

TC74LCX244F, TC74LCX244FT, TC74LCX244FK**Low-Voltage Octal Bus Buffer with 5-V Tolerant Inputs and Outputs**

The TC74LCX244 is a high-performance CMOS octal bus buffer. Designed for use in 3.3-V systems, it achieves high-speed operation while maintaining the CMOS low power dissipation.

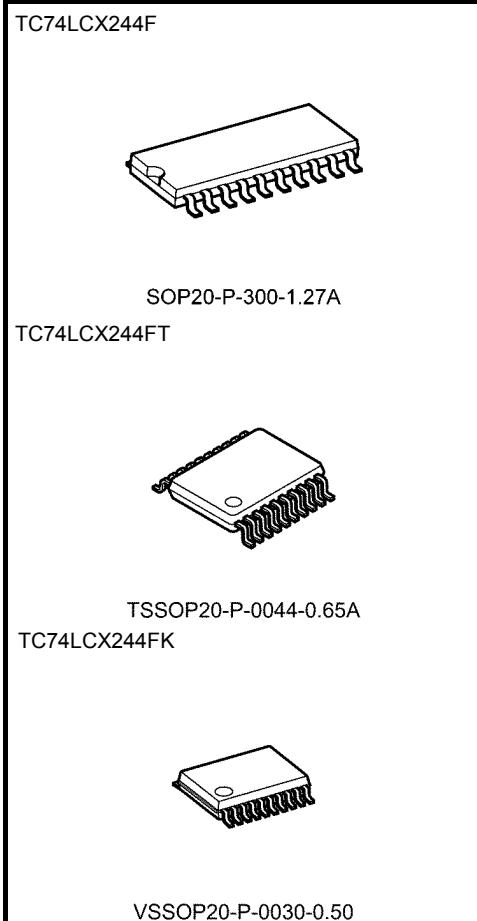
The device is designed for low-voltage (3.3 V) VCC applications, but it could be used to interface to 5 V supply environment for both inputs and outputs.

The 74LCX244F/FT is a non-inverting 3-state buffer having two active-low output enables. This device is designed to be used with 3-state memory address drivers, etc.

All inputs are equipped with protection circuits against static discharge.

Features

- Low-voltage operation: VCC = 1.65 to 3.6 V
- High-speed operation: $t_{pd} = 6.5$ ns (max) (VCC = 3.0 to 3.6 V)
- Output current: $|IOH|/IOL = 24$ mA (min) (VCC = 3.0 V)
- Latch-up performance: $\geq \pm 500$ mA
- Available in JEITA SOP, TSSOP and VSSOP (US)
- Power-down protection provided on all inputs and outputs
- Pin and function compatible with the 74 series
(74AC/VHC/HC/F/ALS/LS etc.) 244 type

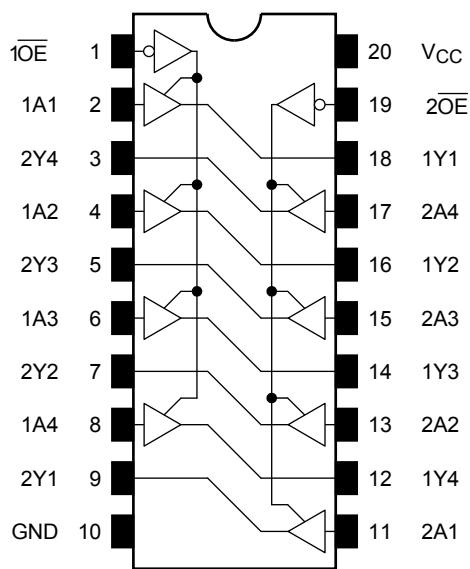
**Weight**

SOP20-P-300-1.27A	: 0.22 g (typ.)
TSSOP20-P-0044-0.65A	: 0.08 g (typ.)
VSSOP20-P-0030-0.50	: 0.03 g (typ.)

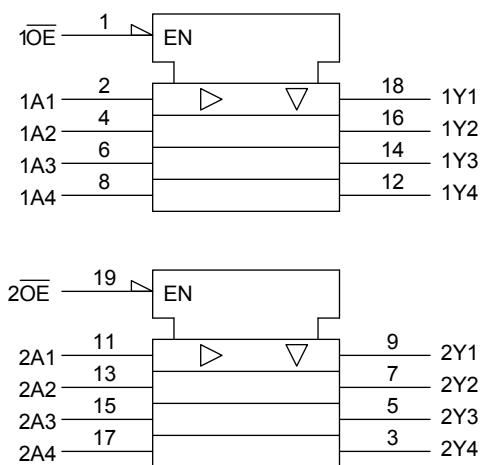
Note: The Electrical Characteristics of VCC=1.8±0.15V is only applicable for products which manufactured from January 2009 onward.

