

16-bit buffer/line driver; with 30Ω series termination resistors; 5V input/output tolerant (3-State)

74LVC162244/ 74LVCH162244A

FEATURES

- 5 volt tolerant inputs/outputs for interfacing with 5V logic
- Wide supply voltage range of 1.2V to 3.6V
- Complies with JEDEC standard no. 8-1A
- CMOS low power consumption
- MULTIBYTE™ flow-through standard pin-out architecture
- Low inductance multiple power and ground pins for minimum noise and ground bounce
- Direct interface with TTL levels
- Bus Hold on data inputs (74LVCH162244A only)
- Integrated 30Ω termination resistors

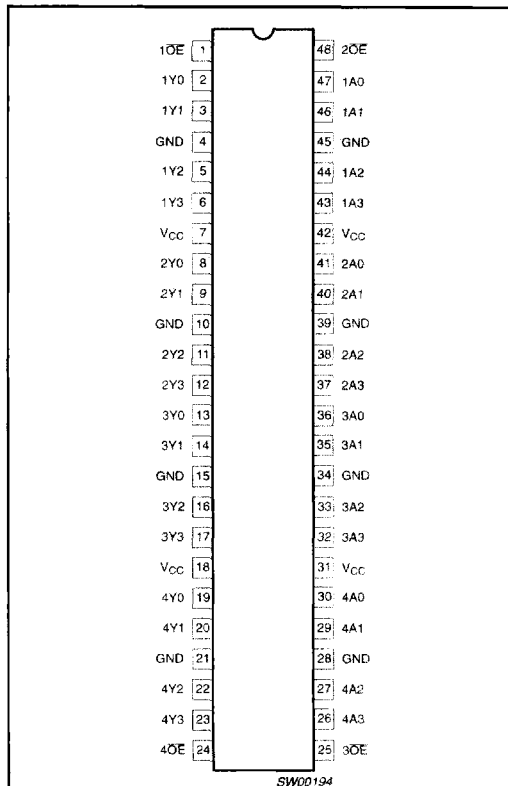
DESCRIPTION

The 74LVC(H)162244A is a high-performance, low-power, low-voltage, Si-gate CMOS device, superior to most advanced CMOS compatible TTL families. Inputs can be driven from either 3.3V or 5V devices. In 3-State operation, outputs can handle 5V. These features allow the use of these devices in a mixed 3.3V/5V environment.

The 74LVC(H)162244A is a 16-bit non-inverting buffer/line driver with 3-State outputs. The device can be used as four 4-bit buffers, two 8-bit buffers or one 16-bit buffer. The 3-State outputs are controlled by the output enable inputs 1OE and 2OE. A HIGH on nOE causes the outputs to assume a high impedance OFF-state. The 74LVC(H)162244A is designed with 30Ω series termination resistors in both HIGH and LOW output stages to reduce line noise. The device can be used as four 4-bit buffers, two 8-bit buffers or one 16-bit buffer.

The 74LVCH162244A bus hold data inputs eliminates the need for external pull up resistors to hold unused inputs.

PIN CONFIGURATION



ORDERING INFORMATION

| PACKAGES | TEMPERATURE RANGE | OUTSIDE NORTH AMERICA | NORTH AMERICA | DWG NUMBER |
|------------------------------|-------------------|-----------------------|----------------|------------|
| 48-Pin Plastic SSOP Type III | -40°C to +85°C | 74LVC162244A DL | VC162244A DL | SOT370-1 |
| 48-Pin Plastic TSSOP Type II | -40°C to +85°C | 74LVC162244A DGG | VC162244A DGG | SOT362-1 |
| 48-Pin Plastic SSOP Type III | -40°C to +85°C | 74LVCH162244A DL | VCH162244A DL | SOT370-1 |
| 48-Pin Plastic TSSOP Type II | -40°C to +85°C | 74LVCH162244A DGG | VCH162244A DGG | SOT362-1 |

