TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC4093BP,TC4093BF,TC4093BFN

TC4093B Quad 2-Input NAND Schmitt Triggers

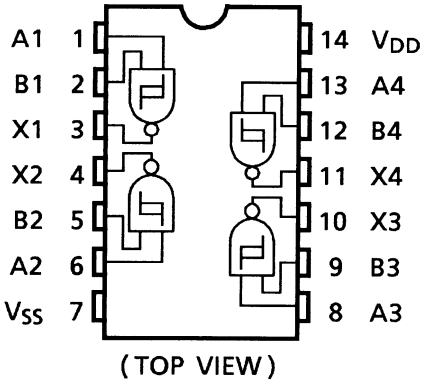
The TC4093B is a quad 2-input NAND gate having Schmitt trigger function for all the input terminals.

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, monosatable multivibrators, etc.

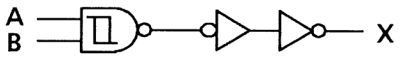
In addtion to regular NAND gates.

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

Pin Assignment



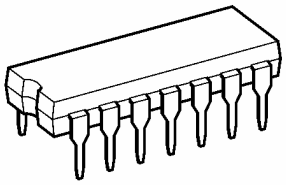
Logic Diagram



$X = \overline{A \cdot B}$

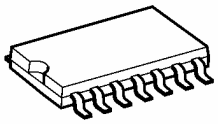
Note: xxxFN (JEDEC SOP) is not available in Japan.

TC4093BP

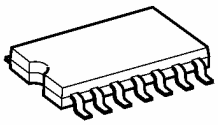


DIP14-P-300-2.54

TC4093BF

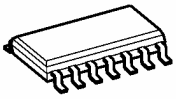


SOP14-P-300-1.27A



SOP14-P-300-1.27

TC4093BFN

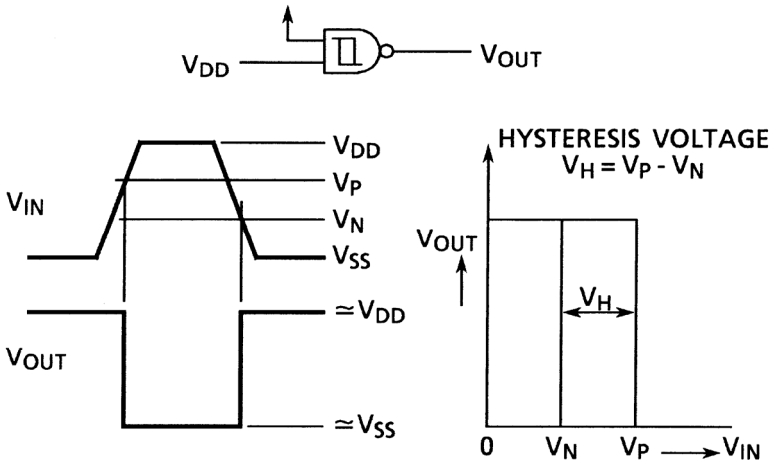


SOL14-P-150-1.27

Weight

DIP14-P-300-2.54	: 0.96 g (typ.)
SOP14-P-300-1.27A	: 0.18 g (typ.)
SOP14-P-300-1.27	: 0.18 g (typ.)
SOL14-P-150-1.27	: 0.12 g (typ.)

Input-Output Characteristic



Input-Output Voltage Waveform **Transfer Characteristics**

Absolute Maximum Ratings (Note)

Characteristics	Symbol	Rating	Unit
DC supply voltage	V_{DD}	V_{SS} − 0.5~V_{SS} + 20	V
Input voltage	V_{IN}	V_{SS} − 0.5~V_{DD} + 0.5	V
Output voltage	V_{OUT}	V_{SS} − 0.5~V_{DD} + 0.5	V
DC input current	I_{IN}	±10	mA
Power dissipation	P_D	300 (DIP)/180 (SOIC)	mW
Operating temperature range	T_{opr}	−40~85	°C
Storage temperature range	T_{stg}	−65~150	°C

Note: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Recommended Operating Conditions (V_{SS} = 0 V) (Note)

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

Note: The recommended operating conditions are required to ensure the normal operation of the device. Unused inputs must be tied to either VCC or GND.

