TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

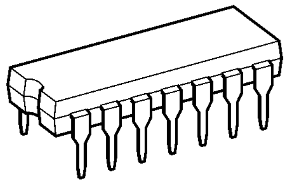
TC4066BP,TC4066BF ,TC4066BFT

TC4066B Quad Bilateral Switch

TC4066B contains four independent circuits of bidirectional switches. When control input CONT is set to "H" level, the impedance between input and output of the switch becomes low and when it is set to "L" level, the impedance becomes high. This can be applied for switching of analog signals and digital signals.

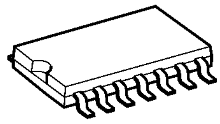
- ON-resistance, Ron
  250 Ω (typ.): $V_{DD} - V_{SS} = 5$ V
  110 Ω (typ.): $V_{DD} - V_{SS} = 10$ V
  70 Ω (typ.): $V_{DD} - V_{SS} = 15$ V
- OFF-resistance, Roff
  Roff (typ.) > 10^9 Ω

TC4066BP



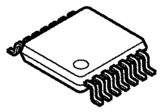
DIP14-P-300-2.54

TC4066BF



SOP14-P-300-1.27A

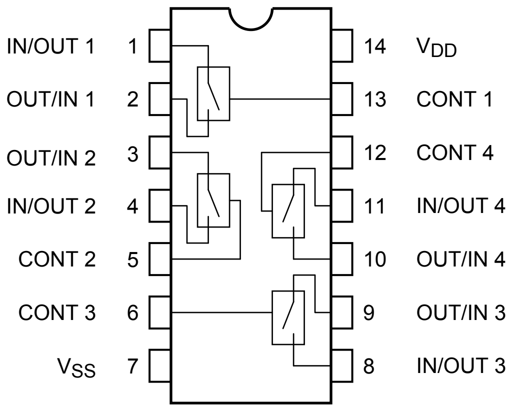
TC4066BFT



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.)

Pin Assignment



(top view)

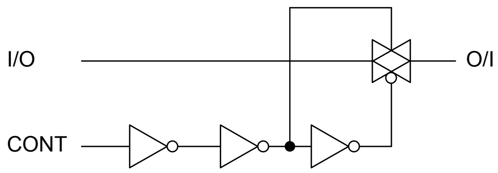
Truth Table

Control	Impedance between IN/OUT-OUT/IN (Note)
H	0.5 to 5 × 10^2 Ω
L	>10^9 Ω

Note: See static electrical characteristics

Logic Diagram

1/4 TC4066B



Absolute Maximum Ratings (Note)

Characteristics	Symbol	Rating	Unit
DC supply voltage	V_{DD}	V_{SS} − 0.5 to V_{SS} + 20	V
Control input voltage	V_{CIN}	V_{SS} − 0.5 to V_{DD} + 0.5	V
Switch I/O voltage	$V_{I/O}$	V_{SS} − 0.5 to V_{DD} + 0.5	V
Potential difference across I/O during ON	$I_{I/O}$	±0.5	V
Control input current	I_{CIN}	±10	mA
Power dissipation	P_D	300 (DIP)/180 (SOIC)	mW
Operating temperature range	T_{opr}	−40 to 85	°C
Storage temperature range	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 (V_{SS} = 0 V) (Note)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
DC supply voltage	V_{DD}	—	3	—	18	V
Input voltage	V_{DD}/V_{OUT}	—	0	—	V_{DD}	V

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

Static Electrical Characteristics (in case not specifically appointed, V_{SS} = 0 V)

