

## SN74LVCH16244A 16-Bit Buffer/Driver With 3-State Outputs

### 1 Features

- Member of the Texas Instruments Widebus™ Family
- Operates From 1.65 V to 3.6 V
- Inputs Accept Voltages to 5.5 V
- Max  $t_{pd}$  of 4.1 ns at 3.3 V
- Typical  $V_{OLP}$  (Output Ground Bounce) <0.8 V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- Typical  $V_{OHV}$  (Output  $V_{OH}$  Undershoot) >2 V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- $I_{off}$  Supports Live Insertion, Partial-Power-Down Mode, and Back-Drive Protection
- Supports Mixed-Mode Signal Operation on All Ports (5-V Input or Output Voltage With 3.3-V  $V_{CC}$ )
- Bus Hold on Data Inputs Eliminates the Need for External Pullup or Pulldown Resistors
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)

### 2 Applications

- Servers
- PCs and Notebooks
- Network Switches
- Wireless and Telecom Infrastructures
- TV Set-top Boxes
- Electronic Points of Sale

### 3 Description

This 16-bit buffer/driver is designed for 1.65-V to 3.6-V  $V_{CC}$  operation. The device can be used as four 4-bit buffers, two 8-bit buffers, or one 16-bit buffer.

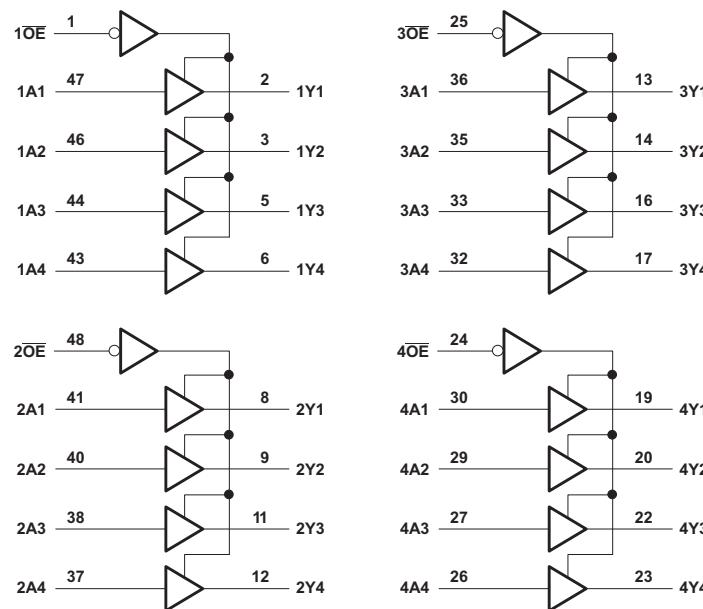
The SN74LVCH16244A device is designed specifically to improve the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters.

### Device Information<sup>(1)</sup>

PART NUMBER	PACKAGE	BODY SIZE (NOM)
SN74LVCH16244A	TSSOP (48)	12.50 mm x 6.10 mm
	TVSOP (48)	9.70 mm x 4.40 mm
	SSOP (48)	15.88 mm x 7.49 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

### 4 Simplified Schematic



Pin numbers shown are for the DGG, DGV, and DL packages.



An **IMPORTANT NOTICE** at the end of this data sheet addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers. **PRODUCTION DATA**.

## Table of Contents

<b>1</b>	<b>Features</b>	<b>1</b>	9.1	Overview	11
<b>2</b>	<b>Applications</b>	<b>1</b>	9.2	Functional Block Diagram	11
<b>3</b>	<b>Description</b>	<b>1</b>	9.3	Feature Description	12
<b>4</b>	<b>Simplified Schematic</b>	<b>1</b>	9.4	Device Functional Modes	12
<b>5</b>	<b>Revision History</b>	<b>2</b>	<b>10</b>	<b>Application and Implementation</b>	<b>13</b>
<b>6</b>	<b>Pin Configuration and Functions</b>	<b>3</b>	10.1	Application Information	13
<b>7</b>	<b>Specifications</b>	<b>6</b>	10.2	Typical Application	13
7.1	Absolute Maximum Ratings	6	<b>11</b>	<b>Power Supply Recommendations</b>	<b>14</b>
7.2	Handling Ratings	6	<b>12</b>	<b>Layout</b>	<b>14</b>
7.3	Recommended Operating Conditions	7	12.1	Layout Guidelines	14
7.4	Thermal Information	7	12.2	Layout Example	14
7.5	Electrical Characteristics	8	<b>13</b>	<b>Device and Documentation Support</b>	<b>15</b>
7.6	Switching Characteristics	8	13.1	Trademarks	15
7.7	Operating Characteristics	8	13.2	Electrostatic Discharge Caution	15
7.8	Typical Characteristics	9	13.3	Glossary	15
<b>8</b>	<b>Parameter Measurement Information</b>	<b>10</b>	<b>14</b>	<b>Mechanical, Packaging, and Orderable</b>	
<b>9</b>	<b>Detailed Description</b>	<b>11</b>	<b>Information</b>		<b>15</b>

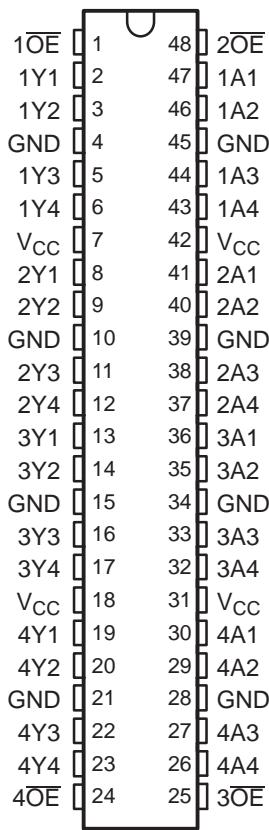
## 5 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision A (November 2005) to Revision B	Page
• Updated document to new TI data sheet format.	1
• Removed Ordering Information table.	1
• Updated $I_{off}$ Feature bullet.	1
• Added Applications.	1
• Added Device Information table.	1
• Added Handling Ratings table.	6
• Changed MAX ambient temperature to 125°C.	7
• Added Thermal Information table.	7
• Updated $t_{sk(0)}$ values in Switching Characteristics table.	8
• Added Typical Characteristics.	9

## 6 Pin Configuration and Functions

**DGG, DGV, OR DL PACKAGE  
(TOP VIEW)**

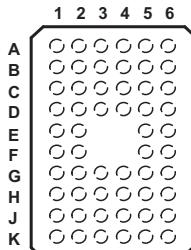


**Pin Functions**

NO.	PIN NAME	I/O	DESCRIPTION
1	1OE	I	Output enable 1
2	1Y1	O	1Y1 Output
3	1Y2	O	1Y2 Output
4	GND	—	Ground pin
5	1Y3	O	1Y3 Output
6	1Y4	O	1Y4 Output
7	VCC	—	Power pin
8	2Y1	O	2Y1 Output
9	2Y2	O	2Y2 Output
10	GND	—	Ground pin
11	2Y3	O	2Y3 Output
12	2Y4	O	2Y4 Output
13	3Y1	O	3Y1 Output
14	3Y2	O	3Y2 Output
15	GND	—	Ground pin
16	3Y3	O	3Y3 Output
17	3Y4	O	3Y4 Output
18	VCC	—	Power pin

