A = +25^\circ C$		$T_A = -55^\circ C$ to $+125^\circ C$		$T_A = -40^\circ C$ to $+85^\circ C$			
			Typ	Guaranteed Limits						
$V_{IH}$	Minimum High Level Input Voltage	3.0	1.5	2.1	2.1	2.1	2.1	2.1	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$
		4.5	2.25	3.15	3.15	3.15	3.15	3.15		
		5.5	2.75	3.85	3.85	3.85	3.85	3.85		
$V_{IL}$	Maximum Low Level Input Voltage	3.0	1.5	0.9	0.9	0.9	0.9	0.9	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$
		4.5	2.25	1.35	1.35	1.35	1.35	1.35		
		5.5	2.75	1.65	1.65	1.65	1.65	1.65		
$V_{OH}$	Minimum High Level Output Voltage	3.0	2.99	2.9	2.9	2.9	2.9	2.9	V	$I_{OUT} = -50 \mu A$
		4.5	4.49	4.4	4.4	4.4	4.4	4.4		
		5.5	5.49	5.4	5.4	5.4	5.4	5.4		
		3.0		2.56	2.4	2.46			V	* $V_{IN} = V_{IL}$ or $V_{IH}$ -12 mA $I_{OH}$ -24 mA -24 mA
		4.5		3.86	3.7	3.76				
		5.5		4.86	4.7	4.76				
$V_{OL}$	Maximum Low Level Output Voltage	3.0	0.002	0.1	0.1	0.1	0.1	0.1	V	$I_{OUT} = 50 \mu A$
		4.5	0.001	0.1	0.1	0.1	0.1	0.1		
		5.5	0.001	0.1	0.1	0.1	0.1	0.1		
		3.0		0.36	0.50	0.44			V	* $V_{IN} = V_{IL}$ or $V_{IH}$ 12 mA $I_{OL}$ 24 mA 24 mA
		4.5		0.36	0.50	0.44				
		5.5		0.36	0.50	0.44				
$I_{IN}$	Maximum Input Leakage Current	5.5		±0.1	±1.0	±1.0	±1.0	μA	$V_I = V_{CC}, GND$	

\*All outputs loaded; thresholds on input associated with output under test.

## DC Characteristics for 'AC Family Devices (Continued)

Symbol	Parameter	V <sub>CC</sub> (V)	74AC			54AC	74AC		Units	Conditions
			T <sub>A</sub> = +25°C			T <sub>A</sub> = -55°C to +125°C	T <sub>A</sub> = -40°C to +85°C			
			Typ	Guaranteed Limits						
I <sub>OZ</sub>	Maximum TRI-STATE® Current	5.5		±0.25	±5.0		±2.5	μA	V <sub>I</sub> (OE) = V <sub>IL</sub> , V <sub>IH</sub> V <sub>I</sub> = V <sub>CC</sub> , GND V <sub>O</sub> = V <sub>CC</sub> , GND	
I <sub>OLD</sub>	†Minimum Dynamic Output Current	5.5			50		75	mA	V <sub>OLD</sub> = 1.65V Max	
I <sub>OHD</sub>		5.5			-50		-75	mA	V <sub>OHD</sub> = 3.85V Min	
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5		4.0	80.0		40.0	μA	V <sub>IN</sub> = V <sub>CC</sub> or GND	

†Maximum test duration 2.0 ms, one output loaded at a time.

Note: I<sub>IN</sub> and I<sub>CC</sub> @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V V<sub>CC</sub>.  
I<sub>CC</sub> for 54AC @ 25°C is identical to 74AC @ 25°C.