Static Electrical Characteristics (V_{SS} = 0 V)

Characteristics		Sym-bol	Test Condition		−40°C		25°C			85°C		Unit
				V_{DD} (V)	Min	Max	Min	Typ.	Max	Min	Max	
High-level output voltage		V_{OH}	$\|I_{OUT}\| < 1$ μA $V_{IN} = V_{SS}, V_{DD}$	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_{OL}	$\|I_{OUT}\| < 1$ μA $V_{IN} = V_{DD}$	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_{OH}	V_{OH} = 4.6 V	5	−0.61	—	−0.51	−1.0	—	−0.42	—	mA
			V_{OH} = 2.5 V	5	−2.50	—	−2.10	−4.0	—	−1.70	—	
			V_{OH} = 9.5 V	10	−1.50	—	−1.30	−2.2	—	−1.10	—	
			V_{OH} = 13.5 V	15	−4.00	—	−3.40	−9.0	—	−2.80	—	
			$V_{IN} = V_{SS}, V_{DD}$									
Output low current		I_{OL}	V_{OL} = 0.4 V	5	0.61	—	0.51	1.5	—	0.42	—	mA
			V_{OL} = 0.5 V	10	1.5	—	1.30	3.8	—	1.10	—	
			V_{OL} = 1.5 V	15	4.0	—	3.40	15.0	—	2.80	—	
			$V_{IN} = V_{DD}$									
High threshold voltage		V_P	V_{OUT} = 0.5 V, 4.5 V	5	—	—	2.05	2.8	3.55	—	—	V
			V_{OUT} = 1.0 V, 9.0 V	10	—	—	4.10	5.3	7.00	—	—	
			V_{OUT} = 1.5 V, 13.5 V	15	—	—	6.20	7.8	10.40	—	—	
Low threshold voltage		V_N	V_{OUT} = 0.5 V, 4.5 V	5	—	—	1.5	2.3	3.15	—	—	V
			V_{OUT} = 1.0 V, 9.0 V	10	—	—	3.2	4.5	6.30	—	—	
			V_{OUT} = 1.5 V, 13.5 V	15	—	—	4.8	6.6	9.30	—	—	
Hysteresis voltage		V_H	—	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_{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	
Quiescent supply current		I_{DD}	$V_{IN} = V_{SS}, V_{DD}$ (Note)	5	—	1	—	0.001	1	—	7.5	μA
				10	—	2	—	0.002	2	—	15.0	
				15	—	4	—	0.004	4	—	30.0	

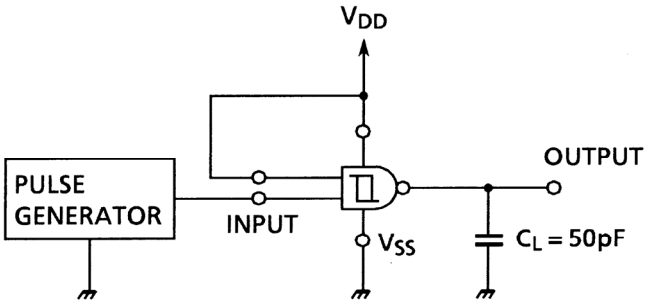
Note: All valid input combinations.

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

Characteristics	Symbol	Test Condition	V_{DD} (V)	Min	Typ.	Max	Unit
Output transition time (low to high)	t_{TLH}	—	5	—	80	200	ns
			10	—	50	100	
			15	—	40	80	
Output transition time (high to low)	t_{THL}	—	5	—	80	200	ns
			10	—	50	100	
			15	—	40	80	
Propagation delay time	t_{pLH} t_{pHL}	—	5	—	130	260	ns
			10	—	60	120	
			15	—	40	80	
Input capacitance	C_{IN}	—		—	5	7.5	pF

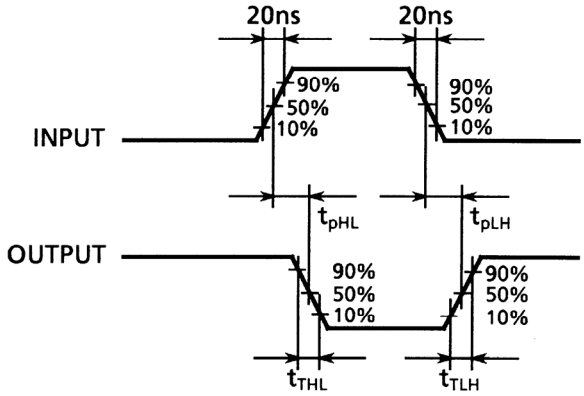
Circuit and Waveform for Measurement of Dynamic Characteristics

