

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74VHCT240AF, TC74VHCT240AFW, TC74VHCT240AFT, TC74VHCT240AFK TC74VHCT244AF, TC74VHCT244AFW, TC74VHCT244AFT, TC74VHCT244AFK

Octal Bus Buffer

TC74VHCT240AF/AFW/AFT/AFK
Inverted, 3-State Outputs

TC74VHCT244AF/AFW/AFT/AFK
Non-Inverted, 3-State Outputs

The TC74VHCT240A and 244A are advanced high speed CMOS OCTAL BUS BUFFERS fabricated with silicon gate C²MOS technology. They achieve the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

The TC74VHCT240A is an inverting 3-state buffer having two active-low output enables. The TC74VHCT244A is a non-inverting 3-state buffer, and has two active-low output enables.

These devices are designed to be used with 3-state memory address drivers, etc.

The input voltage are compatible with TTL output voltage.

These devices may be used as a level converter for interfacing 3.3 V to 5 V system.

Input protection and output circuit ensure that 0 to 5.5 V can be applied to the input and output (Note) pins without regard to the supply voltage. These structure prevents device destruction due to mismatched supply and input/output voltages such as battery back up, hot board insertion, etc.

Note: Output in off-state

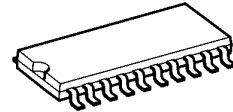
Features

- High speed: $t_{pd} = 6.1 \text{ ns (typ.)}$ at $V_{CC} = 5 \text{ V}$
- Low power dissipation: $I_{CC} = 4 \text{ } \mu\text{A (max)}$ at $T_a = 25^\circ\text{C}$
- Compatible with TTL outputs: $V_{IL} = 0.8 \text{ V (max)}$
 $V_{IH} = 2.0 \text{ V (min)}$
- Power down protection is provided on all inputs and outputs
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Low noise: $V_{OLP} = 1.0 \text{ V (max)}$
- Pin and function compatible with the 74 series (74AC/HC/F/ALS/LS etc.) 240/244 type.

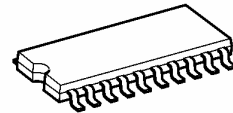
Weight	
SOP20-P-300-1.27A	: 0.22 g (typ.)
SOP20-P-300-1.27	: 0.22 g (typ.)
SOL20-P-300-1.27	: 0.46 g (typ.)
TSSOP20-P-0044-0.65A	: 0.08 g (typ.)
VSSOP20-P-0030-0.50	: 0.03 g (typ.)

Note: xxxFW (JEDEC SOP) is not available in Japan.

TC74VHCT240AF, TC74VHCT244AF

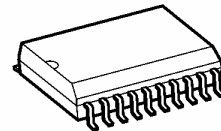


SOP20-P-300-1.27A



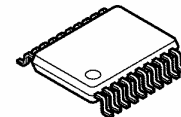
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TC74VHCT240AFW, TC74VHCT244AFW



