

## SN74LVC244A Octal Buffer/Driver With 3-State Outputs

### 1 Features

- Operates From 1.65 V to 3.6 V
- Inputs Accept Voltages to 5.5 V
- Specified From  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$  and  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$
- Max  $t_{pd}$  of 5.9 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,  $T_A = 25^{\circ}\text{C}$
- Supports Mixed-Mode Signal Operation on All Ports (5-V Input/Output Voltage With 3.3-V  $V_{CC}$ )
- $I_{off}$  Supports Live Insertion, Partial-Power-Down Mode, and Back-Drive Protection
- Can Be Used as a Down Translator to Translate Inputs From a Max of 5.5 V Down to the  $V_{CC}$  Level
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model
  - 200-V Machine Model
  - 1000-V Charged-Device Model

### 2 Applications

- Servers
- LED Displays
- Network Switches
- Telecom Infrastructure
- Motor Drivers
- I/O Expanders

### 3 Description

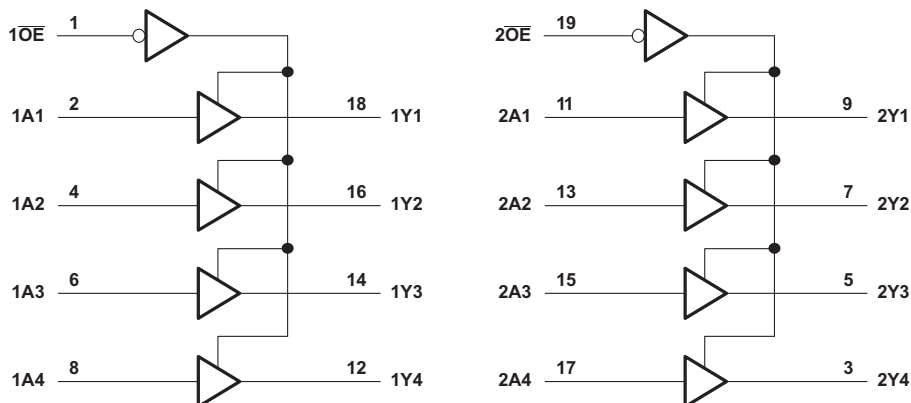
These octal bus buffers are designed for 1.65-V to 3.6-V  $V_{CC}$  operation. The 'LVC244A devices are designed for asynchronous communication between data buses.

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

PART NUMBER	PACKAGE (PIN)	BODY SIZE
SN74LVC244A	PDIP (20)	25.40 mm x 6.35 mm
	SOP (20)	12.60 mm x 5.30 mm
	SSOP (20)	7.50 mm x 5.30 mm
	TVSOP (20)	5.00 mm x 4.40 mm
	SOIC (20)	12.80 mm x 7.50 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 DB, DGV, DW, N, NS, PW, and RGY packages.



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## 5 Revision History

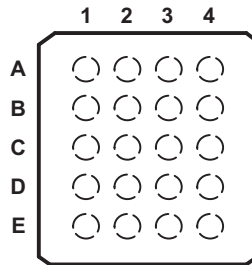
### Changes from Revision Y (September 2010) to Revision Z

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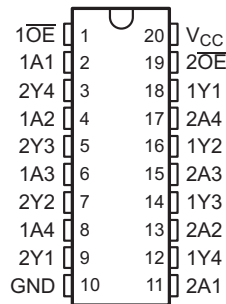
• Added <i>Applications</i> , <i>Device Information</i> table, <i>Pin Functions</i> table, <i>ESD Ratings</i> table, <i>Thermal Information</i> table, <i>Typical Characteristics</i> , <i>Feature Description</i> section, <i>Device Functional Modes</i> , <i>Application and Implementation</i> section, <i>Power Supply Recommendations</i> section, <i>Layout</i> section, <i>Device and Documentation Support</i> section, and <i>Mechanical, Packaging, and Orderable Information</i> section. ....	<b>1</b>
• Deleted <i>Ordering Information</i> table. ....	<b>1</b>
• Updated <i>Features</i> . ....	<b>1</b>

## 6 Pin Configuration and Functions

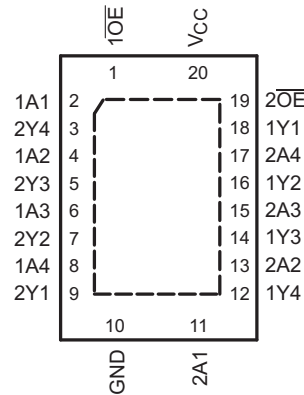
GQN OR ZQN PACKAGE  
(TOP VIEW)



DB, DGV, DW, N, NS, OR PW PACKAGE  
(TOP VIEW)



RGY PACKAGE  
(TOP VIEW)



### Pin Functions

NAME	PIN		TYPE	DESCRIPTION
	DB, DGV, DW, NS, PW, and RGY	GQN or ZQN		
1A1	2	A1	I	Input
1A2	4	B1	I	Input
1A3	6	C1	I	Input
1A4	8	D1	I	Input
1OE	1	A2	I	Output enable
1Y1	18	B4	O	Output
1Y2	16	C4	O	Output
1Y3	14	D4	O	Output
1Y4	12	E4	O	Output
2A1	11	E3	I	Input
2A2	13	D2	I	Input
2A3	15	C3	I	Input
2A4	17	B2	I	Input
2OE	19	A2	I	Output enable
2Y1	9	E2	O	Output
2Y2	7	D3	O	Output
2Y3	5	C2	O	Output
2Y4	3	B3	O	Output
GND	10	E1	—	Ground
V <sub>CC</sub>	20	A3	—	Power pin

## 7 Specifications

### 7.1 Absolute Maximum Ratings

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

		MIN	MAX	UNIT	
V <sub>CC</sub>	Supply voltage range	-0.5	6.5	V	
V <sub>I</sub>	Input voltage range <sup>(2)</sup>	-0.5	6.5	V	
V <sub>O</sub>	Voltage range applied to any output in the high-impedance or power-off state <sup>(2)</sup>	-0.5	6.5	V	
V <sub>O</sub>	Voltage range applied to any output in the high or low state <sup>(2)(3)</sup>	-0.5	V <sub>CC</sub> + 0.5	V	
I <sub>IK</sub>	Input clamp current	V <sub>I</sub> < 0	-50	mA	
I <sub>OK</sub>	Output clamp current	V <sub>O</sub> < 0	-50	mA	
I <sub>O</sub>	Continuous output current		±50	mA	
	Continuous current through V <sub>CC</sub> or GND		±100	mA	
θ <sub>JA</sub>	Package thermal impedance	DB package <sup>(4)</sup>	70	°C/W	
		DGV package <sup>(4)</sup>	92		
		DW package <sup>(4)</sup>	58		
		GQN or ZQN package <sup>(4)</sup>	78		
		N package <sup>(4)</sup>	69		
		NS package <sup>(4)</sup>	60		
		PW package <sup>(4)</sup>	83		
		RGY package <sup>(5)</sup>	37		
P <sub>tot</sub>	Power dissipation	T <sub>A</sub> = -40°C to 125°C <sup>(6)(7)</sup>	500	mW	
T <sub>stg</sub>	Storage temperature range		-65	150	°C

- (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 and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) The value of V<sub>CC</sub> is provided in the *Recommended Operating Conditions* table.
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.
- (5) The package thermal impedance is calculated in accordance with JESD 51-5.
- (6) For the DW package: above 70°C the value of P<sub>tot</sub> derates linearly with 8 mW/K.
- (7) For the DB, DGV, N, NS, and PW packages: above 60°C the value of P<sub>tot</sub> derates linearly with 5.5 mW/K.

