TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74HC4066AP, TC74HC4066AF, TC74HC4066AFT

Quad Bilateral Switch

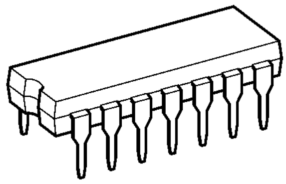
The TC74HC4066A is a high speed CMOS QUAD BILATERAL SWITCH fabricated with silicon gate C^2MOS technology.

It consists of four independent high speed switches capable of controlling either digital or analog signals while maintaining the CMOS low power dissipation.

Control input (C) is provided to control the switch. The switch turns ON while the C input is high, and the switch turns OFF while low.

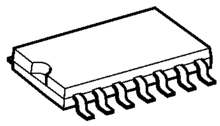
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

TC74HC4066AP



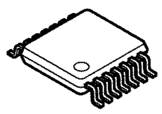
DIP14-P-300-2.54

TC74HC4066AF



SOP14-P-300-1.27A

TC74HC4066AFT



TSSOP14-P-0044-0.65A

Weight

DIP14-P-300-2.54	: 0.96 g (typ.)
SOP14-P-300-1.27A	: 0.18 g (typ.)
TSSOP14-P-0044-0.65A	: 0.06 g (typ.)

Features

Low power dissipation: I_{CC} = 1.0 μA (max) at Ta = 25°C

High noise immunity: V_{NIH} = V_{NIL} = 28% V_{CC} (min)

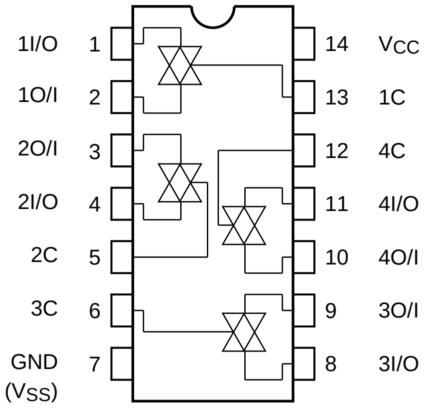
Low ON resistance: R_{ON} = 50 Ω (typ.) at V_{CC} = 9 V

High degree of linearity: THD = 0.05% (typ.) at V_{CC} = 4.5 V

Pin and function compatible with TC4066B series

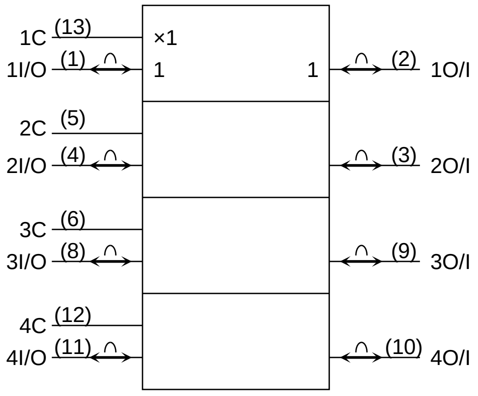
Start of commercial production
1986-11

Pin Assignment



(top view)

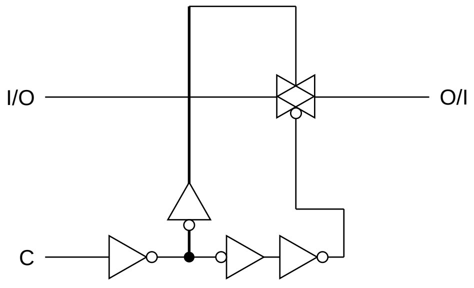
IEC Logic Symbol



Truth Table

Control	Switch Function
H	On
L	Off

System diagram (Per Circuit)



Absolute Maximum Ratings (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V_{CC}	-0.5 to 13	V
Control input voltage	V_{IN}	-0.5 to V_{CC} + 0.5	V
Switch I/O voltage	$V_{I/O}$	-0.5 to V_{CC} + 0.5	V
Control input diode current	I_{IK}	±20	mA
I/O diode current	$I_{I/OK}$	±20	mA
Switch through Current	I_T	±25	mA
DC V_{CC}/ground current	I_{CC}	±50	mA
Power dissipation	P_D	500 (DIP) (Note 1)/180 (SOP/TSSOP)	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).

Note 1: 500 mW in the range of Ta = -40 to 65°C. From Ta = 65 to 85°C a derating factor of -10 mW/°C should be applied up to 300 mW.

Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	2 to 12	V
Control input voltage	V_{IN}	0 to V_{CC}	V
Switch I/O voltage	$V_{I/O}$	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) 0 to 250 (V_{CC} = 10.0 V)	ns

Note: The operating ranges must be maintained to ensure the normal operation of the device.
Unused control 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 control input voltage	V_{IHC}	—	2.0	1.50	—	—	1.50	—	V
			4.5	3.15	—	—	3.15	—	
			9.0	6.30	—	—	6.30	—	
			12.0	8.40	—	—	8.40	—	
Low-level control input voltage	V_{ILC}	—	2.0	—	—	0.50	—	0.50	V
			4.5	—	—	1.35	—	1.35	
			9.0	—	—	2.70	—	2.70	
			12.0	—	—	3.60	—	3.60	
ON resistance	R_{ON}	$V_{IN} = V_{IHC}$	4.5	—	96	170	—	200	Ω
		$V_{I/O} = V_{CC}$ to GND	9.0	—	55	85	—	100	
		$I_{I/O} \leq 1$ mA	12.0	—	45	80	—	90	
		$V_{IN} = V_{IHC}$	2.0	—	160	—	—	—	
		$V_{I/O} = V_{CC}$ or GND	4.5	—	70	100	—	130	
		$I_{I/O} \leq 1$ mA	9.0	—	50	75	—	95	
			12.0	—	45	70	—	90	
Difference of ON resistance between switches	ΔR_{ON}	$V_{IN} = V_{IHC}$	4.5	—	10	—	—	—	Ω
		$V_{I/O} = V_{CC}$ to GND	9.0	—	5	—	—	—	
		$I_{I/O} \leq 1$ mA	12.0	—	5	—	—	—	
Input/output leakage current (switch off)	I_{OFF}	$V_{OS} = V_{CC}$ or GND $V_{IS} =$ GND or V_{CC} $V_{IN} = V_{ILC}$	12.0	—	—	±100	—	±1000	nA
Switch input leakage current (switch on, output open)	I_{IZ}	$V_{OS}=V_{CC}$ or GND $V_{IN} = V_{IHC}$	12.0	—	—	±100	—	±1000	nA
Control input current	I_{IN}	$V_{IN} = V_{CC}$ or GND	12.0	—	—	±100	—	±1000	nA
Quiescent supply current	I_{CC}	$V_{IN} = V_{CC}$ or GND	6.0	—	—	1.0	—	10.0	μA
			9.0	—	—	4.0	—	40.0	
			12.0	—	—	8.0	—	80.0	

AC Characteristics (C_L = 50 pF, input: t_r = t_f = 6 ns)

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit
			VCC (V)	Min	Typ.	Max	Min	Max	
Phase difference between input and output	$\phi_{I\text{-}O}$	—	2.0	—	10	50	—	65	ns
			4.5	—	4	10	—	13	
			9.0	—	3	8	—	10	
			12.0	—	3	7	—	9	
Output enable time	t_{pZL} t_{pZH}	R_L = 1 kΩ C_L = 50 pF	2.0	—	18	100	—	125	ns
			4.5	—	8	20	—	25	
			9.0	—	6	12	—	22	
			12.0	—	6	12	—	18	
Output disable time	t_{pLZ} t_{pHZ}	R_L = 1 kΩ C_L = 50 pF	2.0	—	20	115	—	145	ns
			4.5	—	10	23	—	29	
			9.0	—	8	20	—	25	
			12.0	—	8	18	—	22	
Maximum control input frequency		R_L = 1 kΩ C_L = 50 pF V_{OUT} = 1/2 V_{CC}	2.0	—	30	—	—	—	MHz
			4.5	—	30	—	—	—	
			9.0	—	30	—	—	—	
			12.0	—	30	—	—	—	
Control input capacitance	C_{IN}	—		—	5	10	—	10	pF
Switch terminal capacitance	$C_{I/O}$	—		—	6	—	—	—	pF
Feed through capacitance	C_{IOS}	—		—	0.5	—	—	—	pF
Power dissipation capacitance	C_{PD}	(Note 1)		—	15	—	—	—	pF

Note 1: 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:

$$I_{CC\ (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 4 \text{ (per channel)}$$

