

# CD74HC367, CD74HCT367, CD74HC368, CD74HCT368

## High Speed CMOS Logic Hex Buffer/Line Driver, Three-State Non-Inverting and Inverting

November 1997

### Features

- Buffered Inputs
- High Current Bus Driver Outputs
- Two Independent Three-State Enable Controls
- Typical Propagation Delay  $t_{PLH}$ ,  $t_{PHL} = 8\text{ns}$  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
- Wide Operating Temperature Range . . .  $-55^\circ\text{C}$  to  $125^\circ\text{C}$
- 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  $V_{CC} = 5\text{V}$
- HCT Types
  - 4.5V to 5.5V Operation
  - 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

The Harris CD74HC367, CD74HCT367, CD74HC368, and CD74HCT368 silicon gate CMOS three-state buffers are general purpose high-speed non-inverting and inverting buffers. They have high drive current outputs which enable high speed operation even when driving large bus capacitances. These circuits possess the low power dissipation of CMOS circuitry, yet have speeds comparable to low power Schottky TTL circuits. Both circuits are capable of driving up to 15 low power Schottky inputs.

The CD74HC367 and CD74HCT367 are non-inverting buffers, whereas the CD74HC368 and CD74HCT368 are inverting buffers. These devices have two output enables, one enable (OE1) controls 4 gates and the other (OE2) controls the remaining 2 gates.

The CD74HCT367 and CD74HCT368 logic families are speed, function and pin compatible with the standard 74LS logic family.

### Ordering Information

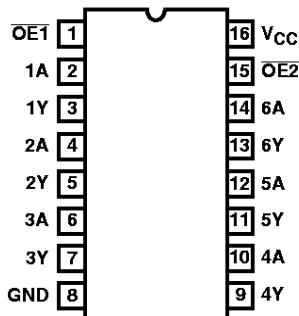
PART NUMBER	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
CD74HC367E	-55 to 125	16 Ld PDIP	E16.3
CD74HCT367E	-55 to 125	16 Ld PDIP	E16.3
CD74HCT368E	-55 to 125	16 Ld PDIP	E16.3
CD74HC367M	-55 to 125	16 Ld SOIC	M16.15
CD74HCT367M	-55 to 125	16 Ld SOIC	M16.15
CD74HC368M	-55 to 125	16 Ld SOIC	M16.15
CD74HCT368M	-55 to 125	16 Ld SOIC	M16.15

#### NOTES:

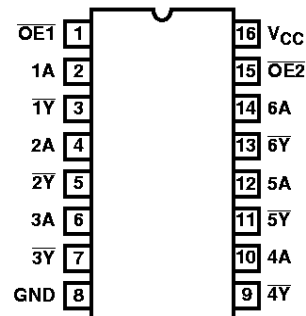
1. When ordering, use the entire part number. Add the suffix 96 to obtain the variant in the tape and reel.
2. Wafer or die for this part number is available which meets all electrical specifications. Please contact your local sales office or Harris customer service for ordering information.

### Pinouts

CD74HC367, CD74HCT367 (PDIP, SOIC)  
TOP VIEW

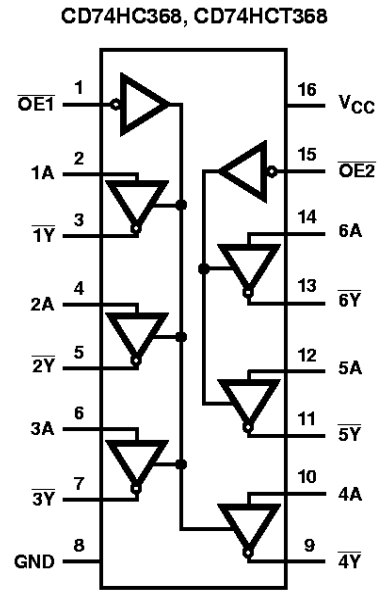
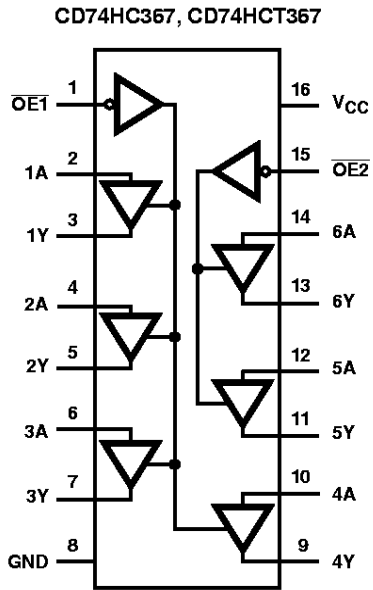


