

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

## TC74HC4049AP,TC74HC4049AF,TC74HC4049AFN,TC74HC4049AFT TC74HC4050AP,TC74HC4050AF,TC74HC4050AFN,TC74HC4050AFT

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

TC74HC4050AP/AF/AFN/AFT Hex  
Buffer/Converter

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

The TC74HC4049A and TC74HC4050A are high speed CMOS HEX 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.

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 inverters, 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 VCC 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 VCC.

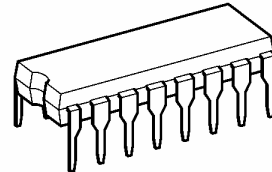
### Features

- High speed:  $t_{pd} = 9 \text{ ns}$  (typ.) at  $V_{CC} = 5 \text{ V}$
- Low power dissipation:  $I_{CC} = 1 \mu\text{A}$  (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:  $|I_{OH}| = I_{OL} = 6 \text{ mA}$  (min)
- Balanced propagation delays:  $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range:  $V_{CC}(\text{opr}) = 2 \text{ V}$  to  $6 \text{ V}$
- Pin and function compatible with 4049B/4050B

#### Weight

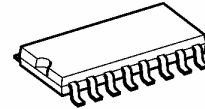
DIP16-P-300-2.54A	: 1.00 g (typ.)
SOP16-P-300-1.27A	: 0.18 g (typ.)
SOP16-P-300-1.27	: 0.18 g (typ.)
SOL16-P-150-1.27	: 0.13 g (typ.)
TSSOP16-P-0044-0.65A	: 0.06 g (typ.)

TC74HC4049AP, TC74HC4050AP

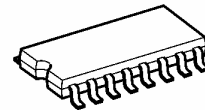


DIP16-P-300-2.54A

TC74HC4049AF, TC74HC4050AF

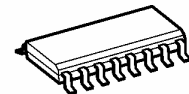


SOP16-P-300-1.27A



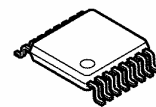
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TC74HC4049AFT, TC74HC4050AFT



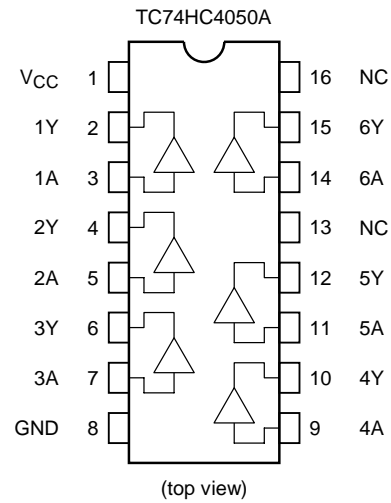
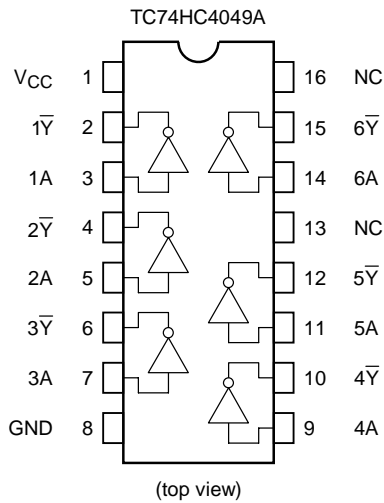
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TC74HC4049AFT, TC74HC4050AFT



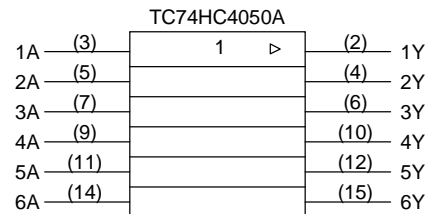
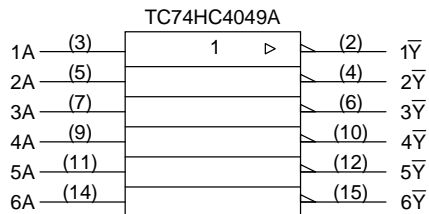
TSSOP16-P-0044-0.65A

