

# SN54HCT574, SN74HCT574 OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

SCLS177E – MARCH 1984 – REVISED AUGUST 2003

- Operating Voltage Range of 4.5 V to 5.5 V
- High-Current 3-State Noninverting Outputs Drive Bus Lines Directly or Up To 15 LSTTL Loads
- Low Power Consumption, 80- $\mu$ A Max  $I_{CC}$
- Typical  $t_{pd} = 22$  ns
- $\pm 6$ -mA Output Drive at 5 V
- Low Input Current of 1  $\mu$ A Max
- Inputs Are TTL-Voltage Compatible
- Bus-Structured Pinout

## description/ordering information

These octal edge-triggered D-type flip-flops feature 3-state outputs designed specifically for bus driving. The 'HCT574 devices are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

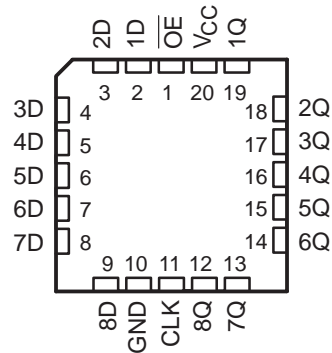
The eight flip-flops enter data on the low-to-high transition of the clock (CLK) input.

A buffered output-enable ( $\overline{OE}$ ) input can be used to place the eight outputs in either a normal logic state (high or low logic levels) 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 increased drive provide the capability to drive bus lines without interface or pullup components.

SN54HCT574 . . . J OR W PACKAGE  
SN74HCT574 . . . DB, DW, N, NS, OR PW PACKAGE  
(TOP VIEW)



SN54HCT574 . . . FK PACKAGE  
(TOP VIEW)



## ORDERING INFORMATION

$T_A$	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	PDIP – N	Tube of 20	SN74HCT574N	SN74HCT574N
	SOIC – DW	Tube of 25	SN74HCT574DW	HCT574
		Reel of 2000	SN74HCT574DWR	
	SOP – NS	Reel of 2000	SN74HCT574NSR	HCT574
	SSOP – DB	Reel of 2000	SN74HCT574DBR	HT574
	TSSOP – PW	Tube of 70	SN74HCT574PW	HT574
Reel of 2000		SN74HCT574PWR		
Reel of 250		SN74HCT574PWT		
-55°C to 125°C	CDIP – J	Tube of 20	SNJ54HCT574J	SNJ54HCT574J
	CFP – W	Tube of 85	SNJ54HCT574W	SNJ54HCT574W
	LCCC – FK	Tube of 55	SNJ54HCT574FK	SNJ54HCT574FK

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).



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 **TEXAS  
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## description/ordering information (continued)

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

FUNCTION TABLE  
(each flip-flop)

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

## logic diagram (positive logic)



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

Supply voltage range, $V_{CC}$	-0.5 V to 7 V
Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ ) (see Note 1)	$\pm 20$ mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ ) (see Note 1)	$\pm 20$ mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )	$\pm 35$ mA
Continuous current through $V_{CC}$ or GND	$\pm 70$ mA
Package thermal impedance, $\theta_{JA}$ (see Note 2):	
DB package	70°C/W
DW package	58°C/W
N package	69°C/W
NS package	60°C/W
PW package	83°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.

- NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.  
2. The package thermal impedance is calculated in accordance with JESD 51-7.

