

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.

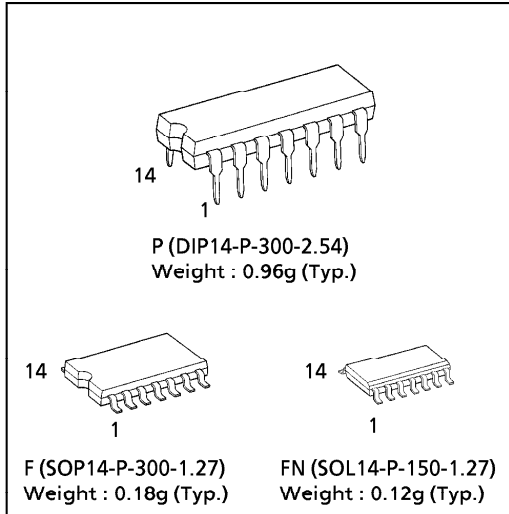
In addition to regular NAND gates.

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

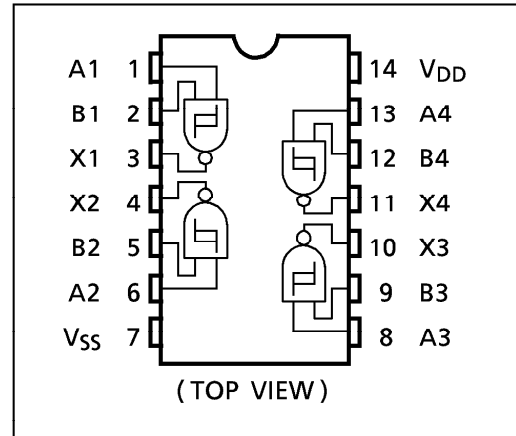
(Note) The JEDEC SOP (FN) is not available in Japan.

MAXIMUM RATINGS

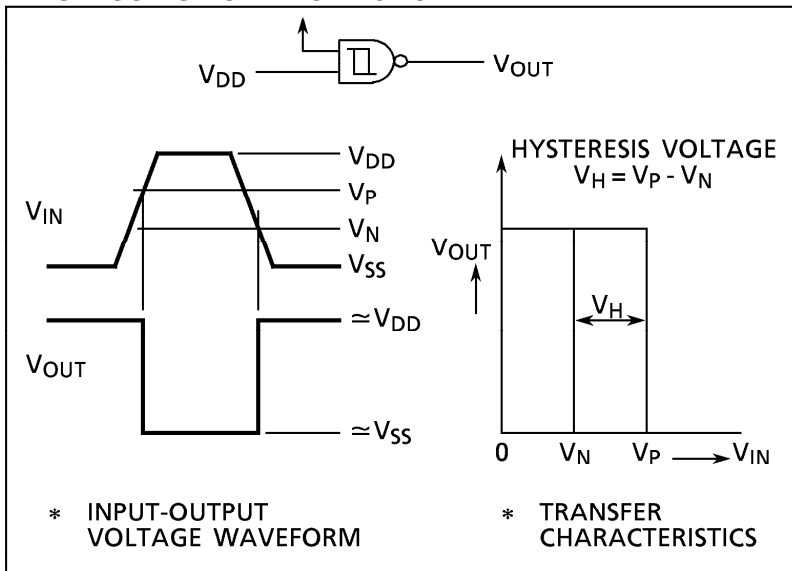
CHARACTERISTIC	SYMBOL	RATING	UNIT
DC Supply Voltage	V_{DD}	$V_{SS} - 0.5 \sim V_{SS} + 20$	V
Input Voltage	V_{IN}	$V_{SS} - 0.5 \sim V_{DD} + 0.5$	V
Output Voltage	V_{OUT}	$V_{SS} - 0.5 \sim V_{DD} + 0.5$	V
DC Input Current	I_{IN}	± 10	mA
Power Dissipation	P_D	300 (DIP) / 180 (SOIC)	mW
Operating Temperature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



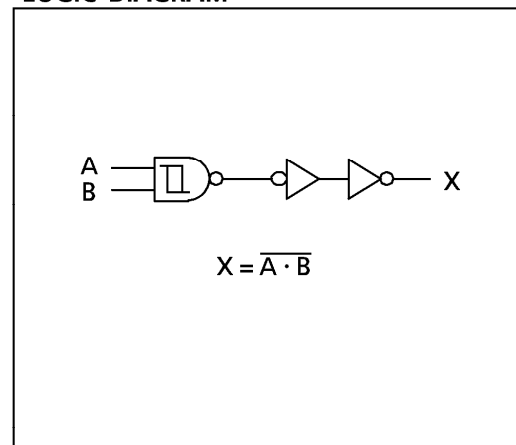
PIN ASSIGNMENT



INPUT - OUTPUT CHARACTERISTIC



LOGIC DIAGRAM



961001EBA2

● TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.