## Pin Assignment



NC: No connection

## IEC Logic Symbol

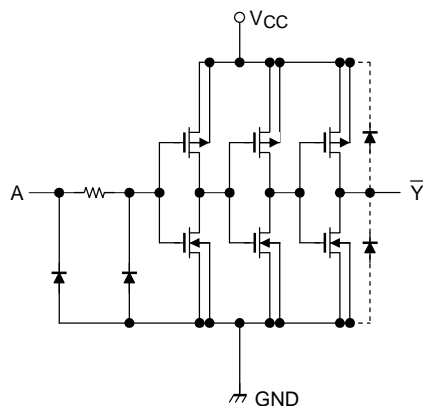


## Truth Table

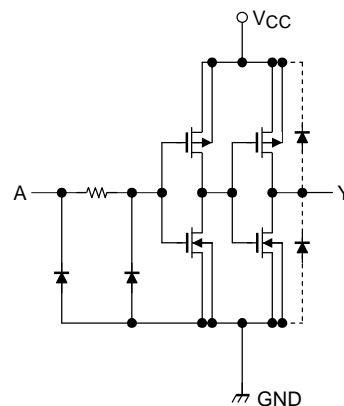
A	$\bar{Y}$ (4049A)	Y (4050A)
L	H	L
H	L	H

## 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	$I_{OK}$	$\pm 20$	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 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.

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  $T_a = -40$  to  $65^\circ\text{C}$ . From  $T_a = 65$  to  $85^\circ\text{C}$  a derating factor of  $-10$  mW/°C shall be applied until 300 mW.

## Recommended Operating Conditions (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 recommended operating conditions are required 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 <sub>CC</sub> (V)	Min	Typ.	Max	Min	Max
High-level input voltage	V <sub>IH</sub>	—		2.0 4.5 6.0	1.50 3.15 4.20	— — —	— — —	1.50 3.15 4.20	V
Low-level input voltage	V <sub>IL</sub>	—		2.0 4.5 6.0	— — —	— — —	0.50 1.35 1.80	— — —	V
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 4.5 6.0	1.9 4.4 5.9	2.0 4.5 6.0	— — —	1.9 4.4 5.9	V
			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	—	5.63	
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 4.5 6.0	— — —	0.0 0.0 0.0	0.1 0.1 0.1	— — —	V
			I <sub>OL</sub> = 6 mA	4.5	—	0.17	0.26	—	
			I <sub>OL</sub> = 7.8 mA	6.0	—	0.18	0.26	—	
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		6.0	—	—	±0.1	—	µA
		V <sub>IN</sub> = 15 V		6.0	—	—	±0.5	—	
Quiescent supply current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		6.0	—	—	1.0	—	10.0

AC Characteristics (input: t<sub>r</sub> = t<sub>f</sub> = 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	tTLH tTHL	—	50	2.0	—	25	60	—	75	ns
				4.5	—	6	12	—	15	
				6.0	—	5	10	—	13	
Propagation delay time	tpLH tpHL	—	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	CIN	—			—	5	10	—	10	pF
Power dissipation capacitance	CPD	(Note)			—	26	—	—	—	pF