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## recommended operating conditions (see Note 3)

		SN54HCT574			SN74HCT574			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub>	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V			2			V
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V			0.8			V
V <sub>I</sub>	Input voltage	0		V <sub>CC</sub>	0		V <sub>CC</sub>	V
V <sub>O</sub>	Output voltage	0		V <sub>CC</sub>	0		V <sub>CC</sub>	V
Δt/Δv	Input transition rise/fall time	500			500			ns
T <sub>A</sub>	Operating free-air temperature	-55		125	-40		85	°C

NOTE 3: All unused inputs of the device must be held at V<sub>CC</sub> 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 free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	T <sub>A</sub> = 25°C			SN54HCT574		SN74HCT574		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V <sub>OH</sub>	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	4.5 V	I <sub>OH</sub> = -20 μA		4.4	4.499	4.4	4.4	V	
			I <sub>OH</sub> = -6 mA		3.98	4.3	3.7	3.84		
V <sub>OL</sub>	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	4.5 V	I <sub>OL</sub> = 20 μA		0.001	0.1	0.1	0.1	V	
			I <sub>OL</sub> = 6 mA		0.17	0.26	0.4	0.33		
I <sub>I</sub>	V <sub>I</sub> = V <sub>CC</sub> or 0	5.5 V	±0.1	±100	±1000	±1000	±1000	nA		
I <sub>OZ</sub>	V <sub>O</sub> = V <sub>CC</sub> or 0	5.5 V	±0.01	±0.5	±10	±10	±5	μA		
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or 0, I <sub>O</sub> = 0	5.5 V		8	160	80	80	μA		
ΔI <sub>CC</sub> †	One input at 0.5 V or 2.4 V, Other inputs at 0 or V <sub>CC</sub>	5.5 V	1.4	2.4	3	2.9	2.9	mA		
C <sub>i</sub>		4.5 V to 5.5 V	3	10	10	10	10	pF		

† This is the increase in supply current for each input that is at one of the specified TTL voltage levels rather than 0 V or V<sub>CC</sub>.

## timing requirements over recommended operating free-air temperature range (unless otherwise noted)

		V <sub>CC</sub>	T <sub>A</sub> = 25°C		SN54HCT574		SN74HCT574		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
f <sub>clock</sub>	Clock frequency	4.5 V		30	20	24		MHz	
		5.5 V		33	22	27			
t <sub>w</sub>	Pulse duration, CLK high or low	4.5 V	16		24	20		ns	
		5.5 V	14		22	18			
t <sub>su</sub>	Setup time, data before CLK↑	4.5 V	20		30	25		ns	
		5.5 V	17		27	23			
t <sub>h</sub>	Hold time, data after CLK↑	4.5 V	5		5	5		ns	
		5.5 V	5		5	5			

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switching characteristics over recommended operating free-air temperature range,  $C_L = 50 \text{ pF}$  (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC}$	$T_A = 25^\circ\text{C}$			SN54HCT574		SN74HCT574		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$f_{max}$			4.5 V	30	36		20		24	MHz	
			5.5 V	33	40		22		27		
$t_{pd}$	CLK	Any Q	4.5 V		30	36		54		45	ns
			5.5 V		25	32		48		41	
$t_{en}$	$\overline{OE}$	Any Q	4.5 V		26	30		45		38	ns
			5.5 V		23	27		41		34	
$t_{dis}$	$\overline{OE}$	Any Q	4.5 V		23	30		45		38	ns
			5.5 V		22	27		41		34	
$t_t$		Any Q	4.5 V		10	12		18		15	ns
			5.5 V		9	11		16		14	

switching characteristics over recommended operating free-air temperature range,  $C_L = 150 \text{ pF}$  (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC}$	$T_A = 25^\circ\text{C}$			SN54HCT574		SN74HCT574		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$f_{max}$			4.5 V	30	36		20		24	MHz	
			5.5 V	33	40		22		27		
$t_{pd}$	CLK	Any Q	4.5 V		40	53		80		66	ns
			5.5 V		35	47		71		60	
$t_{en}$	$\overline{OE}$	Any Q	4.5 V		34	47		71		59	ns
			5.5 V		29	39		94		78	
$t_t$		Any Q	4.5 V		18	42		63		53	ns
			5.5 V		16	38		57		48	

operating characteristics,  $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TYP	UNIT
$C_{pd}$ Power dissipation capacitance per flip-flop	No load	93	pF

