



CD74HC373, CD74HCT373, CD54HC573, CD74HC573, CD74HCT573

High Speed CMOS Logic Octal Transparent Latch, Three-State Output

November 1997

Features

- Common Latch Enable Control
- Common Three-State Output Enable Control
- Buffered Inputs
- Three-State Outputs
- Bus Line Driving Capacity
- Typical Propagation Delay = 12ns at $V_{CC} = 5V$, $C_L = 15pF$, $T_A = 25^\circ C$ (Data to Output for HC373)
- Fanout (Over Temperature Range)
 - Standard Outputs 10 LSTTL Loads
 - Bus Driver Outputs 15 LSTTL Loads
- Wide Operating Temperature Range . . . $-55^\circ C$ to $125^\circ C$
- Balanced Propagation Delay and Transition Times
- Significant Power Reduction Compared to LSTTL Logic ICs
- HC Types
 - 2V to 6V Operation
 - High Noise Immunity: $N_{IL} = 30\%$, $N_{IH} = 30\%$ of V_{CC} at $V_{CC} = 5V$
- HCT Types
 - 4.5V to 5.5V Operation
 - Direct LSTTL Input Logic Compatibility, $V_{IL} = 0.8V$ (Max), $V_{IH} = 2V$ (Min)
 - CMOS Input Compatibility, $I_I \leq 1\mu A$ at V_{OL} , V_{OH}

Description

The Harris CD74HC373, CD74HCT373, CD54HC573, CD74HC573, and CD74HCT573 are high speed Octal Transparent Latches manufactured with silicon gate CMOS technology. They possess the low power consumption of standard CMOS integrated circuits, as well as the ability to drive 15 LSTTL devices. The CD74HCT373 and CD74HCT573 are functionally as well as pin compatible with the standard 74LS373 and 74LS573.

The outputs are transparent to the inputs when the latch enable (\overline{LE}) is high. When the latch enable (\overline{LE}) goes low the data is latched. The output enable (\overline{OE}) controls the three-state outputs. When the output enable (\overline{OE}) is high the outputs are in the high impedance state. The latch operation is independent to the state of the output enable. The 373 and 573 are identical in function and differ only in their pinout arrangements.

Ordering Information

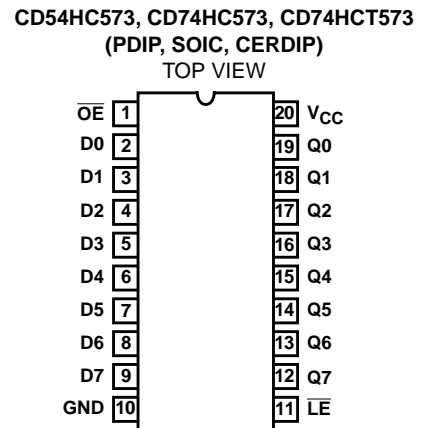
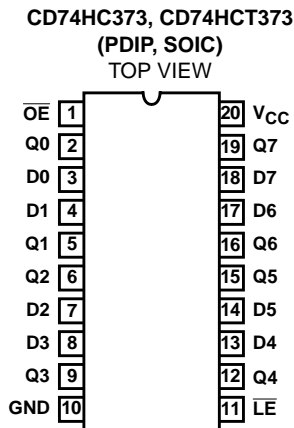
PART NUMBER	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
CD54HC573F	-55 to 125	20 Ld CERDIP	F20.3
CD74HC373E	-55 to 125	20 Ld PDIP	F20.3
CD74HCT373E	-55 to 125	20 Ld PDIP	E20.3
CD74HC573E	-55 to 125	20 Ld PDIP	E20.3
CD74HCT573E	-55 to 125	20 Ld PDIP	E20.3
CD74HC373M	-55 to 125	20 Ld SOIC	M20.3
CD74HCT373M	-55 to 125	20 Ld SOIC	M20.3
CD74HC573M	-55 to 125	20 Ld SOIC	M20.3
CD74HCT573M	-55 to 125	20 Ld SOIC	M20.3

NOTES:

