

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

## TC74HC125AP, TC74HC125AF TC74HC126AP, TC74HC126AF

TC74HC125AP/AF Quad Bus Buffer

TC74HC126AP/AF Quad Bus Buffer

The TC74HC125A/126A are high speed CMOS QUAD BUS BUFFERS fabricated with silicon gate C<sup>2</sup>MOS technology.

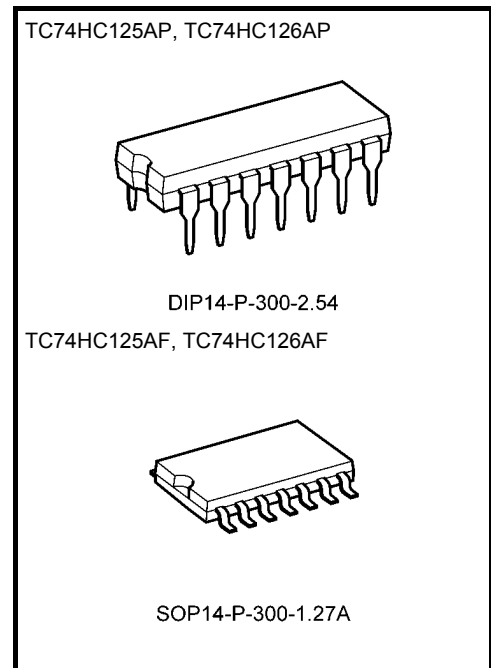
They achieve the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

The TC74HC125A requires the 3-state control input  $\overline{G}$  to be set high to place the output into the high impedance state, whereas the TC74HC126A requires the control input to be set low to place the output into high impedance.

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:  $V_{CC} (\text{opr}) = 2 \text{ to } 6 \text{ V}$
- Pin and function compatible with 74LS125/126



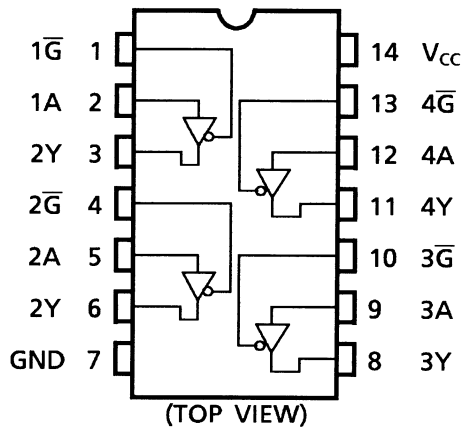
Weight

|                   |                 |
|-------------------|-----------------|
| DIP14-P-300-2.54  | : 0.96 g (typ.) |
| SOP14-P-300-1.27A | : 0.18 g (typ.) |

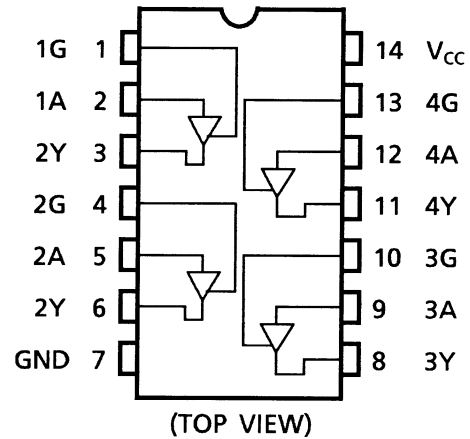
Start of commercial production  
1988-05

## Pin Assignment

### TC74HC125A

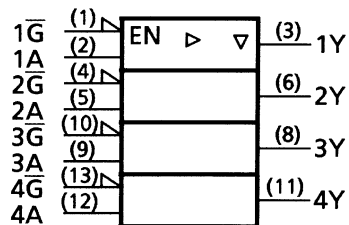


### TC74HC126A

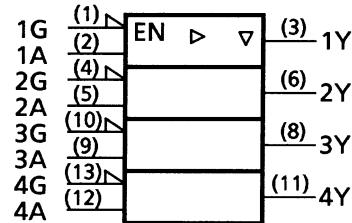


## IEC Logic Symbol

### TC74HC125A



### TC74HC126A



## Truth Table

### TC74HC125A

| Inputs    |   | Output |
|-----------|---|--------|
| $\bar{G}$ | A | Y      |
| H         | X | Z      |
| L         | L | L      |
| L         | H | H      |

