

## TC74VHC08F, TC74VHC08FN, TC74VHC08FT, TC74VHC08FK

### Quad 2-Input AND Gate

The TC74VHC08 is an advanced high speed CMOS 2-INPUT AND GATE fabricated with silicon gate 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.

The internal circuit is composed of 4 stages including buffer output, which provide high noise immunity and stable output.

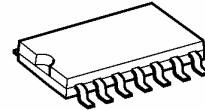
An input protection circuit ensures that 0 to 5.5 V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5 V to 3 V systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input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

### Features

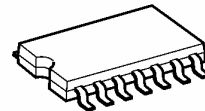
- High speed:  $t_{pd} = 4.3 \text{ ns}$  (typ.) at  $V_{CC} = 5 \text{ V}$
- Low power dissipation:  $I_{CC} = 2 \mu\text{A}$  (max) at  $T_a = 25^\circ\text{C}$
- High noise immunity:  $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (min)
- Power down protection is provided on all inputs.
- Balanced propagation delays:  $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range:  $V_{CC} (\text{opr}) = 2 \text{ V to } 5.5 \text{ V}$
- Low noise:  $V_{OLP} = 0.8 \text{ V}$  (max)
- Pin and function compatible with 74ALS08

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

TC74VHC08F

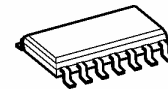


SOP14-P-300-1.27A



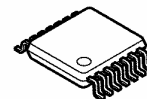
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TC74VHC08FN



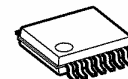
SOL14-P-150-1.27

TC74VHC08FT



TSSOP14-P-0044-0.65A

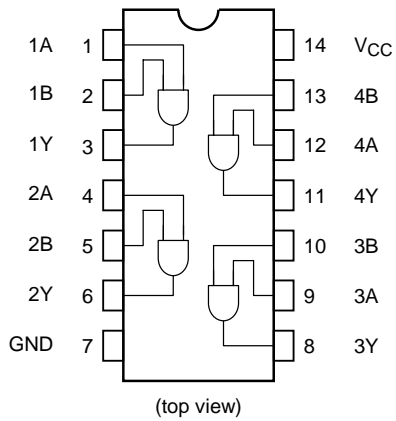
TC74VHC08FK



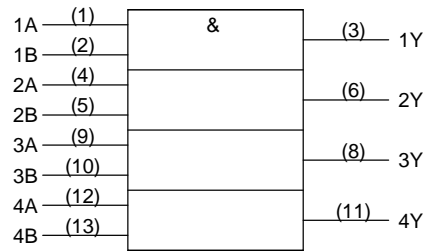
VSSOP14-P-0030-0.50

| Weight               |                 |
|----------------------|-----------------|
| SOP14-P-300-1.27A    | : 0.18 g (typ.) |
| SOP14-P-300-1.27     | : 0.18 g (typ.) |
| SOL14-P-150-1.27     | : 0.12 g (typ.) |
| TSSOP14-P-0044-0.65A | : 0.06 g (typ.) |
| VSSOP14-P-0030-0.50  | : 0.02 g (typ.) |

## Pin Assignment



## IEC Logic Symbol



## Truth Table

| A | B | Y |
|---|---|---|
| L | L | L |
| L | H | L |
| H | L | L |
| H | H | H |

## 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        | $I_{OK}$  | $\pm 20$               | mA          |
| DC output current           | $I_{OUT}$ | $\pm 25$               | mA          |
| DC $V_{CC}$ /ground current | $I_{CC}$  | $\pm 50$               | mA          |
| Power dissipation           | $P_D$     | 180                    | mW          |
| Storage temperature         | $T_{stg}$ | -65 to 150             | $^{\circ}C$ |

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 ( $V_{CC} = 3.3 \pm 0.3$ V)<br>0 to 20 ( $V_{CC} = 5 \pm 0.5$ 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  $V_{CC}$  or GND.

