

TC74AC390P, TC74AC390F, TC74AC390FN

DUAL DECADE COUNTER

The TC74AC390 is an advanced high speed CMOS DUAL DECADE COUNTER fabricated with silicon gate and double-layer metal wiring C²MOS technology.

It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

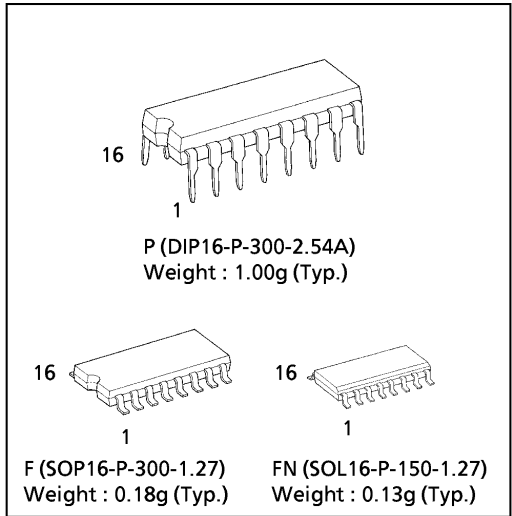
It consists of two independent 4-bit counters, each composed of a divide-by-two and a divide-by-five counter. The divide-by-two counter is incremented on the negative going transition of clock A (\overline{CKA}). The divided-by-five counter is incremented on the negative going transition of clock B (\overline{CKB}). The counter can be cascaded to form decade, bi-quinary, or various combinations up to a divide-by-100 counter. When the CLEAR input is set high, the Q outputs are set to low independent of the clock inputs.

All inputs are equipped with protection circuits against static discharge or transient excess voltage.

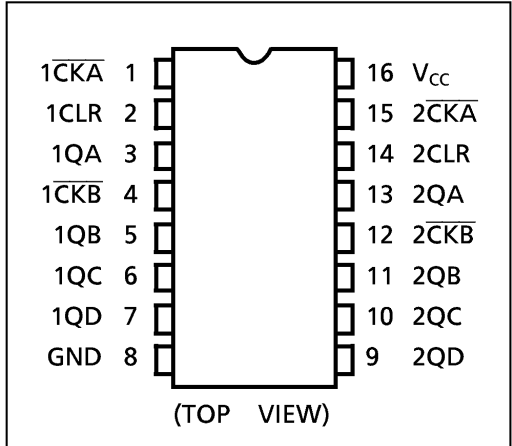
FEATURES:

- High Speed..... $f_{MAX} = 160\text{MHz}$ (typ.)
at $V_{CC} = 5\text{V}$
- Low Power Dissipation..... $I_{CC} = 8\mu\text{A}$ (Max.) at $T_a = 25^\circ\text{C}$
- High Noise Immunity..... $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (Min.)
- Symmetrical Output Impedance... $|I_{OH}| = I_{OL} = 24\text{mA}$ (Min.)
Capability of driving 50Ω transmission lines.
- Balanced Propagation Delays..... $t_{pLH} \approx t_{pHL}$
- Wide Operating Voltage Range... V_{CC} (opr) = $2\text{V} \sim 5.5\text{V}$
- Pin and Function Compatible with 74HC390

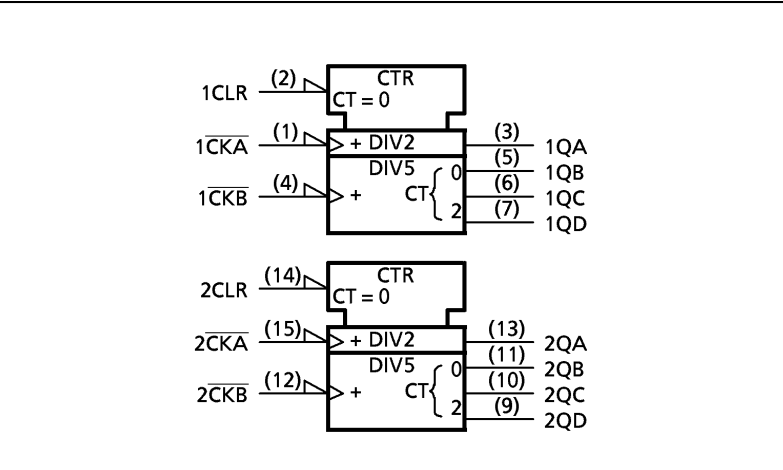
(Note) The JEDEC SOP (FN) is not available in Japan.



