TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC74HC240AP,TC74HC240AF,TC74HC240AFW
# TC74HC241AP,TC74HC241AF
# TC74HC244AP,TC74HC244AF,TC74HC244AFW

Octal Bus Buffer

| | |
|---|---|
| TC74HC240AP/AF/AFW | Inverted, 3-State Outputs |
| TC74HC241AP/AF | Non-Inverted, 3-State Outputs |
| TC74HC244AP/AF/AFW | Non-Inverted, 3-State Outputs |

The TC74HC240A, 241A and 244A are high speed CMOS OCTAL BUS BUFFERs fabricated with silicon gate C2MOS technology.

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

The 74HC240A is an inverting 3-state buffer having two active-low output enables. The TC74HC241A and TC74HC244A are non-inverting 3-state buffers that differ only in that the 241A has one active-high and one active-low output enable, and the 244A has two active-low output enables.

These devices are designed to be used with 3-state memory address drivers, etc.

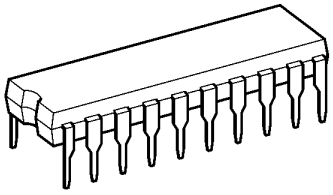
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

## Features

- High speed: $t_{pd}$ = 10 ns (typ.) at $V_{CC}$ = 5 V
- Low power dissipation: $I_{CC}$ = 4 μA (max) at Ta = 25°C
- High noise immunity: $V_{NIH} = V_{NIL}$ = 28% $V_{CC}$ (min)
- Output drive capability: 15 LSTTL loads
- Symmetrical output impedance: $|I_{OH}| = I_{OL}$ = 6 mA (min)
- Balanced propagation delays: $t_{pLH} \simeq t_{pHL}$
- Wide operating voltage range: $V_{CC}$ (opr) = 2~6 V
- Pin and function compatible with 74LS240/241/244

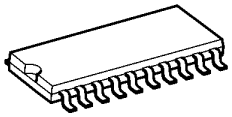
Note: xxxFW (JEDEC SOP) is not available in Japan.

TC74HC240AP, TC74HC241AP, TC74HC244AP

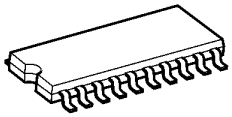


DIP20-P-300-2.54A

TC74HC240AF, TC74HC241AF, TC74HC244AF

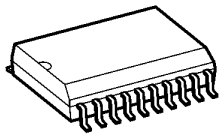


SOP20-P-300-1.27A



SOP20-P-300-1.27

TC74HC240AFW, TC74HC244AFW



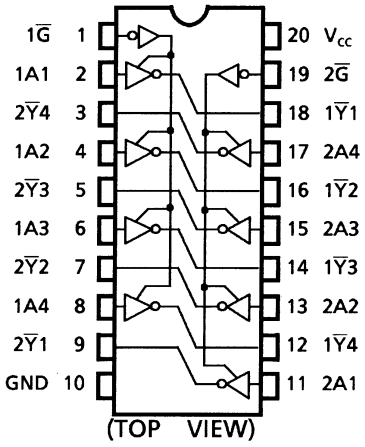
SOL20-P-300-1.27

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.) |

## Pin Assignment

**TC74HC240A**

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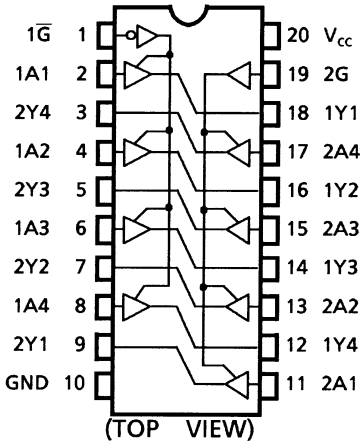
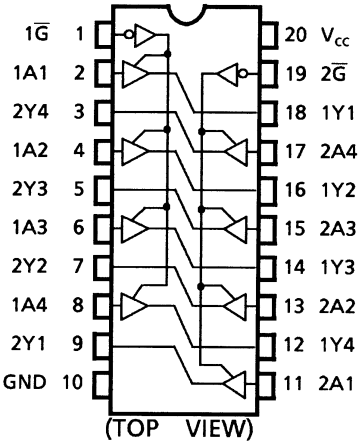
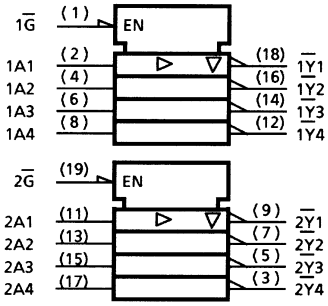



