

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74HC564AP, TC74HC564AF, TC74HC574AP, TC74HC574AF

Octal D-Type Flip-Flop with 3-State Output

TC74HC564AP/AF Inverting

TC74HC574AP/AF Non-Inverting

The TC74HC564A and HC574A are high speed CMOS OCTAL FLIP-FLOPs with 3-STATE OUTPUT fabricated with silicon gate C²MOS 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 ($\overline{OE}$).

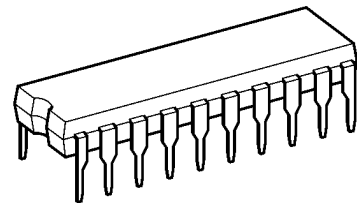
The TC74HC564A has inverting outputs, and the TC74HC574A has non-inverting outputs.

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

Features

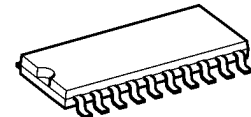
- High speed: $f_{\max} = 62$ MHz (typ.) at $V_{CC} = 5$ V
- Low power dissipation: $I_{CC} = 4$ μ A (max) at $T_a = 25^\circ\text{C}$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (min)
- Output drive capability: 15 LSTTL loads
- Symmetrical output impedance: $|I_{OH}| = I_{OL} = 6$ mA (min)
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range: $V_{CC}(\text{opr}) = 2$ to 6 V
- Pin and function compatible with 74LS564/574

TC74HC564AP, TC74HC574AP



DIP20-P-300-2.54A

TC74HC564AF, TC74HC574AF



SOP20-P-300-1.27A

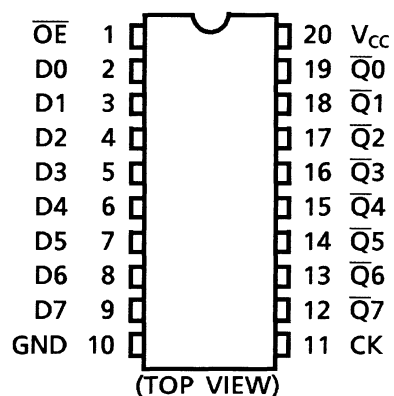
Weight

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

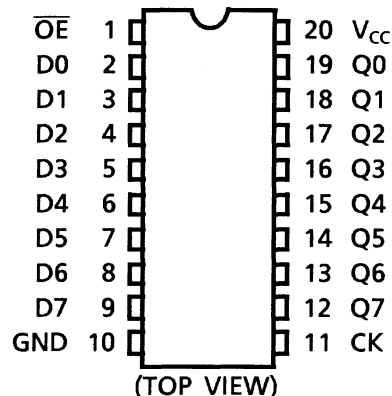
SOP20-P-300-1.27A : 0.22 g (typ.)

Pin Assignment

TC74HC564A

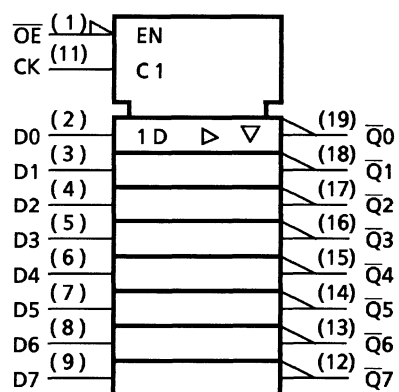


TC74HC574A

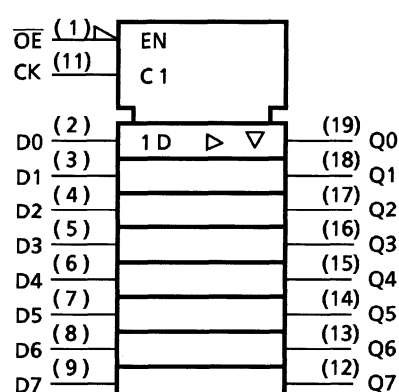


IEC Logic Symbol

TC74HC564A



TC74HC574A



Truth Table

Inputs			Outputs	
OE	CK	D	Q (574A)	Q̄ (564A)
H	X	X	Z	Z
L	↓	X	Q _n	Q̄ _n
L	↑	L	L	H
L	↑	H	H	L

