TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74HC4049AP, TC74HC4049AF, TC74HC4049AFT
TC74HC4050AP, TC74HC4050AF, TC74HC4050AFT

TC74HC4049AP/AF/AFT Hex Buffer/Converter (inverting)

TC74HC4050AP/AF/AFT Hex Buffer/Converter

The TC74HC4049A and TC74HC4050A are high speed CMOS HEX BUFFERs fabricated with silicon gate C^2MOS technology.

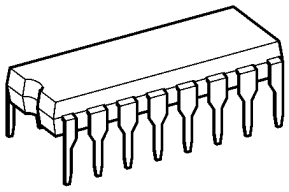
They achieve the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

The TC74HC4049A is an inverting buffer, while the TC74HC4050A is a non-inverting buffer. The internal circuits are composed of 3-stages (HC4049A) or 2-stages (HC4050A) of invertaers, which provided high noise immunity and stable output.

Input protection circuits are different from those of other high speed CMOS IC's. They eliminate the diodes on the V_{CC} side thus providing of logic-level conversion from high-level volages up to 15 V to low-level voltages.

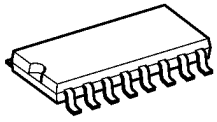
They are useful for battery back up circuits, because input voltage can be applied on IC's which are not biased by V_{CC}.

TC74HC4049AP, TC74HC4050AP



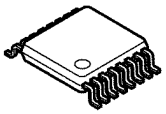
DIP16-P-300-2.54A

TC74HC4049AF, TC74HC4050AF



SOP16-P-300-1.27A

TC74HC4049AFT, TC74HC4050AFT



TSSOP16-P-0044-0.65A

Weight

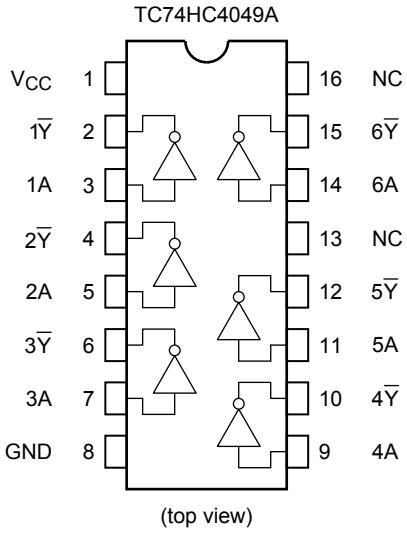
DIP16-P-300-2.54A	: 1.00 g (typ.)
SOP16-P-300-1.27A	: 0.18 g (typ.)
TSSOP16-P-0044-0.65A	: 0.06 g (typ.)

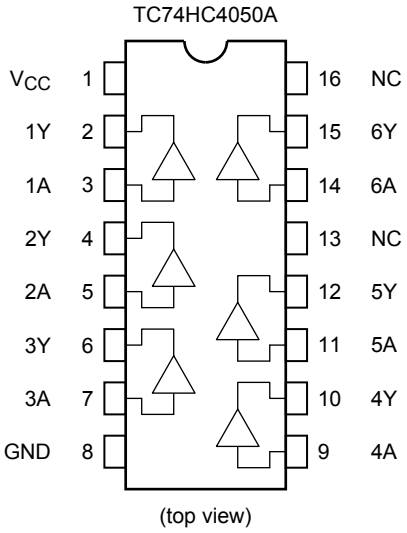
Features

- High speed: t_{pd} = 9 ns (typ.) at V_{CC} = 5 V
- Low power dissipation: I_{CC} = 1 μA (max) at Ta = 25°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 mA (min)
- Balanced propagation delays: $t_{pLH} \simeq t_{pHL}$
- Wide operating voltage range: $V_{CC\ (opr)}$ = 2 V to 6 V
- Pin and function compatible with 4049B/4050B

