

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7MBL3257CFT, TC7MBL3257CFK

4-Bit 1-of-2 Multiplexer/Demultiplexer

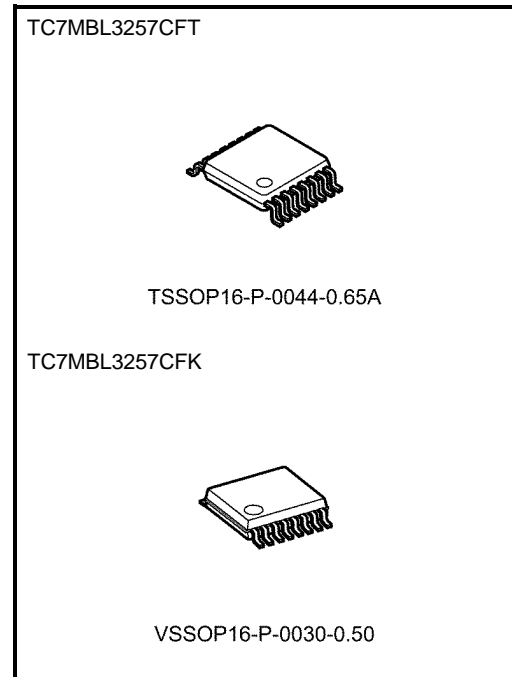
The TC7MBL3257C is a Low Voltage/Low Capacitance CMOS 4bit 1-of-2 Multiplexer/Demultiplexer. The low on-resistance of the switch allows connections to be made with minimal propagation delay time.

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

All inputs are equipped with protection circuits against static discharge.

Features

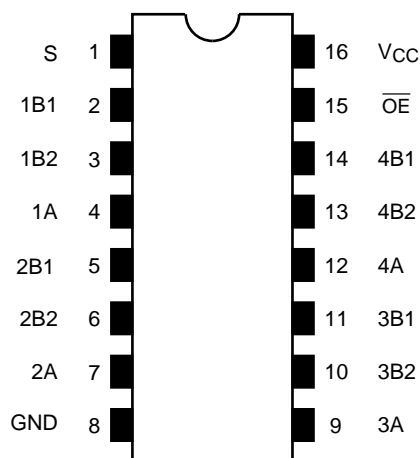
- Operating voltage: $V_{CC} = 1.65$ to 3.6 V
- On-capacitance: $C_{I/O} = 8$ pF Switch On (typ.) @ $V_{CC} = 3$ V
- On-resistance: $R_{ON} = 8.5 \Omega$ (typ.) @ $V_{CC} = 3$ V, $V_{I/O} = 0$ V
- ESD performance: Machine model $\geq \pm 200$ V
Human body model $\geq \pm 2000$ V
- Power-down protection for inputs (\overline{OE} , S and I/O)
- Package: TSSOP16, VSSOP16 (US16)
- Pin compatible with the TC7MBL3257A type



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

Pin Assignment (top view)