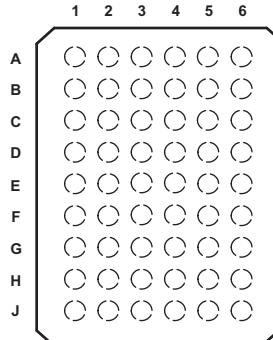
**Pin Functions (continued)**

PIN		I/O	DESCRIPTION
NO.	NAME		
19	4Y1	O	4Y1 Output
20	4Y2	O	4Y2 Output
21	GND	—	Ground pin
22	4Y3	O	4Y3 Output
23	4Y4	O	4Y4 Output
24	$\overline{4OE}$	I	Output enable 4
25	$\overline{3OE}$	I	Output enable 3
26	4A4	I	4A4 Input
27	4A3	I	4A3 Input
28	GND	—	Ground pin
29	4A2	I	4A2 Input
30	4A1	I	4A1 Input
31	VCC	—	Power pin
32	3A4	I	3A4 Input
33	3A3	I	3A3 Input
34	GND	—	Ground pin
35	3A2	I	3A2 Input
36	3A1	I	3A1 Input
37	2A4	I	2A4 Input
38	2A3	I	2A3 Input
39	GND	—	Ground pin
40	2A2	I	2A2 Input
41	2A1	I	2A1 Input
42	VCC	—	Power pin
43	1A4	I	1A4 Input
44	1A3	I	1A3 Input
45	GND	—	Ground pin
46	1A2	I	1A2 Input
47	1A1	I	1A1 Input
48	$\overline{2OE}$	I	Output enable 2

**GQL OR ZQL PACKAGE  
(TOP VIEW)**

**Pin Assignments<sup>(1)</sup>  
(56-Ball GQL or ZQL Package)**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
<b>A</b>	$1\overline{OE}$	NC	NC	NC	NC	$2\overline{OE}$
<b>B</b>	1Y2	1Y1	GND	GND	1A1	1A2
<b>C</b>	1Y4	1Y3	$V_{CC}$	$V_{CC}$	1A3	1A4
<b>D</b>	2Y2	2Y1	GND	GND	2A1	2A2
<b>E</b>	2Y4	2Y3			2A3	2A4
<b>F</b>	3Y1	3Y2			3A2	3A1
<b>G</b>	3Y3	3Y4	GND	GND	3A4	3A3
<b>H</b>	4Y1	4Y2	$V_{CC}$	$V_{CC}$	4A2	4A1
<b>J</b>	4Y3	4Y4	GND	GND	4A4	4A3
<b>K</b>	$4\overline{OE}$	NC	NC	NC	NC	$3\overline{OE}$

(1) NC – No internal connection

**GRD OR ZRD PACKAGE  
(TOP VIEW)**

**Pin Assignments<sup>(1)</sup>  
(54-Ball GRD or ZRD Package)**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
<b>A</b>	1Y1	NC	$1\overline{OE}$	$2\overline{OE}$	NC	1A1
<b>B</b>	1Y3	1Y2	NC	NC	1A2	1A3
<b>C</b>	2Y1	1Y4	$V_{CC}$	$V_{CC}$	1A4	2A1
<b>D</b>	2Y3	2Y2	GND	GND	2A2	2A3
<b>E</b>	3Y1	2Y4	GND	GND	2A4	3A1
<b>F</b>	3Y3	3Y2	GND	GND	3A2	3A3
<b>G</b>	4Y1	3Y4	$V_{CC}$	$V_{CC}$	3A4	4A1
<b>H</b>	4Y3	4Y2	NC	NC	4A2	4A3
<b>J</b>	4Y4	NC	$4\overline{OE}$	$3\overline{OE}$	NC	4A4

(1) NC – No internal connection

## 7 Specifications

### 7.1 Absolute Maximum Ratings<sup>(1)</sup>

over operating free-air temperature range (unless otherwise noted)

		MIN	MAX	UNIT
$V_{CC}$	Supply voltage range	–0.5	6.5	V
$V_I$	Input voltage range <sup>(2)</sup>	–0.5	6.5	V
$V_O$	Voltage range applied to any output in the high-impedance or power-off state <sup>(2)</sup>	–0.5	6.5	V
$V_O$	Voltage range applied to any output in the high or low state <sup>(2)(3)</sup>	–0.5	$V_{CC} + 0.5$	V
$I_{IK}$	Input clamp current	$V_I < 0$	–50	mA
$I_{OK}$	Output clamp current	$V_O < 0$	–50	mA
$I_O$	Continuous output current		±50	mA
	Continuous current through each $V_{CC}$ or GND		±100	mA

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* 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.
- (2) The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) The value of  $V_{CC}$  is provided in the *Recommended Operating Conditions* table.

### 7.2 Handling Ratings

		MIN	MAX	UNIT
$T_{stg}$	Storage temperature range	–65	150	°C
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins <sup>(1)</sup>	0	2000
		Charged device model (CDM), per JEDEC specification JESD22-C101, all pins <sup>(2)</sup>	0	1000

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
- (2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

### 7.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

			MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage	Operating	1.65	3.6	V
		Data retention only	1.5		
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	0.65 × V <sub>CC</sub>		V
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.7		
		V <sub>CC</sub> = 2.7 V to 3.6 V	2		
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	0.35 × V <sub>CC</sub>		V
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.7		
		V <sub>CC</sub> = 2.7 V to 3.6 V	0.8		
V <sub>I</sub>	Input voltage		0	5.5	V
V <sub>O</sub>	Output voltage	High or low state	0	V <sub>CC</sub>	V
		3-state	0	5.5	
I <sub>OH</sub>	High-level output current	V <sub>CC</sub> = 1.65 V		-4	mA
		V <sub>CC</sub> = 2.3 V		-8	
		V <sub>CC</sub> = 2.7 V		-12	
		V <sub>CC</sub> = 3 V		-24	
I <sub>OL</sub>	Low-level output current	V <sub>CC</sub> = 1.65 V		4	mA
		V <sub>CC</sub> = 2.3 V		8	
		V <sub>CC</sub> = 2.7 V		12	
		V <sub>CC</sub> = 3 V		24	
Δt/Δv	Input transition rise or fall rate			10	ns/V
T <sub>A</sub>	Operating free-air temperature		-40	125	°C

(1) All unused control inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number [SCBA004](#).

### 7.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>	DGG	DGV	DL	UNIT
	48 PINS	48 PINS	48 PINS	
R <sub>θJA</sub>	64.3	78.4	68.4	°C/W
R <sub>θJC(top)</sub>	17.6	30.7	34.7	
R <sub>θJB</sub>	31.5	41.8	41.0	
Ψ <sub>JT</sub>	1.1	3.8	12.3	
Ψ <sub>JB</sub>	31.2	41.3	40.4	
R <sub>θJC(bot)</sub>	n/a	n/a	n/a	

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, [SPRA953](#).