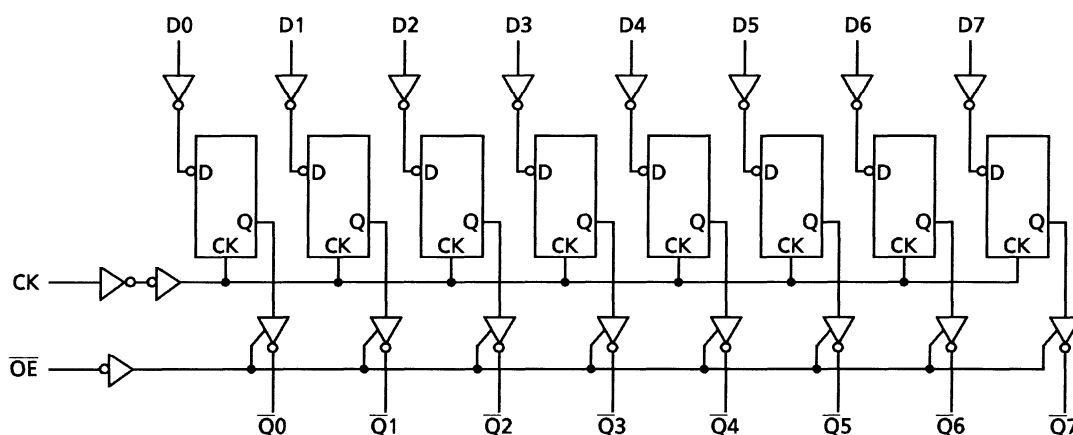
X: Don't care

Z: High impedance

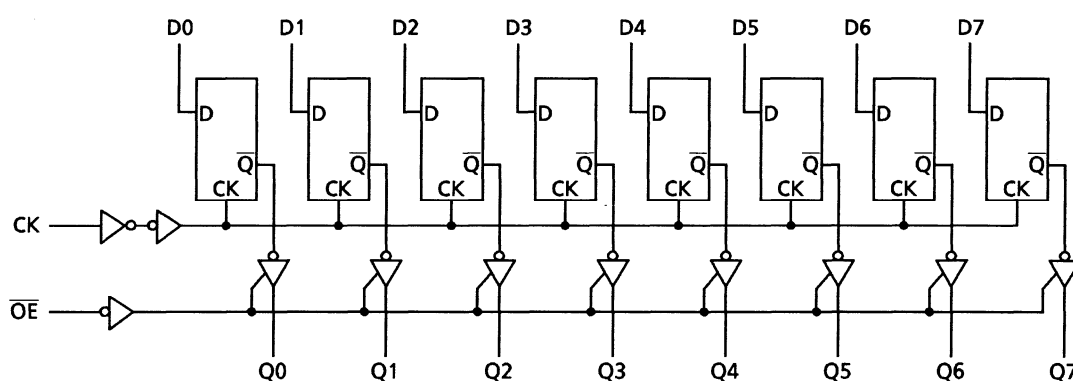
Q_n (Q̄_n): No change

System Diagram

TC74HC564A



TC74HC574A



Absolute Maximum Ratings (Note 1)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V _{CC}	−0.5 to 7	V
DC input voltage	V _{IN}	−0.5 to V _{CC} + 0.5	V
DC output voltage	V _{OUT}	−0.5 to 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) (Note 2)/180 (SOP)	mW
Storage temperature	T _{stg}	−65 to 150	°C

Note 1: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 2: 500 mW in the range of $T_a = -40$ to 65°C . From $T_a = 65$ to 85°C a derating factor of $-10 \text{ mW}/^\circ\text{C}$ shall be applied until 300 mW.

Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	2 to 6	V
Input voltage	V_{IN}	0 to V_{CC}	V
Output voltage	V_{OUT}	0 to V_{CC}	V
Operating temperature	T_{opr}	-40 to 85	°C
Input rise and fall time	t_r, t_f	0 to 1000 ($V_{CC} = 2.0$ V) 0 to 500 ($V_{CC} = 4.5$ V) 0 to 400 ($V_{CC} = 6.0$ V)	ns

Note: The operating ranges must be maintained to ensure the normal operation of the device.
Unused inputs must be tied to either V_{CC} or GND.