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



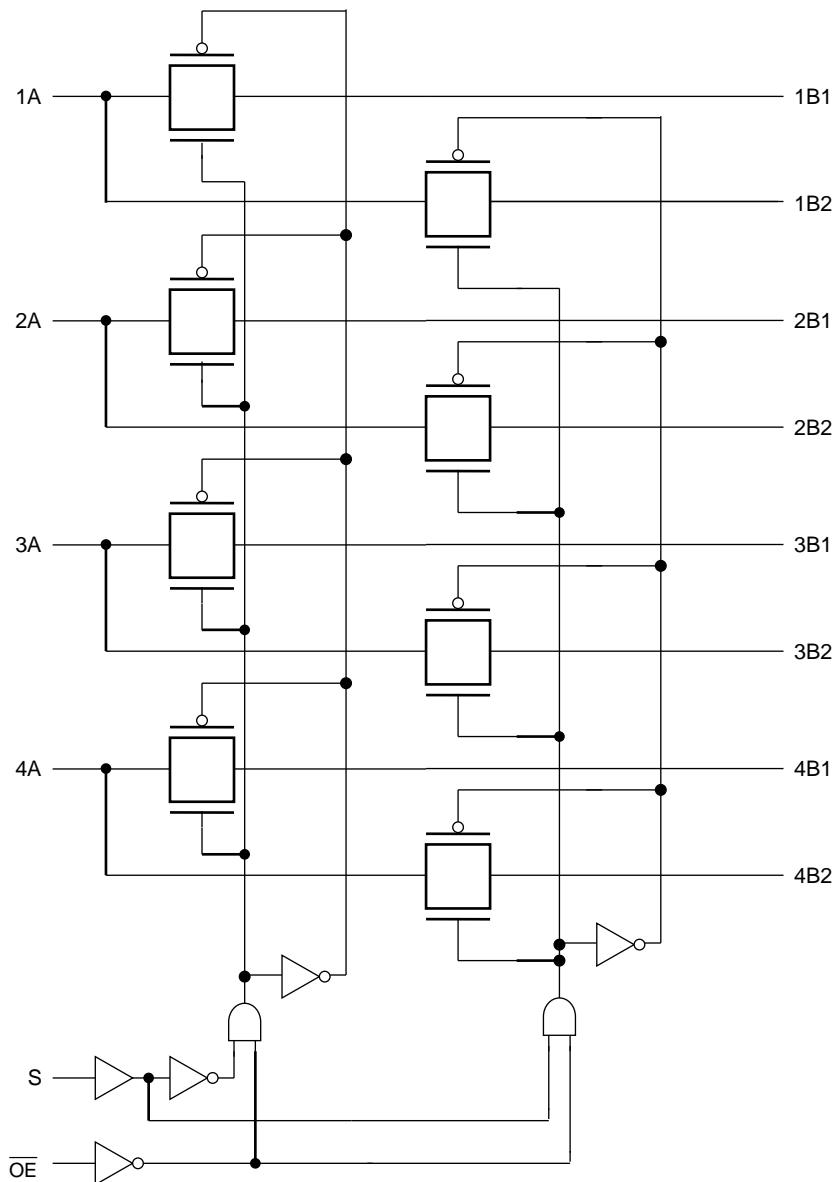
Start of Commercial Production
2007-12

Truth Table

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

X: Don't care

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		V_{IN}	-0.5 to 4.6	V
Switch terminal I/O voltage	$V_{CC} = 0\text{ V}$ 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	$^{\circ}\text{C}$

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	$V_{CC} = 0\text{ V}$ 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	$^{\circ}\text{C}$
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 inputs must be tied to either V_{CC} or GND.

Electrical Characteristics

DC Characteristics (Ta = -40 to 85°C)

Characteristic		Symbol	Test Condition	V _{CC} (V)	Min	Typ.	Max	Unit
Input voltage (\overline{OE} , S)	"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} , S)		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} , S, 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 (Note 1) (Note2)	R _{ON}	V _{IS} = 0 V, I _{IS} = 30 mA	3.0	—	8.5	13	Ω	
		V _{IS} = 3.0 V, I _{IS} = 30 mA	3.0	—	16	24		
		V _{IS} = 2.4 V, I _{IS} = 15 mA	3.0	—	18	27		
		V _{IS} = 0 V, I _{IS} = 24 mA	2.3	—	10	15		
		V _{IS} = 2.3 V, I _{IS} = 24 mA	2.3	—	20	30		
		V _{IS} = 2.0 V, I _{IS} = 15 mA	2.3	—	23	33		
		V _{IS} = 0 V, I _{IS} = 4 mA	1.65	—	12	18		
		V _{IS} = 1.65 V, I _{IS} = 4 mA	1.65	—	26	37		
Quiescent supply current		I _{CC}	V _{IN} = V _{CC} or GND, I _{OUT} = 0 A	3.6	—	—	10	μA

Note 1: All 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)