Circuit



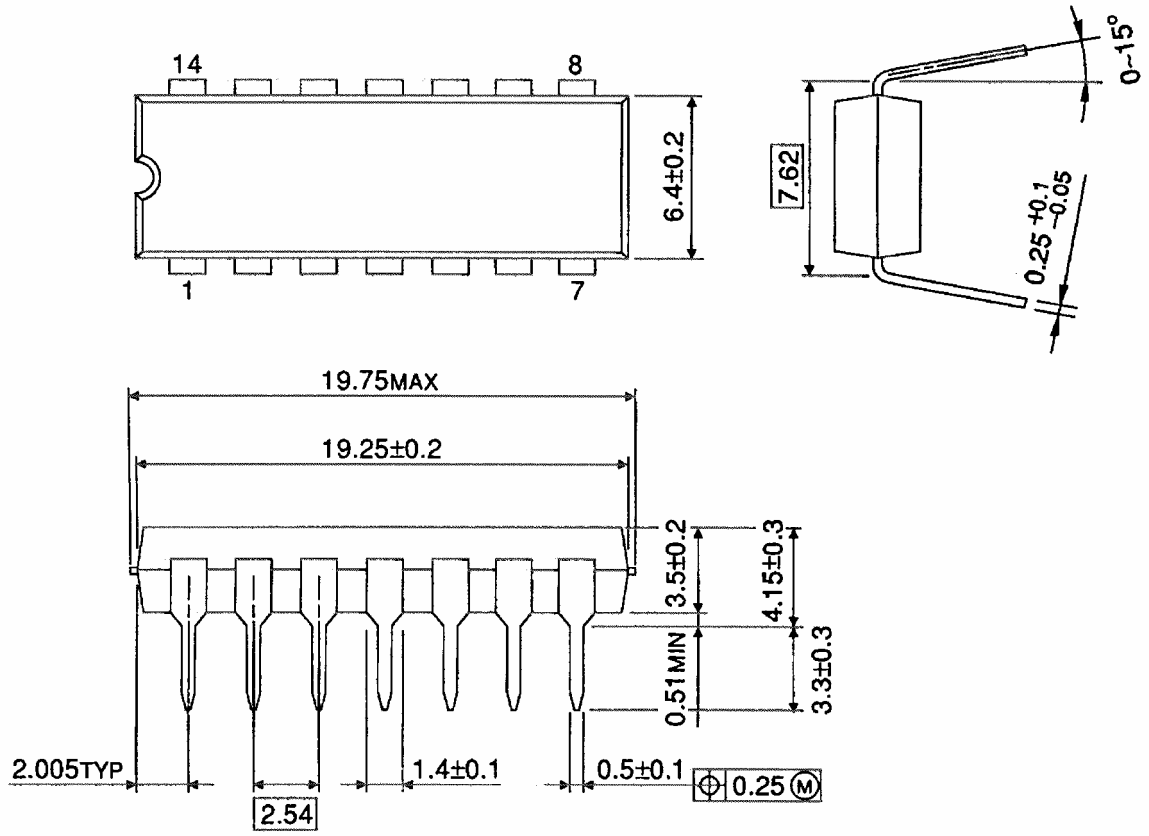
DUTY RATIO = 50%, f = 500kHz

Waveform



Package Dimensions

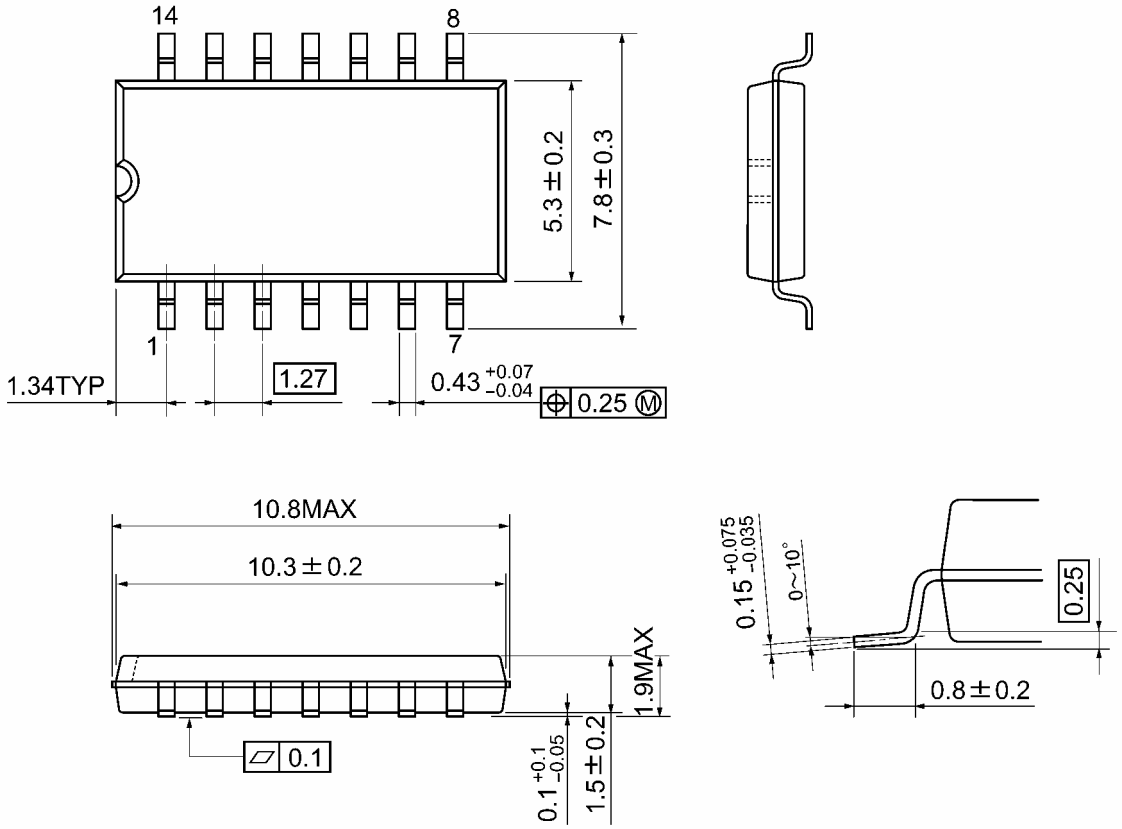
DIP14-P-300-2.54 Unit : mm



Weight: 0.96 g (typ.)