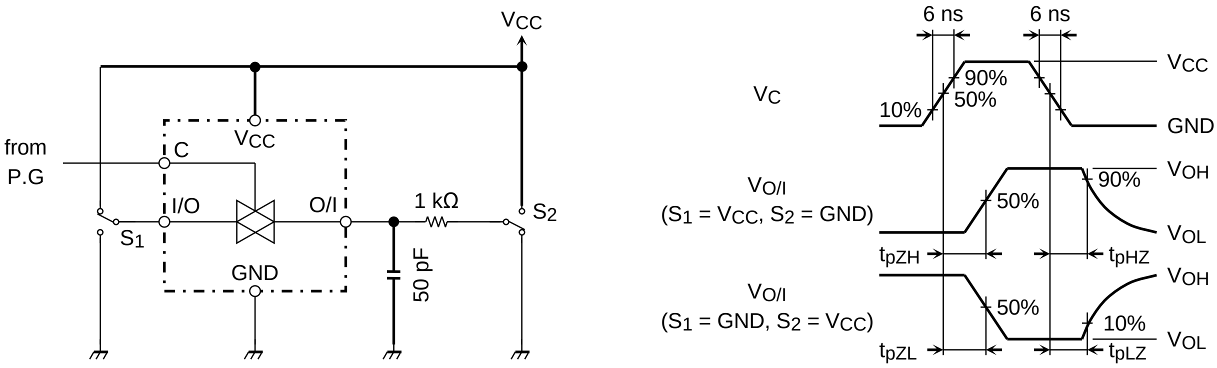
Analog Switch Characteristics (Note) (GND = 0 V, Ta = 25°C)

Characteristics	Symbol	Test Condition	V_{CC} (V)	Typ.	Unit
Sine wave distortion (T.H.D)		f_{IN} = 1 kHz, V_{IN} = 4 $V_{p\text{-}p}$, @V_{CC} = 4.5 V R_L = 10 kΩ, V_{IN} = 8 $V_{p\text{-}p}$, @V_{CC} = 9.0 V C_L = 50 pF	4.5 9.0	0.05 0.04	%
Frequency response (switch on)	f_{max}	Adjust f_{IN} voltage to obtain 0dBm at V_{OS} Increase f_{IN} frequency until dB meter reads -3dB R_L = 50 Ω, C_L = 10 pF f_{IN} = 1 MHz, sine wave	4.5 9.0	200 200	MHz
Feedthrough attenuation (switch off)		V_{IN} is centered at V_{CC}/2 Adjust input for 0dBm R_L = 600 Ω, C_L = 50 pF f_{IN} = 1 MHz, sine wave	4.5 9.0	-60 -60	dB
Crosstalk (control input to signal output)		R_L = 600 Ω, C_L = 50 pF f_{IN} = 1 MHz, square wave (t_r = t_f = 6 ns)	4.5 9.0	60 100	mV
Crosstalk (between any switches)		Adjust V_{IN} to obtain 0dBm at input R_L = 600 Ω, C_L = 50 pF f_{IN} = 1 MHz, sine wave	4.5 9.0	-60 -60	dB

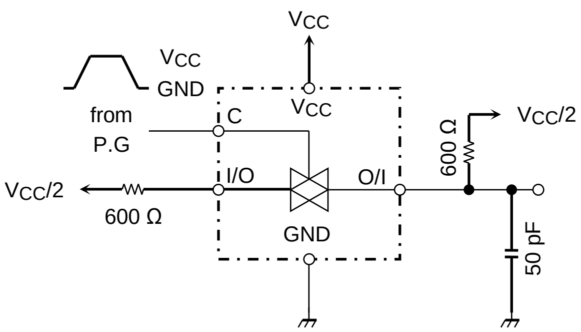
Note: These characteristics are determined by design of devices.