## Electrical Characteristics

### DC Characteristics

| Characteristics           | Symbol     | Test Condition                  | $T_a = 25^\circ\text{C}$   |                             |                   |                             | $T_a = -40$ to $85^\circ\text{C}$ |                             | Unit              |   |   |
|---------------------------|------------|---------------------------------|----------------------------|-----------------------------|-------------------|-----------------------------|-----------------------------------|-----------------------------|-------------------|---|---|
|                           |            |                                 | $V_{CC}$ (V)               | Min                         | Typ.              | Max                         | Min                               | Max                         |                   |   |   |
| High-level input voltage  | $V_{IH}$   | —                               | 2.0<br>3.0 to 5.5          | 1.50<br>$V_{CC} \times 0.7$ | —<br>—            | —<br>—                      | 1.50<br>$V_{CC} \times 0.7$       | —<br>—                      | V                 |   |   |
| Low-level input voltage   | $V_{IL}$   | —                               | 2.0<br>3.0 to 5.5          | —<br>—                      | —<br>—            | 0.50<br>$V_{CC} \times 0.3$ | —<br>—                            | 0.50<br>$V_{CC} \times 0.3$ | V                 |   |   |
| High-level output voltage | $V_{OH}$   | $V_{IN} = V_{IH}$               | $I_{OH} = -50 \mu\text{A}$ | 2.0<br>3.0<br>4.5           | 1.9<br>2.9<br>4.4 | 2.0<br>3.0<br>4.5           | —<br>—<br>—                       | 1.9<br>2.9<br>4.4           | —<br>—<br>—       | V |   |
|                           |            |                                 | $I_{OH} = -4 \text{ mA}$   | 3.0<br>4.5                  | 2.58<br>3.94      | —<br>—                      | —<br>—                            | 2.48<br>3.80                | —<br>—            |   |   |
|                           |            |                                 | $I_{OL} = 50 \mu\text{A}$  | 2.0<br>3.0<br>4.5           | —<br>—<br>—       | 0.0<br>0.0<br>0.0           | 0.1<br>0.1<br>0.1                 | —<br>—<br>—                 | 0.1<br>0.1<br>0.1 |   | V |
|                           |            |                                 | $I_{OL} = 4 \text{ mA}$    | 3.0<br>4.5                  | —<br>—            | —<br>—                      | 0.36<br>0.36                      | —<br>—                      | 0.44<br>0.44      |   |   |
| $I_{OL} = 8 \text{ mA}$   | 3.0<br>4.5 | —<br>—                          | —<br>—                     | 0.36<br>0.36                | —<br>—            | 0.44<br>0.44                |                                   |                             |                   |   |   |
| Input leakage current     | $I_{IN}$   | $V_{IN} = 5.5 \text{ V}$ or GND | 0 to 5.5                   | —                           | —                 | $\pm 0.1$                   | —                                 | $\pm 1.0$                   | $\mu\text{A}$     |   |   |
| Quiescent supply current  | $I_{CC}$   | $V_{IN} = V_{CC}$ or GND        | 5.5                        | —                           | —                 | 2.0                         | —                                 | 20.0                        | $\mu\text{A}$     |   |   |

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

| Characteristics               | Symbol           | Test Condition      |                     | Ta = 25°C |      |      | Ta = -40 to 85°C |      | Unit |
|-------------------------------|------------------|---------------------|---------------------|-----------|------|------|------------------|------|------|
|                               |                  | V <sub>CC</sub> (V) | C <sub>L</sub> (pF) | Min       | Typ. | Max  | Min              | Max  |      |
| Propagation delay time        | t <sub>pLH</sub> | 3.3 ± 0.3           | 15                  | —         | 6.2  | 8.8  | 1.0              | 10.5 | ns   |
|                               |                  |                     | 50                  | —         | 8.7  | 12.3 | 1.0              | 14.0 |      |
|                               | t <sub>pHL</sub> | 5.0 ± 0.5           | 15                  | —         | 4.3  | 5.9  | 1.0              | 7.0  |      |
|                               |                  |                     | 50                  | —         | 5.8  | 7.9  | 1.0              | 9.0  |      |
| Input capacitance             | C <sub>IN</sub>  | —                   |                     | —         | 4    | 10   | —                | 10   | pF   |
| Power dissipation capacitance | C <sub>PD</sub>  | (Note)              |                     | —         | 18   | —    | —                | —    | pF   |

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.

