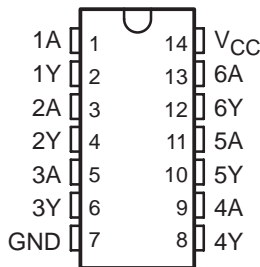


# SN54LV14A, SN74LV14A HEX SCHMITT-TRIGGER INVERTERS

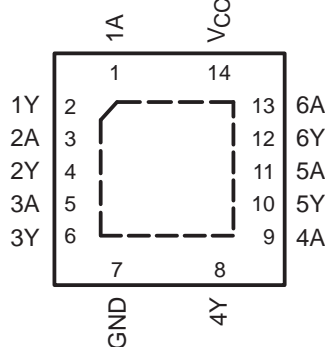
SCLS386I – SEPTEMBER 1997 – REVISED DECEMBER 2004

- 2-V to 5.5-V  $V_{CC}$  Operation
- Max  $t_{pd}$  of 10 ns at 5 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)  $>2.3$  V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- Support Mixed-Mode Voltage Operation on All Ports
- $I_{off}$  Supports Partial-Power-Down Mode Operation
- 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)
  - 1000-V Charged-Device Model (C101)

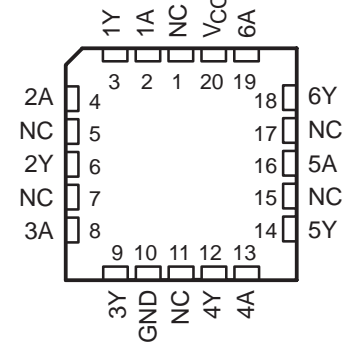
SN54LV14A . . . J OR W PACKAGE  
SN74LV14A . . . D, DB, DGV, NS,  
OR PW PACKAGE  
(TOP VIEW)



SN74LV14A . . . RGY PACKAGE  
(TOP VIEW)



SN54LV14A . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

## description/ordering information

These hex Schmitt-trigger inverters are designed for 2-V to 5.5-V  $V_{CC}$  operation.

The 'LV14A devices contain six independent inverters. These devices perform the Boolean function  $Y = \bar{A}$ .

These devices are fully specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the devices when they are powered down.

## ORDERING INFORMATION

$T_A$	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	QFN – RGY	Reel of 1000	SN74LV14ARGYR	LV14A
	SOIC – D	Tube of 50	SN74LV14AD	LV14A
		Reel of 2500	SN74LV14ADR	
	SOP – NS	Reel of 2000	SN74LV14ANSR	74LV14A
	SSOP – DB	Reel of 2000	SN74LV14ADBR	LV14A
	TSSOP – PW	Tube of 90	SN74LV14APW	LV14A
		Reel of 2000	SN74LV14APWR	
Reel of 250		SN74LV14APWT		
TVSOP – DGV	Reel of 2000	SN74LV14ADGVR	LV14A	
–55°C to 125°C	CDIP – J	Tube of 25	SNJ54LV14AJ	SNJ54LV14AJ
	CFP – W	Tube of 150	SNJ54LV14AW	SNJ54LV14AW
	LCCC – FK	Tube of 55	SNJ54LV14AFK	SNJ54LV14AFK

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).



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 **TEXAS  
INSTRUMENTS**

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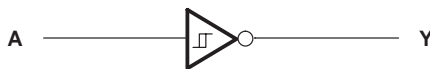
# SN54LV14A, SN74LV14A HEX SCHMITT-TRIGGER INVERTERS

SCLS386I – SEPTEMBER 1997 – REVISED DECEMBER 2004

FUNCTION TABLE  
(each inverter)

INPUT A	OUTPUT Y
H	L
L	H

logic diagram, each inverter (positive logic)



