

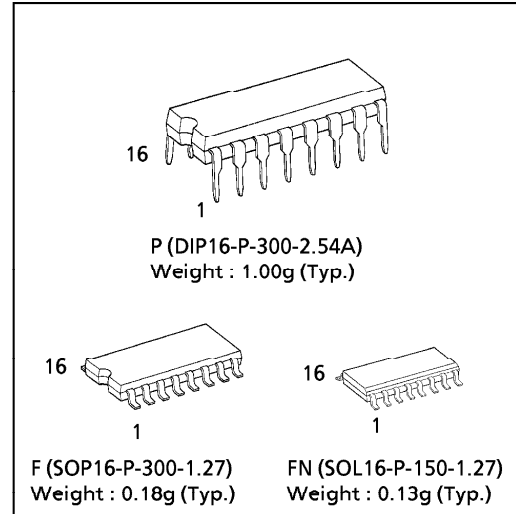
TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

# TC4520BP, TC4520BF, TC4520BFN

## TC4520BP/BF/BFN DUAL BINARY UP COUNTER

TC4520B is up counters of 4 bit binary.  
 Since both of TC4520B contain two independent circuits of counters with the same functions in one package, counting or frequency division of two BCD digits or eight binary bits can be achieved with one IC. The counters can be reset to "O" (Q0~Q3="L") by giving "H" level signal to RESET input regardless of other inputs.  
 The counting condition is changed by the rising edge of CLOCK input if ENABLE="H" or by the falling edge of ENABLE if CLOCK="L".

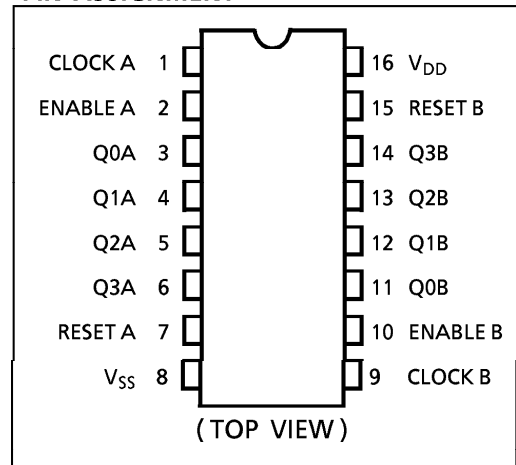
(Note) The JEDEC SOP (FN) is not available in Japan.



### MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
DC Supply Voltage	$V_{DD}$	$V_{SS} - 0.5 \sim V_{SS} + 20$	V
Input Voltage	$V_{IN}$	$V_{SS} - 0.5 \sim V_{DD} + 0.5$	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	$T_{opr}$	-40~85	°C
Storage Temperature Range	$T_{stg}$	-65~150	°C

