PCB **SN54HC14, SN74HC14**
HEX SCHMITT-TRIGGER INVERTERS

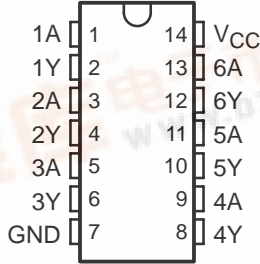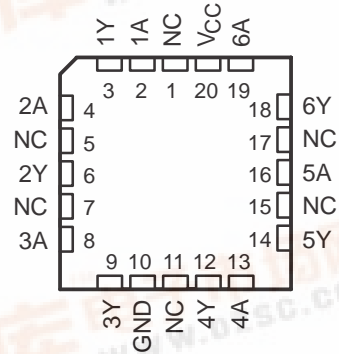SCLS085E − DECEMBER 1982 − REVISED NOVEMBER 2004

- **Wide Operating Voltage Range of 2 V to 6 V**
- **Outputs Can Drive Up To 10 LSTTL Loads**
- **Low Power Consumption, 20-μA Max I_{CC}**
- **Typical t_{pd} = 11 ns**
- **±4-mA Output Drive at 5 V**
- **Low Input Current of 1 μA Max**

SN54HC14 . . . J OR W PACKAGE
SN74HC14 . . . D, DB, N, NS, OR PW PACKAGE
(TOP VIEW)

```
        ┌───┬───┐
1A  [ 1      14 ] V_CC
1Y  [ 2      13 ] 6A
2A  [ 3      12 ] 6Y
2Y  [ 4      11 ] 5A
3A  [ 5      10 ] 5Y
3Y  [ 6       9 ] 4A
GND [ 7       8 ] 4Y
        └───────┘
```

SN54HC14 . . . FK PACKAGE
(TOP VIEW)

```
        1Y 1A NC V_CC 6A
         3  2  1  20 19
2A  [ 4           18 ] 6Y
NC  [ 5           17 ] NC
2Y  [ 6           16 ] 5A
NC  [ 7           15 ] NC
3A  [ 8           14 ] 5Y
         9 10 11 12 13
        3Y GND NC 4Y 4A
```

NC − No internal connection

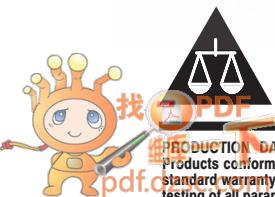## description/ordering information

These Schmitt-trigger devices contain six independent inverters. They perform the Boolean function $Y = \overline{A}$ in positive logic.

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
−40°C to 85°C	PDIP − N	Tube of 25	SN74HC14N	SN74HC14N
	SOIC − D	Tube of 50	SN74HC14D	HC14
		Reel of 2500	SN74HC14DR	
		Reel of 250	SN74HC14DT	
	SOP − NS	Reel of 2000	SN74HC14NSR	HC14
	SSOP − DB	Reel of 2000	SN74HC14DBR	HC14
	TSSOP − PW	Tube of 90	SN74HC14PW	HC14
		Reel of 2000	SN74HC14PWR	
		Reel of 250	SN74HC14PWT	
−55°C to 125°C	CDIP − J	Tube	SNJ54HC14J	SNJ54HC14J
	CFP − W	Tube	SNJ54HC14W	SNJ54HC14W
	LCCC − FK	Tube	SNJ54HC14FK	SNJ54HC14FK

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

TEXAS INSTRUMENTS

SN54HC14, SN74HC14
HEX SCHMITT-TRIGGER INVERTERS

SCLS085E – DECEMBER 1982 – REVISED NOVEMBER 2004

FUNCTION TABLE
(each inverter)

INPUT A	OUTPUT Y
H	L
L	H

logic diagram (positive logic)

A ——————▷⟑○—— Y

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

Supply voltage range, V_{CC} .... −0.5 V to 7 V
Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{CC}$) (see Note 1) .... ±20 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$) (see Note 1) .... ±20 mA
Continuous output current, I_O ($V_O = 0$ to V_{CC}) .... ±25 mA
Continuous current through V_{CC} or GND .... ±50 mA
Package thermal impedance, θ_{JA} (see Note 2): D package .... 86°C/W
DB package .... 96°C/W
N package .... 80°C/W
NS package .... 76°C/W
PW package .... 113°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. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 3)

		SN54HC14			SN74HC14			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage	2	5	6	2	5	6	V
V_I	Input voltage	0		V_{CC}	0		V_{CC}	V
V_O	Output voltage	0		V_{CC}	0		V_{CC}	V
T_A	Operating free-air temperature	−55		125	−40		85	°C

NOTE 3: 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.

TEXAS
INSTRUMENTS

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

PARAMETER	TEST CONDITIONS		V_{CC}	$T_A = 25°C$			SN54HC14		SN74HC14		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V_{T+}			2 V	0.7	1.2	1.5	0.7	1.5	0.7	1.5	V
			4.5 V	1.55	2.5	3.15	1.55	3.15	1.55	3.15	
			6 V	2.1	3.3	4.2	2.1	4.2	2.1	4.2	
V_{T-}			2 V	0.3	0.6	1	0.3	1	0.3	1	V
			4.5 V	0.9	1.6	2.45	0.9	2.45	0.9	2.45	
			6 V	1.2	2	3.2	1.2	3.2	1.2	3.2	
$V_{T+} - V_{T-}$			2 V	0.2	0.6	1.2	0.2	1.2	0.2	1.2	V
			4.5 V	0.4	0.9	2.1	0.4	2.1	0.4	2.1	
			6 V	0.5	1.3	2.5	0.5	2.5	0.5	2.5	
V_{OH}	$V_I = V_{IH}$ or V_{IL}	$I_{OH} = -20\ \mu A$	2 V	1.9	1.998		1.9		1.9		V
			4.5 V	4.4	4.499		4.4		4.4		
			6 V	5.9	5.999		5.9		5.9		
		$I_{OH} = -4\ mA$	4.5 V	3.98	4.3		3.7		3.84		
		$I_{OH} = -5.2\ mA$	6 V	5.48	5.8		5.2		5.34		
V_{OL}	$V_I = V_{IH}$ or V_{IL}	$I_{OL} = 20\ \mu A$	2 V		0.002	0.1		0.1		0.1	V
			4.5 V		0.001	0.1		0.1		0.1	
			6 V		0.001	0.1		0.1		0.1	
		$I_{OL} = 4\ mA$	4.5 V		0.17	0.26		0.4		0.33	
		$I_{OL} = 5.2\ mA$	6 V		0.15	0.26		0.4		0.33	
I_I	$V_I = V_{CC}$ or 0		6 V		±0.1	±100		±1000		±1000	nA
I_{CC}	$V_I = V_{CC}$ or 0, $I_O = 0$		6 V			2		40		20	µA
C_i			2 V to 6 V		3	10		10		10	pF

