

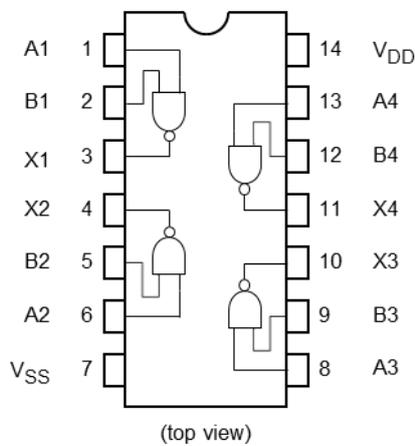
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC4011BP, TC4011BF, TC4011BFT

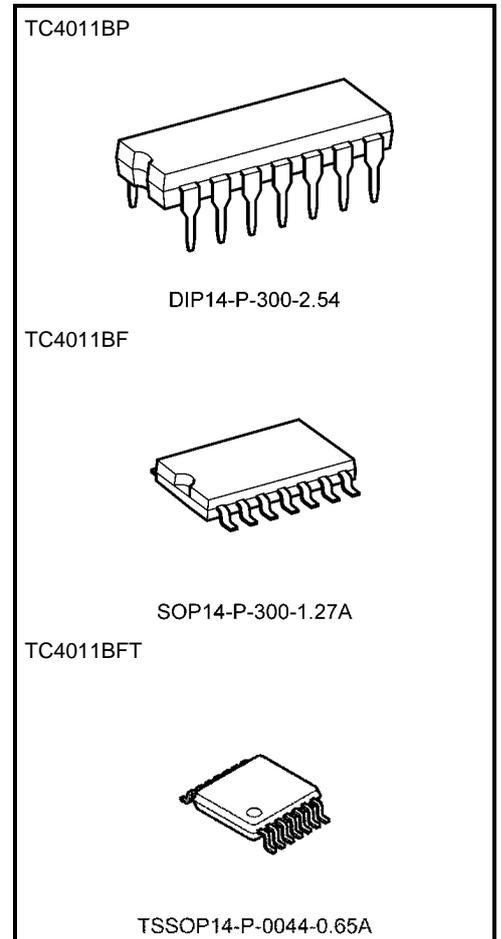
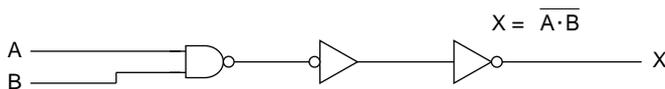
## TC4011B Quad 2 Input NAND Gate

The TC4011B is 2-input positive logic NAND gate respectively. Since all the outputs of these gates are provided with the inverters as buffers, the input/output characteristics have been improved and the variation of propagation delay time due to the increase in load capacity is kept down to the minimum.

### Pin Assignment



### Logic Diagram



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.)

Start of commercial production  
1978-06

### Absolute Maximum Ratings (Note)

Characteristics	Symbol	Rating	Unit
DC supply voltage	V <sub>DD</sub>	V <sub>SS</sub> - 0.5 to V <sub>SS</sub> + 20	V
Input voltage	V <sub>IN</sub>	V <sub>SS</sub> - 0.5 to V <sub>DD</sub> + 0.5	V
Output voltage	V <sub>OUT</sub>	V <sub>SS</sub> - 0.5 to V <sub>DD</sub> + 0.5	V
DC input current	I <sub>IN</sub>	±10	mA
Power dissipation	P <sub>D</sub>	300 (DIP) / 180 (SOP/TSSOP)	mW
Operating temperature range	T <sub>opr</sub>	-40 to 85	°C
Storage temperature range	T <sub>stg</sub>	-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<sub>SS</sub> = 0 V) (Note)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
DC supply voltage	V <sub>DD</sub>	—	3	—	18	V
Input voltage	V <sub>IN</sub>	—	0	—	V <sub>DD</sub>	V

Note: The operating ranges must be maintained to ensure the normal operation of the device.  
Unused inputs must be tied to either V<sub>DD</sub> or V<sub>SS</sub>.

