

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

## TC7MB3125CFT, TC7MB3125CFK, TC7MB3125CFTG TC7MB3126CFT, TC7MB3126CFK, TC7MB3126CFTG

### Low Capacitance Quad Bus Switch

The TC7MB3125C,3126C is a Low Voltage/Low Capacitance CMOS 4bit Bus Switch. The low on-resistance of the switch allows connections to be made with minimal propagation delay time.

The TC7MB3125C requires the output enable ( $\overline{OE}$ ) input to be set high to place the output into the high impedance state, whereas the TC7MB3126C requires the output enable (OE) input to be set low to place the output into the high impedance.

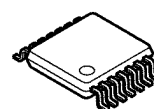
All inputs are equipped with protection circuits against static discharge.

### Features

- Operating voltage:  $V_{CC} = 4.0 \sim 5.5 \text{ V}$
- On-capacitance:  $C_{I/O} = 7\text{pF}$  Switch On (typ.)@ $V_{CC}=5\text{V}$
- On-resistance:  $R_{ON} = 3 \Omega$  (typ.)@ $V_{CC}=4.5 \text{ V}$ ,  $V_{IS}=0 \text{ V}$
- ESD performance: Machine model  $\geq \pm 200 \text{ V}$   
Human body model  $\geq \pm 2000 \text{ V}$
- Compatible with TTL outputs (control inputs)
- Power-down protection for inputs ( $\overline{OE}$  and I/O)
- Package: TSSOP14, VSSOP14 (US14), VQON16

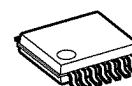
Note: When mounting VQON package, the type of recommended flux is RA or RMA.

TC7MB3125CFT, TC7MB3126CFT

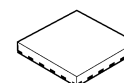


TSSOP14-P-0044-0.65A

TC7MB3125CFK, TC7MB3126CFK



VSSOP14-P-0030-0.50  
TC7MB3125CFTG, TC7MB3126CFTG



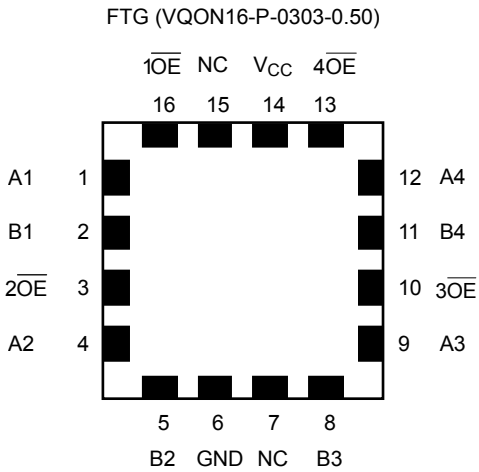
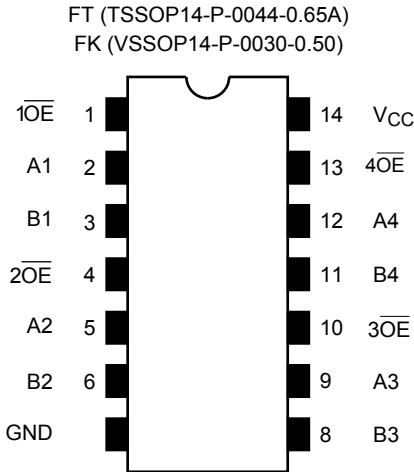
VQON16-P-0303-0.50