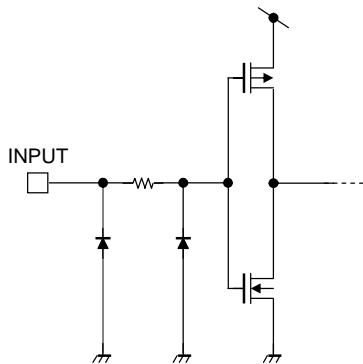
Average operating current can be obtained by the equation:

$$I_{CC (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/4 \text{ (per gate)}$$

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

| Characteristics                              | Symbol           | Test Condition         | Ta = 25°C           |      | Unit |       |
|--|------------------|------------------------|---------------------|------|------|-------|
|  |                  |                        | V <sub>CC</sub> (V) | Typ. |      | Limit |
| Quiet output maximum dynamic V <sub>OL</sub> | V <sub>OLP</sub> | C <sub>L</sub> = 50 pF | 5.0                 | 0.3  | 0.8  | V     |
| Quiet output minimum dynamic V <sub>OL</sub> | V <sub>OLV</sub> | C <sub>L</sub> = 50 pF | 5.0                 | -0.3 | -0.8 | V     |
| Minimum high level dynamic input voltage     | V <sub>IHD</sub> | C <sub>L</sub> = 50 pF | 5.0                 | —    | 3.5  | V     |
| Maximum low level dynamic input voltage      | V <sub>ILD</sub> | C <sub>L</sub> = 50 pF | 5.0                 | —    | 1.5  | V     |