### 7.2 ESD Ratings

PARAMETER	DEFINITION	VALUE	UNIT
V <sub>(ESD)</sub>	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins <sup>(1)</sup>	2000
		Charged device model (CDM), per JEDEC specification JESD22-C101, all pins <sup>(2)</sup>	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 recommended operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

		T <sub>A</sub> = 25°C		–40 TO 85°C		–40 TO 125°C		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
V <sub>CC</sub>	Supply voltage	Operating		1.65	3.6	1.65	3.6	V
		Data retention only		1.5		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>		0.65 × V <sub>CC</sub>		V
		V <sub>CC</sub> = 2.3 V to 2.7 V		1.7		1.7		
		V <sub>CC</sub> = 2.7 V to 3.6 V		2		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>		0.35 × V <sub>CC</sub>		V
		V <sub>CC</sub> = 2.3 V to 2.7 V		0.7		0.7		
		V <sub>CC</sub> = 2.7 V to 3.6 V		0.8		0.8		
V <sub>I</sub>	Input voltage	0	5.5	0	5.5	0	5.5	V
V <sub>O</sub>	Output voltage	0	V <sub>CC</sub>	0	V <sub>CC</sub>	0	V <sub>CC</sub>	V
I <sub>OH</sub>	High-level output current	V <sub>CC</sub> = 1.65 V		–4		–4		mA
		V <sub>CC</sub> = 2.3 V		–8		–8		
		V <sub>CC</sub> = 2.7 V		–12		–12		
		V <sub>CC</sub> = 3 V		–24		–24		
I <sub>OL</sub>	Low-level output current	V <sub>CC</sub> = 1.65 V		4		4		mA
		V <sub>CC</sub> = 2.3 V		8		8		
		V <sub>CC</sub> = 2.7 V		12		12		
		V <sub>CC</sub> = 3 V		24		24		

(1) All unused 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>		SN74LVC244A								UNIT
		DB <sup>(2)</sup>	DGV <sup>(2)</sup>	DW <sup>(2)</sup>	GQN or ZQN <sup>(2)</sup>	N <sup>(2)</sup>	NS <sup>(2)</sup>	PW <sup>(2)</sup>	RGY <sup>(3)</sup>	
		20 PINS								
R <sub>θJA</sub>	Junction-to-ambient thermal resistance	108.1	128.7	90.9	78	61.6	90.1	114.7	50.3	°C/W
R <sub>θJC(to p)</sub>	Junction-to-case(top) thermal resistance	70.2	43.7	55.3		46.5	56.4	48.4	58.4	
R <sub>θJB</sub>	Junction-to-board thermal resistance	63.3	70.2	58.8		42.5	57.7	65.6	28.3	
ψ <sub>JT</sub>	Junction-to-top characterization parameter	30.6	3.1	29.1		34.6	28.4	6.8	4.9	
ψ <sub>JB</sub>	Junction-to-board characterization parameter	62.9	69.5	58.3		42.4	57.2	65.1	28.4	
R <sub>θJC(bot)</sub>	Junction-to-case(bottom) thermal resistance	—	—	—		—	—	—	22.7	

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

(2) The package thermal impedance is calculated in accordance with JESD 51-7.

(3) The package thermal impedance is calculated in accordance with JESD 51-5.

## 7.5 Electrical Characteristics

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

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	T <sub>A</sub> = 25°C			–40 TO 85°C		–40 TO 125°C		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V <sub>OH</sub>	I <sub>OH</sub> = –100 μA	1.65 V to 3.6 V	V <sub>CC</sub> – 0.2			V <sub>CC</sub> – 0.2		V <sub>CC</sub> – 0.3		V
	I <sub>OH</sub> = –4 mA	1.65 V	1.29			1.2		1.05		
	I <sub>OH</sub> = –8 mA	2.3 V	1.9			1.7		1.55		
	I <sub>OH</sub> = –12 mA	2.7 V	2.2			2.2		2.05		
		3 V	2.4			2.4		2.25		
I <sub>OH</sub> = –24 mA	3 V	2.3			2.2		2			
V <sub>OL</sub>	I <sub>OL</sub> = 100 μA	1.65 V to 3.6 V	0.1			0.2		0.3		V
	I <sub>OL</sub> = 4 mA	1.65 V	0.24			0.45		0.6		
	I <sub>OL</sub> = 8 mA	2.3 V	0.3			0.7		0.75		
	I <sub>OL</sub> = 12 mA	2.7 V	0.4			0.4		0.6		
	I <sub>OL</sub> = 24 mA	3 V	0.55			0.55		0.8		
I <sub>I</sub>	V <sub>I</sub> = 5.5 V or GND	3.6 V	±1			±5		±20		μA
I <sub>off</sub>	V <sub>I</sub> or V <sub>O</sub> = 5.5 V	0	±1			±10		±20		μA
I <sub>OZ</sub>	V <sub>O</sub> = 0 to 5.5 V	3.6 V	±1			±10		±20		μA
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	3.6 V	1			10		40		μA
	3.6 V ≤ V <sub>I</sub> ≤ 5.5 V <sup>(1)</sup>		1			10		40		
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			500		5000		μA
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	3.3 V	4							pF
C <sub>o</sub>	V <sub>O</sub> = V <sub>CC</sub> or GND	3.3 V	5.5							pF

(1) This applies in the disabled state only.

## 7.6 Switching Characteristics

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

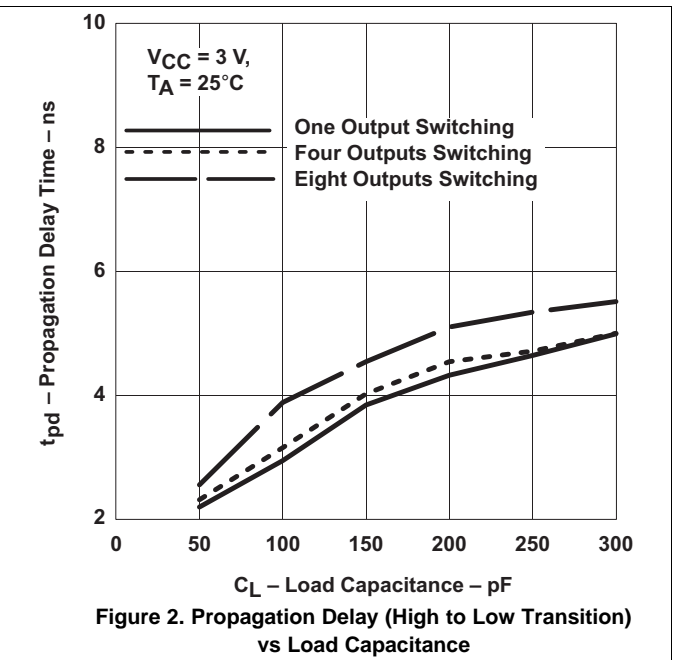
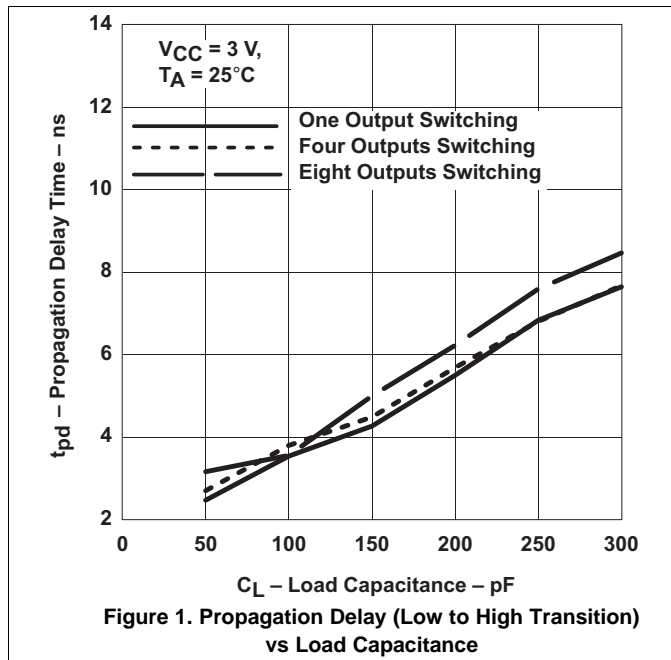
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub>	T <sub>A</sub> = 25°C			–40 TO 85°C		–40 TO 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t <sub>pd</sub>	A	Y	1.5 V	1	7	14.4	1	14.9	1	16.4	ns
			1.8 V ± 0.15 V	1	5.9	10.4	1	10.9	1	12.4	
			2.5 V ± 0.2 V	1	4.2	7.4	1	7.9	1	10	
			2.7 V	1	4.2	6.7	1	6.9	1	8.2	
			3.3 V ± 0.3 V	1.5	3.9	5.7	1.5	5.9	1.5	7.2	
t <sub>en</sub>	$\overline{OE}$	Y	1.5 V	1	8.3	17.8	1	18.3	1	19.8	ns
			1.8 V ± 0.15 V	1	6.4	12.1	1	12.6	1	14.1	
			2.5 V ± 0.2 V	1	4.6	9.1	1	9.6	1	11.7	
			2.7 V	1	5	8.4	1	8.6	1	10.3	
			3.3 V ± 0.3 V	1.5	4.5	7.4	1.5	7.6	1.5	9.4	
t <sub>dis</sub>	$\overline{OE}$	Y	1.5 V	1	7.2	15.6	1	16.1	1	17.6	ns
			1.8 V ± 0.15 V	1	5.8	11.6	1	12.1	1	13.6	
			2.5 V ± 0.2 V	1	3.7	7.3	1	7.8	1	9.9	
			2.7 V	1	3.8	6.6	1	6.8	1	8.6	
			3.3 V ± 0.3 V	1.5	3.8	6.3	1.5	6.5	1.5	8	
t <sub>sk(o)</sub>			3.3 V ± 0.3 V				1		1.5	ns	

