National Semiconductor

August 1998

54FCT541
Octal Buffer/Line Driver with TRI-STATE® Outputs

General Description

The 'FCT541 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. The 'FCT541 is similar to the 'FCT244 with broadside pinout.

- TTL input and output level compatible
- CMOS power consumption
- Output sink capability of 48 mA, source capability of 12 mA
- Flow-through pinout for ease of PC board layout
- Standard Microcircuit Drawing (SMD) 5962-8976601

Features

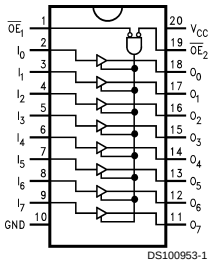
- Non-inverting buffers

Ordering Code

Military	Package Number	Package Description
54FCT541DMQB	J20A	20-Lead Ceramic Dual-In-Line
54FCT541FMQB	W20A	20-Lead Cerpack
54FCT541LMQB	E20A	20-Lead Ceramic Leadless Chip Carrier, Type C

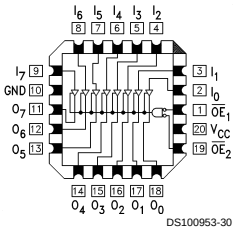
Connection Diagram

Pin Assignment
DIP and Cerpack



DS100953-1

Pin Assignment
LCC



DS100953-30

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

Truth Table

Inputs			Outputs
$\overline{OE}_1$	$\overline{OE}_2$	I	FCT541
L	L	H	H
H	X	X	Z
X	H	X	Z
L	L	L	L

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

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

Absolute Maximum Ratings (Note 1)

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		FCT541 Min	FCT541 Typ	FCT541 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	54FCT	4.3			V	Min	I_{OH} = −300 µA
		54FCT	2.4			V	Min	I_{OH} = −12 mA
V_{OL}	Output LOW Voltage	54FCT			0.2	V	Min	I_{OL} = 300 µA
		54FCT			0.55	V	Min	I_{OL} = 48 mA
I_{IH}	Input HIGH Current				5	µA	Max	V_{IN} = V_{CC}
I_{IL}	Input LOW Current				−5	µA	Max	V_{IN} = 0.0V
I_{OZH}	Output Leakage Current				10	µA	Max	V_{OUT} = 5.5V; $\overline{OE}_n$ = 2.0V
I_{OZL}	Output Leakage Current				−10	µA	Max	V_{OUT} = 0.0V; $\overline{OE}_n$ = 2.0V
I_{OS}	Output Short-Circuit Current				-60	mA	Max	V_{OUT} = 0.0V
I_{CCQ}	Quiescent Power Supply Current				1.5	mA	Max	V_{IN} < 0.2V or V_{IN} 5.3V, V_{CC} = 5.5V
ΔI_{CC}	Quiescent Power Supply Current				2.0	mA	Max	V_I = V_{CC} − 2.1V
I_{CCD}	Dynamic I_{CC}				0.4	mA/ MHz	Max	V_{CC} = 5.5V, Outputs Open, One Bit Toggling, 50% Duty Cycle, $\overline{OE}_n$ = GND
I_{CC}	Total Power Supply Current				6.0	mA	Max	V_{CC} = 5.5V, Outputs Open, fI = 10MHz, $\overline{OE}_n$ = GND, One Bit Toggling, 50% Duty Cycle, $\overline{OE}_n$ = GND

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.

AC Electrical Characteristics

Symbol	Parameter	54FCT T_A = −55˚C to +125˚C, V_{CC} = 4.5V–5.5V, C_L = 50 pF Min	54FCT Max	Units	Fig. No.
t_{PLH}	Propagation Delay	2.0	9.0	ns	*Figure 4*

AC Electrical Characteristics (Continued)

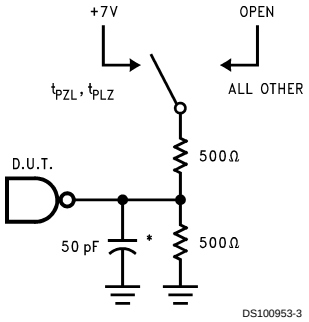
Symbol	Parameter	54FCT $T_A = -55^\circ C$ to $+125^\circ C$, $V_{CC} = 4.5V–5.5V$, $C_L = 50$ pF		Units	Fig. No.
		Min	Max		
t_{PHL}	Data to Outputs	2.0	9.0		
t_{PZH}	Output Enable Time	2.0	12.5	ns	*Figure 5*
t_{PZL}		2.0	12.5		
t_{PHZ}	Output Disable Time	2.0	12.5	ns	*Figure 5*
t_{PLZ}		2.0	12.5		

Capacitance

Symbol	Parameter	Max	Units	Conditions $T_A = 25^\circ C$
C_{IN}	Input Capacitance	10.0	pF	$V_{CC} = 0.0V$
C_{OUT} (Note 3)	Output Capacitance	12.0	pF	$V_{CC} = 5.0V$

Note 3: C_{OUT} is measured at frequency of f = 1 MHz, per MIL-STD-883B, Method 3012.

