

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74VHC367F,TC74VHC367FN,TC74VHC367FT,TC74VHC367FK TC74VHC368F,TC74VHC368FN,TC74VHC368FT,TC74VHC368FK

Hex Bus Buffer

TC74VHC367F/FN/FT/FK Non-Inverted,
3-State Outputs

TC74VHC368F/FN/FT/FK Inverted, 3-State
Outputs

The TC74VHC367 and 368 are advanced high speed CMOS HEX BUS BUFFERs fabricated with silicon gate C²MOS technology.

They achieve the high speed operation similar to equivalent Bipolar Schottky TTL 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 TC74VHC367 is a non-inverting output type, while the TC74VHC368 is an inverting output type.

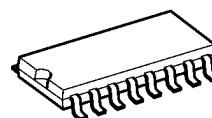
An input protection circuit ensures that 0 to 5.5 V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5 V to 3 V systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

Features

- High speed: $t_{pd} = 3.8$ ns (typ.) at $V_{CC} = 5$ V
- Low power dissipation: $I_{CC} = 4$ μ A (max) at $T_a = 25^\circ\text{C}$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\%$ V_{CC} (min)
- Power down protection is provided on all inputs.
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range: $V_{CC(opr)} = 2$ V to 5.5 V
- Low noise: $V_{OLP} = 0.8$ V (max)
- Pin and function compatible with 74ALS367/368

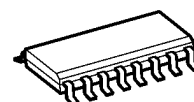
Note: The JEDEC SOP (FN) is not available in Japan.

TC74VHC367F, TC74VHC368F



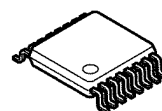
SOP16-P-300-1.27A

TC74VHC367FN, TC74VHC368FN



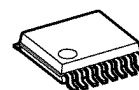
SOL16-P-150-1.27

TC74VHC367FT, TC74VHC368FT



TSSOP16-P-0044-0.65A

TC74VHC367FK, TC74VHC368FK

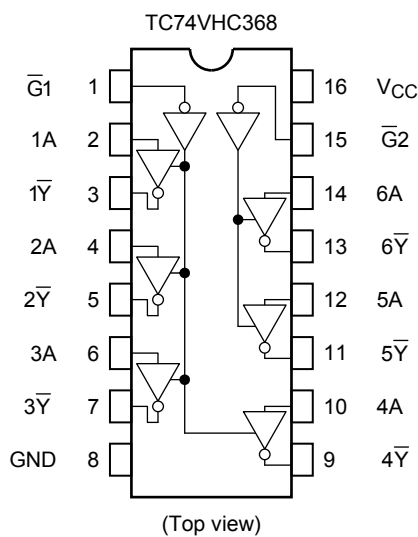
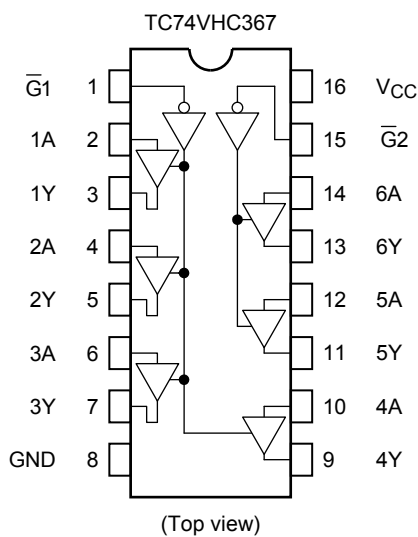


VSSOP16-P-0030-0.50

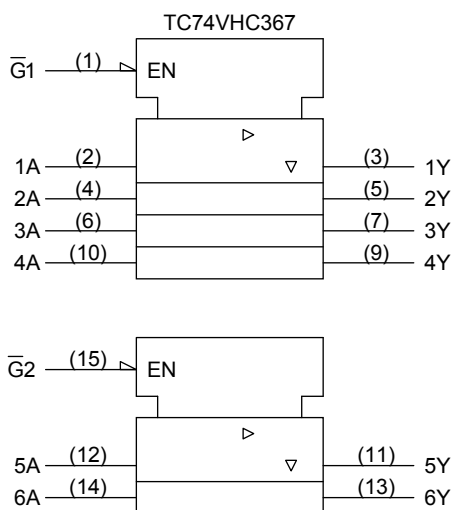
Weight

SOP16-P-300-1.27A:	0.18 g (typ.)
SOL16-P-150-1.27:	0.13 g (typ.)
TSSOP16-P-0044-0.65A:	0.06 g (typ.)
VSSOP16-P-0030-0.50:	0.02 g (typ.)