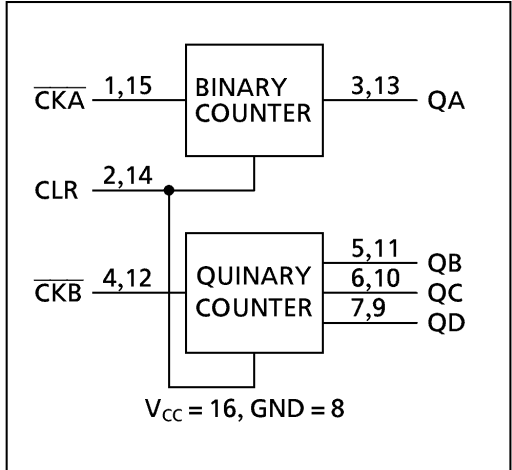
PIN ASSIGNMENT



IEC LOGIC SYMBOL



BLOCK DAIGRAM



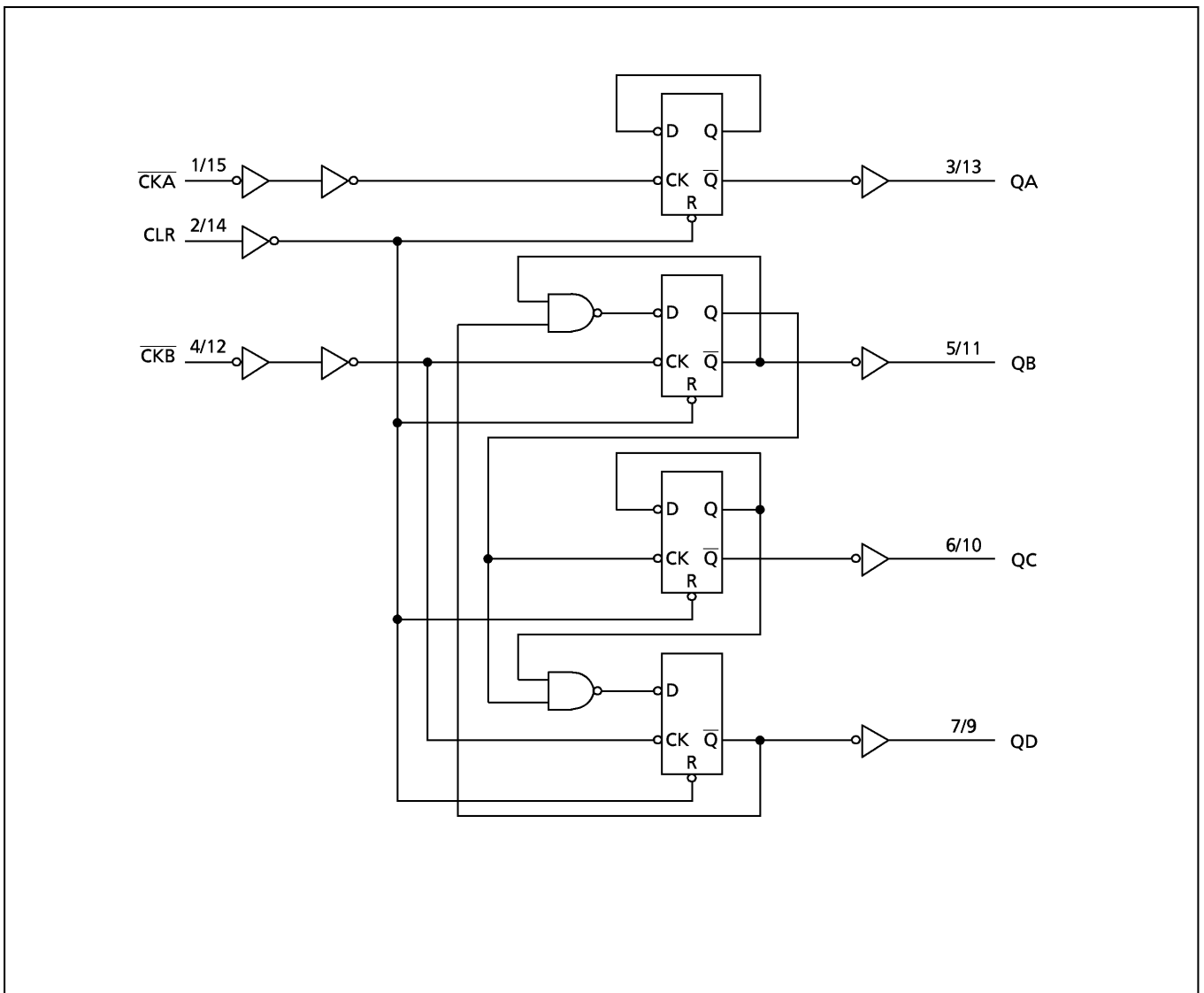
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TRUTH TABLE

