

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC74HC173AP, TC74HC173AF

QUAD D - TYPE REGISTER (3 - STATE)

The TC74HC173A is a high speed CMOS D - TYPE REGISTER fabricated with silicon gate C²MOS technology.

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

It consists a 4 - bit register consisting of D - type flip - flops and 3 - state buffers. The four flip - flops are controlled by a common clock input (CK) and a common clear input (CLR).

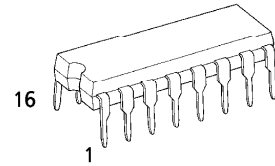
Signals applied to the data inputs (D1~D4) are stored in the respective flip - flops on the positive going transition of CK when clock control inputs (G1, G2) are held low.

The clear function is asynchronous to CK and active on a high level. The stored data are enabled to each outputs when output control inputs (M, N) are held low, else the outputs are high impedance state.

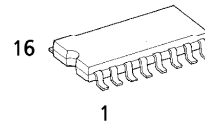
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

FEATURES:

- High Speed..... $f_{MAX} = 47\text{MHz}(\text{typ.})$ at $V_{CC} = 5\text{V}$
- Low Power Dissipation..... $I_{CC} = 4\mu\text{A}(\text{Max.})$ at $T_a = 25^\circ\text{C}$
- High Noise Immunity..... $V_{NIH} = V_{NIL} = 28\% V_{CC} (\text{Min.})$
- Output Drive Immunity..... 15 LSTTL Loads
- Symmetrical Output Impedance... $|I_{OH}| = I_{OL} = 6\text{mA}(\text{Min.})$
- Balanced Propagation Delays..... $t_{PLH} \approx t_{PHL}$
- Wide Operating Voltage Range.... $V_{CC} (\text{opr.}) = 2\text{V} \sim 6\text{V}$
- Pin and Function Compatible with 74LS173

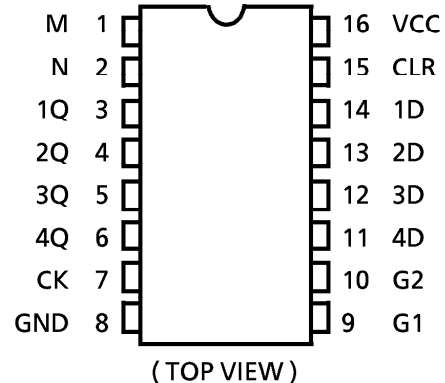


P (DIP16-P-300-2.54A)
Weight : 1.00g (Typ.)

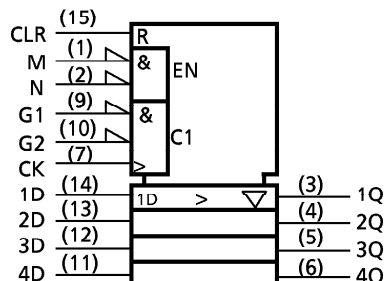


F (SOP16-P-300-1.27)
Weight : 0.18g (Typ.)

