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

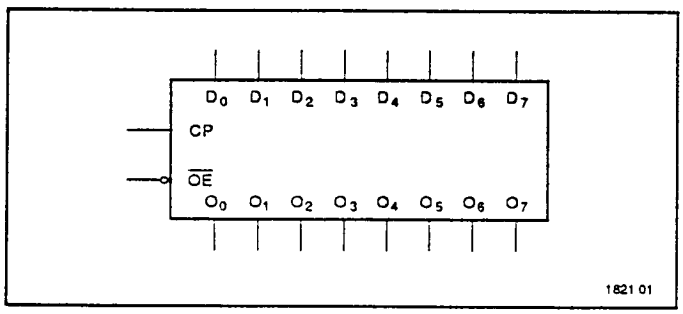
- Function, Pinout, and Drive Compatible with the FCT and F Logic
- FCT-C speed at 5.2ns max. (Com'l)
  FCT-A speed at 6.5ns max. (Com'l)
- CMOS V_{OH} Levels for Low Power Consumption — Typically 1/3 of FAST Bipolar Logic
- Edge-rate Control Circuitry for Significantly Improved Noise Characteristics
- 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'l), 48 mA (Mil)
  15 mA Source Current (Com'l), 12 mA (Mil)
- 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

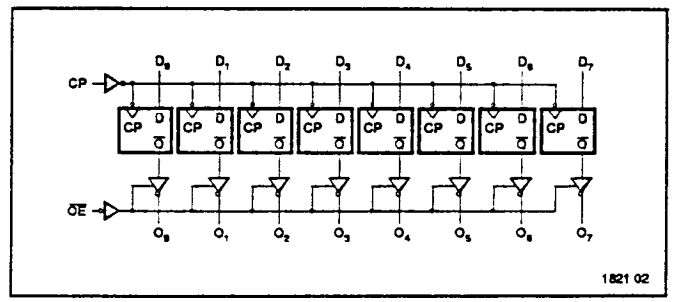
The 'FCT374 and 'FCT574 are high-speed low power octal D-type flip-flops featuring separate D-type inputs for each flip-flop. Both devices have 3-state outputs for bus oriented applications. A buffered clock (CP) and output enable ($\overline{OE}$) are common to all flip-flops. The 'FCT574 is the same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



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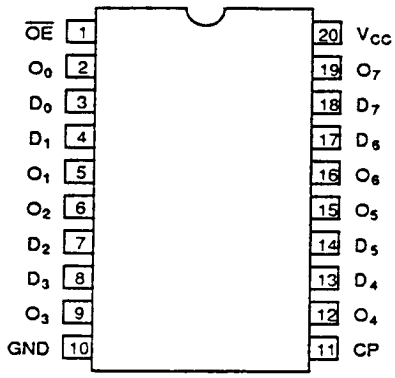
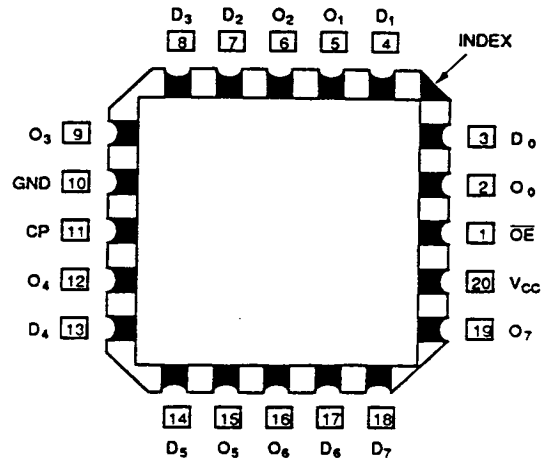
PIN CONFIGURATIONS

'FCT374



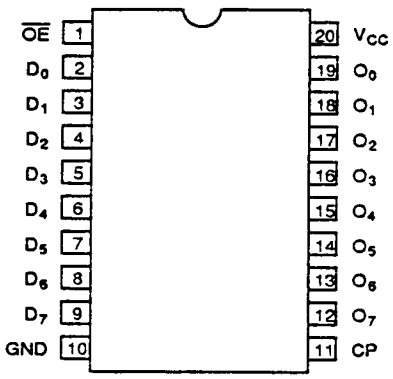
DIP(D2, P2)
SOIC (S2)



