

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7MBL6125SFT, TC7MBL6125SFK, TC7MBL6125SFTG
TC7MBL6126SFT, TC7MBL6126SFK, TC7MBL6126SFTG

Quad Low Voltage/Low Capacitance Bus Switch

TC7MBL6125S/6126S is low voltage CMOS 4-bit Bus Switch. The low on resistance of the switch allows connections to be made with minimal propagation delay and while maintaining CMOS low power dissipation.

The TC7MBL6125S requires the output enable (\overline{OE}) input to be set high to place the output into the high impedance state, whereas the TC7MBL6126S requires the output enable (OE) input to be set low to place the output into high impedance.

All inputs are equipped with protection circuits against static discharge.

Features

- Operating voltage: $V_{CC} = 1.65\sim 3.6\text{ V}$
- Low capacitance : $C_{I/O}=12\text{ pF}$ Switch On (typ.) @3 V
- Low on resistance: $R_{ON} = 9\ \Omega$ (typ.) @3 V
- ESD performance: Machine model $\geq \pm 200\text{ V}$
Human body model $\geq \pm 2000\text{ V}$
- Power down protection for inputs
- Package: TSSOP14,VSSOP (US14), VQON16

TC7MBL6125SFT, TC7MBL6126SFT



TSSOP14-P-0044-0.65A

TC7MBL6125SFK, TC7MBL6126SFK



VSSOP14-P-0030-0.50

TC7MBL6125SFTG, TC7MBL6126SFTG



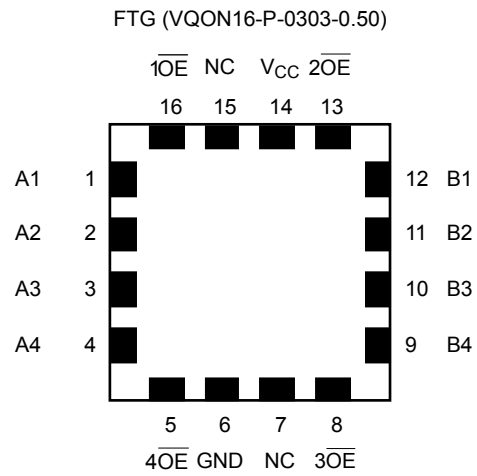
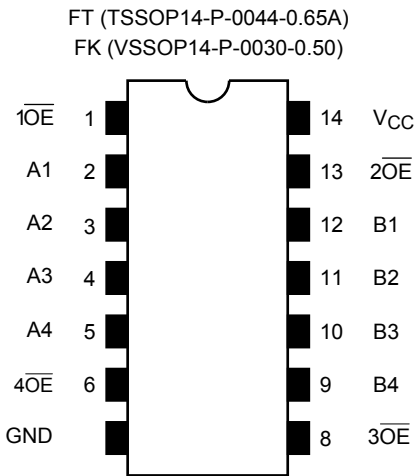
VQON16-P-0303-0.50

| | |
|----------------------|------------------|
| 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.) |

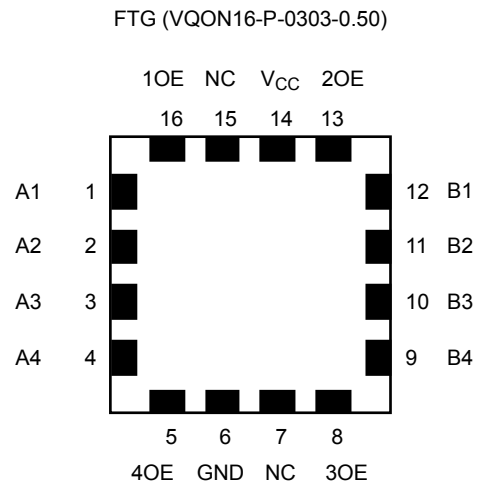
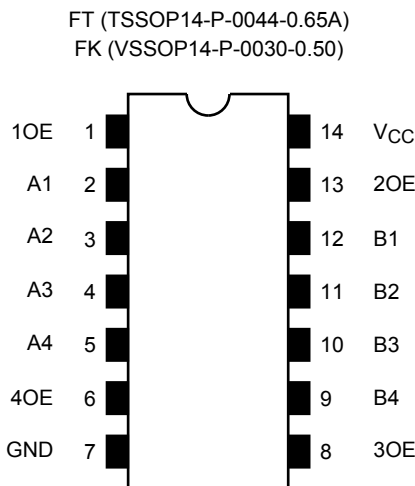
Note: When mounting VQON package, the type of recommended flux is RA or RMA.

