

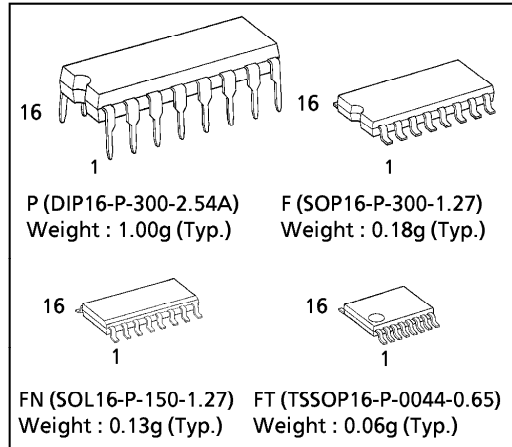
### TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

**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

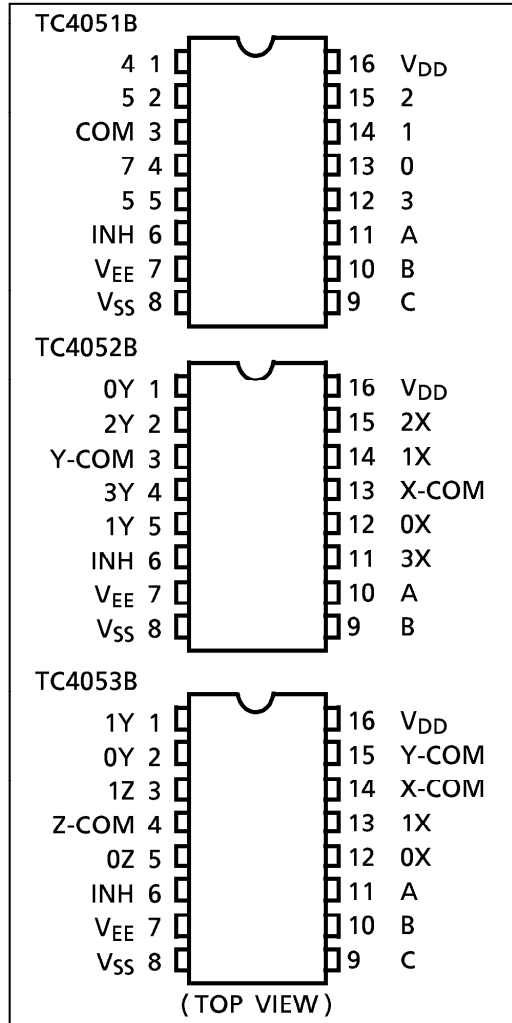
CHARACTERISTIC	SYMBOL	RATING	UNIT
DC Supply Voltage	$V_{DD}-V_{SS}$	-0.5~20	V
DC Supply Voltage	$V_{DD}-V_{EE}$	-0.5~20	V
Control Input Voltage	$V_{CIN}$	$V_{SS}-0.5\sim V_{DD}+0.5$	V
Switch I/O Voltage	$V_I/V_O$	$V_{EE}-0.5\sim V_{DD}+0.5$	V
Control Input Current	$I_{CIN}$	±10	mA
Potential difference 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△	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    △ Except TC4052B

