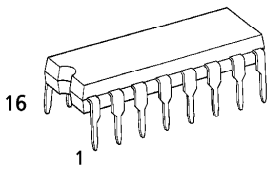
TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

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

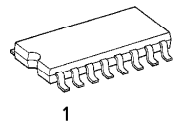
TC4051B SINGLE 8 – CHANNEL MULTIPLEXER / DEMULTIPLEXER
TC4052B DIFFERENTIAL 4 – CHANNEL MULTIPLEXER / DEMULTIPLEXER
TC4053B TRIPLE 2 – CHANNEL MULTIPLEXER / DEMULTIPLEXER

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

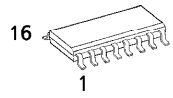
TC4051B, TC4052B and TC4053B are multiplexers with capabilities of selection and mixture of analog signal and digital signal. TC4051B has 8 channels configuration. TC4052B has 4 channel×2 configuration and TC4053B has 2 channel×3 configuration. The digital signal to the control terminal turns "ON" the 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.



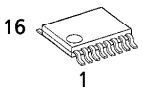
P (DIP16-P-300-2.54A)
Weight : 1.00g (Typ.)



F (SOP16-P-300-1.27)
Weight : 0.18g (Typ.)



FN (SOL16-P-150-1.27)
Weight : 0.13g (Typ.)



FT (TSSOP16-P-0044-0.65)
Weight : 0.06g (Typ.)

MAXIMUM RATINGS

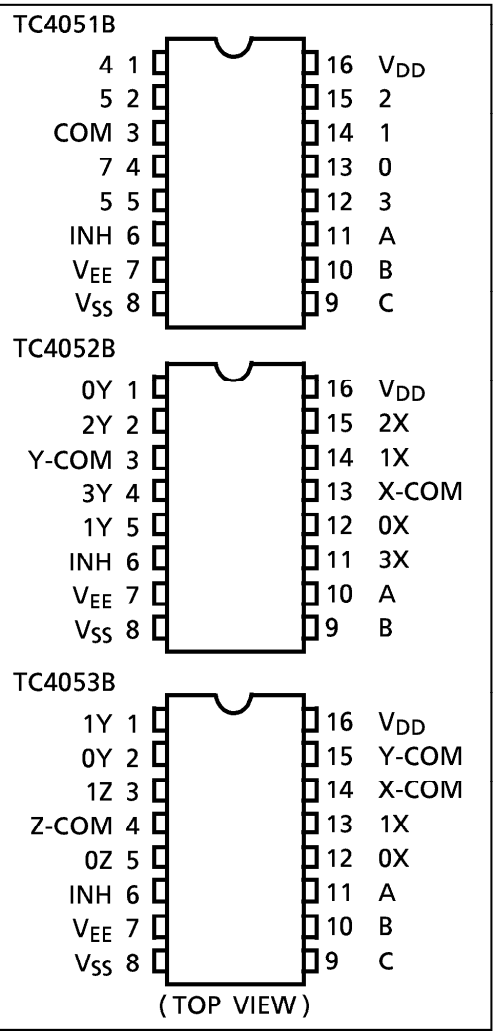
CHARACTERISTIC	SYMBOL	RATING	UNIT
DC Supply Voltage	V_{DD} - V_{SS}	−0.5~20	V
DC Supply Voltage	V_{DD} - V_{EE}	−0.5~20	V
Control Input Voltage	V_{CIN}	V_{SS} −0.5~V_{DD} +0.5	V
Switch I/O Voltage	V_I / V_O	V_{EE} −0.5~V_{DD} +0.5	V
Control Input Current	I_{CIN}	±10	mA
Potential difference across I/O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

