

# CD74HCT574-Q1

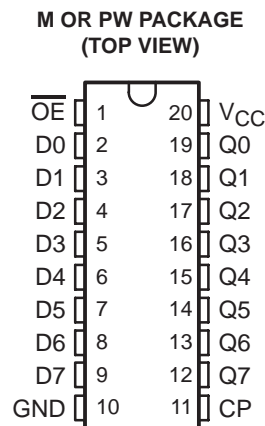
## HIGH-SPEED CMOS LOGIC OCTAL D-TYPE FLIP-FLOP 3-STATE, POSITIVE-EDGE TRIGGERED

SCLS570A – FEBRUARY 2004 – REVISED APRIL 2008

- Qualified for Automotive Applications
- Buffered Inputs
- Common 3-State Output-Enable Control
- 3-State Outputs
- Bus-Line Driving Capability
- Typical Propagation Delay (Clock to Q):  
15 ns at  $V_{CC} = 5\text{ V}$ ,  $C_L = 15\text{ pF}$ ,  $T_A = 25^\circ\text{C}$
- Fanout (Over Temperature Range)
  - Standard Outputs . . . 10 LSTTL Loads
  - Bus Driver Outputs . . . 15 LSTTL Loads
- Balanced Propagation Delay and Transition Times
- Significant Power Reduction Compared to LSTTL Logic ICs
- $V_{CC}$  Voltage = 4.5 V to 5.5 V
- Direct LSTTL Input Logic Compatibility,  
 $V_{IL} = 0.8\text{ V (Max)}$ ,  $V_{IH} = 2\text{ V (Min)}$
- CMOS Input Compatibility,  $I_I \leq 1\ \mu\text{A}$  at  $V_{OL}$ ,  $V_{OH}$

### description/ordering information

The CD74HCT574 is an octal D-type flip-flop with 3-state outputs and the capability to drive 15 LSTTL loads. The eight edge-triggered flip-flops enter data into their registers on the low-to-high transition of the clock (CP). The output enable ( $\overline{OE}$ ) 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.



### ORDERING INFORMATION†

T <sub>A</sub>	PACKAGE‡		ORDERABLE PART NUMBER	TOP-SIDE MARKING
	SOIC – M	Tape and reel		
–40°C to 125°C	SOIC – M	Tape and reel	CD74HCT574QM96Q1	HCT574Q
	TSSOP – PW	Tape and reel	CD74HCT574QPWRQ1	HCT574Q

† For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at <http://www.ti.com>.

‡ Package drawings, thermal data, and symbolization are available at <http://www.ti.com/packaging>.



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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.

**TEXAS  
INSTRUMENTS**

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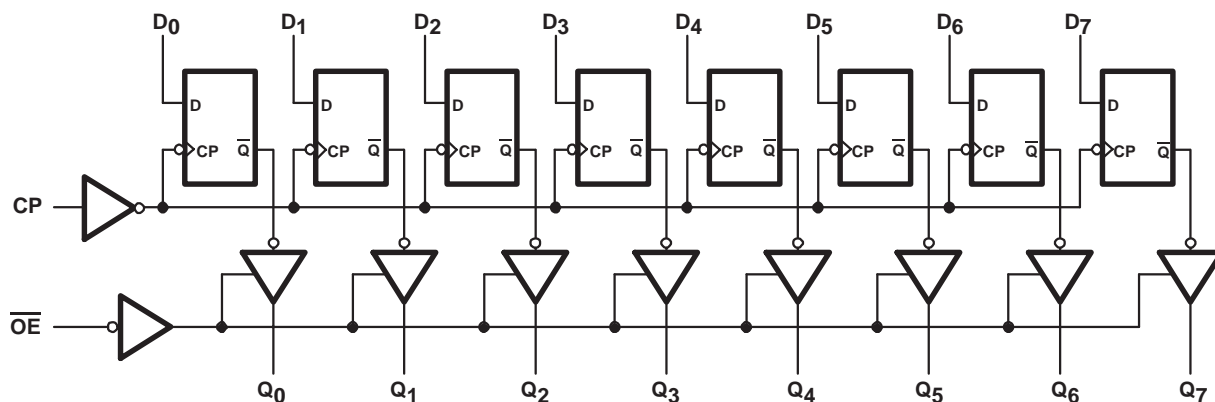
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FUNCTION TABLE