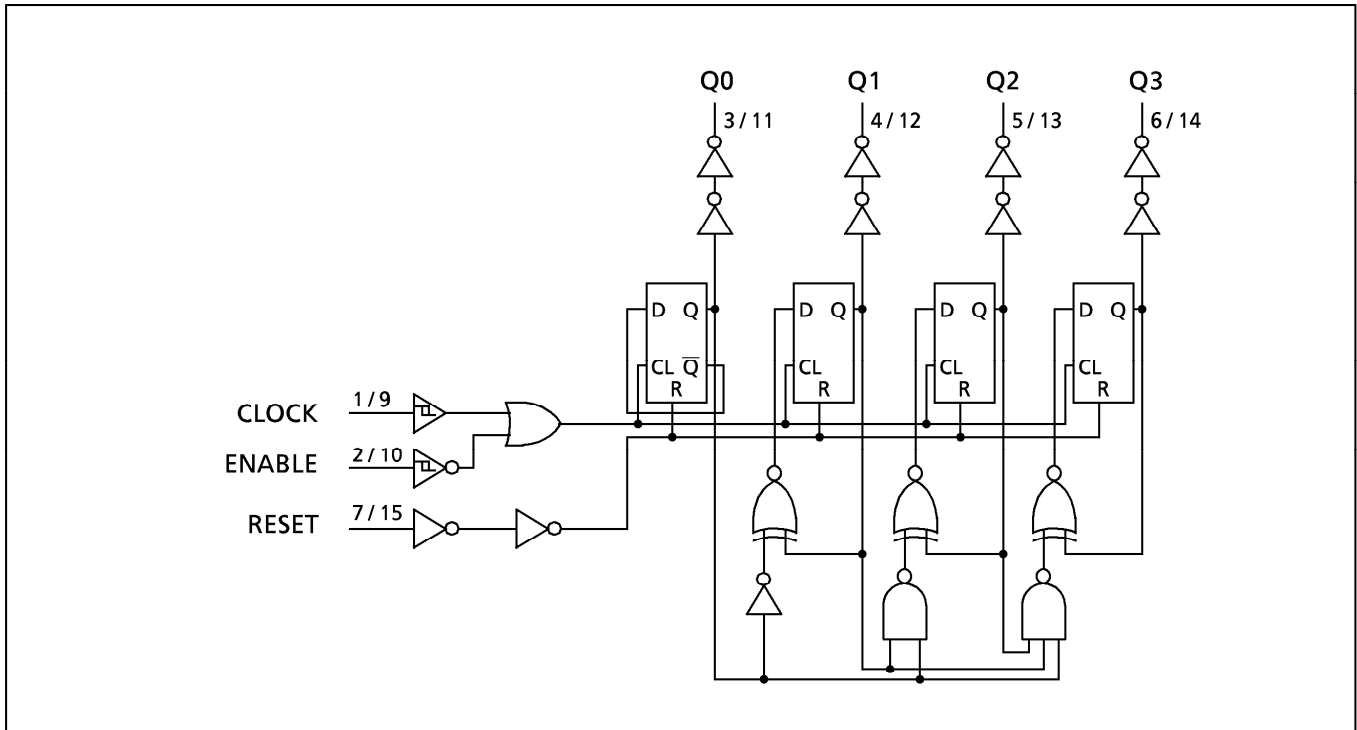
### PIN ASSIGNMENT



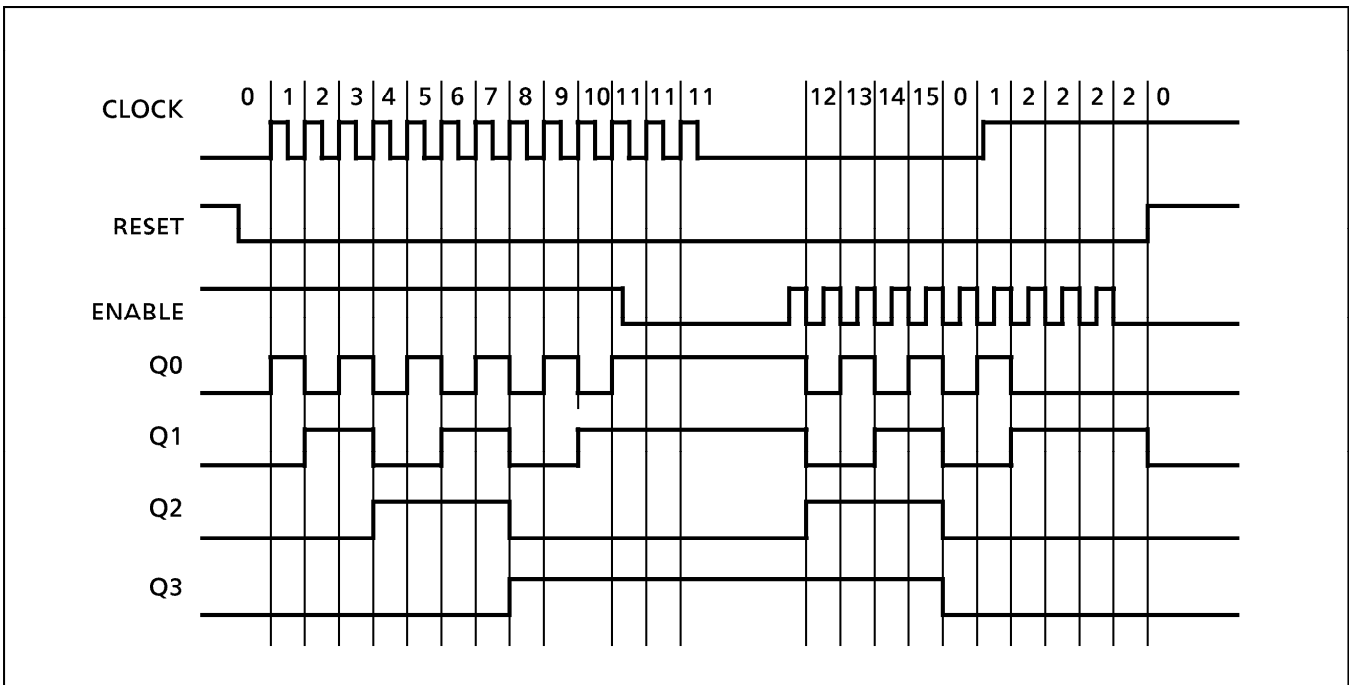
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**LOGIC DIAGRAM**