switching characteristics over recommended operating free-air temperature range, $C_L = 50$ pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC}	$T_A = 25°C$			SN54HC14		SN74HC14		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A	Y	2 V		55	125		190		155	ns
			4.5 V		12	25		38		31	
			6 V		11	21		32		26	
t_t		Y	2 V		38	75		110		95	ns
			4.5 V		8	15		22		19	
			6 V		6	13		19		16	

operating characteristics, $T_A = 25°C$

PARAMETER		TEST CONDITIONS	TYP	UNIT
C_{pd}	Power dissipation capacitance per inverter	No load	20	pF

PARAMETER MEASUREMENT INFORMATION

From Output Under Test — **Test Point**

C_L = 50 pF
(see Note A)

LOAD CIRCUIT

Input 50% 90% 90% 50% 10% — V_{CC} / 0 V

t_r t_f

VOLTAGE WAVEFORM
INPUT RISE AND FALL TIMES

Input 50% 50% — V_{CC} / 0 V

t_{PLH} t_{PHL}

In-Phase Output 50% 90% 90% 50% 10% 10% — V_{OH} / V_{OL}

t_r t_f

t_{PHL} t_{PLH}

Out-of-Phase Output 90% 50% 50% 90% 10% 10% — V_{OH} / V_{OL}

t_f t_r

VOLTAGE WAVEFORMS
PROPAGATION DELAY AND OUTPUT TRANSITION TIMES
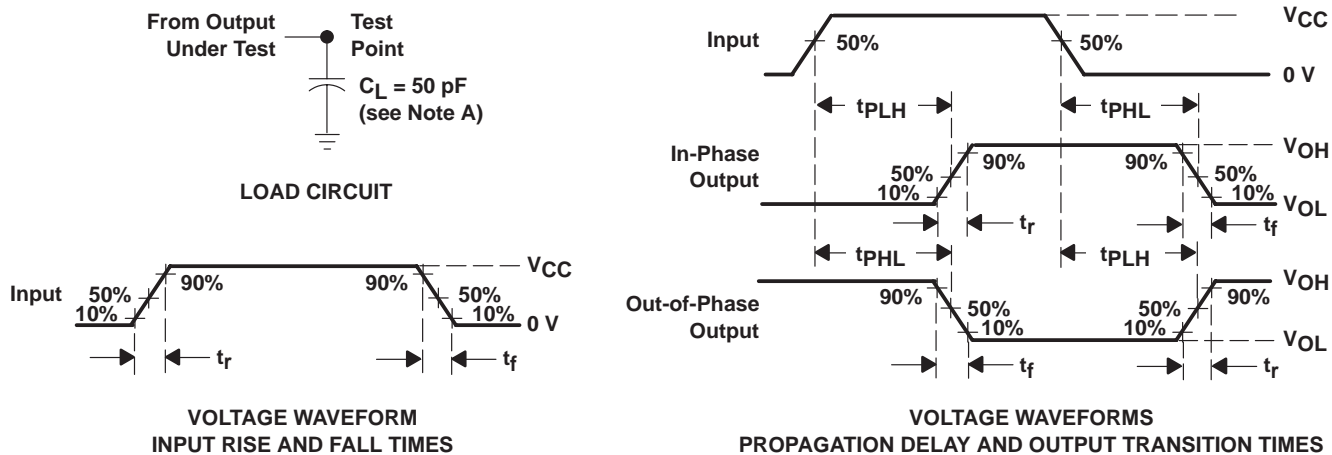
NOTES: A. C_L includes probe and test-fixture capacitance.
   B. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z_O = 50 Ω, t_r = 6 ns, t_f = 6 ns.
   C. The outputs are measured one at a time, with one input transition per measurement.
   D. t_{PLH} and t_{PHL} are the same as t_{pd}.

Figure 1. Load Circuit and Voltage Waveforms

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INSTRUMENTS

PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
5962-8409101VCA	ACTIVE	CDIP	J	14	1	None	Call TI	Level-NC-NC-NC
5962-8409101VDA	ACTIVE	CFP	W	14	1	None	Call TI	Level-NC-NC-NC
84091012A	ACTIVE	LCCC	FK	20	1	None	Call TI	Level-NC-NC-NC
8409101CA	ACTIVE	CDIP	J	14	1	None	Call TI	Level-NC-NC-NC
8409101DA	ACTIVE	CFP	W	14	1	None	Call TI	Level-NC-NC-NC
JM38510/65702BCA	ACTIVE	CDIP	J	14	1	None	Call TI	Level-NC-NC-NC
JM38510/65702BDA	ACTIVE	CFP	W	14	1	None	Call TI	Level-NC-NC-NC
SN54HC14J	ACTIVE	CDIP	J	14	1	None	Call TI	Level-NC-NC-NC
SN74HC14D	ACTIVE	SOIC	D	14	50	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74HC14DBR	ACTIVE	SSOP	DB	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74HC14DR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74HC14DT	ACTIVE	SOIC	D	14	250	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74HC14N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74HC14N3	OBSOLETE	PDIP	N	14		None	Call TI	Call TI
SN74HC14NS	ACTIVE	SO	NS	14		Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74HC14NSLE	OBSOLETE	SO	NS	14		None	Call TI	Call TI
SN74HC14NSR	ACTIVE	SO	NS	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74HC14PW	ACTIVE	TSSOP	PW	14	90	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74HC14PWLE	OBSOLETE	TSSOP	PW	14		None	Call TI	Call TI
SN74HC14PWR	ACTIVE	TSSOP	PW	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74HC14PWT	ACTIVE	TSSOP	PW	14	250	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SNJ54HC14FK	ACTIVE	LCCC	FK	20	1	None	Call TI	Level-NC-NC-NC
SNJ54HC14J	ACTIVE	CDIP	J	14	1	None	Call TI	Level-NC-NC-NC
SNJ54HC14W	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 JEDECindustry standard classifications, and peak solder temperature.