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	SYM-BOL	TEST CONDITION	V _{DD} (V)	- 40°C		25°C			85°C		UNIT	
				MIN.	MAX.	MIN.	TYP.	MAX.	MIN.	MAX.		
High-Level Output Voltage	V _{OH}	I _{OUT} < 1μA 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} < 1μA 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} = 4.6V V _{OH} = 2.5V V _{OH} = 9.5V V _{OH} = 13.5V V _{IN} = V _{SS} , V _{DD}	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 _{OL}	V _{OL} = 0.4V V _{OL} = 0.5V V _{OL} = 1.5V V _{IN} = V _{DD}	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 _P	V _{OUT} = 0.5V, 4.5V V _{OUT} = 1.0V, 9.0V V _{OUT} = 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 _N	V _{OUT} = 0.5V, 4.5V V _{OUT} = 1.0V, 9.0V V _{OUT} = 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 _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} = 18V	18	—	0.1	—	10 ⁻⁵	0.1	—	1.0	μA
	"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.

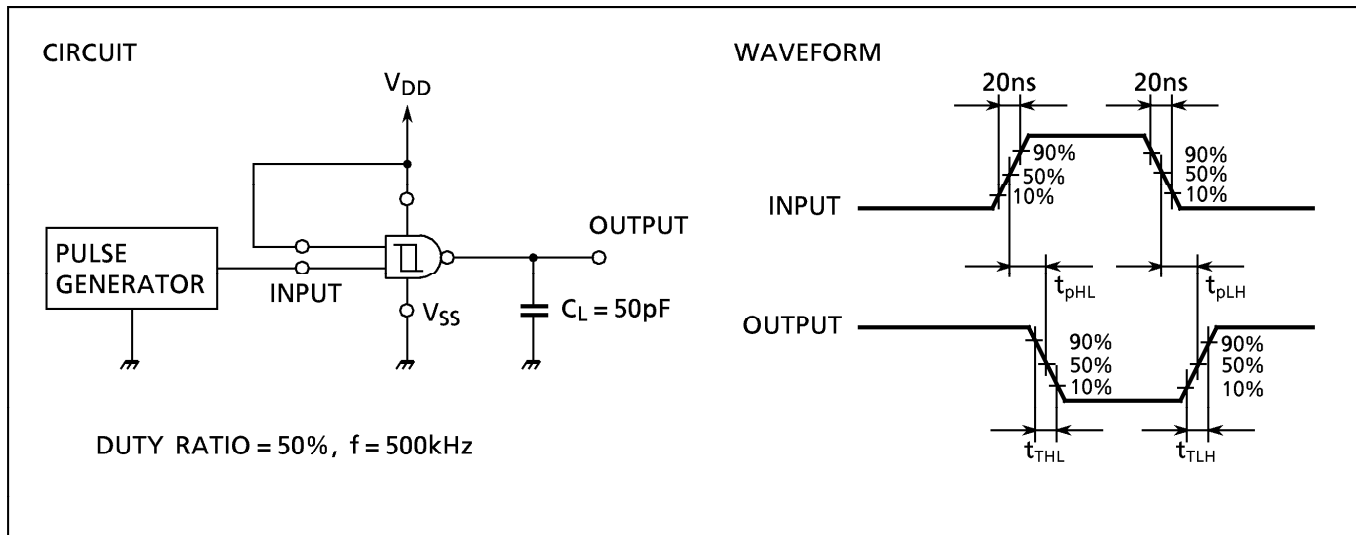
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DYNAMIC ELECTRICAL CHARACTERISTICS (Ta = 25°C, Vss = 0V, CL = 50pF)