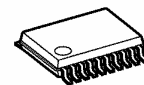
SOL20-P-300-1.27

TC74VHCT240AFT, TC74VHCT244AFT



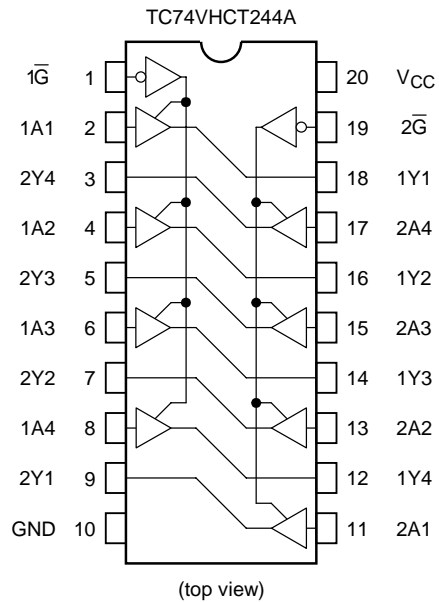
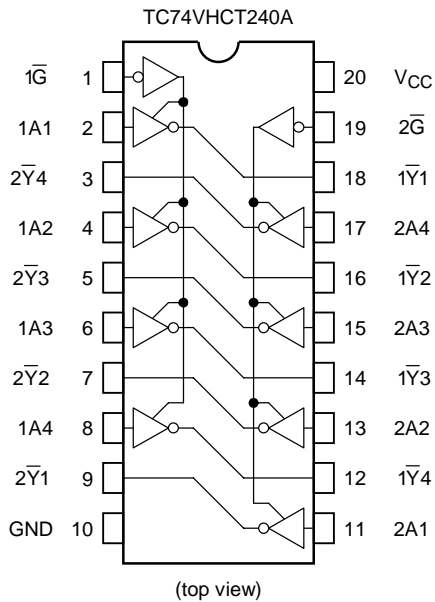
TSSOP20-P-0044-0.65A

TC74VHCT240AFK, TC74VHCT244AFK

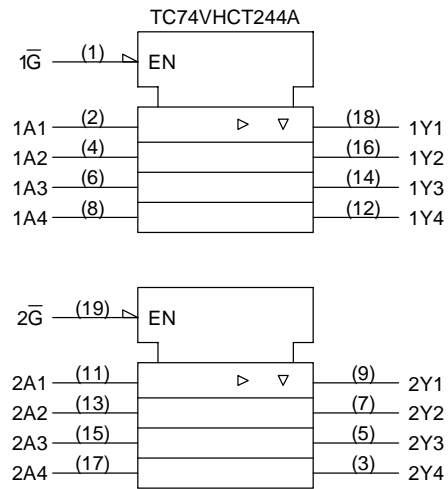
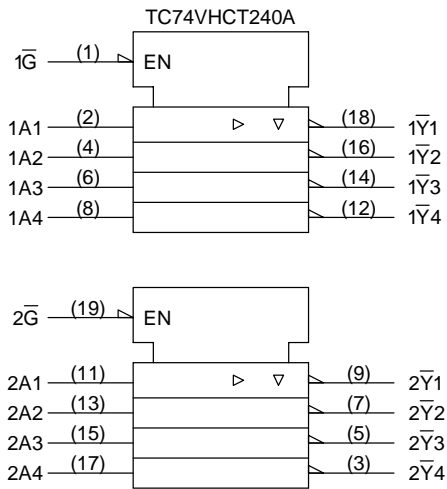


VSSOP20-P-0030-0.50

Pin Assignment



IEC Logic Symbol



Truth Table

Inputs		Outputs	
\overline{G}	A_n	Y_n	\overline{Y}_n
L	L	L	H
L	H	H	L
H	X	Z	Z

X: Don't care

Z: High impedance

Y_n : TC74VHCT244A

\overline{Y}_n : TC74VHCT240A

Absolute Maximum Ratings (Note 1)

Characteristics	Symbol	Rating	Unit
Supply voltage range	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}	-20	mA
Output diode current	I_{OK}	± 20 (Note 4)	mA
DC output current	I_{OUT}	± 25	mA
DC V_{CC} /ground current	I_{CC}	± 75	mA
Power dissipation	P_D	180	mW
Storage temperature	T_{stg}	-65 to 150	$^{\circ}C$

Note 1: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Note 2: Output in off-state

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

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

Recommended Operating Conditions (Note 1)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	4.5 to 5.5	V
Input voltage	V_{IN}	0 to 5.5	V
Output voltage	V_{OUT}	0 to 5.5 (Note 2)	V
		0 to V_{CC} (Note 3)	
Operating temperature	T_{opr}	-40 to 85	$^{\circ}C$
Input rise and fall time	dt/dV	0 to 20	ns/V

Note 1: The recommended operating conditions are required to ensure the normal operation of the device. Unused inputs must be tied to either V_{CC} or GND .

