

TC74VHC257F, TC74VHC257FN, TC74VHC257FT, TC74VHC257FK

Quad 2-Channel Multiplexer (3-state)

The TC74VHC257 is an advanced high speed CMOS MULTIPLEXER fabricated with silicon gate C²MOS technology.

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

It is composed of four independent 2-channel multiplexers with common SELECT and OUTPUT ENABLE (OE).

If OE is set low, the outputs are held in a high-impedance state. When SELECT is set low, "A" data inputs are enabled.

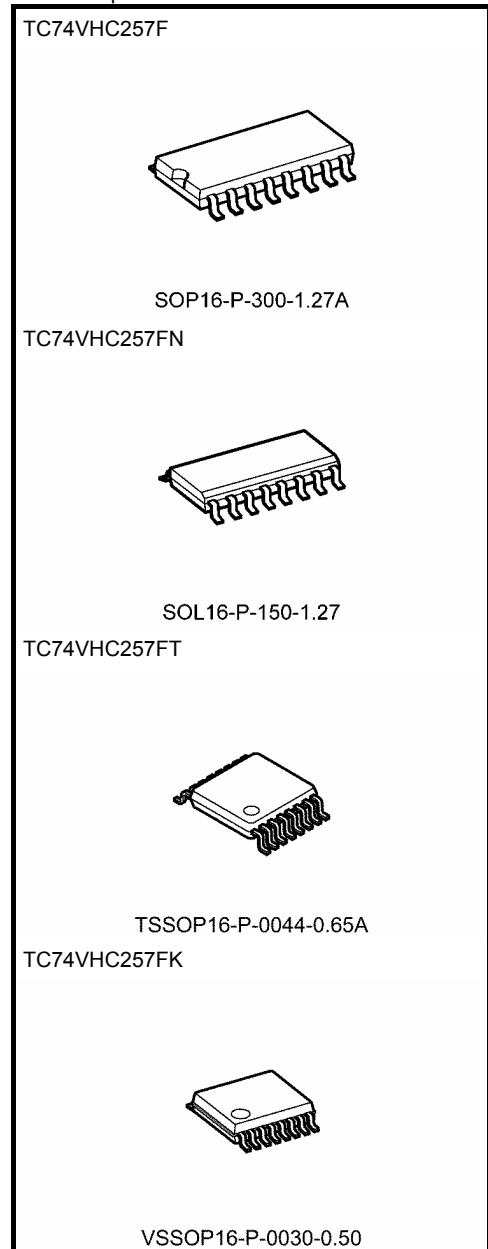
Conversely, when SELECT is high, "B" data inputs are enabled.

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

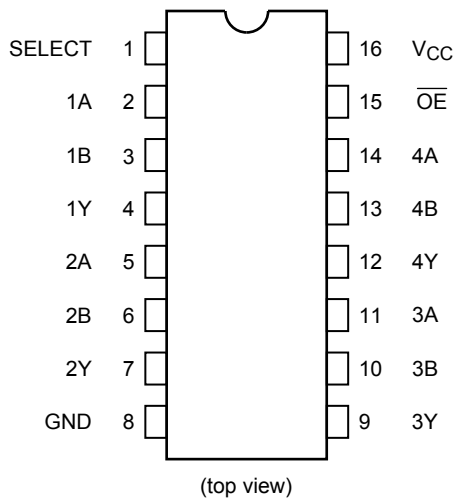
- High speed: $t_{pd} = 3.6 \text{ ns (typ.)}$ at $V_{CC} = 5 \text{ V}$
- Low power dissipation: $I_{CC} = 4 \mu\text{A (max)}$ at $T_a = 25^\circ\text{C}$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (min)}$
- Power down protection is provided on all inputs.
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range: $V_{CC (opr)} = 2 \text{ to } 5.5 \text{ V}$
- Low noise: $V_{OLP} = 0.8 \text{ V (max)}$
- Pin and function compatible with 74ALS257

