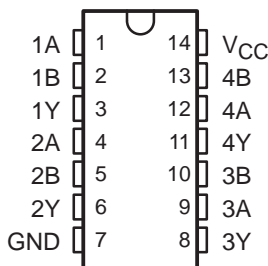


SN54LVC86A, SN74LVC86A QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES

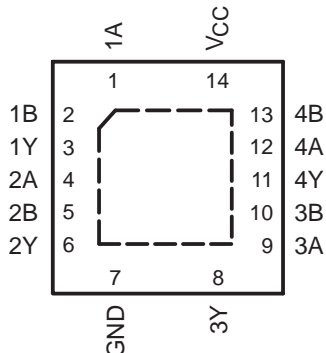
SCAS288P – JANUARY 1993 – REVISED FEBRUARY 2004

- Operate From 1.65 V to 3.6 V
- Specified From -40°C to 85°C , -40°C to 125°C , and -55°C to 125°C
- Inputs Accept Voltages to 5.5 V
- Max t_{pd} of 4.6 ns at 3.3 V
- Typical V_{OLP} (Output Ground Bounce) $<0.8\text{ V}$ at $V_{CC} = 3.3\text{ V}$, $T_A = 25^{\circ}\text{C}$
- Typical V_{OHV} (Output V_{OH} Undershoot) $>2\text{ V}$ at $V_{CC} = 3.3\text{ V}$, $T_A = 25^{\circ}\text{C}$
- 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)

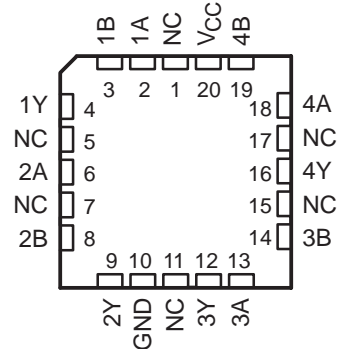
SN54LVC86A . . . J OR W PACKAGE
SN74LVC86A . . . D, DB, NS, OR PW PACKAGE
(TOP VIEW)



SN74LVC86A . . . RGY PACKAGE
(TOP VIEW)



SN54LVC86A . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

description/ordering information

The SN54LVC86A quadruple 2-input exclusive-OR gate is designed for 2.7-V to 3.6-V V_{CC} operation, and the SN74LVC86A quadruple 2-input exclusive-OR gate is designed for 1.65-V to 3.6-V V_{CC} operation.

The 'LVC86A devices perform the Boolean function $Y = A \oplus B$ or $Y = \bar{A}B + A\bar{B}$ in positive logic.

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	QFN – RGY	Reel of 1000	SN74LVC86ARGYR	LC86A
-40°C to 125°C	SOIC – D	Tube of 50	SN74LVC86AD	LVC86A
		Reel of 2500	SN74LVC86ADR	
		Reel of 250	SN74LVC86ADT	
	SOP – NS	Reel of 2000	SN74LVC86ANSR	LVC86A
	SSOP – DB	Reel of 2000	SN74LVC86ADBR	LC86A
	TSSOP – PW	Tube of 90	SN74LVC86APW	LC86A
Reel of 2000		SN74LVC86APWR		
Reel of 250		SN74LVC86APWT		
-55°C to 125°C	CDIP – J	Tube of 25	SNJ54LVC86AJ	SNJ54LVC86AJ
	CFP – W	Tube of 150	SNJ54LVC86AW	SNJ54LVC86AW
	LCCC – FK	Tube of 55	SNJ54LVC86AFK	SNJ54LVC86AFK

† 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.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 2004, Texas Instruments Incorporated
On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

SN54LVC86A, SN74LVC86A QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES

SCAS288P – JANUARY 1993 – REVISED FEBRUARY 2004

description/ordering information (continued)

A common application is as a true/complement element. If one of the inputs is low, the other input is reproduced in true form at the output. If one of the inputs is high, the signal on the other input is reproduced inverted at the output.

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

FUNCTION TABLE
(each gate)

INPUTS		OUTPUT
A	B	Y
L	L	L
L	H	H
H	L	H
H	H	L

exclusive-OR logic

An exclusive-OR gate has many applications, some of which can be represented better by alternative logic symbols.



