

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC74HC374AP, TC74HC374AF, TC74HC374AFW

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

The TC74HC374A is a high speed CMOS OCTAL FLIP - FLOP with 3 - STATE OUTPUT fabricated with silicon gate C²MOS technology.

It achieves 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 a output enable input (\overline{OE}).

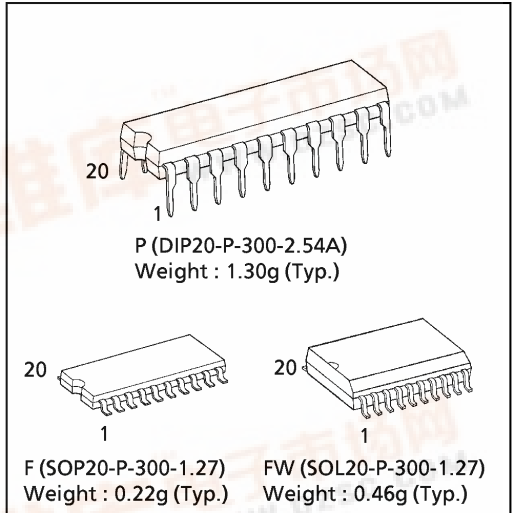
When the \overline{OE} input is high, the eight outputs are in a high impedance state.

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

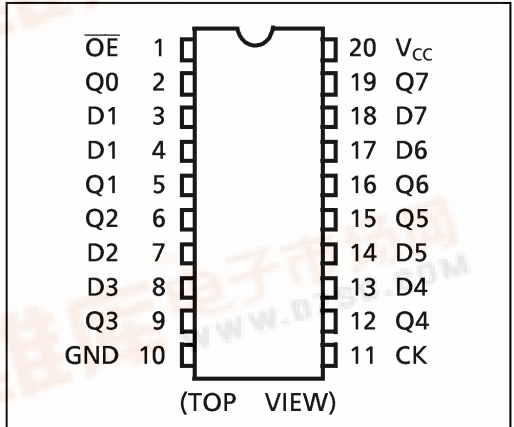
FEATURES :

- High Speed..... $f_{MAX} = 77\text{MHz}(\text{typ.})$
at $V_{CC} = 5\text{V}$
- Low Power Dissipation..... $I_{CC} = 4\mu\text{A}(\text{Max.})$ at $T_a = 25^\circ\text{C}$
- High Noise Immunity..... $V_{NIH} = V_{NIL} = 28\% V_{CC} (\text{Min.})$
- Output Drive Capability..... 15 LSTTL Loads
- Symmetrical Output Impedance... $|I_{OH}| = |I_{OL}| = 6\text{mA}(\text{Min.})$
- Balanced Propagation Delays..... $t_{pLH} \approx t_{pHL}$
- Wide Operating Voltage Range... $V_{CC} (\text{opr.}) = 2\text{V} \sim 6\text{V}$
- Pin and Function Compatible with 74LS374