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

Supply voltage range, $V_{CC}$ .....	-0.5 V to 7 V
Input voltage range, $V_I$ (see Note 1) .....	-0.5 V to 7 V
Voltage range applied to any output in the high-impedance or power-off state, $V_O$ (see Note 1) .....	-0.5 V to 7 V
Output voltage range, $V_O$ (see Notes 1 and 2) .....	-0.5 V to $V_{CC} + 0.5$ V
Input clamp current, $I_{IK}$ ( $V_I < 0$ ) .....	-20 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ ) .....	-50 mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ ) .....	$\pm 25$ mA
Continuous current through $V_{CC}$ or GND .....	$\pm 50$ mA
Package thermal impedance, $\theta_{JA}$ (see Note 3): D package .....	86°C/W
(see Note 3): DB package .....	96°C/W
(see Note 3): DGV package .....	127°C/W
(see Note 3): NS package .....	76°C/W
(see Note 3): PW package .....	113°C/W
(see Note 4): RGY package .....	47°C/W
Storage temperature range, $T_{stg}$ .....	-65°C to 150°C

† 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 and output voltage ratings may be exceeded if the input and output current ratings are observed.
  2. This value is limited to 5.5 V maximum.
  3. The package thermal impedance is calculated in accordance with JESD 51-7.
  4. The package thermal impedance is calculated in accordance with JESD 51-5.

# SN54LV14A, SN74LV14A HEX SCHMITT-TRIGGER INVERTERS

SCLS3861 – SEPTEMBER 1997 – REVISED DECEMBER 2004

## recommended operating conditions (see Note 5)

		SN54LV14A		SN74LV14A		UNIT
		MIN	MAX	MIN	MAX	
V <sub>CC</sub>	Supply voltage	2	5.5	2	5.5	V
V <sub>I</sub>	Input voltage	0	5.5	0	5.5	V
V <sub>O</sub>	Output voltage	0	V <sub>CC</sub>	0	V <sub>CC</sub>	V
I <sub>OH</sub>	High-level output current	V <sub>CC</sub> = 2 V		-50	-50	μA
		V <sub>CC</sub> = 2.3 V to 2.7 V		-2	-2	mA
		V <sub>CC</sub> = 3 V to 3.6 V		-6	-6	
		V <sub>CC</sub> = 4.5 V to 5.5 V		-12	-12	
I <sub>OL</sub>	Low-level output current	V <sub>CC</sub> = 2 V		50	50	μA
		V <sub>CC</sub> = 2.3 V to 2.7 V		2	2	mA
		V <sub>CC</sub> = 3 V to 3.6 V		6	6	
		V <sub>CC</sub> = 4.5 V to 5.5 V		12	12	
T <sub>A</sub>	Operating free-air temperature	-55	125	-40	85	°C

NOTE 5: 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.

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

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	SN54LV14A			SN74LV14A			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V <sub>T+</sub> Positive-going threshold		2.5 V	1.75			1.75			V
		3.3 V	2.31			2.31			
		5 V	3.5			3.5			
V <sub>T-</sub> Negative-going threshold		2.5 V	0.75			0.75			V
		3.3 V	0.99			0.99			
		5 V	1.5			1.5			
ΔV <sub>T</sub> Hysteresis (V <sub>T+</sub> - V <sub>T-</sub> )		2.5 V	0.25			0.25			V
		3.3 V	0.33			0.33			
		5 V	0.5			0.5			
V <sub>OH</sub>	I <sub>OH</sub> = -50 μA	2 V to 5.5 V	V <sub>CC</sub> - 0.1			V <sub>CC</sub> - 0.1			V
	I <sub>OH</sub> = -2 mA	2.3 V	2			2			
	I <sub>OH</sub> = -6 mA	3 V	2.48			2.48			
	I <sub>OH</sub> = -12 mA	4.5 V	3.8			3.8			
V <sub>OL</sub>	I <sub>OL</sub> = 50 μA	2 V to 5.5 V	0.1			0.1			V
	I <sub>OL</sub> = 2 mA	2.3 V	0.4			0.4			
	I <sub>OL</sub> = 6 mA	3 V	0.44			0.44			
	I <sub>OL</sub> = 12 mA	4.5 V	0.55			0.55			
I <sub>I</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	0 V to 5.5 V	±1			±1			μA
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	5.5 V	20			20			μA
I <sub>off</sub>	V <sub>I</sub> or V <sub>O</sub> = 0 to 5.5 V	0 V	5			5			μA
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	3.3 V	2.3			2.3			pF
		5 V	2.3			2.3			