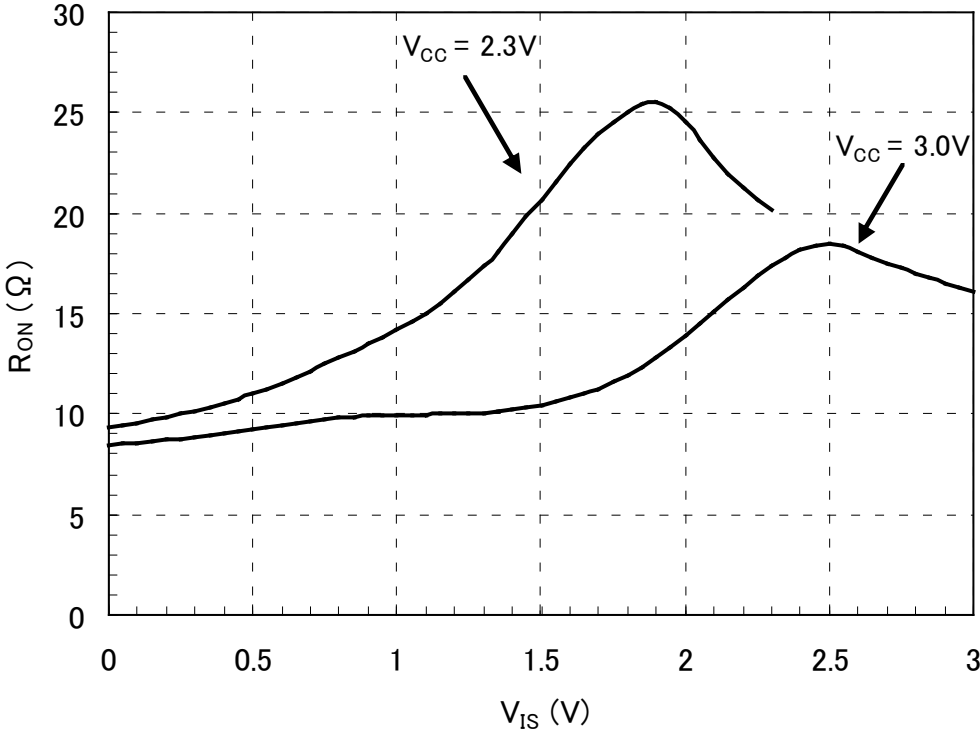
Characteristics	Symbol	Test Condition	V _{CC} (V)	Min	Max	Unit
Output enable time (\overline{OE} to bus)	t_{pZL} t_{pZH}	Figure 1, Figure 2	3.3 ± 0.3	—	6	ns
			2.5 ± 0.2	—	7	
			1.8 ± 0.15	—	11	
Output enable time (S to bus)	t_{pZL} t_{pZH}	Figure 1, Figure 2	3.3 ± 0.3	—	6	ns
			2.5 ± 0.2	—	7	
			1.8 ± 0.15	—	11	
Output disable time (\overline{OE} to bus)	t_{pLZ} t_{pHZ}	Figure 1, Figure 2	3.3 ± 0.3	—	6	ns
			2.5 ± 0.2	—	7	
			1.8 ± 0.15	—	11	
Output disable time (S to bus)	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 (\overline{OE} , S)	C _{IN}	V _{IN} = 0 V (Note 1)	3.0	4	pF
Switch terminal capacitance (B1,B2) (switch off)	C _{I/O}	$\overline{OE} = V_{CC}, V_{IS} = 0 V$ (Note 1)	3.0	3	pF
Switch terminal capacitance (A) (switch off)	C _{I/O}	$\overline{OE} = V_{CC}, V_{IS} = 0 V$ (Note 1)	3.0	5	pF
Switch terminal capacitance (B1,B2) (switch on)	C _{I/O}	$\overline{OE} = GND, V_{IS} = 0 V$ (Note 1)	3.0	8	pF
Switch terminal capacitance (A) (switch on)	C _{I/O}	$\overline{OE} = GND, V_{IS} = 0 V$ (Note 1)	3.0	8	pF

