

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

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.

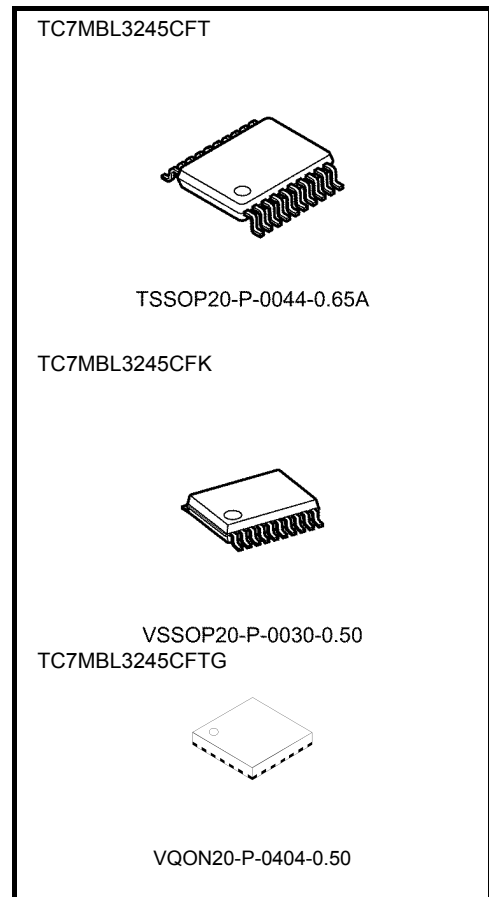
The TC7MBL3245C requires the output enable (\overline{OE}) input to be set high to place the output into the high impedance.

All inputs are equipped with protection circuits against static discharge.

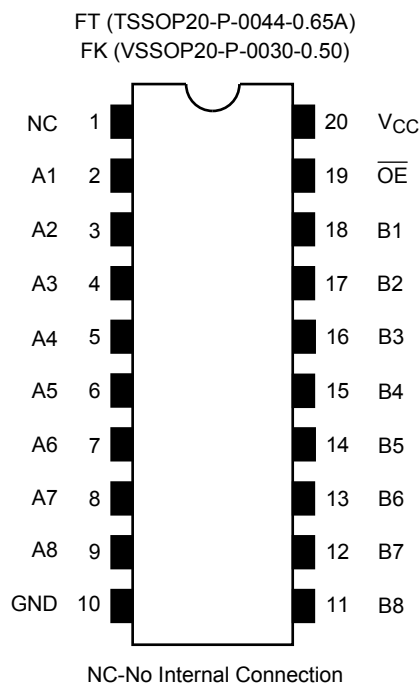
Features

- 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 : $R_{ON} = 6.5$ Ω (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.

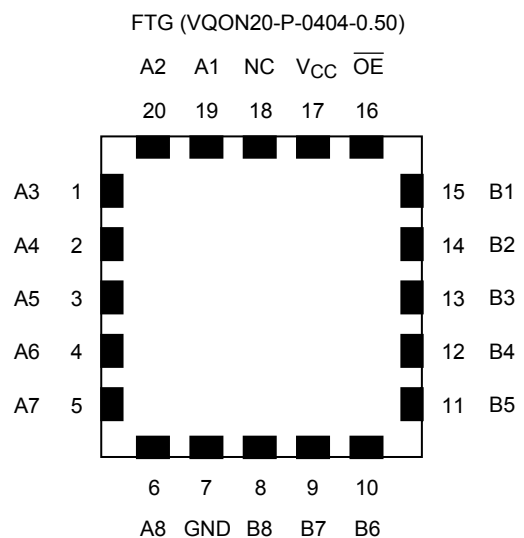


Pin Assignment (top view)



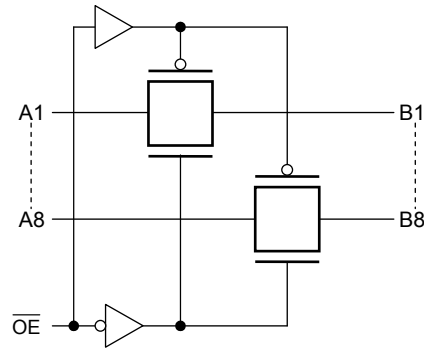
Weight

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{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	$^{\circ}C$

