

## TC74AC574P, TC74AC574F, TC74AC574FT

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

The TC74AC574 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.

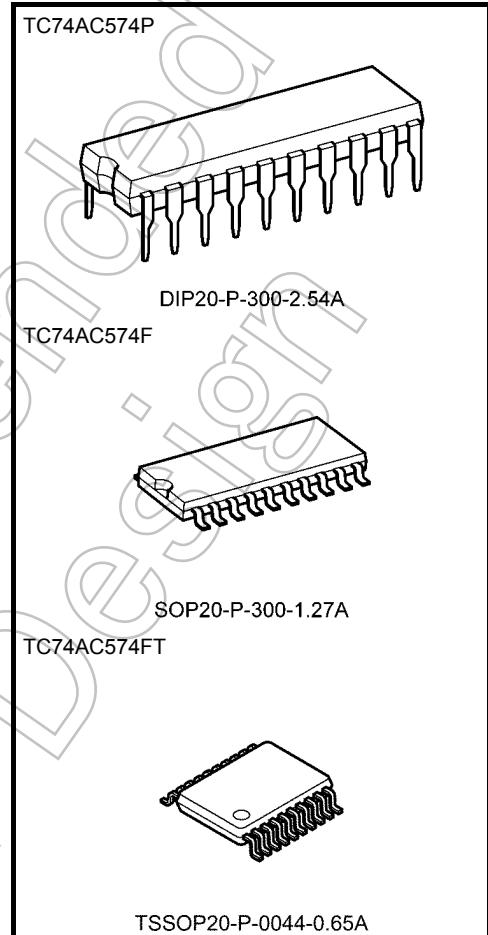
These 8-bit D-type flip-flops are controlled by a clock input (CK) and a output enable input ( $\overline{OE}$ ).

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:  $f_{\max} = 180 \text{ MHz (typ.)}$  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:  $V_{CC} \text{ (opr)} = 2 \text{ to } 5.5 \text{ V}$
- Pin and function compatible with 74F574

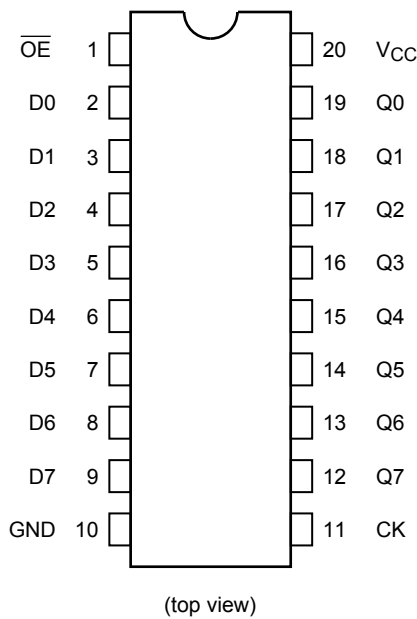


### Weight

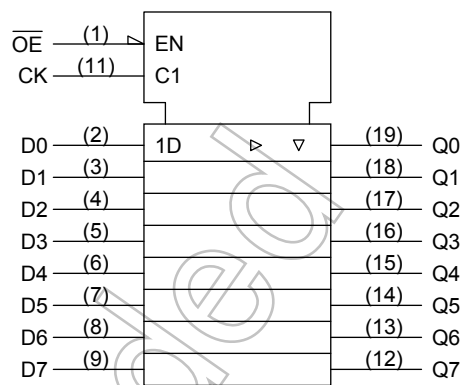
|                      |                 |
|----------------------|-----------------|
| DIP20-P-300-2.54A    | : 1.30 g (typ.) |
| SOP20-P-300-1.27A    | : 0.22 g (typ.) |
| TSSOP20-P-0044-0.65A | : 0.08 g (typ.) |