PIN ASSIGNMENT



IEC LOGIC SYMBOL



961001EBA2

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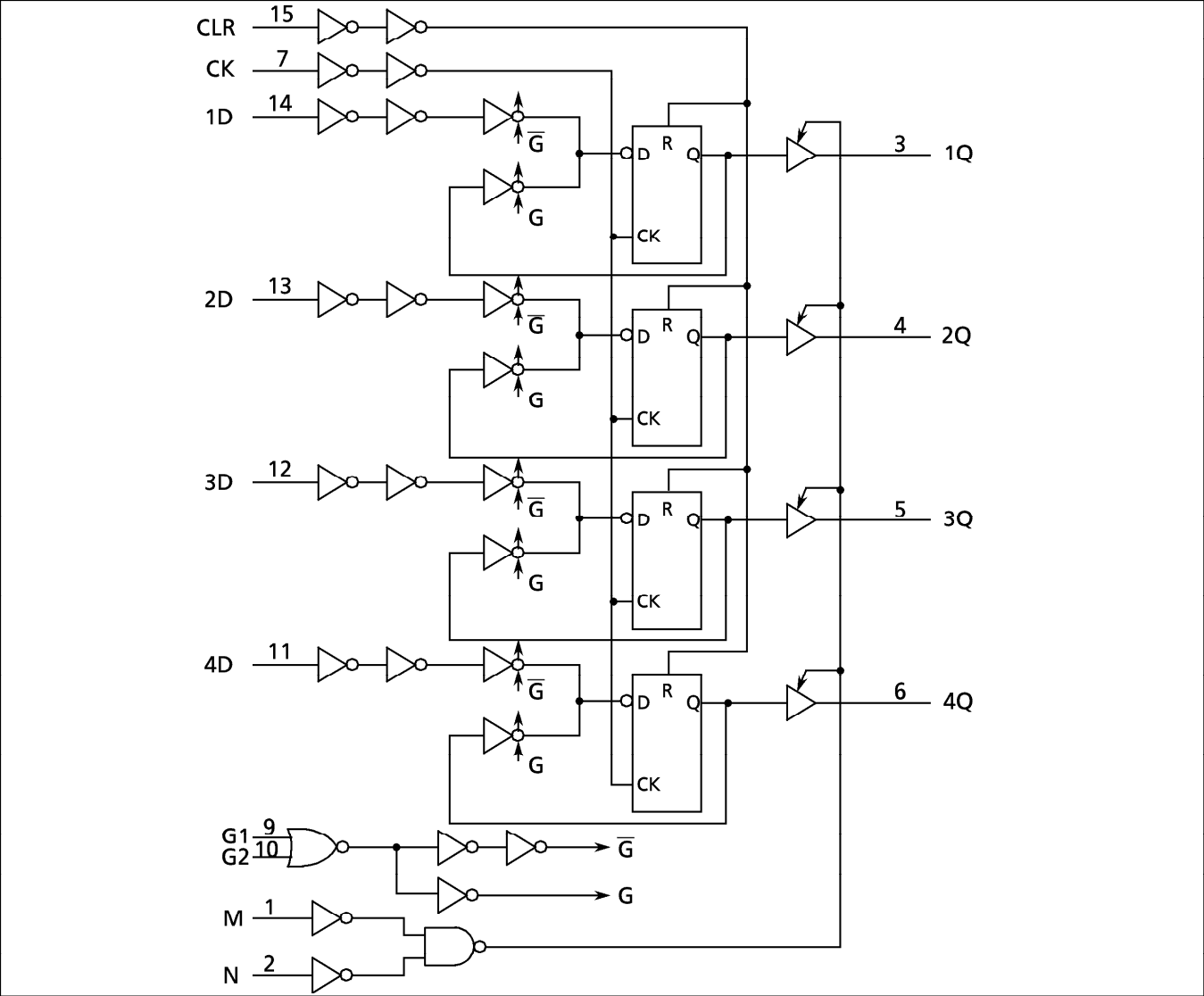
TRUTH TABLE

CLR	CK	DATA INABLE		Dn	OUTPUT CONTROL		Qn
		G1	G2		M	N	
X	X	X	X	X	H	X	Z
X	X	X	X	X	X	H	Z
H	X	X	X	X	L	L	L
L		X	X	X	L	L	Q0
L		H	X	X	L	L	Q0
L		X	H	X	L	L	Q0
L		L	L	H	L	L	H
L		L	L	L	L	L	L

H : Don't Care

Z : High Impedance

SYSTEM DIAGRAM



961001EBA2'

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ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	V_{CC}	$-0.5 \sim 7$	V
DC Input Voltage	V_{IN}	$-0.5 \sim V_{CC} + 0.5$	V
DC Output Voltage	V_{OUT}	$-0.5 \sim V_{CC} + 0.5$	V
Input Diode Current	I_{IK}	± 20	mA
Output Diode Current	I_{OK}	± 20	mA
DC Output Current	I_{OUT}	± 35	mA
DC V_{CC} / Ground Current	I_{CC}	± 75	mA
Power Dissipation	P_D	500 (DIP)* / 180 (SOP)	mW
Storage Temperature	T_{stg}	$-65 \sim 150$	°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 $-10\text{mW}/^\circ\text{C}$ shall be applied until 300mW.