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)

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

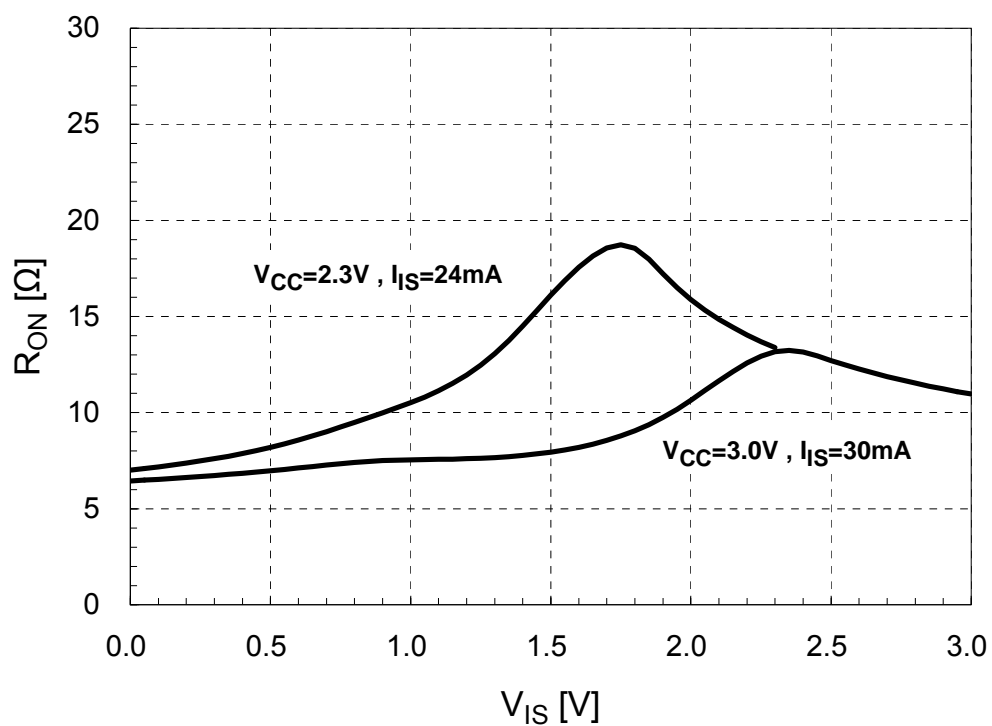
AC Characteristics (Ta = -40 to 85°C)

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	

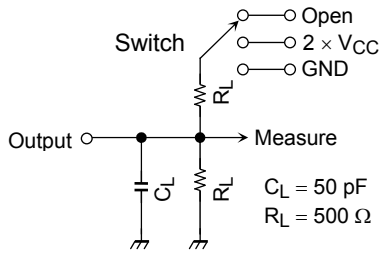
Capacitive Characteristics (Ta = 25°C)

