TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

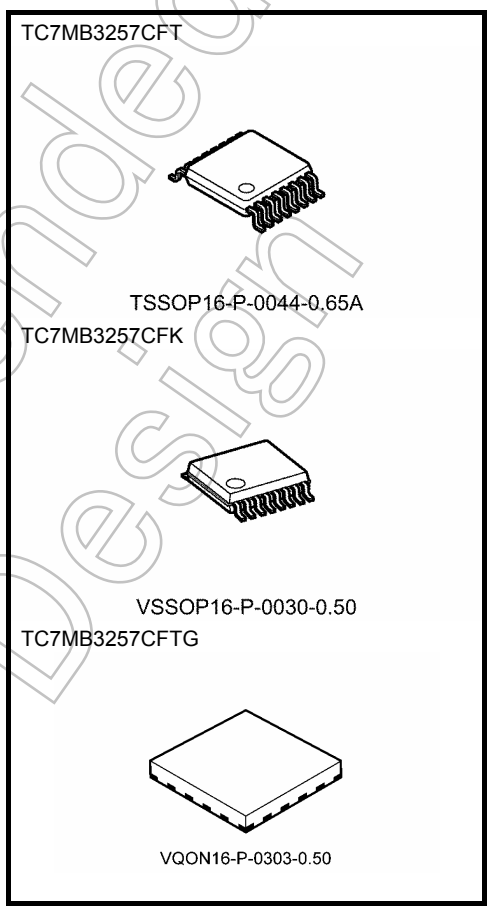
TC7MB3257CFT, TC7MB3257CFK, TC7MB3257CFTG

Low Capacitance Quad 1-of-2 Multiplexer/Demultiplexer

The TC7MB3257C is a Low Capacitance CMOS Quad 1-of-2 multiplexer/demultiplexer. The low on resistance and the low capacitance of the switch allows connections to be made with minimal propagation delay time.

This device consists of four individual two-inputs multiplexer/demultiplexer with common select input (S) and output enable ($\overline{OE}$). The A inputs is connected to the B1 or B2 outputs determined by the combination both the select input (S) and output enable ($\overline{OE}$). When the output enable ($\overline{OE}$) input is held "H" level, the switches are open with regardless the state of select inputs and a high-impedance state exists between the switches.

All inputs are equipped with protection circuits against static discharge.



Weight:
TSSOP16-P-0044-0.65A : 0.06 g (typ.)
VSSOP16-P-0030-0.50 : 0.02 g (typ.)
VQON16-P-0303-0.50 : 0.013 g (typ.)

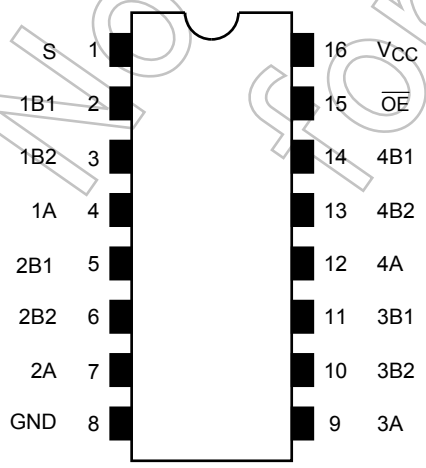
Features

- Operating voltage: V_{CC} = 4.0 to 5.5 V
- On-capacitance: $C_{I/O}$ = 8.5 pF Switch On (typ.)@V_{CC}=5V
- On resistance: R_{ON} = 3 Ω (typ.) @V_{CC}=4.5V, V_{IS}=0 V
- ESD performance: Machine model ≥ ±200 V
  Human body model ≥ ±2000 V
- Compatible with TTL outputs (control inputs)
- Power-down protection for inputs ($\overline{OE}$,S and I/O)
- Package: TSSOP16,VSSOP16 (US16) , VQON16
- Pin compatible with the TC7MB3257FT/FK.