### Static Electrical Characteristics (V<sub>SS</sub> = 0 V)

Characteristics	Symbol	Test Condition	V <sub>DD</sub> (V)	-40°C		25°C			85°C		Unit	
				Min	Max	Min	Typ.	Max	Min	Max		
High-level output voltage	V <sub>OH</sub>	I <sub>OUT</sub>   < 1 μA V <sub>IN</sub> = V <sub>SS</sub> , V <sub>DD</sub>	5	4.95	—	4.95	5.00	—	4.95	—	V	
			10	9.95	—	9.95	10.00	—	9.95	—		
			15	14.95	—	14.95	15.00	—	14.95	—		
Low-level output voltage	V <sub>OL</sub>	I <sub>OUT</sub>   < 1 μA V <sub>IN</sub> = V <sub>DD</sub>	5	—	0.05	—	0.00	0.05	—	0.05	V	
			10	—	0.05	—	0.00	0.05	—	0.05		
			15	—	0.05	—	0.00	0.05	—	0.05		
Output high current	I <sub>OH</sub>	V <sub>OH</sub> = 4.6 V V <sub>OH</sub> = 2.5 V V <sub>OH</sub> = 9.5 V V <sub>OH</sub> = 13.5 V V <sub>IN</sub> = V <sub>SS</sub> , V <sub>DD</sub>	5	-0.61	—	-0.51	-1.0	—	-0.42	—	mA	
			5	-2.50	—	-2.10	-4.0	—	-1.70	—		
			10	-1.50	—	-1.30	-2.2	—	-1.10	—		
			15	-4.00	—	-3.40	-9.0	—	-2.80	—		
Output low current	I <sub>OL</sub>	V <sub>OL</sub> = 0.4 V V <sub>OL</sub> = 0.5 V V <sub>OL</sub> = 1.5 V V <sub>IN</sub> = V <sub>DD</sub>	5	0.61	—	0.51	1.2	—	0.42	—	mA	
			10	1.50	—	1.30	3.2	—	1.10	—		
			15	4.00	—	3.40	12.0	—	2.80	—		
			—	—	—	—	—	—	—	—		
Input high voltage	V <sub>IH</sub>	V <sub>OUT</sub> = 0.5 V, 4.5 V V <sub>OUT</sub> = 1.0 V, 9.0 V V <sub>OUT</sub> = 1.5 V, 13.5 V  I <sub>OUT</sub>   < 1 μA	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	—		
Input low voltage	V <sub>IL</sub>	V <sub>OUT</sub> = 4.5 V V <sub>OUT</sub> = 9.0 V V <sub>OUT</sub> = 13.5 V  I <sub>OUT</sub>   < 1 μA	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		
			—	—	—	—	—	—	—	—		
Input current	"H" level	I <sub>IH</sub>	V <sub>IH</sub> = 18 V	18	—	0.1	—	10 <sup>-5</sup>	0.1	—	1.0	μA
	"L" level	I <sub>IL</sub>	V <sub>IL</sub> = 0 V	18	—	-0.1	—	-10 <sup>-5</sup>	-0.1	—	-1.0	
Quiescent supply current	I <sub>DD</sub>	V <sub>IN</sub> = V <sub>SS</sub> , V <sub>DD</sub> (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		

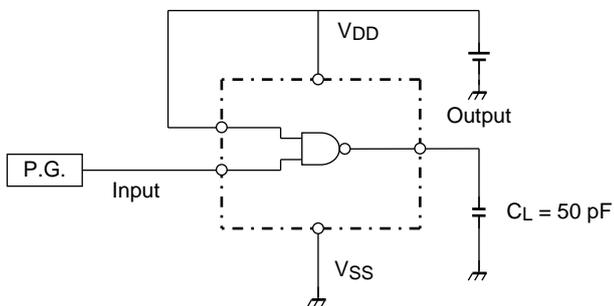
Note: All valid input combinations.