## AC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub> * (V)	74AC			54AC		74AC		Units
			T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF			T <sub>A</sub> = -55°C to +125°C C <sub>L</sub> = 50 pF		T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF		
			Min	Typ	Max	Min	Max	Min	Max	
t <sub>PLH</sub>	Propagation Delay Data to Output	3.3	1.5	5.5	7.5	1.0	9.0	1.0	8.0	ns
		5.0	1.5	4.0	6.0	1.5	7.0	1.0	6.5	
t <sub>PHL</sub>	Propagation Delay Data to Output	3.3	1.5	5.0	7.0	1.0	8.0	1.0	7.5	ns
		5.0	1.5	4.0	5.5	1.5	6.5	1.0	6.0	
t <sub>PZH</sub>	Output Enable Time	3.3	3.0	8.5	11.0	1.0	13.0	2.5	12.0	ns
		5.0	2.0	6.5	8.5	1.5	10.0	2.0	9.5	
t <sub>PZL</sub>	Output Enable Time	3.3	2.5	7.5	10.0	1.0	12.0	2.0	11.0	ns
		5.0	2.0	6.0	7.5	1.5	9.0	1.5	8.5	
t <sub>PHZ</sub>	Output Disable Time	3.3	2.5	8.5	13.0	1.0	15.5	1.5	14.0	ns
		5.0	1.5	7.5	10.5	1.5	12.0	1.0	11.0	
t <sub>PLZ</sub>	Output Disable Time	3.3	2.5	7.0	10.0	1.0	12.0	2.0	11.0	ns
		5.0	1.5	6.0	8.0	1.5	10.0	1.5	9.0	

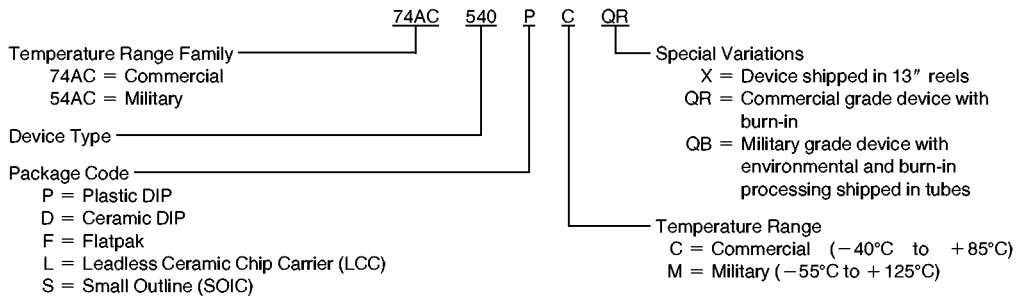
\*Voltage Range 3.3 is 3.3V ±0.3V  
Voltage Range 5.0 is 5.0V ±0.5V

## Capacitance

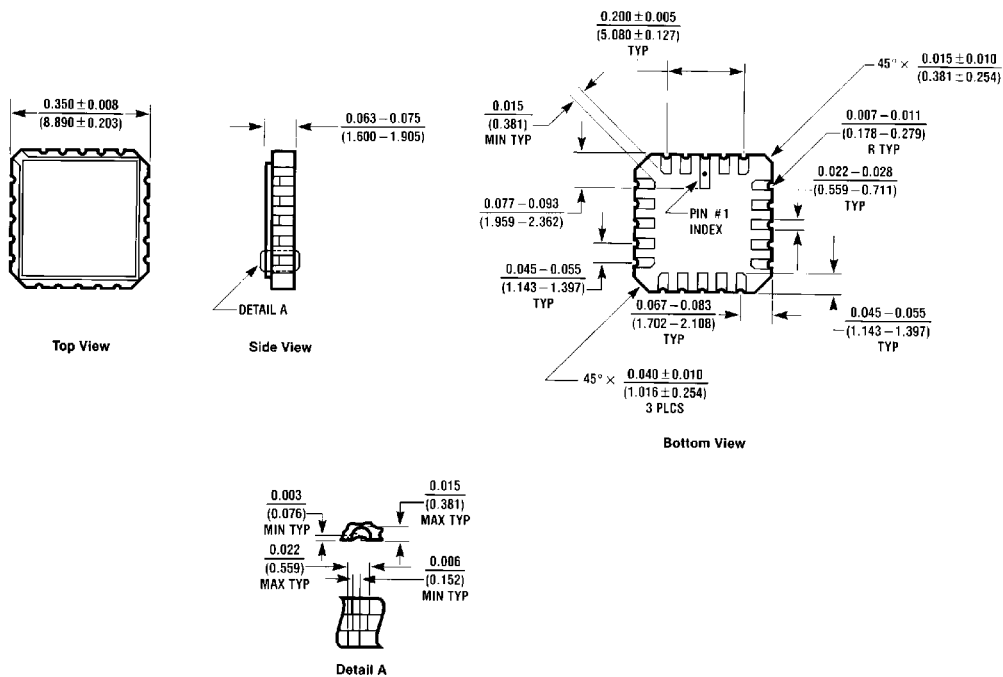
Symbol	Parameter	Typ	Units	Conditions
C <sub>IN</sub>	Input Capacitance	4.5	pF	V <sub>CC</sub> = OPEN
C <sub>PD</sub>	Power Dissipation Capacitance	30.0	pF	V <sub>CC</sub> = 5.0V