Characteristics		Symbol	Test Condition	V_{DD} (V)	−40°C Min	−40°C Max	25°C Min	25°C Typ.	25°C Max	85°C Min	85°C Max	Unit
Control input high voltage		V_{IH}	$\|I_{IS}\| < 10\ \mu A$	5	3.5	—	3.5	2.75	—	3.5	—	V
				10	7.0	—	7.0	5.50	—	7.0	—	
				15	11.0	—	11.0	8.25	—	11.0	—	
Control input low voltage		V_{IL}	$\|I_{IS}\| < 10\ \mu A$	5	—	1.5	—	2.25	1.5	—	1.5	V
				10	—	3.0	—	4.50	3.0	—	3.0	
				15	—	4.0	—	6.75	4.0	—	4.0	
On-state resistance		R_{ON}	$0 \le V_{IS} \le$ VDD R_L = 10 kΩ	5	—	800	—	290	950	—	1200	Ω
				10	—	210	—	120	250	—	300	
				15	—	140	—	85	160	—	200	
ΔOn-state resistance (between any 2 switches)		$R_{ON}\Delta$	—	5	—	—	—	10	—	—	—	Ω
				10	—	—	—	6	—	—	—	
				15	—	—	—	4	—	—	—	
Input/output leakage current		I_{OFF}	V_{IN} = 18 V, V_{OUT} = 0 V	18	—	±100	—	±0.1	±100	—	±1000	nA
			V_{IN} = 0 V, V_{OUT} = 18 V	18	—	±100	—	±0.1	±100	—	±1000	
Quiescent supply current		I_{DD}	V_{IN} = V_{SS}, V_{DD} (Note)	5	—	0.25	—	0.001	0.25	—	7.5	μA
				10	—	0.50	—	0.001	0.50	—	15.0	
				15	—	1.00	—	0.002	1.00	—	30.0	
Input current	"H" level	I_{IH}	V_{IH} = 18 V	18	—	0.1	—	10^{-5}	0.1	—	1.0	μA
	"L" level	I_{IL}	V_{IL} = 0 V	18	—	−0.1	—	-10^{-5}	−0.1	—	−1.0	

Note: All valid input combinations.

Dynamic Electrical Characteristics (Ta = 25°C, V_{SS} = 0 V, C_L = 50 pF)

Characteristics	Symbol	Test Condition	V_{SS} (V)	V_{DD} (V)	Min	Typ.	Max	Unit
Phase difference between input to output	$\phi_{I\text{-}O}$	C_L = 50 pF	0	5	—	15	40	ns
			0	10	—	8	20	
			0	15	—	5	15	
Propagation delay time (control-OUT)	t_{pZL} t_{pZH}	R_L = 1 kΩ, C_L = 50 pF	0	5	—	55	120	ns
			0	10	—	25	40	
			0	15	—	20	30	
Propagation delay time (control -OUT)	t_{pLZ} t_{pHZ}	R_L = 1 kΩ, C_L = 50 pF	0	5	—	45	80	ns
			0	10	—	30	70	
			0	15	—	25	60	
Max control input repetition rate	f_{max} (C)	R_L = 1 kΩ, C_L = 50 pF	0	5	—	10	—	MHz
			0	10	—	12	—	
			0	15	—	12	—	
−3dB cutoff frequency	f_{max} (I-O)	R_L = 1 kΩ, C_L = 15 pF (Note 1)	−5	5	—	30	—	MHz
Total harmonic distortion	—	R_L = 10 kΩ, f = 1 kHz (Note 2)	−5	5	—	0.03	—	%
−50dB feed through frequency	—	R_L = 1 kΩ (Note 3)	−5	5	—	600	—	kHz
−50dB crosstalk frequency	—	R_L = 1 kΩ (Note 4)	−5	5	—	1	—	MHz
Crosstalk (control-OUT)	—	R_{IN} = 1 kΩ, R_{OUT} = 10 kΩ, C_L = 15 pF	0	5	—	200	—	mV
			0	10	—	400	—	
			0	15	—	600	—	
Input capacitance	C_{IN}	Control input			—	5	7.5	pF
		Switch I/O			—	10	—	
Feed through capacitance	$C_{IN\text{-}OUT}$	—			—	0.5	—	pF

Note 1: Sine wave of ±2.5 $_{p\text{-}p}$ shall be used for V_{is} and the frequency of 20 log 10 $\frac{V_{OS}}{V_{is}}$ = −3dB shall be f_{max}.

