INTEGRATED CIRCUIT

TOSHIBA

TECHNICAL DATA

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT

TC74AC164P/F/FN/FS

SILICON MONOLITHIC

8 – BIT SHIFT REGISTER (S – IN, P – OUT)

The TC74AC164 is an advanced high speed CMOS 8 - BIT SERIAL - IN PARALLEL - OUT SHIFT REGISTER fabricated with silicon gate and double - layer metal wiring C^2MOS technology.

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

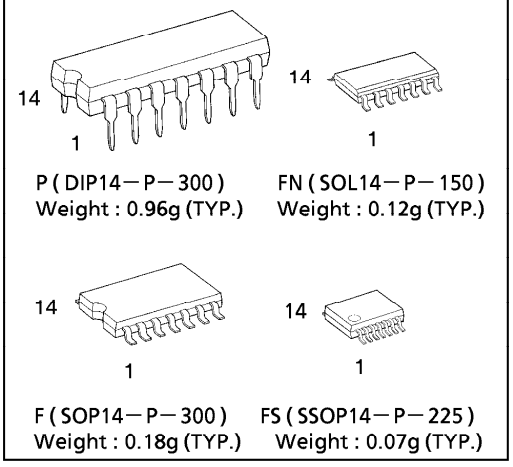
It consists of a serial - in, parallel - out 8 - bit shift register with a CLOCK input and an overriding $\overline{CLEAR}$ input.

Two serial data inputs (A, B) are provided so that one may be used as a data enable.

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

FEATURES :

- High Speed ····· f_{MAX} = 170MHz (typ.) at V_{CC} = 5V
- Low Power Dissipation ····· I_{CC} = 8μA(Max.) at Ta = 25°C
- High Noise Immunity ····· $V_{NIH} = V_{NIL}$ = 28% V_{CC} (Min.)
- Symmetrical Output Impedance ··· $|I_{OH}| = I_{OL}$ = 24mA(Min.) Capability of driving 50Ω transmission lines.
- Balanced Propagation Delays ····· $t_{pLH} \simeq t_{pHL}$
- Wide Operating Voltage Range ···· V_{CC} (opr) = 2V ~ 5.5V
- Pin and Function Compatible with 74F164



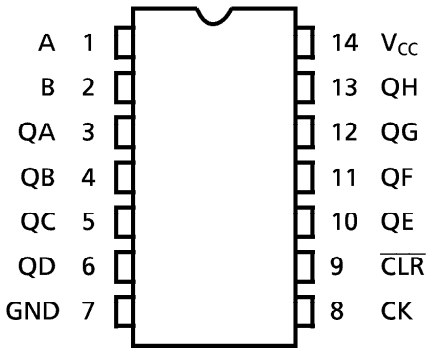
P (DIP14 – P – 300) Weight : 0.96g (TYP.)

FN (SOL14 – P – 150) Weight : 0.12g (TYP.)

F (SOP14 – P – 300) Weight : 0.18g (TYP.)

FS (SSOP14 – P – 225) Weight : 0.07g (TYP.)

PIN ASSIGNMENT



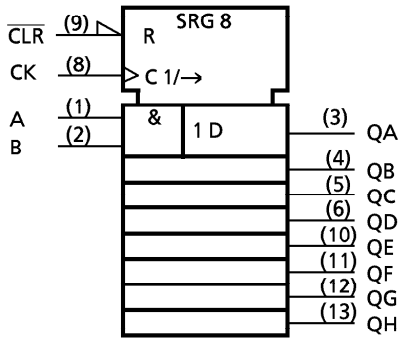
TRUTH TABLE

INPUTS				OUTPUTS			
$\overline{CLR}$	CK	SERIAL IN		QA	QB	···	QH
		A	B				
L	X	X	X	L	L	···	L
H	↓	X	X	NO CHANGE			
H	↑	L	X	L	QA_n	···	QG_n
H	↑	X	L	L	QA_n	···	QG_n
H	↑	H	H	H	QA_n	···	QG_n

