

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

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

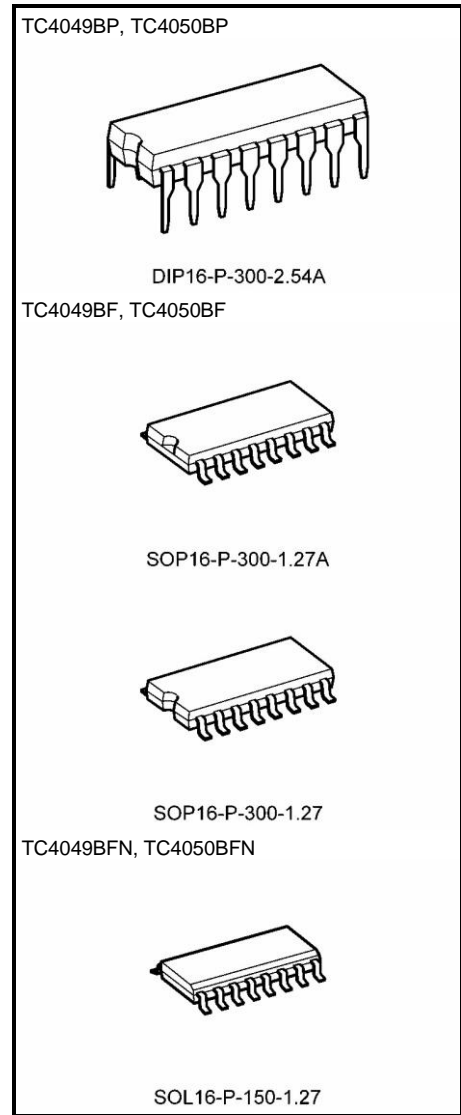
TC4049B Hex Buffer/Converter (inverting type)
TC4050B Hex Buffer/Converter (non-inverting type)

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.

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

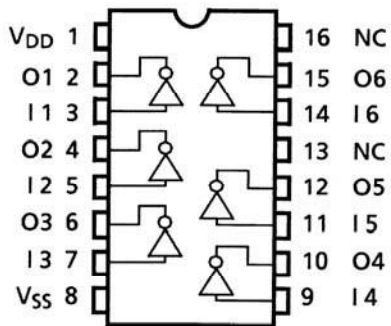


Weight

DIP16-P-300-2.54A	: 1.00 g (typ.)
SOP16-P-300-1.27A	: 0.18 g (typ.)
SOP16-P-300-1.27	: 0.18 g (typ.)
SOL16-P-150-1.27	: 0.13 g (typ.)

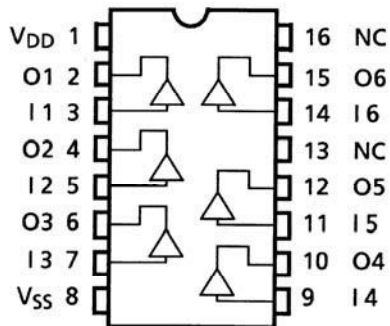
Pin Assignment

TC4049B



(TOP VIEW)

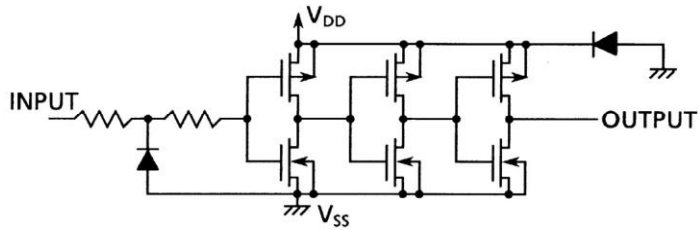
TC4050B



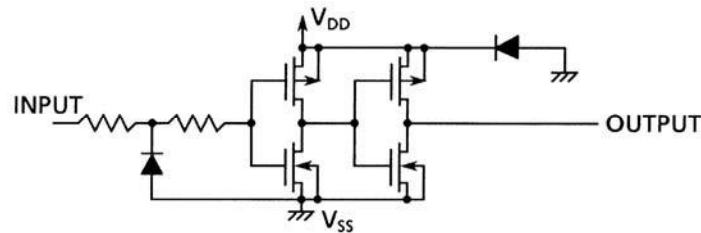
(TOP VIEW)

