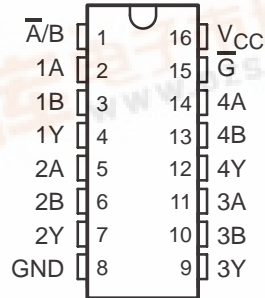# QUADRUPLE 2-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS
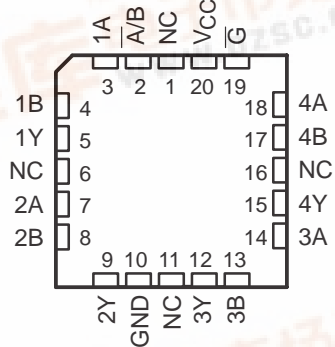
SCLS397F – APRIL 1998 – REVISED APRIL 2005

- **2-V to 5.5-V V_{CC} Operation**
- **Max t_{pd} of 7.5 ns at 5 V**
- **Typical V_{OLP} (Output Ground Bounce) <0.8 V at V_{CC}, T_A = 25°C**
- **Typical V_{OHV} (Output V_{OH} Undershoot) >2.3 V at V_{CC}, T_A = 25°C**
- **I_{off} Supports Partial-Power-Down-Mode Operation**
- **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)**

SN54LV157A . . . J OR W PACKAGE
SN74LV157A . . . D, DB, DGV, NS, OR PW PACKAGE
(TOP VIEW)

```
        _____ ___
$\overline{A}$/B [ 1    16 ] V_CC
     1A [ 2    15 ] $\overline{G}$
     1B [ 3    14 ] 4A
     1Y [ 4    13 ] 4B
     2A [ 5    12 ] 4Y
     2B [ 6    11 ] 3A
     2Y [ 7    10 ] 3B
    GND [ 8     9 ] 3Y
```

SN54LV157A . . . FK PACKAGE
(TOP VIEW)

```
         1A  $\overline{A}$/B  NC  V_CC  $\overline{G}$
         3   2    1   20   19
    1B [ 4              18 ] 4A
    1Y [ 5              17 ] 4B
    NC [ 6              16 ] NC
    2A [ 7              15 ] 4Y
    2B [ 8              14 ] 3A
         9  10  11  12  13
         2Y GND NC  3Y  3B
```

NC – No internal connection

description/ordering information

The 'LV157A devices are quadruple 2-line to 1-line data selectors/multiplexers designed for 2-V to 5.5-V V_{CC} operation.

These devices contain inverters and drivers to supply full data selection to the four output gates. A separate strobe ($\overline{G}$) input is provided. A 4-bit word is selected from one of two sources and is routed to the four outputs. The 'LV157A devices present true data.

ORDERING INFORMATION

T_A	PACKAGE[†]		ORDERABLE PART NUMBER	TOP-SIDE MARKING
−40°C to 85°C	SOIC – D	Tube of 40	SN74LV157AD	LV157A
		Reel of 2500	SN74LV157ADR	
	SOP – NS	Reel of 2000	SN74LV157ANSR	74LV157A
	SSOP – DB	Reel of 2000	SN74LV157ADBR	LV157A
	TSSOP – PW	Tube of 90	SN74LV157APW	LV157A
		Reel of 2000	SN74LV157APWR	
		Reel of 250	SN74LV157APWT	
	TVSOP – DGV	Reel of 2000	SN74LV157ADGVR	LV157A
−55°C to 125°C	CDIP – J	Tube of 25	SNJ54LV157AJ	SNJ54LV157AJ
	CFP – W	Tube of 150	SNJ54LV157AW	SNJ54LV157AW
	LCCC – FK	Tube of 55	SNJ54LV157AFK	SNJ54LV157AFK

[†] 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.
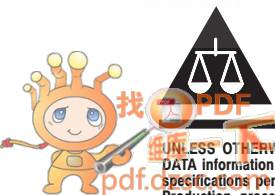
TEXAS INSTRUMENTS

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description/ordering information (continued)

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.