Start of commercial production  
1988-10

Pin Assignment



IEC Logic Symbol

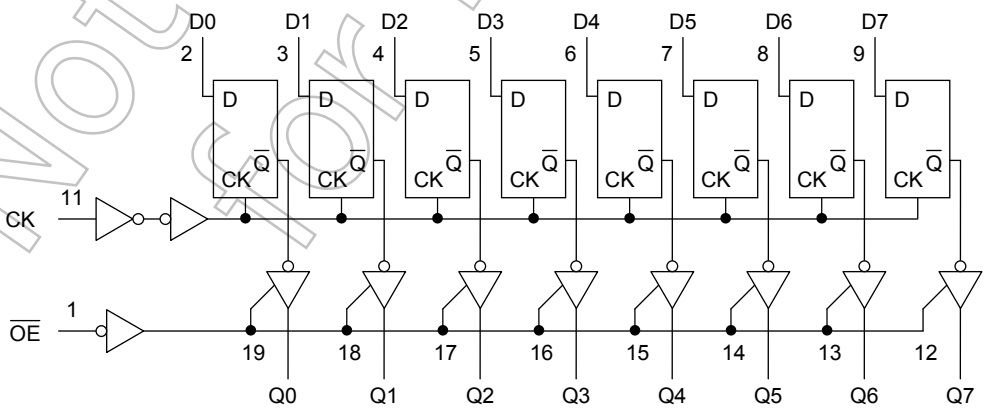


Truth Table

| Inputs |                                                                                     |   | Output |
|--------|-------------------------------------------------------------------------------------|---|--------|
| 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                         | °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/°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 ( $V_{CC} = 3.3 \pm 0.3$ V)<br>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  $V_{CC}$  or GND.

## Electrical Characteristics

## DC Characteristics

| Characteristics                  | Symbol          | Test Condition                                                                                    |                                                                                        | V <sub>CC</sub><br>(V) | Ta = 25°C            |             |                      | Ta =<br>-40 to 85°C  |                      | Unit |
|----------------------------------|-----------------|---------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|------------------------|----------------------|-------------|----------------------|----------------------|----------------------|------|
|                                  |                 |                                                                                                   |                                                                                        |                        | Min                  | Typ.        | Max                  | Min                  | Max                  |      |
| High-level input voltage         | V <sub>IH</sub> | —                                                                                                 |                                                                                        | 2.0<br>3.0<br>5.5      | 1.50<br>2.10<br>3.85 | —<br>—<br>— | —<br>—<br>—          | 1.50<br>2.10<br>3.85 | —<br>—<br>—          | V    |
| Low-level input voltage          | V <sub>IL</sub> | —                                                                                                 |                                                                                        | 2.0<br>3.0<br>5.5      | —<br>—<br>—          | —<br>—<br>— | 0.50<br>0.90<br>1.65 | —<br>—<br>—          | 0.50<br>0.90<br>1.65 | 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                                                               | 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 <sub>OH</sub> = -4 mA<br>I <sub>OH</sub> = -24 mA<br>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<br>I <sub>OL</sub> = 24 mA<br>I <sub>OL</sub> = 75 mA (Note)   | 3.0                    | —                    | —           | 0.36                 | —                    | 0.44                 |      |
|                                  |                 |                                                                                                   |                                                                                        | 4.5                    | —                    | —           | 0.36                 | —                    | 0.44                 |      |
| 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   |

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) | —              | 3.3 ± 0.3           | 7.0              | ns   |
|                          | t <sub>w</sub> (L) |                | 5.0 ± 0.5           | 5.0              |      |
| Minimum set-up time      | t <sub>s</sub>     | —              | 3.3 ± 0.3           | 9.0              | ns   |
|                          |                    |                | 5.0 ± 0.5           | 4.5              |      |
| Minimum hold time        | t <sub>h</sub>     | —              | 3.3 ± 0.3           | 1.0              | ns   |
|                          |                    |                | 5.0 ± 0.5           | 1.0              |      |

