

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7MBL3245SFT, TC7MBL3245SFK, TC7MBL3245SFTG

Low Voltage/Low Capacitance Octal Bus Switch

The TC7MBL3245S provides eight bits of low-voltage, high-speed bus switching in a standard '245 device pinout. The low ON-resistance of the switch allows connections to be made with minimal propagation delay and while maintaining CMOS low power dissipation.

The device comprises a single 8-bit switch. When output enable (\overline{OE}) is low, the switch is on and port A is connected to port B. When \overline{OE} is high, the switch is open and a high-impedance state exists between the two ports.

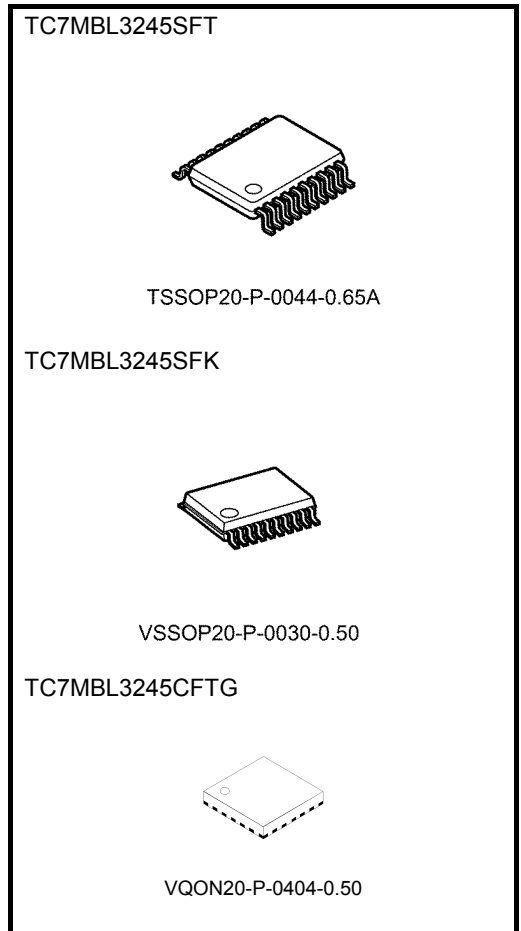
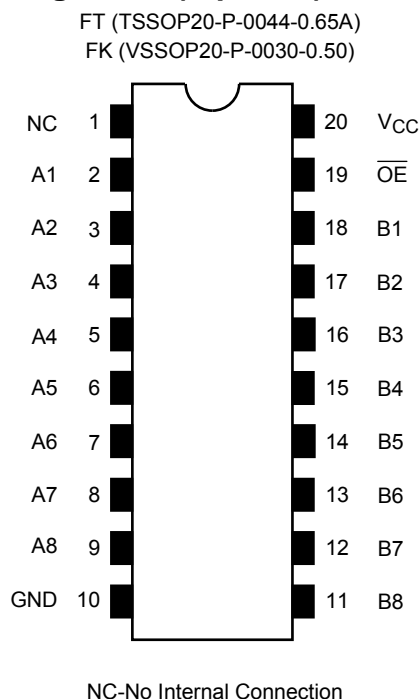
All inputs are equipped with protection circuits to guard against static discharge.

Features

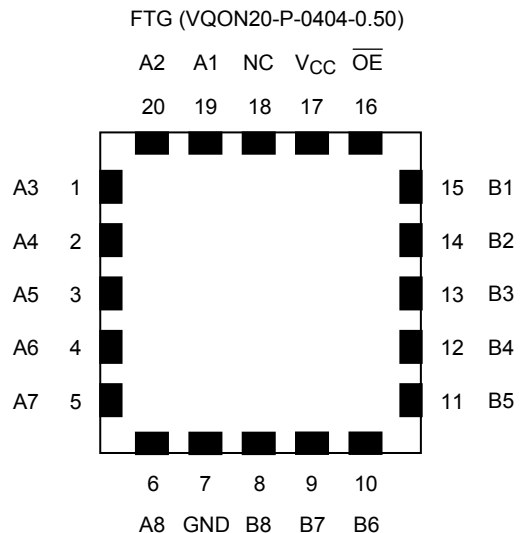
- Operating voltage: $V_{CC} = 1.65$ to 3.6 V
- Low capacitance: $C_{I/O} = 12$ pF Switch On (typ.) @3 V
- Low on resistance: $R_{ON} = 9 \Omega$ (typ.) @3 V
- ESD performance: Machine model $\geq \pm 200$ V
Human body model $\geq \pm 2000$ V
- Power down protection for inputs (\overline{OE} input only)
- Package: TSSOP20, VSSOP (US20), VQON20
- Pin compatible with the 74xx245 type

