TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC74VHC240F,TC74VHC240FW,TC74VHC240FT,TC74VHC240FK
# TC74VHC244F,TC74VHC244FW,TC74VHC244FT,TC74VHC244FK

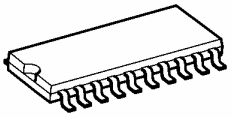
Octal Bus Buffer

TC74VHC240F/FW/FT/FK
Inverted, 3-State Outputs

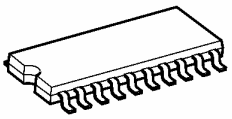
TC74VHC244F/FW/FT/FK
Non-Inverted, 3-State Outputs

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

TC74VHC240F, TC74VHC244F

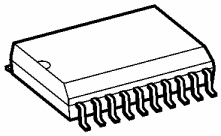


SOP20-P-300-1.27A



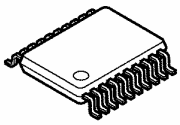
SOP20-P-300-1.27

TC74VHC240FW, TC74VHC244FW



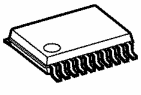
SOL20-P-300-1.27

TC74VHC240FT, TC74VHC244FT



TSSOP20-P-0044-0.65A

TC74VHC240FK, TC74VHC244FK



VSSOP20-P-0030-0.50

The TC74VHC240 and 244 are advanced high speed CMOS OCTAL BUS BUFFERs fabricated with silicon gate $C^2MOS$ technology.

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

The 74VHC240 is an inverting 3-state buffer having two active-low output enables. The TC74VHC244 is a non-inverting 3-state buffer, and has two active-low output enables.

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

An input protection circuit ensures that 0 to 5.5 V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5 V to 3 V systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

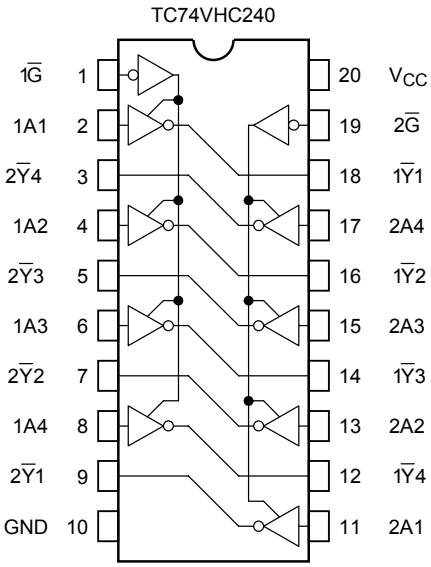
## Features

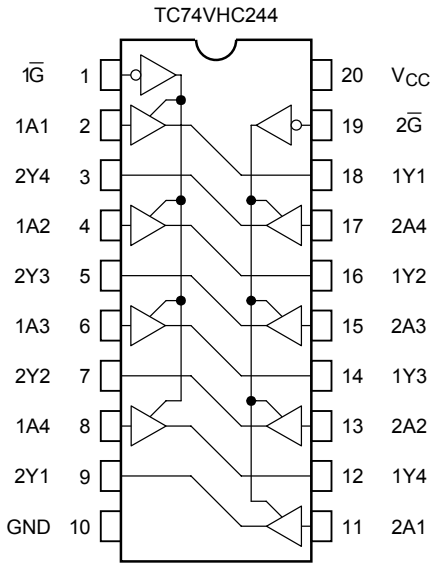
- High speed: $t_{pd}$ = 3.9 ns (typ.) at $V_{CC}$ = 5 V
- Low power dissipation: $I_{CC}$ = 4 μA (max) at Ta = 25°C
- High noise immunity: $V_{NIH} = V_{NIL}$ = 28% $V_{CC}$ (min)
- Power down protection is provided on all inputs.
- Balanced propagation delays: $t_{pLH} \simeq t_{pHL}$
- Wide operating voltage range: $V_{CC\ (opr)}$ = 2 to 5.5 V
- Low noise: $V_{OLP}$ = 0.9 V (max)
- Pin and function compatible with 74ALS240/244

