TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC4520BP,TC4520BF,TC4520BFN

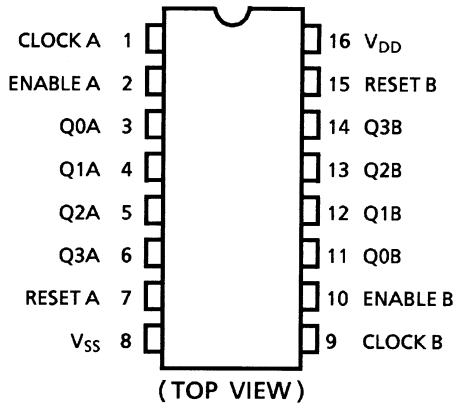
TC4520B Dual Binary Up Counter

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 achived with one IC. The counters can be reset to "0" (Q0~Q3 = "L") by giving "H" level signal to RESET input regardless of other inputs.

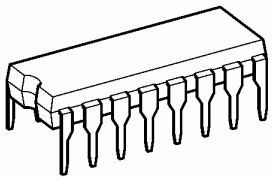
The counting condition is changed by the rising edge of CLOCK input if ENABLE = "H" or by the falling edge of ENABLE if CLOCK = "L".

Pin Assignment



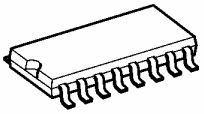
Note: xxxFN (JEDEC SOP) is not available in Japan.

