

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

# TC4093BP, TC4093BF, TC4093BFN

## TC4093B QUAD 2-INPUT NAND SCHMITT TRIGGERS

The TC4093B is a quad 2-input NAND gate having Schmitt trigger function for all the input terminals.

Since the circuit threshold voltage varies with rising time and falling time of the input waveform ( $V_P$  and  $V_N$ ), this gate can be used for a wide variety of applications to line receivers, waveform shaping.

Astable multivibrators, monostable multivibrators, etc.

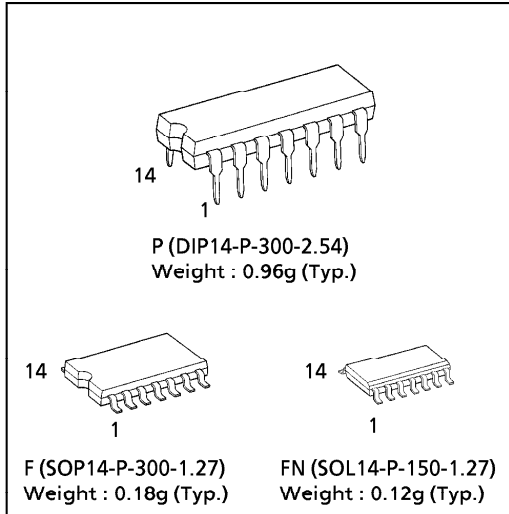
In addition to regular NAND gates.

As the TC4093B and the TC4011B are identical in pin assignment, they are compatible each other.

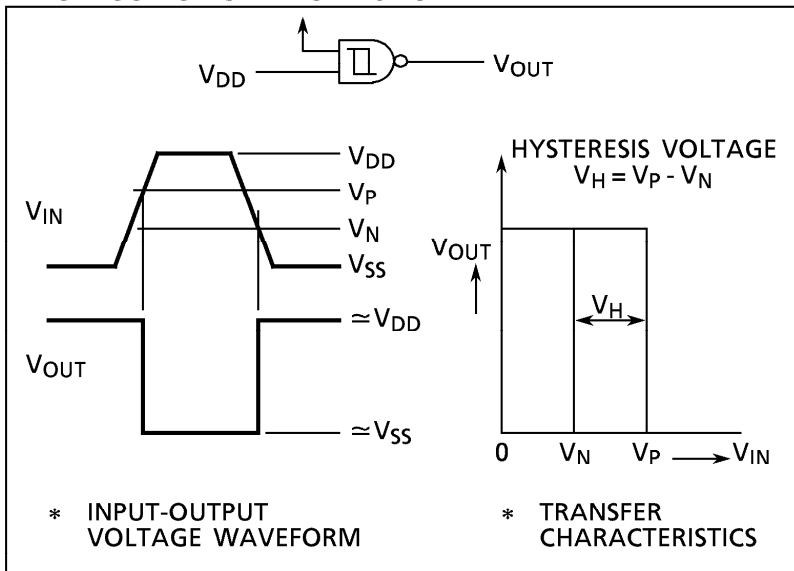
(Note) The JEDEC SOP (FN) is not available in Japan.

### MAXIMUM RATINGS

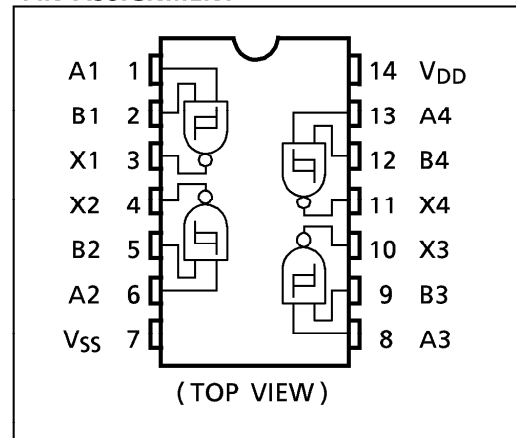
CHARACTERISTIC	SYMBOL	RATING	UNIT
DC Supply Voltage	$V_{DD}$	$V_{SS} - 0.5 \sim V_{SS} + 20$	V
Input Voltage	$V_{IN}$	$V_{SS} - 0.5 \sim V_{DD} + 0.5$	V
Output Voltage	$V_{OUT}$	$V_{SS} - 0.5 \sim V_{DD} + 0.5$	V
DC Input Current	$I_{IN}$	$\pm 10$	mA
Power Dissipation	$P_D$	300 (DIP) / 180 (SOIC)	mW
Operating Temperature Range	$T_{opr}$	$-40 \sim 85$	$^{\circ}C$
Storage Temperature Range	$T_{stg}$	$-65 \sim 150$	$^{\circ}C$



