

**TC74AC390P, TC74AC390F, TC74AC390FN**

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

**DUAL DECADE COUNTER**

The TC74AC390 is an advanced high speed CMOS DUAL DECADE COUNTER fabricated with silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

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

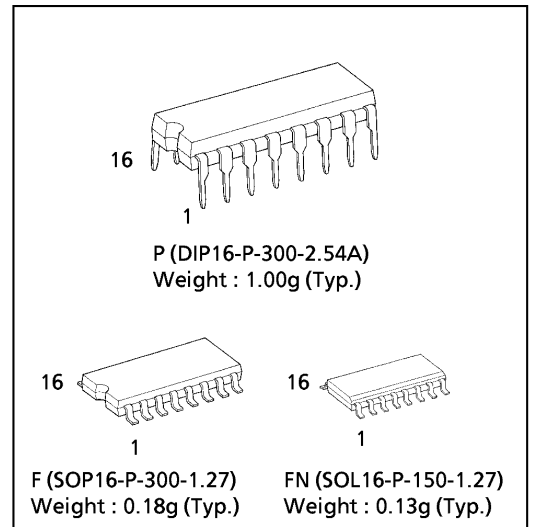
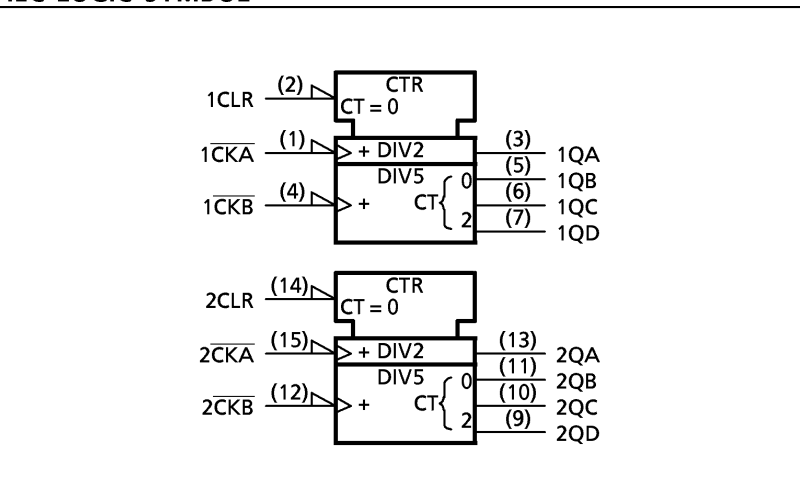
It consists of two independent 4-bit counters, each composed of a divide-by-two and a divide-by-five counter. The divide-by-two counter is incremented on the negative going transition of clock A ( $\overline{CKA}$ ). The divided-by-five counter is incremented on the negative going transition of clock 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.

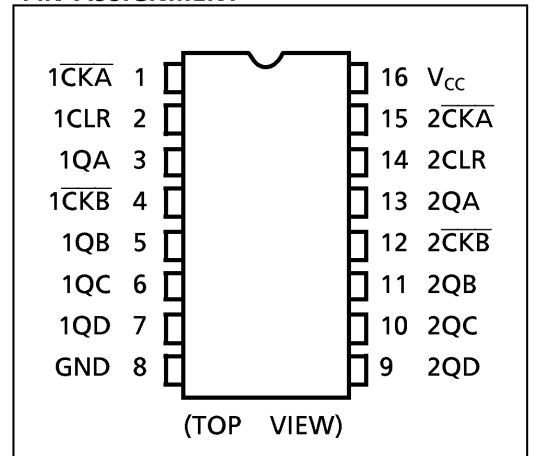
**FEATURES :**

- 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  $50\Omega$  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