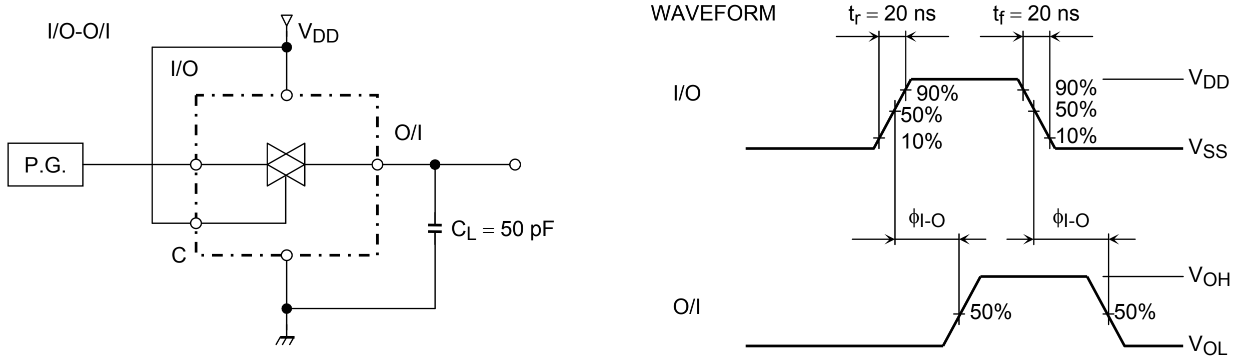
Note 2: V_{is} shall be sine wave of ±2.5 $V_{p\text{-}p}$

Note 3: Sine wave of ±2.5 $V_{p\text{-}p}$ shall be used for V_{is} and the frequency of 20 log 10 $\frac{V_{OUT}}{V_{is}}$ = −50dB shall be feed-through.

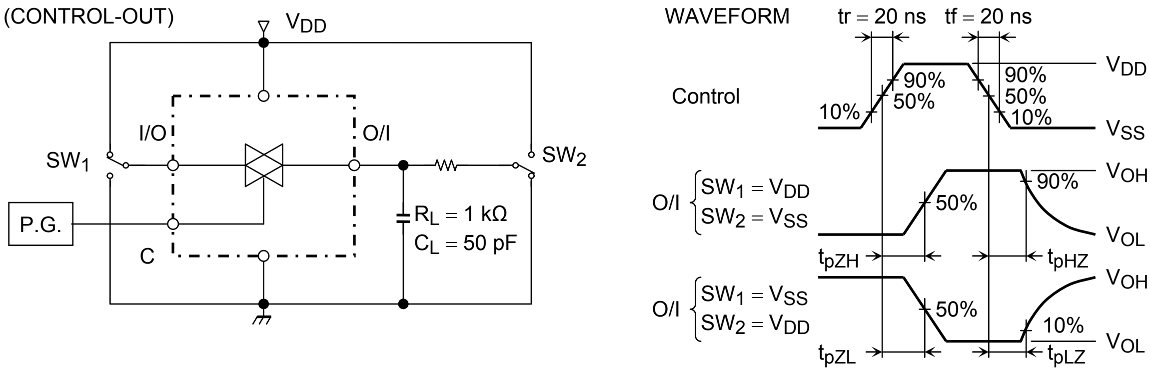
Note 4: Sine wave of ±2.5 $V_{p\text{-}p}$ shall be used for V_{is} and the frequency of 20 log 10 $\frac{V_{OUT}}{V_{is}}$ = −50dB shall be crosstalk.

