

## TC7MBL3245CFT, TC7MBL3245CFK, TC7MBL3245CFTG

### Low Voltage/Low Capacitance Octal Bus Switch

The TC7MBL3245C is a Low Voltage/Low Capacitance CMOS 8bit Bus Switch. The low on-resistance of the switch allows connections to be made with minimal propagation delay time.

The TC7MBL3245C requires the output enable ( $\overline{OE}$ ) input to be set high to place the output into the high impedance.

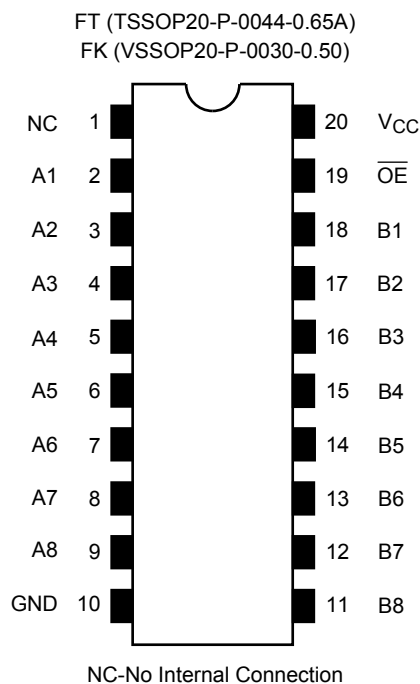
All inputs are equipped with protection circuits against static discharge.

### Features

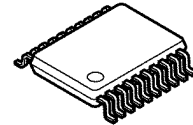
- Operating voltage :  $V_{CC} = 1.65$  to  $3.6$  V
- On-capacitance :  $C_{I/O} = 7.5$  pF Switch On (typ.)@ $V_{CC} = 3$  V
- On-resistance :  $R_{ON} = 6.5$   $\Omega$  (typ.)@ $V_{CC} = 3$  V,  $V_{I/O} = 0$  V
- ESD performance : Machine model  $\geq \pm 200$  V  
Human body model  $\geq \pm 2000$  V
- Power-down protection for inputs ( $\overline{OE}$  and I/O)
- Package: TSSOP20, VSSOP20 (US20), VQON20
- Pin compatible with the TC7MBL3245A,B,S

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

### Pin Assignment (top view)

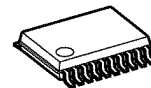


TC7MBL3245CFT

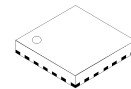


TSSOP20-P-0044-0.65A

TC7MBL3245CFK



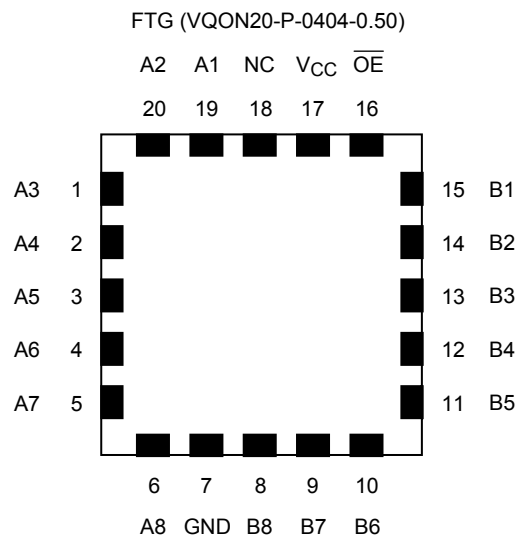
VSSOP20-P-0030-0.50  
TC7MBL3245CFTG



VQON20-P-0404-0.50

### Weight

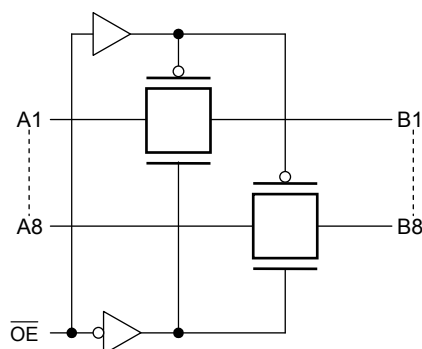
TSSOP20-P-0044-0.65A	: 0.08 g (typ.)
VSSOP20-P-0030-0.50	: 0.03 g (typ.)
VQON20-P-0404-0.50	: 0.0145g (typ.)