Pin Assignment (top view)

TC7MBL6125S



TC7MBL6126S

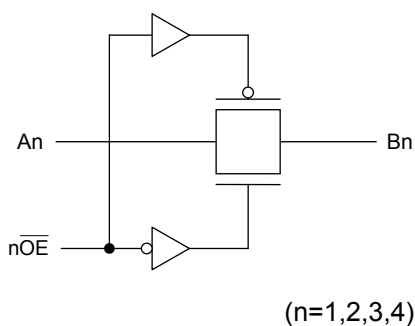


Truth Table

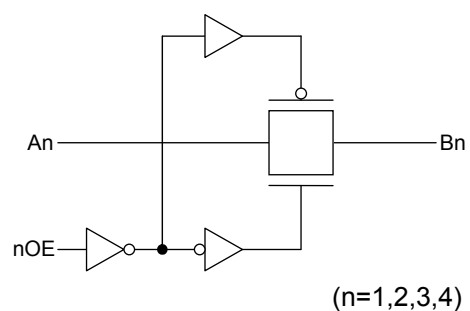
| Inputs (6125S) | Inputs (6126S) | Function |
|-----------------|----------------|-----------------|
| \overline{OE} | OE | |
| L | H | A port = B port |
| H | L | Disconnect |

System Diagram

TC7MBL6125S



TC7MBL6126S



Absolute Maximum Ratings (Note)

| Characteristic | | Symbol | Rating | Unit |
|-----------------------------|-------------------|------------------|----------------------|------|
| Power supply range | | V_{CC} | -0.5~4.6 | V |
| Control pin input voltage | | V_{IN} | -0.5~4.6 | V |
| Switch terminal I/O voltage | | V_S | -0.5~ $V_{CC} + 0.5$ | V |
| Clump diode current | Control input pin | I_{IK} | -50 | mA |
| | Switch terminal | | ±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} | ±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} | 1.65~3.6 | V |
| Control pin input voltage | | V_{IN} | 0~3.6 | V |
| Switch I/O voltage | | V_S | 0~ V_{CC} | 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 inputs must be tied to either VCC or GND.

Electrical Characteristics

DC Characteristics (Ta = -40~85°C)

| Parameter | | Symbol | Test Condition | V _{CC} (V) | Min | Typ. | Max | Unit |
|--|-----------|-----------------|--|---------------------|-----------------------|------|-----------------------|------|
| | | | | | | | | |
| Input voltage | "H" level | V _{IH} | — | 1.65~3.6 | 0.7 × V _{CC} | — | — | V |
| | "L" level | V _{IL} | — | 1.65~3.6 | — | — | 0.3 × V _{CC} | |
| Input leakage current (OE, S) | | | V _{IN} = 0~3.6V | 1.65~3.6 | — | — | ±1.0 | μA |
| Power off leakage current | | | \overline{OE} , OE = 0~3.6 V | 0 | — | — | 1.0 | μA |
| Off-state leakage current (switch off) | | | A, B = 0~V _{CC} , \overline{OE} = V _{CC} (6125S), OE=GND(6126S) | 1.65~3.6 | — | — | ±1.0 | μA |
| On resistance (Note2) | | | V _{IS} = 0 V, I _{IS} = 30 mA (Note1) | 3.0 | — | 9 | 13 | Ω |
| | | | V _{IS} = 3.0 V, I _{IS} = 30 mA (Note1) | 3.0 | — | 15 | 20 | |
| | | | V _{IS} = 2.4 V, I _{IS} = 15 mA (Note1) | 3.0 | — | 19 | 27 | |
| | | | V _{IS} = 0 V, I _{IS} = 24 mA (Note1) | 2.3 | — | 10 | 16 | |
| | | | V _{IS} = 2.3 V, I _{IS} = 24 mA (Note1) | 2.3 | — | 17 | 24 | |
| | | | V _{IS} = 2.0 V, I _{IS} = 15 mA (Note1) | 2.3 | — | 21 | 30 | |
| Increase in I _{CC} per input | | | V _{IN} = V _{CC} or GND, I _{OUT} = 0 | 3.6 | — | — | 10 | 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)