QUICK REFERENCE DATA

GND = 0 V; T_{amb} = 25°C; t_r = t_f ≤ 2.5 ns

| SYMBOL | PARAMETER | CONDITIONS | TYPICAL | UNIT |
|------------------------------------|--|--|---------|------|
| t _{PHL} /t _{PLH} | Propagation delay 1An to 1Yn; 2An to 2Yn | C _L = 50pF V _{CC} = 3.3V | 2.9 | ns |
| C _I | Input capacitance | | 5.0 | pF |
| C _{PD} | Power dissipation capacitance per buffer | V _I = GND to V _{CC} ¹ | 25 | pF |

NOTES:

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μW):

$$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$$
 where:
 f_i = input frequency in MHz; C_L = output load capacity in pF;
 f_o = output frequency in MHz; V_{CC} = supply voltage in V;
 $\sum (C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs.

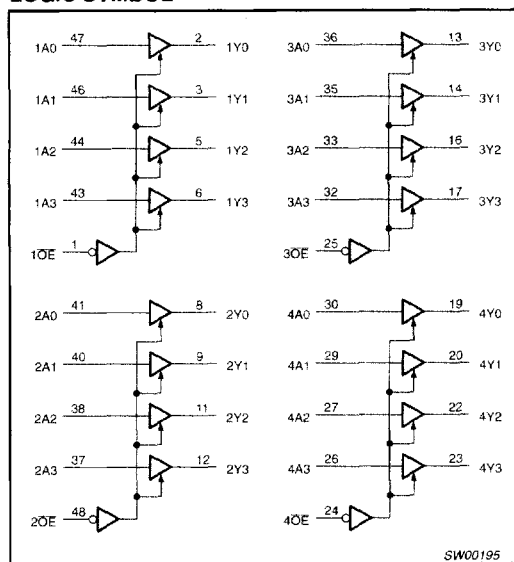
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PIN DESCRIPTION

| PIN NUMBER | SYMBOL | NAME AND FUNCTION |
|-------------------------------|-----------------|----------------------------------|
| 1 | 1OE | Output enable input (active LOW) |
| 2, 3, 5, 6 | 1Y0 to 1Y3 | Data outputs |
| 4, 10, 15, 21, 28, 34, 39, 45 | GND | Ground (0V) |
| 7, 18, 31, 42 | V _{CC} | Positive supply voltage |
| 8, 9, 11, 12 | 2Y0 to 2Y3 | Data outputs |
| 13, 14, 16, 17 | 3Y0 to 3Y3 | Data outputs |
| 19, 20, 22, 23 | 4Y0 to 4Y3 | Data outputs |
| 24 | 4OE | Output enable input (active LOW) |
| 25 | 3OE | Output enable input (active LOW) |
| 30, 29, 27, 26 | 4A0 to 4A3 | Data inputs |
| 36, 35, 33, 32 | 3A0 to 3A3 | Data inputs |
| 41, 40, 38, 37 | 2A0 to 2A3 | Data inputs |
| 47, 46, 44, 43 | 1A0 to 1A3 | Data inputs |
| 48 | 2OE | Output enable input (active LOW) |