**TC74HC244A**




## IEC Logic Symbol

**TC74HC240A**

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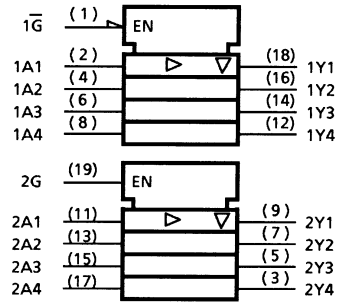
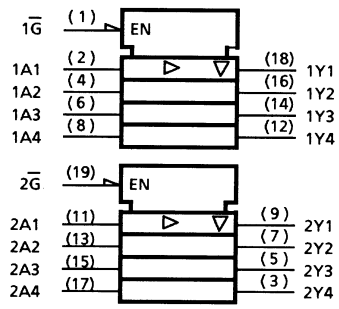



**TC74HC244A**




## Truth Table

| Inputs | | | Outputs | |
|---|---|---|---|---|
| $\overline{G}$ | $G^{\Delta}$ | $A_n$ | $Y_n$ | $\overline{Y}_n$ $^{\Delta\Delta}$ |
| L | H | L | L | H |
| L | H | H | H | L |
| H | L | X | Z | Z |

$\Delta$: For TC74HC241A only

$\Delta\Delta$: For TC74HC240A only

X: Don't care

Z: High impedance

## Absolute Maximum Ratings (Note 1)

| Characteristics | Symbol | Rating | 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) (Note 2)/180 (SOP) | mW |
| Storage temperature | $T_{stg}$ | −65~150 | °C |

Note 1: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Note 2: 500 mW in the range of Ta = −40 to 65°C. From Ta = 65 to 85°C a derating factor of −10 mW/°C shall be applied until 300 mW.

## Recommended Operating Conditions (Note)

| Characteristics | Symbol | Rating | 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 V)<br>0~500 ($V_{CC}$ = 4.5 V)<br>0~400 ($V_{CC}$ = 6.0 V) | ns |

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.

## Electrical Characteristics

### DC Characteristics

| Characteristics | Symbol | Test Condition | | $V_{CC}$ (V) | Ta = 25°C Min | Ta = 25°C Typ. | Ta = 25°C Max | Ta = –40~85°C Min | Ta = –40~85°C Max | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 μA | 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 | — | |
| | | | $I_{OH}$ = –6 mA | 4.5 | 4.18 | 4.31 | — | 4.13 | — | |
| | | | $I_{OH}$ = –7.8 mA | 6.0 | 5.68 | 5.80 | — | 5.63 | — | |
| Low-level output voltage | $V_{OL}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 20 μA | 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 | |
| | | | $I_{OL}$ = 6 mA | 4.5 | — | 0.17 | 0.26 | — | 0.33 | |
| | | | $I_{OL}$ = 7.8 mA | 6.0 | — | 0.18 | 0.26 | — | 0.33 | |
| 3-state output off-state current | $I_{OZ}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$<br>$V_{OUT}$ = $V_{CC}$ 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 | μA |
| Quiescent supply current | $I_{CC}$ | $V_{IN}$ = $V_{CC}$ or GND | | 6.0 | — | — | 4.0 | — | 40.0 | μA |