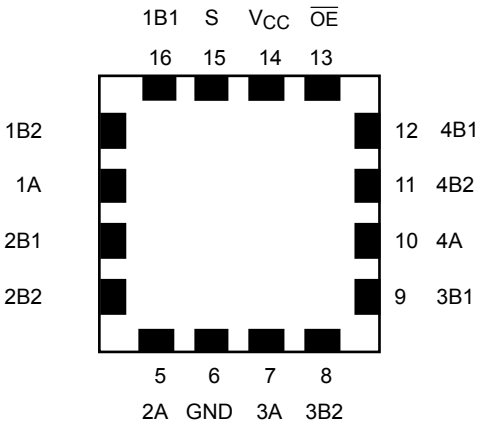
Note: When mounting VQON package, the type of recommended flux is RA or RMA.

Pin Assignment (top view)

FT (TSSOP16-P-0044-0.65A)
FK (VSSOP16-P-0030-0.50)



FTG (VQON16-P-0303-0.50)



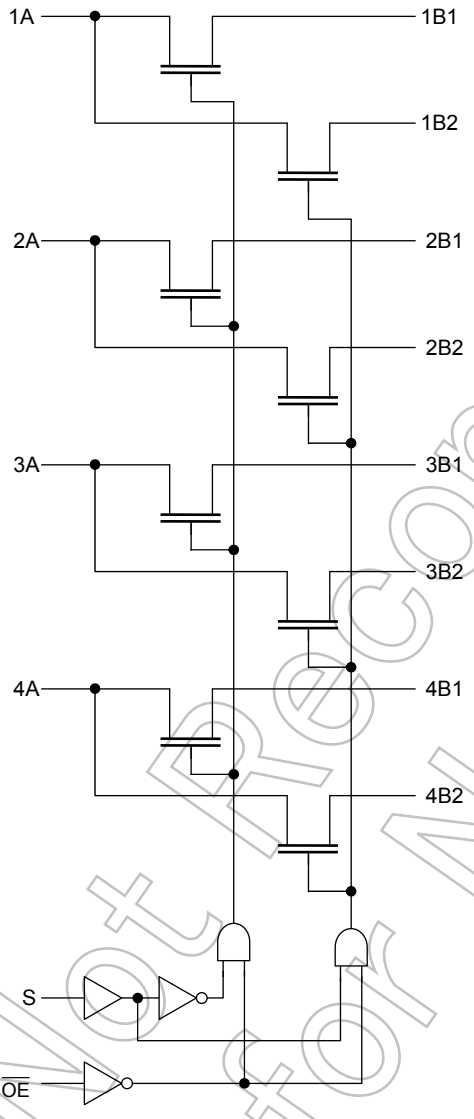
Start of commercial production
2010-10

Not Recommended for New Design

Truth Table

Inputs		Function
$\overline{OE}$	S	
L	L	A port = B1 port
L	H	A port = B2 port
H	X	Disconnect

System Diagram



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Absolute Maximum Ratings (Note)

Characteristics	Symbol	Rating	Unit
Power supply range	V_{CC}	−0.5 to 7.0	V
DC input voltage	V_{IN}	−0.5 to 7.0	V
DC switch voltage	V_S	−0.5 to 7.0	V
Input diode current	I_{IK}	−50	mA
Continuous channel 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)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	4.0 to 5.5	V
Input voltage	V_{IN}	0 to 5.5	V
Switch voltage	V_S	0 to 5.5	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.
Unused control pin inputs must be tied to either V_{CC} or GND.
Leave unused switch I/O pins open.