Note: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

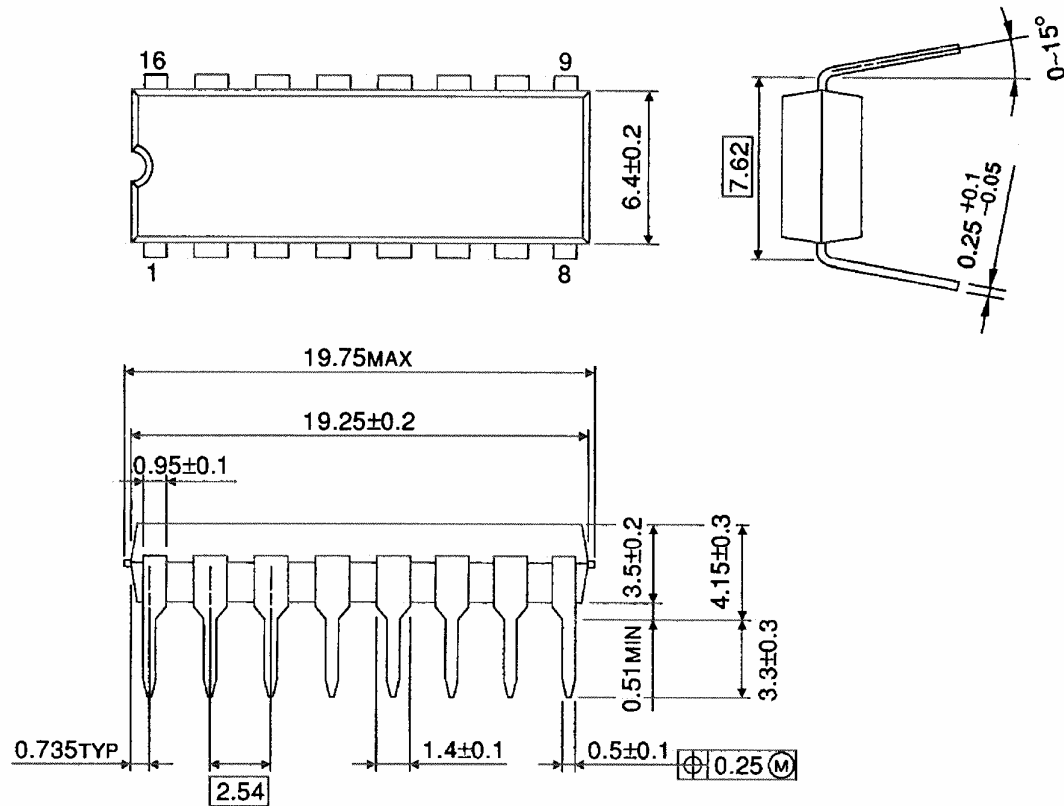
Average operating current can be obtained by the equation:

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

## Package Dimensions

DIP16-P-300-2.54A

Unit : mm

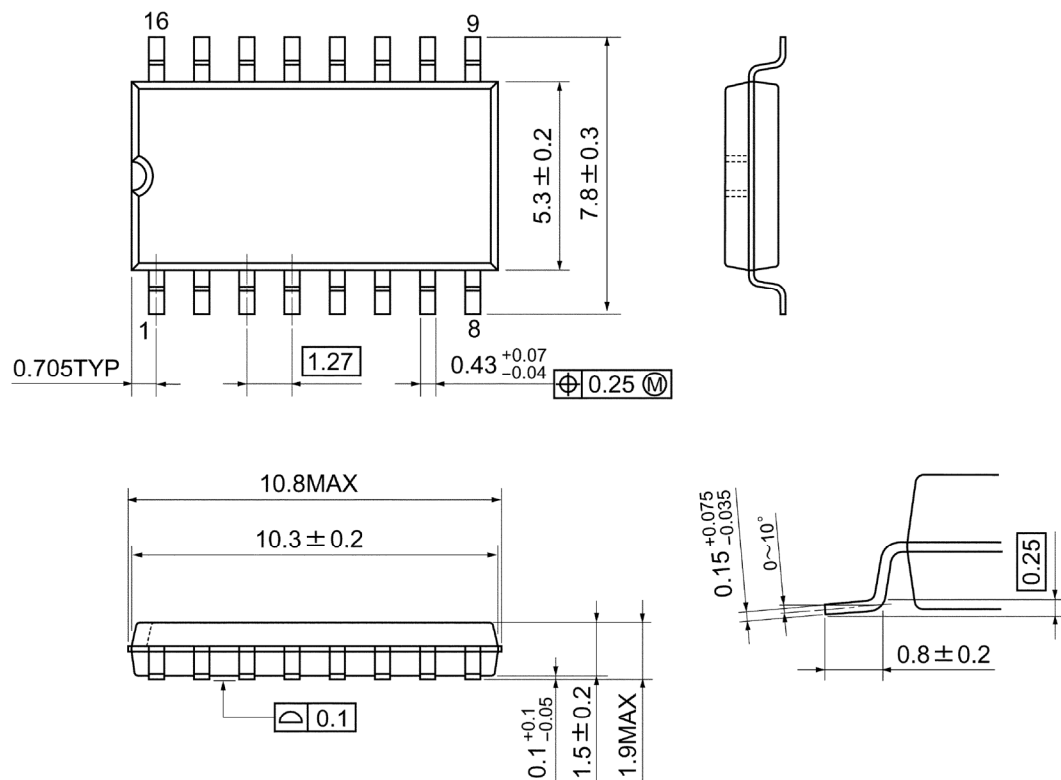


Weight: 1.00 g (typ.)

## Package Dimensions

SOP16-P-300-1.27A

Unit: mm

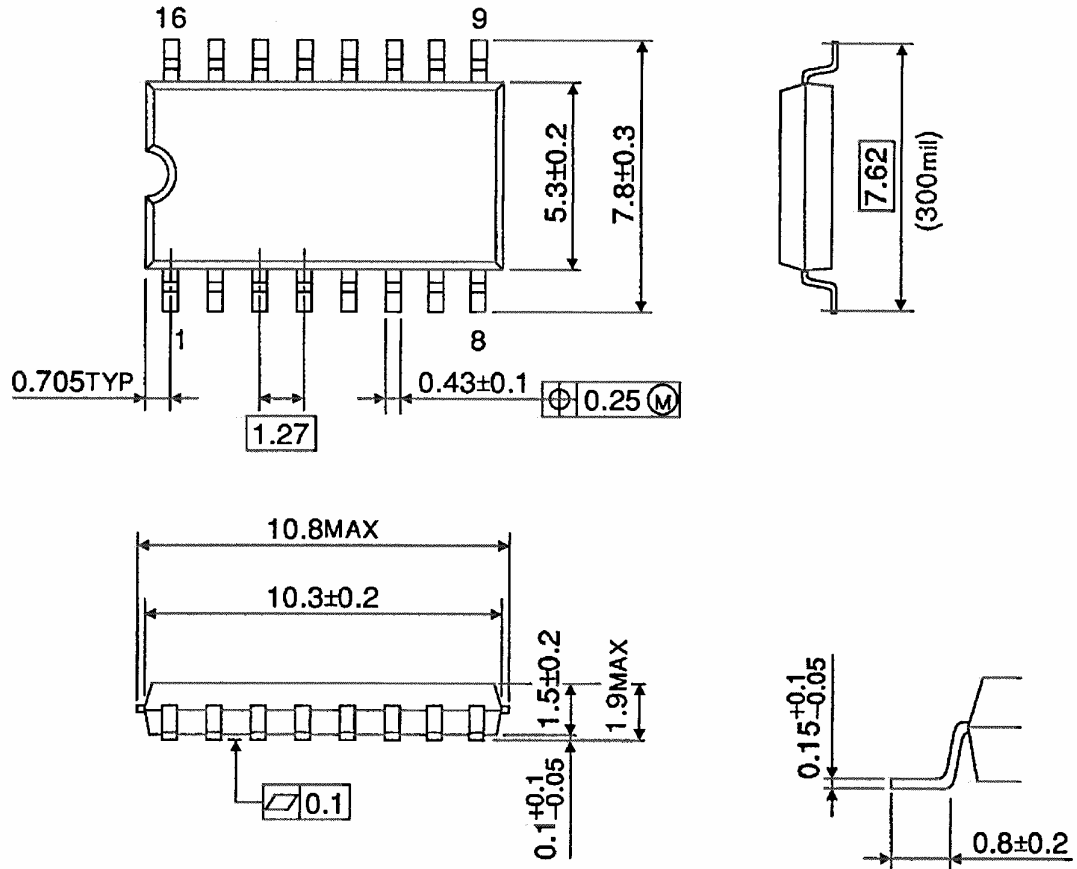


Weight: 0.18 g (typ.)