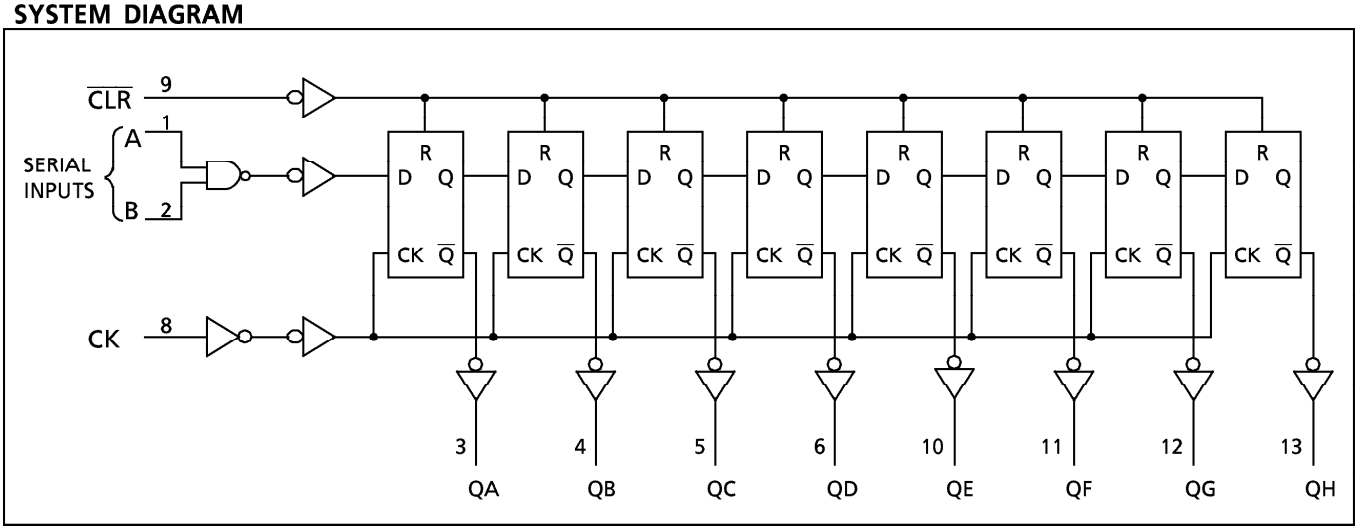
X : Don't Care

$QA_n \sim QG_n$: The level of QA ~ QG, respectively, before the most recent positive edge of the clock.