Weight

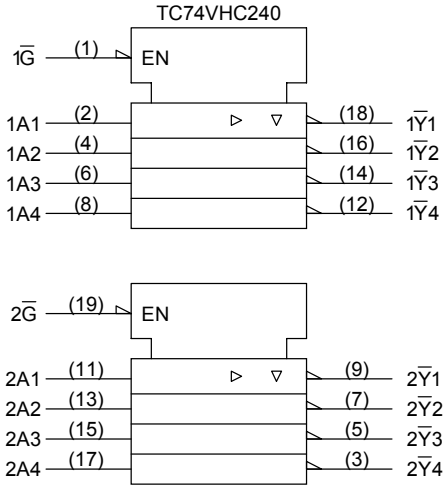
| | |
|---|---|
| SOP20-P-300-1.27A | : 0.22 g (typ.) |
| SOP20-P-300-1.27 | : 0.22 g (typ.) |
| SOL20-P-300-1.27 | : 0.46 g (typ.) |
| TSSOP20-P-0044-0.65A | : 0.08 g (typ.) |
| VSSOP20-P-0030-0.50 | : 0.03 g (typ.) |

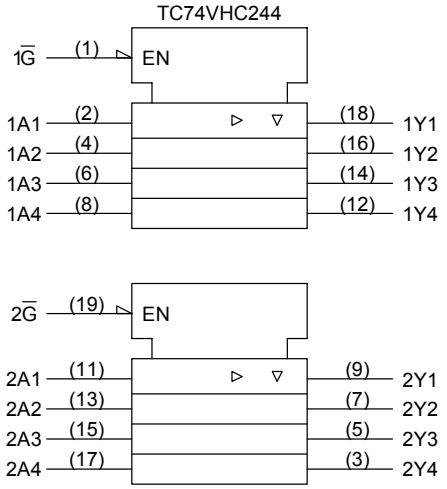
## Pin Assignment




## Iec Logic Symbol




## Truth Table

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

X: Don't care

Z: High impedance

$Y_n$: TC74VHC244

$\overline{Y}_n$ : TC74VHC240

## Absolute Maximum Ratings (Note)

| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Supply voltage range | $V_{CC}$ | −0.5 to 7.0 | V |
| DC input voltage | $V_{IN}$ | −0.5 to 7.0 | V |
| DC output voltage | $V_{OUT}$ | −0.5 to $V_{CC}$ + 0.5 | V |
| Input diode current | $I_{IK}$ | −20 | mA |
| Output diode current | $I_{OK}$ | ±20 | mA |
| DC output current | $I_{OUT}$ | ±25 | mA |
| DC $V_{CC}$/ground current | $I_{CC}$ | ±75 | mA |
| Power dissipation | $P_D$ | 180 | mW |
| Storage temperature | $T_{stg}$ | −65 to 150 | °C |

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

## Recommended Operating Conditions (Note)

| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Supply voltage | $V_{CC}$ | 2.0 to 5.5 | V |
| Input voltage | $V_{IN}$ | 0 to 5.5 | 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.

## Electrical Characteristics

### DC Characteristics

| Characteristics | Symbol | Test Condition | | | Ta = 25°C | | | Ta = −40 to 85°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $V_{CC}$ (V) | Min | Typ. | Max | Min | Max | |
| High-level input voltage | $V_{IH}$ | — | | 2.0 | 1.50 | — | — | 1.50 | — | V |
| | | | | 3.0 to 5.5 | $V_{CC}$ × 0.7 | — | — | $V_{CC}$ × 0.7 | — | |
| Low-level input voltage | $V_{IL}$ | — | | 2.0 | — | — | 0.50 | — | 0.50 | V |
| | | | | 3.0 to 5.5 | — | — | $V_{CC}$ × 0.3 | — | $V_{CC}$ × 0.3 | |
| 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 | — | |
| | | | $I_{OH}$ = −8 mA | 4.5 | 3.94 | — | — | 3.80 | — | |
| 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 | |
| | | | $I_{OL}$ = 4 mA | 3.0 | — | — | 0.36 | — | 0.44 | |
| | | | $I_{OL}$ = 8 mA | 4.5 | — | — | 0.36 | — | 0.44 | |
| 3-state output off-state current | $I_{OZ}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$<br>$V_{OUT}$ = $V_{CC}$ or GND | | 5.5 | — | — | ±0.25 | — | ±2.50 | μA |
| Input leakage current | $I_{IN}$ | $V_{IN}$ = 5.5 V or GND | | 0 to 5.5 | — | — | ±0.1 | — | ±1.0 | μA |
| Quiescent supply current | $I_{CC}$ | $V_{IN}$ = $V_{CC}$ or GND | | 5.5 | — | — | 4.0 | — | 40.0 | μA |

