

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC4520BP, TC4520BF

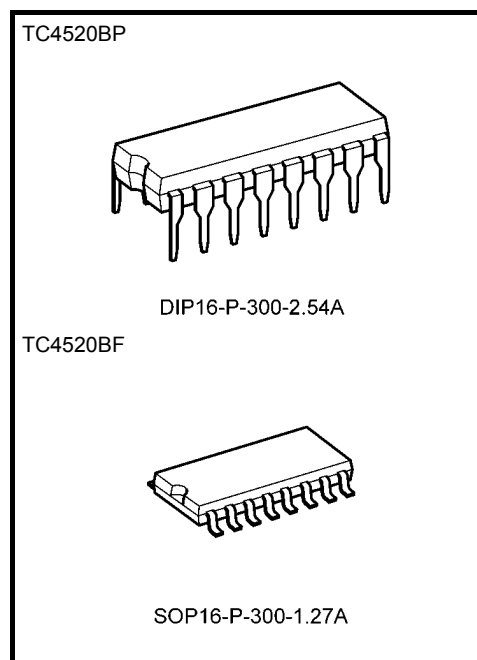
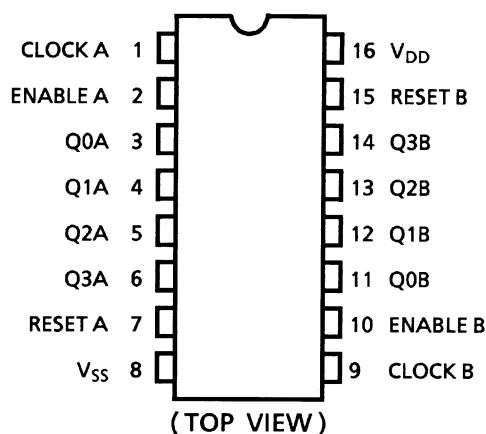
TC4520B Dual Binary Up Counter

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 eight binary bits can be achieved with one IC. The counters can be reset to "0" (Q0 to 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".

