TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC74HC564AP, TC74HC564AF
TC74HC574AP, TC74HC574AF, TC74HC574AFW

OCTAL D-TYPE FLIP-FLOP WITH 3-STATE OUTPUT

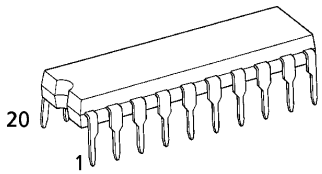
TC74HC564AP/AF INVERTING
TC74HC574AP/AF/AFW NON-INVERTING

The TC74HC564A and HC574A are high speed CMOS OCTAL FLIP-FLOPs with 3-STATE OUTPUT fabricated with silicon gate C^2MOS technology.
They achieve the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.
These 8-bit D-type flip-flops are controlled by a clock input (CK) and an output enable input ($\overline{OE}$).
The TC74HC564A has inverting outputs, and the TC74HC574A has non-inverting outputs.
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

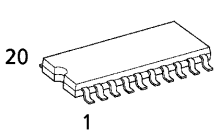
FEATURES:

- High Speed ..... f_{MAX} = 62MHz(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
- Symmetrical Output Impedance ... $|I_{OH}| = I_{OL}$ = 6mA(Min.)
- Balanced Propagation Delays ..... $t_{pLH} \simeq t_{pHL}$
- Wide Operating Voltage Range ..... V_{CC} (opr.) = 2V~6V
- Pin and Function Compatible with 74LS564/574

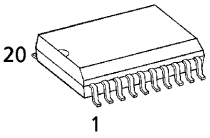
(Note) The JEDEC SOP (FW) is not available in Japan.



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



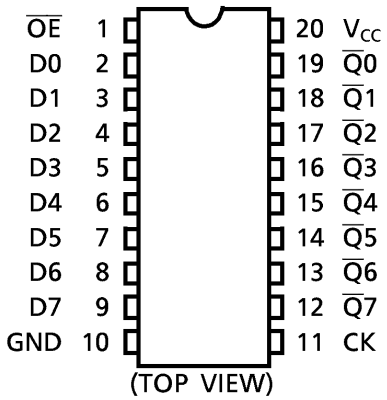
F (SOP20-P-300-1.27)
Weight : 0.22g (Typ.)



FW (SOL20-P-300-1.27)
Weight : 0.46g (Typ.)

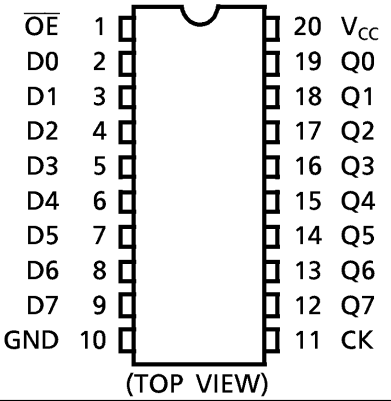
PIN ASSIGNMENT

TC74HC564A



(TOP VIEW)

TC74HC574A



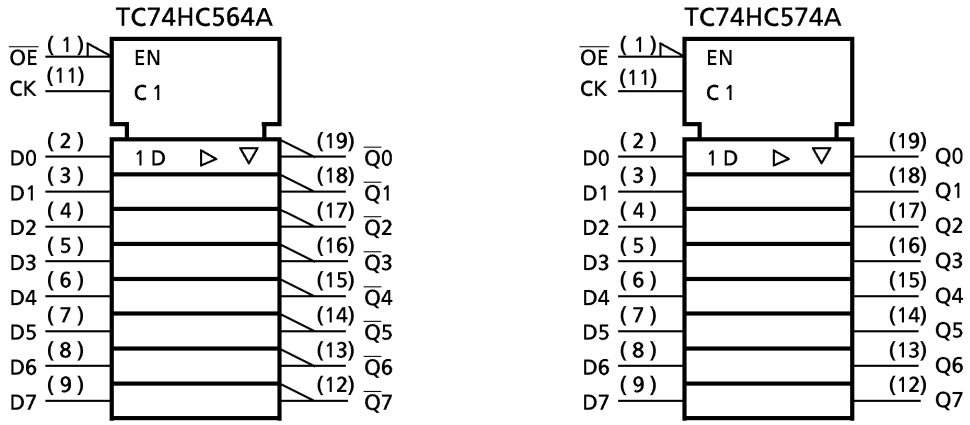
(TOP VIEW)

TRUTH TABLE

INPUTS			OUTPUTS	
$\overline{OE}$	CK	D	Q(574A)	$\overline{Q}$(564A)
H	X	X	Z	Z
L	↓	X	Q_n	$\overline{Q_n}$
L	↑	L	L	H
L	↑	H	H	L

