National Semiconductor

54FCT/74FCT544A
Octal Registered Transceiver

General Description

The 'FCT544A octal transceiver contains two sets of D-type latches for temporary storage of data flowing in either direction. Separate Latch Enable and Output Enable inputs are provided for each register to permit independent control of inputting and outputting in either direction of data flow. The 'FCT544A inverts data in both directions.

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

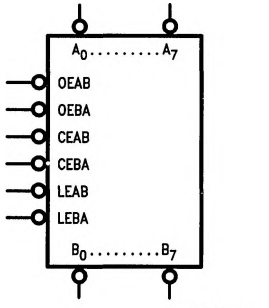
FACT FCTA features undershoot correction and split ground bus for superior performance.

Features

- NSC 54FCT/74FCT544A is pin and functionally equivalent to IDT 54FCT/74FCT544A
- Back to back registers for storage separate controls for data flow in each direction
- Input clamp diodes to limit bus reflections
- TTL/CMOS input and output level compatible
- I_{OL} = 64 mA (Com), 48 mA (Mil)
- CMOS power levels
- 4 kV minimum ESD immunity
- Military Product compliant to MIL-STD 883

Ordering Code: See Section 8

Logic Symbols



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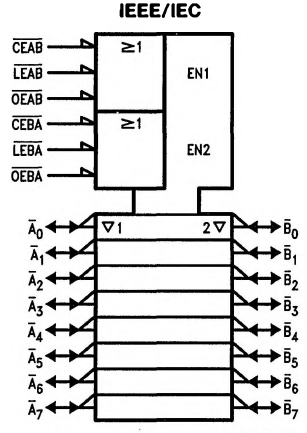
IEEE/IEC



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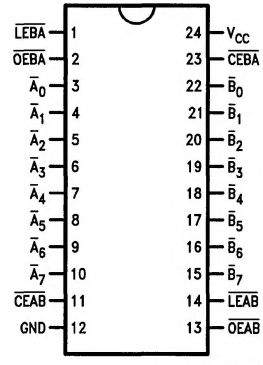
Connection Diagrams

Pin Assignment for DIP and SOIC



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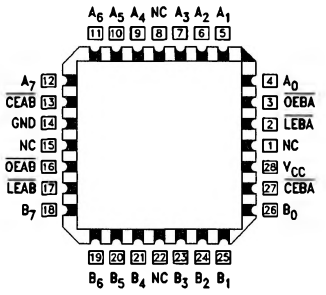
Pin Names	Description
$\overline{OEAB}$	A-to-B Output Enable Input (Active LOW)
$\overline{OEBA}$	B-to-A Output Enable Input (Active LOW)
$\overline{CEAB}$	A-to-B Enable Input (Active LOW)
$\overline{CEBA}$	B-to-A Enable Input (Active LOW)
$\overline{LEAB}$	A-to-B Latch Enable Input (Active LOW)
$\overline{LEBA}$	B-to-A Latch Enable Input (Active LOW)
$\overline{A}_0$–$\overline{A}_7$	A-to-B Data Inputs or B-to-A TRI-STATE® Outputs
$\overline{B}_0$–$\overline{B}_7$	B-to-A Data Inputs or A-to-B TRI-STATE Outputs

Pin Assignment for LCC



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Functional Description

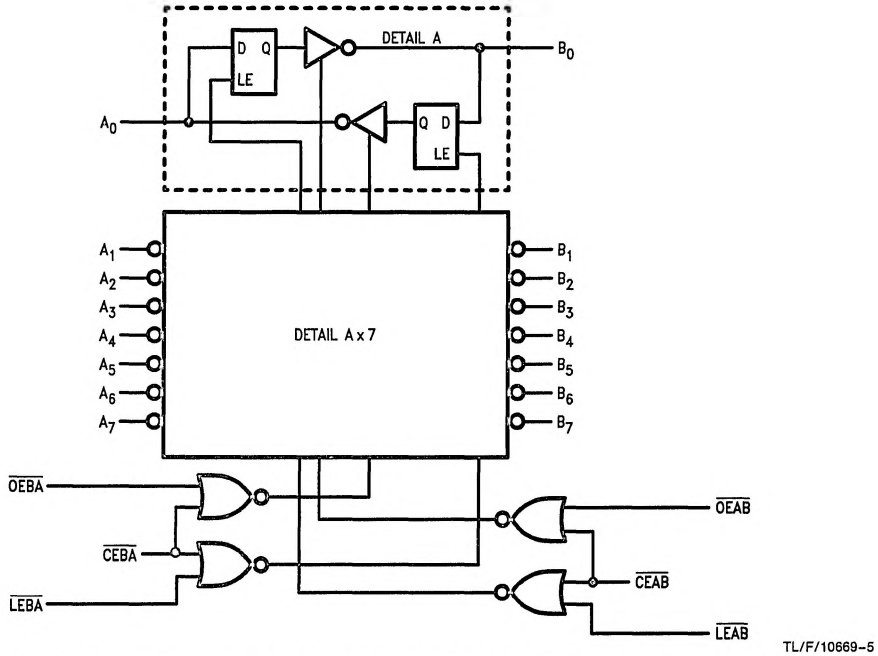
The 'FCT544A contains two sets of eight D-type latches, with separate input and output controls for each set. For data flow from A to B, for example, the A-to-B Enable ($\overline{CEAB}$) input must be LOW in order to enter data from $\overline{A}_0$–$\overline{A}_7$ or take data from $\overline{B}_0$–$\overline{B}_7$, as indicated in the Data I/O Control Table. With $\overline{CEAB}$ LOW, a LOW signal on the A-to-B Latch Enable ($\overline{LEAB}$) input makes the A-to-B latches transparent; a subsequent LOW-to-HIGH transition of the $\overline{LEAB}$ signal puts the A latches in the storage mode and their outputs no longer change with the A inputs. With $\overline{CEAB}$ and $\overline{OEAB}$ both LOW, the TRI-STATE B output buffers are active and reflect the data present at the output of the A latches. Control of data flow from B to A is similar, but using the $\overline{CEBA}$, $\overline{LEBA}$ and $\overline{OEBA}$ outputs.

