TOSHIBA CMOS Digital Integrated Circuit   Silicon Monolithic
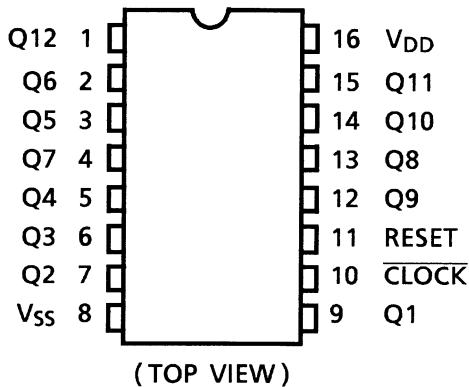
TC4040BP,TC4040BF,TC4040BFN

TC4040B 12 Stage Ripple-Carry Binary Counter/Dividers

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

TC4040B is 12 stage ripple carry binary counter having asynchronous clear function. This counter advances its counting stage by falling edge of $\overline{\text{CLOCK}}$ input. When RESET input is placed "H", all the circuits are reset regardless of $\overline{\text{CLOCK}}$ input making all the outputs (Q1 through Q12) to be "L".

This is most suitable for frequency dividers, control circuits and timing circuits.
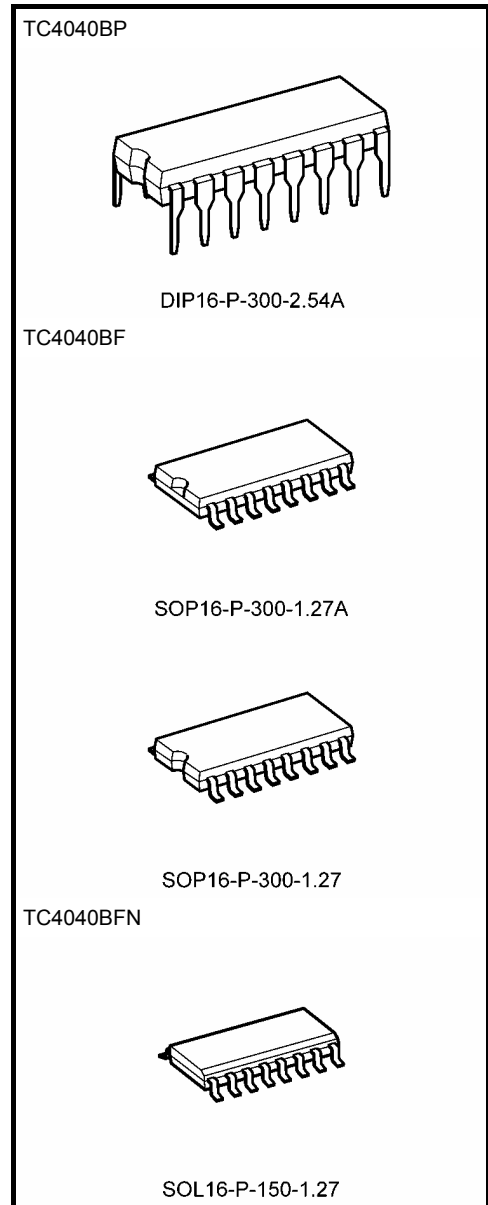
Pin Assignment

Q12	1		16	V_{DD}
Q6	2		15	Q11
Q5	3		14	Q10
Q7	4		13	Q8
Q4	5		12	Q9
Q3	6		11	RESET
Q2	7		10	$\overline{\text{CLOCK}}$
V_{SS}	8		9	Q1

(TOP VIEW)

Truth Table

$\overline{\text{CLOCK}}$ Δ	RESET	Output State
*	H	All Outputs = "L"
⌐_↑	L	No Change
⌐↓_	L	Advance to Next State