INPUTS			OUTPUT
$\overline{OE}$	CP	D	Q
L	↑	H	H
L	↑	L	L
L	L	X	Q <sub>0</sub>
H	X	X	Z

NOTE: H = High voltage level (steady state)  
 L = Low voltage level (steady state)  
 X = Don't care  
 ↑ = Transition from low to high level  
 Q<sub>0</sub> = Level before the indicated steady-state conditions were established  
 Z = High-impedance state

logic diagram (positive logic)



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

Supply voltage range, $V_{CC}$ (see Note 1)	–0.5 V to 7 V
Input clamp current, $I_{IK}$ ( $V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V)	±20 mA
Output clamp current, $I_{OK}$ ( $V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V)	±20 mA
Drain current per output, $I_O$ ( $V_O > -0.5$ V or $V_O < V_{CC} + 0.5$ V)	±35 mA
Output source or sink current per output, $I_O$ ( $V_O > -0.5$ V or $V_O < V_{CC} + 0.5$ V)	±25 mA
Continuous current through $V_{CC}$ or GND, $I_{CC}$	±50 mA
Package thermal impedance, $\theta_{JA}$ (see Note 2): M package	58°C/W
PW package	69°C/W
Maximum junction temperature, $T_J$	150°C
Lead temperature (during soldering):	
At distance $1/16 \pm 1/32$ inch ( $1,59 \pm 0,79$ mm) from case for 10 s max	300°C
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. All voltages referenced to GND unless otherwise specified.  
 2. The package thermal impedance is calculated in accordance with JESD 51-7.

### recommended operating conditions (see Note 3)

		MIN	MAX	UNIT
$V_{CC}$	Supply voltage	4.5	5.5	V
$V_{IH}$	High-level input voltage	$V_{CC} = 4.5$ V to $5.5$ V		V
$V_{IL}$	Low-level input voltage	$V_{CC} = 4.5$ V to $5.5$ V		V
$V_I$	Input voltage	0	$V_{CC}$	V
$V_O$	Output voltage	0	$V_{CC}$	V
$t_t$	Input transition (rise and fall) time	$V_{CC} = 2$ V		ns
		$V_{CC} = 4.5$ V		
		$V_{CC} = 6$ V		
$T_A$	Operating free-air temperature	–40	125	°C

NOTE 3: 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.

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

PARAMETER	TEST CONDITIONS		I <sub>O</sub> (mA)	V <sub>CC</sub>	T <sub>A</sub> = 25°C			T <sub>A</sub> = -40°C TO 125°C		UNIT
					MIN	TYP	MAX	MIN	MAX	
V <sub>OH</sub>	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	CMOS loads	-0.02	4.5 V	4.4			4.4		V
		TTL loads	-6	4.5 V	3.98			3.7		
V <sub>OL</sub>	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	CMOS loads	0.02	4.5 V	0.1			0.1		V
		TTL loads	6	4.5 V	0.26			0.4		
I <sub>I</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND		0	5.5 V	±0.1			±1		μA
I <sub>OZ</sub>	V <sub>I</sub> = V <sub>IL</sub> or V <sub>IH</sub> , V <sub>O</sub> = V <sub>CC</sub> or GND			6 V	±0.5			±10		μA
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND		0	5.5 V	8			160		μA
ΔI <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> - 2.1 V, See Note 4			4.5 V to 5.5 V	100 360			490		μA
C <sub>IN</sub>	C <sub>L</sub> = 50 pF				10			10		pF
C <sub>OUT</sub>	3-state				20			20		pF

NOTE 4: For dual-supply systems, theoretical worst-case (V<sub>I</sub> = 2.4 V, V<sub>CC</sub> = 5.5 V) specification is 1.8 mA.