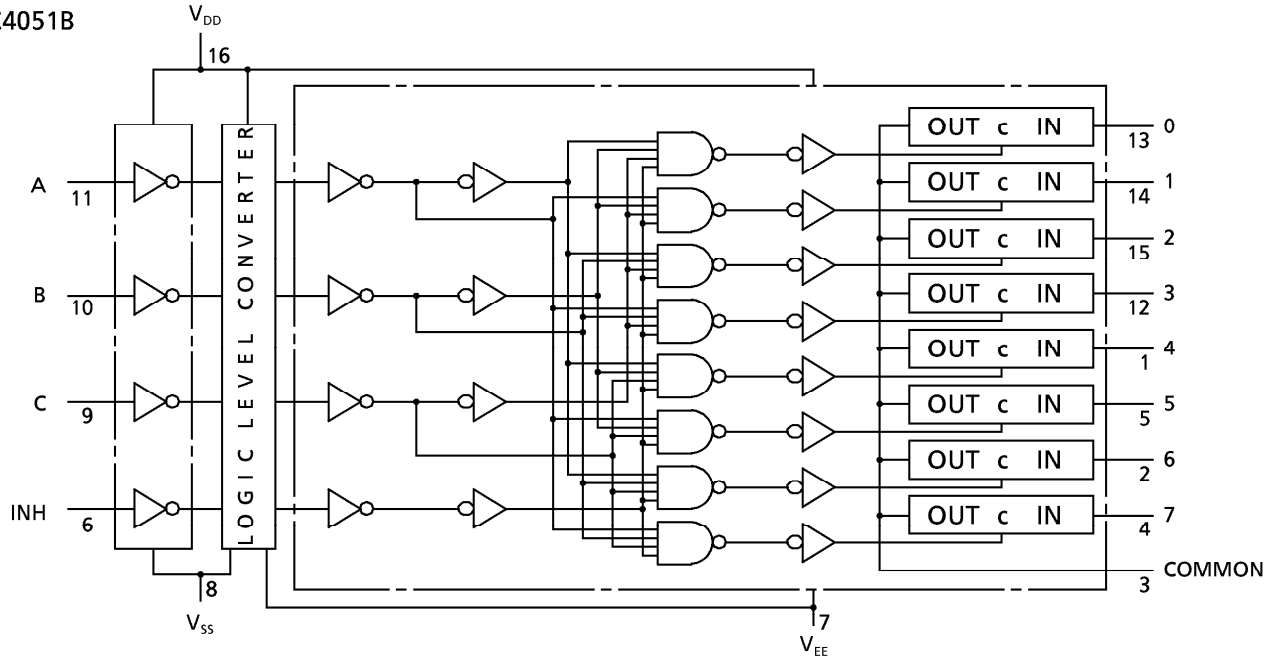
PIN ASSIGNMENT



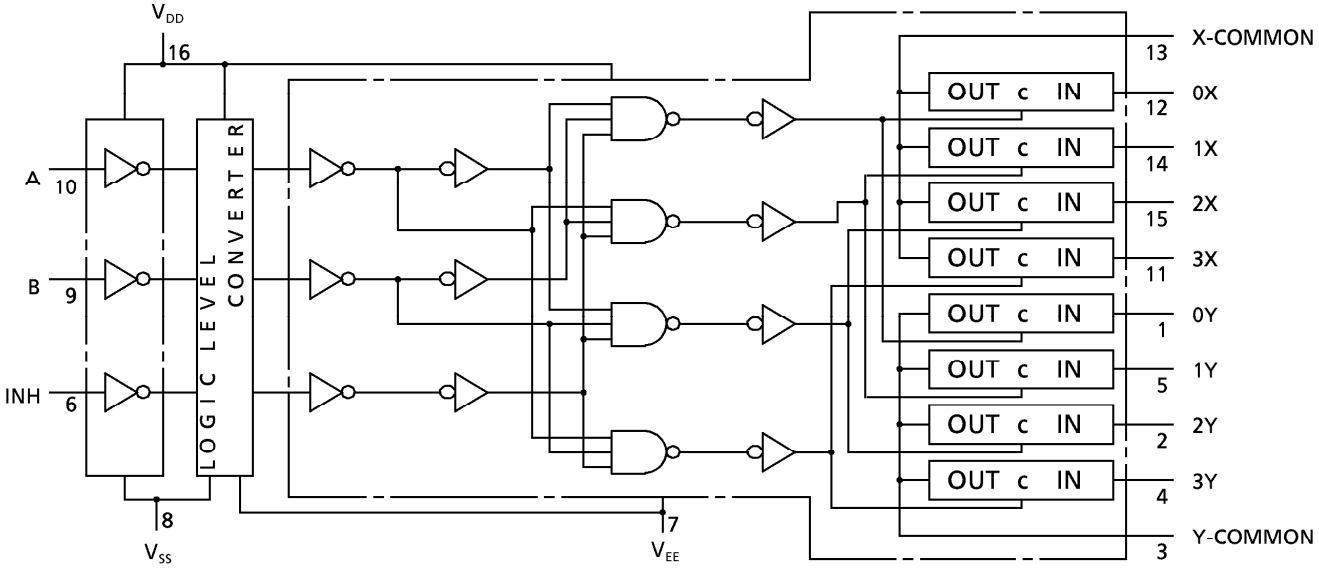
961001EBA2

LOGIC DIAGRAM

TC4051B



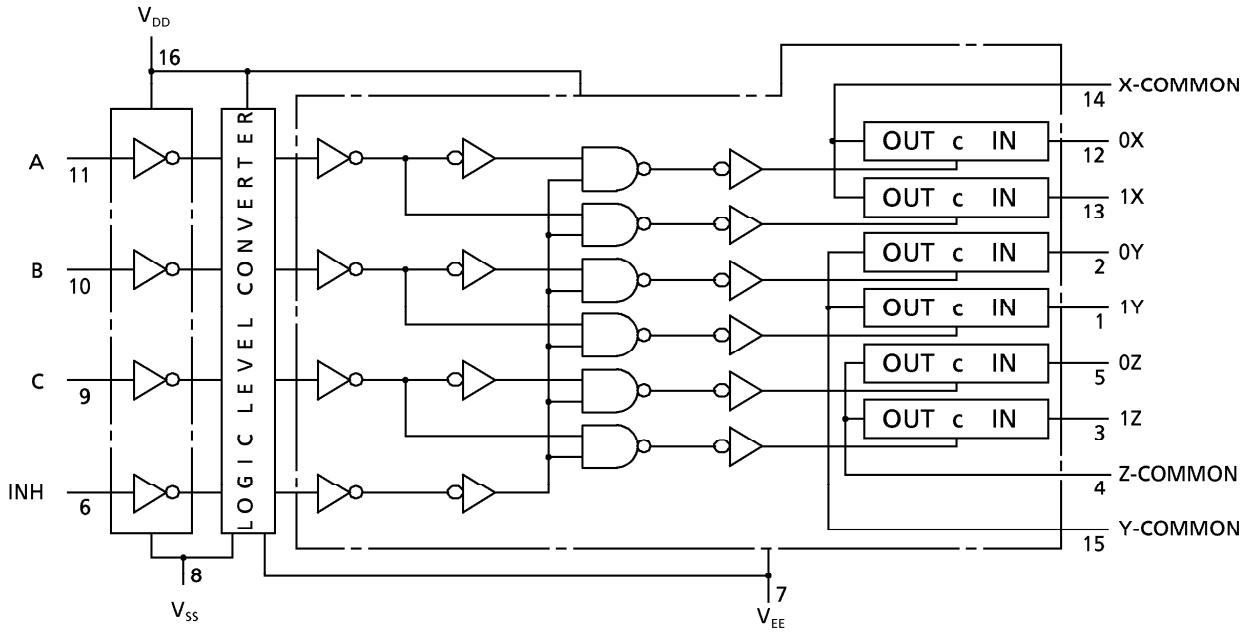
TC4052B

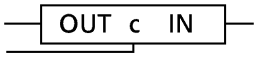


961001EBA2'

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_{SS} (V)	V_{EE} (V)	V_{DD} (V)	−40°C MIN.	−40°C MAX.	25°C MIN.	25°C TYP.	25°C MAX.	85°C MIN.	85°C MAX.	UNIT
Control Input High Voltage	V_{IH}	V_{IS} = V_{DD} thru 1kΩ	V_{EE} = V_{SS}		5	3.5	—	3.5	2.75	—	3.5	—	V
			R_L = 1kΩ		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} < 2μA		5	—	1.5	—	2.25	1.5	—	1.5	
			on all OFF		10	—	3.0	—	4.5	3.0	—	3.0	
			channels		15	—	4.0	—	6.75	4.0	—	4.0	
On-State Resistance	R_{ON}	0 ≦ V_{IS} ≦ V_{DD}	0	0	5	—	850	—	240	950	—	1200	Ω
			0	0	10	—	210	—	110	250	—	300	
