

# 54FCT/74FCT240 Inverting Octal Buffer/Line Driver with TRI-STATE® Outputs

## General Description

The FCT240 is an inverting octal buffer and line driver designed to be employed as a memory address driver, clock driver and bus oriented transmitter or receiver which provides improved PC board density.

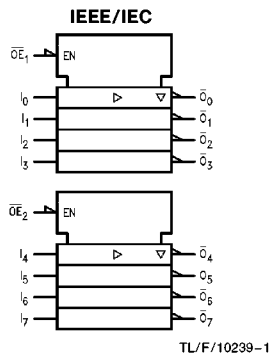
FACT™ FCT utilizes NSC quiet series technology to provide improved quiet output switching and dynamic threshold performance.

FACT FCT features GTO™ output control and undershoot corrector in addition to a split ground bus for superior performance.

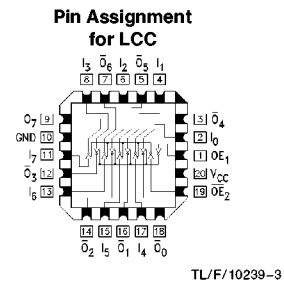
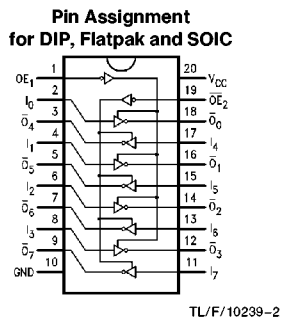
## Features

- $I_{CC}$  and  $I_{OZ}$  reduced to 40.0  $\mu A$  and  $\pm 2.5 \mu A$  respectively
- NSC 54FCT/74FCT240 is pin and functionally equivalent to IDT 54FCT/74FCT240
- Inverting TRI-STATE outputs
- Input clamp diodes to limit bus reflections
- TTL/CMOS input and output level compatible
- $I_{OL} = 64 \text{ mA}$  (commercial), 48 mA (military)
- CMOS power levels
- ESD immunity  $\geq 4 \text{ kV}$  typ
- Military product compliant to MIL-STD 883 and standard military drawing # 5962-87655

## Logic Symbol



## Connection Diagrams



Pin Names	Description
$\overline{OE}_1, \overline{OE}_2$	TRI-STATE Output Enable Inputs
$I_0-I_7$	Inputs
$\overline{O}_0-\overline{O}_7$	Outputs

## Truth Table

Inputs		Outputs (Pins 12, 14, 16, 18)
$\overline{OE}_1$	I	
L	L	H
L	H	L
H	X	Z

Inputs		Outputs (Pins 3, 5, 7, 9)
$\overline{OE}_2$	I	
L	L	H
L	H	L
H	X	Z

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

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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.

Terminal Voltage with Respect to GND ( $V_{TERM}$ )		
74FCT		-0.5V to +7.0V
54FCT		-0.5V to +7.0V
Temperature under Bias ( $T_{BIAS}$ )		
74FCT		-55°C to +125°C
54FCT		-65°C to +135°C
Storage Temperature ( $T_{STG}$ )		
74FCT		-55°C to +125°C
54FCT		-65°C to +150°C
DC Output Current ( $I_{OUT}$ )		120 mA

**Note 1:** Absolute maximum ratings are those values beyond which damage to the device may occur. Exposure to absolute maximum rating conditions for extended periods may affect reliability. 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.

## Recommended Operating Conditions

Supply Voltage ( $V_{CC}$ )		4.5V to 5.5V
54FCT		4.75V to 5.25V
74FCT		4.75V to 5.25V
Input Voltage		0V to $V_{CC}$
Output Voltage		0V to $V_{CC}$
Operating Temperature ( $T_A$ )		
54FCT		-55°C to +125°C
74FCT		-0°C to +70°C
Junction Temperature ( $T_J$ )		
CDIP		175°C
PDIP		140°C

**Note:** All commercial packaging is not recommended for applications requiring greater than 2000 temperature cycles from -40°C to +125°C.

## DC Characteristics for 'FCT Family Devices

Typical values are at  $V_{CC} = 5.0V$ , 25°C ambient and maximum loading. For test conditions shown as Max, use the value specified for the appropriate device type: Com:  $V_{CC} = 5.0V \pm 5\%$ ,  $T_A = 0^\circ C$  to  $+70^\circ C$ ; Mil:  $V_{CC} = 5.0V \pm 10\%$ ,  $T_A = -55^\circ C$  to  $+125^\circ C$ ,  $V_{HC} = V_{CC} - 0.2V$ .

