National Semiconductor

54FCT/74FCT574A
Octal D Flip-Flop with TRI-STATE® Outputs

General Description

The 'FCT574A is a high-speed, low power octal flip-flop with a buffered common Clock (CP) and a buffered common Output Enable ($\overline{OE}$). The information presented to the D inputs is stored in the flip-flops on the LOW-to-HIGH Clock (CP) transition.

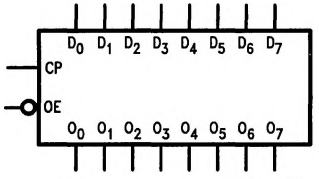
The 'FCT574A is functionally identical to the 'FCT374A except for the pinouts.

Features

- NSC 54/74FCT574A is pin and functionally equivalent to IDT54/74FCT574A
- Inputs and outputs on opposite sides of package allowing easy interface with microprocessors
- Useful as input or output port for microprocessors
- Functionally identical to 'FCT374A
- TRI-STATE outputs for bus-oriented applications
- 'FCT574A has TTL-compatible inputs
- I_{OL} = 48 mA (Comm) and 32 mA (Mil)
- TTL inputs accept CMOS levels

Ordering Code: See Section 8

Logic Symbols



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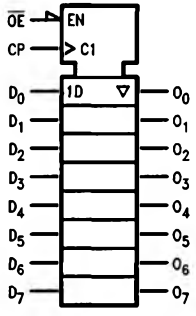
IEEE/IEC



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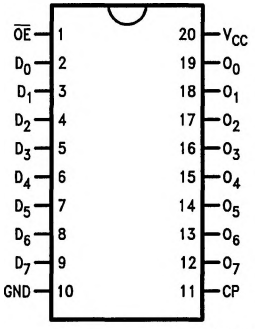
Connection Diagrams

Pin Assignment for DIP, Flatpak and SOIC



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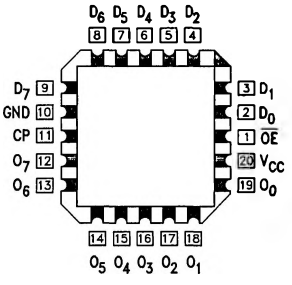
Pin Assignment for LCC



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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

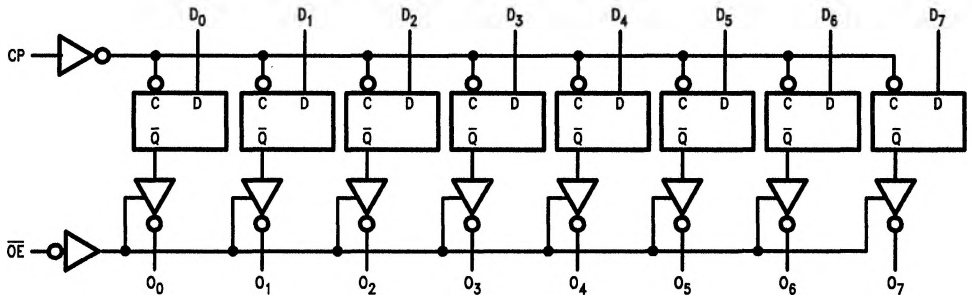
The 'FCT574A consists of eight edge-triggered flip-flops with individual D-type inputs and TRI-STATE true outputs. The buffered clock and buffered Output Enable are common to all flip-flops. The eight flip-flops will store the state of their individual D inputs that meet the setup and hold time requirements 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 $\overline{OE}$ 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.

Function Table

Inputs			Internal	Outputs	Function
$\overline{OE}$	CP	D	Q	O_N	
H	H	L	NC	Z	Hold
H	H	H	NC	Z	Hold
H	↗	L	L	Z	Load
H	↗	H	H	Z	Load
L	↗	L	L	L	Data Available
L	↗	H	H	H	Data Available
L	H	L	NC	NC	No Change in Data
L	H	H	NC	NC	No Change in Data

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial
Z = High Impedance
↗ = LOW-to-HIGH Transition
NC = No Change

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 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 ±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	54FCTA/74FCTA Min	54FCTA/74FCTA Typ	54FCTA/74FCTA 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			10.0 10.0 −10.0 −10.0	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 V_{HC} 2.4 2.4	3.0 V_{CC} 4.3 4.3	V	V_{CC} = 3V; V_{IN} = 0.2V or V_{HC}; I_{OH} = −32 μA V_{CC} = Min, $V_{IN} = V_{IH}$ or V_{IL} V_{CC} = Min, $V_{IN} = V_{IH}$ or V_{IL} 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 0.5 0.5	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} V_{CC} = Min, $V_{IN} = V_{IH}$ or V_{IL} V_{CC} = Min, $V_{IN} = V_{IH}$ or V_{IL}	 I_{OL} = 300 μA I_{OL} = 32 mA (Mil) I_{OL} = 48 mA (Com)

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, V_{HC} = V_{CC} −0.2V (Continued)

Symbol	Parameter	54FCTA/74FCTA			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)		0.15	0.25	mA/MHz	V_{CC} = Max Outputs Open $\overline{OE}$ = 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	V_{CC} = Max Outputs Open $\overline{OE}$ = GND f_i = 5.0 MHz One Bit Toggling 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	7.8		(Note 5) V_{CC} = Max Outputs Open $\overline{OE}$ = GND f_{CD} = 10 MHz f_i = 2.5 MHz Eight Bits Toggling 50% Duty Cycle	$V_{IN} \geq V_{HC}$ $V_{IN} \leq 0.2V$
			5.0	16.8			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.

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 = 500Ω C_L = 50 pF		T_A, V_{CC} = Mil R_L = 500Ω C_L = 50 pF			
		Typ	Min	Max	Min	Max		
t_{PLH} t_{PHL}	Propagation Delay CP 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 CP	1.0	2.0				ns	2-10
t_H	Hold Time High or Low D_n to CP	0.5	1.5				ns	2-10
t_W	CP 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°C, f = 1.0 MHz)

Symbol	Parameter (Note 1)	Typ	Max	Units	Conditions
C_{IN}	Input Capacitance	6	10	pF	V_{IN} = 0V
C_{OUT}	Output Capacitance	8	12	pF	V_{OUT} = 0V