INPUTS			OUTPUTS			
\overline{CKA}	\overline{CKB}	CLR	QA	QB	QC	QD
X	X	H	L	L	L	L
\downarrow	X	L	BINARY COUNT UP			
X	\downarrow	L	QUINARY COUNT UP			

SYSTEM DIAGRAM

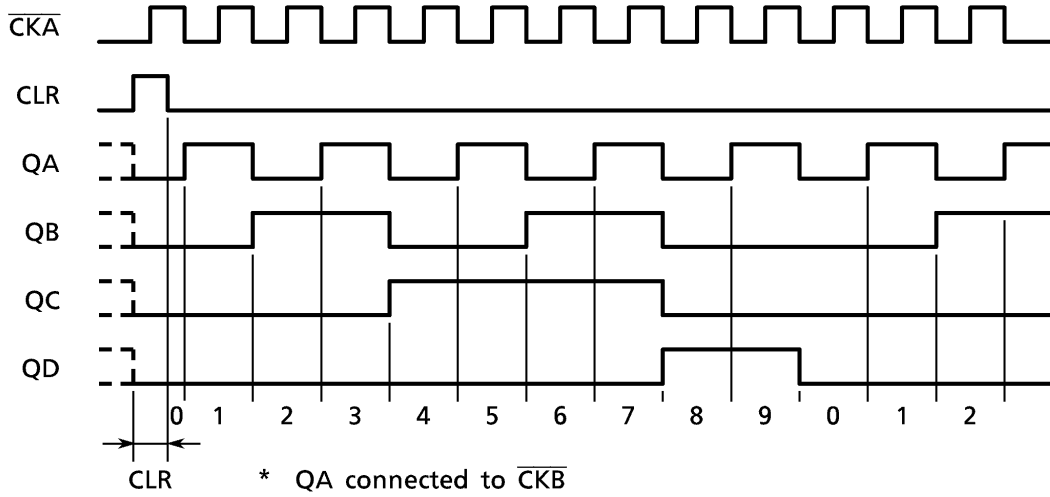


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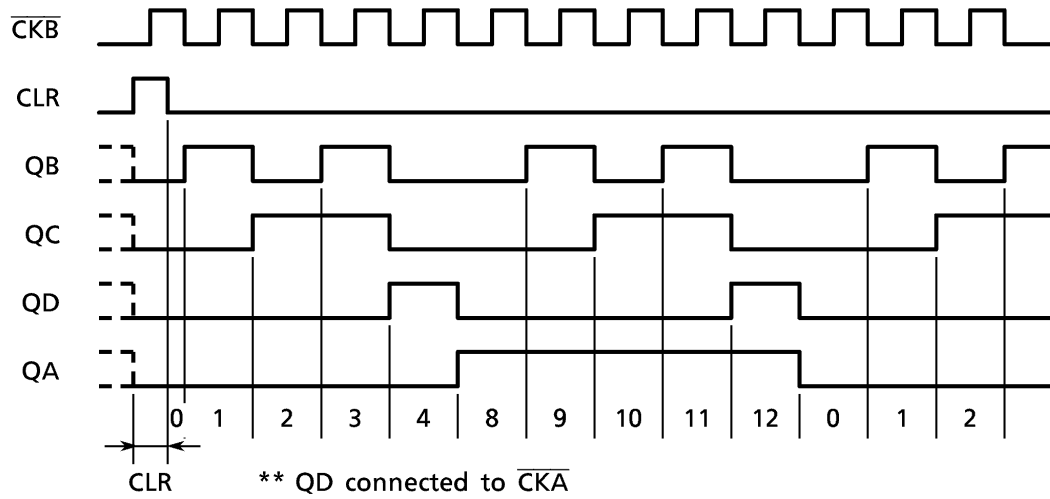
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TIMING CHART

(1) BCD COUNT SEQUENCE*



(2) BI-QUINARY COUNT SEQUENCE**



ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	V_{CC}	-0.5~7.0	V
DC Input Voltage	V_{IN}	-0.5~ $V_{CC} + 0.5$	V
DC Output Voltage	V_{OUT}	-0.5~ $V_{CC} + 0.5$	V
Input Diode Current	I_{IK}	± 20	mA
Output Diode Current	I_{OK}	± 50	mA
DC Output Current	I_{OUT}	± 50	mA
DC V_{CC} /Ground Current	I_{CC}	± 200	mA
Power Dissipation	P_D	500 (DIP)* / 180 (SOP)	mW
Storage Temperature	T_{stg}	-65~150	°C

*500mW in the range of $T_a = -40^{\circ}\text{C} \sim 65^{\circ}\text{C}$. From $T_a = 65^{\circ}\text{C}$ to 85°C a derating factor of $-10\text{mW}/^{\circ}\text{C}$ should be applied up to 300mW.

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	V_{CC}	2.0~5.5	V
Input Voltage	V_{IN}	0~ V_{CC}	V
Output Voltage	V_{OUT}	0~ V_{CC}	V
Operating Temperature	T_{opr}	-40~85	°C