Circuit for Measurement of Electrical Characteristics

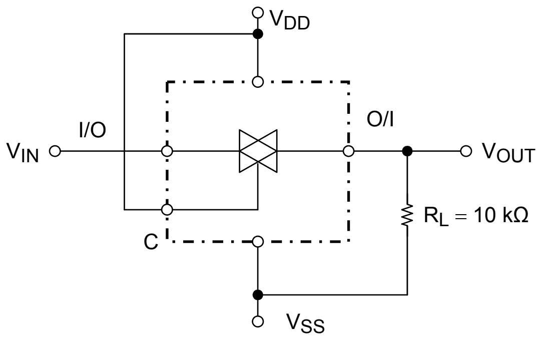
1. $\phi_{I\text{-}O}$



2. t_{pZH}, t_{pHL}, t_{pLZ}, t_{pHZ}

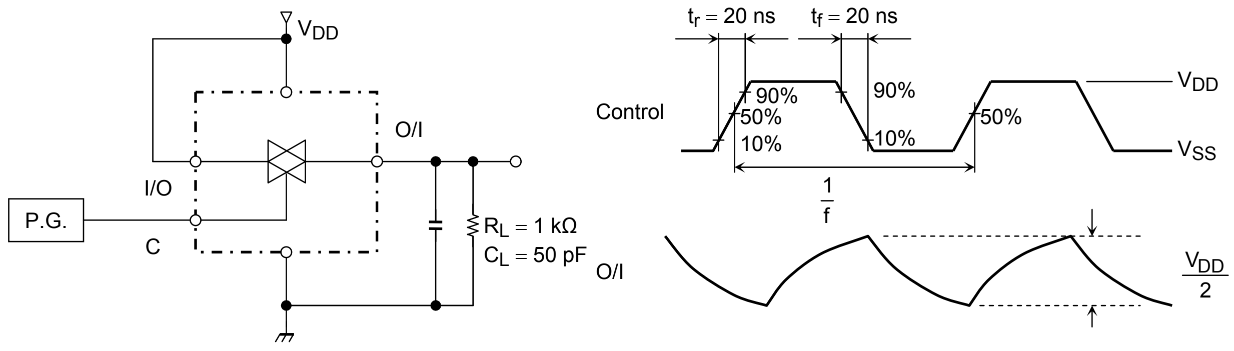


3. RON

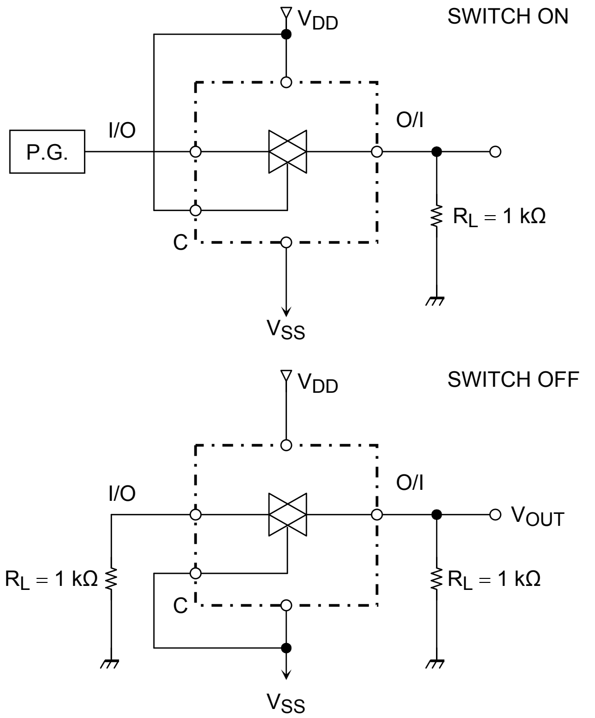


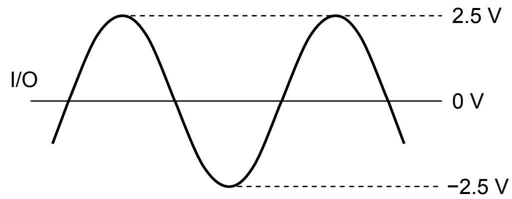
$$R_{ON} = 10 \times \frac{(V_{IN} - V_{OUT})}{V_{OUT}} \; [k\Omega]$$

4. fmax (C)