## 7.5 Electrical Characteristics

over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	MIN	TYP <sup>(1)</sup>	MAX	UNIT
V <sub>OH</sub>	I <sub>OH</sub> = -100 µA	1.65 V to 3.6 V	V <sub>CC</sub> – 0.2			V
	I <sub>OH</sub> = -4 mA	1.65 V		1.2		
	I <sub>OH</sub> = -8 mA	2.3 V		1.7		
	I <sub>OH</sub> = -12 mA	2.7 V		2.2		
	I <sub>OH</sub> = -24 mA	3 V		2.4		
V <sub>OL</sub>	I <sub>OL</sub> = 100 µA	1.65 V to 3.6 V		0.2		V
	I <sub>OL</sub> = 4 mA	1.65 V		0.45		
	I <sub>OL</sub> = 8 mA	2.3 V		0.7		
	I <sub>OL</sub> = 12 mA	2.7 V		0.4		
	I <sub>OL</sub> = 24 mA	3 V		0.55		
I <sub>I</sub>	V <sub>I</sub> = 0 to 5.5 V	3.6 V		±5	µA	
I <sub>I(hold)</sub>	V <sub>I</sub> = 0.58 V	1.65 V		15		µA
	V <sub>I</sub> = 1.07 V			-15		
	V <sub>I</sub> = 0.7 V	2.3 V		45		
	V <sub>I</sub> = 1.7 V			-45		
	V <sub>I</sub> = 0.8 V	3 V		75		
	V <sub>I</sub> = 2 V			-75		
I <sub>off</sub>	V <sub>I</sub> = 0 to 3.6 V <sup>(2)</sup>	3.6 V		±500		
	V <sub>I</sub> or V <sub>O</sub> = 5.5 V	0		±10	µA	
I <sub>OZ</sub>	V <sub>O</sub> = 0 to 5.5 V	3.6 V		±10	µA	
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	I <sub>O</sub> = 0	3.6 V		20	µA
	3.6 V ≤ V <sub>I</sub> ≤ 5.5 V <sup>(3)</sup>				20	
ΔI <sub>CC</sub>	One input at V <sub>CC</sub> – 0.6 V, Other inputs at V <sub>CC</sub> or GND		2.7 V to 3.6 V		500	µA
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND		3.3 V		5.5	pF
C <sub>o</sub>	V <sub>O</sub> = V <sub>CC</sub> or GND		3.3 V		6	pF

(1) All typical values are at V<sub>CC</sub> = 3.3 V, T<sub>A</sub> = 25°C.

(2) This is the bus-hold maximum dynamic current required to switch the input from one state to another.

(3) This applies in the disabled state only.

## 7.6 Switching Characteristics

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 3)

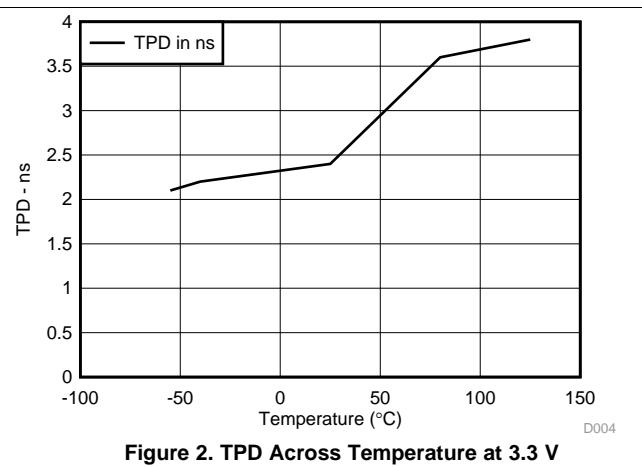
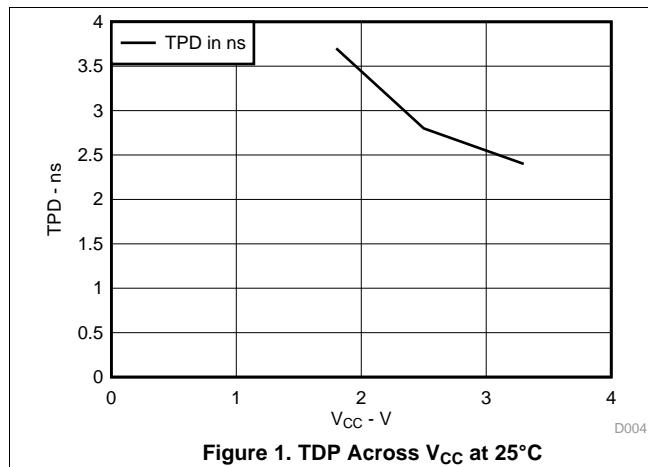
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 1.8 V ± 0.15 V		V <sub>CC</sub> = 2.5 V ± 0.2 V		V <sub>CC</sub> = 2.7 V		V <sub>CC</sub> = 3.3 V ± 0.3 V		
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>pd</sub>	A	Y	1.5	6.6	1	3.9	1	4.7	1.1	4.1	ns
t <sub>en</sub>	OE	Y	1.5	7.5	1	4.7	1	5.8	1	4.6	ns
t <sub>dis</sub>	OE	Y	1.5	10.3	1	5.3	1	6.2	1.8	5.8	ns
t <sub>sk(o)</sub>					1		1		1		ns

## 7.7 Operating Characteristics

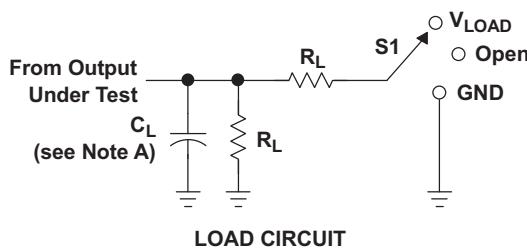
T<sub>A</sub> = 25°C

PARAMETER	TEST CONDITIONS	V <sub>CC</sub> = 1.8 V	V <sub>CC</sub> = 2.5 V	V <sub>CC</sub> = 3.3 V	UNIT	
		TYP	TYP	TYP		
C <sub>pd</sub>	Power dissipation capacitance per buffer/driver	Outputs enabled f = 10 MHz	33	32	35	pF
			2	2	3	

## 7.8 Typical Characteristics



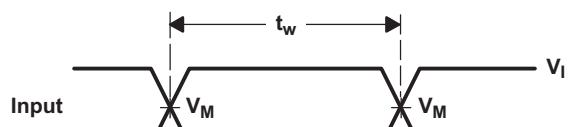
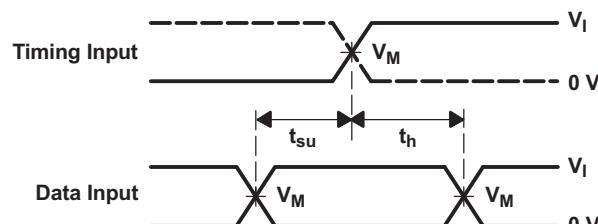
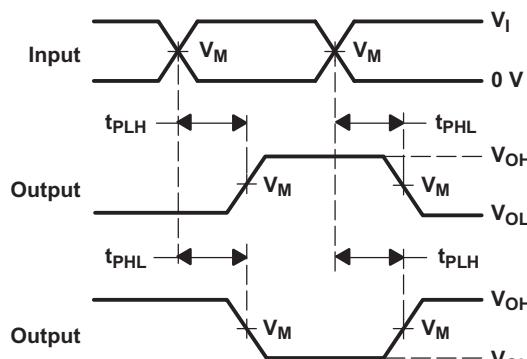
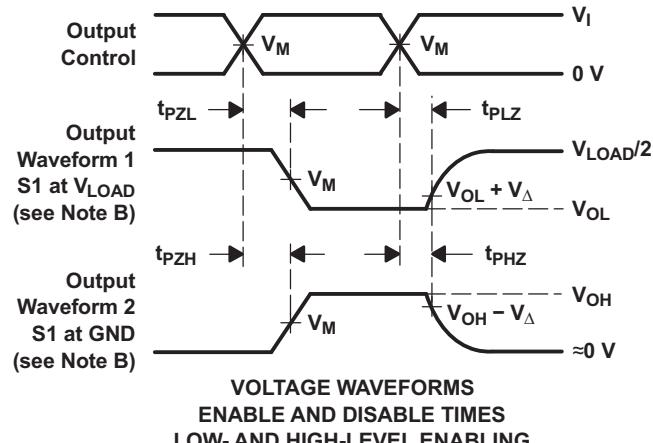
## 8 Parameter Measurement Information