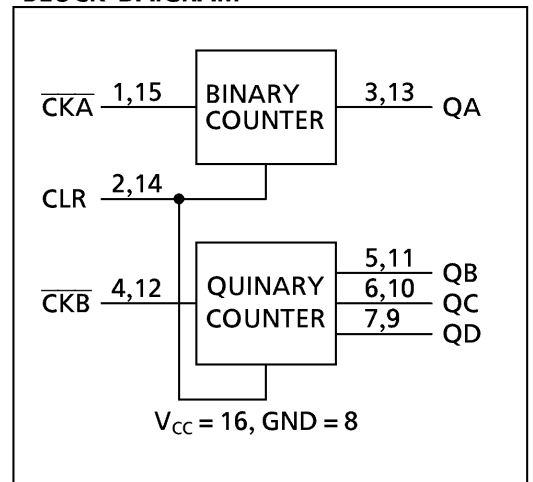
**IEC LOGIC SYMBOL**



**PIN ASSIGNMENT**



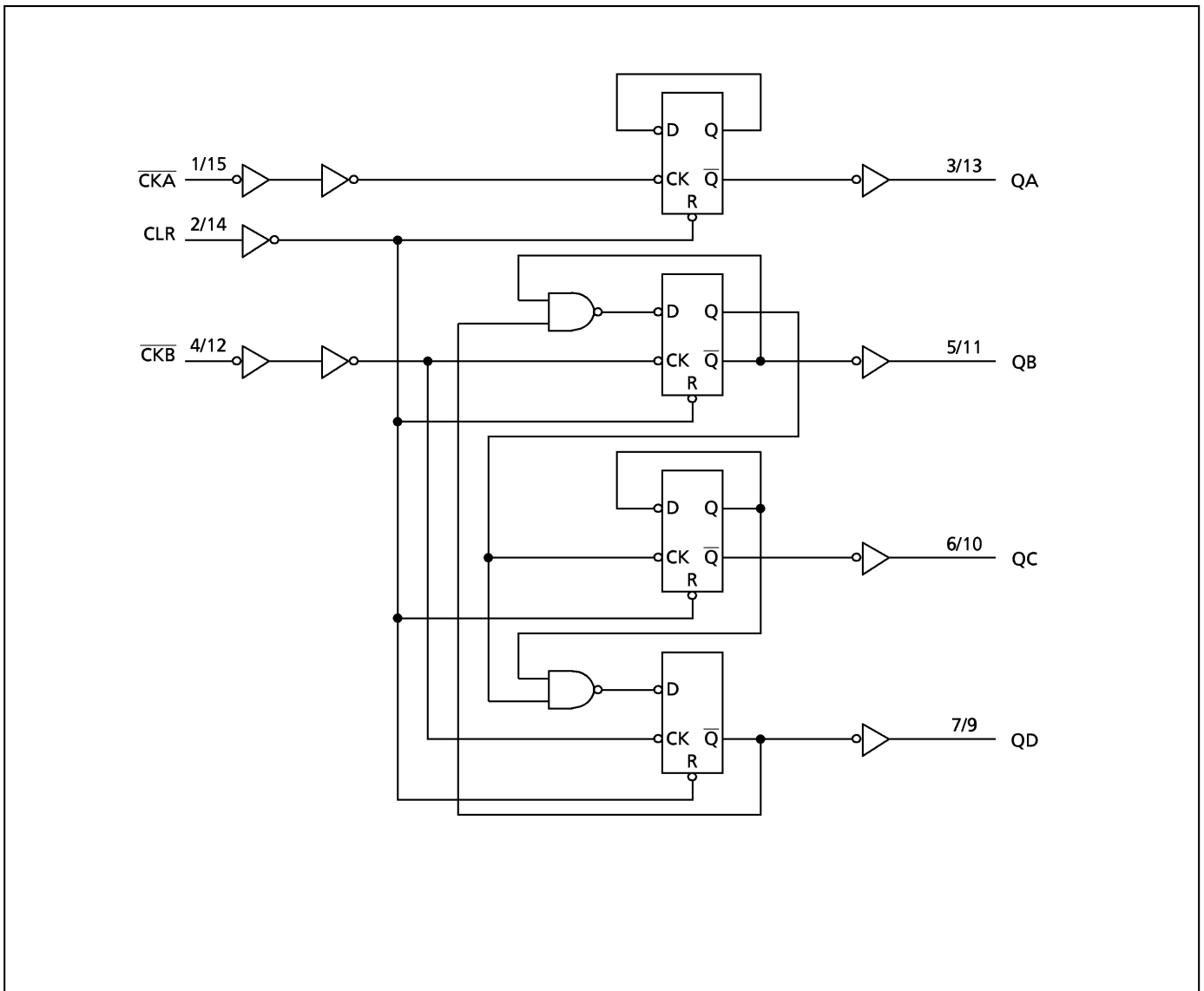
**BLOCK DAIGRAM**



TRUTH TABLE