### 7.7 Operating Characteristics

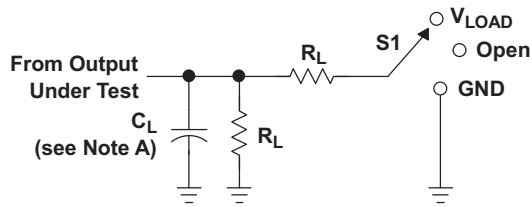
T<sub>A</sub> = 25°C

PARAMETER		TEST CONDITIONS	V <sub>CC</sub>	TYP	UNIT	
C <sub>pd</sub>	Power dissipation capacitance per buffer/driver	Outputs enabled	f = 10 MHz	1.8 V	43	pF
				2.5 V	43	
				3.3 V	44	
	Outputs disabled	f = 10 MHz	1.8 V	1		
			2.5 V	1		
			3.3 V	2		

### 7.8 Typical Characteristics

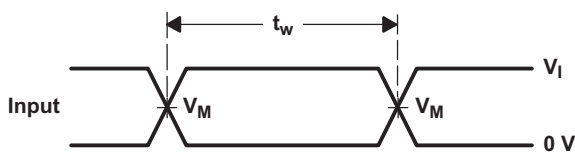
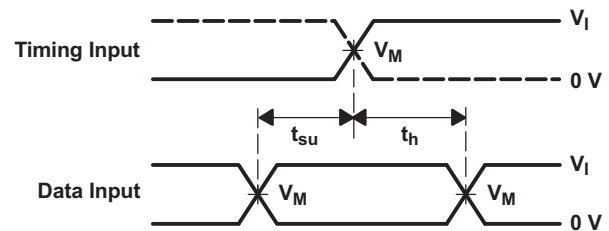
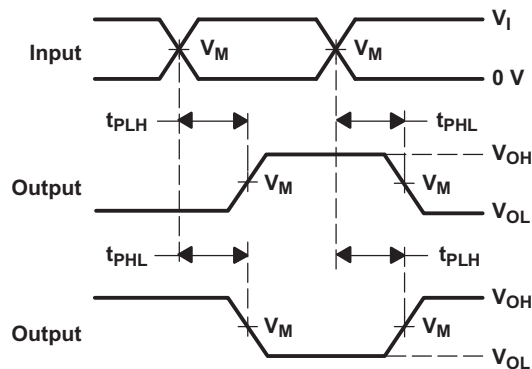
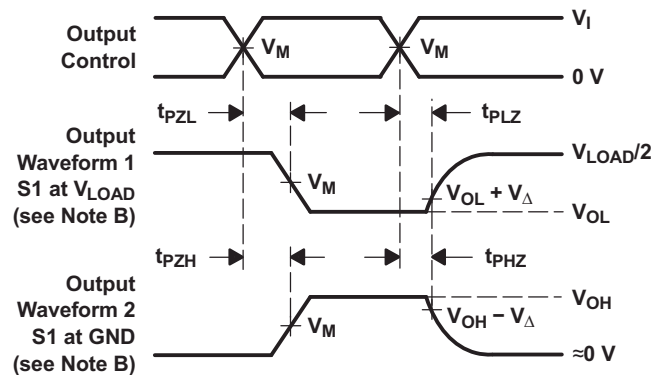


## 8 Parameter Measurement Information


**LOAD CIRCUIT**

TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$V_{LOAD}$
$t_{PHZ}/t_{PZH}$	GND

$V_{CC}$	INPUTS		$V_M$	$V_{LOAD}$	$C_L$	$R_L$	$V_{\Delta}$
	$V_I$	$t_r/t_f$					
1.5 V	$V_{CC}$	$\leq 2$ ns	$V_{CC}/2$	$2 \times V_{CC}$	15 pF	2 k $\Omega$	0.1 V
1.8 V $\pm$ 0.15 V	$V_{CC}$	$\leq 2$ ns	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	1 k $\Omega$	0.15 V
2.5 V $\pm$ 0.2 V	$V_{CC}$	$\leq 2$ ns	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	500 $\Omega$	0.15 V
2.7 V	2.7 V	$\leq 2.5$ ns	1.5 V	6 V	50 pF	500 $\Omega$	0.3 V
3.3 V $\pm$ 0.3 V	2.7 V	$\leq 2.5$ ns	1.5 V	6 V	50 pF	500 $\Omega$	0.3 V


**VOLTAGE WAVEFORMS  
PULSE DURATION**

**VOLTAGE WAVEFORMS  
SETUP AND HOLD TIMES**

**VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES  
INVERTING AND NONINVERTING OUTPUTS**

**VOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES  
LOW- AND HIGH-LEVEL ENABLING**

- NOTES:
- $C_L$  includes probe and jig capacitance.
  - 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.
  - All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10$  MHz,  $Z_O = 50 \Omega$ .
  - The outputs are measured one at a time, with one transition per measurement.
  - $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .
  - All parameters and waveforms are not applicable to all devices.

**Figure 3. Load Circuit and Voltage Waveforms**

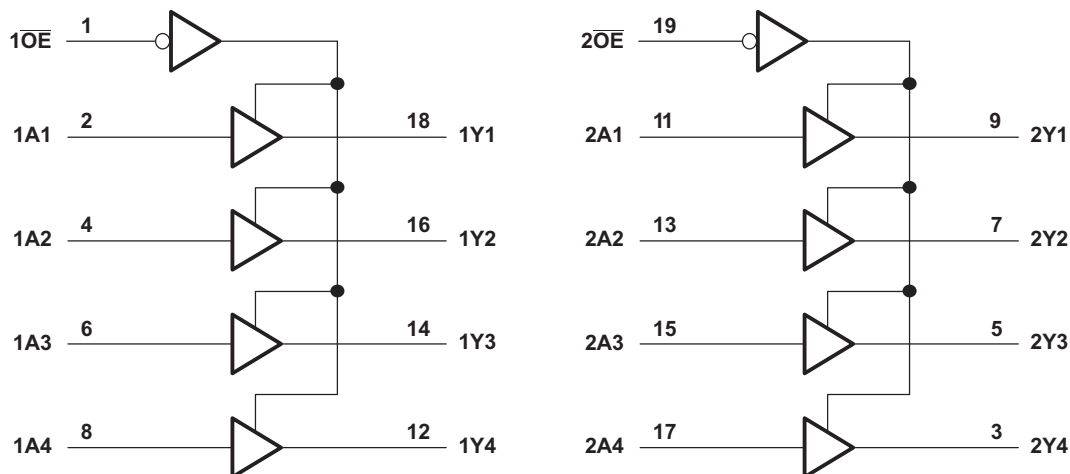


## 9 Detailed Description

### 9.1 Overview

The LVC244A device is organized as two 4-bit buffers/line drivers with separate output-enable ( $\overline{OE}$ ) inputs. When  $\overline{OE}$  is low, the device passes data from the A inputs to the Y outputs. When  $\overline{OE}$  is high, the outputs are in the high-impedance state. 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.

