TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC74HC4094AP, TC74HC4094AF, TC74HC4094AFN

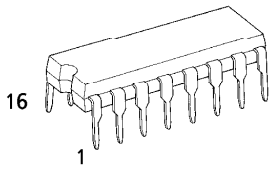
(Note) The JEDEC SOP (FN) is not available in Japan.

8 – BIT SHIFT AND STORE REGISTER (3 – STATE)

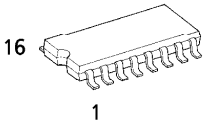
The TC74HC4094A is a high speed CMOS 8 - BIT SHIFT AND STROBE REGISTER fabricated with silicon gate C²MOS technology.
It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.
It consists of an 8-bit shift register and an 8-bit latch with 3-state output buffers. Data is shifted serially though the shift register on the positive going transition of the CK input. The output of the last stage (Qs) can be used to cascade several devices. Data on the Qs output is transferred to a second output (Q's) on the following negative transition of the CK input.The data in each stage of the shift register is provided to a corresponding latch, on the negative going transition of the STROBE input. When STROBE is held high, data propagates through the latch to a 3-state output buffer. This buffer is enabled when OUTPUT ENABLE input is set high.
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

FEATURES :

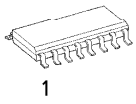
- High Speed····· f_{MAX} = 73MHz(typ.) at V_{CC} = 5V
- Low Power Dissipation····· I_{CC} = 4μA(Max.) at Ta = 25°C
- High Noise Immunity····· $V_{NIH} = V_{NIL}$ = 28% V_{CC} (Min.)
- Output Drive Capability ····· 10 LSTTL Loads
- Symmetrical Output Impedance··· $|I_{OH}| = I_{OL}$ = 4mA(Min.)
- Balanced Propagation Delays····· $t_{pLH} \simeq t_{pHL}$
- Wide Operating Voltage Range···· V_{CC} (opr.) = 2V ~ 6V
- Pin and Function Compatible with 4094B



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

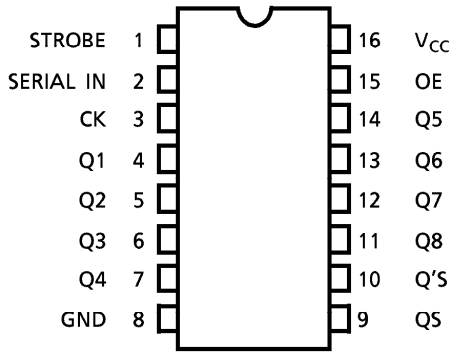


F (SOP16-P-300-1.27)
Weight : 0.18g (Typ.)



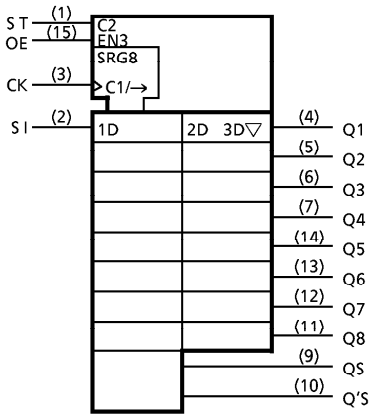
FN (SOL16-P-150-1.27)
Weight : 0.13g (Typ.)

PIN ASSIGNMENT



(TOP VIEW)