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



PIN ASSIGNMENT

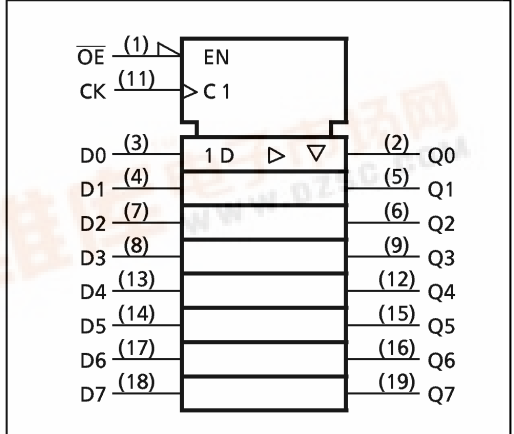


TRUTH TABLE

| 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

IEC LOGIC SYMBOL

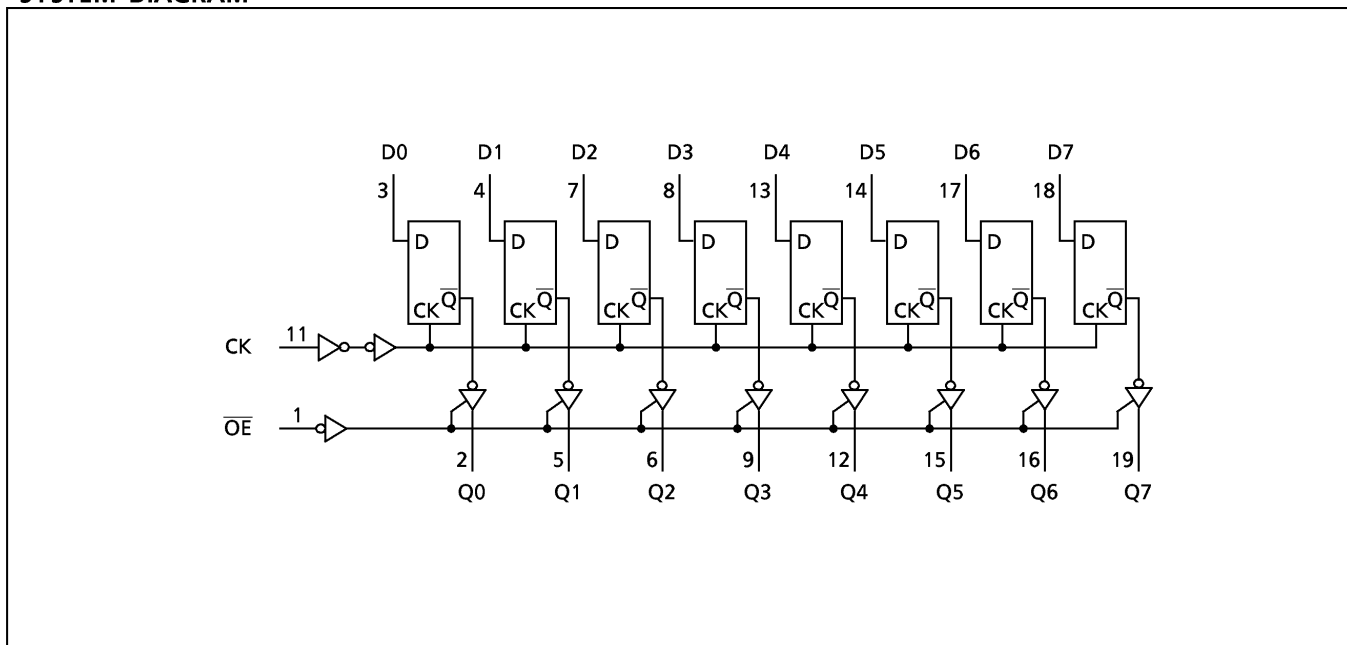


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SYSTEM DIAGRAM



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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 $T_a = -40^\circ\text{C} \sim 65^\circ\text{C}$. From $T_a = 65^\circ\text{C}$ to 85°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} | 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 ($V_{CC} = 2.0\text{V}$) 0~500 ($V_{CC} = 4.5\text{V}$) 0~400 ($V_{CC} = 6.0\text{V}$) | ns |

DC ELECTRICAL CHARACTERISTICS

| PARAMETER | SYMBOL | TEST CONDITION | V_{CC} (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} | | 2.0 | 1.50 | — | — | 1.50 | — | V | |
| | | | 4.5 | 3.15 | — | — | 3.15 | — | | |
| | | | 6.0 | 4.20 | — | — | 4.20 | — | | |
| Low - Level Input Voltage | V_{IL} | | 2.0 | — | — | 0.50 | — | 0.50 | V | |
| | | | 4.5 | — | — | 1.35 | — | 1.35 | | |
| | | | 6.0 | — | — | 1.80 | — | 1.80 | | |
| High - Level Output Voltage | V_{OH} | $V_{IN} = V_{IH}$ or V_{IL} | $I_{OH} = -20\mu\text{A}$ | 2.0 | 1.9 | 2.0 | — | 1.9 | — | V |
| | | | | 4.5 | 4.4 | 4.5 | — | 4.4 | — | |
| | | | | 6.0 | 5.9 | 6.0 | — | 5.9 | — | |
| Low - Level Output Voltage | V_{OL} | $V_{IN} = V_{IH}$ or V_{IL} | $I_{OL} = 20\mu\text{A}$ | 2.0 | — | 0.0 | 0.1 | — | 0.1 | V |
| | | | | 4.5 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | | 6.0 | — | 0.0 | 0.1 | — | 0.1 | |
| 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 | | Ta = -40~85°C | UNIT |
|-----------------------------|--------------------------|----------------|--------------|-----------|-------|---------------|------|
| | | | | TYP. | LIMIT | LIMIT | |
| 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 | 25 | |
| | | | 6.0 | — | 36 | 29 | |

AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 6ns$)

| PARAMETER | SYMBOL | TEST CONDITION | CL (pF) | V_{CC} (V) | Ta = 25°C | | | Ta = -40~85°C | | UNIT |
|----------------------------------|------------------------|------------------|---------|--------------|-----------|------|------|---------------|------|------|
| | | | | | MIN. | TYP. | MAX. | MIN. | MAX. | |
| Output Transition Time | t_{TLH} t_{THL} | | 50 | 2.0 | — | 20 | 60 | — | 75 | ns |
| | | | | 4.5 | — | 6 | 12 | — | 15 | |
| | | | | 6.0 | — | 5 | 10 | — | 13 | |
| Propagation Delay Time (CK-Q) | t_{pLH} t_{pHL} | | 50 | 2.0 | — | 45 | 140 | — | 175 | |
| | | | | 4.5 | — | 15 | 28 | — | 35 | |
| | | | | 6.0 | — | 13 | 24 | — | 30 | |
| | | | 150 | 2.0 | — | 60 | 190 | — | 240 | |
| | | | | 4.5 | — | 20 | 38 | — | 48 | |
| | | | | 6.0 | — | 17 | 32 | — | 41 | |
| Output Enable Time | t_{pZL} t_{pZH} | $R_L = 1k\Omega$ | 50 | 2.0 | — | 39 | 135 | — | 170 | |
| | | | | 4.5 | — | 13 | 27 | — | 34 | |
| | | | | 6.0 | — | 11 | 23 | — | 29 | |
| | | | 150 | 2.0 | — | 54 | 185 | — | 230 | |
| | | | | 4.5 | — | 18 | 37 | — | 46 | |
| | | | | 6.0 | — | 15 | 31 | — | 39 | |
| Output Enable Time | t_{pLZ} t_{pHZ} | $R_L = 1k\Omega$ | 50 | 2.0 | — | 30 | 135 | — | 170 | |
| | | | | 4.5 | — | 13 | 27 | — | 34 | |
| | | | | 6.0 | — | 12 | 23 | — | 29 | |
| Maximum Clock Frequency | f_{MAX} | | 50 | 2.0 | 6 | 18 | — | 5 | — | MHz |
| | | | | 4.5 | 31 | 75 | — | 25 | — | |
| | | | | 6.0 | 36 | 90 | — | 29 | — | |
| Input Capacitance | C_{IN} | | | | — | 5 | 10 | — | 10 | pF |
| Output Capacitance | C_{OUT} | | | | — | 10 | — | — | — | |
| Power Dissipation Capacitance | $C_{PD} (1)$ | | | | — | 47 | — | — | — | |

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 :

