

**8 - BIT SHIFT REGISTER (P - IN, S - OUT)**

The TC74AC166 is an advanced high speed CMOS 8-BIT PARALLEL/SERIAL-IN, SERIAL-OUT SHIFT REGISTER fabricated with silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

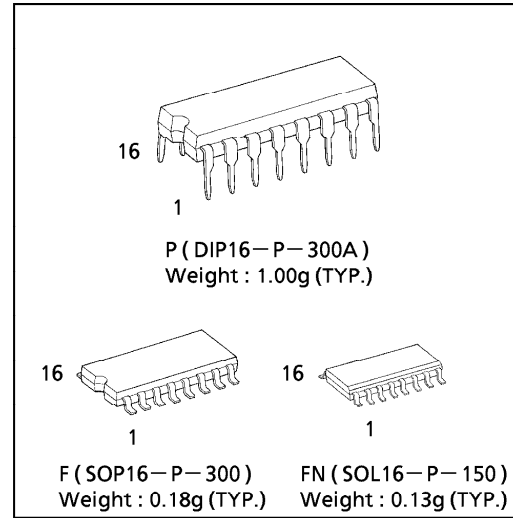
It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

It consists of parallel-in or serial-in, serial-out 8-bit shift register with a gated clock input and an overriding clear input. The parallel-in or serial-in modes are controlled by the SHIFT/LOAD input. When the SHIFT/LOAD input is held high, the serial data input is enabled and the eight flip-flops perform serial shifting on each clock pulse. When held low, the parallel data inputs are enabled and synchronous loading occurs on the next clock pulse. Clocking is accomplished on the low-to-high transition of the clock pulse. The CLOCK-INHIBIT input should be shifted high only while the CLOCK input is held high. A direct clear input overrides all other inputs, including the clock, and sets all the flip-flops to zero. Functional details are shown in the truth table and the timing charts.

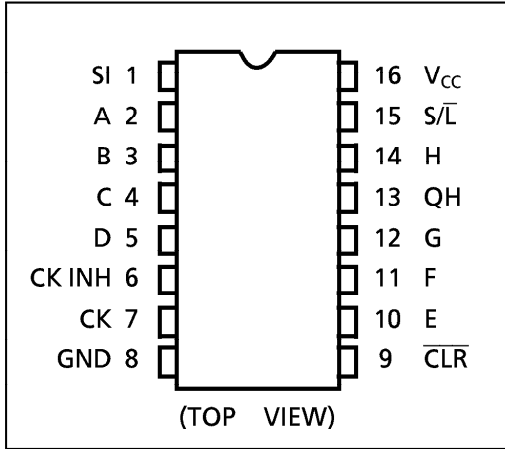
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

**FEATURES :**

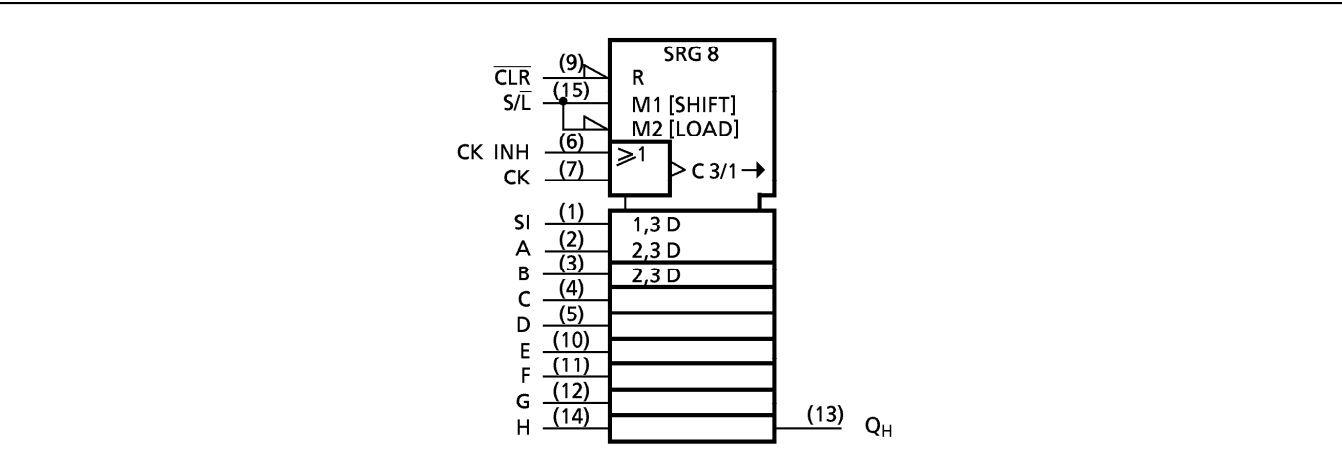
- High Speed..... $f_{MAX} = 170\text{MHz}(\text{typ.})$  at  $V_{CC} = 5\text{V}$
- Low Power Dissipation..... $I_{CC} = 8\mu\text{A}(\text{Max.})$  at  $T_a = 25^\circ\text{C}$
- High Noise Immunity..... $V_{NIH} = V_{NIL} = 28\% V_{CC}(\text{Min.})$
- Symmetrical Output Impedance..... $|I_{OH}| = |I_{OL}| = 24\text{mA}(\text{Min.})$   
Capability of driving 50Ω transmission lines.
- Balanced Propagation Delays..... $t_{pLH} = t_{pHL}$
- Wide Operating Voltage Range..... $V_{CC}(\text{opr}) = 2\text{V} \sim 5.5\text{V}$
- Pin and Function Compatible with 74HC166