Symbol	Parameter	54FCT/74FCT			Units	Conditions	
		Min	Typ	Max			
$V_{IH}$	Minimum High Level Input Voltage	2.0			V		
$V_{IL}$	Maximum Low Level Input Voltage			0.8	V		
$I_{IH}$	Input High Current			5.0 5.0	$\mu A$	$V_{CC} = \text{Max}$	$V_I = V_{CC}$ $V_I = 2.7V$ (Note 2)
$I_{IL}$	Input Low Current			-5.0 -5.0	$\mu A$	$V_{CC} = \text{Max}$	$V_I = 0.5V$ (Note 2) $V_I = \text{GND}$
$I_{OZ}$	Maximum TRI-STATE Current			2.5 2.5 -2.5 -2.5	$\mu A$	$V_{CC} = \text{Max}$	$V_O = V_{CC}$ $V_O = 2.7V$ (Note 2) $V_O = 0.5V$ (Note 2) $V_O = \text{GND}$
$V_{IK}$	Clamp Diode Voltage	-0.7	-1.2		V	$V_{CC} = \text{Min}$ ; $I_N = -18 \text{ mA}$	
$I_{OS}$	Short Circuit Current	-60	-120		mA	$V_{CC} = \text{Max}$ (Note 1); $V_O = \text{GND}$	
$V_{OH}$	Minimum High Level Output Voltage	2.8 $V_{HC}$ 2.4 2.4	3.0 $V_{CC}$ 4.3 4.3		V	$V_{CC} = 3V$ ; $V_{IN} = 0.2V$ or $V_{HC}$ ; $I_{OH} = -32 \mu A$	$I_{OH} = -300 \mu A$ $I_{OH} = -12 \text{ mA}$ (Mil) $I_{OH} = -15 \text{ mA}$ (Com)
$V_{OL}$	Maximum Low Level Output Voltage		GND 0.2 0.3 0.3	0.2 0.2 0.55 0.55	V	$V_{CC} = 3V$ ; $V_{IN} = 0.2V$ or $V_{HC}$ ; $I_{OL} = 300 \mu A$	$I_{OL} = 300 \mu A$ $I_{OL} = 48 \text{ mA}$ (Mil) $I_{OL} = 64 \text{ mA}$ (Com)
$I_{CC}$	Maximum Quiescent Supply Current		1.0	40.0	$\mu A$	$V_{CC} = \text{Max}$ $V_{IN} \geq V_{HC}$ , $V_{IN} \leq 0.2V$ $f_I = 0$	
$\Delta I_{CC}$	Quiescent Supply Current; TTL Inputs HIGH		0.5	2.0	mA	$V_{CC} = \text{Max}$ $V_{IN} = 3.4V$ (Note 3)	

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

Typical values are at  $V_{CC} = 5.0V$ , 25°C ambient and maximum loading. For test conditions shown as Max, use the value specified for the appropriate device type: Com:  $V_{CC} = 5.0V \pm 5\%$ ,  $T_A = 0^\circ C$  to  $+70^\circ C$ ; Mil:  $V_{CC} = 5.0V \pm 10\%$ ,  $T_A = -55^\circ C$  to  $+125^\circ C$ ,  $V_{HC} = V_{CC} - 0.2V$ .

Symbol	Parameter	74FCT			Units	Conditions	
		Min	Typ	Max			
$I_{CCD}$	Dynamic Power Supply Current (Note 4)		0.25	0.55	mA/MHz	$V_{CC} = \text{Max}$ Outputs Open $\overline{OE}_1 = \overline{OE}_2 = \text{GND}$ One Input Toggling 50% Duty Cycle	$V_{IN} \geq V_{HC}$ $V_{IN} \leq 0.2V$
$I_C$	Total Power Supply Current (Note 6)		1.5	5.0	mA	$V_{CC} = \text{Max}$ Outputs Open $\overline{OE}_1 = \overline{OE}_2 = \text{GND}$ $f_i = 10 \text{ MHz}$ One Bit Toggling 50% Duty Cycle	$V_{IN} \geq V_{HC}$ $V_{IN} \leq 0.2V$
			1.8	6.0		$V_{IN} = 3.4V$ $V_{IN} = \text{GND}$	
			3.0	8.0		(Note 5) $V_{CC} = \text{Max}$ Outputs Open $\overline{OE}_1 = \overline{OE}_2 = \text{GND}$ $f_i = 2.5 \text{ MHz}$ Eight Bits Toggling 50% Duty Cycle	$V_{IN} \geq V_{HC}$ $V_{IN} \leq 0.2V$
			5.0	14.5		$V_{IN} = 3.4V$ $V_{IN} = \text{GND}$	

