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November 2001  
Revised November 2001

## 74ALVC162244 Low Voltage 16-Bit Buffer/Line Driver with 3.6V Tolerant Inputs and Outputs and 26Ω Series Resistor in Outputs

### 74ALVC162244

### Low Voltage 16-Bit Buffer/Line Driver with 3.6V Tolerant Inputs and Outputs and 26Ω Series Resistor in Outputs

#### General Description

The ALVC162244 contains sixteen non-inverting buffers with 3-STATE outputs to be employed as a memory and address driver, clock driver, or bus oriented transmitter/receiver. The device is nibble (4-bit) controlled. Each nibble has separate 3-STATE control inputs which can be shorted together for full 16-bit operation.

The 74ALVC162244 is designed for low voltage (1.65V to 3.6V)  $V_{CC}$  applications with I/O capability up to 3.6V. The 74ALVC162244 is also designed with 26Ω series resistors in the outputs. This design reduces line noise in applications such as memory address drivers, clock drivers, and bus transceivers/transmitters.

The 74ALVC162244 is fabricated with an advanced CMOS technology to achieve high speed operation while maintaining low CMOS power dissipation.

#### Features

- 1.65V to 3.6V  $V_{CC}$  supply operation
- 3.6V tolerant inputs and outputs
- 26Ω series resistors in outputs
- $t_{PD}$ 
  - 3.8 ns max for 3.0V to 3.6V  $V_{CC}$
  - 4.3 ns max for 2.3V to 2.7V  $V_{CC}$
  - 7.6 ns max for 1.65V to 1.95V  $V_{CC}$
- Power-off high impedance inputs and outputs
- Supports live insertion and withdrawal
- Uses patented noise/EMI reduction circuitry
- Latchup conforms to JEDEC JED78
- ESD performance:
  - Human body model > 2000V
  - Machine model > 200V
- Also packaged in plastic Fine-Pitch Ball Grid Array (FBGA)

**Note 1:** To ensure the high-impedance state during power up or power down,  $\bar{OE}$  should be tied to  $V_{CC}$  through a pull-up resistor; the minimum value of the resistor is determined by the current-sourcing capability of the driver.

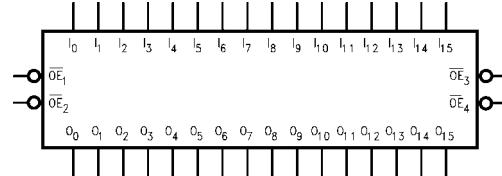
#### Ordering Code:

Order Number	Package Number	Package Description
74ALVC162244GX (Note 2)	BGA54A	54-Ball Fine-Pitch Ball Grid Array (FBGA), JEDEC MO-205, 5.5mm Wide [TAPE and REEL]
74ALVC162244T (Note 3)	MTD48	48-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 6.1mm Wide

**Note 2:** BGA package available in Tape and Reel only.

**Note 3:** Devices also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.

### Logic Symbol

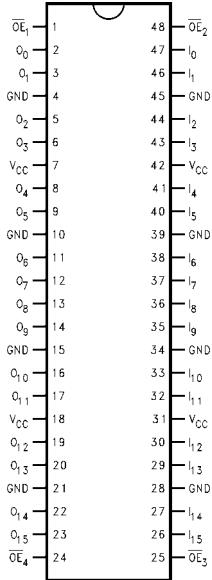


### Pin Descriptions

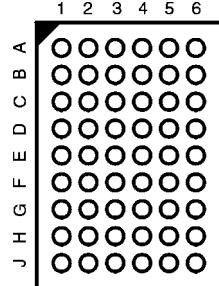
Pin Names	Description
$\overline{OE}_1$	Output Enable Input (Active LOW)
$I_0-I_{15}$	Inputs
$O_0-O_{15}$	Outputs
NC	No Connect

### Connection Diagrams

#### Pin Assignment for TSSOP



#### Pin Assignment for FBGA



(Top Thru View)