**PIN ASSIGNMENT**



**IEC LOGIC SYMBOL**



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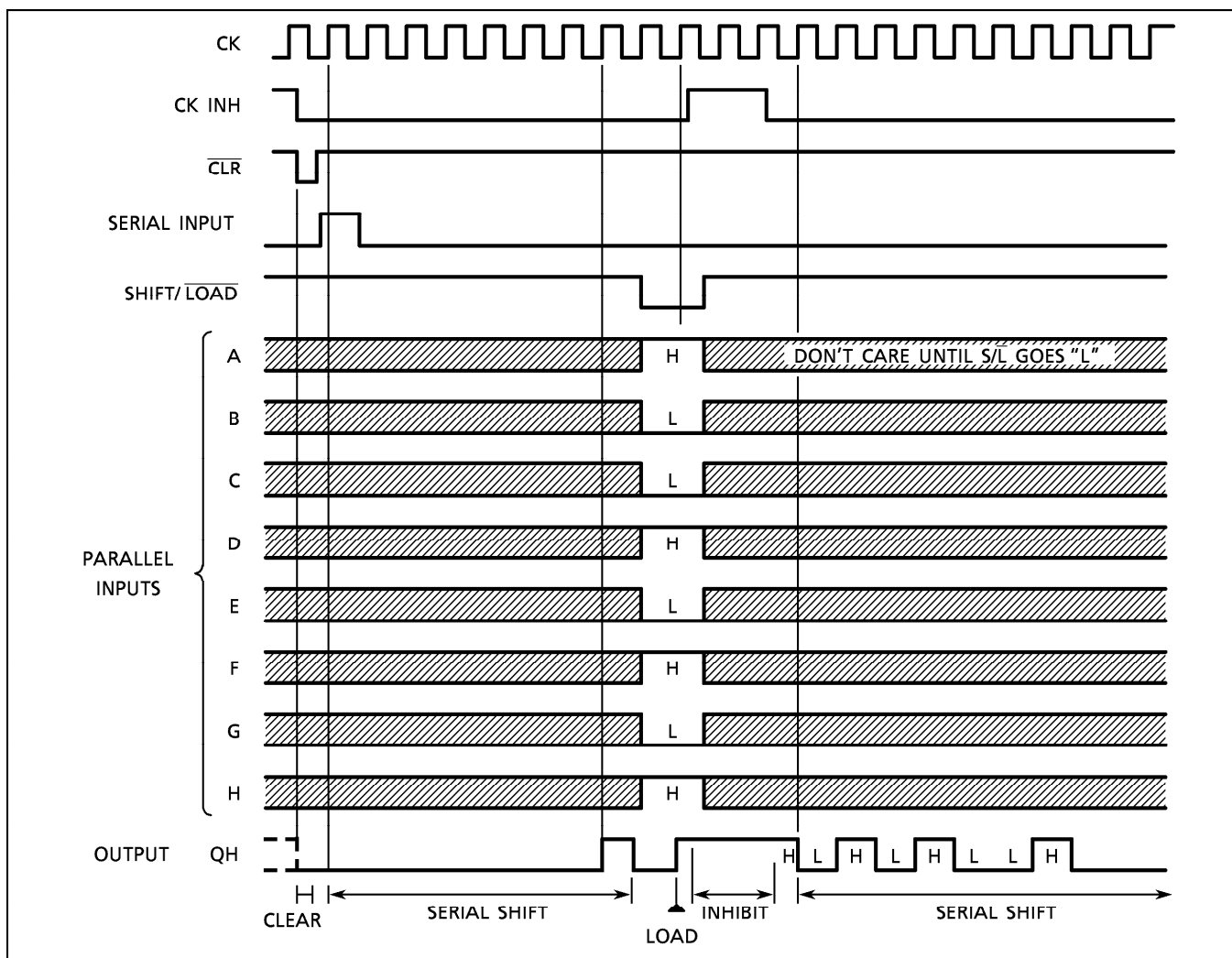
**TRUTH TABLE**

