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.

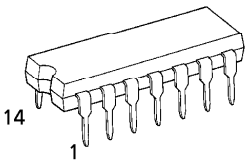
Since the circuit threshold voltage varies with rising time and falling time of the input waveform (V_P and V_N), this gate can be used for a wide variety of applications to line receivers, waveform shaping.

Astable multivibrators, monosatable multivibrators, etc.

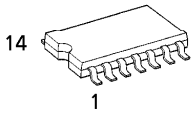
In addtion to regular NAND gates.

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

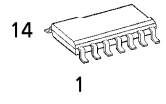
(Note) The JEDEC SOP (FN) is not available in Japan.



P (DIP14-P-300-2.54)
Weight : 0.96g (Typ.)



F (SOP14-P-300-1.27)
Weight : 0.18g (Typ.)

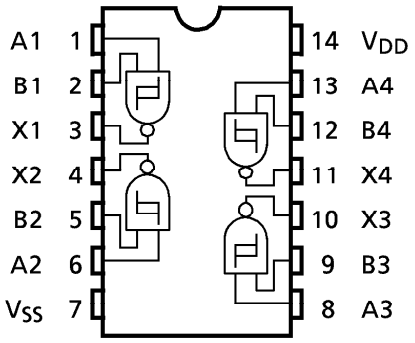


FN (SOL14-P-150-1.27)
Weight : 0.12g (Typ.)

MAXIMUM RATINGS

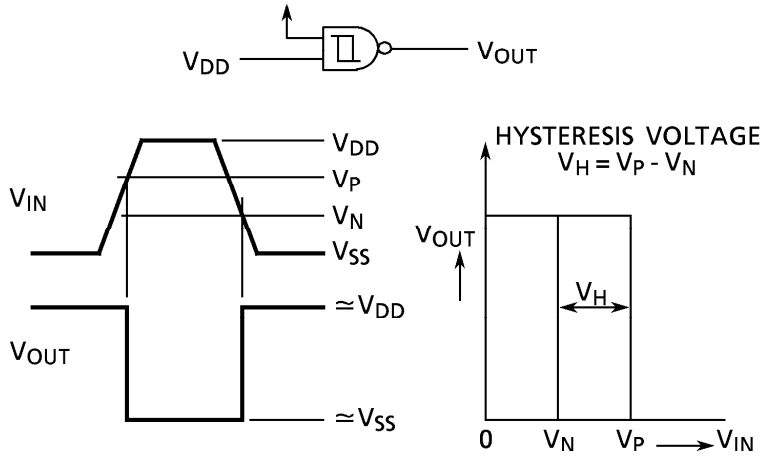
CHARACTERISTIC	SYMBOL	RATING	UNIT
DC Supply Voltage	V_{DD}	$V_{SS}-0.5 \sim V_{SS}+20$	V
Input Voltage	V_{IN}	$V_{SS}-0.5 \sim V_{DD}+0.5$	V
Output Voltage	V_{OUT}	$V_{SS}-0.5 \sim V_{DD}+0.5$	V
DC Input Current	I_{IN}	± 10	mA
Power Dissipation	P_D	300 (DIP) / 180 (SOIC)	mW
Operating Temperature Range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

PIN ASSIGNMENT



(TOP VIEW)

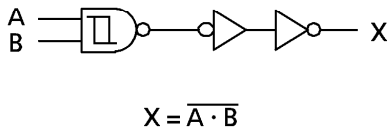
INPUT - OUTPUT CHARACTERISTIC



* INPUT-OUTPUT VOLTAGE WAVEFORM

* TRANSFER CHARACTERISTICS

LOGIC DIAGRAM



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

961001EBA2

RECOMMENDED OPERATING CONDITIONS (V_{SS} = 0V)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNITS
DC Supply Voltage	V_{DD}		3	—	18	V
Input Voltage	V_{IN}		0	—	V_{DD}	V

STATIC ELECTRICAL CHARACTERISTICS (V_{SS} = 0V)