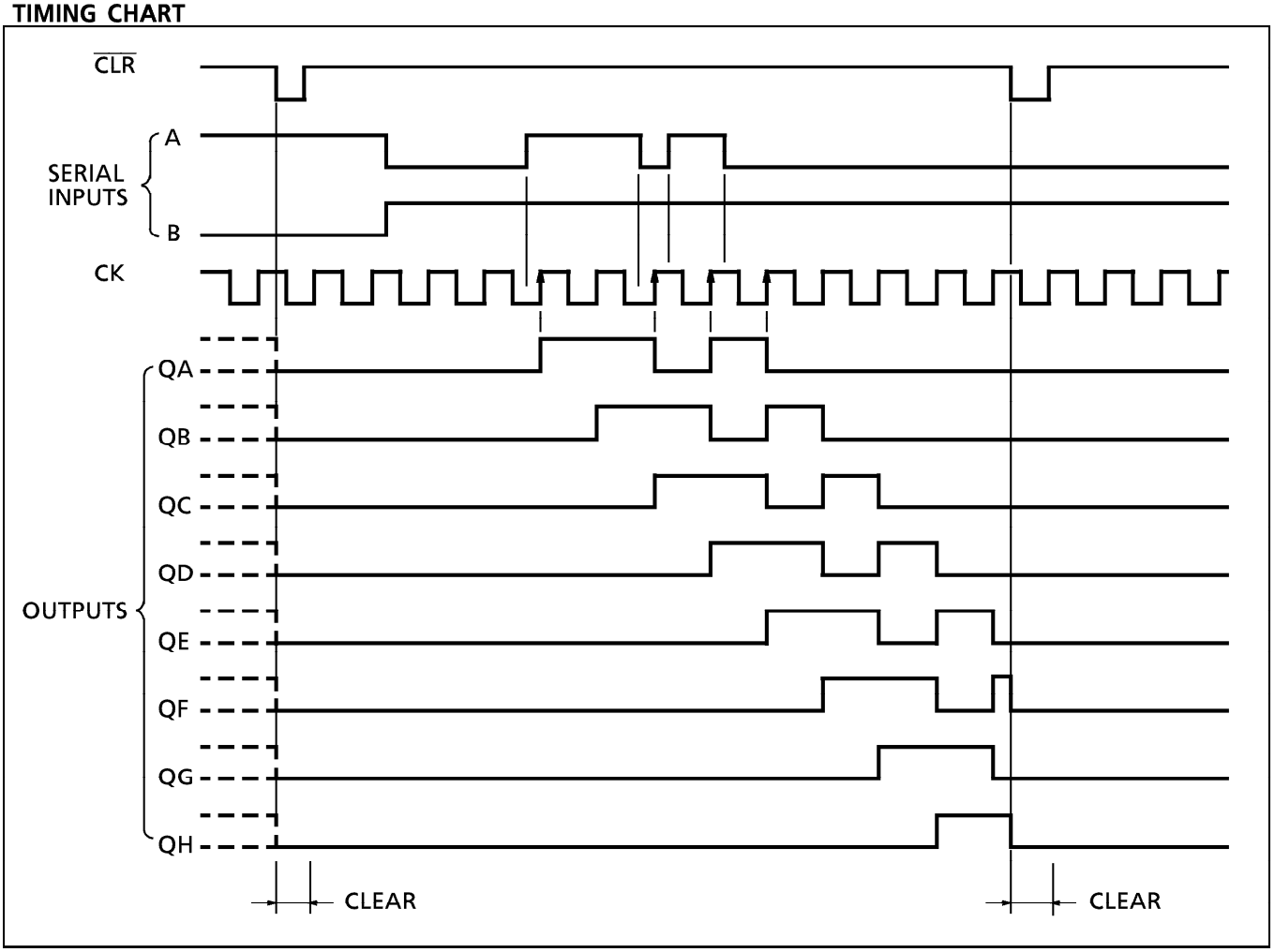
IEC LOGIC SYMBOL



SYSTEM DIAGRAM



TIMING CHART



ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	V_{CC}	−0.5~7.0	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}	±50	mA
DC Output Current	I_{OUT}	±50	mA
DC V_{CC}/Ground Current	I_{CC}	±200	mA
Power Dissipation	P_D	500 (DIP)*/ 180 (SOP/SSOP)	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 should be applied up to 300mW.

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	V_{CC}	2.0~5.5	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	dt / dV	0~ 100 (Vcc = 3.3 ± 0.3V) 0~ 20 (Vcc = 5 ± 0.5V)	ns / V

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 3.0 5.5	1.50 2.10 3.85	— — —	— — —	1.50 2.10 3.85	— — —	V
Low - Level Input Voltage	V_{IL}			2.0 3.0 5.5	— — —	— — —	0.50 0.90 1.65	— — —	0.50 0.90 1.65	V
High - Level Output Voltage	V_{OH}	V_{IN} = V_{IH} or V_{IL}	I_{OH} = −50μA	2.0 3.0 4.5	1.9 2.9 4.4	2.0 3.0 4.5	— — —	1.9 2.9 4.4	— — —	V
			I_{OH} = −4mA I_{OH} = −24mA I_{OH} = −75mA*	3.0 4.5 5.5	2.58 3.94 —	— — —	— — —	2.48 3.80 3.85	— — —	
Low - Level Output Voltage	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 50μA	2.0 3.0 4.5	— — —	0.0 0.0 0.0	0.1 0.1 0.1	— — —	0.1 0.1 0.1	V
			I_{OL} = 12mA I_{OL} = 24mA I_{OL} = 75mA*	3.0 4.5 5.5	— — —	— — —	0.36 0.36 —	— — —	0.44 0.44 1.65	
Input Leakage Current	I_{IN}	V_{IN} = V_{CC} or GND		5.5	—	—	±0.1	—	±1.0	μA
Quiescent Supply Current	I_{CC}	V_{IN} = V_{CC} or GND		5.5	—	—	8.0	—	80.0	

* : This spec indicates the capability of driving 50Ω transmission lines.
One output should be tested at a time for a 10ms maximum duration.

