

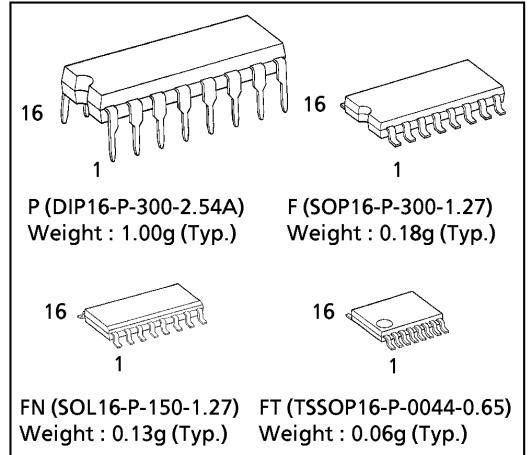
### TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

**TC4051BP, TC4051BF, TC4051BFN, TC4051BFT**  
**TC4052BP, TC4052BF, TC4052BFN, TC4052BFT**  
**TC4053BP, TC4053BF, TC4053BFN, TC4053BFT**

**TC4051B SINGLE 8-CHANNEL MULTIPLEXER / DEMULTIPLEXER**  
**TC4052B DIFFERENTIAL 4-CHANNEL MULTIPLEXER / DEMULTIPLEXER**  
**TC4053B TRIPLE 2-CHANNEL MULTIPLEXER / DEMULTIPLEXER**

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

TC4051B, TC4052B and TC4053B are multiplexers with capabilities of selection and mixture of analog signal and digital signal. TC4051B has 8 channels configuration. TC4052B has 4 channel×2 configuration and TC4053B has 2 channel×3 configuration. The digital signal to the control terminal turns "ON" the corresponding switch of each channel, with large amplitude ( $V_{DD}-V_{EE}$ ) can be switched by the control signal with small logical amplitude ( $V_{DD}-V_{SS}$ ). For example, in the case of  $V_{DD}=5V$ ,  $V_{SS}=0V$  and  $V_{EE}=-5V$ , signals between  $-5V$  and  $+5V$  can be switched from the logical circuit with single power supply of 5 volts. As the ON-resistance of each switch is low, these can be connected to the circuits with low input impedance.



### MAXIMUM RATINGS

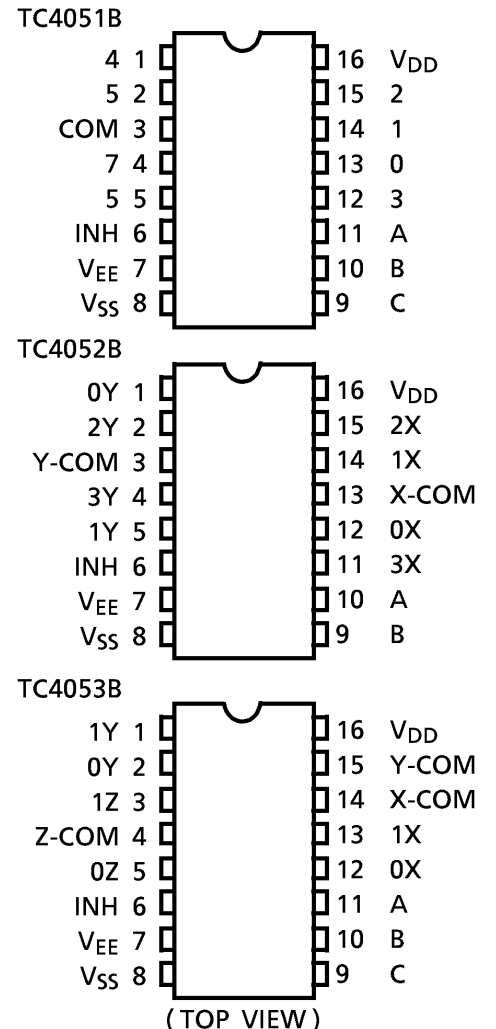
CHARACTERISTIC	SYMBOL	RATING	UNIT
DC Supply Voltage	$V_{DD} - V_{SS}$	- 0.5~20	V
DC Supply Voltage	$V_{DD} - V_{EE}$	- 0.5~20	V
Control Input Voltage	$V_{CIN}$	$V_{SS} - 0.5 \sim V_{DD} + 0.5$	V
Switch I/O Voltage	$V_I / V_O$	$V_{EE} - 0.5 \sim V_{DD} + 0.5$	V
Control Input Current	$I_{CIN}$	$\pm 10$	mA
Potential difference across I/O during ON	$V_I - V_O$	- 0.5~0.5	V
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

