

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

## TC74AC373P, TC74AC373F, TC74AC373FT

### Octal D-Type Latch with 3-State Output

The TC74AC373 is an advanced high speed CMOS OCTAL LATCH with 3-STATE OUTPUT fabricated with silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

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

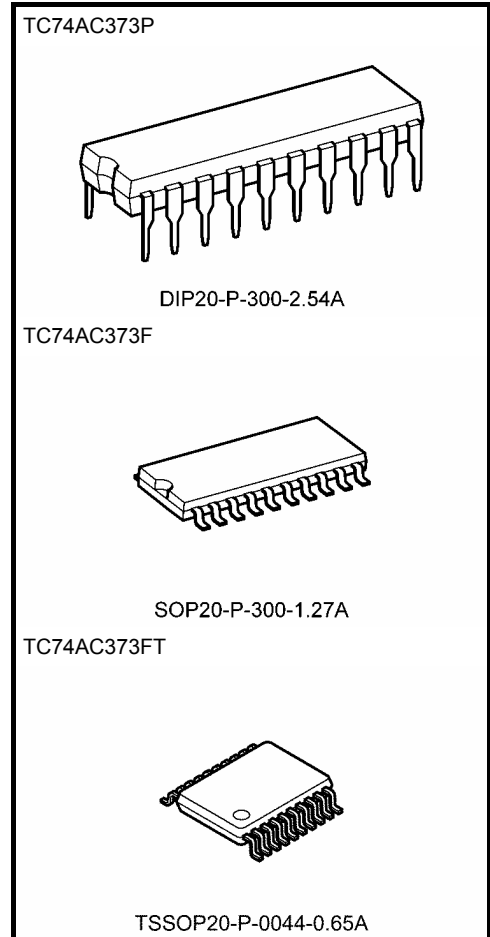
These 8-bit D-type latches are controlled by a latch enable input ( $\overline{LE}$ ) and a output enable input ( $\overline{OE}$ ).

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

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

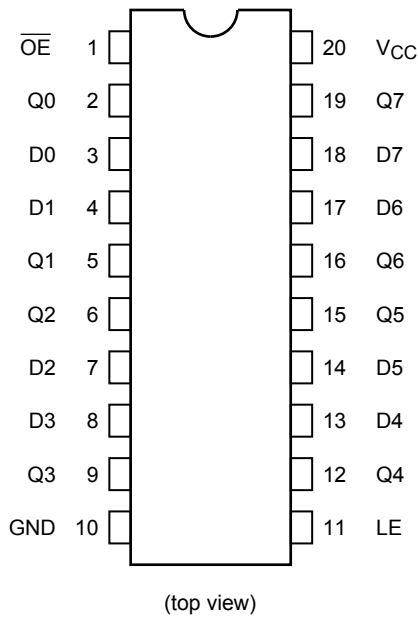
### Features

- High speed:  $t_{pd} = 4.8 \text{ ns (typ.)}$  at  $V_{CC} = 5 \text{ V}$
- Low power dissipation:  $I_{CC} = 8 \mu\text{A (max)}$  at  $T_a = 25^\circ\text{C}$
- High noise immunity:  $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (min)}$
- Symmetrical output impedance:  $|I_{OH}| = I_{OL} = 24 \text{ mA (min)}$   
Capability of driving  $50 \Omega$  transmission lines.
- Balanced propagation delays:  $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range:  $V_{CC (opr)} = 2 \text{ to } 5.5 \text{ V}$
- Pin and function compatible with 74F373

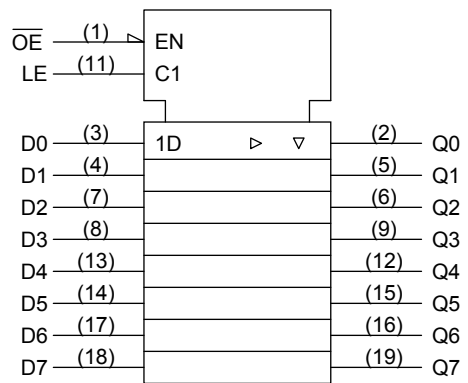


Weight	
DIP20-P-300-2.54A	: 1.30 g (typ.)
SOP20-P-300-1.27A	: 0.22 g (typ.)
TSSOP20-P-0044-0.65A	: 0.08 g (typ.)