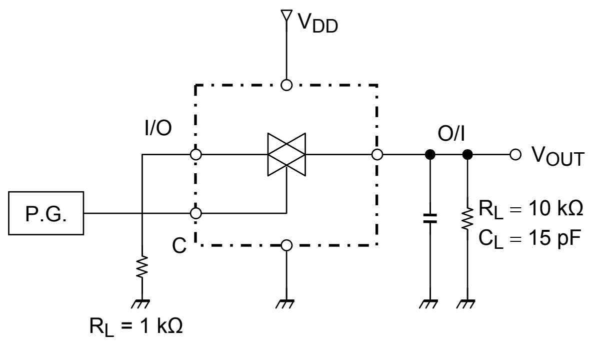


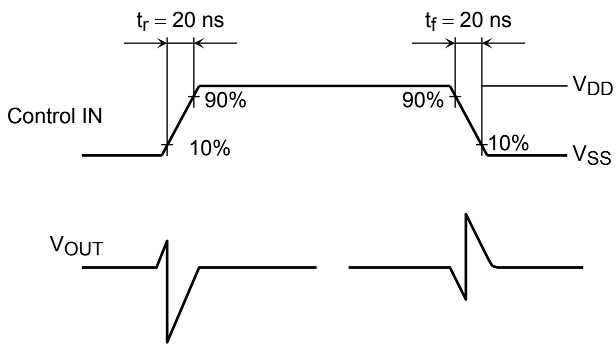
5. Crosstalk between Any Two Switches



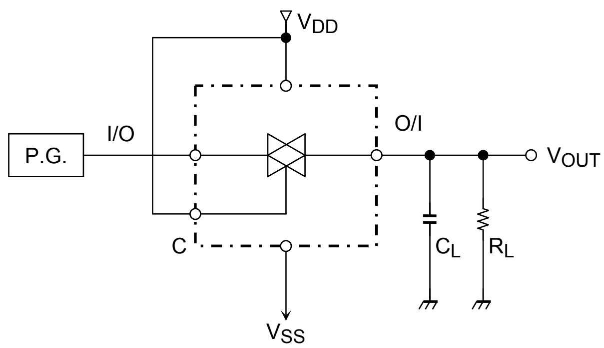


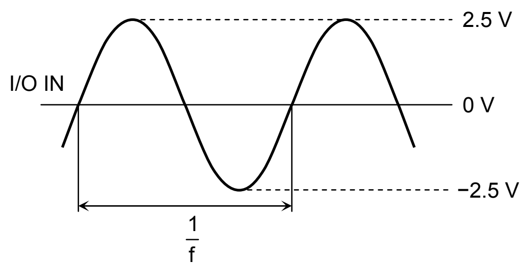
6. Crosstalk, Control to Input





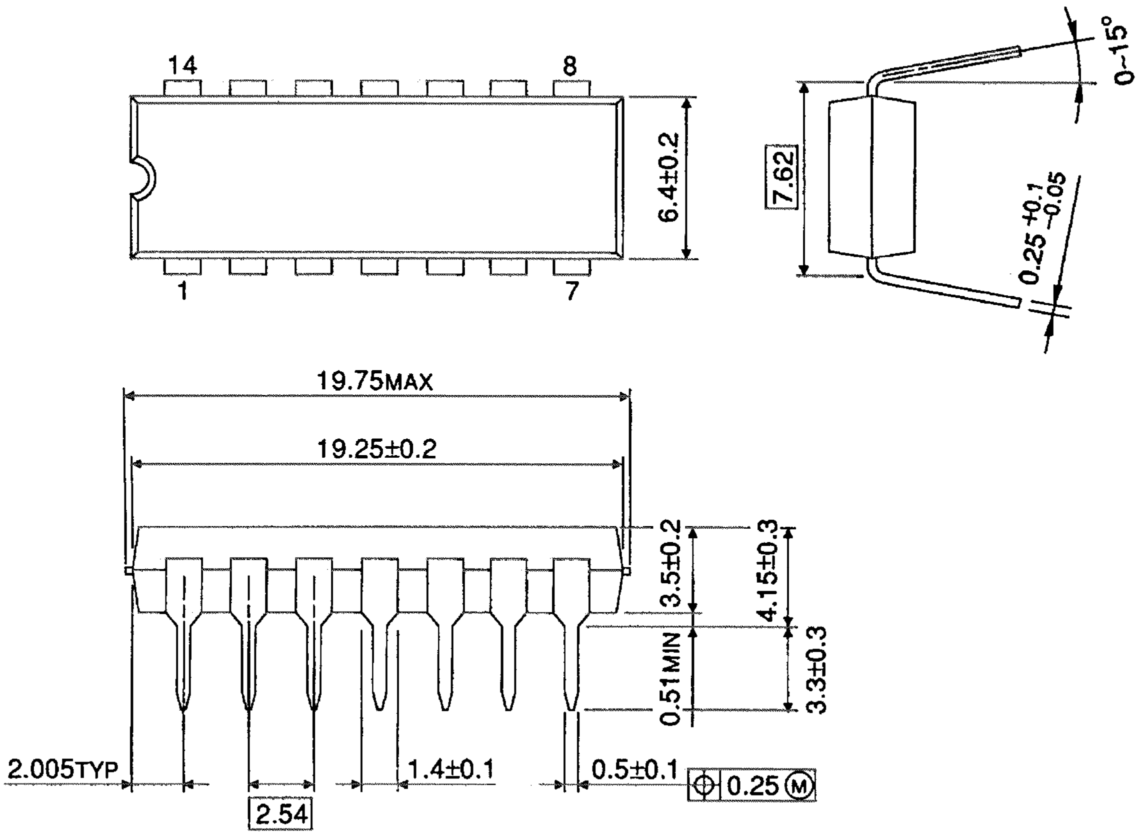
7. Total Harmonic Distortion, fmax (I-O), Feedthrough





