

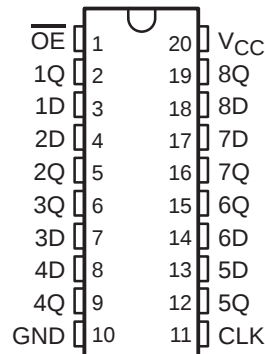
CD74FCT374

BiCMOS OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOP WITH 3-STATE OUTPUTS

SCBS739 – JULY 2000

- BiCMOS Technology With Low Quiescent Power
- 3-State Outputs Drive Bus Lines Directly
- Buffered Inputs
- Noninverted Outputs
- Input/Output Isolation From V_{CC}
- Controlled Output Edge Rates
- 48-mA Output Sink Current
- Output Voltage Swing Limited to 3.7 V
- SCR Latch-Up-Resistant BiCMOS Process and Circuit Design
- Package Options Include Plastic Small-Outline (M) and Shrink Small-Outline (SM) Packages and Standard Plastic (E) DIP

E, M, OR SM PACKAGE
(TOP VIEW)



description

The CD74FCT374 is an octal, edge-triggered, D-type flip-flop that uses a small-geometry BiCMOS technology and features 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. This device is particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

The output stage is a combination of bipolar and CMOS transistors that limits the output high level to two diode drops below V_{CC} . This resultant lowering of output swing (0 V to 3.7 V) reduces power-bus ringing [a source of electromagnetic interference (EMI)] and minimizes V_{CC} bounce and ground bounce and their effects during simultaneous output switching. The output configuration also enhances switching speed and is capable of sinking 48 mA.

The eight flip-flops enter data into their registers on the low-to-high transition of the clock (CLK). The output-enable ($\overline{OE}$) input controls the 3-state outputs and is independent of the register operation. When $\overline{OE}$ is high, the outputs are in the high-impedance state.

A buffered $\overline{OE}$ input can be used to place the eight outputs in either a normal logic state (high or low) or the high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and the increased drive provide the capability to drive bus lines without interface or pullup components.

$\overline{OE}$ does not affect internal operations of the flip-flop. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

To ensure the high-impedance state during power up or power down, $\overline{OE}$ should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

The CD74FCT374 is characterized for operation from 0°C to 70°C.



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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WITH 3-STATE OUTPUTS

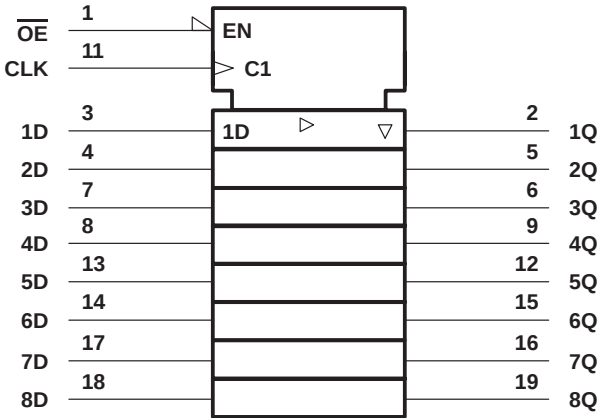
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FUNCTION TABLE

(each flip-flop)

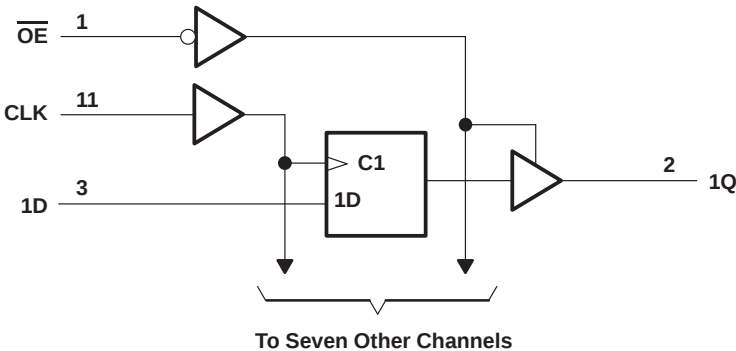
INPUTS			OUTPUT Q
$\overline{OE}$	CLK	D	
L	$\uparrow$	H	H
L	$\uparrow$	L	L
L	H or L	X	Q_0
H	X	X	Z

logic symbol[†]



