# TOSHIBA

TOSHIBA CMOS Digital Integrated Circuit   Silicon Monolithic

## TC74AC240P,TC74AC240F,TC74AC240FW,TC74AC240FT
## TC74AC244P,TC74AC244F,TC74AC244FW,TC74AC244FT

Octal Bus Buffer

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

Note: xxxFW (JEDEC SOP) is not available in Japan.

   The TC74AC240 and 244 are advanced high speed CMOS OCTAL BUS BUFFERs fabricated with silicon gate and double-layer metal wiring C²MOS 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.
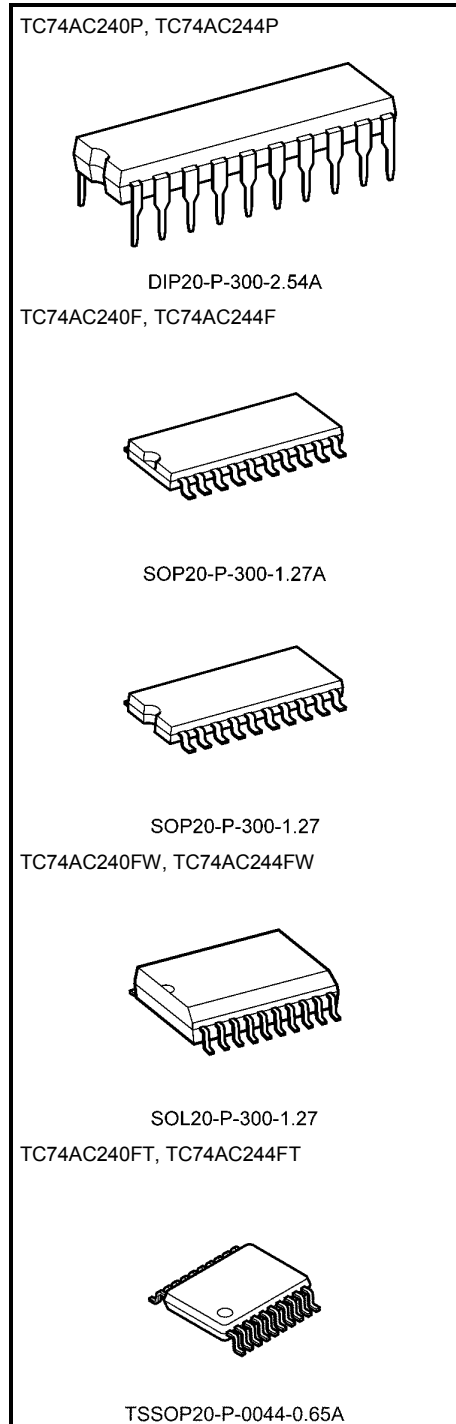
   All inputs are equipped with protection circuits against static discharge or transient excess voltage.

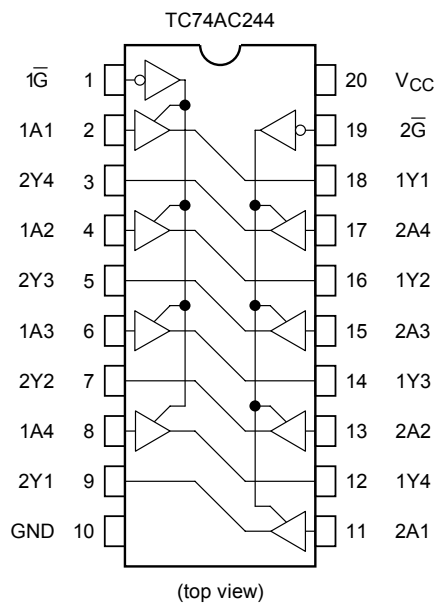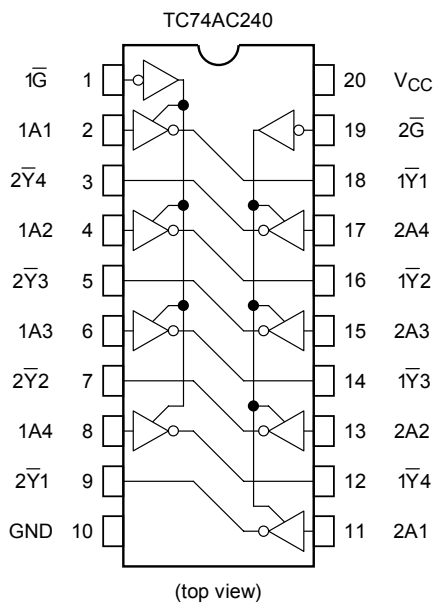TC74AC240P, TC74AC244P