CD74HC368, CD74HCT368 (PDIP, SOIC)  
TOP VIEW



**CD74HC367, CD74HCT367, CD74HC368, CD74HCT368**

**Functional Diagrams**



**TRUTH TABLE**

INPUTS		OUTPUTS (Y)	
OE	A	HC/HCT367	HC/HCT368
L	L	L	H
L	H	H	L
H	X	(Z)	(Z)

NOTE:

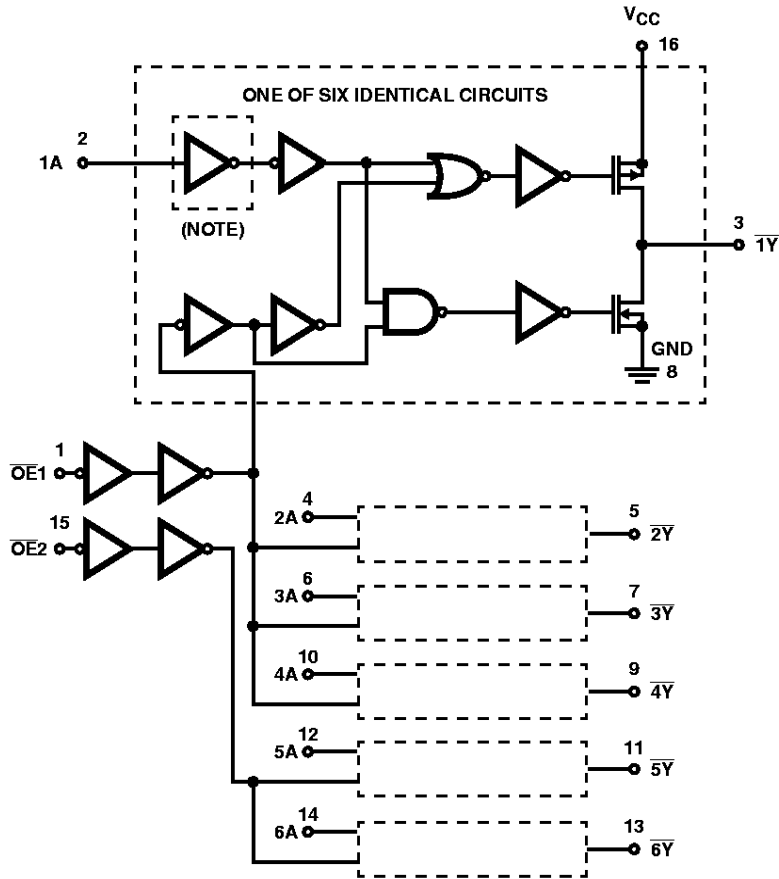
H = High Voltage Level

L = Low Voltage Level

X = Don't Care

Z = High Impedance (OFF) State

Logic Diagram



NOTE: Inverter not included in HC/HCT367.

FIGURE 1. LOGIC DIAGRAM FOR THE HC/HCT367 AND HC/HCT368 (OUTPUTS FOR HC/HCT367 ARE COMPLEMENTS OF THOSE SHOWN, i.e., 1Y, 2Y, ETC.)

## CD74HC367, CD74HCT367, CD74HC368, CD74HCT368

### 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)	$\theta_{JA}$ ( $^{\circ}C/W$ )
PDIP Package .....	90
SOIC Package .....	160
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 - 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:

- $\theta_{JA}$  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		
<b>HC TYPES</b>													
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	-0.02	2	1.9	-	-	1.9	-	1.9	-	V
			-0.02	-0.02	4.5	4.4	-	-	4.4	-	4.4	-	V
			-0.02	-0.02	6	5.9	-	-	5.9	-	5.9	-	V
High Level Output Voltage TTL Loads	$V_{OH}$	$V_{IH}$ or $V_{IL}$	-6	-6	4.5	3.98	-	-	3.84	-	3.7	-	V
			-7.8	-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	0.02	2	-	-	0.1	-	0.1	-	0.1	V
			0.02	0.02	4.5	-	-	0.1	-	0.1	-	0.1	V
			0.02	0.02	6	-	-	0.1	-	0.1	-	0.1	V
Low Level Output Voltage TTL Loads	$V_{OL}$	$V_{IH}$ or $V_{IL}$	6	6	4.5	-	-	0.26	-	0.33	-	0.4	V
			7.8	7.8	6	-	-	0.26	-	0.33	-	0.4	V
Input Leakage Current	$I_I$	$V_{CC}$ or GND	-	6	-	-	$\pm 0.1$	-	$\pm 1$	-	$\pm 1$	$\mu A$	
Quiescent Device Current	$I_{CC}$	$V_{CC}$ or GND	0	6	-	-	8	-	80	-	160	$\mu A$	