IEC LOGIC SYMBOL



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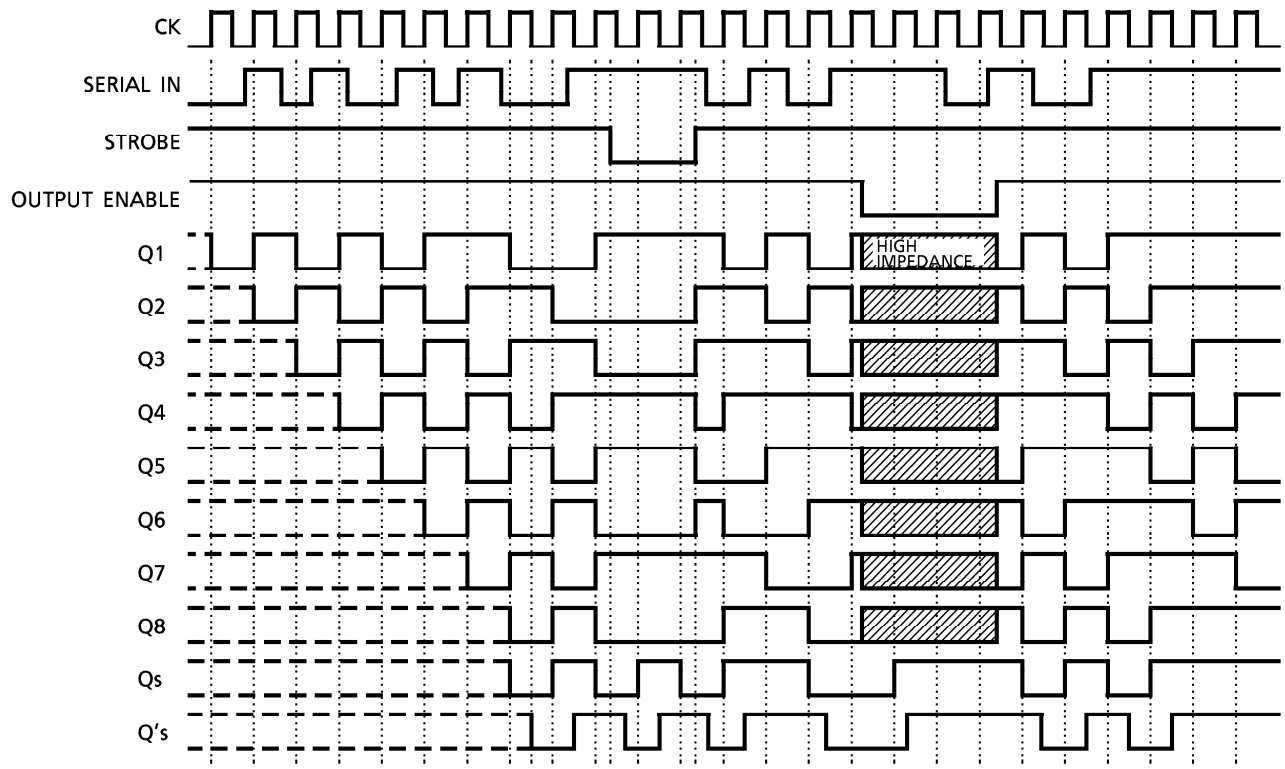
TRUTH TABLE