**TIMING CHART**



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RECOMMENDED OPERATING CONDITIONS ( $V_{SS} = 0V$ )

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNITS
DC Supply Voltage	$V_{DD}$		3	—	18	V
Input Voltage	$V_{IN}$		0	—	$V_{DD}$	V

STATIC ELECTRICAL CHARACTERISTICS ( $V_{SS} = 0V$ )

CHARACTERISTIC	SYM-BOL	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\mu A$ $V_{IN} = V_{SS}, V_{DD}$	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\mu A$ $V_{IN} = V_{SS}, V_{DD}$	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	$I_{OH}$	$V_{OH} = 4.6V$ $V_{OH} = 2.5V$ $V_{OH} = 9.5V$ $V_{OH} = 13.5V$ $V_{IN} = V_{SS}, V_{DD}$	5	-0.61	—	-0.51	-1.0	—	-0.42	—	mA	
			5	-2.5	—	-2.1	-4.0	—	-1.7	—		
			10	-1.5	—	-1.3	-2.2	—	-1.1	—		
			15	-4.0	—	-3.4	-9.0	—	-2.8	—		
Output Low Current	$I_{OL}$	$V_{OL} = 0.4V$ $V_{OL} = 0.5V$ $V_{OL} = 1.5V$ $V_{IN} = V_{SS}, V_{DD}$	5	0.61	—	0.51	1.2	—	0.42	—	mA	
			10	1.5	—	1.3	3.2	—	1.1	—		
			15	4.0	—	3.4	12.0	—	2.8	—		
Input High Voltage	$V_{IH}$	$V_{OUT} = 0.5V, 4.5V$ $V_{OUT} = 1.0V, 9.0V$ $V_{OUT} = 1.5V, 13.5V$ $ I_{OUT}  < 1\mu A$	5	3.5	—	3.5	2.75	—	3.5	—	V	
			10	7.0	—	7.0	5.5	—	7.0	—		
			15	11.0	—	11.0	8.25	—	11.0	—		
Input Low Voltage	$V_{IL}$	$V_{OUT} = 0.5V, 4.5V$ $V_{OUT} = 1.0V, 9.0V$ $V_{OUT} = 1.5V, 13.5V$ $ I_{OUT}  < 1\mu A$	5	—	1.5	—	2.25	1.5	—	1.5	V	
			10	—	3.0	—	4.5	3.0	—	3.0		
			15	—	4.0	—	6.75	4.0	—	4.0		
Input Current	"H" Level	$I_{IH}$	$V_{IH} = 18V$	18	—	0.1	—	$10^{-5}$	0.1	—	1.0	$\mu A$
	"L" Level	$I_{IL}$	$V_{IL} = 0V$	18	—	-0.1	—	$-10^{-5}$	-0.1	—	-1.0	
Quiescent Supply Current	$I_{DD}$	$V_{IN} = V_{SS}, V_{DD} *$	5	—	5	—	0.005	5	—	150	$\mu A$	
			10	—	10	—	0.010	10	—	300		
			15	—	20	—	0.015	20	—	600		

