

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

**TC74VHC240F, TC74VHC240FW, TC74VHC240FT**  
**TC74VHC244F, TC74VHC244FW, TC74VHC244FT****OCTAL BUS BUFFER****TC74VHC240F/FW/FT INVERTED, 3-STATE OUTPUTS****TC74VHC244F/FW/FT 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.

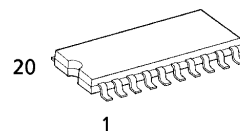
These devices are designed to be used with 3-state memory address drivers, etc.

An input protection circuit ensures that 0 to 7V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5V to 3V systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

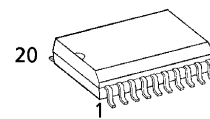
**FEATURES:**

- High Speed..... $t_{pd} = 3.9\text{ns}(\text{typ.})$  at  $V_{CC} = 5\text{V}$
- Low Power Dissipation..... $I_{CC} = 4\mu\text{A}(\text{Max.})$  at  $T_a = 25^\circ\text{C}$
- High Noise Immunity..... $V_{NIH} = V_{NIL} = 28\% V_{CC}(\text{Min.})$
- Power Down Protection is provided on all inputs.
- Balanced Propagation Delays..... $t_{pLH} \approx t_{pHL}$
- Wide Operating Voltage Range..... $V_{CC}(\text{opr}) = 2\text{V} \sim 5.5\text{V}$
- Low Noise..... $V_{OLP} = 0.9\text{V}(\text{Max.})$
- Pin and Function Compatible with 74ALS240/244

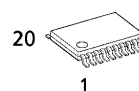
(Note) The JEDEC SOP (FW) is not available in Japan.



F (SOP20-P-300-1.27)  
Weight : 0.22g (Typ.)



FW (SOL20-P-300-1.27)  
Weight : 0.46g (Typ.)



FT (TSSOP20-P-0044-0.65)  
Weight : 0.08g (Typ.)

**TRUTH TABLE**

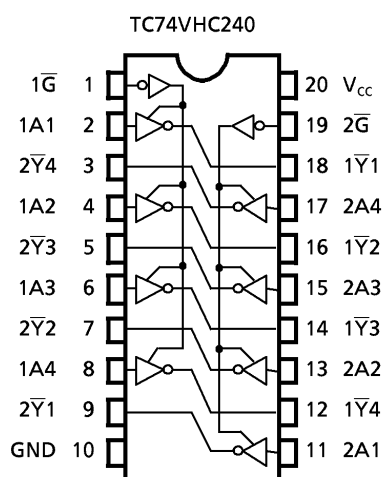
| INPUTS         |       | OUTPUTS |                  |
|----------------|-------|---------|------------------|
| $\overline{G}$ | $A_n$ | $Y_n$   | $\overline{Y}_n$ |
| L              | L     | L       | H                |
| L              | H     | H       | L                |
| H              | X     | Z       | Z                |