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

Pin Assignment (top view)



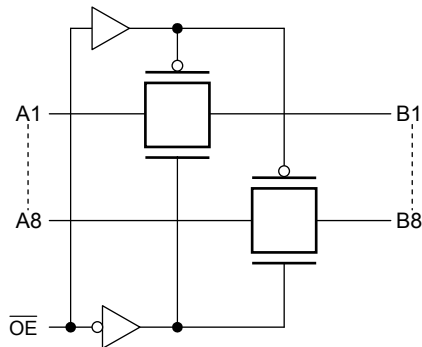
Weight
TSSOP20-P-0044-0.65A : 0.08 g (typ.)
VSSOP20-P-0030-0.50 : 0.03 g (typ.)
VQON20-P-0404-0.50 : 0.0145g (typ.)



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 voltage		V_{CC}	-0.5 to 4.6	V
Control pin input voltage		V_{IN}	-0.5 to 4.6	V
Switch terminal I/O voltage		V_S	-0.5 to $V_{CC} + 0.5$	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 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)

Characteristic	Symbol	Rating	Unit
Power supply voltage	V_{CC}	1.65 to 3.6	V
Control pin input voltage	V_{IN}	0 to 3.6	V
Switch I/O voltage	V_S	0 to V_{CC}	V
Operating temperature	T_{opr}	-40 to 85	°C
Input rise and fall time	dt/dv	0 to 10	ns/V

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

Electrical Characteristics

DC Characteristics (Ta = -40 to 85°C)

Parameter		Symbol	Test Condition	V _{CC} (V)	Min	Typ.	Max	Unit
Input voltage	"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		I _{IN}	V _{IN} = 0 to 3.6V	1.65 to 3.6	—	—	±1.0	μA
Power off leakage current		I _{OFF}	\overline{OE} = 0 to 3.6 V	0	—	—	1.0	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	—	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	
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)

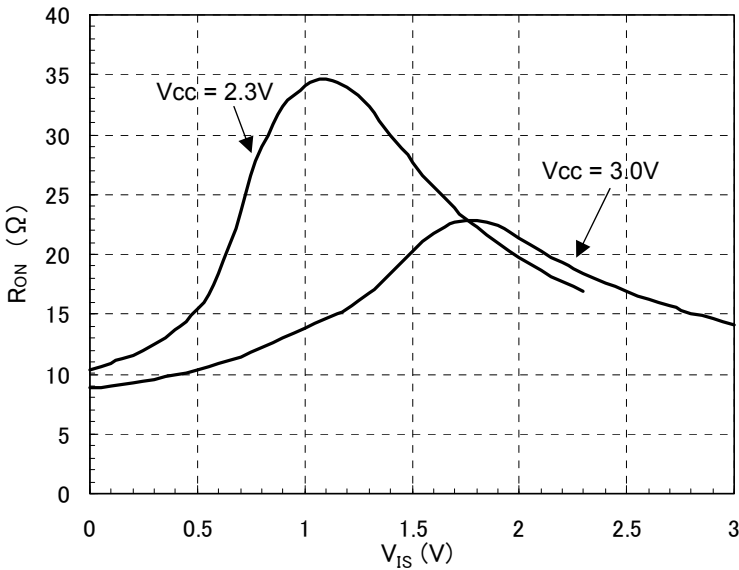
Characteristics	Symbol	Test Condition	V _{CC} (V)	Min	Max	Unit
Output enable time	t _{pZL}	Figure 1, Figure 2	3.3 ± 0.3	—	6	ns
	t _{pZH}		2.5 ± 0.2	—	7	
			1.8 ± 0.15	—	11	
Output disable time	t _{pLZ}	Figure 1, Figure 2	3.3 ± 0.3	—	6	ns
	t _{pHZ}		2.5 ± 0.2	—	7	
			1.8 ± 0.15	—	11	