### 9.2 Functional Block Diagram



Pin numbers shown are for the DB, DGV, DW, N, NS, PW, and RGY packages.

### 9.3 Feature Description

- Allows down voltage translation
  - 5 V to 3.3 V
  - 5 V or 3.3 V to 1.8 V
- Inputs accept voltage levels up to 5.5 V

### 9.4 Device Functional Modes

Table 1. Function Table

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

## 10 Application and Implementation

### NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

### 10.1 Application Information

SN74LVC244A is a high drive CMOS device that can be used for a multitude of bus interface type applications where output drive or PCB trace length is a concern. The inputs can accept voltages to 5.5 V at any valid  $V_{CC}$  making it ideal for down translation.

### 10.2 Typical Application

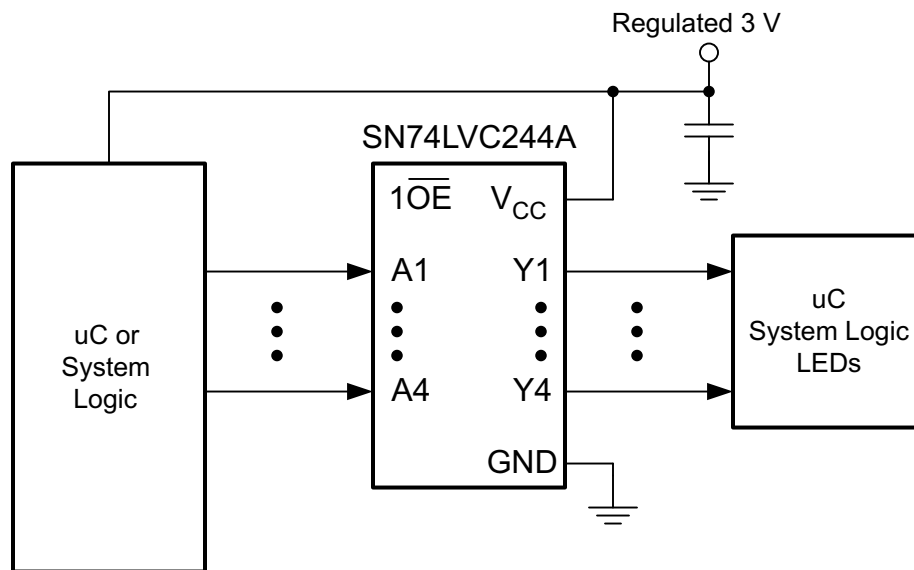


Figure 4. Application Schematic

#### 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 so routing and load conditions should be considered to prevent ringing.

#### 10.2.2 Detailed Design Procedure

##### 1. Recommended Input Conditions:

- For rise time and fall time specifications, see  $(\Delta t/\Delta V)$  in the [Recommended Operating Conditions](#) table.
- For 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  $(V_I \text{ max})$  in the [Recommended Operating Conditions](#) table at any valid  $V_{CC}$ .

##### 2. Recommend Output Conditions:

- Load currents should not exceed  $(I_O \text{ max})$  per output and should not exceed (Continuous current through  $V_{CC}$  or GND) total current for the part. These limits are located in the [Absolute Maximum Ratings](#) table.
- Outputs should not be pulled above  $V_{CC}$ .

Typical Application (continued)

10.2.3 Application Curves

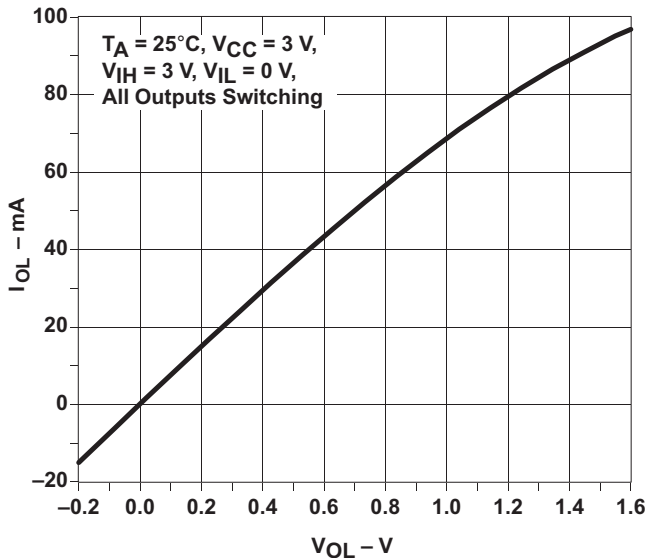


Figure 5. Output Drive Current ( $I_{OL}$ ) vs LOW-level Output Voltage ( $V_{OL}$ )

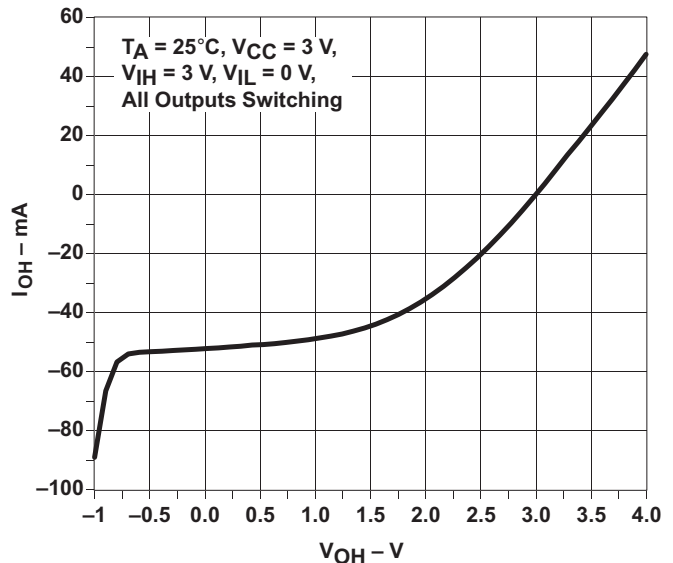


Figure 6. Output Drive Current ( $I_{OH}$ ) vs HIGH-level Output Voltage ( $V_{OH}$ )

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  $V_{CC}$  terminal should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, a 0.1  $\mu\text{F}$  capacitor is recommended. If there are multiple  $V_{CC}$  terminals then 0.01  $\mu\text{F}$  or 0.022  $\mu\text{F}$  capacitors are recommended for each power terminal. It is ok to parallel multiple bypass capacitors to reject different frequencies of noise. Multiple bypass capacitors may be paralleled to reject different frequencies of noise. The bypass capacitor should be installed as close to the power terminal as possible for the best results.

12 Layout

12.1 Layout Guidelines

When using multiple bit logic devices, inputs should not float. In many cases, functions or parts of functions of digital logic devices are unused. Some examples are when only two inputs of a triple-input AND gate are used, or when 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.

Specified in [Figure 7](#) are 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  $V_{CC}$ , whichever makes more sense or is more convenient.

12.2 Layout Example

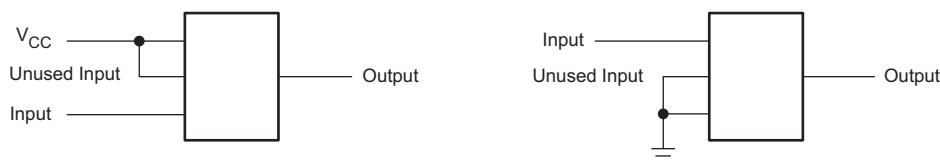


Figure 7. Layout Diagram

## 13 Device and Documentation Support

### 13.1 Trademarks

All 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 Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74LVC244ADBLE	OBSOLETE	SSOP	DB	20		TBD	Call TI	Call TI	-40 to 125		
SN74LVC244ADBR	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC244A	<a href="#">Samples</a>
SN74LVC244ADBRE4	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC244A	<a href="#">Samples</a>
SN74LVC244ADBRG4	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC244A	<a href="#">Samples</a>
SN74LVC244ADGVR	ACTIVE	TVSOP	DGV	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC244A	<a href="#">Samples</a>
SN74LVC244ADGVRE4	ACTIVE	TVSOP	DGV	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC244A	<a href="#">Samples</a>
SN74LVC244ADGVRG4	ACTIVE	TVSOP	DGV	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC244A	<a href="#">Samples</a>
SN74LVC244ADW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC244A	<a href="#">Samples</a>
SN74LVC244ADWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC244A	<a href="#">Samples</a>
SN74LVC244ADWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC244A	<a href="#">Samples</a>
SN74LVC244ADWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU   CU SN	Level-1-260C-UNLIM	-40 to 125	LVC244A	<a href="#">Samples</a>
SN74LVC244ADWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC244A	<a href="#">Samples</a>
SN74LVC244ADWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC244A	<a href="#">Samples</a>
SN74LVC244AGQNR	OBSOLETE	BGA MICROSTAR JUNIOR	GQN	20		TBD	Call TI	Call TI	-40 to 85	LC244A	
SN74LVC244AN	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-40 to 125	SN74LVC244AN	<a href="#">Samples</a>
SN74LVC244ANE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-40 to 125	SN74LVC244AN	<a href="#">Samples</a>
SN74LVC244ANSR	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC244A	<a href="#">Samples</a>