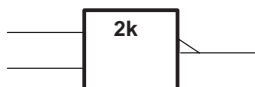
These five equivalent exclusive-OR symbols are valid for an SN74LVC86A gate in positive logic; negation may be shown at any two ports.

LOGIC-IDENTITY ELEMENT



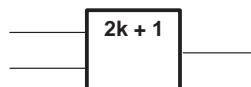
The output is active (low) if all inputs stand at the same logic level (i.e., $A = B$).

EVEN-PARITY ELEMENT



The output is active (low) if an even number of inputs (i.e., 0 or 2) are active.

ODD-PARITY ELEMENT



The output is active (high) if an odd number of inputs (i.e., only 1 of the 2) are active.

SN54LVC86A, SN74LVC86A QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES

SCAS288P – JANUARY 1993 – REVISED FEBRUARY 2004

recommended operating conditions (see Note 7)

		SN54LVC86A		UNIT
		-55 TO 125°C		
		MIN	MAX	
V _{CC}	Supply voltage	Operating		V
		Data retention only		
V _{IH}	High-level input voltage	V _{CC} = 2.7 V to 3.6 V		V
V _{IL}	Low-level input voltage	V _{CC} = 2.7 V to 3.6 V		V
V _I	Input voltage	0	5.5	V
V _O	Output voltage	0	V _{CC}	V
I _{OH}	High-level output current	V _{CC} = 2.7 V		mA
		V _{CC} = 3 V		
I _{OL}	Low-level output current	V _{CC} = 2.7 V		mA
		V _{CC} = 3 V		
Δt/Δv	Input transition rise or fall rate	9		ns/V

NOTE 7: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

recommended operating conditions (see Note 7)

		SN74LVC86A						UNIT
		T _A = 25°C		-40 TO 85°C		-40 TO 125°C		
		MIN	MAX	MIN	MAX	MIN	MAX	
V _{CC}	Supply voltage	Operating		1.65		3.6		V
		Data retention only		1.5		1.5		
V _{IH}	High-level input voltage	V _{CC} = 1.65 V to 1.95 V		0.65 × V _{CC}		0.65 × V _{CC}		V
		V _{CC} = 2.3 V to 2.7 V		1.7		1.7		
		V _{CC} = 2.7 V to 3.6 V		2		2		
V _{IL}	Low-level input voltage	V _{CC} = 1.65 V to 1.95 V		0.35 × V _{CC}		0.35 × V _{CC}		V
		V _{CC} = 2.3 V to 2.7 V		0.7		0.7		
		V _{CC} = 2.7 V to 3.6 V		0.8		0.8		
V _I	Input voltage	0	5.5	0	5.5	0	5.5	V
V _O	Output voltage	0	V _{CC}	0	V _{CC}	0	V _{CC}	V
I _{OH}	High-level output current	V _{CC} = 1.65 V		-4		-4		mA
		V _{CC} = 2.3 V		-8		-8		
		V _{CC} = 2.7 V		-12		-12		
		V _{CC} = 3 V		-24		-24		
I _{OL}	Low-level output current	V _{CC} = 1.65 V		4		4		mA
		V _{CC} = 2.3 V		8		8		
		V _{CC} = 2.7 V		12		12		
		V _{CC} = 3 V		24		24		
Δt/Δv	Input transition rise or fall rate	9		9		9		ns/V

NOTE 7: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.



SN54LVC86A, SN74LVC86A QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES

SCAS288P – JANUARY 1993 – REVISED FEBRUARY 2004

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

PARAMETER	TEST CONDITIONS	V _{CC}	SN54LVC86A			UNIT	
			-55 TO 125°C				
			MIN	TYP	MAX		
V _{OH}	I _{OH} = -100 μA	2.7 V to 3.6 V	V _{CC} -0.2			V	
	I _{OH} = -12 mA	2.7 V	2.2				
		3 V	2.4				
	I _{OH} = -24 mA	3 V	2.2				
V _{OL}	I _{OL} = 100 μA	2.7 V to 3.6 V	0.2			V	
	I _{OL} = 12 mA	2.7 V	0.4				
	I _{OL} = 24 mA	3 V	0.55				
I _I	V _I = 5.5 V or GND	3.6 V	±5			μA	
I _{CC}	V _I = V _{CC} or GND	I _O = 0	3.6 V	10			μA
ΔI _{CC}	One input at V _{CC} - 0.6 V, Other inputs at V _{CC} or GND	2.7 V to 3.6 V	500			μA	
C _i	V _I = V _{CC} or GND	3.3 V	5†			pF	