Start of commercial production
1994-03

Pin Assignment (top view)



IEC Logic Symbol



Truth Table

Inputs		Outputs
\overline{OE}	A_n	
L	L	L
L	H	H
H	X	Z

X: Don't care

Z: High impedance

Absolute Maximum Ratings (Note 1)

Characteristics	Symbol	Rating	Unit
Power supply voltage	V_{CC}	–0.5 to 7.0	V
DC input voltage	V_{IN}	–0.5 to 7.0	V
DC output voltage	V_{OUT}	–0.5 to 7.0 (Note 2)	V
		–0.5 to $V_{CC} + 0.5$ (Note 3)	
Input diode current	I_{IK}	–50	mA
Output diode current	I_{OK}	± 50 (Note 4)	mA
DC output current	I_{OUT}	± 50	mA
Power dissipation	P_D	180	mW
DC V_{CC} /ground current	I_{CC}/I_{GND}	± 100	mA
Storage temperature	T_{stg}	–65 to 150	°C

Note 1: 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.).

Note 2: Output in OFF state

Note 3: High or low state. I_{OUT} absolute maximum rating must be observed.

Note 4: $V_{OUT} < GND$, $V_{OUT} > V_{CC}$

Operating Ranges (Note 1)

Characteristics	Symbol	Rating	Unit
Power supply voltage	V_{CC}	1.65 to 3.6	V
		1.5 to 3.6 (Note 2)	
Input voltage	V_{IN}	0 to 5.5	V
Output voltage	V_{OUT}	0 to 5.5 (Note 3)	V
		0 to V_{CC} (Note 4)	
Output current	I_{OH}/I_{OL}	± 24 (Note 5)	mA
		± 12 (Note 6)	
Operating temperature	T_{opr}	–40 to 85	°C
Input rise and fall time	dt/dv	0 to 10 (Note 7)	ns/V

Note 1: 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.

Note 2: Data retention only

Note 3: Output in OFF state

Note 4: High or low state

Note 5: $V_{CC} = 3.0$ to 3.6 V

Note 6: $V_{CC} = 2.7$ to 3.0 V

Note 7: $V_{IN} = 0.8$ to 2.0 V, $V_{CC} = 3.0$ V

Electrical Characteristics

DC Characteristics (Ta = -40 to 85°C)

Characteristics		Symbol	Test Condition	V _{CC} (V)	Min	Max	Unit	
Input voltage	H-level	V _{IH}	—	1.65 to 2.3	V _{CC} ×0.9	—	V	
				2.3 to 2.7	1.7	—		
				2.7 to 3.6	2.0	—		
	L-level	V _{IL}	—	1.65 to 2.3	—	V _{CC} ×0.1		
				2.3 to 2.7	—	0.7		
				2.7 to 3.6	—	0.8		
Output voltage	H-level	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -100 µA	1.65 to 3.6	V _{CC} -0.2	V	
				I _{OH} = -4 mA	1.65	1.05		
				I _{OH} = -8 mA	2.3	1.7		
				I _{OH} = -12 mA	2.7	2.2		
				I _{OH} = -18 mA	3.0	2.4		
				I _{OH} = -24 mA	3.0	2.2		
	L-level	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 100 µA	1.65 to 3.6	—	V	
				I _{OL} = 4 mA	1.65	—		
				I _{OL} = 8 mA	2.3	—		
				I _{OL} = 12 mA	2.7	—		
				I _{OL} = 16 mA	3.0	—		
				I _{OL} = 24 mA	3.0	—		
Input leakage current		I _{IN}	V _{IN} = 0 to 5.5 V	1.65 to 3.6	—	±5.0	µA	
3-state output off-state current		I _{OZ}	V _{IN} = V _{IH} or V _{IL} V _{OUT} = 0 to 5.5 V	1.65 to 3.6	—	±5.0	µA	
Power off leakage current		I _{OFF}	V _{IN} /V _{OUT} = 5.5 V	0	—	10.0	µA	
Quiescent supply current		I _{CC}	V _{IN} = V _{CC} or GND	1.65 to 3.6	—	10.0	µA	
			V _{IN} /V _{OUT} = 3.6 to 5.5 V	1.65 to 3.6	—	±10.0		
Increase in I _{CC} per input		ΔI _{CC}	V _{IH} = V _{CC} - 0.6V	2.7 to 3.6	—	500	µA	