Circuit Diagram

1/6 TC4049B



1/6 TC4050B



Absolute Maximum Ratings (Note)

Characteristics	Symbol	Rating	Unit
DC supply voltage	VDD	$V_{SS} - 0.5 \sim V_{SS} + 20$	V
Input voltage	VIN	$V_{SS} - 0.5 \sim V_{SS} + 20$	V
Output voltage	VOU	$V_{SS} - 0.5 \sim V_{DD} + 0.5$	V
DC input current	IIN	± 10	mA
Power dissipation	PD	300 (DIP)/180 (SOIC)	mW
Operating temperature range	Topr	-40~85	°C
Storage temperature range	Tstg	-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 (VSS = 0 V) (Note)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
DC supply voltage	VDD	—	3	—	18	V
Input voltage	VIN	—	0	—	18	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	Symbol	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} < 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 _{SS} , 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	-0.73	—	-0.65	-1.2	—	-0.58	—	mA	
		V _{OH} = 2.5 V	5	-2.40	—	-2.10	-3.9	—	-1.90	—		
		V _{OH} = 9.5 V	10	-1.80	—	-1.65	-2.5	—	-1.35	—		
		V _{OH} = 13.5 V	15	-4.80	—	-4.30	-8.0	—	-3.50	—		
		V _{IN} = V _{SS} , V _{DD}										
Output low current	I _{OL}	V _{OL} = 0.4 V	5	3.8	—	3.2	6.4	—	2.9	—	mA	
		V _{OL} = 0.5 V	10	9.6	—	8.0	16.0	—	6.6	—		
		V _{OL} = 1.5 V	15	28.0	—	24.0	48.0	—	20.0	—		
		V _{IN} = V _{SS} , V _{DD}										
Input high voltage	V _{IH}	V _{OUT} = 0.5 V, 4.5 V	5	3.5	—	3.5	2.75	—	3.5	—	V	
		V _{OUT} = 1.0 V, 9.0 V	10	7.0	—	7.0	5.50	—	7.0	—		
		V _{OUT} = 1.5 V, 13.5 V	15	11.0	—	11.0	8.25	—	11.0	—		
		I _{OUT} < 1 μA										
Input low voltage	V _{IL}	V _{OUT} = 0.5 V, 4.5 V	5	—	1.5	—	2.25	1.5	—	1.5	V	
		V _{OUT} = 1.0 V, 9.0 V	10	—	3.0	—	4.50	3.0	—	3.0		
		V _{OUT} = 1.5 V, 13.5 V	15	—	4.0	—	6.75	4.0	—	4.0		
		I _{OUT} < 1 μA										
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	—	0.002	1	—	30	μA	
			10	—	2	—	0.004	2	—	60		
			15	—	4	—	0.008	4	—	120		

Note: All valid input combinations.

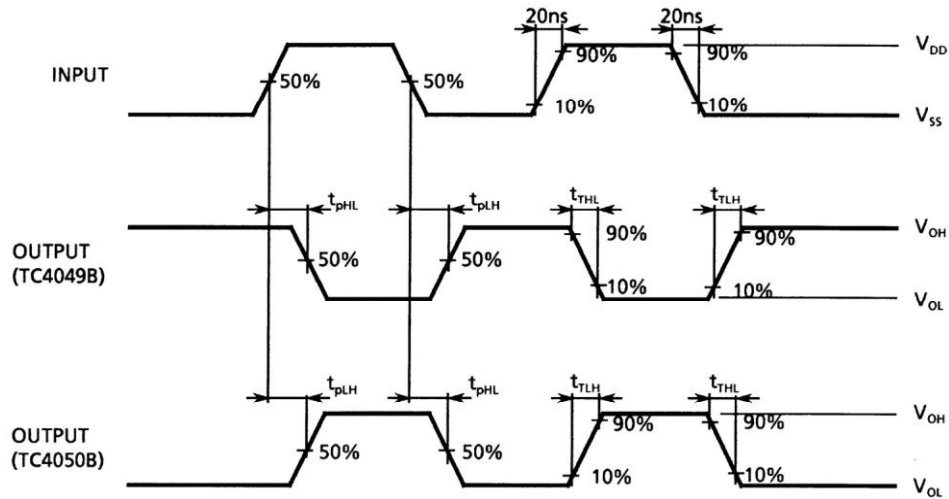
Dynamic Electrical Characteristics (T_a = 25°C, V_{SS} = 0 V, C_L = 50 pF)

