

## TC74ACT574P, TC74ACT574F, TC74ACT574FT

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

The TC74ACT574 is an advanced high speed CMOS OCTAL FLIP-FLOP 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.

This devices may be used as a level converter for interfacing TTL or NMOS to High Speed CMOS. The inputs are compatible with TTL, NMOS and CMOS output voltage levels.

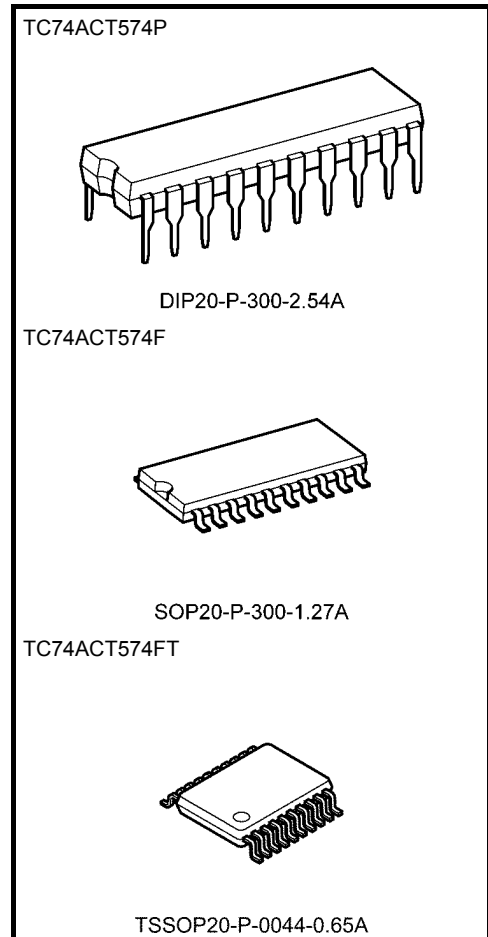
These 8-bit D-type flip-flops are controlled by a clock input (CK) and a output enable input ( $\overline{OE}$ ).

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:  $f_{max} = 180$  MHz (typ.) at  $V_{CC} = 5$  V
- Low power dissipation:  $I_{CC} = 8$   $\mu$ A (max) at  $T_a = 25^\circ$ C
- Compatible with TTL outputs:  
 $V_{IL} = 0.8$  V (max),  $V_{IH} = 2.0$  V (min)
- Symmetrical output impedance:  
 $|I_{OH}| = I_{OL} = 24$  mA (min) Capability of driving 50  $\Omega$  transmission lines.
- Balanced propagation delays:  $t_{pLH} \approx t_{pHL}$
- Pin and function compatible with 74F574

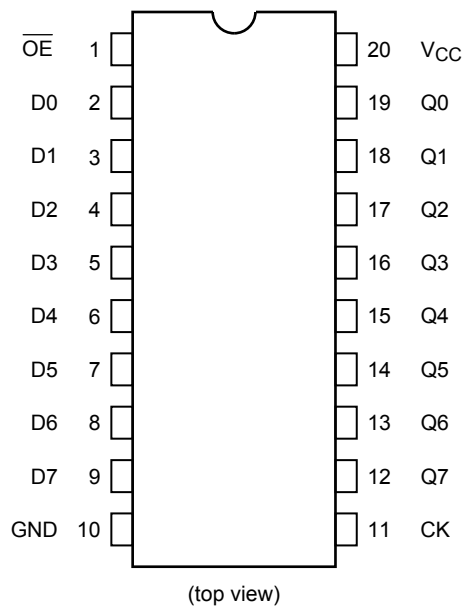


### Weight

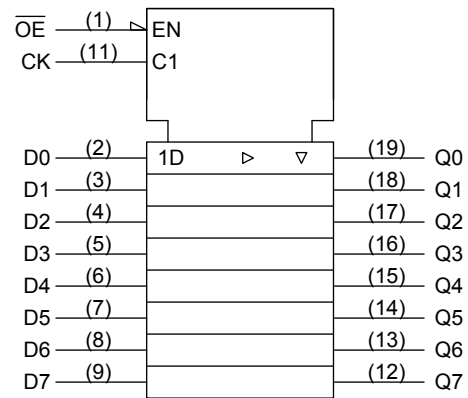
|                      |                 |
|----------------------|-----------------|
| DIP20-P-300-2.54A    | : 1.30 g (typ.) |
| SOP20-P-300-1.27A    | : 0.22 g (typ.) |
| TSSOP20-P-0044-0.65A | : 0.08 g (typ.) |

