

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC74VHC240F, TC74VHC240FK

# TC74VHC244F, TC74VHC244FK

### Octal Bus Buffer

TC74VHC240F/FK

Inverted, 3-State Outputs

TC74VHC244F/FK

Non-Inverted, 3-State Outputs

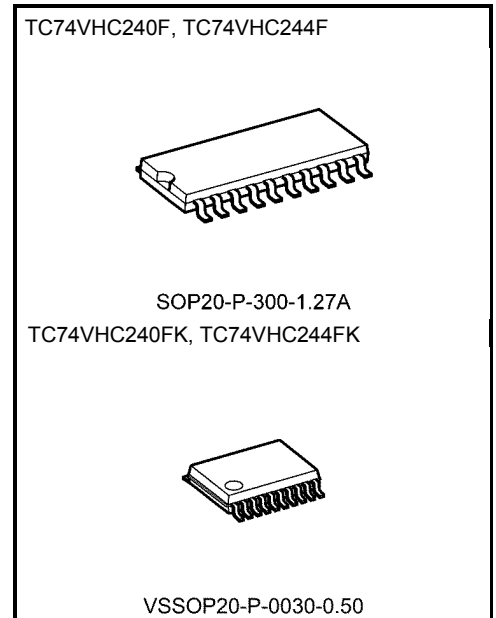
The TC74VHC240 and 244 are advanced high speed CMOS OCTAL BUS BUFFERS fabricated with silicon gate C<sup>2</sup>MOS technology.

They achieve the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

The 74VHC240 is an inverting 3-state buffer having two active-low output enables. The TC74VHC244 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.

An input protection circuit ensures that 0 to 5.5 V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5 V to 3 V systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.



Weight

SOP20-P-300-1.27A : 0.22 g (typ.)

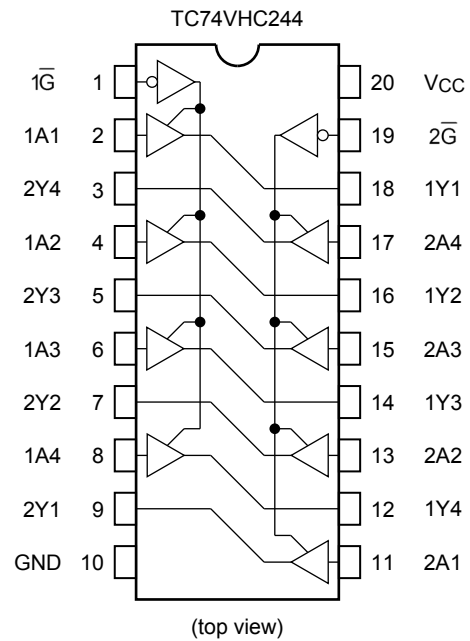
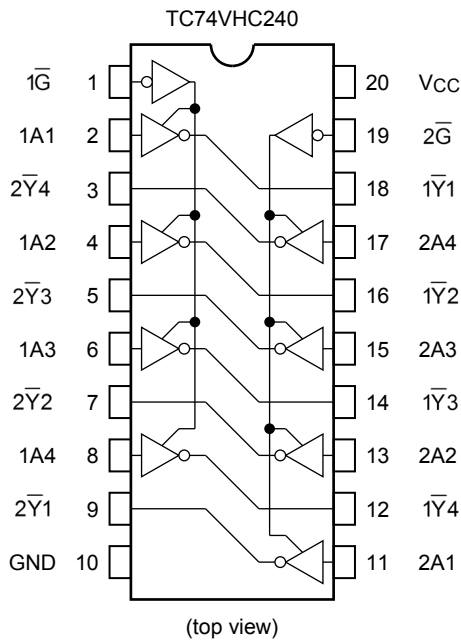
VSSOP20-P-0030-0.50 : 0.03 g (typ.)