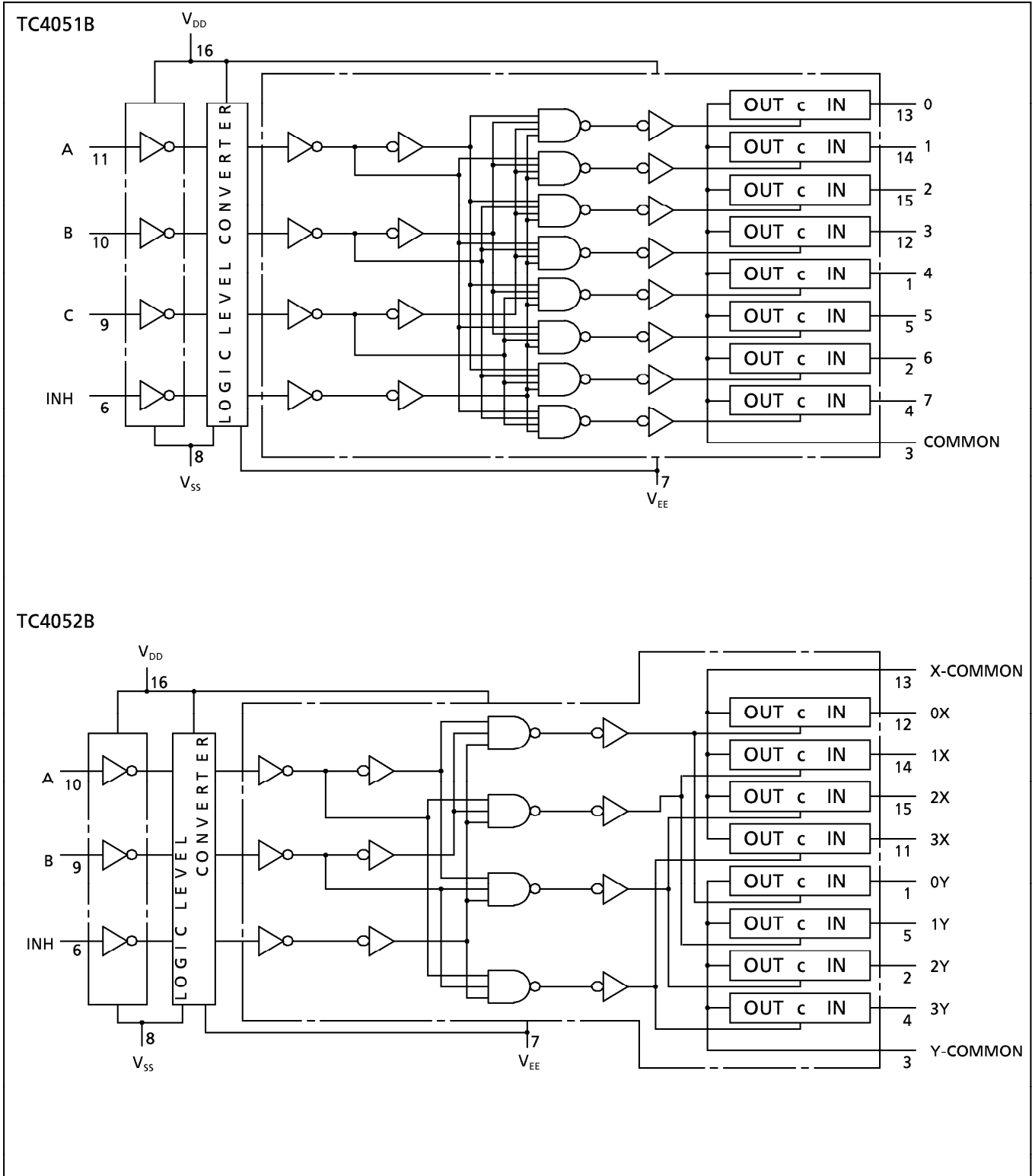
#### PIN ASSIGNMENT



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.