X: Don't care

Z: High impedance

### TC74HC126A

| Inputs |   | Output |
|--------|---|--------|
| G      | A | Y      |
| L      | X | Z      |
| H      | L | L      |
| H      | H | H      |

X: Don't care

Z: High impedance

## Absolute Maximum Ratings (Note 1)

| Characteristics             | Symbol    | Rating                       | Unit               |
|-----------------------------|-----------|------------------------------|--------------------|
| Supply voltage range        | $V_{CC}$  | -0.5 to 7                    | V                  |
| DC input voltage            | $V_{IN}$  | -0.5 to $V_{CC} + 0.5$       | V                  |
| DC output voltage           | $V_{OUT}$ | -0.5 to $V_{CC} + 0.5$       | 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 to 150                   | $^{\circ}\text{C}$ |

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: 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  $-10$  mW/ $^{\circ}\text{C}$  shall be applied until 300 mW.

## Operating Ranges (Note)

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

Note: 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.

## 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                 | 1.50 | —    | —                | 1.50 | —    | V   |
|                                  |                 |   |  | 4.5                 | 3.15 | —    | —                | 3.15 | —    |     |
|                                  |                 |   |  | 6.0                 | 4.20 | —    | —                | 4.20 | —    |     |
| Low-level input voltage          | V <sub>IL</sub> | —   |  | 2.0                 | —    | —    | 0.50             | —    | 0.50 | V   |
|                                  |                 |   |  | 4.5                 | —    | —    | 1.35             | —    | 1.35 |     |
|                                  |                 |   |  | 6.0                 | —    | —    | 1.80             | —    | 1.80 |     |
| 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: $t_r = t_f = 6$ ns)

| Characteristics               | Symbol             | Test Condition       |         | Ta = 25°C |      |     | Ta = -40 to 85°C |     | Unit |    |
|-------------------------------|--------------------|----------------------|---------|-----------|------|-----|------------------|-----|------|----|
|                               |                    | CL (pF)              | VCC (V) | Min       | Typ. | Max | Min              | Max |      |    |
| Output transition time        | $t_{TLH}$          | —                    | 50      | 2.0       | —    | 20  | 60               | —   | 75   | ns |
|                               | $t_{THL}$          |                      |         | 4.5       | —    | 6   | 12               | —   | 15   |    |
|                               |                    |                      |         | 6.0       | —    | 5   | 10               | —   | 13   |    |
| Propagation delay time        | $t_{pLH}$          | —                    | 50      | 2.0       | —    | 30  | 90               | —   | 115  | ns |
|                               |                    |                      |         | 4.5       | —    | 11  | 18               | —   | 23   |    |
|                               |                    |                      |         | 6.0       | —    | 10  | 15               | —   | 20   |    |
|                               | $t_{pHL}$          |                      | 150     | 2.0       | —    | 42  | 130              | —   | 165  |    |
|                               |                    |                      |         | 4.5       | —    | 14  | 26               | —   | 33   |    |
|                               |                    |                      |         | 6.0       | —    | 12  | 22               | —   | 28   |    |
| Output enable time            | $t_{pZL}$          | $R_L = 1$ k $\Omega$ | 50      | 2.0       | —    | 30  | 90               | —   | 115  | ns |
|                               |                    |                      |         | 4.5       | —    | 11  | 18               | —   | 23   |    |
|                               |                    |                      |         | 6.0       | —    | 10  | 15               | —   | 20   |    |
|                               | $t_{pZH}$          |                      | 150     | 2.0       | —    | 42  | 130              | —   | 165  |    |
|                               |                    |                      |         | 4.5       | —    | 14  | 26               | —   | 33   |    |
|                               |                    |                      |         | 6.0       | —    | 12  | 22               | —   | 28   |    |
| Output disable time           | $t_{pLZ}$          | $R_L = 1$ k $\Omega$ | 50      | 2.0       | —    | 24  | 100              | —   | 125  | ns |
|                               |                    |                      |         | 4.5       | —    | 12  | 20               | —   | 25   |    |
|                               |                    |                      |         | 6.0       | —    | 10  | 17               | —   | 21   |    |
| $t_{pHZ}$                     | 150                |                      | 2.0     | —         | 42   | 130 | —                | 165 |      |    |
|                               |                    |                      | 4.5     | —         | 14   | 26  | —                | 33  |      |    |
|                               |                    |                      | 6.0     | —         | 12   | 22  | —                | 28  |      |    |
| Input capacitance             | $C_{IN}$           | —                    |         | —         | 5    | 10  | —                | 10  | pF   |    |
| Output capacitance            | $C_{OUT}$          | —                    |         | —         | 10   | —   | —                | —   | pF   |    |
| Power dissipation capacitance | $C_{PD}$<br>(Note) | —                    |         | —         | 41   | —   | —                | —   | pF   |    |