Switching Characteristics Test Circuits

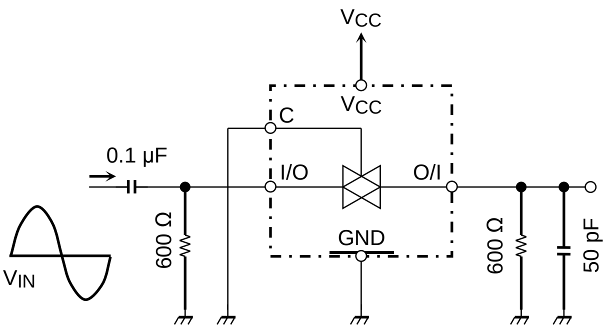
1. t_{pLZ}, t_{pHZ}, t_{pZL}, t_{pZH}



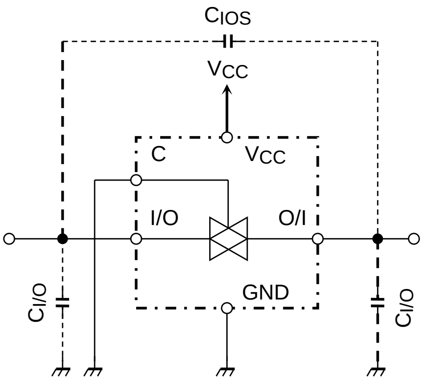
2. Cross Talk (control input-switch output)
f_{IN} = 1 MHz duty = 50% tr = tf = 6 ns