Pin Assignment



IEC Logic Symbol



Truth Table

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

X: Don't care

Z: High impedance

Absolute Maximum Ratings (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V_{CC}	-0.5 to 7.0	V
DC input voltage	V_{IN}	-0.5 to 7.0	V
DC output voltage	V_{OUT}	-0.5 to $V_{CC} + 0.5$	V
Input diode current	I_{IK}	-20	mA
Output diode current	I_{OK}	± 20	mA
DC output current	I_{OUT}	± 25	mA
DC V_{CC} /ground current	I_{CC}	± 50	mA
Power dissipation	P_D	180	mW
Storage temperature	T_{stg}	-65 to 150	°C

Note: 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.).

Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	2.0 to 5.5	V
Input voltage	V_{IN}	0 to 5.5	V
Output voltage	V_{OUT}	0 to V_{CC}	V
Operating temperature	T_{opr}	-40 to 85	°C
Input rise and fall time	dt/dv	0 to 100 ($V_{CC} = 3.3 \pm 0.3$ V) 0 to 20 ($V_{CC} = 5 \pm 0.5$ V)	ns/V

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	
				V _{CC} (V)	Min	Typ.	Max	Min		Max
High-level input voltage	V _{IH}	—		2.0 3.0 to 5.5	1.50 V _{CC} × 0.7	— —	— —	1.50 V _{CC} × 0.7	— —	V
Low-level input voltage	V _{IL}	—		2.0 3.0 to 5.5	— —	— —	0.50 V _{CC} × 0.3	— —	0.50 V _{CC} × 0.3	V
High-level output voltage	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -50 μA	2.0	1.9	2.0	—	1.9	—	V
				3.0	2.9	3.0	—	2.9	—	
			I _{OH} = -4 mA I _{OH} = -8 mA	4.5	4.4	4.5	—	4.4	—	
				3.0 4.5	2.58 3.94	— —	— —	2.48 3.80	— —	
Low-level output voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 50 μA	2.0	—	0.0	0.1	—	0.1	V
				3.0 4.5	— —	0.0 0.0	0.1 0.1	— —	0.1 0.1	
			I _{OL} = 4 mA I _{OL} = 8 mA	3.0 4.5	— —	— —	0.36 0.36	— —	0.44 0.44	
3-state output off-state current	I _{OZ}	V _{IN} = V _{IH} or V _{IL} V _{OUT} = V _{CC} or GND		5.5	—	—	±0.25	—	±2.50	μA
Input leakage current	I _{IN}	V _{IN} = 5.5 V or GND		0 to 5.5	—	—	±0.1	—	±1.0	μA
Quiescent supply current	I _{CC}	V _{IN} = V _{CC} or GND		5.5	—	—	4.0	—	40.0	μA

AC Characteristics (input: $t_r = t_f = 3 \text{ ns}$)

Characteristics	Symbol	Test Condition			Ta = 25°C			Ta = -40 to 85°C		Unit
			V _{CC} (V)	C _L (pF)	Min	Typ.	Max	Min	Max	
Propagation delay time (TC74VHC367)	t_{pLH} t_{pHL}	—	3.3 ± 0.3	15	—	5.9	8.3	1.0	10.0	ns
				50	—	8.4	11.8	1.0	13.5	
			5.0 ± 0.5	15	—	4.1	5.9	1.0	7.0	
				50	—	5.6	7.9	1.0	9.0	
Propagation delay time (TC74VHC368)	t_{pLH} t_{pHL}	—	3.3 ± 0.3	15	—	5.3	7.5	1.0	9.0	ns
				50	—	7.8	11.0	1.0	12.5	
			5.0 ± 0.5	15	—	3.8	5.5	1.0	6.5	
				50	—	5.3	7.5	1.0	8.5	
3-state output enable time	t_{pZL} t_{pZH}	R _L = 1 kΩ	3.3 ± 0.3	15	—	6.8	10.5	1.0	12.5	ns
				50	—	9.3	14.0	1.0	16.0	
			5.0 ± 0.5	15	—	4.8	7.2	1.0	8.5	
				50	—	6.3	9.2	1.0	10.5	
3-state output disable time	t_{pLZ} t_{pHZ}	R _L = 1 kΩ	3.3 ± 0.3	50	—	9.9	13.6	1.0	15.5	ns
			5.0 ± 0.5	50	—	6.3	9.2	1.0	10.5	
Output to output skew	$t_{oS LH}$ $t_{oS HL}$	(Note 1)	3.3 ± 0.3	50	—	—	1.5	—	1.5	ns
			5.0 ± 0.5	50	—	—	1.0	—	1.0	
Input capacitance	C _{IN}	—			—	4	10	—	10	pF
Output capacitance	C _{OUT}	—			—	6	—	—	—	pF
Power dissipation capacitance	C _{PD}	(Note 2)			—	19	—	—	—	pF

