

# P54/74FCT374/A/C (P54/74PCT374/A/C) P54/74FCT574/A/C (P54/74PCT574/A/C) OCTAL D FLIP-FLOPS WITH 3-STATE OUTPUTS



## FEATURES

- Function, Pinout, and Drive Compatible with the FCT and F Logic
- FCT-C speed at 5.2ns max. (Com'I)  
FCT-A speed at 6.5ns max. (Com'I)
- CMOS  $V_{OH}$  Levels for Low Power Consumption — Typically 1/3 of FAST Bipolar Logic
- Edge-rate Control Circuitry for Significantly Improved Noise Characteristics
- ESD protection exceeds 2000V
- Inputs and Outputs Interface Directly with TTL, NMOS, and CMOS Devices
- Outputs Meet Levels Required for CMOS Static RAM Low Power Standby Mode
- 64 mA Sink Current (Com'I), 48 mA (MII)  
15 mA Source Current (Com'I), 12 mA (MII)
- Edge Triggered D Type Inputs
- 250MHz Typical Toggle Rate
- Buffered Positive Edge Trigered Clock
- Input Clamp Diode to Limit Bus Reflections
- Manufactured in 0.8 micron PACE Technology™



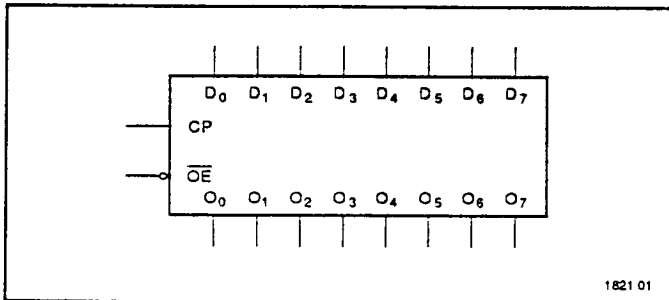
## DESCRIPTION

The 'FCT374 and 'FCT574 are high-speed low power octal D-type flip-flops featuring separate D-type inputs for each flip-flop. Both devices have 3-state outputs for bus oriented applications. A buffered clock (CP) and output enable ( $\overline{OE}$ ) are common to all flip-flops. The 'FCT574 is the same as the 'FCT374 except that all the outputs are on one side of the package and the inputs on the other side.

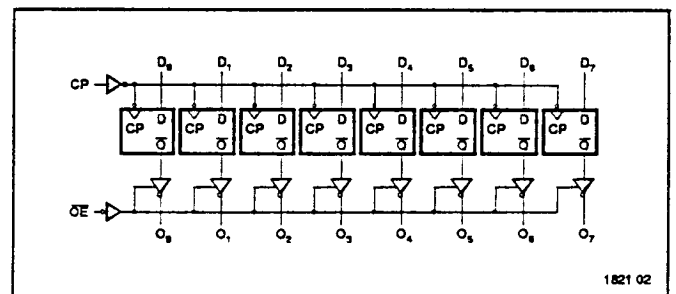
The eight flip-flops contained in the 'FCT374 and 'FCT574 will store the state of their individual D inputs that meet the setup and hold time requirements on the low-to-high clock (CP) transition. When  $\overline{OE}$  is LOW, the contents of the eight flip-flops are available at the outputs. When  $\overline{OE}$  is HIGH, the outputs will be in the high impedance state. The state of output enable does not affect the state of the flip-flops.