Start of commercial production
1986-05

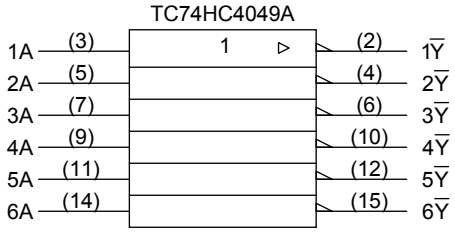
Pin Assignment

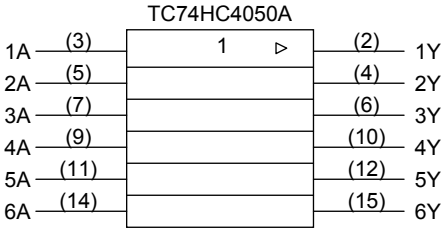




NC: No connection

IEC Logic Symbol



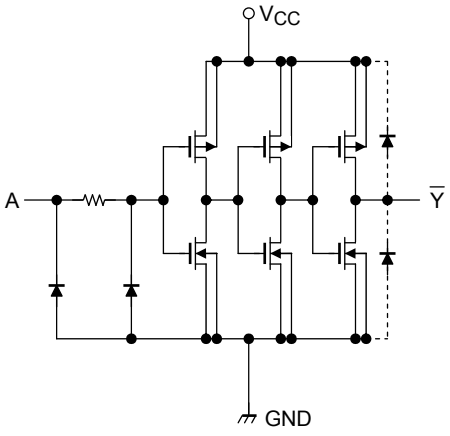


Truth Table

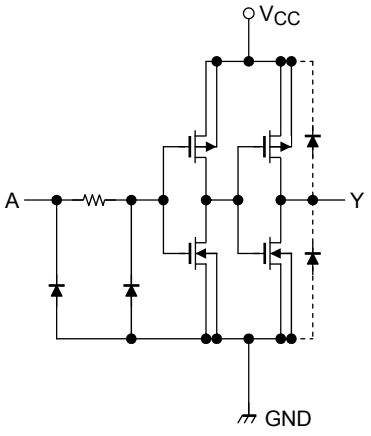
A	$\overline{Y}$ (4049A)	Y (4050A)
L	H	L
H	L	H

Input and Output Equivalent Circuit

TC74HC4049A



TC74HC4050A



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 18 (Note 2)	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}	±35	mA
DC V_{CC}/ground current	I_{CC}	±75	mA
Power dissipation	P_D	500 (DIP) (Note 3)/180 (SOP/TSSOP)	mW
Storage temperature	T_{stg}	−65 to 150	°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: DC input voltage (V_{IN}) specified is measured to GND and is not related to V_{CC}.
Recommended operating range is 0 V to 15 V and it is possible to convert logic-levels from 15 V to 5 V or 5 V to 2 V.

Note 3: 500 mW in the range of Ta = −40 to 65°C. From Ta = 65 to 85°C a derating factor of −10 mW/°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 15	V
Output voltage	V_{OUT}	0 to V_{CC}	V
Operating temperature	T_{opr}	−40 to 85	°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
			V_{CC} (V)	Min	Typ.	Max	Min	Max	
High-level input voltage	V_{IH}	—	2.0	1.50	—	—	1.50	—	V
			4.5	3.15	—	—	3.15	—	
			6.0	4.20	—	—	4.20	—	
Low-level input voltage	V_{IL}	—	2.0	—	—	0.50	—	0.50	V
			4.5	—	—	1.35	—	1.35	
			6.0	—	—	1.80	—	1.80	
High-level output voltage	V_{OH}	V_{IN} = V_{IH} or V_{IL}	2.0	1.9	2.0	—	1.9	—	V
		I_{OH} = −20 μA	4.5	4.4	4.5	—	4.4	—	
			6.0	5.9	6.0	—	5.9	—	
		I_{OH} = −6 mA	4.5	4.18	4.31	—	4.13	—	
		I_{OH} = −7.8 mA	6.0	5.68	5.80	—	5.63	—	
Low-level output voltage	V_{OL}	V_{IN} = V_{IH} or V_{IL}	2.0	—	0.0	0.1	—	0.1	V
		I_{OL} = 20 μA	4.5	—	0.0	0.1	—	0.1	
			6.0	—	0.0	0.1	—	0.1	
		I_{OL} = 6 mA	4.5	—	0.17	0.26	—	0.33	
		I_{OL} = 7.8 mA	6.0	—	0.18	0.26	—	0.33	
Input leakage current	I_{IN}	V_{IN} = V_{CC} or GND	6.0	—	—	±0.1	—	±1.0	μA
		V_{IN} = 15 V	6.0	—	—	±0.5	—	±5.0	
Quiescent supply current	I_{CC}	V_{IN} = V_{CC} or GND	6.0	—	—	1.0	—	10.0	μA