Characteristics	Symbol	Test Condition	V _{DD} (V)	Min	Typ.	Max	Unit
Output transition time (low to high)	t _{TLH}	—	5	—	60	160	ns
			10	—	30	80	
			15	—	25	60	

Output transition time (high to low)		t_{THL}	—	5 10 15	— — —	120 10 8	60 40 30	ns
TC4049B	Propagation delay time (low to high)	t_{pLH}	—	5 10 15	— — —	60 35 30	120 65 50	ns
	Propagation delay time (high to low)	t_{pHL}	—	5 10 15	— — —	40 20 15	60 30 20	ns
TC4050B	Propagation delay time (low to high)	t_{pLH}	—	5 10 15	— — —	50 30 25	130 70 55	ns
	Propagation delay time (high to low)	t_{pHL}	—	5 10 15	— — —	30 17 14	70 35 25	ns
Input capacitance		C_{IN}	—	—	—	5	7.5	pF

Waveform for Measurement of Dynamic Characteristics

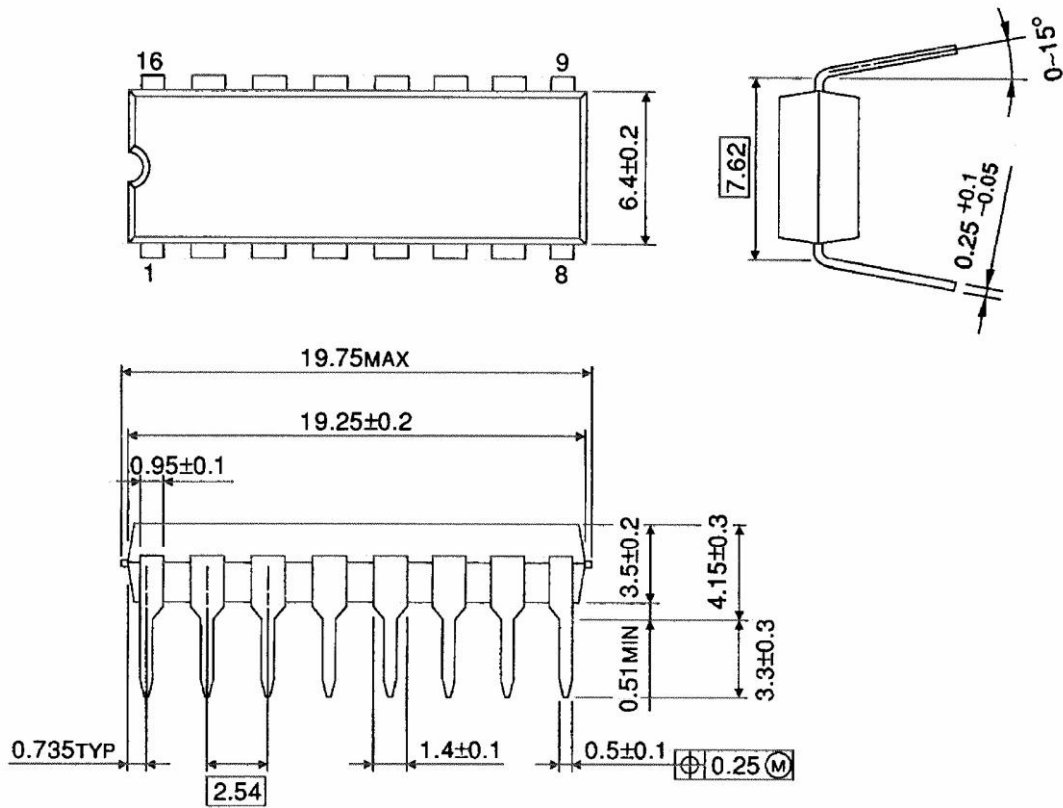
Waveform



Package Dimensions

DIP16-P-300-2.54A

Unit : mm

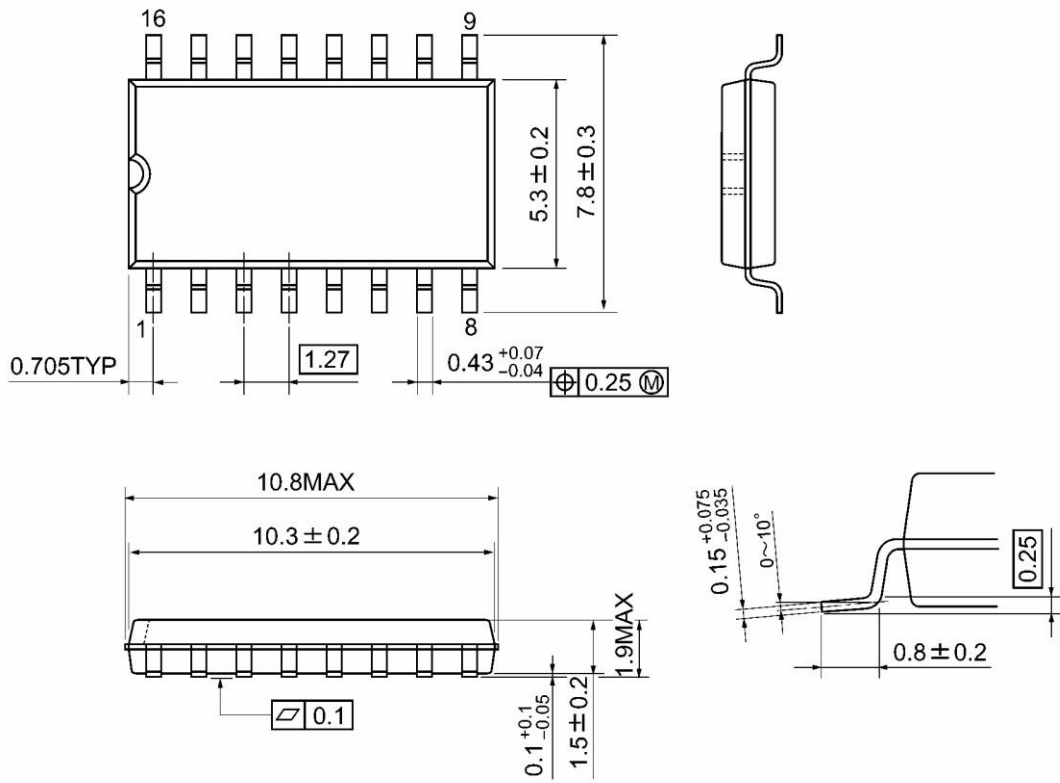


Weight: 1.00 g (typ.)

Package Dimensions

SOP16-P-300-1.27A

Unit: mm

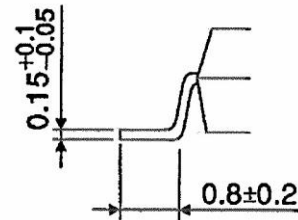
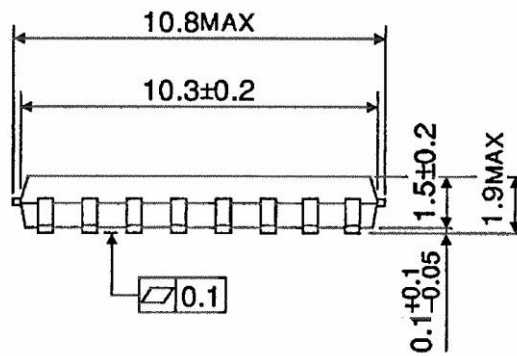
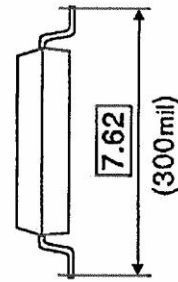
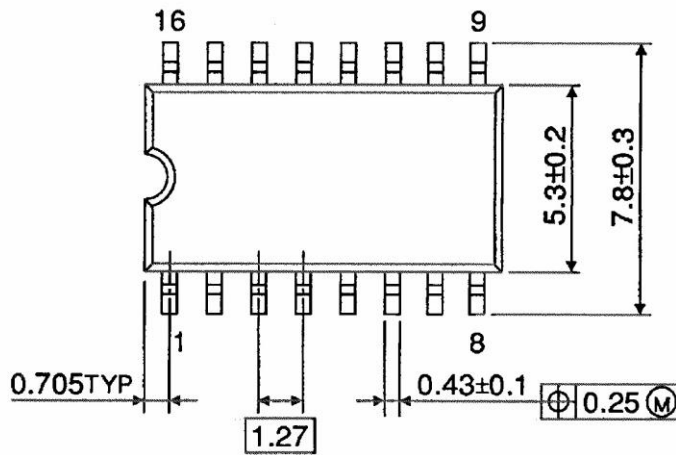


Weight: 0.18 g (typ.)

