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T-46-07-11

74FCT374A

Octal D Flip-Flop with TRI-STATE® Outputs

General Description

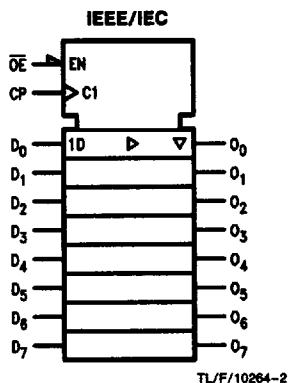
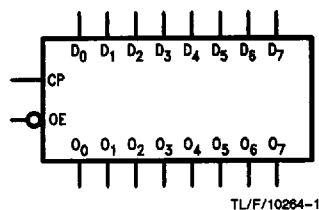
The 74FCT374A is a high-speed, low-power octal D-type flip-flop featuring separate D-type inputs for each flip-flop and TRI-STATE outputs for bus-oriented applications. A buffered Clock (CP) and Output Enable (\overline{OE}) are common to all flip-flops.

Features

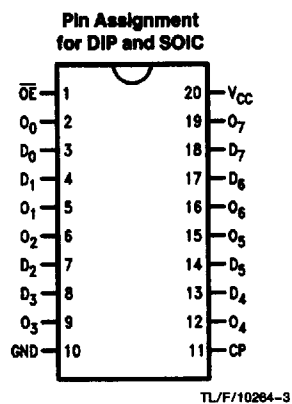
- I_{CC} and I_{OZ} reduced to 40.0 μA and $\pm 2.5 \mu A$ respectively
- NSC 74FCT374A is pin and functionally equivalent to IDT 74FCT374A
- Buffered positive edge triggered clock
- TRI-STATE outputs for bus-oriented applications
- TTL input and output level compatible
- TTL inputs accept CMOS levels
- High current latch up immunity
- $I_{OL} = 48 \text{ mA}$
- Electrostatic discharge protection $\geq 2 \text{ kV}$

Ordering Code: See Section 8

Logic Symbols



Connection Diagram






Pin Names	Description
D_0 - D_7	Data Inputs
CP	Clock Pulse Input
\overline{OE}	TRI-STATE Output Enable Input
O_0 - O_7	TRI-STATE Outputs

Functional Description

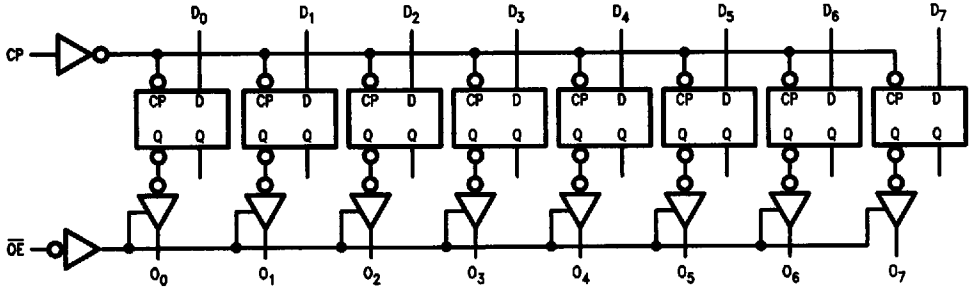
The 'FCT374A consists of eight edge-triggered flip-flops with individual D-type inputs and TRI-STATE outputs. The buffered clock and buffered Output Enable are common to all flip-flops. The eight flip-flops will store the state of their individual D inputs that meet the setup and hold time requirements on the LOW-to-HIGH Clock (CP) transition. With the Output Enable (\overline{OE}) LOW, the contents of the eight flip-flops are available at the outputs. When the \overline{OE} is HIGH, the outputs go to the high impedance state. Operation of the \overline{OE} input does not affect the state of the flip-flops.

