TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

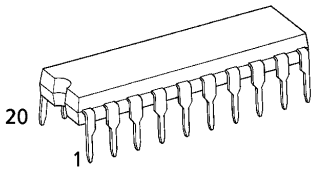
TC74HC299AP, TC74HC299AF

8−BIT PIPO SHIFT REGISTER WITH ASYNCHRONOUS CLEAR

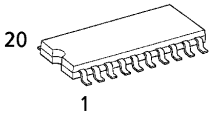
The TC74HC299A is a high speed CMOS 8-BIT PIPO SHIFT REGISTER fabricated with silicon gate C²MOS technology.
It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.
It has four modes (HOLD, SHIFT LEFT, SHIFT RIGHT and LOAD DATA) controlled by the two selection inputs (S0, S1).
When one or both enable ($\overline{G}1$, $\overline{G}2$) are high, the eight I/O outputs are forced to the high-impedance state; however, sequential operation or clearing of the register is not affected.
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

FEATURES:

- High Speed ····· f_{MAX} = 42MHz(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 ····· 15 LSTTL Loads For QA~QH
  10 LSTTL Loads For QA′, QH′
- Symmetrical Output Impedance···
  $|I_{OH}| = I_{OL}$ = 6mA(min.)ForQA~QH
  $|I_{OH}| = I_{OL}$ = 4mA(min.)ForQA′, QH′
- Balanced Propagation Delays ····· $t_{pLH} \simeq t_{pHL}$
- Wide Operating Voltage Range···· V_{CC} (opr.) = 2V~6V
- Pin and Function Compatible with 74LS299

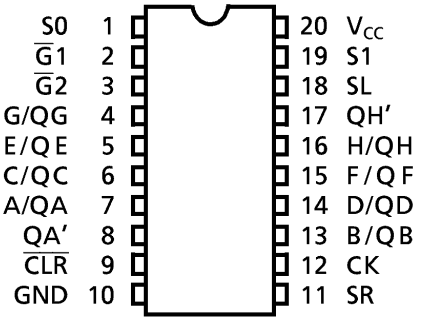


P (DIP20-P-300-2.54A)
Weight : 1.30g (Typ.)



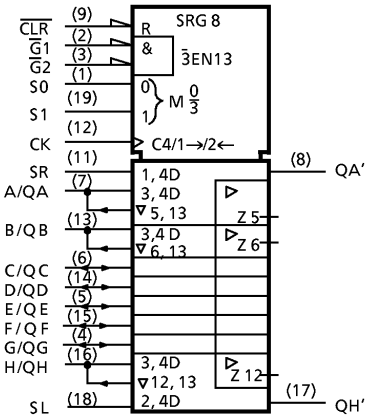
F (SOP20-P-300-1.27)
Weight : 0.22g (Typ.)

PIN ASSIGNMENT



(TOP VIEW)

IEC LOGIC SYMBOL



APPLICATION NOTES

1) Do not apply a signal to any bus terminal when it is in the output mode. Damage may result.
2) All floating (high impedance) bus terminals must have their input levels fixed by means of pull up or pull down resistors.