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Electrical Characteristics

DC Characteristics (Ta = –40 to 85°C)

Characteristics		Symbol	Test Condition		V_{CC} (V)	Min	Typ.	Max	Unit
Input voltage	"H" level	V_{IH}	—		4.5 to 5.5	2.0	—	—	V
	"L" level	V_{IL}	—		4.5 to 5.5	—	—	0.8	
Input leakage current ($\overline{OE}$, S)		I_{IN}	V_{IN} = 0 to 5.5 V		4.5 to 5.5	—	—	±1.0	μA
Power off leakage current		I_{OFF}	A, B, $\overline{OE}$ = 0 to 5.5 V		0	—	—	10	μA
Off-state leakage current (switch off)		I_{SZ}	A, B = 0 to 5.5 V, $\overline{OE}$ = V_{CC}		4.5 to 5.5	—	—	±1.0	μA
ON resistance (Note 2)		R_{ON}	V_{IS} = 0 V	I_{IS} = 30 mA (Note1)	4.5	—	3	7	Ω
			V_{IS} = 2.4 V	I_{IS} = 15 mA (Note1)	4.5	—	5	15	
					4.0	—	9	20	
Quiescent supply current		I_{CC}	V_{IN} = V_{CC} or GND, I_{OUT} = 0		5.5	—	—	10	μA
Increase in I_{CC} per input		ΔI_{CC}	V_{IN} = 3.4 V (one input)		5.5	—	—	500	μA

Note 1: Typical values are at Ta = 25°C.

Note 2: 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 ($\overline{OE}$ to bus)	t_{pZL} t_{pZH}	Figure 1, Figure 2	4.5	—	7	ns
Output enable time (S to bus)	t_{pZL} t_{pZH}	Figure 1, Figure 2	4.5	—	9	ns
Output disable time ($\overline{OE}$ to bus)	t_{pLZ} t_{pHZ}	Figure 1, Figure 2	4.5	—	7	ns
Output disable time (S to bus)	t_{pLZ} t_{pHZ}	Figure 1, Figure 2	4.5	—	9	ns

Capacitive Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition		V_{CC} (V)	Typ.	Unit
Control pin input capacitance ($\overline{OE}$, S)	C_{IN}	V_{IN} = 0 V	(Note)	5.0	5	pF
Switch OFF terminal capacitance (A port)	$C_{I/O}$	$\overline{OE}$ = V_{CC}, V_{IS} = 0 V	(Note)	5.0	6	pF
Switch OFF terminal capacitance (B port)	$C_{I/O}$	$\overline{OE}$ = V_{CC}, V_{IS} = 0 V	(Note)	5.0	4	pF
Switch ON terminal capacitance (A port)	$C_{I/O}$	$\overline{OE}$ = GND, V_{IS} = 0 V	(Note)	5.0	8.5	pF
Switch ON terminal capacitance (B port)	$C_{I/O}$	$\overline{OE}$ = GND, V_{IS} = 0 V	(Note)	5.0	8.5	pF

Note: This parameter is guaranteed by design.

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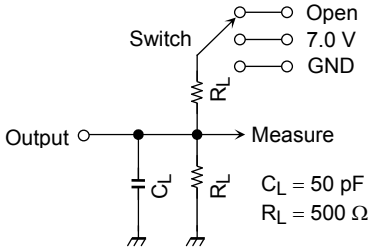
AC Test Circuit