AC Characteristics (Ta = -40 to 85°C)

Characteristics	Symbol	Test Condition	V _{CC} (V)	Min	Max	Unit	
Propagation delay time	t _{pLH} t _{pHL}	Figure 1, Figure 2	1.8 ± 0.15	—	25.0	ns	
			2.5 ± 0.2	—	8.5		
			2.7	—	7.5		
			3.3 ± 0.3	1.5	6.5		
Output enable time	t _{pZL} t _{pZH}	Figure 1, Figure 3	1.8 ± 0.15	—	32.0	ns	
			2.5 ± 0.2	—	16.0		
			2.7	—	9.0		
			3.3 ± 0.3	1.5	8.0		
Output disable time	t _{pLZ} t _{pHZ}	Figure 1, Figure 3	1.8 ± 0.15	—	30.0	ns	
			2.5 ± 0.2	—	15.0		
			2.7	—	8.0		
			3.3 ± 0.3	1.5	7.0		
Output to output skew	t _{osLH} t _{osHL}	(Note)	2.7	—	—	ns	
			3.3 ± 0.3	—	1.0		

Note: Parameter guaranteed by design.

$$(t_{osLH} = |t_{pLHm} - t_{pLHn}|, t_{osHL} = |t_{pHLm} - t_{pHLn}|)$$

Dynamic Switching Characteristics (Ta = 25°C, input: t_r = t_f = 2.5 ns, C_L = 50 pF, R_L = 500 Ω)

Characteristics	Symbol	Test Condition	V _{CC} (V)	Typ.	Unit
Quiet output maximum dynamic V _{OL}	V _{OLP}	V _{IH} = 3.3 V, V _{IL} = 0 V	3.3	0.8	V
Quiet output minimum dynamic V _{OL}	V _{OLV}	V _{IH} = 3.3 V, V _{IL} = 0 V	3.3	0.8	V

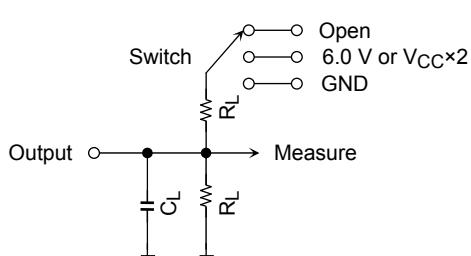
Capacitive Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	V _{CC} (V)	Typ.	Unit	
Input capacitance	C _{IN}	—	3.3	7	pF	
Output capacitance	C _{OUT}	—	3.3	8	pF	
Power dissipation capacitance	C _{PD}	f _{IN} = 10 MHz	(Note)	3.3	25	pF

Note: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption.

Average operating current can be obtained by the equation:

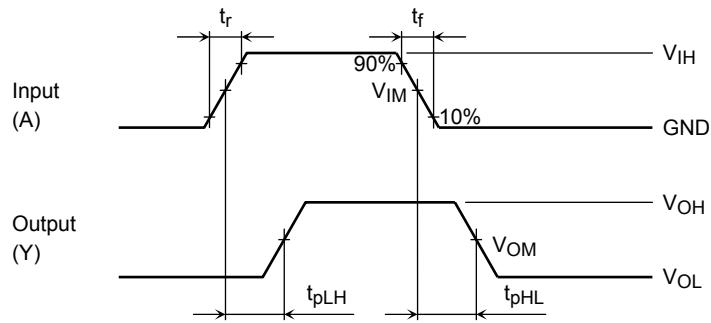
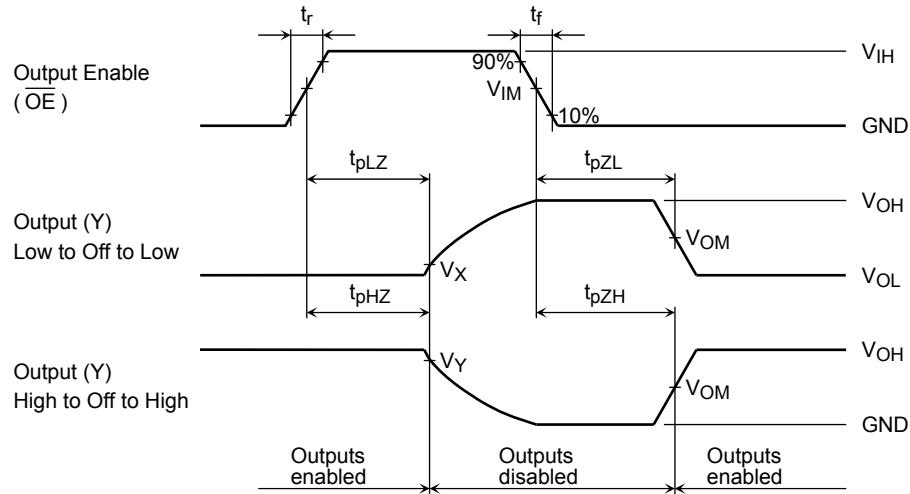
$$I_{CC\ (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8 \text{ (per bit)}$$