**AC Characteristics (input: $t_r = t_f = 6$ ns)**

| Characteristics | Symbol | Test Condition | | | Ta = 25°C | | | Ta = –40~85°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | CL (pF) | $V_{CC}$ (V) | Min | Typ. | Max | Min | Max | |
| Output transition time | $t_{TLH}$ $t_{THL}$ | — | 50 | 2.0 | — | 25 | 60 | — | 75 | ns |
| | | | | 4.5 | — | 7 | 12 | — | 15 | |
| | | | | 6.0 | — | 6 | 10 | — | 13 | |
| Propagation delay time | $t_{pLH}$ $t_{pHL}$ | — | 50 | 2.0 | — | 36 | 90 | — | 115 | ns |
| | | | | 4.5 | — | 12 | 18 | — | 23 | |
| | | | | 6.0 | — | 10 | 15 | — | 20 | |
| | | | 150 | 2.0 | — | 51 | 130 | — | 165 | |
| | | | | 4.5 | — | 17 | 26 | — | 33 | |
| | | | | 6.0 | — | 14 | 22 | — | 28 | |
| Output enable time | $t_{pZL}$ $t_{pZH}$ | $R_L = 1$ kΩ | 50 | 2.0 | — | 48 | 125 | — | 155 | ns |
| | | | | 4.5 | — | 16 | 25 | — | 31 | |
| | | | | 6.0 | — | 14 | 21 | — | 26 | |
| | | | 150 | 2.0 | — | 63 | 165 | — | 205 | |
| | | | | 4.5 | — | 21 | 33 | — | 41 | |
| | | | | 6.0 | — | 18 | 28 | — | 35 | |
| Output disable time | $t_{pLZ}$ $t_{pHZ}$ | $R_L = 1$ kΩ | 50 | 2.0 | — | 32 | 125 | — | 155 | ns |
| | | | | 4.5 | — | 15 | 25 | — | 31 | |
| | | | | 6.0 | — | 14 | 21 | — | 26 | |
| Input capacitance | $C_{IN}$ | — | | | — | 5 | 10 | — | 10 | pF |
| Output capacitance | $C_{OUT}$ | — | | | — | 10 | — | — | — | pF |
| Power dissipation capacitance | $C_{PD}$ (Note) | TC74HC240A | | | — | 31 | — | — | — | pF |
| | | TC74HC241A/244A | | | — | 33 | — | — | — | |

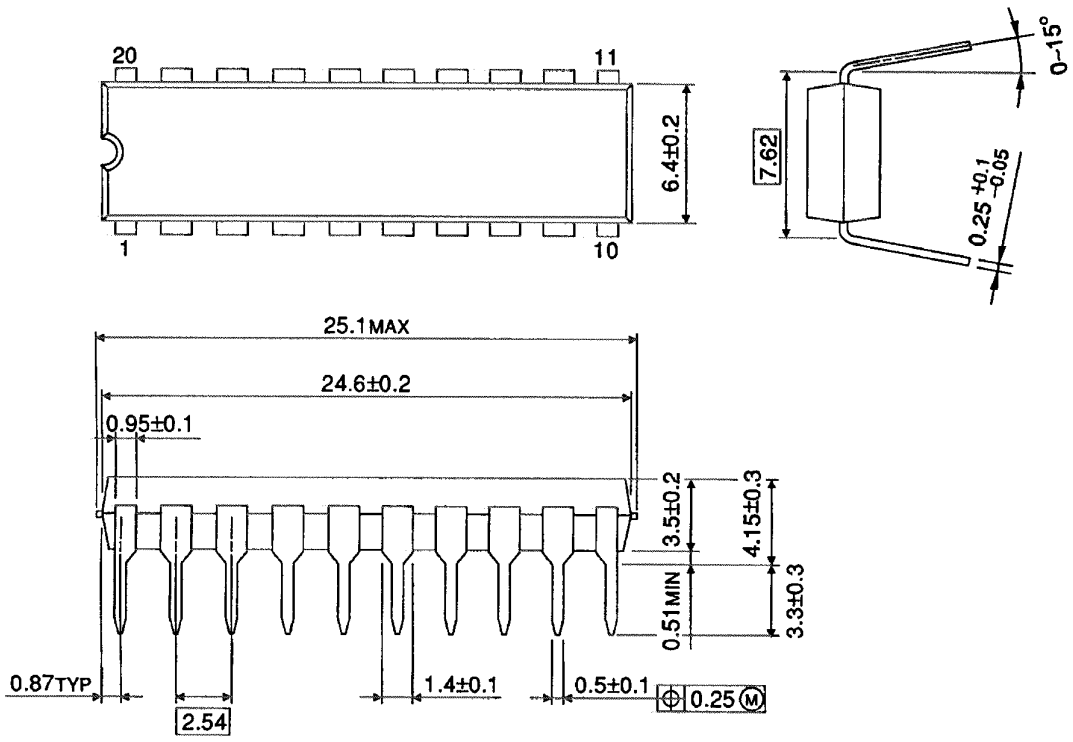
Note: $C_{PD}$ is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:

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

## Package Dimensions

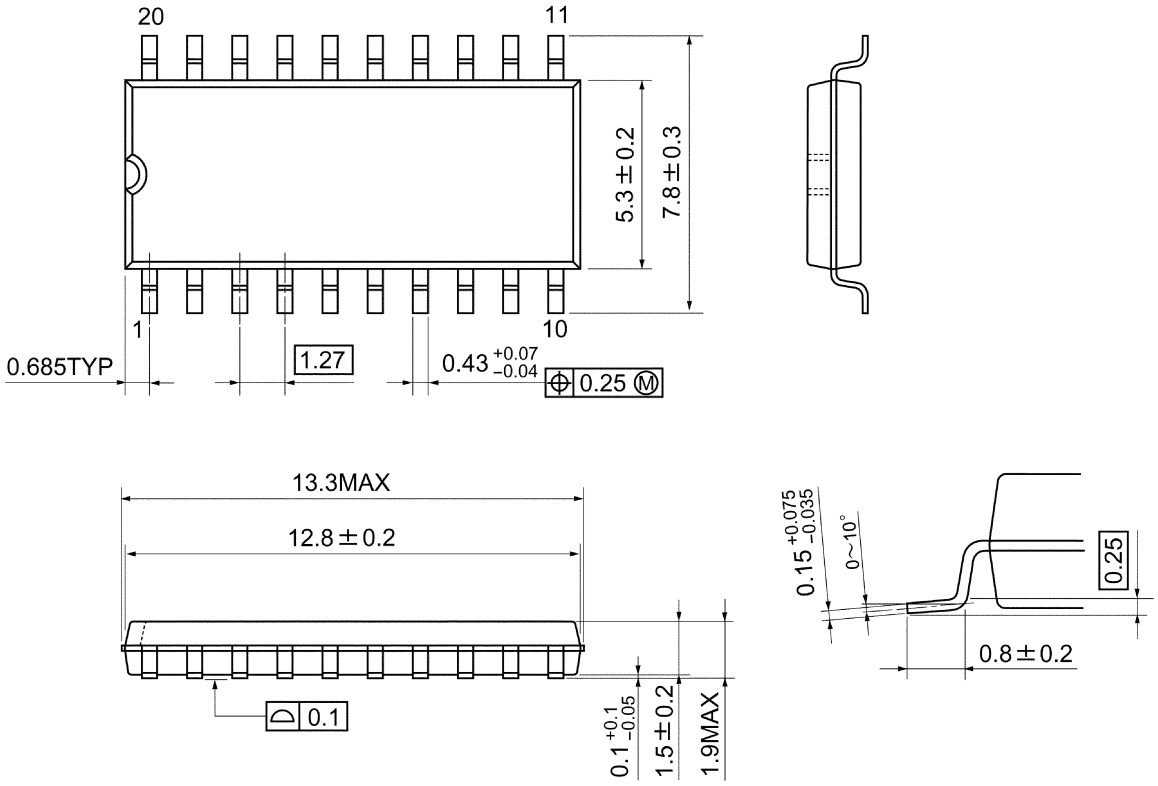
DIP20-P-300-2.54A Unit : mm




Weight: 1.30 g (typ.)