## Ordering Information

The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:



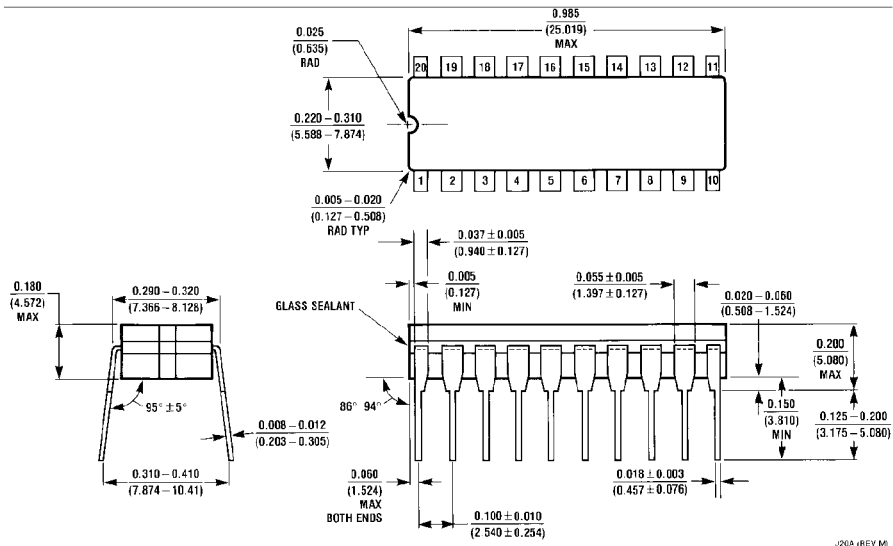
## Physical Dimensions inches (millimeters)



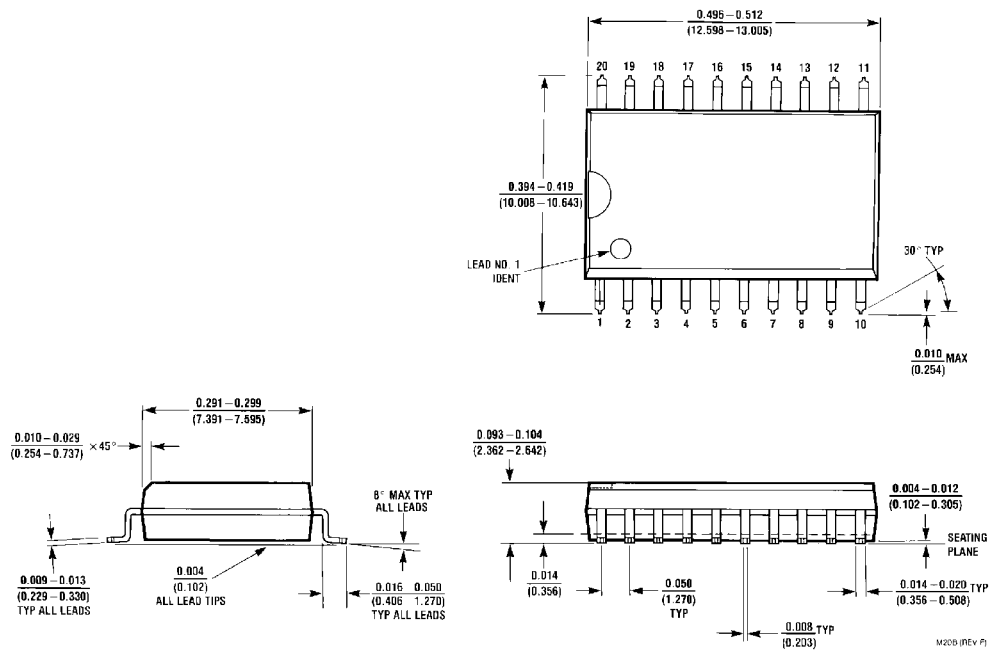
20-Terminal Ceramic Leadless Chip Carrier (L)  
NS Package Number E20A

EN24 (REV D)