[†] This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

DC supply voltage range, V_{CC}	–0.5 V to 6 V
DC input clamp current, I_{IK} ($V_I < -0.5$ V)	–20 mA
DC output clamp current, I_{OK} ($V_O < -0.5$ V)	–50 mA
DC output sink current per output pin, I_{OL}	70 mA
DC output source current per output pin, I_{OH}	–30 mA
Continuous current through V_{CC} , I_{CC}	140 mA
Continuous current through GND	400 mA
Package thermal impedance, θ_{JA} (see Note 1): E package	69°C/W
M package	58°C/W
SM package	70°C/W
Storage temperature range, T_{stg}	–65°C to 150°C

[†] Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: The package thermal impedance is calculated in accordance with JESD 51.

recommended operating conditions (see Note 2)

	MIN	MAX	UNIT
V_{CC} Supply voltage	4.75	5.25	V
V_{IH} High-level input voltage	2		V
V_{IL} Low-level input voltage		0.8	V
V_I Input voltage	0	V_{CC}	V
V_O Output voltage	0	V_{CC}	V
I_{OH} High-level output current		–15	mA
I_{OL} Low-level output current		48	mA
$\Delta t/\Delta v$ Input transition rise or fall rate	0	10	ns/V
T_A Operating free-air temperature	0	70	°C

NOTE 2: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

electrical characteristics over recommended operating temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	V_{CC}	$T_A = 25^\circ\text{C}$		MIN	MAX	UNIT
			MIN	MAX			
V_{IK}	$I_I = -18$ mA	4.75 V	–1.2		–1.2		V
V_{OH}	$I_{OH} = -15$ mA	4.75 V	2.4		2.4		V
V_{OL}	$I_{OL} = 48$ mA	4.75 V		0.55		0.55	V
I_I	$V_I = V_{CC}$ or GND	5.25 V		± 0.1		± 1	μA
I_{OZ}	$V_O = V_{CC}$ or GND	5.25 V		± 0.5		± 10	μA
$I_{OS}^\ddagger$	$V_I = V_{CC}$ or GND, $V_O = 0$	5.25 V	–60		–60		mA
I_{CC}	$V_I = V_{CC}$ or GND, $I_O = 0$	5.25 V		8		80	μA
$\Delta I_{CC}^\S$	One input at 3.4 V, Other inputs at V_{CC} or GND	5.25 V		1.6		1.6	mA
C_i	$V_I = V_{CC}$ or GND			10		10	pF
C_o	$V_O = V_{CC}$ or GND			15		15	pF

[‡] Not more than one output should be tested at a time, and the duration of the test should not exceed 100 ms.

[§] This is the increase in supply current for each input at one of the specified TTL voltage levels rather than 0 V or V_{CC} .



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timing requirements over recommended operating conditions, (unless otherwise noted) (see Figure 1)

			MIN	MAX	UNIT
f_{clock}	Clock frequency			70	MHz
t_w	Pulse duration	CLK high or low	7		ns
t_{su}	Setup time	Data before CLK $\uparrow$	2		ns
t_h	Hold time	Data after CLK $\uparrow$	2		ns

switching characteristics over recommended operating conditions, $V_{\text{CC}} = 5 \text{ V} \pm 0.25 \text{ V}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$	MIN	MAX	UNIT
			TYP			
f_{max}				70		MHz
t_{pd}	CLK	Q	6.6	2	10	ns
t_{en}	$\overline{\text{OE}}$	Q	9	1.5	12.5	ns
t_{dis}	$\overline{\text{OE}}$	Q	6	1.5	8	ns

