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<u>Texas Instruments</u> <u>SN74AUC240RGYR</u>

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Datasheet of SN74AUC240RGYR - IC INVERTER DUAL 4-INPUT 20QFN

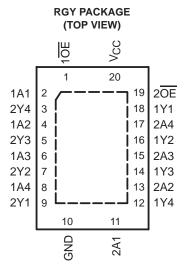
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### SN74AUC240 OCTAL BUFFER/DRIVER WITH 3-STATE OUTPUTS

SCES430A - MARCH 2003 - REVISED MARCH 2003



- I<sub>off</sub> Supports Partial-Power-Down Mode Operation
- Sub 1-V Operable
- Max t<sub>pd</sub> of 1.7 ns at 1.8 V
- Low Power Consumption, 20-μA Max I<sub>CC</sub>
- ±8-mA Output Drive at 1.8 V
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)



#### description/ordering information

This octal buffer/driver is operational at 0.8-V to 2.7-V  $V_{CC}$ , but is designed specifically for 1.65-V to 1.95-V  $V_{CC}$  operation.

The SN74AUC240 is designed specifically to improve the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters.

This device is organized as two 4-bit buffers/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.

This device is fully specified for partial-power-down applications using I<sub>off</sub>. The I<sub>off</sub> circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

#### ORDERING INFORMATION

TA	PACKAC	3E†	ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	QFN – RGY	Tape and reel	SN74AUC240RGYR	MS240

<sup>†</sup> Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.



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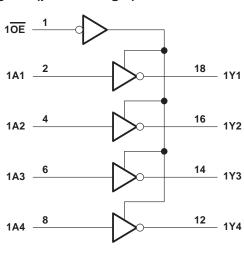
### SN74AUC240 **OCTAL BUFFER/DRIVER** WITH 3-STATE OUTPUTS

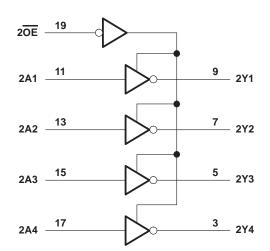
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#### **FUNCTION TABLE** (each 4-bit buffer/driver)

INP	JTS	OUTPUT
ŌE	Α	Υ
L	Н	L
L	L	Н
Н	Χ	Z

#### logic diagram (positive logic)





### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, V <sub>CC</sub>	–0.5 V to 3.6 V
Input voltage range, V <sub>I</sub> (see Note 1)	–0.5 V to 3.6 V
Voltage range applied to any output in the high-impedance or power-off state, VO	
(see Note 1)	–0.5 V to 3.6 V
Output voltage range, V <sub>O</sub> (see Note 1)	$\dots$ -0.5 V to V <sub>CC</sub> + 0.5 V
Input clamp current, I <sub>IK</sub> (V <sub>I</sub> < 0)	–50 mA
Output clamp current, I <sub>OK</sub> (V <sub>O</sub> < 0)	–50 mA
Continuous output current, IO	±20 mA
Continuous current through V <sub>CC</sub> or GND	±100 mA
Package thermal impedance, θ <sub>JA</sub> (see Note 2)	37°C/W
Storage temperature range, T <sub>stg</sub>	–65°C to 150°C

<sup>†</sup> 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.

NOTES: 1. The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.

2. The package thermal impedance is calculated in accordance with JESD 51-5.





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## **SN74AUC240 OCTAL BUFFER/DRIVER** WITH 3-STATE OUTPUTS SCES430A - MARCH 2003 - REVISED MARCH 2003

### recommended operating conditions (see Note 3)

			MIN	MAX	UNIT
VCC	Supply voltage		0.8	2.7	V
		V <sub>CC</sub> = 0.8 V	Vcc		
$V_{IH}$	High-level input voltage	$V_{CC} = 1.1 \text{ V to } 1.95 \text{ V}$	0.65 × V <sub>CC</sub>		V
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	1.7		
		V <sub>CC</sub> = 0.8 V		0	
٧ <sub>IL</sub>	Low-level input voltage	$V_{CC} = 1.1 \text{ V to } 1.95 \text{ V}$		0.35 × V <sub>CC</sub>	V
		V <sub>CC</sub> = 2.3 V to 2.7 V		0.7	
٧ <sub>I</sub>	Input voltage		0	3.6	V
.,	0	Active state	0	Vcc	
V <sub>O</sub> Output voltage		3-state	0	3.6	V
		V <sub>CC</sub> = 0.8 V		-0.7	
		V <sub>CC</sub> = 1.1 V		-3	
lOH	High-level output current	V <sub>CC</sub> = 1.4 V		-5	mA
		V <sub>CC</sub> = 1.65 V		-8	
		V <sub>CC</sub> = 2.3 V		-9	
		V <sub>CC</sub> = 0.8 V		0.7	
		V <sub>CC</sub> = 1.1 V		3	
loL	Low-level output current	V <sub>CC</sub> = 1.4 V		5	mA
		V <sub>CC</sub> = 1.65 V		8	
		V <sub>CC</sub> = 2.3 V		9	
Δt/Δν	Input transition rise or fall rate	•		20	ns/V
TA	Operating free-air temperature		-40	85	°C

NOTE 3: 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.