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

Characteristics	Symbol	Test Condition			Ta = 25°C			Ta = −40 to 85°C		Unit
			C_L (pF)	V_{CC} (V)	Min	Typ.	Max	Min	Max	
Output transition time	t_{TLH} t_{THL}	—	50	2.0	—	25	60	—	75	ns
				4.5	—	6	12	—	15	
				6.0	—	5	10	—	13	
Propagation delay time	t_{pLH} t_{pHL}	—	50	2.0	—	30	75	—	95	ns
				4.5	—	9	15	—	19	
				6.0	—	8	13	—	16	
			150	2.0	—	45	100	—	145	
				4.5	—	14	20	—	29	
				6.0	—	12	17	—	25	
Input capacitance	C_{IN}	—			—	5	10	—	10	pF
Power dissipation capacitance	C_{PD}	(Note)			—	26	—	—	—	pF

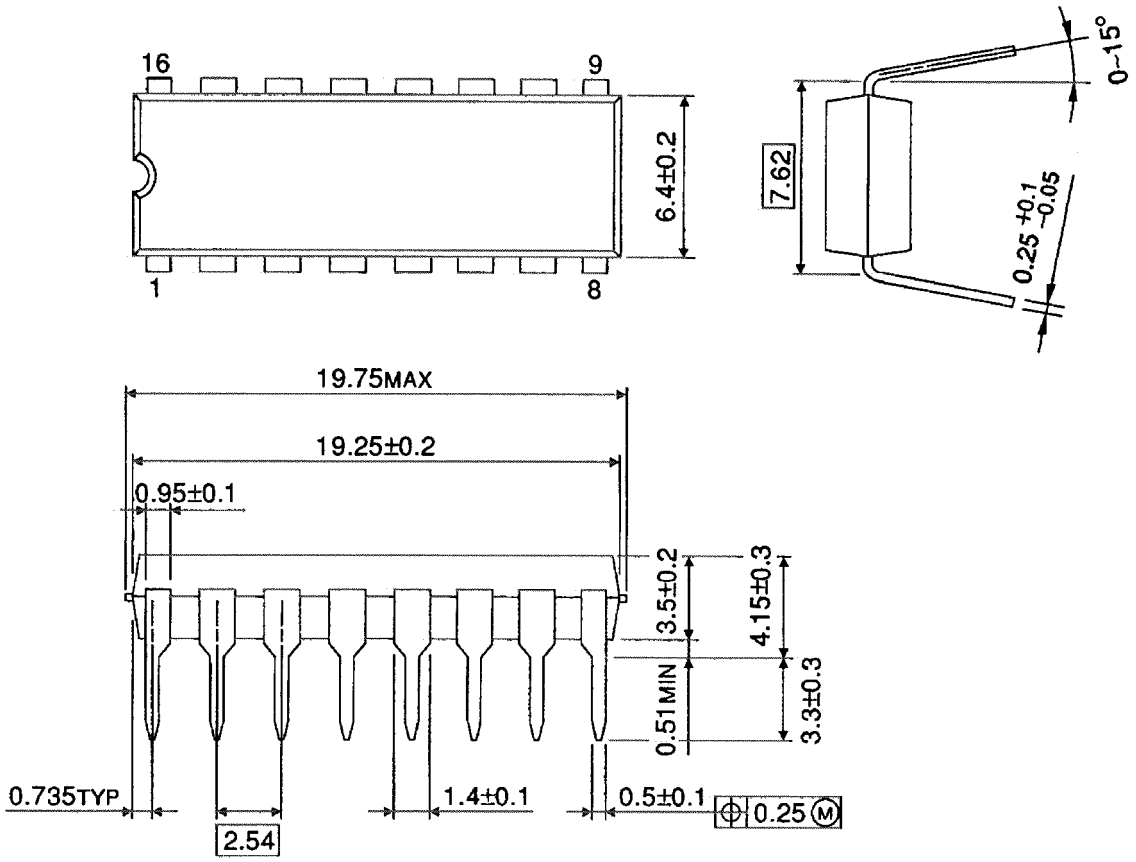
Note: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:

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

Package Dimensions

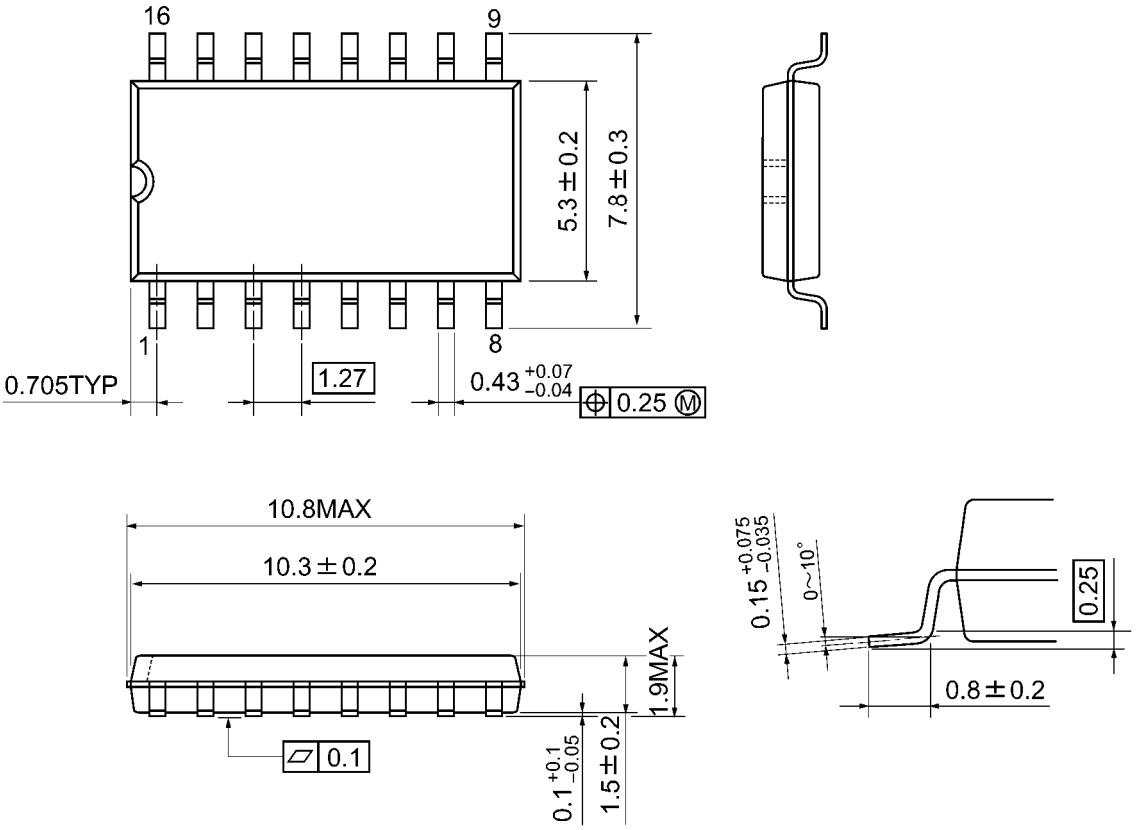
DIP16-P-300-2.54A Unit : mm



Weight: 1.00 g (typ.)