Note 2: Output in off-state

Note 3: High or low state

Electrical Characteristics

DC Characteristics

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit	
				V _{CC} (V)	Min	Typ.	Max	Min		Max
High-level input voltage	V _{IH}	—		4.5 to 5.5	2.0	—	—	2.0	—	V
Low-level input voltage	V _{IL}	—		4.5 to 5.5	—	—	0.8	—	0.8	V
High-level output voltage	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -50 μA	4.5	4.40	4.50	—	4.40	—	V
			I _{OH} = -8 mA	4.5	3.94	—	—	3.80	—	
Low-level output voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 50 μA	4.5	—	0.0	0.10	—	0.10	V
			I _{OL} = 8 mA	4.5	—	—	0.36	—	0.44	
3-state output off-state current	I _{OZ}	V _{IN} = V _{IH} or V _{IL} V _{OUT} = V _{CC} or GND		5.5	—	—	±0.25	—	±2.50	μA
Input leakage current	I _{IN}	V _{IN} = 5.5 V or GND		0 to 5.5	—	—	±0.1	—	±1.0	μA
Quiescent supply current	I _{CC}	V _{IN} = V _{CC} or GND		5.5	—	—	4.0	—	40.0	μA
	I _{CCCT}	Per input: V _{IN} = 3.4 V Other input: V _{CC} or GND		5.5	—	—	1.35	—	1.50	mA
Output leakage current	I _{OPD}	V _{OUT} = 5.5 V		0	—	—	0.5	—	5.0	μA

AC Characteristics (input: $t_r = t_f = 3$ ns)

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit		
			V _{CC} (V)	C _L (pF)	Min	Typ.	Max		Min	Max
Propagation delay time (TC74VHCT240A)	t _{pLH}	—	5.0 ± 0.5	15	—	5.6	7.8	1.0	9.0	ns
	t _{pHL}			50	—	6.1	8.8	1.0	10.0	
Propagation delay time (TC74VHCT244A)	t _{pLH}	—	5.0 ± 0.5	15	—	5.4	7.4	1.0	8.5	ns
	t _{pHL}			50	—	5.9	8.4	1.0	9.5	
3-state output enable time	t _{pZL}	R _L = 1 kΩ	5.0 ± 0.5	15	—	7.7	10.4	1.0	12.0	ns
	t _{pZH}			50	—	8.2	11.4	1.0	13.0	
3-state output disable time	t _{pLZ}	R _L = 1 kΩ	5.0 ± 0.5	50	—	8.8	11.4	1.0	13.0	ns
	t _{pHZ}									
Output to output skew	t _{osLH}	(Note 1)	5.0 ± 0.5	50	—	—	1.0	—	1.0	ns
	t _{osHL}									
Input capacitance	C _{IN}	—	—	—	—	4	10	—	10	pF
Output capacitance	C _{OUT}	—	—	—	—	9	—	—	—	pF
Power dissipation capacitance (Note 2)	C _{PD}	TC74VHCT240A	—	—	—	19	—	—	—	pF
		TC74VHCT244A	—	—	—	18	—	—	—	

Note 1: Parameter guaranteed by design.

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

Note 2: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:

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

Noise Characteristics (input: $t_r = t_f = 3$ ns) (Note)