		R_L = 10kΩ	0	0	15	—	140	—	80	160	—	200	
△On-State Resistance Between Any 2 Switches	R_{ON}△		0	0	5	—	—	—	10	—	—	—	
			0	0	10	—	—	—	6	—	—	—	
			0	0	15	—	—	—	4	—	—	—	
Input / Output Leakage Current	I_{OFF}	V_{IN} = 18V, V_{OUT} = 0V			18	—	±100	—	±0.01	±100	—	±1000	nA
		V_{IN} = 0V, V_{OUT} = 18V			18	—	±100	—	±0.01	±100	—	±1000	
Quiescent Supply Current	I_{DD}	V_{IN} = V_{SS}, V_{DD}*			5	—	5.0	—	0.005	5.0	—	150	μA
					10	—	10	—	0.010	10	—	300	
					15	—	20	—	0.015	20	—	600	
Input Current	I_{IN}	V_{IH} = 18V			18	—	0.1	—	10^{-5}	0.1	—	1.0	
		V_{IL} = 0V			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			10	—	—	—	58	—	—	—	
		TC4052B			10	—	—	—	30	—	—	—	
		TC4053B			10	—	—	—	17	—	—	—	
Feedthrough Capacitance	C_{IN}-C_{OUT}	TC4051B			10	—	—	—	0.2	—	—	—	
		TC4052B			10	—	—	—	0.2	—	—	—	
		TC4053B			10	—	—	—	0.2	—	—	—	