## Package Dimensions

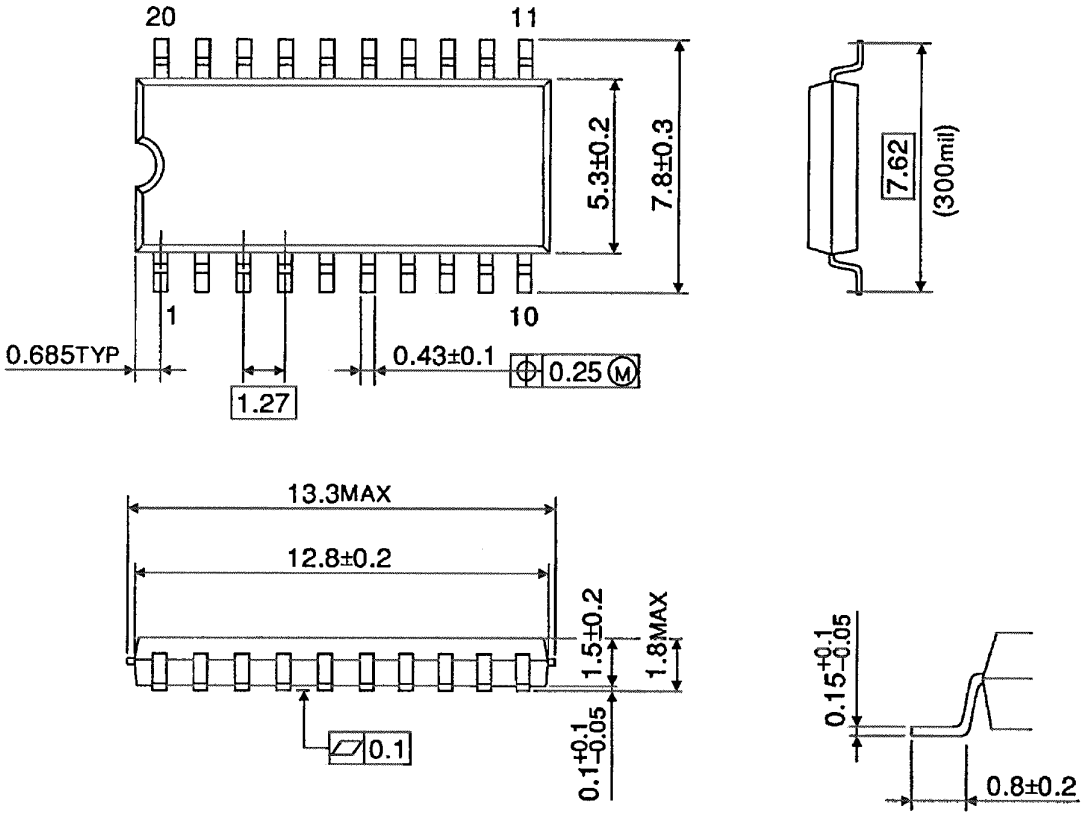
SOP20-P-300-1.27A Unit: mm




Weight: 0.22 g (typ.)

**Package Dimensions**

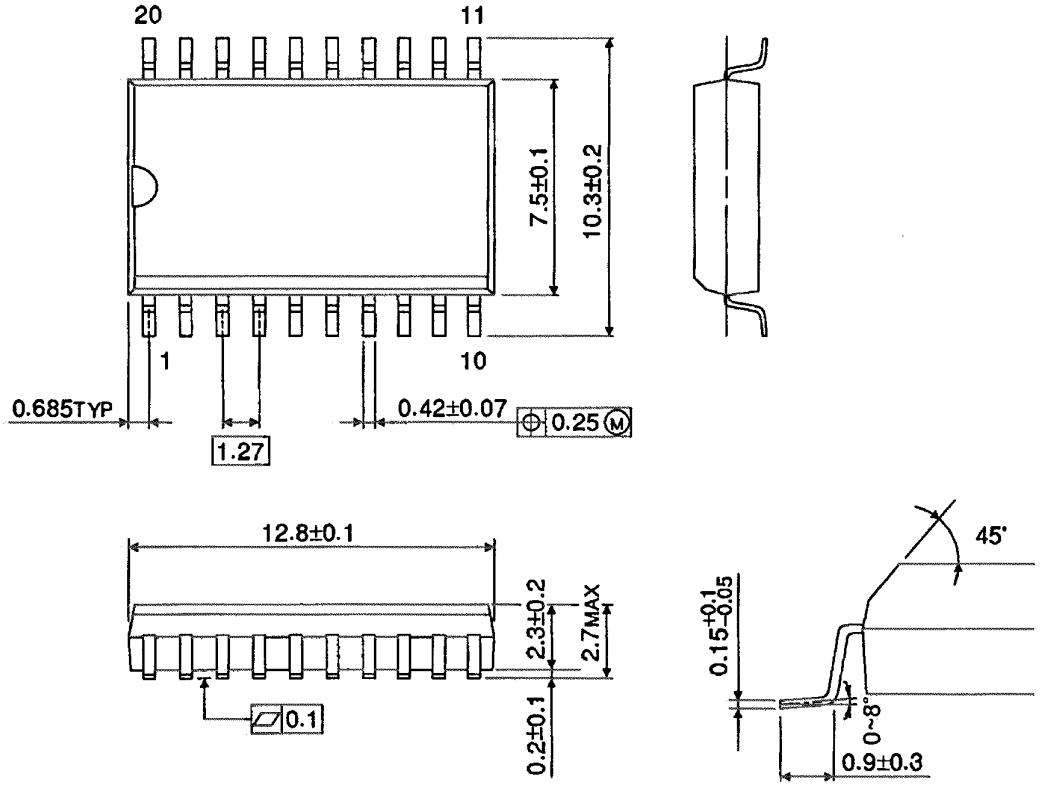
SOP20-P-300-1.27 Unit : mm




Weight: 0.22 g (typ.)

**Package Dimensions (Note)**

SOL20-P-300-1.27 Unit : mm




Note: This package is not available in Japan.

Weight: 0.46 g (typ.)

**Note: Lead (Pb)-Free Packages**

**DIP20-P-300-2.54A SOP20-P-300-1.27A**

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