

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

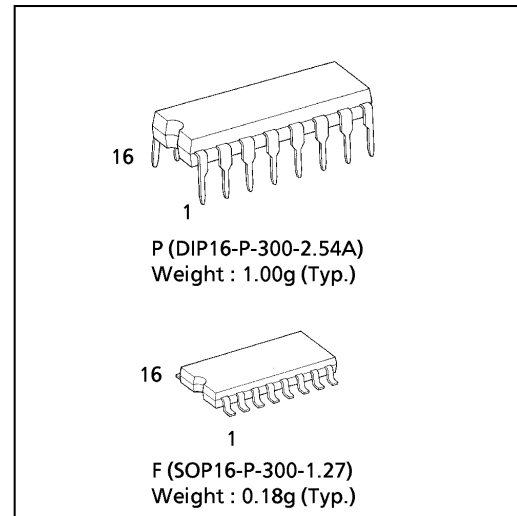
# TC74HC592AP, TC74HC592AF

## 8-BIT BINARY COUNTER WITH INPUT REGISTER

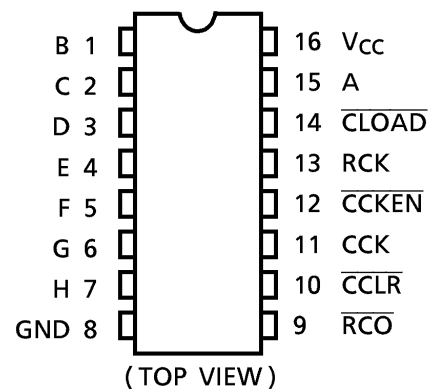
The TC74HC592A is high speed CMOS 8-BIT REGISTER COUNTER fabricated with silicon gate C<sup>2</sup>MOS technology. It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation. The internal counter counts at positive edge of Counter Clock (CCK) when Counter Clock Enable ( $\overline{\text{CCKEN}}$ ) is held "L" level. If Counter clear ( $\overline{\text{CCLR}}$ ) is held "L", the internal counter is cleared asynchronously to clock. Input A~H are loaded to register at positive edge of Register Clock (RCK), and the register outputs are loaded to Counter when Counter Load ( $\overline{\text{CLOAD}}$ ) is held "L" level. All inputs are equipped with protection circuits against static discharge or transient excess voltage.

### FEATURES :

- High Speed.....  $f_{\text{MAX}} = 35\text{MHz}(\text{typ.})$  at  $V_{\text{CC}} = 5\text{V}$
- Low Power Dissipation.....  $I_{\text{CC}} = 4\mu\text{A}(\text{Max.})$  at  $T_a = 25^\circ\text{C}$
- High Noise Immunity.....  $V_{\text{NIH}} = V_{\text{NIL}} = 28\% V_{\text{CC}} (\text{Min.})$
- Output Drive Capability..... 10 LSTTL Loads
- Symmetrical Output Impedance...  $|I_{\text{OH}}| = I_{\text{OL}} = 4\text{mA}(\text{Min.})$
- Balanced Propagation Delays.....  $t_{\text{pLH}} \approx t_{\text{pHL}}$
- Wide Operating Voltage Range...  $V_{\text{CC}} (\text{opr.}) = 2\text{V} \sim 6\text{V}$
- Pin and Function Compatible with 74LS592



### PIN ASSIGNMENT



### TRUTH TABLE

INPUT					FUNCTION
RCK	$\overline{\text{CLOAD}}$	$\overline{\text{CCLR}}$	$\overline{\text{CCKEN}}$	CCK	
X	L	H	X	X	REGISTER DATA IS LOADED INTO COUNTER
X	H	L	X	X	COUNTER CLEAR
$\uparrow$	H	H	X	X	THE DATA OF A THRU H INPUTS IS STORED INTO REGISTER
$\downarrow$	H	H	X	X	REGISTER STATE IS NOT CHANGED
X	H	H	L	$\uparrow$	COUNTER ADVANCES THE COUNT
X	H	H	L	$\downarrow$	NO COUNT
X	H	H	H	X	NO COUNT