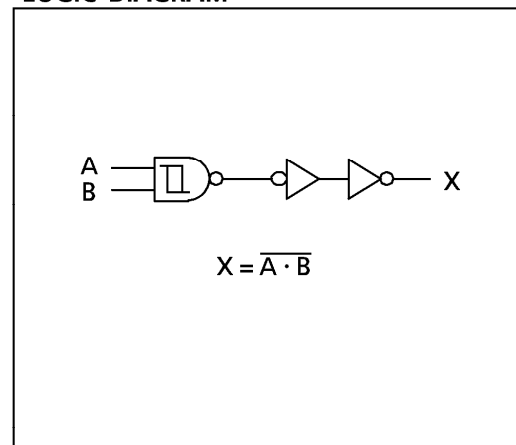
### INPUT - OUTPUT CHARACTERISTIC



### PIN ASSIGNMENT



### LOGIC DIAGRAM



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**RECOMMENDED OPERATING CONDITIONS (V<sub>SS</sub> = 0V)**

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNITS
DC Supply Voltage	V <sub>DD</sub>		3	—	18	V
Input Voltage	V <sub>IN</sub>		0	—	V <sub>DD</sub>	V

**STATIC ELECTRICAL CHARACTERISTICS (V<sub>SS</sub> = 0V)**

CHARACTERISTIC	SYM-BOL	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>   < 1μA 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>   < 1μA 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> = 4.6V V <sub>OH</sub> = 2.5V V <sub>OH</sub> = 9.5V V <sub>OH</sub> = 13.5V 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> = 0.4V V <sub>OL</sub> = 0.5V V <sub>OL</sub> = 1.5V V <sub>IN</sub> = V <sub>DD</sub>	5	0.61	—	0.51	1.5	—	0.42	—	mA	
			10	1.5	—	1.30	3.8	—	1.10	—		
			15	4.0	—	3.40	15.0	—	2.80	—		
High Threshold Voltage	V <sub>P</sub>	V <sub>OUT</sub> = 0.5V, 4.5V V <sub>OUT</sub> = 1.0V, 9.0V V <sub>OUT</sub> = 1.5V, 13.5V	5	—	—	2.05	2.8	3.55	—	—	V	
			10	—	—	4.10	5.3	7.00	—	—		
			15	—	—	6.20	7.8	10.40	—	—		
Low Threshold Voltage	V <sub>N</sub>	V <sub>OUT</sub> = 0.5V, 4.5V V <sub>OUT</sub> = 1.0V, 9.0V V <sub>OUT</sub> = 1.5V, 13.5V	5	—	—	1.5	2.3	3.15	—	—	V	
			10	—	—	3.2	4.5	6.30	—	—		
			15	—	—	4.8	6.6	9.30	—	—		
Hysteresis Voltage	V <sub>H</sub>		5	—	—	0.20	0.5	0.85	—	—	V	
			10	—	—	0.30	0.8	1.40	—	—		
			15	—	—	0.45	1.2	1.90	—	—		
Input Current	"H" Level	I <sub>IH</sub>	V <sub>IH</sub> = 18V	18	—	0.1	—	10 <sup>-5</sup>	0.1	—	1.0	μA
	"L" Level	I <sub>IL</sub>	V <sub>IL</sub> = 0V	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> *	5	—	1	—	0.001	1	—	7.5	μA	
			10	—	2	—	0.002	2	—	15.0		
			15	—	4	—	0.004	4	—	30.0		

\* All valid input combinations.