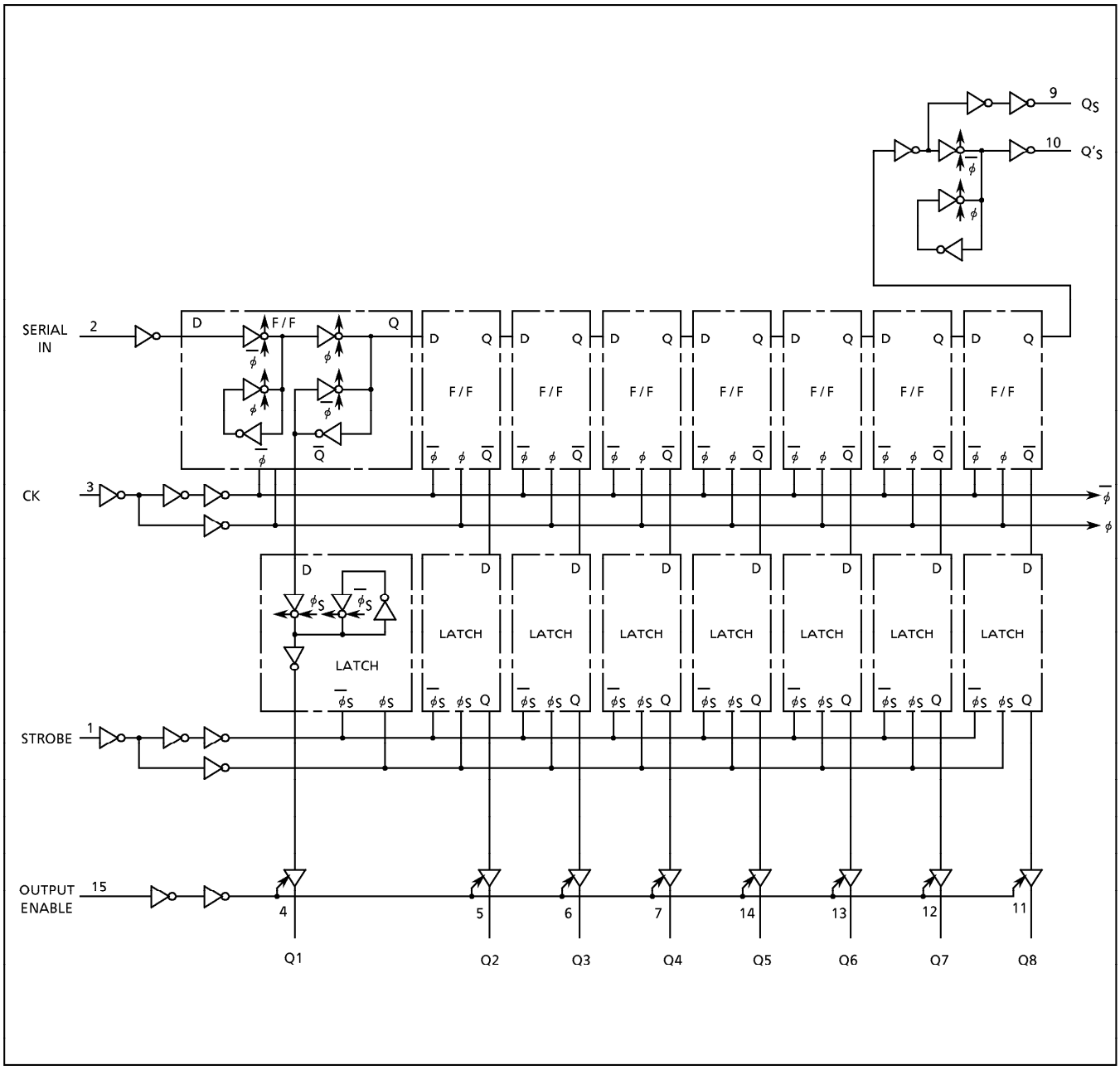
CK	OE	ST	SI	PARA. OUT		SERI. OUT	
				Q_1	Qn	Qs	Q's
↑	H	H	L	L	Qn - 1	Q7	NC
↑	H	H	H	H	Qn - 1	Q7	NC
↑	H	L	*	NC	NC	Q7	NC
↑	L	*	*	Z	Z	Q7	NC
↓	H	*	*	NC	NC	NC	Qs
↓	L	*	*	Z	Z	NC	Qs

X : DON'T CARE
NC : NO CHANGE
Z : HIGH IMPEDANCE

TIMING CHART



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}	±20	mA
Output Diode Current	I_{OK}	±20	mA
DC Output Current	I_{OUT}	±25	mA
DC V_{CC}/Ground Current	I_{CC}	±50	mA
Power Dissipation	P_D	500 (DIP)* / 180 (SOP)	mW
Storage Temperature	T_{stg}	−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 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}=2.0V) 0~500 (V_{CC}=4.5V) 0~400 (V_{CC}=6.0V)	ns

DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION		V_{CC} (V)	Ta=25°C MIN.	Ta=25°C TYP.	Ta=25°C MAX.	Ta=−40~85°C MIN.	Ta=−40~85°C MAX.	UNIT
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} or V_{IL}	I_{OH}=−20μA	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}=−4 mA I_{OH}=−5.2mA	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} or V_{IL}	I_{OL}=20μA	2.0 4.5 6.0	— — —	0.0 0.0 0.0	0.1 0.1 0.1	— — —	0.1 0.1 0.1	V
			I_{OL}=4 mA I_{OL}=5.2mA	4.5 6.0	— —	0.17 0.18	0.26 0.26	— —	0.33 0.33	
3-State Output Off-State Current	I_{OZ}	V_{IN}=V_{IH} or V_{IL} V_{OUT}=V_{CC} or GND		6.0	—	—	±0.5	—	±5.0	μA
Input Leakage Current	I_{IN}	V_{IN}=V_{CC} or GND		6.0	—	—	±0.1	—	±1.0	
Quiescent Supply Current	I_{CC}	V_{IN}=V_{CC} or GND		6.0	—	—	4.0	—	40.0	