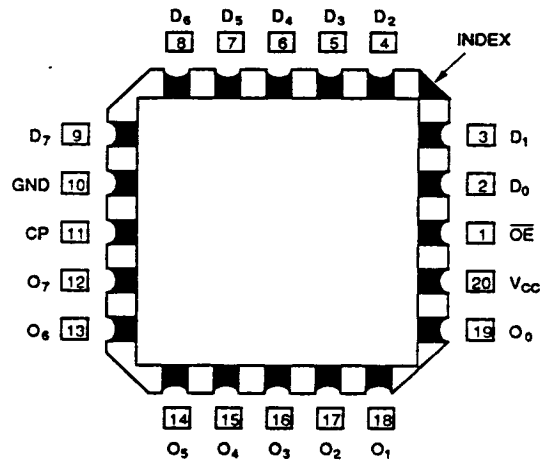
LCC(L2)

1821 03

'FCT574



DIP(D2, P2)
SOIC (S2)



LCC(L2)

1821 04

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ABSOLUTE MAXIMUM RATINGS[1,2]

Symbol	Parameter	Value	Unit
T_{STG}	Storage Temperature	–65 to +150	°C
T_A	Ambient Temperature Under Bias	–65 to +135	°C
V_{CC}	V_{CC} Potential to Ground	–0.5 to +7.0	V
I_{IN}	Input Current	–30 to +5.0	mA

1821 Tbl 01

Symbol	Parameter	Value	Unit
I_{OUTPUT}	Current Applied to Output	120	mA
V_{IN}	Input Voltage	–0.5 to V_{CC} + 0.5	V
V_{OUT}	Voltage Applied to Output	–0.5 to V_{CC} + 0.5	V

1821 Tbl 02

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_{CC} or ground.

RECOMMENDED OPERATING CONDITIONS

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

1821 Tbl 03

Supply Voltage (V_{CC})	Min	Max
Military	+4.5V	+5.5V
Commercial	+4.75V	+5.25V

1821 Tbl 04

DC ELECTRICAL CHARACTERISTICS (Over recommended operating conditions)

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

1821 Tbl 05

Notes:

1. Typical limits are at V_{CC} = 5.0V, T_A = +25°C ambient.
2. 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_{os} tests should be performed last.
3. This parameter is guaranteed but not tested.

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

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

1821 Tbl 06

Notes:

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

1821 Tbl 07

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.[1]	Max.	Min.[1]	Max.	Min.[1]	Max.	Min.[1]	Max.	Min.[1]	Max.	Min.[1]	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

1821 Tbl 08

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.[1]	Max.	Min.[1]	Max.	Min.[1]	Max.	Min.[1]	Max.	Min.[1]	Max.	Min.[1]	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

1821 Tbl 09

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.[1]	Max.	Min.[1]	Max.	Min.[1]	Max.	Min.[1]	Max.	Min.[1]	Max.	Min.[1]	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[2] High or Low	7.0	–	6.0	–	6.0	–	5.0	–	6.0	–	5.0	–	ns	5

1821 Tbl 10

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

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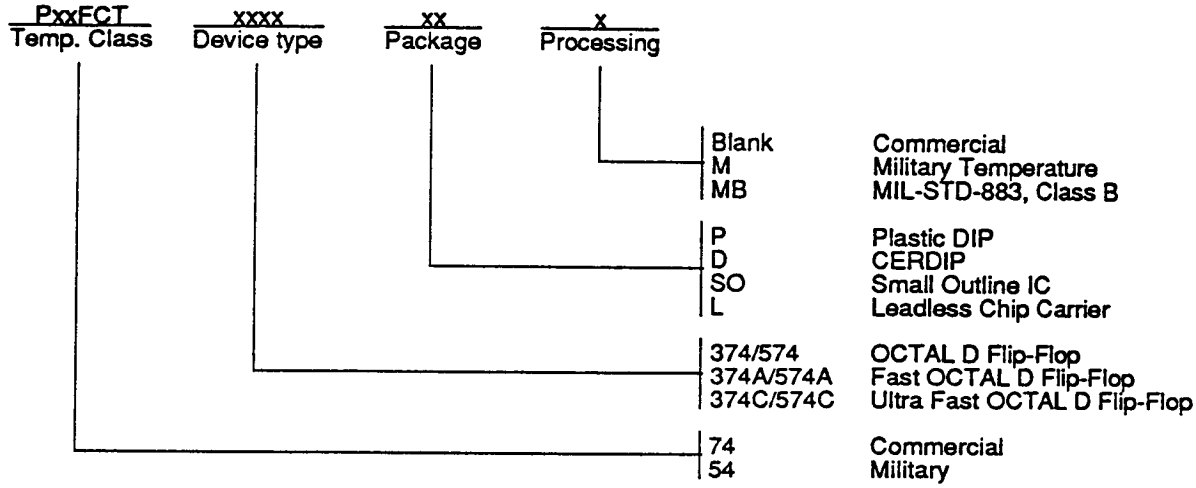
ORDERING INFORMATION



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