## AC Characteristics (input: $t_r = t_f = 3$ ns)

| Characteristics | Symbol | Test Condition | | | Ta = 25°C | | | Ta = −40 to 85°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | $V_{CC}$ (V) | $C_L$ (pF) | Min | Typ. | Max | Min | Max | |
| Propagation delay time (TC74VHC240) | $t_{pLH}$ $t_{pHL}$ | — | 3.3 ± 0.3 | 15 | — | 5.3 | 7.5 | 1.0 | 9.0 | ns |
| | | | | 50 | — | 7.8 | 11.0 | 1.0 | 12.5 | |
| | | | 5.0 ± 0.5 | 15 | — | 3.6 | 5.5 | 1.0 | 6.5 | |
| | | | | 50 | — | 5.1 | 7.5 | 1.0 | 8.5 | |
| Propagation delay time (TC74VHC244) | $t_{pLH}$ $t_{pHL}$ | — | 3.3 ± 0.3 | 15 | — | 5.8 | 8.4 | 1.0 | 10.0 | ns |
| | | | | 50 | — | 8.3 | 11.9 | 1.0 | 13.5 | |
| | | | 5.0 ± 0.5 | 15 | — | 3.9 | 5.5 | 1.0 | 6.5 | |
| | | | | 50 | — | 5.4 | 7.5 | 1.0 | 8.5 | |
| 3-state output enable time | $t_{pZL}$ $t_{pZH}$ | $R_L$ = 1 kΩ | 3.3 ± 0.3 | 15 | — | 6.6 | 10.6 | 1.0 | 12.5 | ns |
| | | | | 50 | — | 9.1 | 14.1 | 1.0 | 16.0 | |
| | | | 5.0 ± 0.5 | 15 | — | 4.7 | 7.3 | 1.0 | 8.5 | |
| | | | | 50 | — | 6.2 | 9.3 | 1.0 | 10.5 | |
| 3-state output disable time | $t_{pLZ}$ $t_{pHZ}$ | $R_L$ = 1 kΩ | 3.3 ± 0.3 | 50 | — | 10.3 | 14.0 | 1.0 | 16.0 | ns |
| | | | 5.0 ± 0.5 | 50 | — | 6.7 | 9.2 | 1.0 | 10.5 | |
| Output to output skew | $t_{osLH}$ $t_{osHL}$ | (Note 1) | 3.3 ± 0.3 | 50 | — | — | 1.5 | — | 1.5 | ns |
| | | | 5.0 ± 0.5 | 50 | — | — | 1.0 | — | 1.0 | |
| Input capacitance | $C_{IN}$ | — | | | — | 4 | 10 | — | 10 | pF |
| Output capacitance | $C_{OUT}$ | — | | | — | 6 | — | — | — | pF |
| Power dissipation capacitance (Note 2) | $C_{PD}$ | TC74VHC240 | | | — | 17 | — | — | — | pF |
| | | TC74VHC244 | | | — | 19 | — | — | — | |

Note 1: Parameter guaranteed by design.

$$t_{osLH} = |t_{pLHm} - t_{pLHn}|,\ t_{osHL} = |t_{pHLm} - t_{pHLn}|$$

Note 2: $C_{PD}$ 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:

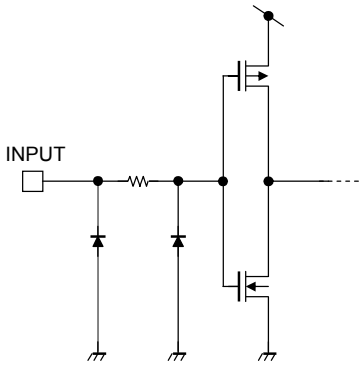
$$I_{CC\ (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8 \text{ (per bit)}$$