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74LVC244ANSRE4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LVC244A	<a href="#">Samples</a>
SN74LVC244APW	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC244A	<a href="#">Samples</a>
SN74LVC244APWE4	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC244A	<a href="#">Samples</a>
SN74LVC244APWG4	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC244A	<a href="#">Samples</a>
SN74LVC244APWLE	OBSOLETE	TSSOP	PW	20		TBD	Call TI	Call TI	-40 to 125		
SN74LVC244APWR	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU   CU SN	Level-1-260C-UNLIM	-40 to 125	LC244A	<a href="#">Samples</a>
SN74LVC244APWRE4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC244A	<a href="#">Samples</a>
SN74LVC244APWRG3	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	LC244A	<a href="#">Samples</a>
SN74LVC244APWRG4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC244A	<a href="#">Samples</a>
SN74LVC244APWT	ACTIVE	TSSOP	PW	20	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC244A	<a href="#">Samples</a>
SN74LVC244APWTE4	ACTIVE	TSSOP	PW	20	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC244A	<a href="#">Samples</a>
SN74LVC244APWTG4	ACTIVE	TSSOP	PW	20	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LC244A	<a href="#">Samples</a>
SN74LVC244ARGYR	ACTIVE	VQFN	RGY	20	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 125	LC244A	<a href="#">Samples</a>
SN74LVC244ARGYRG4	ACTIVE	VQFN	RGY	20	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 125	LC244A	<a href="#">Samples</a>
SN74LVC244AZQNR	ACTIVE	BGA MICROSTAR JUNIOR	ZQN	20	1000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	LC244A	<a href="#">Samples</a>

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

#### **OTHER QUALIFIED VERSIONS OF SN74LVC244A :**

- Automotive: [SN74LVC244A-Q1](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

**TAPE AND REEL INFORMATION**

**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
SN74LVC244ADBR	SSOP	DB	20	2000	330.0	16.4	8.2	7.5	2.5	12.0	16.0	Q1
SN74LVC244ADGVR	TVSOP	DGV	20	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LVC244ADWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN74LVC244ANSR	SO	NS	20	2000	330.0	24.4	9.0	13.0	2.4	4.0	24.0	Q1
SN74LVC244APWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1
SN74LVC244APWRG3	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1
SN74LVC244APWT	TSSOP	PW	20	250	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1
SN74LVC244ARGYR	VQFN	RGY	20	3000	330.0	12.4	3.8	4.8	1.6	8.0	12.0	Q1
SN74LVC244ARGYR	VQFN	RGY	20	3000	330.0	12.4	3.8	4.8	1.6	8.0	12.0	Q1
SN74LVC244AZQNR	BGA MICROSTAR JUNIOR	ZQN	20	1000	330.0	12.4	3.3	4.3	1.6	8.0	12.0	Q1



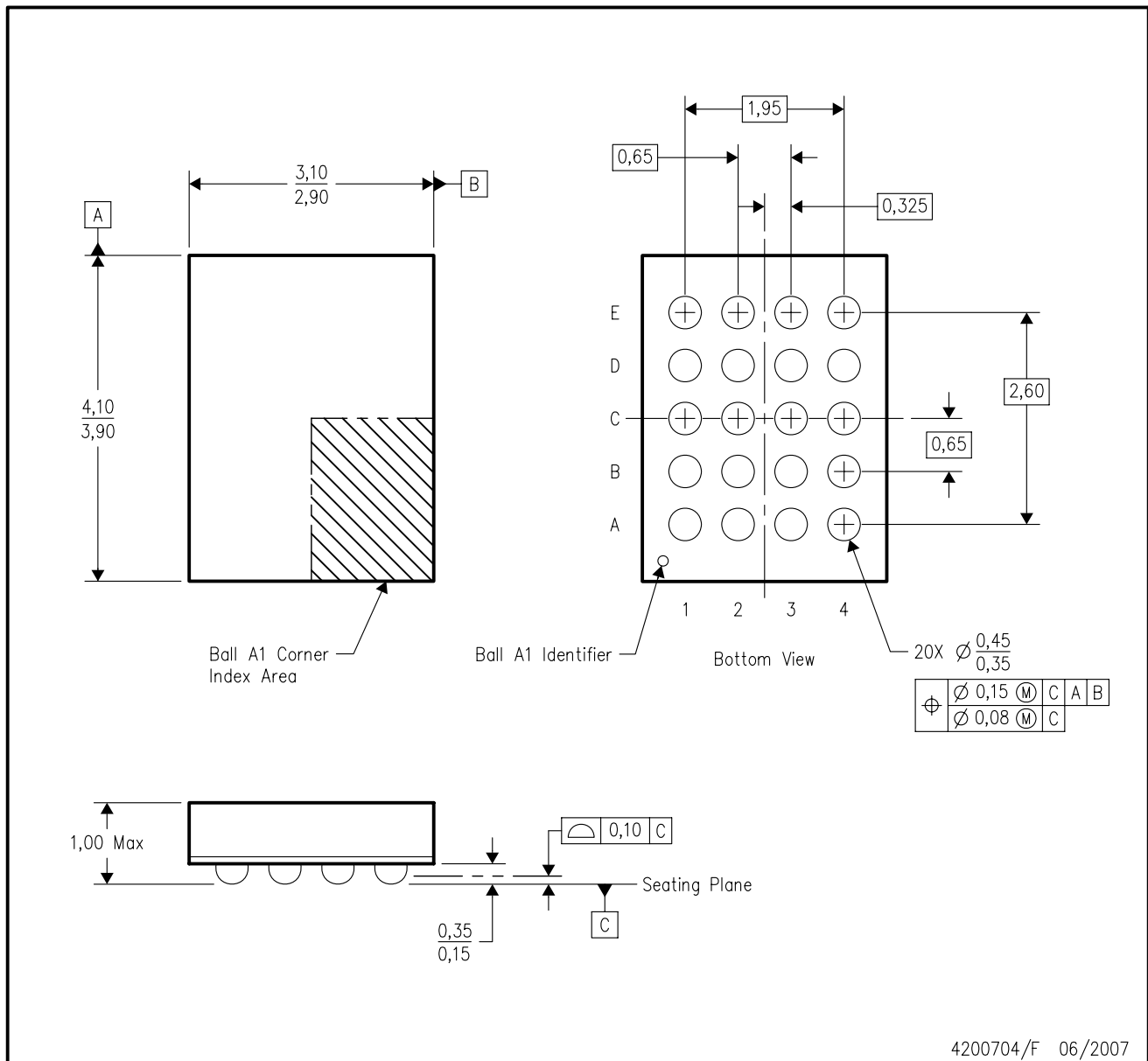
**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LVC244ADBR	SSOP	DB	20	2000	367.0	367.0	38.0
SN74LVC244ADGVR	TVSOP	DGV	20	2000	367.0	367.0	35.0
SN74LVC244ADWR	SOIC	DW	20	2000	366.0	364.0	50.0
SN74LVC244ANSR	SO	NS	20	2000	367.0	367.0	45.0
SN74LVC244APWR	TSSOP	PW	20	2000	367.0	367.0	38.0
SN74LVC244APWRG3	TSSOP	PW	20	2000	364.0	364.0	27.0
SN74LVC244APWT	TSSOP	PW	20	250	367.0	367.0	38.0
SN74LVC244ARGYR	VQFN	RGY	20	3000	367.0	367.0	35.0
SN74LVC244ARGYR	VQFN	RGY	20	3000	355.0	350.0	50.0
SN74LVC244AZQNR	BGA MICROSTAR JUNIOR	ZQN	20	1000	338.1	338.1	20.6