### TRUTH TABLE

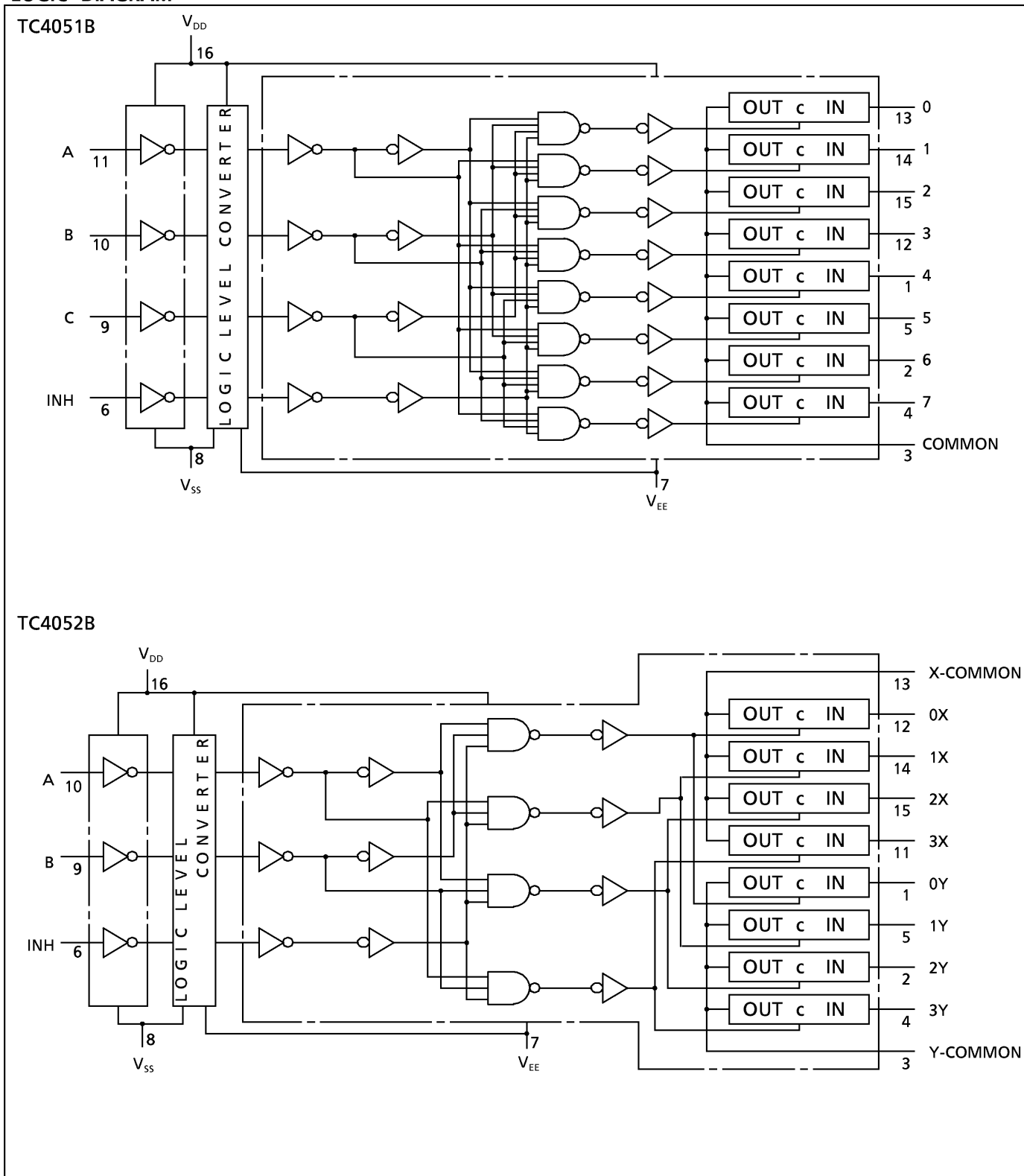
CONTROL INPUTS				"ON" CHANNEL		
INHIBIT	$C\triangle$	B	A	TC4051B	TC4052B	TC4053B
L	L	L	L	0	0X, 0Y	0X, 0Y, 0Z
L	L	L	H	1	1X, 1Y	1X, 0Y, 0Z
L	L	H	L	2	2X, 2Y	0X, 1Y, 0Z
L	L	H	H	3	3X, 3Y	1X, 1Y, 0Z
L	H	L	L	4	—	0X, 0Y, 1Z
L	H	L	H	5	—	1X, 0Y, 1Z
L	H	H	L	6	—	0X, 1Y, 1Z
L	H	H	H	7	—	1X, 1Y, 1Z
H	*	*	*	NONE	NONE	NONE