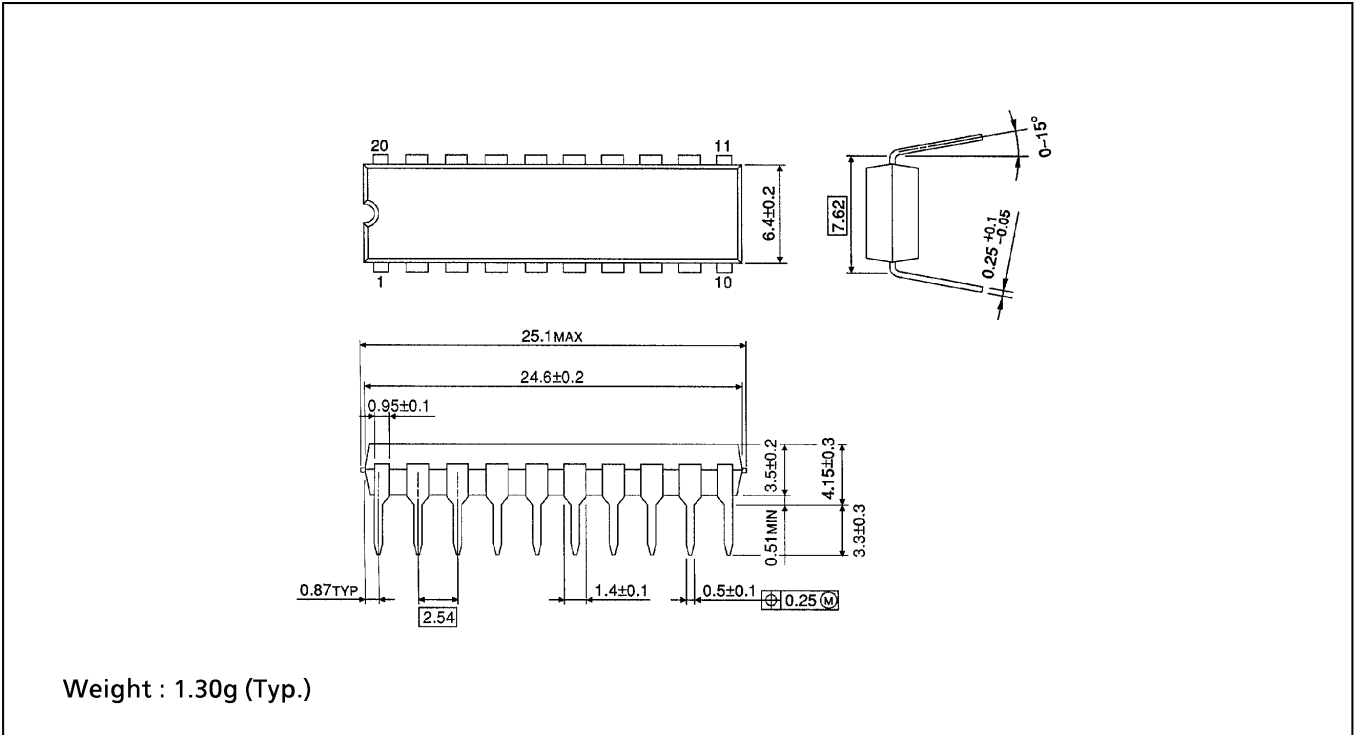
$$I_{CC} (opr) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 8 \text{ (per Flip Flop)}$$