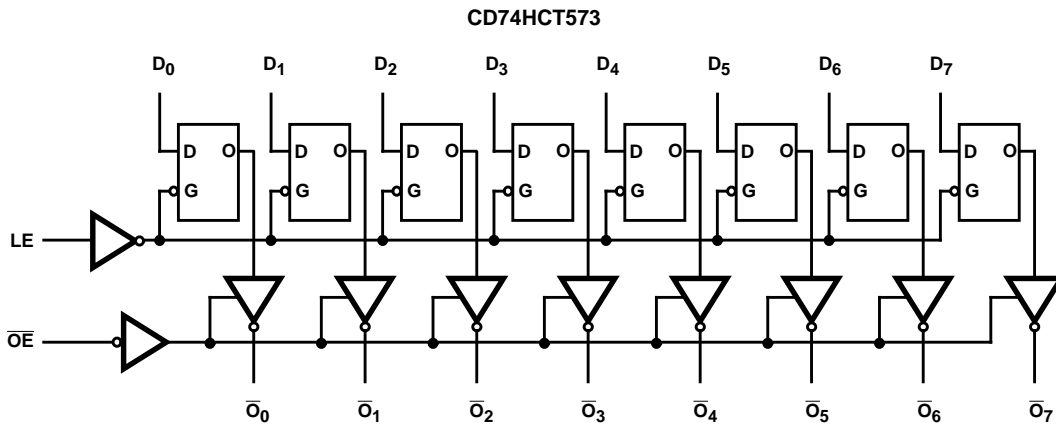
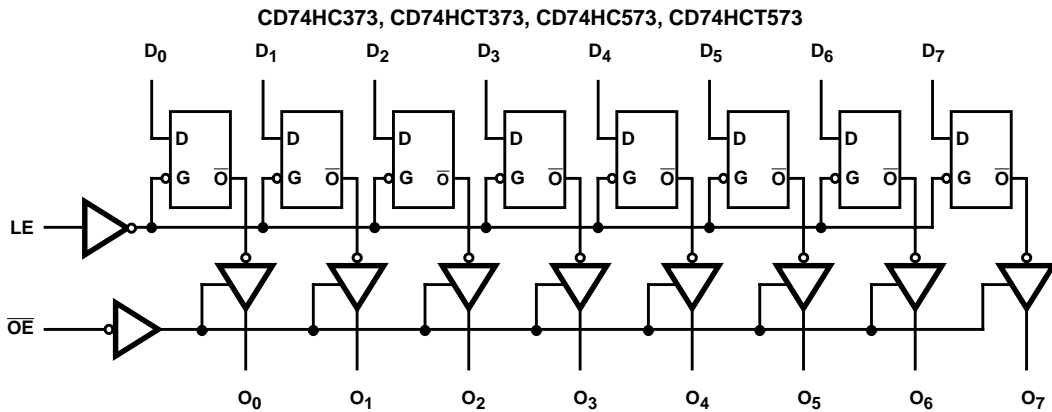
1. When ordering, use the entire part number. Add the suffix 96 to obtain the variant in the tape and reel.
2. Wafer or die for this part number are available which meets all electrical specifications. Please contact your local sales office or Harris customer service for ordering information.

CD74HC373, CD74HCT373, CD54HC573, CD74HC573, CD74HCT573

Pinout



Functional Block Diagrams



TRUTH TABLE

OUTPUT ENABLE	LATCH ENABLE	DATA	OUTPUT
L	H	H	H
L	H	L	L
L	L	l	L
L	L	h	H
H	X	X	Z

NOTE: H = High Voltage Level, L = Low Voltage Level, X = Don't Care, Z = High Impedance State, l = Low voltage level one set-up time prior to the high to low latch enable transition, h = High voltage level one set-up time prior to the high to low latch enable transition.

CD74HC373, CD74HCT373, CD54HC573, CD74HC573, CD74HCT573

Absolute Maximum Ratings

DC Supply Voltage, V_{CC}	-0.5V to 7V
DC Input Diode Current, I_{IK}	
For $V_I < -0.5V$ or $V_I > V_{CC} + 0.5V$	$\pm 20mA$
DC Output Diode Current, I_{OK}	
For $V_O < -0.5V$ or $V_O > V_{CC} + 0.5V$	$\pm 20mA$
DC Drain Current, per Output, I_O	
For $-0.5V < V_O < V_{CC} + 0.5V$	$\pm 35mA$
DC Output Source or Sink Current per Output Pin, I_O	
For $V_O > -0.5V$ or $V_O < V_{CC} + 0.5V$	$\pm 25mA$
DC V_{CC} or Ground Current, I_{CC}	$\pm 50mA$

