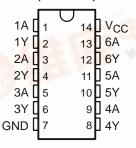
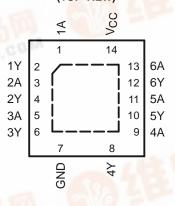
SCLS238I - OCTOBER 1995 - REVISED JULY 2003

- Operating Range 2-V to 5.5-V V<sub>CC</sub>
- 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)

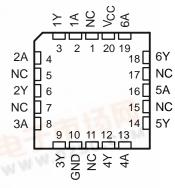
SN54AHC14...J OR W PACKAGE SN74AHC14...D, DB, DGV, N, NS, OR PW PACKAGE (TOP VIEW)



SN74AHC14 . . . RGY PACKAGE (TOP VIEW)



SN54AHC14 . . . FK PACKAGE (TOP VIEW)



NC - No internal connection

### description/ordering information

The 'AHC14 devices contain six independent inverters. These devices perform the Boolean function  $Y = \overline{A}$ .

Each circuit functions as an independent inverter, but because of the Schmitt action, the inverters have different input threshold levels for positive-going  $(V_{T+})$  and negative-going  $(V_{T-})$  signals.

#### ORDERING INFORMATION

TA	PACKAGET		ORDERABLE PART NUMBER	TOP-SIDE MARKING
	QFN – RGY	Tape and reel	SN74AHC14RGYR	HA14
	PDIP – N	Tube	SN74AHC14N	SN74AHC14N
111	SOIC - D	Tube	SN74AHC14D	AHC14
A COLOR	3010 - D	Tape and reel	SN74AHC14DR	AIIC14
-40°C to 85°C	SOP – NS Tape and re		SN74AHC14NSR	AHC14
	SSOP – DB	Tape and reel	SN74AHC14DBR	HA14
	TSSOP – PW	Tube	SN74AHC14PW	HA14
	1330F = FW	Tape and reel	SN74AHC14PWR	HA14
	TVSOP - DGV	Tape and reel	SN74AHC14DGVR	HA14
	CDIP – J	Tube	SNJ54AHC14J	SNJ54AHC14J
–55°C to 125°C	CFP – W	Tube	SNJ54AHC14W	SNJ54AHC14W
	LCCC – FK	Tube	SNJ54AHC14FK	SNJ54AHC14FK

<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.



SCLS238I - OCTOBER 1995 - REVISED JULY 2003

## FUNCTION TABLE (each inverter)

INPUT A	OUTPUT Y
Н	L
L	Н

### logic diagram (positive logic)



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

Supply voltage range, V <sub>CC</sub>	
Output voltage range, VO (see Note 1)	–0.5 V to $V_{CC}$ + 0.5 V
Input clamp current, I <sub>IK</sub> (V <sub>I</sub> < 0)	–20 mA
Output clamp current, I <sub>OK</sub> (V <sub>O</sub> < 0 or V <sub>O</sub> > V <sub>CC</sub> )	±20 mA
Continuous output current, I <sub>O</sub> (V <sub>O</sub> = 0 to V <sub>CC</sub> )	±25 mA
Continuous current through V <sub>CC</sub> or GND	±50 mA
Package thermal impedance, θ <sub>JA</sub> (see Note 2): D package	86°C/W
(see Note 2): DB package	96°C/W
(see Note 2): DGV package	
(see Note 2): N package	
(see Note 2): NS package	76°C/W
(see Note 2): PW package	113°C/W
(see Note 3): RGY package	
Storage temperature range, T <sub>stq</sub>	

<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 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 51-7.
- 3. The package thermal impedance is calculated in accordance with JESD 51-5.