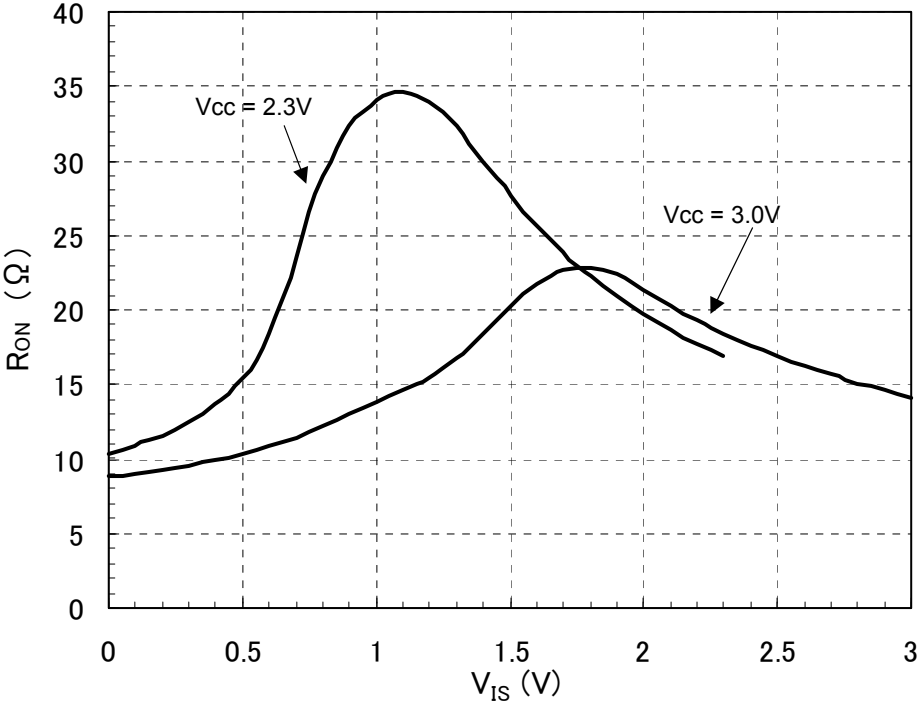
| Characteristics | Symbol | Test Condition | V _{CC} (V) | Min | Max | Unit |
|---------------------|--------------------------------------|--------------------|---------------------|-----|-----|------|
| | | | | | | |
| Output enable time | t _{pZL} t _{pZH} | Figure 1, Figure 2 | 3.3 ± 0.3 | — | 6 | ns |
| | | | 2.5 ± 0.2 | — | 7 | |
| | | | 1.8 ± 0.15 | — | 11 | |
| Output disable time | t _{pLZ} t _{pHZ} | Figure 1, Figure 2 | 3.3 ± 0.3 | — | 6 | ns |
| | | | 2.5 ± 0.2 | — | 7 | |
| | | | 1.8 ± 0.15 | — | 11 | |

Capacitive Characteristics (Ta = 25°C)

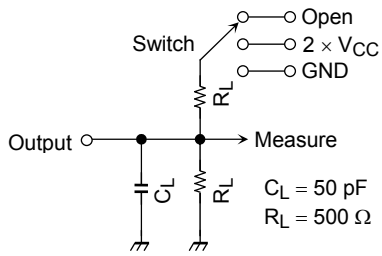
| Characteristics | Symbol | Test Condition | V _{CC} (V) | Typ. | Unit |
|-------------------------------|------------------|--|---------------------|------|------|
| | | | | | |
| Control pin input capacitance | C _{IN} | | 3.0 | 3 | pF |
| Switch terminal capacitance | C _{I/O} | \overline{OE} = V _{CC} (6125S), OE=GND (6126S) Switch Off | 3.0 | 6 | pF |
| | | \overline{OE} = GND (6125S), OE= V _{CC} (6126S) Switch On | 3.0 | 12 | pF |

Note: This parameter is guaranteed by design

• RON Characteristic (typ.) Ta=25°C



AC Test Circuit



| Parameter | Switch |
|--------------------|-------------------|
| t_{pLH}, t_{pHL} | Open |
| t_{pLZ}, t_{pZL} | $2 \times V_{CC}$ |
| t_{pHZ}, t_{pZH} | GND |