Δ: Level change

*: Don't care

TC4040BP

DIP16-P-300-2.54A

TC4040BF

SOP16-P-300-1.27A

SOP16-P-300-1.27

TC4040BFN

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
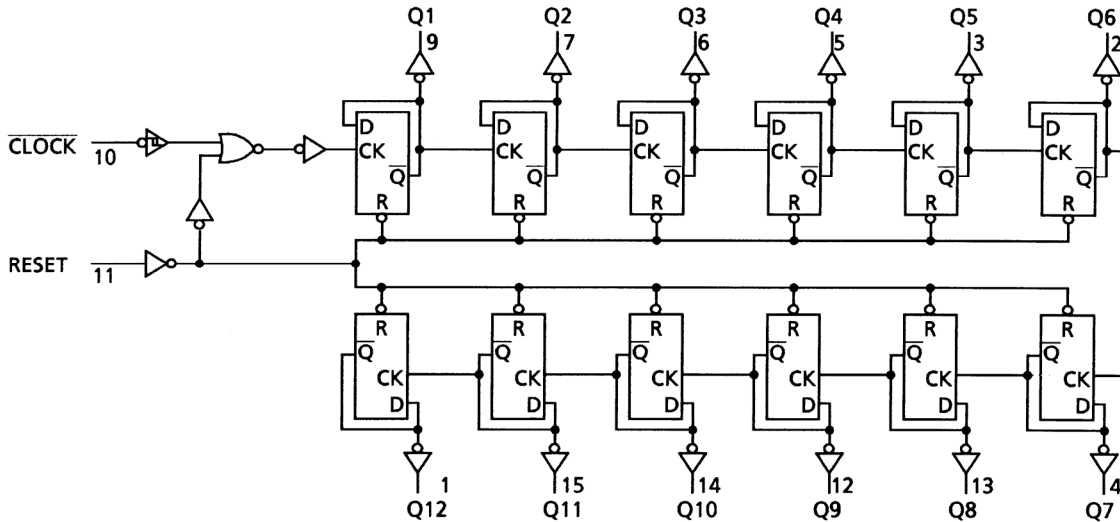
Absolute Maximum Ratings (Note)

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.

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	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
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$_{OH}$ = 4.6 V	5	−0.61	—	−0.51	−1.0	—	−0.42	—	mA
			V$_{OH}$ = 2.5 V	5	−2.50	—	−2.10	−4.0	—	−1.70	—	
			V$_{OH}$ = 9.5 V	10	−1.50	—	−1.30	−2.2	—	−1.10	—	
			V$_{OH}$ = 13.5 V	15	−4.00	—	−3.40	−9.0	—	−2.80	—	
			V$_{IN}$ = V$_{SS}$, V$_{DD}$									
Output low current		I$_{OL}$	V$_{OL}$ = 0.4 V	5	0.61	—	0.51	1.5	—	0.42	—	mA
			V$_{OL}$ = 0.5 V	10	1.50	—	1.30	3.2	—	1.10	—	
			V$_{OL}$ = 1.5 V	15	4.00	—	3.40	12.0	—	2.80	—	
			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	5.50	—	7.0	—	
			V$_{OUT}$ = 1.5 V, 13.5 V	15	11.0	—	11.0	8.25	—	11.0	—	
			$\|I_{OUT}\| < 1\ \mu A$									
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	—	4.50	3.0	—	3.0	
			V$_{OUT}$ = 1.5 V, 13.5 V	15	—	4.0	—	6.75	4.0	—	4.0	
			$\|I_{OUT}\| < 1\ \mu A$									
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 ($\overline{CLOCK}$ -Q1)	t_{pLH}	—	5	—	160	360	ns
			10	—	80	160	
			15	—	65	130	
Propagation delay time ($\overline{CLOCK}$ -Q1)	t_{pHL}	—	5	—	160	360	ns
			10	—	80	160	
			15	—	65	130	
Propagation delay time ($\overline{CLOCK}$ -Q12)	t_{pLH}	—	5	—	900	1800	ns
			10	—	450	900	
			15	—	360	720	
Propagation delay time ($\overline{CLOCK}$ -Q12)	t_{pHL}	—	5	—	900	1800	ns
			10	—	450	900	
			15	—	360	720	
Propagation delay time (RESET-Q)	t_{pHL}	—	5	—	150	280	ns
			10	—	70	120	
			15	—	50	100	
Max clock frequency	f_{CL}	—	5	3.5	10	—	MHz
			10	8.0	20	—	
			15	12.0	25	—	
Min clock pulse width	t_W	—	5	—	50	140	ns
			10	—	20	60	
			15	—	15	40	
Min pulse width (RESET)	t_W	—	5	—	100	200	ns
			10	—	40	80	
			15	—	30	60	
Min removal time (RESET- $\overline{CLOCK}$)	t_{rem}	—	5	—	—	350	ns
			10	—	—	150	
			15	—	—	100	
Max clock input rise time / Max clock input fall time	t_{rCL} / t_{fCL}	—	5 / 10 / 15	No limit			μs
Input capacitance	C_{IN}	—		—	5	7.5	pF