### FBGA Pin Assignments

	1	2	3	4	5	6
<b>A</b>	$O_0$	NC	$\overline{OE}_1$	$\overline{OE}_2$	NC	$I_0$
<b>B</b>	$O_2$	$O_1$	NC	NC	$I_1$	$I_2$
<b>C</b>	$O_4$	$O_3$	$V_{CC}$	$V_{CC}$	$I_3$	$I_4$
<b>D</b>	$O_6$	$O_5$	GND	GND	$I_5$	$I_6$
<b>E</b>	$O_8$	$O_7$	GND	GND	$I_7$	$I_8$
<b>F</b>	$O_{10}$	$O_9$	GND	GND	$I_9$	$I_{10}$
<b>G</b>	$O_{12}$	$O_{11}$	$V_{CC}$	$V_{CC}$	$I_{11}$	$I_{12}$
<b>H</b>	$O_{14}$	$O_{13}$	NC	NC	$I_{13}$	$I_{14}$
<b>J</b>	$O_{15}$	NC	$\overline{OE}_4$	$\overline{OE}_3$	NC	$I_{15}$

### Truth Tables

Inputs		Outputs
$\overline{OE}_1$	$I_0-I_3$	$O_0-O_3$
L	L	L
L	H	H
H	X	Z

Inputs		Outputs
$\overline{OE}_2$	$I_4-I_7$	$O_4-O_7$
L	L	L
L	H	H
H	X	Z

Inputs		Outputs
$\overline{OE}_3$	$I_8-I_{11}$	$O_8-O_{11}$
L	L	L
L	H	H
H	X	Z

Inputs		Outputs
$\overline{OE}_4$	$I_{12}-I_{15}$	$O_{12}-O_{15}$
L	L	L
L	H	H
H	X	Z

H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial (HIGH or LOW, inputs may not float)

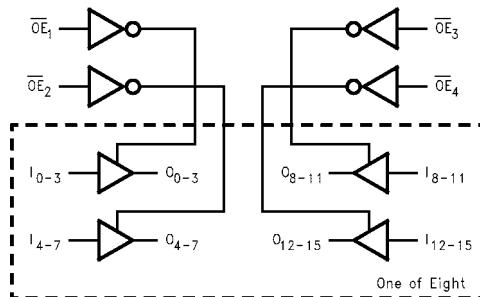
Z = High Impedance

## Functional Description

The 74ALVC162244 contains sixteen non-inverting buffers with 3-STATE outputs. The device is nibble (4 bits) controlled with each nibble functioning identically, but independent of each other. The control pins may be shorted together to obtain full 16-bit operation. The 3-STATE out-

puts are controlled by an Output Enable ( $\overline{OE}_n$ ) input. When  $\overline{OE}_n$  is LOW, the outputs are in the 2-state mode. When  $\overline{OE}_n$  is HIGH, the standard outputs are in the high impedance mode but this does not interfere with entering new data into the inputs.

## Logic Diagram



**Absolute Maximum Ratings**(Note 4)

Supply Voltage ( $V_{CC}$ )	-0.5V to +4.6V
DC Input Voltage ( $V_I$ )	-0.5V to 4.6V
Output Voltage ( $V_O$ ) (Note 5)	-0.5V to $V_{CC}$ +0.5V
DC Input Diode Current ( $I_{IK}$ ) $V_I < 0V$	-50 mA
DC Output Diode Current ( $I_{OK}$ ) $V_O < 0V$	-50 mA
DC Output Source/Sink Current ( $I_{OH}/I_{OL}$ )	±50 mA
DC $V_{CC}$ or GND Current per Supply Pin ( $I_{CC}$ or GND)	±100 mA
Storage Temperature Range ( $T_{STG}$ )	-65°C to +150°C

**Recommended Operating  
Conditions** (Note 6)

Power Supply	
Operating	1.65V to 3.6V
Input Voltage	0V to $V_{CC}$
Output Voltage ( $V_O$ )	0V to $V_{CC}$
Free Air Operating Temperature ( $T_A$ )	-40°C to +85°C
Minimum Input Edge Rate ( $\Delta t/\Delta V$ )	
$V_{IN} = 0.8V$ to 2.0V, $V_{CC} = 3.0V$	10 ns/V

**Note 4:** The Absolute Maximum Ratings are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the Absolute Maximum Ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