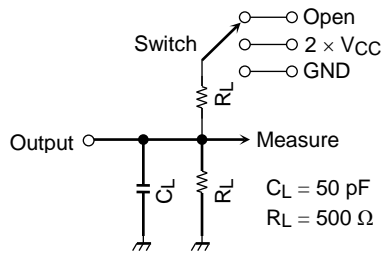
Note 1: This parameter is guaranteed by design

RON - VIS Characteristic (typ.) Ta = 25°C



AC Test Circuit

Test Circuit



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

Figure 1 AC Characteristics Test Circuit

AC Waveform

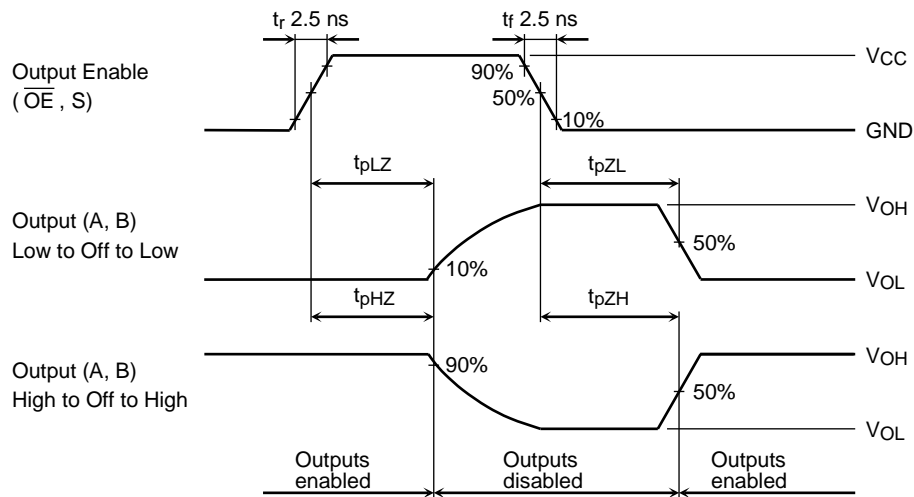


Figure 2 $t_{pLZ}, t_{pHZ}, t_{pZL}, t_{pZH}$

Rise and Fall Times (tr / tf) of the TC7MBL3257C 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 (CI/O) and the on-resistance (RON) 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 TC7MBL3257C.

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, RDRIVE is the output impedance of the previous-stage circuit.

