TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

# TC74HC4094AP, TC74HC4094AF, TC74HC4094AFN

# 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 C<sup>2</sup>MOS technology.

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

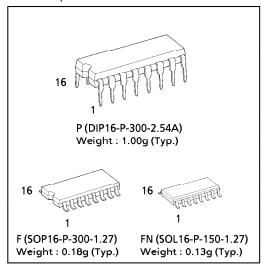
It consists of an 8-bit shift register and an 8-bit latch with 3-state output buffers. Data is shifted serially though the shift register on the positive going transition of the CK input. The output of the last stage (Qs) can be used to cascade several devices. Data on the Qs output is transferred to 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.

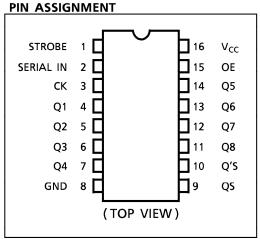
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

#### FEATURES:

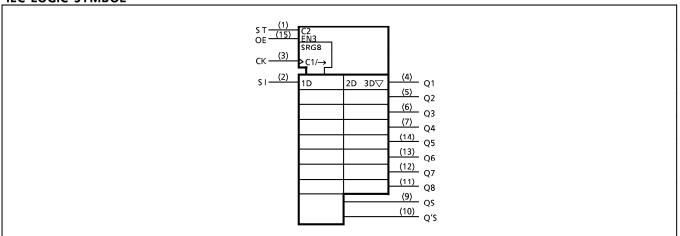
- High Speed······f<sub>MAX</sub> = 73MHz(typ.) at  $V_{CC}$  = 5V
- Low Power Dissipation ············ $I_{CC} = 4\mu A(Max.)$  at Ta = 25°C
- High Noise Immunity  $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (Min.)
- Output Drive Capability ......10 LSTTL Loads
- Symmetrical Output Impedance···  $| I_{OH} |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

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





# **IEC LOGIC SYMBOL**



961001EBA2

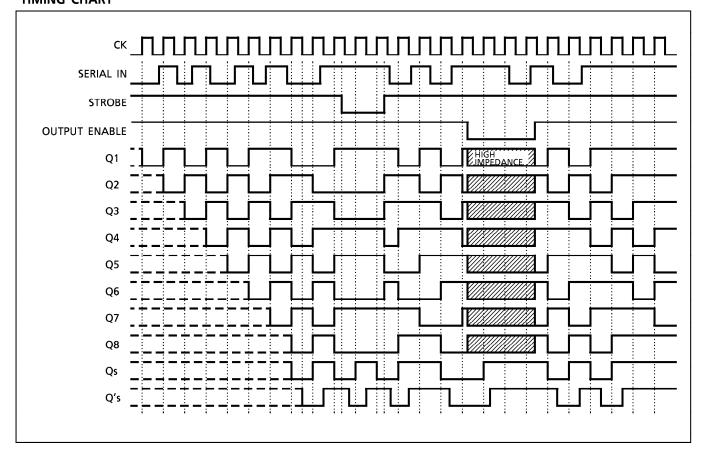
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#### TRUTH TABLE

СК	<b>C</b>	ст	CI	PARA	. OUT	SERI. OUT		
2	CK OE ST SI		Q1	Qn	Q's	Q's		
<b>-</b>	Н	Η	L	L	Qn - 1	Q7	NC	
	Н	Н	Н	Н	Qn - 1	Q7	NC	
4	Н	L	*	NC	NC	Q7	NC	
4	L	*	*	Z	Z	Q7	NC	
٦	Н	*	*	NC	NC	NC	Qs	
۲	L	*	*	Z	Z	NC	Qs	