## Features

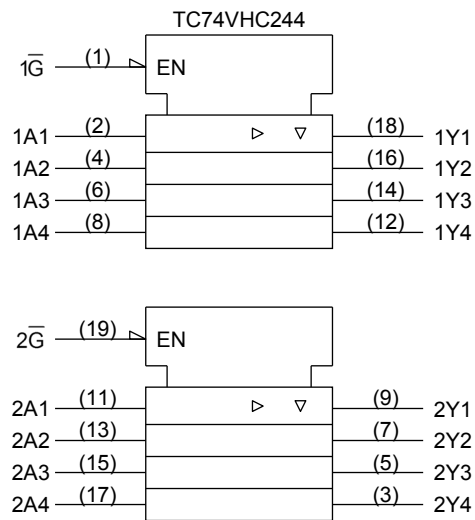
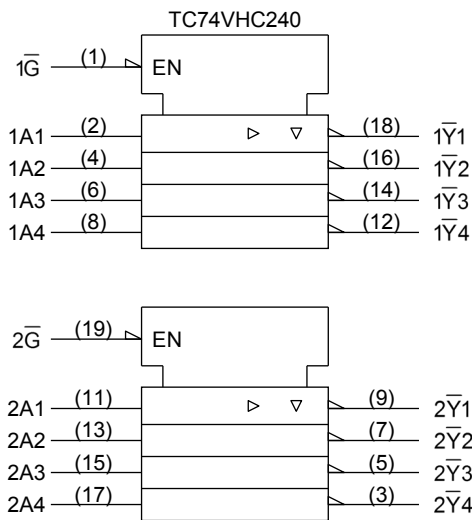
- High speed:  $t_{pd} = 3.9 \text{ ns}$  (typ.) at  $V_{CC} = 5 \text{ V}$
- Low power dissipation:  $I_{CC} = 4 \mu\text{A}$  (max) at  $T_a = 25^\circ\text{C}$
- High noise immunity:  $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (min)
- Power down protection is provided on all inputs.
- Balanced propagation delays:  $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range:  $V_{CC}(\text{opr}) = 2 \text{ to } 5.5 \text{ V}$
- Low noise:  $V_{OLP} = 0.8 \text{ V}$  (max)
- Pin and function compatible with 74ALS240/244

Start of commercial production  
1991-05

### Pin Assignment



### IEC Logic Symbol



### Truth Table

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

X: Don't care

Z: High impedance

$Y_n$ : TC74VHC244

$\bar{Y}_n$ : TC74VHC240

### Absolute Maximum Ratings (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V <sub>CC</sub>	-0.5 to 7.0	V
DC input voltage	V <sub>IN</sub>	-0.5 to 7.0	V
DC output voltage	V <sub>OUT</sub>	-0.5 to V <sub>CC</sub> + 0.5	V
Input diode current	I <sub>IK</sub>	-20	mA
Output diode current	I <sub>OK</sub>	±20	mA
DC output current	I <sub>OUT</sub>	±25	mA
DC V <sub>CC</sub> /ground current	I <sub>CC</sub>	±75	mA
Power dissipation	P <sub>D</sub>	180	mW
Storage temperature	T <sub>stg</sub>	-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 <sub>CC</sub>	2.0 to 5.5	V
Input voltage	V <sub>IN</sub>	0 to 5.5	V
Output voltage	V <sub>OUT</sub>	0 to V <sub>CC</sub>	V
Operating temperature	T <sub>opr</sub>	-40 to 85	°C
Input rise and fall time	dt/dv	0 to 100 (V <sub>CC</sub> = 3.3 ± 0.3 V) 0 to 20 (V <sub>CC</sub> = 5 ± 0.5 V)	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<sub>CC</sub> or GND.

### Electrical Characteristics

#### DC Characteristics

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit	
				V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max
High-level input voltage	V <sub>IH</sub>	—		2.0 3.0 to 5.5	1.50 V <sub>CC</sub> × 0.7	— —	— —	1.50 V <sub>CC</sub> × 0.7	— —	V
Low-level input voltage	V <sub>IL</sub>	—		2.0 3.0 to 5.5	— —	— —	0.50 V <sub>CC</sub> × 0.3	— —	0.50 V <sub>CC</sub> × 0.3	V
High-level output voltage	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -50 μA	2.0 3.0 4.5	1.9 2.9 4.4	2.0 3.0 4.5	— — —	1.9 2.9 4.4	— — —	V
			I <sub>OH</sub> = -4 mA	3.0	2.58	—	—	2.48	—	
			I <sub>OH</sub> = -8 mA	4.5	3.94	—	—	3.80	—	
Low-level output voltage	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 50 μA	2.0 3.0 4.5	— — —	0.0 0.0 0.0	0.1 0.1 0.1	— — —	0.1 0.1 0.1	V
			I <sub>OL</sub> = 4 mA	3.0	—	—	0.36	—	0.44	
			I <sub>OL</sub> = 8 mA	4.5	—	—	0.36	—	0.44	
3-state output off-state current	I <sub>OZ</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> V <sub>OUT</sub> = V <sub>CC</sub> or GND		5.5	—	—	±0.25	—	±2.50	μA
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = 5.5 V or GND		0 to 5.5	—	—	±0.1	—	±1.0	μA
Quiescent supply current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		5.5	—	—	4.0	—	40.0	μA