* All valid input combinations.

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

CHARACTERISTIC	SYMBOL	TEST CONDITION	V_{SS} (V)	V_{EE} (V)	V_{DD} (V)	MIN.	TYP.	MAX.	UNIT
Phase Difference Beetween Input to Output	ϕI - 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_{pZL} t_{pZH} t_{pLZ} t_{pHZ}	R_L = 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_{pZL} t_{pZH}	R_L = 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_{pLZ} t_{pHZ}	R_L = 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	f_{MAX} (I - O)	R_L = 1kΩ (*1)	−5	−5	5	—	20	—	MHz
TC4052B			−5	−5	5	—	30	—	
TC4053B			−5	−5	5	—	40	—	
Total Harmonic Distortion	—	R_L = 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_L = 1kΩ (*3)	−5	−5	5	—	500	—	kHz
Crosstalk	—	R_L = 1kΩ (*4)	−5	−5	5	—	1.5	—	MHz
Crosstalk (CONTROL - OUT)	—	R_{IN} = 1kΩ R_{OUT} = 10kΩ C_L = 15pF	0	0	5	—	200	—	mV
			0	0	10	—	400	—	
			0	0	15	—	600	—	

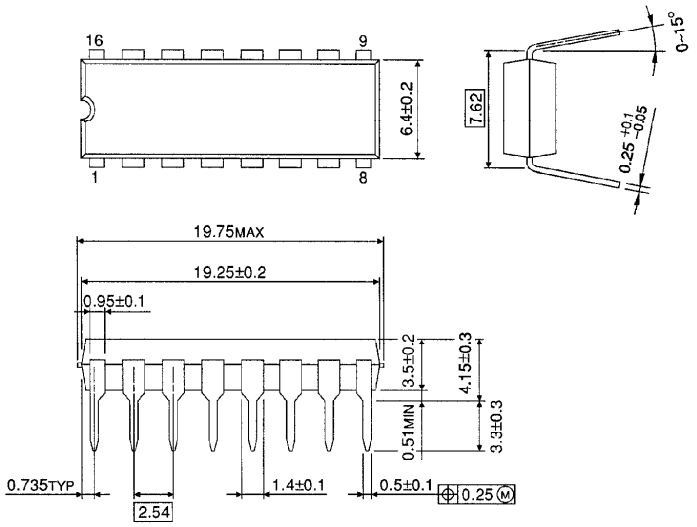
*1 Sine wave of ±2.5Vp-p shall be used for V_{is} and the frequency of 20 log 10 $\frac{V_{OS}}{V_{is}}$ = −3dB shall be f_{MAX}.

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

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

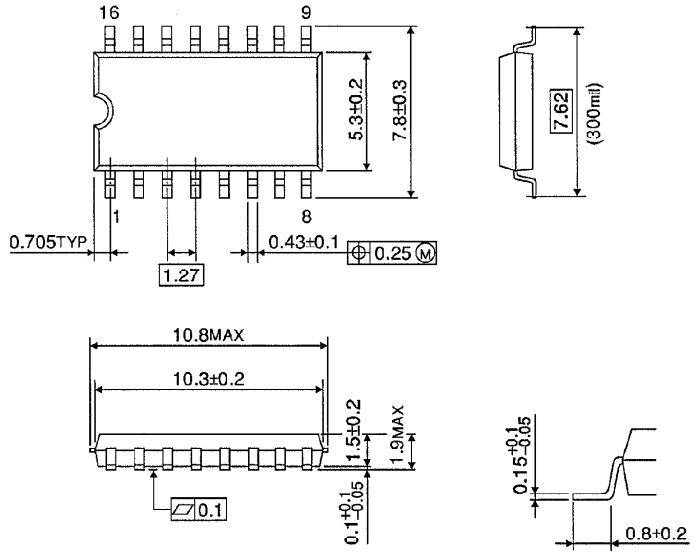
*4 Sine wave of ±2.5Vp-p shall be used for V_{is} and the frequency of 20 log 10 $\frac{V_{OS}}{V_{is}}$ = −50dB shall be Crosstalk.