### Dynamic Electrical Characteristics (Ta = 25°C, Vss = 0 V, CL = 50 pF)

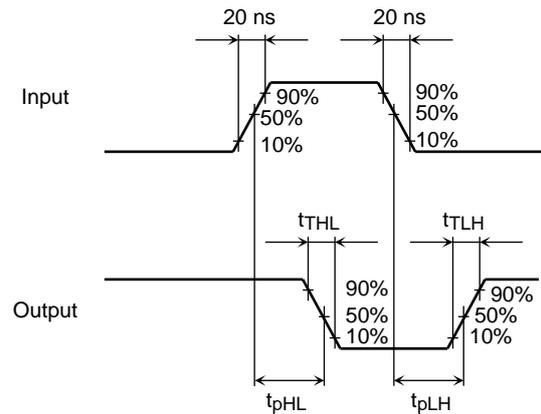
Characteristics	Symbol	Test Condition	VDD (V)	Min	Typ.	Max	Unit
Output transition time	tTLH	—	5	—	70	200	ns
			10	—	35	100	
			15	—	30	80	
Output transition time	tTHL	—	5	—	70	200	ns
			10	—	35	100	
			15	—	30	80	
Propagation delay time	tpLH	—	5	—	65	200	ns
			10	—	30	100	
			15	—	25	80	
Propagation delay time	tpHL	—	5	—	65	200	ns
			10	—	30	100	
			15	—	25	80	
Input capacitance	CIN	—	—	5	7.5	pF	