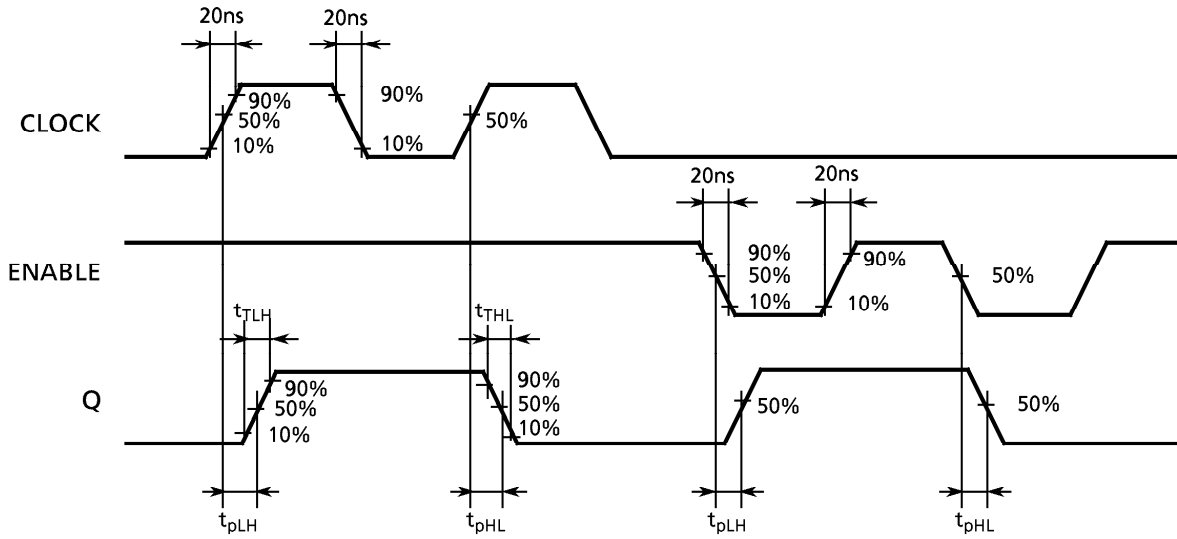
\* All valid input combinations.

DYNAMIC ELECTRICAL CHARACTERISTICS (Ta = 25°C, V<sub>SS</sub> = 0V, C<sub>L</sub> = 50pF)

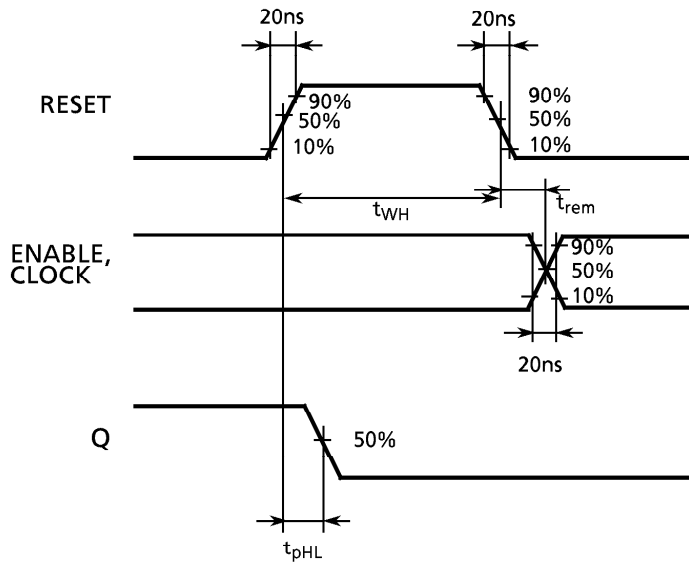
CHARACTERISTIC	SYMBOL	TEST CONDITION	V <sub>DD</sub> (V)	MIN.	TYP.	MAX.	UNIT
Output Transition Time (Low to High)	t <sub>TLH</sub>		5	—	70	200	ns
			10	—	35	100	
			15	—	30	80	
Output Transition Time (High to Low)	t <sub>THL</sub>		5	—	70	200	ns
			10	—	35	100	
			15	—	30	80	
Propagation Delay Time (CLOCK, ENABLE - Q)	t <sub>pLH</sub> t <sub>pHL</sub>		5	—	160	560	ns
			10	—	75	230	
			15	—	60	160	
Propagation Delay Time (RESET - Q)	t <sub>pHL</sub>		5	—	110	560	ns
			10	—	55	230	
			15	—	40	160	
Max. Clock Frequency	t <sub>CL</sub>		5	1.5	6	—	MHz
			10	3	14	—	
			15	4	18	—	
Max. Clock Input Rise / Fall Time	t <sub>rCL</sub> t <sub>fCL</sub>		5	No Limit			μs
			10	No Limit			
			15	No Limit			
Max. Input Rise / Fall Time (ENABLE)	t <sub>r</sub> t <sub>f</sub>		5	No Limit			μs
			10	No Limit			
			15	No Limit			
Min. Clock Pulse Width	t <sub>w</sub>		5	—	30	200	ns
			10	—	15	100	
			15	—	10	70	
Min. Pulse Width (ENABLE)	t <sub>w</sub>		5	—	35	250	ns
			10	—	20	110	
			15	—	15	80	
Min. Pulse Width (RESET)	t <sub>wH</sub>		5	—	45	250	ns
			10	—	20	110	
			15	—	15	80	
Min. Removal Time (RESET - CLOCK, ENABLE)	t <sub>rem</sub>		5	—	—	0	ns
			10	—	—	0	
			15	—	—	0	
Input Capacitance	C <sub>IN</sub>			—	5	7.5	pF