Start of commercial production  
1988-10

## Pin Assignment



## IEC Logic Symbol



## Truth Table

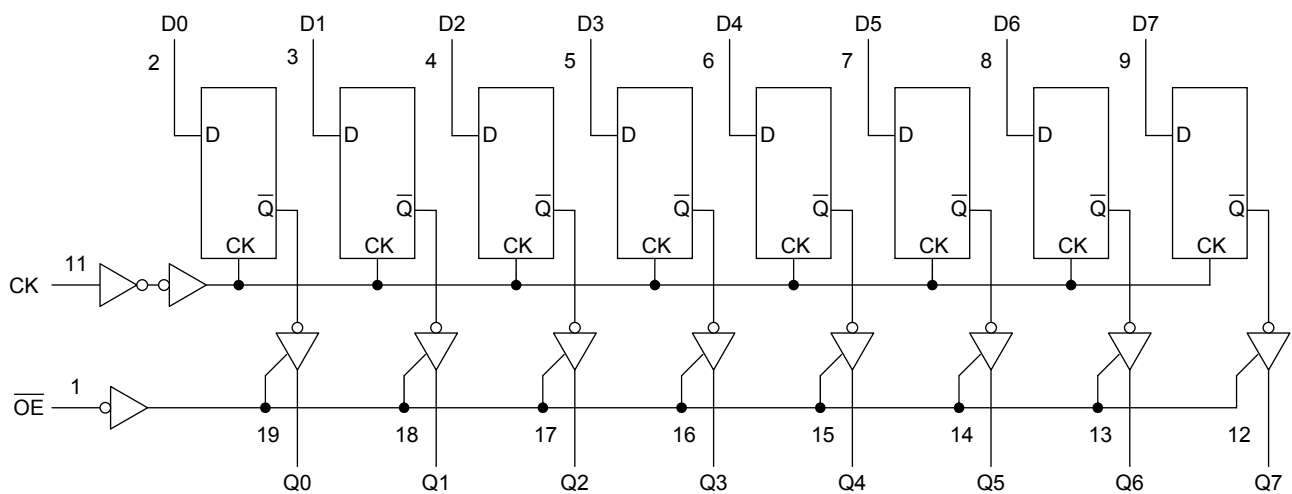
| Inputs          |    |   | Output |
|-----------------|----|---|--------|
| $\overline{OE}$ | CK | D | Q      |
| H               | X  | X | Z      |
| L               |    | X | Qn     |
| L               |    | L | L      |
| L               |    | H | H      |

X: Don't care

Z: High impedance

Qn: No change

## 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                         | $^{\circ}C$ |

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  $65^{\circ}C$ . From  $T_a = 65$  to  $85^{\circ}C$  a derating factor of  $-10$  mW/ $^{\circ}C$  should be applied up to 300 mW.

## Operating Ranges (Note)

| Characteristics          | Symbol    | Rating        | Unit        |
|--------------------------|-----------|---------------|-------------|
| Supply voltage           | $V_{CC}$  | 4.5 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     | $^{\circ}C$ |
| Input rise and fall time | $dt/dV$   | 0 to 10       | 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 <sub>CC</sub> (V) | Min  | Typ. | Max              | Min  |      | Max |
| High-level input voltage         | V <sub>IH</sub> | —   |                                 | 4.5 to 5.5          | 2.0  | —    | —                | 2.0  | —    | V   |
| Low-level input voltage          | V <sub>IL</sub> | —   |                                 | 4.5 to 5.5          | —    | —    | 0.8              | —    | 0.8  | V   |
| 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        | 4.5                 | 4.4  | 4.5  | —                | 4.4  | —    | V   |
|                                  |                 |   | I <sub>OH</sub> = -24 mA        | 4.5                 | 3.94 | —    | —                | 3.80 | —    |     |
|                                  |                 |   | I <sub>OH</sub> = -75 mA (Note) | 5.5                 | —    | —    | —                | 3.85 | —    |     |
| 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         | 4.5                 | —    | 0.0  | 0.1              | —    | 0.1  | V   |
|                                  |                 |   | I <sub>OL</sub> = 24 mA         | 4.5                 | —    | —    | 0.36             | —    | 0.44 |     |
|                                  |                 |   | I <sub>OL</sub> = 75 mA (Note)  | 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><br>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  |
|                                  | I <sub>C</sub>  | Per input: V <sub>IN</sub> = 3.4 V<br>Other input: V <sub>CC</sub> or GND                         |                                 | 5.5                 | —    | —    | 1.35             | —    | 1.5  | mA  |