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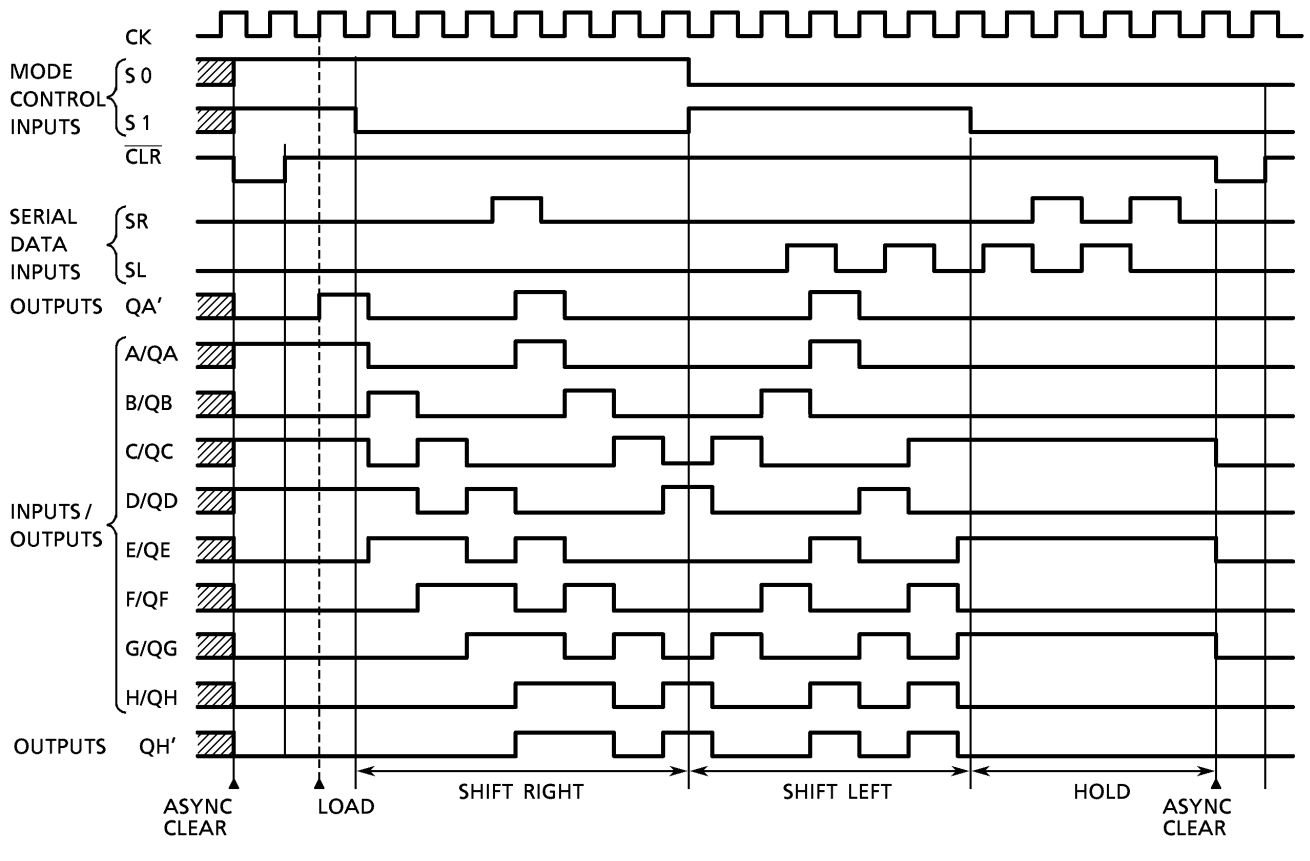
TRUTH TABLE

MODE	INPUTS								INPUTS/ OUTPUTS		OUTPUTS	
	$\overline{CLR}$	FUNCTION SELECT		OUTPUT CONTROL		CLOCK	SERIAL		A/QA	H/QH	QA′	QH′
		S1	S0	$\overline{G}1$*	$\overline{G}2$*	CK	SL	SR				
Z	L	H	H	X	X	X	X	X	Z	Z	L	L
CLR	L	L	X	L	L	X	X	X	L	L	L	L
	L	X	L	L	L	X	X	X	L	L	L	L
HOLD	H	L	L	L	L	X	X	X	QA0	QH0	QA0	QH0
SHIFT	H	L	H	L	L	↑	X	H	H	QGn	H	QGn
RIGHT	H	L	H	L	L	↑	X	L	L	QGn	L	QGn
SHIFT	H	H	L	L	L	↑	H	X	QBn	H	QBn	H
LEFT	H	H	L	L	L	↑	L	X	QBn	L	QBn	L
LOAD	H	H	H	X	X	↑	X	X	a	h	a	h

* When one or both output controls are high, the eight input/output terminals are in the high-impedance state; however sequential or clearing of the register is not affected.

Z : High Impedance
Qn0 : The level of Qn before the indicated steady – state input conditions were established.
Qnn : The level of Qn before the most recent active transition indicated by ↓ or ↑.
a, h : The level of the steady – state inputs A, H, respectively.
X : Don't Care.