### Circuit and Waveform for Measurement of Dynamic Characteristics

#### Circuit



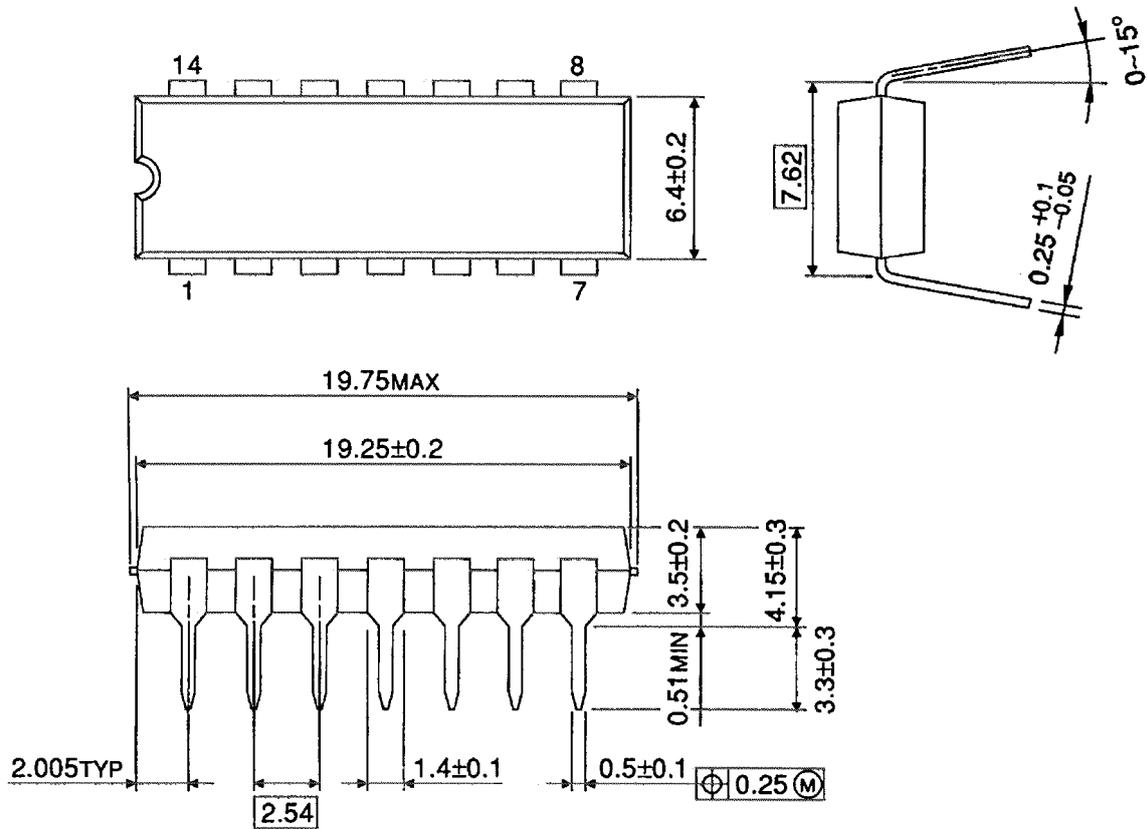
#### Waveform



### Package Dimensions

DIP14-P-300-2.54

Unit : mm

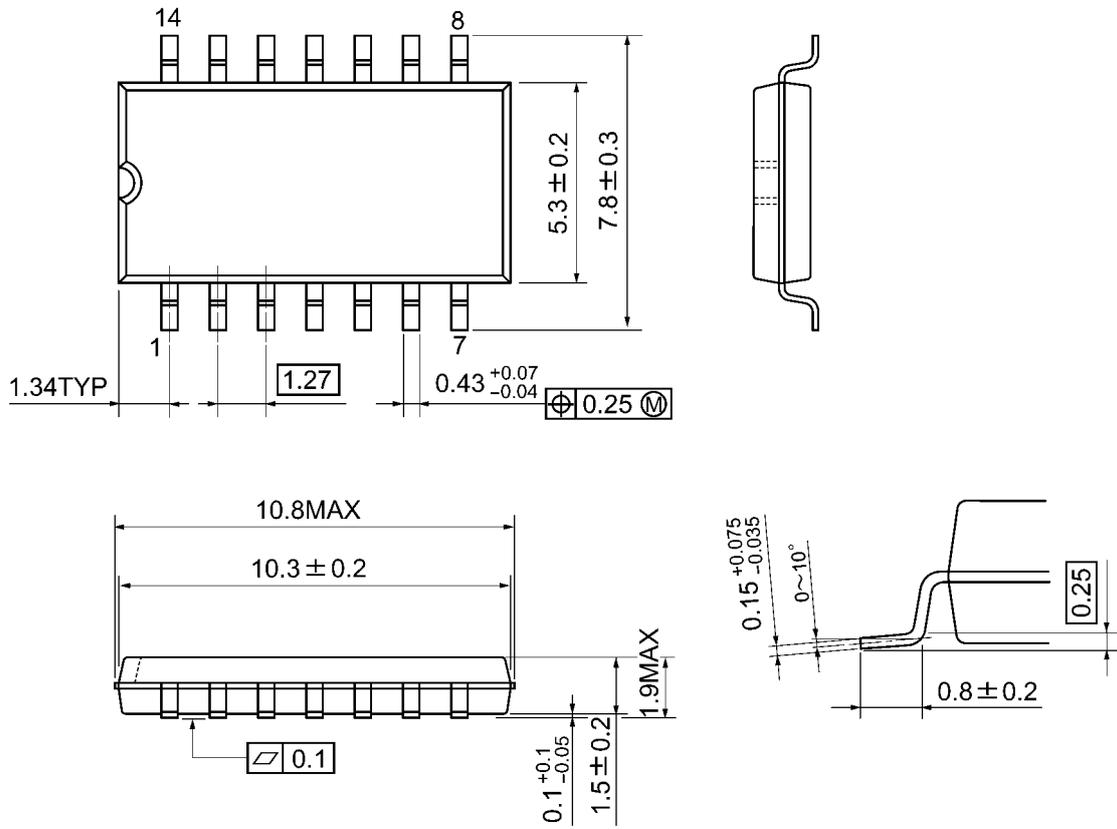


Weight: 0.96 g (typ.)