Weight

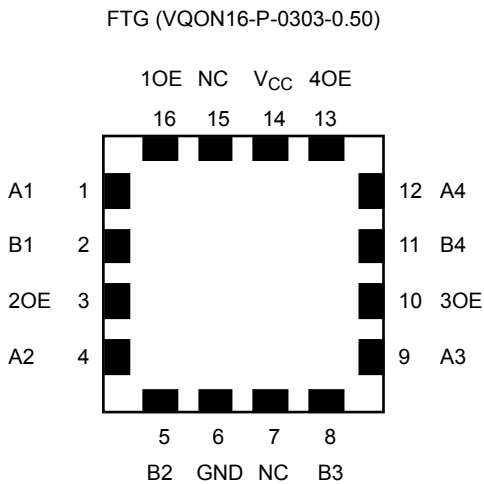
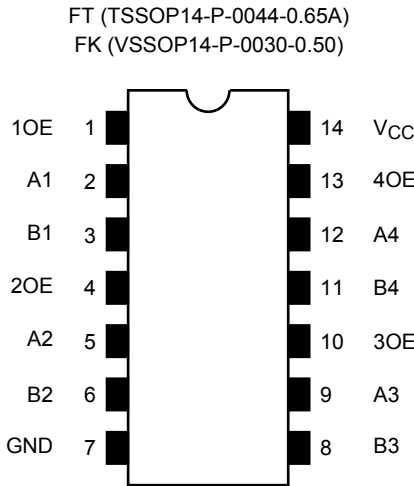
|                      |                  |
|----------------------|------------------|
| TSSOP14-P-0044-0.65A | : 0.06 g (typ.)  |
| VSSOP14-P-0030-0.50  | : 0.02 g (typ.)  |
| VQON16-P-0303-0.50   | : 0.013 g (typ.) |

Pin Assignment (top view)

TC7MB3125C



TC7MB3126C

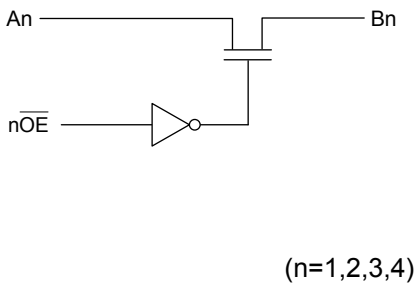


Truth Table

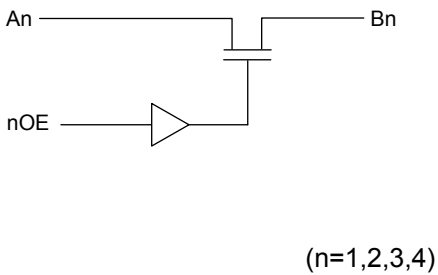
| Inputs (3125C)  | Inputs (3126C) | Function        |
|-----------------|----------------|-----------------|
| $\overline{OE}$ | OE             |                 |
| L               | H              | A port = B port |
| H               | L              | Disconnect      |

System Diagram

TC7MB3125C



TC7MB3126C



## Absolute Maximum Ratings (Note)

| Characteristic                                    | Symbol           | Rating    | Unit |
|---------------------------------------------------|------------------|-----------|------|
| Power supply range                                | $V_{CC}$         | -0.5~7    | V    |
| Control pin input voltage ( $\overline{OE}$ , OE) | $V_{IN}$         | -0.5~7    | V    |
| Switch terminal I/O voltage                       | $V_S$            | -0.5~7    | V    |
| Clump diode current                               | $I_{IK}$         | -50       | mA   |
| Switch I/O current                                | $I_S$            | 50        | mA   |
| Power dissipation                                 | $P_D$            | 180       | mW   |
| DC $V_{CC}$ /GND current                          | $I_{CC}/I_{GND}$ | $\pm 100$ | mA   |
| Storage temperature                               | $T_{stg}$        | -65~150   | °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)

| Characteristic                                    | Symbol    | Rating  | Unit |
|---------------------------------------------------|-----------|---------|------|
| Power supply voltage                              | $V_{CC}$  | 4.0~5.5 | V    |
| Control pin input voltage ( $\overline{OE}$ , OE) | $V_{IN}$  | 0~5.5   | V    |
| Switch I/O voltage                                | $V_S$     | 0~5.5   | V    |
| Operating temperature                             | $T_{opr}$ | -40~85  | °C   |
| Input rise and fall time                          | dt/dv     | 0~10    | ns/V |

Note: The operating ranges must be maintained to ensure the normal operation of the device.