## Noise Characteristics (input: $t_r = t_f = 3$ ns) (Note)

| Characteristics | Symbol | Test Condition | | Ta = 25°C | | Unit |
|---|---|---|---|---|---|---|
| | | | $V_{CC}$ (V) | Typ. | Limit | |
| Quiet output maximum dynamic $V_{OL}$ | $V_{OLP}$ | $C_L$ = 50 pF | 5.0 | 0.5 (0.6) | 0.8 (0.9) | V |
| Quiet output minimum dynamic $V_{OL}$ | $V_{OLV}$ | $C_L$ = 50 pF | 5.0 | −0.5 (−0.6) | −0.8 (−0.9) | V |
| Minimum high level dynamic input voltage | $V_{IHD}$ | $C_L$ = 50 pF | 5.0 | — | 3.5 | V |
| Maximum low level dynamic input voltage | $V_{ILD}$ | $C_L$ = 50 pF | 5.0 | — | 1.5 | V |

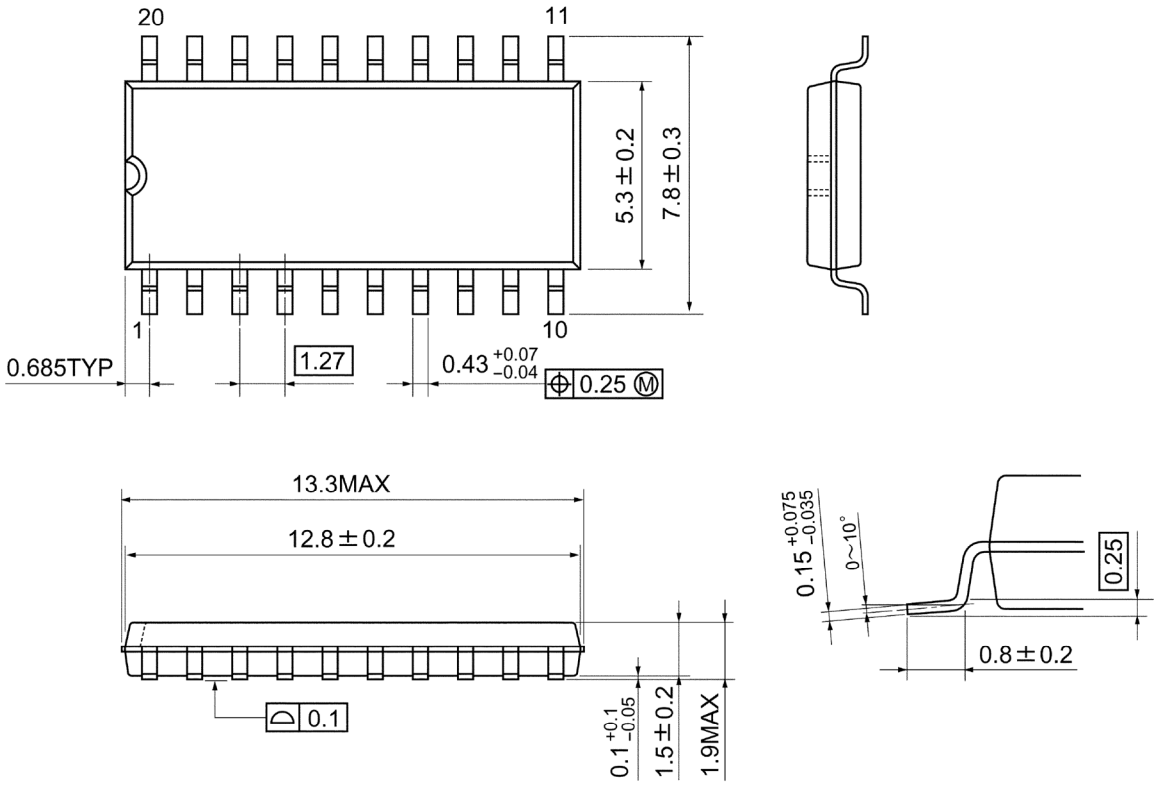
Note: The value in ( ) only applies to JEDEC SOP (FW) devices.

