

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC74HC367AP, TC74HC367AF TC74HC368AP, TC74HC368AF

## Hex Bus Buffer

TC74HC367AP/AF	Non-Inverted (3-state)
TC74HC368AP/AF	Inverted (3-state)

The TC74HC367A and TC74HC368A are high speed CMOS 3-STATE BUS BUFFERS fabricated with silicon gate C<sup>2</sup>MOS technology.

They achieve the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

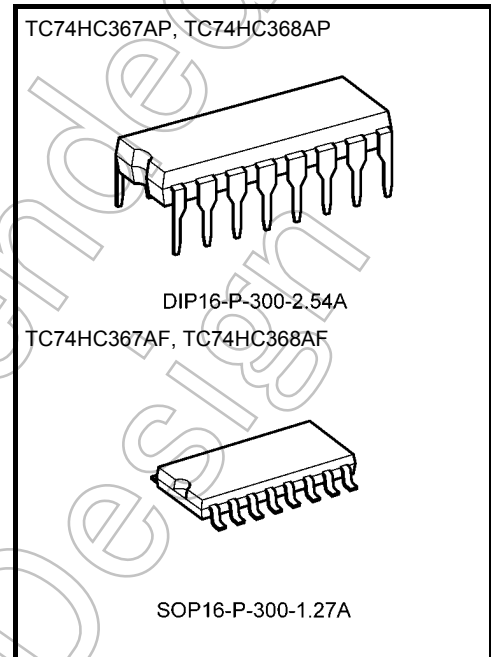
They contain six buffers; four buffers are controlled by an enable input ( $\overline{G1}$ ), and the other two buffers are controlled by another enable input ( $\overline{G2}$ ). The outputs of each buffer group are enabled when  $\overline{G1}$  and/or  $\overline{G2}$  inputs are held low; if held high, these outputs are in a high impedance state.

The TC74HC367A is a non-inverting output type, while the TC74HC368A is an inverting output type.

All inputs are equipped with protection circuits against static discharge or transient excess voltage.

## Features

- High speed:  $t_{pd} = 11 \text{ ns (typ.)}$  at  $V_{CC} = 5 \text{ V}$
- Low power dissipation:  $I_{CC} = 4 \text{ }\mu\text{A (max)}$  at  $T_a = 25^\circ\text{C}$
- High noise immunity:  $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (min)
- Output drive capability: 15 LSTTL loads
- Symmetrical output impedance:  $|I_{OH}| = I_{OL} = 6 \text{ mA}$
- Balanced propagation delays:  $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range:  $V_{CC} \text{ (opr)} = 2 \text{ to } 6 \text{ V}$
- Pin and function compatible with 74LS367/368

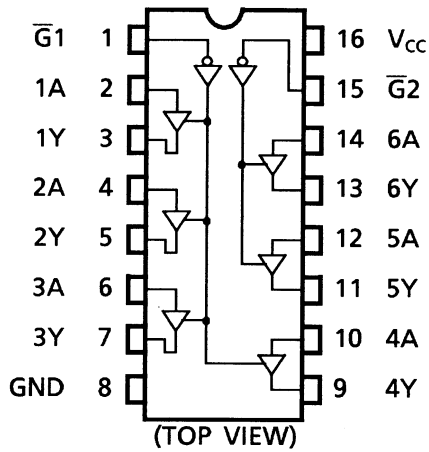


Weight	
DIP16-P-300-2.54A	: 1.00 g (typ.)
SOP16-P-300-1.27A	: 0.18 g (typ.)

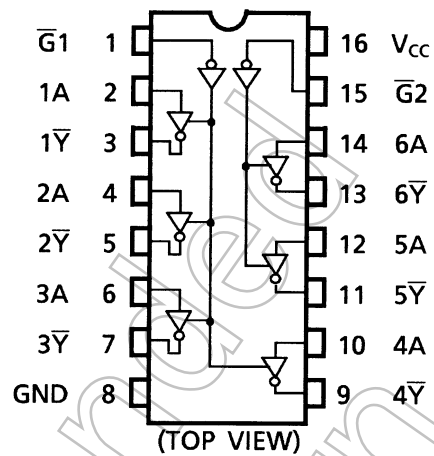
Start of commercial production  
1987-11