Capacitive Characteristics (Ta = 25°C)

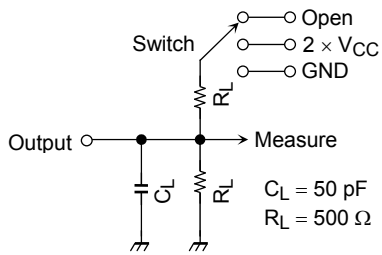
Characteristics (Note)	Symbol	Test Condition	V _{CC} (V)	Typ.	Unit
Control pin input capacitance	C _{IN}		3.0	3	pF
Switch terminal capacitance	C _{I/O}	\overline{OE} = V _{CC} (switch off)	3.0	6	pF
		\overline{OE} = GND (switch on)	3.0	12	pF

Note : This parameter is guaranteed by design

R_{ON} 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

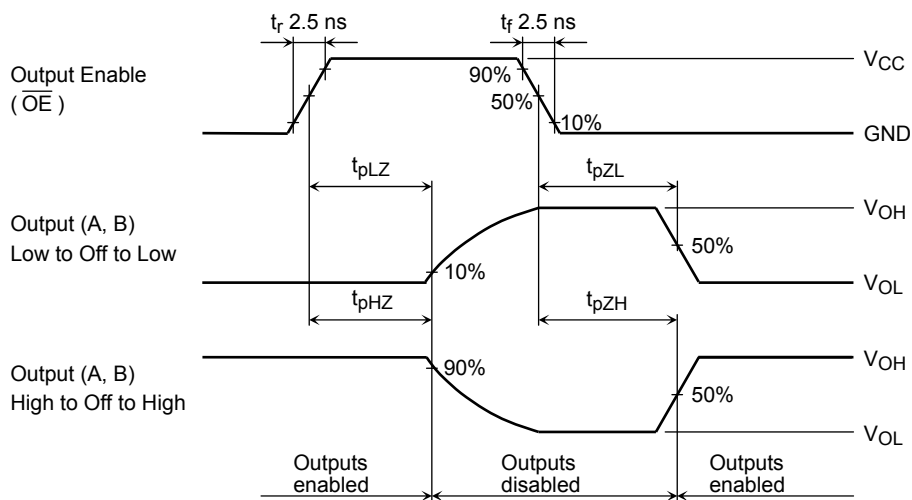


Figure 2 $t_{pLZ}, t_{pHZ}, t_{pZL}, t_{pZH}$

Rise and Fall Times (tr / tf) of the TC7MBL3245S 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 TC7MBL3245S.

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

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

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

Calculation example:

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

$$\approx 2.4ns$$

Calculation conditions:

V_{CC} = 3.0V , C_L = 15pF , R_{DRIVE} = 120 Ω (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)