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## SN74AUC240 OCTAL BUFFER/DRIVER WITH 3-STATE OUTPUTS

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

PARAMETER	TEST CONDITIONS	vcc	MIN	TYP†	MAX	UNIT
	I <sub>OH</sub> = -100 μA	0.8 V to 2.7 V	V <sub>CC</sub> -0.	.1		
	$I_{OH} = -0.7 \text{ mA}$	0.8 V		0.55		
W-	$I_{OH} = -3 \text{ mA}$	1.1 V	0.8			.,
VOH	I <sub>OH</sub> = −5 mA	1.4 V	1			V
	I <sub>OH</sub> = -8 mA	1.65 V	1.2			
	I <sub>OH</sub> = −9 mA	2.3 V	1.8			
	I <sub>OL</sub> = 100 μA	0.8 V to 2.7 V			0.2	
	$I_{OL} = 0.7 \text{ mA}$	0.8 V		0.25		
N.	$I_{OL} = 3 \text{ mA}$	1.1 V			0.3	.,
VOL	$I_{OL} = 5 \text{ mA}$	1.4 V			0.4	V
	$I_{OL} = 8 \text{ mA}$	1.65 V			0.45	
	I <sub>OL</sub> = 9 mA	2.3 V			0.6	
I <sub>I</sub> A and OE inputs	$V_I = V_{CC}$ or GND	0 to 2.7 V			±5	μΑ
l <sub>off</sub>	$V_I$ or $V_O = 2.7 V$	0			±10	μΑ
loz	V <sub>O</sub> = V <sub>CC</sub> or GND	2.7 V			±10	μΑ
ICC	$V_I = V_{CC}$ or GND, $I_O = 0$	0.8 V to 2.7 V			20	μΑ
Ci	V <sub>I</sub> = V <sub>CC</sub> or GND	2.5 V		2.5	3	pF
Co	V <sub>O</sub> = V <sub>CC</sub> or GND	2.5 V		5.5	6	pF

<sup>&</sup>lt;sup>†</sup> All typical values are at  $T_A = 25$ °C.

# switching characteristics over recommended operating free-air temperature range, $C_L = 15 pF$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 0.8 V	V <sub>CC</sub> =		V <sub>CC</sub> =			C = 1.8		V <sub>CC</sub> = ± 0.		UNIT
	(INPOT)	(001701)	TYP	MIN	MAX	MIN	MAX	MIN	TYP	MAX	MIN	MAX	
<sup>t</sup> pd	А	Y	4.8	1.2	3.3	0.8	2	0.7	1.1	1.7	0.6	1.3	ns
t <sub>en</sub>	ŌĒ	Y	6.4	1.4	4	0.9	2.6	0.8	1.2	2.1	0.7	1.5	ns
<sup>t</sup> dis	OE	Y	8.7	2	5.8	1.8	3.9	1.8	2.5	4	0.3	3	ns

# switching characteristics over recommended operating free-air temperature range, $C_L = 30 \text{ pF}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM	TO		C = 1.8 0.15 V	V	V <sub>CC</sub> =	2.5 V 2 V	UNIT
	(INPUT)	(OUTPUT)	MIN	TYP	MAX	MIN	MAX	
<sup>t</sup> pd	А	Υ	1	1.4	2.1	0.9	1.6	ns
<sup>t</sup> en	ŌĒ	Y	1.1	1.7	2.7	1	2	ns
<sup>t</sup> dis	ŌĒ	Υ	1.9	2.5	4	1	2	ns





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## operating characteristics, $T_A = 25^{\circ}C$