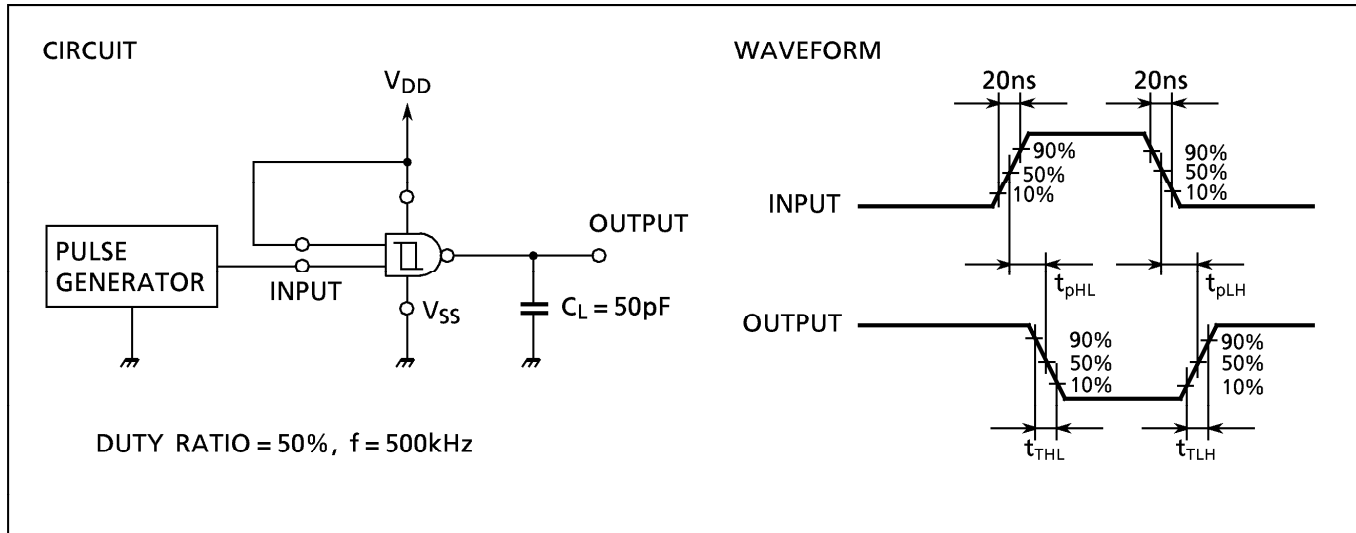
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**DYNAMIC ELECTRICAL CHARACTERISTICS (Ta = 25°C, Vss = 0V, CL = 50pF)**