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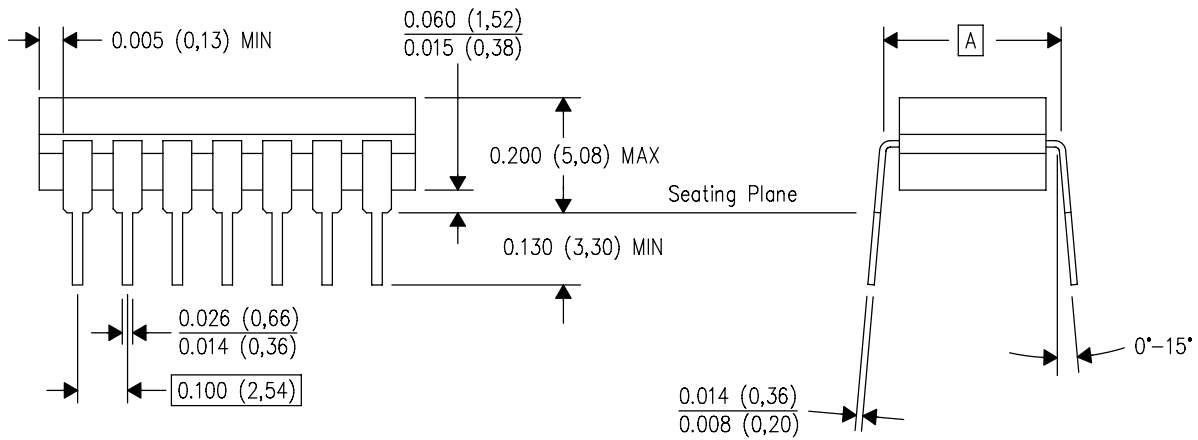
CERAMIC DUAL IN−LINE PACKAGE
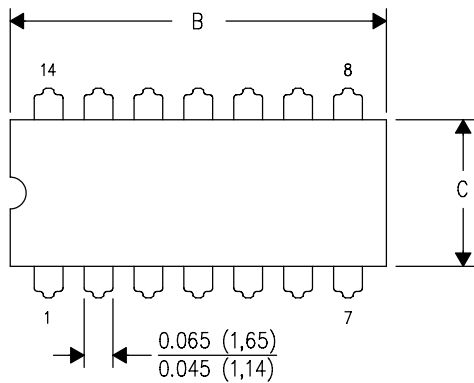
DIM / PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)

B

14   8

1   7

0.065 (1,65)
0.045 (1,14)

C

0.005 (0,13) MIN

0.060 (1,52)
0.015 (0,38)

0.200 (5,08) MAX

Seating Plane

0.130 (3,30) MIN

0.026 (0,66)
0.014 (0,36)

0.100 (2,54)

A

0°−15°

0.014 (0,36)
0.008 (0,20)

4040083/F 03/03

NOTES: 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

Base and Seating Plane

$\frac{0.045\ (1,14)}{0.026\ (0,66)}$

$\frac{0.260\ (6,60)}{0.235\ (5,97)}$

$\frac{0.006\ (0,15)}{0.004\ (0,10)}$

$\frac{0.080\ (2,03)}{0.045\ (1,14)}$

0.280 (7,11) MAX

1   14

$\frac{0.019\ (0,48)}{0.015\ (0,38)}$

0.050 (1,27)

