

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

## TC74HC240AP,TC74HC240AF,TC74HC240AFW TC74HC241AP,TC74HC241AF TC74HC244AP,TC74HC244AF,TC74HC244AFW

### Octal Bus Buffer

|                    |                               |
|--------------------|-------------------------------|
| TC74HC240AP/AF/AFW | Inverted, 3-State Outputs     |
| TC74HC241AP/AF     | Non-Inverted, 3-State Outputs |
| TC74HC244AP/AF/AFW | Non-Inverted, 3-State Outputs |

The TC74HC240A, 241A and 244A are high speed CMOS OCTAL BUS BUFFERS fabricated with silicon gate CMOS technology.

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

The 74HC240A is an inverting 3-state buffer having two active-low output enables. The TC74HC241A and TC74HC244A are non-inverting 3-state buffers that differ only in that the 241A has one active-high and one active-low output enable, and the 244A has two active-low output enables.

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

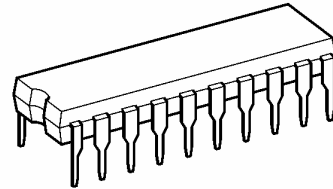
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

### Features

- High speed:  $t_{pd} = 10 \text{ ns}$  (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)
- Output drive capability: 15 LSTTL loads
- Symmetrical output impedance:  $|I_{OH}| = I_{OL} = 6 \text{ mA}$  (min)
- Balanced propagation delays:  $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range:  $V_{CC} \text{ (opr)} = 2\sim 6 \text{ V}$
- Pin and function compatible with 74LS240/241/244

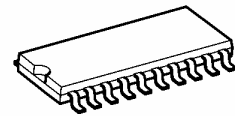
Note: xxxFW (JEDEC SOP) is not available in Japan.

TC74HC240AP, TC74HC241AP,  
TC74HC244AP

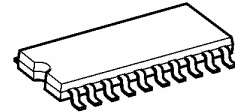


DIP20-P-300-2.54A

TC74HC240AF, TC74HC241AF, TC74HC244AF

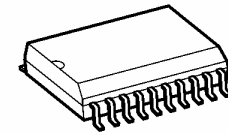


SOP20-P-300-1.27A



SOP20-P-300-1.27

TC74HC240AFW, TC74HC244AFW



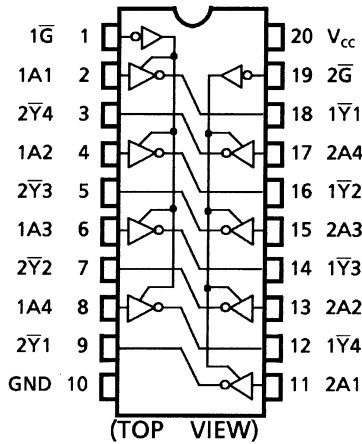
SOL20-P-300-1.27

### Weight

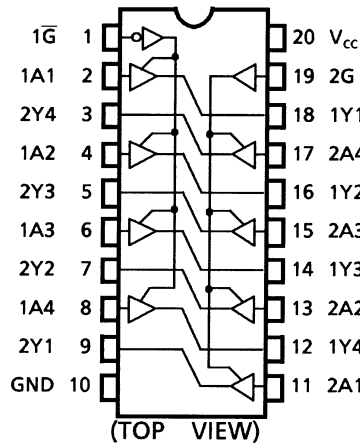
|                   |                 |
|-------------------|-----------------|
| DIP20-P-300-2.54A | : 1.30 g (typ.) |
| SOP20-P-300-1.27A | : 0.22 g (typ.) |
| SOP20-P-300-1.27  | : 0.22 g (typ.) |
| SOL20-P-300-1.27  | : 0.46 g (typ.) |