GQN (R-PBGA-N20)

PLASTIC BALL GRID ARRAY

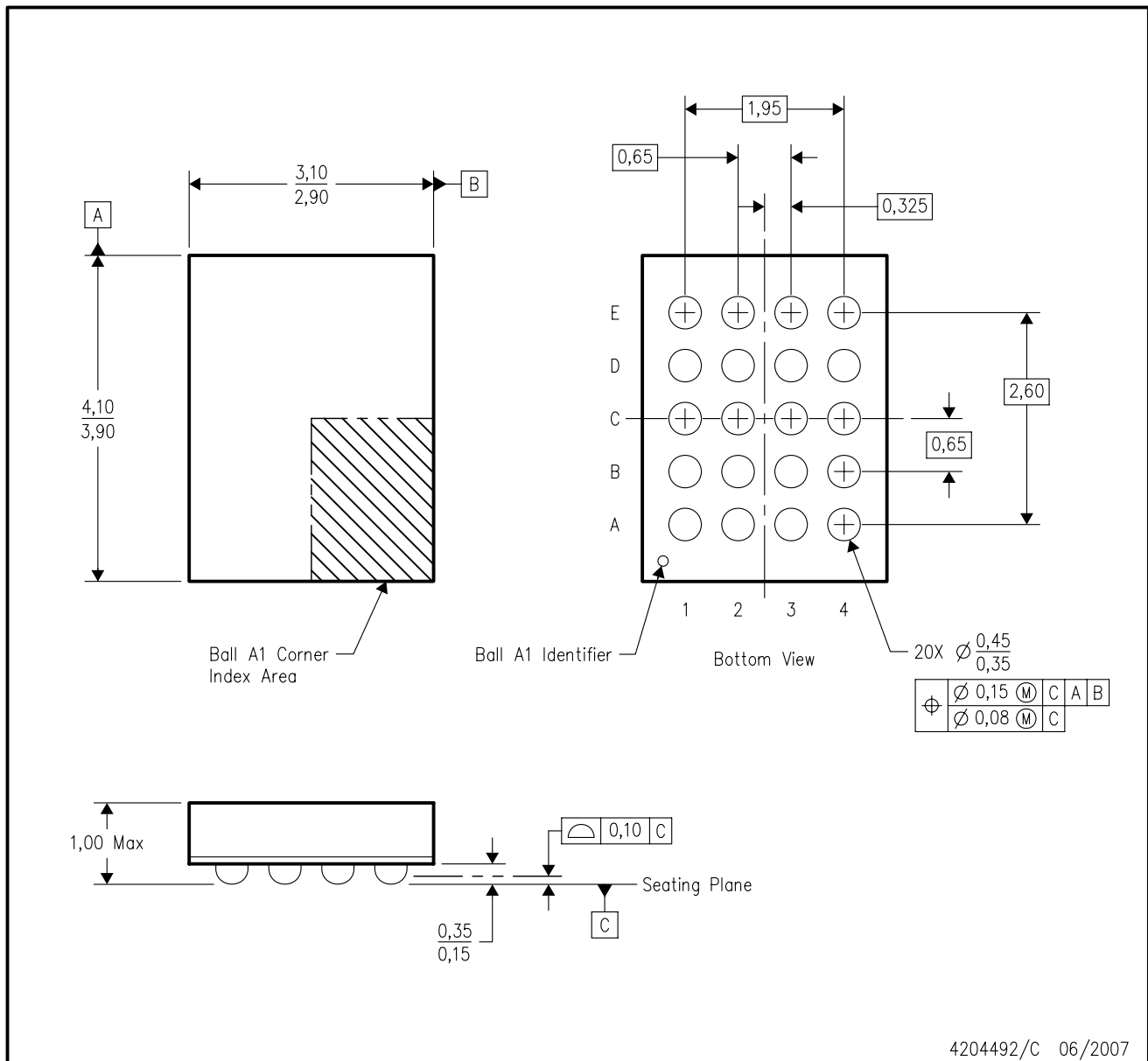


4200704/F 06/2007

- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. Falls within JEDEC MO-285 variation BC-2.
  - D. This package is tin-lead (SnPb). Refer to the 20 ZQN package (drawing 4204492) for lead-free.

ZQN (R-PBGA-N20)

PLASTIC BALL GRID ARRAY



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. Falls within JEDEC MO-285 variation BC-2.
  - D. This package is lead-free. Refer to the 20 GQN package (drawing 4200704) for tin-lead (SnPb).

N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - The 20 pin end lead shoulder width is a vendor option, either half or full width.

DGV (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE

24 PINS SHOWN

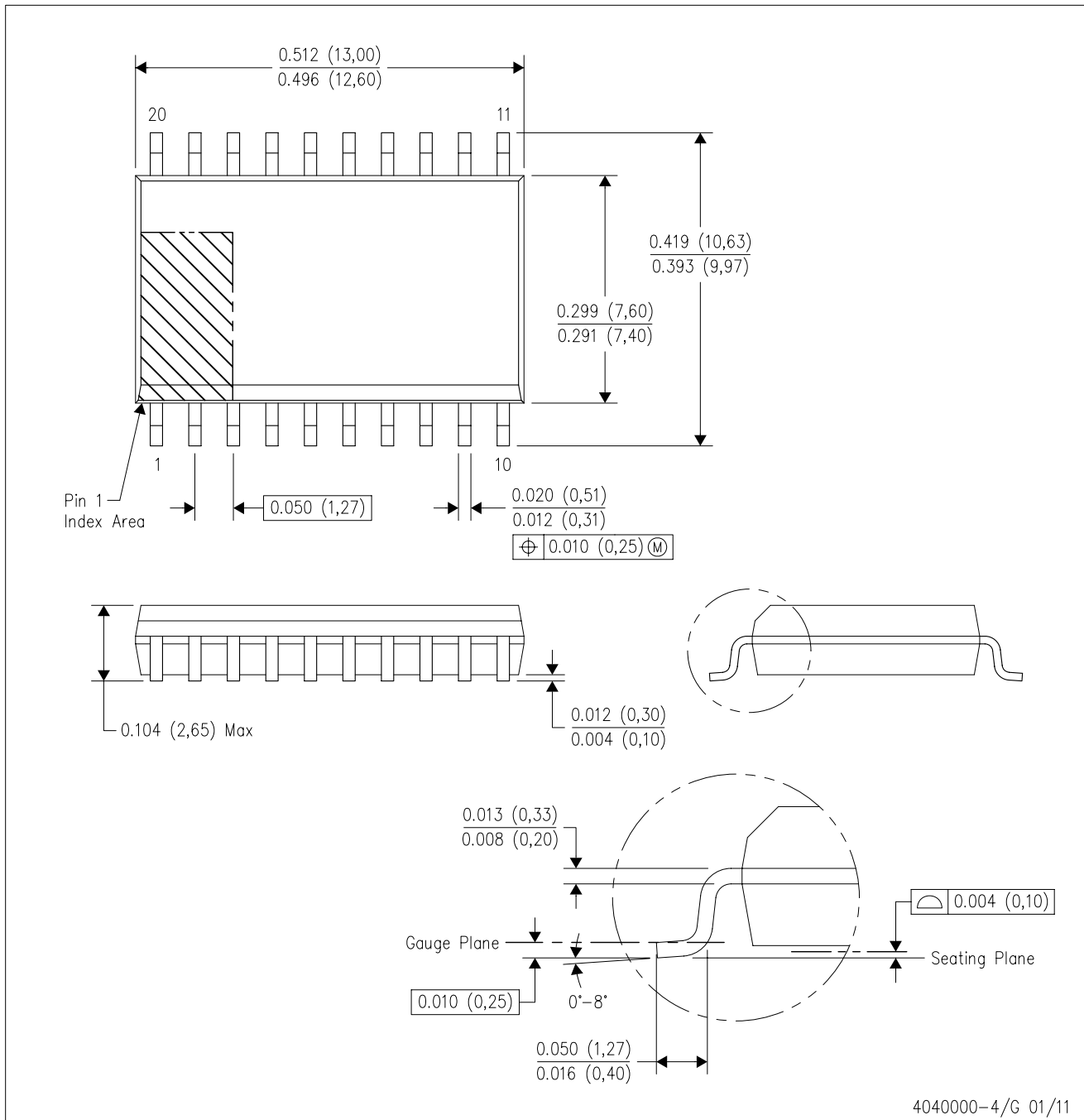


4073251/E 08/00

- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.  
 D. Falls within JEDEC: 24/48 Pins – MO-153  
 14/16/20/56 Pins – MO-194

