

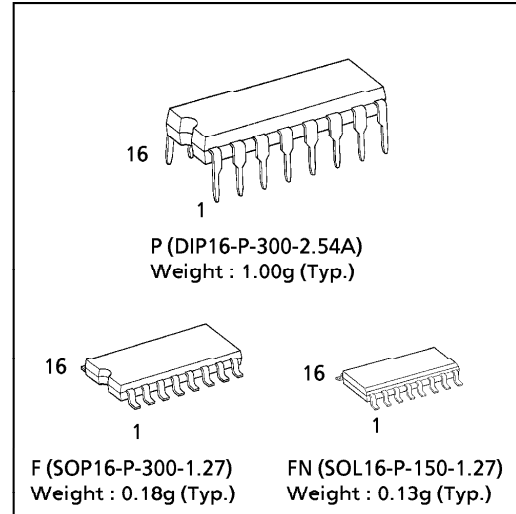
TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

**TC4049BP, TC4049BF, TC4049BFN**  
**TC4050BP, TC4050BF, TC4050BFN**

**TC4049B HEX BUFFER / CONVERTER (Inverting Type)**  
**TC4050B HEX BUFFER / CONVERTER (Non - Inverting Type)**

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

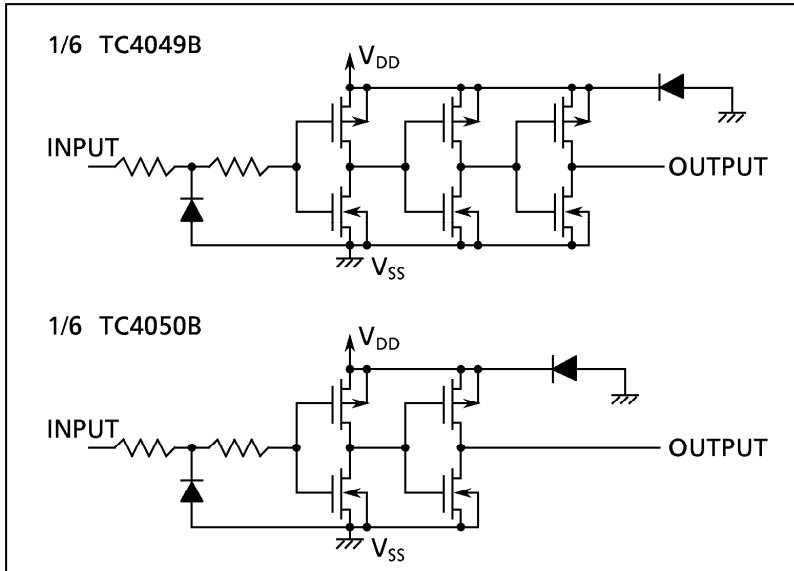
TC4049B, TC4050B contain six circuits of buffers. TC4049B is inverter type and TC4050B is non-inverter type. Since one TTL or DTL can be directly driven having large output current, these are useful for interfacing from CMOS to TTL or DTL. As voltage up to  $V_{SS}+18$  volts can be applied to the input regardless of  $V_{DD}$ , these can be also used as the level converter IC's which converts CMOS logical circuits of 15 volts or 10 volts system to CMOS/TTL logical circuits of 5 volts system. Ideal switching characteristic has been obtained by the circuit diagram of three stage inverters for TC4049B and two stage inverters for TC4050B.