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            |      |
| Minimum pulse width (CK) | t <sub>w</sub> (H) | —              |  | 5.0 ± 0.5           | 5.0              | 5.0  |
|                          | t <sub>w</sub> (L) | —              |  |                     |                  |      |
| Minimum set-up time      | t <sub>s</sub>     | —              |  | 5.0 ± 0.5           | 3.0              | 3.0  |
| Minimum hold time        | t <sub>h</sub>     | —              |  | 5.0 ± 0.5           | 2.0              | 2.0  |

### AC Characteristics (C<sub>L</sub> = 50 pF, R<sub>L</sub> = 500 Ω, 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) | Min | Typ. | Max              | Min |      | Max |
| Propagation delay time (CK-Q) | t <sub>pLH</sub><br>t <sub>pHL</sub> | —              | 5.0 ± 0.5           | —   | 6.2  | 10.1             | 1.0 | 11.5 | ns  |
| Output enable time            | t <sub>pZL</sub><br>t <sub>pZH</sub> | —              | 5.0 ± 0.5           | —   | 6.3  | 10.5             | 1.0 | 12.0 | ns  |
| Output disable time           | t <sub>pLZ</sub><br>t <sub>pHZ</sub> | —              | 5.0 ± 0.5           | —   | 6.6  | 9.6              | 1.0 | 11.0 | ns  |
| Maximum clock frequency       | f <sub>max</sub>                     | —              | 5.0 ± 0.5           | 85  | 160  | —                | 85  | —    | MHz |
| Input capacitance             | C <sub>IN</sub>                      | —              | —                   | —   | 5    | 10               | —   | 10   | pF  |
| Output capacitance            | C <sub>OUT</sub>                     | —              | —                   | —   | 10   | —                | —   | —    | pF  |
| Power dissipation capacitance | C <sub>PD</sub>                      | (Note)         | —                   | —   | 33   | —                | —   | —    | pF  |

Note: C<sub>PD</sub> 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:

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

And the total C<sub>PD</sub> when n pcs. of F/F operate can be gained by the following equation:

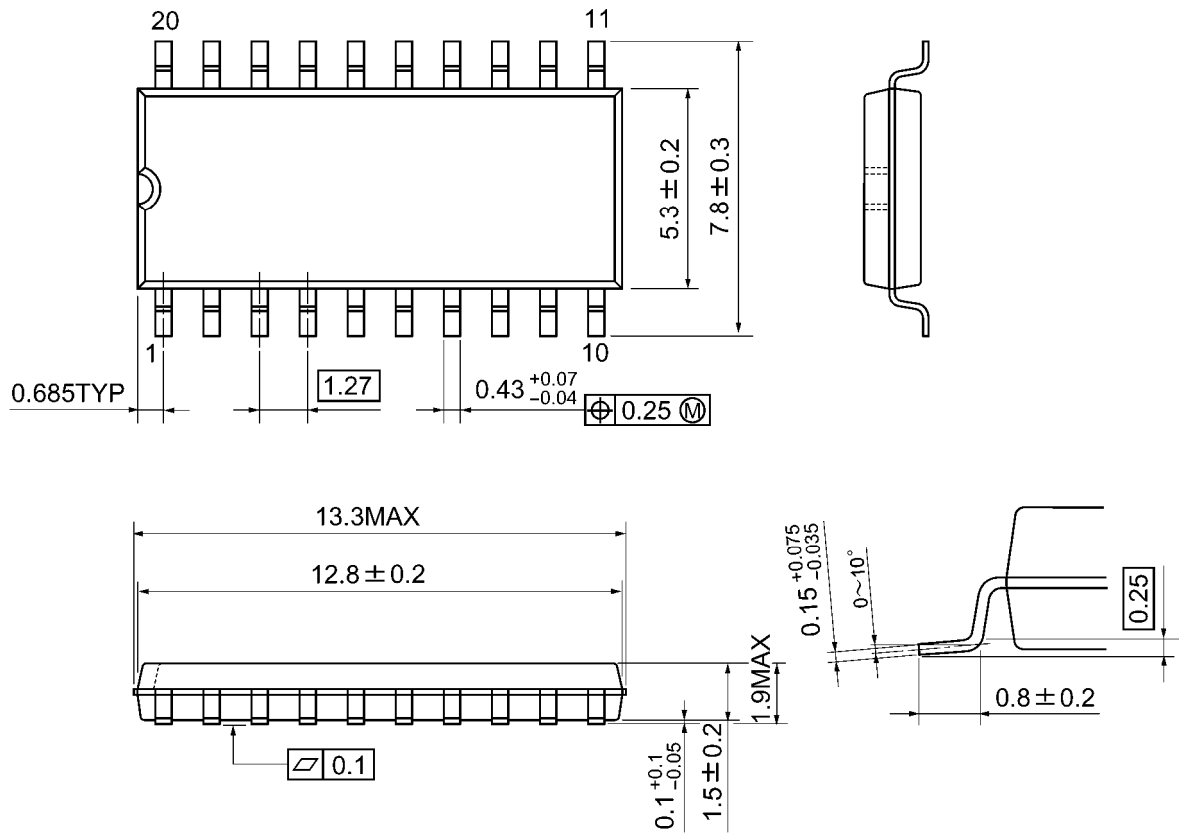
$$C_{PD (total)} = 21 + 12 \cdot n$$



**Package Dimensions**

SOP20-P-300-1.27A

Unit: mm

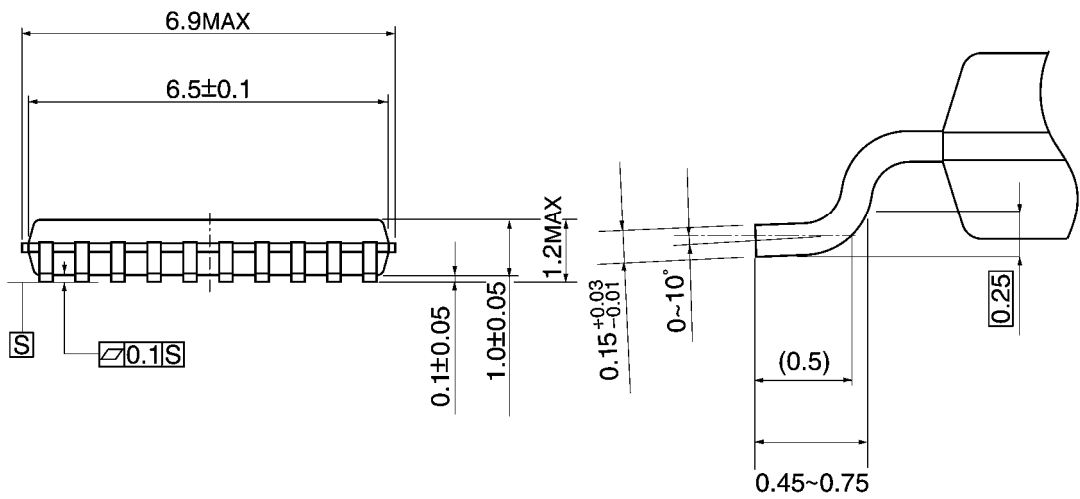
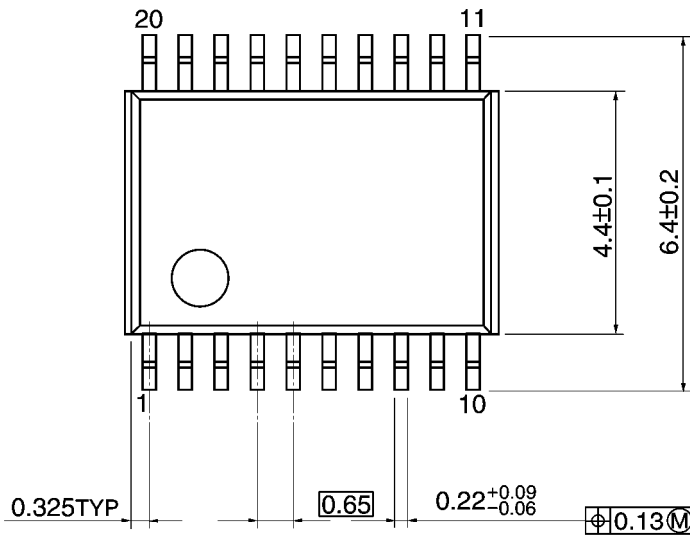


Weight: 0.22 g (typ.)

**Package Dimensions**

TSSOP20-P-0044-0.65A

Unit: mm



Weight: 0.08 g (typ.)

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