X : Don't care

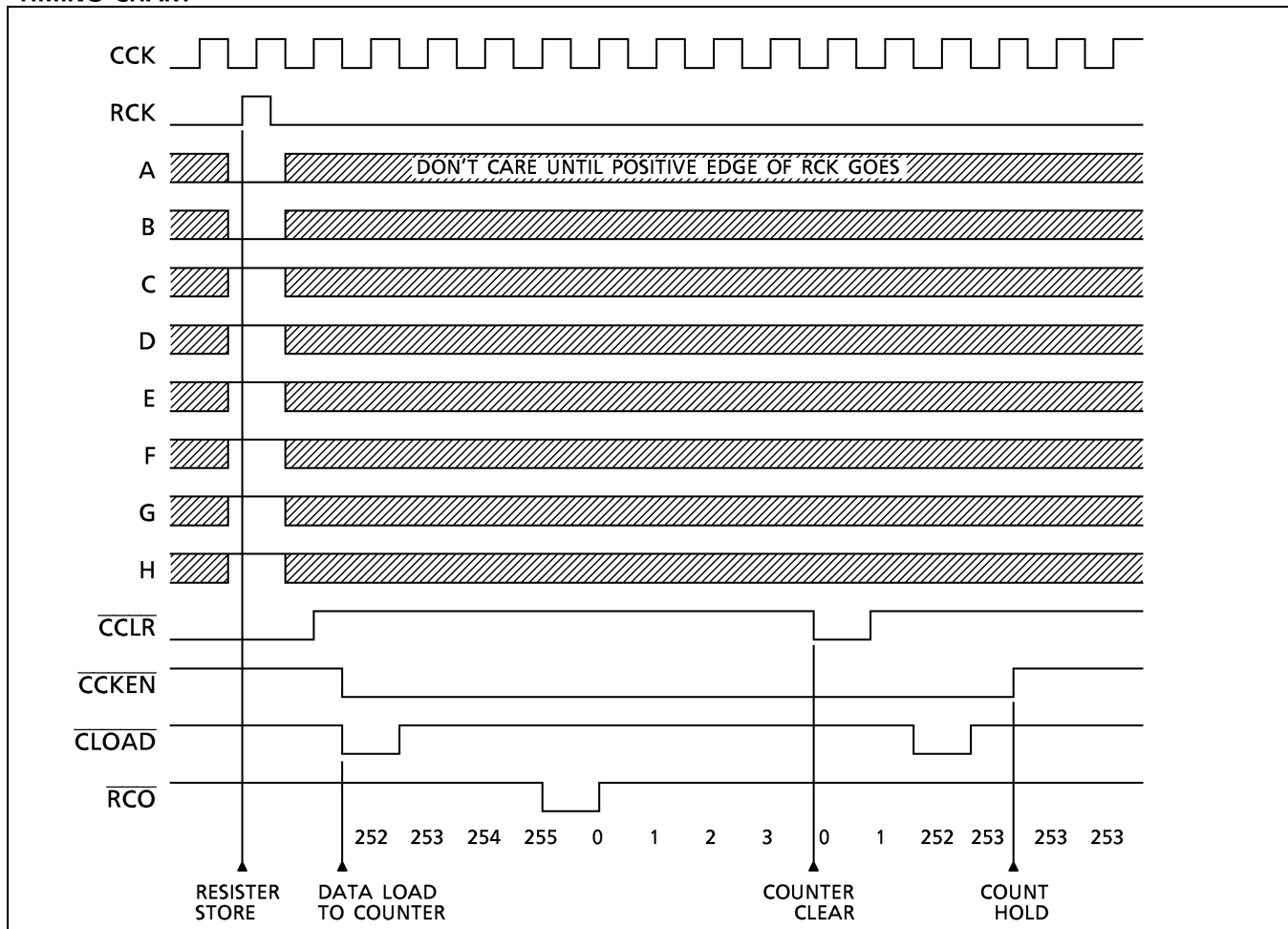
$$\overline{\text{RCO}} = \overline{\text{QA}'} \cdot \overline{\text{QB}'} \cdot \overline{\text{QC}'} \cdot \overline{\text{QD}'} \cdot \overline{\text{QE}'} \cdot \overline{\text{QF}'} \cdot \overline{\text{QG}'} \cdot \overline{\text{QH}'}$$