WAVEFORMS FOR MEASUREMENT OF DYNAMIC CHARACTERISTICS

WAVEFORM 1

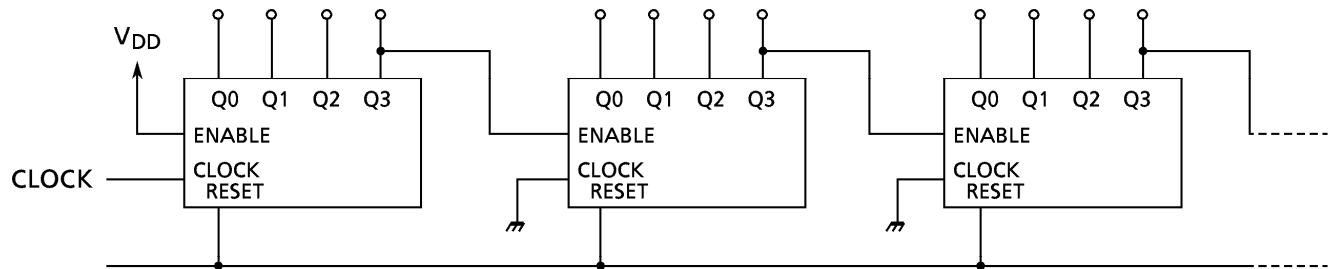


WAVEFORM 2

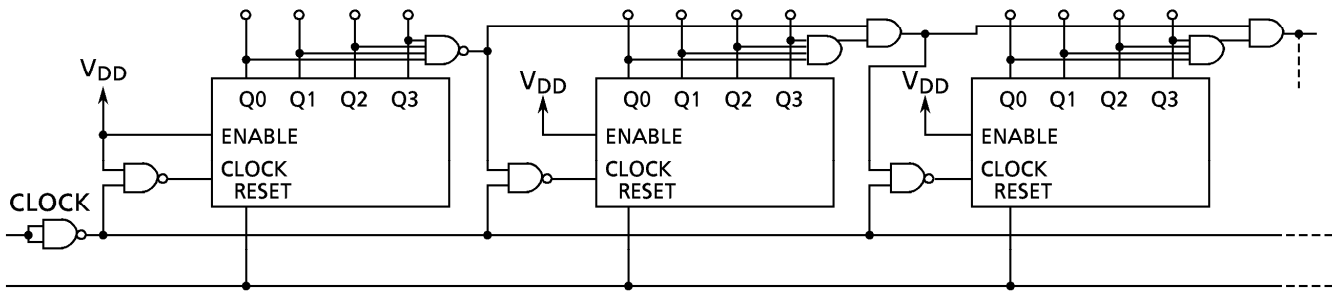


APPLICATION CIRCUIT