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	V_{CC}	$2 \sim 6$	V
Input Voltage	V_{IN}	$0 \sim V_{CC}$	V
Output Voltage	V_{OUT}	$0 \sim V_{CC}$	V
Operating Temperature	T_{opr}	$-40 \sim 85$	°C
Input Rise and Fall Time	t_r, t_f	$0 \sim 1000 (V_{CC} = 2.0\text{V})$ $0 \sim 500 (V_{CC} = 4.5\text{V})$ $0 \sim 400 (V_{CC} = 6.0\text{V})$	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 4.5 6.0	1.50 3.15 4.20	— — —	— — —	1.50 3.15 4.20	— — —	V
Low - Level Input Voltage	V_{IL}		2.0 4.5 6.0	— — —	— — —	0.50 1.35 1.80	— — —	0.50 1.35 1.80	V
High - Level Output Voltage	V_{OH}	$V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OH} = -20\mu\text{A}$	2.0 4.5 6.0	1.9 4.4 5.9	2.0 4.5 6.0	— — —	1.9 4.4 5.9	V
			$I_{OH} = -6 \text{ mA}$ $I_{OH} = -7.8\text{mA}$	4.5 6.0	4.18 5.68	4.31 5.80	— —	4.13 5.63	
Low - Level Output Voltage	V_{OL}	$V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 20\mu\text{A}$	2.0 4.5 6.0	— — —	0.0 0.0 0.0	0.1 0.1 0.1	— — —	V
			$I_{OL} = 6 \text{ mA}$ $I_{OL} = 7.8\text{mA}$	4.5 6.0	— —	0.17 0.18	0.26 0.26	— —	
3 - State Output Off - State Current	I_{OZ}	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $V_{OUT} = V_{CC} \text{ or GND}$	6.0	—	—	± 0.5	—	± 5.0	μA
Input Leakage Current	I_{IN}	$V_{IN} = V_{CC} \text{ or GND}$	6.0	—	—	± 0.1	—	± 1.0	
Quiescent Supply Current	I_{CC}	$V_{IN} = V_{CC} \text{ or GND}$	6.0	—	—	4.0	—	40.0	

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

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C			Ta = -40~85°C	UNIT
			V _{CC} (V)	TYP.	LIMIT	LIMIT	
Minimum Pulse Width (CK)	$t_{W(L)}$ $t_{W(H)}$		2.0	—	75	95	ns
			4.5	—	15	19	
			6.0	—	13	16	
Minimum Pulse Width (CLR)	$t_{W(H)}$		2.0	—	75	95	
			4.5	—	15	19	
			6.0	—	13	16	
Minimum Set—up Time (G1, G2)	t_s		2.0	—	100	125	
			4.5	—	20	25	
			6.0	—	17	21	
Minimum Set—up Time (D)	t_s		2.0	—	75	95	
			4.5	—	15	19	
			6.0	—	13	16	
Minimum Hold Time (G1, G2, D)	t_h		2.0	—	0	0	
			4.5	—	0	0	
			6.0	—	0	0	
Minimum Removal Time (CLR)	t_{rem}		2.0	—	5	5	
			4.5	—	5	5	
			6.0	—	5	5	
Clock Frequency	f		2.0	—	9	7	
			4.5	—	43	34	
			6.0	—	51	40	

AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 6\text{ns}$)