TEST	$S_1$
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$V_{LOAD}$
$t_{PHZ}/t_{PZH}$	GND

LOAD CIRCUIT

$V_{CC}$	INPUTS		$V_M$	$V_{LOAD}$	$C_L$	$R_L$	$V_\Delta$
	$V_I$	$t_r/t_f$					
$1.8 \text{ V} \pm 0.15 \text{ V}$	$V_{CC}$	$\leq 2 \text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	1 k $\Omega$	0.15 V
$2.5 \text{ V} \pm 0.2 \text{ V}$	$V_{CC}$	$\leq 2 \text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	500 $\Omega$	0.15 V
2.7 V	2.7 V	$\leq 2.5 \text{ ns}$	1.5 V	6 V	50 pF	500 $\Omega$	0.3 V
$3.3 \text{ V} \pm 0.3 \text{ V}$	2.7 V	$\leq 2.5 \text{ ns}$	1.5 V	6 V	50 pF	500 $\Omega$	0.3 V

VOLTAGE WAVEFORMS  
PULSE DURATIONVOLTAGE WAVEFORMS  
SETUP AND HOLD TIMESVOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES  
INVERTING AND NONINVERTING OUTPUTSVOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES  
LOW- AND HIGH-LEVEL ENABLING

NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.  
 C. All input pulses are supplied by generators having the following characteristics: PRR  $\leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ .  
 D. The outputs are measured one at a time, with one transition per measurement.  
 E.  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .  
 F.  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .  
 G.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .  
 H. All parameters and waveforms are not applicable to all devices.

Figure 3. Load Circuit and Voltage Waveforms

## 9 Detailed Description

### 9.1 Overview

The SN74LVCH16244A device can be used as four 4-bit buffers, two 8-bit buffers, or one 16-bit buffer. It provides true outputs and symmetrical active-low output-enable ( $\overline{OE}$ ) inputs.

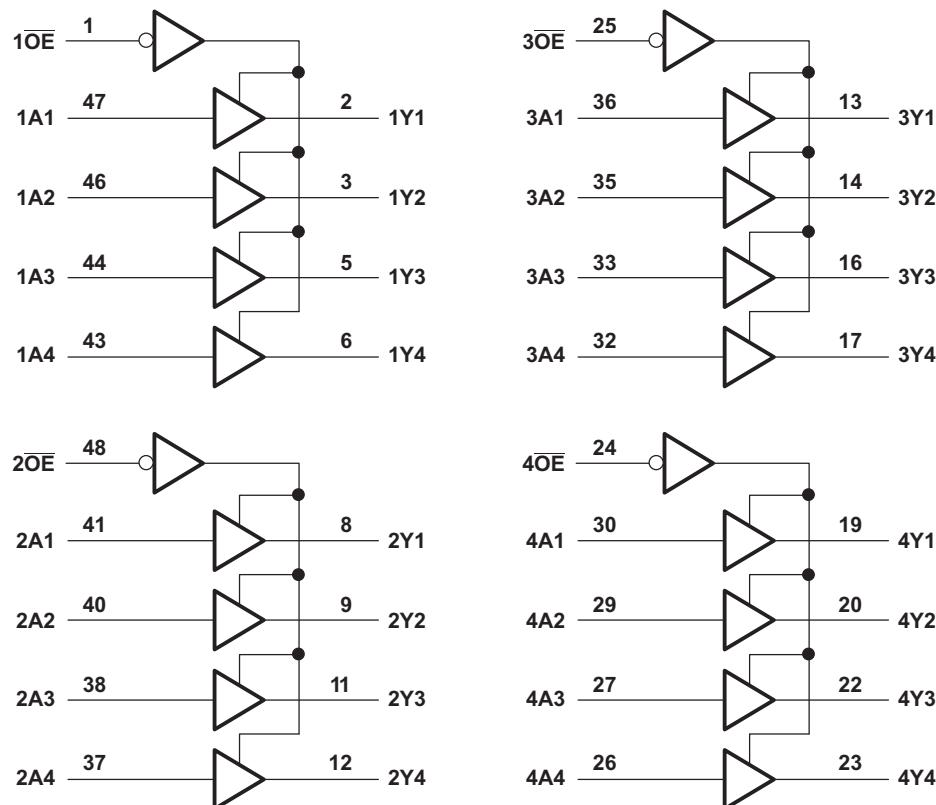
To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

Inputs can be driven from either 3.3-V or 5-V devices. This feature allows the use of this device as a translator in a mixed 3.3-V/5-V system environment.

The SN74LVCH16244A device is fully specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

Active bus-hold circuitry holds unused or undriven inputs at a valid logic state. Use of pullup or pulldown resistors with the bus-hold circuitry is not recommended.

### 9.2 Functional Block Diagram



Pin numbers shown are for the DGG, DGV, and DL packages.

### 9.3 Feature Description

- Wide operating voltage range
  - Operates from 1.65 V to 3.6 V
- Allows down voltage translation
  - Inputs accept voltages to 5.5 V
- $I_{off}$  feature
  - Allows voltages on the inputs and outputs when  $V_{CC}$  is 0 V

### 9.4 Device Functional Modes

**Table 1. Function Table  
(Each 4-bit Buffer)**

INPUTS		OUTPUT
$\overline{OE}$	A	Y
L	H	H
L	L	L
H	X	Z

## 10 Application and Implementation

### 10.1 Application Information

The SN74LVCH16244A device is a 16-bit buffer driver. This device can be used as four 4-bit, two 8-bit, or one 16-bit buffer. It allows data transmission from the A bus to the Y bus with 4 separate enable pins that control 4 bits each. The output-enable ( $\overline{OE}$ ) input can be used to disable sections of the device so that the buses are effectively isolated. The device has 5.5 V tolerant inputs at any valid  $V_{CC}$ . This allows the device to be used in multi-power systems, and it can be used for down translation. Active bus-hold circuitry holds unused or undriven inputs at a valid logic state. Use of pullup or pulldown resistors with the bus-hold circuitry is not recommended.

