National Semiconductor

54FCT/74FCT245
Octal Bidirectional Transceiver with TRI-STATE® Inputs/Outputs

General Description

The 'FCT245 contains eight non-inverting bidirectional buffers with TRI-STATE outputs and is intended for bus-oriented applications. The Transmit/Receive ($T/\overline{R}$) input determines the direction of data flow through the bidirectional transceiver. Transmit (active-HIGH) enables data from A ports to B ports; Receive (active-LOW) enables data from B ports to A ports. The Output Enable input, when HIGH, disables both A and B ports by placing them in a HIGH Z condition.

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

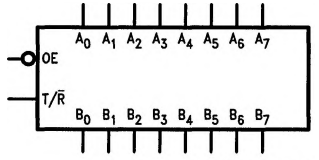
FACT FCT features GTO™ output control and undershoot corrector in addition to a split ground bus for superior performance.

Features

- NSC54FCT/74FCT245 is pin and functionally equivalent to IDT54FCT/74FCT245
- 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 883 and Standard Military Drawing #5962-87629

Ordering Code: See Section 8

Logic Symbols



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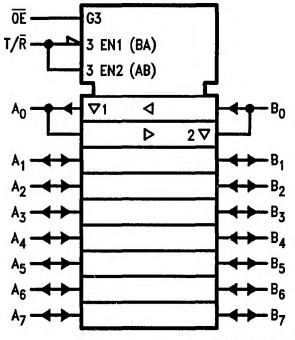
Pin Names	Description
$\overline{OE}$	Output Enable Input
$T/\overline{R}$	Transmit/Receive Input
A_0–A_7	Side A TRI-STATE Inputs or TRI-STATE Outputs
B_0–B_7	Side B TRI-STATE Inputs or TRI-STATE Outputs

IEEE/IEC



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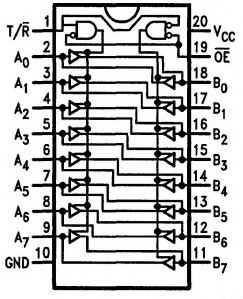
Truth Table

Inputs		Outputs
$\overline{OE}$	$T/\overline{R}$	
L	L	Bus B Data to Bus A
L	H	Bus A Data to Bus B
H	X	HIGH-Z State

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial

Connection Diagrams

Pin Assignment for DIP, Flatpak and SOIC



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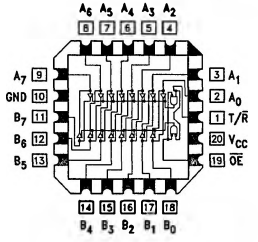
Pin Assignment for LCC and PCC



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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})
- 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

Power Dissipation (P_T): 0.5W

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

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 ±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 (except I/O Pins)			5.0 5.0	μA	V_{CC} = Max	$V_I = V_{CC}$ V_I = 2.7V (Note 2)
I_{IH}	Input High Current (I/O Pins Only)			15 15	μA	V_{CC} = Max	$V_I = V_{CC}$ V_I = 2.7V (Note 2)
I_{IL}	Input Low Current (except I/O Pins)			−5.0 −5.0	μA	V_{CC} = Max	V_I = 0.5V (Note 2) V_I = GND
I_{IL}	Input Low Current (I/O Pins Only)			−15 −15	μA	V_{CC} = Max	V_I = 0.5V (Note 2) V_I = GND
I_{OZ}	Maximum TRI-STATE Current			10.0 10.0 −10.0 −10.0	μA	V_{CC} = Max	$V_I = V_{CC}$ V_I = 2.7V (Note 2) V_I = 0.5V (Note 2) V_I = 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	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	V_{CC} = Min $V_{IN} = V_{IH}$ or V_{IL}	I_{OL} = 300 μA I_{OL} = 48 mA (Mil) I_{OL} = 64 mA (Com)

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 ±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_{CC}	Maximum Quiescent Supply Current		0.001	1.5	mA	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)	
I_{CCD}	Dynamic Power Supply Current (Note 4)		0.25	0.40	mA/MHz	V_{CC} = Max Outputs Open $\overline{OE}_A$ = $\overline{OE}_B$ = 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	4.5	mA	V_{CC} = Max Outputs Open T/$\overline{R}$ = $\overline{OE}$ = GND	$V_{IN} \geq V_{HC}$ $V_{IN} \leq 0.2V$
			1.8	5.0		f_i = 10 MHz One Bit Toggling 50% Duty Cycle	V_{IN} = 3.4V V_{IN} = GND
			3.0	10.0		(Note 5) V_{CC} = Max Outputs Open T/$\overline{R}$ = $\overline{OE}$ = 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
V_H	Input Hysteresis on Clock Only		200		mV		

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 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 = 500Ω C_L = 50 pF		T_A, V_{CC} = Mil R_L = 500Ω C_L = 50 pF			
		Typ	Min (Note)	Max	Min	Max		
t_{PLH} t_{PHL}	Propagation Delay A to B, B to A	5.0	1.5	7.0	1.5	7.5	ns	2-8
t_{PZH} t_{PZL}	Output Enable Time $\overline{OE}$ to A or B	6.0	1.5	9.5	1.5	10.0	ns	2-8
t_{PHZ} t_{PHL}	Output Disable Time $\overline{OE}$ to A or B	6.0	1.5	7.5	1.5	10.0	ns	2-11
t_{PZH} t_{PZL}	Output Enable Time T/$\overline{R}$ to A or B	6.0	1.5	9.5	1.5	10.0	ns	2-11
t_{PHZ} t_{PLZ}	Output Enable Time T/$\overline{R}$ to A or B	6.0	1.5	7.5	1.5	10.0	ns	2-11

Note: Minimum limits 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 74FCT245 only.