

# TC74HCT374AP, TC74HCT374AF, TC74HCT374AFW

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

The TC74HCT374A is high speed CMOS OCTAL FLIP - FLOP with 3 - STATE OUTPUT fabricated with silicon gate C<sup>2</sup>MOS technology.

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

Their inputs are compatible with TTL, NMOS, and CMOS output voltage levels.

This 8 - bit D - type flip - flop is controlled by a clock input (CK) and an output enable input ( $\overline{OE}$ ).

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

### FEATURES :

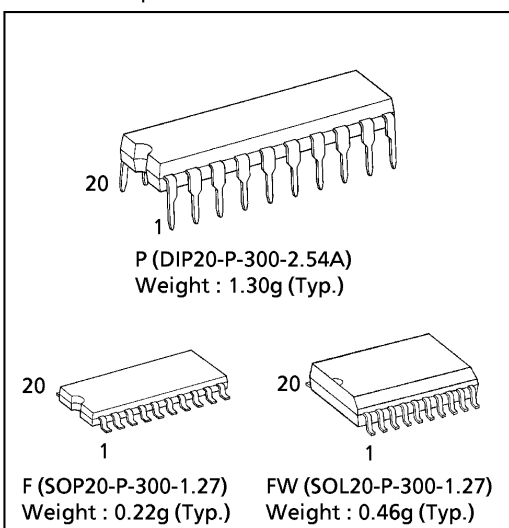
- High Speed..... $f_{MAX} = 62\text{MHz}(\text{typ.})$   
at  $V_{CC} = 5\text{V}$
- Low Power Dissipation..... $I_{CC} = 4\mu\text{A}(\text{Max.})$  at  $T_a = 25^\circ\text{C}$
- Compatible with TTL outputs....  $V_{IH} = 2\text{V}(\text{Min.})$   
 $V_{IL} = 0.8\text{V}(\text{Max.})$
- Wide interfacing ability.....LSTTL, NMOS, CMOS
- Output Drive Capability.....15 LSTTL Loads
- Symmetrical Output Impedance... $|I_{OH}| = I_{OL} = 6\text{mA}(\text{Min.})$
- Balanced Propagation Delays.... $t_{PLH} \approx t_{PHL}$
- Pin and Function Compatible with 74LS374

### TRUTH TABLE

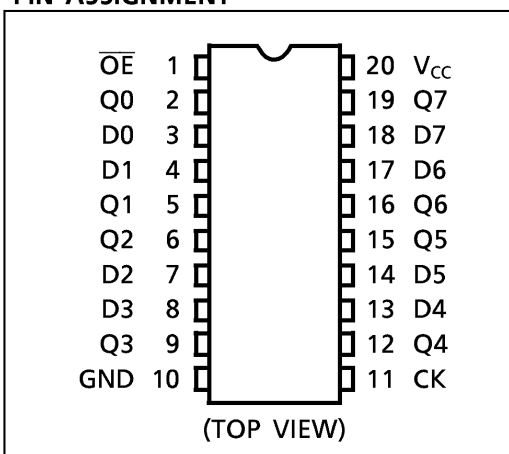
| INPUTS          |                                                                                     |   | OUTPUTS |
|-----------------|-------------------------------------------------------------------------------------|---|---------|
| $\overline{OE}$ | CK                                                                                  | D | Q       |
| H               | X                                                                                   | X | Z       |
| L               |  | X | $Q_n$   |
| L               |  | L | L       |
| L               |  | H | H       |

X : Don't Care  
Z : High Impedance  
 $Q_n$  : No Change

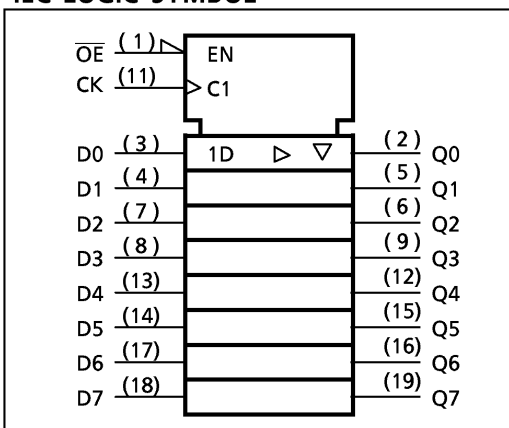
(Note) The JEDEC SOP (FW) is not available in Japan.