### 10.2 Typical Application

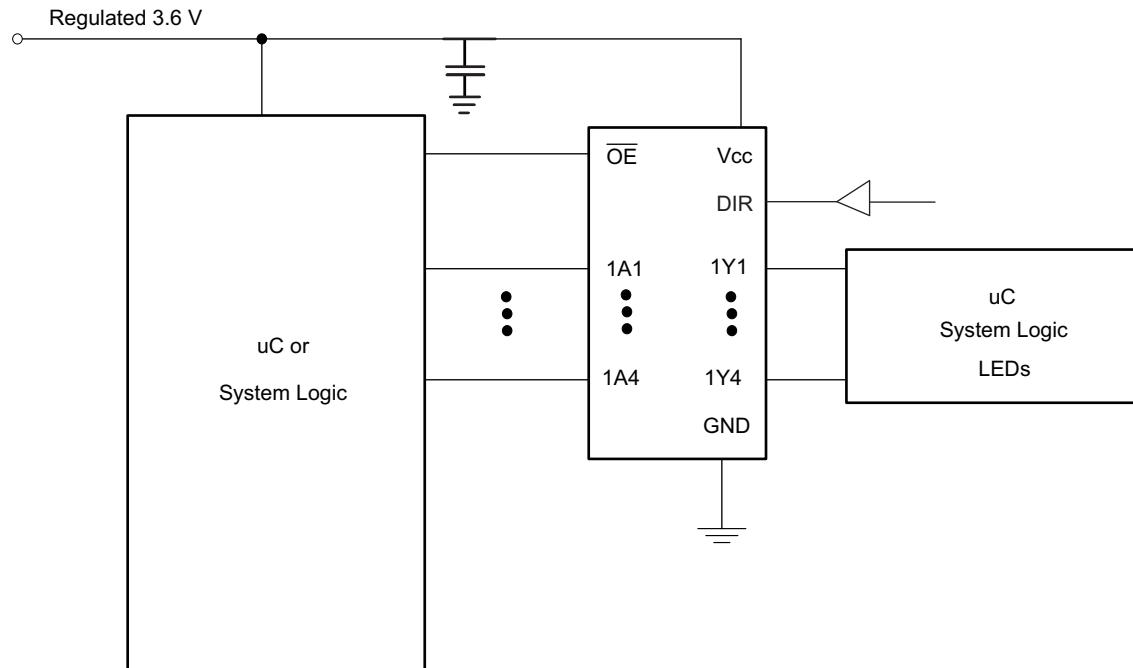


Figure 4. Typical Application Diagram

#### 10.2.1 Design Requirements

This device uses CMOS technology and has balanced output drive. Care should be taken to avoid bus contention because it can drive currents that would exceed maximum limits. The high drive will also create fast edges into light loads; therefore, routing and load conditions should be considered to prevent ringing.

#### 10.2.2 Detailed Design Procedure

1. Recommended Input Conditions
  - Rise time and fall time specs: See  $(\Delta t/\Delta V)$  in the [Recommended Operating Conditions](#) table.
  - Specified high and low levels: See  $(V_{IH}$  and  $V_{IL}$ ) in the [Recommended Operating Conditions](#) table.
  - Inputs are overvoltage tolerant allowing them to go as high as 5.5 V at any valid  $V_{CC}$ .
2. Recommend Output Conditions
  - Load currents should not exceed 25 mA per output and 50 mA total for the part.
  - Outputs should not be pulled above  $V_{CC}$ .

## Typical Application (continued)

### 10.2.3 Application Curves

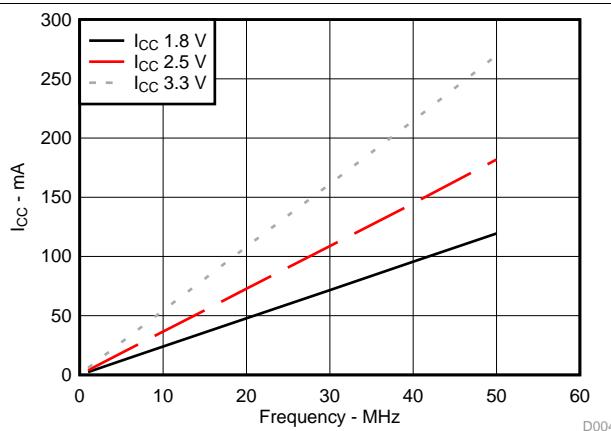


Figure 5. I<sub>CC</sub> vs Frequency

D004

## 11 Power Supply Recommendations

The power supply can be any voltage between the MIN and MAX supply voltage rating located in the *Recommended Operating Conditions* table.

Each V<sub>CC</sub> pin should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, 0.1  $\mu$ F is recommended; if there are multiple V<sub>CC</sub> pins, then 0.01  $\mu$ F or 0.022  $\mu$ F is recommended for each power pin. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. A 0.1  $\mu$ F and a 1  $\mu$ F are commonly used in parallel. The bypass capacitor should be installed as close to the power pin as possible for best results.

## 12 Layout

### 12.1 Layout Guidelines

When using multiple-bit logic devices, inputs should never float.

In many cases, functions or parts of functions of digital logic devices are unused, for example, when only two inputs of a triple-input AND gate are used or only 3 of the 4 buffer gates are used. Such input pins should not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. Figure 6 specifies the rules that must be observed under all circumstances. All unused inputs of digital logic devices must be connected to a high or low bias to prevent them from floating. The logic level that should be applied to any particular unused input depends on the function of the device. Generally they will be tied to GND or V<sub>CC</sub>, whichever makes more sense or is more convenient. It is generally acceptable to float outputs, unless the part is a transceiver. If the transceiver has an output enable pin, it will disable the output section of the part when asserted. This will not disable the input section of the I/Os, so they cannot float when disabled.

### 12.2 Layout Example

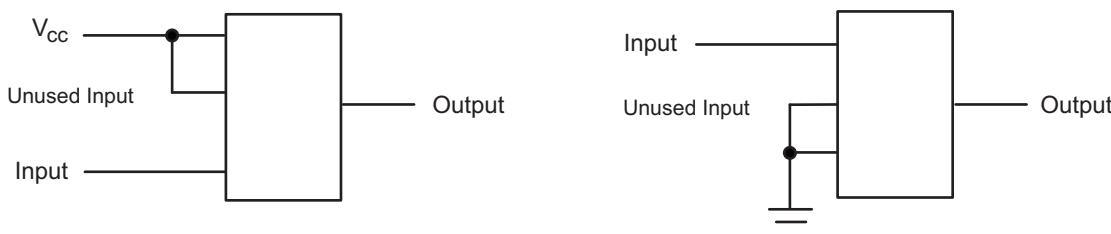


Figure 6. Layout Diagram

## 13 Device and Documentation Support

### 13.1 Trademarks

Widebus is a trademark of Texas Instruments.

All other trademarks are the property of their respective owners.