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

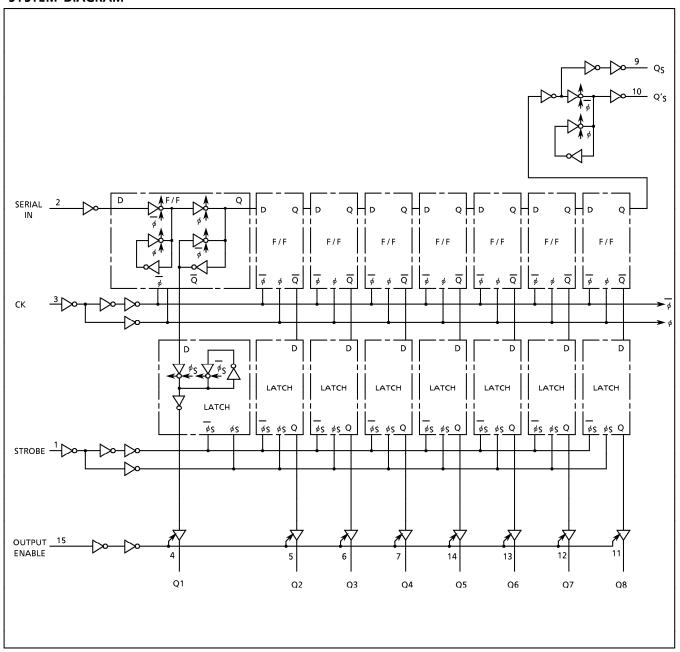
#### **TIMING CHART**



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#### **SYSTEM DIAGRAM**



#### **ABSOLUTE MAXIMUM RATINGS**

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	V <sub>cc</sub>	<b>−</b> 0.5~7	٧
DC Input Voltage	VIN	−0.5~V <sub>CC</sub> + 0.5	V
DC Output Voltage	V <sub>OUT</sub>	-0.5~V <sub>CC</sub> + 0.5	٧
Input Diode Current	I <sub>IK</sub>	± 20	mA
Output Diode Current	I <sub>ok</sub>	±20	mA
DC Output Current	I <sub>OUT</sub>	± 25	mΑ
DC V <sub>CC</sub> / Ground Current	I <sub>cc</sub>	± 50	mΑ
Power Dissipation	P <sub>D</sub>	500 (DIP)* / 180 (SOP)	mW
Storage Temperature	T <sub>stg</sub>	<b>−65~150</b>	°C

\*500mW in the range of Ta=  $-40^{\circ}\text{C}\sim65^{\circ}\text{C}$ . From Ta= $65^{\circ}\text{C}$  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 <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>	<b>−40~85</b>	°C
Input Rise and Fall Time	t <sub>r</sub> , t <sub>f</sub>	$0 \sim 1000 \text{ (V}_{CC} = 2.0\text{V)}$ $0 \sim 500 \text{ (V}_{CC} = 4.5\text{V)}$ $0 \sim 400 \text{ (V}_{CC} = 6.0\text{V)}$	ns

## DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CO	TEST CONDITION		Ta = 25°C		C	Ta = -4	ŀ0~85°C	UNIT
FARAIVIETER	STIVIBUL	TEST CONDITION		V <sub>CC</sub> (V)	MIN.	TYP.	MAX.	MIN.	MAX.	OIVII
High - Level Input Voltage	V <sub>IH</sub>		2.0 4.5 6.0	1.50 3.15 4.20	_ 		1.50 3.15 4.20		V	
Low - Level Input Voltage	VIL			2.0 4.5 6.0			0.50 1.35 1.80		0.50 1.35 1.80	V
High - Level	V <sub>OH</sub>	V <sub>1 N</sub> =	$I_{OH} = -20\mu A$	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
Output Voltage		$V_{IH}$ or $V_{IL}$	$I_{OH} = -4 \text{ mA}$ $I_{OH} = -5.2 \text{ mA}$	4.5 6.0	4.18 5.68	4.31 5.80	_	4.13 5.63	=	
Low - Level	V <sub>OL</sub>	$V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 20 \mu A$	2.0 4.5 6.0	111	0.0 0.0 0.0	0.1 0.1 0.1	_	0.1 0.1 0.1	v
Output Voltage		V <sub>IH</sub> or V <sub>IL</sub>	$I_{OL} = 4$ mA $I_{OL} = 5.2$ mA	4.5 6.0	11	0.17 0.18	0.26 0.26	_	0.33 0.33	
3 - State Output Off - State Current	l <sub>oz</sub>	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $V_{OUT} = V_{CC} \text{ or GND}$		6.0	1	_	± 0.5	_	± 5.0	
Input Leakage Current	I <sub>IN</sub>	$V_{IN} = V_{CC}$ or GND		6.0	_	_	± 0.1	_	± 1.0	] μΑ
Quiescent Supply Current	I <sub>cc</sub>	$V_{IN} = V_{CO}$	or GND	6.0	_	_	4.0	_	40.0	

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

PARAMETER	SYMBOL	MBOL TEST CONDITION		Ta =	25°C	$Ta = -40 \sim 85^{\circ}C$	TINU
PARAIVIETER	STIVIBOL	TEST CONDITION	V <sub>CC</sub> (V)	TYP.	LIMIT	LIMIT	וואוטן
Minimum Pulse Width	t <sub>W(H)</sub>		2.0	_	75 15	95	
( CK )	t <sub>W(L)</sub>		4.5 6.0	_	15 13	19 16	
Minimum Pulse Width			2.0	_	75	95	
(STROBE)	t <sub>W(H)</sub>		4.5 6.0	_ _	15 13	19 16	
Minimum Set-up Time			2.0	_	75	95	
(SERIAL)	t <sub>s</sub>		4.5 6.0		15 13	19 16	
			2.0	_	100	125	1
Minimum Set—up Time (STROBE)	t,		4.5	_	20	25	ns
(31ROBL)			6.0	_	17	21	
Minimum Hold Time	_		2.0		0	0	
(SERIAL)	t <sub>h</sub>		4.5 6.0	_ _	0	0	
Minimum Hold Time			2.0	_	0	0	1 .
(STROBE)	t <sub>h</sub>		4.5 6.0	_	0	0	
			2.0	_	6	5	
Clock Frequency	†		4.5 6.0	_	30 35	24 28	MHz