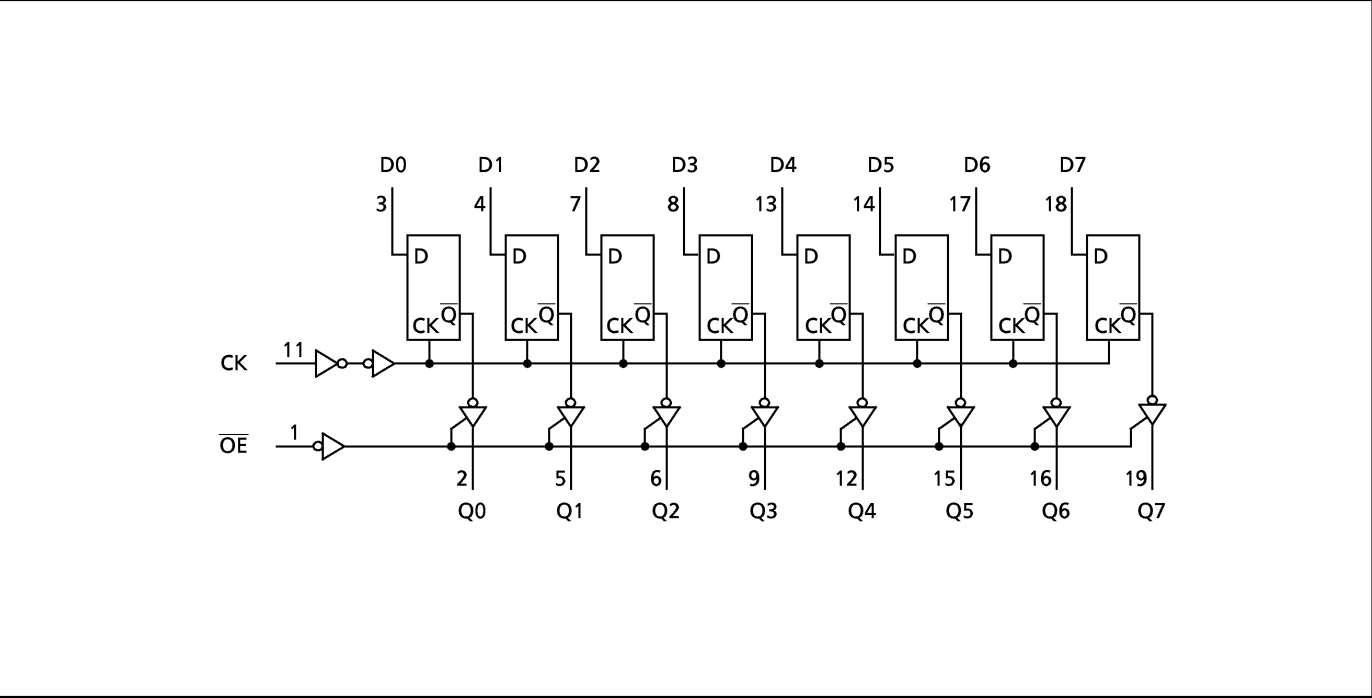
### PIN ASSIGNMENT



### IEC LOGIC SYMBOL



SYSTEM DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

| PARAMETER                   | SYMBOL    | VALUE                    | UNIT |
|-----------------------------|-----------|--------------------------|------|
| Supply Voltage Range        | $V_{CC}$  | $-0.5 \sim 7$            | V    |
| DC Input Voltage            | $V_{IN}$  | $-0.5 \sim V_{CC} + 0.5$ | V    |
| DC Output Voltage           | $V_{OUT}$ | $-0.5 \sim V_{CC} + 0.5$ | V    |
| Input Diode Current         | $I_{IK}$  | $\pm 20$                 | mA   |
| Output Diode Current        | $I_{OK}$  | $\pm 20$                 | mA   |
| DC Output Current           | $I_{OUT}$ | $\pm 35$                 | mA   |
| DC $V_{CC}$ /Ground Current | $I_{CC}$  | $\pm 75$                 | mA   |
| Power Dissipation           | $P_D$     | 500 (DIP)* / 180 (SOP)   | mW   |
| Storage Temperature         | $T_{stg}$ | $-65 \sim 150$           | °C   |