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

Note: This parameter is guaranteed by design

R_{ON} - V_{IS} Characteristic (typ.) Ta = 25°C

AC Test Circuit



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

Figure 1

AC Waveform

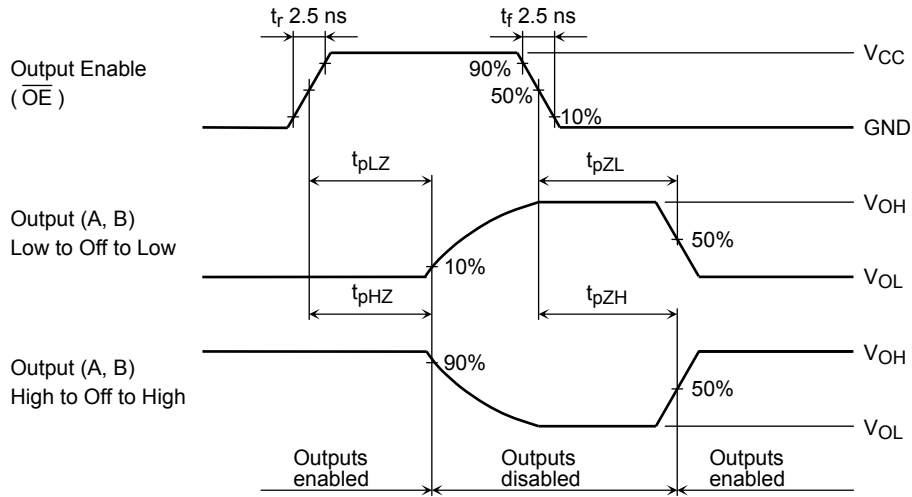


Figure 2 $t_{pLZ}, t_{pLH}, t_{pZL}, t_{pZH}$

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_{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 TC7MBL3245C.

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

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

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

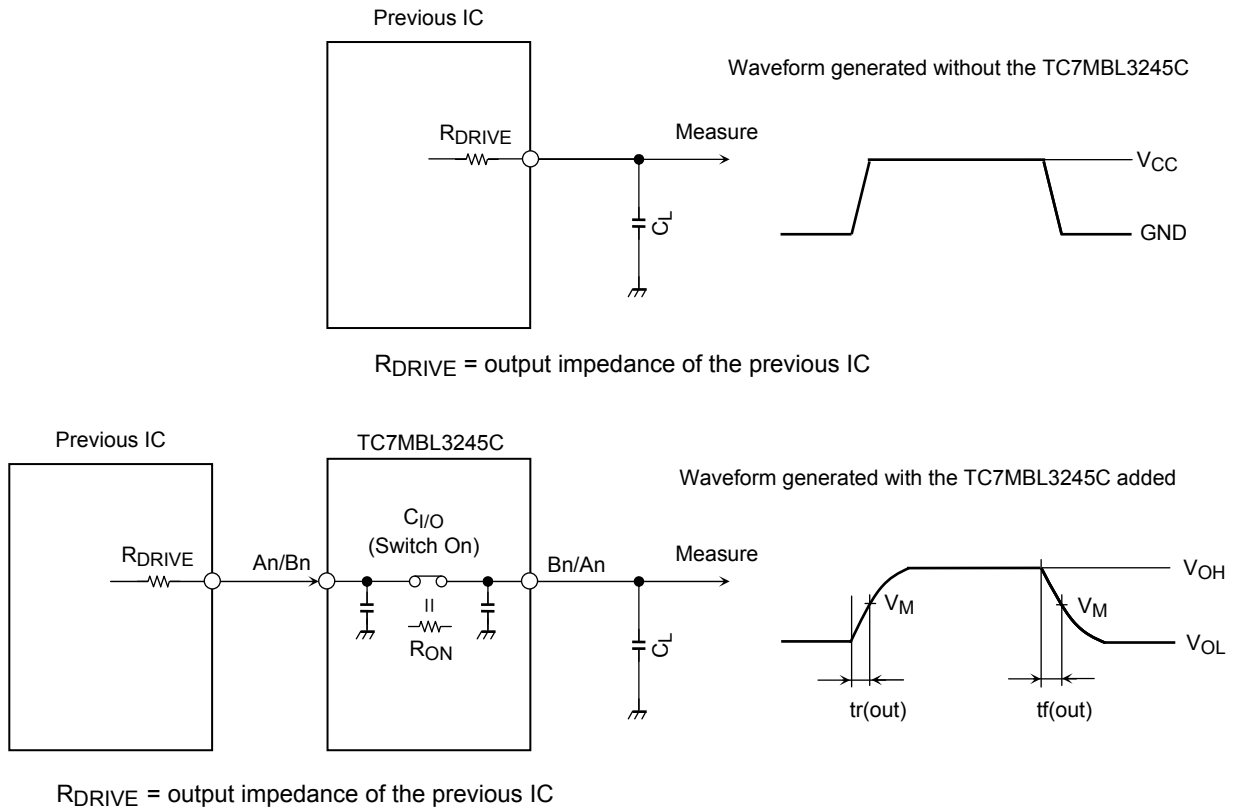
Calculation example:

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

$$\approx 2.0 \text{ ns}$$

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)