**Note 5:**  $I_O$  Absolute Maximum Rating must be observed.

**Note 6:** Floating or unused control inputs must be held HIGH or LOW.

**DC Electrical Characteristics**

Symbol	Parameter	Conditions	$V_{CC}$ (V)	Min	Max	Units
$V_{IH}$	HIGH Level Input Voltage		1.65 - 1.95 2.3 - 2.7 2.7 - 3.6	0.65 x $V_{CC}$ 1.7 2.0		V
$V_{IL}$	LOW Level Input Voltage		1.65 - 1.95 2.3 - 2.7 2.7 - 3.6		0.35 x $V_{CC}$ 0.7 0.8	V
$V_{OH}$	HIGH Level Output Voltage	$I_{OH} = -100 \mu A$	1.65 - 3.6	$V_{CC} - 0.2$		V
		$I_{OH} = -2 mA$	1.65	1.2		
		$I_{OH} = -4 mA$	2.3	1.9		
		$I_{OH} = -6 mA$	2.3	1.7		
		$I_{OH} = -8 mA$	2.7	2		
		$I_{OH} = -12 mA$	3.0	2		
$V_{OL}$	LOW Level Output Voltage	$I_{OL} = 100 \mu A$	1.65 - 3.6		0.2	V
		$I_{OL} = 2 mA$	1.65		0.45	
		$I_{OL} = 4 mA$	2.3		0.4	
		$I_{OL} = 6 mA$	2.3		0.55	
		$I_{OL} = 8 mA$	2.7		0.6	
		$I_{OL} = 12 mA$	3		0.8	
$I_I$	Input Leakage Current	$0 \leq V_I \leq 3.6V$	3.6		±5.0	µA
$I_{OZ}$	3-STATE Output Leakage	$0 \leq V_O \leq 3.6V$	3.6		±10	µA
$I_{CC}$	Quiescent Supply Current	$V_I = V_{CC}$ or GND, $I_O = 0$	3.6		40	µA
$\Delta I_{CC}$	Increase in $I_{CC}$ per Input	$V_{IH} = V_{CC} - 0.6V$	3 - 3.6		750	µA

## AC Electrical Characteristics

Symbol	Parameter	$T_A = -40^\circ\text{C to } +85^\circ\text{C}, R_L = 500\Omega$								Units	
		$C_L = 50 \text{ pF}$				$C_L = 30 \text{ pF}$					
		$V_{CC} = 3.3V \pm 0.3V$		$V_{CC} = 2.7V$		$V_{CC} = 2.5V \pm 0.2V$		$V_{CC} = 1.8V \pm 0.15V$			
		Min	Max	Min	Max	Min	Max	Min	Max		
$t_{PHL}, t_{PLH}$	Propagation Delay	1.3	3.8	1.5	4.3	1.0	3.8	1.5	7.6	ns	
$t_{PZL}, t_{PZH}$	Output Enable Time	1.3	4.3	1.5	5.6	1.0	5.1	1.5	9.8	ns	
$t_{PLZ}, t_{PHZ}$	Output Disable Time	1.3	4.1	1.5	4.5	1.0	4.0	1.5	7.2	ns	

## Capacitance

Symbol	Parameter	Conditions		$T_A = +25^\circ\text{C}$		Units	
				$V_{CC}$	Typical		
$C_{IN}$	Input Capacitance	$V_I = 0V$ or $V_{CC}$		3.3	6	pF	
$C_{OUT}$	Output Capacitance	$V_I = 0V$ or $V_{CC}$		3.3	7	pF	
$C_{PD}$	Power Dissipation Capacitance	Outputs Enabled	$f = 10 \text{ MHz}, C_L = 50 \text{ pF}$		3.3	20	pF
					2.5	20	

## AC Loading and Waveforms

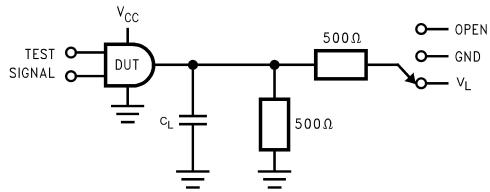


FIGURE 1. AC Test Circuit

TABLE 1. Values for Figure 1

TEST	SWITCH
$t_{PLH}, t_{PHL}$	Open
$t_{PZL}, t_{PLZ}$	$V_L$
$t_{PZH}, t_{PHZ}$	GND

TABLE 2. Variable Matrix  
(Input Characteristics:  $f = t_r = t_f = 2\text{ns}$ ;  $Z_0 = 50\Omega$ )