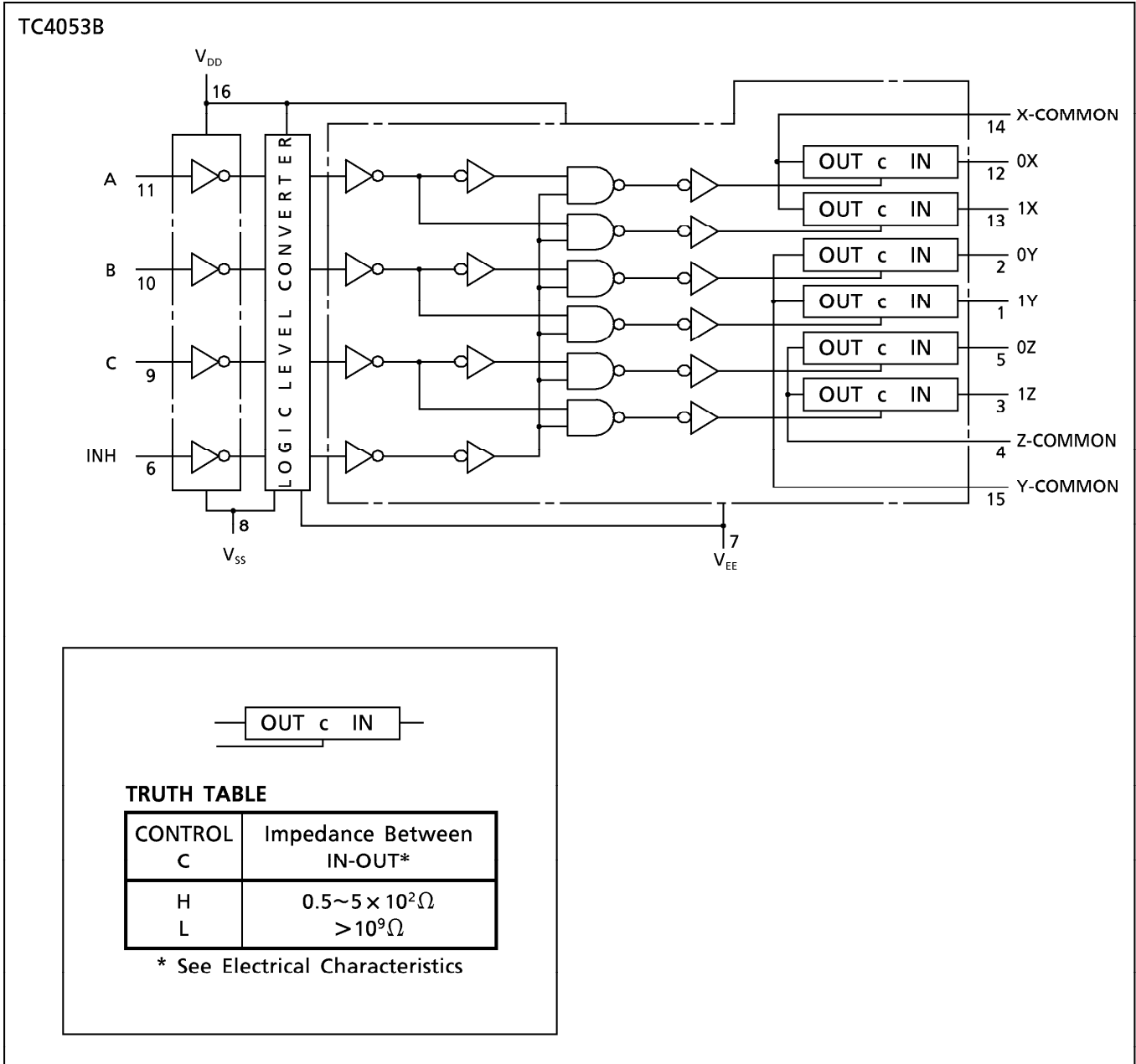
**LOGIC DIAGRAM**



961001EBA2'

- The products described in this document are subject to foreign exchange and foreign trade control laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.