Truth Table

Inputs			Outputs
D_n	CP	\overline{OE}	O_n
H		L	H
L		L	L
X	X	H	Z

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

Logic Diagram



TL/F/10264-5

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

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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})	
74FCTA	-0.5V to 7.0V
Temperature under Bias (T_{BIAS})	
74FCTA	-55°C to +125°C
Storage Temperature (T_{STG})	
74FCTA	-55°C to +125°C
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})	4.75V to 5.25V
74FCTA	
Input Voltage	0V to V_{CC}
Output Voltage	0V to V_{CC}
Operating Temperature (T_A)	0°C to +70°C
74FCTA	
Junction Temperature (T_J)	
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 '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 $+70^\circ C$; $V_{HC} = V_{CC} - 0.2V$

Symbol	Parameter	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			5.0 5.0	μA	$V_{CC} = \text{Max}$	$V_I = V_{CC}$ $V_I = 2.7V$ (Note 2)
I_{IL}	Input Low Current			-5.0 -5.0	μA	$V_{CC} = \text{Max}$	$V_I = 0.5V$ (Note 2) $V_I = \text{GND}$
I_{OZ}	Maximum TRI-STATE Current			2.5 2.5 -2.5 -2.5	μA	$V_{CC} = \text{Max}$	$V_O = V_{CC}$ $V_O = 2.7V$ (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	3.0 V_{CC} 4.3		V	$V_{CC} = 3V$; $V_{IN} = 0.2V$ or V_{HC} ; $I_{OH} = -32 \mu A$ $V_{CC} = \text{Min}$ $V_{IN} = V_{IH}$ or V_{IL} $I_{OH} = -300 \mu A$ $I_{OH} = -15 \text{ mA}$	
V_{OL}	Maximum Low Level Output Voltage		GND GND 0.3	0.2 0.2 0.50	V	$V_{CC} = 3V$; $V_{IN} = 0.2V$ or V_{HC} ; $I_{OL} = 300 \mu A$ $V_{CC} = \text{Min}$ $V_{IN} = V_{IH}$ or V_{IL} $I_{OL} = 300 \mu A$ $I_{OL} = 48 \text{ mA}$	
I_{CC}	Maximum Quiescent Supply Current		1.0	40.0	μA	$V_{CC} = \text{Max}$ $V_{IN} \geq V_{HC}$; $V_{IN} \leq 0.2V$ $I_I = 0$	
ΔI_{CC}	Quiescent Supply Current; TTL Inputs HIGH		0.5	2.0	mA	$V_{CC} = \text{Max}$ $V_{IN} = 3.4V$ (Note 3)	

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 $+70^{\circ}C$; $V_{HC} = V_{CC} - 0.2V$

Symbol	Parameter	74FCTA			Units	Conditions		
		Min	Typ	Max				
I_{CCD}	Dynamic Power Supply Current (Note 4)		0.15	0.25	mA/MHz	$V_{CC} = \text{Max}$ Outputs Open $\overline{OE} = \text{GND}$ 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	4.0				mA
			2.0	6.0	$V_{IN} = 3.4V$ $V_{IN} = \text{GND}$			
				3.75		7.8	(Note 5) $V_{CC} = \text{Max}$ Outputs Open $f_{CP} = 10 \text{ MHz}$ $\overline{OE} = \text{GND}$ $f_1 = 2.5 \text{ MHz}$ Eight Bits Toggling 50% Duty Cycle	
				6.0	16.8	$V_{IN} = 3.4V$ $V_{IN} = \text{GND}$		
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: $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$

$$I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP}/2 + f_1 N_1)$$

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_1 = Input Frequency

N_1 = Number of Inputs at f_1

All currents are in milliamps and all frequencies are in megahertz.

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AC Electrical Characteristics: See Section 2 for Waveforms

Symbol	Parameter	74FCTA		Units	Fig. No.
		$T_A = +25^\circ\text{C}$ $V_{CC} = 5.0\text{V}$			
		Typ	Min (Note 1) Max		
t_{PLH} t_{PHL}	Propagation Delay C_p to O_n	4.5	2.0 6.5	ns	2-8
t_{PZH} t_{PZL}	Output Enable Time	5.5	1.5 6.5	ns	2-11
t_{PHZ} t_{PLZ}	Output Disable Time	4.0	1.5 5.5	ns	2-11
t_{SU}	Set Up Time High or Low D_n to C_p	1.0	2.0	ns	2-10
t_H	Hold Time High or Low D_n to C_p	0.5	1.5	ns	2-10
t_w	C_p Pulse Width High or Low	4.0	5.0	ns	2-9

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	Unit	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.