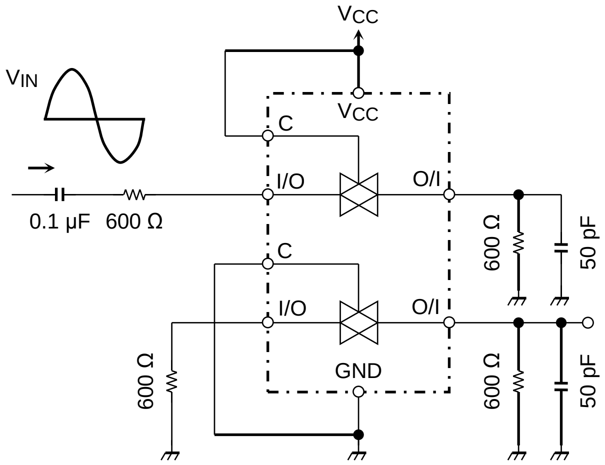
3. Feedthrough Attenuation



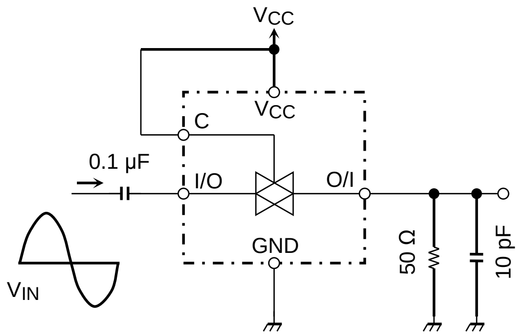
4. C_{IOS}, $C_{I/O}$



5. Crosstalk (between any two switches)

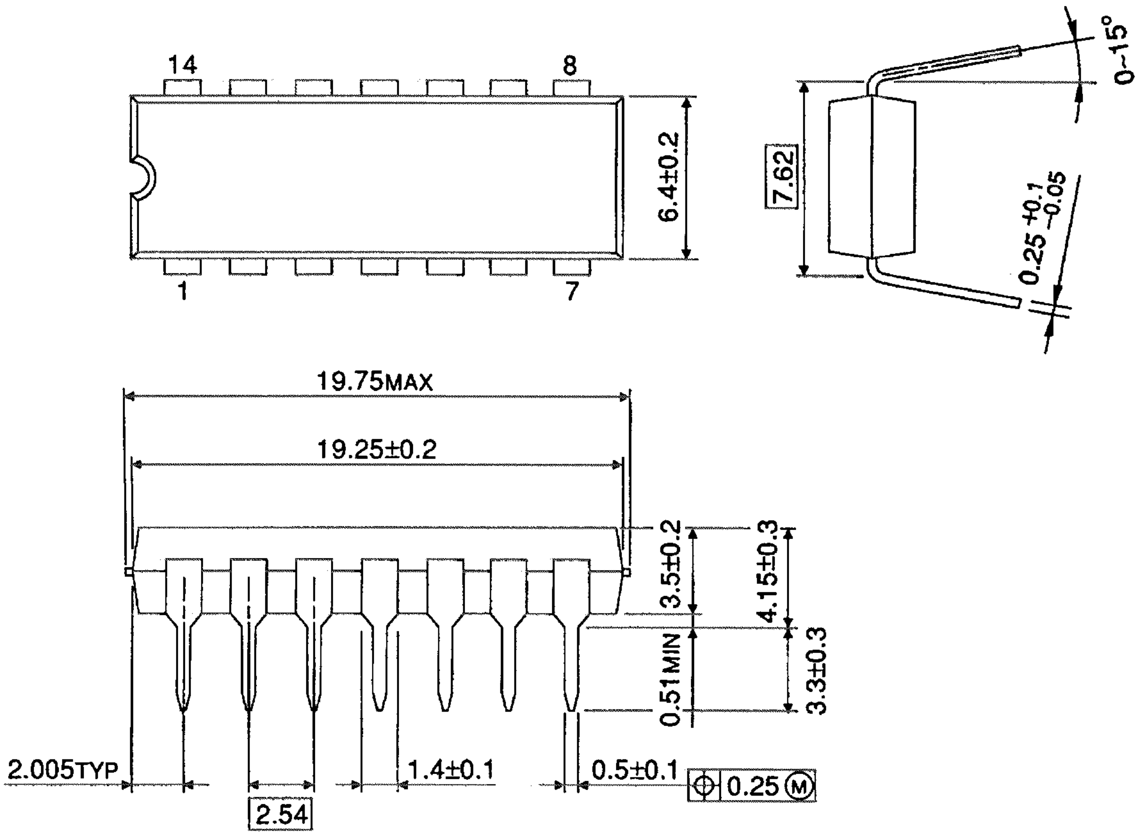


6. Frequency Response (switch on)



Package Dimensions

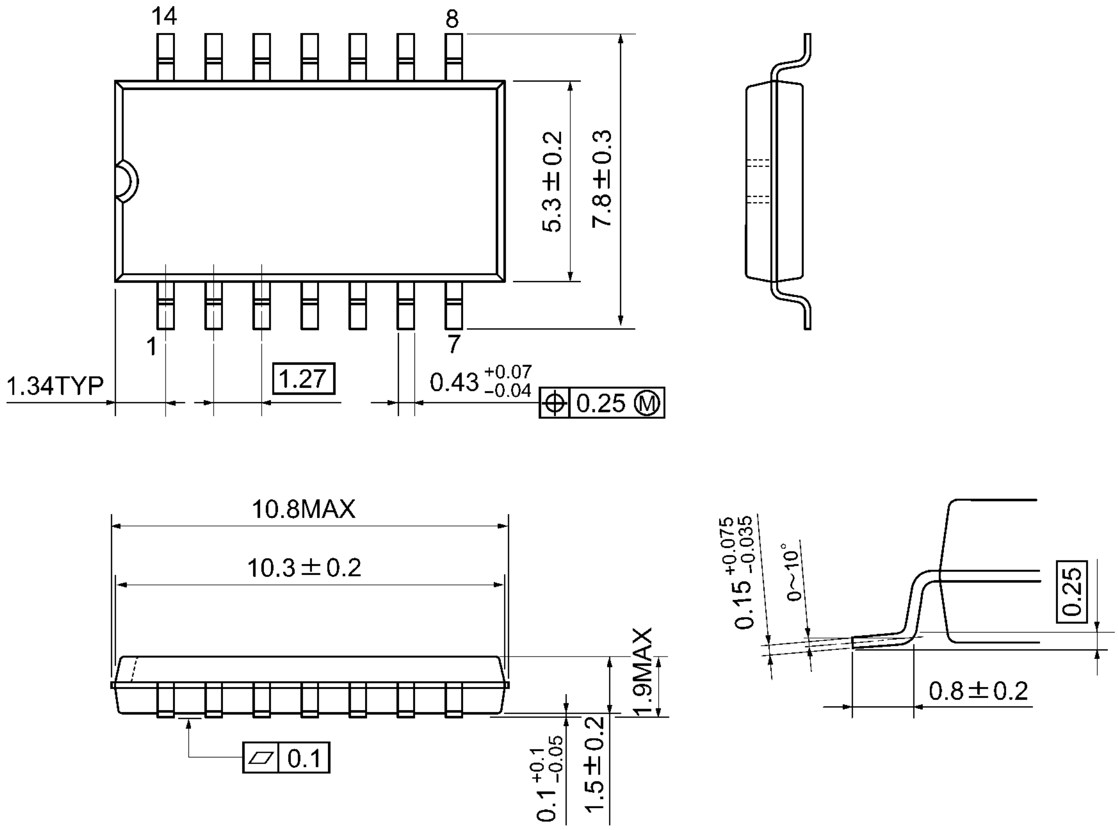
DIP14-P-300-2.54 Unit : mm



Weight: 0.96 g (typ.)