**Note 1:** Maximum test duration not to exceed one second, not more than one output shorted at one time.

**Note 2:** This parameter guaranteed but not tested.

**Note 3:** Per TTL driven input ( $V_{IN} = 3.4V$ ); all other inputs at  $V_{CC}$  or GND.

**Note 4:** This parameter is not directly testable, but is derived for use in Total Power Supply calculations.

**Note 5:** Values for these conditions are examples of the  $I_{CC}$  formula. These limits are guaranteed but not tested.

**Note 6:**  $I_C = I_{\text{QUIESCENT}} + I_{\text{INPUTS}} + I_{\text{DYNAMIC}}$

$$I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP}/2 + f_i N_i)$$

$I_{CC}$  = Quiescent Current

$\Delta I_{CC}$  = Power Supply Current for a TTL High Input ( $V_{IN} = 3.4V$ )

$D_H$  = Duty Cycle for TTL Inputs High

$N_T$  = Number of Inputs at  $D_H$

$I_{CCD}$  = Dynamic Current Caused by an Input Transition Pair (HLH or LHL)

$f_{CP}$  = Clock Frequency for Register Devices (Zero for Non-Register Devices)

$f_i$  = Input Frequency

$N_i$  = Number of Inputs at  $f_i$

All currents are milliamps and all frequencies are in megahertz.

**Note 7:** For 54FCT,  $I_{CCD} = 0.40 \text{ mA/MHz}$ .

Refer to applicable standard military drawing or NSC Table I for test conditions and  $I_C/I_{CC}$  limits.

## AC Electrical Characteristics

Symbol	Parameter	54FCT/74FCT	74FCT		54FCT		Units
		$T_A = +25^\circ\text{C}$ $V_{CC} = 5.0\text{V}$	$T_A, V_{CC} = \text{Com}$ $R_L = 500\Omega$ $C_L = 50\text{pF}$		$T_A, V_{CC} = \text{Mil}$ $R_L = 500\Omega$ $C_L = 50\text{pF}$		
		Typ	Min (Note 1)	Max	Min	Max	
$t_{PLH}$ $t_{PHL}$	Propagation Delay $D_n$ to $O_n$	5.0	1.5	8.0	1.5	9.0	ns
$t_{PZH}$ $t_{PZL}$	Output Enable Time	7.0	1.5	10.0	1.5	10.5	ns
$t_{PHZ}$ $t_{PLZ}$	Output Disable Time	6.0	1.5	9.5	1.5	12.5	ns

**Note 1:** Minimum limits are guaranteed but not tested on propagation delays.

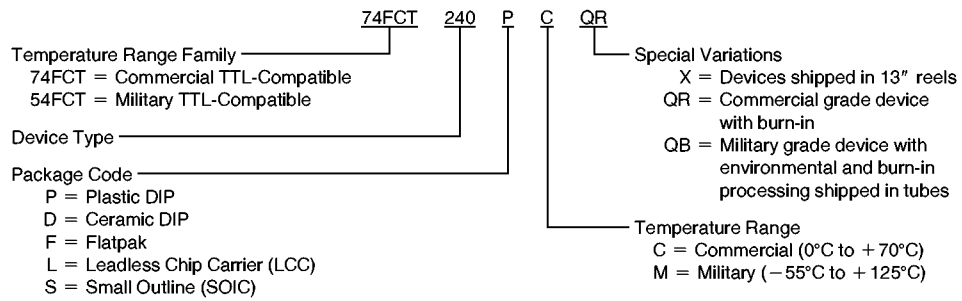
## Capacitance $T_A = +25^\circ\text{C}, f = 1.0\text{MHz}$

Symbol	Parameter (Note)	Typ	Max	Units	Condition
$C_{IN}$	Input Capacitance	6	10	pF	$V_{IN} = 0\text{V}$
$C_{OUT}$	Output Capacitance	8	12	pF	$V_{OUT} = 0\text{V}$