Package Dimensions

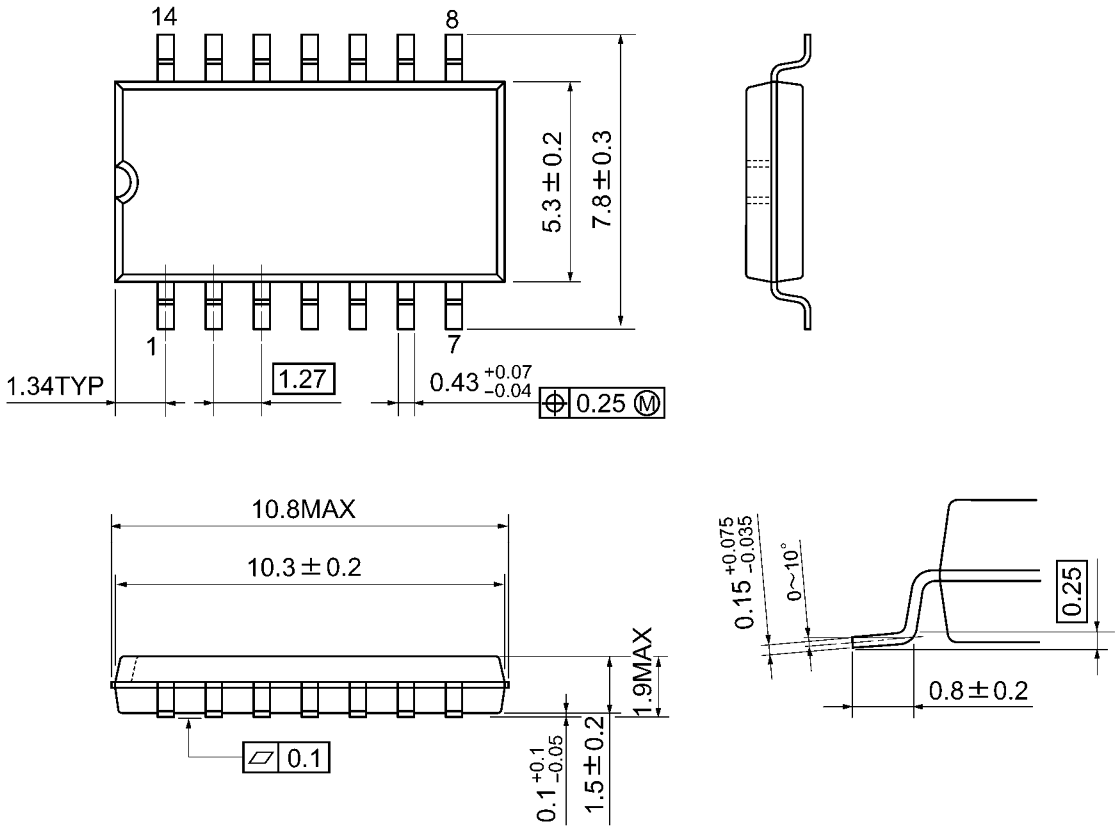
DIP14-P-300-2.54 Unit : mm



Weight: 0.96 g (typ.)