Thermal Information

Thermal Resistance (Typical, Note 3) θ_{JA} ($^{\circ}C/W$)	θ_{JA} ($^{\circ}C/W$)
PDIP Package	125 N/A
CERDIP Package	85 24
SOIC Package	120 N/A
Maximum Junction Temperature (Plastic Package)	150 $^{\circ}C$
Maximum Storage Temperature Range	-65 $^{\circ}C$ to 150 $^{\circ}C$
Maximum Lead Temperature (Soldering 10s)	300 $^{\circ}C$
(SOIC - Lead Tips Only)	

Operating Conditions

Temperature Range, T_A	-55 $^{\circ}C$ to 125 $^{\circ}C$
Supply Voltage Range, V_{CC}	
HC Types	2V to 6V
HCT Types	4.5V to 5.5V
DC Input or Output Voltage, V_I , V_O	0V to V_{CC}
Input Rise and Fall Time	
2V	1000ns (Max)
4.5V	500ns (Max)
6V	400ns (Max)

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.

DC Electrical Specifications

PARAMETER	SYMBOL	TEST CONDITIONS		V_{CC} (V)	25 $^{\circ}C$			-40 $^{\circ}C$ TO 85 $^{\circ}C$		-55 $^{\circ}C$ TO 125 $^{\circ}C$		UNITS
		V_I (V)	I_O (mA)		MIN	TYP	MAX	MIN	MAX	MIN	MAX	
HC TYPES												
High Level Input Voltage	V_{IH}	-	-	2	1.5	-	-	1.5	-	1.5	-	V
				4.5	3.15	-	-	3.15	-	3.15	-	V
				6	4.2	-	-	4.2	-	4.2	-	V
Low Level Input Voltage	V_{IL}	-	-	2	-	-	0.5	-	0.5	-	0.5	V
				4.5	-	-	1.35	-	1.35	-	1.35	V
				6	-	-	1.8	-	1.8	-	1.8	V
High Level Output Voltage CMOS Loads	V_{OH}	V_{IH} or V_{IL}	-0.02	2	1.9	-	-	1.9	-	1.9	-	V
			-0.02	4.5	4.4	-	-	4.4	-	4.4	-	V
			-0.02	6	5.9	-	-	5.9	-	5.9	-	V
High Level Output Voltage TTL Loads	V_{OH}	V_{IH} or V_{IL}	-6	4.5	3.98	-	-	3.84	-	3.7	-	V
			-7.8	6	5.48	-	-	5.34	-	5.2	-	V
Low Level Output Voltage CMOS Loads	V_{OL}	V_{IH} or V_{IL}	0.02	2	-	-	0.1	-	0.1	-	0.1	V
			0.02	4.5	-	-	0.1	-	0.1	-	0.1	V
			0.02	6	-	-	0.1	-	0.1	-	0.1	V
Low Level Output Voltage TTL Loads	V_{OL}	V_{IH} or V_{IL}	6	4.5	-	-	0.26	-	0.33	-	0.4	V
			7.8	6	-	-	0.26	-	0.33	-	0.4	V
Input Leakage Current	I_I	V_{CC} or GND	-	6	-	-	± 0.1	-	± 1	-	± 1	μA
Quiescent Device Current	I_{CC}	V_{CC} or GND	0	6	-	-	8	-	80	-	160	μA

CD74HC373, CD74HCT373, CD54HC573, CD74HC573, CD74HCT573

DC Electrical Specifications (Continued)