**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 |
|----------------------------------|------------------|----------------|---------------------|-----|------|------------------|-----|------|
|                                  |                  |                | V <sub>CC</sub> (V) | Min | Typ. | Max              | Min | Max  |
| Propagation delay time<br>(CK-Q) | t <sub>pLH</sub> | —              | 3.3 ± 0.3           | —   | 9.8  | 16.7             | 1.0 | 19.0 |
|                                  | t <sub>pHL</sub> |                | 5.0 ± 0.5           | —   | 6.1  | 9.2              | 1.0 | 10.5 |
| Output enable time               | t <sub>pZL</sub> | —              | 3.3 ± 0.3           | —   | 9.2  | 15.8             | 1.0 | 18.0 |
|                                  | t <sub>pZH</sub> |                | 5.0 ± 0.5           | —   | 6.1  | 9.3              | 1.0 | 10.6 |
| Output disable time              | t <sub>pLZ</sub> | —              | 3.3 ± 0.3           | —   | 6.6  | 11.0             | 1.0 | 12.5 |
|                                  | t <sub>pHZ</sub> |                | 5.0 ± 0.5           | —   | 5.8  | 8.8              | 1.0 | 10.0 |
| Maximum clock frequency          | f <sub>max</sub> | —              | 3.3 ± 0.3           | 50  | 100  | —                | 50  | —    |
|                                  |                  |                | 5.0 ± 0.5           | 95  | 160  | —                | 95  | —    |
| Input capacitance                | C <sub>IN</sub>  | —              | —                   | —   | 5    | 10               | —   | 10   |
| Output capacitance               | C <sub>OUT</sub> | —              | —                   | —   | 10   | —                | —   | —    |
| Power dissipation capacitance    | C <sub>PD</sub>  | (Note)         | —                   | —   | 36   | —                | —   | —    |

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:

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

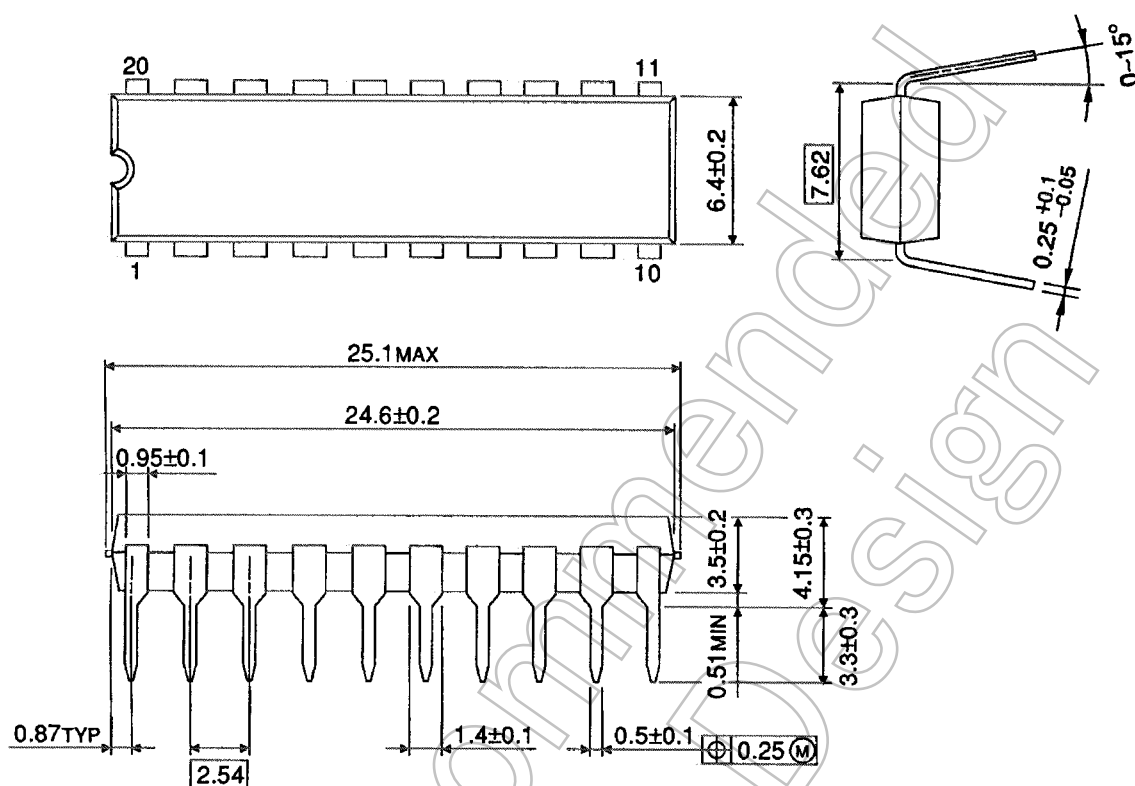
And the total C<sub>PD</sub> when n pcs. of latch operate can be gained by the following equation:

$$C_{PD}(\text{total}) = 26 + 10 \cdot n$$

## Package Dimensions

DIP20-P-300-2.54A

Unit : mm

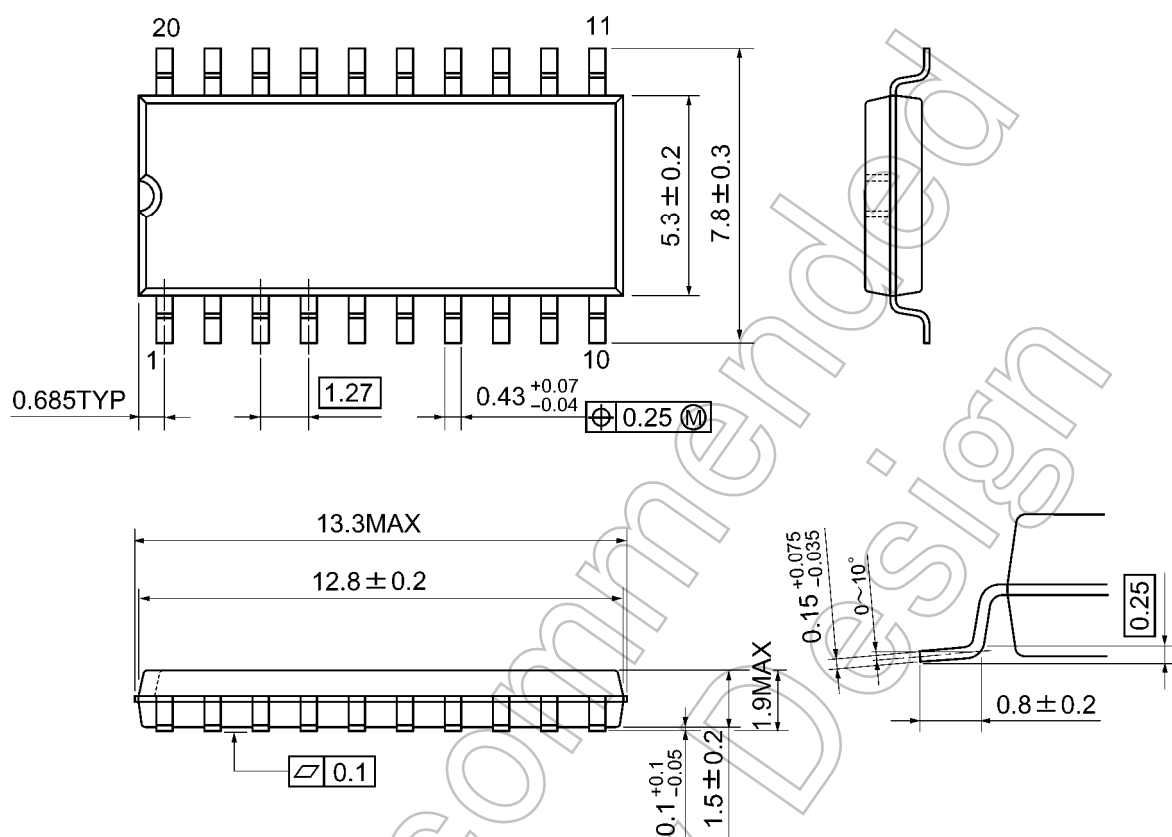


Weight: 1.30 g (typ.)