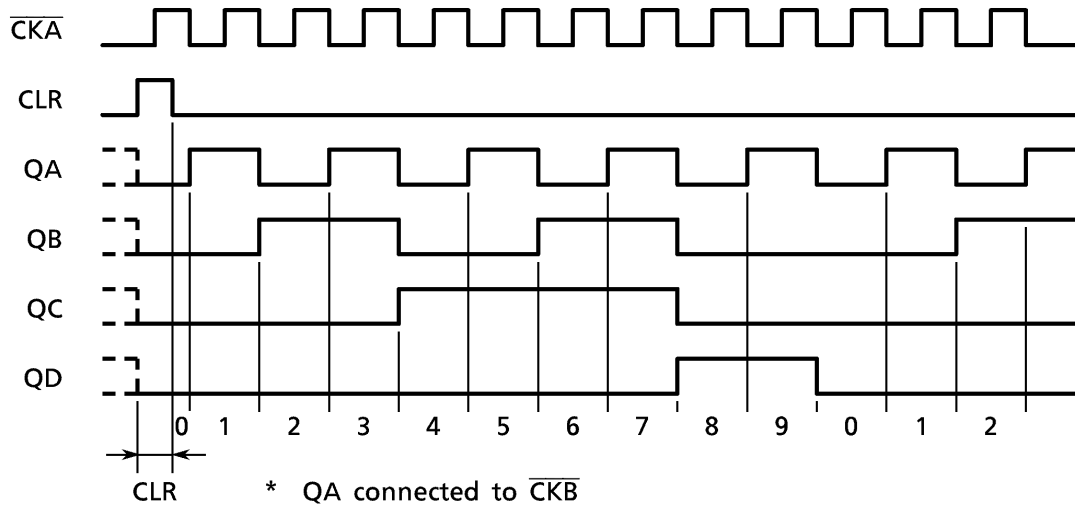
INPUTS			OUTPUTS			
$\overline{CKA}$	$\overline{CKB}$	CLR	QA	QB	QC	QD
X	X	H	L	L	L	L
$\overline{L}$	X	L	BINARY COUNT UP			
X	$\overline{L}$	L	QUINARY COUNT UP			