### 13.2 Electrostatic Discharge Caution



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

### 13.3 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

## 14 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

**PACKAGING INFORMATION**

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
74LVCH16244ADGVRG4	Active	Production	TVSOP (DGV)   48	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LDH244A
74LVCH16244ADGVRG4.B	Active	Production	TVSOP (DGV)   48	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LDH244A
74LVCH16244ADLRG4	Active	Production	SSOP (DL)   48	1000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVCH16244A
74LVCH16244ADLRG4.B	Active	Production	SSOP (DL)   48	1000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVCH16244A
8U244ADGGRG4	Active	Production	TSSOP (DGG)   48	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVCH16244A
8U244ADGGRG4.B	Active	Production	TSSOP (DGG)   48	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVCH16244A
<a href="#">SN74LVCH16244ADGGR</a>	Active	Production	TSSOP (DGG)   48	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVCH16244A
SN74LVCH16244ADGGR.B	Active	Production	TSSOP (DGG)   48	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVCH16244A
<a href="#">SN74LVCH16244ADGVR</a>	Active	Production	TVSOP (DGV)   48	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LDH244A
SN74LVCH16244ADGVR.B	Active	Production	TVSOP (DGV)   48	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LDH244A
<a href="#">SN74LVCH16244ADL</a>	Active	Production	SSOP (DL)   48	25   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVCH16244A
SN74LVCH16244ADL.B	Active	Production	SSOP (DL)   48	25   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVCH16244A
SN74LVCH16244ADLG4	Active	Production	SSOP (DL)   48	25   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVCH16244A
<a href="#">SN74LVCH16244ADLR</a>	Active	Production	SSOP (DL)   48	1000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVCH16244A
SN74LVCH16244ADLR.B	Active	Production	SSOP (DL)   48	1000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVCH16244A

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

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Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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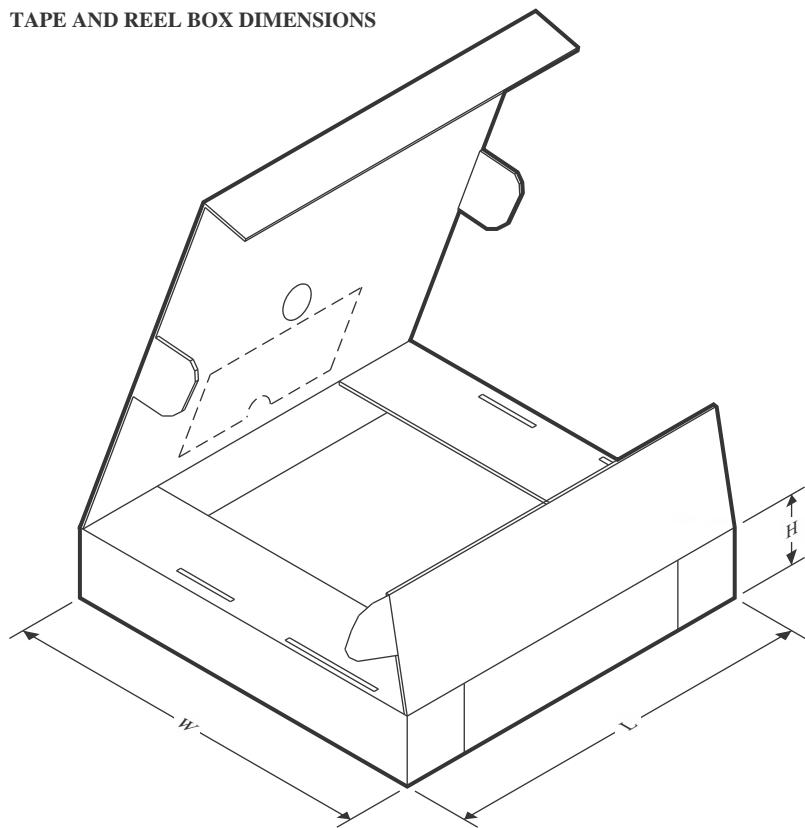
**TAPE AND REEL INFORMATION**


A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
74LVCH16244ADGVRG4	TVSOP	DGV	48	2000	330.0	16.4	7.1	10.2	1.6	12.0	16.0	Q1
74LVCH16244ADLRG4	SSOP	DL	48	1000	330.0	32.4	11.35	16.2	3.1	16.0	32.0	Q1
8U244ADGGRG4	TSSOP	DGG	48	2000	330.0	24.4	8.6	13.0	1.8	12.0	24.0	Q1
SN74LVCH16244ADGGR	TSSOP	DGG	48	2000	330.0	24.4	8.6	13.0	1.8	12.0	24.0	Q1
SN74LVCH16244ADGVR	TVSOP	DGV	48	2000	330.0	16.4	7.1	10.2	1.6	12.0	16.0	Q1
SN74LVCH16244ADLR	SSOP	DL	48	1000	330.0	32.4	11.35	16.2	3.1	16.0	32.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
74LVCH16244ADGVRG4	TVSOP	DGV	48	2000	353.0	353.0	32.0
74LVCH16244ADLRG4	SSOP	DL	48	1000	356.0	356.0	53.0
8U244ADGGRG4	TSSOP	DGG	48	2000	356.0	356.0	45.0
SN74LVCH16244ADGGR	TSSOP	DGG	48	2000	356.0	356.0	45.0
SN74LVCH16244ADGVR	TVSOP	DGV	48	2000	353.0	353.0	32.0
SN74LVCH16244ADLR	SSOP	DL	48	1000	356.0	356.0	53.0

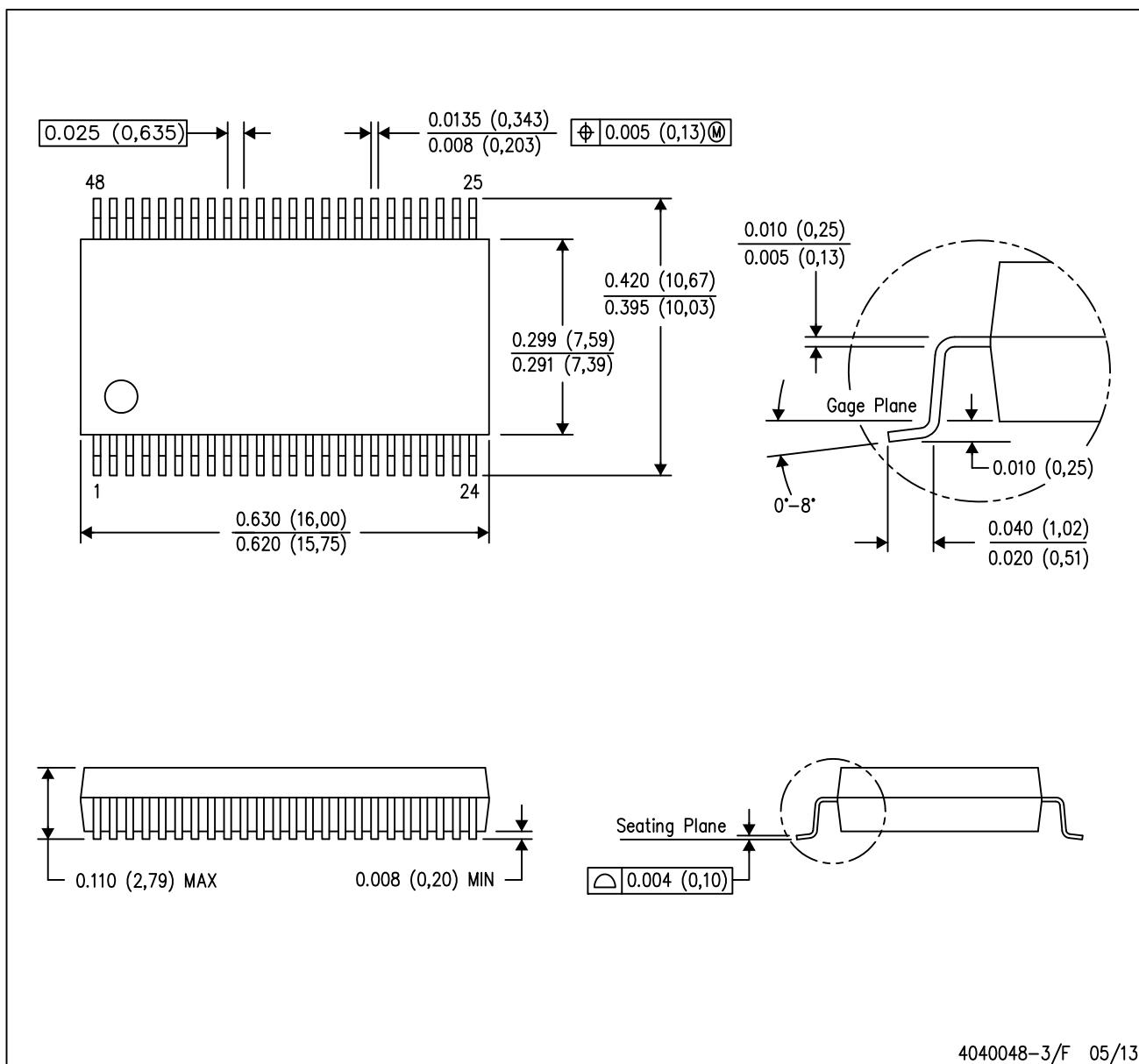
**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN74LVCH16244ADL	DL	SSOP	48	25	473.7	14.24	5110	7.87
SN74LVCH16244ADL.B	DL	SSOP	48	25	473.7	14.24	5110	7.87
SN74LVCH16244ADLG4	DL	SSOP	48	25	473.7	14.24	5110	7.87