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

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Transition Time	t <sub>TLH</sub> t <sub>THL</sub>		_	4	8	
Propagation Delay Time (CK-Qn)	t <sub>pLH</sub> t <sub>pHL</sub>		_	22	35	
Propagation Delay Time (CK-QS, Q'S)	t <sub>pLH</sub> t <sub>pHL</sub>		_	16	25	ns
Propagation Delay Time (STROBE—Qn)	t <sub>pLH</sub> t <sub>pHL</sub>		_	16	27	
3-State Output Enable Time	t <sub>pZL</sub> t <sub>pZH</sub>	$R_L = 1 K\Omega$	_	13	25	
Maximum Clock Frequency	f <sub>MAX</sub>		33	73	_	MHz

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

PARAMETER	SYMBOL	TEST CONDITION			Γa = 25°0	a = 25°C		Ta = −40~85°C	
PARAIVIETER	STIVIBUL	TEST CONDITION	V <sub>CC</sub> (V)	MIN.	TYP.	MAX.	MIN.	MAX.	UNIT
Output Transition Time	t <sub>TLH</sub>		2.0 4.5	_	30 8	75 15	_	95 19	
Catput Transition Time	t <sub>THL</sub>		6.0	_	ž	13	_	16	
Propagation Delay Time	t <sub>pLH</sub>		2.0	_	92	200	_	250	]
(CK-Qn)	t <sub>pHL</sub>		4.5 6.0	_	26 20	40   34	_	50 43	
Propagation Delay Time	t <sub>pLH</sub>		2.0	_	65	150	_	190	1
(CK-QS, Q'S)	t <sub>pHL</sub>		4.5 6.0	_	19 15	30 26	_	38 32	
Propagation Delay Time	+		2.0	_	75	160	_	200	ns
(STROBE—Qn)	t <sub>pLH</sub> t <sub>pHL</sub>		4.5 6.0	_	20 16	32 27	_	40 34	
	t		2.0	_	58	150	_	190	1
3-State Output Enable Time	t <sub>pZL</sub> t <sub>pZH</sub>	$R_L = 1K\Omega$	4.5 6.0	_	16 13	30 26	_	38 32	
	t <sub>pLZ</sub>		2.0	_	35	150	_	190	1
3-State Output Disable Time	t <sub>pHZ</sub>	$R_L = 1K\Omega$	4.5 6.0	_	16 13	30 26	_	38 32	
	,		2.0	6	16	_	5	_	
Maximum Clock Frequency	f <sub>MAX</sub>		4.5 6.0	30 35	66 80	_	24 28	_	MHz
Input Capacitance	C <sub>IN</sub>		•		5	10	_	10	
Bus Input Capacitance	C <sub>OUT</sub>			_	10	_	_	_	рF
Power Dissipation Capacitance	C <sub>PD</sub> (1)			_	140	_	_	_	

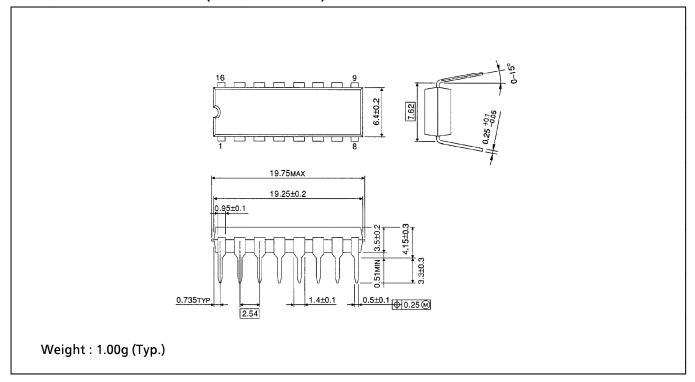
Note (1) C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:

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

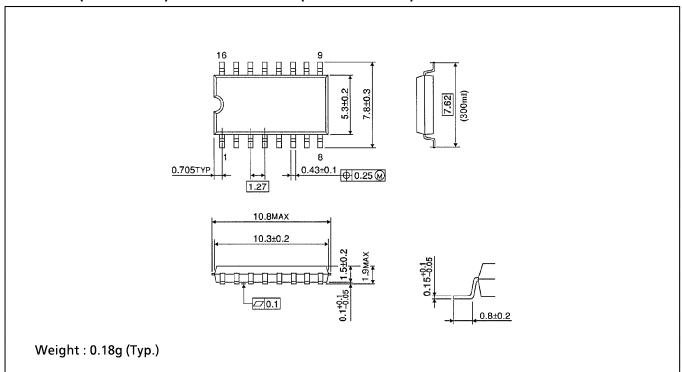
## DIP 16PIN OUTLINE DRAWING (DIP16-P-300-2.54A)

Unit in mm



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

Unit in mm



# SOP 16PIN (150mil BODY) OUTLINE DRAWING (SOL16-P-150 -1.27)

Unit in mm