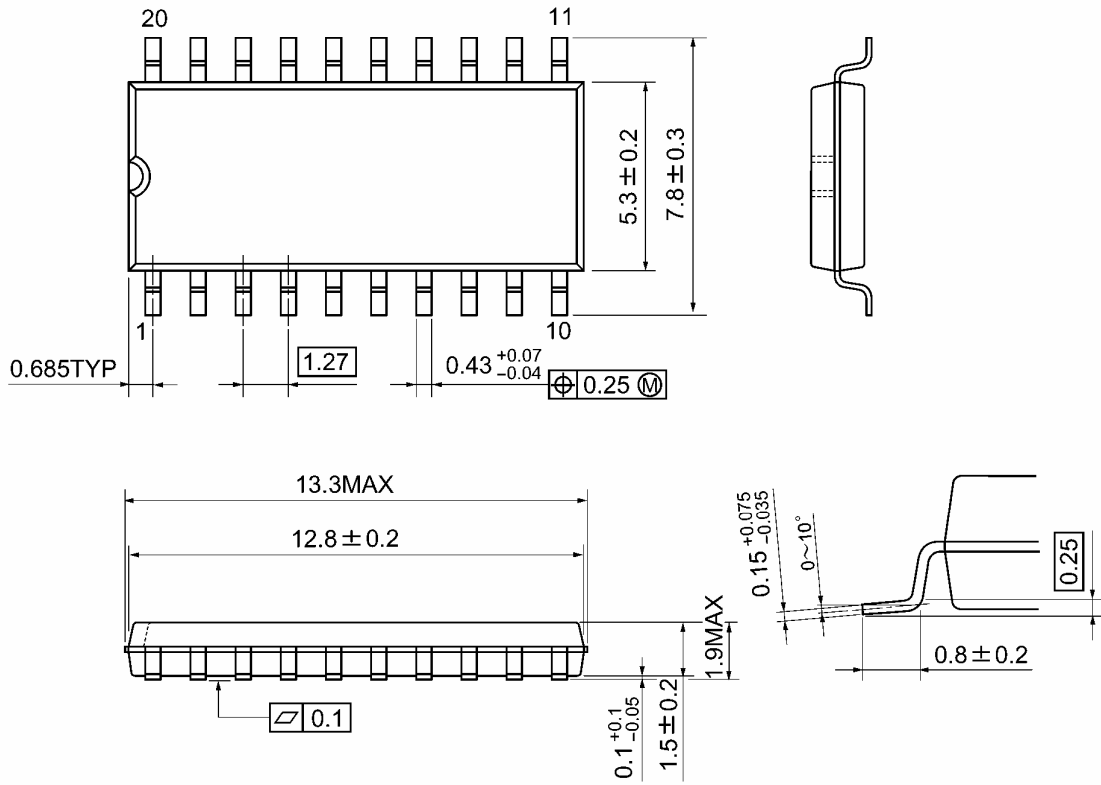
Characteristics	Symbol	Test Condition	Ta = 25°C			Unit
			V _{CC} (V)	Typ.	Limit	
Quiet output maximum dynamic V _{OL}	V _{OLP}	C _L = 50 pF	5.0	0.8 (0.9)	1.0 (1.1)	V
Quiet output minimum dynamic V _{OL}	V _{OLV}	C _L = 50 pF	5.0	-0.8 (-0.9)	-1.0 (-1.1)	V
Minimum high level dynamic input voltage	V _{IHD}	C _L = 50 pF	5.0	—	2.0	V
Maximum low level dynamic input voltage	V _{ILD}	C _L = 50 pF	5.0	—	0.8	V

Note: The value in () only applies to JEDEC SOP (FW) devices.