### recommended operating conditions (see Note 4)

			SN54A	HC14	SN74A	HC14	UNIT
			MIN	MAX	MIN	MAX	UNIT
Vcc	Supply voltage		2	5.5	2	5.5	V
٧ı	Input voltage		0	5.5	0	5.5	V
٧o	Output voltage		0	VCC	0	VCC	V
		V <sub>CC</sub> = 2 V		<del>-</del> 50		-50	μΑ
ЮН	High-level output current	$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$		-4		-4	mA
		$V_{CC} = 5 V \pm 0.5 V$				-8	ША
		V <sub>CC</sub> = 2 V		50		50	μΑ
loL	Low-level output current	$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$		4		4	mA
	$V_{CC} = 5 V \pm 0.5 V$			8		8	IIIA
TA	Operating free-air temperature		-55	125	-40	85	°C

NOTE 4: 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.



SCLS238I - OCTOBER 1995 - REVISED JULY 2003

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

PARAMETER	TEST CONDITIONS	V	T,	Δ = 25°C	SN54A	HC14	SN74A	HC14	UNIT
PARAMETER	TEST CONDITIONS	Vcc	MIN	TYP MAX	MIN	MAX	MIN	MAX	UNIT
V <sub>T+</sub>		3 V	1.2	2.2	1.2	2.2	1.2	2.2	
Positive-going		4.5 V	1.75	3.15	1.75	3.15	1.75	3.15	V
input threshold voltage		5.5 V	2.15	3.85	2.15	3.85	2.15	3.85	
V <sub>T</sub> _		3 V	0.9	1.9	0.9	1.9	0.9	1.9	
Negative-going		4.5 V	1.35	2.75	1.35	2.75	1.35	2.75	V
input threshold voltage		5.5 V	1.65	3.35	1.65	3.35	1.65	3.35	
		3 V	0.3	1.2	0.3	1.2	0.3	1.2	
$\Delta V_T$ Hysteresis ( $V_{T+} - V_{T-}$ )		4.5 V	0.4	1.4	0.4	1.4	0.4	1.4	V
11/30010313 (*   ‡ * *   = /		5.5 V	0.5	1.6	0.5	1.6	0.5	1.6	
		2 V	1.9	2	1.9		1.9		
	I <sub>OH</sub> = -50 μA	3 V	2.9	3	2.9		2.9		
Voн		4.5 V	4.4	4.5	4.4		4.4		V
	$I_{OH} = -4 \text{ mA}$	3 V	2.58		2.48		2.48		
	$I_{OH} = -8 \text{ mA}$	4.5 V	3.94		3.8		3.8		
		2 V		0.1		0.1		0.1	
	I <sub>OL</sub> = 50 μA	3 V		0.1		0.1		0.1	
V <sub>OL</sub>		4.5 V		0.1		0.1		0.1	V
	I <sub>OL</sub> = 4 mA	3 V		0.36		0.5		0.44	
	$I_{OL} = 8 \text{ mA}$	4.5 V		0.36		0.5		0.44	
lį	V <sub>I</sub> = 5.5 V or GND	0 V to 5.5 V		±0.1		±1*		±1	μΑ
lcc	$V_I = V_{CC}$ or GND, $I_O = 0$	5.5 V		2		20		20	μΑ
C <sub>i</sub>	$V_I = V_{CC}$ or GND	5 V		2 10				10	pF

<sup>\*</sup> On products compliant to MIL-PRF-38535, this parameter is not production tested at  $V_{CC} = 0 \text{ V}$ .

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

DADAMETED	FROM	то	LOAD	T,	<sub>Δ</sub> = 25°(	3	SN54A	HC14	SN74A	HC14	UNIT		
PARAMETER	(INPUT)	(OUTPUT)	CAPACITANCE	MIN	TYP	MAX	MIN	MAX	MIN	MAX	UNIT		
<sup>t</sup> PLH	Λ	V	C 15 pF		8.3**	12.8**	1**	15**	1	15	no		
t <sub>PHL</sub>	А	ī	C <sub>L</sub> = 15 pF	OL = 13 bi		8.3**	12.8**	1**	15**	1	15	ns	
t <sub>PLH</sub>	A V	Y	Y C <sub>L</sub> = 50 pF	C: - 50 pE		10.8	16.3	1	18.5	1	18.5	no	
<sup>t</sup> PHL	Α			f	CL = 50 pF	$C_L = 50 \text{ pF}$	CL = 50 pr		10.8	16.3	1	18.5	1