Figure 1

AC Waveform

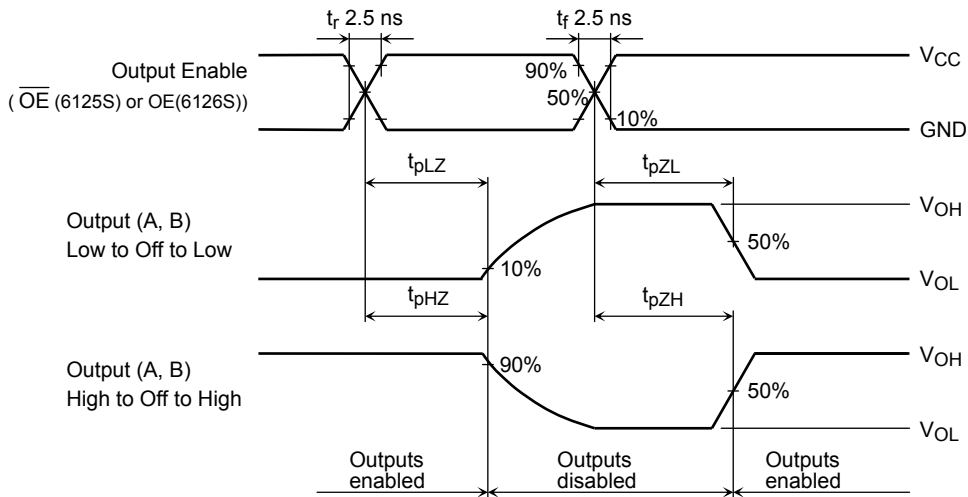


Figure 2 $t_{pLZ}, t_{pHZ}, t_{pZL}, t_{pZH}$

Rise and Fall Times (tr / tf) of the TC7MBL6125S,6126S 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_{I/O}) and the on-resistance (R_{ON}) 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 TC7MBL6125S,6126S.

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

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

where, R_{DRIVE} is the output impedance of the previous-stage circuit.

Calculation example:

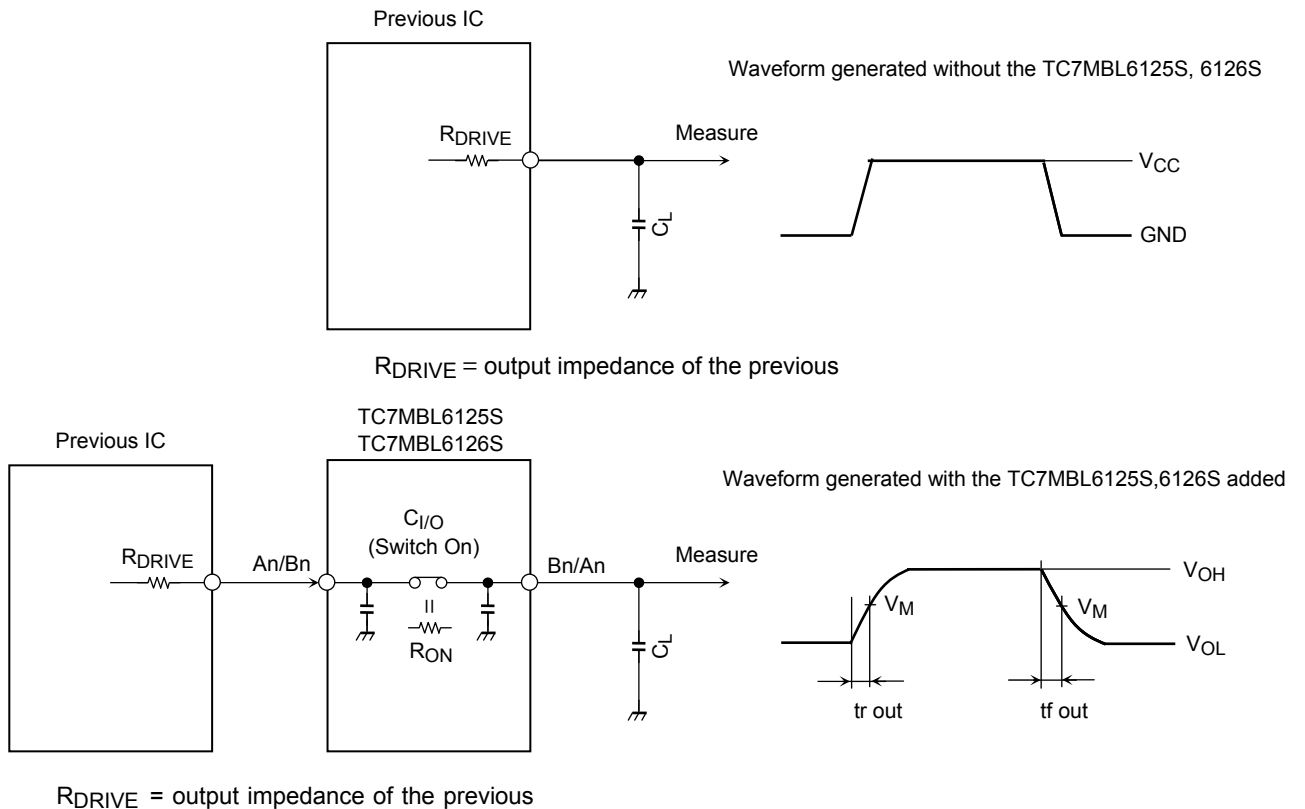
$$tr \text{ out (approx)} = - (12 + 15) E-12 \cdot (120 + 9) \cdot \ln (((3.0 - 0) - 1.5) / (3.0 - 0))$$