**MAXIMUM RATINGS**

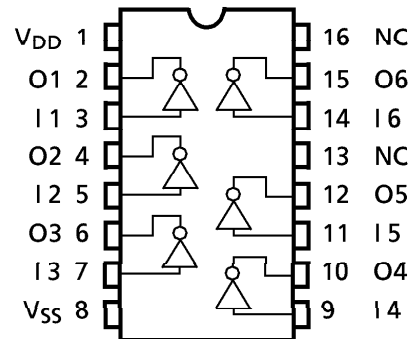
CHARACTERISTIC	SYMBOL	RATING	UNIT
DC Supply Voltage	$V_{DD}$	$V_{SS} - 0.5 \sim V_{SS} + 20$	V
Input Voltage	$V_{IN}$	$V_{SS} - 0.5 \sim V_{SS} + 20$	V
Output Voltage	$V_{OUT}$	$V_{SS} - 0.5 \sim V_{DD} + 0.5$	V
DC Input Current	$I_{IN}$	$\pm 10$	mA
Power Dissipation	$P_D$	300 (DIP) / 180 (SOIC)	mW
Operating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

**CIRCUIT DIAGRAM**

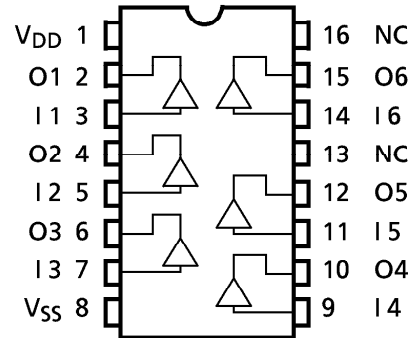


**PIN ASSIGNMENT**

**TC4049B**



**TC4050B**



(TOP VIEW)

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● 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<sub>SS</sub> = 0V)**

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
DC Supply Voltage	V <sub>DD</sub>		3	—	18	V
Input Voltage	V <sub>IN</sub>		0	—	18	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>SS</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	-0.73	—	-0.65	-1.2	—	-0.58	—	mA	
			5	-2.40	—	-2.10	-3.9	—	-1.90	—		
			10	-1.80	—	-1.65	-2.5	—	-1.35	—		
			15	-4.80	—	-4.30	-8.0	—	-3.50	—		
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>SS</sub> , V <sub>DD</sub>	5	3.8	—	3.2	6.4	—	2.9	—	mA	
			10	9.6	—	8.0	16.0	—	6.6	—		
			15	28.0	—	24.0	48.0	—	20.0	—		
			—	—	—	—	—	—	—	—		
Input High Voltage	V <sub>IH</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  I <sub>OUT</sub>   < 1μA	5	3.5	—	3.5	2.75	—	3.5	—	V	
			10	7.0	—	7.0	5.50	—	7.0	—		
			15	11.0	—	11.0	8.25	—	11.0	—		
			—	—	—	—	—	—	—	—		
Input Low Voltage	V <sub>IL</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  I <sub>OUT</sub>   < 1μA	5	—	1.5	—	2.25	1.5	—	1.5	V	
			10	—	3.0	—	4.50	3.0	—	3.0		
			15	—	4.0	—	6.75	4.0	—	4.0		
			—	—	—	—	—	—	—	—		
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	—	0.002	1	—	30	μA	
			10	—	2	—	0.004	2	—	60		
			15	—	4	—	0.008	4	—	120		

\* All valid input combinations.