<sup>\*\*</sup> 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 V $\pm$ 0.5 V (unless otherwise noted) (see Figure 1)

00	•		, ,	•	•							
PARAMETER	FROM	то	LOAD	T,	4 = 25°C	;	SN54A	HC14	SN74A	HC14	UNIT	
PARAMETER	(INPUT)	(OUTPUT)	CAPACITANCE	MIN	TYP	MAX	MIN	MAX	MIN	MAX	UNIT	
tPLH	۸		C <sub>L</sub> = 15 pF		5.5**	8.6**	1**	10**	1	10	no	
t <sub>PHL</sub>	А	ī		OL = 13 pi		5.5**	8.6**	1**	10**	1	10	ns
tPLH	А	V	V C.	C: 50 pF		7	10.6	1	12	1	12	ns
t <sub>PHL</sub>	^	ſ	$C_L = 50 \text{ pF}$		7	10.6	1	12	1	12	115	

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



### SN54AHC14, SN74AHC14 HEX SCHMITT-TRIGGER INVERTERS

SCLS238I - OCTOBER 1995 - REVISED JULY 2003

### noise characteristics, $V_{CC}$ = 5 V, $C_L$ = 50 pF, $T_A$ = 25°C (see Note 5)

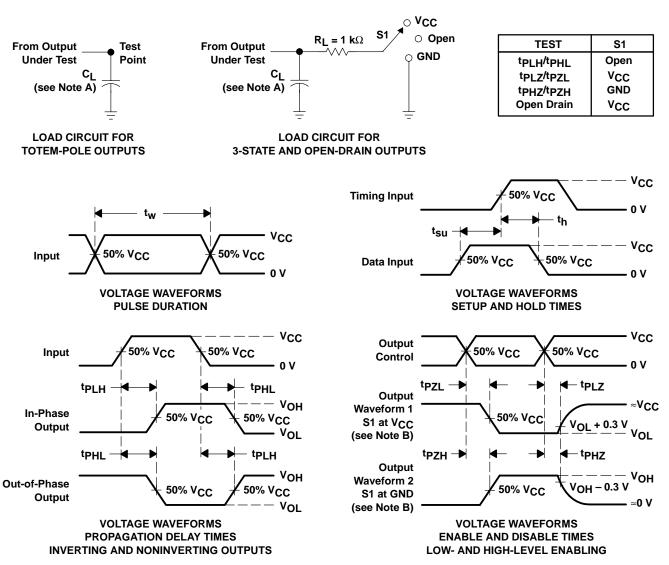
	DADAMETED	SN	UNIT		
	PARAMETER				UNIT
V <sub>OL(P)</sub>	Quiet output, maximum dynamic V <sub>OL</sub>		0.8		V
V <sub>OL(V)</sub>	Quiet output, minimum dynamic V <sub>OL</sub>		-0.4		V
V <sub>OH(V)</sub>	Quiet output, minimum dynamic V <sub>OH</sub>		4.6		V
VIH(D)	High-level dynamic input voltage	3.5			V
V <sub>IL(D)</sub>	Low-level dynamic input voltage			1.5	V

NOTE 5: Characteristics are for surface-mount packages only.

### operating characteristics, $V_{CC}$ = 5 V, $T_A$ = 25°C

	PARAMETER	TEST CONDITIONS	TYP	UNIT
C <sub>pd</sub>	Power dissipation capacitance	No load, f = 1 MHz	9	pF

#### PARAMETER MEASUREMENT INFORMATION



NOTES: A. C<sub>I</sub> 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 MHz,  $Z_O = 50 \Omega$ ,  $t_f \leq 3$  ns.  $t_f \leq 3$  ns.
- D. The outputs are measured one at a time with one input transition per measurement.
- E. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms







18-Mar-2005

### **PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
5962-9680201Q2A	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
5962-9680201QCA	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
5962-9680201QDA	ACTIVE	CFP	W	14	1	TBD	Call TI	Level-NC-NC-NC
5962-9682001QCA	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
5962-9682001QDA	ACTIVE	CFP	W	14	1	TBD	Call TI	Level-NC-NC-NC
SN74AHC14D	ACTIVE	SOIC	D	14	50	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74AHC14DBLE	OBSOLETE	SSOP	DB	14		TBD	Call TI	Call TI
SN74AHC14DBR	ACTIVE	SSOP	DB	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74AHC14DGVR	ACTIVE	TVSOP	DGV	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74AHC14DR	ACTIVE	SOIC	D	14	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74AHC14N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74AHC14NSR	ACTIVE	SO	NS	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74AHC14PW	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC14PWLE	OBSOLETE	TSSOP	PW	14		TBD	Call TI	Call TI
SN74AHC14PWR	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC14RGYR	ACTIVE	QFN	RGY	14	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
SNJ54AHC08J	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
SNJ54AHC08W	ACTIVE	CFP	W	14	1	TBD	Call TI	Level-NC-NC-NC
SNJ54AHC14FK	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
SNJ54AHC14J	ACTIVE	CDIP	J	14	1	TBD	Call TI	Level-NC-NC-NC
SNJ54AHC14W	ACTIVE	CFP	W	14	1	TBD	Call TI	Level-NC-NC-NC

<sup>&</sup>lt;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.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) 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.

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)

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

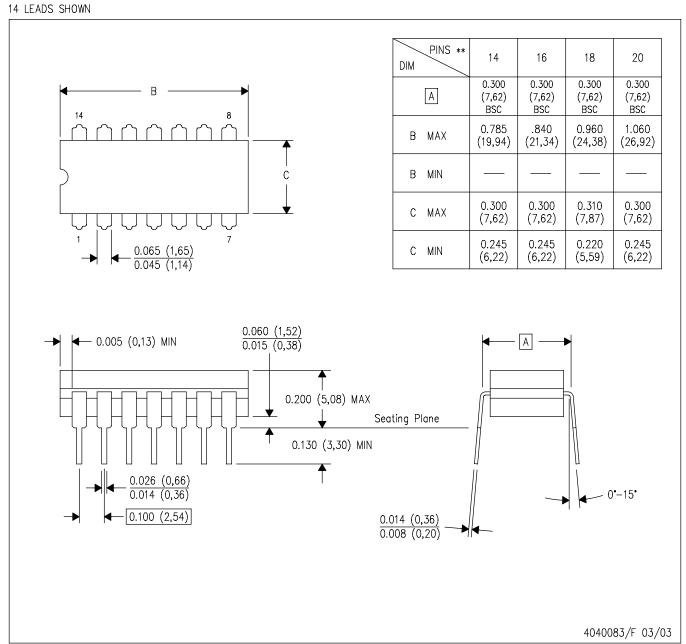


### PACKAGE OPTION ADDENDUM

18-Mar-2005

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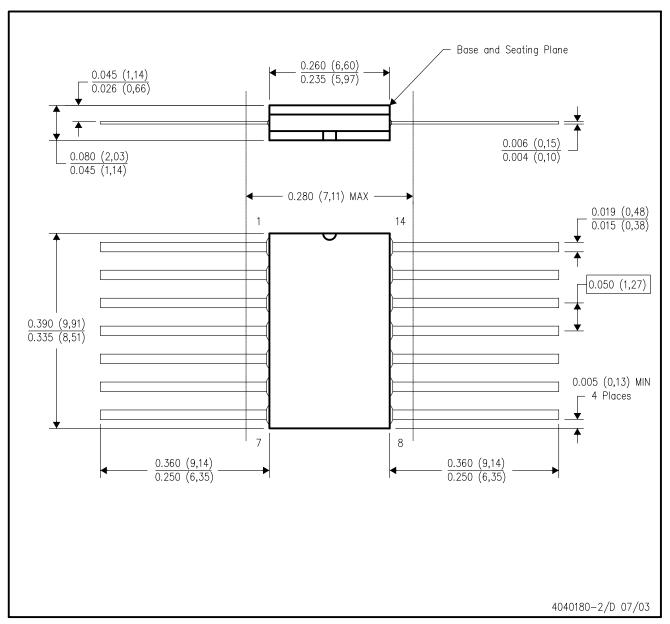
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- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. This package is hermetically sealed with a ceramic lid using glass frit.
- D. Index point is provided on cap for terminal identification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