X : Don't Care

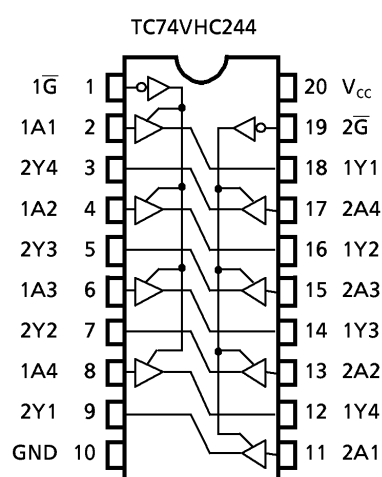
Z : High Impedance

$Y_n$  : TC74VHC244

$\overline{Y}_n$  : TC74VHC240

**PIN ASSIGNMENT**

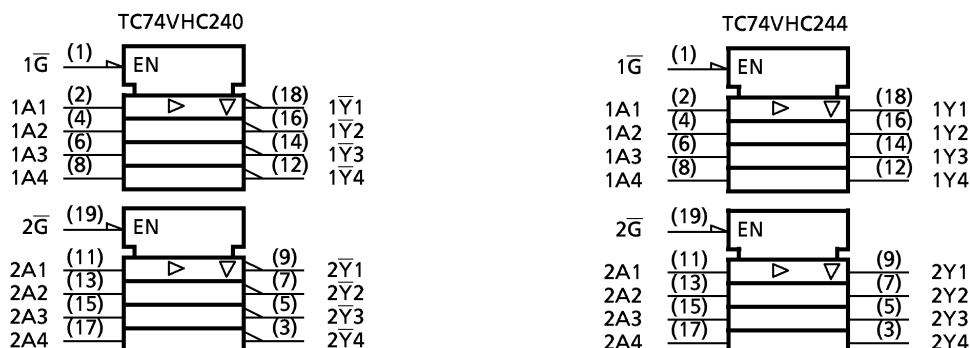
(TOP VIEW)



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## IEC LOGIC SYMBOL



## ABSOLUTE MAXIMUM RATINGS

| PARAMETER                   | SYMBOL    | VALUE                    | UNIT               |
|-----------------------------|-----------|--------------------------|--------------------|
| Supply Voltage Range        | $V_{CC}$  | $-0.5 \sim 7.0$          | V                  |
| DC Input Voltage            | $V_{IN}$  | $-0.5 \sim 7.0$          | V                  |
| DC Output Voltage           | $V_{OUT}$ | $-0.5 \sim V_{CC} + 0.5$ | V                  |
| Input Diode Current         | $I_{IK}$  | $-20$                    | mA                 |
| Output Diode Current        | $I_{OK}$  | $\pm 20$                 | mA                 |
| DC Output Current           | $I_{OUT}$ | $\pm 25$                 | mA                 |
| DC $V_{CC}$ /Ground Current | $I_{CC}$  | $\pm 75$                 | mA                 |
| Power Dissipation           | $P_D$     | 180                      | mW                 |
| Storage Temperature         | $T_{stg}$ | $-65 \sim 150$           | $^{\circ}\text{C}$ |

## RECOMMENDED OPERATING CONDITIONS

| PARAMETER                | SYMBOL    | VALUE                                                                             | UNIT               |
|--------------------------|-----------|-----------------------------------------------------------------------------------|--------------------|
| Supply Voltage           | $V_{CC}$  | 2.0~5.5                                                                           | V                  |
| Input Voltage            | $V_{IN}$  | 0~5.5                                                                             | V                  |
| Output Voltage           | $V_{OUT}$ | 0~ $V_{CC}$                                                                       | V                  |
| Operating Temperature    | $T_{opr}$ | $-40 \sim 85$                                                                     | $^{\circ}\text{C}$ |
| Input Rise and Fall Time | $dt/dv$   | 0~100 ( $V_{CC} = 3.3 \pm 0.3\text{V}$ )<br>0~20 ( $V_{CC} = 5 \pm 0.5\text{V}$ ) | ns/V               |

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## DC ELECTRICAL CHARACTERISTICS