### Package Dimensions

SOP14-P-300-1.27A

Unit: mm

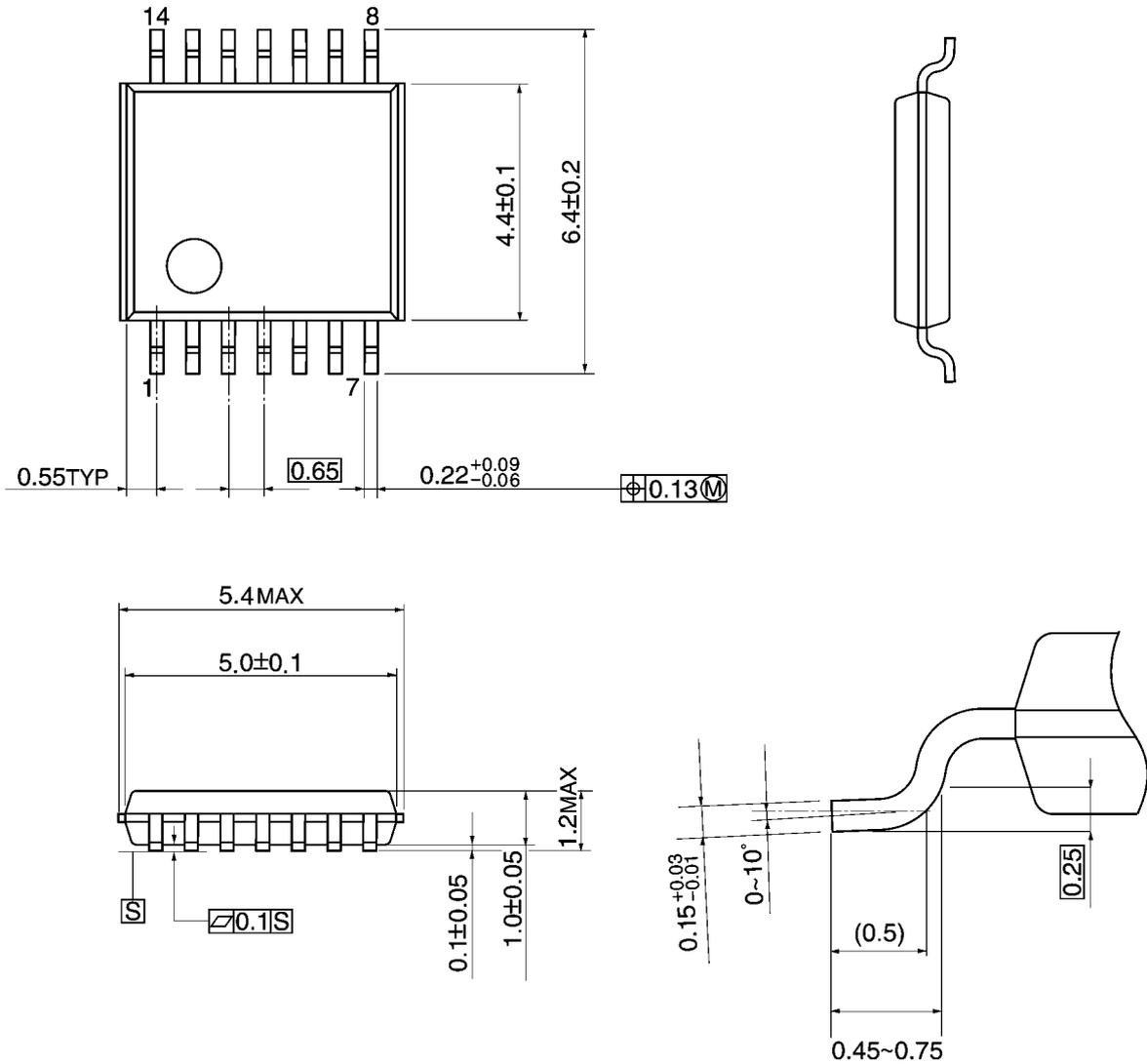


Weight: 0.18 g (typ.)

### Package Dimensions

TSSOP14-P-0044-0.65A

Unit: mm



Weight: 0.06 g (typ.)

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