### W (R-GDFP-F14)

### CERAMIC DUAL FLATPACK



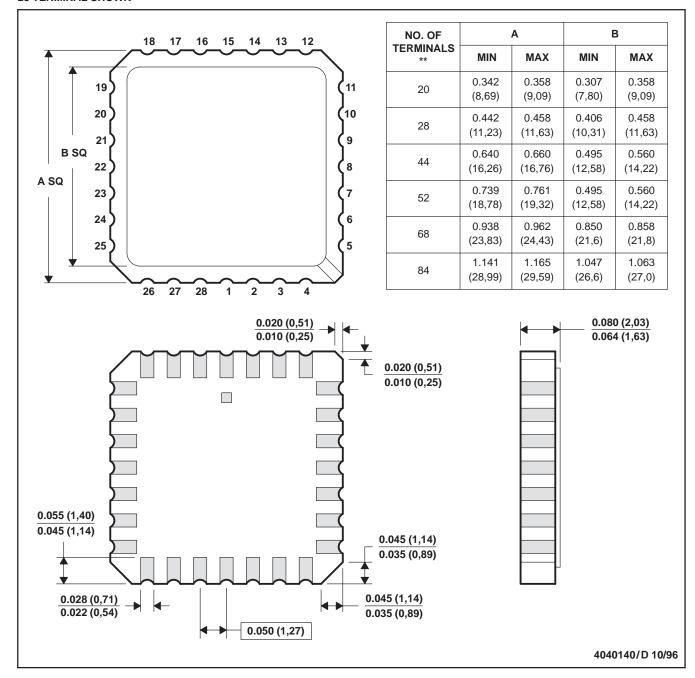
- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. This package can be hermetically sealed with a ceramic lid using glass frit.
- D. Index point is provided on cap for terminal identification only.
- E. Falls within MIL STD 1835 GDFP1-F14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



### FK (S-CQCC-N\*\*)

#### **28 TERMINAL SHOWN**

### LEADLESS CERAMIC CHIP CARRIER



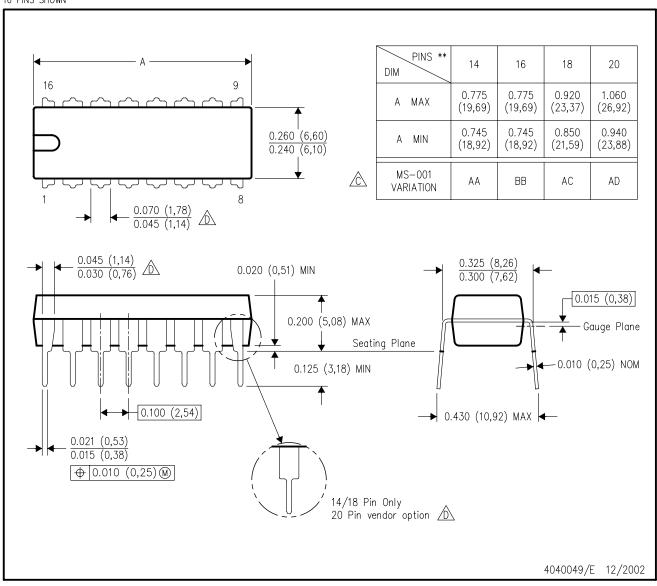
- NOTES: A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a metal lid.
  - D. The terminals are gold plated.
  - E. Falls within JEDEC MS-004