## Pin Assignment

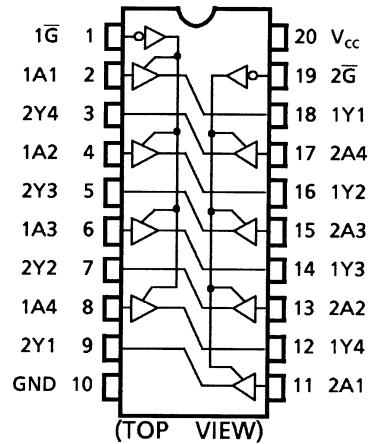
TC74HC240A



TC74HC241A

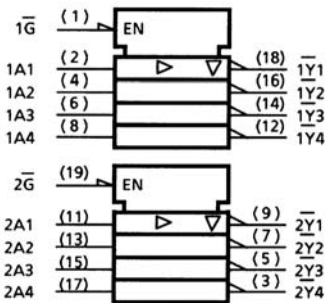


TC74HC244A

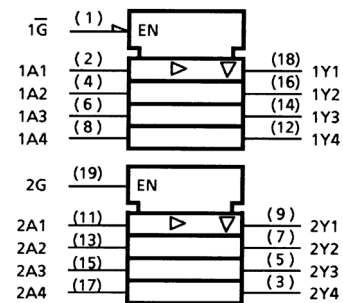


## IEC Logic Symbol

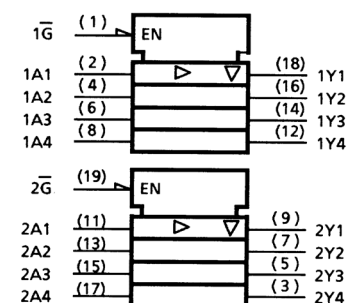
TC74HC240A



TC74HC241A



TC74HC244A



## Truth Table

| Inputs         |              |       | Outputs |                                 |
|----------------|--------------|-------|---------|---------------------------------|
| $\overline{G}$ | $G^{\Delta}$ | $A_n$ | $Y_n$   | $\overline{Y}_n^{\Delta\Delta}$ |
| L              | H            | L     | L       | H                               |
| L              | H            | H     | H       | L                               |
| H              | L            | X     | Z       | Z                               |

$\Delta$ : For TC74HC241A only

$\Delta\Delta$ : For TC74HC240A only

X: Don't care

Z: High impedance

**Absolute Maximum Ratings (Note 1)**

| Characteristics             | Symbol    | Rating                       | Unit |
|-----------------------------|-----------|------------------------------|------|
| Supply voltage range        | $V_{CC}$  | -0.5~7                       | V    |
| DC input voltage            | $V_{IN}$  | -0.5~ $V_{CC} + 0.5$         | V    |
| DC output voltage           | $V_{OUT}$ | -0.5~ $V_{CC} + 0.5$         | V    |
| Input diode current         | $I_{IK}$  | $\pm 20$                     | mA   |
| Output diode current        | $I_{OK}$  | $\pm 20$                     | mA   |
| DC output current           | $I_{OUT}$ | $\pm 35$                     | mA   |
| DC $V_{CC}$ /ground current | $I_{CC}$  | $\pm 75$                     | mA   |
| Power dissipation           | $P_D$     | 500 (DIP) (Note 2)/180 (SOP) | mW   |
| Storage temperature         | $T_{stg}$ | -65~150                      | °C   |

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

Note 2: 500 mW in the range of  $T_a = -40$  to  $65^\circ\text{C}$ . From  $T_a = 65$  to  $85^\circ\text{C}$  a derating factor of  $-10 \text{ mW}/^\circ\text{C}$  shall be applied until 300 mW.

**Recommended Operating Conditions (Note)**

| Characteristics          | Symbol     | Rating                                                                                                          | Unit |
|--------------------------|------------|-----------------------------------------------------------------------------------------------------------------|------|
| Supply voltage           | $V_{CC}$   | 2~6                                                                                                             | V    |
| Input voltage            | $V_{IN}$   | 0~ $V_{CC}$                                                                                                     | V    |
| Output voltage           | $V_{OUT}$  | 0~ $V_{CC}$                                                                                                     | V    |
| Operating temperature    | $T_{opr}$  | -40~85                                                                                                          | °C   |
| Input rise and fall time | $t_r, t_f$ | 0~1000 ( $V_{CC} = 2.0 \text{ V}$ )<br>0~500 ( $V_{CC} = 4.5 \text{ V}$ )<br>0~400 ( $V_{CC} = 6.0 \text{ V}$ ) | ns   |