† T_A = 25°C

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

PARAMETER	TEST CONDITIONS	V _{CC}	SN74LVC86A						UNIT		
			T _A = 25°C			-40 TO 85°C		-40 TO 125°C			
			MIN	TYP	MAX	MIN	MAX	MIN		MAX	
V _{OH}	I _{OH} = -100 μA	1.65 V to 3.6 V	V _{CC} -0.2			V _{CC} -0.2		V _{CC} -0.3		V	
	I _{OH} = -4 mA	1.65 V	1.29			1.2		1.05			
	I _{OH} = -8 mA	2.3 V	1.9			1.7		1.55			
	I _{OH} = -12 mA	2.7 V	2.2			2.2		2.05			
		3 V	2.4			2.4		2.25			
	I _{OH} = -24 mA	3 V	2.3			2.2		2			
V _{OL}	I _{OL} = 100 μA	1.65 V to 3.6 V	0.1			0.2		0.3		V	
	I _{OL} = 4 mA	1.65 V	0.24			0.45		0.6			
	I _{OL} = 8 mA	2.3 V	0.3			0.7		0.75			
	I _{OL} = 12 mA	2.7 V	0.4			0.4		0.6			
	I _{OL} = 24 mA	3 V	0.55			0.55		0.8			
I _I	V _I = 5.5 V or GND	3.6 V	±1			±5		±20		μA	
I _{CC}	V _I = V _{CC} or GND	I _O = 0	3.6 V	1			10		40		μA
ΔI _{CC}	One input at V _{CC} - 0.6 V, Other inputs at V _{CC} or GND	2.7 V to 3.6 V	500			500		5000		μA	
C _i	V _I = V _{CC} or GND	3.3 V	5							pF	



SN54LVC86A, SN74LVC86A QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES

SCAS288P – JANUARY 1993 – REVISED FEBRUARY 2004

switching characteristics over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC}	SN54LVC86A		UNIT
				-55 TO 125°C		
				MIN	MAX	
t _{pd}	A	Y	2.7 V	5.6		ns
			3.3 V ± 0.3 V	1	4.6	

switching characteristics over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

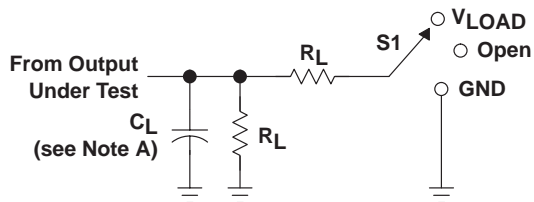
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC}	SN74LVC86A						UNIT	
				T _A = 25°C			-40 TO 85°C		-40 TO 125°C		
				MIN	TYP	MAX	MIN	MAX	MIN		MAX
t _{pd}	A	Y	1.8 V ± 0.15 V	1	4.1	9.4	1	9.9	1	11.4	ns
			2.5 V ± 0.2 V	1	2.9	7.1	1	7.6	1	9.7	
			2.7 V	1	2.8	5.4	1	5.6	1	7.1	
			3.3 V ± 0.3 V	1	2.5	4.4	1	4.6	1	5.8	
t _{sk(o)}			3.3 V ± 0.3 V					1	1.5	ns	

operating characteristics, T_A = 25°C

PARAMETER		TEST CONDITIONS	V _{CC}	TYP	UNIT
C _{pd}	Power dissipation capacitance per gate	f = 10 MHz	1.8 V	6.5	pF
			2.5 V	7.5	
			3.3 V	8.5	