$\frac{0.390\ (9,91)}{0.335\ (8,51)}$

0.005 (0,13) MIN
4 Places

7   8

$\frac{0.360\ (9,14)}{0.250\ (6,35)}$ $\frac{0.360\ (9,14)}{0.250\ (6,35)}$
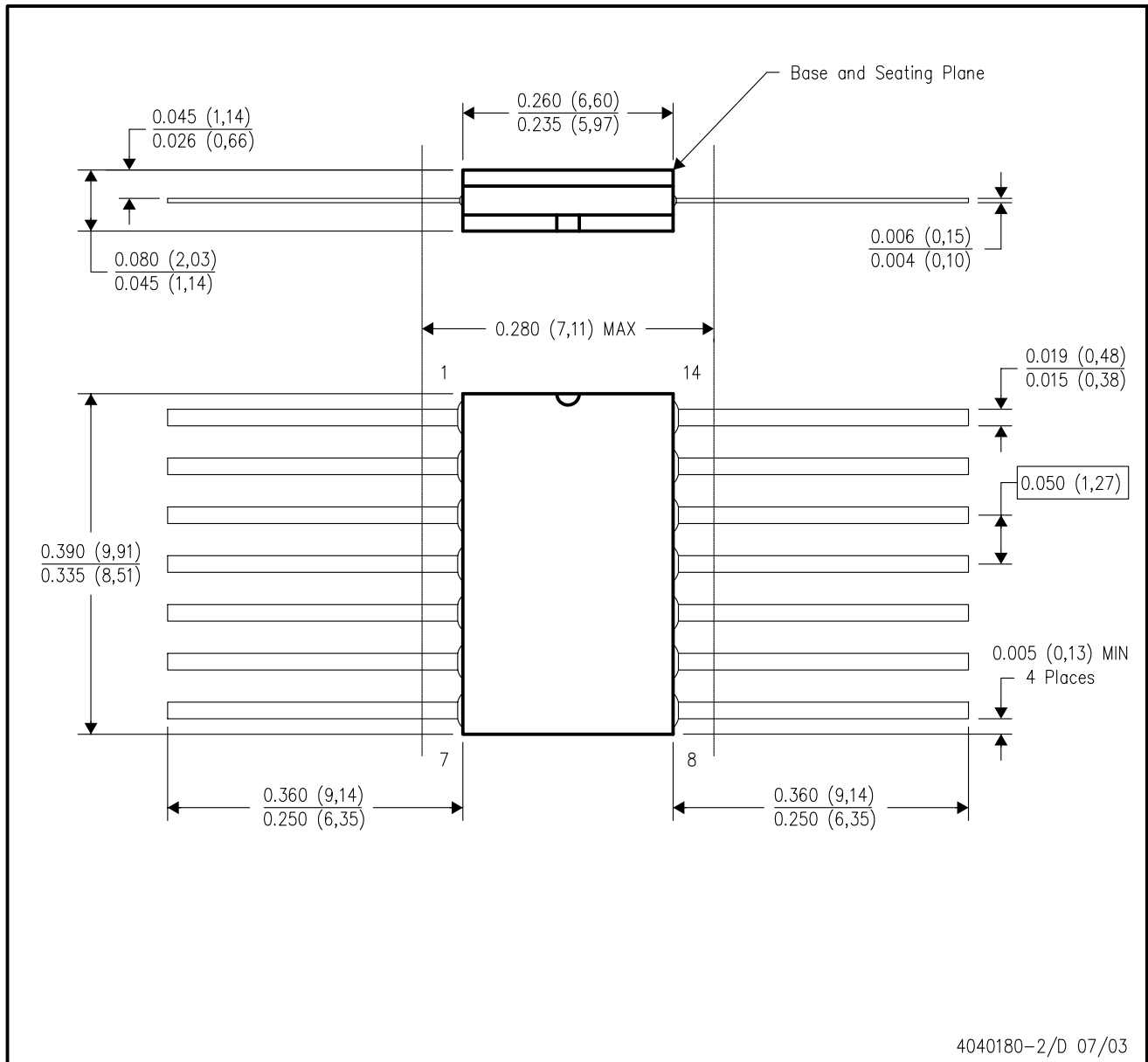
4040180−2/D 07/03

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.
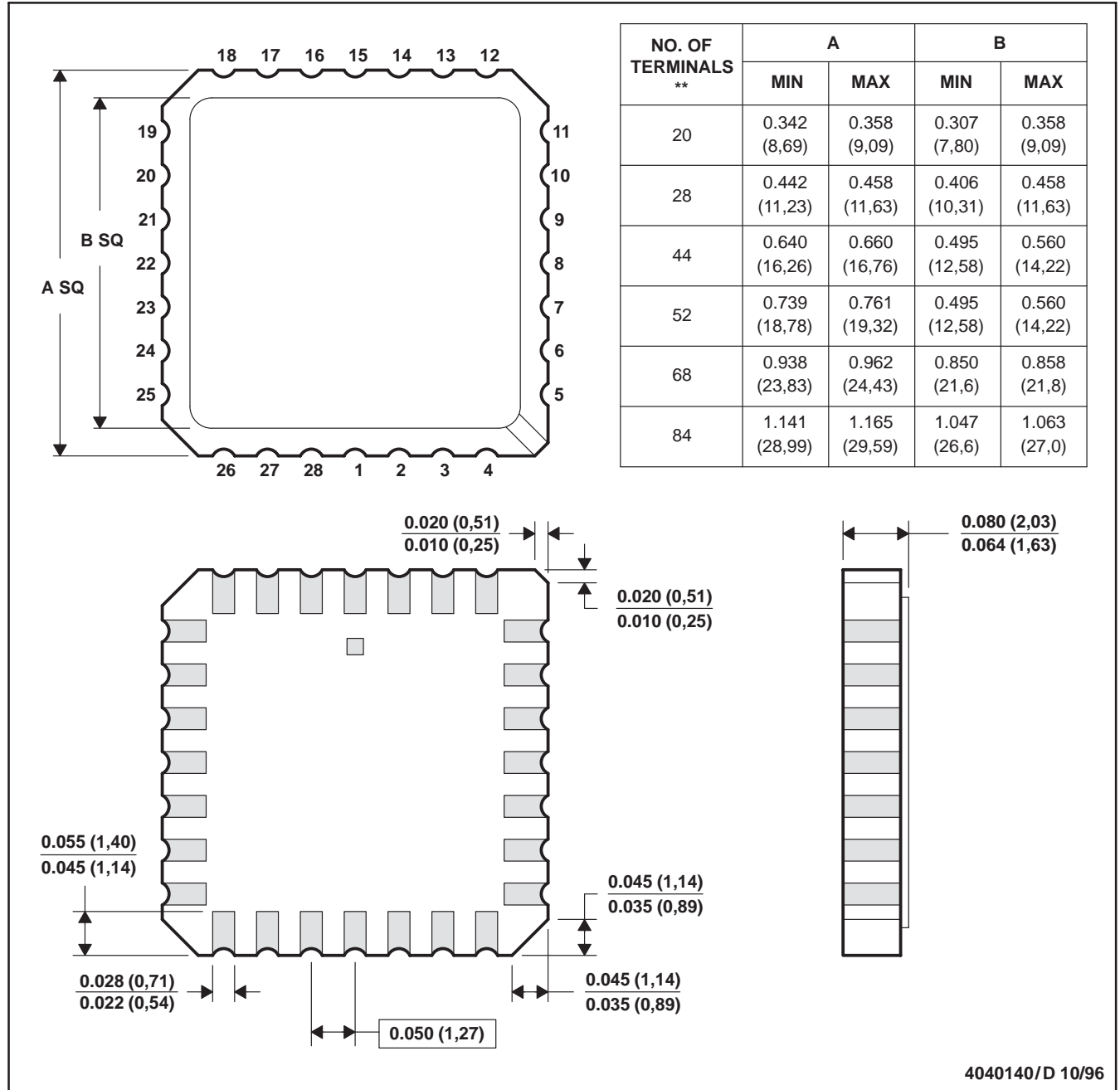   E.   Falls within MIL STD 1835 GDFP1−F14 and JEDEC MO−092AB