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

### PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN

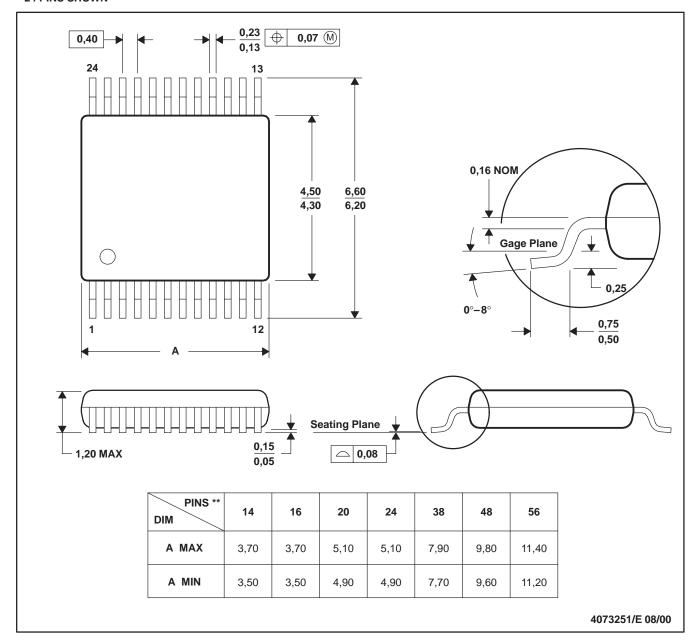


- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
- The 20 pin end lead shoulder width is a vendor option, either half or full width.

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

### **24 PINS SHOWN**

### **PLASTIC SMALL-OUTLINE**



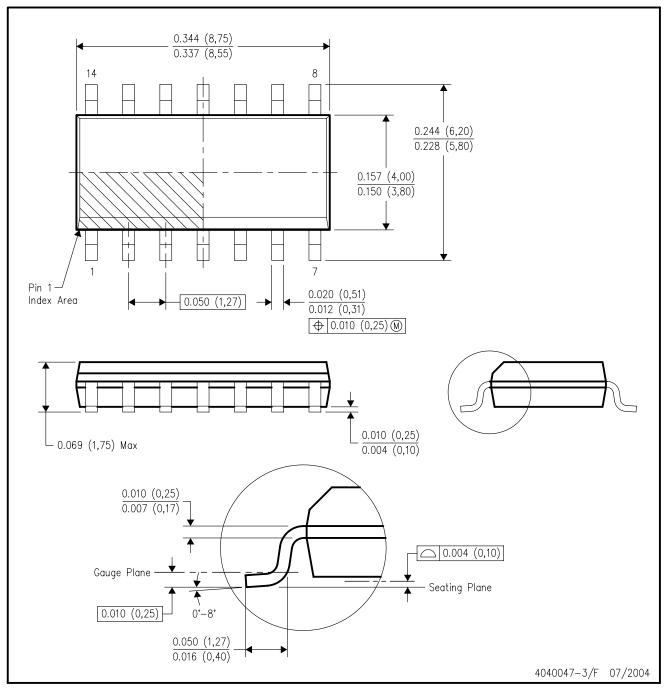
NOTES: A. All linear dimensions are in millimeters.

- 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



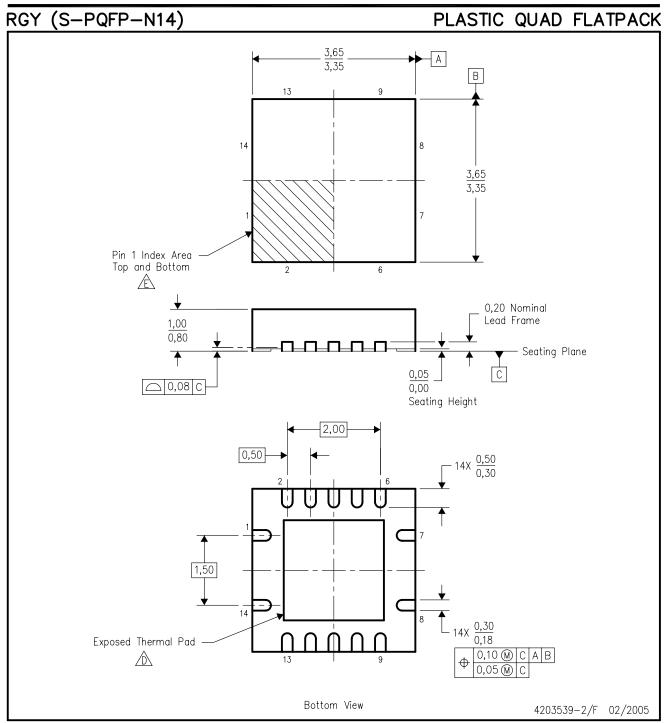
### D (R-PDSO-G14)