TC4520BP

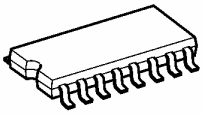


DIP16-P-300-2.54A

TC4520BF

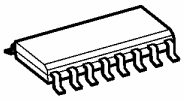


SOP16-P-300-1.27A



SOP16-P-300-1.27

TC4520BFN

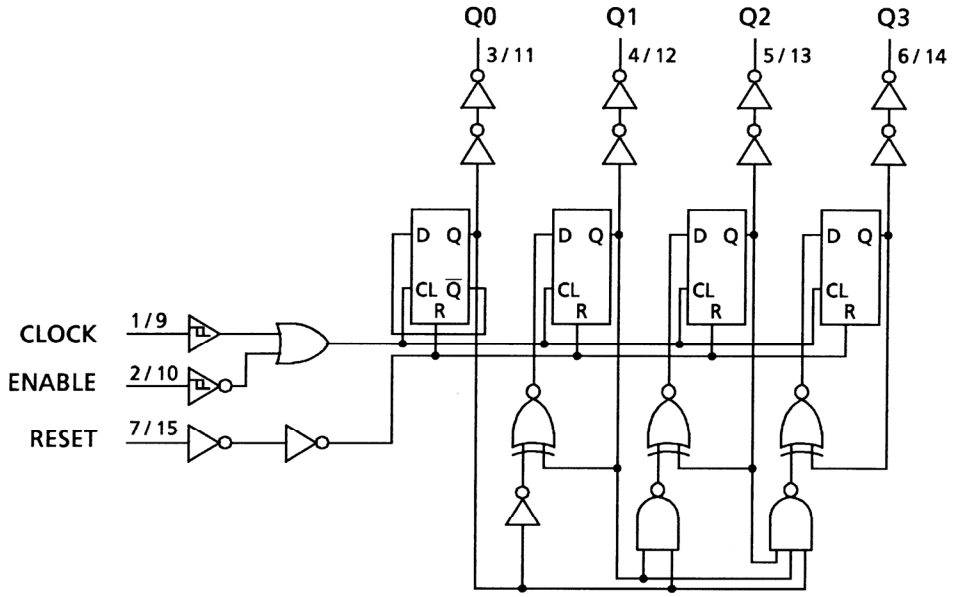


SOL16-P-150-1.27

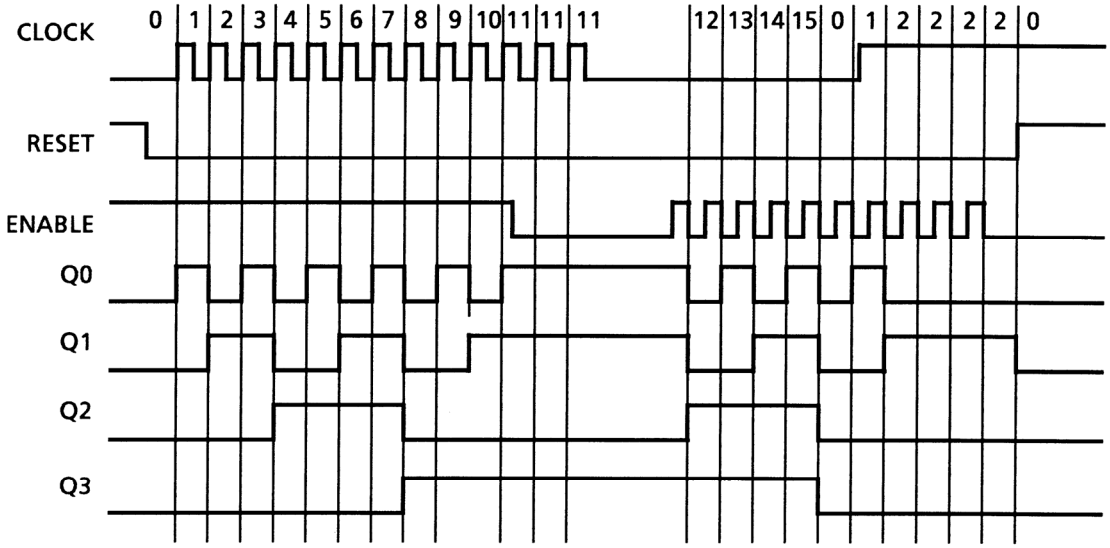
Weight

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.)

Logic Diagram



Timing Chart



Absolute Maximum Ratings (Note)

Characteristics	Symbol	Rating	Unit
DC supply voltage	V_{DD}	V_{SS} − 0.5~V_{SS} + 20	V
Input voltage	V_{IN}	V_{SS} − 0.5~V_{DD} + 0.5	V
Output voltage	V_{OUT}	V_{SS} − 0.5~V_{DD} + 0.5	V
DC input current	I_{IN}	±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

Note: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Recommended Operating Conditions (V_{SS} = 0 V) (Note)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
DC supply voltage	V_{DD}	—	3	—	18	V
Input voltage	V_{IN}	—	0	—	V_{DD}	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		Sym-bol	Test Condition		−40°C		25°C			85°C		Unit
				V_{DD} (V)	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	−0.61	—	−0.51	−1.0	—	−0.42	—	mA
			V_{OH} = 2.5 V	5	−2.5	—	−2.1	−4.0	—	−1.7	—	
			V_{OH} = 9.5 V	10	−1.5	—	−1.3	−2.2	—	−1.1	—	
			V_{OH} = 13.5 V	15	−4.0	—	−3.4	−9.0	—	−2.8	—	
			$V_{IN} = V_{SS}, V_{DD}$									
Output low current		I_{OL}	V_{OL} = 0.4 V	5	0.61	—	0.51	1.2	—	0.42	—	mA
			V_{OL} = 0.5 V	10	1.5	—	1.3	3.2	—	1.1	—	
			V_{OL} = 1.5 V	15	4.0	—	3.4	12.0	—	2.8	—	
			$V_{IN} = V_{SS}, V_{DD}$									
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	5.5	—	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	—	4.5	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	—	5	—	0.005	5	—	150	μA
				10	—	10	—	0.010	10	—	300	
				15	—	20	—	0.015	20	—	600	