TIMING REQUIREMENTS (Input $t_r = t_f = 6ns$)

PARAMETER	SYMBOL	TEST CONDITION		Ta = 25°C		Ta = −40~85°C	UNIT
			V_{CC} (V)	TYP.	LIMIT	LIMIT	
Minimum Pulse Width (CK)	$t_{W(H)}$ $t_{W(L)}$		2.0	—	75	95	ns
			4.5	—	15	19	
			6.0	—	13	16	
Minimum Pulse Width (STROBE)	$t_{W(H)}$		2.0	—	75	95	
			4.5	—	15	19	
			6.0	—	13	16	
Minimum Set−up Time (SERIAL)	t_s		2.0	—	75	95	
			4.5	—	15	19	
			6.0	—	13	16	
Minimum Set−up Time (STROBE)	t_s		2.0	—	100	125	
			4.5	—	20	25	
			6.0	—	17	21	
Minimum Hold Time (SERIAL)	t_h		2.0	—	0	0	
			4.5	—	0	0	
			6.0	—	0	0	
Minimum Hold Time (STROBE)	t_h		2.0	—	0	0	
			4.5	—	0	0	
			6.0	—	0	0	
Clock Frequency	f		2.0	—	6	5	MHz
			4.5	—	30	24	
			6.0	—	35	28	

AC ELECTRICAL CHARACTERISTICS (C_L = 15pF, V_{CC} = 5V, Ta = 25°C, Input $t_r = t_f$ = 6ns)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Transition Time	t_{TLH} t_{THL}		—	4	8	ns
Propagation Delay Time (CK−Qn)	t_{pLH} t_{pHL}		—	22	35	
Propagation Delay Time (CK−QS, Q'S)	t_{pLH} t_{pHL}		—	16	25	
Propagation Delay Time (STROBE−Qn)	t_{pLH} t_{pHL}		—	16	27	
3-State Output Enable Time	t_{pZL} t_{pZH}	R_L = 1KΩ	—	13	25	
Maximum Clock Frequency	f_{MAX}		33	73	—	MHz

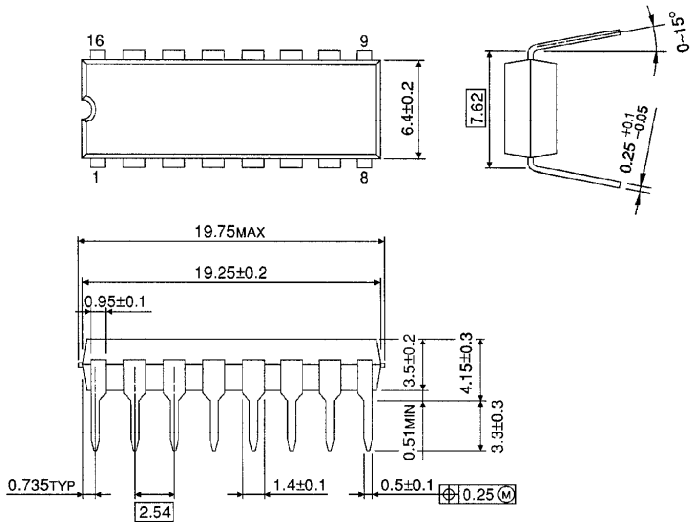
AC ELECTRICAL CHARACTERISTICS (C_L = 50pF, Input $t_r = t_f$ = 6ns)