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

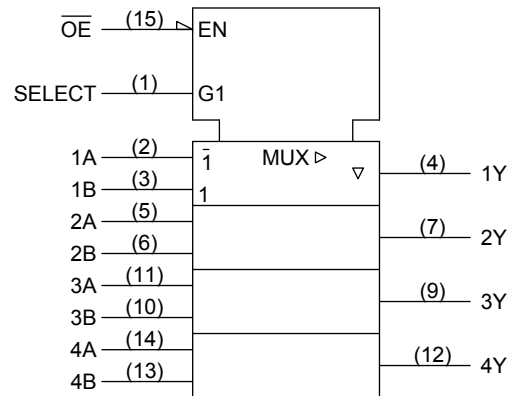


| | |
|----------------------|-----------------|
| Weight | |
| SOP16-P-300-1.27A | : 0.18 g (typ.) |
| SOL16-P-150-1.27 | : 0.13 g (typ.) |
| TSSOP16-P-0044-0.65A | : 0.06 g (typ.) |
| VSSOP16-P-0030-0.50 | : 0.02 g (typ.) |

Pin Assignment



IEC Logic Symbol



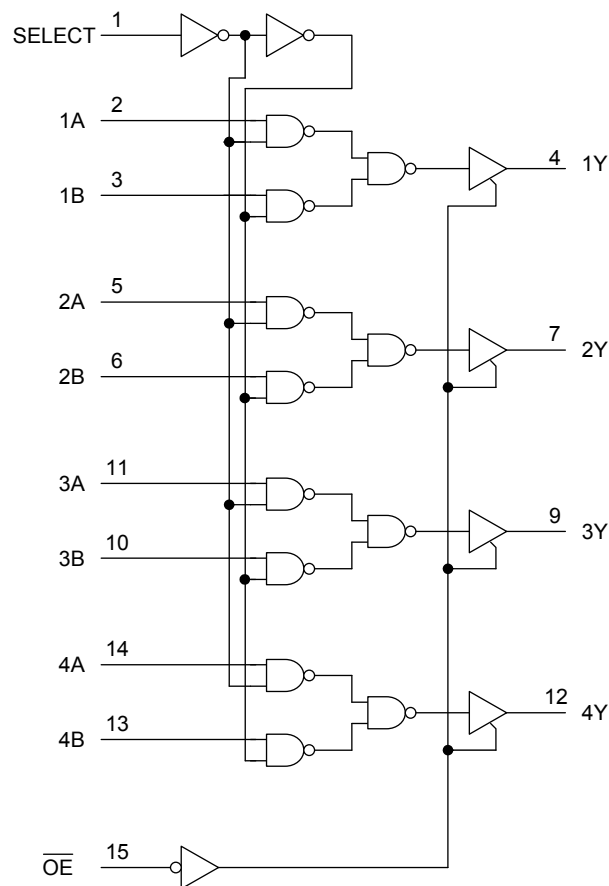
Truth Table

| Inputs | | | | Output |
|-----------------|--------|---|---|--------|
| \overline{OE} | SELECT | A | B | |
| H | X | X | X | Z |
| L | L | L | X | L |
| L | L | H | X | H |
| L | H | X | L | L |
| L | H | X | H | H |

X: Don't care

Z: High impedance

System Diagram



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} | ± 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.

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).

Operating Ranges (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) 0 to 20 ($V_{CC} = 5 \pm 0.5$ V) | ns/V |