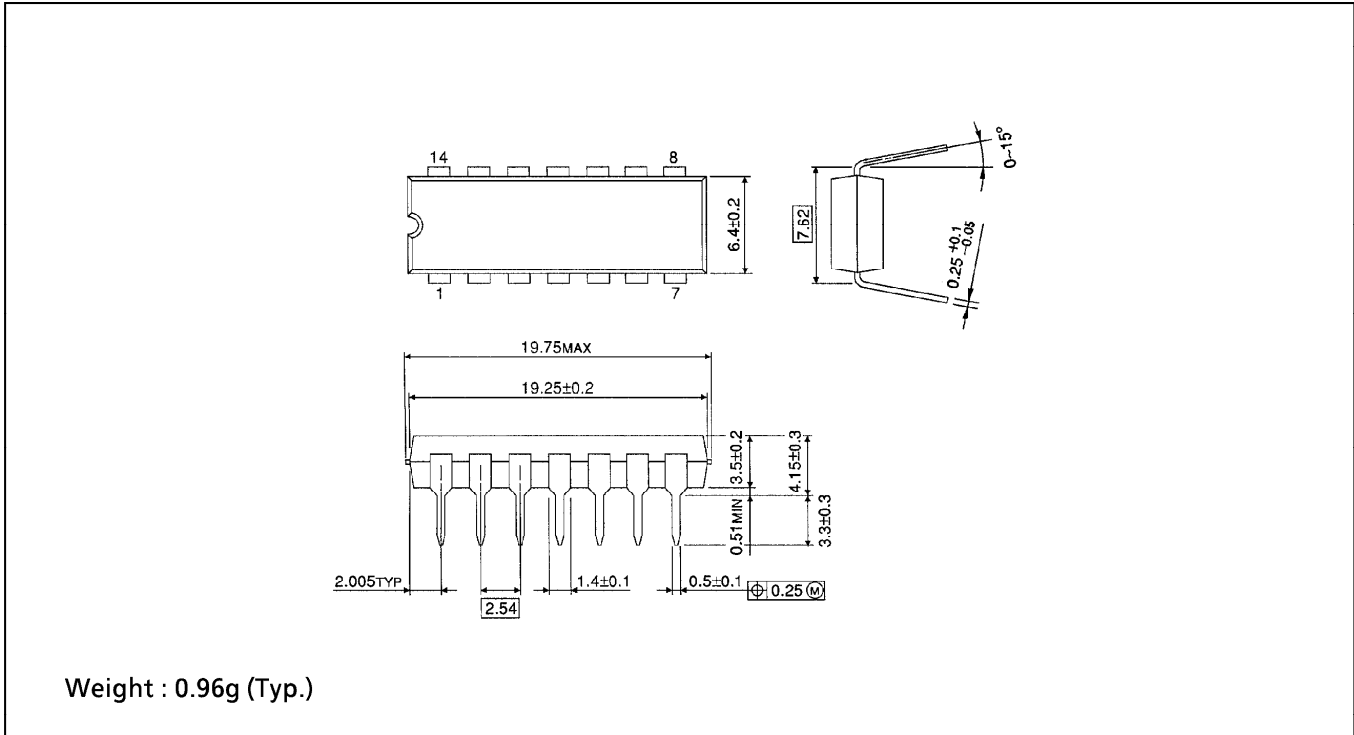
CHARACTERISTIC	SYMBOL	TEST CONDITION	V _{DD} (V)	MIN.	TYP.	MAX.	UNIT
Output Transition Time (Low to High)	t _{TLH}		5	—	80	200	ns
			10	—	50	100	
			15	—	40	80	
Output Transition Time (High to Low)	t _{THL}		5	—	80	200	ns
			10	—	50	100	
			15	—	40	80	
Propagation Delay Time	t _{pLH}		5	—	130	260	ns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