FUNCTION TABLE

	INPUTS			OUTPUT Y
$\overline{G}$	SELECT $\overline{A}/B$	DATA		
		A	B	
H	X	X	X	L
L	L	L	X	L
L	L	H	X	H
L	H	X	L	L
L	H	X	H	H

logic diagram (positive logic)
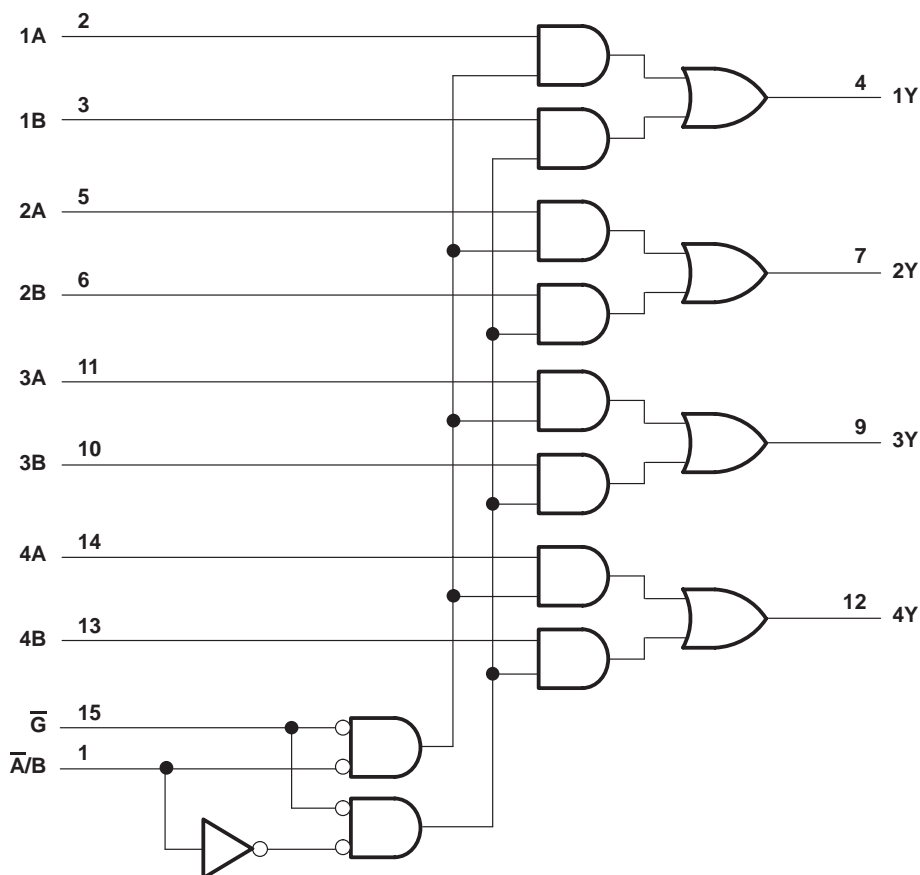
Pin numbers shown are for the D, DB, DGV, J, NS, PW, and W packages.

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

Output voltage range applied in high or low state, V_O (see Notes 1 and 2) .... –0.5 V to V_{CC} + 0.5 V

Output voltage range applied in power-off state, V_O (see Note 1) .... –0.5 V to 7 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}) .... ±25 mA

Continuous current through V_{CC} or GND .... ±50 mA

Package thermal impedance, θ_{JA} (see Note 3): D package .... 73°C/W

DB package .... 82°C/W

DGV package .... 120°C/W

NS package .... 64°C/W

PW package .... 108°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 negative-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.

recommended operating conditions (see Note 4)