DIP 16PIN OUTLINE DRAWING (DIP16-P-300-2.54A) Unit in mm



Weight : 1.00g (Typ.)

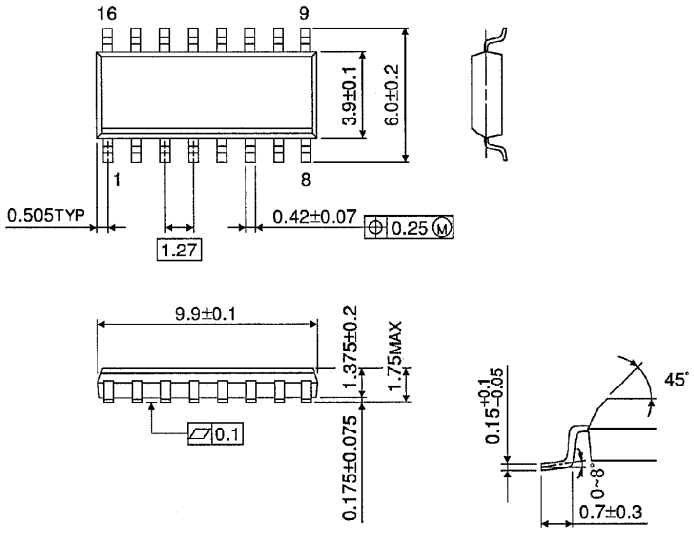
SOP 16PIN (200mil BODY) OUTLINE DRAWING (SOP16-P-300-1.27) Unit in mm



Weight : 0.18g (Typ.)

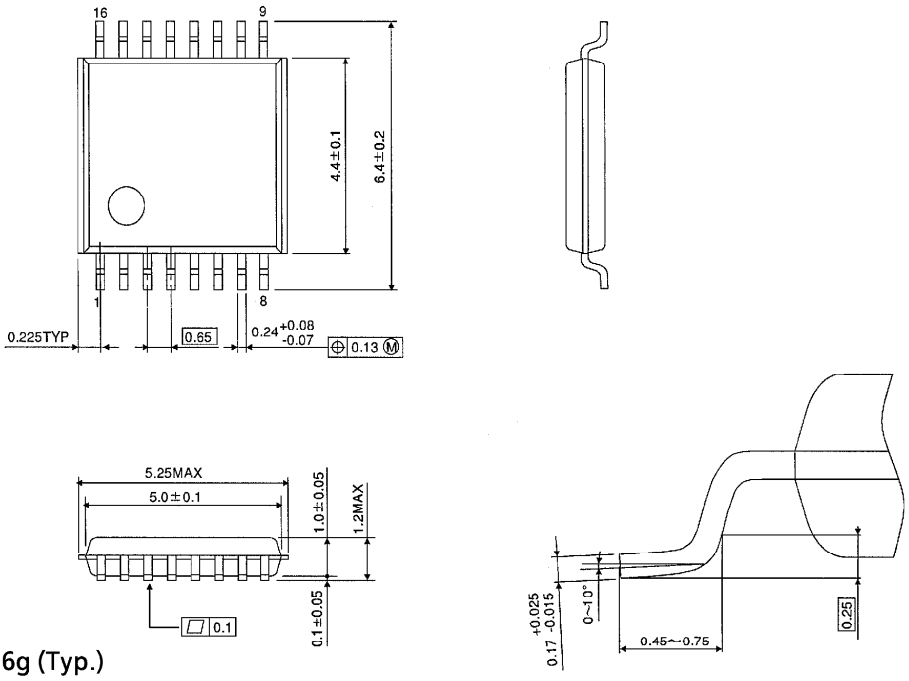
SOP 16PIN (150mil BODY) OUTLINE DRAWING (SOL16-P-150 -1.27) Unit in mm

(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.)