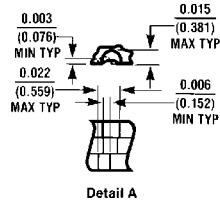
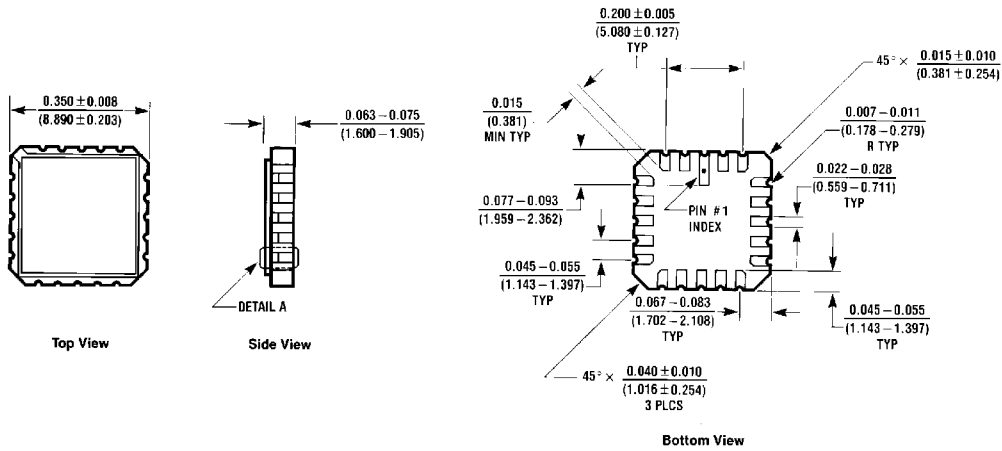
**Note:** This parameter is measured at characterization but not tested.  
 $C_{OUT}$  for 74FCT only.

## 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:

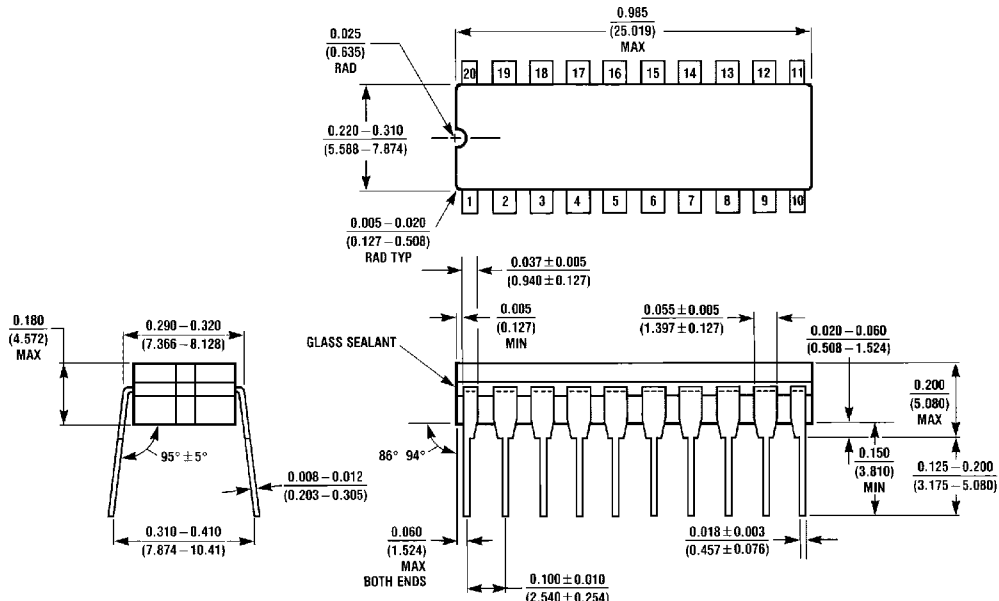


**Physical Dimensions** inches (millimeters)



E20A (REV D)