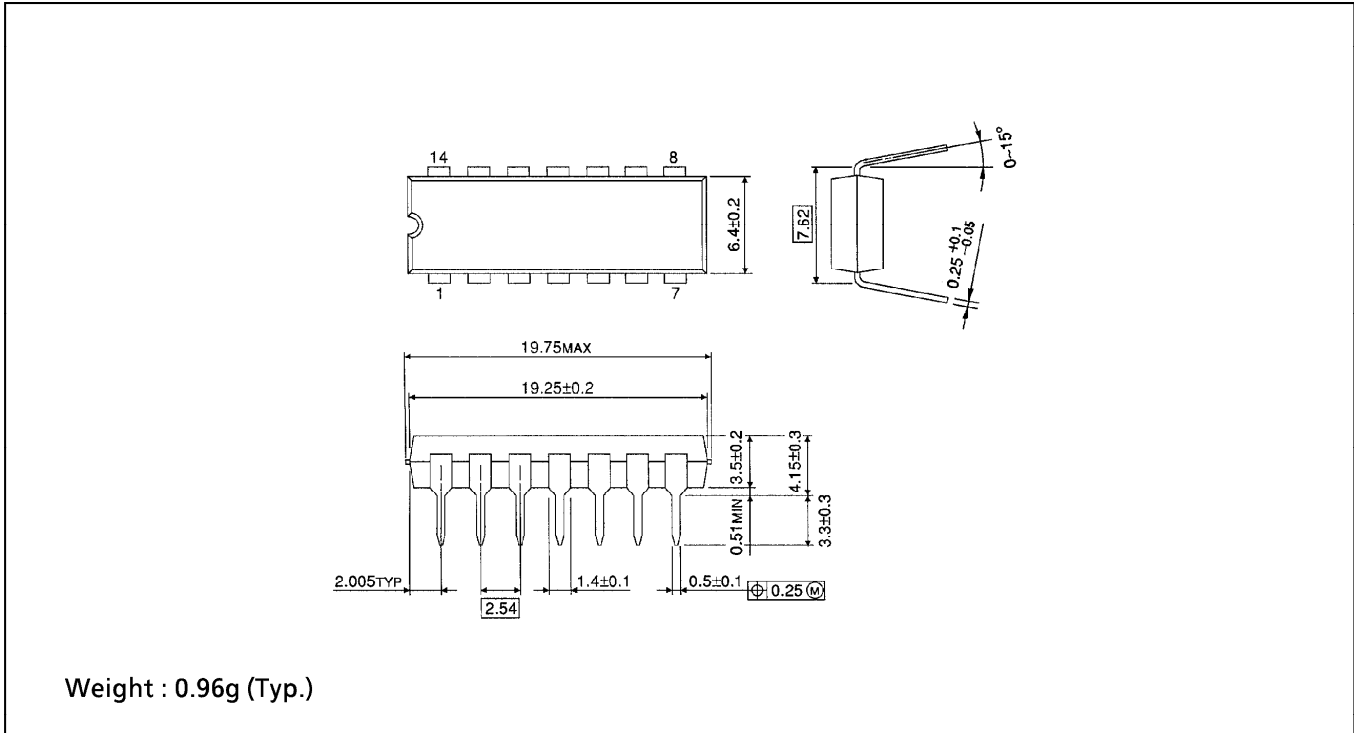
CHARACTERISTIC	SYMBOL	TEST CONDITION	V <sub>DD</sub> (V)	MIN.	TYP.	MAX.	UNIT
Output Transition Time (Low to High)	t <sub>TLH</sub>		5	—	80	200	ns
			10	—	50	100	
			15	—	40	80	
Output Transition Time (High to Low)	t <sub>THL</sub>		5	—	80	200	ns
			10	—	50	100	
			15	—	40	80	
Propagation Delay Time	t <sub>pLH</sub>		5	—	130	260	ns
	t <sub>pHL</sub>		10	—	60	120	
			15	—	40	80	
Input Capacitance	C <sub>IN</sub>			—	5	7.5	pF