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

$$C_{PD} (total) = 30 + 17 \cdot n$$

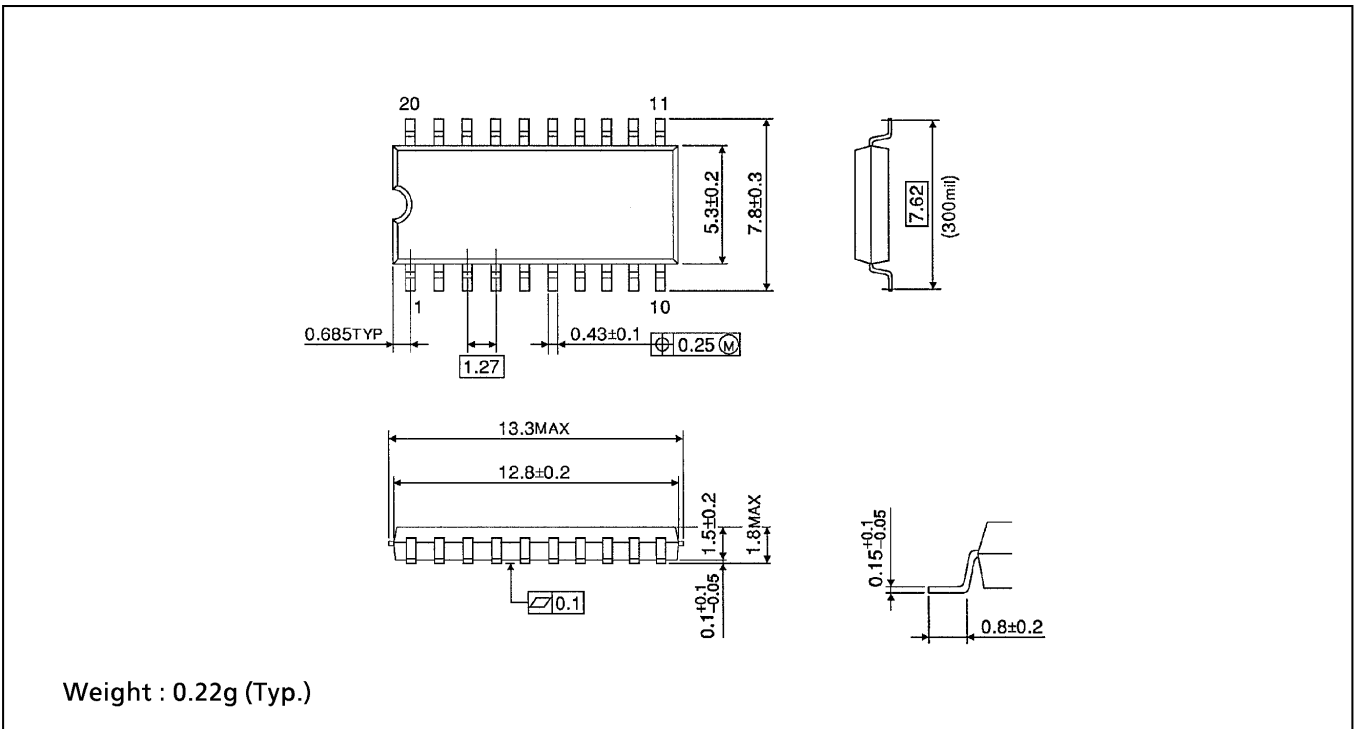
DIP 20PIN OUTLINE DRAWING (DIP20-P-300-2.54A)

Unit in mm



SOP 20PIN (200mil BODY) OUTLINE DRAWING (SOP20-P-300-1.27)

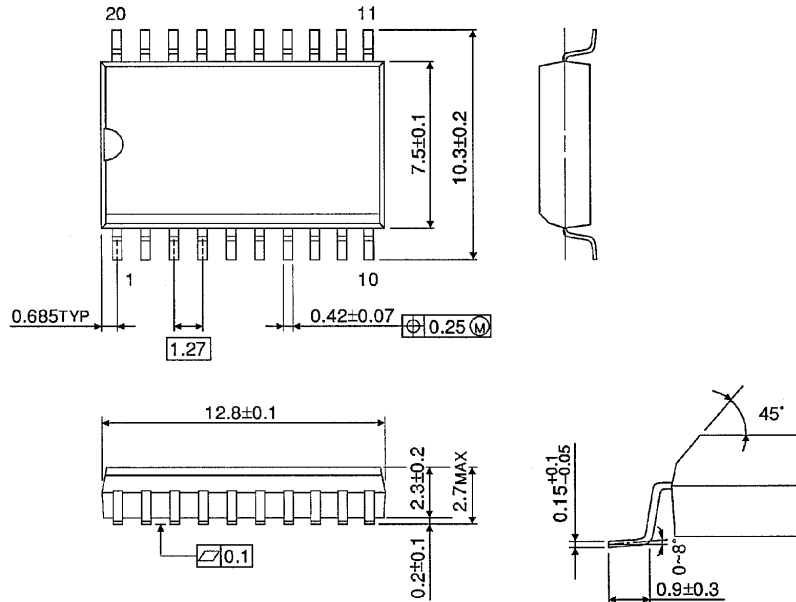
Unit in mm



SOP 20PIN (300mil BODY) OUTLINE DRAWING (SOL20-P-300-1.27)

Unit in mm

(Note) This package is not available in Japan.



Weight : 0.46g (Typ.)