



54FCT/74FCT245A

Octal Bidirectional Transceiver with TRI-STATE® Inputs/Outputs

General Description

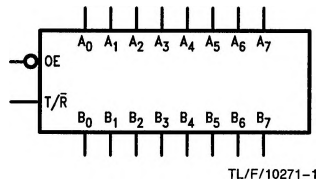
The 'FCT245A contains eight non-inverting bidirectional buffers with TRI-STATE outputs and is intended for bus-oriented applications. The Transmit/Receive (T/R) input determines the direction of data flow through the bidirectional transceiver. Transmit (active-HIGH) enables data from A ports to B ports; 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.

Features

- NSC 54/74FCT245A is pin and functionally equivalent to IDT 54/74FCT245A
- Non-inverting buffers
- Bidirectional data path
- TTL input and output level compatible
- TTL inputs accept CMOS levels
- High current latch up immunity
- $I_{OL} = 64 \text{ mA}$ (commercial) and 48 mA (military)
- Electrostatic discharge protection $\geq 2 \text{ kV}$
- Military product compliant to MIL-STD 883C
- Inherently radiation tolerant

Ordering Code: See Section 8

Logic Symbols

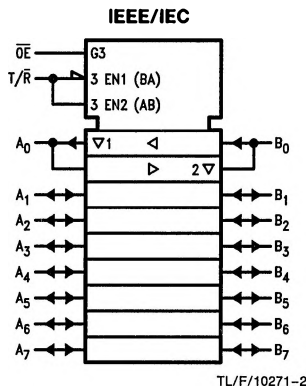


Pin Names	Description
OE	Output Enable Input
T/R	Transmit/Receive Input
A ₀ -A ₇	Side A Inputs or TRI-STATE Outputs
B ₀ -B ₇	Side B Inputs or TRI-STATE Outputs

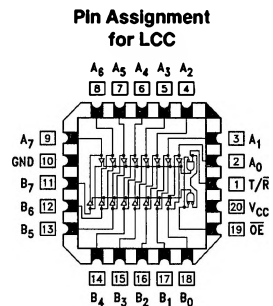
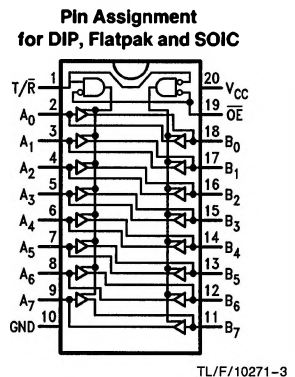
Truth Table

Inputs		Outputs
OE	T/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



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})	
54FCTA	-0.5V to 7.0V
74FCTA	-0.5V to 7.0V
Temperature under Bias (T_{BIAS})	
74FCTA	-55°C to +125°C
54FCTA	-65°C to +135°C
Storage Temperature (T_{STG})	
74FCTA	-55°C to +125°C
54FCTA	-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. 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™ FCT circuits outside databook specifications.

Recommended Operating Conditions

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

DC Characteristics for 'FCTA 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	54FCTA/74FCTA			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 (except I/O Pins)			5.0 5.0	μA	$V_{CC} = \text{Max}$	$V_I = V_{CC}$ $V_I = 2.7V$ (Note 2)
I_{IH}	Input High Current (I/O Pins Only)			15 15	μA	$V_{CC} = \text{Max}$	$V_I = V_{CC}$ $V_I = 2.7V$ (Note 2)
I_{IL}	Input Low Current (except I/O Pins)			-5.0 -5.0	μA	$V_{CC} = \text{Max}$	$V_I = 0.5V$ (Note 2) $V_I = GND$
I_{IL}	Input Low Current (I/O Pins Only)			-15 -15	μA	$V_{CC} = \text{Max}$	$V_I = 0.5V$ (Note 2) $V_I = GND$
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); $V_O = GND$	
V_{OH}	Minimum High Level Output Voltage	2.8	3.0		V	$V_{CC} = 3V$; $V_{IN} = 0.2V$ or V_{HC} ; $I_{OH} = -32 \mu A$	
		V_{HC}	V_{CC}			$V_{CC} = \text{Min}$	$I_{OH} = -300 \mu A$
		2.4	4.3			$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -12 \text{ mA}$ (Mil) $I_{OH} = -15 \text{ mA}$ (Com)
V_{OL}	Maximum Low Level Output Voltage		GND	0.2	V	$V_{CC} = 3V$; $V_{IN} = 0.2V$ or V_{HC} ; $I_{OL} = 300 \mu A$	
			GND	0.2		$V_{CC} = \text{Min}$	$I_{OL} = 300 \mu A$
			0.3	0.55		$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 48 \text{ mA}$ (Mil)
			0.3	0.55			$I_{OL} = 64 \text{ mA}$ (Com)