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

## RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | SYMBOL     | VALUE           | UNIT |
|--------------------------|------------|-----------------|------|
| Supply Voltage           | $V_{CC}$   | 4.5~5.5         | V    |
| Input Voltage            | $V_{IN}$   | $0 \sim V_{CC}$ | V    |
| Output Voltage           | $V_{OUT}$  | $0 \sim V_{CC}$ | V    |
| Operating Temperature    | $T_{opr}$  | $-40 \sim 85$   | °C   |
| Input Rise and Fall Time | $t_r, t_f$ | 0~500           | ns   |

## DC ELECTRICAL CHARACTERISTICS

| PARAMETER                            | SYMBOL   | TEST CONDITION                                                                     | $V_{CC}$<br>(V)            | $T_a = 25^\circ\text{C}$ |      |           | $T_a = -40 \sim 85^\circ\text{C}$ |           | UNIT          |
|--------------------------------------|----------|------------------------------------------------------------------------------------|----------------------------|--------------------------|------|-----------|-----------------------------------|-----------|---------------|
|                                      |          |                                                                                    |                            | MIN.                     | TYP. | MAX.      | MIN.                              | MAX.      |               |
| High - Level Input Voltage           | $V_{IH}$ |                                                                                    | 4.5<br>┆<br>5.5            | 2.0                      | —    | —         | 2.0                               | —         | V             |
| Low - Level Input Voltage            | $V_{IL}$ |                                                                                    | 4.5<br>┆<br>5.5            | —                        | —    | 0.8       | —                                 | 0.8       | V             |
| High - Level Output Voltage          | $V_{OH}$ | $V_{IN} = V_{IH}$<br>or $V_{IL}$                                                   | $I_{OH} = -20 \mu\text{A}$ | 4.5                      | 4.4  | 4.5       | —                                 | 4.4       | V             |
|                                      |          |                                                                                    | $I_{OH} = -6 \text{ mA}$   | 4.5                      | 4.18 | 4.31      | —                                 | 4.13      |               |
| Low - Level Output Voltage           | $V_{OL}$ | $V_{IN} = V_{IH}$<br>or $V_{IL}$                                                   | $I_{OL} = 20 \mu\text{A}$  | 4.5                      | —    | 0.0       | 0.1                               | —         | V             |
|                                      |          |                                                                                    | $I_{OL} = 6 \text{ mA}$    | 4.5                      | —    | 0.17      | 0.26                              | —         |               |
| 3 - State Output Off - State Current | $I_{OZ}$ | $V_{IN} = V_{IH}$ or $V_{IL}$<br>$V_{OUT} = V_{CC}$ or GND                         | 5.5                        | —                        | —    | $\pm 0.5$ | —                                 | $\pm 5.0$ |               |
| Input Leakage Current                | $I_{IN}$ | $V_{IN} = V_{CC}$ or GND                                                           | 5.5                        | —                        | —    | $\pm 0.1$ | —                                 | $\pm 1.0$ | $\mu\text{A}$ |
| Quiescent Supply Current             | $I_{CC}$ | $V_{IN} = V_{CC}$ or GND                                                           | 5.5                        | —                        | —    | 4.0       | —                                 | 40.0      |               |
|                                      | $I_C$    | Per input: $V_{IN} = 0.5\text{V}$ or $2.4\text{V}$<br>Other input: $V_{CC}$ or GND | 5.5                        | —                        | —    | 2.0       | —                                 | 2.9       | mA            |

TIMING REQUIREMENTS ( Input  $t_r = t_f = 6\text{ns}$  )

| PARAMETER                   | SYMBOL                   | TEST CONDITION | $V_{CC}(\text{V})$ | $T_a = 25^\circ\text{C}$ |       | $T_a = -40\sim 85^\circ\text{C}$ | UNIT |
|-----------------------------|--------------------------|----------------|--------------------|--------------------------|-------|----------------------------------|------|
|                             |                          |                |                    | TYP.                     | LIMIT | LIMIT                            |      |
| Minimum Pulse Width<br>(CK) | $t_{W(H)}$<br>$t_{W(L)}$ |                | 4.5                | —                        | 15    | 19                               | ns   |
|                             |                          |                | 5.5                | —                        | 14    | 17                               |      |
| Minimum Set-up Time<br>(Dn) | $t_s$                    |                | 4.5                | —                        | 15    | 19                               |      |
|                             |                          |                | 5.5                | —                        | 14    | 17                               |      |
| Minimum Hold Time<br>(Dn)   | $t_h$                    |                | 4.5                | —                        | 0     | 0                                |      |
|                             |                          |                | 5.5                | —                        | 0     | 0                                |      |
| Clock Frequency             | $f$                      |                | 4.5                | —                        | 31    | 25                               | MHz  |
|                             |                          |                | 5.5                | —                        | 37    | 30                               |      |