**HCT input loading**

TYPE	INPUT	UNIT LOADS†
'574	D0-D7	0.4
	CP	0.75
	$\overline{\text{OE}}$	0.6

†Unit load is ΔI<sub>CC</sub> limit specified in electrical characteristics table, e.g., 360 μA max at 25°C.

timing requirements over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

PARAMETER		V <sub>CC</sub>	T <sub>A</sub> = 25°C		T <sub>A</sub> = -40°C TO 125°C		UNIT
			MIN	MAX	MIN	MAX	
f <sub>max</sub>	Maximum clock frequency	4.5 V	30		20		MHz
t <sub>w</sub>	Clock pulse duration	4.5 V	16		24		ns
t <sub>su</sub>	Setup time, data before clock↑	4.5 V	12		18		ns
t <sub>h</sub>	Hold time, data after clock↑	4.5 V	5		5		ns



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switching characteristics over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	V <sub>CC</sub>	T <sub>A</sub> = 25°C			T <sub>A</sub> = -40°C TO 125°C		UNIT
					MIN	TYP	MAX	MIN	MAX	
t <sub>pd</sub>	CP	Q	C <sub>L</sub> = 50 pF	4.5 V			33		50	ns
			C <sub>L</sub> = 15 pF	5 V		15				
t <sub>dis</sub>	$\overline{OE}$	Q	C <sub>L</sub> = 50 pF	4.5 V				28	42	ns
			C <sub>L</sub> = 15 pF	5 V		11				
t <sub>en</sub>	$\overline{OE}$	Q	C <sub>L</sub> = 50 pF	4.5 V				30	45	ns
			C <sub>L</sub> = 15 pF	5 V		12				
t <sub>f</sub>		Q	C <sub>L</sub> = 50 pF	4.5 V				12	18	ns
f <sub>max</sub>	CP		C <sub>L</sub> = 15 pF	5 V			60			MHz

operating characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C, input t<sub>r</sub>, t<sub>f</sub> = 6 ns

PARAMETER		TYP	UNIT
C <sub>pd</sub>	Power dissipation capacitance (see Note 5)	47	pF

NOTE 5: C<sub>pd</sub> is used to determine the dynamic power consumption (P<sub>D</sub>), per package.

$$P_D = (C_{PD} \times V_{CC}^2 \times f_I) + \Sigma (C_L \times V_{CC}^2 \times f_O)$$

