

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

## TC74AC240P,TC74AC240F,TC74AC240FT TC74AC244P,TC74AC244F,TC74AC244FT

### Octal Bus Buffer

|                 |                               |
|-----------------|-------------------------------|
| TC74AC240P/F/FT | Inverted, 3-State Outputs     |
| TC74AC244P/F/FT | Non-Inverted, 3-State Outputs |

The TC74AC240 and 244 are advanced high speed CMOS OCTAL BUS BUFFERS fabricated with silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

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

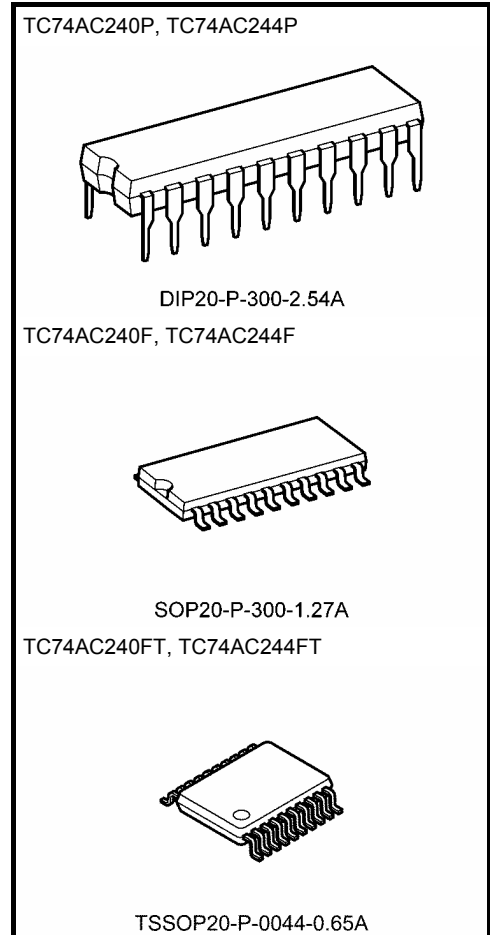
The 74AC240 is an inverting 3-state buffer while the 74AC244 is non-inverting. Both devices have two active-low output enables.

These devices are designed to be used in such applications as 3-state memory address drivers.

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

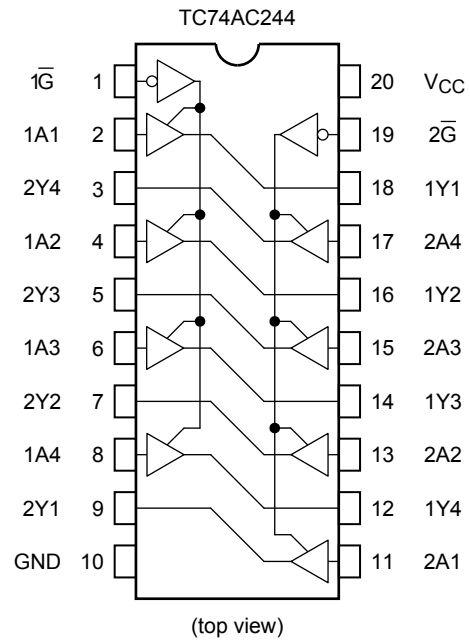
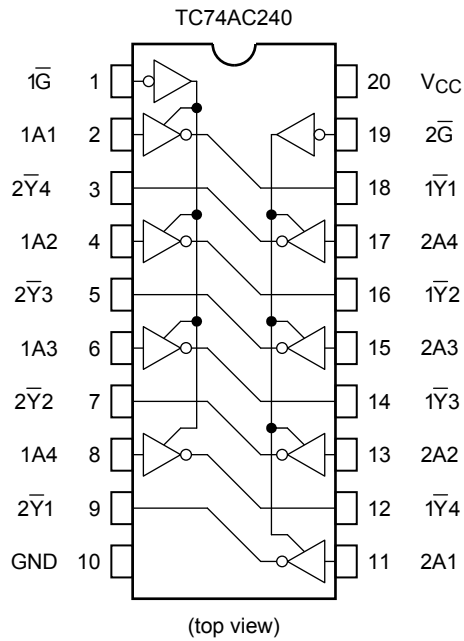
### Features