## Package Dimensions

SOP16-P-300-1.27

Unit : mm

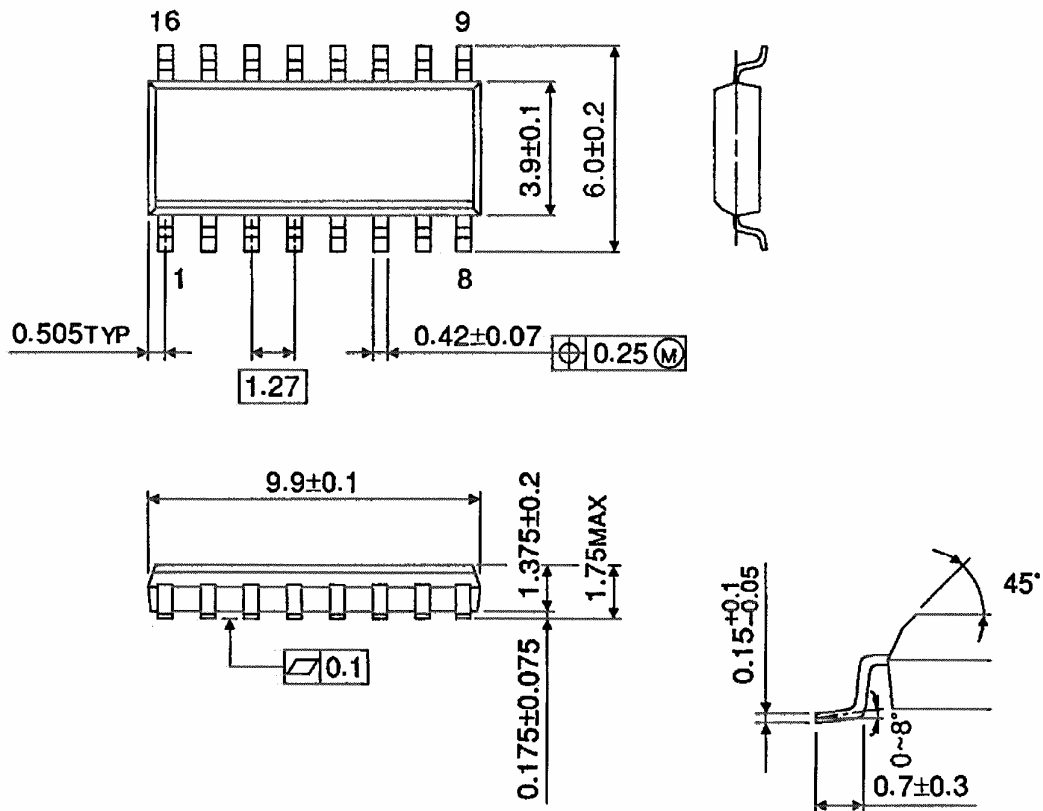


Weight: 0.18 g (typ.)

## Package Dimensions (Note)

SOL16-P-150-1.27

Unit : mm



Note: This package is not available in Japan.