DL (R-PDSO-G48)

PLASTIC SMALL-OUTLINE PACKAGE



4040048-3/F 05/13

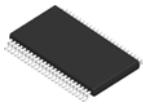
NOTES:

- All linear dimensions are in inches (millimeters).
- This drawing is subject to change without notice.
- Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
- Falls within JEDEC MO-118

PowerPAD is a trademark of Texas Instruments.

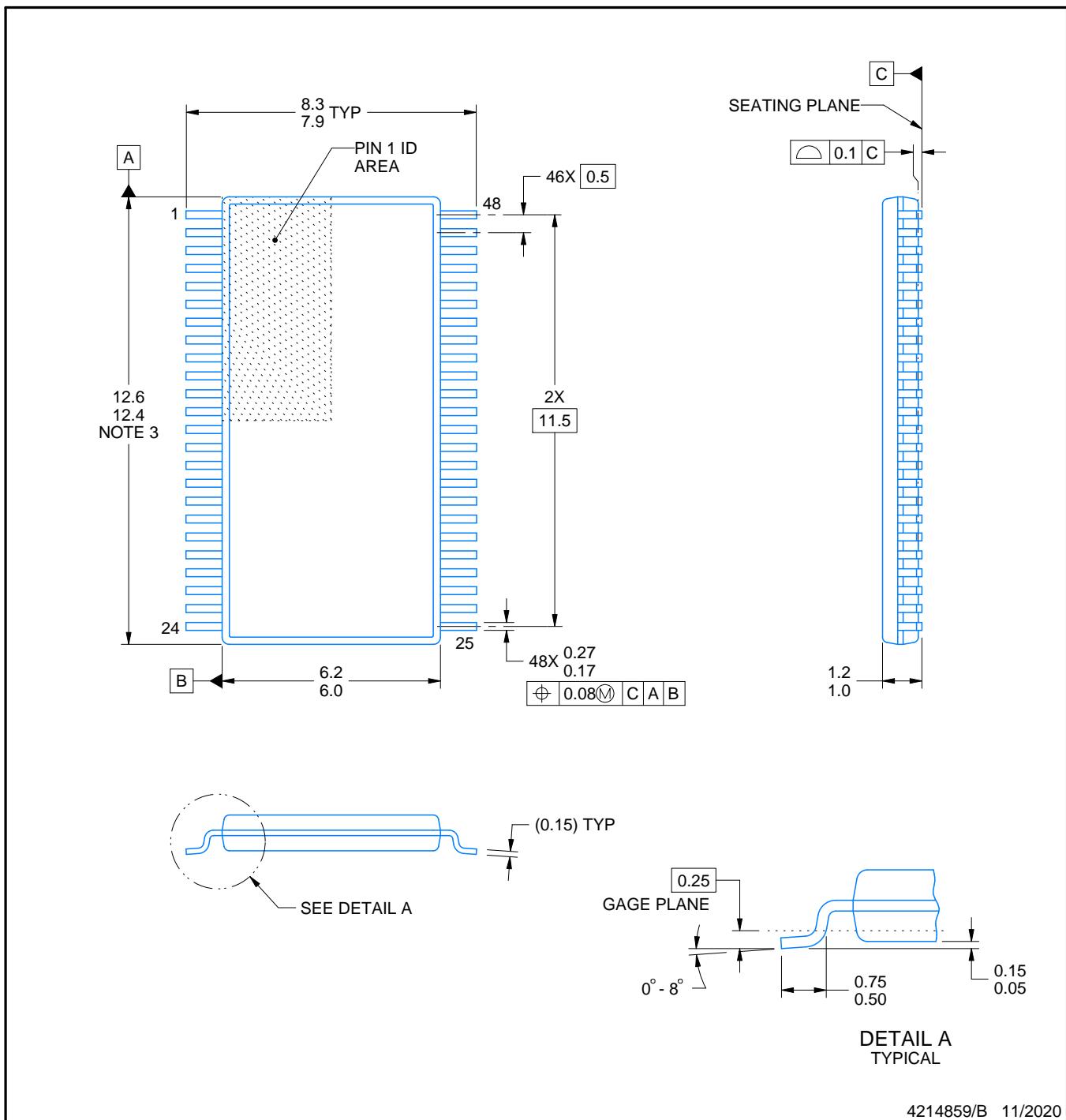
## PACKAGE OUTLINE

**DGG0048A**



## **TSSOP - 1.2 mm max height**

## SMALL OUTLINE PACKAGE



## NOTES:

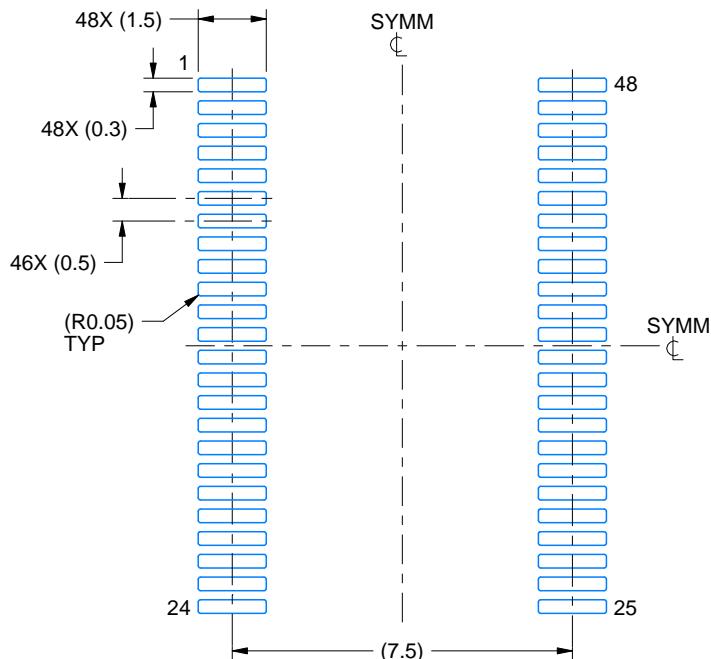
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-153.