**Pin Assignment**



**IEC Logic Symbol**



**Truth Table**

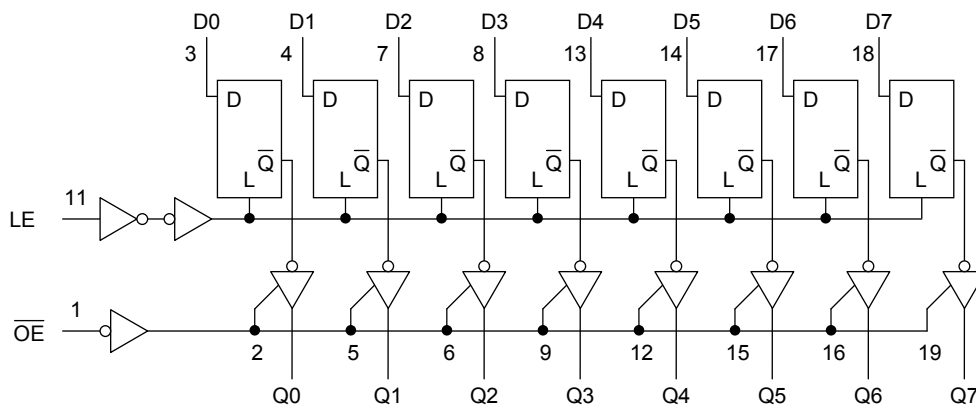
Inputs			Output
$\overline{OE}$	LE	D	Q
H	X	X	Z
L	L	X	$Q_n$
L	H	L	L
L	H	H	H

X: Don't care

Z: High impedance

$Q_n$ : Q outputs are latched at the time when the LE input is taken to a low logic level.

**System Diagram**



**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	$I_{IK}$	$\pm 20$	mA
Output diode current	$I_{OK}$	$\pm 50$	mA
DC output current	$I_{OUT}$	$\pm 50$	mA
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 200$	mA
Power dissipation	$P_D$	500 (DIP) (Note 2)/180 (SOP/TSSOP)	mW
Storage temperature	$T_{stg}$	-65 to 150	$^{\circ}\text{C}$

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  $65^{\circ}\text{C}$ . From  $T_a = 65$  to  $85^{\circ}\text{C}$  a derating factor of  $-10$  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	$^{\circ}\text{C}$
Input rise and fall time	dt/dV	0 to 100 ( $V_{CC} = 3.3 \pm 0.3$ V) 0 to 20 ( $V_{CC} = 5 \pm 0.5$ 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 VCC or GND.

## Electrical Characteristics

### DC Characteristics

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit	
				V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max
High-level input voltage	V <sub>IH</sub>	—		2.0	1.50	—	—	1.50	—	V
				3.0	2.10	—	—	2.10	—	
				5.5	3.85	—	—	3.85	—	
Low-level input voltage	V <sub>IL</sub>	—		2.0	—	—	0.50	—	0.50	V
				3.0	—	—	0.90	—	0.90	
				5.5	—	—	1.65	—	1.65	
High-level output voltage	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -50 μA	2.0	1.9	2.0	—	1.9	—	V
				3.0	2.9	3.0	—	2.9	—	
			I <sub>OH</sub> = -4 mA I <sub>OH</sub> = -24 mA I <sub>OH</sub> = -75 mA (Note)	3.0	2.58	—	—	2.48	—	
				4.5	3.94	—	—	3.80	—	
Low-level output voltage	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 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 <sub>OL</sub> = 12 mA I <sub>OL</sub> = 24 mA I <sub>OL</sub> = 75 mA (Note)	3.0	—	—	0.36	—	0.44	
				4.5	—	—	0.36	—	0.44	
5.5	—	—	—	—	1.65	—				
3-state output off-state current	I <sub>OZ</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> V <sub>OUT</sub> = V <sub>CC</sub> or GND	5.5	—	—	±0.5	—	±5.0	μA	
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5	—	—	±0.1	—	±1.0	μA	
Quiescent supply current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> 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<sub>r</sub> = t<sub>f</sub> = 3 ns)