**LOGIC DIAGRAM**



**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)			- 40°C		25°C			85°C		UNIT
			V <sub>EE</sub> (V)	V <sub>DD</sub> (V)	MIN.	MAX.	MIN.	TYP.	MAX.	MIN.	MAX.		
Control Input High Voltage	$V_{IH}$	$V_{IS} = V_{DD}$ thru 1k $\Omega$	$V_{EE} = V_{SS}$	5	3.5	—	3.5	2.75	—	3.5	—	V	
			$R_L = 1k\Omega$	10	7.0	—	7.0	5.50	—	7.0	—		
			to $V_{SS}$	15	11.0	—	11.0	8.25	—	11.0	—		
Control Input Low Voltage	$V_{IL}$		$I_{IS} < 2\mu A$	5	—	1.5	—	2.25	1.5	—	1.5	V	
			on all OFF channels	10	—	3.0	—	4.5	3.0	—	3.0		
				15	—	4.0	—	6.75	4.0	—	4.0		
On-State Resistance	$R_{ON}$	$0 \leq V_{IS} \leq V_{DD}$ $R_L = 10k\Omega$	0	0	5	—	850	—	240	950	—	1200	$\Omega$
			0	0	10	—	210	—	110	250	—	300	
			0	0	15	—	140	—	80	160	—	200	
$\Delta$ On-State Resistance Between Any 2 Switches	$R_{ON\Delta}$		0	0	5	—	—	—	10	—	—	—	$\Omega$
			0	0	10	—	—	—	6	—	—	—	
			0	0	15	—	—	—	4	—	—	—	
Input/Output Leakage Current	$I_{OFF}$	$V_{IN} = 18V, V_{OUT} = 0V$ $V_{IN} = 0V, V_{OUT} = 18V$		18	—	$\pm 100$	—	$\pm 0.01$	$\pm 100$	—	$\pm 1000$	nA	
				18	—	$\pm 100$	—	$\pm 0.01$	$\pm 100$	—	$\pm 1000$		
Quiescent Supply Current	$I_{DD}$	$V_{IN} = V_{SS}, V_{DD}^*$		5	—	5.0	—	0.005	5.0	—	150	$\mu A$	
				10	—	10	—	0.010	10	—	300		
				15	—	20	—	0.015	20	—	600		
Input Current	$I_{IN}$	$V_{IH} = 18V$ $V_{IL} = 0V$		18	—	0.1	—	$10^{-5}$	0.1	—	1.0	$\mu A$	
				18	—	-0.1	—	$-10^{-5}$	-0.1	—	-1.0		
Input Capacitance	$C_{IN}$				—	—	—	5	7.5	—	—	pF	
Switch Input Capacitance	$C_{IN}$				—	—	—	10	—	—	—		
Output Capacitance	$C_{OUT}$	TC4051B TC4052B TC4053B		10	—	—	—	58	—	—	—		pF
				10	—	—	—	30	—	—	—		
				10	—	—	—	17	—	—	—		
Feedthrough Capacitance	$C_{IN-}$ $C_{OUT}$	TC4051B TC4052B TC4053B		10	—	—	—	0.2	—	—	—	pF	
				10	—	—	—	0.2	—	—	—		
				10	—	—	—	0.2	—	—	—		

\* All valid input combinations.

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

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

\*1 Sine wave of ±2.5Vp-p shall be used for V<sub>is</sub> and the frequency of 20 log 10  $\frac{V_{OS}}{V_{is}}$  = -3dB shall be f<sub>MAX</sub>.

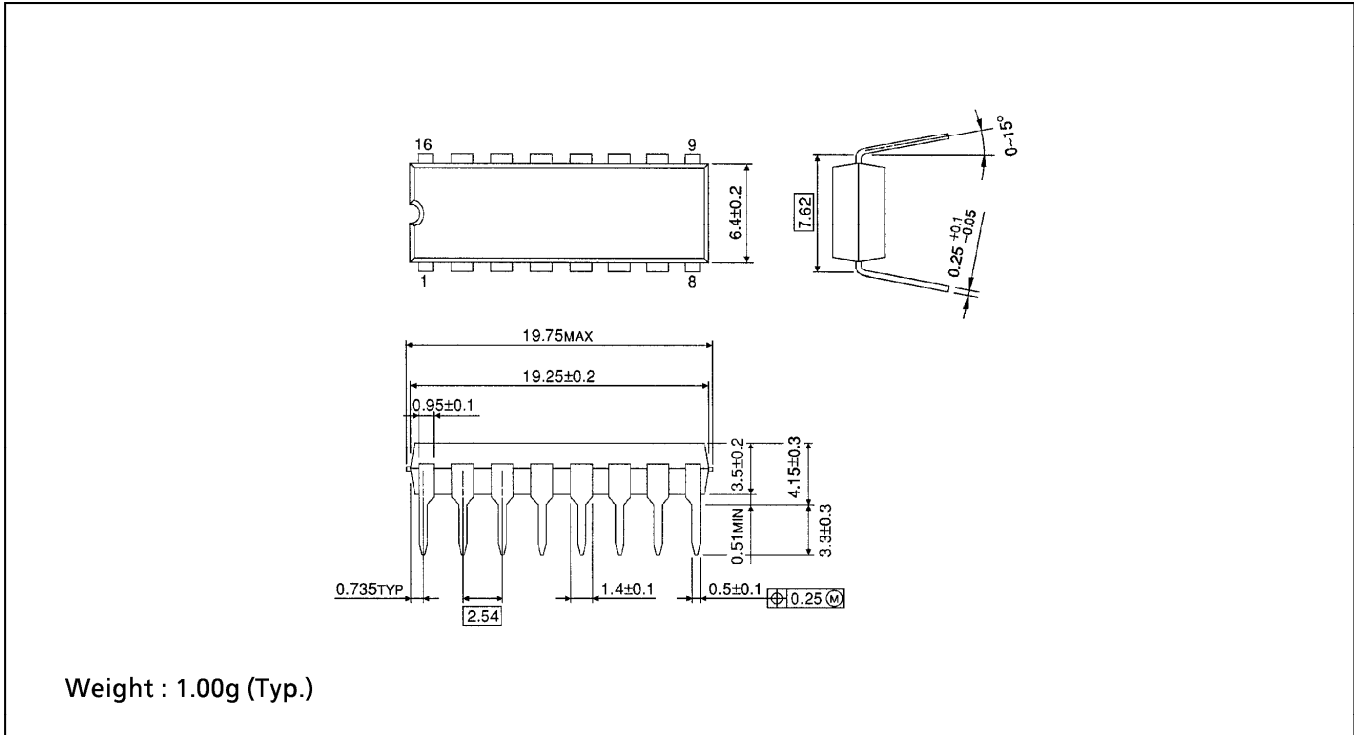
\*2 V<sub>is</sub> shall be sine wave of ±  $\left(\frac{V_{DD}-V_{EE}}{4}\right)$  p-p.