Note 1: The operating ranges must be maintained 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°C | | Unit | | |
|----------------------------------|----------|--|----------------------------|-----------------------------|--------|-----------------------------------|-----------------------------|-----------------------------|---------------|---|
| | | | V_{CC} (V) | Min | Typ. | Max | Min | | Max | |
| High-level input voltage | V_{IH} | — | 2.0 3.0 to 5.5 | 1.50 $V_{CC} \times 0.7$ | — — | — — | 1.50 $V_{CC} \times 0.7$ | — — | V | |
| Low-level input voltage | V_{IL} | — | 2.0 3.0 to 5.5 | — — | — — | 0.50 $V_{CC} \times 0.3$ | — — | 0.50 $V_{CC} \times 0.3$ | V | |
| High-level output voltage | V_{OH} | $V_{IN} = V_{IH}$ or V_{IL} | $I_{OH} = -50 \mu\text{A}$ | 2.0 | 1.9 | 2.0 | — | 1.9 | — | V |
| | | | | 3.0 | 2.9 | 3.0 | — | 2.9 | — | |
| | | | $I_{OH} = -4$ mA | 4.5 | 4.4 | 4.5 | — | 4.4 | — | |
| | | | | 3.0 | 2.58 | — | — | 2.48 | — | |
| Low-level output voltage | V_{OL} | $V_{IN} = V_{IH}$ or V_{IL} | $I_{OL} = 50 \mu\text{A}$ | 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 | |
| Low-level output voltage | V_{OL} | $V_{IN} = V_{IH}$ or V_{IL} | $I_{OL} = 4$ mA | 3.0 | — | — | 0.36 | — | 0.44 | V |
| | | | | 4.5 | — | — | 0.36 | — | 0.44 | |
| | | | | 3.0 | — | — | 0.36 | — | 0.44 | |
| 3-state output off-state current | I_{OZ} | $V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = V_{CC}$ 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: $t_r = t_f = 3 \text{ ns}$)

| 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 (A, B-Y) | t _{pLH} | — | 3.3 ± 0.3 | 15 | — | 5.8 | 9.3 | 1.0 | 11.0 | ns |
| | | | | 50 | — | 8.3 | 12.8 | 1.0 | 14.5 | |
| | 5.0 ± 0.5 | | 15 | — | 3.6 | 5.9 | 1.0 | 7.0 | | |
| | | | 50 | — | 5.1 | 7.9 | 1.0 | 9.0 | | |
| Propagation delay time (SELECT-Y) | t _{pLH} | — | 3.3 ± 0.3 | 15 | — | 7.0 | 11.0 | 1.0 | 13.0 | ns |
| | | | | 50 | — | 9.5 | 14.5 | 1.0 | 16.5 | |
| | 5.0 ± 0.5 | | 15 | — | 4.0 | 6.8 | 1.0 | 8.0 | | |
| | | | 50 | — | 5.5 | 8.8 | 1.0 | 10.0 | | |
| 3-state output enable time | t _{pZL} | R _L = 1 kΩ | 3.3 ± 0.3 | 15 | — | 6.7 | 10.5 | 1.0 | 12.5 | ns |
| | | | | 50 | — | 9.2 | 14.0 | 1.0 | 16.0 | |
| | 5.0 ± 0.5 | | 15 | — | 3.6 | 6.8 | 1.0 | 8.0 | | |
| | | | 50 | — | 5.1 | 8.8 | 1.0 | 10.0 | | |
| 3-state output disable time | t _{pLZ} t _{pHZ} | R _L = 1 kΩ | 3.3 ± 0.3 | 50 | — | 8.6 | 12.0 | 1.0 | 13.5 | ns |
| | | | 5.0 ± 0.5 | 50 | — | 5.7 | 7.9 | 1.0 | 9.0 | |
| Input capacitance | C _{IN} | — | — | — | 4 | 10 | — | 10 | pF | |
| Output capacitance | C _{OUT} | — | — | — | 6 | — | — | — | pF | |
| Power dissipation capacitance | C _{PD} | (Note) | — | — | 23 | — | — | — | pF | |

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

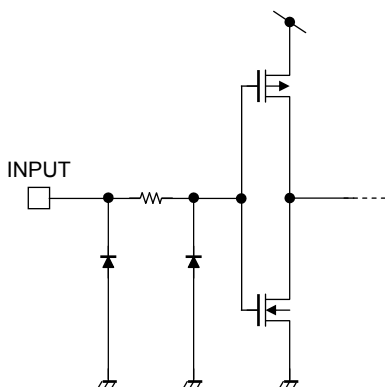
Average operating current can be obtained by the equation:

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

Noise Characteristics (input: $t_r = t_f = 3 \text{ ns}$)

| Characteristics | Symbol | Test Condition | Ta = 25°C | | | Unit |
|--|------------------|------------------------|---------------------|------|------|------|
| | | | V _{CC} (V) | Typ. | Max | |
| Quiet output maximum dynamic V _{OL} | V _{OLP} | C _L = 50 pF | 5.0 | 0.3 | 0.8 | V |
| Quiet output minimum dynamic V _{OL} | V _{OLV} | C _L = 50 pF | 5.0 | -0.3 | -0.8 | 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 |