AC ELECTRICAL CHARACTERISTICS ( Input  $t_r = t_f = 6\text{ns}$  )

| PARAMETER                        | SYMBOL                 | TEST CONDITION          | CL (pF) | $V_{CC}(\text{V})$ | $T_a = 25^\circ\text{C}$ |      |      | $T_a = -40\sim 85^\circ\text{C}$ |      | UNIT |
|----------------------------------|------------------------|-------------------------|---------|--------------------|--------------------------|------|------|----------------------------------|------|------|
|                                  |                        |                         |         |                    | MIN.                     | TYP. | MAX. | MIN.                             | MAX. |      |
| Output Transition Time           | $t_{TLH}$<br>$t_{THL}$ |                         | 50      | 4.5                | —                        | 7    | 12   | —                                | 15   | ns   |
|                                  |                        |                         |         | 5.5                | —                        | 6    | 11   | —                                | 14   |      |
| Propagation Delay Time<br>(CK—Q) | $t_{PLH}$<br>$t_{PHL}$ |                         | 50      | 4.5                | —                        | 20   | 30   | —                                | 38   |      |
|                                  |                        |                         |         | 5.5                | —                        | 17   | 25   | —                                | 31   |      |
|                                  |                        |                         | 150     | 4.5                | —                        | 25   | 38   | —                                | 48   |      |
|                                  |                        |                         |         | 5.5                | —                        | 22   | 33   | —                                | 41   |      |
| Output Enable Time               | $t_{pZL}$<br>$t_{pZH}$ | $R_L = 1\text{k}\Omega$ | 50      | 4.5                | —                        | 17   | 30   | —                                | 38   |      |
|                                  |                        |                         |         | 5.5                | —                        | 14   | 25   | —                                | 31   |      |
|                                  |                        |                         | 150     | 4.5                | —                        | 25   | 38   | —                                | 48   |      |
|                                  |                        |                         |         | 5.5                | —                        | 19   | 33   | —                                | 41   |      |
| Output Disable Time              | $t_{pLZ}$<br>$t_{pHZ}$ | $R_L = 1\text{k}\Omega$ | 50      | 4.5                | —                        | 16   | 28   | —                                | 35   |      |
|                                  |                        |                         |         | 5.5                | —                        | 14   | 24   | —                                | 30   |      |
| Maximum Clock Frequency          | $f_{MAX}$              |                         | 50      | 4.5                | 31                       | 50   | —    | 25                               | —    | MHz  |
|                                  |                        |                         |         | 5.5                | 37                       | 59   | —    | 30                               | —    |      |
| Input Capacitance                | $C_{IN}$               |                         |         |                    | —                        | 5    | 10   | —                                | 10   | pF   |
| Output Capacitance               | $C_{OUT}$              |                         |         |                    | —                        | 10   | —    | —                                | —    |      |
| Power Dissipation Capacitance    | $C_{PD} (1)$           |                         |         |                    | —                        | 48   | —    | —                                | —    |      |

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 :

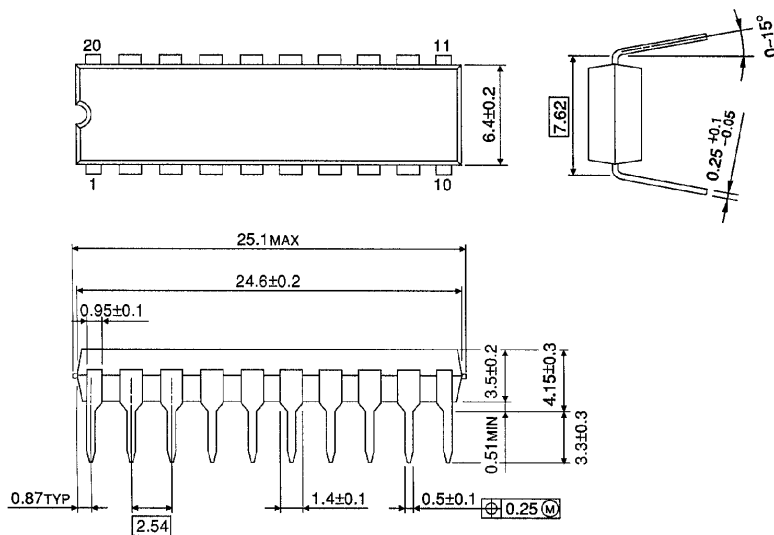
$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8 \text{ (per F/F)}$$