INPUTS						INTERNAL OUTPUTS		OUTPUT
CLR	SHIFT/LOAD	CK INH.	CK	SERIAL IN	PARALLEL A ..... H	QA	QB	QH
L	X	X	X	X	X	L	L	L
H	X	X	$\downarrow$	X	X	NO CHANGE		
H	L	L	$\uparrow$	X	a ..... h	a	b	h
H	H	L	$\uparrow$	H	X	H QAn		QGn
H	H	L	$\uparrow$	L	X	L QAn		QGn
H	X	H	X	X	X	NO CHANGE		

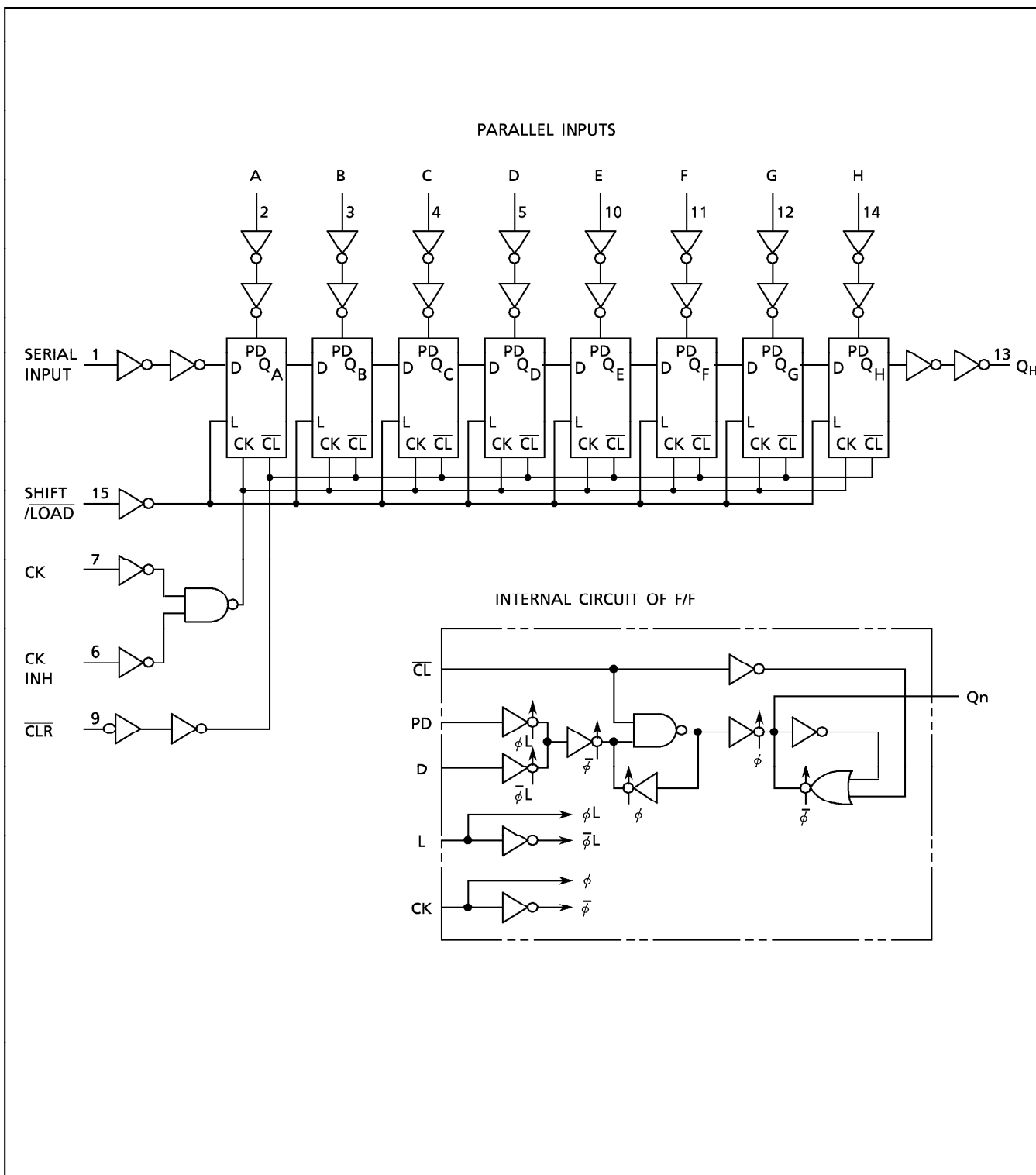
X : Don't Care

a ..... h : The level of steady state input voltage at inputs A through H respectively

**TIMING CHART**



**SYSTEM DIAGRAM**



**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	$I_{CC}$	± 100	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  $85^{\circ}\text{C}$  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	$V_{OH}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OH} = -50\mu\text{A}$	2.0	1.9	2.0	—	1.9	—	V
				3.0	2.9	3.0	—	2.9	—	
			$I_{OH} = -4\text{mA}$ $I_{OH} = -24\text{mA}$ $I_{OH} = -75\text{mA}^*$	4.5	4.4	4.5	—	4.4	—	
				5.5	—	—	—	—	—	
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	
			$I_{OL} = 12\text{mA}$ $I_{OL} = 24\text{mA}$ $I_{OL} = 75\text{mA}^*$	4.5	—	—	0.36	—	0.44	
				5.5	—	—	0.36	—	0.44	
Input Leakage Current	$I_{IN}$	$V_{IN} = V_{CC}$ or GND	5.5	—	—	± 0.1	—	± 1.0	$\mu\text{A}$	