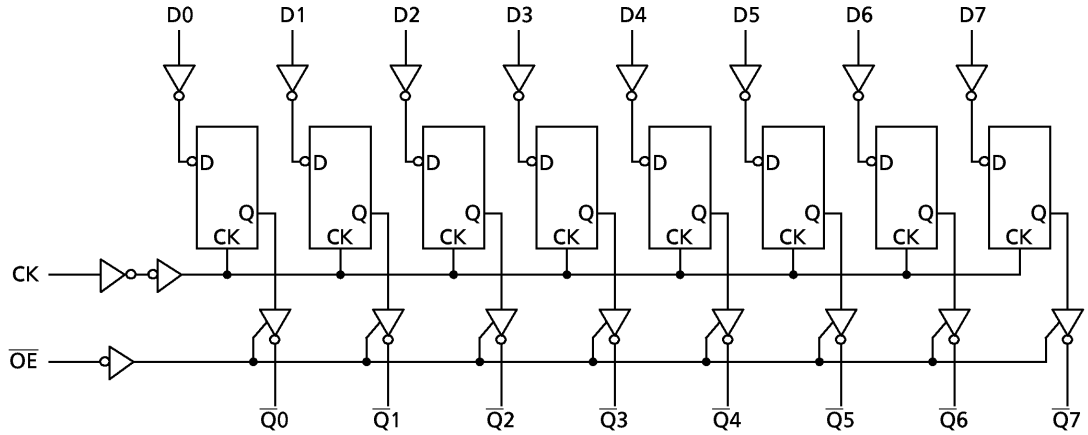
X : Don't Care
Z : High Impedance
Q_n ($\overline{Q_n}$) : No Change

IEC LOGIC SYMBOL

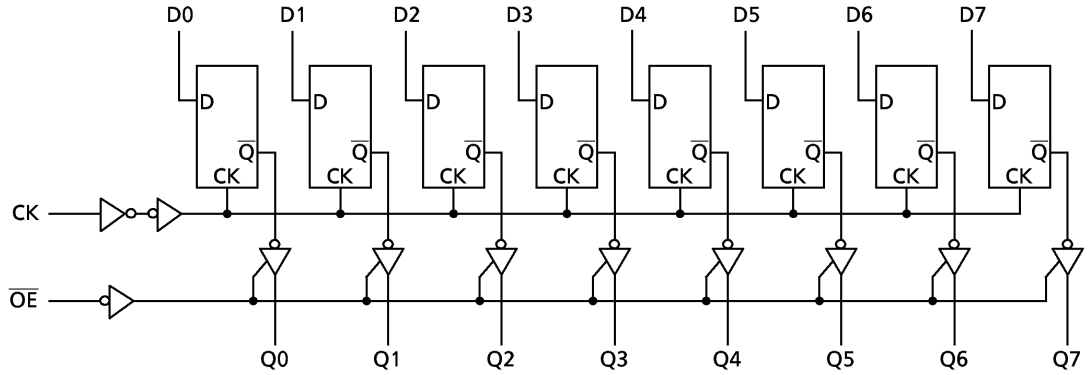


SYSTEM DIAGRAM

TC74HC564A



TC74HC574A



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}	±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
			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
			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 REQUIREMENTS (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 Set−up Time (Dn)	t_s		2.0	—	75	95	
			4.5	—	15	19	
			6.0	—	13	16	
Minimum Hold Time (Dn)	t_h		2.0	—	0	0	
			4.5	—	0	0	
			6.0	—	0	0	
Clock Frequency	f		2.0	—	6	5	MHz
			4.5	—	31	24	
			6.0	—	36	28	

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	t_{TLH} t_{THL}		50	2.0	—	25	60	—	75	ns
				4.5	—	7	12	—	15	
				6.0	—	6	10	—	13	
Propagation Delay Time (CK−Q, $\overline{Q}$)	t_{pLH} t_{pHL}		50	2.0	—	70	150	—	190	
				4.5	—	20	30	—	38	
				6.0	—	15	26	—	33	
			150	2.0	—	88	190	—	240	
				4.5	—	25	38	—	48	
				6.0	—	19	33	—	41	
Output Enable time	t_{pZL} t_{pZH}	$R_L = 1k\Omega$	50	2.0	—	48	125	—	155	
				4.5	—	15	25	—	31	
				6.0	—	12	21	—	26	
			150	2.0	—	60	165	—	205	
				4.5	—	20	33	—	41	
				6.0	—	16	28	—	35	
Output Disable time	t_{pLZ} t_{pHZ}	$R_L = 1k\Omega$	50	2.0	—	34	125	—	155	
				4.5	—	17	25	—	31	
				6.0	—	15	21	—	26	
Maximum Clock Frequency	f_{MAX}		50	2.0	6	17	—	5	—	MHz
				4.5	31	50	—	24	—	
				6.0	36	59	—	28	—	
Input Capacitance	C_{IN}				—	5	10	—	10	pF
Output Capacitance	C_{OUT}				—	10	—	—	—	
Power Dissipation Capacitance	C_{PD} (1)				—	54	—	—	—	