TIMING CHART



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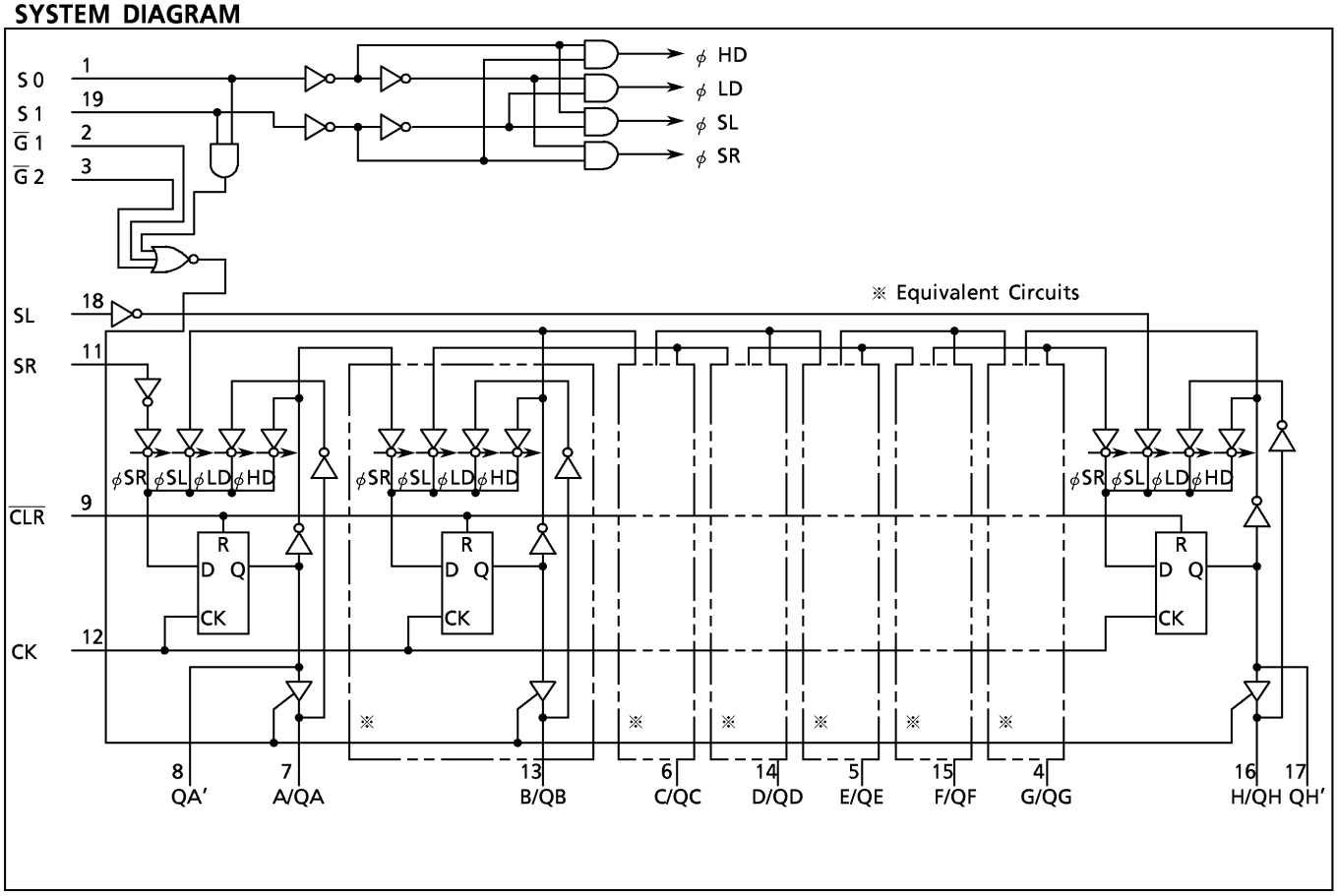
SYSTEM DIAGRAM



