

January 1997

CD74FCT374

BiCMOS FCT Interface Logic, Octal D-Type Flip-Flop, Three-State

**NOT RECOMMENDED
FOR NEW DESIGNS**
Use CMOS Technology

Features

- Buffered Inputs
- Typical Propagation Delay: 6.6ns at $V_{CC} = 5V$, $T_A = 25^\circ C$, $C_L = 50pF$
- Positive Edge Triggered
- Noninverting
- SCR Latchup Resistant BiCMOS Process and

Circuit Design

- Speed of Bipolar FAST™/AS/S
- 48mA Output Sink Current
- Output Voltage Swing Limited to 3.7V at $V_{CC} = 5V$
- Controlled Output Edge Rates
- Input/Output Isolation to V_{CC}
- BiCMOS Technology with Low Quiescent Power

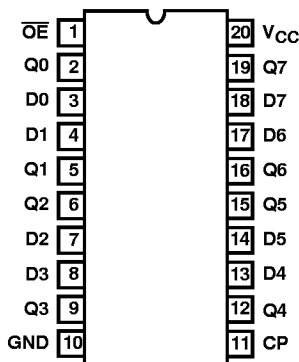
Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
CD74FCT374E	0 to 70	20 Ld PDIP	E20.3
CD74FCT374M	0 to 70	20 Ld SOIC	M20.3
CD74FCT374SM	0 to 70	20 Ld SSOP	M20.209

NOTE: When ordering the suffix M and SM packages, use the entire part number. Add the suffix 96 to obtain the variant in the tape and reel.

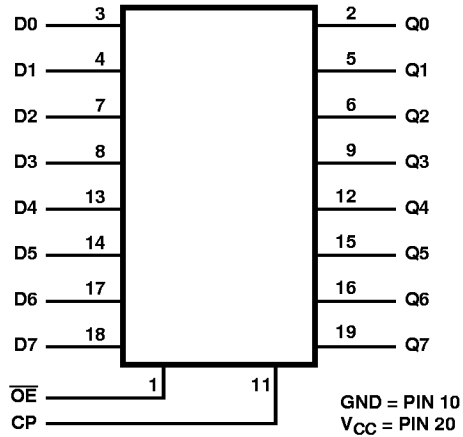
Pinout

CD74FCT374
(PDIP, SOIC, SSOP)
TOP VIEW



CD74FCT374

Functional Diagram



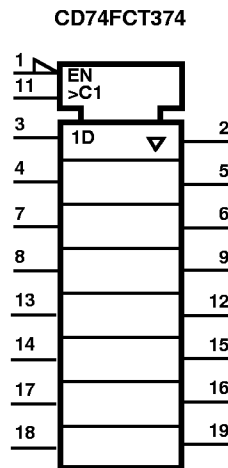
TRUTH TABLE (Note 1)

INPUTS			OUTPUTS
\overline{OE}	CP	Dn	Qn
L	↑	H	H
L	↑	L	L
L	L	X	Q0
H	X	X	Z

NOTE:

- H = HIGH Voltage Level (Steady State)
 L = LOW Voltage Level (Steady State)
 X = Immaterial
 ↑ = Transition from low to high level.
 Q0 = The level of Q before the indicated steady state input conditions were established.
 Z = HIGH Impedance

IEC Logic Symbol



CD74FCT374

Absolute Maximum Ratings

DC Supply Voltage (V_{CC})	-0.5V to 6V
DC Input Diode Current, I_{IK} (For $V_I < -0.5V$)	-20mA
DC Output Diode Current, I_{OK} (for $V_O < -0.5V$)	-50mA
DC Output Sink Current per Output Pin, I_O	70mA
DC Output Source Current per Output Pin, I_O	-30mA
DC V_{CC} Current (I_{CC})	140mA
DC Ground Current (I_{GND})	400mA

Thermal Information

Thermal Resistance (Typical, Note 2)	θ_{JA} ($^{\circ}C/W$)
PDIP Package	135
SOIC Package	125
SSOP Package	130
Maximum Junction Temperature	150 $^{\circ}C$
Maximum Storage Temperature Range	-65 $^{\circ}C$ to 150 $^{\circ}C$
Maximum Lead Temperature (Soldering 10s)	300 $^{\circ}C$ (SOIC and SSOP-Lead Tips Only)

Operating Conditions

Operating Temperature Range (T_A)	0 $^{\circ}C$ to 70 $^{\circ}C$
Supply Voltage Range, V_{CC}	4.75V to 5.25V
DC Input Voltage, V_I	0 to V_{CC}
DC Output Voltage, V_O	0 to $\leq V_{CC}$
Input Rise and Fall Slew Rate, dt/dv	0 to 10ns/V

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTE:

- θ_{JA} is measured with the component mounted on an evaluation PC board in free air.