Waveforms for Measurement of Dynamic Characteristics

Waveform 1
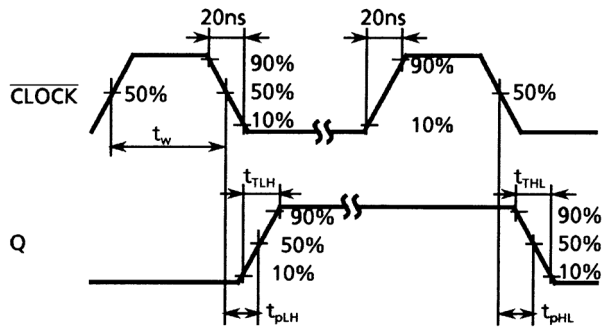
Waveform 2
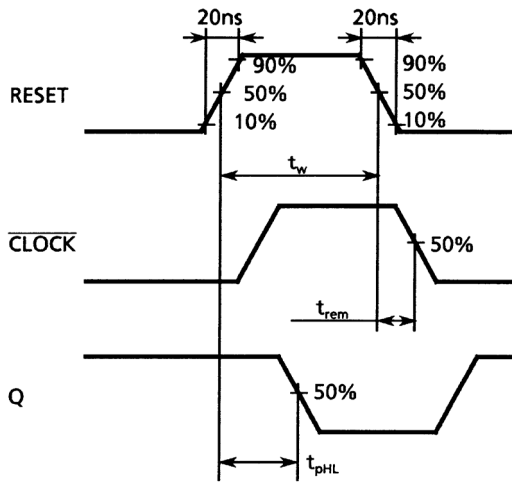
Package Dimensions

