T-52-09

National Semiconductor

54FCT/74FCT244
Octal Buffer/Line Driver with TRI-STATE® Outputs

General Description

The 'FCT244 is an octal buffer and line driver designed to be employed as a memory address driver, clock driver and bus-oriented transmitter/receiver which provides improved PC board density.

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

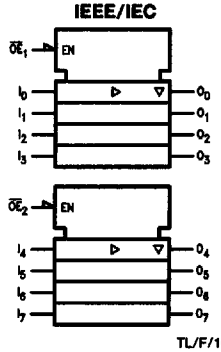
FACT FCT and GTO™ output control and undershoot corrector in addition to a split ground bus for superior performance.

Features

- I_{CC} and I_{OZ} reduced to 40.0 μA and ±2.5 μA respectively
- NSC 54FCT/74FCT244 is pin and functionally equivalent to IDT 54FCT/74FCT244
- Controlled output edge rates and undershoot for improved noise immunity. Internal split ground for improved noise immunity
- Input clamp diodes to limit bus reflections
- TTL/CMOS input and output level compatible
- I_{OL} = 64 mA (commercial) and 48 mA (military)
- CMOS power levels
- ESD immunity ≥ 4 kV typ
- Military product compliant to MIL-STD 883C and standard military drawing #5962-87630

Ordering Code: See Section 8

Logic Symbol



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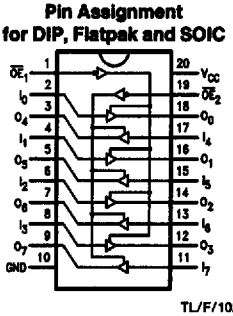
Connection Diagrams



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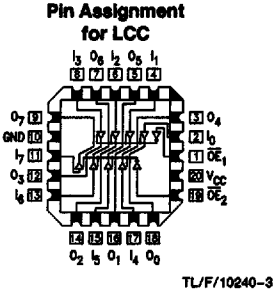

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Pin Names	Description
$\overline{OE}_1$, $\overline{OE}_2$	TRI-STATE Output Enable Inputs
I_0–I_7	Inputs
O_0–O_7	Outputs

Truth Tables

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

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

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

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})
- 54FCT: −0.5V to +7.0V
- 74FCT: −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})
- 54FCT: 4.5V to 5.5V
- 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 conditons shown as Max, use the value specified for the appropriate device type: Com: V_{CC} = 5.0V ±5%, T_A = 0°C to +70°C; Mil: V_{CC} = 5.0V ±10%, T_A = −55°C to +125°C, $V_{HC} = V_{CC} - 0.2V$

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

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DC Characteristics for 'FCT Family Devices (Continued)

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

Symbol	Parameter	74FCT			Units	Conditions	
		Min	Typ	Max			
I_{CCD}	Dynamic Power Supply Current (Note 4)		0.15	0.55	mA/MHz	V_{CC} = Max Outputs Open $\overline{OE}_1 = \overline{OE}_2$ = 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	5.5	mA	V_{CC} = Max Outputs Open $\overline{OE}_1 = \overline{OE}_2$ = GND	$V_{IN} \geq V_{HC}$ $V_{IN} \leq 0.2V$
			1.8	6.0		f_i = 10 MHz One Bit Toggling 50% Duty Cycle	V_{IN} = 3.4V V_{IN} = GND
			3.0	9.0		(Note 5) V_{CC} = Max Outputs Open $\overline{OE}_1 = \overline{OE}_2$ = GND	$V_{IN} \geq V_{HC}$ $V_{IN} \leq 0.2V$
			5.0	14.5		f_i = 2.5 MHz Eight Bits Toggling 50% Duty Cycle	V_{IN} = 3.4V V_{IN} = 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: $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$
$I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP}/2 + f_i N_i)$
I_{CC} = Quiescent Current
ΔI_{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 in milliamps and all frequencies are in megahertz.

Note 7: For 54FCT, I_{CCD} = 0.40 mA/MHz.
Refer to applicable standard military drawing or NSC Table I for test conditions and I_C/I_{CC} limits.

AC Electrical Characteristics: See Section 2 for Waveforms

Symbol	Parameter	54FCT/74FCT	74FCT		54FCT		Units	Fig. No.
		$T_A = +25°C$ $V_{CC} = 5.0V$	$T_A, V_{CC} = Com$ $R_L = 500\Omega$ $C_L = 50\ pF$		$T_A, V_{CC} = Mil$ $R_L = 500\Omega$ $C_L = 50\ pF$			
		Typ	Min (Note 1)	Max	Min	Max		
t_{PLH} t_{PHL}	Propagation Delay D_n to O_n	4.5	1.5	6.5	1.5	7.5	ns	2-8
t_{PZH} t_{PZL}	Output Enable Time	6.0	1.5	8.0	1.5	10.5	ns	2-11
t_{PHZ} t_{PLZ}	Output Disable Time	5.0	1.5	7.0	1.5	8.0	ns	2-11

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

Capacitance ($T_A = +25°C, f = 1.0$ MHz)

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

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