

T-46-07-11

574A



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 (OE). The information presented to the D inputs is stored in the flip-flops on the LOW-to-HIGH Clock (CP) transition.

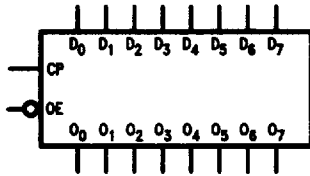
The 'FCT574A is functionally identical to the 'FCT374A except for the pinouts.

Features

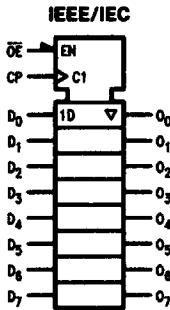
- I_{CC} and I_{OZ} reduced to 400 μ A and $\pm 2.5 \mu$ A respectively
- NSC 74FCT574A is pin and functionally equivalent to IDT74FCT574A
- Inputs and outputs on opposite sides of package allowing easy interface with microprocessors
- Useful as input or output port for microprocessors
- Functionally identical to 'FCT374A
- TRI-STATE outputs for bus-oriented applications
- 'FCT574A has TTL-compatible inputs
- $I_{OL} = 48$ mA
- TTL inputs accept CMOS levels

Ordering Code: See Section 8

Logic Symbols



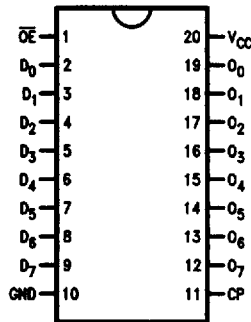
TL/F/10150-1



TL/F/10150-4

Connection Diagram

Pin Assignment for DIP and SOIC



TL/F/10150-2

Pin Names	Description
D ₀ -D ₇	Data Inputs
CP	Clock Pulse Input
OE	TRI-STATE Output Enable Input
O ₀ -O ₇	TRI-STATE Outputs

574A

Functional Description

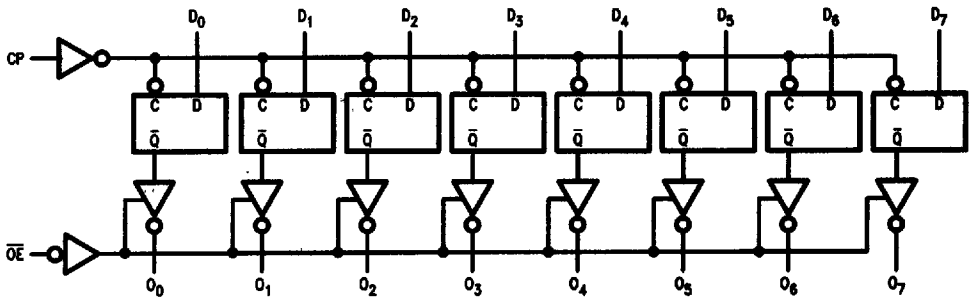
The FCT574A consists of eight edge-triggered flip-flops with individual D-type inputs and TRI-STATE true outputs. The buffered clock and buffered Output Enable are common to all flip-flops. The eight flip-flops will store the state of their individual D inputs that meet the setup and hold time requirements on the LOW-to-HIGH Clock (CP) transition. With the Output Enable (OE) LOW, the contents of the eight flip-flops are available at the outputs. When OE is HIGH, the outputs go to the high impedance state. Operation of the OE input does not affect the state of the flip-flops.

Function Table

Inputs			Internal	Outputs	Function
OE	CP	D	Q	ON	
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



TL/F/10150-5

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})	
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})	
74FCTA	4.75V to 5.25V
Input Voltage	0V to V_{CC}
Output Voltage	0V to V_{CC}
Operating Temperature (T_A)	
74FCTA	0°C to +70°C
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	3.0		V	$V_{CC} = 3V; V_{IN} = 0.2V$ or $V_{HC}; I_{OH} = -32 \mu A$	
		V_{HC} 2.4	V_{CC} 4.3			$V_{CC} = \text{Min}$ $V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -300 \mu A$ $I_{OH} = -15 \text{ mA}$
V_{OL}	Maximum Low Level Output Voltage		GND	0.2	V	$V_{CC} = 3V; V_{IN} = 0.2V$ or $V_{HC}; I_{OL} = 300 \mu A$	
			GND	0.2		$V_{CC} = \text{Min}$ $V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 300 \mu A$ $I_{OL} = 48 \text{ mA}$
			0.3	0.5			

574A

DC Characteristics for 'FCTA Family Devices

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_{CC}	Maximum Quiescent Supply Current		1.0	40.0	μA	$V_{CC} = \text{Max}$ $V_{IN} \geq V_{HC}$; $V_{IN} \leq 0.2V$ $f_i = 0$	
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)		0.15	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	$V_{CC} = \text{Max}$ Outputs Open $\overline{OE} = \text{GND}$ $f_{CP} = 10 \text{ MHz}$ $f_i = 5.0 \text{ MHz}$ One Bit Toggling 50% Duty Cycle	$V_{IN} \geq V_{HC}$ $V_{IN} \leq 0.2V$
			1.8	6.0		$V_{IN} = 3.4V$ $V_{IN} = \text{GND}$	
			3.0	7.8		(Note 5) $V_{CC} = \text{Max}$ Outputs Open $\overline{OE} = \text{GND}$ $f_{CP} = 10 \text{ MHz}$ $f_i = 2.5 \text{ MHz}$ Eight Bits Toggling 50% Duty Cycle	$V_{IN} \geq V_{HC}$ $V_{IN} \leq 0.2V$
			5.0	16.8		$V_{IN} = 3.4V$ $V_{IN} = \text{GND}$	
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: $I_C = I_{QUIESCENT} + I_{INPUTS} + I_{DYNAMIC}$

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

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 milliamperes and all frequencies are in megahertz.

AC Electrical Characteristics: See Section 2 for Waveforms

Symbol	Parameter	74FCTA		Units	Fig. No.
		$T_A = +25^\circ\text{C}$ $V_{CC} = 5.0\text{V}$	$T_A, V_{CC} = \text{Com}$ $R_L = 500\Omega$ $C_L = 50\text{ pF}$		
		Typ	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 ($T_A = +25^\circ\text{C}, f = 1.0\text{ MHz}$)

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