Unused control pin inputs must be tied to either  $V_{CC}$  or GND.

Leave unused switch I/O pins open.

## Electrical Characteristics

## DC Characteristics (Ta = -40~85°C)

| Characteristics                                  |                 | Symbol                  | Test Condition                                                                         | V <sub>CC</sub> (V) | Min | Typ. | Max  | Unit |
|--------------------------------------------------|-----------------|-------------------------|----------------------------------------------------------------------------------------|---------------------|-----|------|------|------|
| Input voltage<br>( $\overline{OE}$ , OE)         | "H" level       | V <sub>IH</sub>         | —                                                                                      | 4.0~5.5             | 2.0 | —    | —    | V    |
|                                                  | "L" level       | V <sub>IL</sub>         | —                                                                                      | 4.0~5.5             | —   | —    | 0.8  |      |
| Input leakage current<br>( $\overline{OE}$ , OE) |                 | I <sub>IN</sub>         | V <sub>IN</sub> = 0~5.5 V                                                              | 4.0~5.5             | —   | —    | ±1.0 | μA   |
| Power-off leakage current                        |                 | I <sub>OFF</sub>        | $\overline{OE}$ , OE, A, B = 0~5.5 V                                                   | 0                   | —   | —    | 10   | μA   |
| Off-state leakage current<br>(switch off)        |                 | I <sub>SZ</sub>         | A, B = 0~V <sub>CC</sub> ,<br>$\overline{OE}$ = V <sub>CC</sub> (3125C), OE=GND(3126C) | 4.0~5.5             | —   | —    | ±1.0 | μA   |
| On resistance<br>(Note2)                         | R <sub>ON</sub> | V <sub>IS</sub> = 0 V   | I <sub>IS</sub> = 30 mA (Note1)                                                        | 4.5                 | —   | 3    | 7    | Ω    |
|                                                  |                 |                         |                                                                                        | 4.5                 | —   | 5    | 15   |      |
|                                                  |                 | V <sub>IS</sub> = 2.4 V | I <sub>IS</sub> = 15 mA (Note1)                                                        | 4.0                 | —   | 9    | 20   |      |
| Quiescent supply current                         |                 | I <sub>CC</sub>         | V <sub>IN</sub> = V <sub>CC</sub> or GND, I <sub>OUT</sub> = 0 V                       | 5.5                 | —   | —    | 10   | μA   |
| Increase in I <sub>CC</sub> per input            |                 | ΔI <sub>CC</sub>        | V <sub>IN</sub> = 3.4V (one input)                                                     | 5.5                 | —   | —    | 500  | μA   |

Note1: All typical values are at Ta=25°C.

Note2: Measured by the voltage drop between A and B pins at the indicated current through the switch.  
On resistance is determined by the lower of the voltages on the two (A or B) pins.