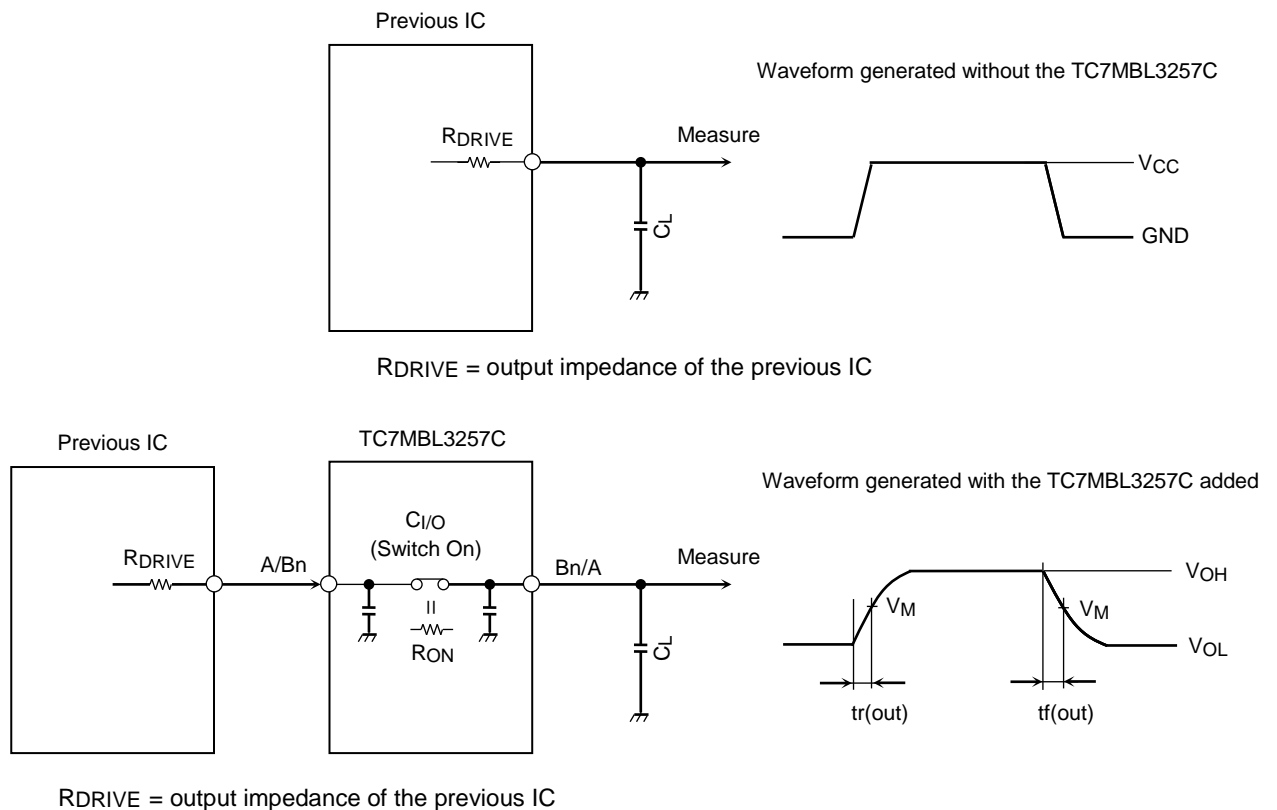
Calculation example:

$$tr(out) \text{ (approx)} = - (8 + 15) E-12 \cdot (120 + 8.5) \cdot \ln (((3.0 - 0) - 1.5) / (3.0 - 0))$$

$$\approx 2.1 \text{ ns}$$

Calculation conditions:

VCC = 3.0 V, CL = 15 pF, RDRIVE = 120 Ω (output impedance of the previous IC), VM = 1.5 V (VCC / 2)
 Output of the previous IC = digital (i.e., high-level voltage = VCC; low-level voltage = GND)



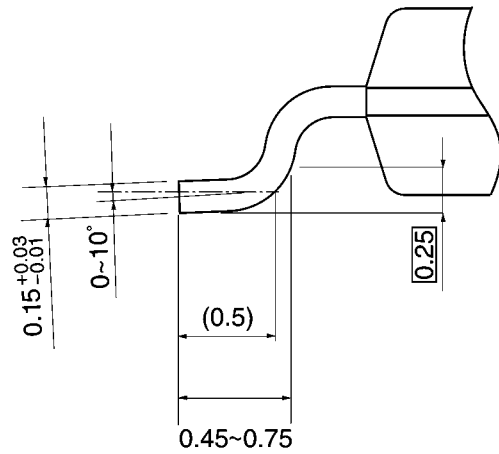
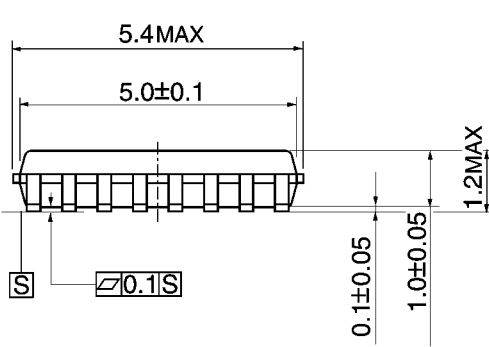
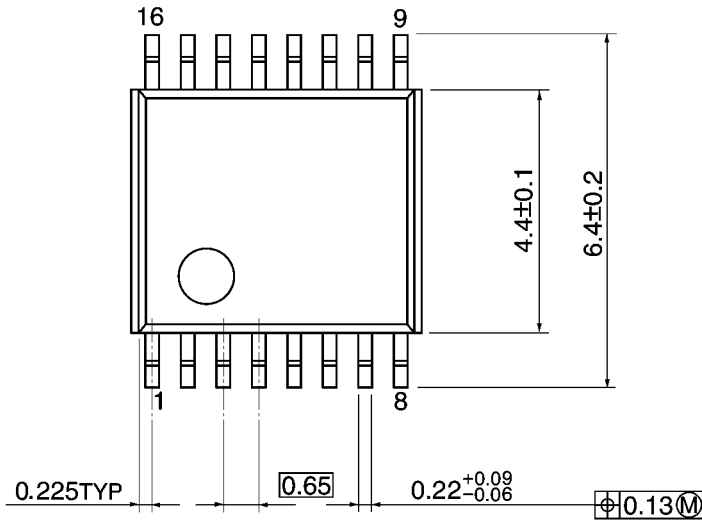
Parameter	VCC		
	3.3 ± 0.3 V	2.5 ± 0.2 V	1.8 ± 0.15 V
VM	VCC / 2	VCC / 2	VCC / 2