			SN54LV157A		SN74LV157A		UNIT
			MIN	MAX	MIN	MAX	
V_{CC}	Supply voltage		2	5.5	2	5.5	V
V_{IH}	High-level input voltage	V_{CC} = 2 V	1.5		1.5		V
		V_{CC} = 2.3 V to 2.7 V	$V_{CC} \times 0.7$		$V_{CC} \times 0.7$		
		V_{CC} = 3 V to 3.6 V	$V_{CC} \times 0.7$		$V_{CC} \times 0.7$		
		V_{CC} = 4.5 V to 5.5 V	$V_{CC} \times 0.7$		$V_{CC} \times 0.7$		
V_{IL}	Low-level input voltage	V_{CC} = 2 V		0.5		0.5	V
		V_{CC} = 2.3 V to 2.7 V		$V_{CC} \times 0.3$		$V_{CC} \times 0.3$	
		V_{CC} = 3 V to 3.6 V		$V_{CC} \times 0.3$		$V_{CC} \times 0.3$	
		V_{CC} = 4.5 V to 5.5 V		$V_{CC} \times 0.3$		$V_{CC} \times 0.3$	
V_I	Input voltage		0	5.5	0	5.5	V
V_O	Output voltage		0	V_{CC}	0	V_{CC}	V
I_{OH}	High-level output current	V_{CC} = 2 V		−50		−50	µA
		V_{CC} = 2.3 V to 2.7 V		−2		−2	mA
		V_{CC} = 3 V to 3.6 V		−6		−6	
		V_{CC} = 4.5 V to 5.5 V		−12		−12	
I_{OL}	Low-level output current	V_{CC} = 2 V		50		50	µA
		V_{CC} = 2.3 V to 2.7 V		2		2	mA
		V_{CC} = 3 V to 3.6 V		6		6	
		V_{CC} = 4.5 V to 5.5 V		12		12	
$\Delta t/\Delta v$	Input transition rise or fall rate	V_{CC} = 2.3 V to 2.7 V		200	0	200	ns/V
		V_{CC} = 3 V to 3.6 V		100	0	100	
		V_{CC} = 4.5 V to 5.5 V		20	0	20	
T_A	Operating free-air temperature		−55	125	−40	85	°C

NOTE 4: 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.

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

PARAMETER	TEST CONDITIONS	V_{CC}	SN54LV157A			SN74LV157A			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{OH}	I_{OH} = −50 µA	2 V to 5.5 V	V_{CC}−0.1			V_{CC}−0.1			V
	I_{OH} = −2 mA	2.3 V	2			2			
	I_{OH} = −6 mA	3 V	2.48			2.48			
	I_{OH} = −12 mA	4.5 V	3.8			3.8			
V_{OL}	I_{OL} = 50 µA	2 V to 5.5 V			0.1			0.1	V
	I_{OL} = 2 mA	2.3 V			0.4			0.4	
	I_{OL} = 6 mA	3 V			0.44			0.44	
	I_{OL} = 12 mA	4.5 V			0.55			0.55	
I_I	V_I = 5.5 V or GND	0 to 5.5 V			±1			±1	µA
I_{CC}	V_I = V_{CC} or GND, I_O = 0	5.5 V			20			20	µA
I_{off}	V_I or V_O = 0 to 5.5 V	0			5			5	µA
C_i	V_I = V_{CC} or GND	3.3 V		1.7			1.7		pF

TEXAS
INSTRUMENTS

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			SN54LV157A		SN74LV157A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A or B	Y	C_L = 15 pF		7.4*	15.9*	1*	19.5*	1	19.5	ns
	$\overline{A}$/B	Y			7.9*	19.4*	1*	23.5*	1	23.5	
	$\overline{G}$	Y			7.8*	19.8*	1*	24*	1	24	
t_{pd}	A or B	Y	C_L = 50 pF		9.4	18.8	1	22	1	22	ns
	$\overline{A}$/B	Y			10.8	22.3	1	26	1	26	
	$\overline{G}$	Y			9.6	22.7	1	26.5	1	26.5	

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

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			SN54LV157A		SN74LV157A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A or B	Y	C_L = 15 pF		5.2*	9.7*	1*	11.5*	1	11.5	ns
	$\overline{A}$/B	Y			5.8*	13.2*	1*	15.5*	1	15.5	
	$\overline{G}$	Y			5.5*	13.6*	1*	16*	1	16	
t_{pd}	A or B	Y	C_L = 50 pF		6.7	13.2	1	15	1	15	ns
	$\overline{A}$/B	Y			7.6	16.7	1	19	1	19	
	$\overline{G}$	Y			7	17.1	1	19.5	1	19.5	