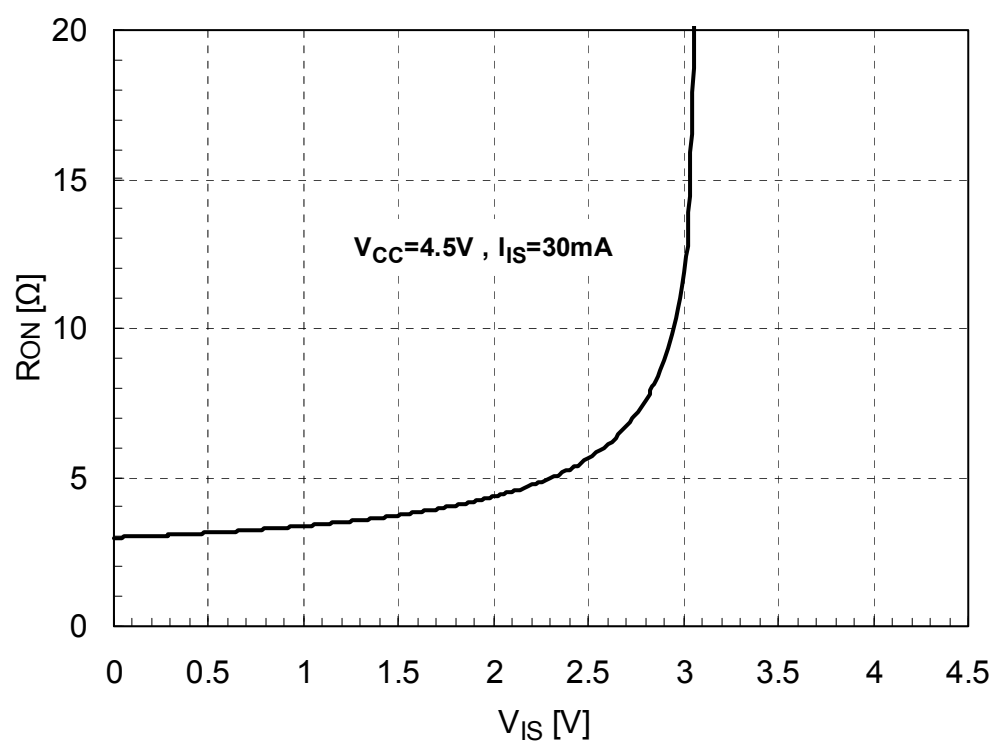
## AC Characteristics (Ta = -40~85°C)

| Characteristics     |  | Symbol           | Test Condition     | V <sub>CC</sub> (V) | Min | Max | Unit |
|---------------------|--|------------------|--------------------|---------------------|-----|-----|------|
| Output enable time  |  | t <sub>pZL</sub> | Figure 1, Figure 2 | 4.5                 | —   | 6   | ns   |
|                     |  | t <sub>pZH</sub> |                    |                     |     |     |      |
| Output disable time |  | t <sub>pLZ</sub> | Figure 1, Figure 2 | 4.5                 | —   | 6   | ns   |
|                     |  | t <sub>pHZ</sub> |                    |                     |     |     |      |

## Capacitive Characteristics (Ta = 25°C)

| Characteristics                 |  | Symbol           | Test Condition                                                                           | V <sub>CC</sub> (V) | Typ. | Unit |
|---------------------------------|--|------------------|------------------------------------------------------------------------------------------|---------------------|------|------|
| Control pin input capacitance   |  | C <sub>IN</sub>  | V <sub>IN</sub> = 0 V (Note)                                                             | 5.0                 | 5    | pF   |
| Switch OFF terminal capacitance |  | C <sub>I/O</sub> | V <sub>I/O</sub> = 0V, $\overline{OE}$ = V <sub>CC</sub> (3125C), OE = GND(3126C) (Note) | 5.0                 | 4    | pF   |
| Switch ON terminal capacitance  |  | C <sub>I/O</sub> | V <sub>I/O</sub> = 0V, $\overline{OE}$ = GND(3125C), OE = V <sub>CC</sub> (3126C) (Note) | 5.0                 | 7    | pF   |