Quiescent Supply Current	$I_{CC}$	$V_{IN} = V_{CC}$ or GND	5.5	—	—	8.0	—	80.0		

\* : This spec indicates the capability of driving  $50\Omega$  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 (CK)	$t_{W(H)}$ $t_{W(L)}$		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)	$t_{W(L)}$		3.3 ± 0.3 5.0 ± 0.5	8.0 5.0	8.0 5.0		
Minimum Set-up Time (SI, PI)	$t_s$		3.3 ± 0.3 5.0 ± 0.5	8.0 4.0	8.0 4.0		
Minimum Set-up Time (S/L)	$t_s$		3.3 ± 0.3 5.0 ± 0.5	7.0 4.0	7.0 4.0		
Minimum Hold Time (SI, PI)	$t_h$		3.3 ± 0.3 5.0 ± 0.5	0.5 0.5	0.5 0.5		
Minimum Hold Time (S/L)	$t_h$		3.3 ± 0.3 5.0 ± 0.5	1.0 1.0	1.0 1.0		
Minimum Removal Time (CLR)	$t_{rem}$		3.3 ± 0.3 5.0 ± 0.5	4.0 1.5	4.0 1.5		

**AC ELECTRICAL CHARACTERISTICS (C<sub>L</sub> = 50pF, R<sub>L</sub> = 500 Ω, 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 (CK-QH)	$t_{pLH}$ $t_{pHL}$		3.3 ± 0.3	—	9.4	16.1	1.0	18.3	ns
			5.0 ± 0.5	—	6.6	10.0	1.0	11.4	
Propagation Delay Time ( $\overline{CLR}$ -QH)	$t_{pHL}$		3.3 ± 0.3 5.0 ± 0.5	— —	9.2 6.4	15.2 9.6	1.0 1.0	17.4 10.9	
Maximum Clock Frequency	$f_{MAX}$		3.3 ± 0.3 5.0 ± 0.5	55 90	105 150	— —	55 90	— —	MHz
Input Capacitance	C <sub>IN</sub>			—	5	10	—	10	pF
Power Dissipation Capacitance	C <sub>PD</sub> (1)			—	67	—	—	—	