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# SN54LV14A, SN74LV14A HEX SCHMITT-TRIGGER INVERTERS

SCLS386I – SEPTEMBER 1997 – REVISED DECEMBER 2004

switching characteristics over recommended operating free-air temperature range,  
 $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$  (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ\text{C}$			SN54LV14A		SN74LV14A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$	A	Y	$C_L = 15\text{ pF}$	10.2*	19.7*	1*	22*	1	22	ns	
			$C_L = 50\text{ pF}$	13.3	24	1	27	1	27		

\* On products compliant to MIL-PRF-38535, this parameter is not production tested.

switching characteristics over recommended operating free-air temperature range,  
 $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$  (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ\text{C}$			SN54LV14A		SN74LV14A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$	A	Y	$C_L = 15\text{ pF}$	7.3*	12.8*	1*	15.9*	1	15	ns	
			$C_L = 50\text{ pF}$	9.6	16.3	1	19.4	1	18.5		

\* On products compliant to MIL-PRF-38535, this parameter is not production tested.

switching characteristics over recommended operating free-air temperature range,  
 $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$  (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ\text{C}$			SN54LV14A		SN74LV14A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{pd}$	A	Y	$C_L = 15\text{ pF}$	5.1*	8.6*	1*	10*	1	10	ns	
			$C_L = 50\text{ pF}$	6.7	10.6	1	12	1	12		

\* On products compliant to MIL-PRF-38535, this parameter is not production tested.

noise characteristics,  $V_{CC} = 3.3\text{ V}$ ,  $C_L = 50\text{ pF}$ ,  $T_A = 25^\circ\text{C}$  (see Note 6)

PARAMETER		SN74LV14A			UNIT
		MIN	TYP	MAX	
$V_{OL(P)}$	Quiet output, maximum dynamic $V_{OL}$		0.2	0.8	V
$V_{OL(V)}$	Quiet output, minimum dynamic $V_{OL}$		-0.1	-0.8	V
$V_{OH(V)}$	Quiet output, minimum dynamic $V_{OH}$		3.1		V
$V_{IH(D)}$	High-level dynamic input voltage		2.31		V
$V_{IL(D)}$	Low-level dynamic input voltage			0.99	V

NOTE 6: Characteristics are for surface-mount packages only.