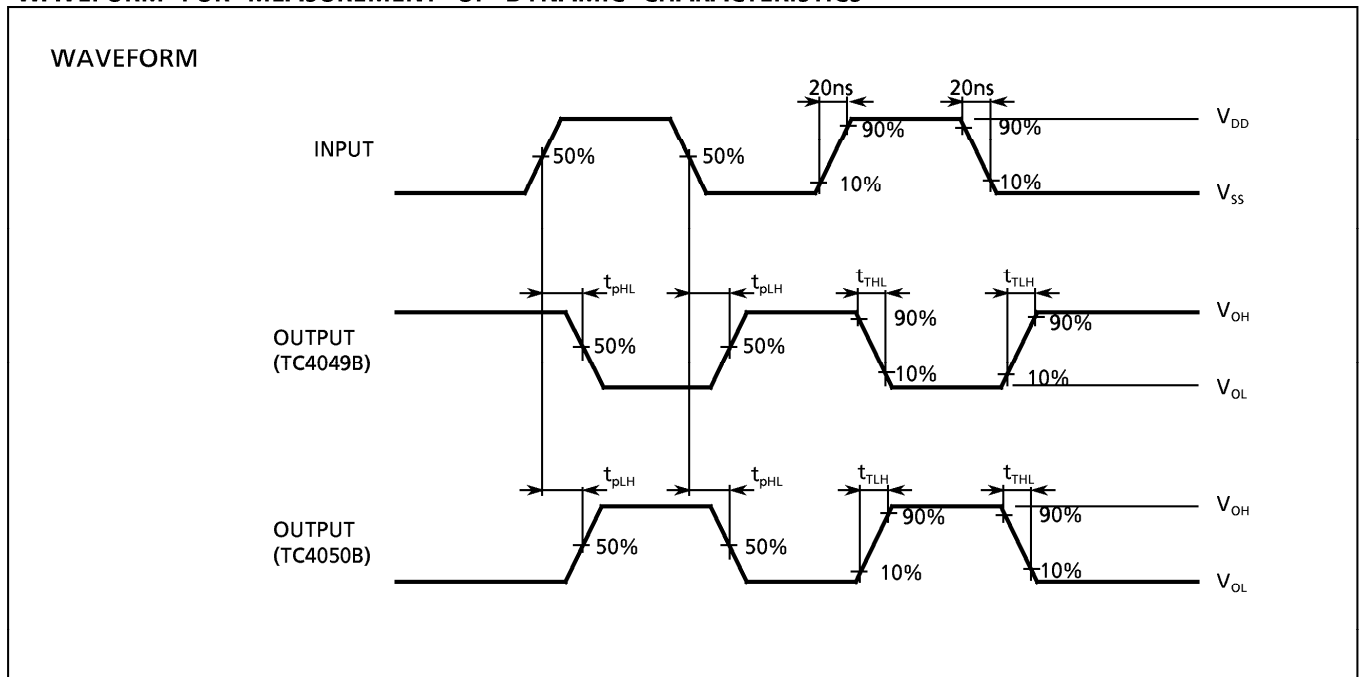
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**DYNAMIC ELECTRICAL CHARACTERISTICS (Ta = 25°C, Vss = 0V, CL = 50pF)**