DIP20-P-300-2.54A

TC74AC240F, TC74AC244F



SOP20-P-300-1.27A

## Features

- High speed: $t_{pd}$ = 4.0 ns (typ.) at $V_{CC}$ = 5 V
- Low power dissipation: $I_{CC}$ = 8 μA (max) at Ta = 25°C
- High noise immunity: $V_{NIH}$ = $V_{NIL}$ = 28% $V_{CC}$ (min)
- Symmetrical output impedance: $|I_{OH}|$ = $I_{OL}$ = 24 mA (min)
  Capability of driving 50 Ω transmission lines.
- Balanced propagation delays: $t_{pLH}$ ≃ $t_{pHL}$
- Wide operating voltage range: $V_{CC (opr)}$ = 2 to 5.5 V
- Pin and function compatible with 74F240/244



SOP20-P-300-1.27

TC74AC240FW, TC74AC244FW



SOL20-P-300-1.27

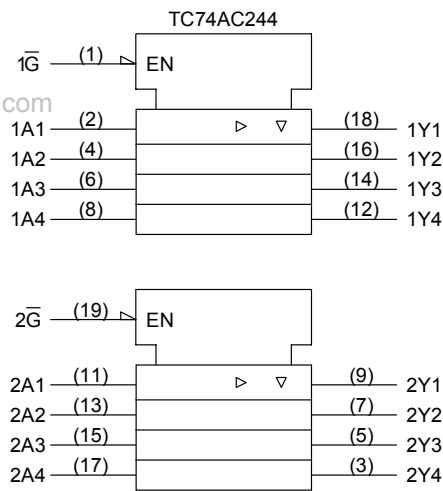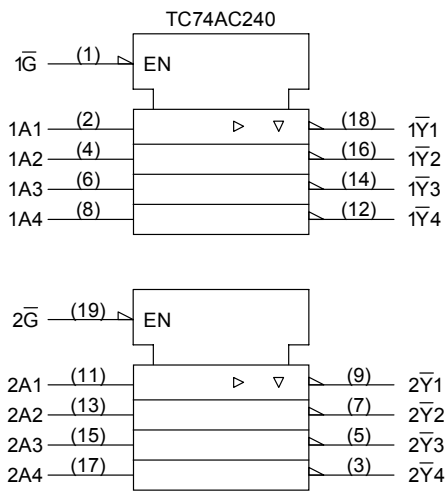TC74AC240FT, TC74AC244FT

Weight
| | |
|---|---|
| DIP20-P-300-2.54A | : 1.30 g (typ.) |
| SOP20-P-300-1.27A | : 0.22 g (typ.) |
| SOP20-P-300-1.27 | : 0.22 g (typ.) |
| SOL20-P-300-1.27 | : 0.46 g (typ.) |
| TSSOP20-P-0044-0.65A | : 0.08 g (typ.) |



TSSOP20-P-0044-0.65A

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## Pin Assignment



TC74AC240

| | | | | |
|---|---|---|---|---|
| 1$\overline{G}$ | 1 | | 20 | V$_{CC}$ |
| 1A1 | 2 | | 19 | 2$\overline{G}$ |
| 2$\overline{Y}$4 | 3 | | 18 | 1$\overline{Y}$1 |
| 1A2 | 4 | | 17 | 2A4 |
| 2$\overline{Y}$3 | 5 | | 16 | 1$\overline{Y}$2 |
| 1A3 | 6 | | 15 | 2A3 |
| 2$\overline{Y}$2 | 7 | | 14 | 1$\overline{Y}$3 |
| 1A4 | 8 | | 13 | 2A2 |
| 2$\overline{Y}$1 | 9 | | 12 | 1$\overline{Y}$4 |
| GND | 10 | | 11 | 2A1 |