Parameter	Switch
t_{pLZ}, t_{pZL}	7.0 V
t_{pHZ}, t_{pZH}	Open

Figure 1

AC Waveform

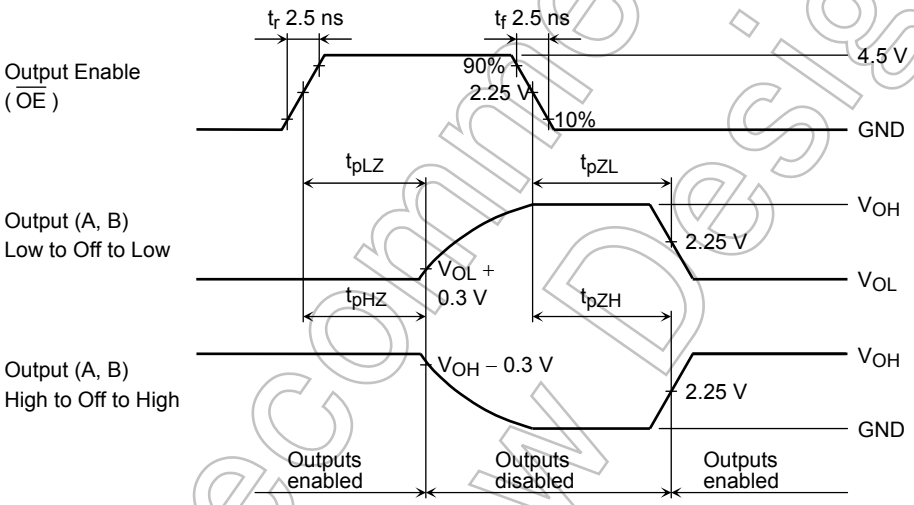


Figure 2 t_{pLZ}, t_{pHZ}, t_{pZL}, t_{pZH}

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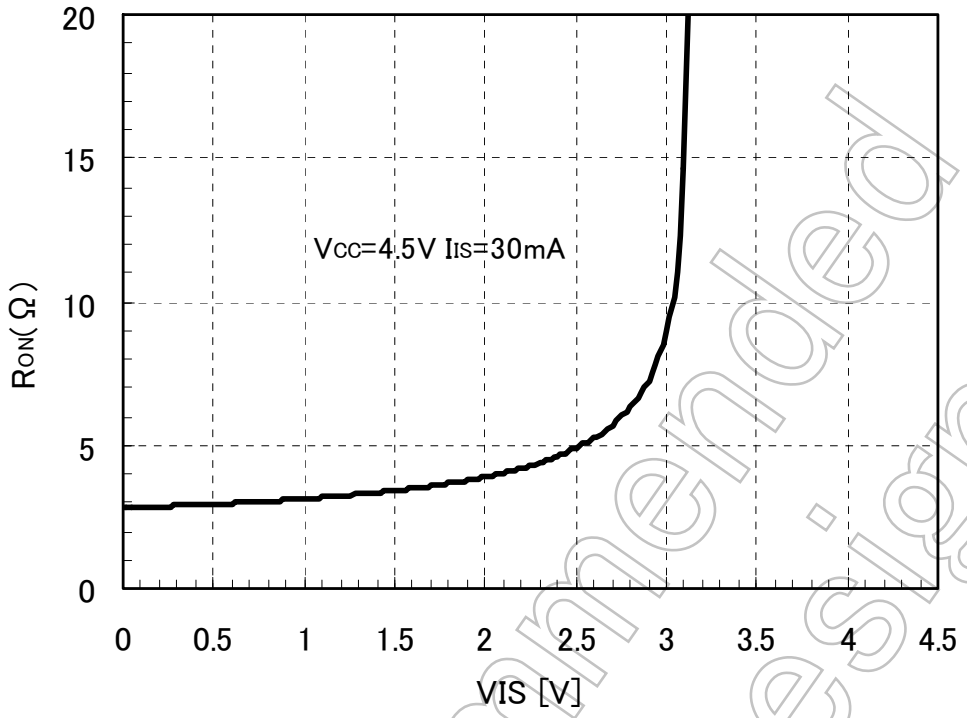
R_{ON} - V_{IS} Characteristic（Typ.）Ta = 25℃



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Rise and Fall Times (tr / tf) of the TC7MB3257C 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 TC7MB3257C.