Electrical Characteristics
DC Characteristics

Characteristics	Symbol	Test Condition		$T_a = 25^\circ\text{C}$			$T_a = -40 \text{ to } 85^\circ\text{C}$		Unit
				V_{CC} (V)	Min	Typ.	Max	Min	Max
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	— — —	V
High-level output voltage	V_{OH}	$V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OH} = -20 \mu\text{A}$	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
			$I_{OH} = -6 \text{ mA}$	4.5 6.0	4.18 5.68	4.31 5.80	— —	4.13 5.63	
			$I_{OH} = -7.8 \text{ mA}$	6.0	5.68	5.80	—	5.63	
Low-level output voltage	V_{OL}	$V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 20 \mu\text{A}$	2.0 4.5 6.0	— — —	0.0 0.0 0.0	0.1 0.1 0.1	— — —	V
			$I_{OL} = 6 \text{ mA}$	4.5 6.0	— —	0.17 0.18	0.26 0.26	— —	0.33 0.33
			$I_{OL} = 7.8 \text{ mA}$	6.0	—	0.18	0.26	—	
3-state output off-state current	I_{OZ}	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $V_{OUT} = V_{CC} \text{ or } \text{GND}$		6.0	—	—	± 0.5	—	± 5.0
Input leakage current	I_{IN}	$V_{IN} = V_{CC} \text{ or } \text{GND}$		6.0	—	—	± 0.1	—	± 1.0
Quiescent supply current	I_{CC}	$V_{IN} = V_{CC} \text{ or } \text{GND}$		6.0	—	—	4.0	—	40.0

Timing Requirements (input: $t_r = t_f = 6 \text{ ns}$)

Characteristics	Symbol	Test Condition	Ta = 25°C		Ta = -40 to 85°C	Unit
			V _{CC} (V)	Typ.	Limit	
Minimum pulse width (CK)	t_W (H) t_W (L)	—	2.0	—	75	ns
			4.5	—	15	
			6.0	—	13	
Minimum set-up time (Dn)	t_s	—	2.0	—	75	ns
			4.5	—	15	
			6.0	—	13	
Minimum hold time (Dn)	t_h	—	2.0	—	0	ns
			4.5	—	0	
			6.0	—	0	
Clock frequency	f	—	2.0	—	6	MHz
			4.5	—	31	
			6.0	—	36	

AC Characteristics (input: $t_r = t_f = 6 \text{ ns}$)

Characteristics	Symbol	Test Condition			Ta = 25°C			Ta = -40 to 85°C		Unit
			CL (pF)	V _{CC} (V)	Min	Typ.	Max	Min	Max	
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, $\bar{Q}$)	t_{pLH} t_{pHL}	—	50	2.0	—	70	150	—	190	ns
				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}	$R_L = 1 \text{ k}\Omega$	50	2.0	—	48	125	—	155	ns
				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}	$R_L = 1 \text{ k}\Omega$	50	2.0	—	34	125	—	155	ns
				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	—	—	—	pF
Power dissipation capacitance	C_{PD} (Note)	—	—	—	—	54	—	—	—	pF

Note: 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:

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

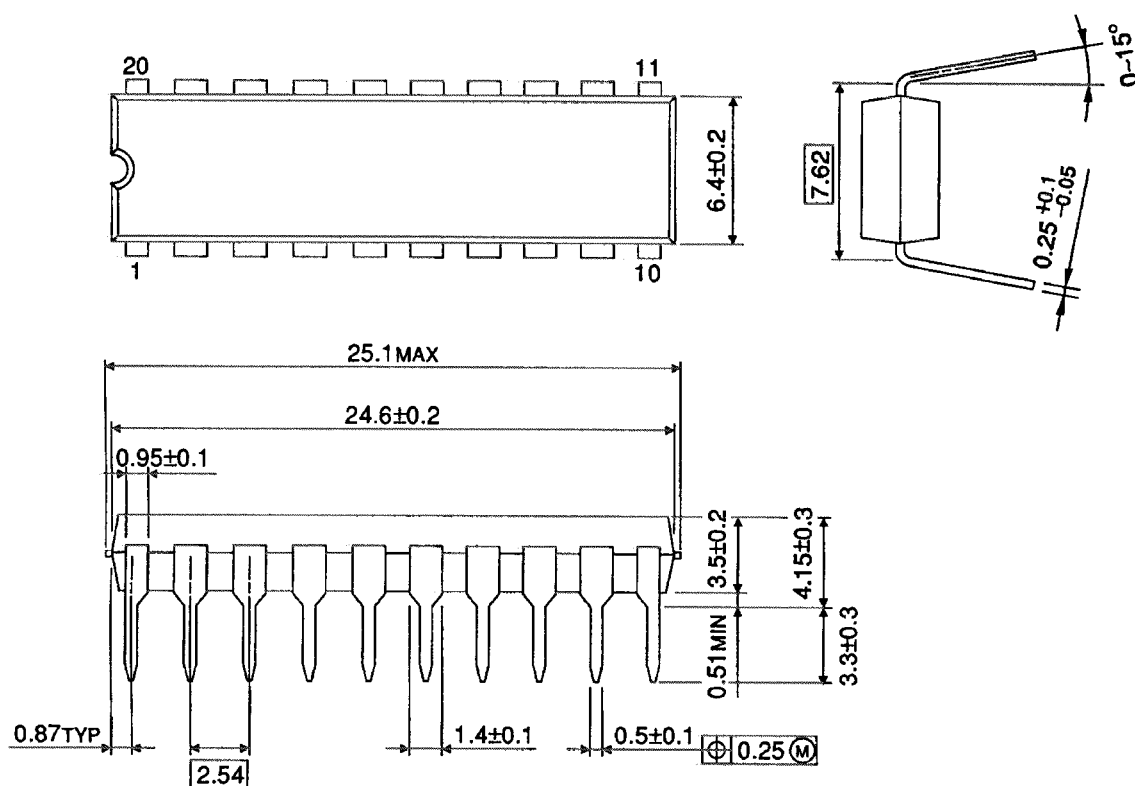
And the total C_{PD} when n pcs. of flip flop operate can be gained by the following equation:

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

Package Dimensions

DIP20-P-300-2.54A

Unit : mm

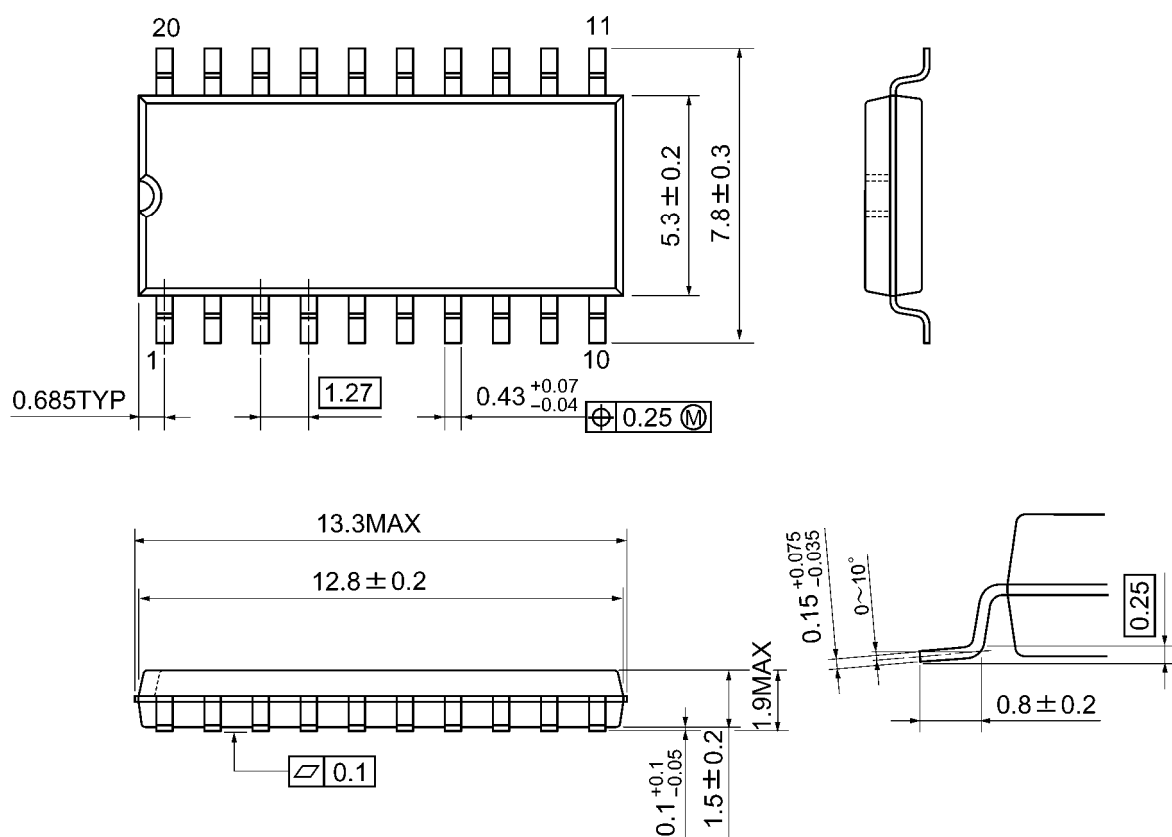


Weight: 1.30 g (typ.)

Package Dimensions

SOP20-P-300-1.27A

Unit: mm



Weight: 0.22 g (typ.)

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