# EXAMPLE BOARD LAYOUT

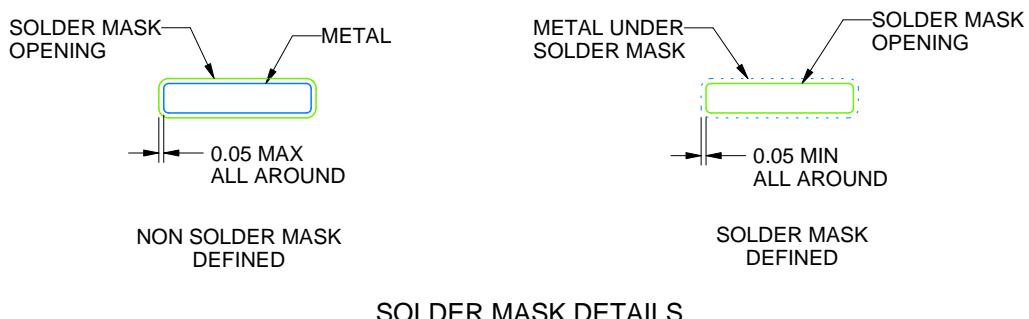
DGG0048A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
SCALE:6X



SOLDER MASK DETAILS

4214859/B 11/2020

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.

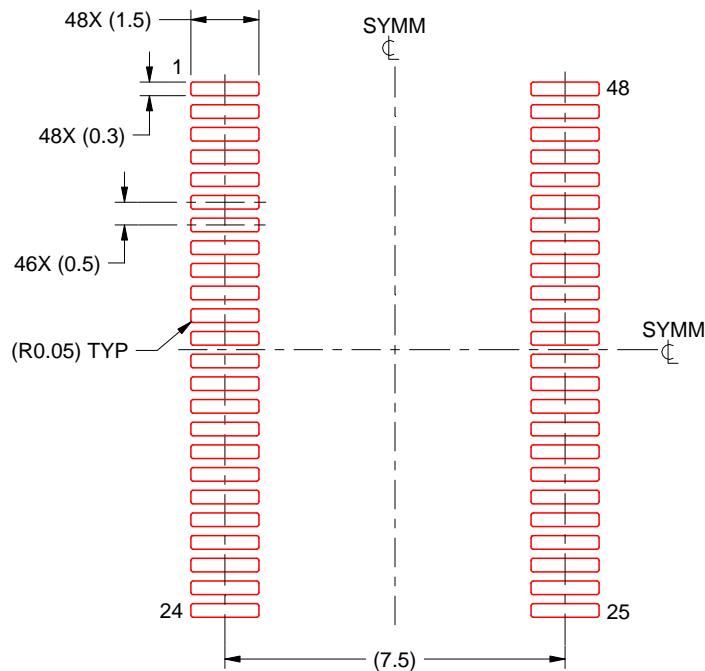
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DGG0048A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:6X

4214859/B 11/2020

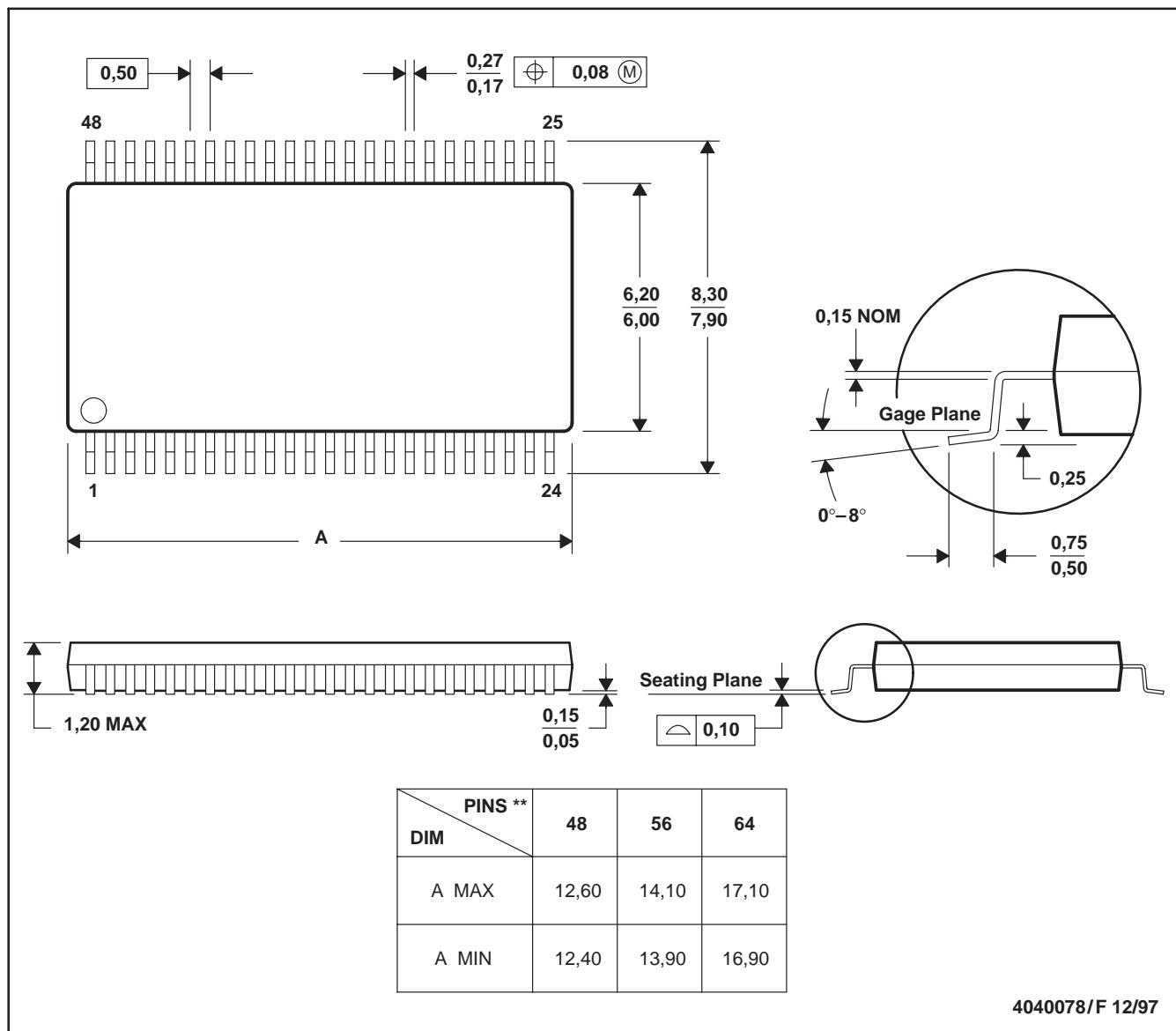
NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

## DGG (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN



NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-153

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