- High speed:  $t_{pd} = 4.0 \text{ ns (typ.)}$  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:  $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (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 74F240/244

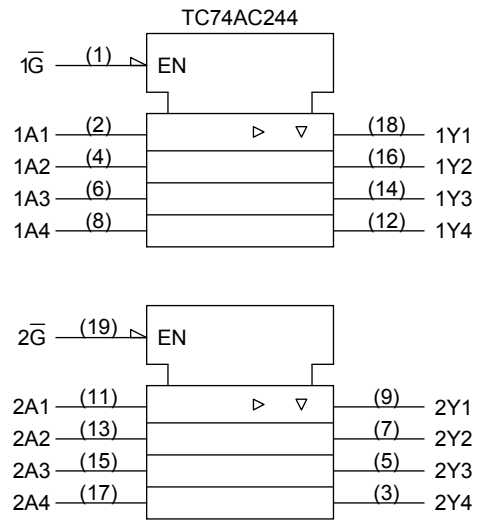
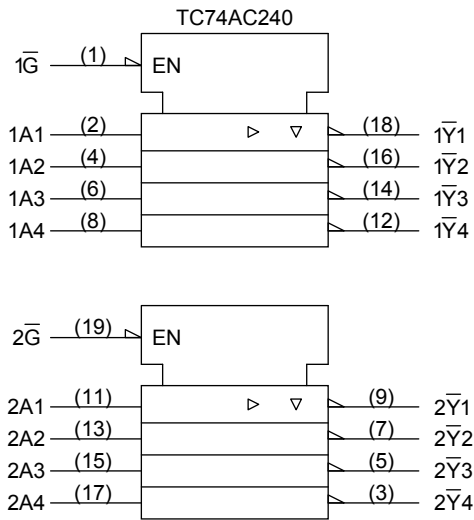


|                      |                 |
|----------------------|-----------------|
| Weight               |                 |
| DIP20-P-300-2.54A    | : 1.30 g (typ.) |
| SOP20-P-300-1.27A    | : 0.22 g (typ.) |
| TSSOP20-P-0044-0.65A | : 0.08 g (typ.) |

## Pin Assignment



## IEC Logic Symbol



## Truth Table

| Inputs    |       | Outputs     |                   |
|-----------|-------|-------------|-------------------|
| $\bar{G}$ | $A_n$ | $Y_n$ (244) | $\bar{Y}_n$ (240) |
| L         | L     | L           | H                 |
| L         | H     | H           | L                 |
| H         | X     | Z           | Z                 |

X: Don't care

Z: High impedance

## 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           | $V_{CC}$  | 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   | $^{\circ}C$ |
| 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 VCC 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                      | 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><br>= V <sub>IH</sub> or<br>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  | 3.0       | 2.58 | —    | —                   | 2.48 | —    |   |
|                                  |                 |   |                          | 4.5       | 3.94 | —    | —                   | 3.80 | —    |   |
| I <sub>OH</sub> = -24 mA         | 4.5             | —   | —                        | —         | 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><br>= V <sub>IH</sub> or<br>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  | 3.0       | —    | —    | 0.36                | —    | 0.44 |   |
|                                  |                 |   |                          | 4.5       | —    | —    | 0.36                | —    | 0.44 |   |
| 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   |   |

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.