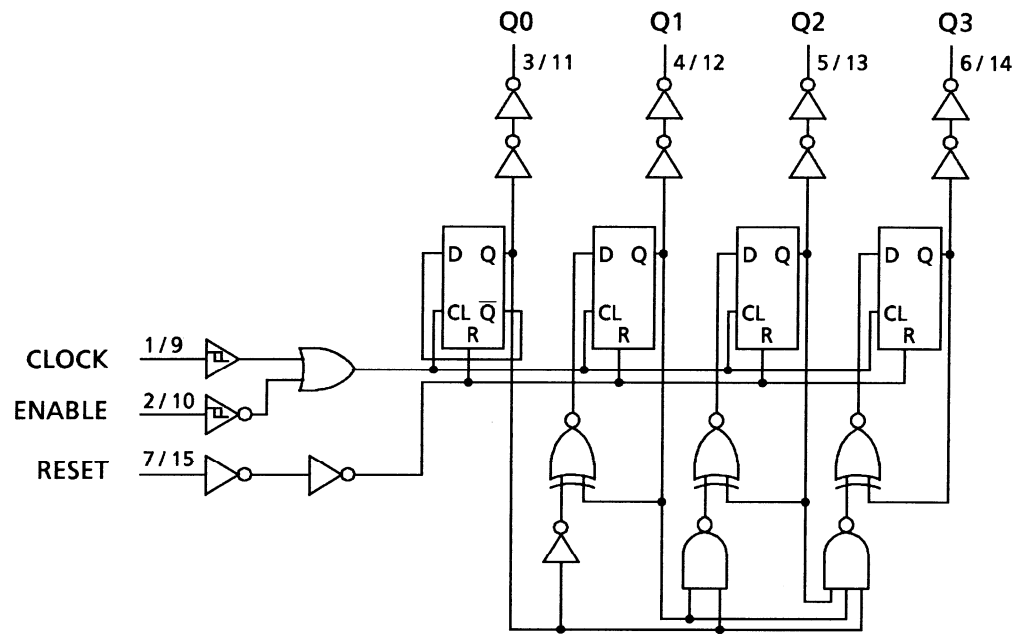
Pin Assignment



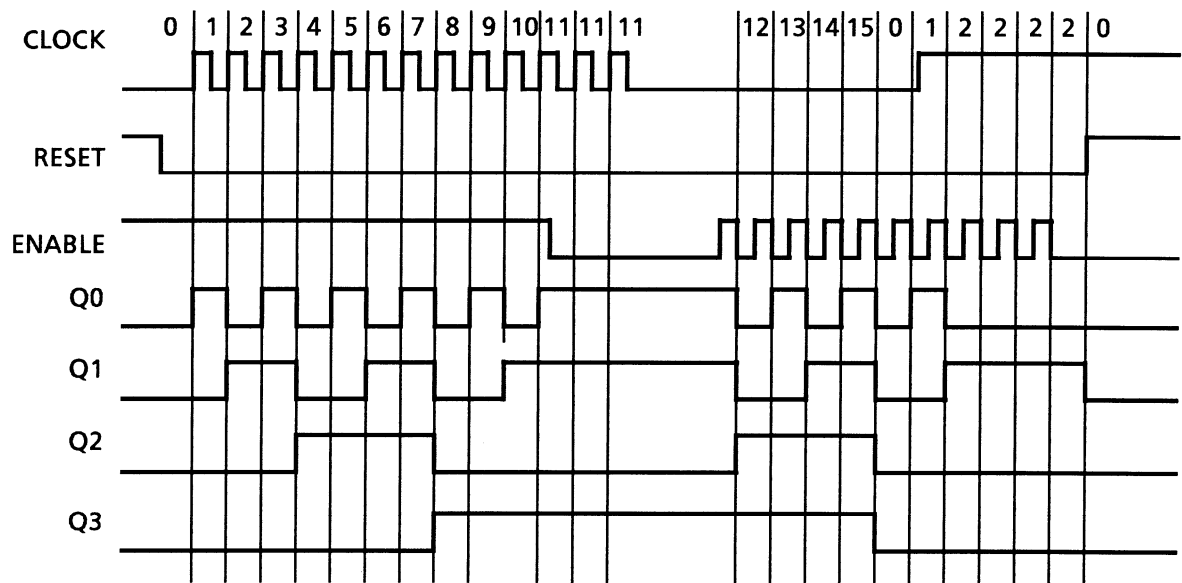
Weight
DIP16-P-300-2.54A : 1.00 g (typ.)
SOP16-P-300-1.27A : 0.18 g (typ.)

Start of commercial production
1978-09

Logic Diagram
1/2 TC4520B



Timing Chart



Absolute Maximum Ratings (Note)

Characteristics	Symbol	Rating	Unit
DC supply voltage	V_{DD}	$V_{SS} - 0.5$ to $V_{SS} + 20$	V
Input voltage	V_{IN}	$V_{SS} - 0.5$ to $V_{DD} + 0.5$	V
Output voltage	V_{OUT}	$V_{SS} - 0.5$ to $V_{DD} + 0.5$	V
DC input current	I_{IN}	± 10	mA
Power dissipation	P_D	300 (DIP)/180 (SOIC)	mW
Operating temperature range	T_{opr}	-40 to 85	°C
Storage temperature range	T_{stg}	-65 to 150	°C

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

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Operating Ranges ($V_{SS} = 0$ 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 operating ranges must be maintained to ensure the normal operation of the device.
Unused inputs must be tied to either V_{DD} or V_{SS} .

Static Electrical Characteristics ($V_{SS} = 0\text{ V}$)

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\text{ }\mu\text{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\text{ }\mu\text{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}	$V_{OH} = 4.6\text{ V}$	5	-0.61	—	-0.51	-1.0	—	-0.42	—	mA
			$V_{OH} = 2.5\text{ V}$	5	-2.5	—	-2.1	-4.0	—	-1.7	—	
			$V_{OH} = 9.5\text{ V}$	10	-1.5	—	-1.3	-2.2	—	-1.1	—	
			$V_{OH} = 13.5\text{ V}$	15	-4.0	—	-3.4	-9.0	—	-2.8	—	
			$V_{IN} = V_{SS}, V_{DD}$									
Output low current		I_{OL}	$V_{OL} = 0.4\text{ V}$	5	0.61	—	0.51	1.2	—	0.42	—	mA
			$V_{OL} = 0.5\text{ V}$	10	1.5	—	1.3	3.2	—	1.1	—	
			$V_{OL} = 1.5\text{ V}$	15	4.0	—	3.4	12.0	—	2.8	—	
			$V_{IN} = V_{SS}, V_{DD}$									
Input high voltage		V_{IH}	$V_{OUT} = 0.5\text{ V}, 4.5\text{ V}$	5	3.5	—	3.5	2.75	—	3.5	—	V
			$V_{OUT} = 1.0\text{ V}, 9.0\text{ V}$	10	7.0	—	7.0	5.5	—	7.0	—	
			$V_{OUT} = 1.5\text{ V}, 13.5\text{ V}$	15	11.0	—	11.0	8.25	—	11.0	—	
			$ I_{OUT} < 1\text{ }\mu\text{A}$									
Input low voltage		V_{IL}	$V_{OUT} = 0.5\text{ V}, 4.5\text{ V}$	5	—	1.5	—	2.25	1.5	—	1.5	V
			$V_{OUT} = 1.0\text{ V}, 9.0\text{ V}$	10	—	3.0	—	4.5	3.0	—	3.0	
			$V_{OUT} = 1.5\text{ V}, 13.5\text{ V}$	15	—	4.0	—	6.75	4.0	—	4.0	
			$ I_{OUT} < 1\text{ }\mu\text{A}$									
Input current	"H" level	I_{IH}	$V_{IH} = 18\text{ V}$	18	—	0.1	—	10^{-5}	0.1	—	1.0	μA
	"L" level	I_{IL}	$V_{IL} = 0\text{ V}$	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	