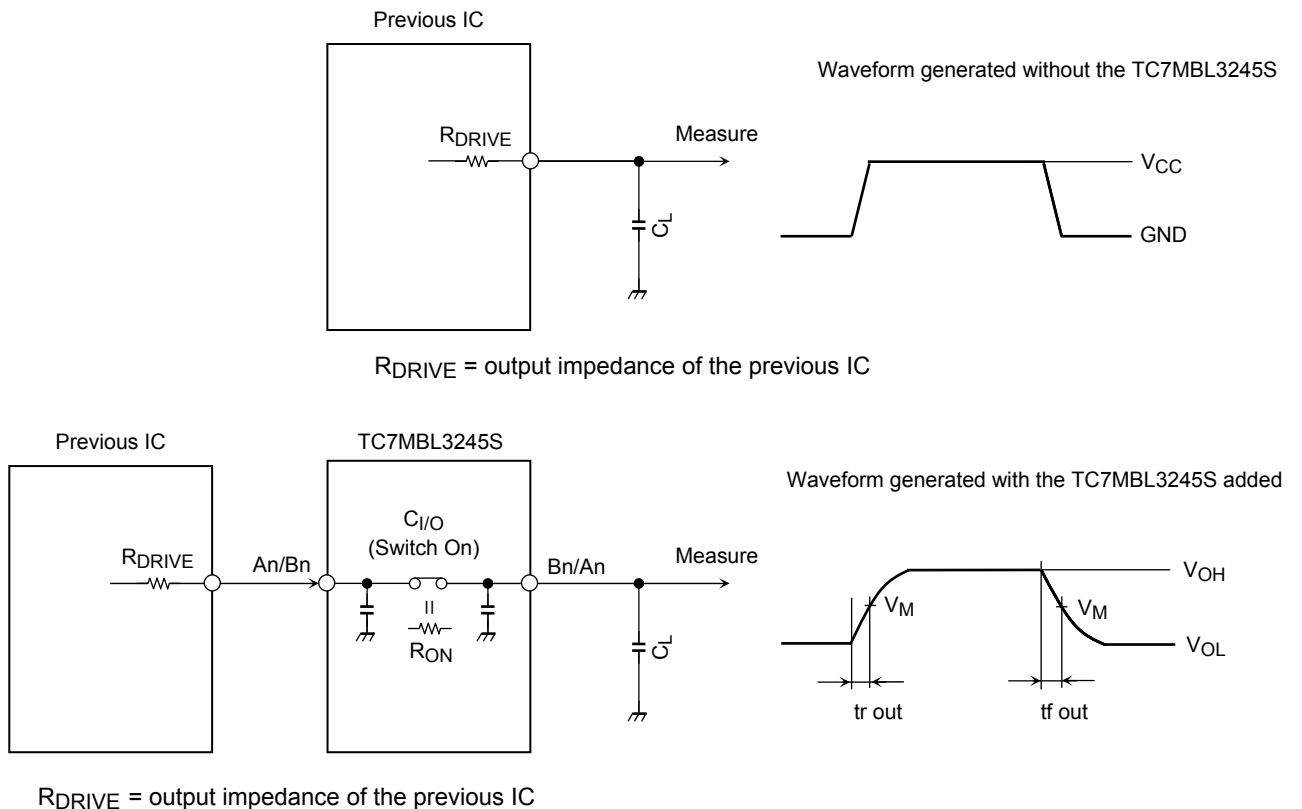