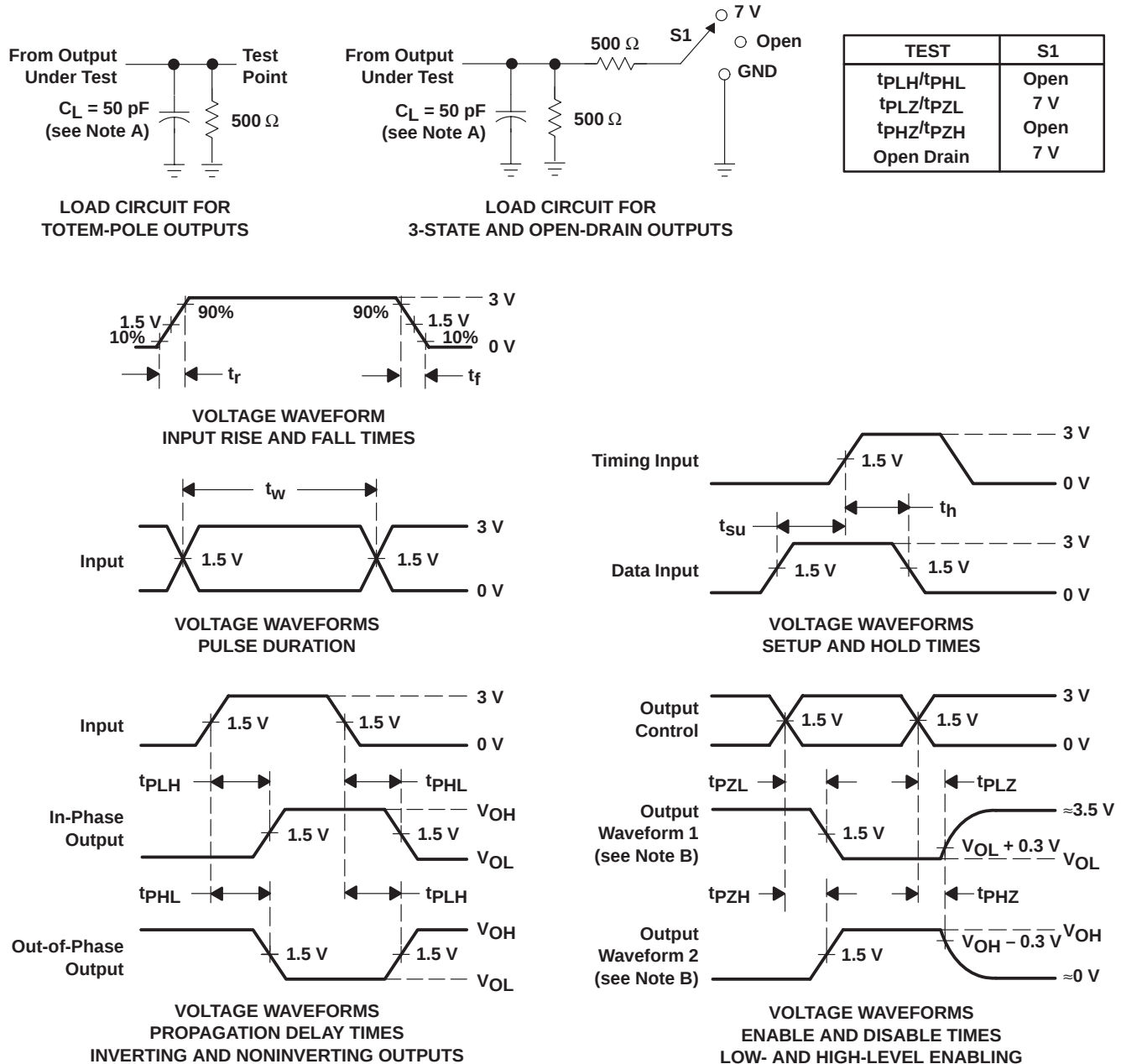
noise characteristics, $V_{\text{CC}} = 5 \text{ V}$, $C_L = 50 \text{ pF}$, $T_A = 25^\circ\text{C}$

PARAMETER		MIN	TYP	MAX	UNIT
$V_{\text{OL(P)}}$	Quiet output, maximum dynamic V_{OL}		1		V
$V_{\text{OH(V)}}$	Quiet output, minimum dynamic V_{OH}		0.5		V
$V_{\text{IH(D)}}$	High-level dynamic input voltage	2			V
$V_{\text{IL(D)}}$	Low-level dynamic input voltage			0.8	V

operating characteristics, $V_{\text{CC}} = 5 \text{ V}$, $T_A = 25^\circ$

PARAMETER		TEST CONDITIONS	TYP	UNIT
C_{pd}	Power dissipation capacitance	No load, $f = 1 \text{ MHz}$	33	pF

PARAMETER MEASUREMENT INFORMATION



- NOTES: A. C_L includes probe and jig capacitance.
- B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
- C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1 \text{ MHz}$, $Z_O = 50 \Omega$, t_r and $t_f = 2.5 \text{ ns}$.
- D. The outputs are measured one at a time with one input transition per measurement.
- E. t_{PLZ} and t_{PHZ} are the same as t_{dis} .
- F. t_{PZL} and t_{PZH} are the same as t_{en} .
- G. t_{PHL} and t_{PLH} are the same as t_{pd} .

Figure 1. Load Circuit and Voltage Waveforms

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