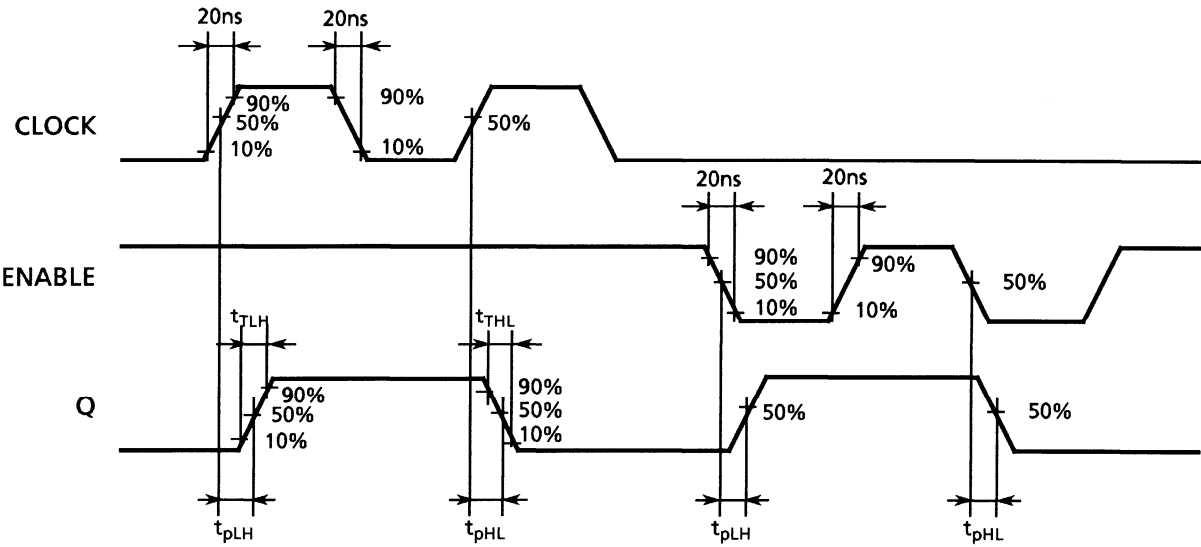
Note: All valid input combinations.

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

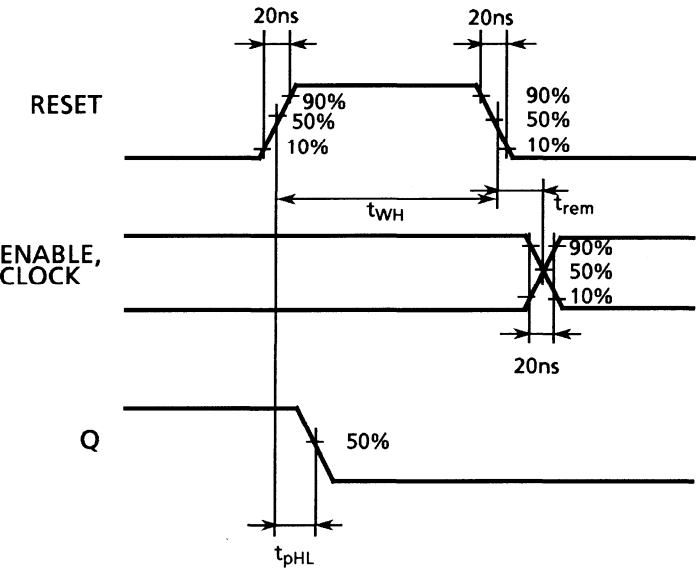
Characteristics	Symbol	Test Condition	V _{DD} (V)	Min	Typ.	Max	Unit
Output transition time (low to high)	t _{TLH}	—	5	—	70	200	ns
			10	—	35	100	
			15	—	30	80	
Output transition time (high to low)	t _{THL}	—	5	—	70	200	ns
			10	—	35	100	
			15	—	30	80	
Propagation delay time (CLOCK, ENABLE-Q)	t _{pLH} 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