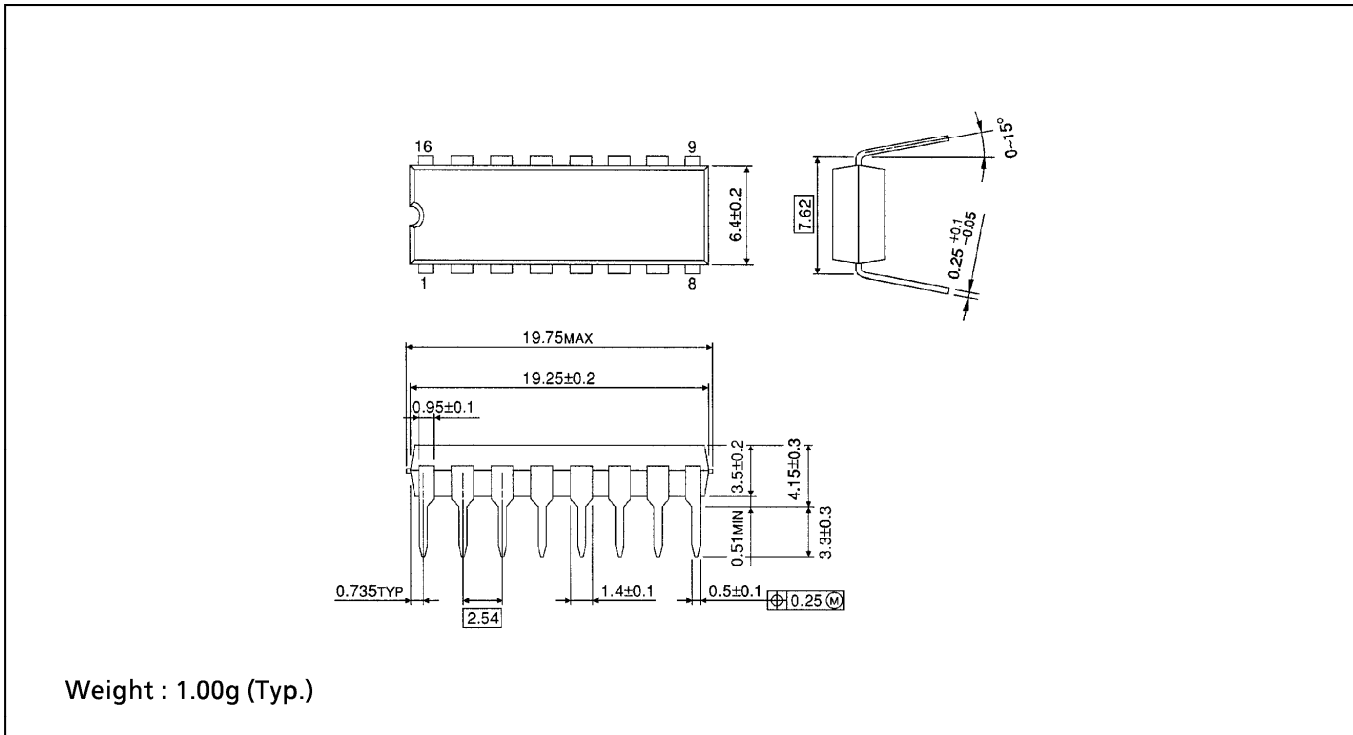
CHARACTERISTIC		SYMBOL	TEST CONDITION	V <sub>DD</sub> (V)	MIN.	TYP.	MAX.	UNIT
Output Transition Time (Low to High)	t <sub>TLH</sub>			5	—	60	160	ns
				10	—	30	80	
				15	—	25	60	
Output Transition Time (High to Low)	t <sub>THL</sub>			5	—	120	60	ns
				10	—	10	40	
				15	—	8	30	
TC4049B	Propagation Delay Time (Low to High)	t <sub>pLH</sub>		5	—	60	120	ns
				10	—	35	65	
TC4049B	Propagation Delay Time (High to Low)	t <sub>pHL</sub>		5	—	40	60	ns
				10	—	20	30	
TC4050B	Propagation Delay Time (Low to High)	t <sub>pLH</sub>		5	—	50	130	ns
				10	—	30	70	
TC4050B	Propagation Delay Time (High to Low)	t <sub>pHL</sub>		5	—	30	70	ns
				10	—	17	35	
Input Capacitance		C <sub>IN</sub>			—	5	7.5	pF