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

**Electrical Characteristics**
**DC Characteristics**

| Characteristics                  | Symbol          | Test Condition                                                                                    |                                                      | V <sub>CC</sub> (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>4.5<br>6.0   | 1.50<br>3.15<br>4.20 | —<br>—<br>— | —<br>—<br>—          | 1.50<br>3.15<br>4.20 | —<br>—<br>—          | V    |
| Low-level input voltage          | V <sub>IL</sub> | —                                                                                                 |                                                      | 2.0<br>4.5<br>6.0   | —<br>—<br>—          | —<br>—<br>— | 0.50<br>1.35<br>1.80 | —<br>—<br>—          | 0.50<br>1.35<br>1.80 | 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> = −20 μA                             | 2.0                 | 1.9                  | 2.0         | —                    | 1.9                  | —                    | V    |
|                                  |                 |                                                                                                   |                                                      | 4.5                 | 4.4                  | 4.5         | —                    | 4.4                  | —                    |      |
|                                  |                 |                                                                                                   | I <sub>OH</sub> = −6 mA<br>I <sub>OH</sub> = −7.8 mA | 4.5                 | 4.18                 | 4.31        | —                    | 4.13                 | —                    |      |
|                                  |                 |                                                                                                   |                                                      | 6.0                 | 5.68                 | 5.80        | —                    | 5.63                 | —                    |      |
| 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> = 20 μA                              | 2.0                 | —                    | 0.0         | 0.1                  | —                    | 0.1                  | V    |
|                                  |                 |                                                                                                   |                                                      | 4.5                 | —                    | 0.0         | 0.1                  | —                    | 0.1                  |      |
|                                  |                 |                                                                                                   | I <sub>OL</sub> = 6 mA<br>I <sub>OL</sub> = 7.8 mA   | 4.5                 | —                    | 0.17        | 0.26                 | —                    | 0.33                 |      |
|                                  |                 |                                                                                                   |                                                      | 6.0                 | —                    | 0.18        | 0.26                 | —                    | 0.33                 |      |
| 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 |                                                      | 6.0                 | —                    | —           | ±0.5                 | —                    | ±5.0                 | μA   |
| Input leakage current            | I <sub>IN</sub> | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                          |                                                      | 6.0                 | —                    | —           | ±0.1                 | —                    | ±1.0                 | μA   |
| Quiescent supply current         | I <sub>CC</sub> | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                          |                                                      | 6.0                 | —                    | —           | 4.0                  | —                    | 40.0                 | μA   |

## AC Characteristics (input: $t_r = t_f = 6 \text{ ns}$ )

| Characteristics               | Symbol        | Test Condition  |         |         | Ta = 25°C |      |     | Ta = -40~85°C |     | Unit |
|-------------------------------|---------------|-----------------|---------|---------|-----------|------|-----|---------------|-----|------|
|                               |               |                 | CL (pF) | VCC (V) | Min       | Typ. | Max | Min           | Max |      |
| Output transition time        | tTLH          | —               | 50      | 2.0     | —         | 25   | 60  | —             | 75  | ns   |
|                               | tTHL          |                 |         | 4.5     | —         | 7    | 12  | —             | 15  |      |
|                               |               |                 |         | 6.0     | —         | 6    | 10  | —             | 13  |      |
| Propagation delay time        | tpLH          | —               | 50      | 2.0     | —         | 36   | 90  | —             | 115 | ns   |
|                               |               |                 |         | 4.5     | —         | 12   | 18  | —             | 23  |      |
|                               | 6.0           |                 |         | —       | 10        | 15   | —   | 20            |     |      |
|                               | tpHL          |                 | 150     | 2.0     | —         | 51   | 130 | —             | 165 |      |
|                               |               |                 |         | 4.5     | —         | 17   | 26  | —             | 33  |      |
|                               |               |                 |         | 6.0     | —         | 14   | 22  | —             | 28  |      |
| Output enable time            | tpZL          | RL = 1 kΩ       | 50      | 2.0     | —         | 48   | 125 | —             | 155 | ns   |
|                               |               |                 |         | 4.5     | —         | 16   | 25  | —             | 31  |      |
|                               | 6.0           |                 |         | —       | 14        | 21   | —   | 26            |     |      |
|                               | tpZH          |                 | 150     | 2.0     | —         | 63   | 165 | —             | 205 |      |
|                               |               |                 |         | 4.5     | —         | 21   | 33  | —             | 41  |      |
|                               |               |                 |         | 6.0     | —         | 18   | 28  | —             | 35  |      |
| Output disable time           | tpLZ          | RL = 1 kΩ       | 50      | 2.0     | —         | 32   | 125 | —             | 155 | ns   |
|                               |               |                 |         | 4.5     | —         | 15   | 25  | —             | 31  |      |
|                               |               |                 |         | 6.0     | —         | 14   | 21  | —             | 26  |      |
| Input capacitance             | CIN           | —               |         |         | —         | 5    | 10  | —             | 10  | pF   |
| Output capacitance            | COUT          | —               |         |         | —         | 10   | —   | —             | —   | pF   |
| Power dissipation capacitance | CPD<br>(Note) | TC74HC240A      |         |         | —         | 31   | —   | —             | —   | pF   |
|                               |               | TC74HC241A/244A |         |         | —         | 33   | —   | —             | —   |      |