**CD74HC367, CD74HCT367, CD74HC368, CD74HCT368**

**DC Electrical Specifications (Continued)**

PARAMETER	SYMBOL	TEST CONDITIONS		V <sub>CC</sub> (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
		V <sub>I</sub> (V)	I <sub>O</sub> (mA)		MIN	TYP	MAX	MIN	MAX	MIN	MAX	
Three-State Leakage Current	I <sub>OZ</sub>	V <sub>IL</sub> or V <sub>IH</sub>	V <sub>O</sub> = V <sub>CC</sub> or GND	6	-	-	±0.5	-	±5.0	-	±10	μA
<b>HCT TYPES</b>												
High Level Input Voltage	V <sub>IH</sub>	-	-	4.5 to 5.5	2	-	-	2	-	2	-	V
Low Level Input Voltage	V <sub>IL</sub>	-	-	4.5 to 5.5	-	-	0.8	-	0.8	-	0.8	V
High Level Output Voltage CMOS Loads	V <sub>OH</sub>	V <sub>IH</sub> or V <sub>IL</sub>	-0.02	4.5	4.4	-	-	4.4	-	4.4	-	V
High Level Output Voltage TTL Loads			-4	4.5	3.98	-	-	3.84	-	3.7	-	V
Low Level Output Voltage CMOS Loads	V <sub>OL</sub>	V <sub>IH</sub> or V <sub>IL</sub>	0.02	4.5	-	-	0.1	-	0.1	-	0.1	V
Low Level Output Voltage TTL Loads			4	4.5	-	-	0.26	-	0.33	-	0.4	V
Input Leakage Current	I <sub>I</sub>	V <sub>CC</sub> to GND	0	5.5	-	-	±0.1	-	±1	-	±1	μA
Quiescent Device Current	I <sub>CC</sub>	V <sub>CC</sub> or GND	0	5.5	-	-	8	-	80	-	160	μA
Additional Quiescent Device Current Per Input Pin: 1 Unit Load (Note 4)	ΔI <sub>CC</sub>	V <sub>CC</sub> -2.1	-	4.5 to 5.5	-	100	360	-	450	-	490	μA
Three-State Leakage Current	I <sub>OZ</sub>	V <sub>IL</sub> or V <sub>IH</sub>	V <sub>O</sub> = V <sub>CC</sub> or GND	5.5	-	-	±0.5	-	±5.0	-	±10	μA

NOTE:

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

**HCT Input Loading Table**

INPUT	UNIT LOADS
OE <sub>T</sub>	0.6
All Others	0.55

NOTE: Unit Load is ΔI<sub>CC</sub> limit specified in DC Electrical Specifications table, e.g., 360μA max at 25°C.

**Switching Specifications** Input t<sub>r</sub>, t<sub>f</sub> = 6ns

PARAMETER	SYMBOL	TEST CONDITIONS	V <sub>CC</sub> (V)	25°C		-40°C TO 85°C	-55°C TO 125°C	UNITS
				TYP	MAX	MAX	MAX	
<b>HC TYPES</b>								
Propagation Delay, Data to Outputs HC/HCT367	t <sub>PLH</sub> , t <sub>PHL</sub>	C <sub>L</sub> = 50pF	2	-	105	130	160	ns
			4.5	-	21	26	32	ns
			6	-	18	24	27	ns
		C <sub>L</sub> = 15pF	5	8	-	-	-	ns

**CD74HC367, CD74HCT367, CD74HC368, CD74HCT368**

**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	
Propagation Delay, Data to Outputs HC/HCT368	$t_{PLH}, t_{PHL}$	$C_L = 50\text{pF}$	2	-	105	130	160	ns
			4.5	-	21	26	32	ns
			6	-	18	24	27	ns
		$C_L = 15\text{pF}$	5	9	-	-	-	ns
Propagation Delay, Output Enable and Disable to Outputs	$t_{PLH}, t_{PHL}$	$C_L = 50\text{pF}$	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	40	-	-	-	pF
<b>HCT TYPES</b>								
Propagation Delay, Data to Outputs HC/HCT367	$t_{PLH}, t_{PHL}$	$C_L = 50\text{pF}$	4.5	-	25	31	38	ns
		$C_L = 15\text{pF}$	5	9	-	-	-	ns
Propagation Delay, Data to Outputs HC/HCT368	$t_{PLH}, t_{PHL}$	$C_L = 50\text{pF}$	4.5	-	30	38	45	ns
		$C_L = 15\text{pF}$	5	11	-	-	-	ns
Propagation Delay, Output Enable and Disable to Outputs	$t_{PLH}, t_{PHL}$	$C_L = 50\text{pF}$	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	$C_{IN}$	-	-	-	10	10	10	pF
Three-State Capacitance	$C_O$	-	-	-	20	20	20	pF
Power Dissipation Capacitance (Notes 5, 6)	$C_{PD}$	-	5	42	-	-	-	pF