Input Rise and Fall Time	dt/dV	0~ 100 ($V_{CC} = 3.3 \pm 0.3\text{V}$) 0~ 20 ($V_{CC} = 5 \pm 0.5\text{V}$)	ns/V

DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION	V_{CC} (V)	$T_a = 25^{\circ}\text{C}$			$T_a = -40 \sim 85^{\circ}\text{C}$		UNIT	
				MIN.	TYP.	MAX.	MIN.	MAX.		
High - Level Input Voltage	V_{IH}		2.0	1.50	—	—	1.50	—	V	
			3.0	2.10	—	—	2.10	—		
			5.5	3.85	—	—	3.85	—		
Low - Level Input Voltage	V_{IL}		2.0	—	—	0.50	—	0.50	V	
			3.0	—	—	0.90	—	0.90		
			5.5	—	—	1.65	—	1.65		
High - Level Output Voltage	V_{OH}	$V_{IN} = V_{IH}$	$I_{OH} = -50\mu\text{A}$	2.0	1.9	2.0	—	1.9	V	
				3.0	2.9	3.0	—	2.9		—
		$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -4\text{mA}$	3.0	2.58	—	—	2.48		—
				4.5	3.94	—	—	3.80		—
Low - Level Output Voltage	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 50\mu\text{A}$	2.0	—	0.0	0.1	—	0.1	V
				3.0	—	0.0	0.1	—	0.1	
		$I_{OL} = 12\text{mA}$	3.0	—	—	0.36	—	0.44		
			4.5	—	—	0.36	—	0.44		
$I_{OL} = 24\text{mA}$	4.5	—	—	—	—	—	1.65			
	5.5	—	—	—	—	—	—			
Input Leakage Current	I_{IN}	$V_{IN} = V_{CC}$ or GND	5.5	—	—	± 0.1	—	± 1.0	μA	
Quiescent Supply Current	I_{CC}	$V_{IN} = V_{CC}$ or GND	5.5	—	—	8.0	—	80.0		