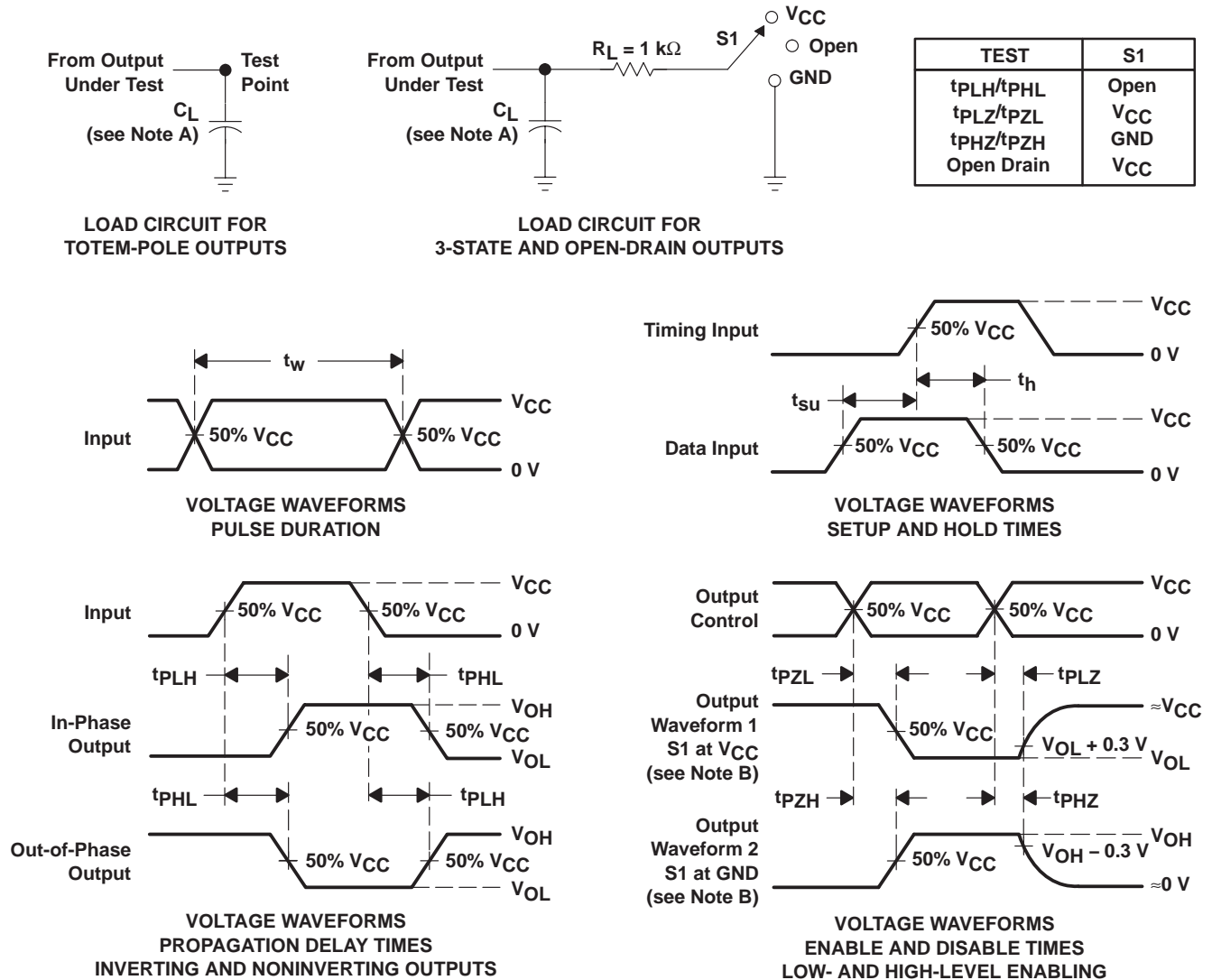
operating characteristics,  $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	$V_{CC}$	TYP	UNIT
$C_{pd}$	Power dissipation capacitance	$C_L = 50\text{ pF}$ , $f = 10\text{ MHz}$	3.3 V	8.8	pF
			5 V	9.6	

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## PARAMETER MEASUREMENT INFORMATION



- 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:  $PRR \leq 1\text{ MHz}$ ,  $Z_O = 50\ \Omega$ ,  $t_r \leq 3\text{ ns}$ ,  $t_f \leq 3\text{ ns}$ .
  - D. The outputs are measured one at a time, with one input 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.  $t_{PHL}$  and  $t_{PLH}$  are the same as  $t_{pd}$ .
  - H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
SN74LV14AD	ACTIVE	SOIC	D	14	50	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74LV14ADBLE	OBSOLETE	SSOP	DB	14		None	Call TI	Call TI
SN74LV14ADBR	ACTIVE	SSOP	DB	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74LV14ADGVR	ACTIVE	TVSOP	DGV	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74LV14ADR	ACTIVE	SOIC	D	14	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74LV14ANSR	ACTIVE	SO	NS	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74LV14APW	ACTIVE	TSSOP	PW	14	90	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74LV14APWLE	OBSOLETE	TSSOP	PW	14		None	Call TI	Call TI
SN74LV14APWR	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV14APWT	ACTIVE	TSSOP	PW	14	250	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74LV14ARGYR	ACTIVE	QFN	RGY	14	1000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR

<sup>(1)</sup> 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.

<sup>(2)</sup> Eco Plan - May not be currently available - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**None:** Not yet available Lead (Pb-Free).