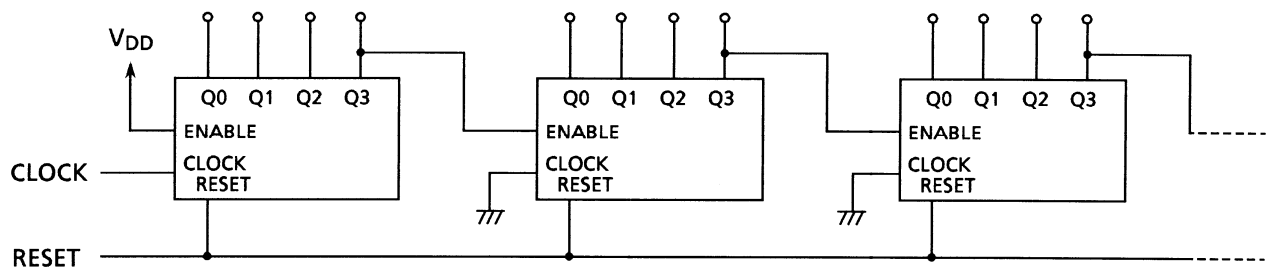


Waveform 2

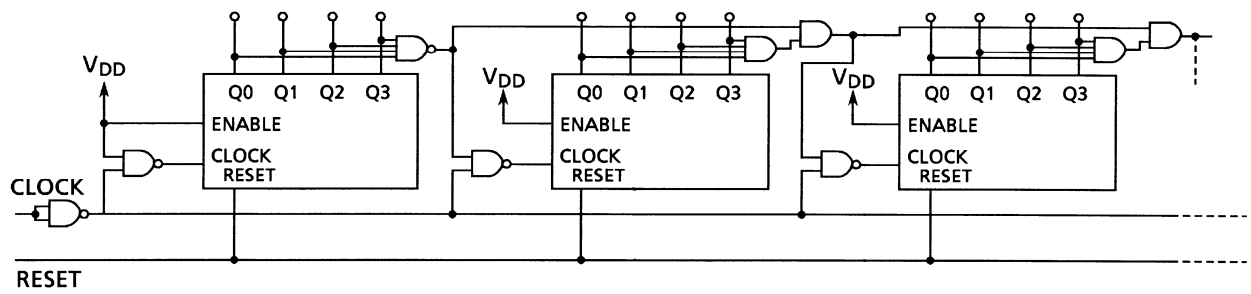


Application Circuit

Ripple carry counter



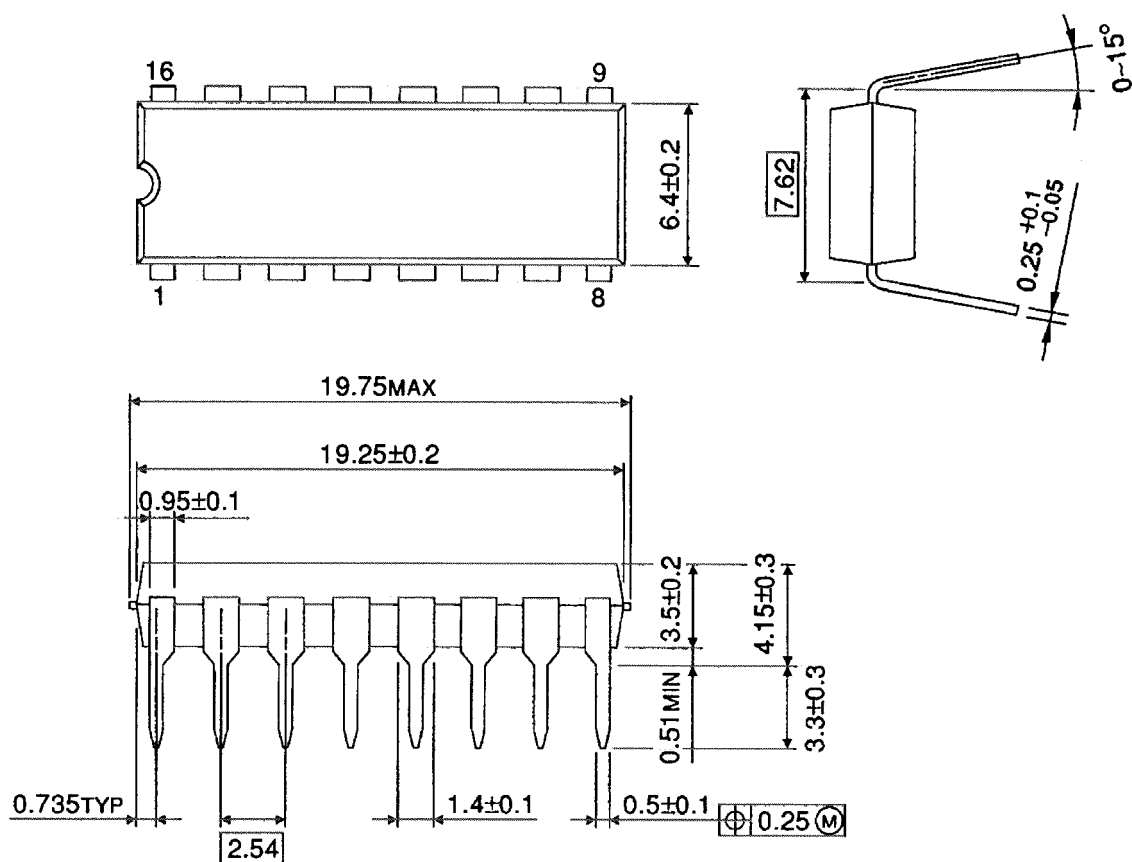
Ripple carry counter



Package Dimensions