(QA'~QH' : Internal outputs of the counter)

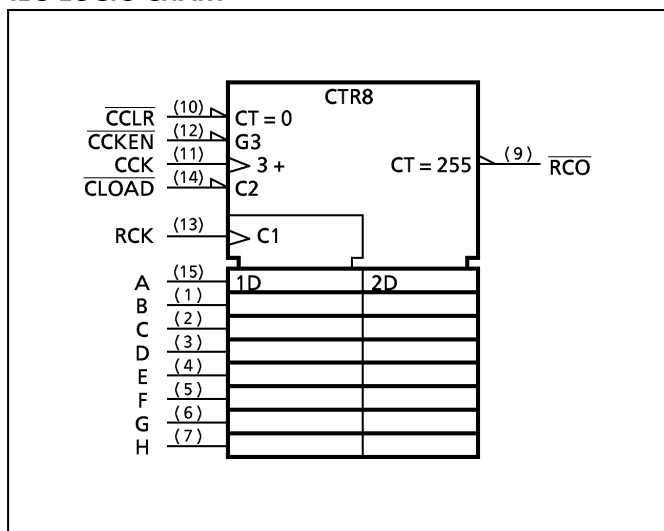
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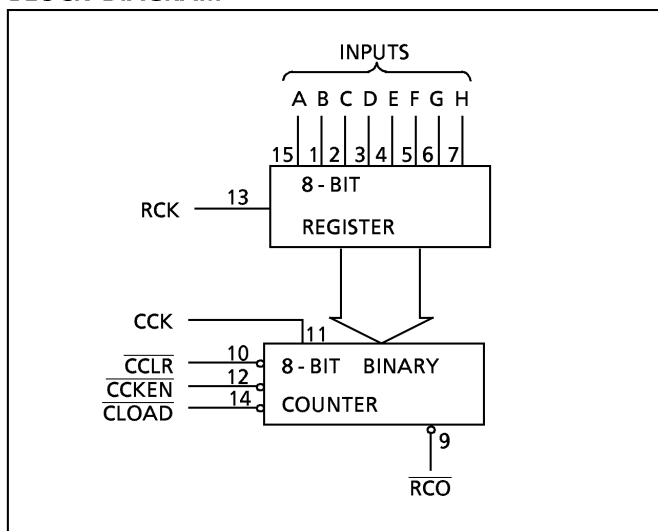
TIMING CHART