(top view)

TC74AC244

| | | | | |
|---|---|---|---|---|
| 1$\overline{G}$ | 1 | | 20 | V$_{CC}$ |
| 1A1 | 2 | | 19 | 2$\overline{G}$ |
| 2Y4 | 3 | | 18 | 1Y1 |
| 1A2 | 4 | | 17 | 2A4 |
| 2Y3 | 5 | | 16 | 1Y2 |
| 1A3 | 6 | | 15 | 2A3 |
| 2Y2 | 7 | | 14 | 1Y3 |
| 1A4 | 8 | | 13 | 2A2 |
| 2Y1 | 9 | | 12 | 1Y4 |
| GND | 10 | | 11 | 2A1 |

(top view)

## IEC Logic Symbol



TC74AC240

1$\overline{G}$ —— (1) → EN

| | | | |
|---|---|---|---|
| 1A1 | (2) | (18) | 1$\overline{Y}$1 |
| 1A2 | (4) | (16) | 1$\overline{Y}$2 |
| 1A3 | (6) | (14) | 1$\overline{Y}$3 |
| 1A4 | (8) | (12) | 1$\overline{Y}$4 |

2$\overline{G}$ —— (19) → EN

| | | | |
|---|---|---|---|
| 2A1 | (11) | (9) | 2$\overline{Y}$1 |
| 2A2 | (13) | (7) | 2$\overline{Y}$2 |
| 2A3 | (15) | (5) | 2$\overline{Y}$3 |
| 2A4 | (17) | (3) | 2$\overline{Y}$4 |

TC74AC244

1$\overline{G}$ —— (1) → EN

| | | | |
|---|---|---|---|
| 1A1 | (2) | (18) | 1Y1 |
| 1A2 | (4) | (16) | 1Y2 |
| 1A3 | (6) | (14) | 1Y3 |
| 1A4 | (8) | (12) | 1Y4 |

2$\overline{G}$ —— (19) → EN

| | | | |
|---|---|---|---|
| 2A1 | (11) | (9) | 2Y1 |
| 2A2 | (13) | (7) | 2Y2 |
| 2A3 | (15) | (5) | 2Y3 |
| 2A4 | (17) | (3) | 2Y4 |

## Truth Table

| Inputs | | Outputs | |
|---|---|---|---|
| $\overline{G}$ | An | Y$_n$ (244) | $\overline{Y}_n$ (240) |
| L | L | L | H |
| L | H | H | L |
| H | X | Z | Z |

X: Don't care

Z: High impedance

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## 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 | $I_{IK}$ | ±20 | mA |
| Output diode current | $I_{OK}$ | ±50 | mA |
| DC output current | $I_{OUT}$ | ±50 | mA |
| DC $V_{CC}$/ground current | $I_{CC}$ | ±200 | mA |
| Power dissipation | $P_D$ | 500 (DIP) (Note 2)/180 (SOP/TSSOP) | mW |
| Storage temperature | $T_{stg}$ | −65 to 150 | °C |

Note1:   Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Note2:   500 mW in the range of Ta = −40 to 65°C. From Ta = 65 to 85°C a derating factor of −10 mW/°C should be applied up to 300 mW.

## Recommended Operating Conditions (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 ± 0.3 V)<br>0 to 20 ($V_{CC}$ = 5 ± 0.5 V) | ns/V |

Note:   The recommended operating conditions are required to ensure the normal operation of the device. Unused inputs must be tied to either VCC or GND.

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## Electrical Characteristics