DW (R-PDSO-G20)

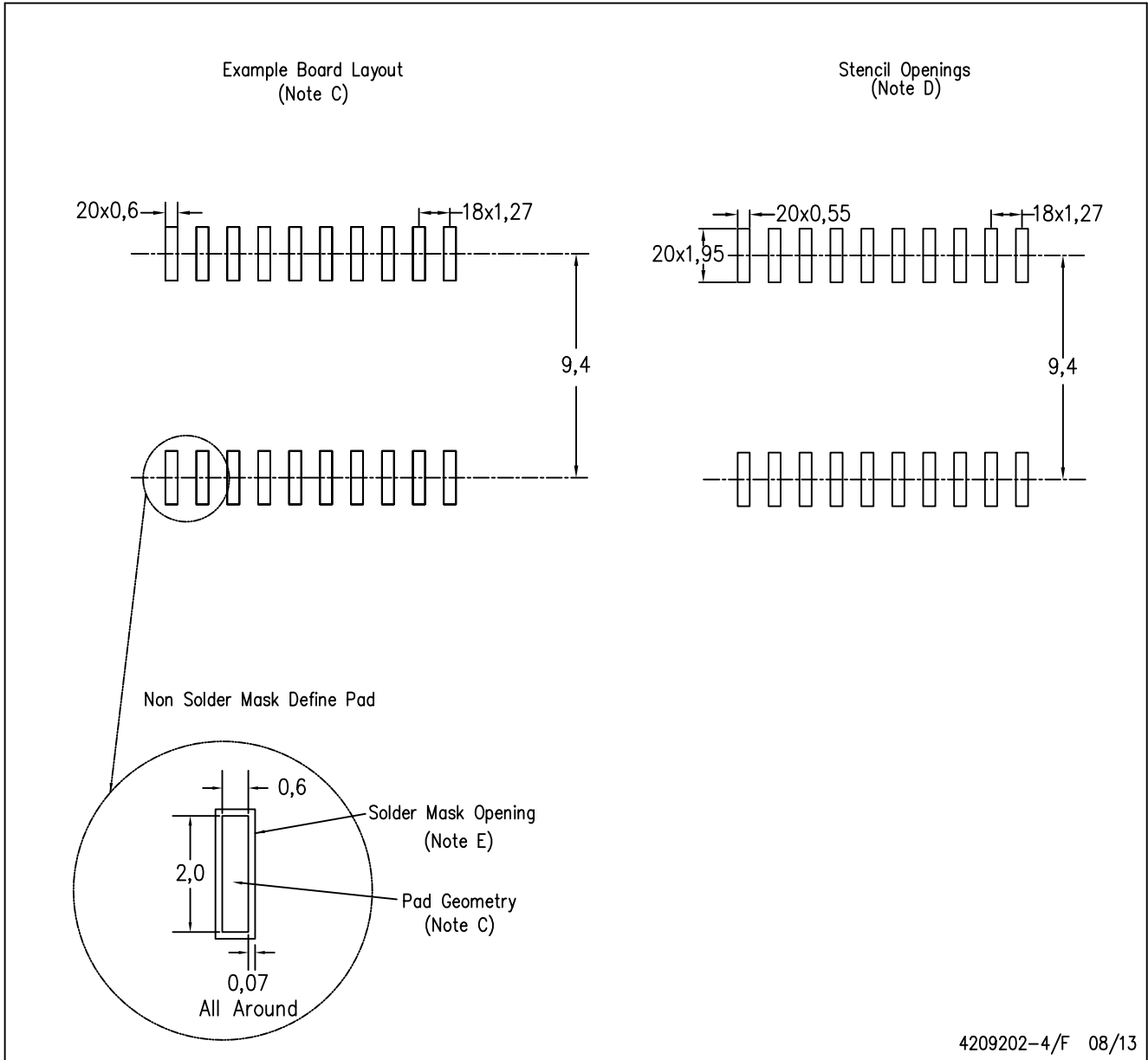
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - D. Falls within JEDEC MS-013 variation AC.

DW (R-PDSO-G20)

PLASTIC SMALL OUTLINE



4209202-4/F 08/13

- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Refer to IPC7351 for alternate board design.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

PW (R-PDSO-G20)

PLASTIC SMALL OUTLINE



4040064-5/G 02/11

- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
  - E. Falls within JEDEC MO-153



PW (R-PDSO-G20)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate design.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

DB (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE

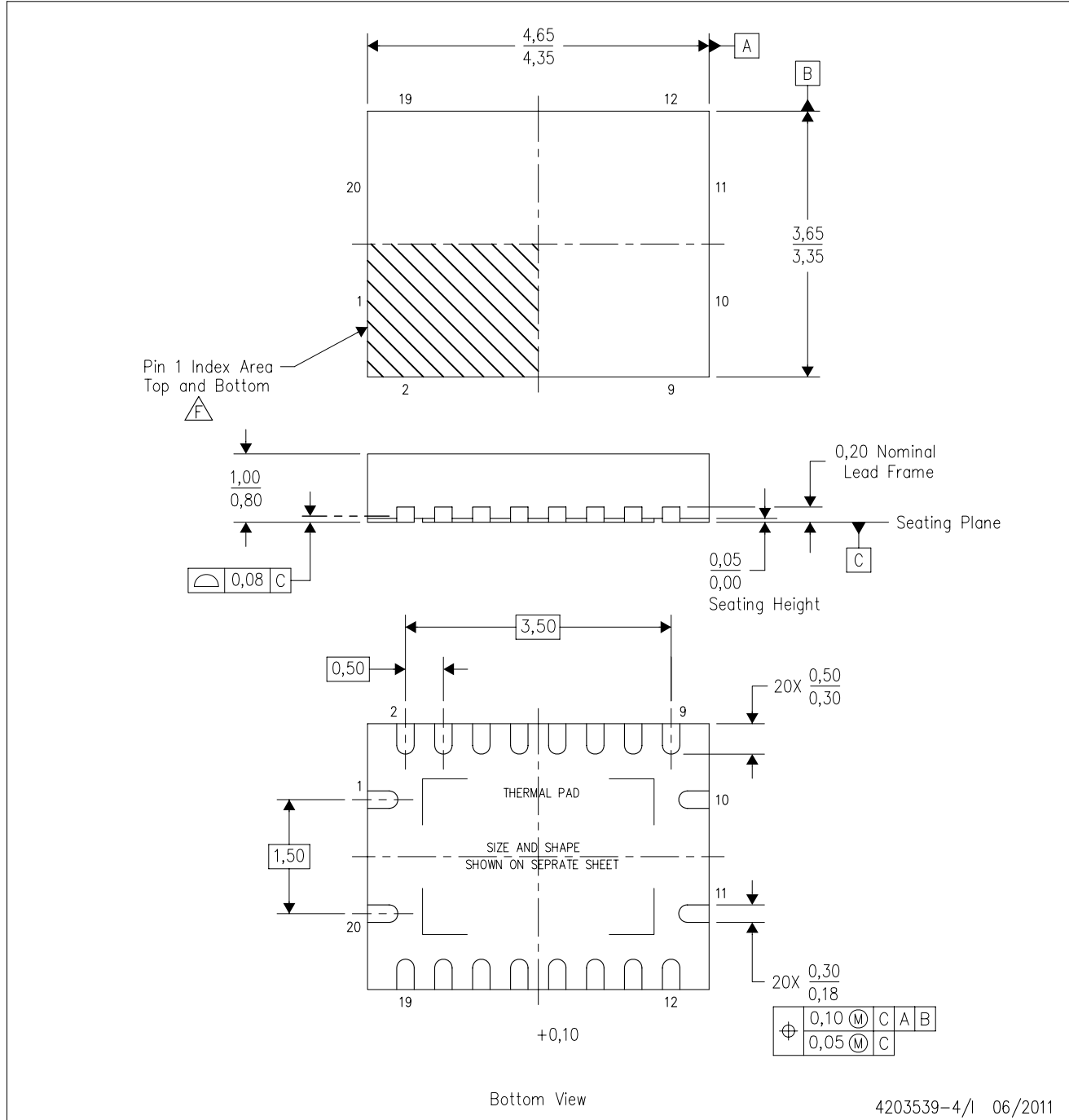
28 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-150