* 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 V ± 0.5 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			SN54LV157A		SN74LV157A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A or B	Y	C_L = 15 pF		3.6*	6.4*	1*	7.5*	1	7.5	ns
	$\overline{A}$/B	Y			4.1*	8.1*	1*	9.5*	1	9.5	
	$\overline{G}$	Y			3.8*	8.6*	1*	10*	1	10	
t_{pd}	A or B	Y	C_L = 50 pF		4.8	8.4	1	9.5	1	9.5	ns
	$\overline{A}$/B	Y			5.4	10.1	1	11.5	1	11.5	
	$\overline{G}$	Y			5	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 V, C_L = 50 pF, T_A = 25°C (see Note 5)

PARAMETER		SN74LV157A			UNIT
		MIN	TYP	MAX	
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}		0.3	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}		3.2		V
$V_{IH(D)}$	High-level dynamic input voltage	2.31			V
$V_{IL(D)}$	Low-level dynamic input voltage			0.99	V

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

TEXAS INSTRUMENTS

operating characteristics, $T_A = 25°C$

PARAMETER		TEST CONDITIONS	V_{CC}	TYP	UNIT
C_{pd}	Power dissipation capacitance	C_L = 50 pF, f = 10 MHz	3.3 V	12.1	pF
			5 V	13.1	

PARAMETER MEASUREMENT INFORMATION

From Output Under Test — **Test Point**

C_L (see Note A)

LOAD CIRCUIT FOR TOTEM-POLE OUTPUTS

From Output Under Test — $R_L = 1$ kΩ — **S1** — V_{CC} / Open / GND

C_L (see Note A)

LOAD CIRCUIT FOR 3-STATE AND OPEN-DRAIN OUTPUTS

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

Input
t_w
50% V_{CC} 50% V_{CC}
V_{CC}
0 V

VOLTAGE WAVEFORMS PULSE DURATION

Timing Input
50% V_{CC}
V_{CC}
0 V

t_{su} t_h

Data Input
50% V_{CC} 50% V_{CC}
V_{CC}
0 V

VOLTAGE WAVEFORMS SETUP AND HOLD TIMES

Input
50% V_{CC} 50% V_{CC}
V_{CC}
0 V

t_{PLH} t_{PHL}

In-Phase Output
50% V_{CC} 50% V_{CC}
V_{OH}
V_{OL}

t_{PHL} t_{PLH}

Out-of-Phase Output
50% V_{CC} 50% V_{CC}
V_{OH}
V_{OL}

VOLTAGE WAVEFORMS PROPAGATION DELAY TIMES INVERTING AND NONINVERTING OUTPUTS

Output Control
50% V_{CC} 50% V_{CC}
V_{CC}
0 V

t_{PZL} t_{PLZ}

Output Waveform 1 S1 at V_{CC} (see Note B)
50% V_{CC}
$\approx V_{CC}$
$V_{OL} + 0.3$ V V_{OL}

t_{PZH} t_{PHZ}

Output Waveform 2 S1 at GND (see Note B)
50% V_{CC}
$V_{OH} - 0.3$ V V_{OH}
≈ 0 V

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 ≤ 1 MHz, $Z_O = 50$ Ω, $t_r \le 3$ ns, $t_f \le 3$ 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

TEXAS INSTRUMENTS

PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
SN74LV157AD	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV157ADBR	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV157ADBRE4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV157ADG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV157ADGVR	ACTIVE	TVSOP	DGV	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV157ADGVRE4	ACTIVE	TVSOP	DGV	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV157ADR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV157ADRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV157ANSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV157ANSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV157APW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV157APWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV157APWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV157APWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV157APWT	ACTIVE	TSSOP	PW	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LV157APWTG4	ACTIVE	TSSOP	PW	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

[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) 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)