MECHANICAL DATA

FK (S-CQCC-N**)

28 TERMINAL SHOWN

LEADLESS CERAMIC CHIP CARRIER

NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.739 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)

0.020 (0,51) / 0.010 (0,25)

0.020 (0,51) / 0.010 (0,25)

0.080 (2,03) / 0.064 (1,63)

0.055 (1,40) / 0.045 (1,14)

0.045 (1,14) / 0.035 (0,89)

0.028 (0,71) / 0.022 (0,54)

0.045 (1,14) / 0.035 (0,89)
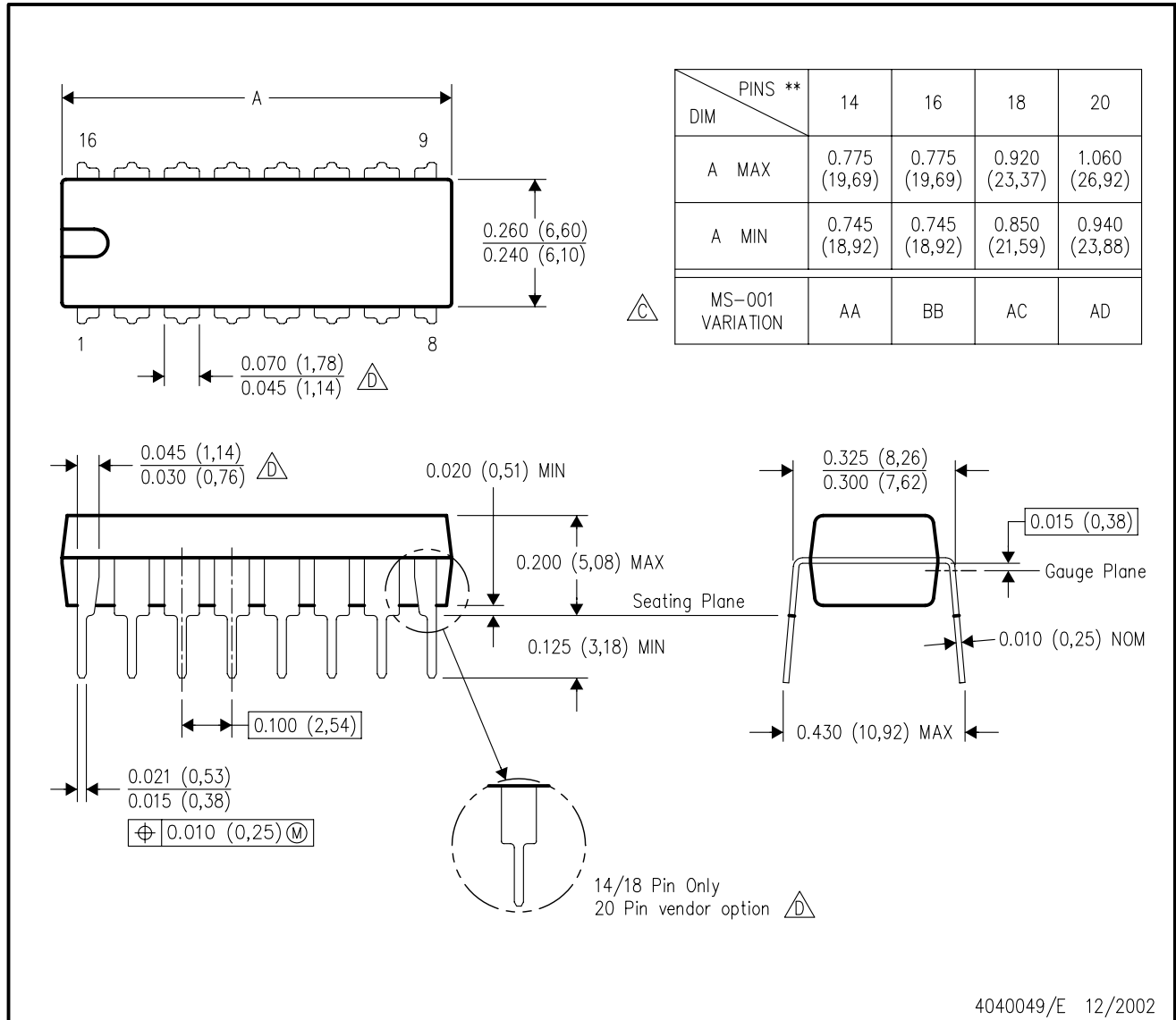
0.050 (1,27)

4040140 / D 10/96

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

TEXAS
INSTRUMENTS

N (R-PDIP-T**)
PLASTIC DUAL-IN-LINE PACKAGE
16 PINS SHOWN

PINS ** DIM	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
△C MS-001 VARIATION	AA	BB	AC	AD

0.260 (6,60)
0.240 (6,10)

0.070 (1,78)
0.045 (1,14) △D

0.045 (1,14)
0.030 (0,76) △D

0.020 (0,51) MIN

0.200 (5,08) MAX

Seating Plane

0.125 (3,18) MIN

0.100 (2,54)

0.021 (0,53)
0.015 (0,38)

⊕ 0.010 (0,25) Ⓜ

0.325 (8,26)
0.300 (7,62)