DIP16-P-300-2.54A   Unit : mm
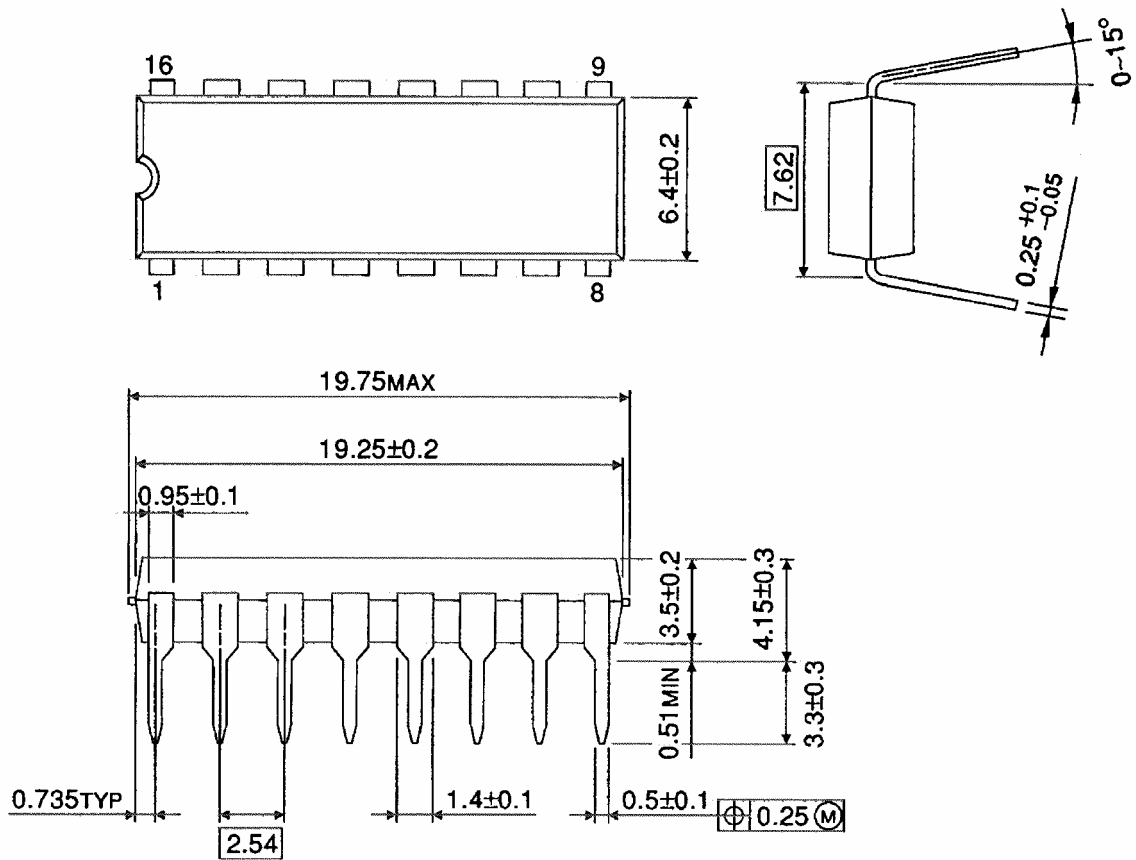
Weight: 1.00 g (typ.)
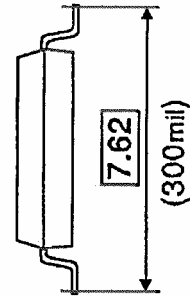
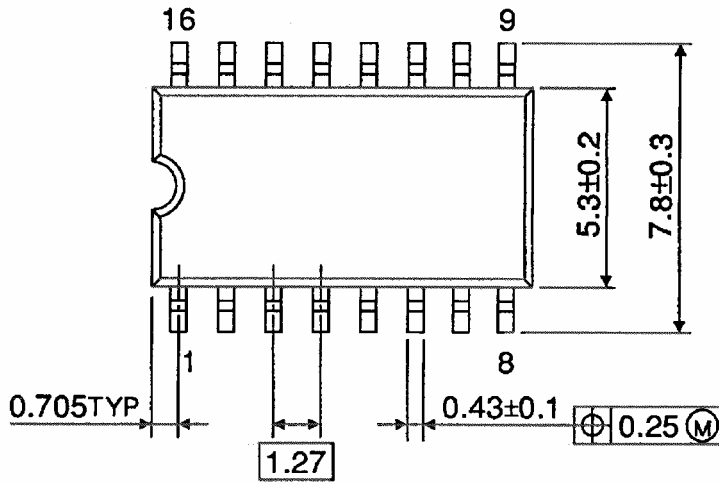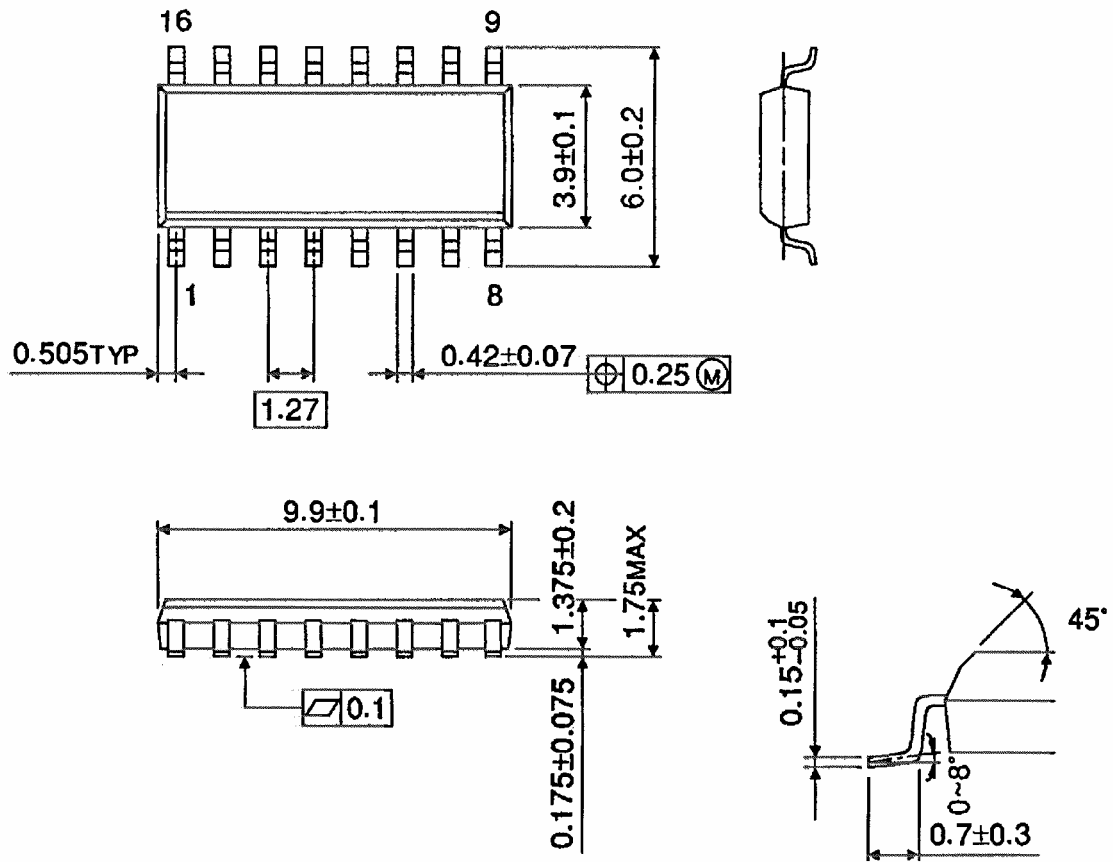## Package Dimensions