Characteristics	Symbol	Test Condition		Ta = 25°C	Ta = -40 to 85°C	Unit	
				V <sub>CC</sub> (V)	Limit		Limit
Minimum pulse width (LE)	t <sub>w</sub> (H)	—		3.3 ± 0.3	7.0	7.0	ns
				5.0 ± 0.5	5.0	5.0	
Minimum set-up time	t <sub>s</sub>	—		3.3 ± 0.3	6.0	6.0	ns
				5.0 ± 0.5	3.5	3.5	
Minimum hold time	t <sub>h</sub>	—		3.3 ± 0.3	1.0	1.0	ns
				5.0 ± 0.5	1.0	1.0	

## AC Characteristics ( $C_L = 50 \text{ pF}$ , $R_L = 500 \text{ } \Omega$ , 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 (LE-Q)	$t_{pLH}$	—	3.3 ± 0.3	—	7.7	13.2	1.0	15.0	ns
	$t_{pHL}$		5.0 ± 0.5	—	6.1	8.7	1.0	10.0	
Propagation delay time (D-Q)	$t_{pLH}$	—	3.3 ± 0.3	—	7.6	12.9	1.0	14.7	ns
	$t_{pHL}$		5.0 ± 0.5	—	5.8	8.3	1.0	9.5	
Output enable time	$t_{pZL}$	—	3.3 ± 0.3	—	7.6	12.9	1.0	14.7	ns
	$t_{pZH}$		5.0 ± 0.5	—	6.1	8.7	1.0	10.0	
Output disable time	$t_{pLZ}$	—	3.3 ± 0.3	—	7.0	11.0	1.0	12.5	ns
	$t_{pHZ}$		5.0 ± 0.5	—	5.4	7.5	1.0	8.5	
Input capacitance	$C_{IN}$	—	—	5	10	—	10	pF	
Output capacitance	$C_{OUT}$	—	—	10	—	—	—	pF	
Power dissipation capacitance	$C_{PD}$	(Note)	—	38	—	—	—	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:

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

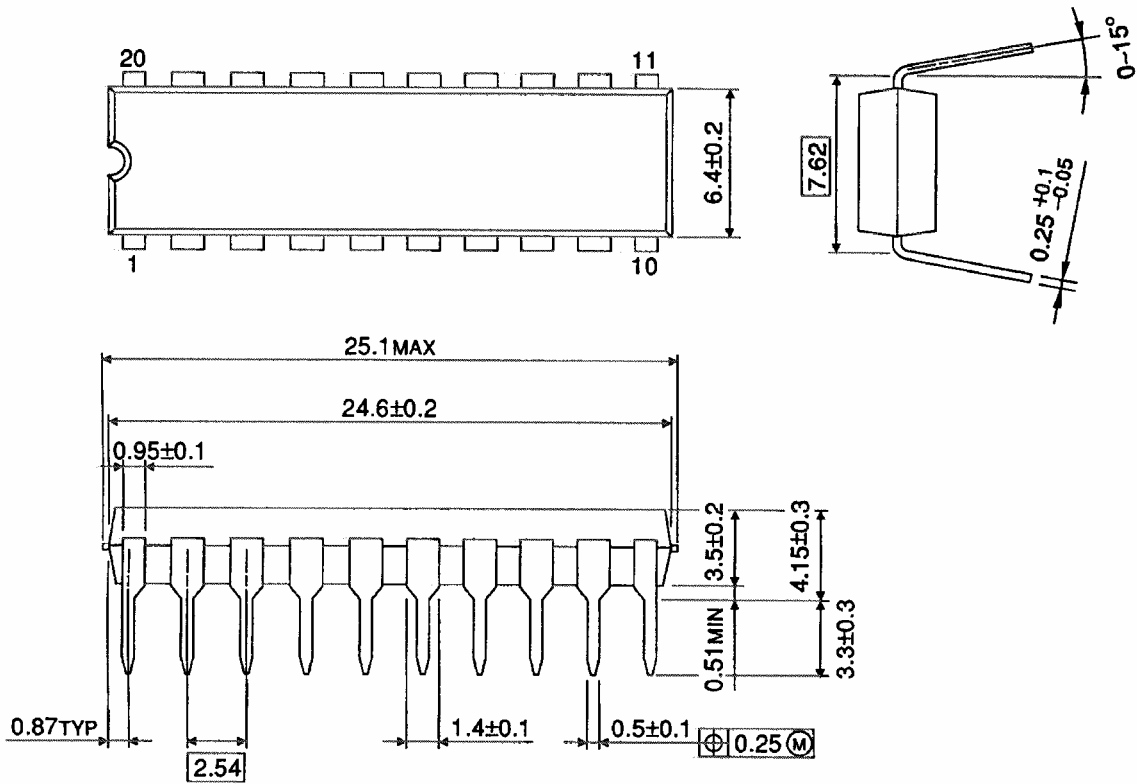
And the total  $C_{PD}$  when n pcs. of latch operate can be gained by the following equation:

$$C_{PD (total)} = 26 + 12 \cdot n$$

## Package Dimensions

DIP20-P-300-2.54A

Unit : mm



Weight: 1.30 g (typ.)

**Package Dimensions**

SOP20-P-300-1.27A

Unit: mm

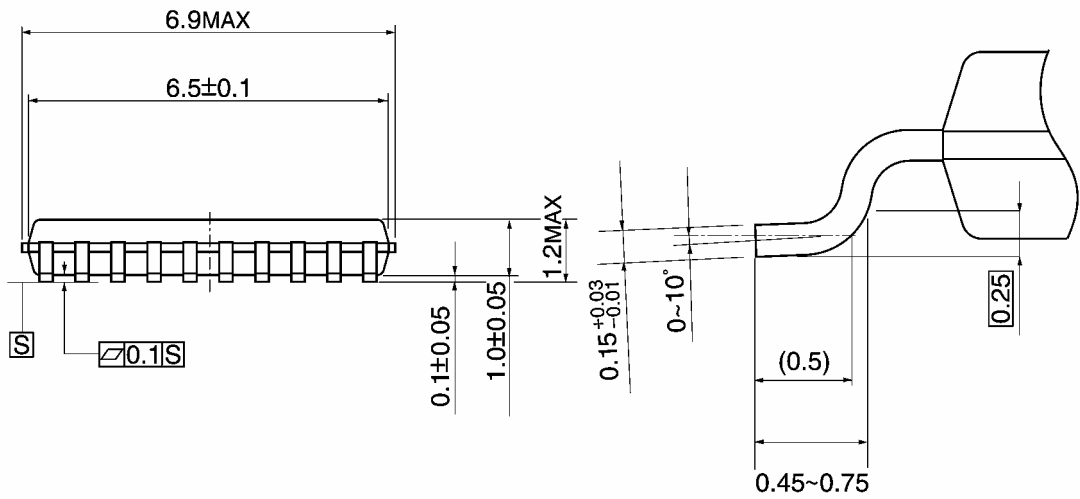


Weight: 0.22 g (typ.)

**Package Dimensions**

TSSOP20-P-0044-0.65A

Unit: mm



Weight: 0.08 g (typ.)



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20070701-EN GENERAL

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