**Input Equivalent Circuit**



## Package Dimensions

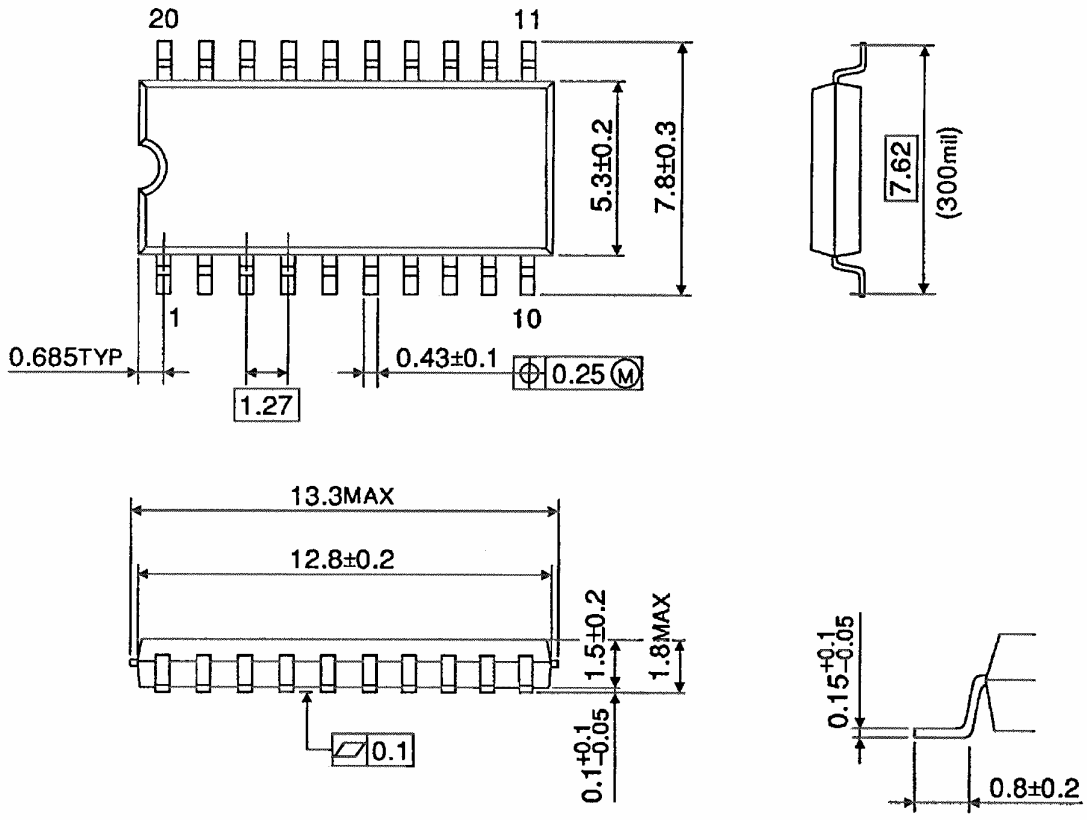
SOP20-P-300-1.27A Unit: mm




Weight: 0.22 g (typ.)