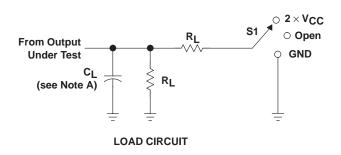
	PARAMETE	D	TEST	V <sub>CC</sub> = 0.8 V	V <sub>CC</sub> = 1.2 V	V <sub>CC</sub> = 1.5 V	V <sub>CC</sub> = 1.8 V	V <sub>CC</sub> = 2.5 V	LINUT
	PARAMETE	N.	CONDITIONS	TYP	TYP	TYP	TYP	TYP	UNIT
	Power	Outputs enabled		21	21	21	22	25	. [
C <sub>pd</sub>	dissipation capacitance	Outputs disabled	f = 10 MHz	3	3	3	3	5	pF



SN74AUC240 OCTAL BUFFER/DRIVER

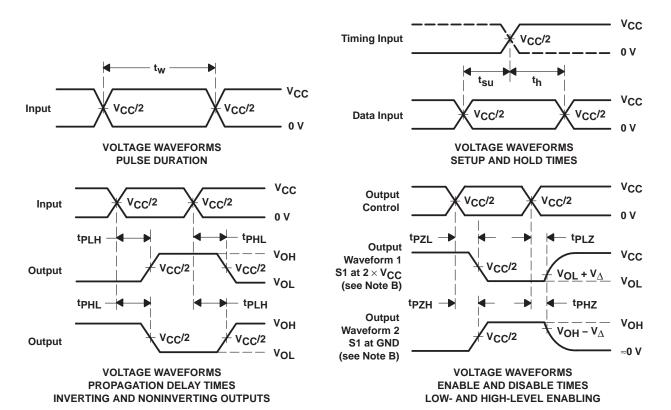
WITH 3-STATE OUTPUTS SCES430A - MARCH 2003 - REVISED MARCH 2003

#### PARAMETER MEASUREMENT INFORMATION



TEST	S1
tPLH/tPHL	Open
tPLZ/tPZL	2×V <sub>CC</sub>
tPHZ/tPZH	GND

VCC	CL	RL	$v_{\!\scriptscriptstyle\Delta}$
0.8 V	15 pF	<b>2 k</b> Ω	0.1 V
1.2 V $\pm$ 0.1 V	15 pF	<b>2 k</b> Ω	0.1 V
1.5 V $\pm$ 0.1 V	15 pF	<b>2 k</b> Ω	0.1 V
1.8 V $\pm$ 0.15 V	15 pF	<b>2 k</b> Ω	0.15 V
2.5 V $\pm$ 0.2 V	15 pF	<b>2 k</b> Ω	0.15 V
1.8 V $\pm$ 0.15 V	30 pF	<b>1 k</b> Ω	0.15 V
2.5 V $\pm$ 0.2 V	30 pF	<b>500</b> Ω	0.15 V



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 MHz,  $Z_0 = 50 \Omega$ , slew rate  $\geq$  1 V/ns.
- D. The outputs are measured one at a time with one transition per measurement.
- E. tpLz and tpHz are the same as tdis.
- F. tpzL and tpzH are the same as ten.
- G.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .
- H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms





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PACKAGE OPTION ADDENDUM

10-Jun-2014

#### PACKAGING INFORMATION

Orderable Device	Status	Package Type	e Package	Pins	Package	Eco Plan	Lead/Ball Finish	MSL Peak Temp	Op Temp (°C)	Device Marking	Samples
	(1)		Drawing		Qty	(2)	(6)	(3)		(4/5)	
SN74AUC240RGYR	ACTIVE	VQFN	RGY	20	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	MS240	Samples

(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
- (6) 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.

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Addendum-Page 1



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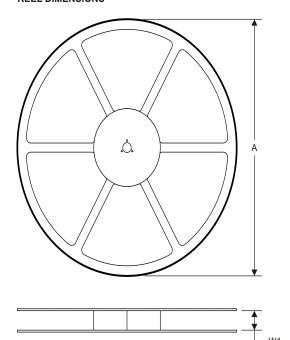


## **PACKAGE MATERIALS INFORMATION**

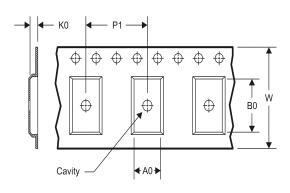
www.ti.com 14-Jul-2012

#### **TAPE AND REEL INFORMATION**

#### **REEL DIMENSIONS**



#### TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
В0	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

#### TAPE AND REEL INFORMATION

\*All dimensions are nominal

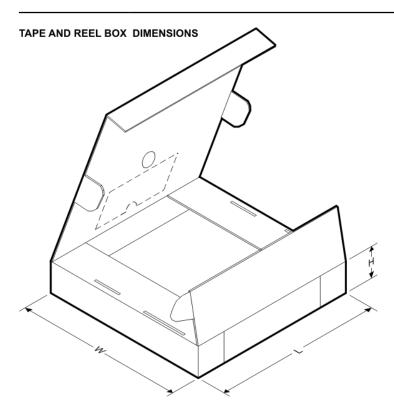
Device	Package Type	Package Drawing			Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74AUC240RGYR	VQFN	RGY	20	3000	330.0	12.4	3.8	4.8	1.6	8.0	12.0	Q1