AC Loading



*Includes jig and probe capacitance

FIGURE 1. Standard AC Test Load

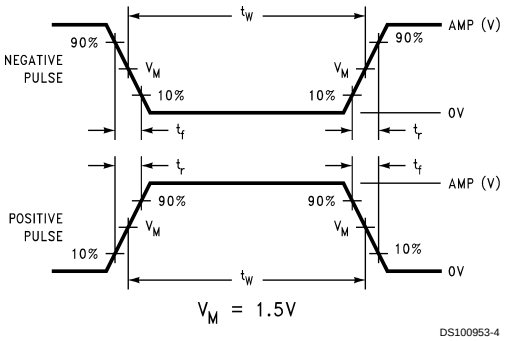


FIGURE 2. Test Input Signal Levels

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

AC Waveforms

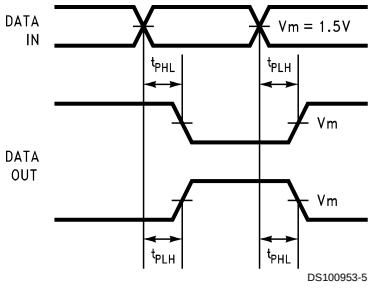


FIGURE 4. Propagation Delay Waveforms for Inverting and Non-Inverting Functions

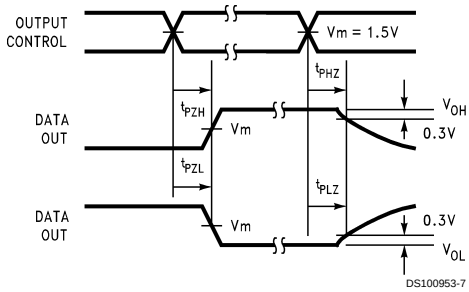
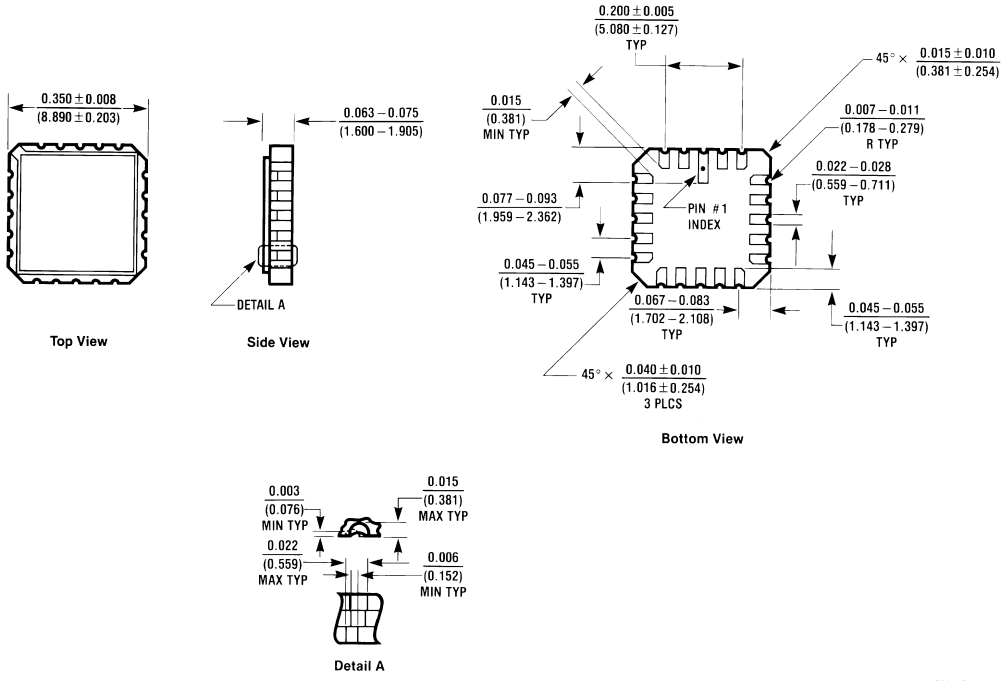
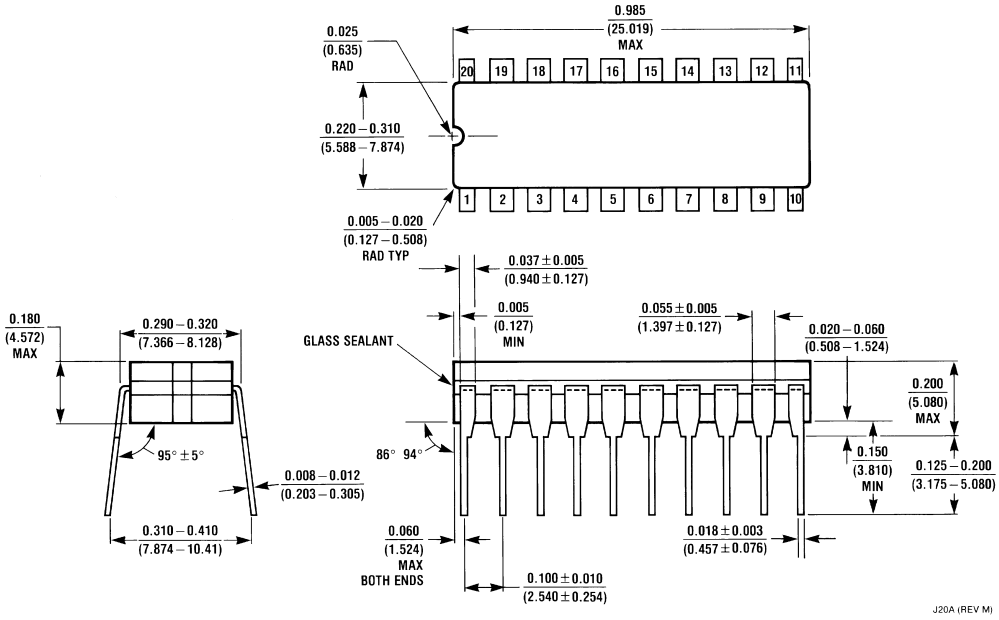