Symbol	$V_{CC}$			
	$3.3V \pm 0.3V$	$2.7V$	$2.5V \pm 0.2V$	$1.8V \pm 0.15V$
$V_{mi}$	1.5V	1.5V	$V_{CC}/2$	$V_{CC}/2$
$V_{mo}$	1.5V	1.5V	$V_{CC}/2$	$V_{CC}/2$
$V_X$	$V_{OL} + 0.3V$	$V_{OL} + 0.3V$	$V_{OL} + 0.15V$	$V_{OL} + 0.15V$
$V_Y$	$V_{OH} - 0.3V$	$V_{OH} - 0.3V$	$V_{OH} - 0.15V$	$V_{OH} - 0.15V$
$V_L$	6V	6V	$V_{CC}^*2$	$V_{CC}^*2$

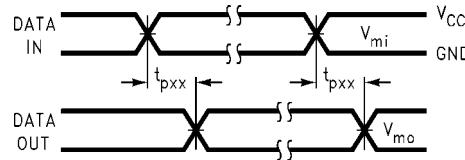


FIGURE 2. Waveform for Inverting and Non-Inverting Functions

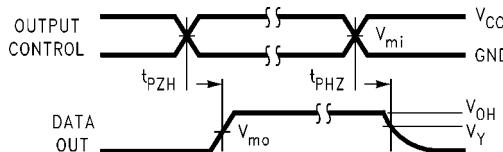


FIGURE 3. 3-STATE Output High Enable and Disable Times for Low Voltage Logic

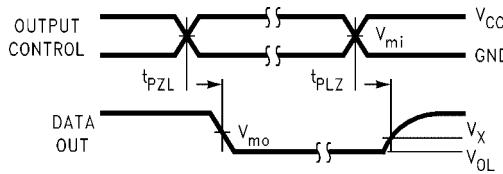
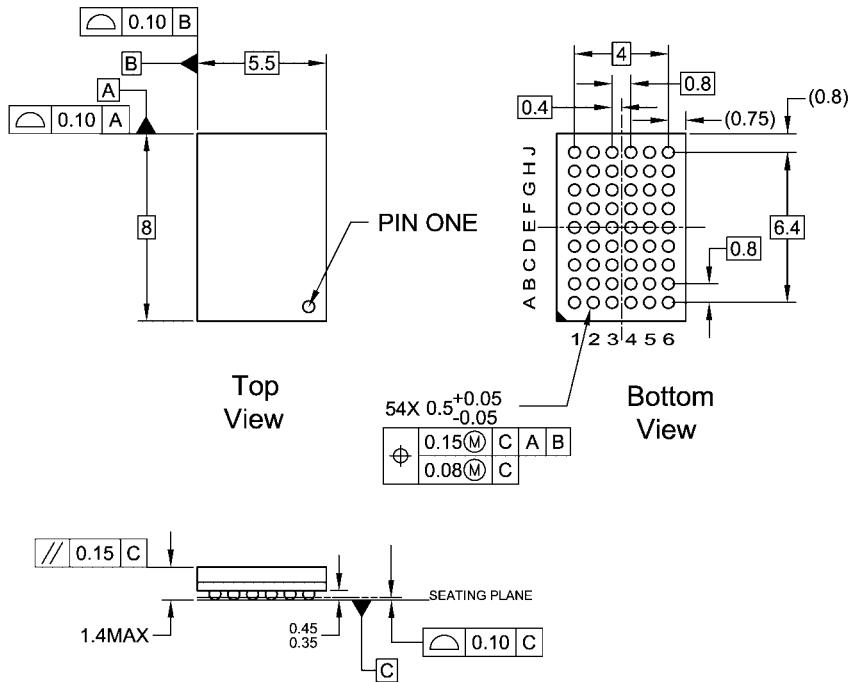