Note: This parameter is guaranteed by design

$R_{ON}$  -  $V_{IS}$  Curve (Typ.)  $T_a = 25^\circ\text{C}$ 

AC Test Circuit

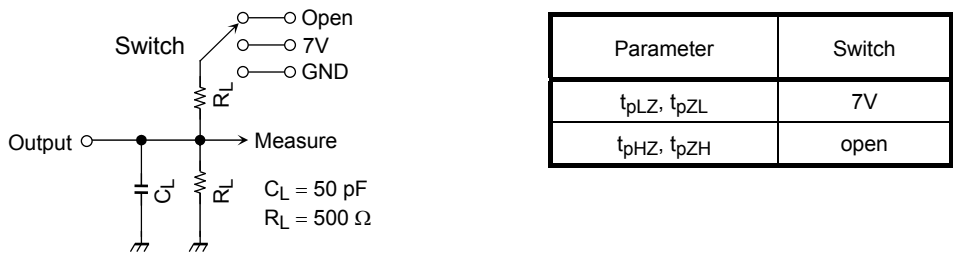


Figure 1

AC Waveform

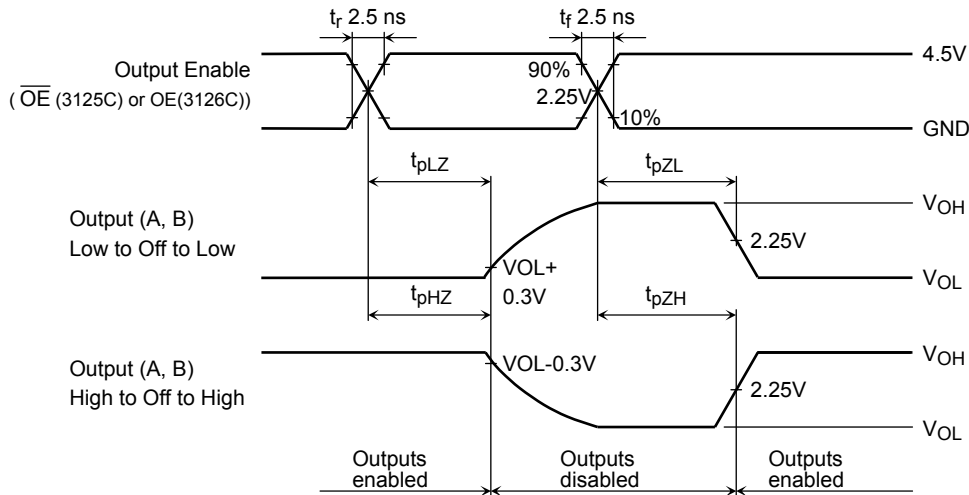


Figure 2  $t_{pLZ}, t_{pHZ}, t_{pZL}, t_{pZH}$

## Rise and Fall Times (tr / tf) of the TC7MB3125C, 3126C I/O Signals

The tr(out) and tf(out) values of the output signals are affected by the CR time constant of the input, which consists of the switch terminal capacitance (C<sub>I/O</sub>) and the on-resistance (R<sub>ON</sub>) of the input.

In practice, the tr(out) and tf(out) values are also affected by the circuit's capacitance and resistance components other than those of the TC7MB3125C, 3126C.

The tr / tf (out) values can be approximated as follows. (Figure 3 shows the test circuit.)

$$tr / tf \text{ out (approx)} = - (C_{I/O} + C_L) \cdot (R_{DRIVE} + R_{ON}) \cdot \ln \left( \frac{(V_{OH} - V_{OL}) - V_M}{(V_{OH} - V_{OL})} \right)$$

where, R<sub>DRIVE</sub> is the output impedance of the previous-stage circuit.