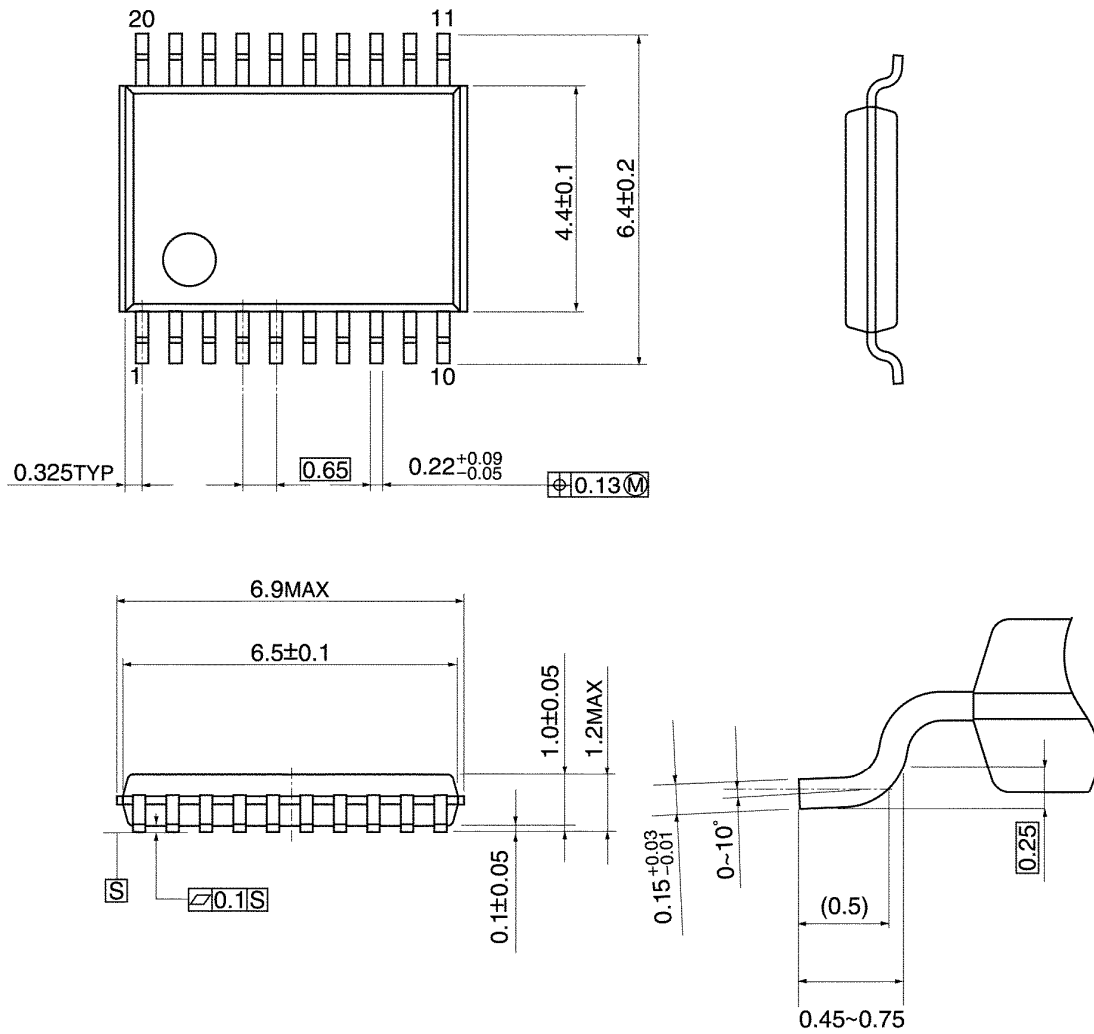
項目	V _{CC}		
		3.3 ± 0.3 V	2.5 ± 0.2 V
V _M	V _{CC} / 2	V _{CC} / 2	V _{CC} / 2