TIMING REQUIREMENTS (Input $t_r = t_f = 3ns$)

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C	Ta = −40~85°C	UNIT
		V_{CC} (V)	LIMIT	LIMIT	
Minimum Pulse Width (CK)	$t_{W(L)}$ $t_{W(H)}$	3.3 ± 0.3 5.0 ± 0.5	9.0 5.0	10.0 6.0	ns
Minimum Pulse Width ($\overline{CLR}$)	$t_{W(L)}$	3.3 ± 0.3 5.0 ± 0.5	9.0 5.0	10.0 6.0	
Minimum Set - up Time	t_s	3.3 ± 0.3 5.0 ± 0.5	7.0 4.0	7.0 4.0	
Minimum Hold Time	t_h	3.3 ± 0.3 5.0 ± 0.5	1.0 1.0	1.0 1.0	
Minimum Removal Time ($\overline{CLR}$)	t_{rem}	3.3 ± 0.3 5.0 ± 0.5	8.5 5.0	8.5 5.0	

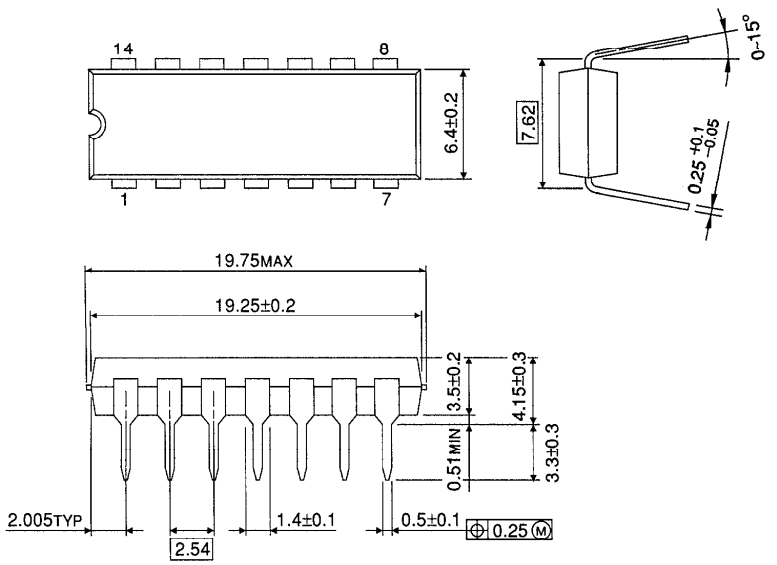
AC ELECTRICAL CHARACTERISTICS ($C_L = 50pF$, $R_L = 500\ \Omega$, Input $t_r = t_f = 3ns$)

PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C			Ta = −40~85°C		UNIT
		V_{CC} (V)	MIN.	TYP.	MAX.	MIN.	MAX.	
Propagation Delay Time (CK−Q)	t_{pLH} t_{pHL}	3.3 ± 0.3 5.0 ± 0.5	− −	9.6 6.6	16.3 9.8	1.0 1.0	18.6 11.2	ns
Propagation Delay Time ($\overline{CLR}$−Q)	t_{pHL}	3.3 ± 0.3 5.0 ± 0.5	− −	8.0 6.0	15.4 11.0	1.0 1.0	17.5 12.5	
Maximum Clock Frequency	f_{MAX}	3.3 ± 0.3 5.0 ± 0.5	45 80	100 150	− −	45 80	− −	MHz
Input Capacitance	C_{IN}		−	5	10	−	10	pF
Power Dissipation Capacitance	C_{PD} (1)		−	110	−	−	−	

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 :

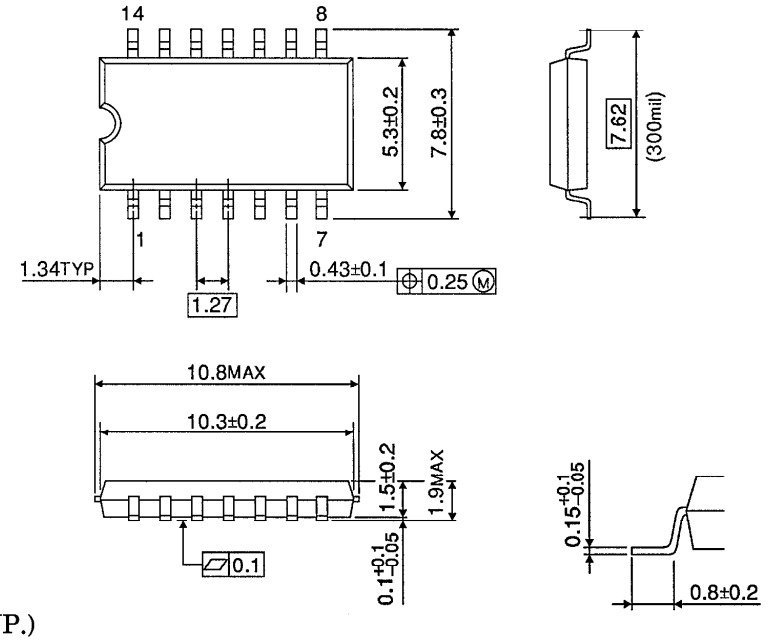
$$I_{CC}(opr.) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