| PARAMETER                            | SYMBOL          | TEST CONDITION                                                                                    |                                                  | V <sub>CC</sub><br>(V) | Ta = 25°C                     |                   |                               | Ta = -40~85°C                 |                               | UNIT |
|--------------------------------------|-----------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------|------------------------|-------------------------------|-------------------|-------------------------------|-------------------------------|-------------------------------|------|
|                                      |                 |                                                                                                   |                                                  |                        | MIN.                          | TYP.              | MAX.                          | MIN.                          | MAX.                          |      |
| High - Level Input Voltage           | V <sub>IH</sub> |                                                                                                   |                                                  | 2.0<br>3.0~5.5         | 1.50<br>V <sub>CC</sub> × 0.7 | —<br>—            | —<br>—                        | 1.50<br>V <sub>CC</sub> × 0.7 | —<br>—                        | V    |
| Low - Level Input Voltage            | V <sub>IL</sub> |                                                                                                   |                                                  | 2.0<br>3.0~5.5         | —<br>—                        | —<br>—            | 0.50<br>V <sub>CC</sub> × 0.3 | —<br>—                        | 0.50<br>V <sub>CC</sub> × 0.3 | V    |
| High - Level Output Voltage          | V <sub>OH</sub> | V <sub>IN</sub> =<br>V <sub>IH</sub> or V <sub>IL</sub>                                           | I <sub>OH</sub> = -50 μA                         | 2.0<br>3.0<br>4.5      | 1.9<br>2.9<br>4.4             | 2.0<br>3.0<br>4.5 | —<br>—<br>—                   | 1.9<br>2.9<br>4.4             | —<br>—<br>—                   | V    |
|                                      |                 |                                                                                                   | I <sub>OH</sub> = -4mA<br>I <sub>OH</sub> = -8mA | 3.0<br>4.5             | 2.58<br>3.94                  | —<br>—            | —<br>—                        | 2.48<br>3.80                  | —<br>—                        |      |
| Low - Level Output Voltage           | V <sub>OL</sub> | V <sub>IN</sub> =<br>V <sub>IH</sub> or V <sub>IL</sub>                                           | I <sub>OL</sub> = 50 μA                          | 2.0<br>3.0<br>4.5      | —<br>—<br>—                   | 0.0<br>0.0<br>0.0 | 0.1<br>0.1<br>0.1             | —<br>—<br>—                   | 0.1<br>0.1<br>0.1             | V    |
|                                      |                 |                                                                                                   | I <sub>OL</sub> = 4mA<br>I <sub>OL</sub> = 8mA   | 3.0<br>4.5             | —<br>—                        | —<br>—            | 0.36<br>0.36                  | —<br>—                        | 0.44<br>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><br>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> = 5.5V or GND                                                                     |                                                  | 0~5.5                  | —                             | —                 | ± 0.1                         | —                             | ± 1.0                         |      |
| Quiescent Supply Current             | I <sub>CC</sub> | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                          |                                                  | 5.5                    | —                             | —                 | 4.0                           | —                             | 40.0                          |      |

AC ELECTRICAL CHARACTERISTICS (Input t<sub>r</sub> = t<sub>f</sub> = 3ns)

| PARAMETER                                 | SYMBOL                                 | TEST CONDITION |  | V <sub>CC</sub> (V) | CL (pF) | Ta = 25°C |      |      | Ta = -40~85°C |      | UNIT |
|-------------------------------------------|----------------------------------------|----------------|--|---------------------|---------|-----------|------|------|---------------|------|------|
|                                           |                                        |                |  |                     |         | MIN.      | TYP. | MAX. | MIN.          | MAX. |      |
| Propagation Delay Time<br>(TC74VHC240)    | t <sub>pLH</sub><br>t <sub>pHL</sub>   |                |  | 3.3 ± 0.3           | 15      | —         | 5.3  | 7.5  | 1.0           | 9.0  | ns   |
|                                           |                                        |                |  |                     | 50      | —         | 7.8  | 11.0 | 1.0           | 12.5 |      |
|                                           |                                        |                |  | 5.0 ± 0.5           | 15      | —         | 3.6  | 5.5  | 1.0           | 6.5  |      |
|                                           |                                        |                |  |                     | 50      | —         | 5.1  | 7.5  | 1.0           | 8.5  |      |
| Propagation Delay Time<br>(TC74VHC244)    | t <sub>pLH</sub><br>t <sub>pHL</sub>   |                |  | 3.3 ± 0.3           | 15      | —         | 5.8  | 8.4  | 1.0           | 10.0 |      |
|                                           |                                        |                |  |                     | 50      | —         | 8.3  | 11.9 | 1.0           | 13.5 |      |
|                                           |                                        |                |  | 5.0 ± 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 <sub>pZL</sub><br>t <sub>pZH</sub>   | RL = 1kΩ       |  | 3.3 ± 0.3           | 15      | —         | 6.6  | 10.6 | 1.0           | 12.5 |      |
|                                           |                                        |                |  |                     | 50      | —         | 9.1  | 14.1 | 1.0           | 16.0 |      |
|                                           |                                        |                |  | 5.0 ± 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 <sub>pLZ</sub><br>t <sub>pHZ</sub>   | RL = 1kΩ       |  | 3.3 ± 0.3           | 50      | —         | 10.3 | 14.0 | 1.0           | 16.0 |      |
|                                           |                                        |                |  | 5.0 ± 0.5           | 50      | —         | 6.7  | 9.2  | 1.0           | 10.5 |      |
| Output to Output Skew                     | t <sub>OSLH</sub><br>t <sub>OSHL</sub> | (Note 1)       |  | 3.3 ± 0.3           | 50      | —         | —    | 1.5  | —             | 1.5  |      |
|                                           |                                        |                |  | 5.0 ± 0.5           | 50      | —         | —    | 1.0  | —             | 1.0  |      |
| Input Capacitance                         | C <sub>IN</sub>                        |                |  |                     |         | —         | 4    | 10   | —             | 10   | pF   |
| Output Capacitance                        | C <sub>OUT</sub>                       |                |  |                     |         | —         | 6    | —    | —             | —    |      |
| Power Dissipation Capacitance<br>(Note 2) | C <sub>PD</sub>                        | TC74VHC240     |  |                     |         | —         | 17   | —    | —             | —    |      |
|                                           |                                        | TC74VHC244     |  |                     |         | —         | 19   | —    | —             | —    |      |