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

\*4 Sine wave of ±2.5Vp-p shall be used for V<sub>is</sub> and the frequency of 20 log 10  $\frac{V_{OS}}{V_{is}}$  = -50dB shall be Crosstalk.

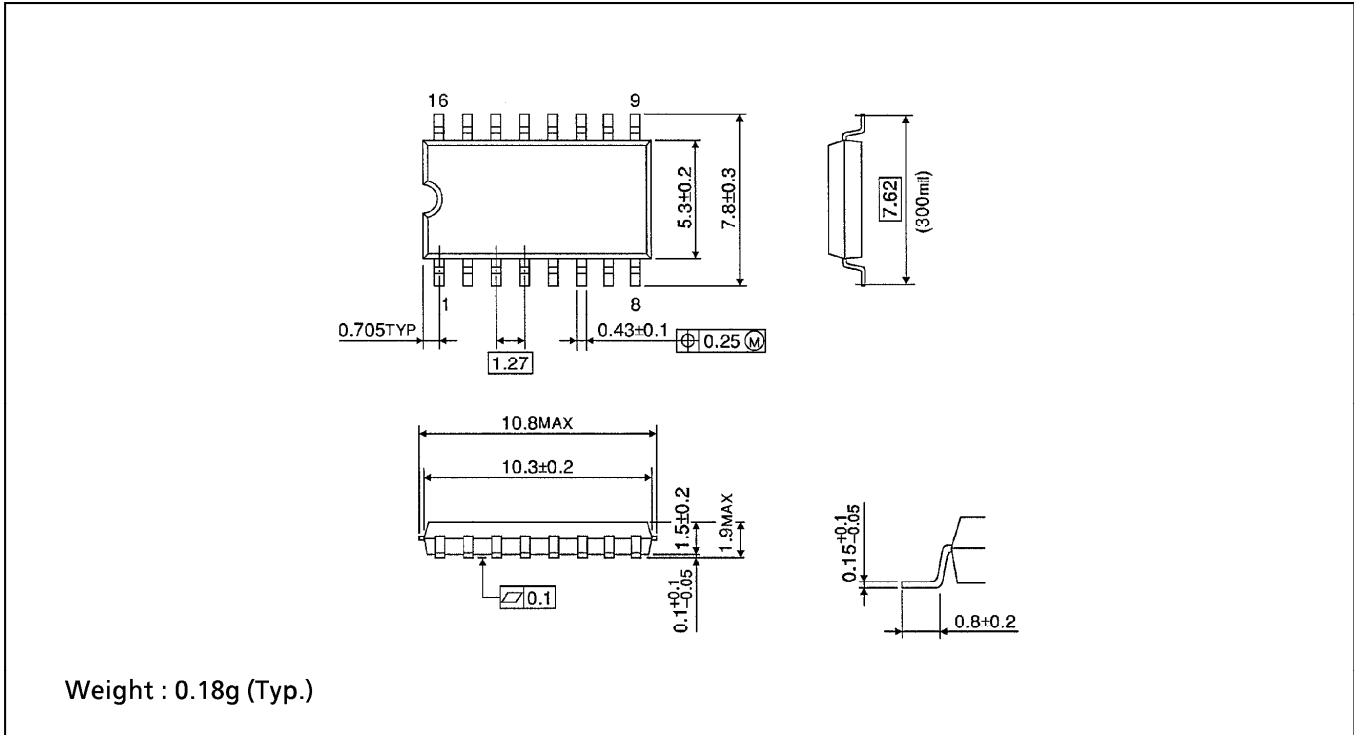
**DIP 16PIN OUTLINE DRAWING (DIP16-P-300-2.54A)**