DC Characteristics for 'FCTA Family Devices (Continued)

Typical values are at $V_{CC} = 5.0V$, $25^{\circ}C$ 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			
I_{CC}	Maximum Quiescent Supply Current		0.001	1.5	mA	$V_{CC} = \text{Max}$ $V_{IN} \geq V_{HC}$, $V_{IN} \leq 0.2V$ $f_i = 0$	
ΔI_{CC}	Quiescent Supply Current; TTL Inputs HIGH		0.5	2.0	mA	$V_{CC} = \text{Max}$ $V_{IN} = 3.4V$ (Note 3)	
I_{CCD}	Dynamic Power Supply Current (Note 4)		0.25	0.40	mA/MHz	$V_{CC} = \text{Max}$ Outputs Open $T/R = \text{GND}$ or V_{CC} $\overline{OE} = \text{GND}$ 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	4.5	mA	$V_{CC} = \text{Max}$ Outputs Open $T/R = \overline{OE} = \text{GND}$	$V_{IN} \geq V_{HC}$ $V_{IN} \leq 0.2V$
			1.8	5.0		$f_i = 10 \text{ MHz}$ One Bit Toggling 50% Duty Cycle	$V_{IN} = 3.4V$ $V_{IN} = \text{GND}$
			3.0	8.0		(Note 5) $V_{CC} = \text{Max}$ Outputs Open $T/R = \overline{OE} = \text{GND}$	$V_{IN} \geq V_{HC}$ $V_{IN} \leq 0.2V$
			5.0	14.5		$f_i = 2.5 \text{ MHz}$ Eight Bits Toggling 50% Duty Cycle	$V_{IN} = 3.4V$ $V_{IN} = \text{GND}$
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: $I_C = I_{\text{QUIESCENT}} + I_{\text{INPUTS}} + I_{\text{DYNAMIC}}$
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP}/2 + f_i N_i)$
 I_{CC} = Quiescent Current
 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.

AC Electrical Characteristics: See Section 2 for Waveforms

Symbol	Parameter	54FCTA/74FCTA	74FCTA		54FCTA		Units	Fig. No.
		$T_A = +25^\circ\text{C}$ $V_{CC} = 5.0\text{V}$	$T_A, V_{CC} = \text{Com}$ $R_L = 500\Omega$ $C_L = 50\text{pF}$		$T_A, V_{CC} = \text{Mil}$ $R_L = 500\Omega$ $C_L = 50\text{pF}$			
		Typ	Min (Note 2)	Max	Min (Note 2)	Max		
t_{PLH} t_{PHL}	Propagation Delay A to B, B to A	3.3	1.5	4.6			ns	2-8
t_{PZH} t_{PZL}	Output Enable Time $\overline{\text{OE}}$ to A or B	4.8	1.5	6.2			ns	2-8
t_{PHZ} t_{PHL}	Output Disable Time $\overline{\text{OE}}$ to A or B	4.5	1.5	5.0			ns	2-11
t_{PZH} t_{PZL}	Output Enable Time T/\overline{R} to A or B (Note 1)	4.8	1.5	6.2			ns	2-11
t_{PHZ} t_{PLZ}	Output Enable Time T/\overline{R} to A or B (Note 1)	4.5	1.5	5.0			ns	2-11

Note 1: This parameter is guaranteed but not tested.

Note 2: Minimum limits 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	Conditions
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.