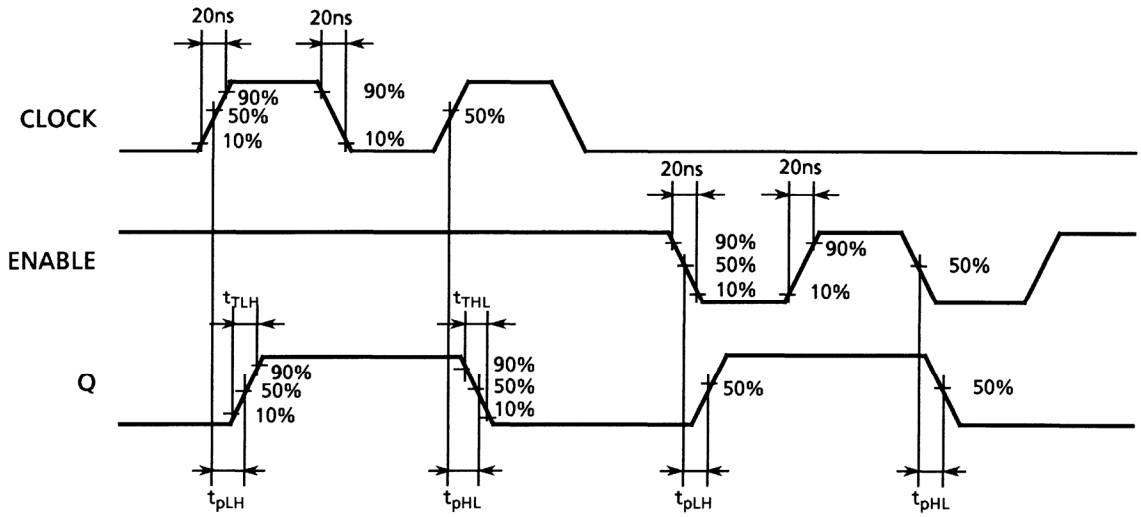
Note: All valid input combinations.

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

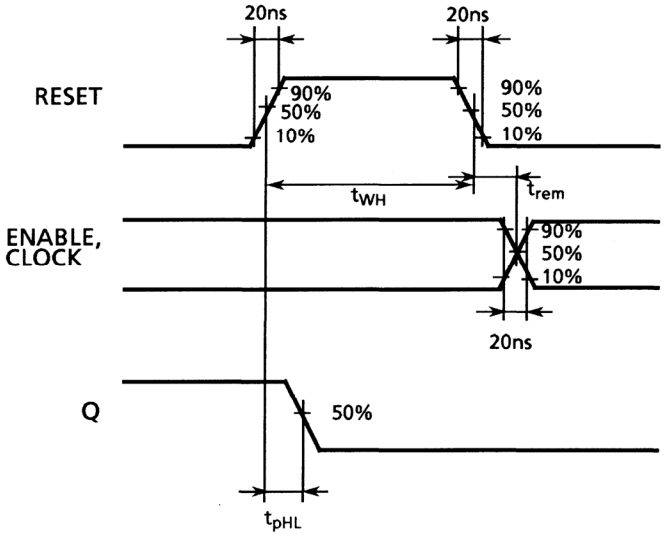
Characteristics	Symbol	Test Condition	V_{DD} (V)	Min	Typ.	Max	Unit
Output transition time (low to high)	t_{TLH}	—	5	—	70	200	ns
			10	—	35	100	
			15	—	30	80	
Output transition time (high to low)	t_{THL}	—	5	—	70	200	ns
			10	—	35	100	
			15	—	30	80	
Propagation delay time (CLOCK, ENABLE-Q)	t_{pLH} t_{pHL}	—	5	—	160	560	ns
			10	—	75	230	
			15	—	60	160	
Propagation delay time (RESET-Q)	t_{pHL}	—	5	—	110	560	ns
			10	—	55	230	
			15	—	40	160	
Max clock frequency	t_{CL}	—	5	1.5	6	—	MHz
			10	3	14	—	
			15	4	18	—	
Max clock input rise/fall time	t_{rCL} t_{fCL}	—	5	No limit			μs
			10				
			15				
Max input rise/fall time (ENABLE)	t_r t_f	—	5	No limit			μs
			10				
			15				
Min clock pulse width	t_W	—	5	—	30	200	ns
			10	—	15	100	
			15	—	10	70	
Min pulse width (ENABLE)	t_W	—	5	—	35	250	ns
			10	—	20	110	
			15	—	15	80	
Min pulse width (RESET)	t_{WH}	—	5	—	45	250	ns
			10	—	20	110	
			15	—	15	80	
Min removal time (RESET-CLOCK, ENABLE)	t_{rem}	—	5	—	—	0	ns
			10	—	—	0	
			15	—	—	0	
Input capacitance	C_{IN}	—		—	5	7.5	pF