SOP16-P-300-1.27A

Unit: mm

16   9

5.3 ± 0.2

7.8 ± 0.3

1   8

0.705TYP

1.27

0.43 +0.07 −0.04

⊕ 0.25 Ⓜ

10.8MAX

10.3 ± 0.2

1.9MAX

▱ 0.1

0.1 +0.1 −0.05

1.5 ± 0.2

0.15 +0.075 −0.035

0〜10°

0.25

0.8 ± 0.2
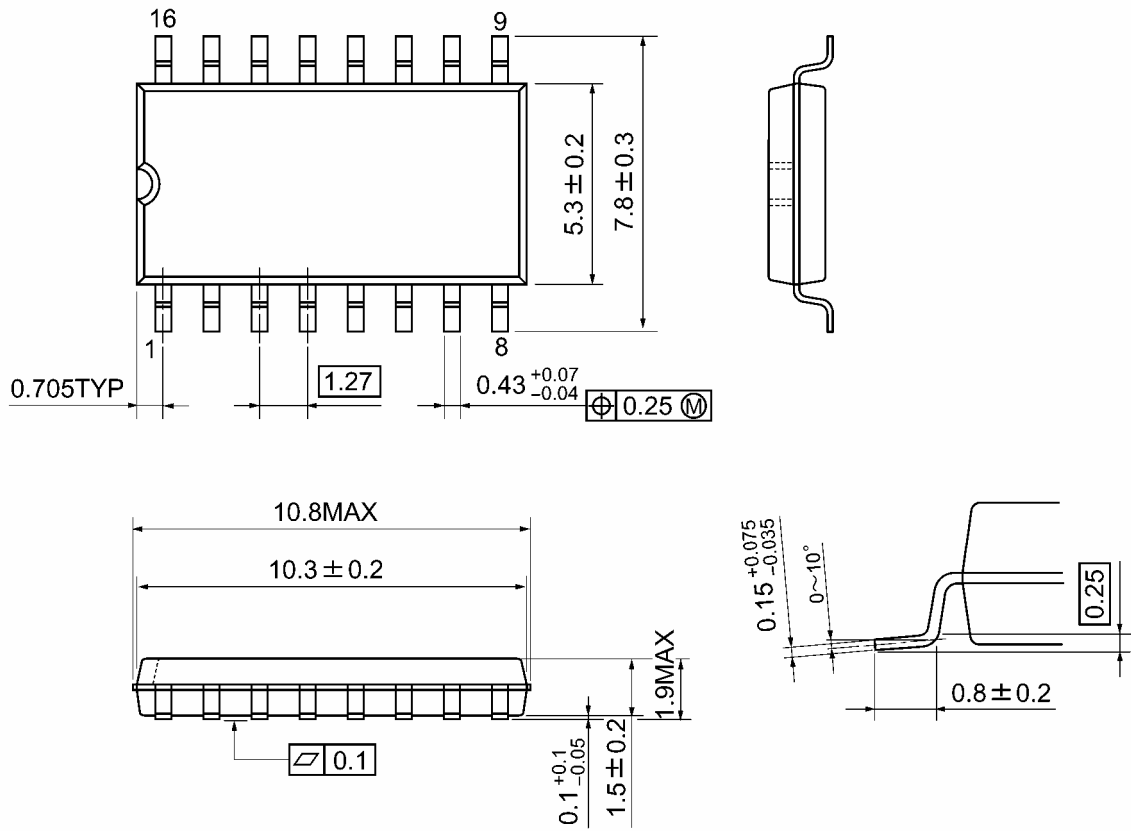
Weight: 0.18 g (typ.)

Package Dimensions

SOP16-P-300-1.27   Unit : mm
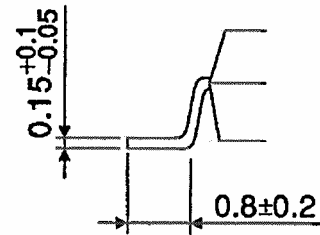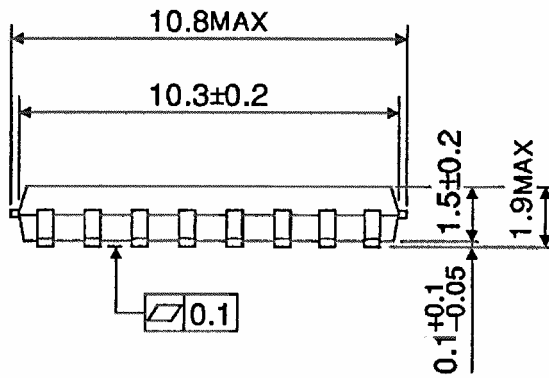
Weight: 0.18 g (typ.)

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