### AC Characteristics (input: $t_r = t_f = 3 \text{ ns}$ )

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit		
			VCC (V)	CL (pF)	Min	Typ.	Max		Min	Max
Propagation delay time (TC74VHC240)	$t_{pLH}$	—	$3.3 \pm 0.3$	15	—	5.3	7.5	1.0	9.0	ns
				50	—	7.8	11.0	1.0	12.5	
	$5.0 \pm 0.5$		15	—	3.6	5.5	1.0	6.5		
			50	—	5.1	7.5	1.0	8.5		
Propagation delay time (TC74VHC244)	$t_{pLH}$	—	$3.3 \pm 0.3$	15	—	5.8	8.4	1.0	10.0	ns
				50	—	8.3	11.9	1.0	13.5	
	$5.0 \pm 0.5$		15	—	3.9	5.5	1.0	6.5		
			50	—	5.4	7.5	1.0	8.5		
3-state output enable time	$t_{pZL}$	$R_L = 1 \text{ k}\Omega$	$3.3 \pm 0.3$	15	—	6.6	10.6	1.0	12.5	ns
				50	—	9.1	14.1	1.0	16.0	
	$5.0 \pm 0.5$		15	—	4.7	7.3	1.0	8.5		
			50	—	6.2	9.3	1.0	10.5		
3-state output disable time	$t_{pLZ}$	$R_L = 1 \text{ k}\Omega$	$3.3 \pm 0.3$	50	—	10.3	14.0	1.0	16.0	ns
			$5.0 \pm 0.5$	50	—	6.7	9.2	1.0	10.5	
Output to output skew	$t_{osLH}$ $t_{osHL}$	(Note 1)	$3.3 \pm 0.3$	50	—	—	1.5	—	1.5	ns
			$5.0 \pm 0.5$	50	—	—	1.0	—	1.0	
Input capacitance	$C_{IN}$	—	—	—	4	10	—	10	pF	
Output capacitance	$C_{OUT}$	—	—	—	6	—	—	—	pF	
Power dissipation capacitance (Note 2)	CPD	TC74VHC240	—	—	17	—	—	—	pF	
		TC74VHC244	—	—	19	—	—	—		

Note 1: Parameter guaranteed by design.

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

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

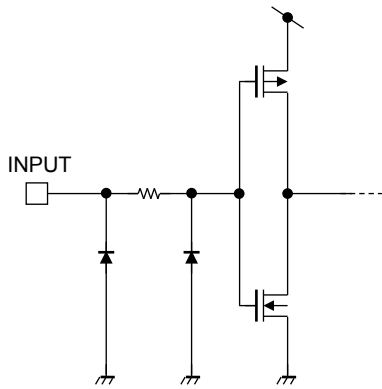
Average operating current can be obtained by the equation:

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

### Noise Characteristics (input: $t_r = t_f = 3 \text{ ns}$ )

Characteristics	Symbol	Test Condition	Ta = 25°C			Unit
			VCC (V)	Typ.	Limit	
Quiet output maximum dynamic $V_{OL}$	$V_{OLP}$	$C_L = 50 \text{ pF}$	5.0	0.5	0.8	V
Quiet output minimum dynamic $V_{OL}$	$V_{OLV}$	$C_L = 50 \text{ pF}$	5.0	-0.5	-0.8	V
Minimum high level dynamic input voltage	$V_{IHD}$	$C_L = 50 \text{ pF}$	5.0	—	3.5	V
Maximum low level dynamic input voltage	$V_{ILD}$	$C_L = 50 \text{ pF}$	5.0	—	1.5	V