## Truth Table

Inputs	Function
$\overline{\text{OE}}$	
L	A port = B port
H	Disconnect

## System Diagram



**Absolute Maximum Ratings (Note)**

Characteristic		Symbol	Rating	Unit
Power supply range		$V_{CC}$	−0.5 to 4.6	V
Control pin input voltage $\overline{OE}$		$V_{IN}$	−0.5 to 4.6	V
Switch terminal I/O voltage	$V_{CC}=0V$ or Switch=Off	$V_S$	−0.5 to 4.6	V
	Switch=On	$V_S$	−0.5 to $V_{CC}+0.5$	
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		$I_{CC}/I_{GND}$	±100	mA
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

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)**

Note:

Characteristic		Symbol	Rating	Unit
Power supply voltage		$V_{CC}$	1.65 to 3.6	V
Control pin input voltage $\overline{OE}$		$V_{IN}$	0 to 3.6	V
Switch terminal I/O voltage	$V_{CC}=0V$ or Switch=Off	$V_S$	0 to 3.6	V
	Switch=On	$V_S$	0 to $V_{CC}$	
Operating temperature		$T_{opr}$	−40 to 85	°C
Input rise and fall time		dt/dv	0 to 10	ns/V

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 (Ta = -40 to 85°C)**

Parameter		Symbol	Test Condition		Min	Typ.	Max	Unit
				V <sub>CC</sub> (V)				
Input voltage $\overline{OE}$	“H” level	V <sub>IH</sub>	—	1.65 to 3.6	0.7 × V <sub>CC</sub>	—	—	V
	“L” level	V <sub>IL</sub>	—	1.65 to 3.6	—	—	0.3 × V <sub>CC</sub>	
Input leakage current $\overline{OE}$		I <sub>IN</sub>	V <sub>IN</sub> = 0 to 3.6 V	1.65 to 3.6	—	—	±1.0	μA
Power-off leakage current		I <sub>OFF</sub>	$\overline{OE}$ ,A,B = 0 to 3.6 V	0	—	—	10	μA
Off-state leakage current (switch off)		I <sub>SZ</sub>	A, B = 0 to V <sub>CC</sub> , $\overline{OE}$ = V <sub>CC</sub>	1.65 to 3.6	—	—	±1.0	μA
On resistance (Note2)	R <sub>ON</sub>	V <sub>IS</sub> = 0 V, I <sub>IS</sub> = 30 mA (Note1)	3.0	—	6.5	11	Ω	
		V <sub>IS</sub> = 3.0 V, I <sub>IS</sub> = 30 mA (Note1)	3.0	—	11	16		
		V <sub>IS</sub> = 2.4V, I <sub>IS</sub> = 15 mA (Note1)	3.0	—	12	18		
		V <sub>IS</sub> = 0 V, I <sub>IS</sub> = 24 mA (Note1)	2.3	—	7	11		
		V <sub>IS</sub> = 2.3 V, I <sub>IS</sub> = 24 mA (Note1)	2.3	—	13	20		
		V <sub>IS</sub> = 2.0V, I <sub>IS</sub> = 15 mA (Note1)	2.3	—	15	21		
		V <sub>IS</sub> = 0 V, I <sub>IS</sub> = 4 mA (Note1)	1.65	—	8	14		
		V <sub>IS</sub> = 1.65 V, I <sub>IS</sub> = 4 mA (Note1)	1.65	—	17	26		
Quiescent supply current		I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND, I <sub>OUT</sub> = 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 to 85°C)**