Package Dimensions

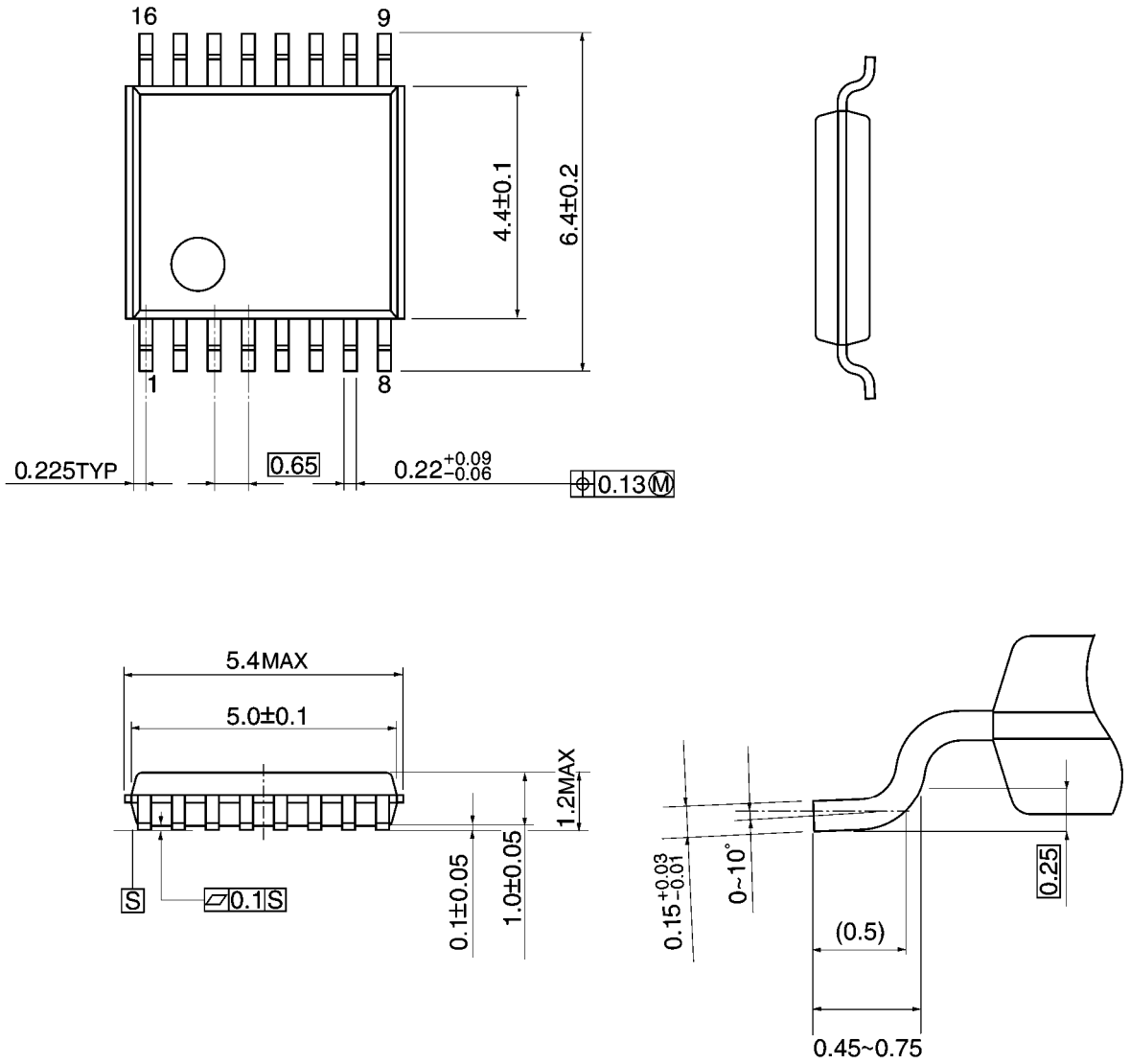
SOP16-P-300-1.27A Unit: mm



Weight: 0.18 g (typ.)

Package Dimensions

TSSOP16-P-0044-0.65A Unit: mm



Weight: 0.06 g (typ.)

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