IEC LOGIC CHART



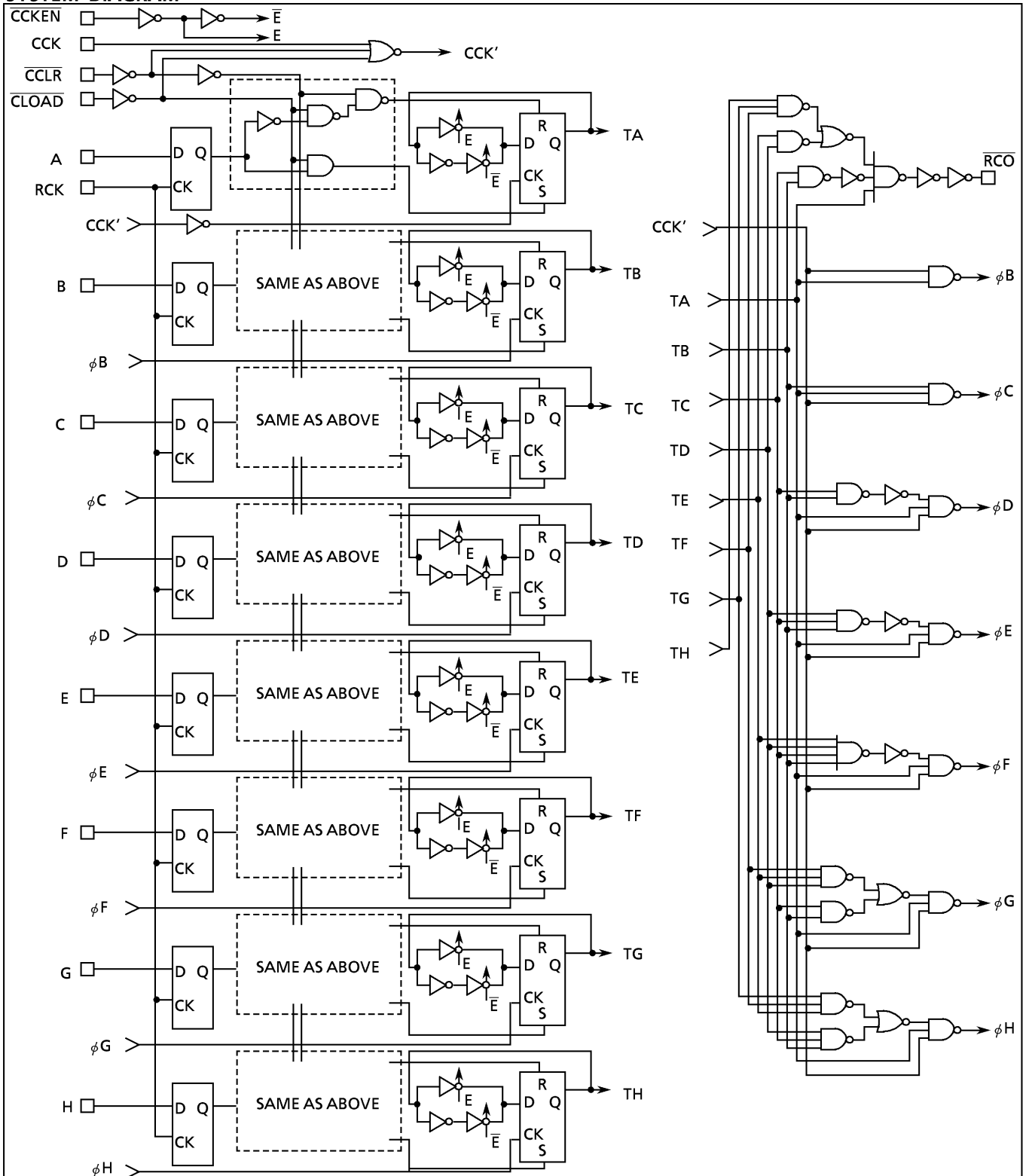
BLOCK DIAGRAM



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SYSTEM DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	$V_{CC}$	-0.5~7	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	$I_{IK}$	$\pm 20$	mA
Output Diode Current	$I_{OK}$	$\pm 20$	mA
DC Output Current	$I_{OUT}$	$\pm 25$	mA
DC $V_{CC}$ /Ground Current	$I_{CC}$	$\pm 50$	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  $-10\text{mW}/^{\circ}\text{C}$  shall be applied until 300mW.

## RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	$V_{CC}$	2~6	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	$t_r, t_f$	0~1000 ( $V_{CC} = 2.0\text{V}$ ) 0~500 ( $V_{CC} = 4.5\text{V}$ ) 0~400 ( $V_{CC} = 6.0\text{V}$ )	ns

## 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	
			4.5	3.15	—	—	3.15	—		
			6.0	4.20	—	—	4.20	—		
Low - Level Input Voltage	$V_{IL}$		2.0	—	—	0.50	—	0.50	V	
			4.5	—	—	1.35	—	1.35		
			6.0	—	—	1.80	—	1.80		
High - Level Output Voltage	$V_{OH}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OH} = -20\mu\text{A}$	2.0	1.9	2.0	—	1.9	—	V
				4.5	4.4	4.5	—	4.4	—	
			$I_{OH} = -4\text{mA}$ $I_{OH} = -5.2\text{mA}$	4.5	4.18	4.31	—	4.13	—	
				6.0	5.68	5.80	—	5.63	—	
Low - Level Output Voltage	$V_{OL}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 20\mu\text{A}$	2.0	—	0.0	0.1	—	0.1	V
				4.5	—	0.0	0.1	—	0.1	
			$I_{OL} = 4\text{mA}$ $I_{OL} = 5.2\text{mA}$	4.5	—	0.17	0.26	—	0.33	
				6.0	—	0.18	0.26	—	0.33	
Input Leakage Current	$I_{IN}$	$V_{IN} = V_{CC}$ or GND	6.0	—	—	$\pm 0.1$	—	$\pm 1.0$	$\mu\text{A}$	
Quiescent Supply Current	$I_{CC}$	$V_{IN} = V_{CC}$ or GND	6.0	—	—	4.0	—	40.0		