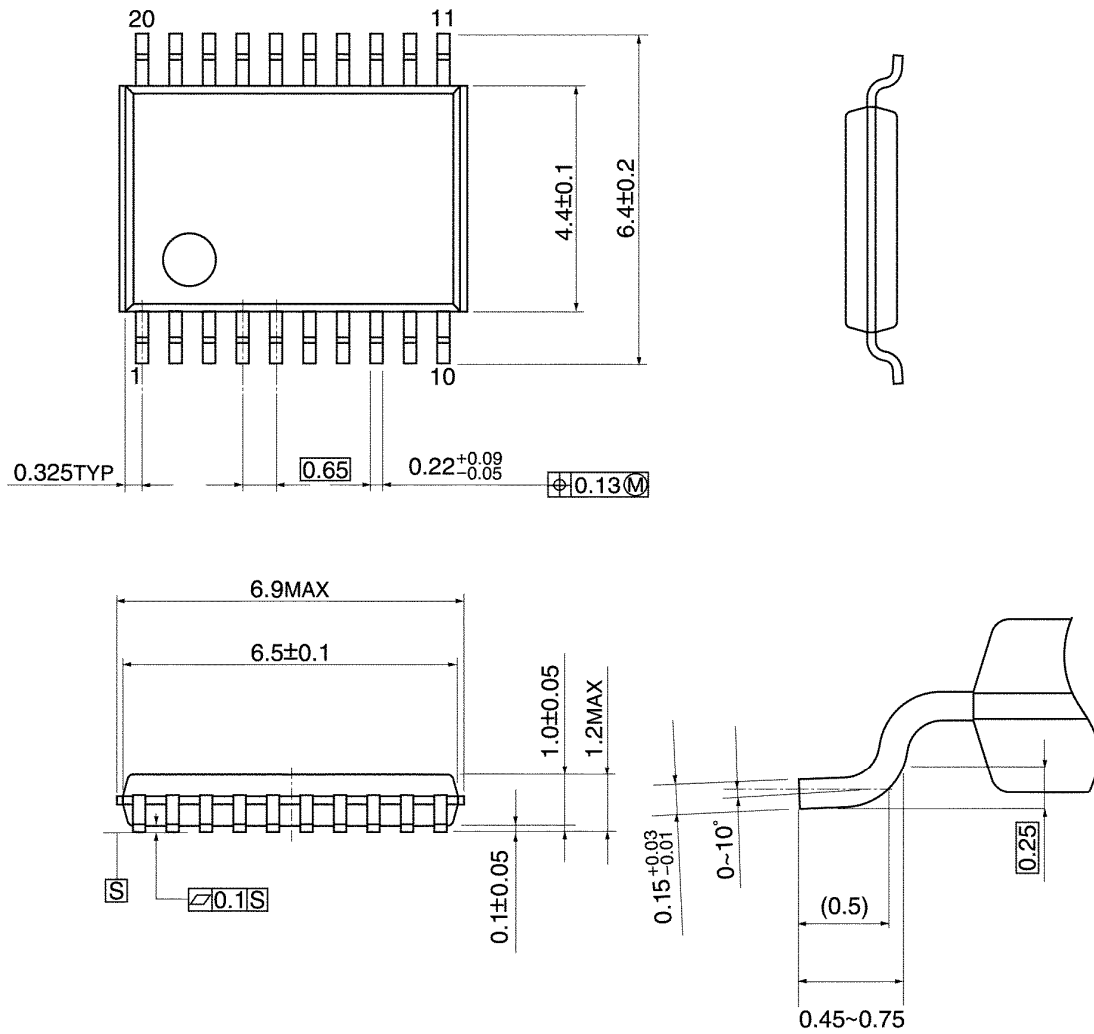