Package Dimensions

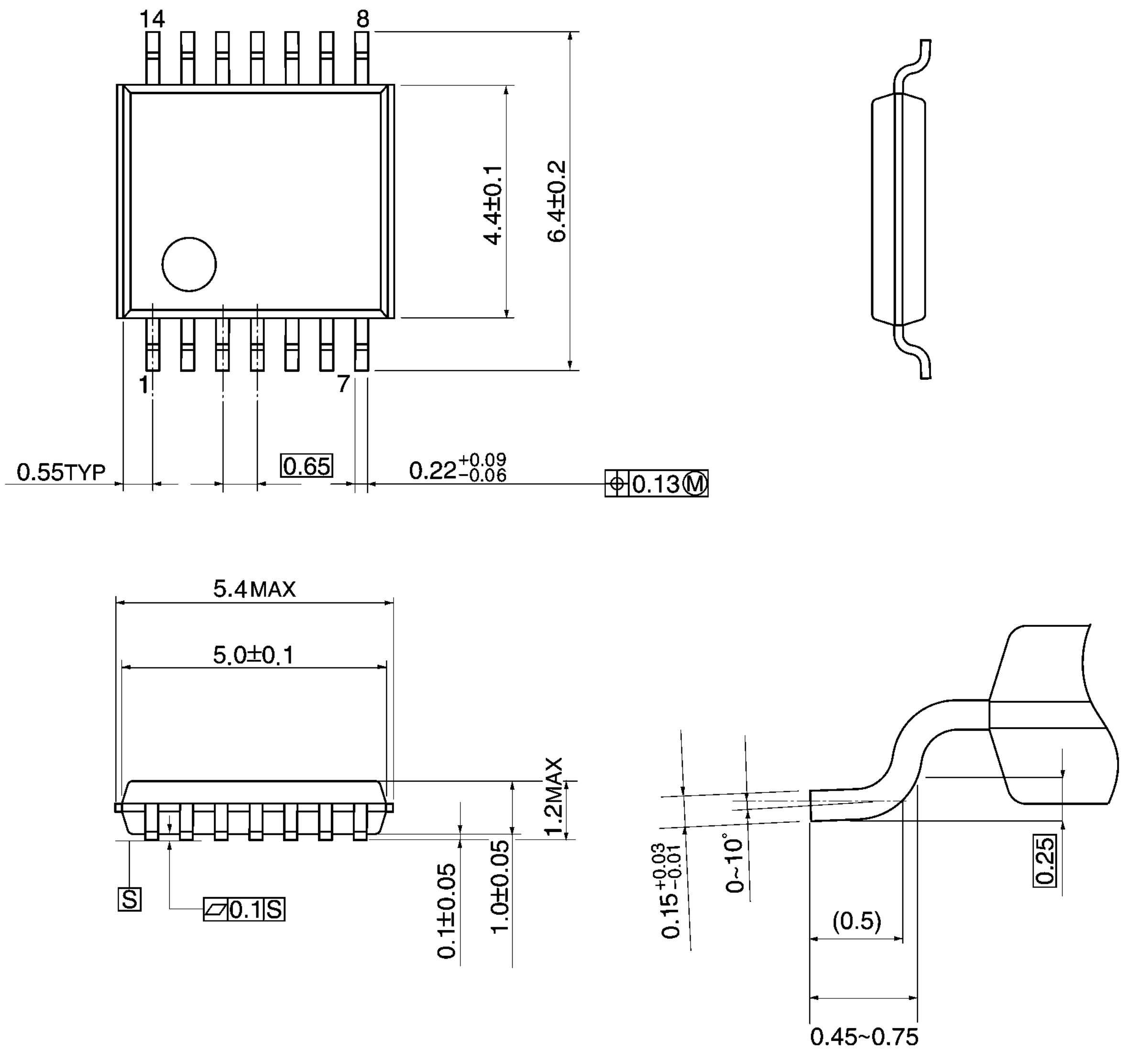
SOP14-P-300-1.27A Unit: mm



Weight: 0.18 g (typ.)

Package Dimensions

TSSOP14-P-0044-0.65A Unit: mm



Weight: 0.06 g (typ.)

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