Figure 3 Test Circuit

Package Dimensions

TSSOP20-P-0044-0.65A

Unit: mm

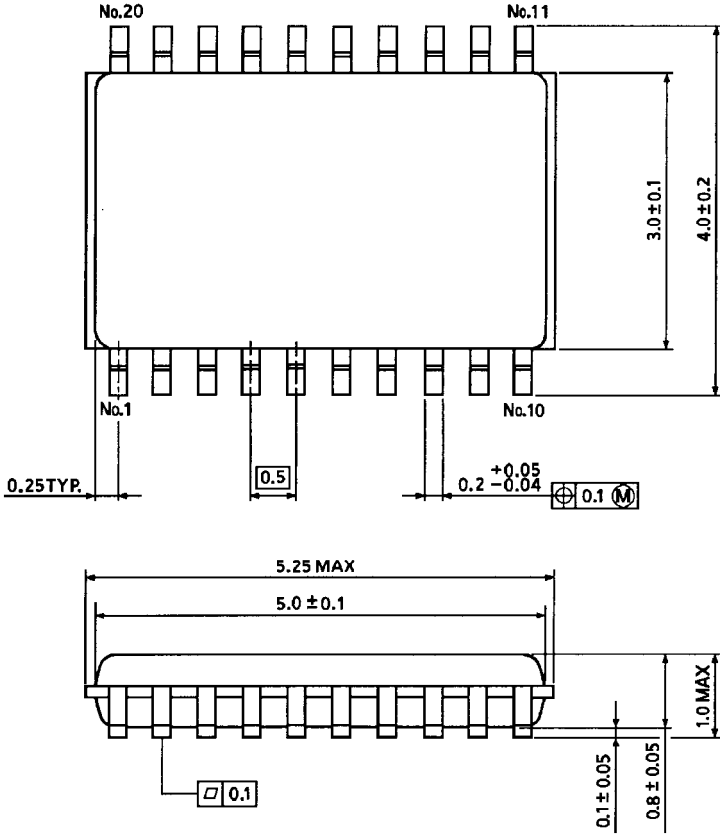


Weight: 0.08 g (typ.)

Package Dimensions

VSSOP20-P-0030-0.50

Unit : mm

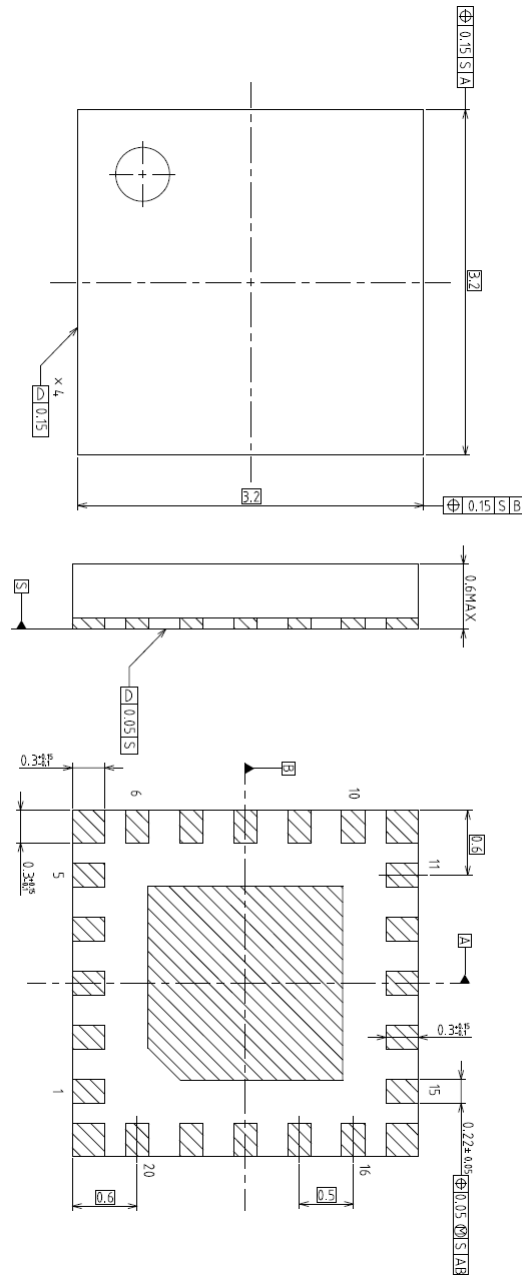


Weight: 0.03 g (typ.)

Package Dimensions

VQON20-P-0404-0.50

Unit : mm



Weight: 0.0145 g (typ.)

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