Note 1: Parameter guaranteed by design.

$$t_{osLH} = |t_{pLHm} - t_{pLHn}|, t_{osHL} = |t_{pHLm} - t_{pHLn}|$$

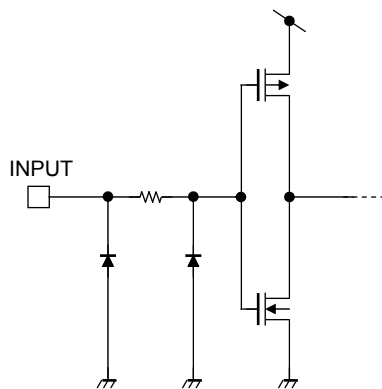
Note 2: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:

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

Noise Characteristics (input: $t_r = t_f = 3 \text{ ns}$)

Characteristics	Symbol	Test Condition		Ta = 25°C		Unit
			V _{CC} (V)	Typ.	Limit	
Quiet output maximum dynamic V _{OL}	V _{OLP}	C _L = 50 pF	5.0	0.4	0.8	V
Quiet output minimum dynamic V _{OL}	V _{OLV}	C _L = 50 pF	5.0	−0.4	−0.8	V
Minimum high level dynamic input voltage	V _{IHD}	C _L = 50 pF	5.0	—	3.5	V
Maximum low level dynamic input voltage	V _{ILD}	C _L = 50 pF	5.0	—	1.5	V