0.015 (0,38)

Gauge Plane

0.010 (0,25) NOM

0.430 (10,92) MAX

14/18 Pin Only
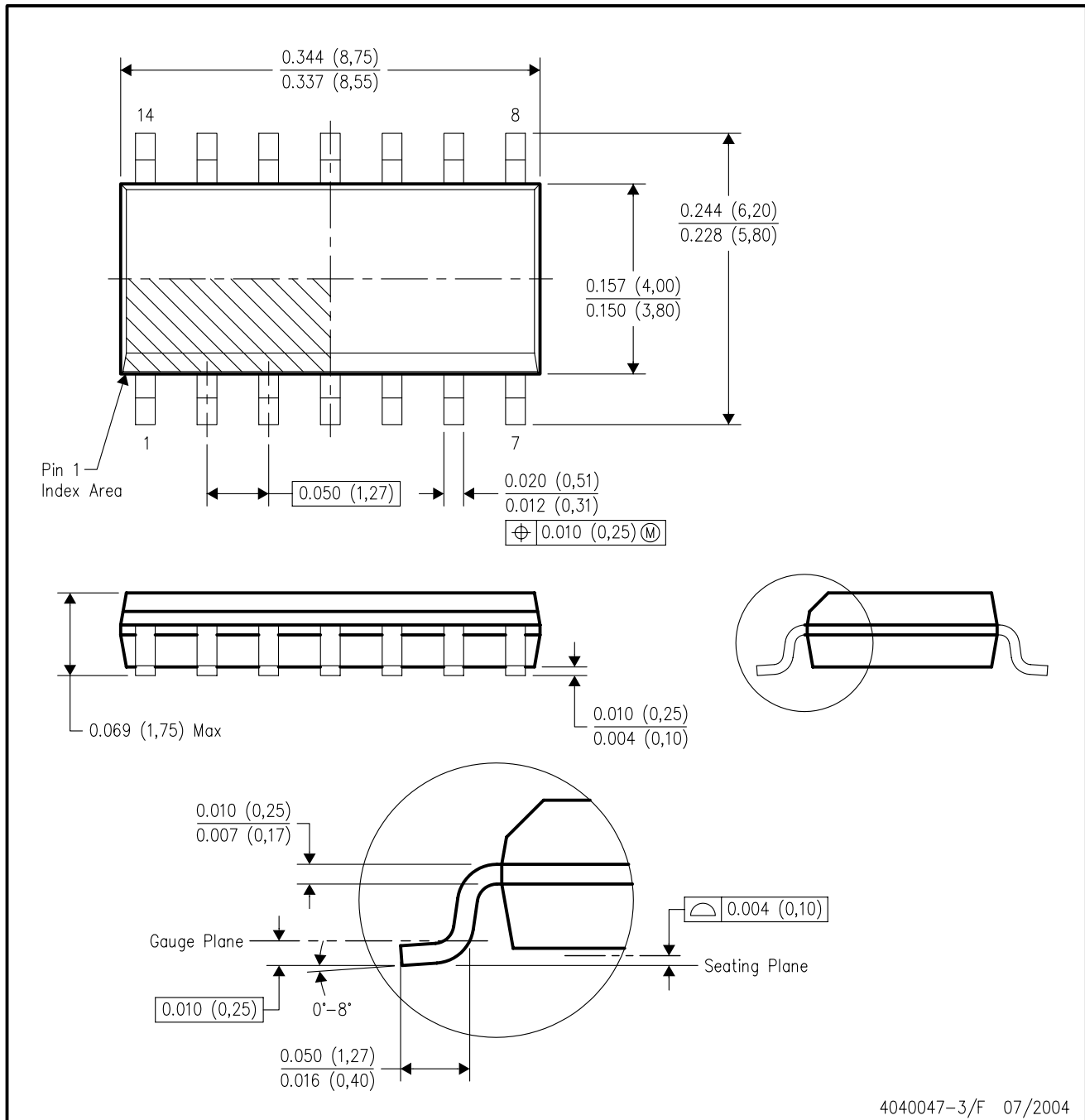20 Pin vendor option △D

4040049/E   12/2002

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

D (R−PDSO−G14) PLASTIC SMALL−OUTLINE PACKAGE

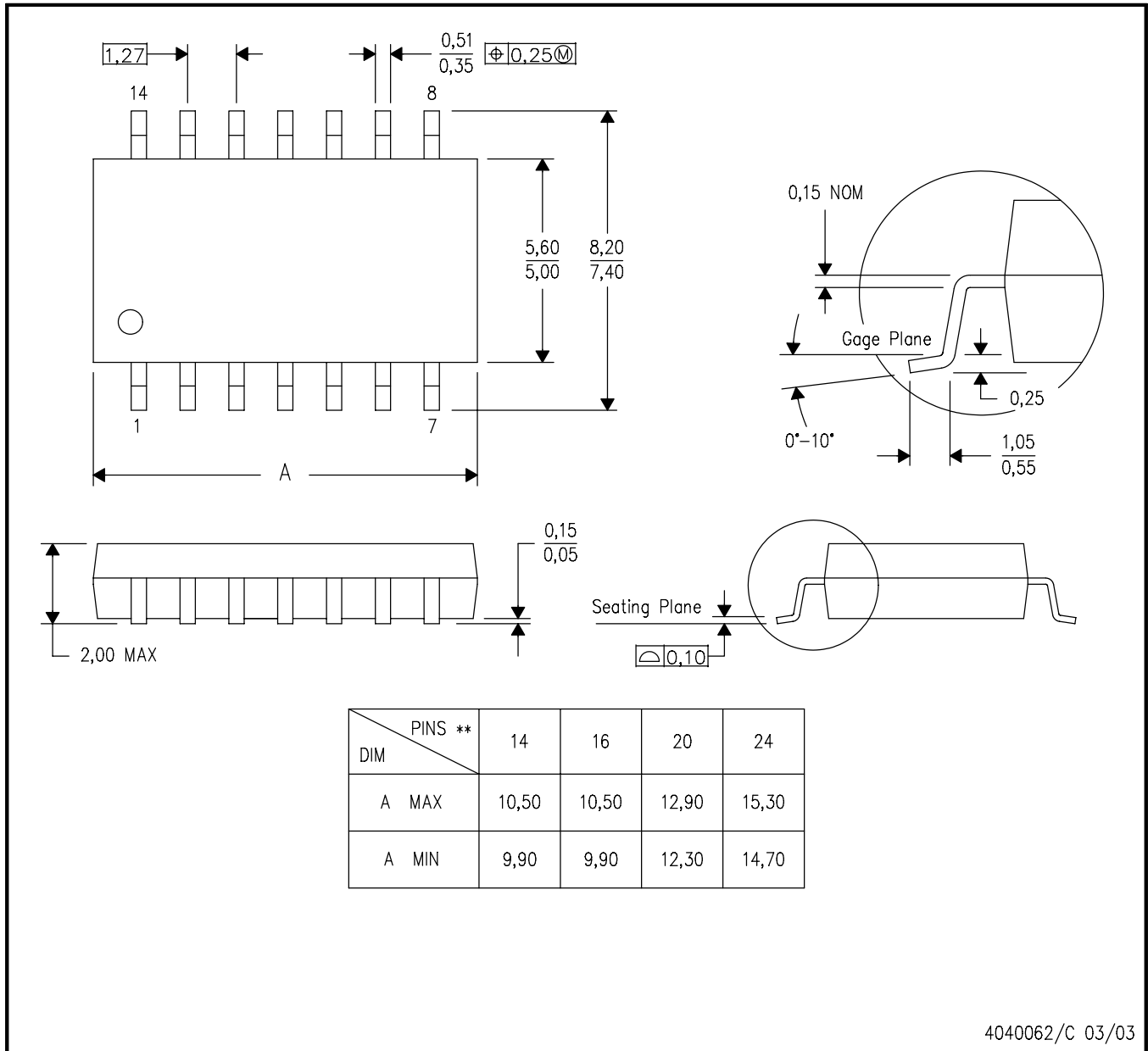0.344 (8,75)
0.337 (8,55)

14

8

1

7

0.244 (6,20)
0.228 (5,80)

0.157 (4,00)
0.150 (3,80)

Pin 1
Index Area

0.050 (1,27)

0.020 (0,51)
0.012 (0,31)

⊕ 0.010 (0,25) Ⓜ

0.069 (1,75) Max

0.010 (0,25)
0.004 (0,10)

0.010 (0,25)
0.007 (0,17)

Gauge Plane

◯ 0.004 (0,10)