Package Dimensions

SOP16-P-300-1.27

Unit : mm

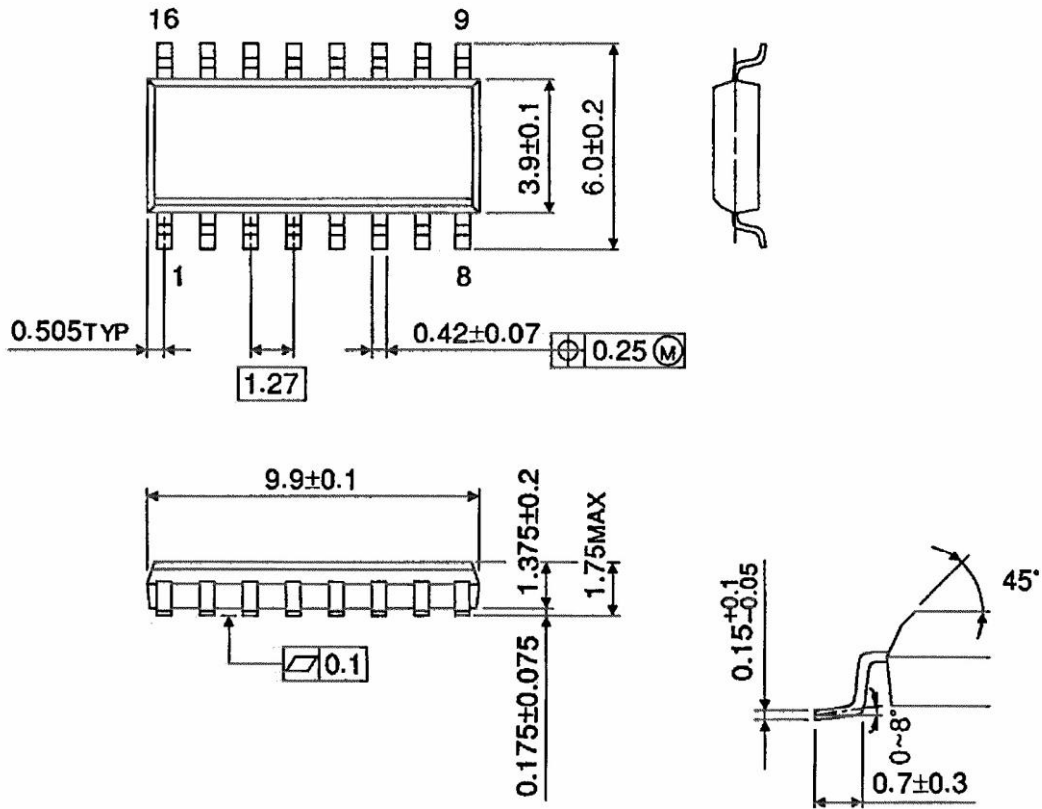


Weight: 0.18 g (typ.)

Package Dimensions (Note)

SOL16-P-150-1.27

Unit : mm



Note: This package is not available in Japan.

Weight: 0.13 g (typ.)

Note: Lead (Pb)-Free Packages DIP16-P-300-2.54A SOP16-P-300-1.27A SOL16-P-150-1.27

RESTRICTIONS ON PRODUCT USE

060116EBA

- The information contained herein is subject to change without notice. 021023_D
- TOSHIBA is continually working to improve the quality and 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 comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products 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 TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc. 021023_A
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk. 021023_B
- The products described in this document shall not be used or embedded to any downstream products of which manufacture, use and/or sale are prohibited under any applicable laws and regulations. 060106_Q
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA for any infringements of patents or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of TOSHIBA or others. 021023_C
- The products described in this document are subject to the foreign exchange and foreign trade laws. 021023_E