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

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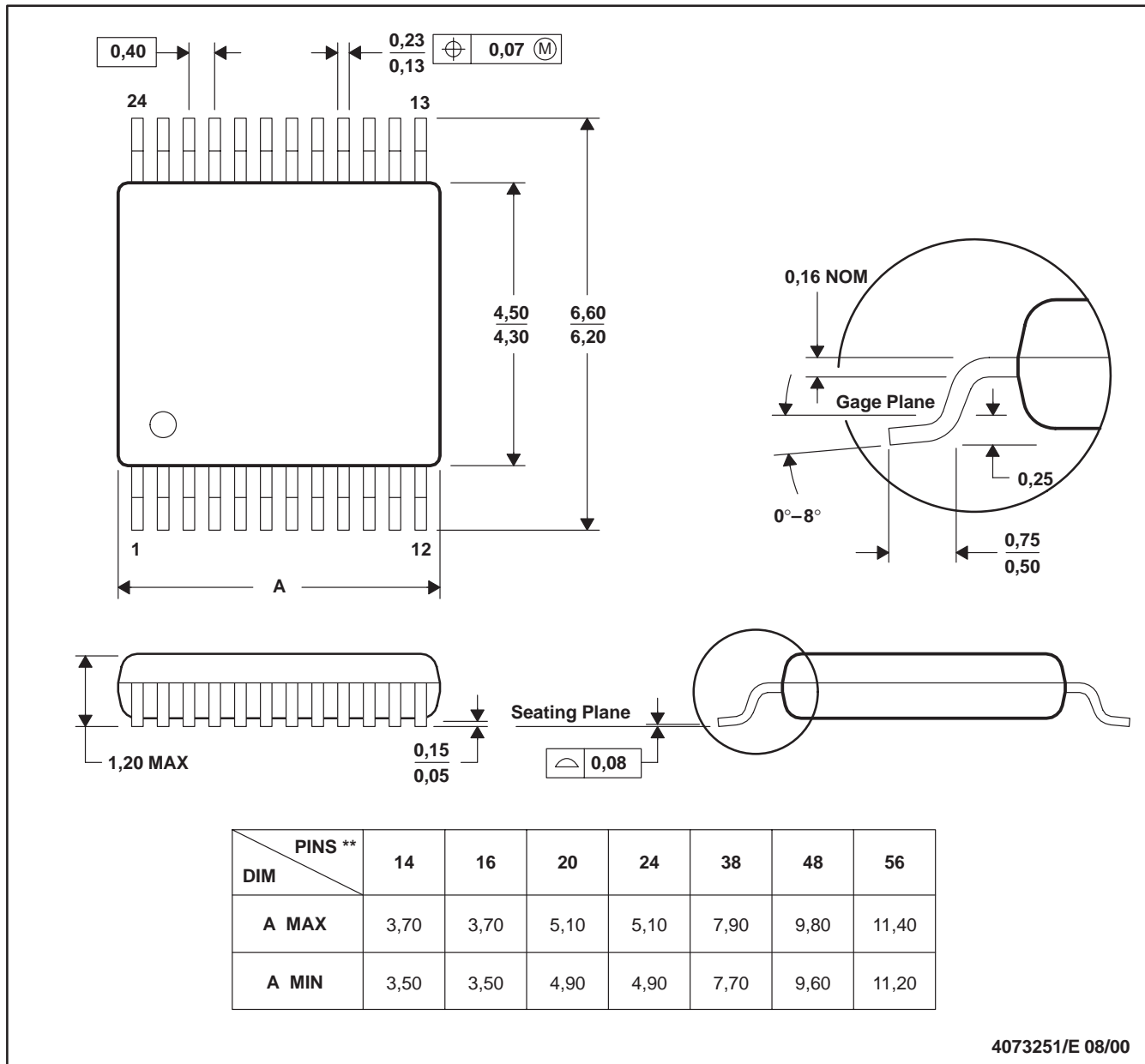
DGV (R-PDSO-G**)   **PLASTIC SMALL-OUTLINE**