**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.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

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

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

PLASTIC SMALL-OUTLINE

24 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 per side.  
 D. Falls within JEDEC: 24/48 Pins – MO-153  
 14/16/20/56 Pins – MO-194

D (R-PDSO-G14)

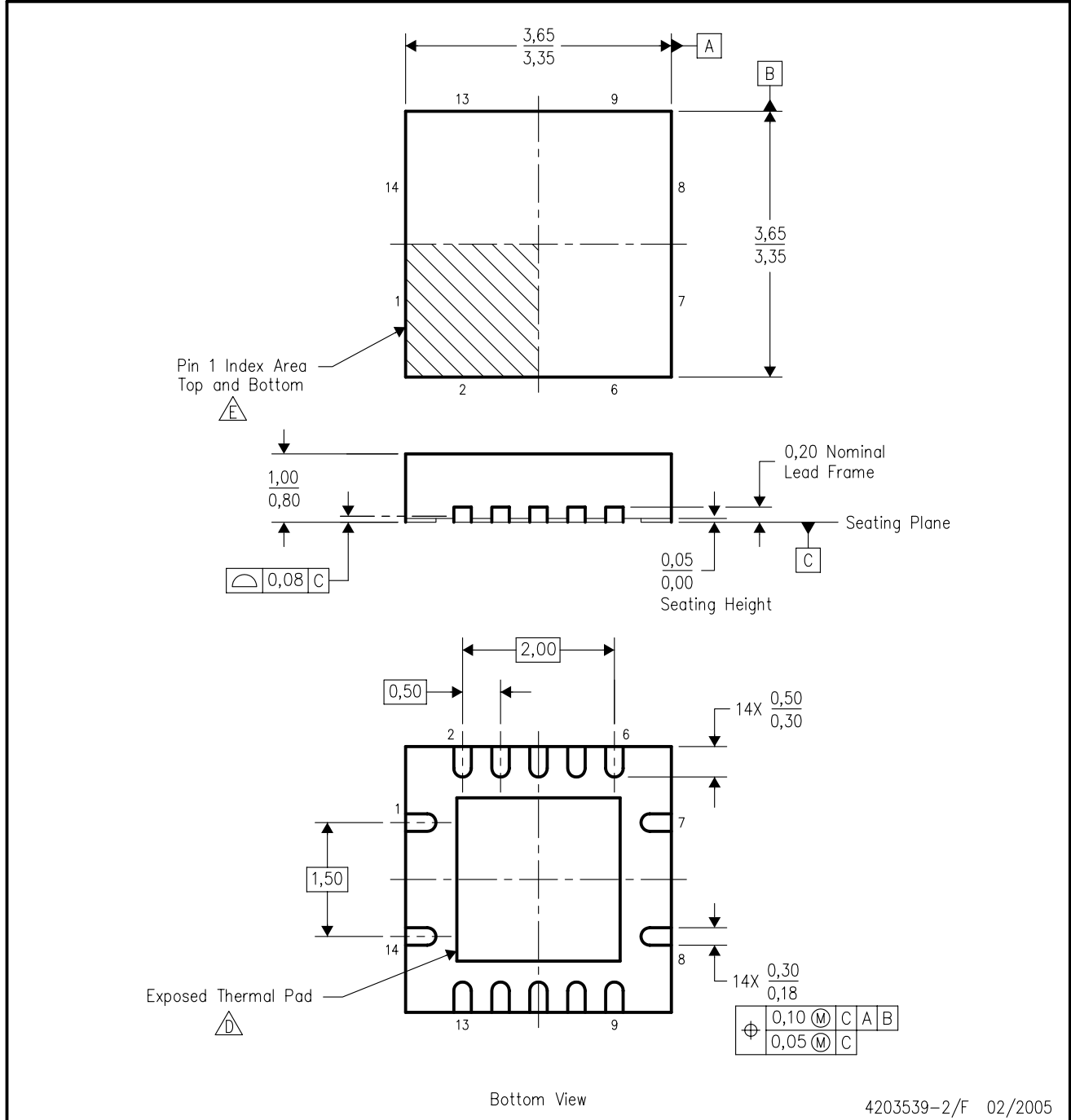
PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - 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-012 variation AB.

RGY (S-PQFP-N14)

PLASTIC QUAD FLATPACK



4203539-2/F 02/2005

- 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.
  - The package thermal pad must be soldered to the board for thermal and mechanical performance. See the Product Data Sheet for details regarding the exposed thermal pad 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.
  - F. Package complies to JEDEC MO-241 variation BA.

# 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.

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

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

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- 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-153

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