TIMING REQUIREMENTS (Input  $t_r = t_f = 6\text{ns}$ )

PARAMETER	SYMBOL	TEST CONDITION	$V_{CC}$ (V)	Ta = 25°C		Ta = -40~85°C	UNIT
				TYP.	LIMIT	LIMIT	
Minimum Pulse Width (CCK, RCK)	$t_{W(H)}$ $t_{W(L)}$		2.0	—	75	95	ns
			4.5	—	15	19	
			6.0	—	13	16	
Minimum Pulse Width ( $\overline{\text{CCLR}}$ )	$t_{W(L)}$		2.0	—	100	125	
			4.5	—	20	25	
			6.0	—	16	21	
Minimum Pulse Width ( $\overline{\text{CLOAD}}$ )	$t_{W(L)}$		2.0	—	175	220	
			4.5	—	35	44	
			6.0	—	30	37	
Minimum Set-up Time ( $\overline{\text{CCKEN}}$ —CCK)	$t_s$		2.0	—	75	95	
			4.5	—	15	19	
			6.0	—	13	16	
Minimum Set-up Time (RCK— $\overline{\text{CLOAD}}$ )	$t_s$		2.0	—	150	190	
			4.5	—	30	38	
			6.0	—	26	32	
Minimum Set-up Time (A~H—RCK)	$t_s$		2.0	—	100	125	
			4.5	—	20	25	
			6.0	—	17	21	
Minimum Hold Time	$t_h$		2.0	—	5	5	
			4.5	—	5	5	
			6.0	—	5	5	
Minimum Removal Time ( $\overline{\text{CCLR}}$ )	$t_{rem}$		2.0	—	75	95	
			4.5	—	15	19	
			6.0	—	13	16	
Minimum Removal Time ( $\overline{\text{CLOAD}}$ )	$t_{rem}$		2.0	—	75	95	
			4.5	—	15	19	
			6.0	—	13	16	
Clock Frequency	f		2.0	—	4	3.5	MHz
			4.5	—	22	18	
			6.0	—	26	21	

**AC ELECTRICAL CHARACTERISTICS ( C<sub>L</sub> = 15pF, V<sub>CC</sub> = 5V, Ta = 25°C, Input t<sub>r</sub> = t<sub>f</sub> = 6ns )**

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Transition Time	t <sub>TLH</sub> t <sub>THL</sub>		—	6	12	ns
Propagation Delay Time ( CCK – RCO )	t <sub>pLH</sub> t <sub>pHL</sub>		—	25	38	
Propagation Delay Time ( RCK – RCO )	t <sub>pLH</sub> t <sub>pHL</sub>		—	39	60	
Propagation Delay Time ( CCLR – RCO )	t <sub>pLH</sub>		—	24	36	
Propagation Delay Time ( CLOAD – RCO )	t <sub>pLH</sub> t <sub>pHL</sub>		—	35	53	
Maximum Clock Frequency	f <sub>MAX</sub>		25	35	—	MHz

**AC ELECTRICAL CHARACTERISTICS ( C<sub>L</sub> = 50pF, Input t<sub>r</sub> = t<sub>f</sub> = 6ns )**

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C			Ta = -40~85°C		UNIT	
			V <sub>CC</sub> (V)	MIN.	TYP.	MAX.	MIN.		MAX.
Output Transition Time	t <sub>TLH</sub> t <sub>THL</sub>		2.0	—	30	75	—	95	ns
			4.5	—	8	15	—	19	
			6.0	—	7	13	—	16	
Propagation Delay Time ( CCK – RCO )	t <sub>pLH</sub> t <sub>pHL</sub>		2.0	—	94	220	—	275	
			4.5	—	29	44	—	55	
			6.0	—	24	37	—	47	
Propagation Delay Time ( RCK – RCO )	t <sub>pLH</sub> t <sub>pHL</sub>		2.0	—	160	340	—	425	
			4.5	—	45	68	—	85	
			6.0	—	34	58	—	73	
Propagation Delay Time ( CCLR – RCO )	t <sub>pLH</sub>		2.0	—	89	215	—	270	
			4.5	—	28	43	—	54	
			6.0	—	22	37	—	46	
Propagation Delay Time ( CLOAD – RCO )	t <sub>pLH</sub> t <sub>pHL</sub>		2.0	—	140	300	—	375	
			4.5	—	40	60	—	75	
			6.0	—	30	51	—	64	
Maximum Clock Frequency	f <sub>MAX</sub>		2.0	4	20	—	3.5	—	MHz
			4.5	22	33	—	18	—	
			6.0	26	49	—	21	—	
Input Capacitance	C <sub>IN</sub>		—	5	10	—	10	pF	
Power Dissipation Capacitance	C <sub>PD</sub> (1)		—	31	—	—	—		