Waveforms for Measurement of Dynamic Characteristics

Waveform 1

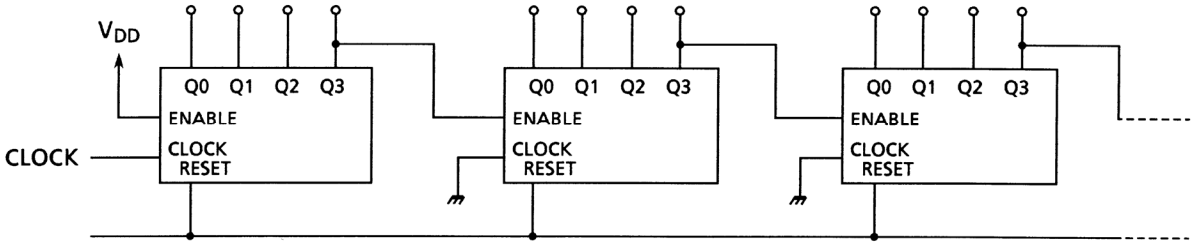


Waveform 2

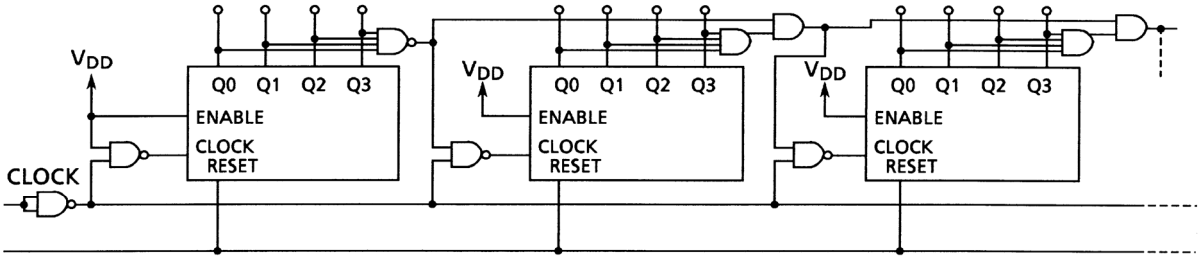


Application Circuit

(1) Ripple carry counter