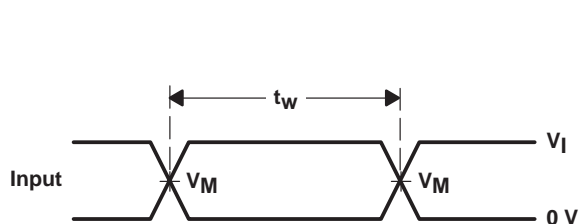
PARAMETER MEASUREMENT INFORMATION



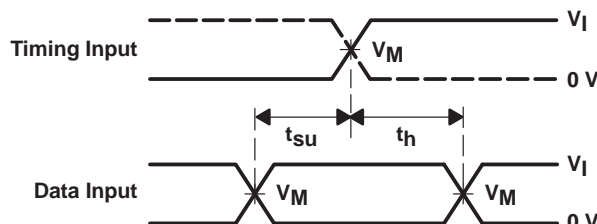
LOAD CIRCUIT

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

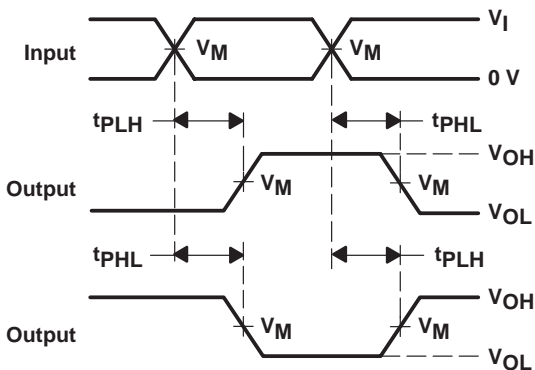
V_{CC}	INPUTS		V_M	V_{LOAD}	C_L	R_L	V_{Δ}
	V_I	t_r/t_f					
$1.8\text{ V} \pm 0.15\text{ V}$	V_{CC}	$\leq 2\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	1 k Ω	0.15 V
$2.5\text{ V} \pm 0.2\text{ V}$	V_{CC}	$\leq 2\text{ ns}$	$V_{CC}/2$	$2 \times V_{CC}$	30 pF	500 Ω	0.15 V
2.7 V	2.7 V	$\leq 2.5\text{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



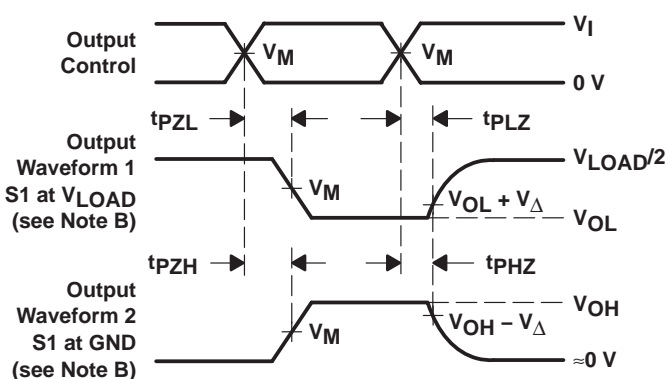
VOLTAGE WAVEFORMS
PULSE DURATION



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:
- 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 1. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
5962-9761901Q2A	ACTIVE	LCCC	FK	20	1	None	Call TI	Level-NC-NC-NC
5962-9761901QCA	ACTIVE	CDIP	J	14	1	None	Call TI	Level-NC-NC-NC
5962-9761901QDA	ACTIVE	CFP	W	14	1	None	Call TI	Level-NC-NC-NC
SN74LVC86AD	ACTIVE	SOIC	D	14	50	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74LVC86ADBLE	OBSOLETE	SSOP	DB	14		None	Call TI	Call TI
SN74LVC86ADBR	ACTIVE	SSOP	DB	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74LVC86ADR	ACTIVE	SOIC	D	14	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74LVC86ADT	ACTIVE	SOIC	D	14	250	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74LVC86ANSR	ACTIVE	SO	NS	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74LVC86APW	ACTIVE	TSSOP	PW	14	90	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74LVC86APWLE	OBSOLETE	TSSOP	PW	14		None	Call TI	Call TI
SN74LVC86APWR	ACTIVE	TSSOP	PW	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74LVC86APWT	ACTIVE	TSSOP	PW	14	250	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74LVC86ARGYR	ACTIVE	QFN	RGY	14	1000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR
SNJ54LVC86AFK	ACTIVE	LCCC	FK	20	1	None	Call TI	Level-NC-NC-NC
SNJ54LVC86AJ	ACTIVE	CDIP	J	14	1	None	Call TI	Level-NC-NC-NC
SNJ54LVC86AW	ACTIVE	CFP	W	14	1	None	Call TI	Level-NC-NC-NC

⁽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 - 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.