Package Dimensions

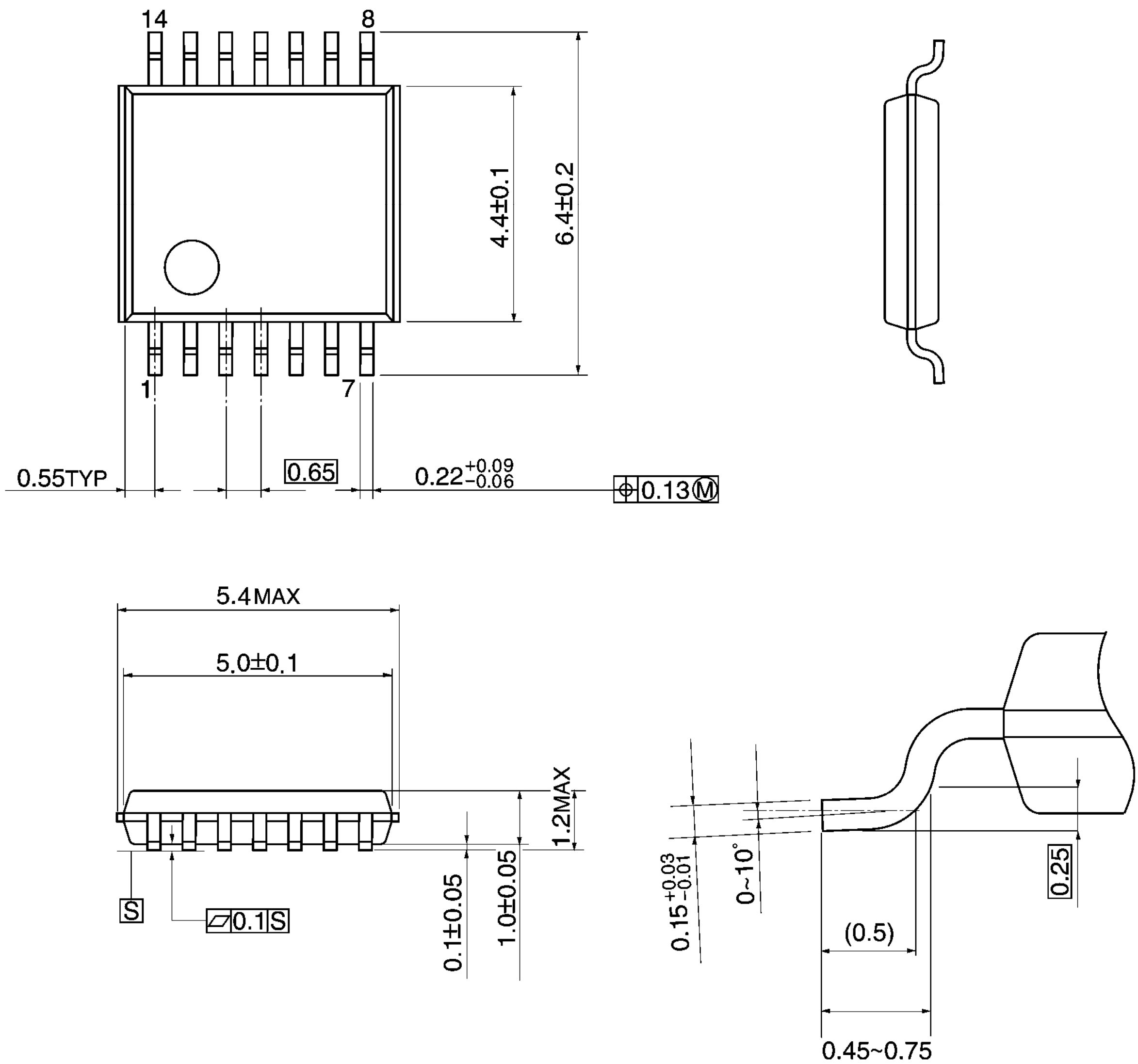
SOP14-P-300-1.27A Unit: mm



Weight: 0.18 g (typ.)

Package Dimensions

TSSOP14-P-0044-0.65A Unit: mm



Weight: 0.06 g (typ.)

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