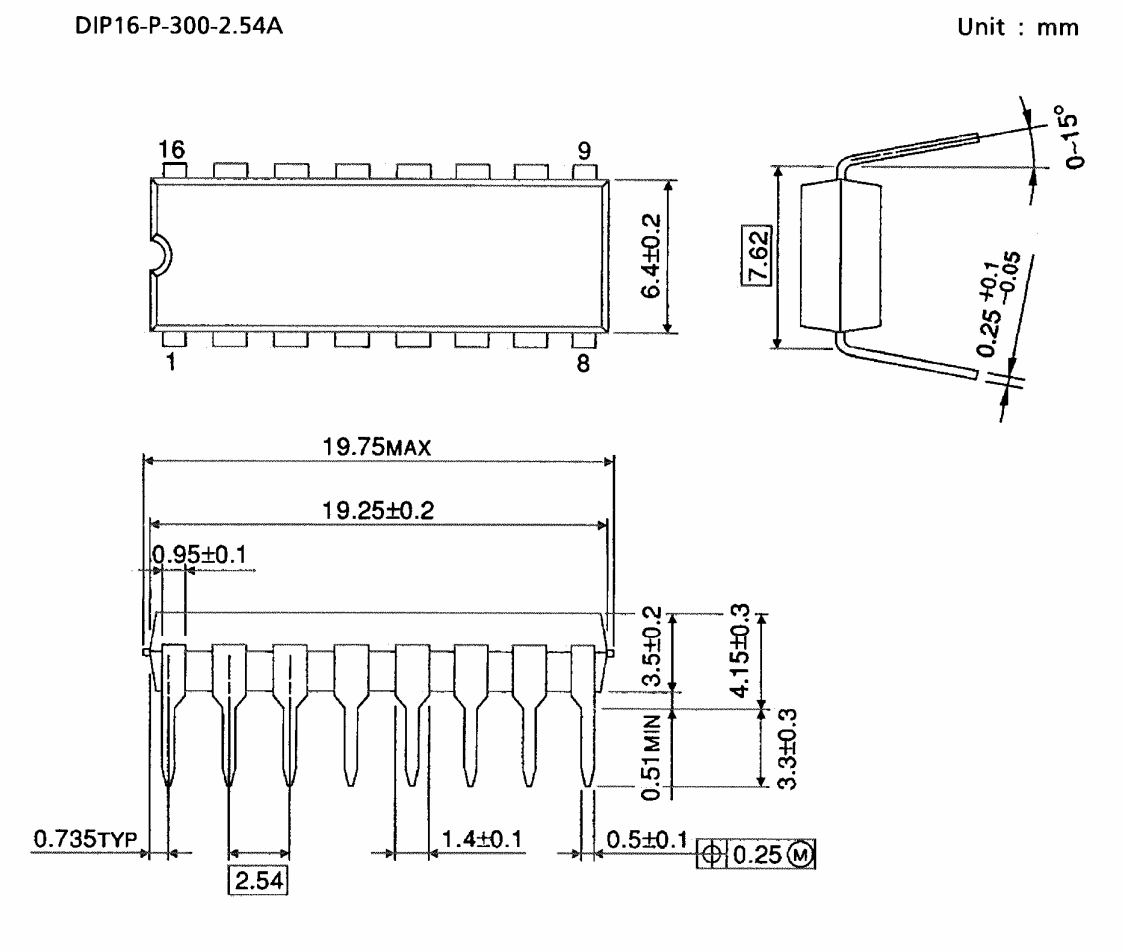


(2) Ripple carry counter



Package Dimensions

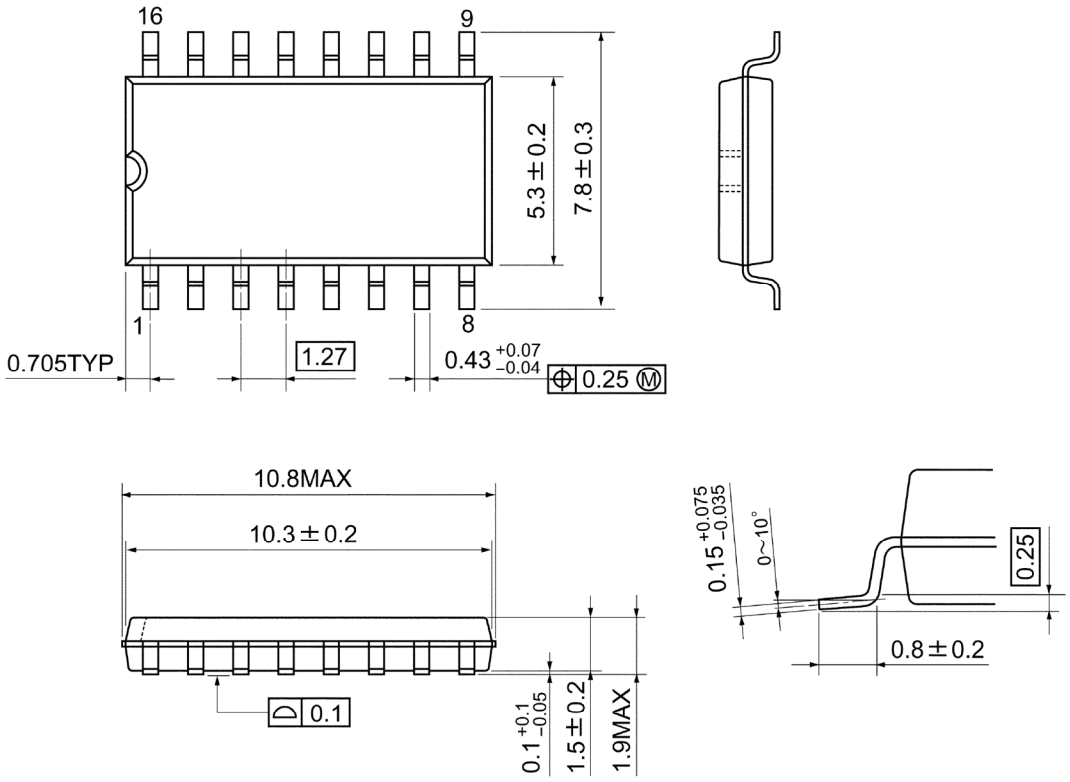
DIP16-P-300-2.54A Unit : mm



Weight: 1.00 g (typ.)