Seating Plane

0.010 (0,25)

0°−8°

0.050 (1,27)
0.016 (0,40)

4040047−3/F 07/2004

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.

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INSTRUMENTS
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MECHANICAL DATA

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN

DIM	PINS ** 14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

4040062/C 03/03

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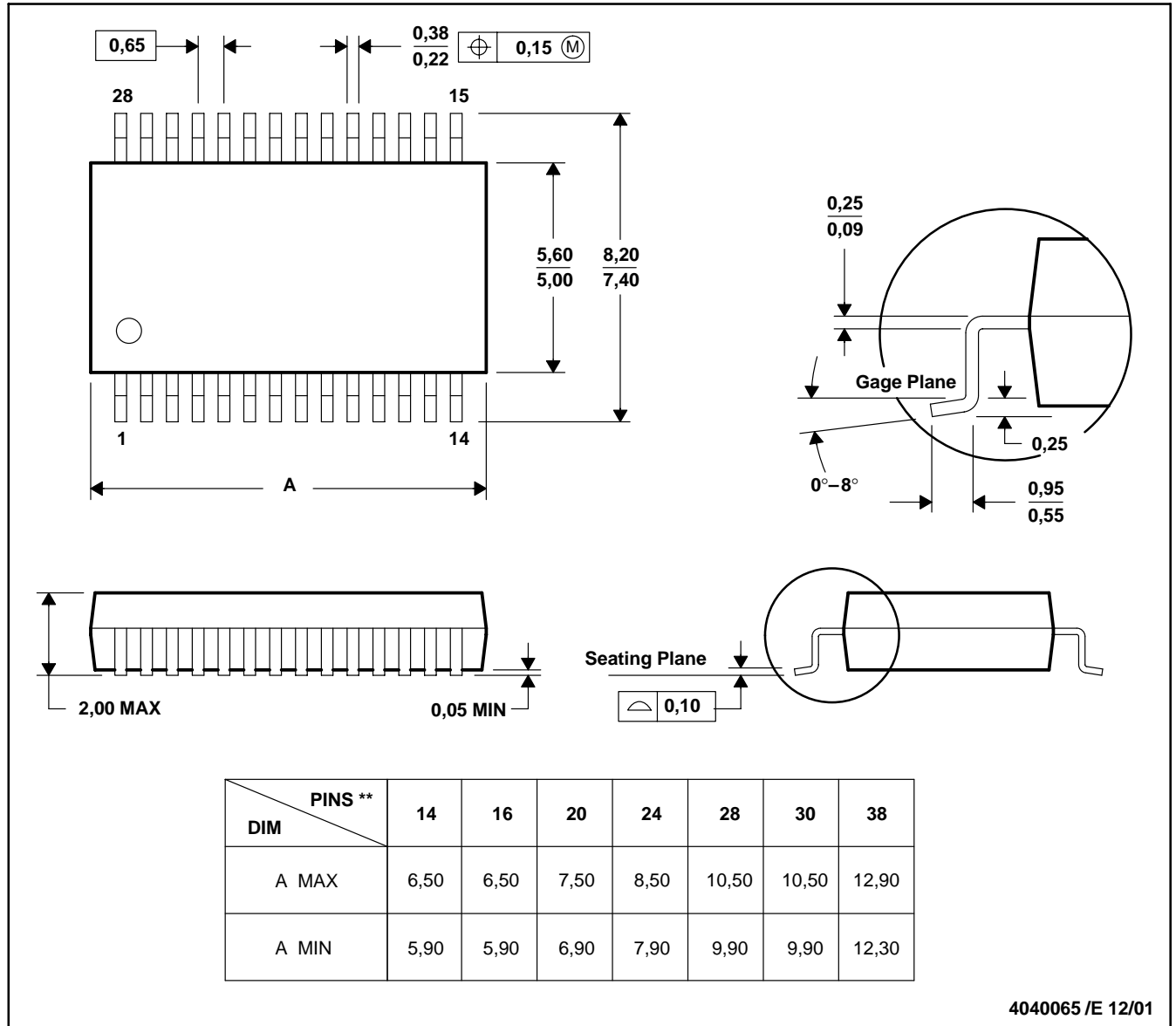   C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