Figure 3 Test Circuit

Package Dimensions

TSSOP20-P-0044-0.65A

Unit: mm

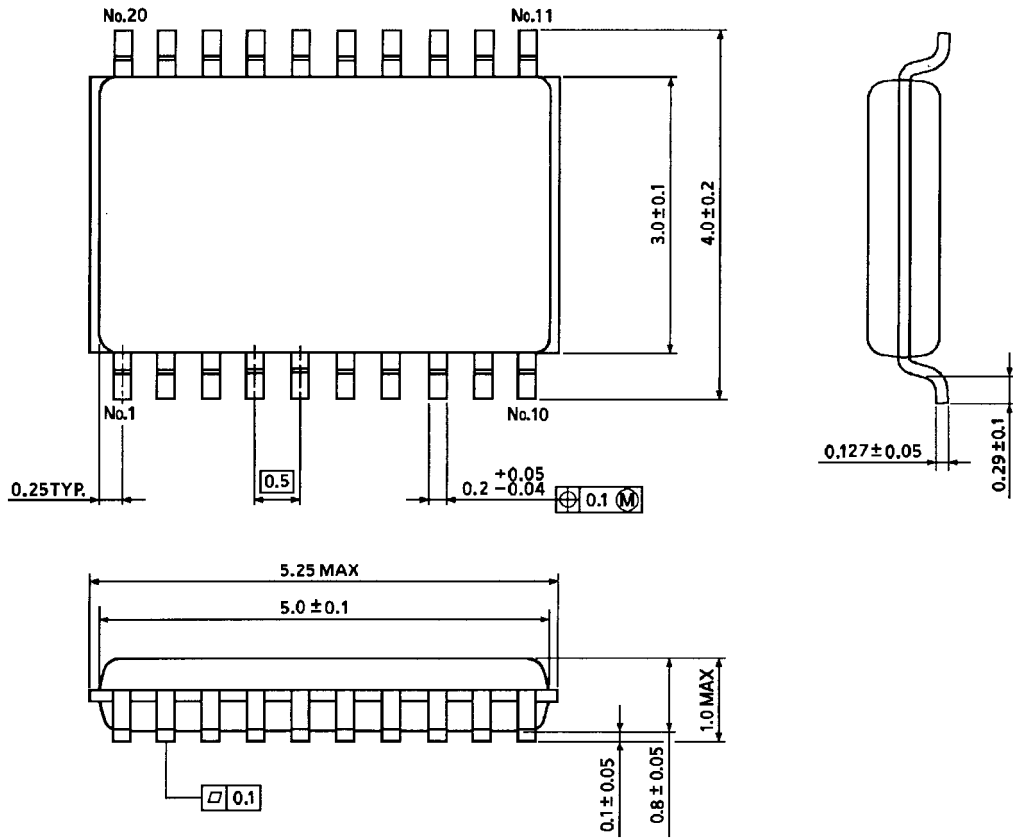


Weight: 0.08g (typ.)

Package Dimensions

VSSOP20-P-0030-0.50

Unit : mm

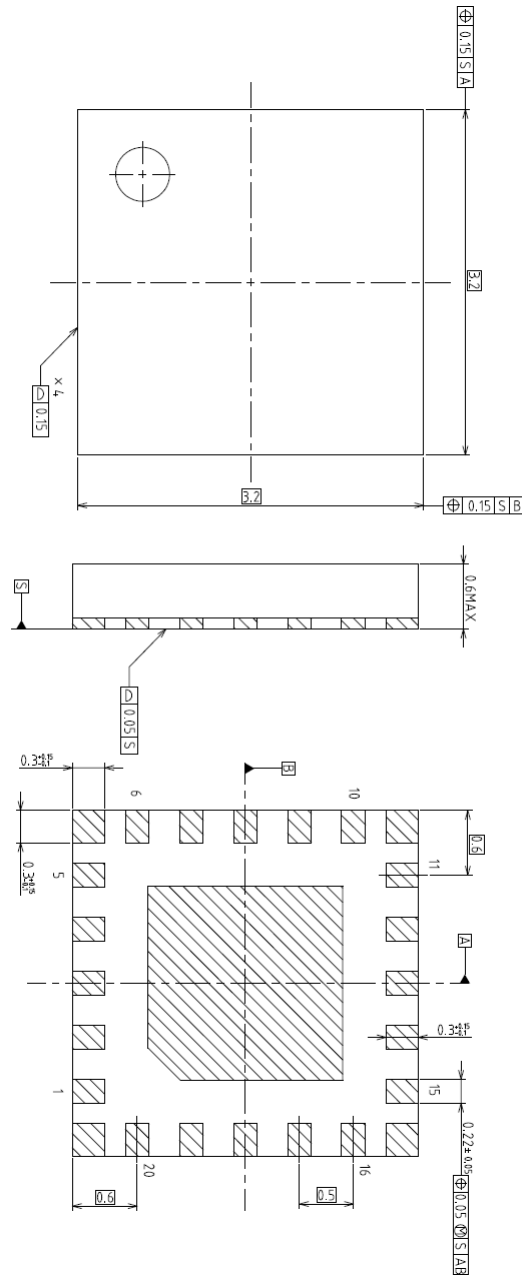


Weight: 0.03g (typ.)

Package Dimensions

VQON20-P-0404-0.50

Unit : mm



Weight: 0.0145 g (typ.)

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