

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74AC374P, TC74AC374F, TC74AC374FT TC74AC534P, TC74AC534F

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

TC74AC374P/F/FT	Non-Inverting
TC74AC534P/F	Inverting

The TC74AC374 and TC74AC534 are advanced high speed CMOS OCTAL FLIP-FLOPS fabricated with silicon gate and double-layer metal wiring C²MOS technology.

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

These 8-bit D-type flip-flops are controlled by a clock input (CK) and a output enable input (\overline{OE}).

When the \overline{OE} input is high, the eight outputs are in a high impedance state.

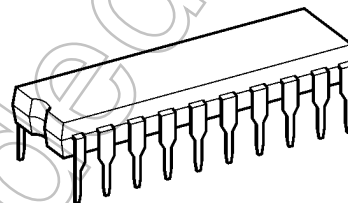
The TC74AC374 has non-inverting outputs, and TC74AC534 has inverting outputs.

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

Features

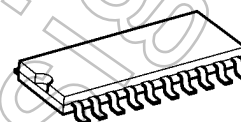
- High speed: $f_{max} = 200$ MHz (typ.) at $V_{CC} = 5$ V
- Low power dissipation: $I_{CC} = 8$ μ A (max) at $T_a = 25^\circ\text{C}$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (min)
- Symmetrical output impedance: $|I_{OH}| = I_{OL} = 24$ mA (min)
Capability of driving 50 Ω transmission lines.
- Balanced propagation delays: $t_{PLH} \approx t_{PHL}$
- Wide operating voltage range: $V_{CC} (\text{opr}) = 2$ to 5.5 V
- Pin and function compatible with 74F374/534

TC74AC374P, TC74AC534P



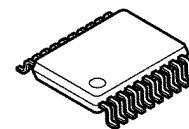
DIP20-P-300-2.54A

TC74AC374F, TC74AC534F



SOP20-P-300-1.27A

TC74AC374FT



TSSOP20-P-0044-0.65A

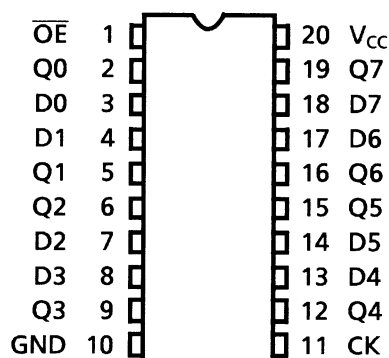
Weight

DIP20-P-300-2.54A	: 1.30 g (typ.)
SOP20-P-300-1.27A	: 0.22 g (typ.)
TSSOP20-P-0044-0.65A	: 0.08 g (typ.)

Start of commercial production
1986-05

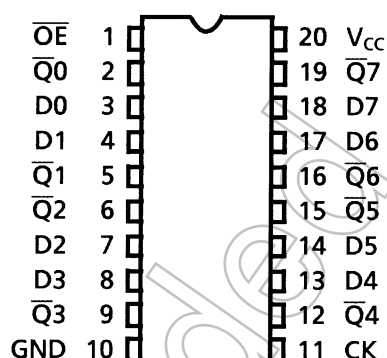
Pin Assignment

TC74AC374



(TOP VIEW)

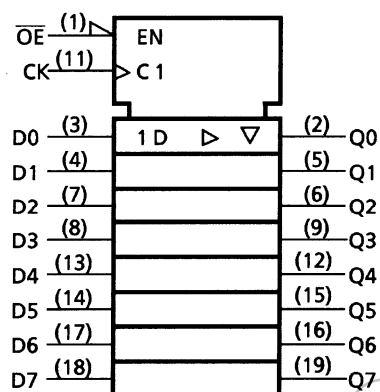
TC74AC534



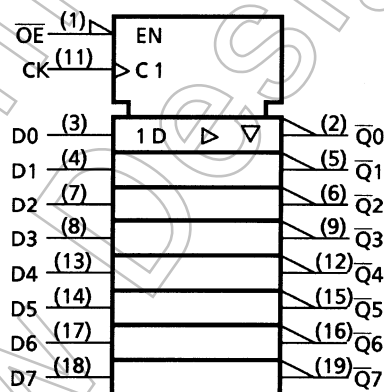
(TOP VIEW)