LOGIC SYMBOL

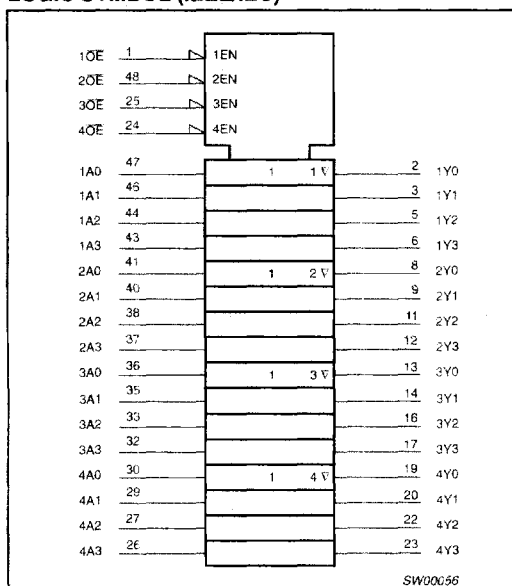


FUNCTION TABLE

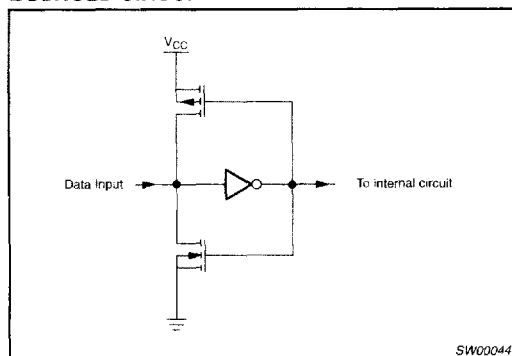
| INPUTS | | OUTPUT |
|--------|-----|--------|
| nOE | nAn | nYn |
| L | L | L |
| L | H | H |
| H | X | Z |

H = HIGH voltage level
L = LOW voltage level
X = don't care
Z = high impedance OFF-state

LOGIC SYMBOL (IEEE/IEC)



BUSHOLD CIRCUIT



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ABSOLUTE MAXIMUM RATINGS¹

In accordance with the Absolute Maximum Rating System (IEC 134) Voltages are referenced to GND (ground = 0V)

| SYMBOL | PARAMETER | CONDITIONS | LIMITS | | UNIT |
|------------------------------------|---|--|--------|-----------------------|------|
| | | | MIN | MAX | |
| V _{CC} | DC supply voltage | | -0.5 | +6.5 | V |
| I _{IK} | DC input diode current | V _I < 0 | - | -50 | mA |
| V _I | DC input voltage | Note 2 | -0.5 | +6.5 | V |
| I _{OK} | DC output diode current | V _O > V _{CC} or V _O < 0 | - | ±50 | mA |
| V _O | DC output voltage; output HIGH or LOW state | Note 2 | -0.5 | V _{CC} + 0.5 | V |
| V _O | DC output voltage; output 3-State | Note 2 | -0.5 | 6.5 | V |
| I _O | DC output source or sink current | V _O = 0 to V _{CC} | - | ±50 | mA |
| I _{GND} , I _{CC} | DC V _{CC} or GND current | | - | ±100 | mA |
| T _{stg} | Storage temperature range | | -65 | +150 | °C |
| P _{tot} | Power dissipation per package - SSOP and TSSOP package | Above +60°C derate linearly 5.5mW/K | | 500 | mW |

NOTES:

- Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- The input and output voltage ratings may be exceeded if the input and output clamp current ratings are observed.

RECOMMENDED OPERATING CONDITIONS

| SYMBOL | PARAMETER | CONDITIONS | LIMITS | | UNIT |
|---------------------------------|---|--|--------|-----------------|------|
| | | | MIN. | MAX. | |
| V _{CC} | DC supply voltage (for max. speed performance) | | 2.7 | 3.6 | V |
| V _{CC} | DC supply voltage (for low-voltage applications) | | 1.2 | 3.6 | V |
| V _I | DC Input voltage range | | 0 | 5.5 | V |
| V _O | DC output voltage range; output HIGH or LOW state | | 0 | V _{CC} | V |
| V _O | DC output voltage range; output 3-State | | 0 | 5.5 | V |
| T _{amb} | Operating ambient temperature range in free air | See DC and AC characteristics for individual device | -40 | +85 | °C |
| t _r , t _f | Input rise and fall times | V _{CC} = 1.2 to 2.7V V _{CC} = 2.7 to 3.6V | 0 | 20 10 | ns/V |

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DC ELECTRICAL CHARACTERISTICS