PARAMETER	SYMBOL	TEST CONDITIONS		V _{CC} (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
		V _I (V)	I _O (mA)		MIN	TYP	MAX	MIN	MAX	MIN	MAX	
Three-State Leakage Current	-	V _{IL} or V _{IH}	V _O = V _{CC} or GND	6	-	-	±0.5	-	±5	-	±10	μA
HCT TYPES												
High Level Input Voltage	V _{IH}	-	-	4.5 to 5.5	2	-	-	2	-	2	-	V
Low Level Input Voltage	V _{IL}	-	-	4.5 to 5.5	-	-	0.8	-	0.8	-	0.8	V
High Level Output Voltage CMOS Loads	V _{OH}	V _{IH} or V _{IL}	-0.02	4.5	4.4	-	-	4.4	-	4.4	-	V
High Level Output Voltage TTL Loads			-6	4.5	3.98	-	-	3.84	-	3.7	-	V
			-7.8	6	5.48	-	-	5.34	-	5.2	-	V
Low Level Output Voltage CMOS Loads	V _{OL}	V _{IH} or V _{IL}	0.02	4.5	-	-	0.1	-	0.1	-	0.1	V
Low Level Output Voltage TTL Loads			6	4.5	-	-	0.26	-	0.33	-	0.4	V
			7.8	6	-	-	0.26	-	0.33	-	0.4	V
Input Leakage Current	I _I	V _{CC} to GND	-	5.5	-	-	±0.1	-	±1	-	±1	μA
Quiescent Device Current	I _{CC}	V _{CC} or GND	0	5.5	-	-	8	-	80	-	160	μA
Three-State Leakage Current	-	V _{IL} or V _{IH}	V _O = V _{CC} or GND	6	-	-	±0.5	-	±5	-	±10	μA
Additional Quiescent Device Current Per Input Pin: 1 Unit Load (Note 4)	ΔI _{CC}	V _{CC} -2.1	-	4.5 to 5.5	-	100	360	-	450	-	490	μA

NOTE:

4. For dual-supply systems theoretical worst case (V_I = 2.4V, V_{CC} = 5.5V) specification is 1.8mA.

HCT Input Loading Table

INPUT	UNIT LOADS	
	HCT373	HCT573
OE	1.5	1.25
Dn	0.4	0.3
LE	0.6	0.65

NOTE: Unit Load is ΔI_{CC} limit specified in DC Electrical Specifications table, e.g., 360μA max at 25°C.

CD74HC373, CD74HCT373, CD54HC573, CD74HC573, CD74HCT573

Prerequisite For Switching Specifications

PARAMETER	SYMBOL	TEST CONDITIONS	V _{CC} (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
HC TYPES											
LE Pulse Width	t _w	-	2	80	-	-	100	-	120	-	ns
			4.5	16	-	-	20	-	24	-	ns
			6	14	-	-	17	-	20	-	ns
Set-up Time Data to LE	t _{SU}	-	2	50	-	-	65	-	75	-	ns
			4.5	10	-	-	13	-	15	-	ns
			6	9	-	-	11	-	13	-	ns
Hold Time, Data to LE (573)	t _H	-	2	40	-	-	50	-	60	-	ns
			4.5	8	-	-	10	-	12	-	ns
			6	7	-	-	9	-	10	-	ns
Hold Time, Data to LE (373)	t _H	-	2	5	-	-	5	-	5	-	ns
			4.5	5	-	-	5	-	5	-	ns
			6	5	-	-	5	-	5	-	ns
HCT TYPES											
LE Pulse Width	t _w	-	4.5	16	-	-	20	-	24	-	ns
Set-up Time Data to LE	t _w	-	4.5	13	-	-	16	-	20	-	ns
Hold Time, Data to LE	t _H	-	4.5	10	-	-	13	-	15	-	ns

Switching Specifications Input t_r, t_f = 6ns

PARAMETER	SYMBOL	TEST CONDITIONS	V _{CC} (V)	25°C		-40°C TO 85°C	-55°C TO 125°C	UNITS
				TYP	MAX	MAX	MAX	
HC TYPES								
Propagation Delay, Data to Qn (HC/HCT373)	t _{PLH} , t _{PHL}	C _L = 50pF	2	-	150	190	225	ns
			4.5	-	30	38	45	ns
			6	-	26	33	38	ns
		C _L = 15pF	5	12	-	-	-	ns
Propagation Delay, Data to Qn (HC/HCT573)	t _{PLH} , t _{PHL}	C _L = 50pF	2	-	175	220	265	ns
			4.5	-	35	44	53	ns
			6	-	30	37	45	ns
		C _L = 15pF	5	14	-	-	-	ns
Propagation Delay, LE to Qn	t _{PLH} , t _{PHL}	C _L = 50pF	2	-	175	220	265	ns
			4.5	-	35	44	53	ns
			6	-	30	37	45	ns
		C _L = 15pF	5	14	-	-	-	ns
Output Enabling Time	t _{PZL} , t _{PZH}	C _L = 50pF	2	-	150	190	225	ns
			4.5	-	30	38	45	ns
			6	-	26	33	38	ns
		C _L = 15pF	5	12	-	-	-	ns