### DC Characteristics

| Characteristics | Symbol | Test Condition | | $V_{CC}$ (V) | Ta = 25°C | | | Ta = −40 to 85°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Min | Typ. | Max | Min | Max | |
| High-level input voltage | $V_{IH}$ | — | | 2.0 | 1.50 | — | — | 1.50 | — | V |
| | | | | 3.0 | 2.10 | — | — | 2.10 | — | |
| | | | | 5.5 | 3.85 | — | — | 3.85 | — | |
| Low-level input voltage | $V_{IL}$ | — | | 2.0 | — | — | 0.50 | — | 0.50 | V |
| | | | | 3.0 | — | — | 0.90 | — | 0.90 | |
| | | | | 5.5 | — | — | 1.65 | — | 1.65 | |
| High-level output voltage | $V_{OH}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OH}$ = −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 | — | |
| | | | $I_{OH}$ = −4 mA | 3.0 | 2.58 | — | — | 2.48 | — | |
| | | | $I_{OH}$ = −24 mA | 4.5 | 3.94 | — | — | 3.80 | — | |
| | | | $I_{OH}$ = −75 mA (Note) | 5.5 | — | — | — | 3.85 | — | |
| Low-level output voltage | $V_{OL}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 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 | |
| | | | $I_{OL}$ = 12 mA | 3.0 | — | — | 0.36 | — | 0.44 | |
| | | | $I_{OL}$ = 24 mA | 4.5 | — | — | 0.36 | — | 0.44 | |
| | | | $I_{OL}$ = 75 mA (Note) | 5.5 | — | — | — | — | 1.65 | |
| 3-state output off-state current | $I_{OZ}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ $V_{OUT}$ = $V_{CC}$ or GND | | 5.5 | — | — | ±0.5 | — | ±5.0 | µA |
| Input leakage current | $I_{IN}$ | $V_{IN}$ = $V_{CC}$ or GND | | 5.5 | — | — | ±0.1 | — | ±1.0 | µA |
| Quiescent supply current | $I_{CC}$ | $V_{IN}$ = $V_{CC}$ 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.

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TC74AC240,244P/F/FW/FT

**AC Characteristics** ($C_L$ = 50 pF, $R_L$ = 500 Ω, input: $t_r$ = $t_f$ = 3 ns)

| Characteristics | Symbol | Test Condition | | Ta = 25°C | | | Ta = −40 to 85°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | $V_{CC}$ (V) | Min | Typ. | Max | Min | Max | |
| Propagation delay time (Note 2) | $t_{pLH}$ | — | 3.3 ± 0.3 | — | 6.3 | 10.5 | 1.0 | 12.0 | ns |
| | $t_{pHL}$ | | 5.0 ± 0.5 | — | 4.8 | 7.0 | 1.0 | 8.0 | |
| Propagation delay time (Note 3) | $t_{pLH}$ | — | 3.3 ± 0.3 | — | 7.0 | 11.4 | 1.0 | 13.0 | ns |
| | $t_{pHL}$ | | 5.0 ± 0.5 | — | 5.2 | 7.5 | 1.0 | 8.5 | |
| Output enable time | $t_{pZL}$ | — | 3.3 ± 0.3 | — | 8.4 | 14.0 | 1.0 | 16.0 | ns |
| | $t_{pZH}$ | | 5.0 ± 0.5 | — | 5.9 | 8.7 | 1.0 | 10.0 | |
| Output disable time | $t_{pLZ}$ | — | 3.3 ± 0.3 | — | 6.4 | 10.5 | 1.0 | 12.0 | ns |
| | $t_{pHZ}$ | | 5.0 ± 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:

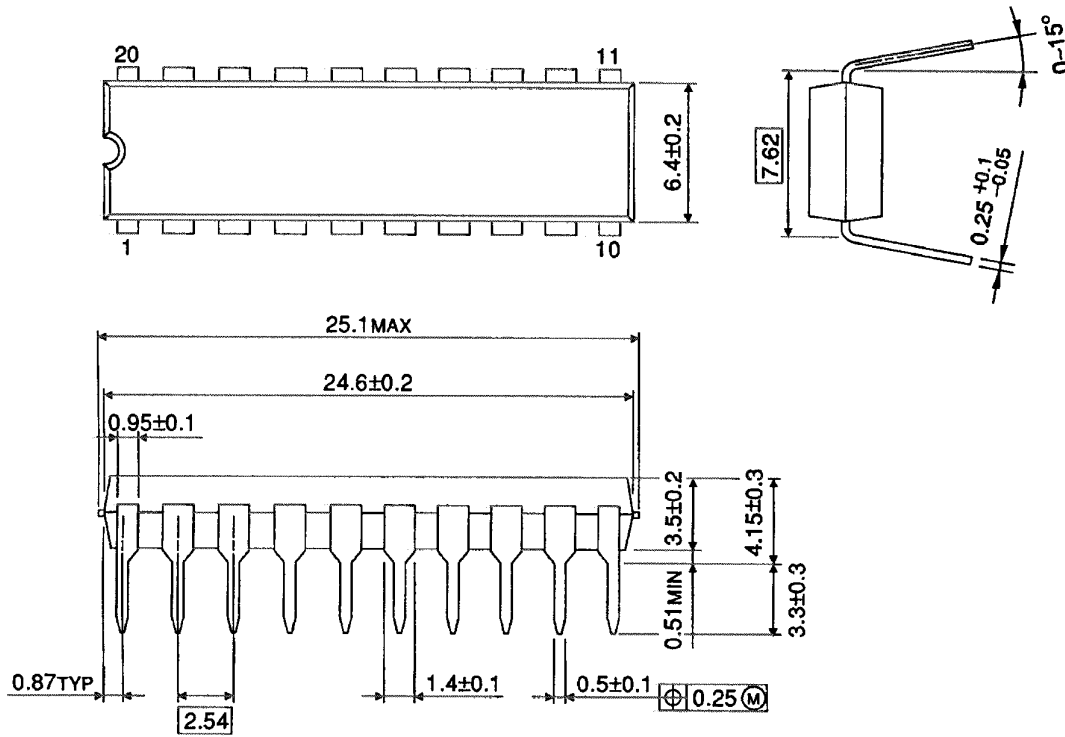$$I_{CC (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8 \text{ (per bit)}$$

Note 2:   For TC74AC240 only

Note 3:   For TC74AC244 only

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## Package Dimensions

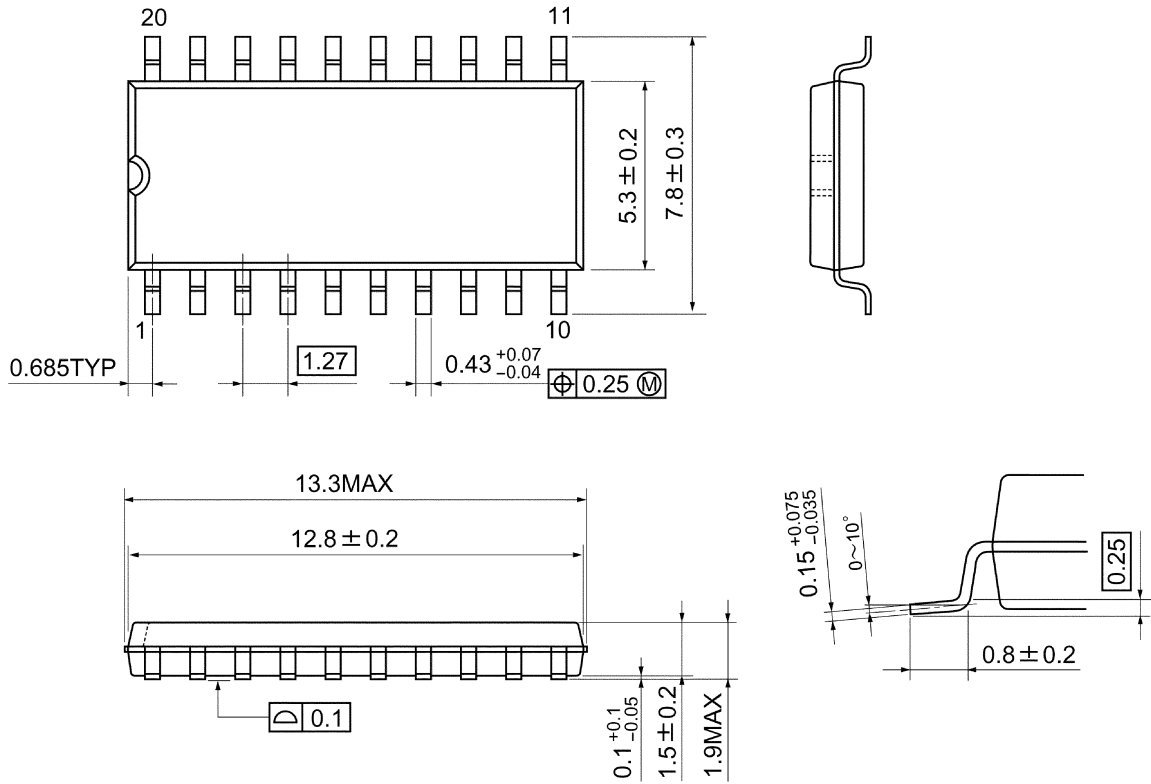DIP20-P-300-2.54A                                                 Unit : mm



Weight: 1.30 g (typ.)