Data I/O Control Table

Input			Latch Status	Output Buffers
$\overline{CEAB}$	$\overline{LEAB}$	$\overline{OEAB}$		
H	X	X	Latched	High-Z
X	H	X	Latched	
L	L	X	Transparent	
X	X	H		High-Z
L	X	L		Driving

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial
A-to-B data flow shown; B-to-A flow control is the same, except using $\overline{CEBA}$, $\overline{LEBA}$ and $\overline{OEBA}$.

Logic Diagram



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Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Ratings (Note)

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})
- 54FCTA: −65°C to +135°C
- 74FCTA: −55°C to +125°C

Storage Temperature (T_{STG})
- 54FCTA: −65°C to +150°C
- 74FCTA: −55°C to +125°C

Power Dissipation (P_T): 0.5W

DC Output Current (I_{OUT}): 120 mA

Note: 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})
- 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 ±5%, T_A = 0°C to +70°C; Mil: V_{CC} = 5.0V ±10%, T_A = −55°C to +125°C.

Symbol	Parameter	54FCTA/74FCTA Min	Typ	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_{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_{IH}	Input High Currents (I/O Pins)			15 15	μA	V_{CC} = Max	$V_I = V_{CC}$ V_I = 2.7V (Note 2)
I_{IL}	Input Low Currents (I/O Pins)			−15 −15	μA	V_{CC} = MAx	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_{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 GND 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 μA	
						V_{CC} = Min $V_{IN} = V_{IH}$ or V_{IL}	I_{OL} = 300 μA I_L = 48 mA (Mil) I_{OL} = 64 mA (Com)
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)	

DC Characteristics for 'FCTA 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.

Symbol	Parameter	54FCTA/74FCTA			Units	Conditions	
		Min	Typ	Max			
I_{CCD}	Dynamic Power Supply Current (Note 4)		0.25	0.3	mA/MHz	V_{CC} = Max Outputs Open $\overline{CEAB}$ + $\overline{OEAB}$ = GND $\overline{CEBA}$ = V_{CC} 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	4.0	mA	V_{CC} = Max Outputs Open f_{CP} = 10 MHz 50% Duty Cycle $\overline{CEAB}$ + $\overline{OEAB}$ = GND $\overline{CEBA}$ = V_{CC}. f_{CP} = $\overline{LEAB}$ = 10 MHz One Bit Toggling at f_1 = 5 MHz 50% Duty Cycle	$V_{IN} \geq V_{HC}$ $V_{IN} \leq 0.2V$
			1.8	6.0			V_{IN} = 3.4V V_{IN} = GND
			3.0	16.5		(Note 5) V_{CC} = Max Outputs Open f_{CP} = 10 MHz 50% Duty Cycle $\overline{CEAB}$ + $\overline{OEAB}$ = GND $\overline{CEBA}$ = V_{CC}. f_{CP} = $\overline{LEAB}$ = 10 MHz Eight Bits Toggling at f_1 = 5 MHz 50% Duty Cycle	$V_{IN} \geq V_{HC}$ $V_{IN} \leq 0.2V$
			5.0	21.75			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} = 3.4); 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.

AC Electrical Characteristics: See Section 2 for Waveforms

Symbol	Parameter	54FCTA/74FCTA	74FCTA		54FCTA		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 Transparent Mode A_n to B_n or B_n to A_n		1.5	7.0			ns	2-8
t_{PLH} t_{PHL}	Propagation Delay $\overline{LEAB}$ to A_n, $\overline{LEAB}$ to B_n		1.5	8.0			ns	2-8
t_{PZH} t_{PZL}	Output Enable Time $\overline{OEBA}$ or $\overline{OEAB}$ to A_n or B_n $\overline{CEBA}$ or $\overline{CEAB}$ to A_n or B_n		1.5	9			ns	2-11
t_{PHZ} t_{PLZ}	Output Disable Time $\overline{CEBA}$ or $\overline{OEAB}$ to A_n or B_n $\overline{CEBA}$ or $\overline{OEAB}$ to A_n or B_n		1.5	7.5			ns	2-11
t_{SU}	Setup Time High or Low A_n or B_n to $\overline{LEBA}$ or $\overline{LEAB}$		2				ns	2-10
t_H	Hold Time High or Low A_n or B_n to $\overline{LEBA}$ or $\overline{LEAB}$		2				ns	2-10

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

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.