## Package Dimensions

SOP20-P-300-1.27A

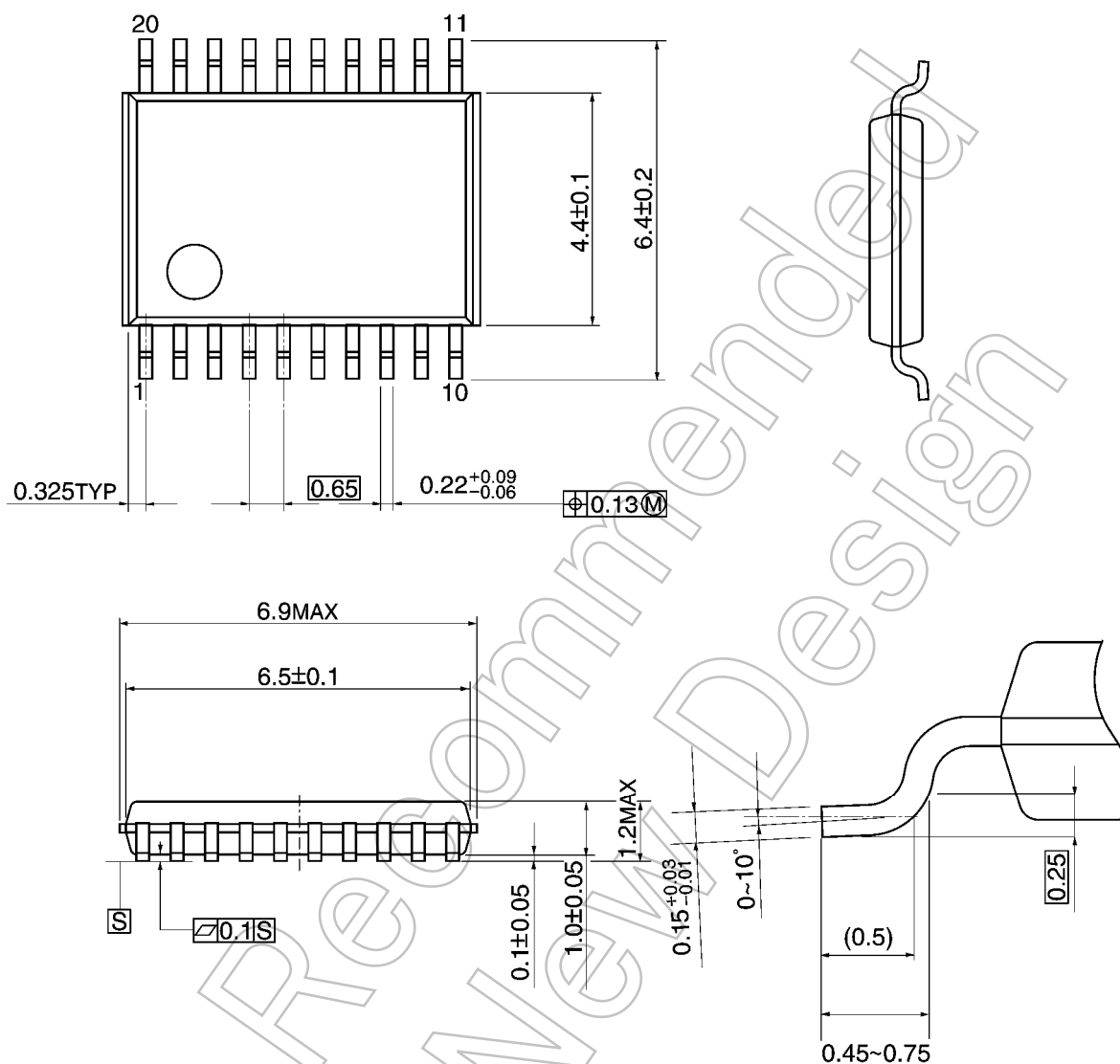
Unit: mm



## Package Dimensions

TSSOP20-P-0044-0.65A

Unit: mm



Weight: 0.08 g (typ.)

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