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

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.

J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)

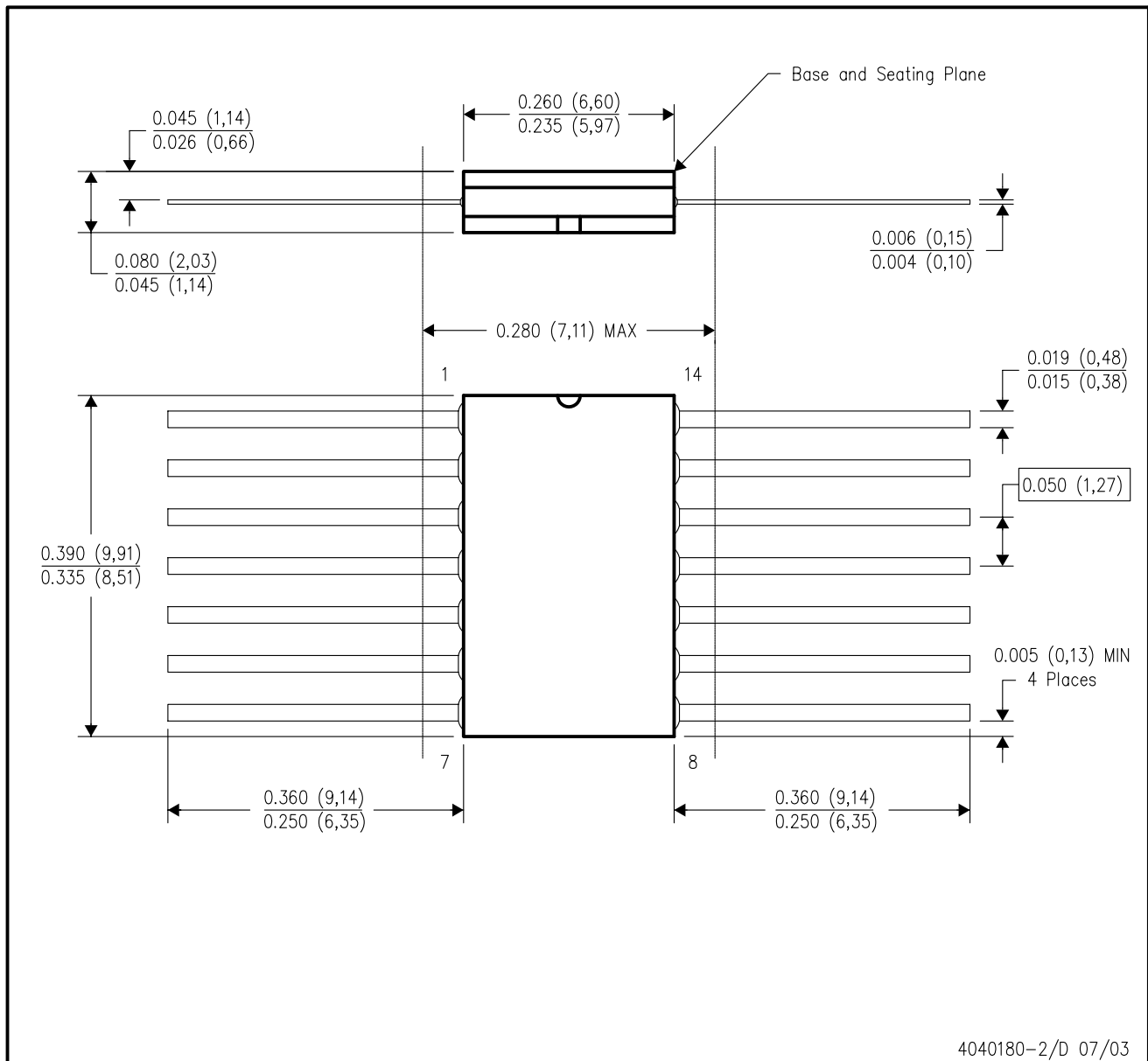


4040083/F 03/03

- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package is hermetically sealed with a ceramic lid using glass frit.
 - Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

W (R-GDFP-F14)

CERAMIC DUAL FLATPACK



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package can be hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only.
 - E. Falls within MIL STD 1835 GDFP1-F14 and JEDEC MO-092AB