Package Dimensions

SOP20-P-300-1.27A

Unit: mm

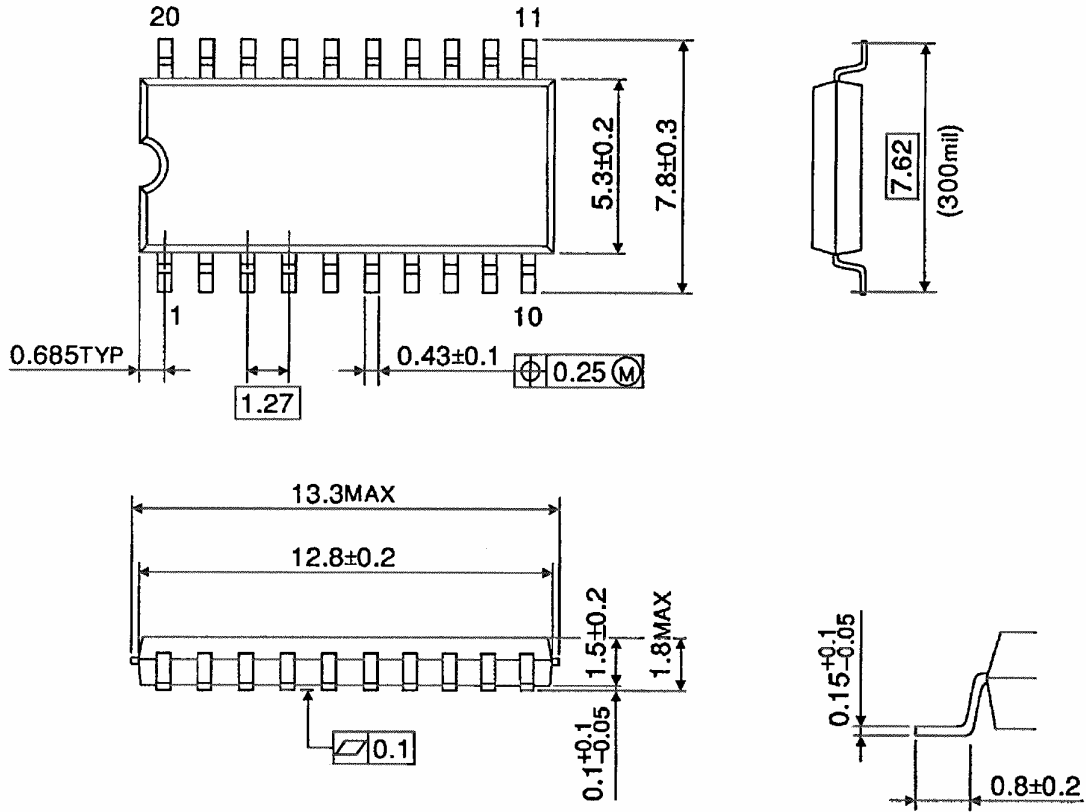


Weight: 0.22 g (typ.)