CD74HC373, CD74HCT373, CD54HC573, CD74HC573, CD74HCT573

Switching Specifications Input $t_r, t_f = 6\text{ns}$ (Continued)

PARAMETER	SYMBOL	TEST CONDITIONS	V_{CC} (V)	25°C		-40°C TO 85°C	-55°C TO 125°C	UNITS
				TYP	MAX	MAX	MAX	
Output Disabling Time	t_{PLZ}, t_{PHZ}	$C_L = 50\text{pF}$	2	-	150	190	225	ns
			4.5	-	30	38	45	ns
			6	-	26	33	38	ns
		$C_L = 15\text{pF}$	5	12	-	-	-	ns
Output Transition Time	t_{TLH}, t_{THL}	$C_L = 50\text{pF}$	2	-	60	75	90	ns
			4.5	-	12	15	18	ns
			6	-	10	13	15	ns
Input Capacitance	C_I	-	-	-	10	10	10	pF
Three-State Output Capacitance	C_O	-	-	-	20	20	20	pF
Power Dissipation Capacitance (Notes 5, 6)	C_{PD}	-	5	51	-	-	-	pF
HCT TYPES								
Propagation Delay, Data to Qn (HC/HCT373)	t_{PLH}, t_{PHL}	$C_L = 50\text{pF}$	4.5	-	32	40	48	ns
		$C_L = 15\text{pF}$	5	13	-	-	-	ns
Propagation Delay, Data to Qn (HC/HCT573)	t_{PLH}, t_{PHL}	$C_L = 50\text{pF}$	4.5	-	35	44	53	ns
		$C_L = 15\text{pF}$	5	17	-	-	-	ns
Propagation Delay, LE to Qn	t_{PLH}, t_{PHL}	$C_L = 50\text{pF}$	4.5	-	35	44	53	ns
		$C_L = 15\text{pF}$	5	14	-	-	-	ns
Output Enabling Time	t_{PZL}, t_{PZH}	$C_L = 50\text{pF}$	4.5	-	35	44	53	ns
		$C_L = 15\text{pF}$	5	14	-	-	-	ns
Output Disabling Time	t_{PLZ}, t_{PZH}	$C_L = 50\text{pF}$	4.5	-	35	44	53	ns
		$C_L = 15\text{pF}$	5	14	-	-	-	ns
Output Transition Time	t_{TLH}, t_{THL}	$C_L = 50\text{pF}$	4.5	-	12	15	18	ns
Input Capacitance	C_I	-	-	-	10	10	10	pF
Three-State Output Capacitance	C_O	-	-	-	20	20	20	pF
Power Dissipation Capacitance (Notes 5, 6)	C_{PD}	-	5	53	-	-	-	pF

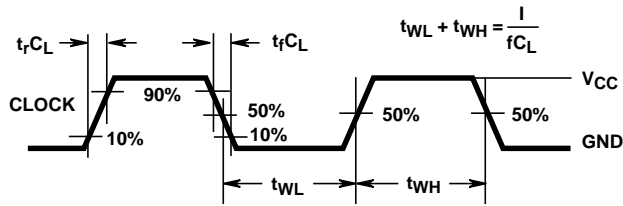
NOTES:

5. C_{PD} is used to determine the no-load dynamic power consumption, per latch.

6. P_D (total power per latch) = $V_{CC}^2 f_i (C_{PD} + C_L)$ where f_i = Input Frequency, C_L = Output Load Capacitance, V_{CC} = Supply Voltage.