**Package Dimensions**

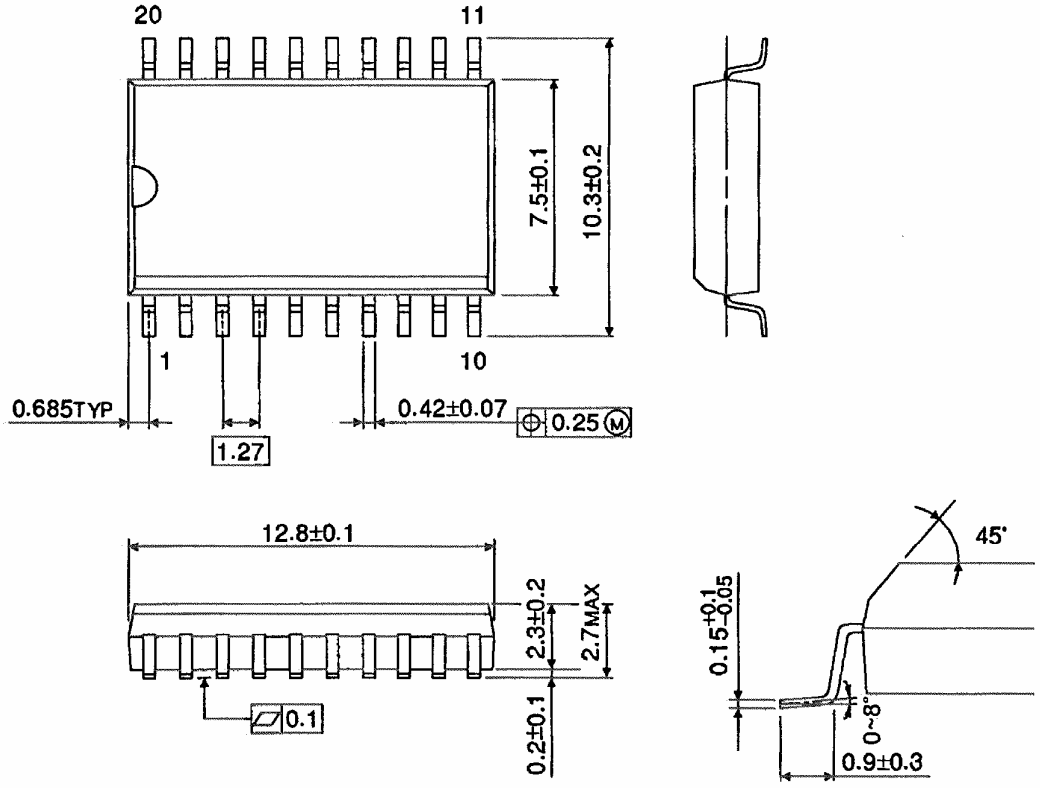
SOP20-P-300-1.27 Unit : mm




Weight: 0.22 g (typ.)