PARAMETER	SYMBOL	TEST CONDITION		Ta = 25°C			Ta = −40~85°C		UNIT
			V_{CC} (V)	MIN.	TYP.	MAX.	MIN.	MAX.	
Output Transition Time	t_{TLH} t_{THL}		2.0	—	30	75	—	95	ns
			4.5	—	8	15	—	19	
			6.0	—	7	13	—	16	
Propagation Delay Time (CK−Qn)	t_{pLH} t_{pHL}		2.0	—	92	200	—	250	
			4.5	—	26	40	—	50	
			6.0	—	20	34	—	43	
Propagation Delay Time (CK−QS, Q'S)	t_{pLH} t_{pHL}		2.0	—	65	150	—	190	
			4.5	—	19	30	—	38	
			6.0	—	15	26	—	32	
Propagation Delay Time (STROBE−Qn)	t_{pLH} t_{pHL}		2.0	—	75	160	—	200	
			4.5	—	20	32	—	40	
			6.0	—	16	27	—	34	
3-State Output Enable Time	t_{pZL} t_{pZH}	R_L = 1KΩ	2.0	—	58	150	—	190	
			4.5	—	16	30	—	38	
			6.0	—	13	26	—	32	
3-State Output Disable Time	t_{pLZ} t_{pHZ}	R_L = 1KΩ	2.0	—	35	150	—	190	
			4.5	—	16	30	—	38	
			6.0	—	13	26	—	32	
Maximum Clock Frequency	f_{MAX}		2.0	6	16	—	5	—	MHz
			4.5	30	66	—	24	—	
			6.0	35	80	—	28	—	
Input Capacitance	C_{IN}			—	5	10	—	10	pF
Bus Input Capacitance	C_{OUT}			—	10	—	—	—	
Power Dissipation Capacitance	C_{PD} (1)			—	140	—	—	—	

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:

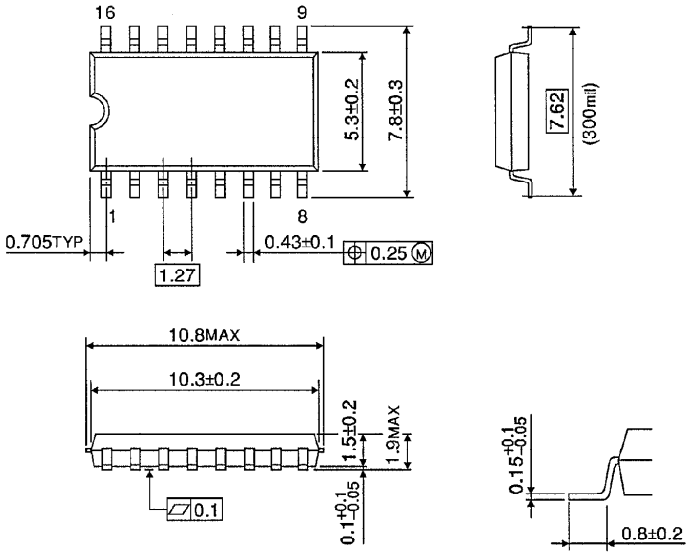
$$I_{CC}(opr) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

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



Weight : 1.00g (Typ.)

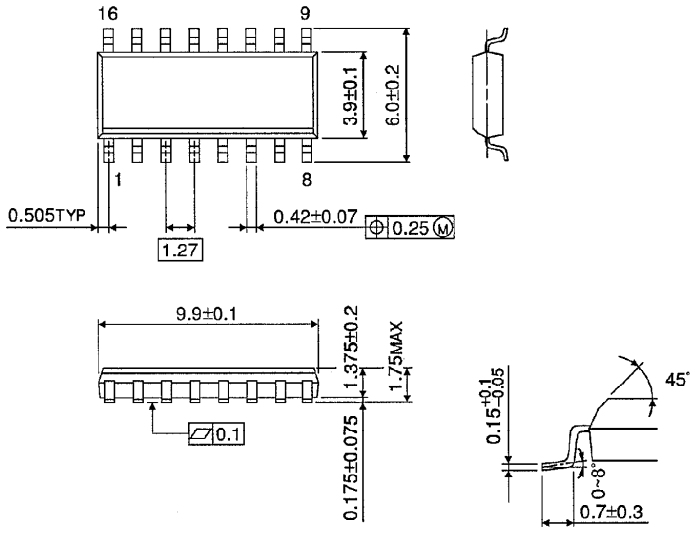
SOP 16PIN (200mil BODY) OUTLINE DRAWING (SOP16-P-300-1.27) Unit in mm



Weight : 0.18g (Typ.)

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.)