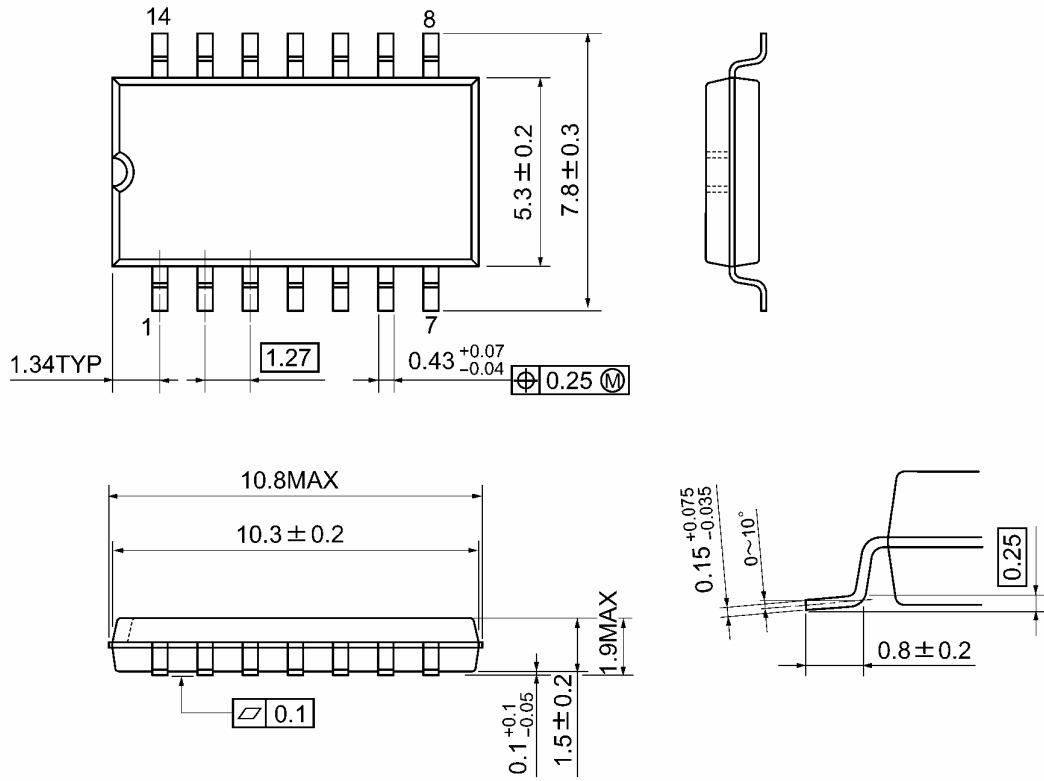
### Input Equivalent Circuit



## Package Dimensions

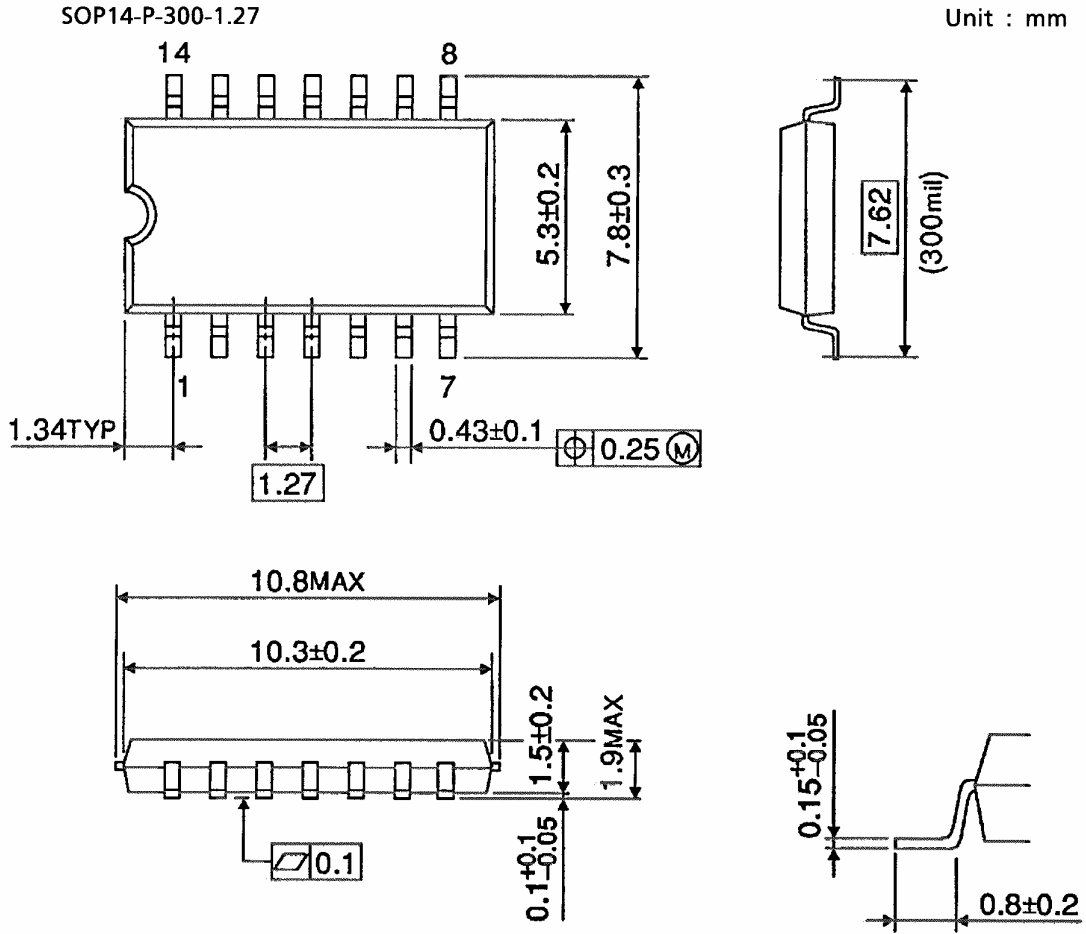
SOP14-P-300-1.27A

Unit: mm



Weight: 0.18 g (typ.)