PARAMETER	SYMBOL	TEST CONDITION	CL (pF)	V _{CC} (V)	Ta = 25°C			Ta = -40~85°C		UNIT	
					MIN.	TYP.	MAX.	MIN.	MAX.		
Output Transition Time	t _{TLH} t _{THL}		50	2.0 4.5 6.0	— — —	20 6 5	60 12 10	— — —	75 15 13	ns	
Propagation Delay Time (CK—Q)	t _{PLH} t _{PHL}		50	2.0 4.5 6.0	— — —	50 15 12	115 23 20	— — —	145 29 25		
				150	2.0 4.5 6.0	— — —	65 20 16	155 31 26	— — —		195 39 33
Propagation Delay Time (CLR—Q)	t _{PHL}		50		2.0 4.5 6.0	— — —	50 15 12	115 23 20	— — —		145 29 25
				150	2.0 4.5 6.0	— — —	63 20 16	155 31 26	— — —		195 39 33
Output Enable time	t _{PzL} t _{PzH}	R _L = 1kΩ	50		2.0 4.5 6.0	— — —	50 15 12	115 23 20	— — —		145 29 25
				150	2.0 4.5 6.0	— — —	63 20 16	115 31 26	— — —		195 39 33
Output Disable time	t _{PLZ} t _{PHZ}	R _L = 1kΩ	50		2.0 4.5 6.0	— — —	36 17 15	135 27 23	— — —		170 34 29
Maximum Clock Frequency	f _{MAX}		50	2.0 4.5 6.0	9 43 51	20 67 84	— — —	7 34 40	— — —		MHz
Input Capacitance	C _{IN}				—	5	10	—	10		pF
Output Capacitance	C _{OUT}				—	10	—	—	—		
Power Dissipation Capacitance	C _{PD} (1)				—	45	—	—	—		

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 :

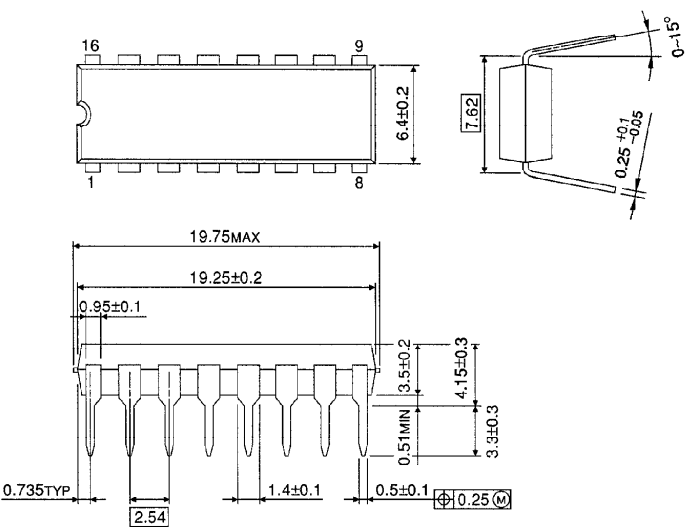
$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

And the total C_{PD} when n pcs of Flip Flop operate be gained by the following equation :

$$CPD(\text{total}) = 28 + 17 \cdot n$$

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

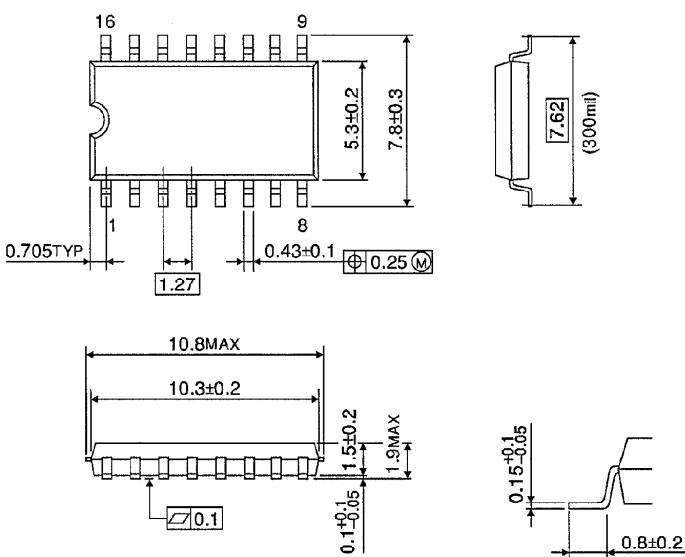
Unit in mm



Weight : 1.00g (Typ.)

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

Unit in mm



Weight : 0.18g (Typ.)