* : This spec indicates the capability of driving 50Ω transmission lines.

One output should be tested at a time for a 10ms maximum duration.

TIMING REQUIREMENTS (Input $t_r = t_f = 3ns$)

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C		Ta = -40~85°C		UNIT
			V _{CC} (V)	LIMIT	LIMIT	LIMIT	
Minimum Pulse Width (\overline{CKA} , \overline{CKB})	$t_{W(H)}$ $t_{W(L)}$		3.3 ± 0.3	7.0	7.0	7.0	ns
			5.0 ± 0.5	5.0	5.0	5.0	
Minimum Pulse Width (CLR)	$t_{W(H)}$		3.3 ± 0.3	7.0	7.0	7.0	
			5.0 ± 0.5	5.0	5.0	5.0	
Minimum Removal Time	t_{rem}		3.3 ± 0.3	7.0	7.0	7.0	
			5.0 ± 0.5	3.5	3.5	3.5	

AC ELECTRICAL CHARACTERISTICS (C_L = 50pF, R_L = 500Ω, Input $t_r = t_f = 3ns$)

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C			Ta = -40~85°C		UNIT	
			V _{CC} (V)	MIN.	TYP.	MAX.	MIN.		MAX.
Propagation Delay Time (\overline{CKA} - QA)	t_{pLH} t_{pHL}		3.3 ± 0.3	—	8.2	14.0	1.0	16.0	ns
			5.0 ± 0.5	—	5.5	8.4	1.0	9.6	
Propagation Delay Time (\overline{CKA} - QC)	t_{pLH} t_{pHL}	QA connected to \overline{CKB}	3.3 ± 0.3	—	17.0	30.0	1.0	34.0	
			5.0 ± 0.5	—	10.5	17.5	1.0	20.0	
Propagation Delay Time (\overline{CKB} - QB, QD)	t_{pLH} t_{pHL}		3.3 ± 0.3	—	8.8	14.9	1.0	17.0	
			5.0 ± 0.5	—	6.0	9.4	1.0	10.7	
Propagation Delay Time (\overline{CKB} - QC)	t_{pLH} t_{pHL}		3.3 ± 0.3	—	11.0	18.8	1.0	21.5	
			5.0 ± 0.5	—	7.1	11.3	1.0	12.8	
Propagation Delay Time (CLR - Qn)	t_{pHL}		3.3 ± 0.3	—	7.7	12.5	1.0	14.3	
			5.0 ± 0.5	—	5.7	8.5	1.0	9.7	
Maximum Clock Frequency (\overline{CKA})	f_{MAX}		3.3 ± 0.3	60	120	—	60	—	MHz
			5.0 ± 0.5	100	180	—	100	—	
Maximum Clock Frequency (\overline{CKB})	f_{MAX}		3.3 ± 0.3	45	90	—	45	—	
			5.0 ± 0.5	90	140	—	90	—	
Input Capacitance	C _{IN}		—	5	10	—	10	pF	
Power Dissipation Capacitance	C _{PD} (1)		—	40	—	—	—		