## Package Dimensions

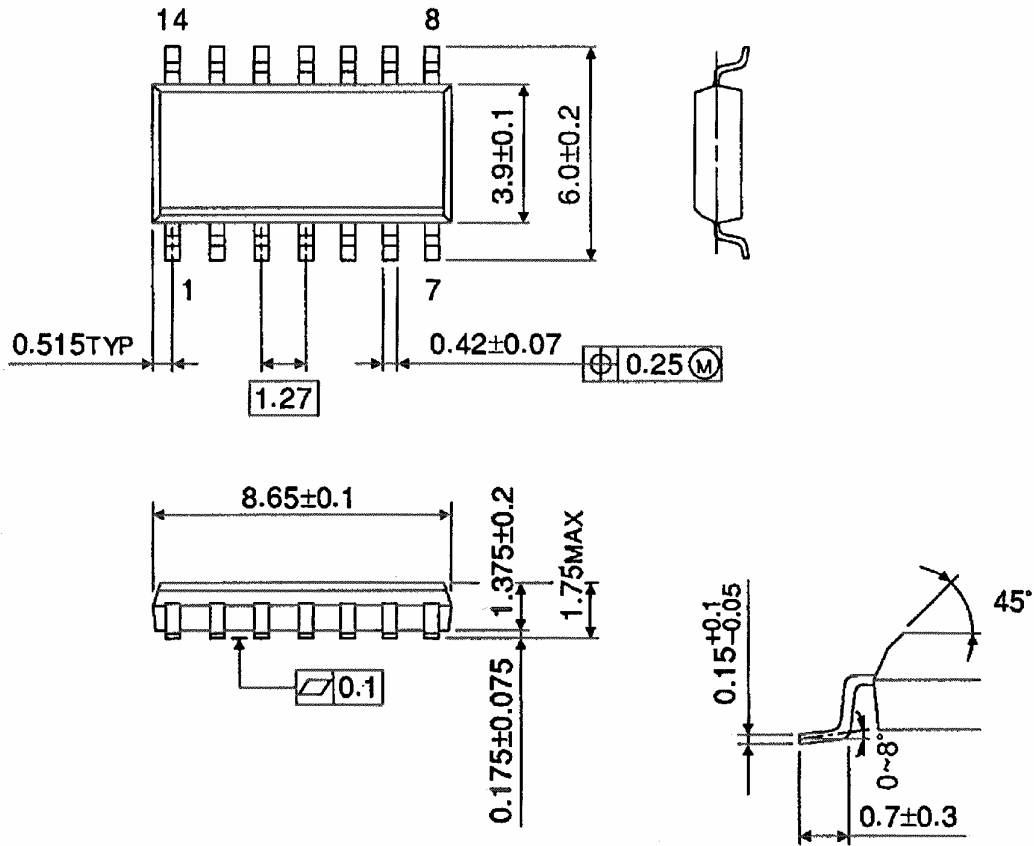


Weight: 0.18 g (typ.)

## Package Dimensions (Note)

SOL14-P-150-1.27

Unit : mm



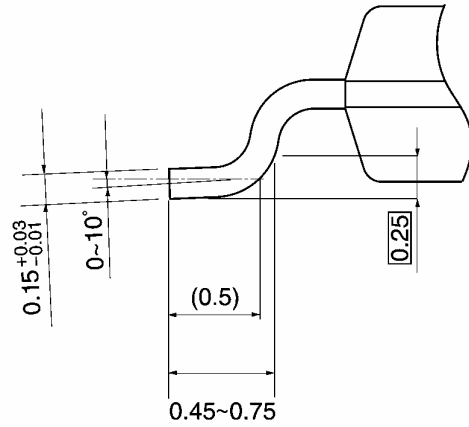
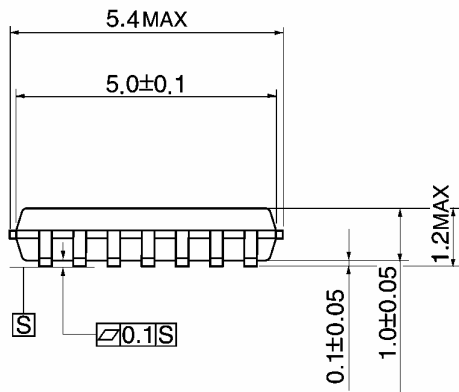
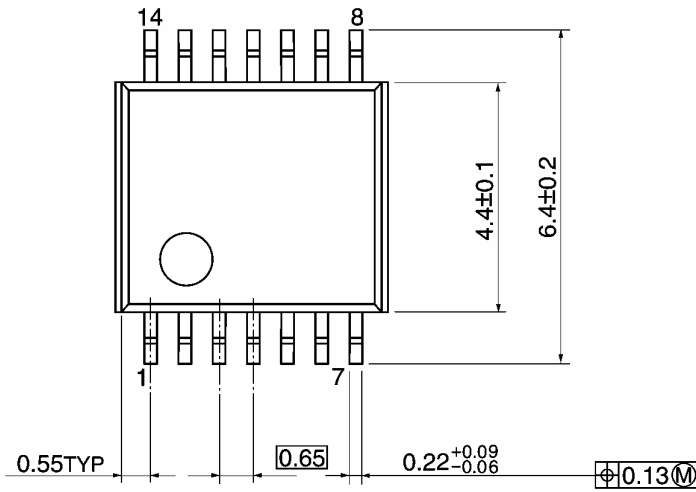
Note: This package is not available in Japan.