SYSTEM DIAGRAM

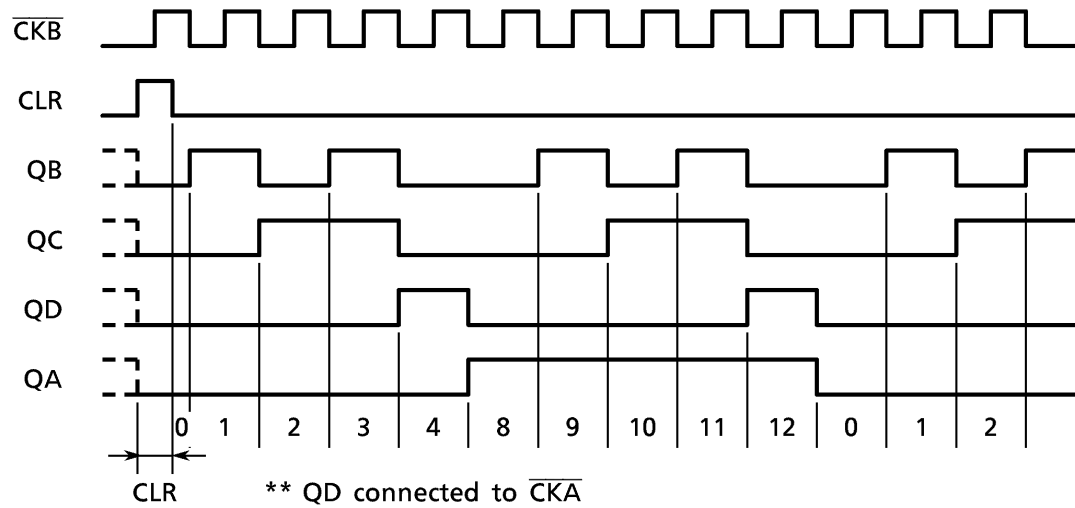


TIMING CHART

(1) BCD COUNT SEQUENCE\*



(2) BI-QUINARY COUNT SEQUENCE\*\*



**ABSOLUTE MAXIMUM RATINGS**

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	V <sub>CC</sub>	-0.5~7.0	V
DC Input Voltage	V <sub>IN</sub>	-0.5~V <sub>CC</sub> +0.5	V
DC Output Voltage	V <sub>OUT</sub>	-0.5~V <sub>CC</sub> +0.5	V
Input Diode Current	I <sub>IK</sub>	±20	mA
Output Diode Current	I <sub>OK</sub>	±50	mA
DC Output Current	I <sub>OUT</sub>	±50	mA
DC V <sub>CC</sub> /Ground Current	I <sub>CC</sub>	±200	mA
Power Dissipation	P <sub>D</sub>	500 (DIP)* / 180 (SOP)	mW
Storage Temperature	T <sub>stg</sub>	-65~150	°C

\*500mW in the range of Ta = -40°C~65°C. From Ta = 65°C to 85°C a derating factor of -10mW/°C should be applied up to 300mW.

**RECOMMENDED OPERATING CONDITIONS**

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	V <sub>CC</sub>	2.0~5.5	V
Input Voltage	V <sub>IN</sub>	0~V <sub>CC</sub>	V
Output Voltage	V <sub>OUT</sub>	0~V <sub>CC</sub>	V
Operating Temperature	T <sub>opr</sub>	-40~85	°C
Input Rise and Fall Time	dt/dV	0~100 (V <sub>CC</sub> = 3.3 ± 0.3V) 0~20 (V <sub>CC</sub> = 5 ± 0.5V)	ns/V

**DC ELECTRICAL CHARACTERISTICS**

PARAMETER	SYMBOL	TEST CONDITION	V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40~85°C		UNIT	
				MIN.	TYP.	MAX.	MIN.	MAX.		
High - Level Input Voltage	V <sub>IH</sub>		2.0	1.50	—	—	1.50	—	V	
			3.0	2.10	—	—	2.10	—		
			5.5	3.85	—	—	3.85	—		
Low - Level Input Voltage	V <sub>IL</sub>		2.0	—	—	0.50	—	0.50	V	
			3.0	—	—	0.90	—	0.90		
			5.5	—	—	1.65	—	1.65		
High - Level Output Voltage	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -50μA	2.0	1.9	2.0	—	1.9	—	V
				3.0	2.9	3.0	—	2.9	—	
			I <sub>OH</sub> = -4mA I <sub>OH</sub> = -24mA I <sub>OH</sub> = -75mA*	4.5	4.4	4.5	—	4.4	—	
				3.0	2.58	—	—	2.48	—	
				4.5	3.94	—	—	3.80	—	
				5.5	—	—	—	3.85	—	
Low - Level Output Voltage	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 50μA	2.0	—	0.0	0.1	—	0.1	V
				3.0	—	0.0	0.1	—	0.1	
			I <sub>OL</sub> = 12mA I <sub>OL</sub> = 24mA I <sub>OL</sub> = 75mA*	4.5	—	0.0	0.1	—	0.1	
				3.0	—	—	0.36	—	0.44	
				4.5	—	—	0.36	—	0.44	
				5.5	—	—	—	—	1.65	
Input Leakage Current	I <sub>IN</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5	—	—	±0.1	—	±1.0	μA	
Quiescent Supply Current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> 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 <sub>CC</sub> (V)	LIMIT	LIMIT	LIMIT	
Minimum Pulse Width ( $\overline{CKA}$ , $\overline{CKB}$ )	$t_{W(H)}$		3.3 ± 0.3	7.0	7.0	7.0	ns
	$t_{W(L)}$		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<sub>L</sub> = 50pF, R<sub>L</sub> = 500Ω, Input  $t_r = t_f = 3ns$  )**

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C			Ta = -40~85°C		UNIT	
			V <sub>CC</sub> (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 <sub>IN</sub>		—	5	10	—	10	pF	
Power Dissipation Capacitance	C <sub>PD</sub> (1)		—	40	—	—	—		