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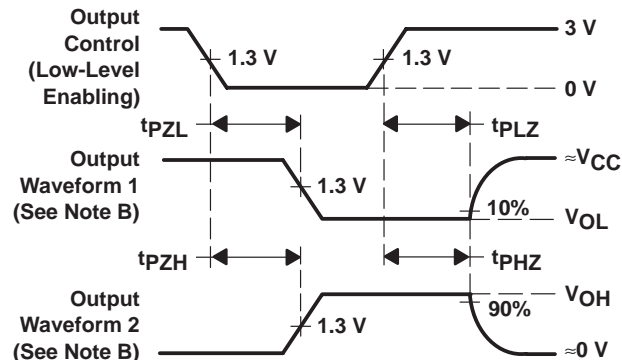
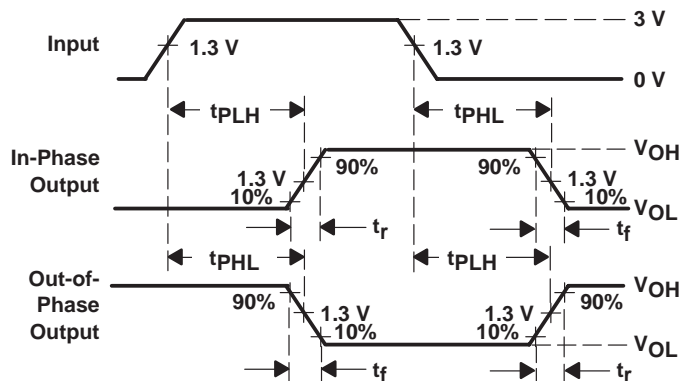
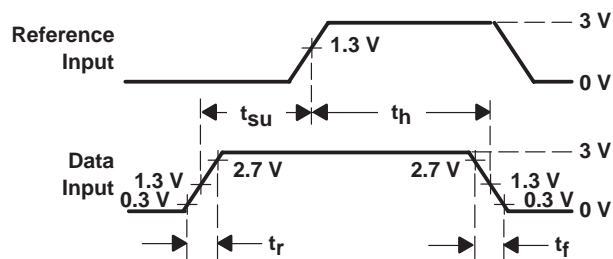
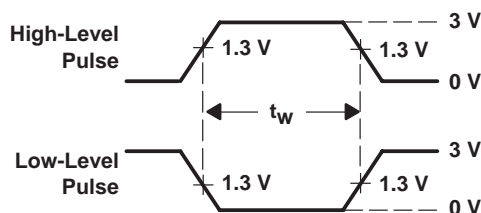
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## PARAMETER MEASUREMENT INFORMATION



PARAMETER	$R_L$	$C_L$	S1	S2	
$t_{en}$	$t_{PZH}$	1 k $\Omega$	50 pF or 150 pF	Open	Closed
	$t_{PZL}$			Closed	Open
$t_{dis}$	$t_{PHZ}$	1 k $\Omega$	50 pF	Open	Closed
	$t_{PLZ}$			Closed	Open
$t_{pd}$ or $t_t$	--	50 pF or 150 pF	Open	Open	



- NOTES:
- $C_L$  includes probe and test-fixture capacitance.
  - 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.
  - Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1$  MHz,  $Z_O = 50 \Omega$ ,  $t_r = 6$  ns,  $t_f = 6$  ns.
  - For clock inputs,  $f_{max}$  is measured when the input duty cycle is 50%.
  - The outputs are measured one at a time with one input transition per measurement.
  - $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .

Figure 1. Load Circuit and Voltage Waveforms

N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

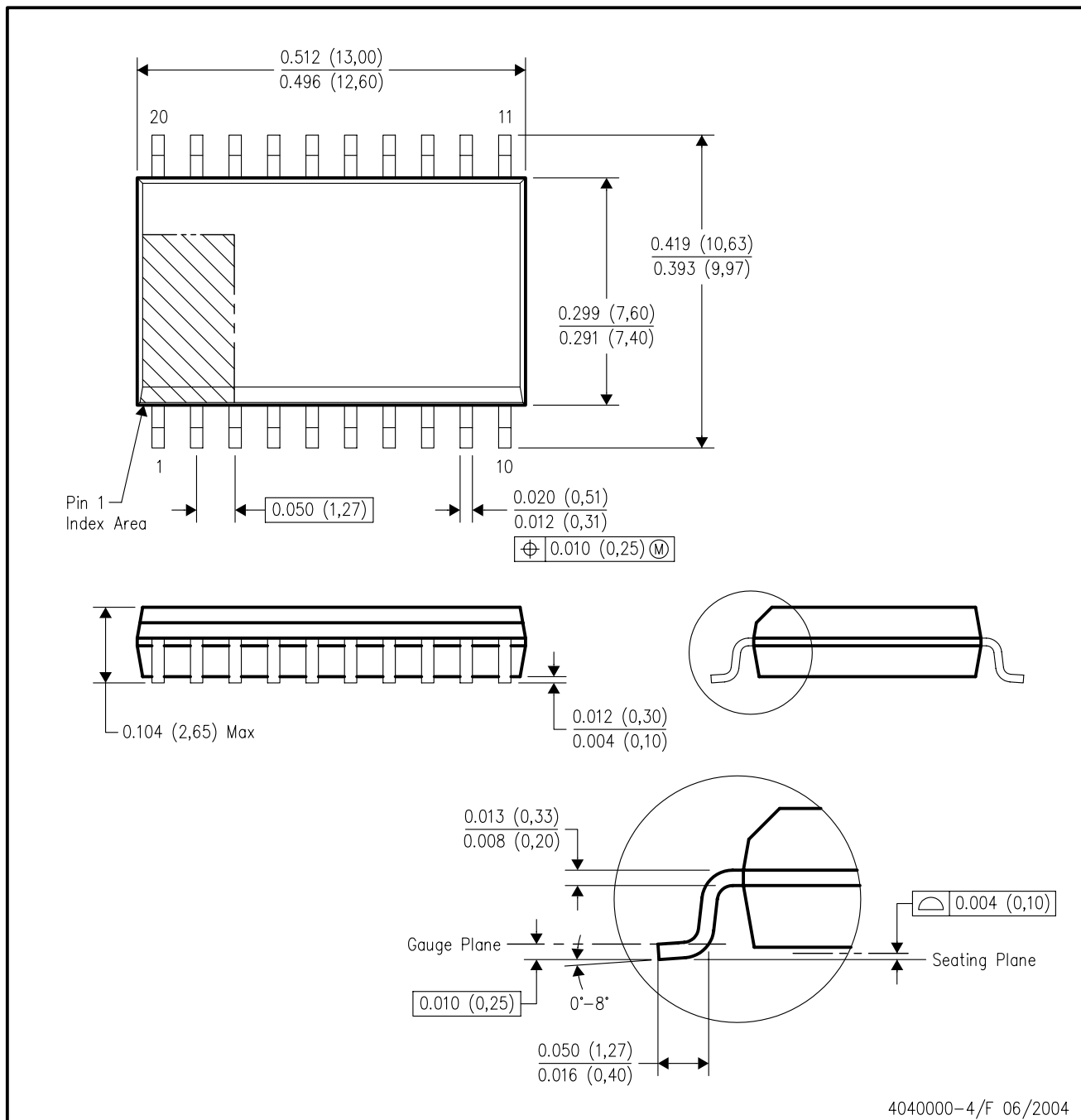
16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - The 20 pin end lead shoulder width is a vendor option, either half or full width.

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - D. Falls within JEDEC MS-013 variation AC.

## MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.



DB (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE

28 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-150

PW (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-153

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