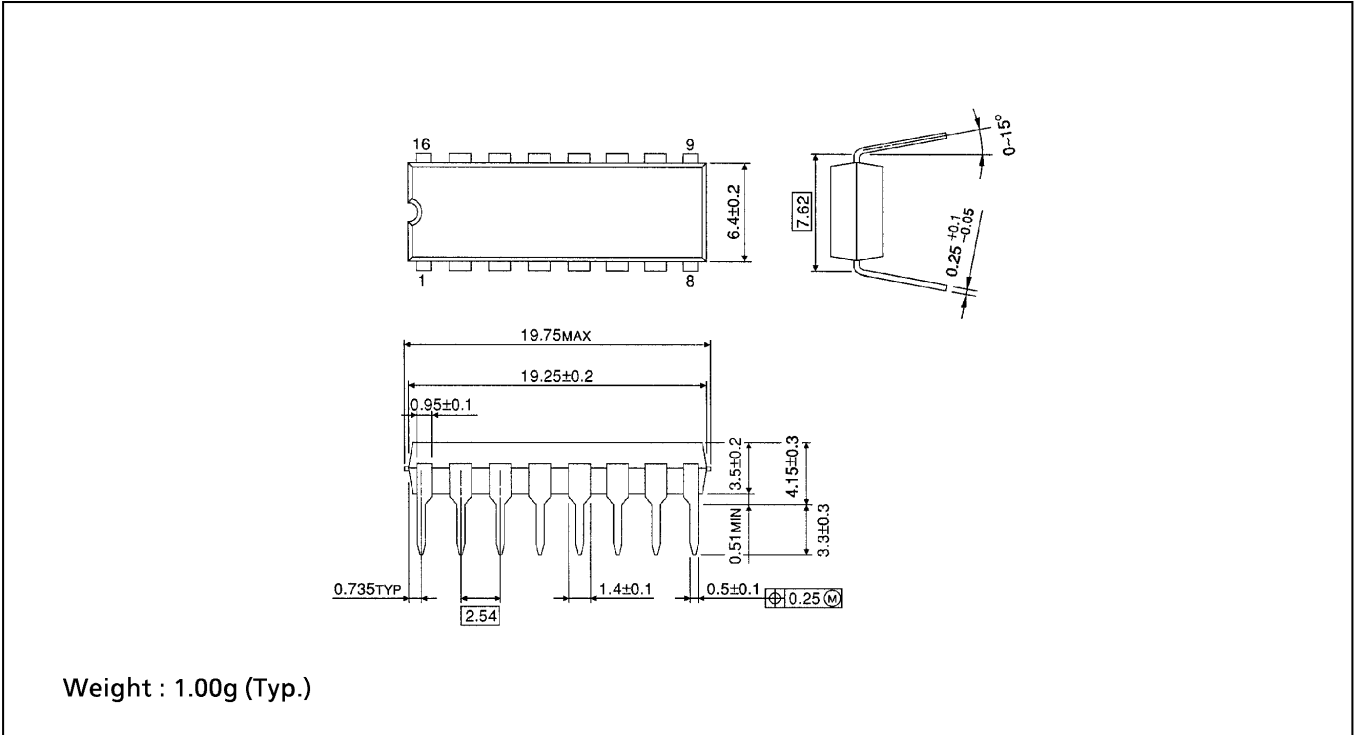
Note (1) C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

$$I_{CC(opr.)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 2 \text{ (per Counter)}$$