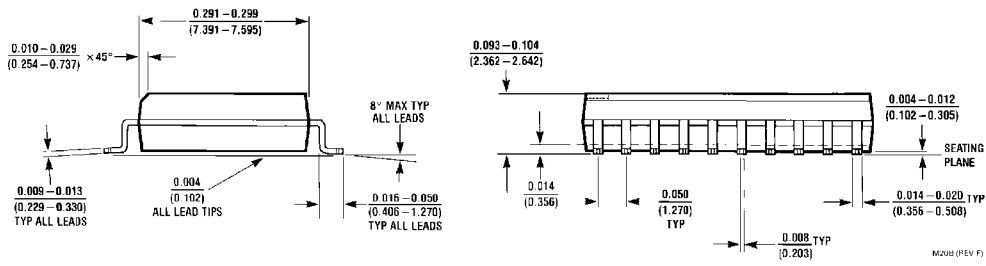
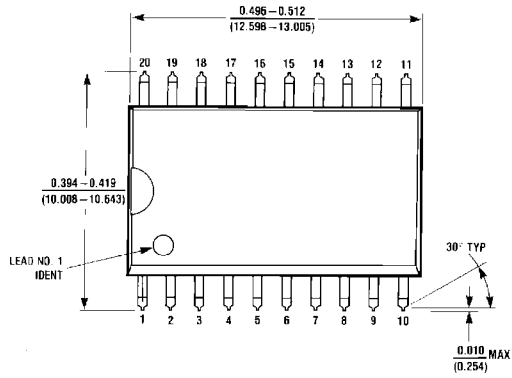
**20-Terminal Ceramic Leadless Chip Carrier (L)**  
 NS Package Number E20A



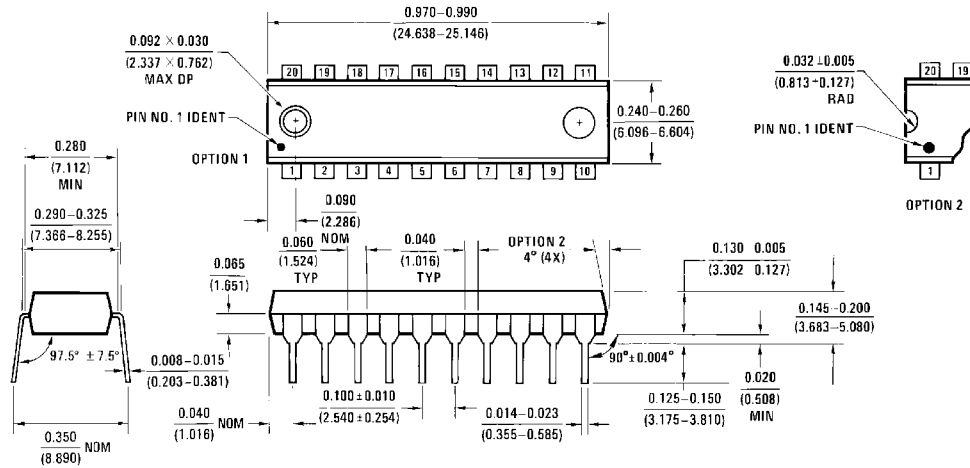
J20A (REV M)

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

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



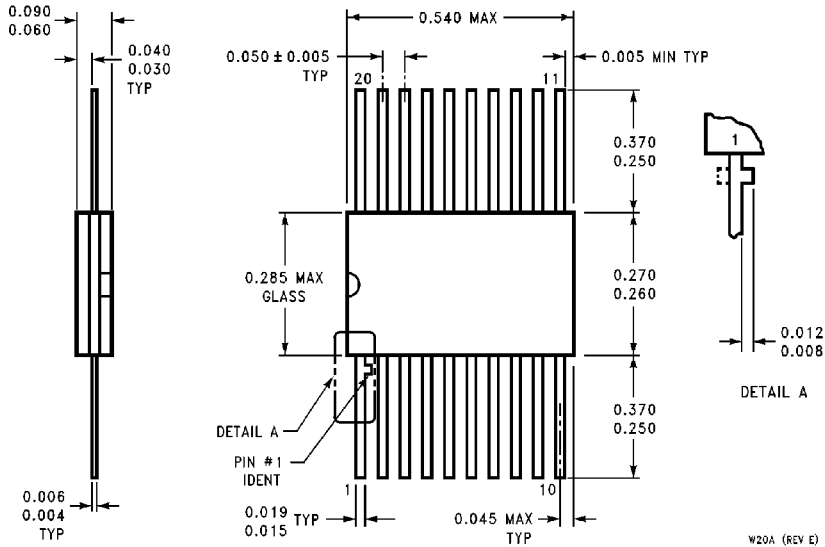
**20-Lead Small Outline Integrated Circuit (S)**  
NS Package Number M20B



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

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

Lit. # 114695



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