f<sub>I</sub> = input frequency

f<sub>O</sub> = output frequency

C<sub>L</sub> = output load capacitance

V<sub>CC</sub> = supply voltage

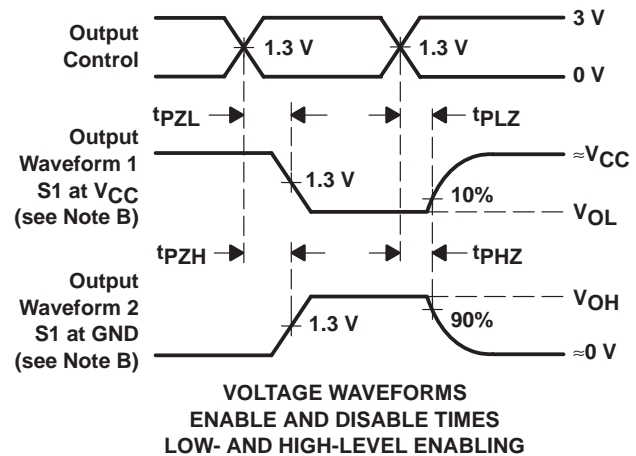
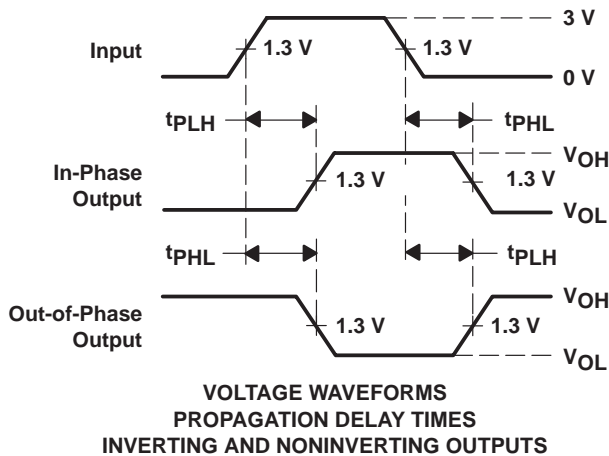
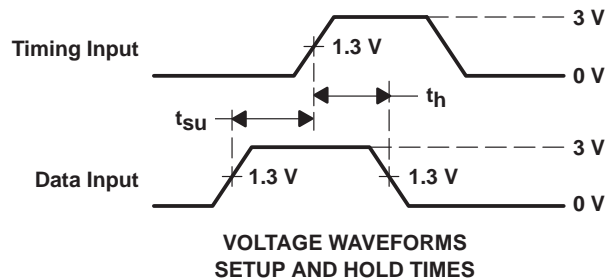
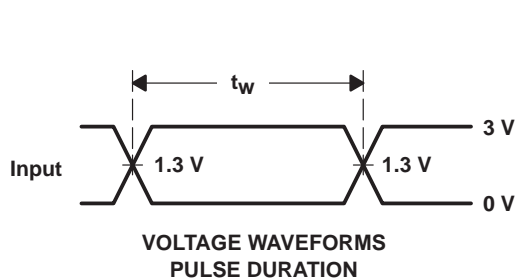
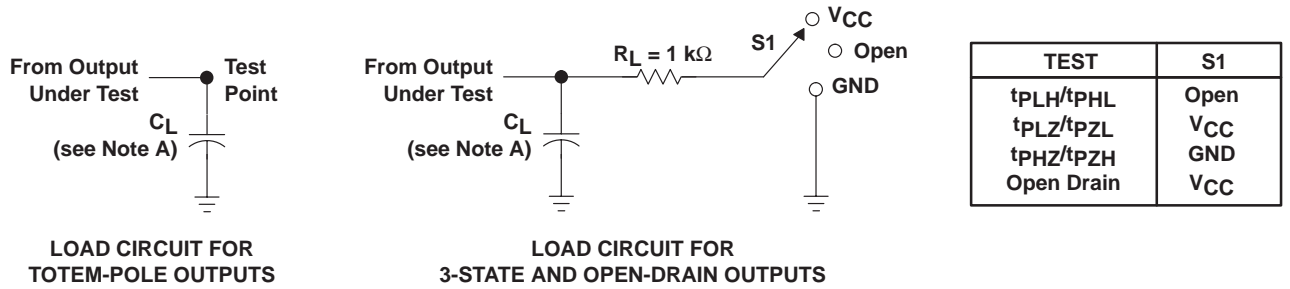
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#### PARAMETER MEASUREMENT INFORMATION



- 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 MHz,  $Z_O = 50\ \Omega$ ,  $t_r \leq 6\text{ ns}$ ,  $t_f \leq 6\text{ ns}$ .
  - D. The outputs are measured one at a time, with one input transition per measurement.
  - E. All parameters and waveforms are not applicable to all devices.
  - F.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .
  - G.  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - H.  $t_{PZH}$  and  $t_{PZL}$  are the same as  $t_{en}$ .

Figure 1. Load Circuit and Voltage Waveforms

## PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
CD74HCT574QM96G4Q1	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HCT574Q1	<a href="#">Samples</a>
CD74HCT574QM96Q1	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HCT574Q1	<a href="#">Samples</a>
CD74HCT574QPWRG4Q1	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HCT574Q1	<a href="#">Samples</a>
CD74HCT574QPWRQ1	OBSOLETE	TSSOP	PW	20		TBD	Call TI	Call TI	-40 to 125	HCT574Q1	

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) Only one of markings shown within the brackets will appear on the physical device.

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- Catalog: [CD74HCT574](#)
- Enhanced Product: [CD74HCT574-EP](#)
- Military: [CD54HCT574](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Enhanced Product - Supports Defense, Aerospace and Medical Applications
- Military - QML certified for Military and Defense Applications



## TAPE AND REEL INFORMATION



### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
CD74HCT574QPWRG4Q 1	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1

**TAPE AND REEL BOX DIMENSIONS**



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CD74HCT574QPWRG4Q1	TSSOP	PW	20	2000	367.0	367.0	38.0

DW (R-PDSO-G20)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
  - 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.

DW (R-PDSO-G20)

PLASTIC SMALL OUTLINE



4209202-4/E 07/11

- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Refer to IPC7351 for alternate board design.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

PW (R-PDSO-G20)

PLASTIC SMALL OUTLINE



4040064-5/G 02/11

- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
  - E. Falls within JEDEC MO-153

PW (R-PDSO-G20)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate design.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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