Note (1) C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

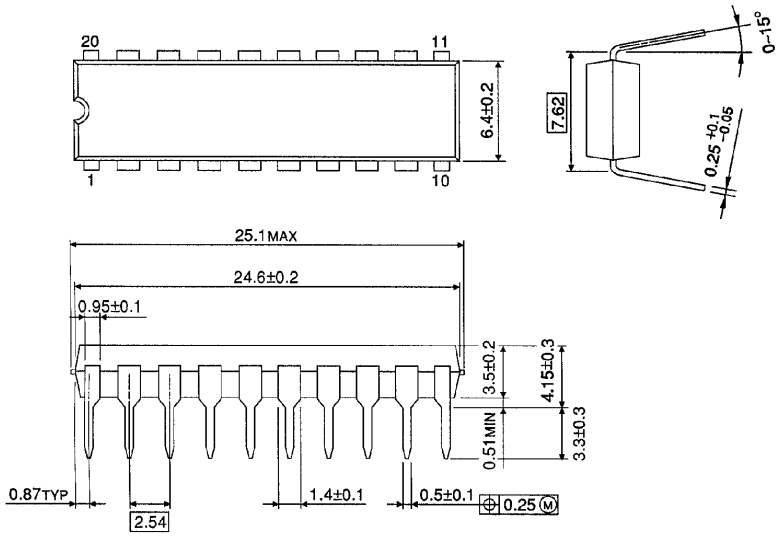
Average operating current can be obtained by the equation :

$$I_{CC}(opr) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 8 \text{ (per bit)}$$

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

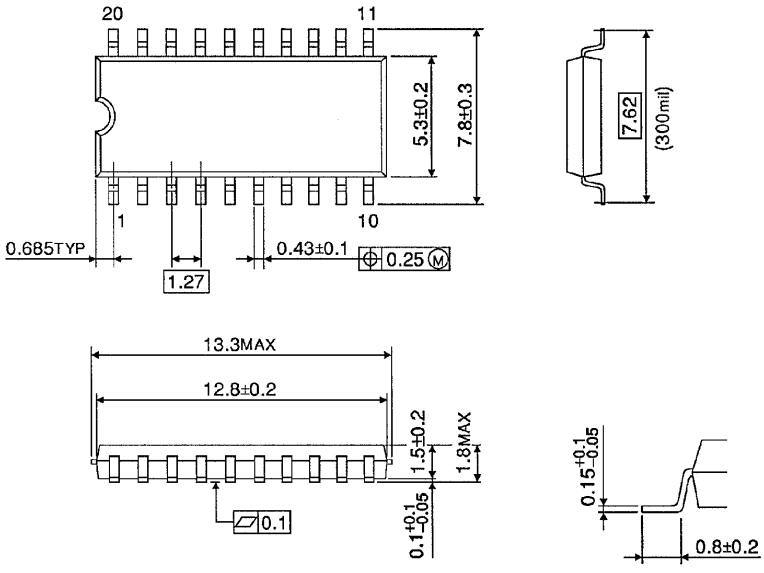
$$C_{PD}(total) = 39 + 15 \cdot n$$

DIP 20PIN PACKAGE DIMENSIONS (DIP20-P-300-2.54A) Unit in mm



Weight : 1.30g (Typ.)

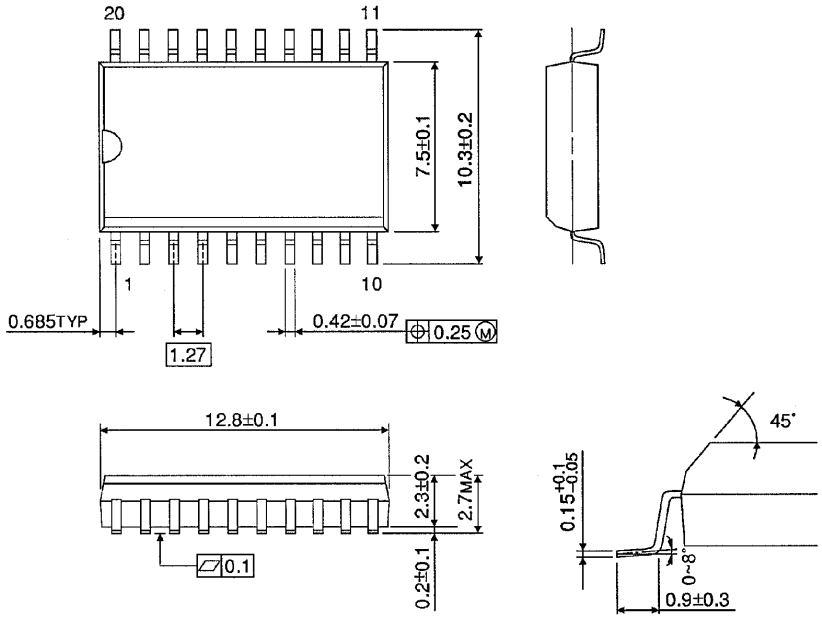
SOP 20PIN (200mil BODY) PACKAGE DIMENSIONS (SOP20-P-300-1.27) Unit in mm



Weight : 0.22g (Typ.)

SOP 20PIN (300mil BODY) PACKAGE DIMENSIONS (SOL20-P-300-1.27) Unit in mm

(Note) This package is not available in Japan.



Weight : 0.46g (Typ.)

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