\* : Don't Care     $\triangle$  Except TC4052B

### PIN ASSIGNMENT

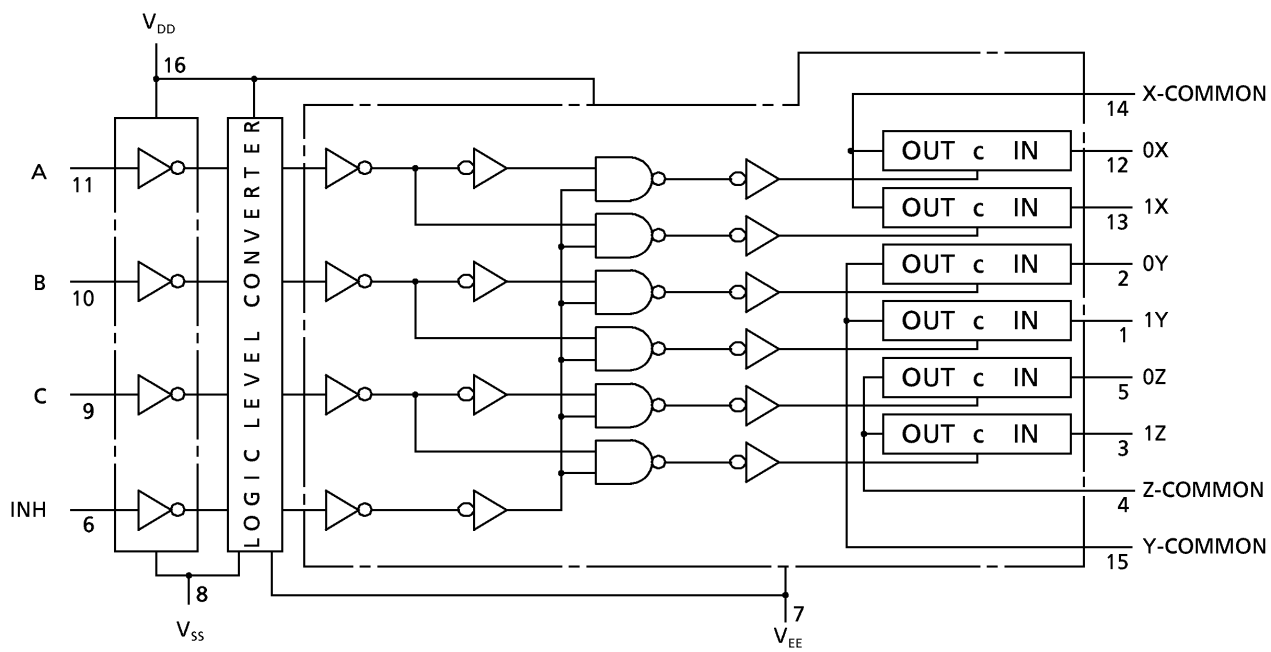


## LOGIC DIAGRAM



LOGIC DIAGRAM

TC4053B



TRUTH TABLE

CONTROL C	Impedance Between IN-OUT*
H	$0.5 \sim 5 \times 10^2 \Omega$
L	$> 10^9 \Omega$

\* See Electrical Characteristics

## RECOMMENDED OPERATING CONDITIONS

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
DC Supply Voltage	$V_{DD}-V_{SS}$		3	—	18	V
	$V_{DD}-V_{EE}$		3	—	18	
Control Input Voltage	$V_{IN}$		$V_{SS}$	—	$V_{DD}$	V
Input / Output Voltage	$V_{IN} / V_{OUT}$		$V_{EE}$	—	$V_{DD}$	V

## STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	SYM-BOL	TEST CONDI-TION	V <sub>SS</sub> (V)	V <sub>EE</sub> (V)	V <sub>DD</sub> (V)	- 40°C		25°C			85°C		UNIT
						MIN.	MAX.	MIN.	TYP.	MAX.	MIN.	MAX.	
Control Input High Voltage	V <sub>IH</sub>	V <sub>IS</sub> = V <sub>DD</sub> thru 1kΩ	V <sub>EE</sub> = V <sub>SS</sub> R <sub>L</sub> = 1kΩ to V <sub>SS</sub>		5	3.5	—	3.5	2.75	—	3.5	—	V
Control Input Low Voltage	V <sub>IL</sub>		I <sub>IS</sub> < 2μA on all OFF channels	10	7.0	—	7.0	5.50	—	7.0	—		
				15	11.0	—	11.0	8.25	—	11.0	—		
				5	—	1.5	—	2.25	1.5	—	1.5		
On-State Resistance	R <sub>ON</sub>		0 ≤ V <sub>IS</sub> ≤ V <sub>DD</sub> R <sub>L</sub> = 10kΩ	10	—	3.0	—	4.5	3.0	—	3.0		
				15	—	4.0	—	6.75	4.0	—	4.0		
		5		—	850	—	240	950	—	1200			
△On-State Resistance Between Any 2 Switches	R <sub>ON</sub> △	0	0	5	—	—	—	10	—	—	—	Ω	
		0	0	10	—	—	—	6	—	—	—		
		0	0	15	—	—	—	4	—	—	—		
Input / Output Leakage Current	I <sub>OFF</sub>	V <sub>IN</sub> = 18V, V <sub>OUT</sub> = 0V V <sub>IN</sub> = 0V, V <sub>OUT</sub> = 18V			18	—	± 100	—	± 0.01	± 100	—	± 1000	nA
				18	—	± 100	—	± 0.01	± 100	—	± 1000		
Quiescent Supply Current	I <sub>DD</sub>	V <sub>IN</sub> = V <sub>SS</sub> , V <sub>DD</sub> *			5	—	5.0	—	0.005	5.0	—	150	μA
Input Current	I <sub>IN</sub>	V <sub>IH</sub> = 18V V <sub>IL</sub> = 0V			10	—	10	—	0.010	10	—	300	
					15	—	20	—	0.015	20	—	600	
Input Capacitance	C <sub>IN</sub>				18	—	0.1	—	10 <sup>-5</sup>	0.1	—	1.0	
					18	—	-0.1	—	- 10 <sup>-5</sup>	-0.1	—	- 1.0	
Switch Input Capacitance	C <sub>IN</sub>					—	—	—	5	7.5	—	—	pF
Output Capacitance	C <sub>OUT</sub>					—	—	—	10	—	—	—	
Feedthrough Capacitance	C <sub>IN</sub> - C <sub>OUT</sub>	TC4051B			10	—	—	—	58	—	—	—	
		TC4052B			10	—	—	—	30	—	—	—	
		TC4053B			10	—	—	—	17	—	—	—	
Feedthrough Capacitance	C <sub>IN</sub> - C <sub>OUT</sub>	TC4051B											
		TC4052B											
		TC4053B											

\* All valid input combinations.