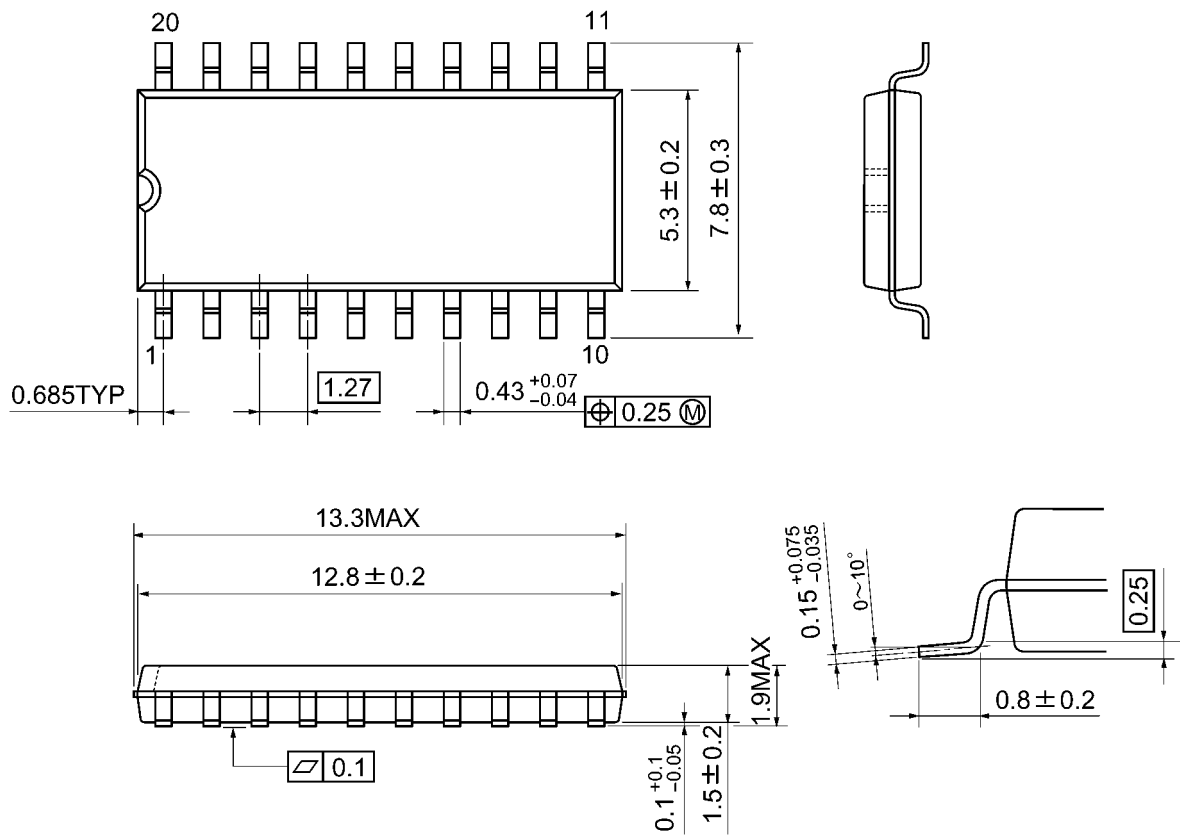
### Input Equivalent Circuit



### Package Dimensions

SOP20-P-300-1.27A

Unit: mm

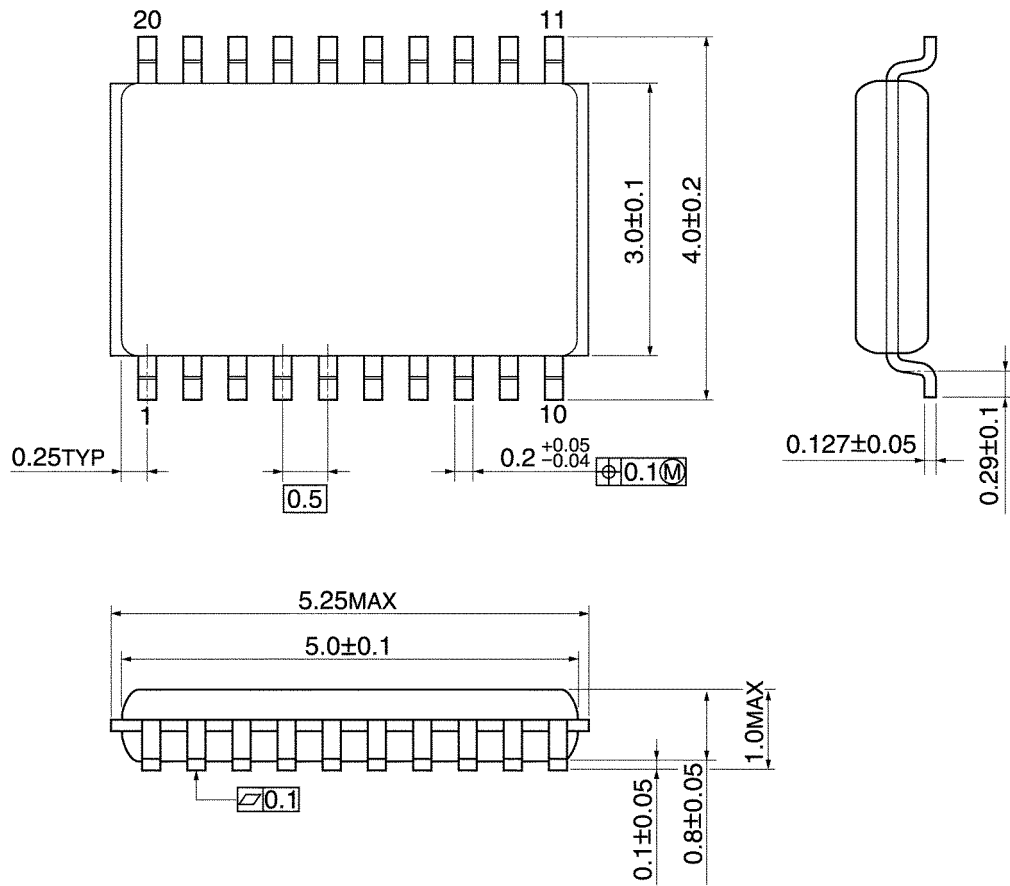


Weight: 0.22 g (typ.)

### Package Dimensions

VSSOP20-P-0030-0.50

Unit: mm



Weight: 0.03 g (typ.)



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