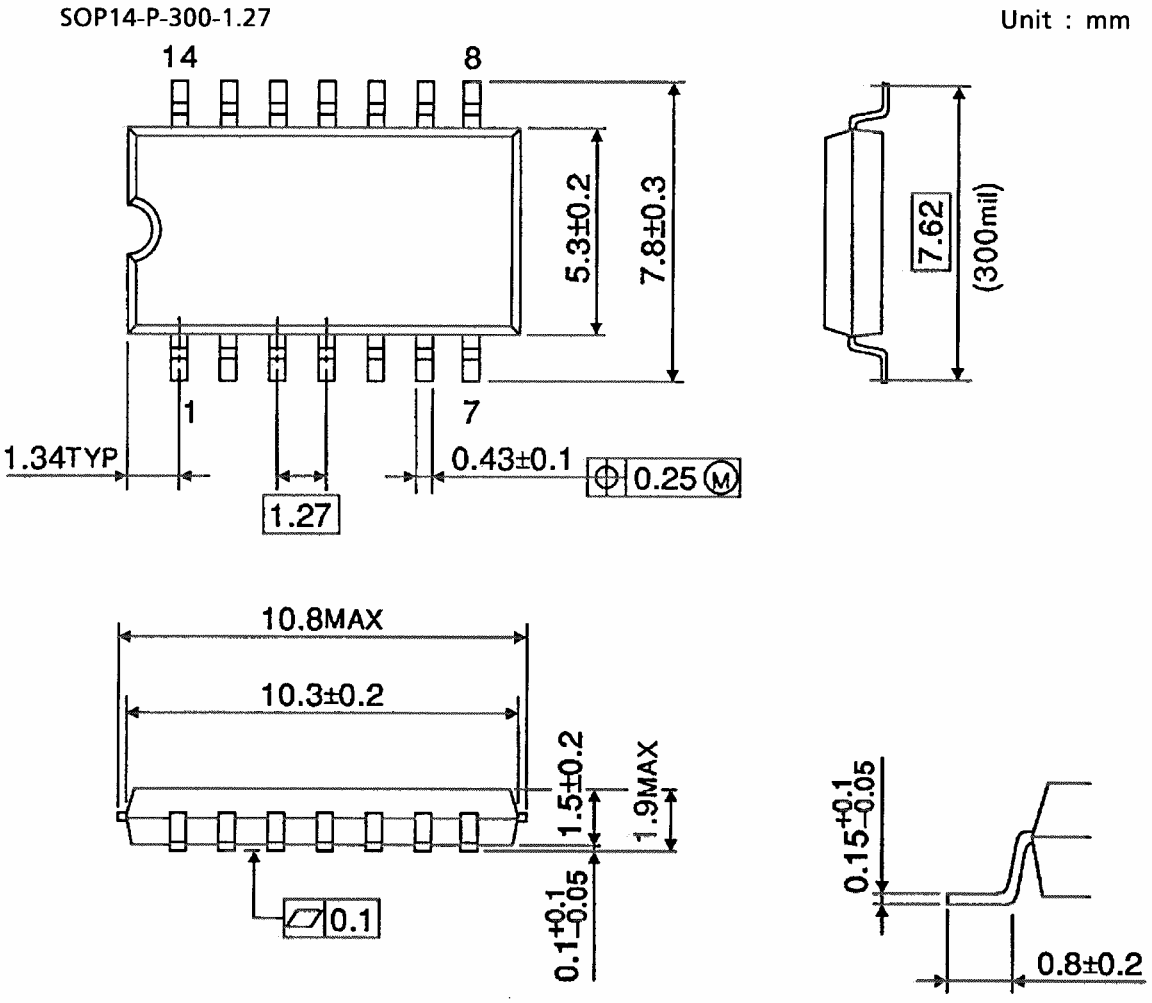
Package Dimensions

SOP14-P-300-1.27A Unit: mm



Weight: 0.18 g (typ.)

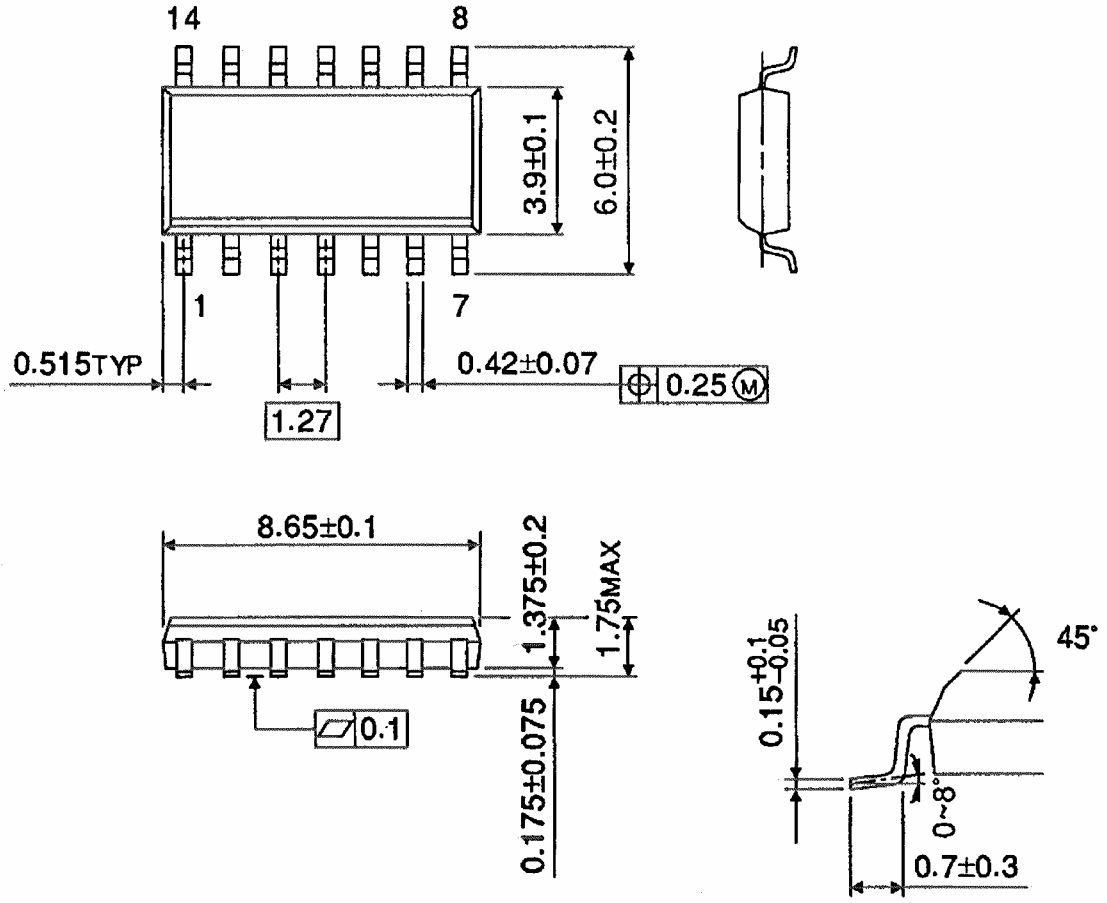
Package Dimensions



Weight: 0.18 g (typ.)

Package Dimensions (Note)

SOL14-P-150-1.27 Unit : mm



Note: This package is not available in Japan.

Weight: 0.12 g (typ.)

Note: Lead (Pb)-Free Packages

DIP14-P-300-2.54 SOP14-P-300-1.27A SOL14-P-150-1.27

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