## DYNAMIC ELECTRICAL CHARACTERISTICS (Ta = 25°C, CL = 50pF)

CHARACTERISTIC	SYMBOL	TEST CONDITION	V <sub>SS</sub> (V)	V <sub>EE</sub> (V)	V <sub>DD</sub> (V)	MIN.	TYP.	MAX.	UNIT
Phase Difference Between Input to Output	$\phi_I - O$		0 0 0	0 0 0	5 10 15	— — —	15 8 6	45 20 15	ns
Propagation Delay Time (A, B, C, - OUT)	$t_{pZL}$	$R_L = 1k\Omega$	0	0	5	—	170	550	
	$t_{pZH}$		0	0	10	—	90	240	
	$t_{pLZ}$		0	0	15	—	70	160	
	$t_{pHZ}$		0	-5	5	—	100	240	
	$t_{pHZ}$		0	-7.5	7.5	—	80	160	
Propagation Delay Time (INH - OUT)	$t_{pZL}$	$R_L = 1k\Omega$	0	0	5	—	120	380	
	$t_{pZH}$		0	0	10	—	60	200	
	$t_{pLZ}$		0	0	15	—	50	160	
	$t_{pHZ}$		0	-5	5	—	80	200	
	$t_{pHZ}$		0	-7.5	7.5	—	60	160	
Propagation Delay Time (INH - OUT)	$t_{pLZ}$	$R_L = 1k\Omega$	0	0	5	—	170	450	
	$t_{pZH}$		0	0	10	—	90	210	
	$t_{pLZ}$		0	0	15	—	70	160	
	$t_{pHZ}$		0	-5	5	—	100	210	
	$t_{pHZ}$		0	-7.5	7.5	—	80	160	
- 3dB Cutoff Frequency TC4051B TC4052B TC4053B	$f_{MAX}$ (I - O)	$R_L = 1k\Omega$ (*1)	-5 -5 -5	-5 -5 -5	5 5 5	— — —	20 30 40	— — —	MHz
Total Harmonic Distortion	—	$R_L = 10k\Omega$ $f = 1kHz$ (*2)	-2.5 -5 -7.5	-2.5 -5 -7.5	2.5 5 7.5	— — —	0.15 0.03 0.02	— — —	%
- 50dB Feedthrough (SWITCH OFF)	—	$R_L = 1k\Omega$ (*3)	-5	-5	5	—	500	—	kHz
Crosstalk	—	$R_L = 1k\Omega$ (*4)	-5	-5	5	—	1.5	—	MHz
Crosstalk (CONTROL - OUT)	—	$R_{IN} = 1k\Omega$ $R_{OUT} = 10k\Omega$ $C_L = 15pF$	0 0 0	0 0 0	5 10 15	— — —	200 400 600	— — —	mV

\*1 Sine wave of  $\pm 2.5V_{p-p}$  shall be used for  $V_{is}$  and the frequency of  $20 \log 10 \frac{V_{OS}}{V_{is}} = -3dB$  shall be  $f_{MAX}$ .

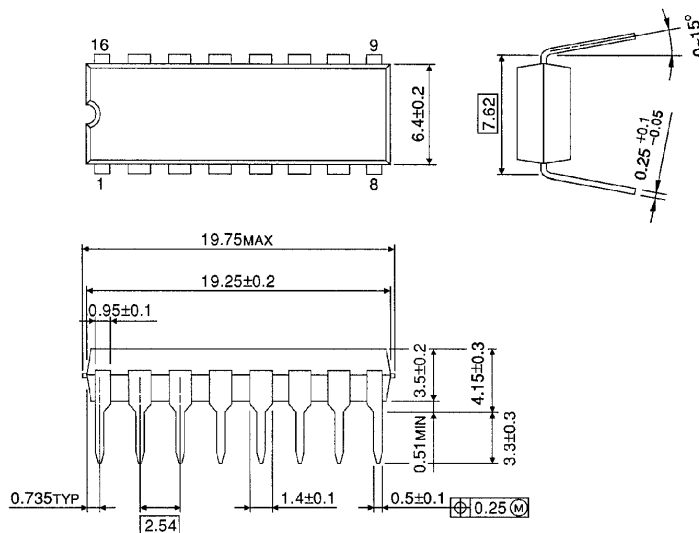
\*2  $V_{is}$  shall be sine wave of  $\pm \left( \frac{V_{DD} - V_{EE}}{4} \right) p-p$ .

\*3 Sine wave of  $\pm 2.5V_{p-p}$  shall be used for  $V_{is}$  and the frequency of  $20 \log 10 \frac{V_{OS}}{V_{is}} = -50dB$  shall be feed-through.

\*4 Sine wave of  $\pm 2.5V_{p-p}$  shall be used for  $V_{is}$  and the frequency of  $20 \log 10 \frac{V_{OS}}{V_{is}} = -50dB$  shall be Crosstalk.

## DIP 16PIN PACKAGE DIMENSIONS (DIP16-P-300-2.54A)

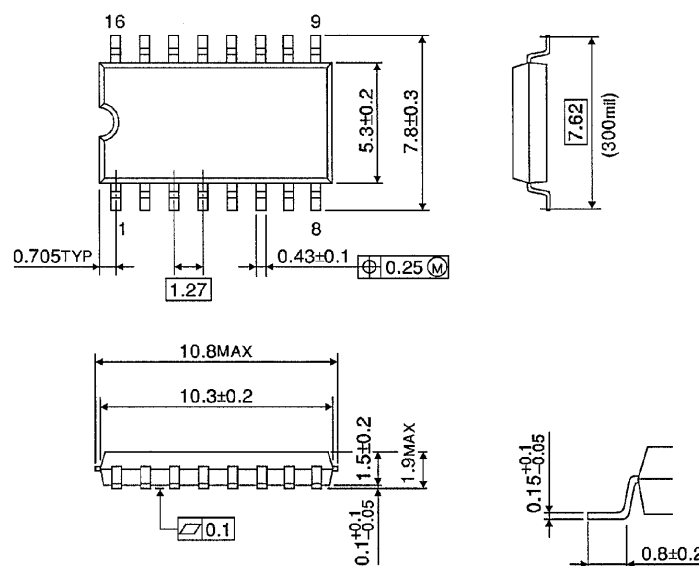
Unit in mm



Weight : 1.00g (Typ.)