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}	±20	mA
Output Diode Current	I_{OK}	±20	mA
DC Output Current $\frac{(Q_H')}{(Q_A \sim Q_H)}$	I_{OUT}	±25 ±35	mA
DC V_{CC}/Ground Current	I_{CC}	±75	mA
Power Dissipation	P_D	500 (DIP)* / 180 (SOP)	mW
Storage Temperature	T_{stg}	−65~150	°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
			Q'_A, Q'_H	I_{OH} = −4 mA I_{OH} = −5.2mA	4.5 6.0	4.18 5.68	4.31 5.80	— —	4.13 5.63	— —	
			Q_A~Q_H	I_{OH} = −6 mA I_{OH} = −7.8mA	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
			Q'_A, Q'_H	I_{OL} = 4 mA I_{OL} = 5.2mA	4.5 6.0	— —	0.17 0.18	0.26 0.26	— —	0.33 0.33	
			Q_A~Q_H	I_{OL} = 6 mA I_{OL} = 7.8mA	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 RECOMMENDED OPERATING CONDITIONS (Input $t_r = t_f = 6ns$)

PARAMETER	SYMBOL	TEST CONDITION	V_{CC} (V)	Ta = 25°C TYP.	Ta = 25°C LIMIT	Ta = −40~85°C LIMIT	UNIT
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 ($\overline{CLR}$)	$t_{W(L)}$		2.0	—	75	88	
			4.5	—	15	18	
			6.0	—	12	15	
Minimum Set−up Time ($\overline{SL}$, SR, A~H)	t_s		2.0	—	100	125	
			4.5	—	20	25	
			6.0	—	17	21	
Minimum Set−up Time (S0, S1)	t_s		2.0	—	100	125	
			4.5	—	20	25	
			6.0	—	17	21	
Minimum Hold Time (SL, SR, A~H)	t_h		2.0	—	0	0	
			4.5	—	0	0	
			6.0	—	0	0	
Minimum Hold Time (S0, S1)	t_h		2.0	—	0	0	
			4.5	—	0	0	
			6.0	—	0	0	
Minimum Removal Time ($\overline{CLR}$)	t_{rem}		2.0	—	50	65	
			4.5	—	10	13	
			6.0	—	8	10	
Clock Frequency	f		2.0	—	6	5	
			4.5	—	30	24	
			6.0	—	35	23	

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 (QA′, QH′)	t_{TLH} t_{THL}		—	4	8	ns
Propagation Delay Time (CK−QA′, QH′)	t_{pLH} t_{pHL}		—	19	30	
Propagation Delay Time ($\overline{CLR}$−QA′, QH′)	t_{pLH} t_{pHL}		—	17	30	
Maximum Clock Frequency	f_{MAX}		35	73	—	MHz

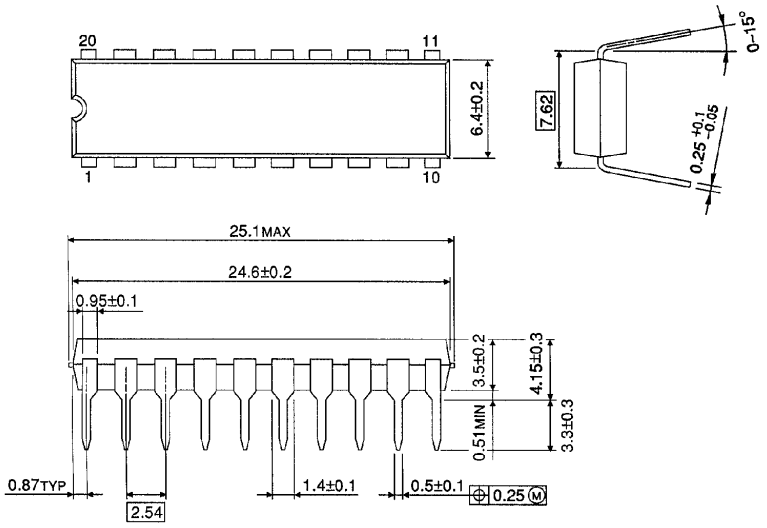
AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 6ns$)