DIP16-P-300-2.54A

Unit : mm

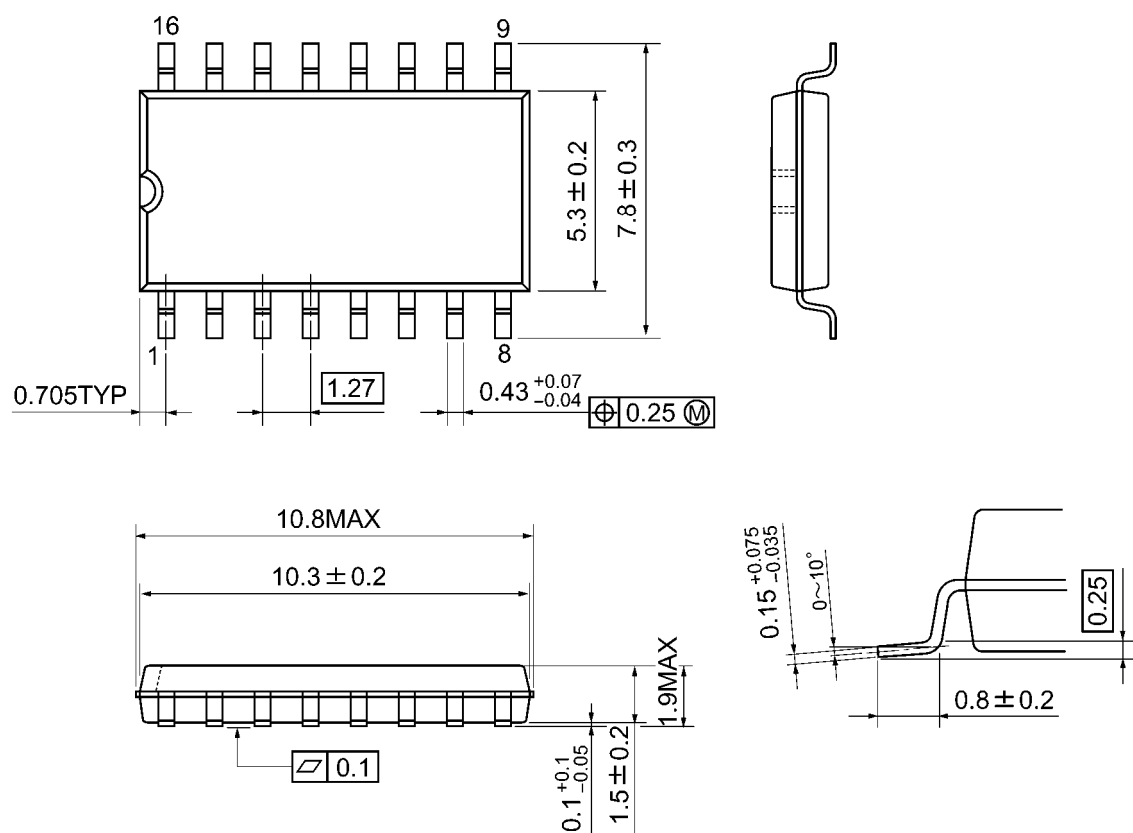


Weight: 1.00 g (typ.)

Package Dimensions

SOP16-P-300-1.27A

Unit: mm



Weight: 0.18 g (typ.)

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