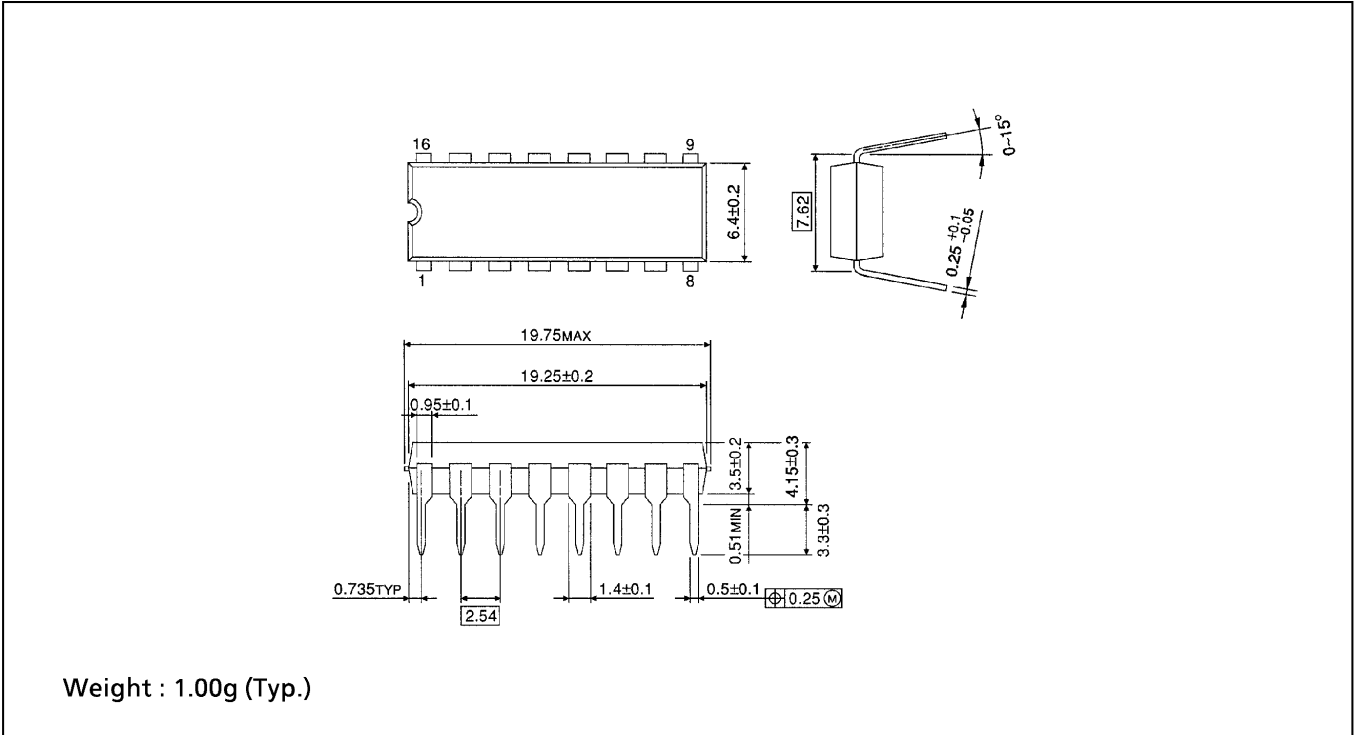
Note (1) C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

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-300-2.54A)**

Unit in mm



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

Unit in mm