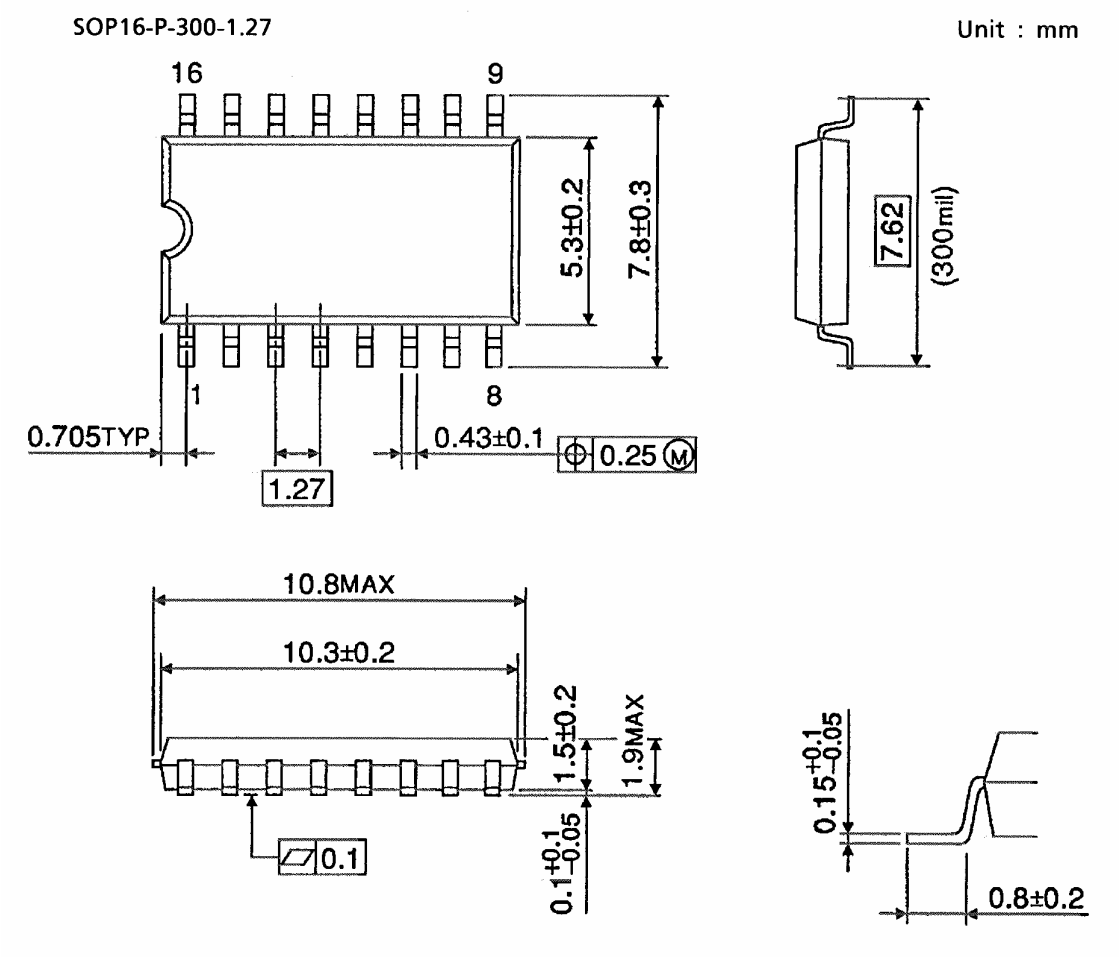
Package Dimensions

SOP16-P-300-1.27A Unit: mm



Weight: 0.18 g (typ.)