IEC Logic Symbol

TC74AC374



TC74AC534



Truth Table

Inputs			Outputs	
OE	CK	D	Q (374)	Q̄ (534)
H	X	X	Z	Z
L		X	Q _n	Q̄ _n
L		L	L	H
L		H	H	L

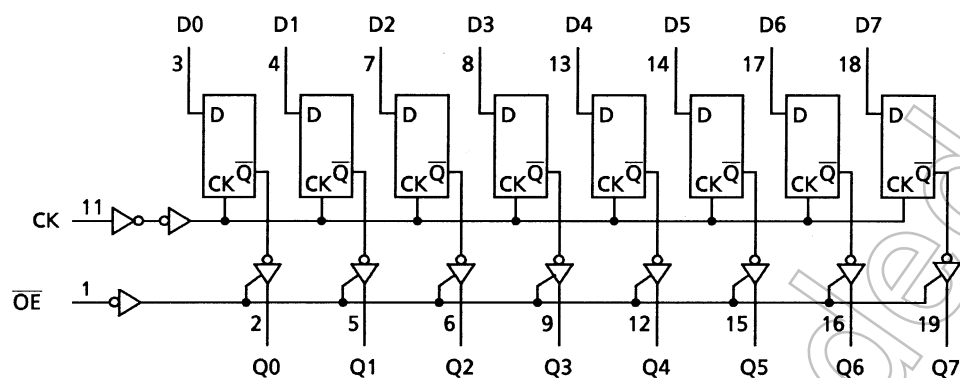
X: Don't care

Z: High impedance

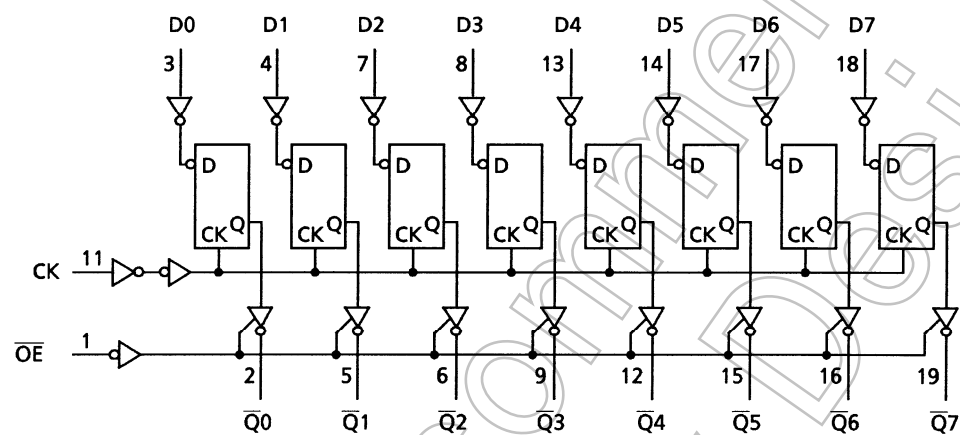
Q_n (Q̄_n): No change

System Diagram

TC74AC374



TC74AC534



Absolute Maximum Ratings (Note 1)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V_{CC}	-0.5 to 7.0	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}	± 50	mA
DC output current	I_{OUT}	± 50	mA
DC V_{CC} /ground current	I_{CC}	± 200	mA
Power dissipation	P_D	500 (DIP) (Note 2)/180 (SOP/TSSOP)	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 $-10\text{ mW}/^\circ\text{C}$ should be applied up to 300 mW.

Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	2.0 to 5.5	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	dt/dV	0 to 100 ($V_{CC} = 3.3 \pm 0.3\text{ V}$) 0 to 20 ($V_{CC} = 5 \pm 0.5\text{ V}$)	ns/V

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		Ta = 25°C			Ta = -40 to 85°C		Unit	
				V _{CC} (V)	Min	Typ.	Max	Min		Max
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	— — 1.65	V	
High-level output voltage	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -50 μA	2.0	1.9	2.0	—	1.9	—	V
				3.0	2.9	3.0	—	2.9	—	
				4.5	4.4	4.5	—	4.4	—	
			I _{OH} = -4 mA I _{OH} = -24 mA I _{OH} = -75 mA (Note)	3.0	2.58	—	—	2.48	—	
				4.5	3.94	—	—	3.80	—	
Low-level output voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 50 μA	2.0	—	0.0	0.1	—	0.1	V
				3.0	—	0.0	0.1	—	0.1	
				4.5	—	0.0	0.1	—	0.1	
			I _{OL} = 12 mA I _{OL} = 24 mA I _{OL} = 75 mA (Note)	3.0	—	—	0.36	—	0.44	
				4.5	—	—	0.36	—	0.44	
3-state output off-state current	I _{OZ}	V _{IN} = V _{IH} or V _{IL} V _{OUT} = V _{CC} or GND		5.5	—	—	±0.5	—	±5.0	μA
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	μA

Note: This spec indicates the capability of driving 50 Ω transmission lines.