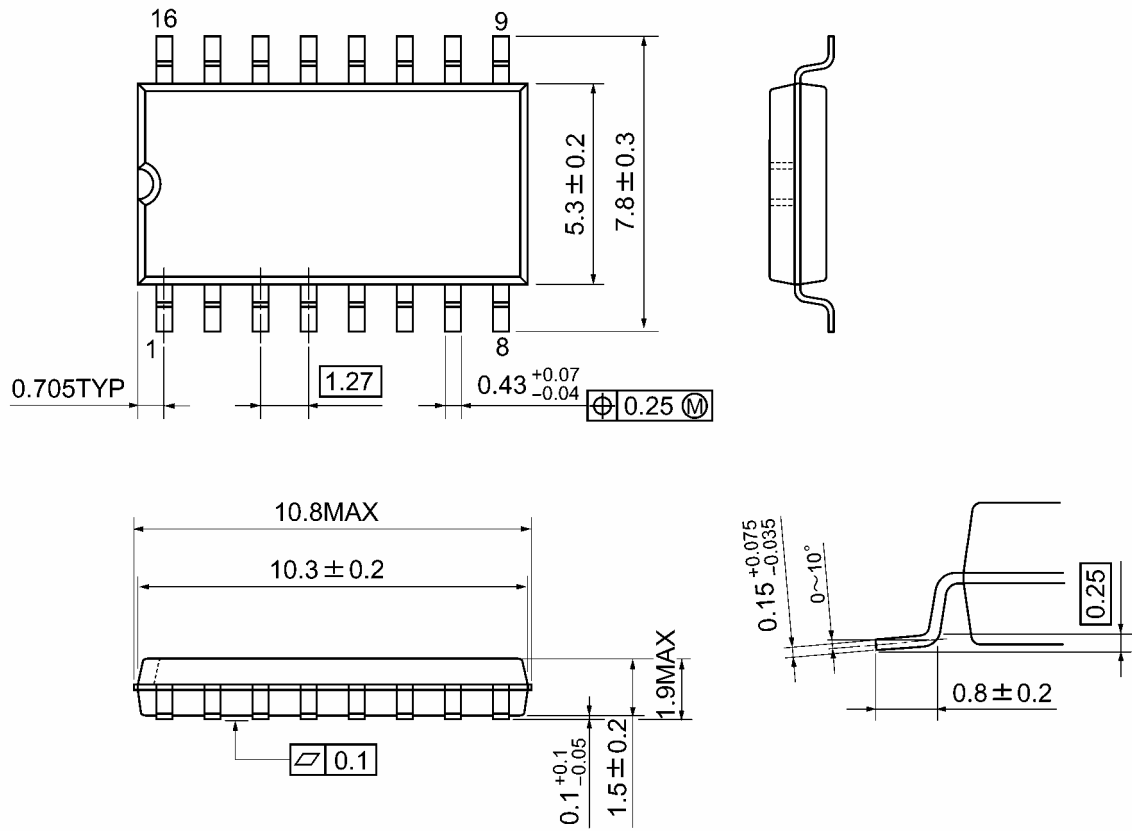
Input Equivalent Circuit



Package Dimensions

SOP16-P-300-1.27A

Unit: mm

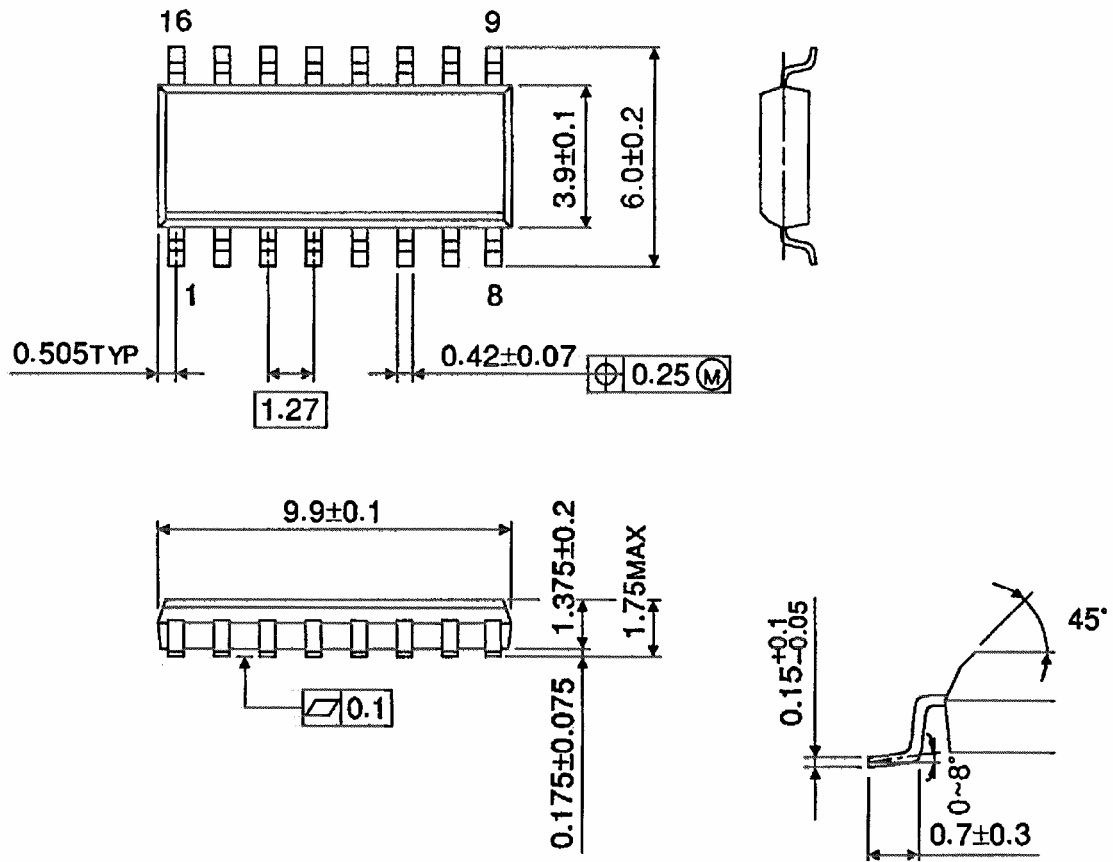


Weight: 0.18 g (typ.)

Package Dimensions (Note)

SOL16-P-150-1.27