NOTES:

- $C_{PD}$  is used to determine the dynamic power consumption, per buffer.
- $P_D = V_{CC}^2 f_i (C_{PD} + C_L)$  where  $f_i$  = Input Frequency,  $C_L$  = Output Load Capacitance,  $V_{CC}$  = Supply Voltage.

Test Circuits and Waveforms

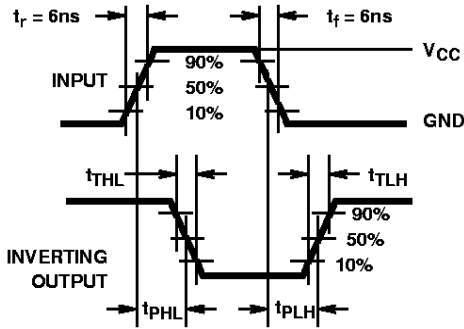


FIGURE 2. HC TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

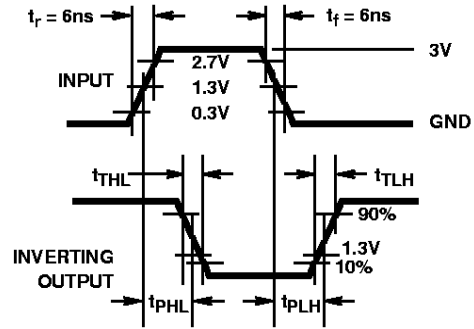


FIGURE 3. HCT TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

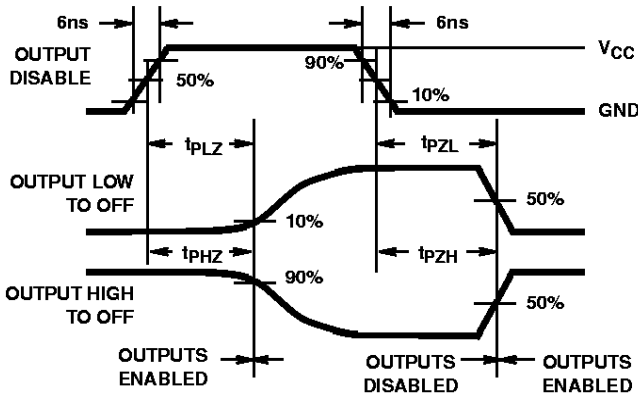


FIGURE 4. HC THREE-STATE PROPAGATION DELAY WAVEFORM

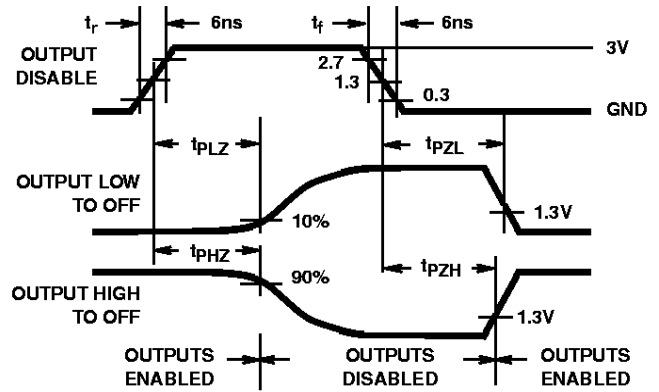
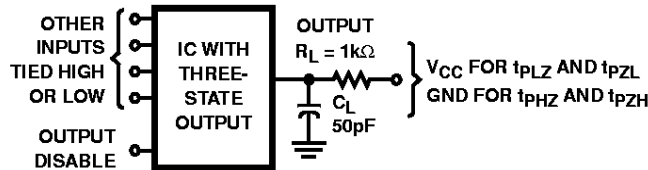


FIGURE 5. HCT THREE-STATE PROPAGATION DELAY WAVEFORM



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 6. HC AND HCT THREE-STATE PROPAGATION DELAY TEST CIRCUIT