$$\approx 2.4 \text{ ns}$$

Calculation conditions:

V_{CC} = 3.0V , C_L = 15pF , R_{DRIVE} = 120Ω(output impedance of the previous IC), V_M = 1.5V(V_{CC} / 2)

Output of the previous IC = digital (i.e., high-level voltage = V_{CC}; low-level voltage = GND)



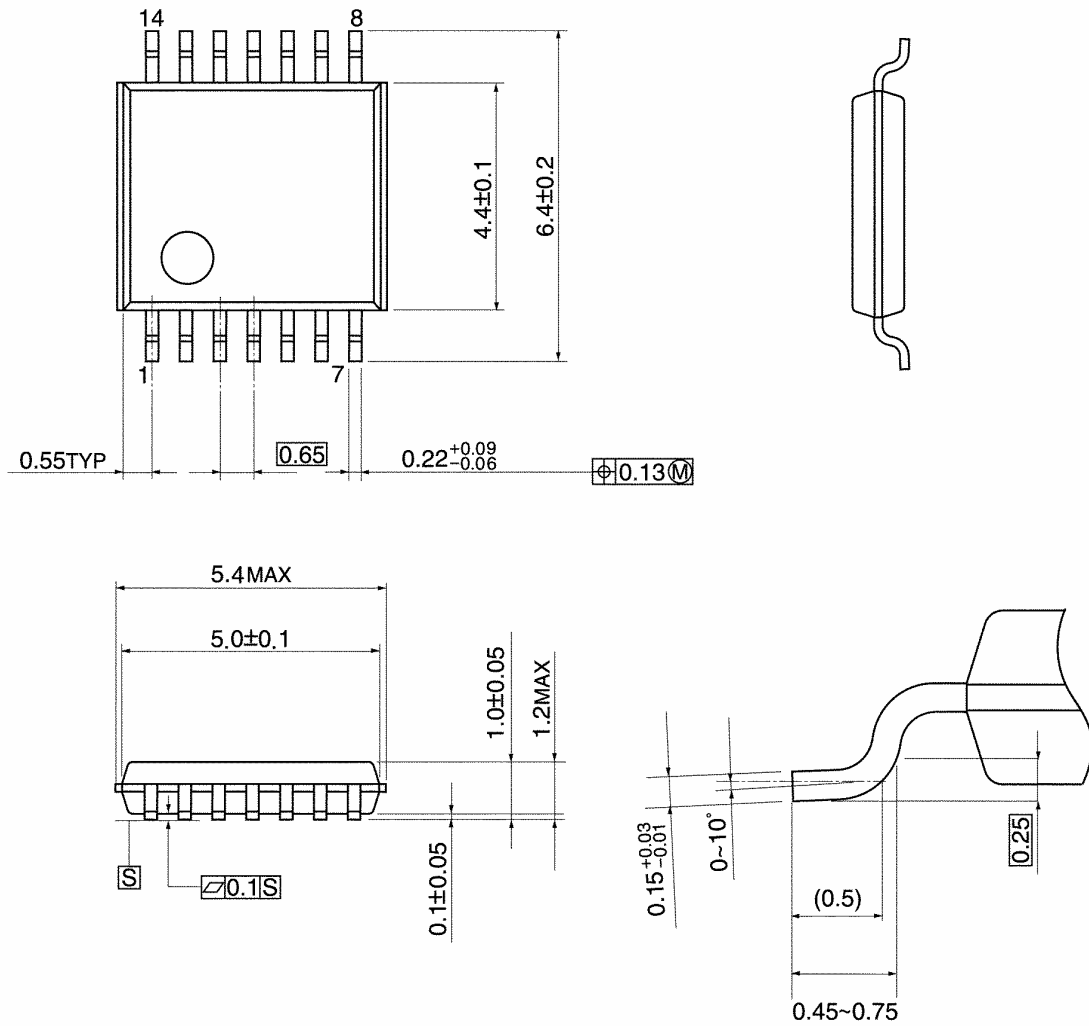
| Parameter | V _{CC} | | |
|----------------|---------------------|---------------------|---------------------|
| | | 3.3 ± 0.3 V | 2.5 ± 0.2 V |
| V _M | V _{CC} / 2 | V _{CC} / 2 | V _{CC} / 2 |