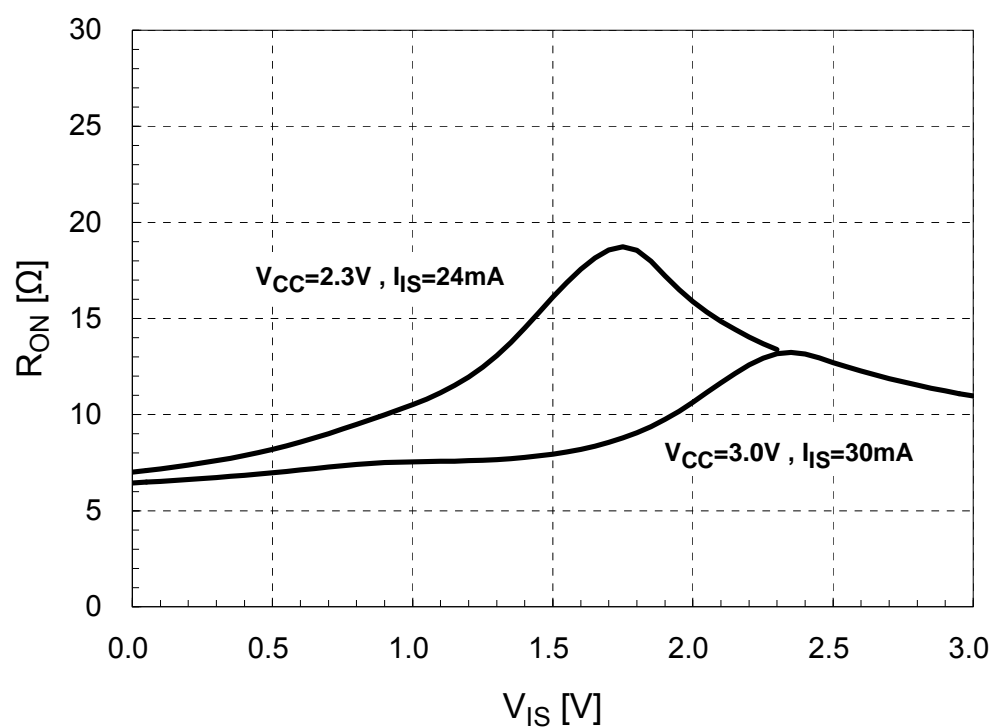
Characteristics	Symbol	Test Condition	V <sub>CC</sub> (V)	Min	Max	Unit
Output enable time	t <sub>pZL</sub> t <sub>pZH</sub>	Figure 1, Figure 2	3.3 ± 0.3	—	6	ns
			2.5 ± 0.2	—	7	
			1.8 ± 0.15	—	11	
Output disable time	t <sub>pLZ</sub> t <sub>pHZ</sub>	Figure 1, Figure 2	3.3 ± 0.3	—	6	ns
			2.5 ± 0.2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

**Capacitive Characteristics (Ta = 25°C)**

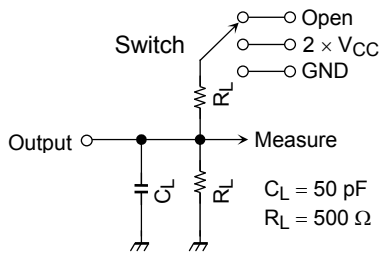
Characteristics	Symbol	Test Condition	V <sub>CC</sub> (V)	Typ.	Unit
Control pin input capacitance	C <sub>IN</sub>	V <sub>IN</sub> = 0 V (Note)	3.0	4	pF
Switch terminal capacitance (Switch Off)	C <sub>I/O</sub>	$\overline{OE} = V_{CC}$ , V <sub>IS</sub> = 0 V (Note)	3.0	3.5	pF
Switch terminal capacitance (Switch On)	C <sub>I/O</sub>	$\overline{OE} = GND$ , V <sub>IS</sub> = 0 V (Note)	3.0	7.5	pF