FIGURE 5. TRI-STATE Output HIGH and LOW Enable and Disable Time

Physical Dimensions inches (millimeters) unless otherwise noted

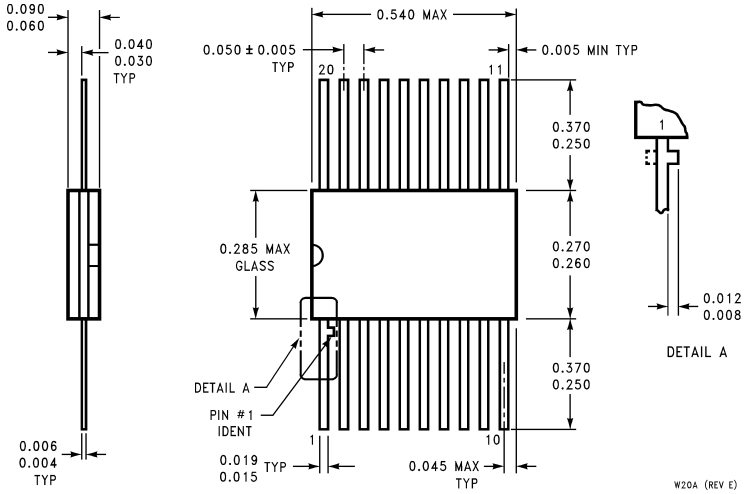


20-Terminal Ceramic Chip Carrier
NS Package Number E20A



20-Lead Ceramic Dual-In-Line Package
NS Package Number J20A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



20-Lead Ceramic Flatpack
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 in 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
Americas
Tel: 1-800-272-9959
Fax: 1-800-737-7018
Email: support@nsc.com

www.national.com

National Semiconductor Europe
Fax: +49 (0) 1 80-530 85 86
Email: europe.support@nsc.com
Deutsch Tel: +49 (0) 1 80-530 85 85
English Tel: +49 (0) 1 80-532 78 32
Français Tel: +49 (0) 1 80-532 93 58
Italiano Tel: +49 (0) 1 80-534 16 80

National Semiconductor Asia Pacific Customer Response Group
Tel: 65-2544466
Fax: 65-2504466
Email: sea.support@nsc.com

National Semiconductor Japan Ltd.
Tel: 81-3-5620-6175
Fax: 81-3-5620-6179