## SOP 16PIN (200mil BODY) PACKAGE DIMENSIONS (SOP16-P-300-1.27)

Unit in mm

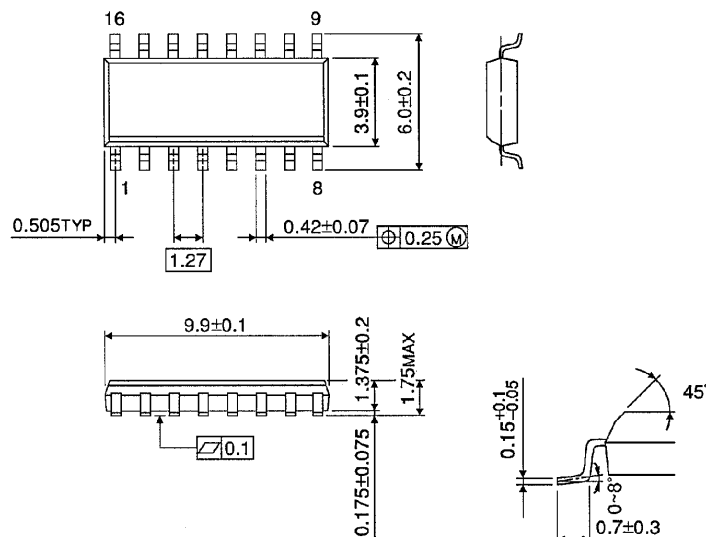


Weight : 0.18g (Typ.)

## SOP 16PIN (150mil BODY) PACKAGE DIMENSIONS (SOL16-P-150 -1.27)

Unit in mm

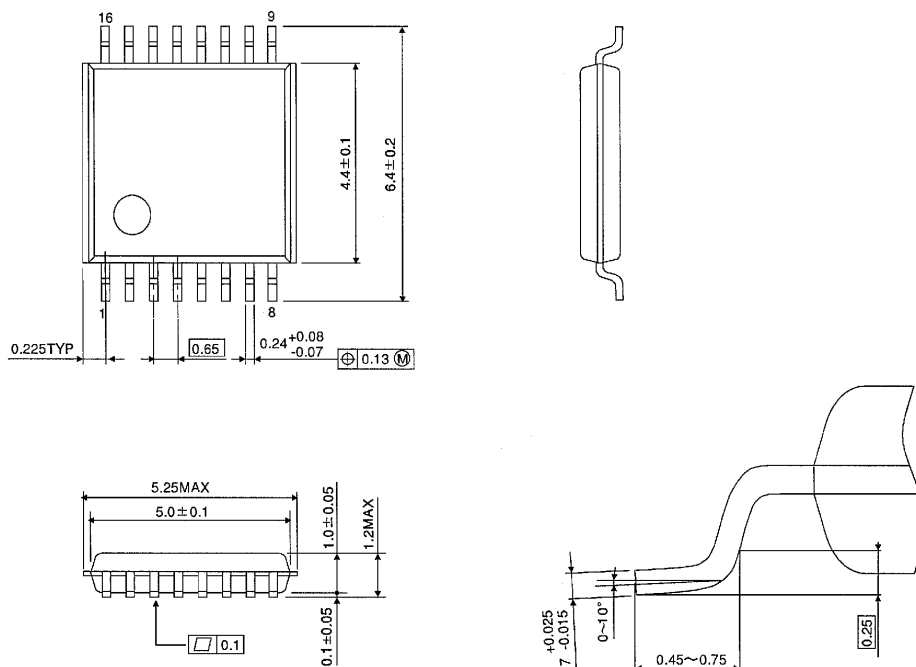
(Note) This package is not available in Japan.



Weight : 0.13g (Typ.)

## TSSOP 16PIN PACKAGE DIMENSIONS (TSSOP16-P-0044-0.65)

Unit in mm



Weight : 0.06g (Typ.)

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