One output should be tested at a time for a 10 ms maximum duration.

Timing Requirements (input: $t_r = t_f = 3\text{ ns}$)

Characteristics	Symbol	Test Condition		Ta = 25°C	Ta = −40 to 85°C	Unit
			VCC (V)	Limit	Limit	
Minimum pulse width (CK)	tW (H)	—	3.3 ± 0.3	7.0	7.0	ns
	tW (L)		5.0 ± 0.5	5.0	5.0	
Minimum set-up time	tS	—	3.3 ± 0.3	9.0	9.0	ns
			5.0 ± 0.5	5.0	5.0	
Minimum hold time	tH	—	3.3 ± 0.3	0.0	0.0	ns
			5.0 ± 0.5	0.0	0.0	

AC Characteristics ($C_L = 50\text{ pF}$, $R_L = 500\ \Omega$, input: $t_r = t_f = 3\text{ ns}$)

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit	
			VCC (V)	Min	Typ.	Max	Min		Max
Propagation delay time (CK-Q, \overline{Q})	t _{pLH} t _{pHL}	—	3.3 ± 0.3 5.0 ± 0.5	— —	8.5 6.1	15.8 8.7	1.0 1.0	18.0 10.0	ns
Output enable time	t _{pZL} t _{pZH}	—	3.3 ± 0.3 5.0 ± 0.5	— —	7.5 6.1	14.0 8.7	1.0 1.0	16.0 10.0	ns
Output disable time	t _{pLZ} t _{pHZ}	—	3.3 ± 0.3 5.0 ± 0.5	— —	5.5 4.7	12.3 7.0	1.0 1.0	14.0 8.0	ns
Maximum clock frequency	f _{max}	—	3.3 ± 0.3 5.0 ± 0.5	55 100	120 160	— —	55 100	— —	MHz
Input capacitance	C _{IN}	—	—	—	5	10	—	10	pF
Output capacitance	C _{OUT}	—	—	—	10	—	—	—	pF
Power dissipation capacitance	C _{PD} (Note)	—	—	—	37	—	—	—	pF

Note: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption

Average operating current can be obtained by the equation:

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

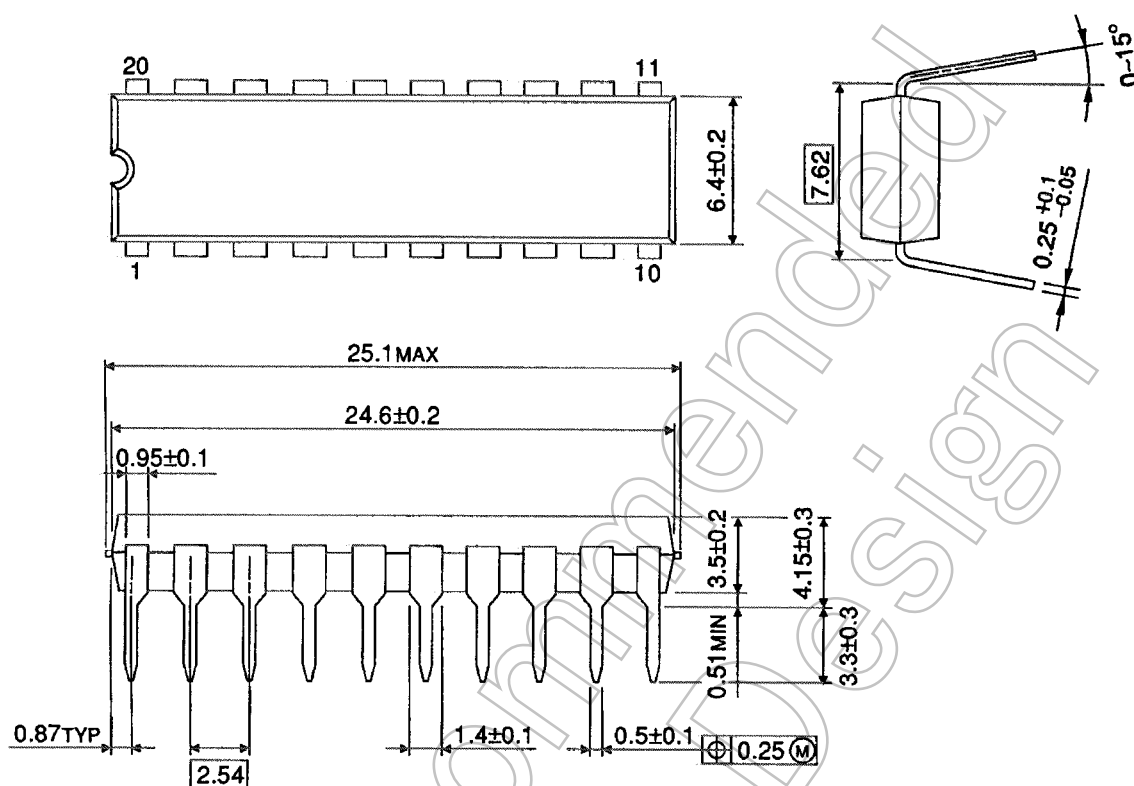
And the total C_{PD} when n pcs. of F/F operate can be gained by the following equation:

$$C_{PD}(\text{total}) = 25 + 12 \cdot n$$

Package Dimensions

DIP20-P-300-2.54A

Unit : mm

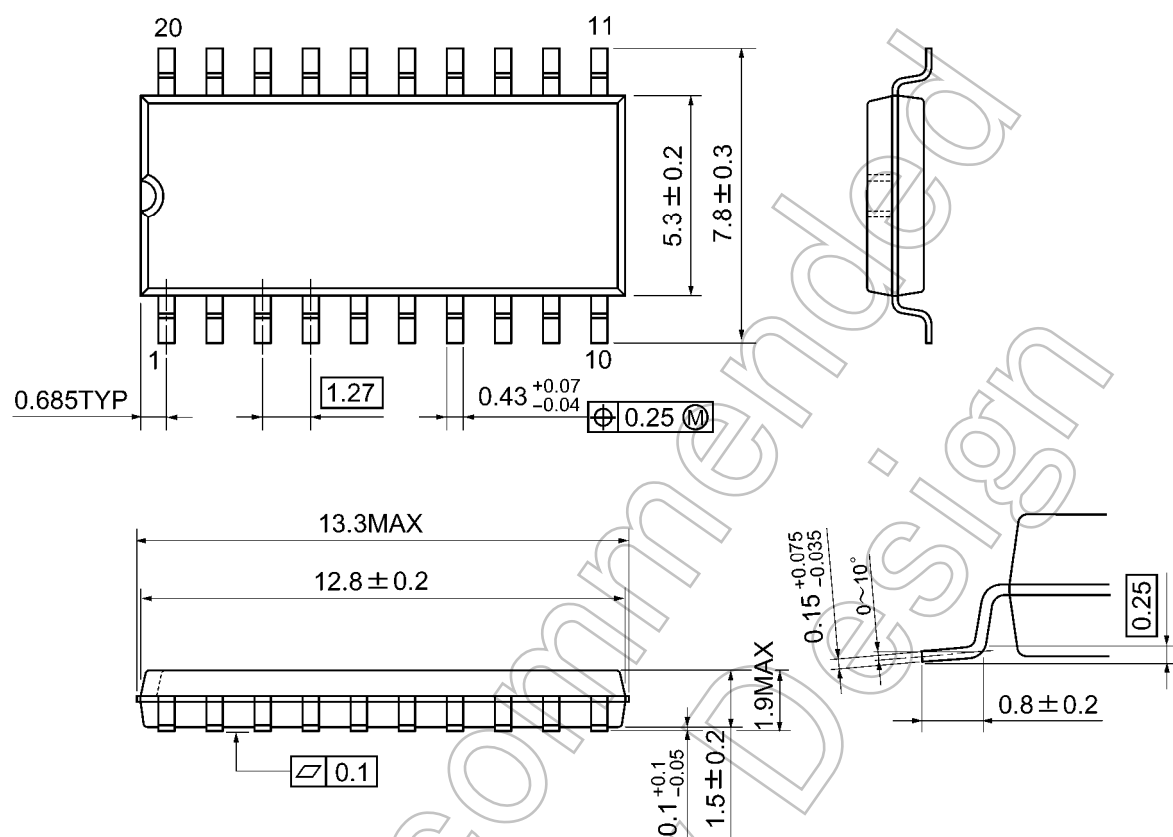


Weight: 1.30 g (typ.)