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

$$C_{PD}(\text{total}) = 30 + 18 \cdot n$$

### DIP 20PIN PACKAGE DIMENSIONS (DIP20-P-300-2.54A)

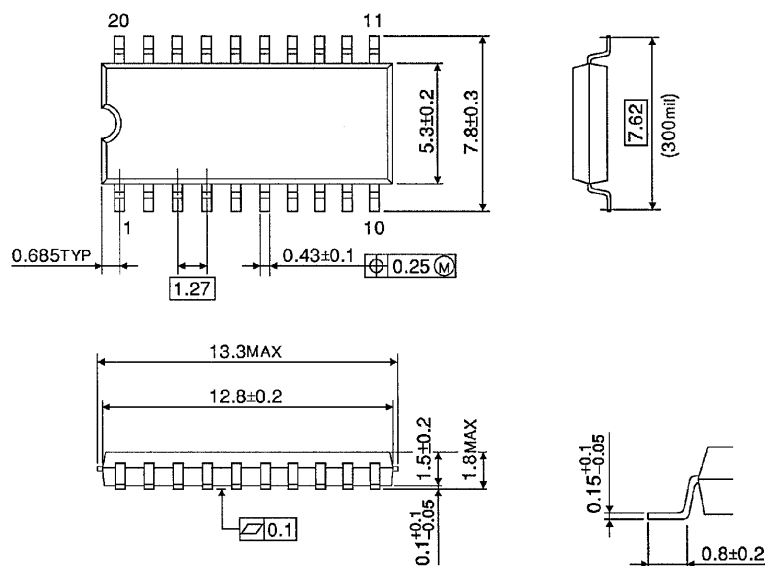
Unit in mm



Weight : 1.30g (Typ.)

### SOP 20PIN (200mil BODY) PACKAGE DIMENSIONS (SOP20-P-300-1.27)

Unit in mm

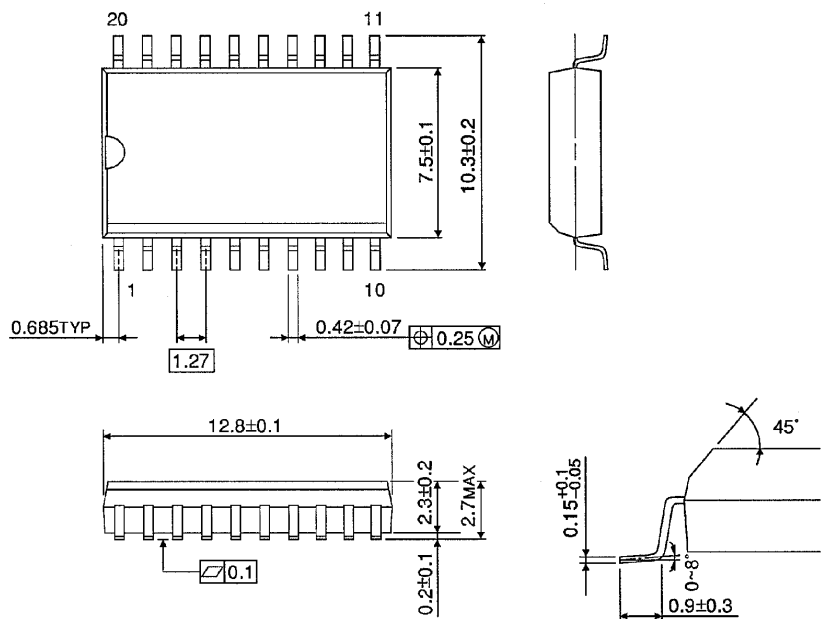


Weight : 0.22g (Typ.)

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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