Weight: 0.12 g (typ.)

## Package Dimensions

TSSOP14-P-0044-0.65A

Unit: mm



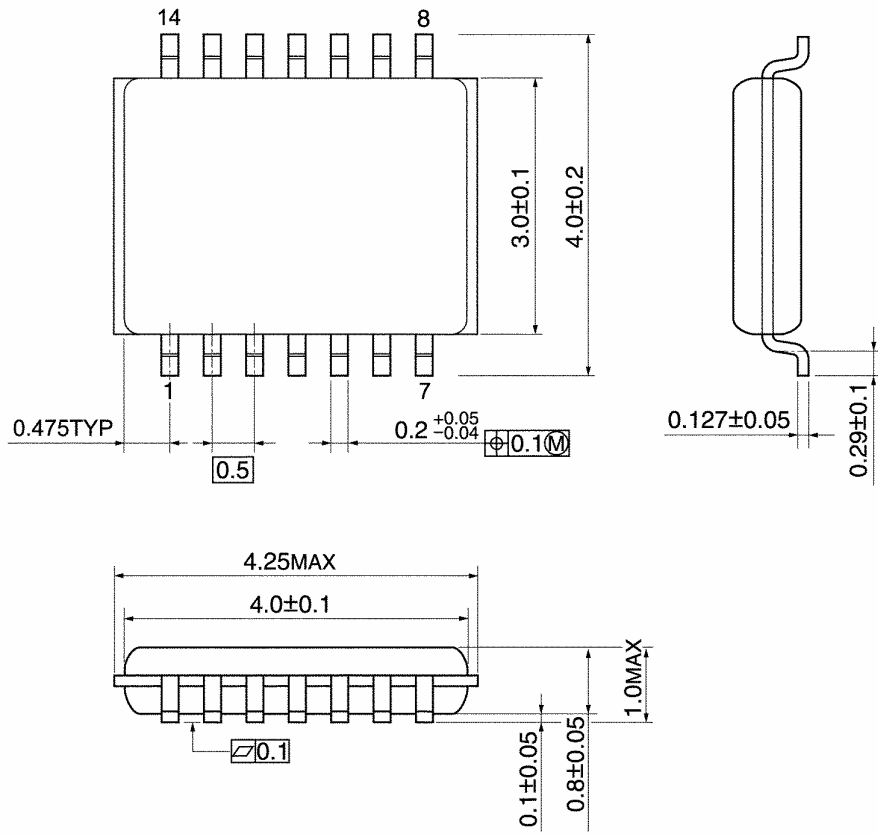
Weight: 0.06 g (typ.)



**Package Dimensions**

VSSOP14-P-0030-0.50

Unit: mm



Weight: 0.02 g (typ.)

**Note: Lead (Pb)-Free Packages****SOP14-P-300-1.27A SOL14-P-150-1.27 TSSOP14-P-0044-0.65A VSSOP14-P-0030-0.50****RESTRICTIONS ON PRODUCT USE**

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