## LOGIC SYMBOL



## LOGIC DIAGRAMS



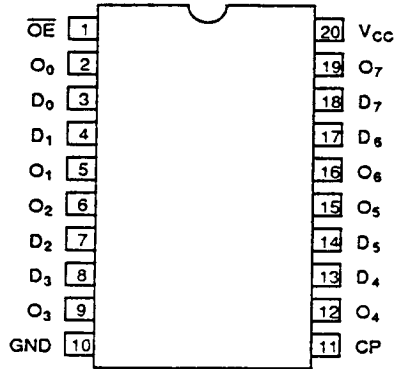
Means Quality, Service and Speed

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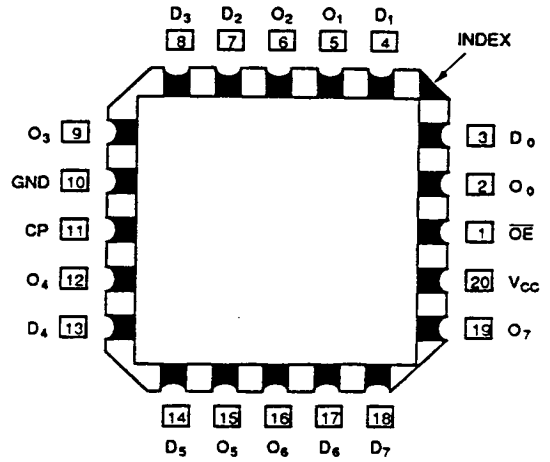
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**PIN CONFIGURATIONS**

'FCT374



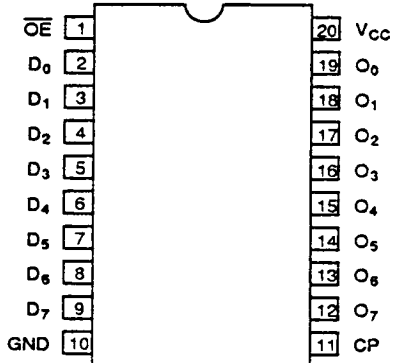
DIP(D2, P2)  
SOIC (S2)



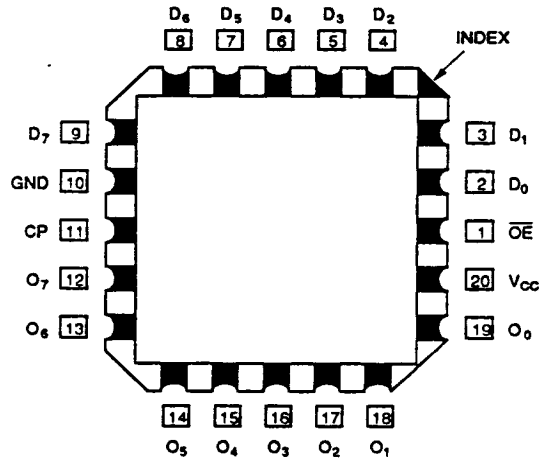
LCC(L2)

1821 03

'FCT574



DIP(D2, P2)  
SOIC (S2)



LCC(L2)

1821 04

**ABSOLUTE MAXIMUM RATINGS<sup>1,2</sup>**

Symbol	Parameter	Value	Unit
T <sub>STG</sub>	Storage Temperature	-65 to +150	°C
T <sub>A</sub>	Ambient Temperature Under Bias	-65 to +135	°C
V <sub>CC</sub>	V <sub>CC</sub> Potential to Ground	-0.5 to +7.0	V
I <sub>IN</sub>	Input Current	-30 to +5.0	mA

Symbol	Parameter	Value	Unit
I <sub>OUTPUT</sub>	Current Applied to Output	120	mA
V <sub>IN</sub>	Input Voltage	-0.5 to V <sub>CC</sub> + 0.5	V
V <sub>OUT</sub>	Voltage Applied to Output	-0.5 to V <sub>CC</sub> + 0.5	V

**Notes:**

1. Operation beyond the limits set forth in the above table may impair the useful life of the device. Unless otherwise noted, these limits are over the operating free-air temperature range.

2. Unused inputs must always be connected to an appropriate logic voltage level, preferably either V<sub>CC</sub> or ground.