## Pin Assignment

### TC74HC367A



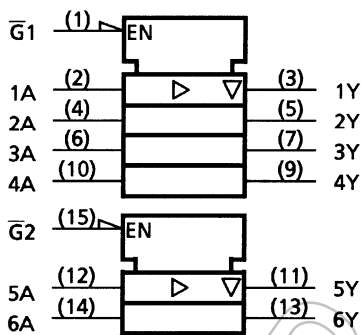
### TC74HC368A



## IEC Logic Symbol

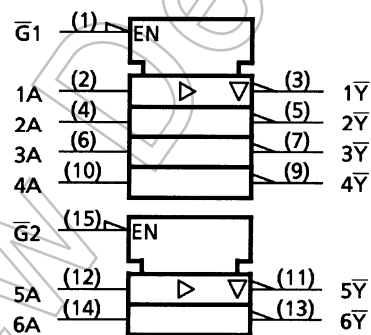
### TC74HC367A

HEX BUS BUFFER  
(3 - STATE)



### TC74HC368A

HEX BUS BUFFER  
(3 - STATE / INV.)



## Truth Table

Inputs		Outputs	
$\bar{G}$	$A_n$	Y (367A)	$\bar{Y}$ (368A)
L	L	L	H
L	H	H	L
H	X	Z	Z

X: Don't care

Z: High impedance

## Absolute Maximum Ratings (Note 1)

Characteristics	Symbol	Rating	Unit
Supply voltage range	$V_{CC}$	-0.5 to 7	V
DC input voltage	$V_{IN}$	-0.5 to $V_{CC} + 0.5$	V
DC output voltage	$V_{OUT}$	-0.5 to $V_{CC} + 0.5$	V
Input diode current	$I_{IK}$	$\pm 20$	mA
Output diode current	$I_{OK}$	$\pm 20$	mA
DC output current	$I_{OUT}$	$\pm 35$	mA
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 75$	mA
Power dissipation	$P_D$	500 (DIP) (Note 2)/180 (SOP)	mW
Storage temperature	$T_{stg}$	-65 to 150	$^{\circ}C$

Note 1: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 2: 500 mW in the range of  $T_a = -40$  to  $65^{\circ}C$ . From  $T_a = 65$  to  $85^{\circ}C$  a derating factor of  $-10$  mW/ $^{\circ}C$  shall be applied until 300 mW.

## Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	2 to 6	V
Input voltage	$V_{IN}$	0 to $V_{CC}$	V
Output voltage	$V_{OUT}$	0 to $V_{CC}$	V
Operating temperature	$T_{opr}$	-40 to 85	$^{\circ}C$
Input rise and fall time	$t_r, t_f$	0 to 1000 ( $V_{CC} = 2.0$ V) 0 to 500 ( $V_{CC} = 4.5$ V) 0 to 400 ( $V_{CC} = 6.0$ V)	ns

Note: The operating ranges must be maintained to ensure the normal operation of the device. Unused inputs must be tied to either  $V_{CC}$  or GND.

**Electrical Characteristics**

**DC Characteristics**

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit			
				VCC (V)	Min	Typ.	Max	Min		Max		
High-level input voltage	V <sub>IH</sub>	—		2.0	1.50	—	—	1.50	—	V		
				4.5	3.15	—	—	3.15	—			
				6.0	4.20	—	—	4.20	—			
Low-level input voltage	V <sub>IL</sub>	—		2.0	—	—	0.50	—	0.50	V		
				4.5	—	—	1.35	—	1.35			
				6.0	—	—	1.80	—	1.80			
High-level output voltage	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>		I <sub>OH</sub> = -20 μA		2.0	1.9	2.0	—	1.9	—	V
						4.5	4.4	4.5	—	4.4	—	
						6.0	5.9	6.0	—	5.9	—	
				I <sub>OH</sub> = -6 mA		4.5	4.18	4.31	—	4.13	—	
						I <sub>OH</sub> = -7.8 mA		6.0	5.68	5.80	—	
Low-level output voltage	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>		I <sub>OL</sub> = 20 μA		2.0	—	0.0	0.1	—	0.1	V
						4.5	—	0.0	0.1	—	0.1	
						6.0	—	0.0	0.1	—	0.1	
				I <sub>OL</sub> = 6 mA		4.5	—	0.17	0.26	—	0.33	
						I <sub>OL</sub> = 7.8 mA		6.0	—	0.18	0.26	
3-state output off-state current	I <sub>OZ</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> V <sub>OUT</sub> = V <sub>CC</sub> or GND		6.0	—	—	±0.5	—	±5.0	μA		
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		6.0	—	—	±0.1	—	±1.0	μA		
Quiescent supply current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		6.0	—	—	4.0	—	40.0	μA		