Note:  $C_{PD}$  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:

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

DIP20-P-300-2.54A

Technical drawing of the 11-pin connector showing three views: top, side, and front views with dimensions.

**Top View:** Shows the connector housing with 11 pins. Pin 1 is on the left, and pin 11 is on the right. The overall width is  $6.4 \pm 0.2$ .

**Side View:** Shows the profile of the connector. The height of the housing is  $7.62$ . The pins are angled at  $0-15^\circ$  relative to the vertical. The pin height is  $0.25 \pm 0.1$  with a tolerance of  $-0.05$ .

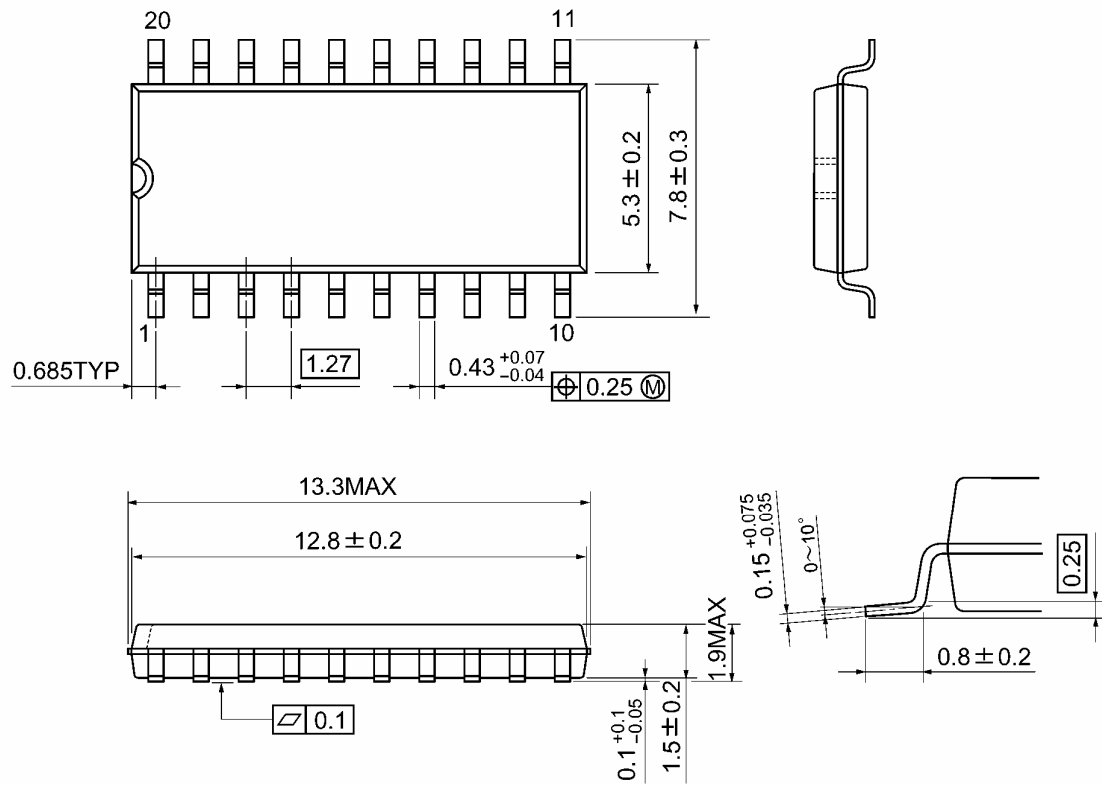
**Front View:** Shows the pins in detail. The overall length is  $25.1 \text{ MAX}$ . The length of the pins is  $24.6 \pm 0.2$ . The pin pitch is  $2.54$ . The pin diameter is  $0.87 \text{ TYP}$ . The pin height is  $0.95 \pm 0.1$ . The pin length is  $1.4 \pm 0.1$ . The pin diameter is  $0.5 \pm 0.1$ . The pin length is  $0.51 \text{ MIN}$ . The pin height is  $3.5 \pm 0.2$ . The pin length is  $4.15 \pm 0.3$ . The pin height is  $3.3 \pm 0.3$ . The pin length is  $0.25 \text{ (M)}$ .