## AC Characteristics ( $C_L = 50 \text{ pF}$ , $R_L = 500 \Omega$ , input: $t_r = t_f = 3 \text{ ns}$ )

| Characteristics                    | Symbol    | Test Condition | $V_{CC} \text{ (V)}$ | $T_a = 25^\circ\text{C}$ |      |      | $T_a = -40 \text{ to } 85^\circ\text{C}$ |      | Unit |
|------------------------------------|-----------|----------------|----------------------|--------------------------|------|------|--|------|------|
|                                    |           |                |                      | Min                      | Typ. | Max  | Min                                      | Max  |      |
| Propagation delay time<br>(Note 2) | $t_{pLH}$ | —              | $3.3 \pm 0.3$        | —                        | 6.3  | 10.5 | 1.0                                      | 12.0 | ns   |
|                                    | $t_{pHL}$ |                | $5.0 \pm 0.5$        | —                        | 4.8  | 7.0  | 1.0                                      | 8.0  |      |
| Propagation delay time<br>(Note 3) | $t_{pLH}$ | —              | $3.3 \pm 0.3$        | —                        | 7.0  | 11.4 | 1.0                                      | 13.0 | ns   |
|                                    | $t_{pHL}$ |                | $5.0 \pm 0.5$        | —                        | 5.2  | 7.5  | 1.0                                      | 8.5  |      |
| Output enable time                 | $t_{pZL}$ | —              | $3.3 \pm 0.3$        | —                        | 8.4  | 14.0 | 1.0                                      | 16.0 | ns   |
|                                    | $t_{pZH}$ |                | $5.0 \pm 0.5$        | —                        | 5.9  | 8.7  | 1.0                                      | 10.0 |      |
| Output disable time                | $t_{pLZ}$ | —              | $3.3 \pm 0.3$        | —                        | 6.4  | 10.5 | 1.0                                      | 12.0 | ns   |
|                                    | $t_{pHZ}$ |                | $5.0 \pm 0.5$        | —                        | 5.5  | 7.9  | 1.0                                      | 9.0  |      |
| Input capacitance                  | $C_{IN}$  | —              | —                    | 5                        | 10   | —    | 10                                       | pF   |      |
| Output capacitance                 | $C_{OUT}$ | —              | —                    | 10                       | —    | —    | —  | pF   |      |
| Power dissipation capacitance      | $C_{PD}$  | (Note 1)       | —                    | 30                       | —    | —    | —  | pF   |      |

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:

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

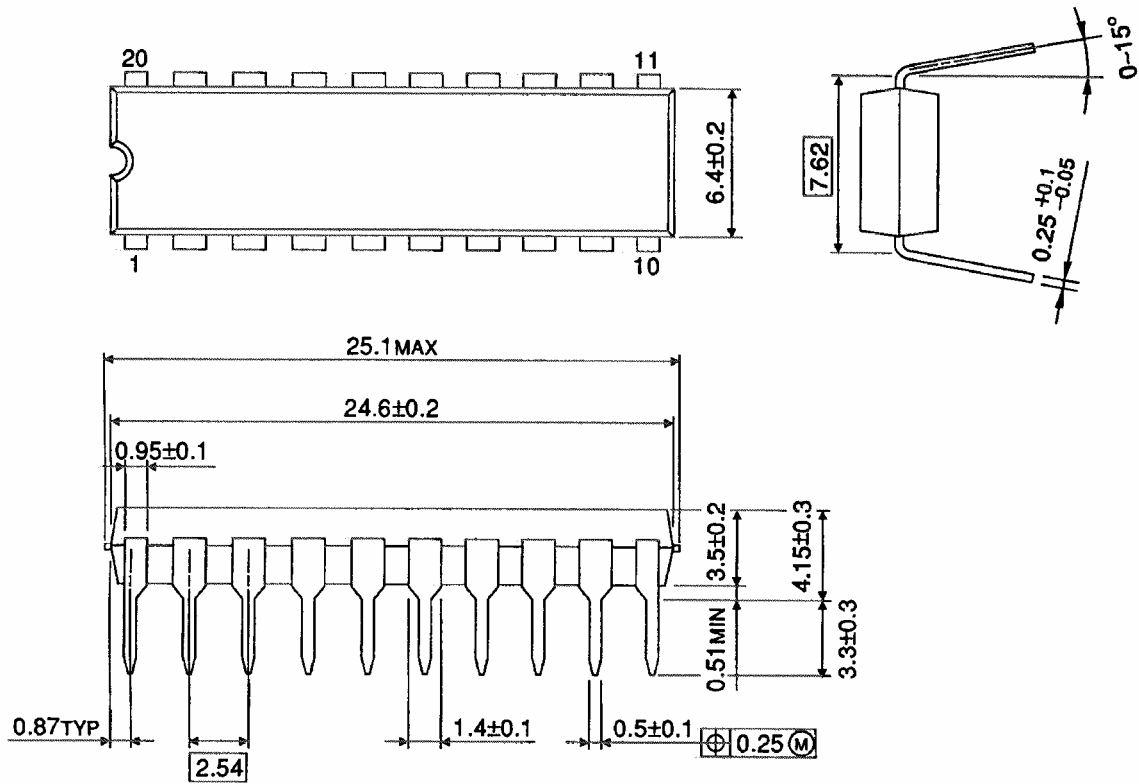
Note 2: For TC74AC240 only

Note 3: For TC74AC244 only

## Package Dimensions

DIP20-P-300-2.54A

Unit : mm

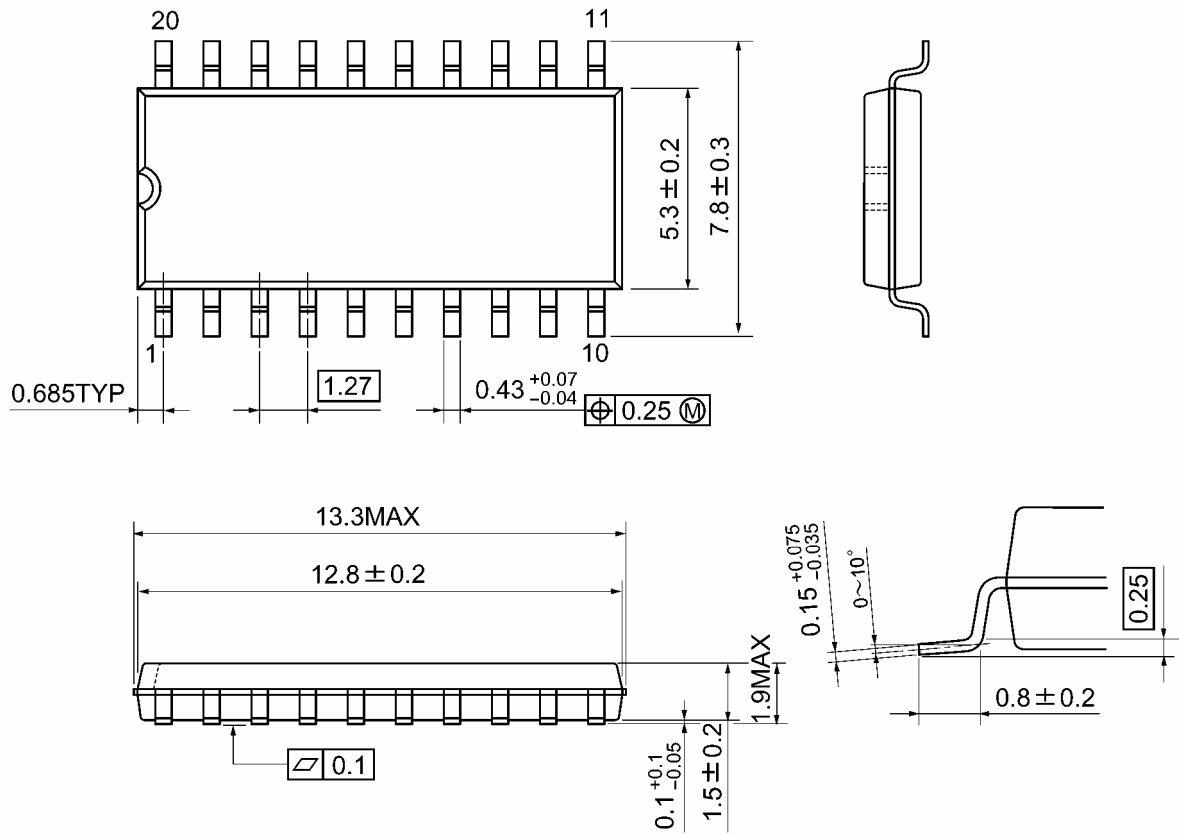


Weight: 1.30 g (typ.)