Over recommended operating conditions. Voltages are referenced to GND (ground = 0V)

| SYMBOL | PARAMETER | TEST CONDITIONS | LIMITS | | | UNIT |
|-------------------|--|--|-----------------------|------------------|------|------|
| | | | Temp = -40°C to +85°C | | | |
| | | | MIN | TYP ¹ | MAX | |
| V _{IH} | HIGH level Input voltage | V _{CC} = 1.2V | V _{CC} | | | V |
| | | V _{CC} = 2.7 to 3.6V | 2.0 | | | |
| V _{IL} | LOW level Input voltage | V _{CC} = 1.2V | | | GND | V |
| | | V _{CC} = 2.7 to 3.6V | | | 0.8 | |
| V _{OH} | HIGH level output voltage | V _{CC} = 2.7V; V _I = V _{IH} or V _{IL} ; I _O = -6mA | V _{CC} - 0.5 | | | V |
| | | V _{CC} = 3.0V; V _I = V _{IH} or V _{IL} ; I _O = -100μA | V _{CC} - 0.2 | V _{CC} | | |
| | | V _{CC} = 3.0V; V _I = V _{IH} or V _{IL} ; I _O = 12mA | V _{CC} - 0.8 | | | |
| V _{OL} | LOW level output voltage | V _{CC} = 2.7V; V _I = V _{IH} or V _{IL} ; I _O = 6mA | | | 0.40 | V |
| | | V _{CC} = 3.0V; V _I = V _{IH} or V _{IL} ; I _O = 100μA | | | 0.20 | |
| | | V _{CC} = 3.0V; V _I = V _{IH} or V _{IL} ; I _O = 12mA | | | 0.55 | |
| I _I | Input leakage current | V _{CC} = 3.6V; V _I = 5.5V or GND ⁶ | | ±0.1 | ±5 | μA |
| I _{OZ} | 3-State output OFF-state current | V _{CC} = 3.6V; V _I = V _{IH} or V _{IL} ; V _O = 5.5V or GND | | 0.1 | ±5 | μA |
| I _{off} | Power off leakage supply | V _{CC} = 0.0V; V _I or V _O = 5.5V | | 0.1 | ±10 | μA |
| I _{CC} | Quiescent supply current | V _{CC} = 3.6V; V _I = V _{CC} or GND; I _O = 0 | | 0.1 | 20 | μA |
| ΔI _{CC} | Additional quiescent supply current per control pin | V _{CC} = 2.7V to 3.6V; V _I = V _{CC} - 0.6V; I _O = 0 | | 5 | 500 | μA |
| ΔI _{CC} | Additional quiescent supply current per data input pin | V _{CC} = 2.7V to 3.6V; V _I = V _{CC} - 0.6V; I _O = 0 | | 150 | 750 | μA |
| I _{BHL} | Bus hold LOW sustaining current | V _{CC} = 3.0V; V _I = 0.8V ^{2, 3, 4} | 75 | | | μA |
| I _{BHH} | Bus hold HIGH sustaining current | V _{CC} = 3.0V; V _I = 2.0V ^{2, 3, 4} | -75 | | | μA |
| I _{BHLO} | Bus hold LOW overdrive current | V _{CC} = 3.6V ^{2, 3, 5} | 450 | | | μA |
| I _{BHHO} | Bus hold HIGH overdrive current | V _{CC} = 3.6V ^{2, 3, 5} | -450 | | | μA |

NOTES:

- All typical values are at V_{CC} = 3.3V and T_{amb} = 25°C.
- Valid for data inputs of bus hold parts (LVCH16-A) only.
- For data inputs only, control inputs do not have a bus hold circuit.
- The specified sustaining current at the data input holds the input below the specified V_I level.
- The specified overdrive current at the data input forces the data input to the opposite logic input state.
- For bus hold parts, the bus hold circuit is switched off when V_I exceeds V_{CC} allowing 5.5V on the input terminal.

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AC CHARACTERISTICS

GND = 0V; $t_{r} = t_{f} = 2.5\text{ns}$; $C_L = 50\text{pF}$; $R_L = 500\Omega$; $T_{\text{amb}} = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$.