Electrical Specifications Commercial Temperature Range 0 $^{\circ}C$ to 70 $^{\circ}C$, V_{CC} Max = 5.25V, V_{CC} Min = 4.75V (Note 5)

PARAMETER	SYMBOL	TEST CONDITIONS		V_{CC} (V)	AMBIENT TEMPERATURE (T_A)				UNITS
		V_I (V)	I_O (mA)		25 $^{\circ}C$		0 $^{\circ}C$ TO 70 $^{\circ}C$		
					MIN	MAX	MIN	MAX	
High Level Input Voltage	V_{IH}			4.75 to 5.25	2	-	2	-	V
Low Level Input Voltage	V_{IL}			4.75 to 5.25	-	0.8	-	0.8	V
High Level Output Voltage	V_{OH}	V_{IH} or V_{IL}	-15	Min	2.4	-	2.4	-	V
Low Level Output Voltage	V_{OL}	V_{IH} or V_{IL}	48	Min	-	0.55	-	0.55	V
High Level Input Current	I_{IH}	V_{CC}		Max	-	0.1	-	1	μA
Low Level Input Current	I_{IL}	GND		Max	-	-0.1	-	-1	μA
Three State Leakage Current	I_{OZH}	V_{CC}		Max	-	0.5	-	10	μA
	I_{OZL}	GND		Max	-	-0.5	-	-10	μA
Input Clamp Voltage	V_{IK}	V_{CC} or GND	-18	Min	-	-1.2	-	-1.2	V
Short Circuit Output Current (Note 3)	I_{OS}	$V_O = 0$ V_{CC} or GND		Max	-60	-	-60	-	mA
Quiescent Supply Current, MSI	I_{CC}	V_{CC} or GND	0	Max	-	8	-	80	μA
Additional Quiescent Supply Current per Input Pin TTL Inputs High, 1 Unit Load	ΔI_{CC}	3.4V (Note 4)		Max	-	1.6	-	1.6	mA

NOTES:

- Not more than one output should be shorted at one time. Test duration should not exceed 100ms.
- Inputs that are not measured are at V_{CC} or GND.
- FCT Input Loading: All inputs are 1 unit load. Unit load is ΔI_{CC} limit specified in Electrical Specifications table, e.g., 1.6mA Max. at 70 $^{\circ}C$.

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Switching Specifications Over Operating Range FCT Series $t_r, t_f = 2.5\text{ns}$, $C_L = 50\text{pF}$, R_L (Figure 4) (Note 6)

PARAMETER	SYMBOL	V_{CC} (V)	25°C	0°C TO 70°C		UNITS
			TYP	MIN	MAX	
Propagation Delays						
Clock to Q	t_{PLH}, t_{PHL}	5	6.6	2	10	ns
Output Disable to Q	t_{PLZ}, t_{PHZ}	5	6	1.5	8	ns
Output Enable to Q	t_{PZL}, t_{PZH}	5	9	1.5	12.5	ns
Power Dissipation Capacitance	C_{PD} (Note 7)	-	33	-	-	pF
Minimum (Valley) V_{OHV} During Switching of Other Outputs (Output Under Test Not Switching)	V_{OHV}	5	0.5	-	-	V
Maximum (Peak) V_{OLP} During Switching of Other Outputs (Output Under Test Not Switching)	V_{OLP}	5	1	-	-	V
Input Capacitance	C_I	-	-	-	10	pF
Three State Output Capacitance	C_O	-	-	-	15	pF

NOTES:

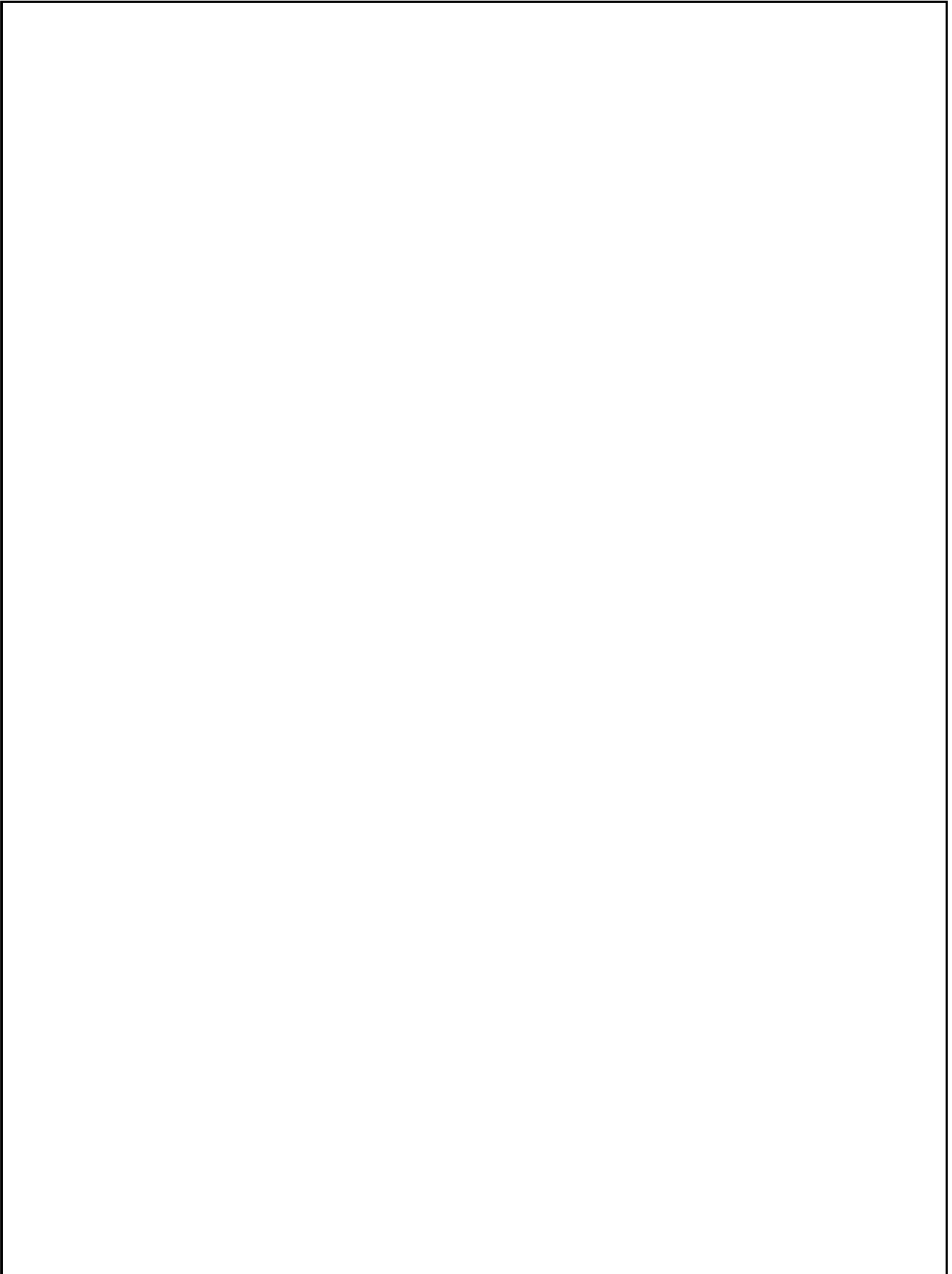
6. 5V: Min is at 5.25V for 0°C to 70°C, Max is at 4.75V for 0°C to 70°C, Typ is at 5V.
7. C_{PD} , measured per flip-flop, is used to determine the dynamic power consumption.
 P_D (per package) = $V_{CC} I_{CC} + \Sigma(V_{CC}^2 f_I C_{PD} + V_O^2 f_O C_L + V_{CC} \Delta I_{CC} D)$ where:
 V_{CC} = supply voltage
 ΔI_{CC} = flow through current x unit load
 C_L = output load capacitance
 D = duty cycle of input high
 f_O = output frequency
 f_I = input frequency

Prerequisite for Switching

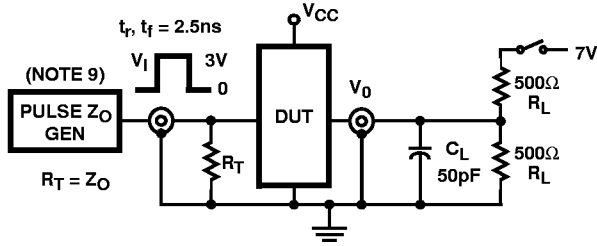
PARAMETER	SYMBOL	V_{CC} (V)	25°C	0°C TO 70°C		UNITS
			TYP	MIN	MAX	
Setup Time Data to Clock	t_{SU}	5 (Note 8)	-	2	-	ns
Data to Clock Hold Time	t_H	5	-	2	-	ns
Clock Pulse Width	t_W	5	-	7	-	ns
Maximum Clock Frequency	f_{MAX}	5	-	70	-	MHz

NOTE:

8. 5V: Minimum is at 4.75V for 0°C to 70°C, Typical is at 5V.