Note: This parameter is guaranteed by design

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



AC Test Circuit



Parameter	Switch
$t_{pLZ}, t_{pZL}$	$2 \times V_{CC}$
$t_{pHZ}, t_{pZH}$	GND

Figure 1

AC Waveform

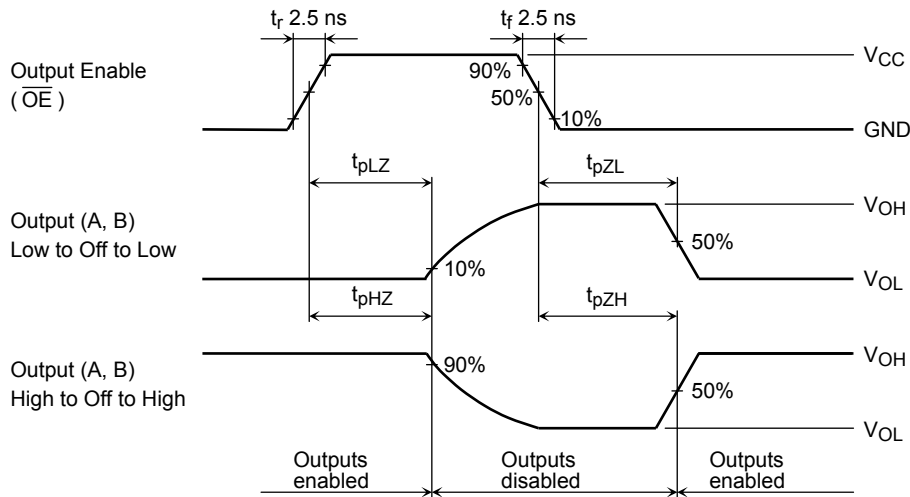


Figure 2  $t_{pLZ}, t_{pHZ}, t_{pZL}, t_{pZH}$

## Rise and Fall Times (tr / tf) of the TC7MBL3245C 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 TC7MBL3245C.

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

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

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

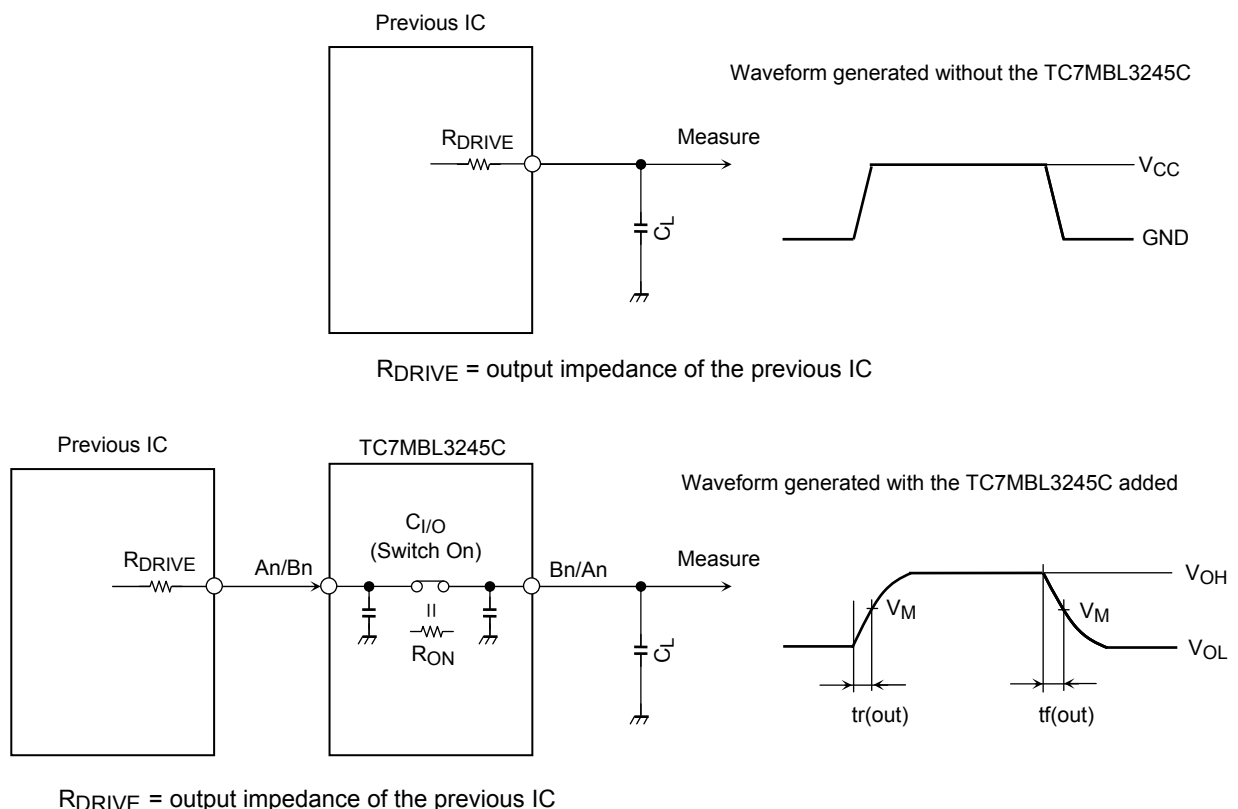
Calculation example:

$$tr(out) \text{ (approx)} = - (7.5 + 15) \text{E-12} \cdot (120 + 6.5) \cdot \ln \left( \frac{(3.0 - 0) - 1.5}{(3.0 - 0)} \right) \approx 2.0 \text{ ns}$$

Calculation conditions:

V<sub>CC</sub> = 3.0V, C<sub>L</sub> = 15pF, R<sub>DRIVE</sub> = 120Ω (output impedance of the previous IC), V<sub>M</sub> = 1.5V (V<sub>CC</sub> / 2)

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



項目	V <sub>CC</sub>		
	3.3 ± 0.3 V	2.5 ± 0.2 V	1.8 ± 0.15 V
V <sub>M</sub>	V <sub>CC</sub> / 2	V <sub>CC</sub> / 2	V <sub>CC</sub> / 2

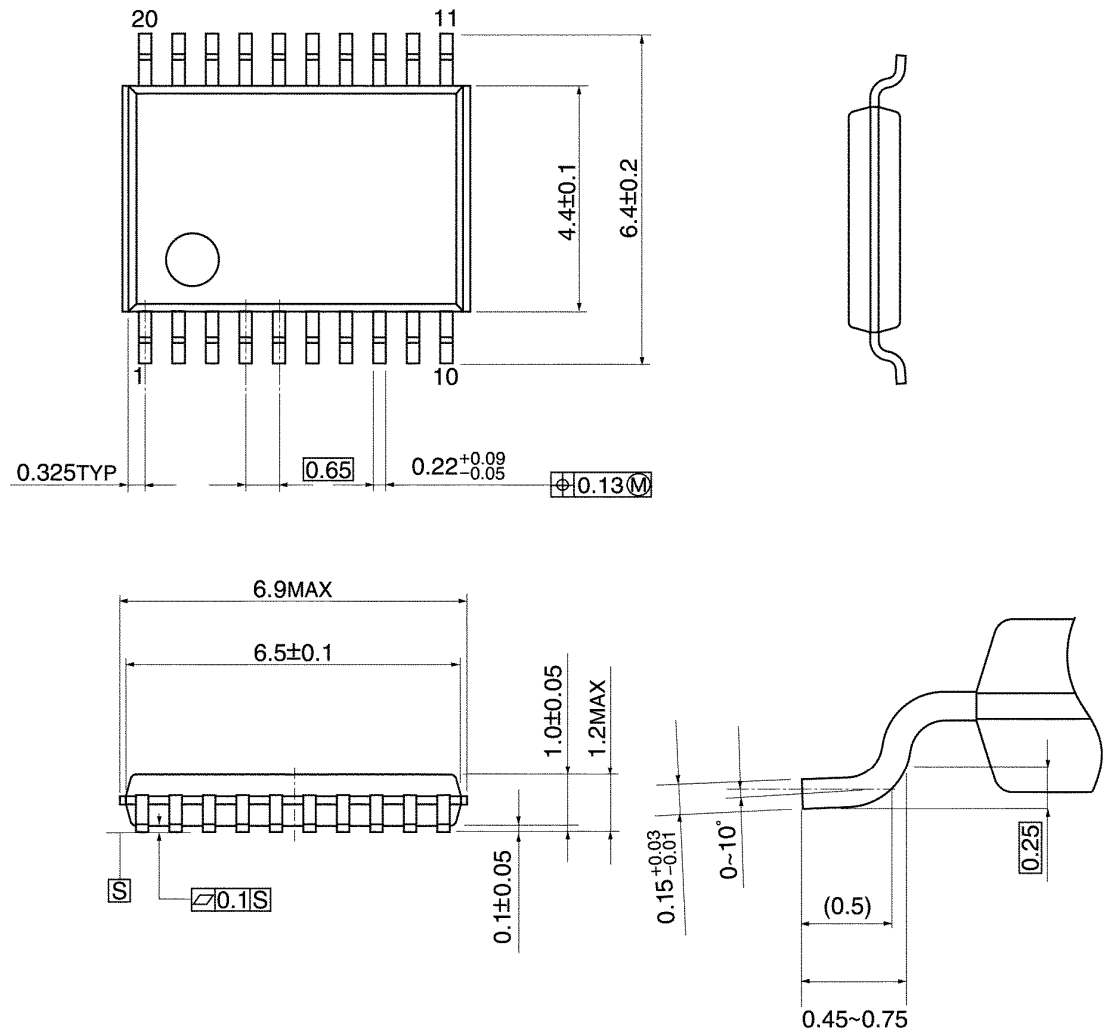
**Figure 3 Test Circuit**



Package Dimensions

TSSOP20-P-0044-0.65A

Unit: mm

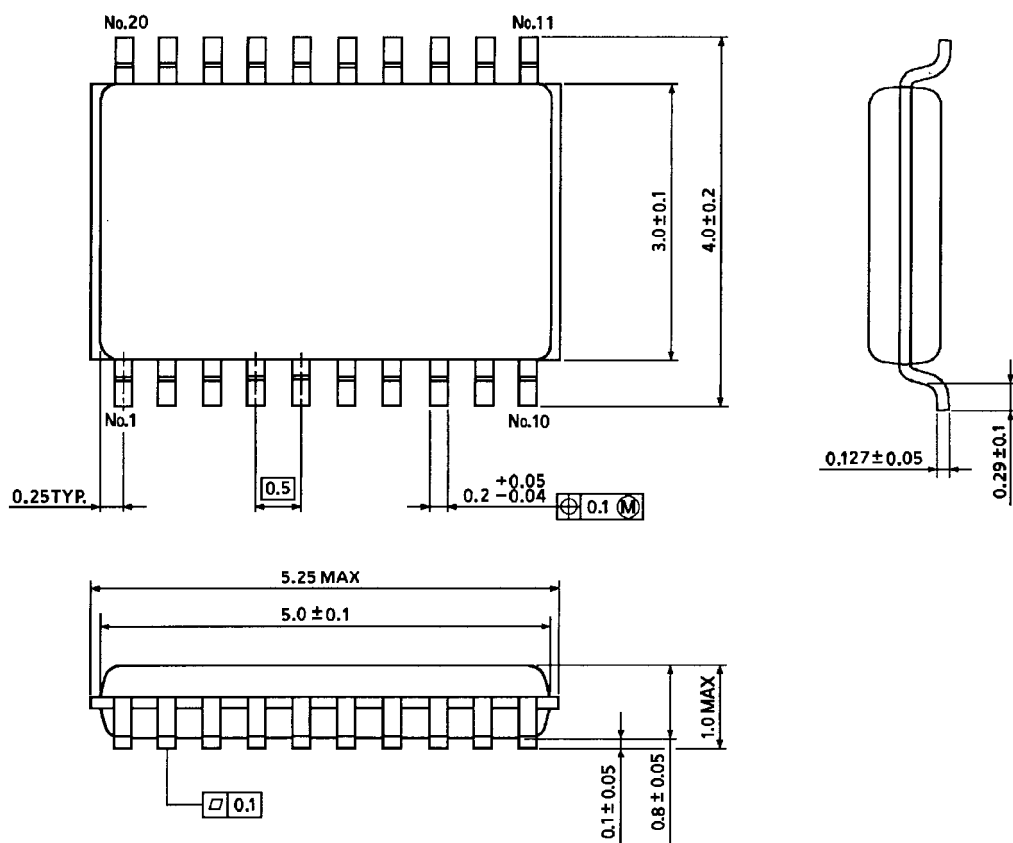


Weight: 0.08 g (typ.)

## Package Dimensions

VSSOP20-P-0030-0.50

Unit : mm



Weight: 0.03 g (typ.)

**VQON20-P-0404-0.50**

Technical drawing of a mechanical part showing three views: front, top, and side. The front view shows a rectangular part with a central hole and a circular feature. The top view shows a rectangular part with a central hole and a circular feature. The side view shows a rectangular part with a central hole and a circular feature. Dimensions are given in millimeters (mm).