Figure 3 Test Circuit

Package Dimensions

TSSOP14-P-0044-0.65A

Unit: mm

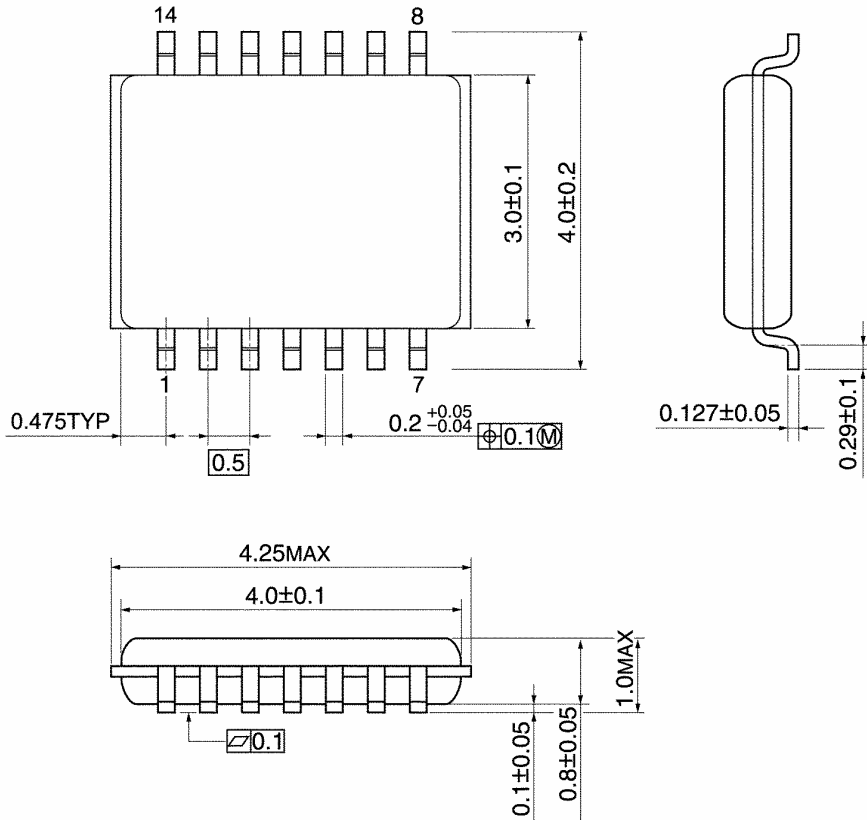


Weight: 0.06 g (typ.)

Package Dimensions

VSSOP14-P-0030-0.50

Unit: mm

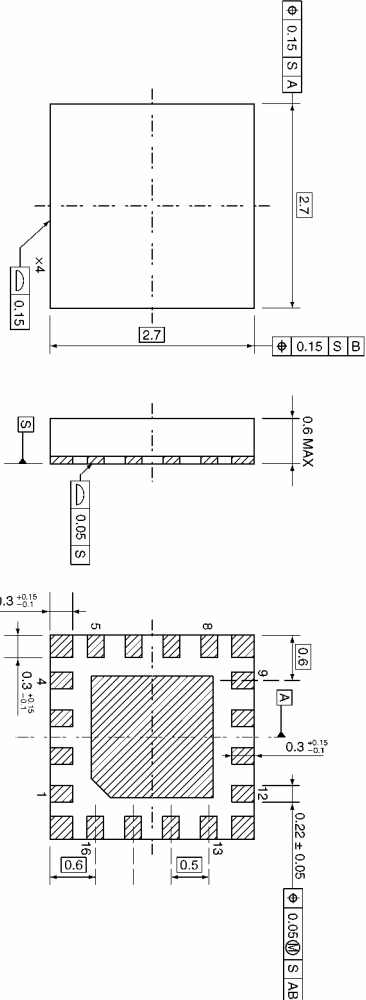


Weight: 0.02 g (typ.)

Package Dimensions

VQON16-P-0303-0.50

Unit: mm



Weight: 0.013 g (typ.)

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20070701-EN GENERAL

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