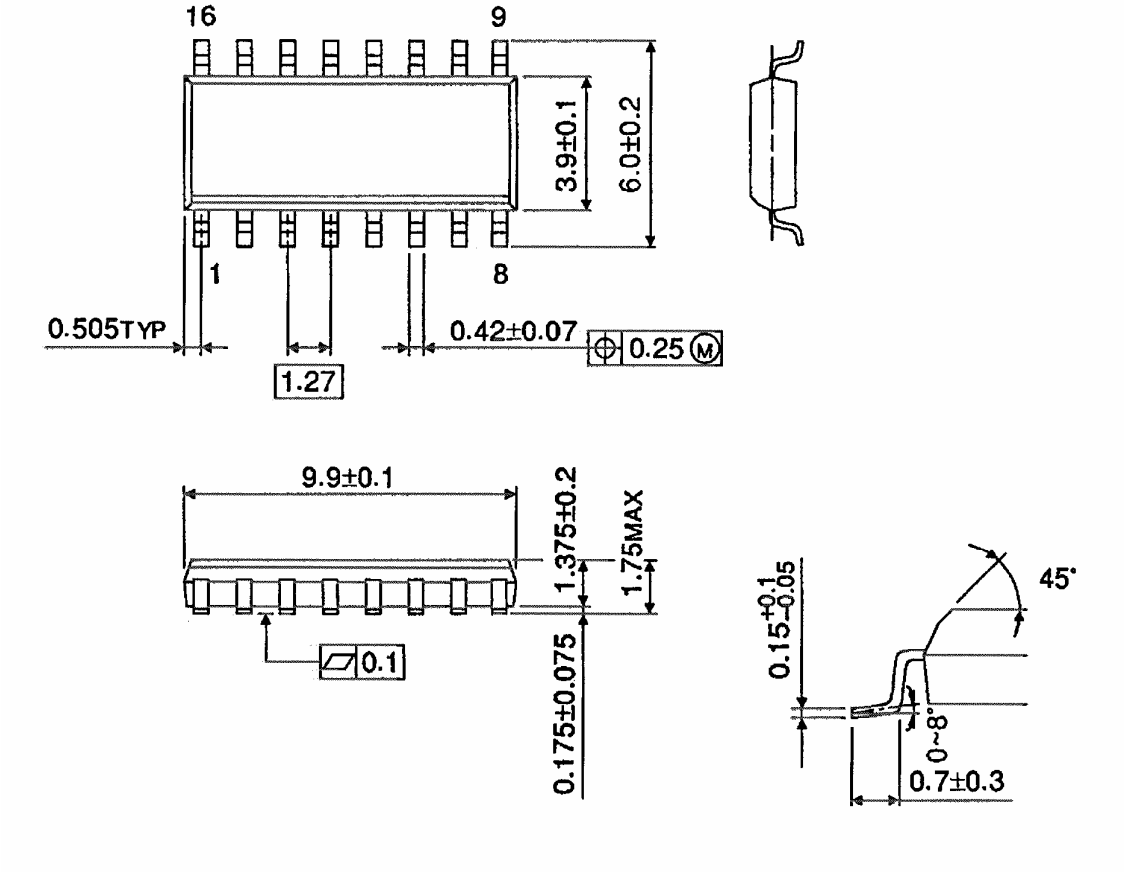
Package Dimensions



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