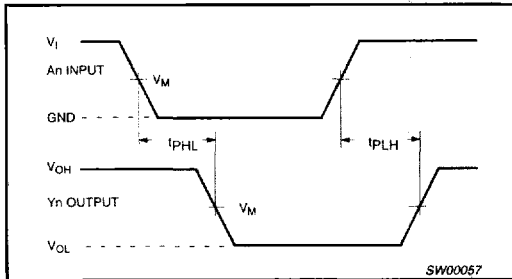
| SYMBOL | PARAMETER | WAVEFORM | LIMITS | | | | | UNIT |
|------------------------|--|----------|--------------------------|------------------|-----|-----------------|-----|------|
| | | | $V_{CC} = 3.3V \pm 0.3V$ | | | $V_{CC} = 2.7V$ | | |
| | | | MIN | TYP ¹ | MAX | MIN | MAX | |
| t_{PHL} t_{PLH} | Propagation delay 1An to 1Yn; 2An to 2Yn | 1 | 1.5 | 2.9 | 6.3 | 1.5 | 7.3 | ns |
| t_{PZH} t_{PZL} | 3-State output enable time 1OE to 1Yn; 2OE to 2Yn | 2, 3 | 1.5 | 3.4 | 7.1 | 1.5 | 8.1 | ns |
| t_{PHZ} t_{PLZ} | 3-State output disable time 1OE to 1Yn; 2OE to 2Yn | 2, 3 | 1.5 | 2.8 | 5.0 | 1.5 | 6.0 | ns |

NOTE:

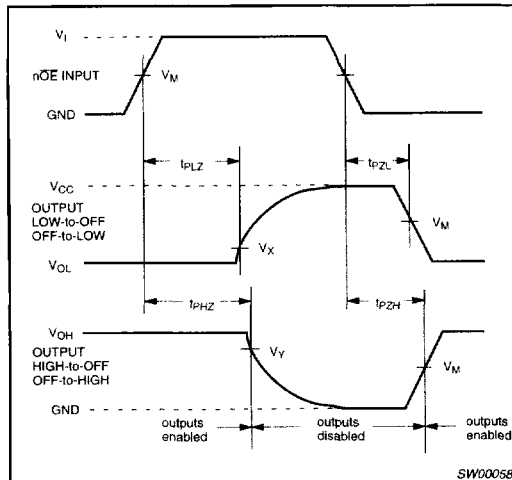
1. All typical values are at $V_{CC} = 3.3V$ and $T_{\text{amb}} = 25^{\circ}\text{C}$.

AC WAVEFORMS

$V_M = 1.5V$ at $V_{CC} \geq 2.7V$; $V_M = 0.5 V_{CC}$ at $V_{CC} < 2.7V$.
 V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.
 $V_X = V_{OL} + 0.3V$ at $V_{CC} \geq 2.7V$; $V_X = V_{OL} + 0.1 V_{CC}$ at $V_{CC} < 2.7V$
 $V_Y = V_{OH} - 0.3V$ at $V_{CC} \geq 2.7V$; $V_Y = V_{OH} - 0.1 V_{CC}$ at $V_{CC} < 2.7V$

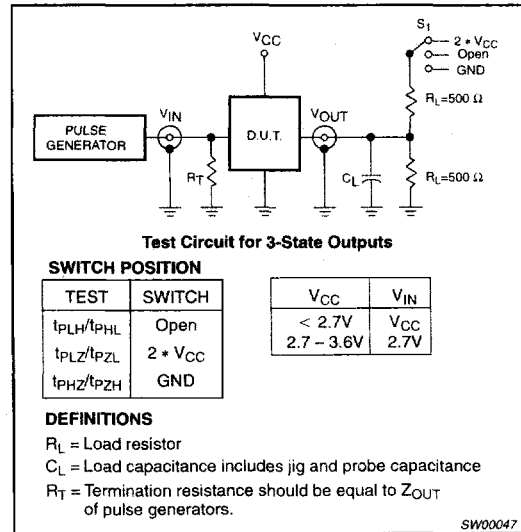


Waveform 1. Input (An) to output (Yn) propagation delay times



Waveform 2. 3-State enable and disable times

TEST CIRCUIT



Waveform 3. Load circuitry for switching times