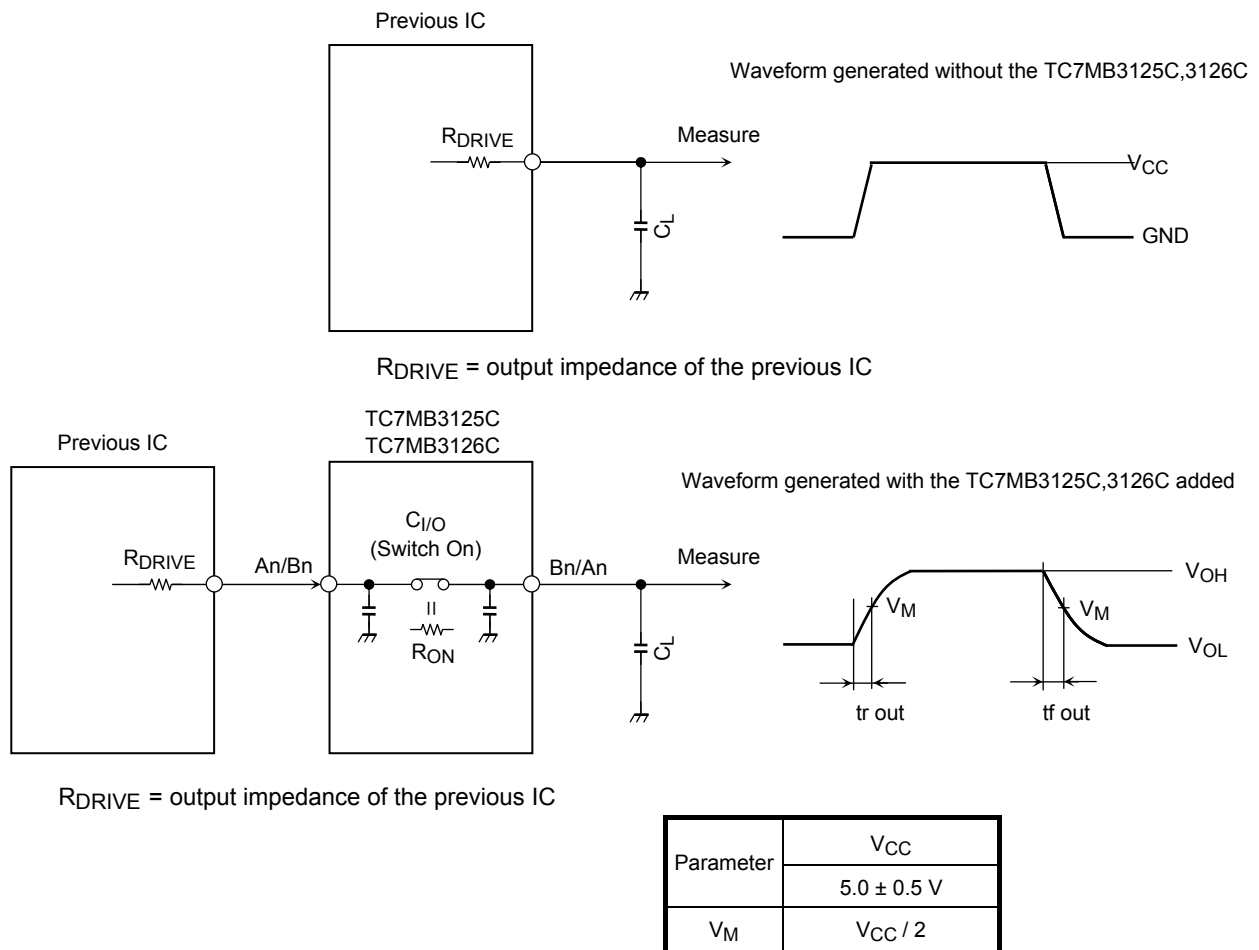
Calculation example:

$$tr \text{ out (approx)} = - (8 + 15) \times 10^{-12} \cdot (120 + 5.5) \cdot \ln \left( \frac{(4.5 - 0) - 2.25}{(4.5 - 0)} \right) \approx 2.0 \text{ ns}$$

Calculation conditions:

V<sub>CC</sub> = 4.5V, C<sub>L</sub> = 15pF, R<sub>DRIVE</sub> = 120Ω (output impedance of the previous IC), V<sub>M</sub> = 2.25V (V<sub>CC</sub> / 2)

Output of the previous IC = digital (i.e., high-level voltage = V<sub>CC</sub>; low-level voltage = GND)