Unit : mm



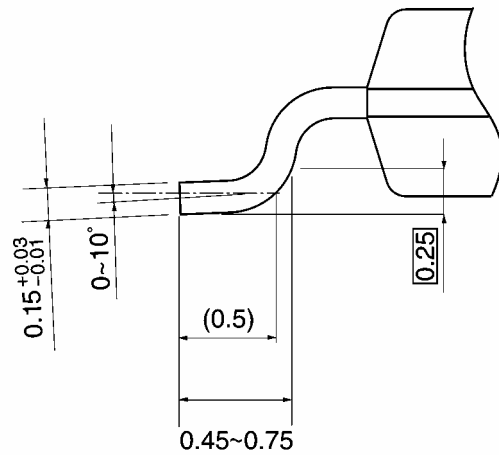
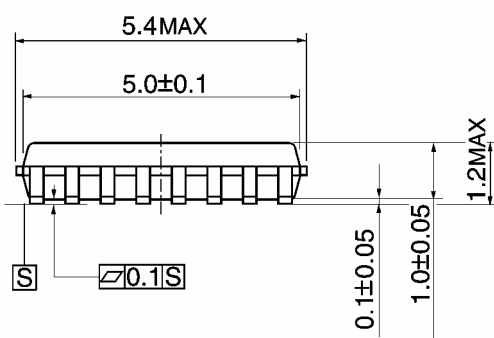
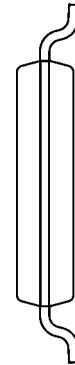
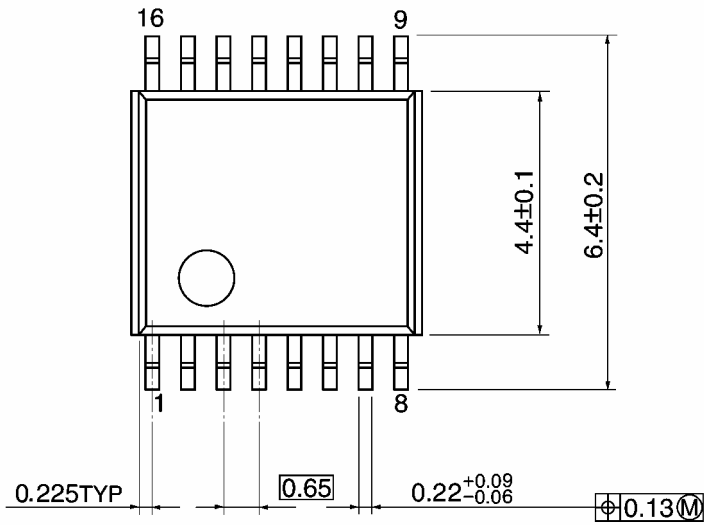
Note: This package is not available in Japan.