Package Dimensions

SOP20-P-300-1.27

Unit : mm

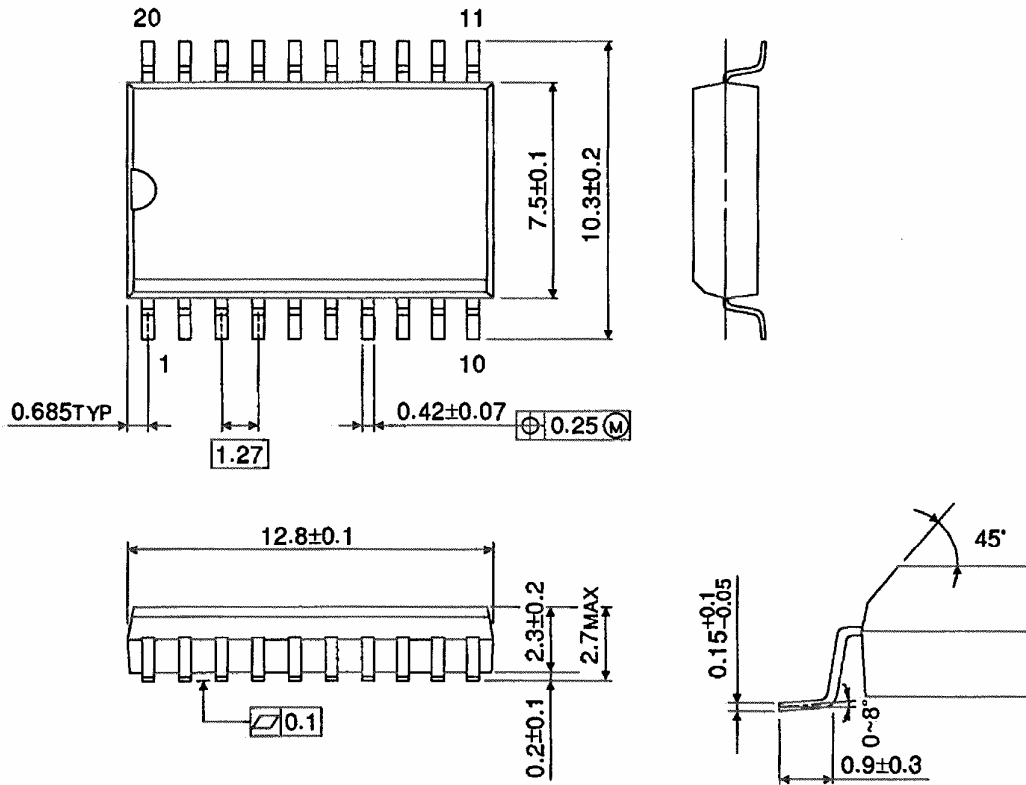


Weight: 0.22 g (typ.)

Package Dimensions (Note)

SOL20-P-300-1.27

Unit : mm



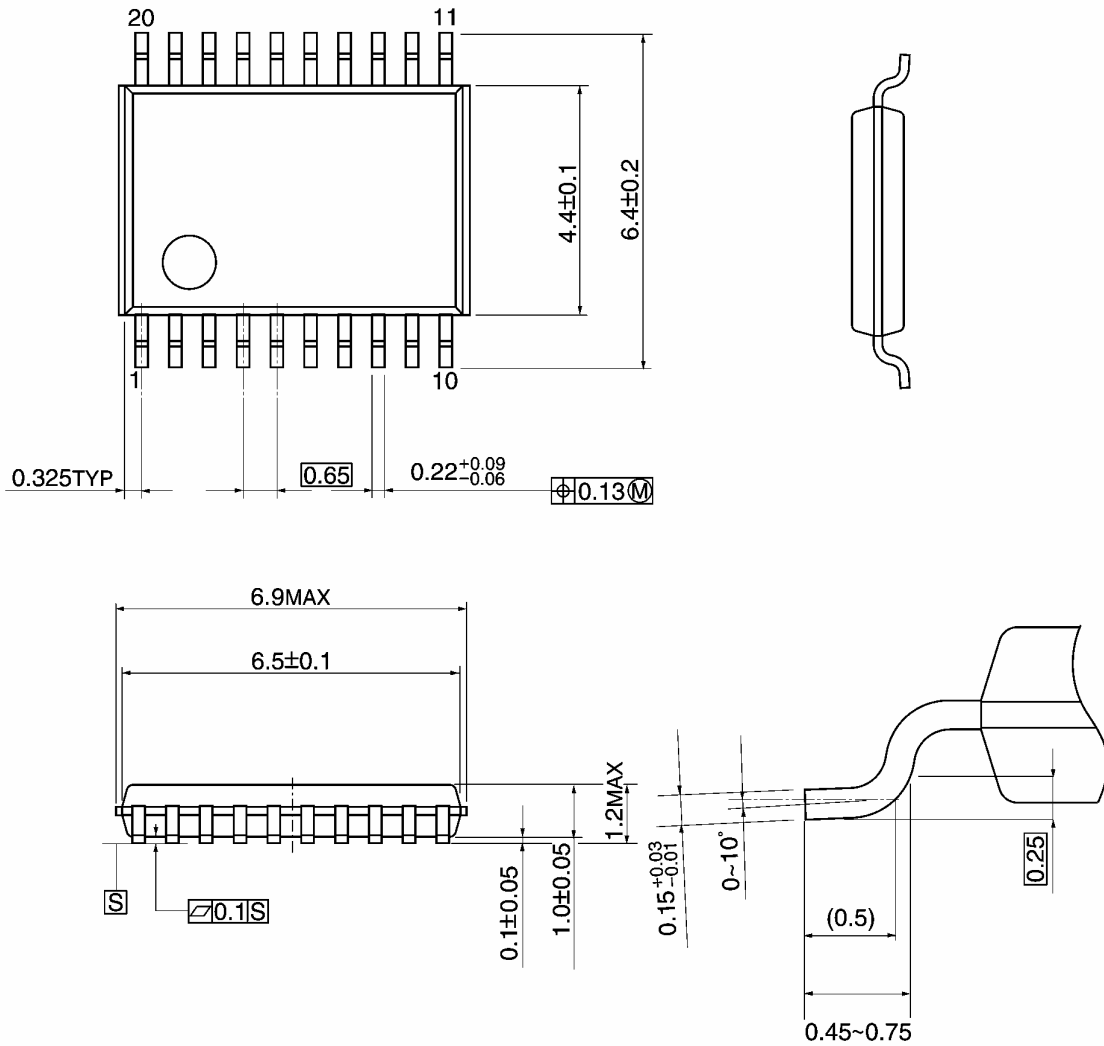
Note: This package is not available in Japan.