**Package Dimensions (Note)**

SOL20-P-300-1.27 Unit : mm

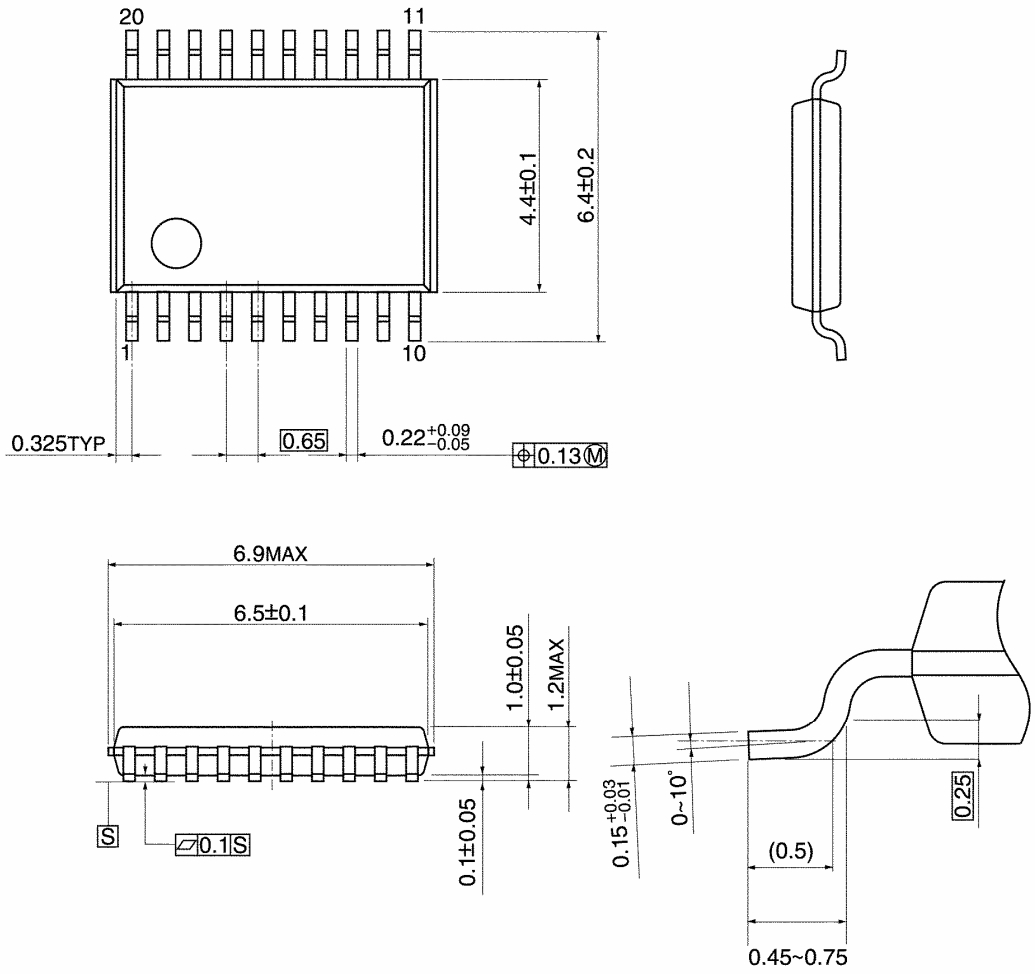



Note: This package is not available in Japan.

Weight: 0.46 g (typ.)

## Package Dimensions

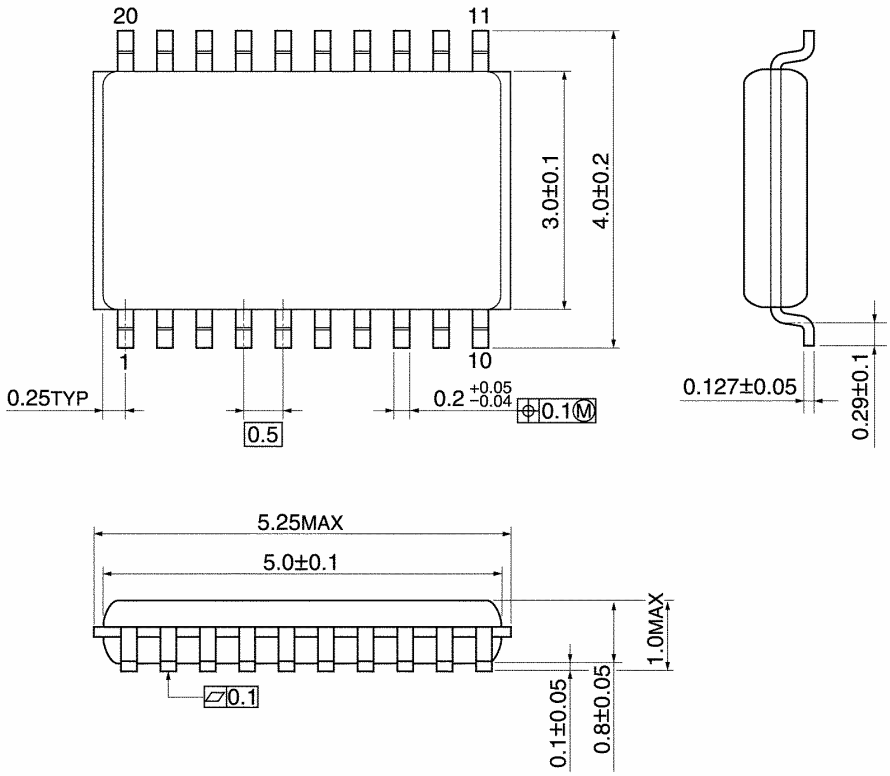
TSSOP20-P-0044-0.65A Unit: mm




Weight: 0.08 g (typ.)

## Package Dimensions

VSSOP20-P-0030-0.50 Unit: mm




Weight: 0.03 g (typ.)

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

**SOP20-P-300-1.27A TSSOP20-P-0044-0.65A VSSOP20-P-0030-0.50**

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