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

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

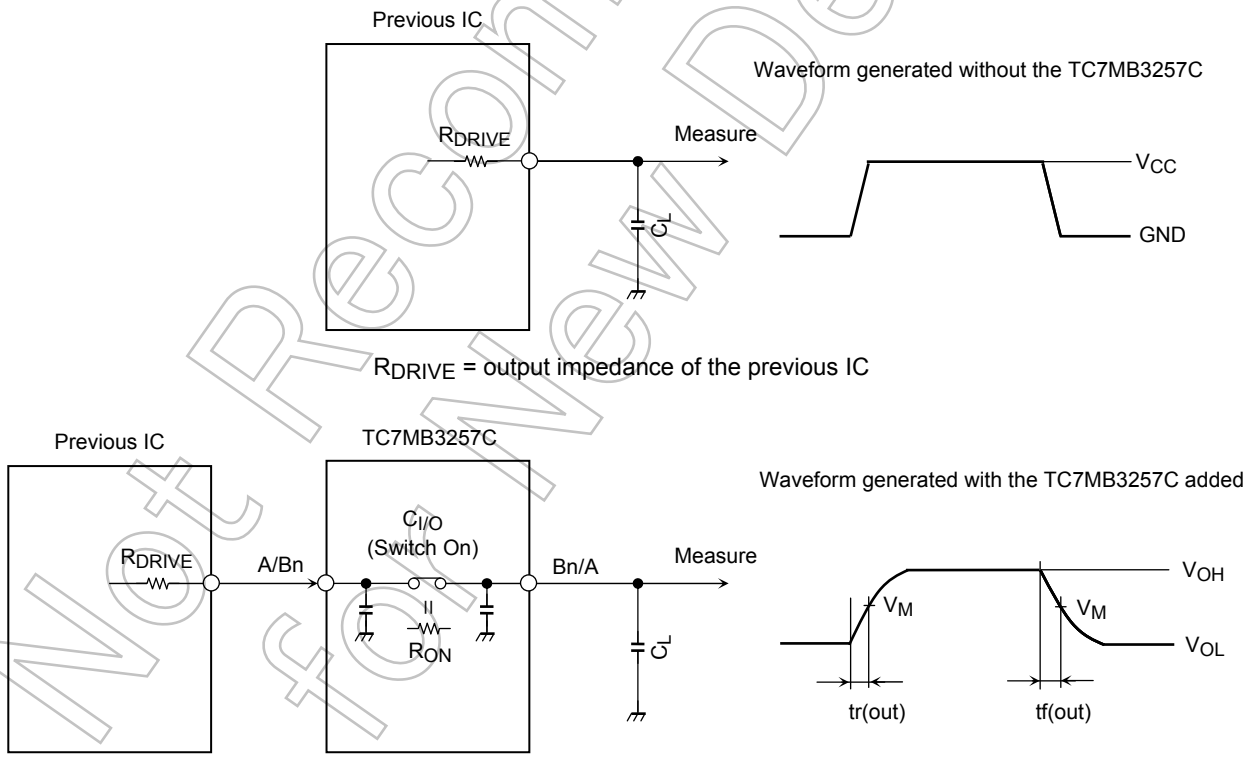
where, R_{DRIVE} is the output impedance of the previous-stage circuit.

Calculation example:

$$tr(out) (approx) = - (8.5 + 15)E-12 \cdot (120 + 3) \cdot \ln (((4.5 - 0) – 2.25) / (4.5 – 0))$$
$$\approx 2.0 \text{ ns}$$

Calculation conditions:

V_{CC} = 4.5 V , C_L = 15 pF , R_{DRIVE} = 120 Ω (output impedance of the previous IC), V_M = 2.25 V (V_{CC} / 2)
Output of the previous IC = digital (i.e., high-level voltage = V_{CC}; low-level voltage = GND)