Weight: 0.46 g (typ.)

Package Dimensions

TSSOP20-P-0044-0.65A

Unit: mm

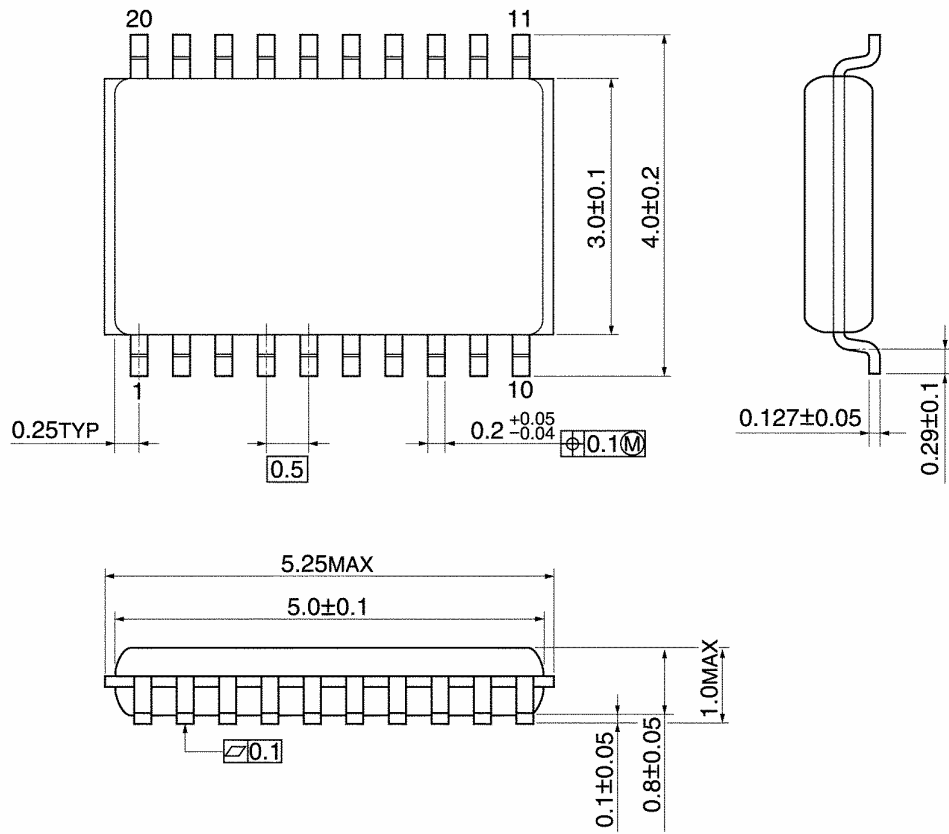


Weight: 0.08 g (typ.)

Package Dimensions

VSSOP20-P-0030-0.50

Unit: mm



Weight: 0.03 g (typ.)

Note: Lead (Pb)-Free Packages

SOP20-P-300-1.27A TSSOP20-P-0044-0.65A VSSOP20-P-0030-0.50

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