Test Circuits and Waveforms



NOTE:

9. Pulse Generator for All Pulses: Rate $\leq 1.0\text{MHz}$; $Z_{OUT} \leq 50\Omega$; $t_r, t_f \leq 2.5\text{ns}$.

FIGURE 1. TEST CIRCUIT

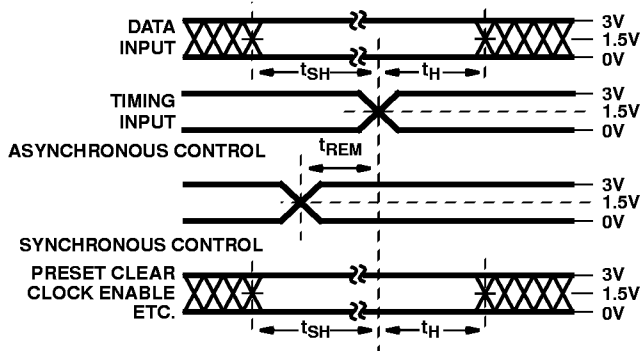


FIGURE 2. SETUP, HOLD, AND RELEASE TIMING

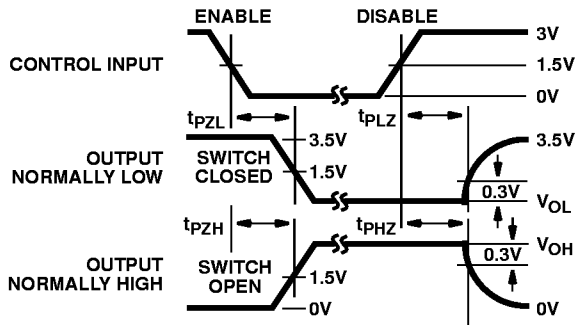


FIGURE 4. ENABLE AND DISABLE TIMING

SWITCH POSITION

TEST	SWITCH
t_{PLZ}, t_{PZL} , Open Drain	Closed
$t_{PHZ}, t_{PZH}, t_{PLH}, t_{PHL}$	Open

DEFINITIONS:

C_L = Load capacitance, includes jig and probe capacitance.

R_T = Termination resistance, should be equal to Z_{OUT} of the Pulse Generator.

$V_{IN} = 0V$ to $3V$.

Input: $t_r = t_f = 2.5\text{ns}$ (10% to 90%), unless otherwise specified

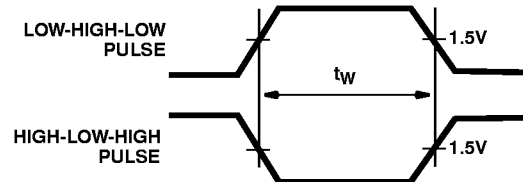


FIGURE 3. PULSE WIDTH

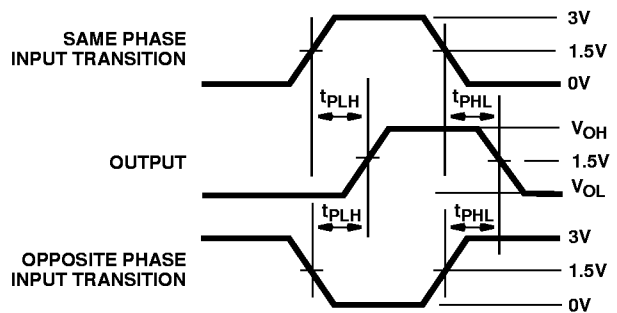
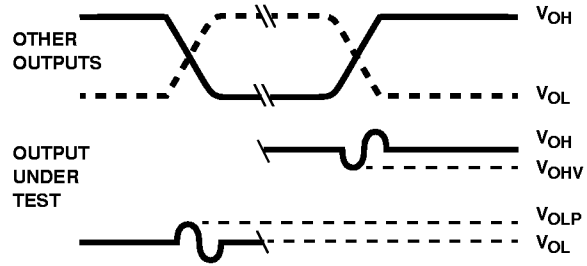


FIGURE 5. PROPAGATION DELAY

Test Circuits and Waveforms (Continued)



NOTES:

10. V_{OLP} is measured with respect to a ground reference near the output under test. V_{OHV} is measured with respect to V_{OH} .
11. Input pulses have the following characteristics:
 $P_{RR} \leq 1\text{MHz}$, $t_r = 2.5\text{ns}$, $t_f = 2.5\text{ns}$, skew 1ns.
12. R.F. fixture with 700MHz design rules required. IC should be soldered into test board and bypassed with $0.1\mu\text{F}$ capacitor. Scope and probes require 700MHz bandwidth.

FIGURE 6. SIMULTANEOUS SWITCHING TRANSIENT WAVEFORMS