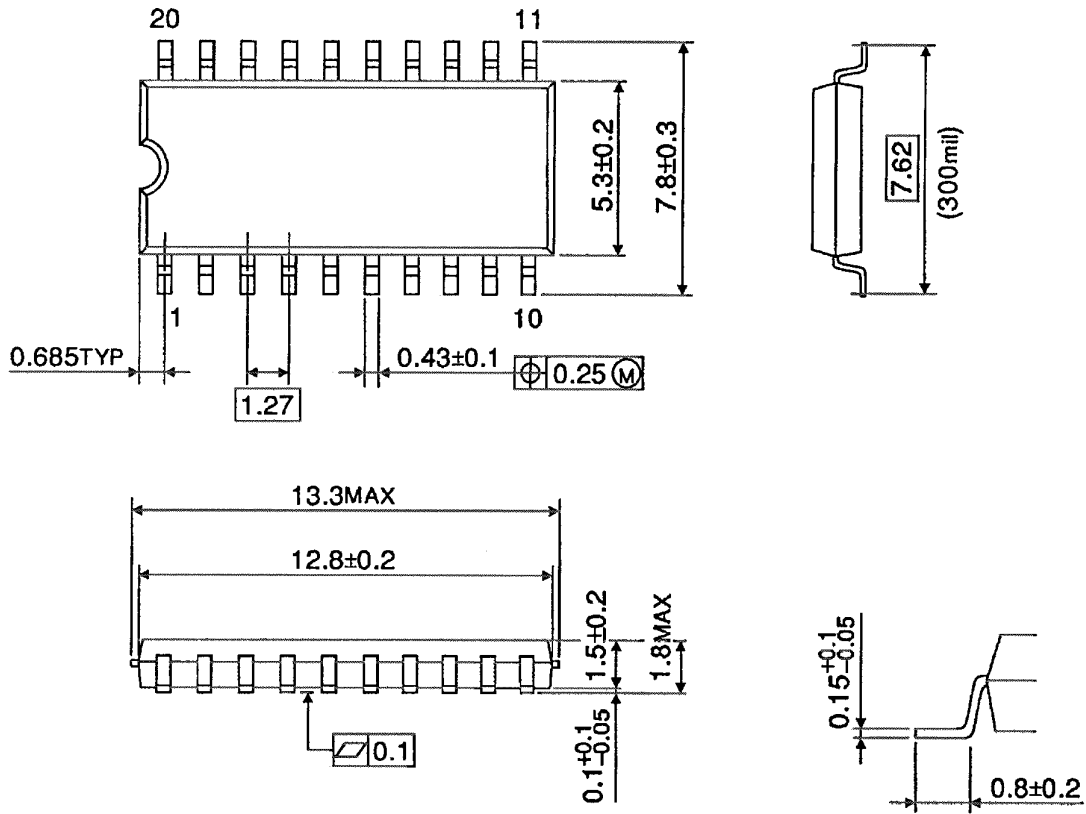# TOSHIBA

## Package Dimensions

SOP20-P-300-1.27A

Unit: mm



20     11

5.3 ± 0.2

7.8 ± 0.3

1     10

0.685TYP

1.27

0.43 $^{+0.07}_{-0.04}$

⊕ 0.25 Ⓜ

13.3MAX

12.8 ± 0.2

◿ 0.1

0.1 $^{+0.1}_{-0.05}$

1.5 ± 0.2

1.9MAX

0.15 $^{+0.075}_{-0.035}$

0～10°

0.25

0.8 ± 0.2

Weight: 0.22 g (typ.)

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## Package Dimensions

SOP20-P-300-1.27

Unit : mm



Weight: 0.22 g (typ.)