Weight: 0.13 g (typ.)

Package Dimensions

TSSOP16-P-0044-0.65A

Unit: mm

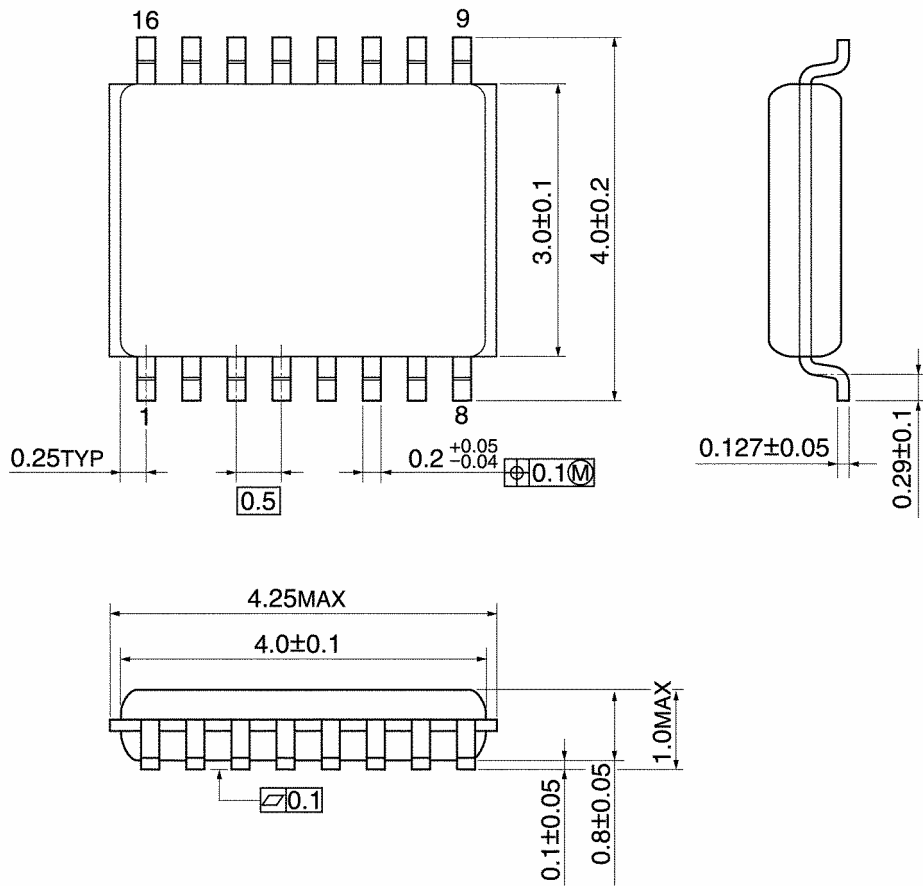


Weight: 0.06 g (typ.)

Package Dimensions

VSSOP16-P-0030-0.50

Unit: mm



Weight: 0.02 g (typ.)

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20070701-EN GENERAL

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