Parameter	V_{CC}
	5.0 ± 0.5 V
V_M	V_{CC} / 2

Figure 3 Test Circuit

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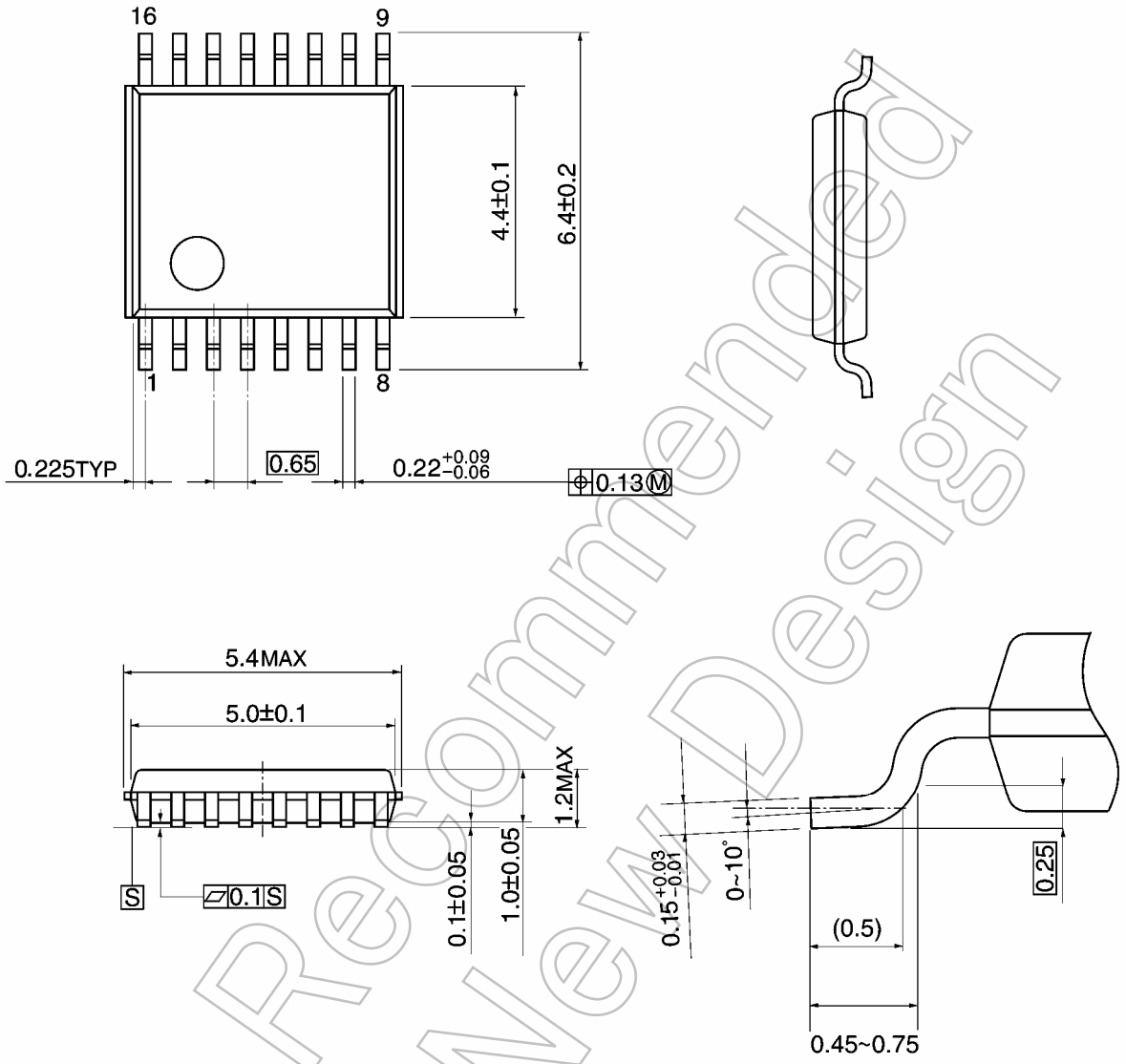
Package Dimensions

TSSOP16-P-0044-0.65A Unit: mm



Weight: 0.06 g (typ.)