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## Package Dimensions (Note)

SOL20-P-300-1.27

Unit : mm
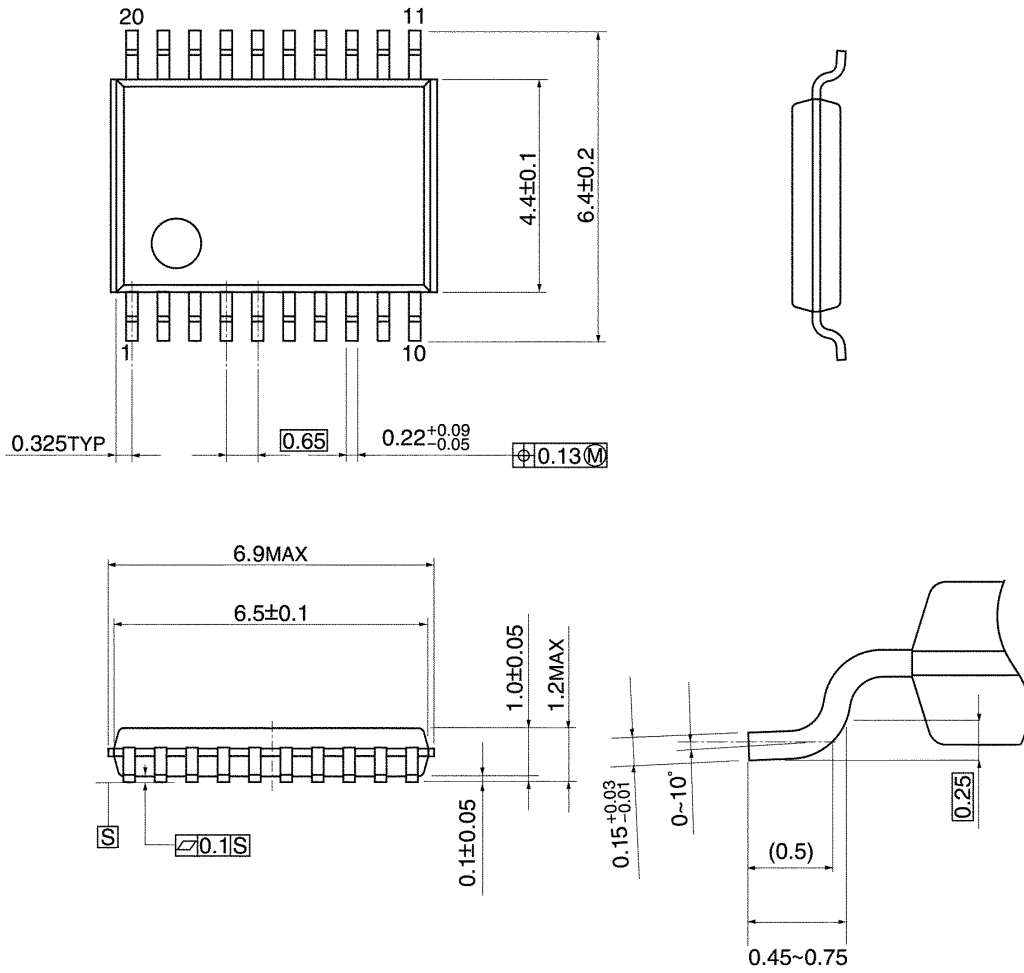


Note: This package is not available in Japan.

Weight: 0.46 g (typ.)

## Package Dimensions

TSSOP20-P-0044-0.65A                                                                                    Unit: mm



20                    11

4.4±0.1

6.4±0.2

1                     10

0.325TYP          | 0.65 |    0.22$^{+0.09}_{-0.05}$    | ⌖ |0.13|Ⓜ|

6.9MAX

6.5±0.1

1.0±0.05

1.2MAX

0.1±0.05

|S|    |⟋|0.1|S|

0.15$^{+0.03}_{-0.01}$

0~10°

(0.5)

0.45~0.75

|0.25|

Weight: 0.08 g (typ.)

**Note: Lead (Pb)-Free Packages**
**DIP20-P-300-2.54A   SOP20-P-300-1.27A   TSSOP20-P-0044-0.65A**

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060116EBA

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