2006-06-01

## Package Dimensions

SOP20-P-300-1.27A

Unit: mm

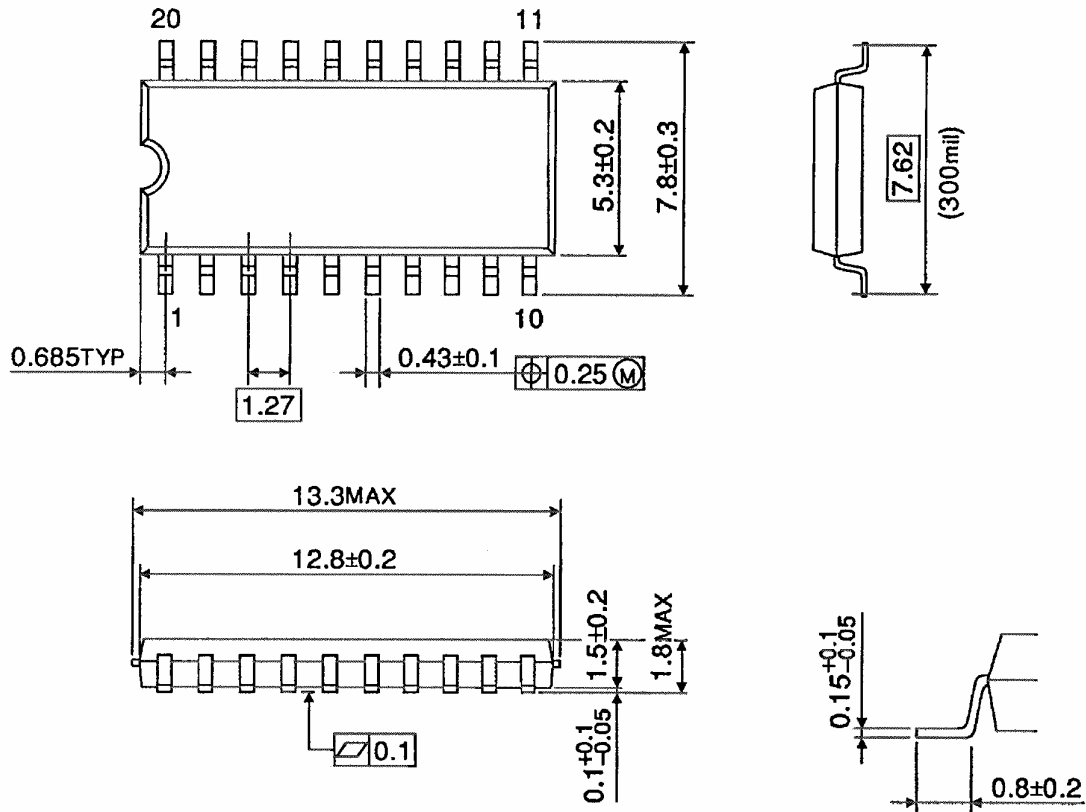


Weight: 0.22 g (typ.)

## Package Dimensions

SOP20-P-300-1.27

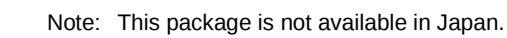
Unit : mm



Weight: 0.22 g (typ.)

SOL20-P-300-1.27

Unit : mm



Weight: 0.46 g (typ.)

**Note: Lead (Pb)-Free Packages**

**DIP20-P-300-2.54A SOP20-P-300-1.27A**

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060116EBA

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