**Figure 3 Test Circuit**

## TSSOP14-P-0044-0.65A

0.55TYP

1

7

14

8

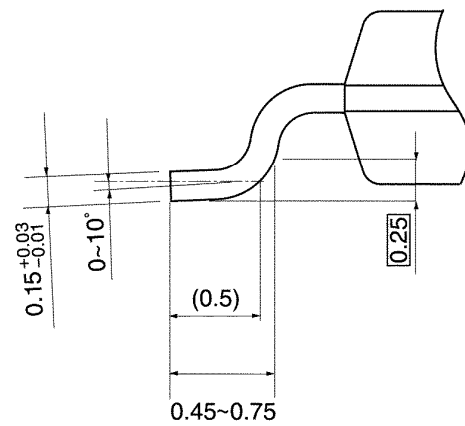
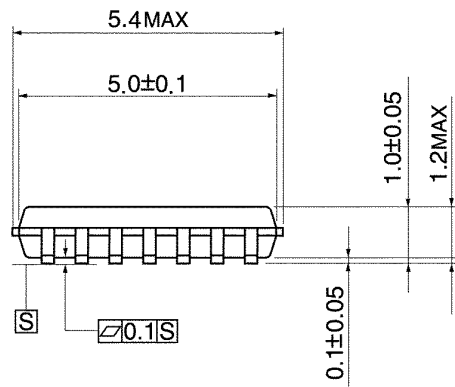
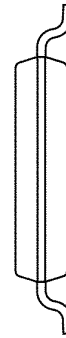
4.4±0.1

6.4±0.2

0.65

0.22<sup>+0.09</sup><sub>-0.06</sub>

⌀0.13(M)



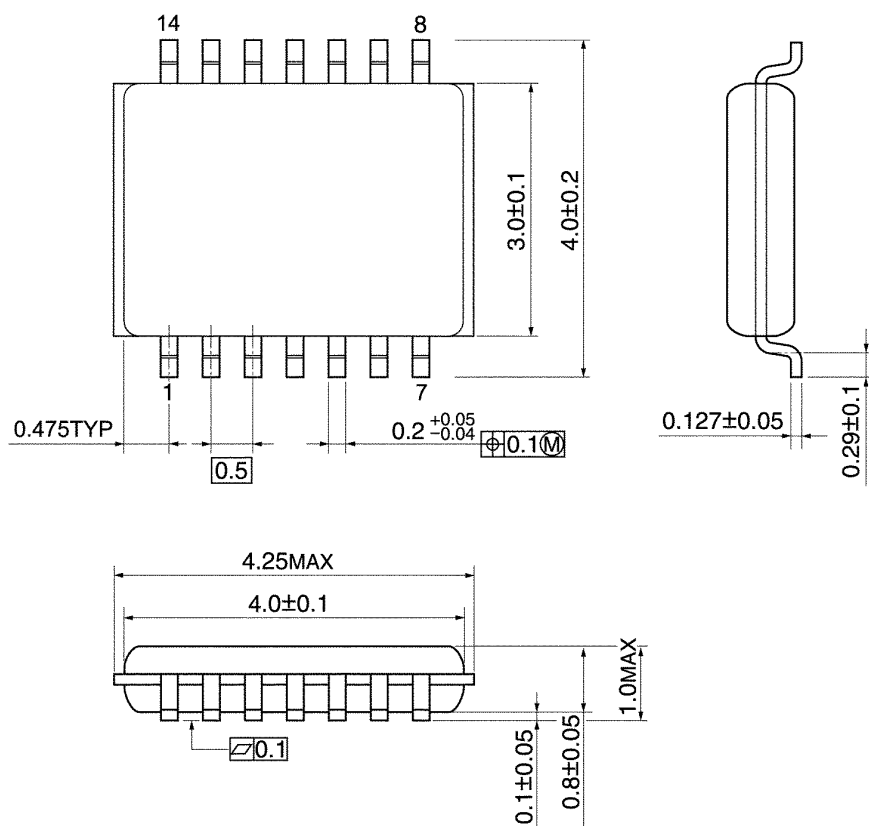
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## Package Dimensions

VSSOP14-P-0030-0.50

Unit: mm



Weight: 0.02 g (typ.)



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