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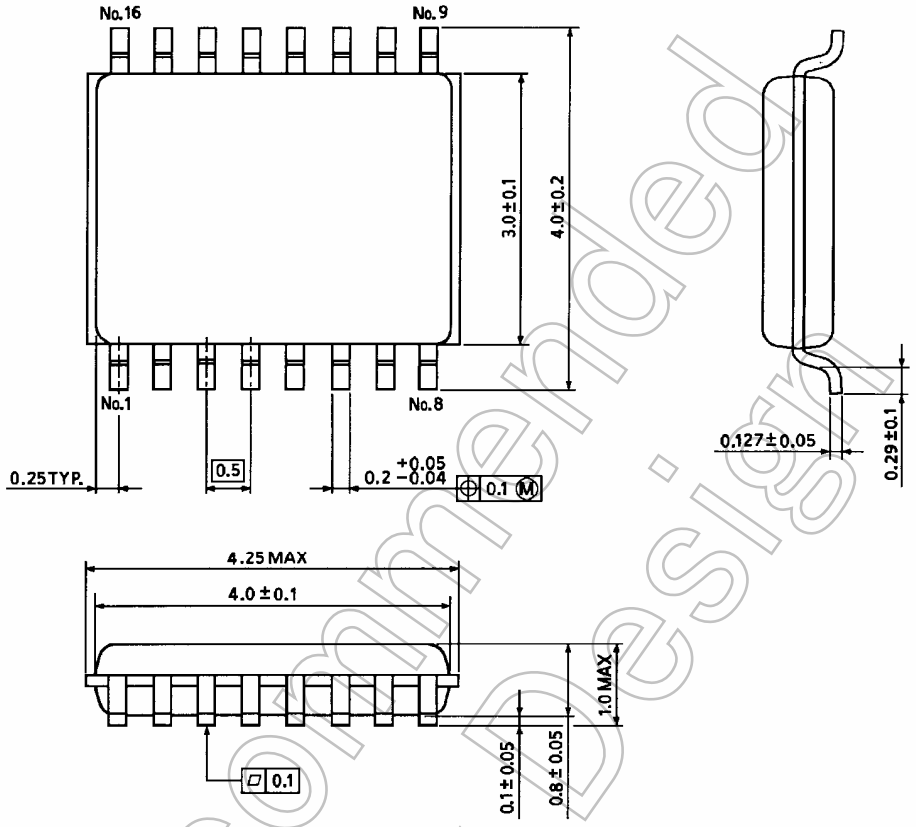
Package Dimensions

VSSOP16-P-0030-0.50 Unit : mm



Weight: 0.02 g (typ.)

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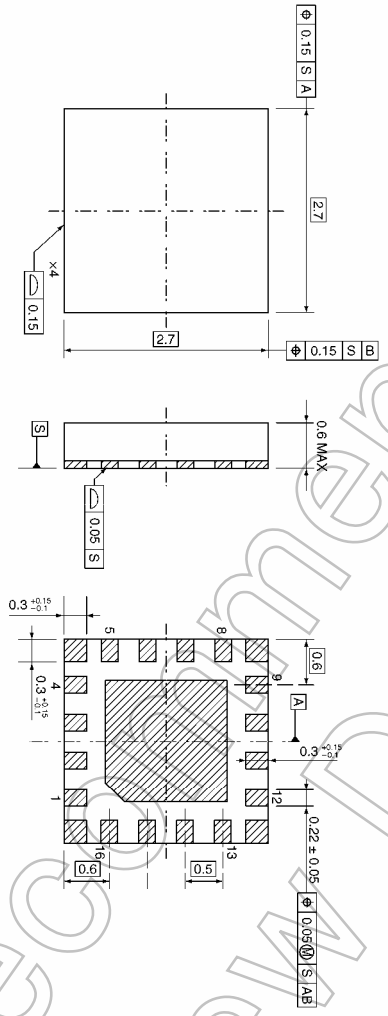
Package Dimensions

VQON16-P-0303-0.50 Unit: mm



Weight: 0.013 g (typ.)

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