**Front View Dimensions:**

- Overall width:  $100 \pm 0.15$  S B
- Overall height:  $100 \pm 0.15$  S A
- Central hole diameter:  $\varnothing 3.2$
- Distance from top edge to center of hole:  $50 \pm 0.15$
- Distance from bottom edge to center of hole:  $50 \pm 0.15$
- Distance from left edge to center of hole:  $50 \pm 0.15$
- Distance from right edge to center of hole:  $50 \pm 0.15$
- Distance from top edge to bottom edge of hole:  $10 \pm 0.15$
- Distance from bottom edge to top edge of hole:  $10 \pm 0.15$
- Distance from left edge to right edge of hole:  $10 \pm 0.15$
- Distance from right edge to left edge of hole:  $10 \pm 0.15$

**Top View Dimensions:**

- Overall width:  $100 \pm 0.15$  S B
- Overall height:  $100 \pm 0.15$  S A
- Central hole diameter:  $\varnothing 3.2$
- Distance from top edge to center of hole:  $50 \pm 0.15$
- Distance from bottom edge to center of hole:  $50 \pm 0.15$
- Distance from left edge to center of hole:  $50 \pm 0.15$
- Distance from right edge to center of hole:  $50 \pm 0.15$
- Distance from top edge to bottom edge of hole:  $10 \pm 0.15$
- Distance from bottom edge to top edge of hole:  $10 \pm 0.15$
- Distance from left edge to right edge of hole:  $10 \pm 0.15$
- Distance from right edge to left edge of hole:  $10 \pm 0.15$

**Side View Dimensions:**

- Overall width:  $100 \pm 0.15$  S B
- Overall height:  $100 \pm 0.15$  S A
- Central hole diameter:  $\varnothing 3.2$
- Distance from top edge to center of hole:  $50 \pm 0.15$
- Distance from bottom edge to center of hole:  $50 \pm 0.15$
- Distance from left edge to center of hole:  $50 \pm 0.15$
- Distance from right edge to center of hole:  $50 \pm 0.15$
- Distance from top edge to bottom edge of hole:  $10 \pm 0.15$
- Distance from bottom edge to top edge of hole:  $10 \pm 0.15$
- Distance from left edge to right edge of hole:  $10 \pm 0.15$
- Distance from right edge to left edge of hole:  $10 \pm 0.15$

2008-09-01

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