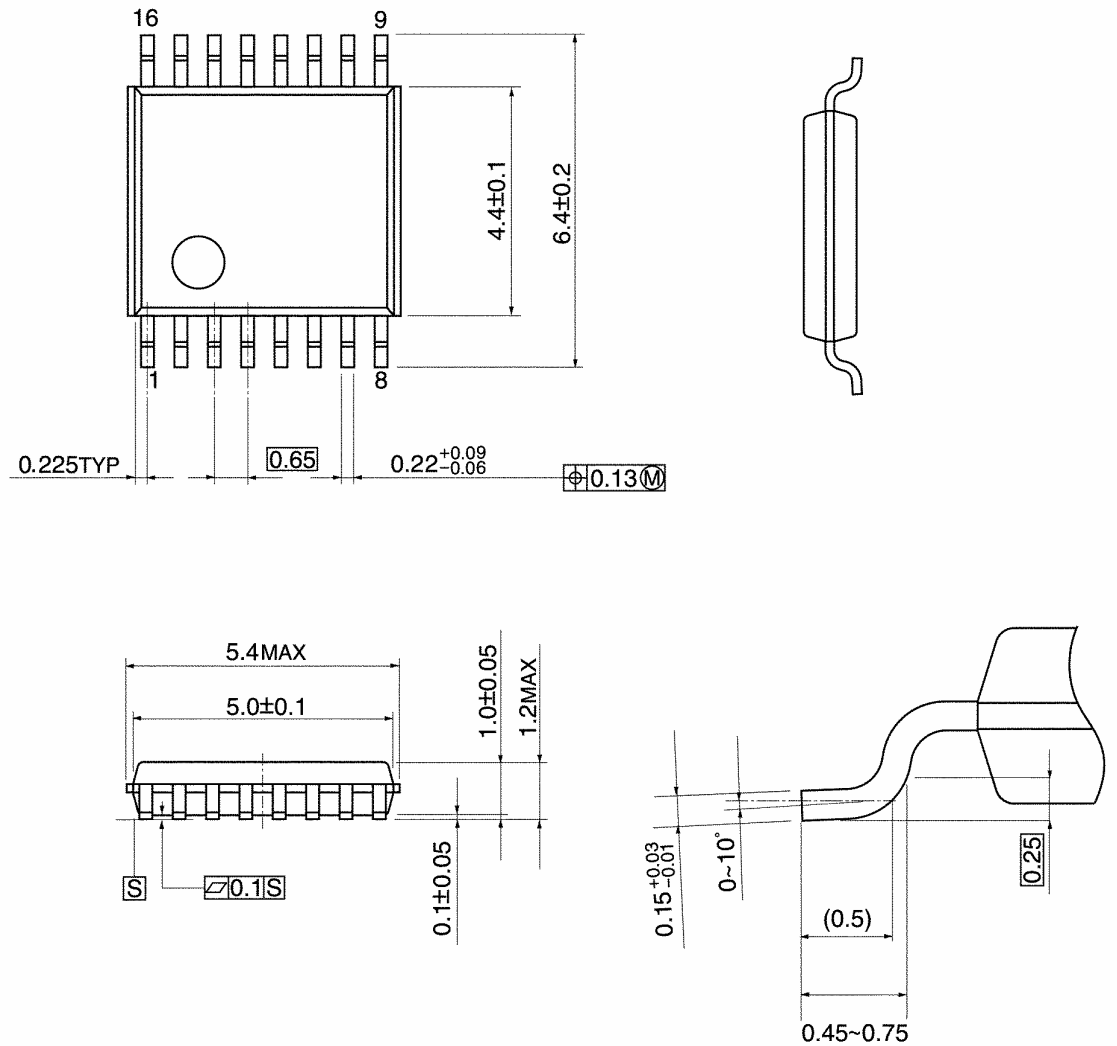
Weight: 0.13 g (typ.)



## Package Dimensions

TSSOP16-P-0044-0.65A

Unit: mm



Weight: 0.06 g (typ.)

**Note: Lead (Pb)-Free Packages**

**DIP16-P-300-2.54A SOP16-P-300-1.27A SOL16-P-150-1.27 TSSOP16-P-0044-0.65A**

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