AC Test Circuit

Parameter	Switch
t_{pLH}, t_{pHL}	Open
t_{pLZ}, t_{pZL}	6.0 V @ $V_{CC} = 3.3 \pm 0.3V$
	@ $V_{CC} = 2.7V$
t_{pHZ}, t_{pZH}	$V_{CC} \times 2$ @ $V_{CC} = 2.5 \pm 0.2V$
	@ $V_{CC} = 1.8 \pm 0.15V$
t_{pHZ}, t_{pZH}	GND

Figure 1

AC Waveform

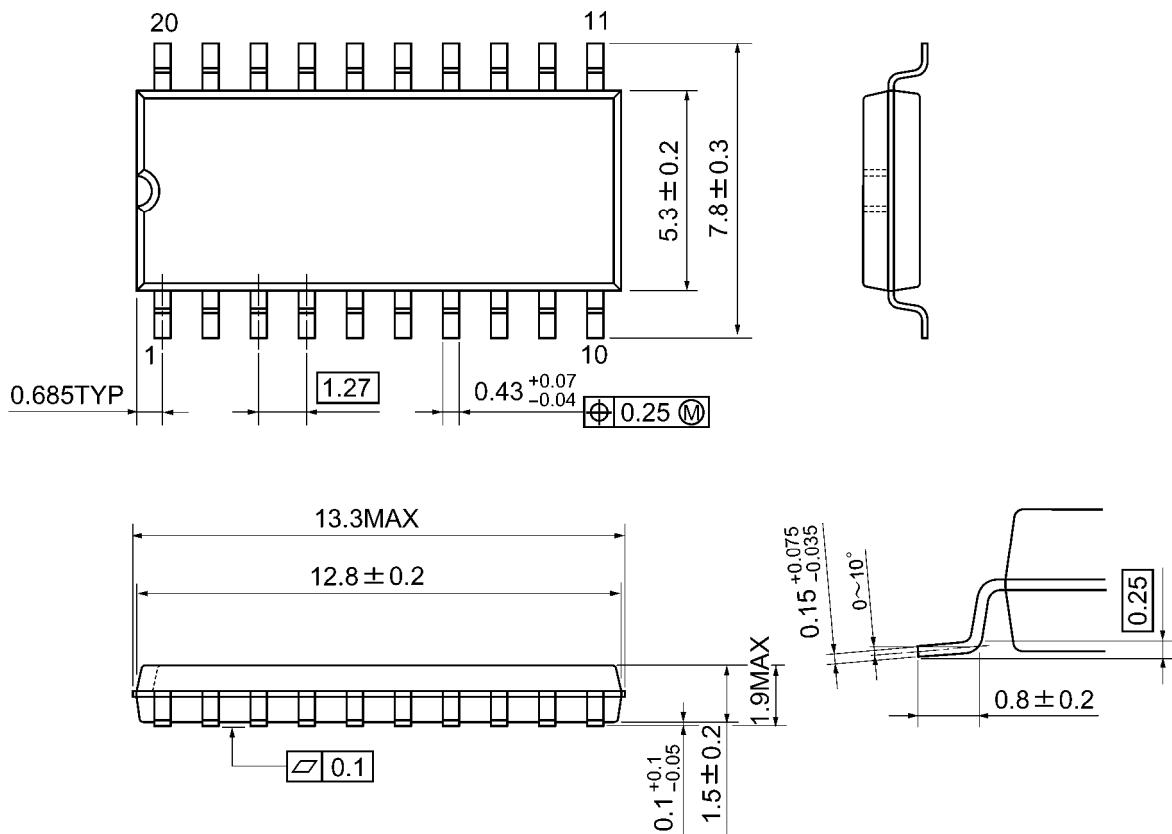
Figure 2 t_{PLH}, t_{PHL} Figure 3 $t_{PLZ}, t_{PHZ}, t_{pzL}, t_{pzH}$