FIGURE 4. 3-STATE Output Low Enable and Disable Times for Low Voltage Logic

**Physical Dimensions** inches (millimeters) unless otherwise noted



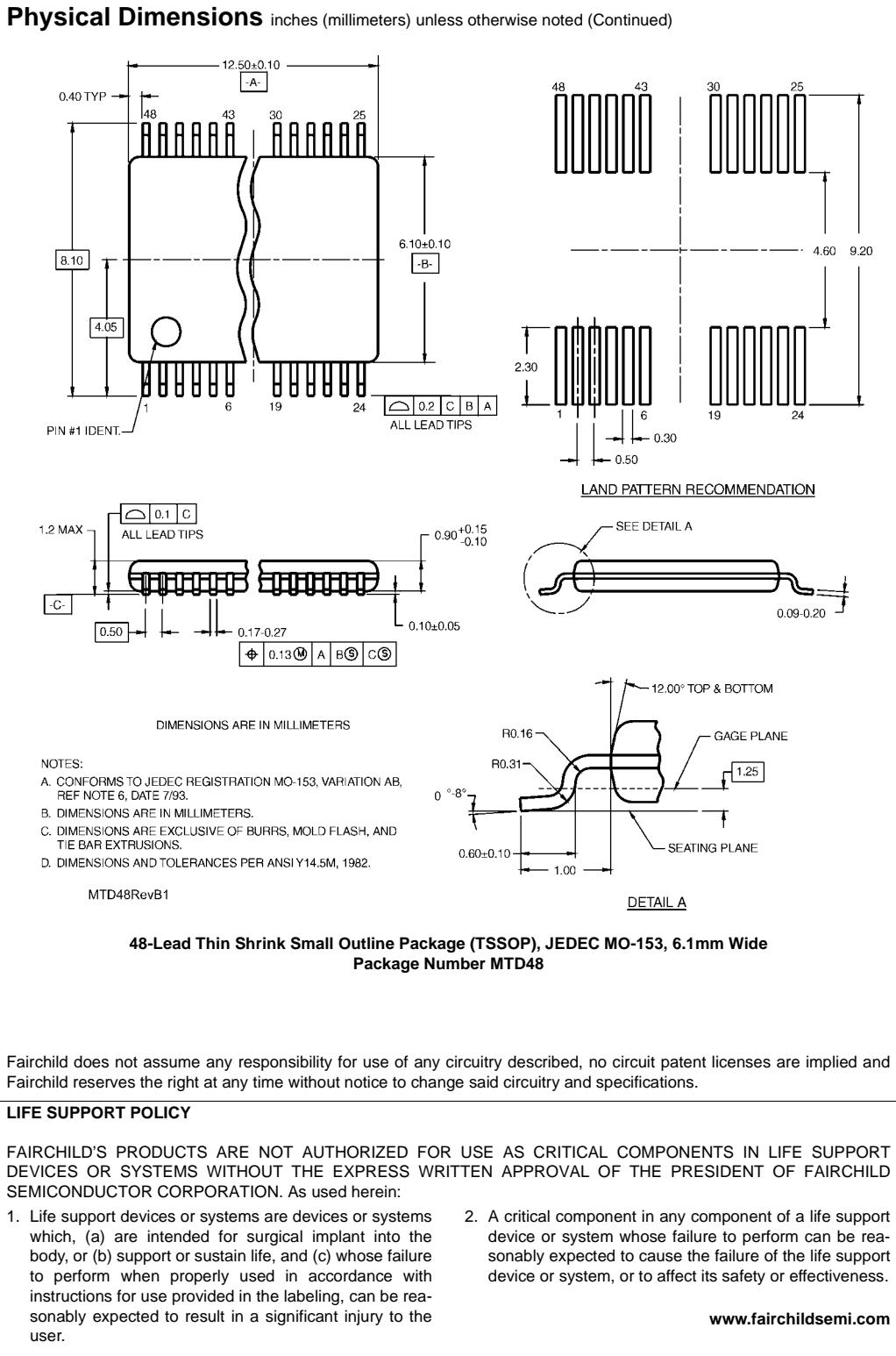
NOTES:

- A. THIS PACKAGE CONFORMS TO JEDEC M0-205
- B. ALL DIMENSIONS IN MILLIMETERS
- C. LAND PATTERN RECOMMENDATION: NSMD (Non Solder Mask Defined)  
.35MM DIA PADS WITH A SOLDERMASK OPENING OF .45MM CONCENTRIC TO PADS
- D. DRAWING CONFORMS TO ASME Y14.5M-1994

BGA54RevD

54-Ball Fine-Pitch Ball Grid Array (FBGA), JEDEC M0-205, 5.5mm Wide  
Package Number BGA54A

**74ALVC162244 Low Voltage 16-Bit Buffer/Line Driver with 3.6V Tolerant Inputs and Outputs and 26Ω Series Resistor in Outputs**



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