Package Dimensions

SOP20-P-300-1.27A

Unit: mm

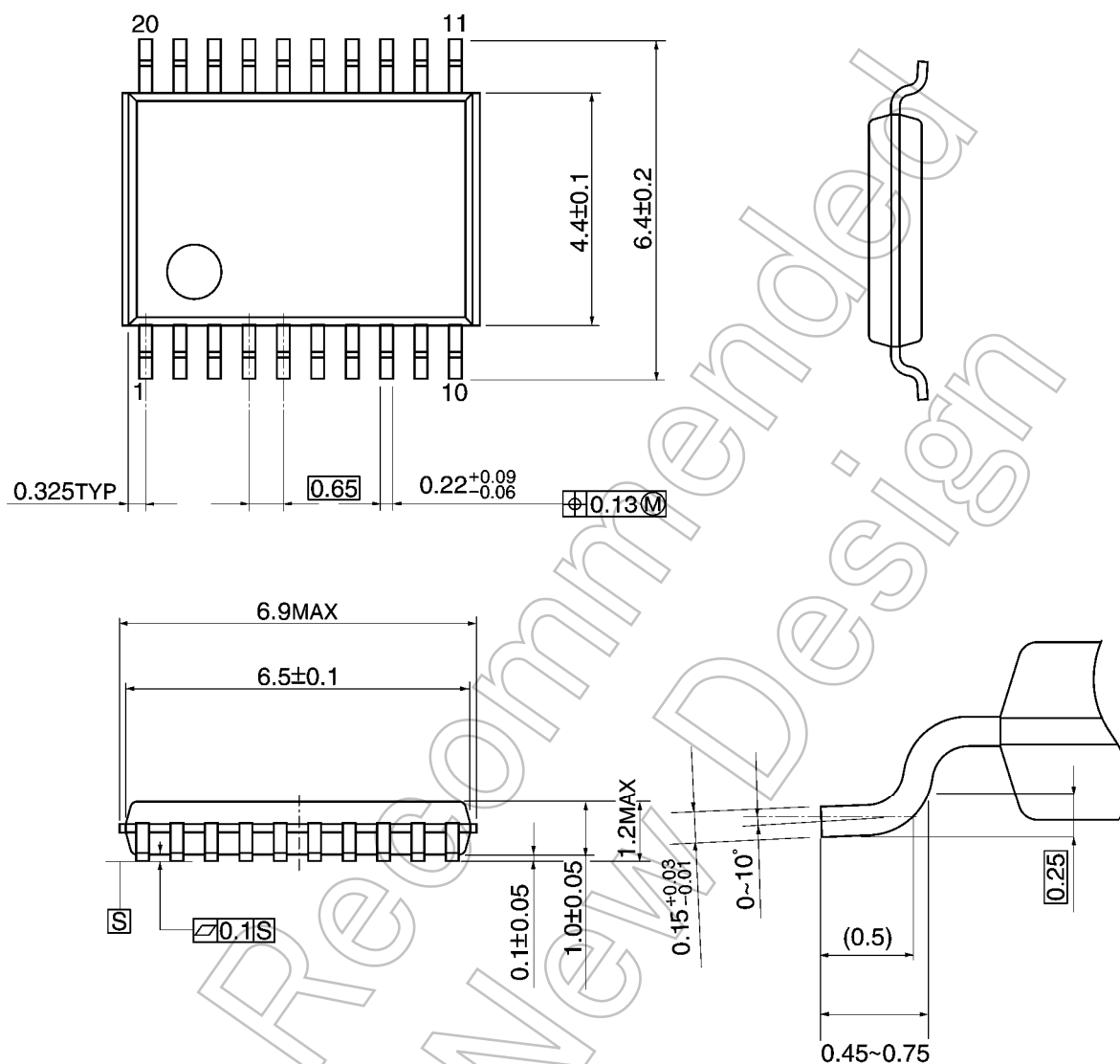


Weight: 0.22 g (typ.)

Package Dimensions

TSSOP20-P-0044-0.65A

Unit: mm



Weight: 0.08 g (typ.)

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