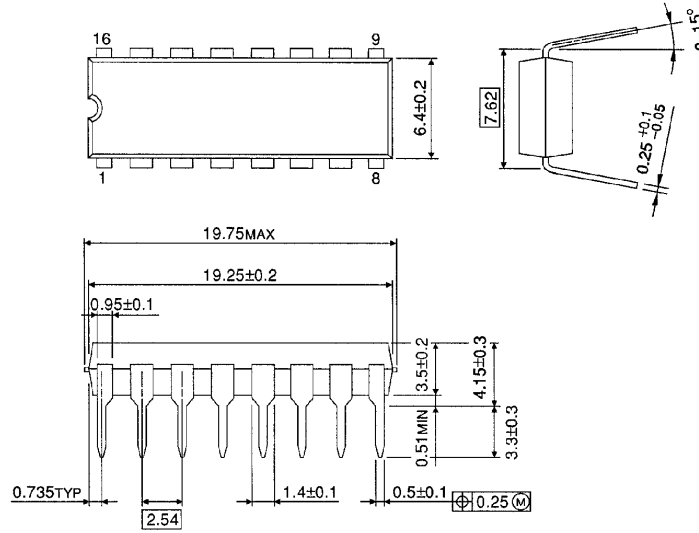
Note (1) C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

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

DIP 16PIN PACKAGE DIMENSIONS (DIP16-P-300-2.54A)

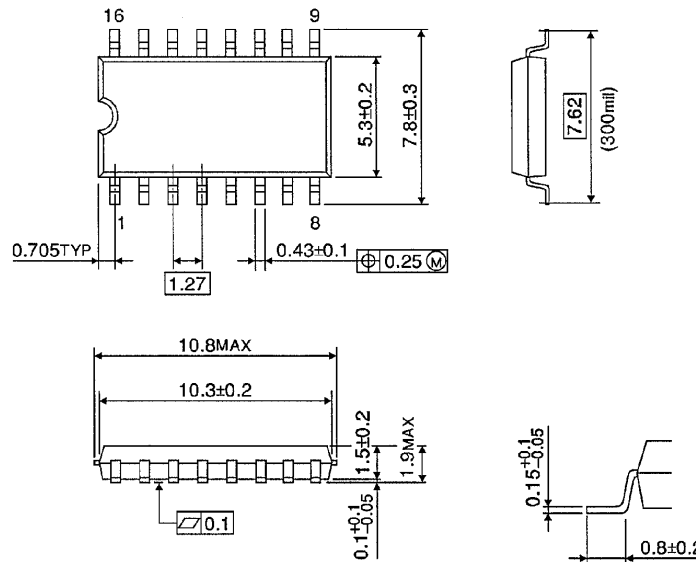
Unit in mm



Weight : 1.00g (Typ.)

SOP 16PIN (200mil BODY) PACKAGE DIMENSIONS (SOP16-P-300-1.27)

Unit in mm

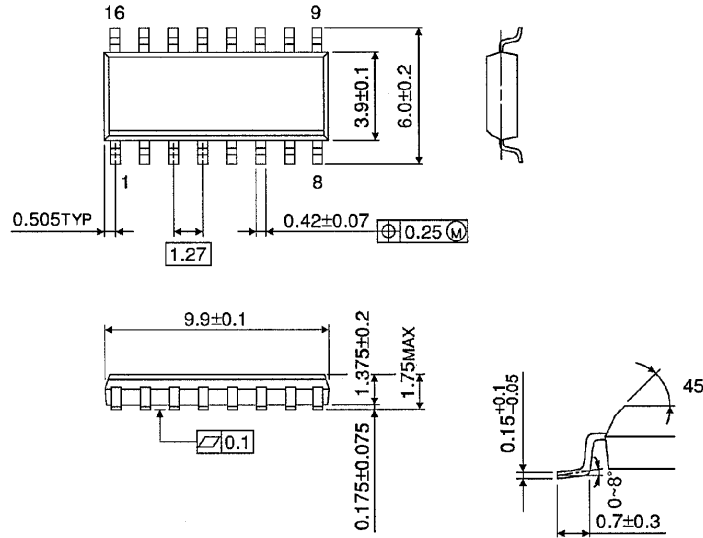


Weight : 0.18g (Typ.)

SOP 16PIN (150mil BODY) PACKAGE DIMENSIONS (SOL16-P-150 -1.27)

Unit in mm

(Note) This package is not available in Japan.



Weight : 0.13g (Typ.)

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