**RECOMMENDED OPERATING CONDITIONS**

Free Air Ambient Temperature	Min	Max
Military	-55°C	+125°C
Commercial	0°C	+70°C

Supply Voltage (V <sub>CC</sub> )	Min	Max
Military	+4.5V	+5.5V
Commercial	+4.75V	+5.25V

**DC ELECTRICAL CHARACTERISTICS** (Over recommended operating conditions)

Symbol	Parameter	Min	Typ <sup>1</sup>	Max	Units	V <sub>CC</sub>	Conditions	
V <sub>IH</sub>	Input HIGH Voltage	2.0			V			
V <sub>IL</sub>	Input LOW Voltage			0.8	V			
V <sub>H</sub>	Hysteresis		0.35		V		All inputs	
V <sub>CD</sub>	Input Clamp Diode Voltage		-0.7	-1.2	V	MIN	I <sub>IN</sub> = -18mA	
V <sub>OH</sub>	Output HIGH Voltage	V <sub>CC</sub> = 3V, V <sub>IN</sub> = 0.2V, or V <sub>CC</sub> - 0.2V		V <sub>CC</sub> - 0.2	V <sub>CC</sub>	V	I <sub>OH</sub> = -32µA	
		Military/Commercial (CMOS)	V <sub>CC</sub> - 0.2	V <sub>CC</sub>	V	MIN	I <sub>OH</sub> = -300µA	
		Military (TTL)	2.4	4.3	V	MIN	I <sub>OH</sub> = -12mA	
		Commercial (TTL)	2.4	4.3	V	MIN	I <sub>OH</sub> = -15mA	
V <sub>OL</sub>	Output LOW Voltage	V <sub>CC</sub> = 3V, V <sub>IN</sub> = 0.2V, or V <sub>CC</sub> - 0.2V			GND	0.2	V	I <sub>OL</sub> = 300µA
		Military/Commercial (CMOS)		GND	0.2	V	MIN	I <sub>OL</sub> = 300µA
		Military (TTL)		0.3	0.5	V	MIN	I <sub>OL</sub> = 32mA
		Commercial (TTL)		0.3	0.5	V	MIN	I <sub>OL</sub> = 48mA
		Commercial (TTL)		0.3	0.5	V	MIN	I <sub>OL</sub> = 64mA
I <sub>IH</sub>	Input HIGH Current			5	µA	MAX	V <sub>IN</sub> = V <sub>CC</sub>	
I <sub>IL</sub>	Input LOW Current			-5	µA	MAX	V <sub>IN</sub> = GND	
I <sub>IH</sub>	Input HIGH Current <sup>3</sup>			5	µA	MAX	V <sub>IN</sub> = 2.7V	
I <sub>IL</sub>	Input LOW Current <sup>3</sup>			-5	µA	MAX	V <sub>IN</sub> = 0.5V	
I <sub>OZH</sub>	Off State I <sub>OUT</sub> HIGH-Level Output Current			10	µA	MAX	V <sub>OUT</sub> = V <sub>CC</sub>	
I <sub>OZL</sub>	Off State I <sub>OUT</sub> LOW-Level Output Current			-10	µA	MAX	V <sub>OUT</sub> = GND	
I <sub>OZH</sub>	Off State I <sub>OUT</sub> HIGH-Level Output Current <sup>3</sup>			10	µA	MAX	V <sub>OUT</sub> = 2.7V	
I <sub>OZL</sub>	Off State I <sub>OUT</sub> LOW-Level Output Current <sup>3</sup>			-10	µA	MAX	V <sub>OUT</sub> = 0.5V	
I <sub>OS</sub>	Output Short Circuit Current <sup>2</sup>	-60	-120	-225	mA	MAX	V <sub>OUT</sub> = 0.0V	
C <sub>IN</sub>	Input Capacitance <sup>3</sup>		5	10	pF	MAX	All inputs	
C <sub>OUT</sub>	Output Capacitance <sup>3</sup>		9	12	pF	MAX	All outputs	

**Notes:**

- Typical limits are at V<sub>CC</sub> = 5.0V, T<sub>A</sub> = +25°C ambient.
- Not more than one output should be shorted at a time. Duration of short should not exceed one second. The use of high speed test apparatus and/or sample and hold techniques are preferable in order to minimize internal chip heating and more accurately reflect

operational values. Otherwise prolonged shorting of a high output may raise the chip temperature well above normal and thereby cause invalid readings in other parameter tests. In any sequence of parameter tests, I<sub>OS</sub> tests should be performed last.