**Physical Dimensions** inches (millimeters) (Continued)

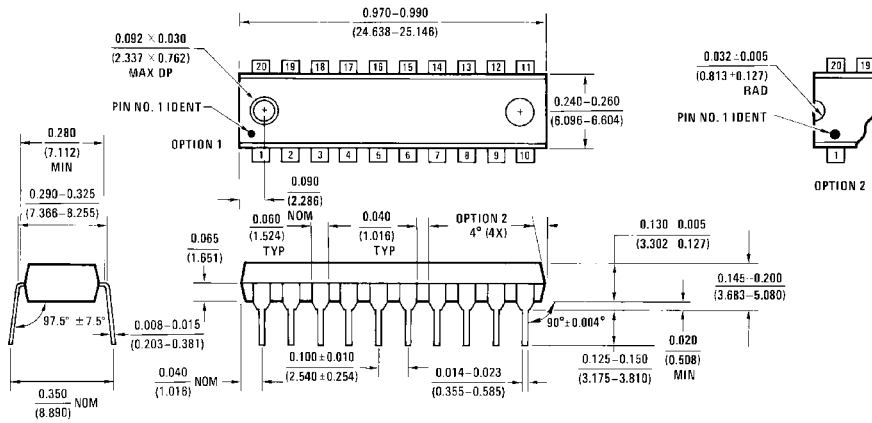


**20-Lead Ceramic Dual-In-Line Package (D)**  
**NS Package Number J20A**

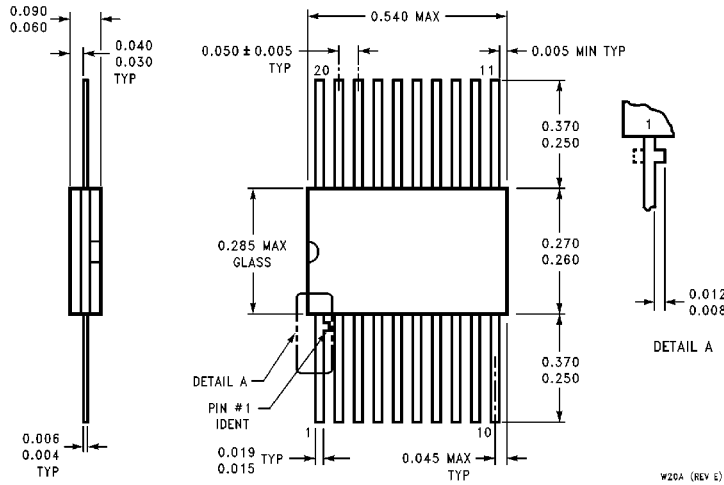


**20-Lead Small Outline Integrated Circuit (S)**  
**NS Package Number M20B**

**Physical Dimensions** inches (millimeters) (Continued)



**20-Lead Plastic Dual-In-Line Package (P)**  
NS Package Number N20B



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

**LIFE SUPPORT POLICY**

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems 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.
2. A critical component is any component of 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.



**National Semiconductor Corporation**  
2900 Semiconductor Drive  
P.O. Box 58090  
Santa Clara, CA 95052-8090  
Tel: 1(800) 272-9959  
TWX: (910) 339-9240

**National Semiconductor GmbH**  
Livy-Gargan-Str. 10  
D-82256 Fürstfeldbruck  
Germany  
Tel: (81-41) 35-0  
Telex: 527649  
Fax: (81-41) 35-1

**National Semiconductor Japan Ltd.**  
Sumitomo Chemical  
Engineering Center  
Bldg. 7F  
1-7-1, Nakase, Mihama-Ku  
Chiba-City,  
Chiba Prefecture 261  
Tel: (043) 299-2300  
Fax: (043) 299-2500

**National Semiconductor Hong Kong Ltd.**  
13th Floor, Straight Block,  
Ocean Centre, 5 Canton Rd.  
Tsimshatsui, Kowloon  
Hong Kong  
Tel: (852) 2737-1600  
Fax: (852) 2736-9960

**National Semicondutores Do Brazil Ltda.**  
Rua Deputado Lacerda Franco  
120-3A  
Sao Paulo-SP  
Brazil 05418-000  
Tel: (55-11) 212-5066  
Telex: 391-1131931 NSBR BR  
Fax: (55-11) 212-1181

**National Semiconductor (Australia) Pty. Ltd.**  
Building 16  
Business Park Drive  
Monash Business Park  
Nottingham, Melbourne  
Victoria 3168 Australia  
Tel: (3) 558-9999  
Fax: (3) 558-9998

National does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and National reserves the right at any time without notice to change said circuitry and specifications.