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package can be hermetically sealed with a metal lid.
 - D. The terminals are gold plated.
 - E. Falls within JEDEC MS-004

D (R-PDSO-G14)

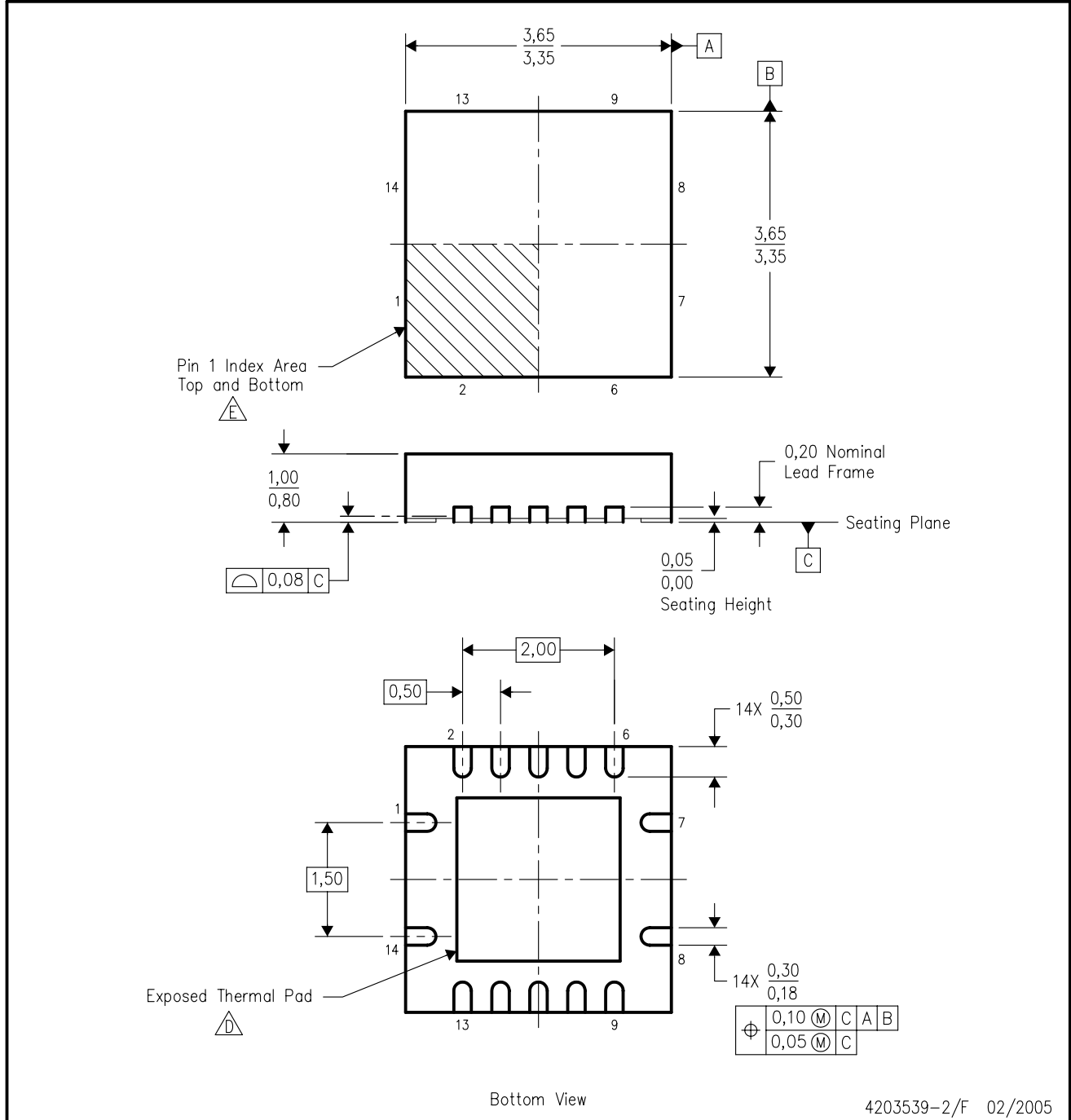
PLASTIC SMALL-OUTLINE PACKAGE



- 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

4040065 /E 12/01

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

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265