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

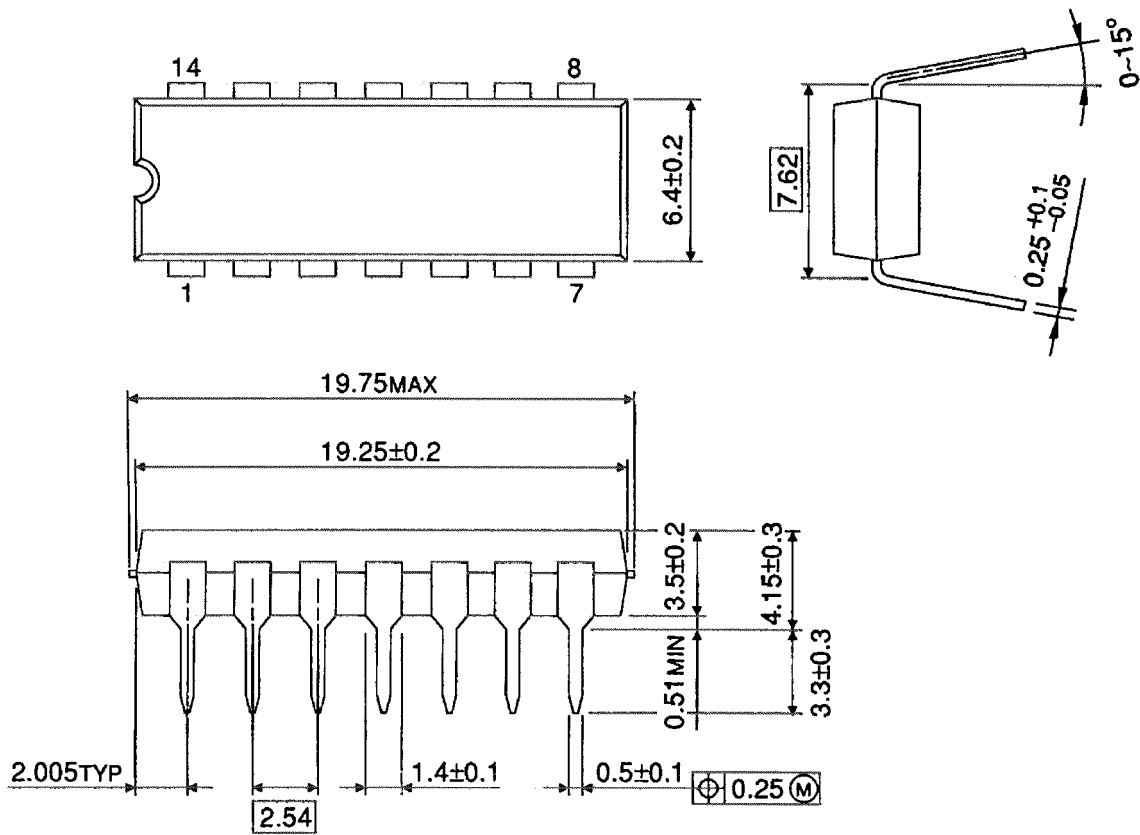
Average operating current can be obtained by the equation:

$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/4 \text{ (per gate)}$$

## Package Dimensions

DIP14-P-300-2.54

Unit : mm

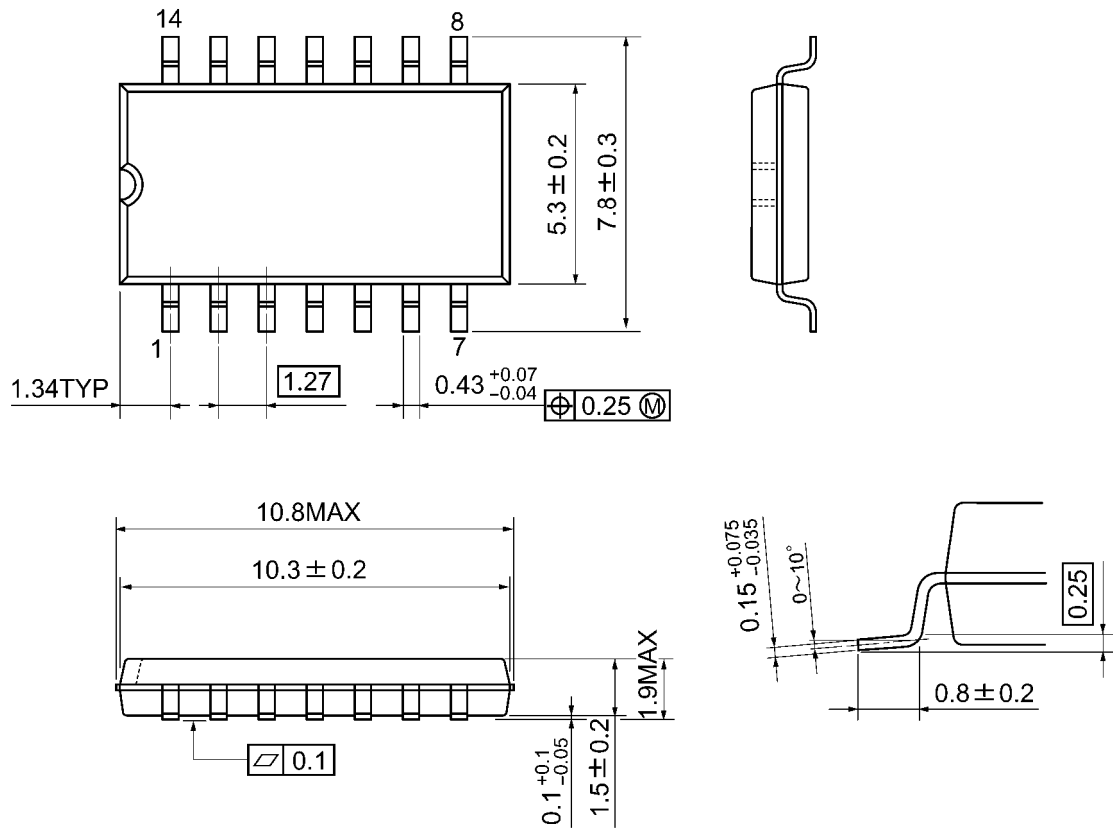


Weight: 0.96 g (typ.)

**Package Dimensions**

SOP14-P-300-1.27A

Unit: mm



Weight: 0.18 g (typ.)

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