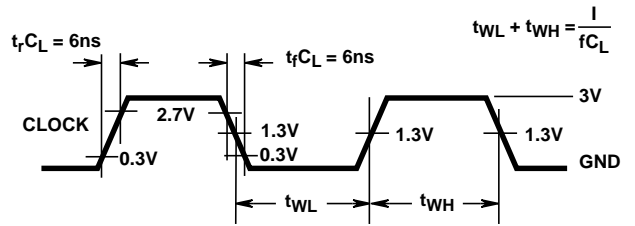
CD74HC373, CD74HCT373, CD54HC573, CD74HC573, CD74HCT573

Test Circuits and Waveforms



NOTE: Outputs should be switching from 10% V_{CC} to 90% V_{CC} in accordance with device truth table. For f_{MAX} , input duty cycle = 50%.

FIGURE 1. HC CLOCK PULSE RISE AND FALL TIMES AND PULSE WIDTH



NOTE: Outputs should be switching from 10% V_{CC} to 90% V_{CC} in accordance with device truth table. For f_{MAX} , input duty cycle = 50%.

FIGURE 2. HCT CLOCK PULSE RISE AND FALL TIMES AND PULSE WIDTH

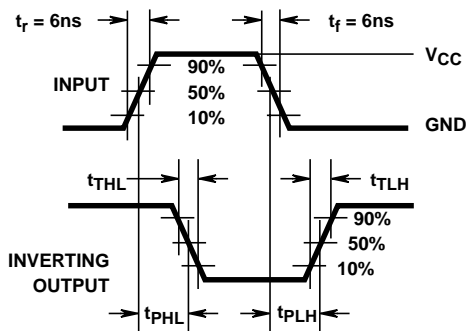


FIGURE 3. HC TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

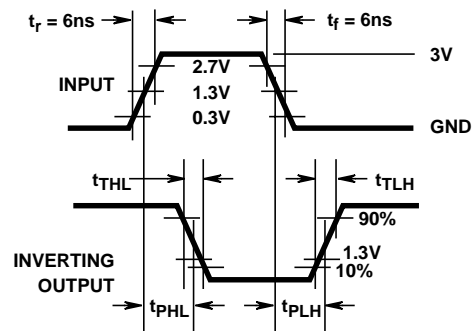


FIGURE 4. HCT TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

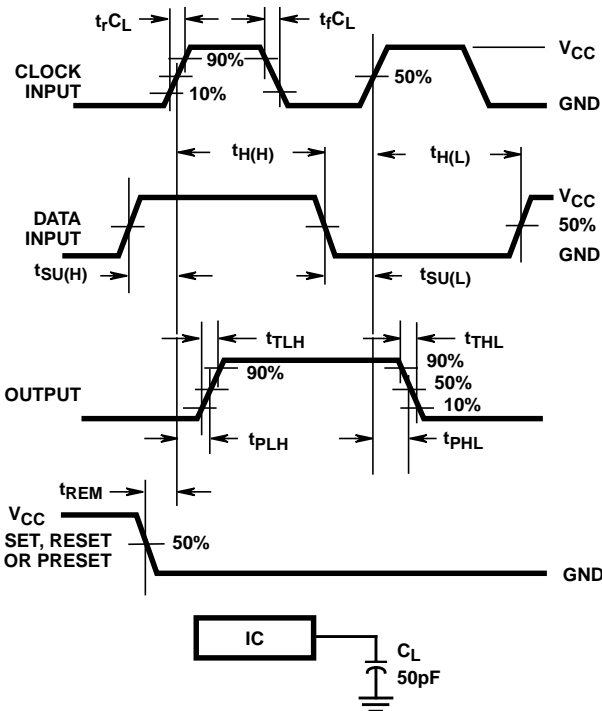


FIGURE 5. HC SETUP TIMES, HOLD TIMES, REMOVAL TIME, AND PROPAGATION DELAY TIMES FOR EDGE TRIGGERED SEQUENTIAL LOGIC CIRCUITS