**WAVEFORM FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS**



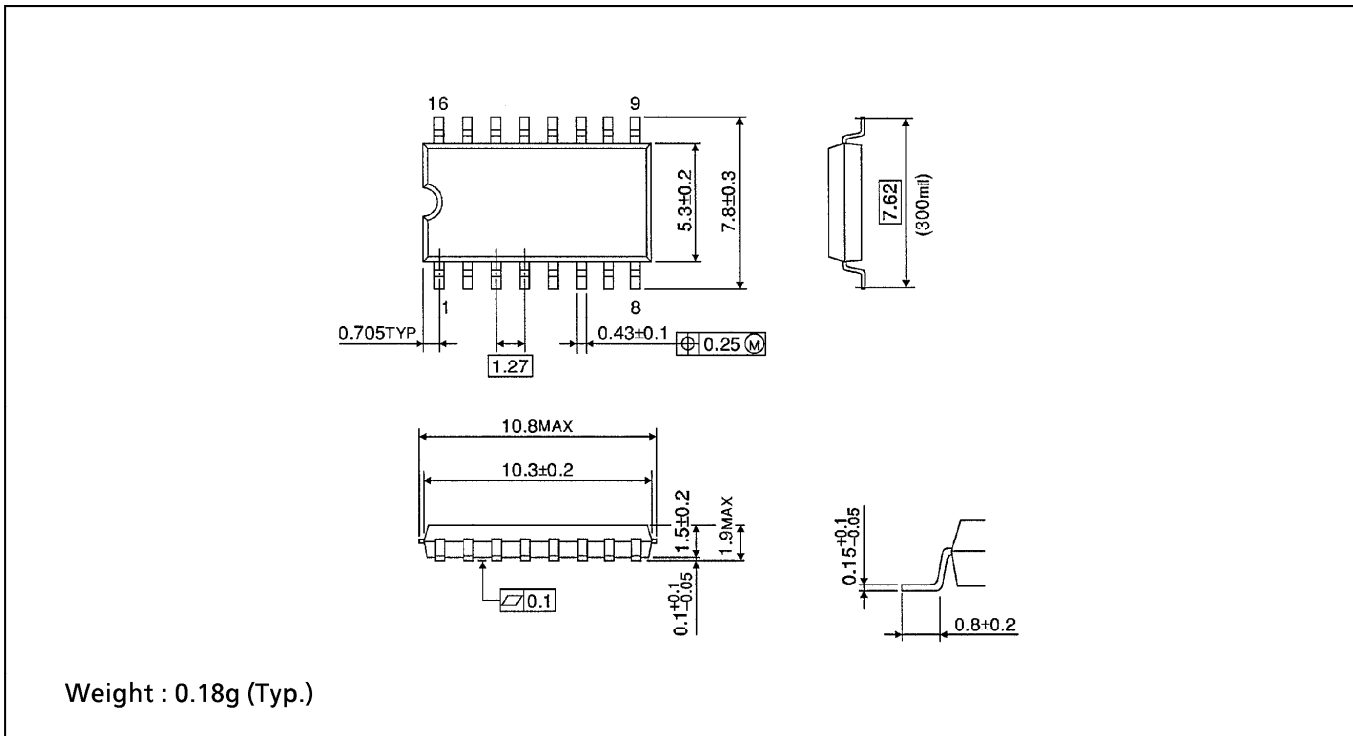
**DIP 16PIN OUTLINE DRAWING (DIP16-P-300-2.54A)**

Unit in mm



**SOP 16PIN (200mil BODY) OUTLINE DRAWING (SOP16-P-300-1.27)**

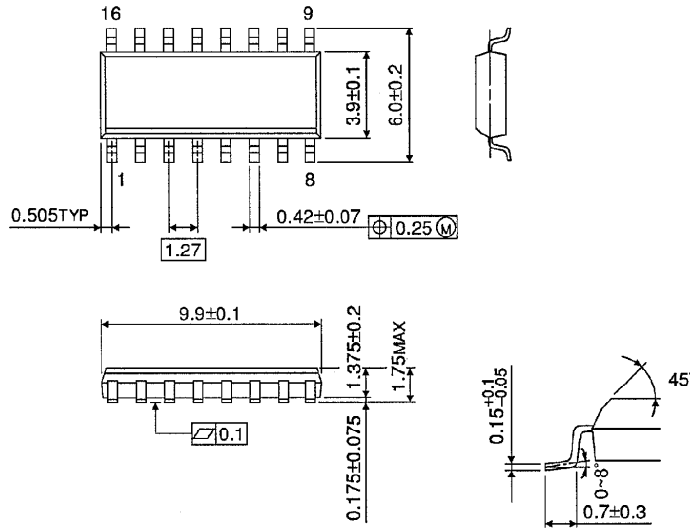
Unit in mm



**SOP 16PIN (150mil BODY) OUTLINE DRAWING (SOL16-P-150-1.27)**

Unit in mm

(Note) This package is not available in Japan.



Weight : 0.13g (Typ.)