**CIRCUIT AND WAVEFORM FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS**



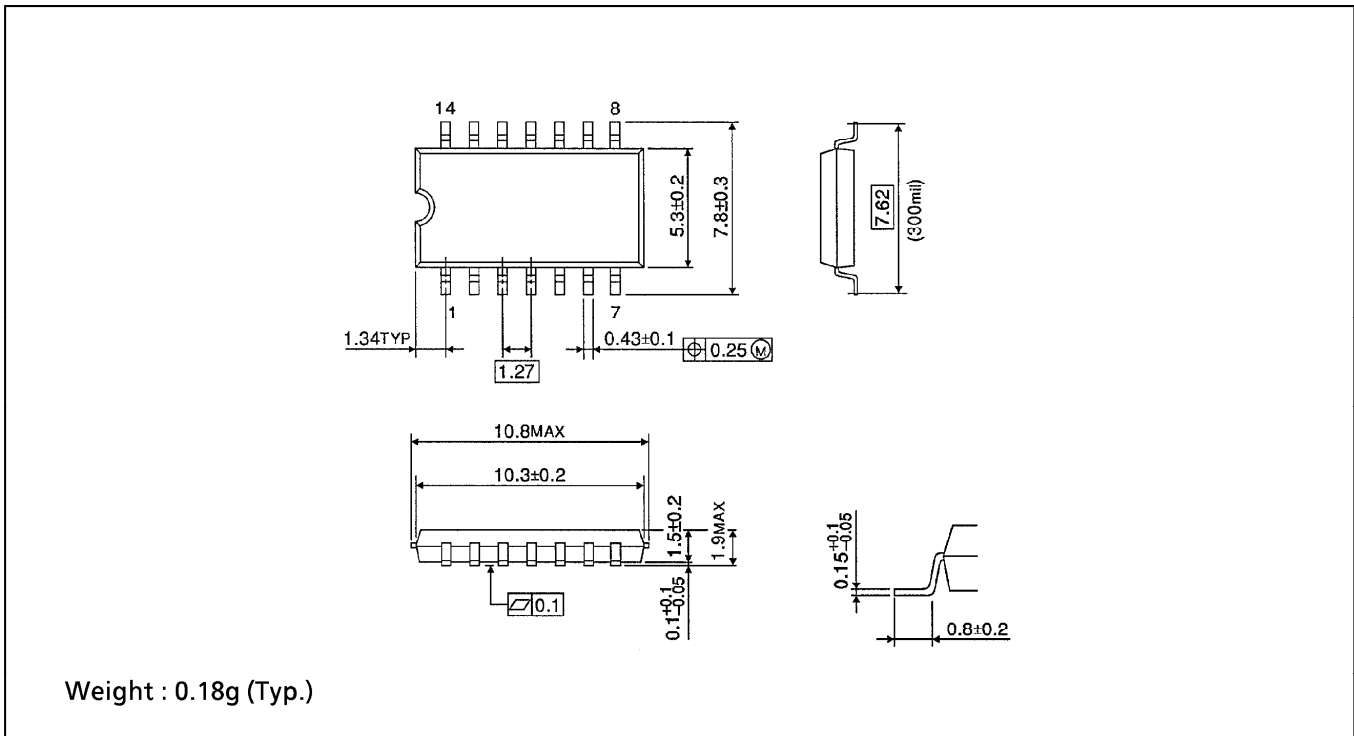
DIP 14PIN OUTLINE DRAWING (DIP14-P-300-2.54)

Unit in mm



SOP 14PIN (200mil BODY) OUTLINE DRAWING (SOP14-P-300-1.27)

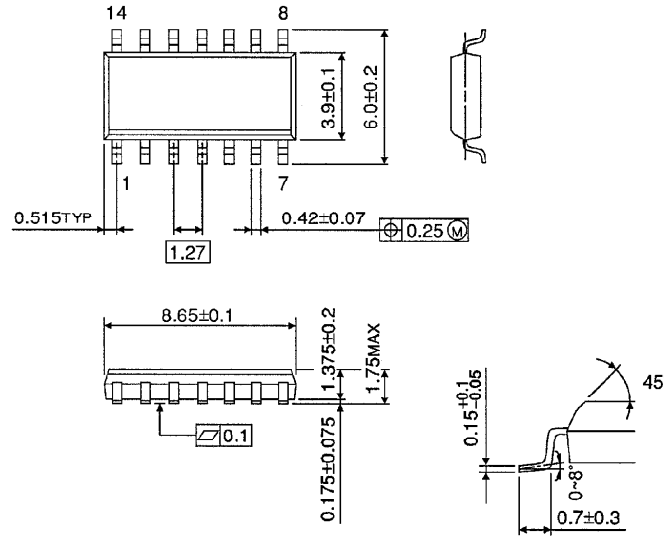
Unit in mm



SOP 14PIN (150mil BODY) OUTLINE DRAWING (SOL14-P-150-1.27)

Unit in mm

(Note) This package is not available in Japan.



Weight : 0.12g (Typ.)