	Symbol	V _{CC}		
		3.3 ± 0.3 V 2.7V	2.5 ± 0.2 V	1.8 ± 0.15 V
Input	V _{IH}	2.7V	V _{CC}	V _{CC}
	V _{IM}	1.5V	V _{CC} /2	V _{CC} /2
	t _r , t _f	2.5ns	2.0ns	2.0ns
Output	V _{OM}	1.5V	V _{OH} /2	V _{OH} /2
	V _X	V _{OL} + 0.3V	V _{OL} + 0.15V	V _{OL} + 0.15V
	V _Y	V _{OH} - 0.3V	V _{OH} - 0.15V	V _{OH} - 0.15V
Load	C _L	50pF	30pF	30pF
	R _L	500Ω	500Ω	1kΩ

Package Dimensions

SOP20-P-300-1.27A

Unit: mm

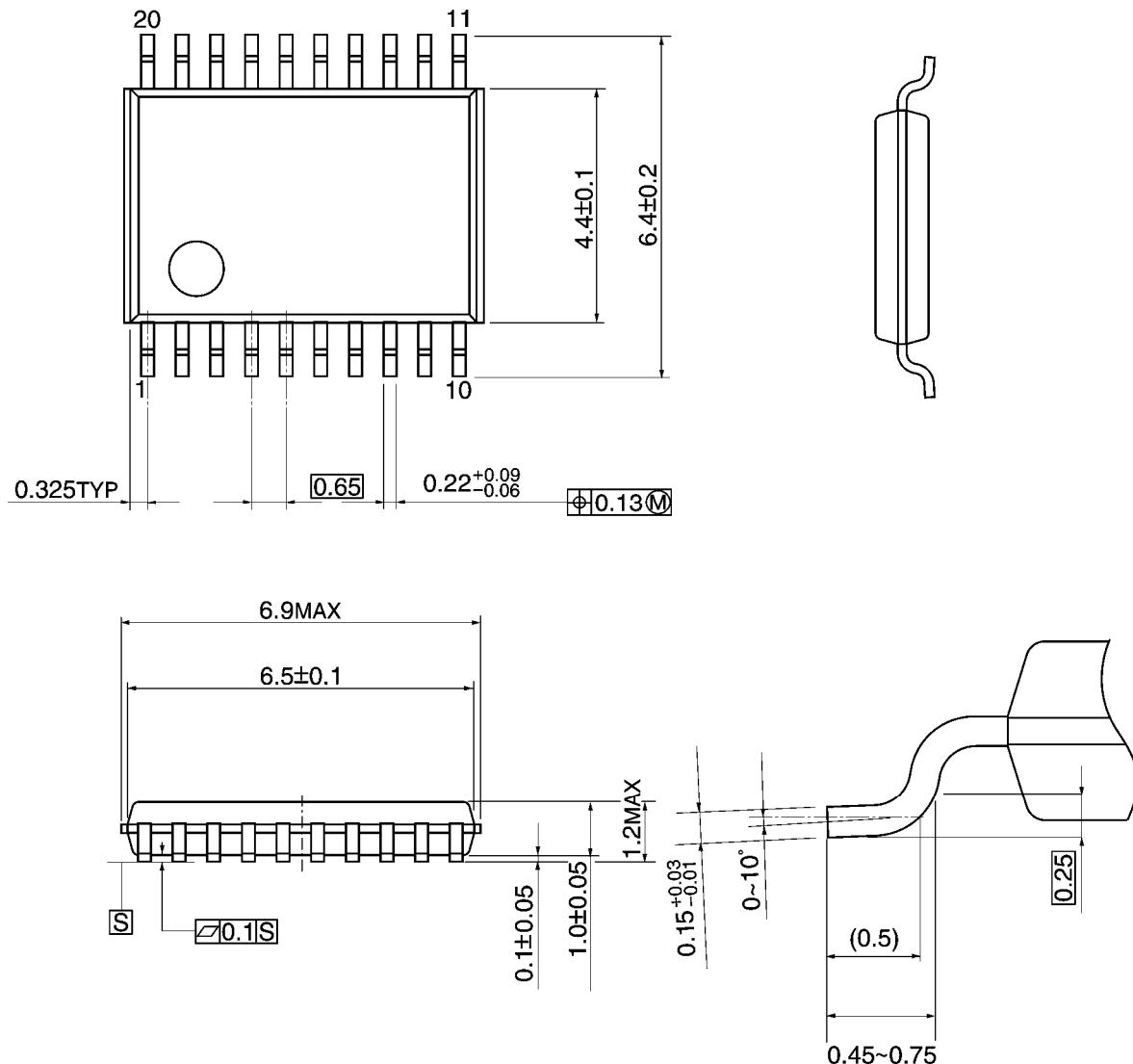


Weight: 0.22 g (typ.)

Package Dimensions

TSSOP20-P-0044-0.65A

Unit: mm

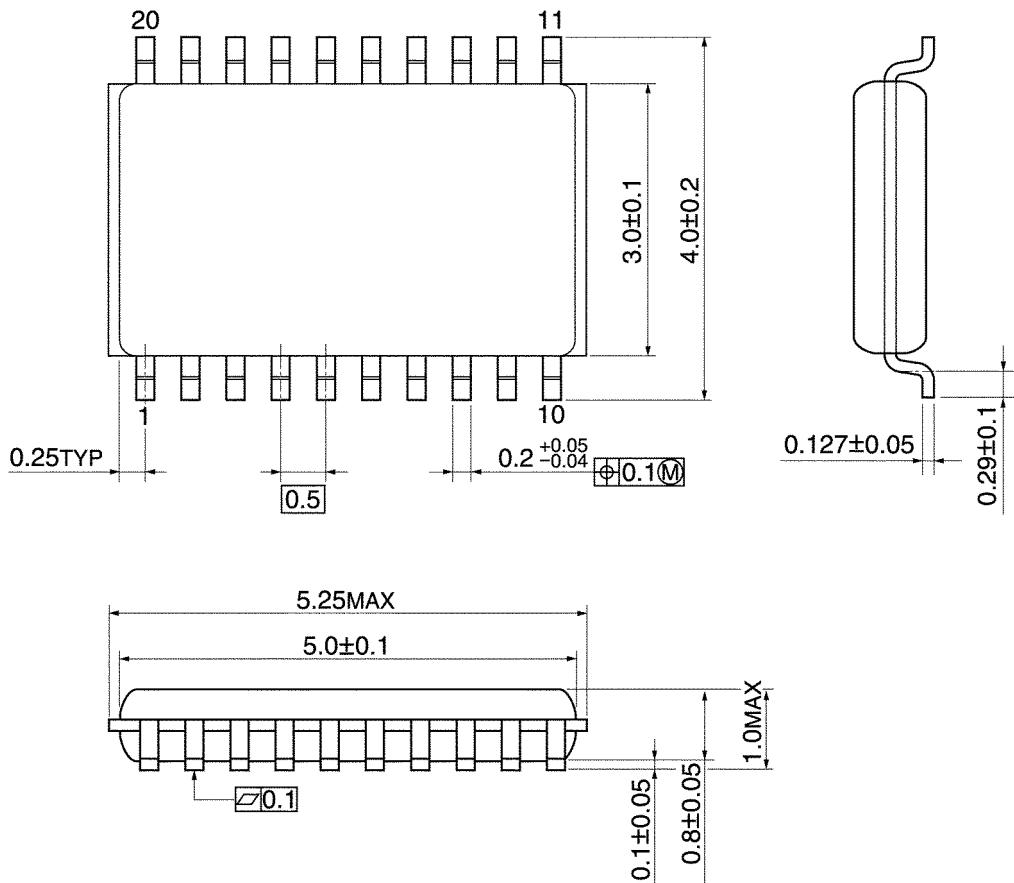


Weight: 0.08 g (typ.)

Package Dimensions

VSSOP20-P-0030-0.50

Unit: mm



Weight: 0.03 g (typ.)

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