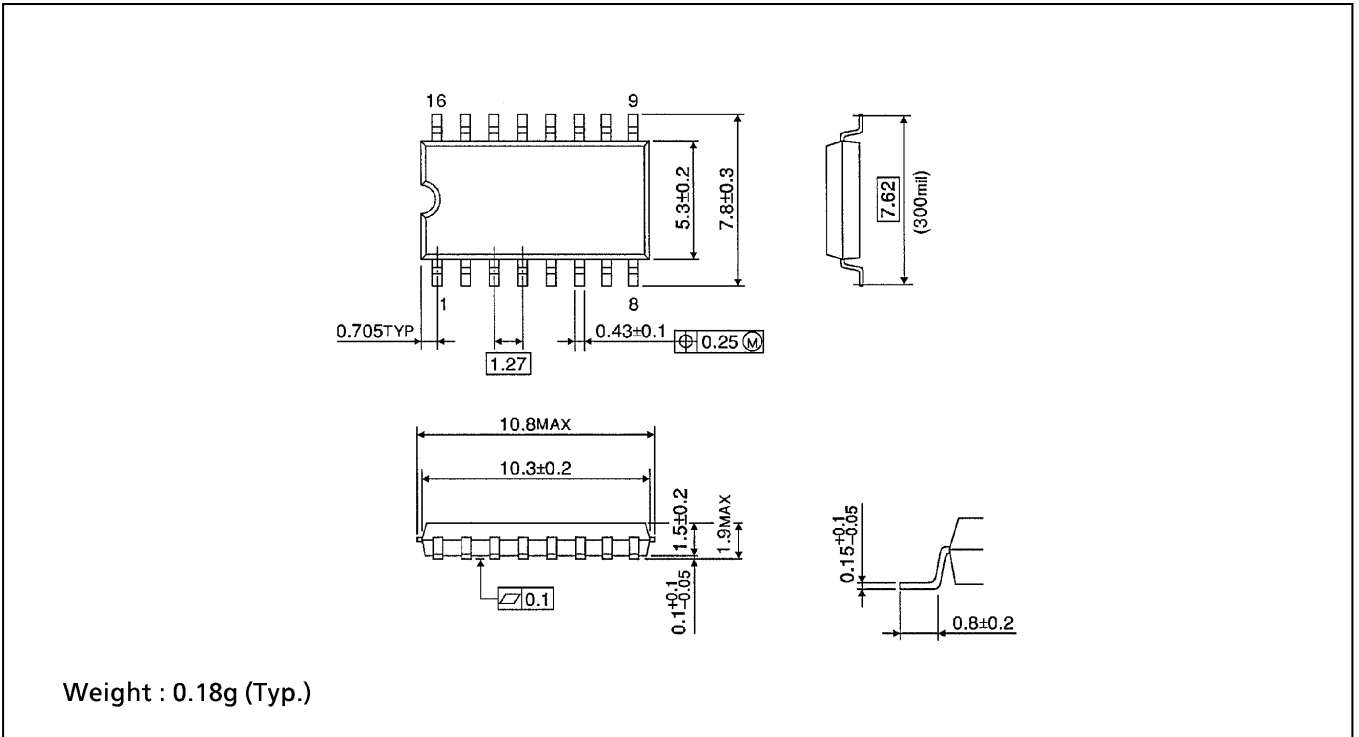
DIP 16PIN OUTLINE DRAWING (DIP16-P-300-2.54A)

Unit in mm



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

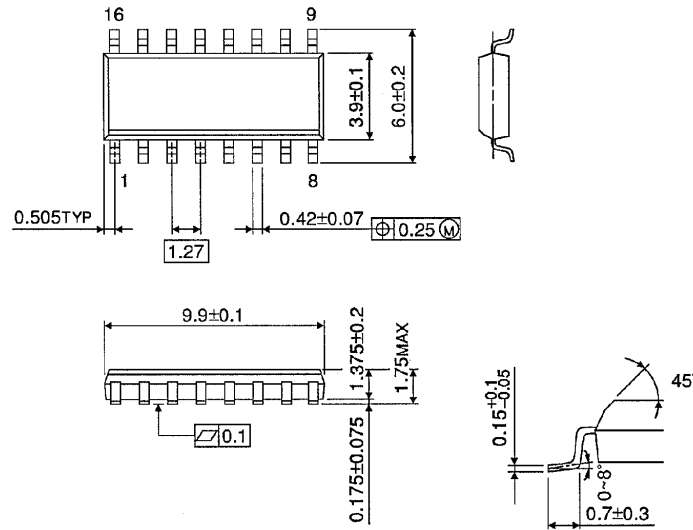
Unit in mm



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.)