Input Equivalent Circuit

Package Dimensions

SOP16-P-300-1.27A

Unit: mm

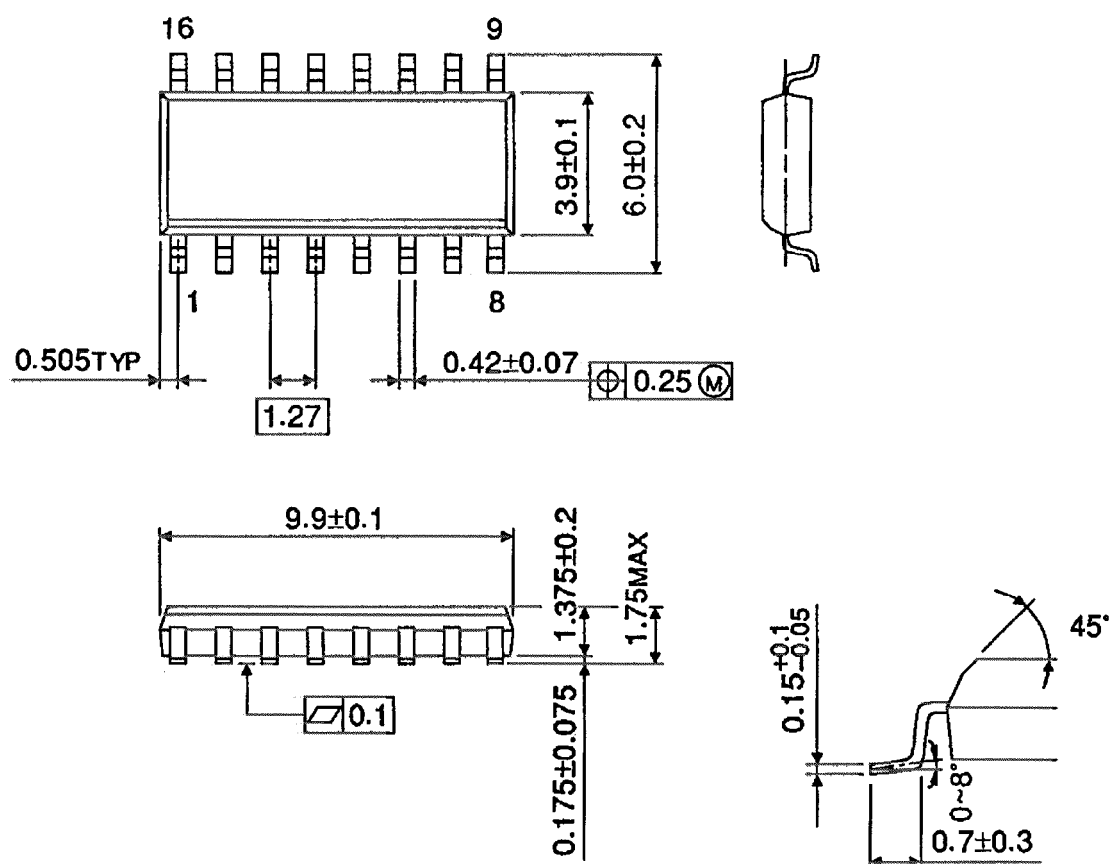


Weight: 0.18 g (typ.)

Package Dimensions (Note)

SOL16-P-150-1.27

Unit : mm



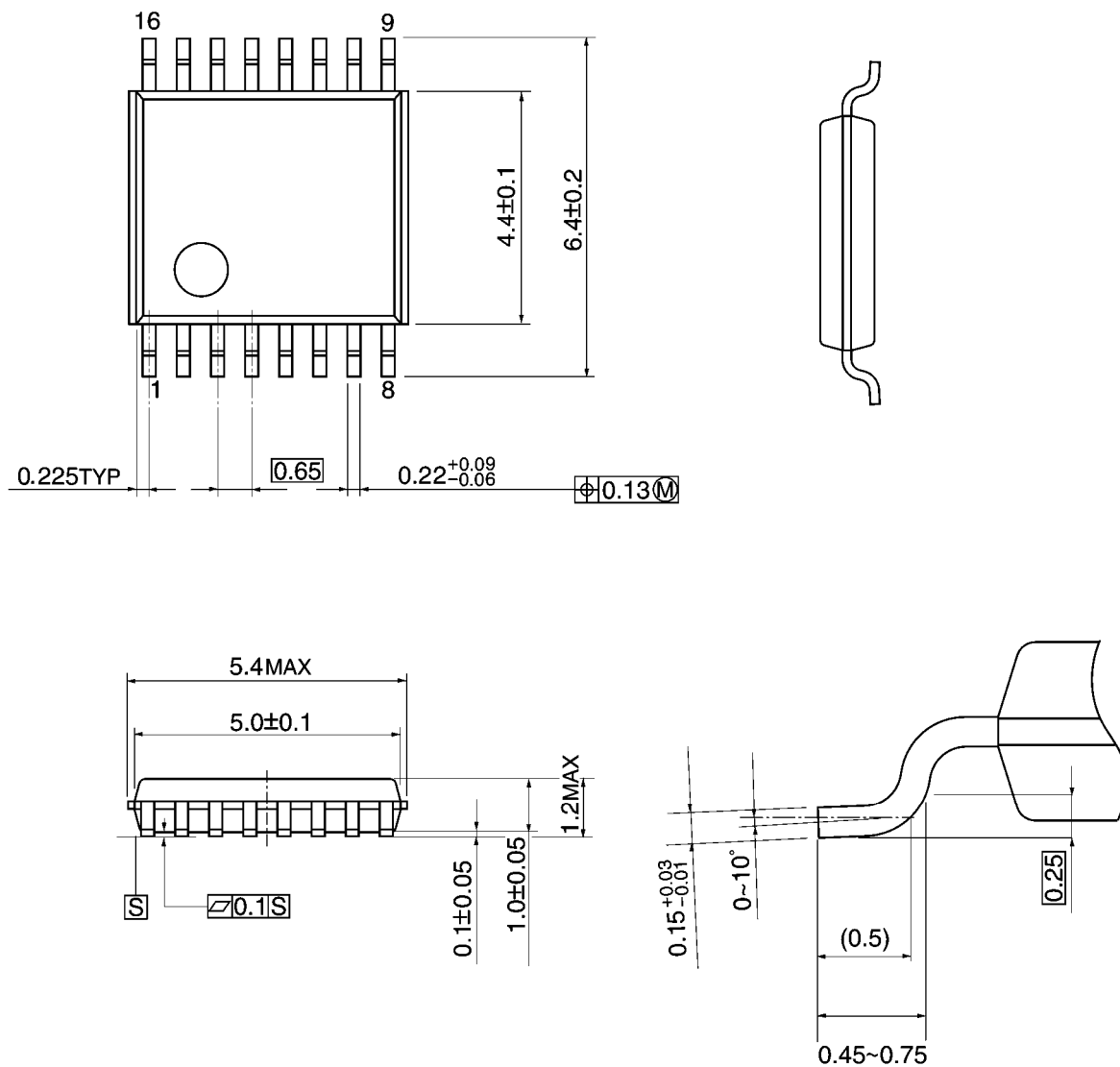
Note: This package is not available in Japan.