Figure 3 Test Circuit

Package Dimensions

TSSOP16-P-0044-0.65A

Unit: mm

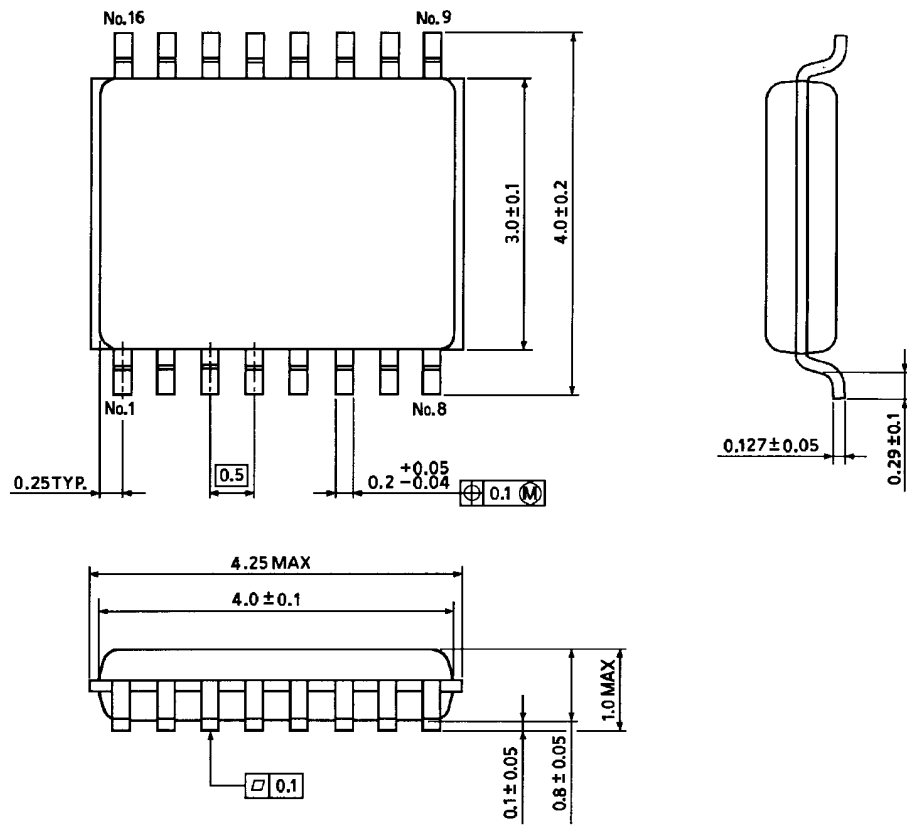


Weight: 0.06 g (typ.)

Package Dimensions

VSSOP16-P-0030-0.50

Unit : mm



Weight: 0.02 g (typ.)

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