CHARACTERISTIC	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
High-Level Output Voltage	V_{OH}	$\|I_{OUT}\| < 1\mu A$ $V_{IN} = V_{SS}, V_{DD}$	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}	$\|I_{OUT}\| < 1\mu A$ $V_{IN} = V_{DD}$	5	—	0.05	—	0.00	0.05	—	0.05	
			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} = 4.6V	5	−0.61	—	−0.51	−1.0	—	−0.42	—	mA
		V_{OH} = 2.5V	5	−2.50	—	−2.10	−4.0	—	−1.70	—	
		V_{OH} = 9.5V	10	−1.50	—	−1.30	−2.2	—	−1.10	—	
		V_{OH} = 13.5V	15	−4.00	—	−3.40	−9.0	—	−2.80	—	
		$V_{IN} = V_{SS}, V_{DD}$									
Output Low Current	I_{OL}	V_{OL} = 0.4V	5	0.61	—	0.51	1.5	—	0.42	—	
		V_{OL} = 0.5V	10	1.5	—	1.30	3.8	—	1.10	—	
		V_{OL} = 1.5V	15	4.0	—	3.40	15.0	—	2.80	—	
		$V_{IN} = V_{DD}$									
High Threshold Voltage	V_P	V_{OUT} = 0.5V, 4.5V	5	—	—	2.05	2.8	3.55	—	—	V
		V_{OUT} = 1.0V, 9.0V	10	—	—	4.10	5.3	7.00	—	—	
		V_{OUT} = 1.5V, 13.5V	15	—	—	6.20	7.8	10.40	—	—	
Low Threshold Voltage	V_N	V_{OUT} = 0.5V, 4.5V	5	—	—	1.5	2.3	3.15	—	—	
		V_{OUT} = 1.0V, 9.0V	10	—	—	3.2	4.5	6.30	—	—	
		V_{OUT} = 1.5V, 13.5V	15	—	—	4.8	6.6	9.30	—	—	
Hysteresis Voltage	V_H		5	—	—	0.20	0.5	0.85	—	—	
			10	—	—	0.30	0.8	1.40	—	—	
			15	—	—	0.45	1.2	1.90	—	—	
Input Current "H" Level	I_{IH}	V_{IH} = 18V	18	—	0.1	—	10^{-5}	0.1	—	1.0	μA
Input Current "L" Level	I_{IL}	V_{IL} = 0V	18	—	−0.1	—	-10^{-5}	−0.1	—	−1.0	
Quiescent Supply Current	I_{DD}	$V_{IN} = V_{SS}, V_{DD}$ *	5	—	1	—	0.001	1	—	7.5	μA
			10	—	2	—	0.002	2	—	15.0	
			15	—	4	—	0.004	4	—	30.0	

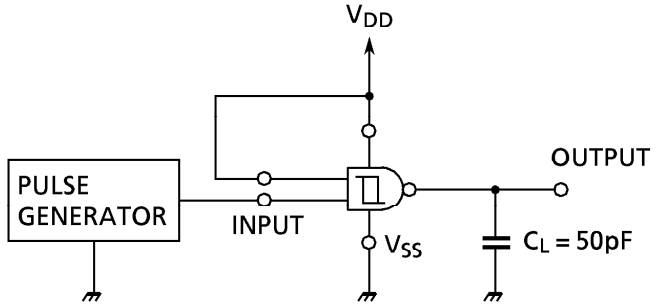
* All valid input combinations.

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

CHARACTERISTIC	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	
		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

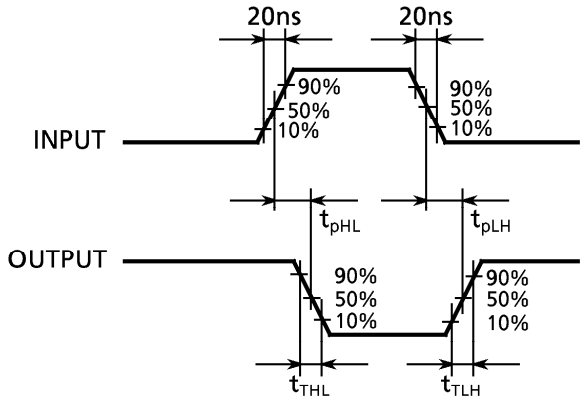
CIRCUIT AND WAVEFORM FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS

CIRCUIT

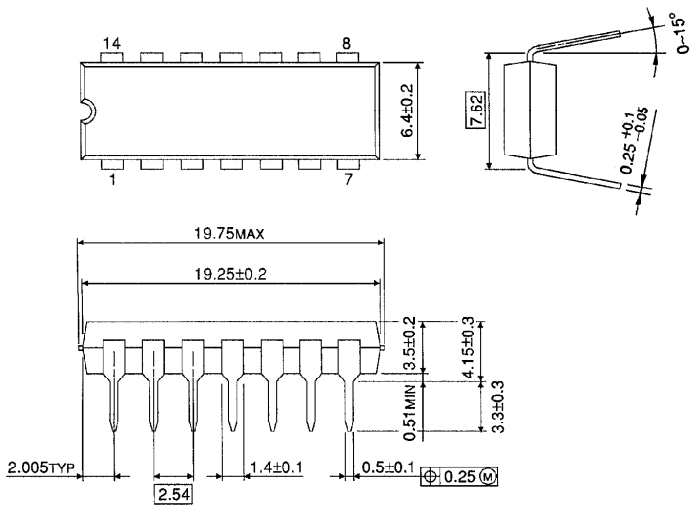


DUTY RATIO = 50%, f = 500kHz

WAVEFORM

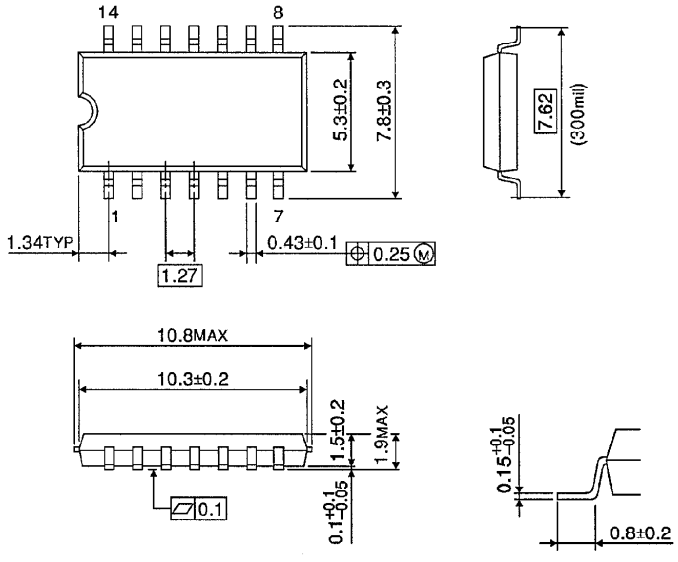


DIP 14PIN OUTLINE DRAWING (DIP14-P-300-2.54) Unit in mm



Weight : 0.96g (Typ.)

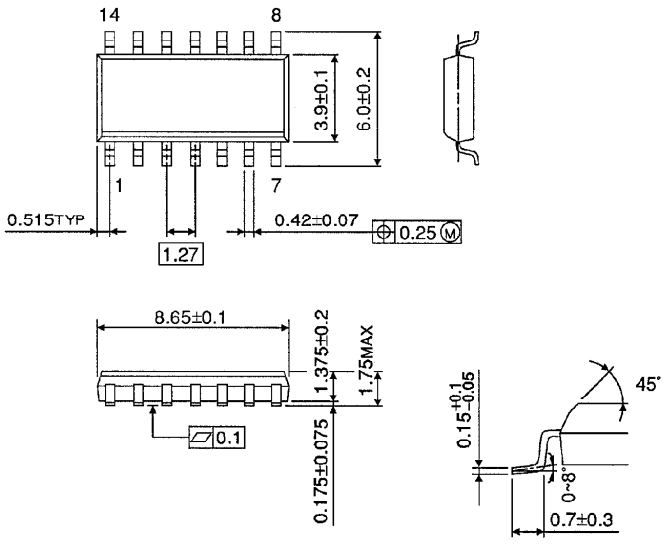
SOP 14PIN (200mil BODY) OUTLINE DRAWING (SOP14-P-300-1.27) Unit in mm



Weight : 0.18g (Typ.)

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.)