TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC4093BP, TC4093BF

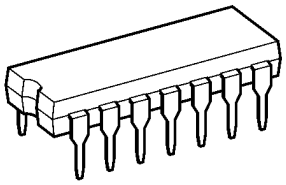
TC4093B Quad 2-Input NAND Schmitt Triggers

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 in addtion to regular NAND gates.

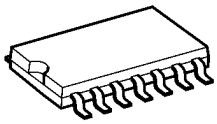
As the TC4093B and the TC4011B are identical in pin assignment, they are compatible each other.

TC4093BP



DIP14-P-300-2.54

TC4093BF

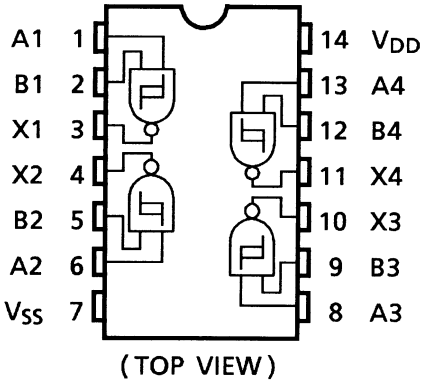


SOP14-P-300-1.27A

Weight

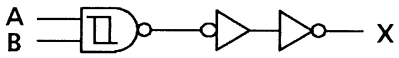
DIP14-P-300-2.54	: 0.96 g (typ.)
SOP14-P-300-1.27A	: 0.18 g (typ.)

Pin Assignment



(TOP VIEW)

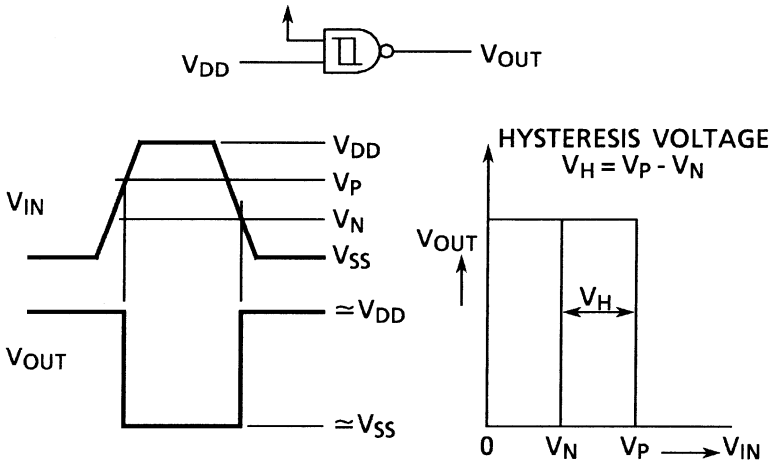
Logic Diagram



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

Start of commercial production
1978-04

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 to V_{SS} + 20	V
Input voltage	V_{IN}	V_{SS} − 0.5 to V_{DD} + 0.5	V
Output voltage	V_{OUT}	V_{SS} − 0.5 to 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 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_{IN}	—	0	—	V_{DD}	V

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

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

Characteristics	Sym-bol	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
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
Input current "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	

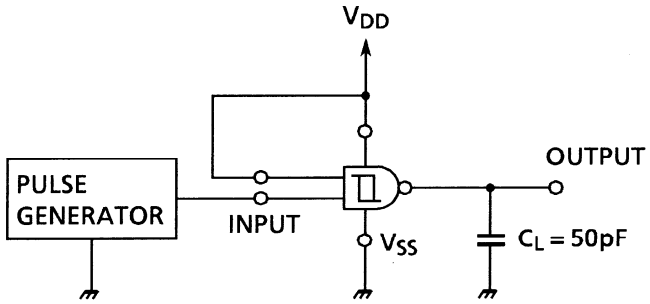
Note: All valid input combinations.

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

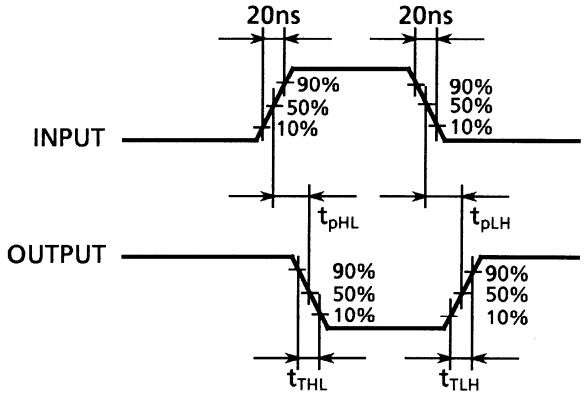
Circuit and Waveform for Measurement of Dynamic Characteristics