**Package Dimensions**

SOP20-P-300-1.27A

Unit: mm

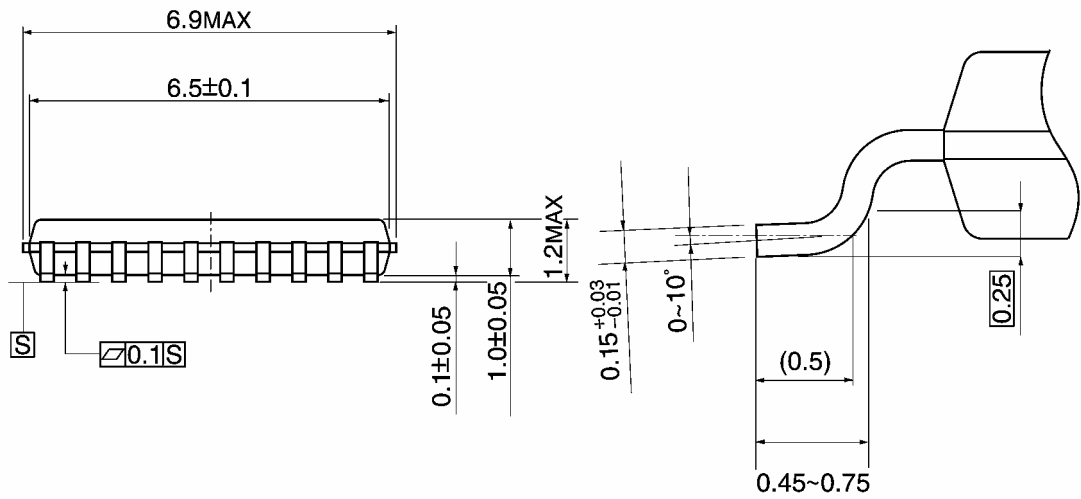
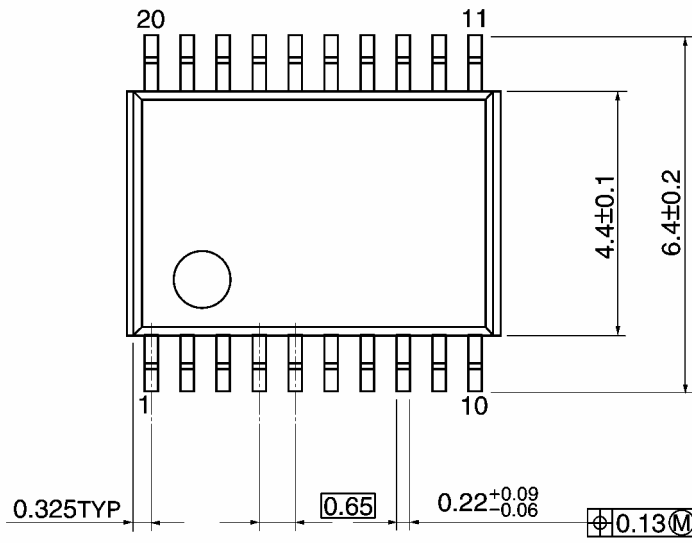


Weight: 0.22 g (typ.)

**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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