Note (1) Parameter guaranteed by design. t<sub>OSLH</sub> = |t<sub>pLHm</sub> - t<sub>pLHn</sub>|, t<sub>OSHL</sub> = |t<sub>pHLm</sub> - t<sub>pHLn</sub>|

Note (2) C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

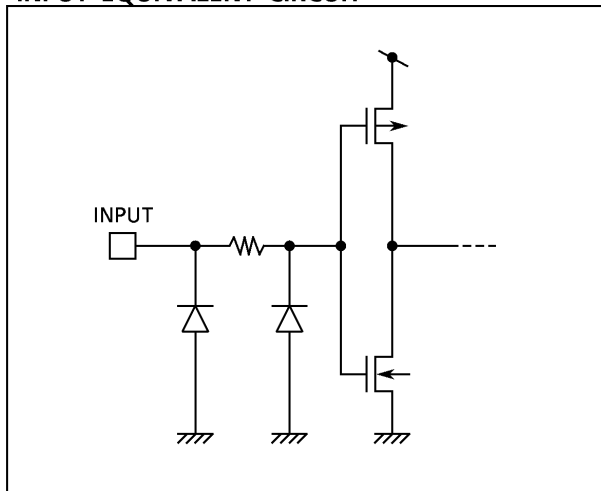
Average operating current can be obtained by the equation :

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

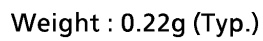
**NOISE CHARACTERISTICS ( Input  $t_r = t_f = 3\text{ns}$  )**

| PARAMETER                                   | SYMBOL           | TEST CONDITION |                     | Ta = 25°C      |                | UNIT |
|---------------------------------------------|------------------|----------------|---------------------|----------------|----------------|------|
|                                             |                  |                | V <sub>CC</sub> (V) | TYP.           | LIMIT          |      |
| Quiet Output<br>Maximum Dynamic VOL         | V <sub>OLP</sub> | CL = 50pF      | 5.0                 | 0.5<br>(0.6)   | 0.8<br>(0.9)   | V    |
| Quiet Output<br>Minimum Dynamic VOL         | V <sub>OLV</sub> | CL = 50pF      | 5.0                 | −0.5<br>(−0.6) | −0.8<br>(−0.9) | V    |
| Minimum High Level<br>Dynamic Input Voltage | V <sub>IHD</sub> | CL = 50pF      | 5.0                 | —              | 3.5            | V    |
| Maximum Low Level<br>Dynamic Input Voltage  | V <sub>ILD</sub> | CL = 50pF      | 5.0                 | —              | 1.5            | V    |

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

**INPUT EQUIVALENT CIRCUIT**

## Unit in mm



## Unit in mm

Weight : 0.46g (Typ.)

**TSSOP 20PIN OUTLINE DRAWING (TSSOP20-P-0044-0.65)**

Unit in mm