Circuit



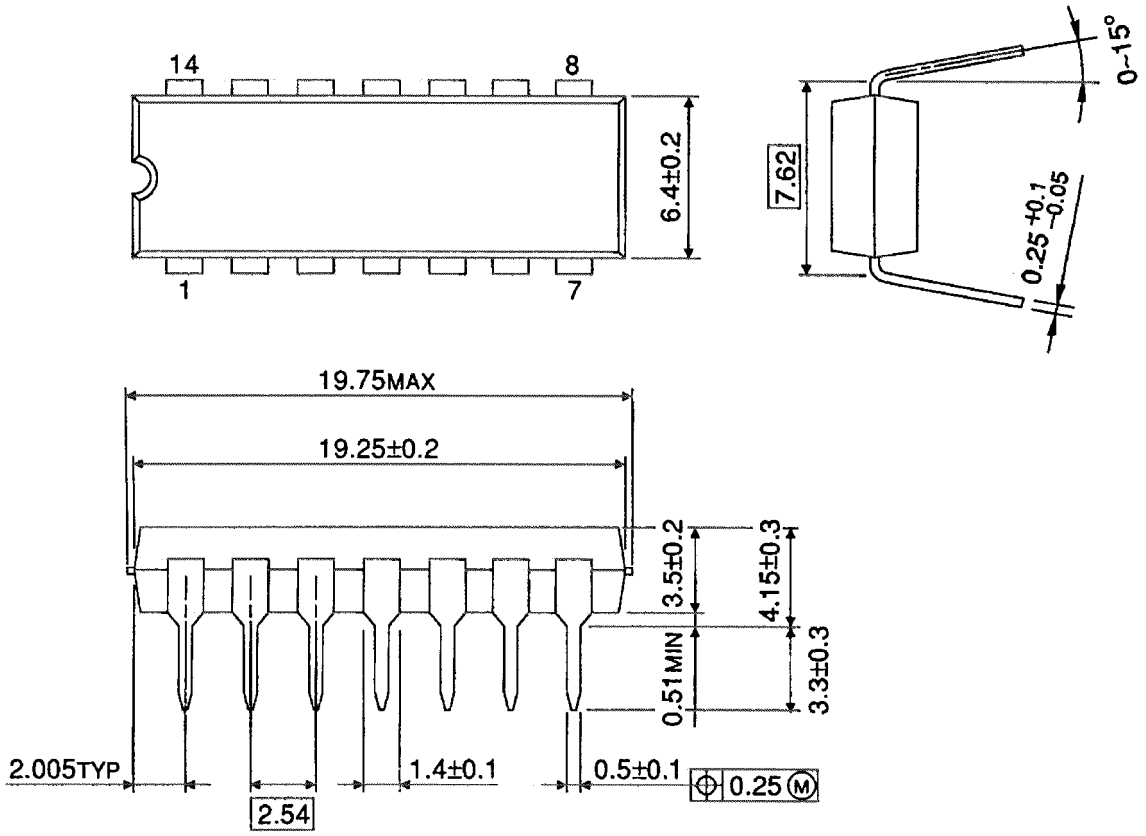
DUTY RATIO = 50%, f = 500kHz

Waveform



Package Dimensions

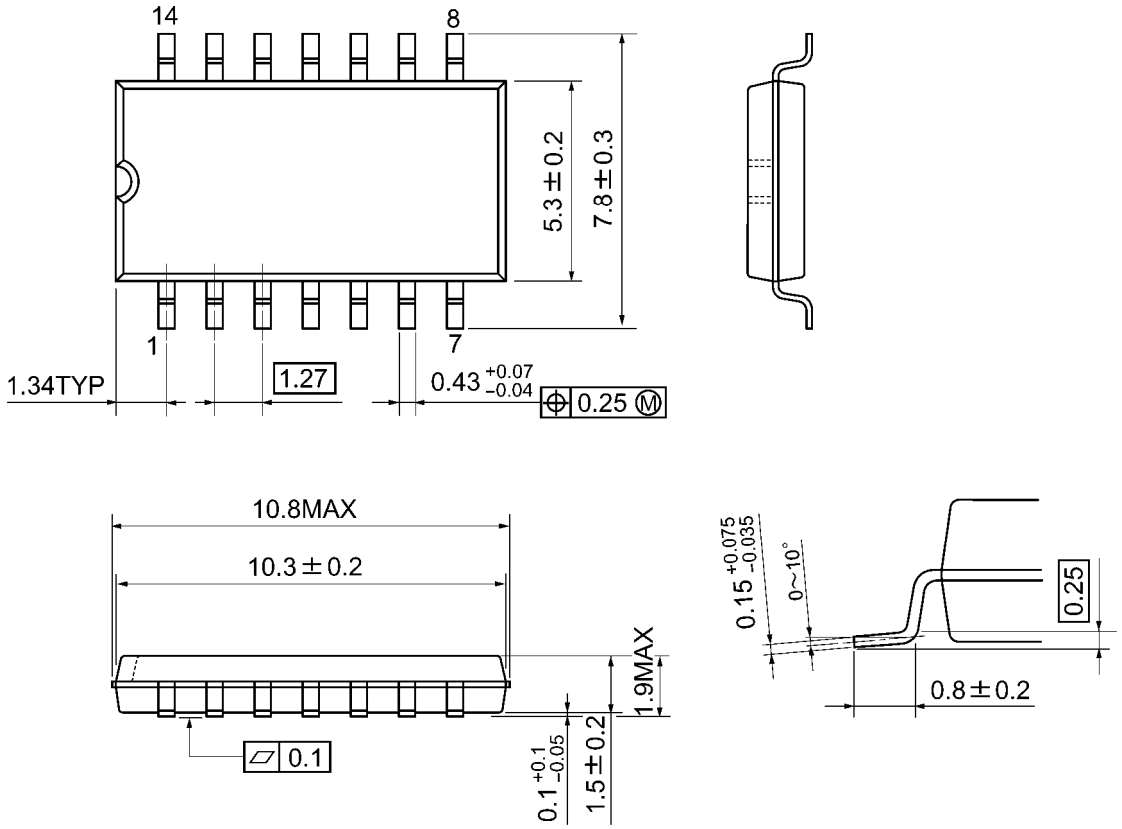
DIP14-P-300-2.54 Unit : mm



Weight: 0.96 g (typ.)

Package Dimensions

SOP14-P-300-1.27A Unit: mm



Weight: 0.18 g (typ.)

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