3. This parameter is guaranteed but not tested.

**DC CHARACTERISTICS** (Over recommended operating conditions unless otherwise specified.)

Symbol	Parameter	Typ <sup>1</sup>	Max	Units	Conditions
$I_{CC}$	Quiescent Power Supply Current (CMOS inputs)	0.003	0.5	mA	$V_{CC} = \text{MAX}$ , $f_1 = 0$ , Outputs Open, $V_{IN} \leq 0.2V$ or $V_{IN} \geq V_{CC} - 0.2V$
$\Delta I_{CC}$	Quiescent Power Supply Current (TTL inputs)	0.5	2.0	mA	$V_{CC} = \text{MAX}$ , $V_{IN} = 3.4V^2$ , $f_1 = 0$ , Outputs Open
$I_{CCD}$	Dynamic Power Supply Current <sup>3</sup>	0.15	0.25	mA/ mHz	$V_{CC} = \text{MAX}$ , One Bit Toggling, 50% Duty Cycle, Outputs Open, $\overline{OE} = \text{GND}$ , $V_{IN} \leq 0.2V$ or $V_{IN} \geq V_{CC} - 0.2V$
$I_C$	Total Power Supply Current <sup>5</sup>	1.7	4.0	mA	$V_{CC} = \text{MAX}$ , $f_0 = 10\text{MHz}$ 50% Duty Cycle, Outputs Open, One Bit Toggling at $f_1 = 5\text{MHz}$ , $\overline{OE} = \text{GND}$ , $V_{IN} \leq 0.2V$ or $V_{IN} \geq V_{CC} - 0.2V$
		2.2	6.0	mA	$V_{CC} = \text{MAX}$ , $f_0 = 10\text{MHz}$ 50% Duty Cycle, Outputs Open, One Bit Toggling at $f_1 = 5\text{MHz}$ , $\overline{OE} = \text{GND}$ , $V_{IN} = 3.4V$ or $V_{IN} = \text{GND}$
		4.0	7.8 <sup>4</sup>	mA	$V_{CC} = \text{MAX}$ , $f_0 = 10\text{MHz}$ 50% Duty Cycle, Outputs Open, Eight Bits Toggling at $f_1 = 2.5\text{MHz}$ , $\overline{OE} = \text{GND}$ , $V_{IN} \leq 0.2V$ or $V_{IN} \geq V_{CC} - 0.2V$
		6.2	16.8 <sup>4</sup>	mA	$V_{CC} = \text{MAX}$ , $f_0 = 10\text{MHz}$ 50% Duty Cycle, Outputs Open, Eight Bits Toggling at $f_1 = 2.5\text{MHz}$ , $\overline{OE} = \text{GND}$ , $V_{IN} = 3.4V$ or $V_{IN} = \text{GND}$



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**Notes:**

- Typical values are at  $V_{CC} = 5.0V$ ,  $+25^\circ\text{C}$  ambient and maximum loading.
- Per TTL driven input ( $V_{IN} = 3.4V$ ); all other inputs at  $V_{CC}$  or GND.
- This parameter is not directly testable, but is derived for use in Total Power Supply calculations.
- Values for these conditions are examples of the  $I_{CC}$  formula. These limits are guaranteed but not tested.
- $I_C = I_{\text{QUIESCENT}} + I_{\text{INPUTS}} + I_{\text{DYNAMIC}}$   
 $I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_0/2 + f_1 N_1)$   
 $I_{CC}$  = Quiescent Current with CMOS input levels

- $\Delta I_{CC}$  = Power Supply Current for a TTL High Input ( $V_{IN} = 3.4V$ )
- $D_H$  = Duty Cycle for TTL Inputs High
- $N_T$  = Number of TTL Inputs at  $D_H$
- $I_{CCD}$  = Dynamic Current Caused by an Input Transition Pair (HLH or LHL)
- $f_0$  = 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.