CIRCUIT AND WAVEFORM FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS



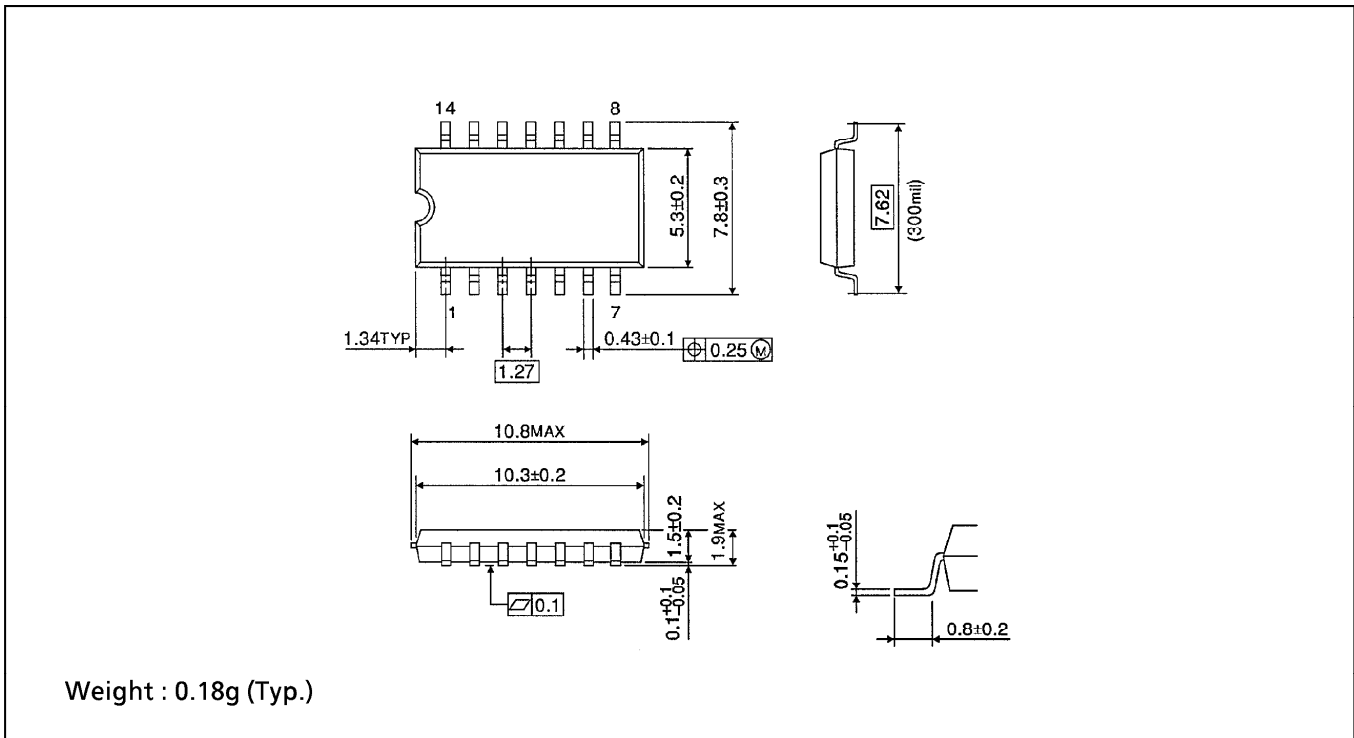
DIP 14PIN OUTLINE DRAWING (DIP14-P-300-2.54)

Unit in mm



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

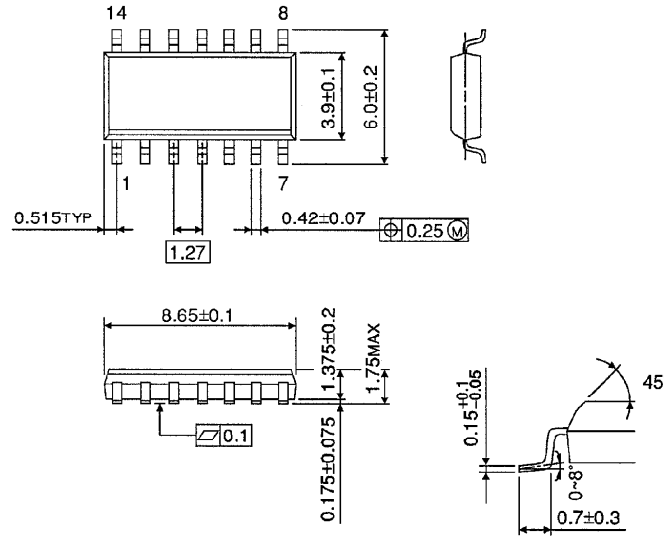
Unit in mm



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.)