DIP 14PIN OUTLINE DRAWING (DIP14−P−300) Unit in mm



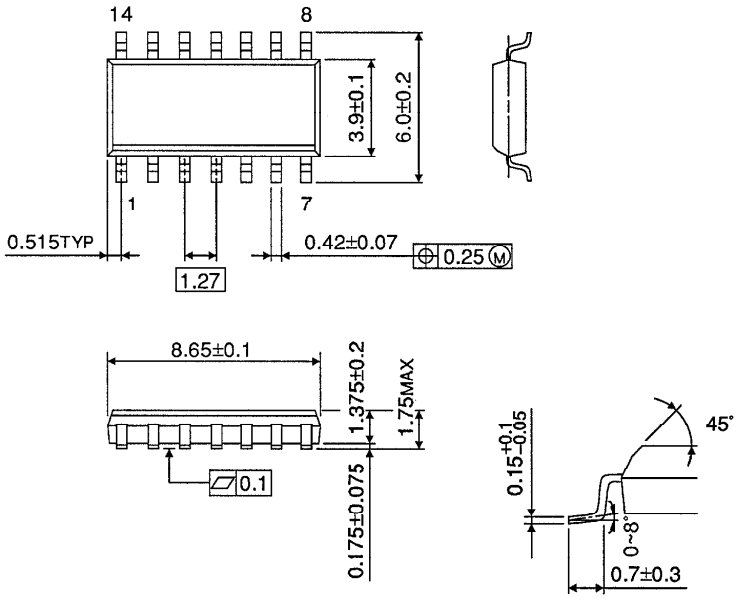
Weight : 0.96g (TYP.)

SOP 14PIN (200mil BODY) OUTLINE DRAWING (SOP14−P−300) Unit in mm



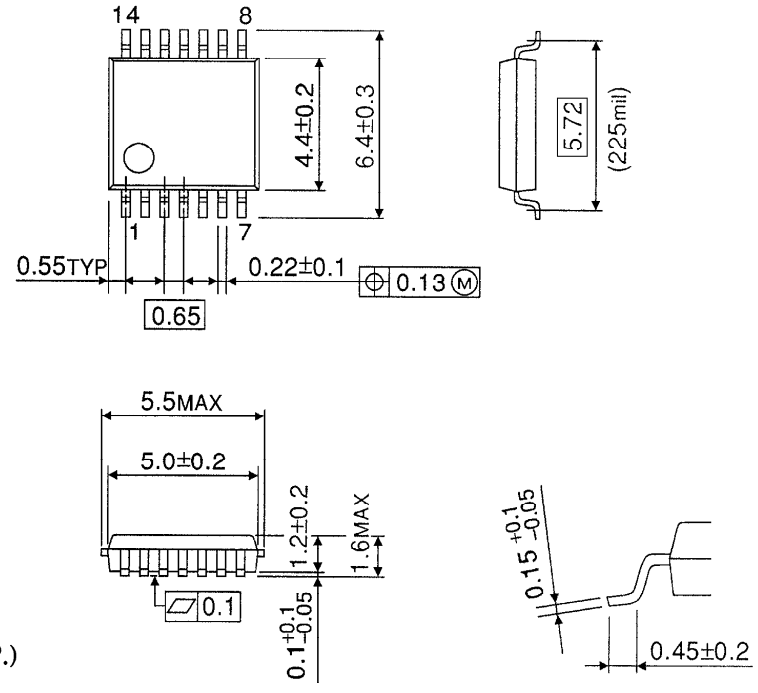
Weight : 0.18g (TYP.)

SOP 14PIN (150mil BODY) OUTLINE DRAWING (SOL14−P−150) Unit in mm



Weight : 0.12g (TYP.)

SSOP 14PIN OUTLINE DRAWING (SSOP14−P−225) Unit in mm



Weight : 0.07g (TYP.)