Not Recommended for New Design

## AC Characteristics (input: $t_r = t_f = 6$ ns)

Characteristics	Symbol	Test Condition			Ta = 25°C			Ta = -40 to 85°C		Unit	
		CL (pF)	VCC (V)		Min	Typ.	Max	Min	Max		
Output transition time	$t_{TLH}$	—	50	2.0	—	25	60	—	75	ns	
	$t_{THL}$			4.5	—	7	12	—	15		
				6.0	—	6	10	—	13		
Propagation delay time	$t_{pLH}$	—	50	2.0	—	36	95	—	120	ns	
				4.5	—	12	19	—	24		
				6.0	—	10	16	—	20		
	150		2.0	—	40	130	—	165			
			4.5	—	16	26	—	33			
			6.0	—	14	22	—	28			
Output enable time	$t_{pZL}$	$R_L = 1$ k $\Omega$	50	2.0	—	36	120	—	150	ns	
				4.5	—	12	24	—	30		
				6.0	—	10	20	—	26		
	150		2.0	—	40	160	—	200			
			4.5	—	16	32	—	40			
			6.0	—	14	27	—	34			
Output disable time	$t_{pLZ}$	$R_L = 1$ k $\Omega$	50	2.0	—	35	120	—	150	ns	
				4.5	—	15	24	—	30		
				6.0	—	13	20	—	26		
Input capacitance	$C_{IN}$		—	—	—	5	10	—	10		pF
					—	—	—	—	—		
					—	—	—	—	—		
Output capacitance	$C_{OUT}$	—	—	—	10	—	—	—	pF		
				—	—	—	—	—			
Power dissipation capacitance	$C_{PD}$ (Note)	TC74HC367A	—	36	—	—	—	pF			
		TC74HC368A	—	30	—	—	—				

Note:  $C_{PD}$  is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

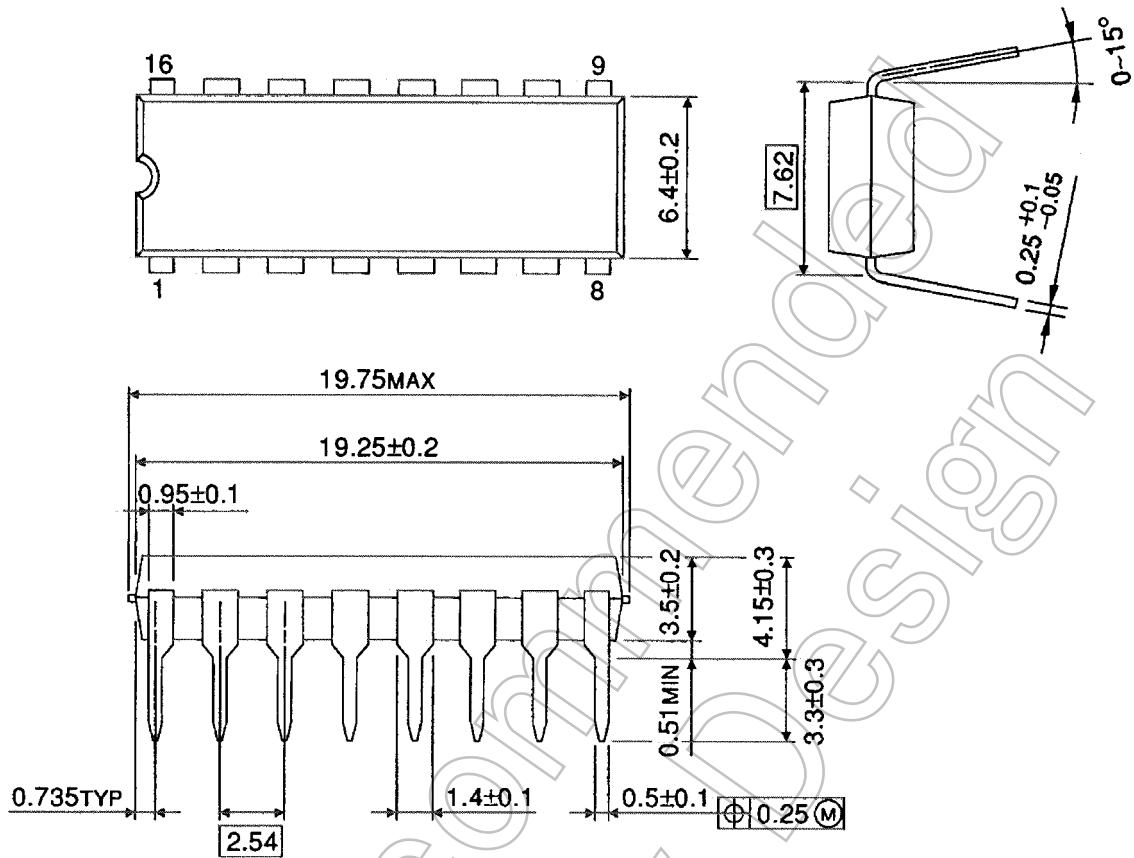
Average operating current can be obtained by the equation:

$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/6 \text{ (per bit)}$$

**Package Dimensions**

DIP16-P-300-2.54A

Unit : mm



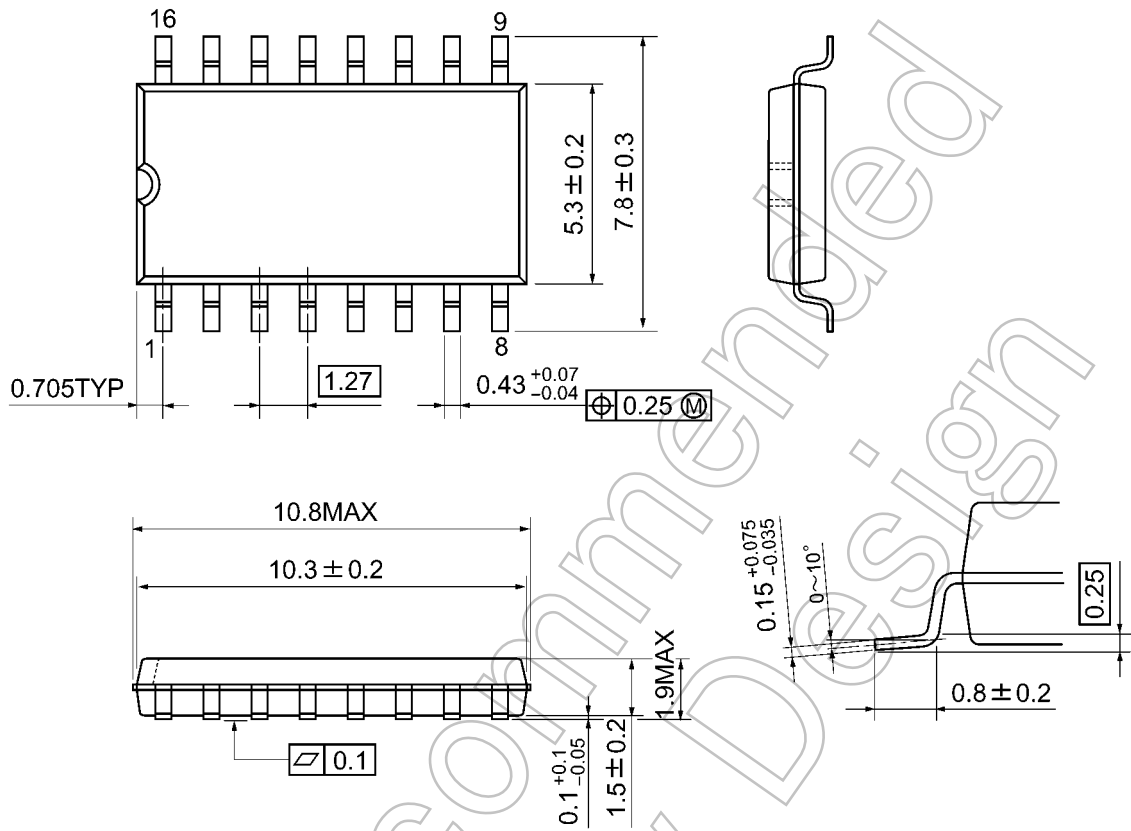
Weight: 1.00 g (typ.)

Not Recommended for New Design

**Package Dimensions**

SOP16-P-300-1.27A

Unit: mm



Weight: 0.18 g (typ.)

Not Recommended for New Design

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