**TRUTH TABLE**

Inputs			Outputs 'FCT374—'FCT574
$D_n$	CP	$\overline{OE}$	$O_n$
H		L	H
L		L	L
X	X	H	Z

- H = HIGH Voltage Level
- L = LOW Voltage Level
- X = Don't Care
-  = LOW-to-HIGH clock transition
- Z = HIGH Impedance

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### AC CHARACTERISTICS

Sym.	Parameter	'FCT374				'FCT374A				'FCT374C				Units	Fig. No.
		MIL		COM'L		MIL		COM'L		MIL		COM'L			
		Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.		
$t_{PLH}$ $t_{PHL}$	Prop. Delay Clock to Output	1.5	9.0	1.5	8.0	2.0	7.2	2.0	6.5	2.0	6.2	2.0	5.2	ns	1, 5
$t_{PZH}$ $t_{PZL}$	Output Enable Time	1.5	9.0	1.5	8.0	1.5	7.5	1.5	6.5	1.5	6.2	1.5	5.5	ns	1, 7, 8
$t_{PHZ}$ $t_{PLZ}$	Output Disable Time	1.5	8.0	1.5	8.0	1.5	6.5	1.5	5.5	1.5	5.7	1.5	5.0	ns	1, 7, 8

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**Note:**

1. AC Characteristics guaranteed with  $C_L = 50pF$  as shown in Figure 1.

### AC CHARACTERISTICS

Sym.	Parameter	'FCT574				'FCT574A				'FCT574C				Units	Fig. No.
		MIL		COM'L		MIL		COM'L		MIL		COM'L			
		Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.		
$t_{PLH}$ $t_{PHL}$	Prop. Delay Clock to Output	2.0	11.0	2.0	10.0	2.0	7.2	2.0	6.5	2.0	6.2	2.0	5.2	ns	1, 5
$t_{PZH}$ $t_{PZL}$	Output Enable Time	1.5	14.0	1.5	12.5	1.5	7.5	1.5	6.5	1.5	6.2	1.5	5.5	ns	1, 7, 8
$t_{PHZ}$ $t_{PLZ}$	Output Disable Time	1.5	8.0	1.5	8.0	1.5	6.5	1.5	5.5	1.5	5.7	1.5	5.0	ns	1, 7, 8

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**Note:**

1. AC Characteristics guaranteed with  $C_L = 50pF$  as shown in Figure 1.

### AC CHARACTERISTICS

Sym.	Parameter	'FCT374 'FCT574				'FCT374A 'FCT574A				'FCT374C 'FCT574C				Units	Fig. No.
		MIL		COM'L		MIL		COM'L		MIL		COM'L			
		Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.	Min. <sup>1</sup>	Max.		
$t_s(H)$ $t_s(L)$	Setup Time, High or Low $D_n$ to CP	2.5	-	2.0	-	2.0	-	2.0	-	2.0	-	2.0	-	ns	4
$t_n(H)$ $t_n(L)$	Hold Time, High or Low $D_n$ to CP	1.0	-	1.0	-	1.5	-	1.5	-	1.5	-	1.5	-	ns	
$t_w(H)$ $t_w(L)$	Clk Pulse Width <sup>2</sup> High or Low	7.0	-	6.0	-	6.0	-	5.0	-	6.0	-	5.0	-	ns	5

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**Notes:**

1. Minimum limits are guaranteed but not tested on Propagation Delays.
2. With one data channel toggling,  $t_v(L) = t_v(H) = 2.0ns$  and  $t_r = t_f = 1.0ns$ .

### ORDERING INFORMATION

<u>PxxFCT</u> Temp. Class	<u>xxxx</u> Device type	<u>xx</u> Package	<u>x</u> Processing	
			Blank	Commercial
			M	Military Temperature
			MB	MIL-STD-883, Class B
			P	Plastic DIP
			D	CERDIP
			SO	Small Outline IC
			L	Leadless Chip Carrier
			374/574	OCTAL D Flip-Flop
			374A/574A	Fast OCTAL D Flip-Flop
			374C/574C	Ultra Fast OCTAL D Flip-Flop
			74	Commercial
			54	Military

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