Unit in mm



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

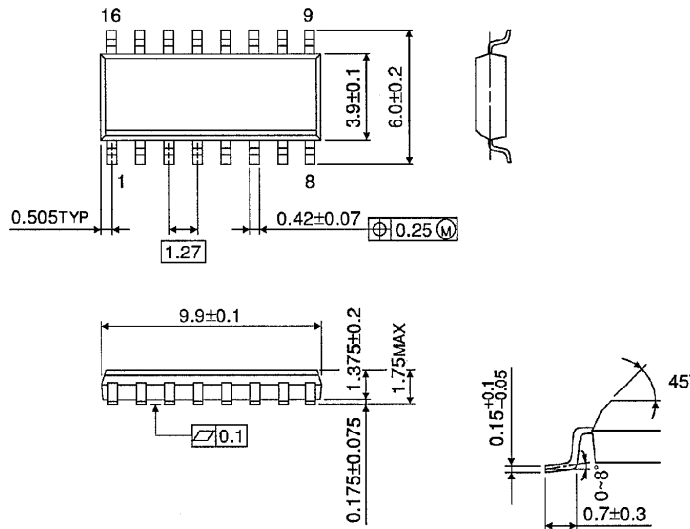
Unit in mm



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

Unit in mm

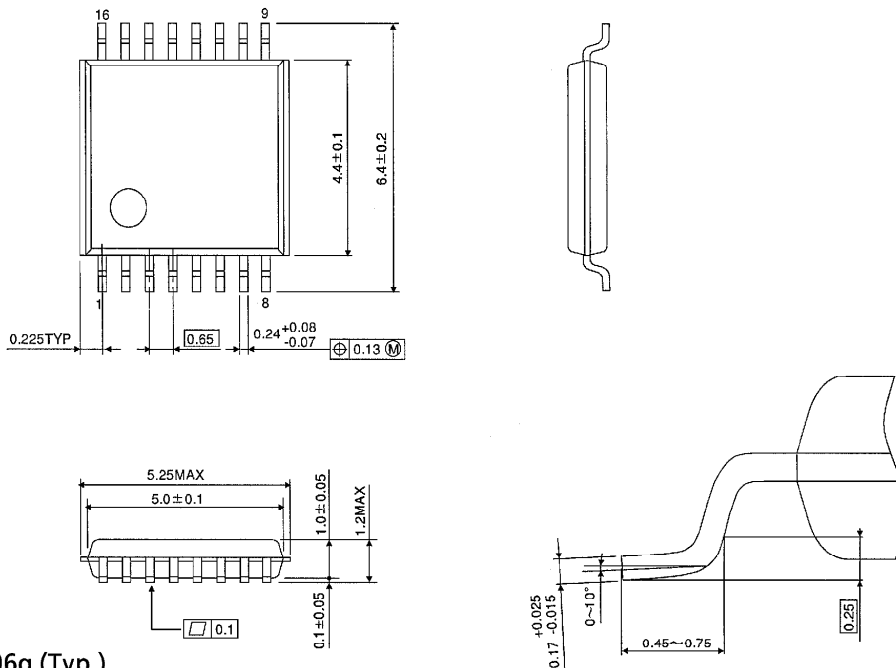
(Note) This package is not available in Japan.



Weight : 0.13g (Typ.)

**TSSOP 16PIN OUTLINE DRAWING (TSSOP16-P-0044-0.65)**

Unit in mm



Weight : 0.06g (Typ.)

This datasheet has been downloaded from:

[www.DatasheetCatalog.com](http://www.DatasheetCatalog.com)

Datasheets for electronic components.