RGY (R-PVQFN-N20)

PLASTIC QUAD FLATPACK NO-LEAD



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. QFN (Quad Flatpack No-Lead) package configuration.
  - D. The package thermal pad must be soldered to the board for thermal and mechanical performance.
  - E. See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.
  - △ Pin 1 identifiers are located on both top and bottom of the package and within the zone indicated. The Pin 1 identifiers are either a molded, marked, or metal feature.
  - G. Package complies to JEDEC MO-241 variation BA.

RGY (R-PVQFN-N20)

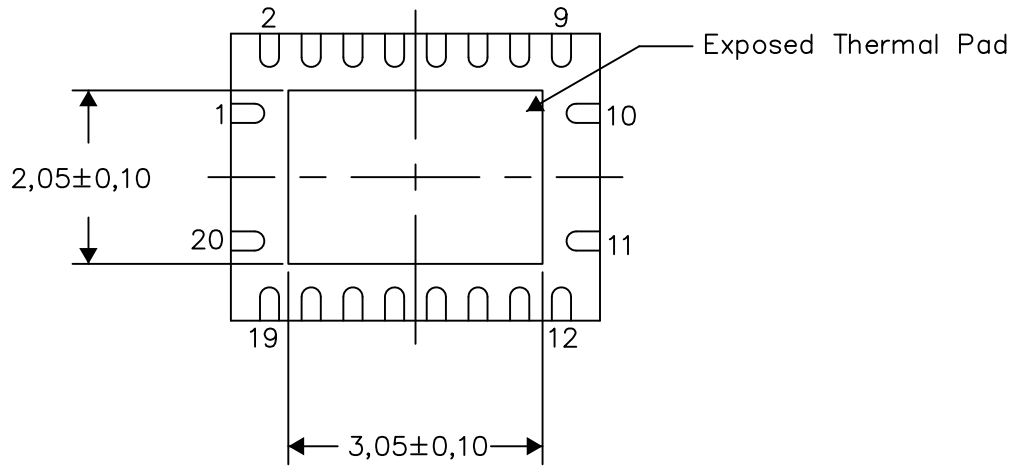
PLASTIC QUAD FLATPACK NO-LEAD

**THERMAL INFORMATION**

This package incorporates an exposed thermal pad that is designed to be attached directly to an external heatsink. The thermal pad must be soldered directly to the printed circuit board (PCB). After soldering, the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to the appropriate copper plane shown in the electrical schematic for the device, or alternatively, can be attached to a special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For information on the Quad Flatpack No-Lead (QFN) package and its advantages, refer to Application Report, QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271. This document is available at [www.ti.com](http://www.ti.com).

The exposed thermal pad dimensions for this package are shown in the following illustration.



Bottom View

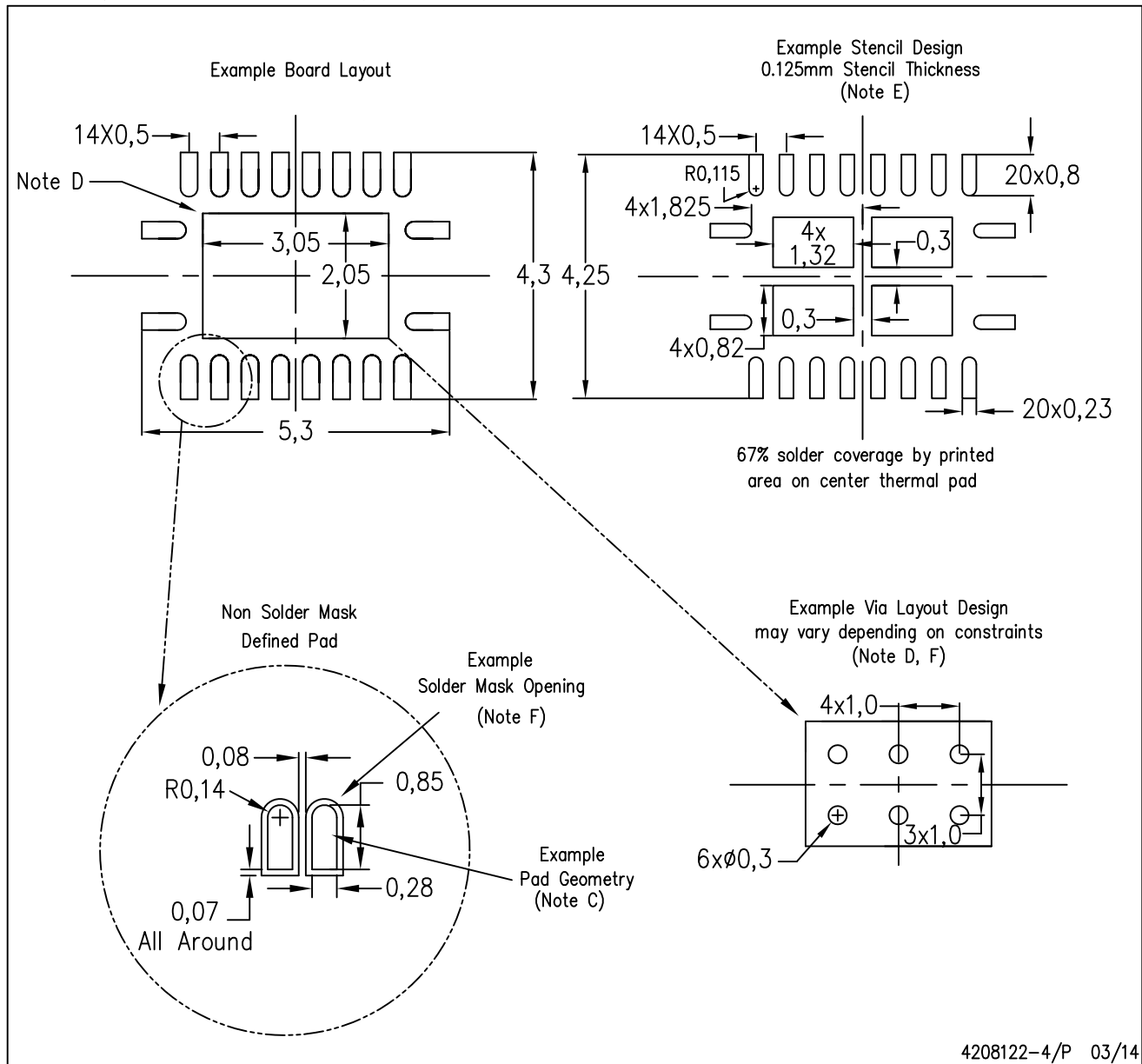
Exposed Thermal Pad Dimensions

4206353-4/P 03/14

NOTE: All linear dimensions are in millimeters

RGY (R-PVQFN-N20)

PLASTIC QUAD FLATPACK NO-LEAD



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. This package is designed to be soldered to a thermal pad on the board. Refer to Application Note, Quad Flat-Pack QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271, and also the Product Data Sheets for specific thermal information, via requirements, and recommended board layout. These documents are available at [www.ti.com](http://www.ti.com) <<http://www.ti.com>>.
  - E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC 7525 for stencil design considerations.
  - F. Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.

## MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-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 flash or protrusion, not to exceed 0,15.

## IMPORTANT NOTICE

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