DB (R-PDSO-G**)   **PLASTIC SMALL-OUTLINE**

28 PINS SHOWN

PINS **	14	16	20	24	28	30	38
DIM							
A MAX	6,50	6,50	7,50	8,50	10,50	10,50	12,90
A MIN	5,90	5,90	6,90	7,90	9,90	9,90	12,30

4040065 /E 12/01

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.
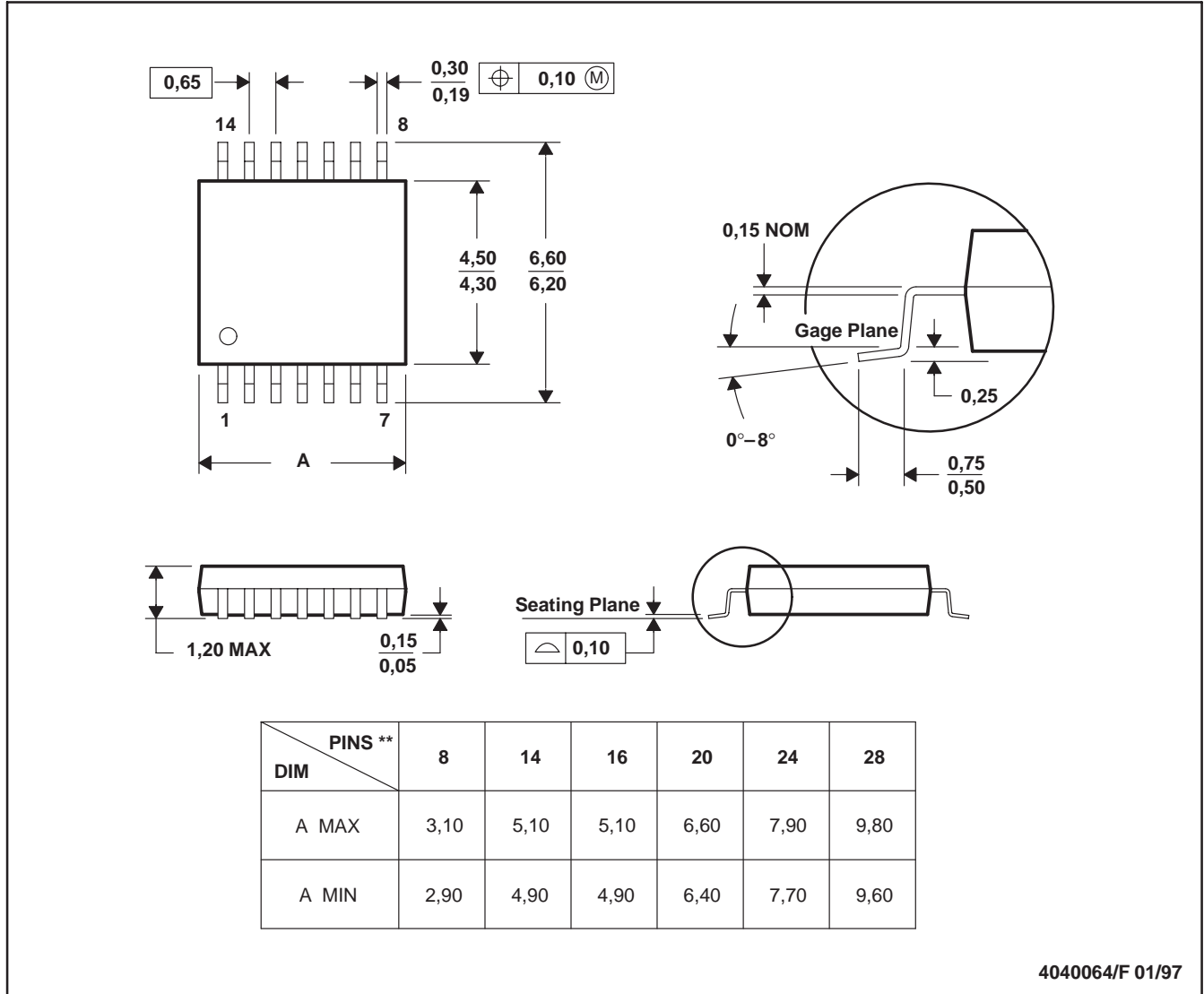D. Falls within JEDEC MO-150

**TEXAS
INSTRUMENTS**

MECHANICAL DATA

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN

0,65

$\dfrac{0,30}{0,19}$ ⊕ | 0,10 Ⓜ

14   8

$\dfrac{4,50}{4,30}$ $\dfrac{6,60}{6,20}$

1   7

A

0,15 NOM

Gage Plane

0,25

0°−8°

$\dfrac{0,75}{0,50}$

1,20 MAX

$\dfrac{0,15}{0,05}$

Seating Plane

◁ | 0,10

DIM \ PINS **	8	14	16	20	24	28
A MAX	3,10	5,10	5,10	6,60	7,90	9,80
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

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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