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## **PACKAGE MATERIALS INFORMATION**

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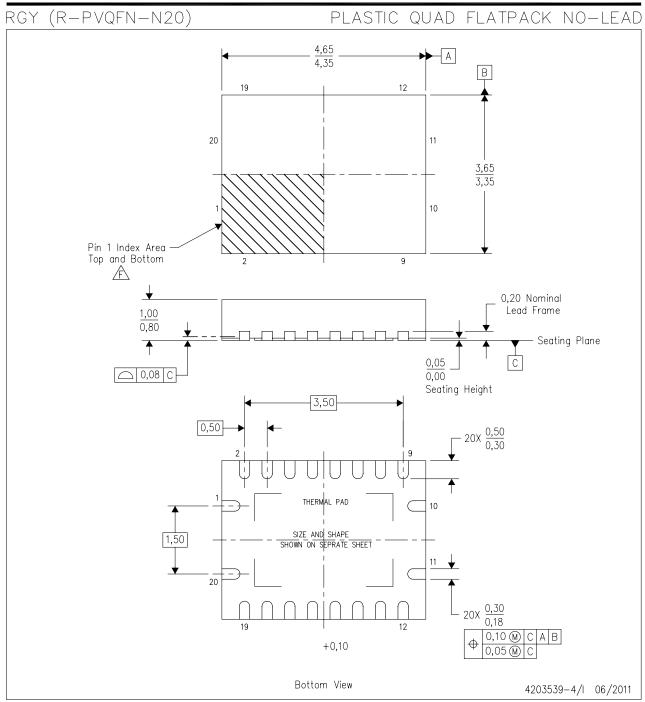


#### \*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)	
SN74AUC240RGYR	VQFN	RGY	20	3000	367.0	367.0	35.0	



#### **MECHANICAL DATA**



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.





### THERMAL PAD MECHANICAL DATA

### RGY (R-PVQFN-N20)

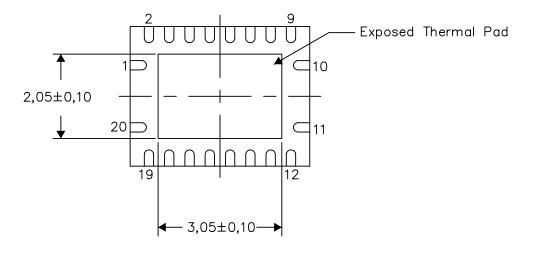
#### PLASTIC QUAD FLATPACK NO-LEAD

#### 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.

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



Bottom View

Exposed Thermal Pad Dimensions

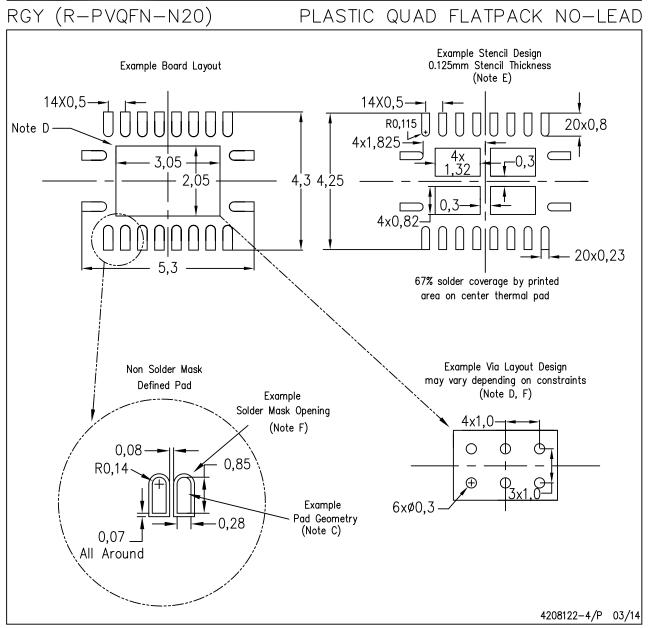
4206353-4/P 03/14

NOTE: All linear dimensions are in millimeters





#### LAND PATTERN DATA



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 <a href="http://www.ti.com">www.ti.com</a>>.
- 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.





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