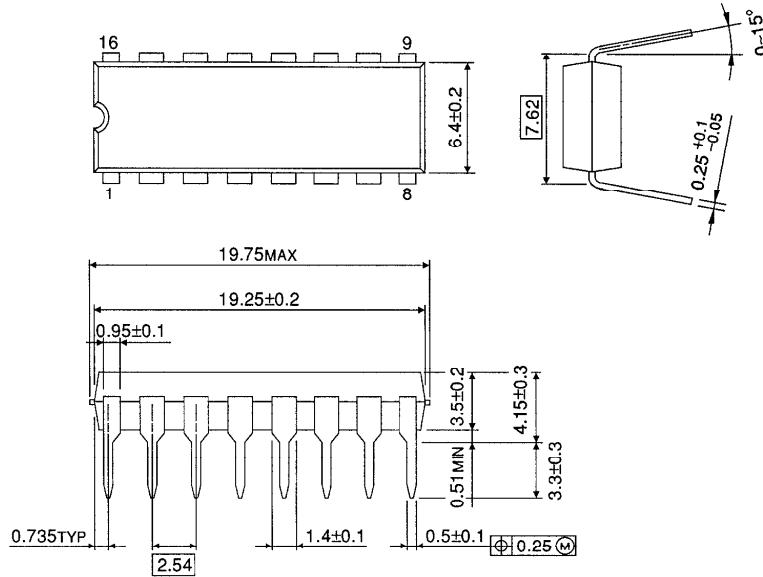
Note(1) C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

$$I_{CC(opr.)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

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

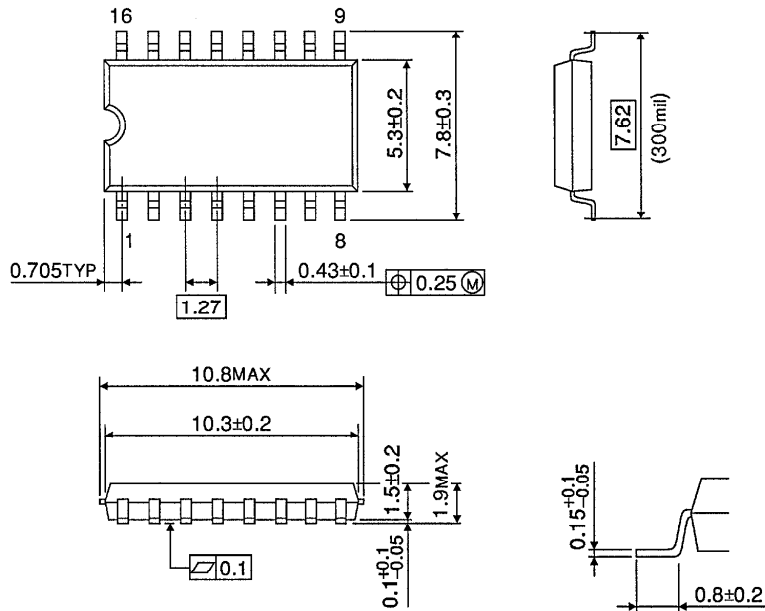
Unit in mm



Weight : 1.00g (TYP.)

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

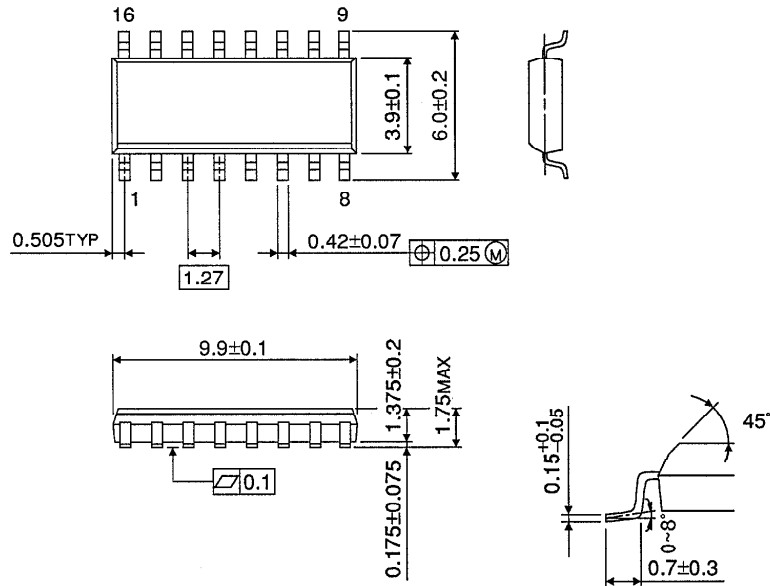
Unit in mm



Weight : 0.18g (TYP.)

SOP 16PIN (150mil BODY) OUTLINE DRAWING (SOL16-P-150)

Unit in mm



Weight : 0.13g (TYP.)