### PLASTIC SMALL-OUTLINE PACKAGE



- 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.





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.

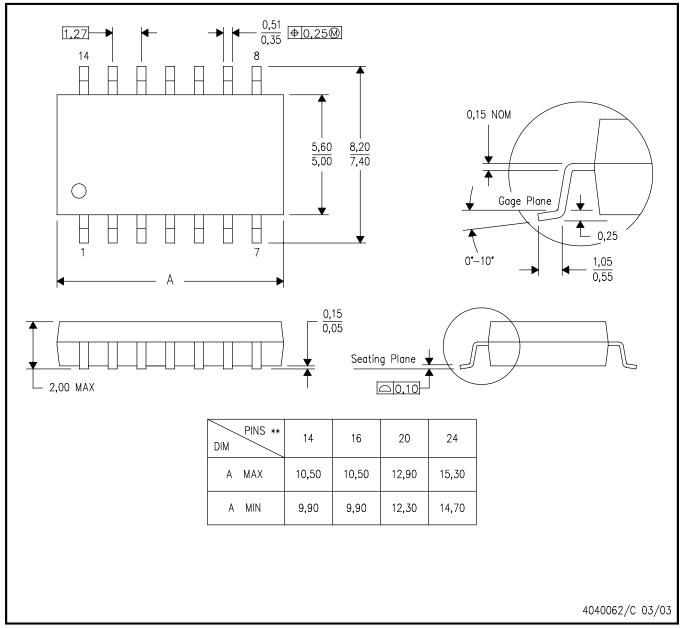


### **MECHANICAL DATA**

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

### 14-PINS SHOWN

### PLASTIC SMALL-OUTLINE PACKAGE



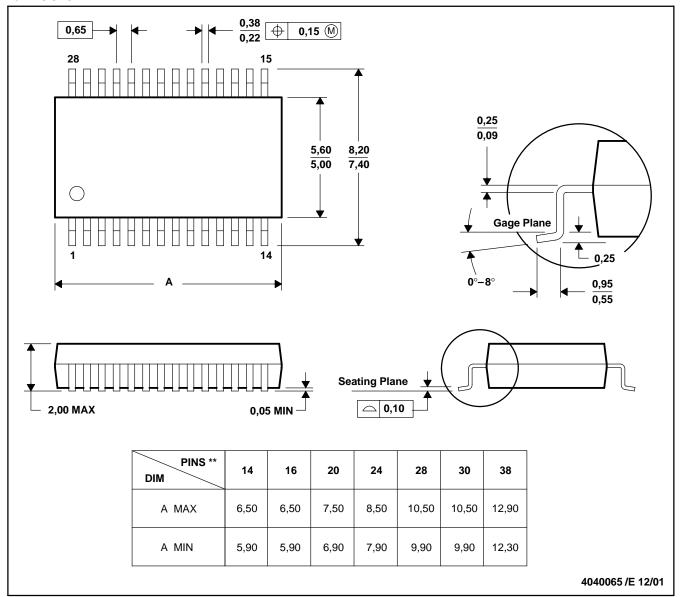
- . All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.



### 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\*\*)

### 14 PINS SHOWN

### PLASTIC SMALL-OUTLINE PACKAGE



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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