Weight: 0.13 g (typ.)

Package Dimensions

TSSOP16-P-0044-0.65A

Unit: mm

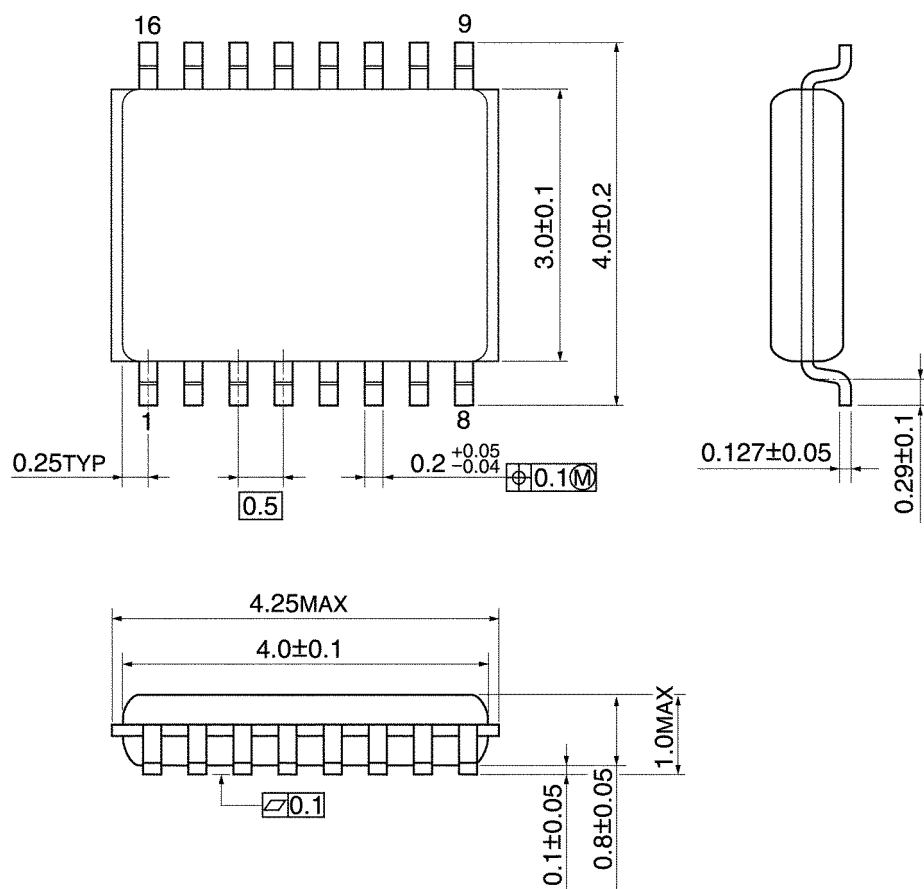


Weight: 0.06 g (typ.)

Package Dimensions

VSSOP16-P-0030-0.50

Unit: mm



Weight: 0.02 g (typ.)

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