PARAMETER	SYMBOL	TEST CONDITION	CL (pF)	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
Output Transition Time (QA~QH)	t_{TLH} t_{THL}		50	2.0	−	25	60	−	75	ns
				4.5	−	7	12	−	15	
				6.0	−	6	10	−	13	
Output Transition Time (QA', QH')	t_{TLH} t_{THL}		50	2.0	−	30	75	−	95	
				4.5	−	8	15	−	19	
				6.0	−	7	13	−	16	
Propagation Delay Time (CK−QA' QH')	t_{pLH} t_{pHL}		50	2.0	−	85	170	−	215	
				4.5	−	23	34	−	43	
				6.0	−	18	29	−	37	
Propagation Delay Time ($\overline{CLR}$−QA' QH')	t_{pHL}		50	2.0	−	85	175	−	220	
				4.5	−	24	35	−	44	
				6.0	−	18	30	−	37	
Propagation Delay Time (CK−QA~QH)	t_{pLH} t_{pHL}		50	2.0	−	80	160	−	200	
				4.5	−	21	32	−	40	
				6.0	−	17	27	−	34	
			150	2.0	−	100	200	−	250	
				4.5	−	26	40	−	50	
				6.0	−	21	34	−	43	
Propagation Delay Time ($\overline{CLR}$−QA~QH)	t_{pHL}		50	2.0	−	85	190	−	240	
				4.5	−	24	38	−	48	
				6.0	−	18	30	−	38	
			150	2.0	−	105	230	−	90	
				4.5	−	29	46	−	58	
				6.0	−	22	36	−	46	
Output Enable time	t_{pZL} t_{pZH}	$R_L = 1k\Omega$	50	2.0	−	60	130	−	165	
				4.5	−	17	26	−	33	
				6.0	−	13	22	−	28	
			150	2.0	−	78	170	−	215	
				4.5	−	23	34	−	43	
				6.0	−	17	29	−	36	
Output Disable time	t_{pLZ} t_{pHZ}	$R_L = 1k\Omega$	50	2.0	−	54	150	−	190	
				4.5	−	19	30	−	38	
				6.0	−	16	26	−	33	
Maximum Clock Frequency	f_{MAX}		50	2.0	6	12	−	5	−	MHz
				4.5	30	58	−	24	−	
				6.0	35	80	−	28	−	
Input Capacitance	C_{IN}				−	5	10	−	10	pF
Output Capacitance	C_{OUT}				−	13	−	−	−	
Power Dissipation Capacitance	C_{PD} (1)				−	170	−	−	−	

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:

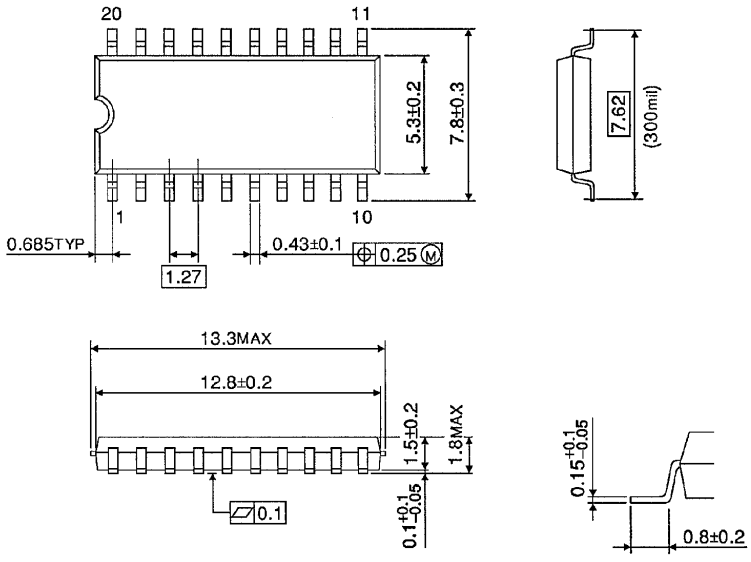
$$I_{CC}(opr) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

DIP 20PIN OUTLINE DRAWING (DIP20-P-300-2.54A) Unit in mm



Weight : 1.30g (Typ.)

SOP 20PIN (200mil BODY) OUTLINE DRAWING (SOP20-P-300-1.27) Unit in mm



Weight : 0.22g (Typ.)