(1) RIPPLE CARRY COUNTER

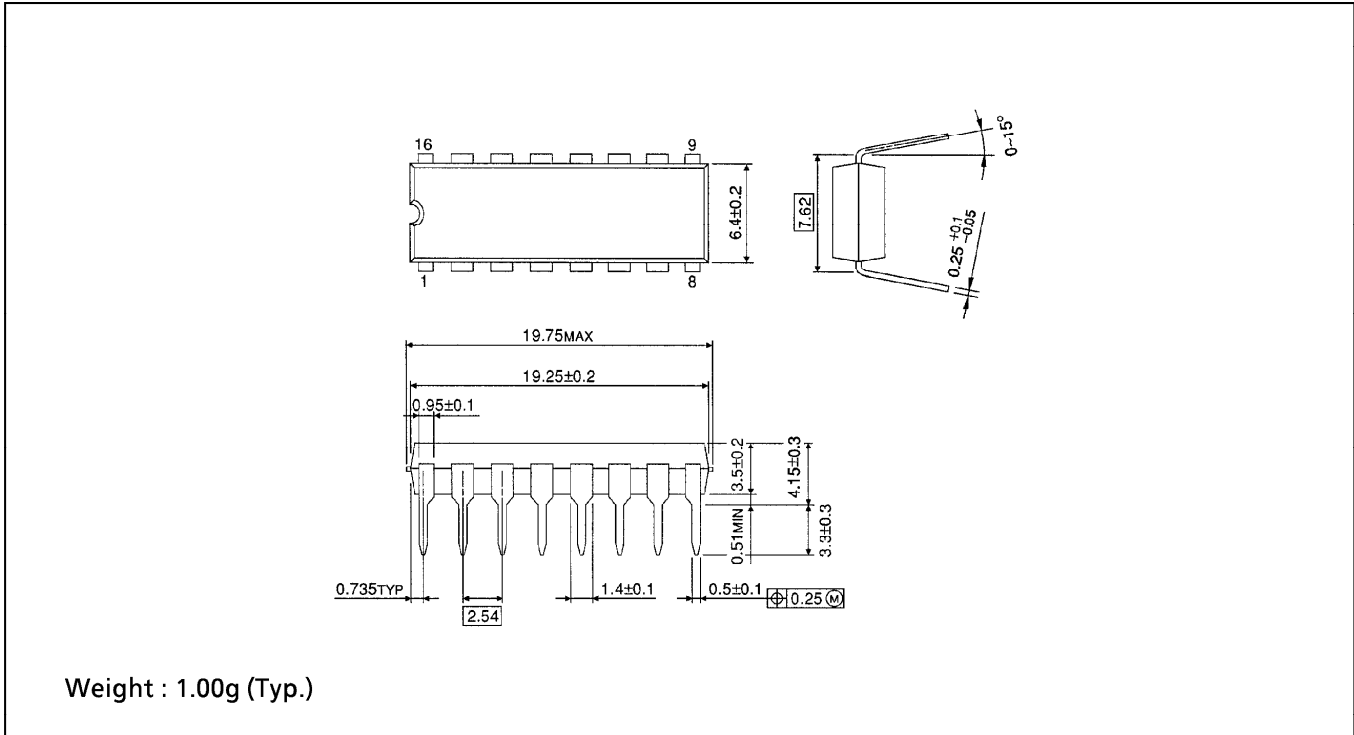


(2) RIPPLE CARRY COUNTER



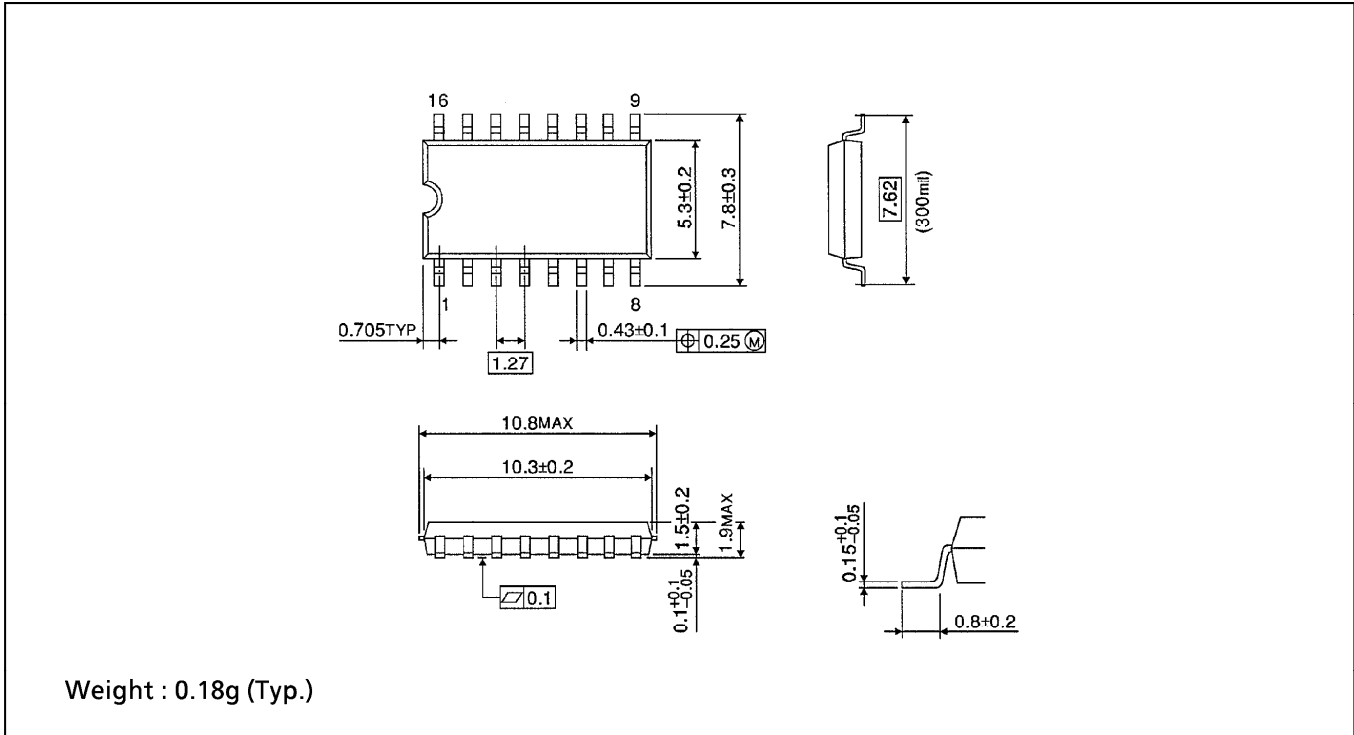
**DIP 16PIN OUTLINE DRAWING (DIP16-P-300-2.54A)**

Unit in mm



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

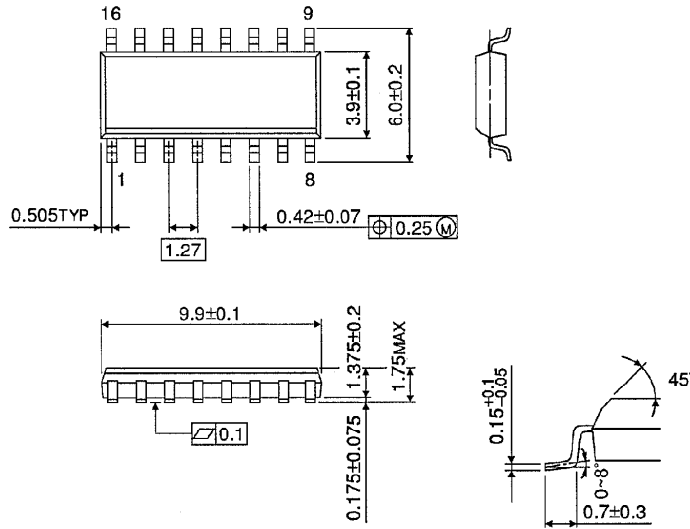
Unit in mm



**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.)