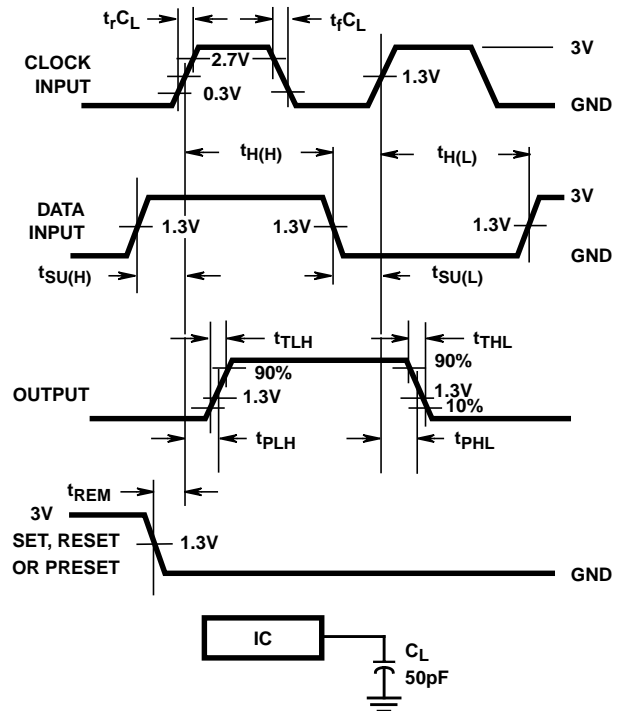


FIGURE 6. HCT SETUP TIMES, HOLD TIMES, REMOVAL TIME, AND PROPAGATION DELAY TIMES FOR EDGE TRIGGERED SEQUENTIAL LOGIC CIRCUITS

CD74HC373, CD74HCT373, CD54HC573, CD74HC573, CD74HCT573

Test Circuits and Waveforms (Continued)

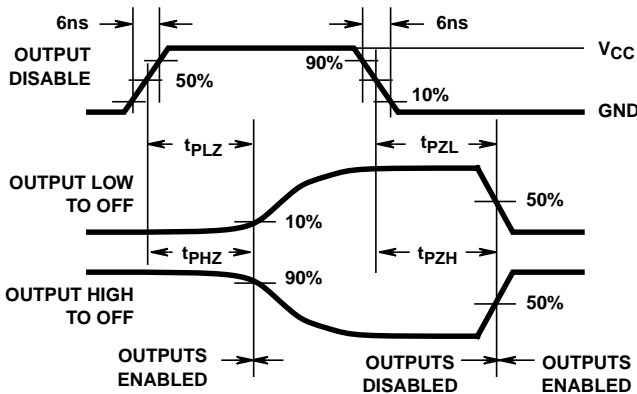


FIGURE 7. HC THREE-STATE PROPAGATION DELAY WAVEFORM

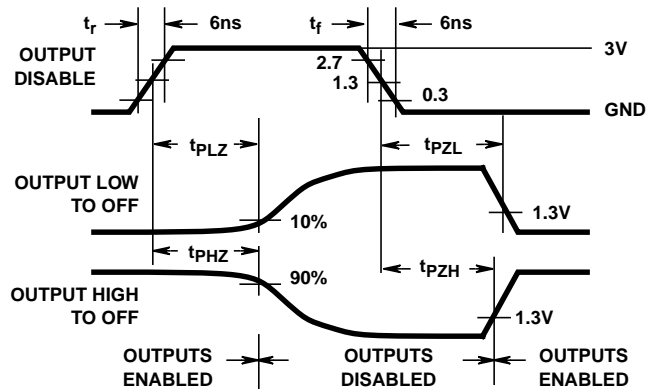
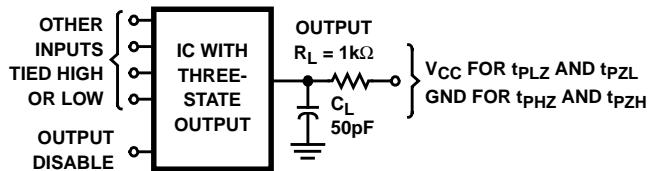


FIGURE 8. HCT THREE-STATE PROPAGATION DELAY WAVEFORM



NOTE: Open drain waveforms t_{PLZ} and t_{PZL} are the same as those for three-state shown on the left. The test circuit is Output $R_L = 1k\Omega$ to V_{CC} . $C_L = 50pF$.

FIGURE 9. HC AND HCT THREE-STATE PROPAGATION DELAY TEST CIRCUIT

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 100, Rue de la Fusee
 1130 Brussels, Belgium
 TEL: (32) 2.724.2111
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ASIA
 Harris Semiconductor PTE Ltd.
 No. 1 Tannery Road
 Cencon 1, #09-01
 Singapore 1334
 TEL: (65) 748-4200
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