24 PINS SHOWN

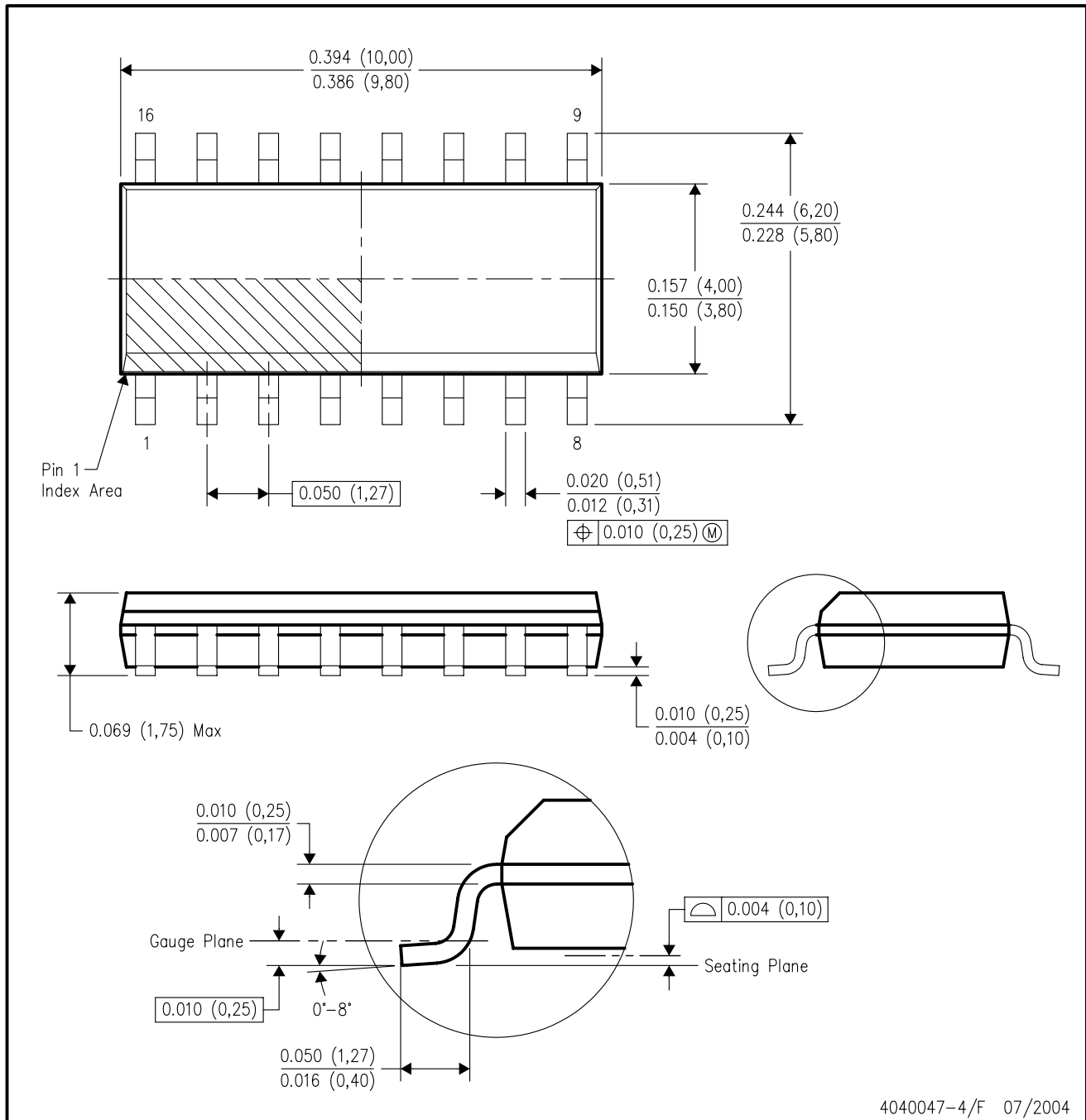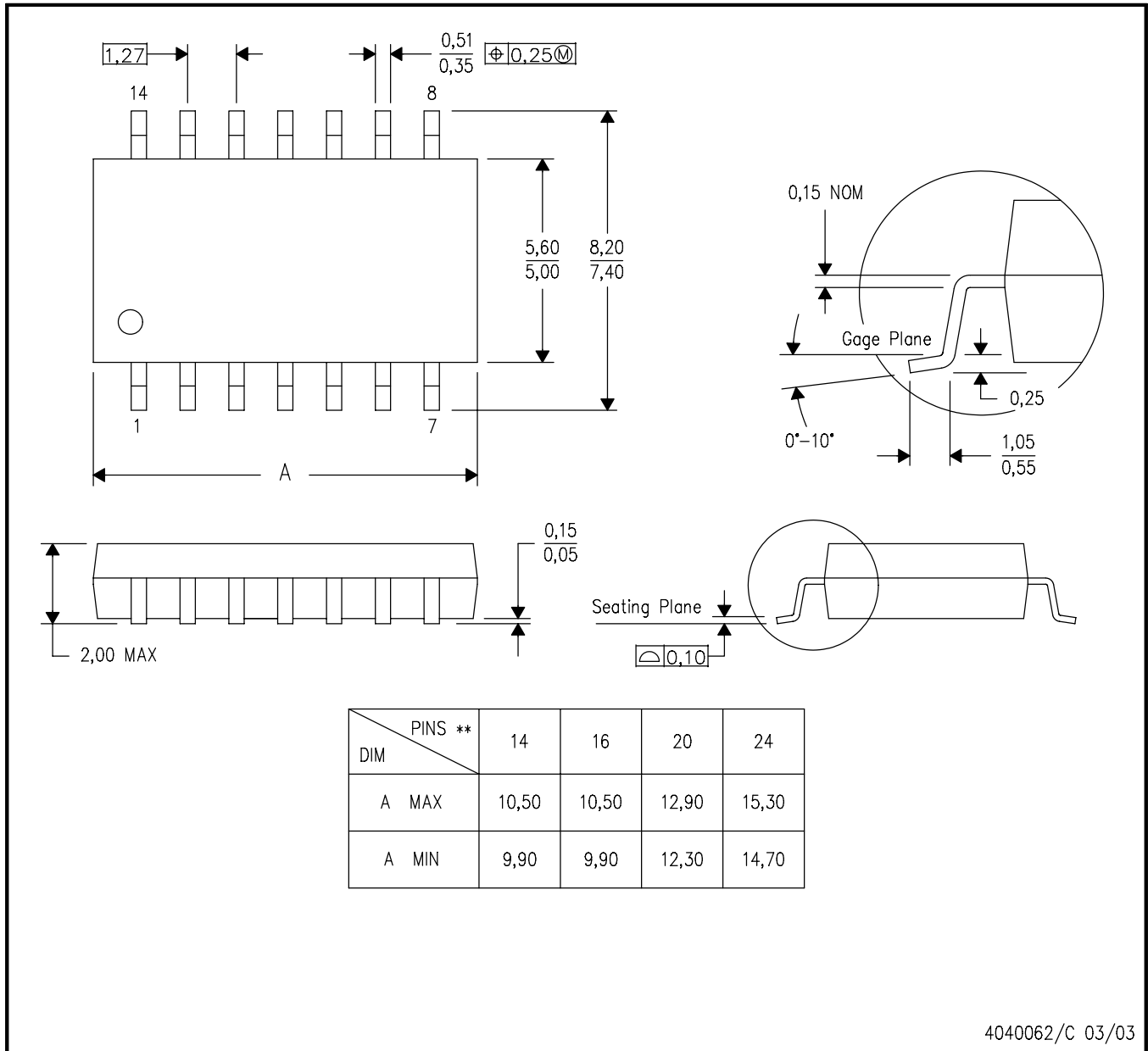| PINS ** / DIM	14	16	20	24	38	48	56
A MAX	3,70	3,70	5,10	5,10	7,90	9,80	11,40
A MIN	3,50	3,50	4,90	4,90	7,70	9,60	11,20

4073251/E 08/00

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

TEXAS INSTRUMENTS

D (R−PDSO−G16) PLASTIC SMALL−OUTLINE PACKAGE

0.394 (10,00)
0.386 (9,80)

16

9

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

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

1

8

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)

0.004 (0,10)

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

Gauge Plane

Seating Plane

0.010 (0,25)

0°−8°

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

4040047−4/F 07/2004

NOTES: A.   All linear dimensions are in inches (millimeters).
         B.   This drawing is subject to change without notice.
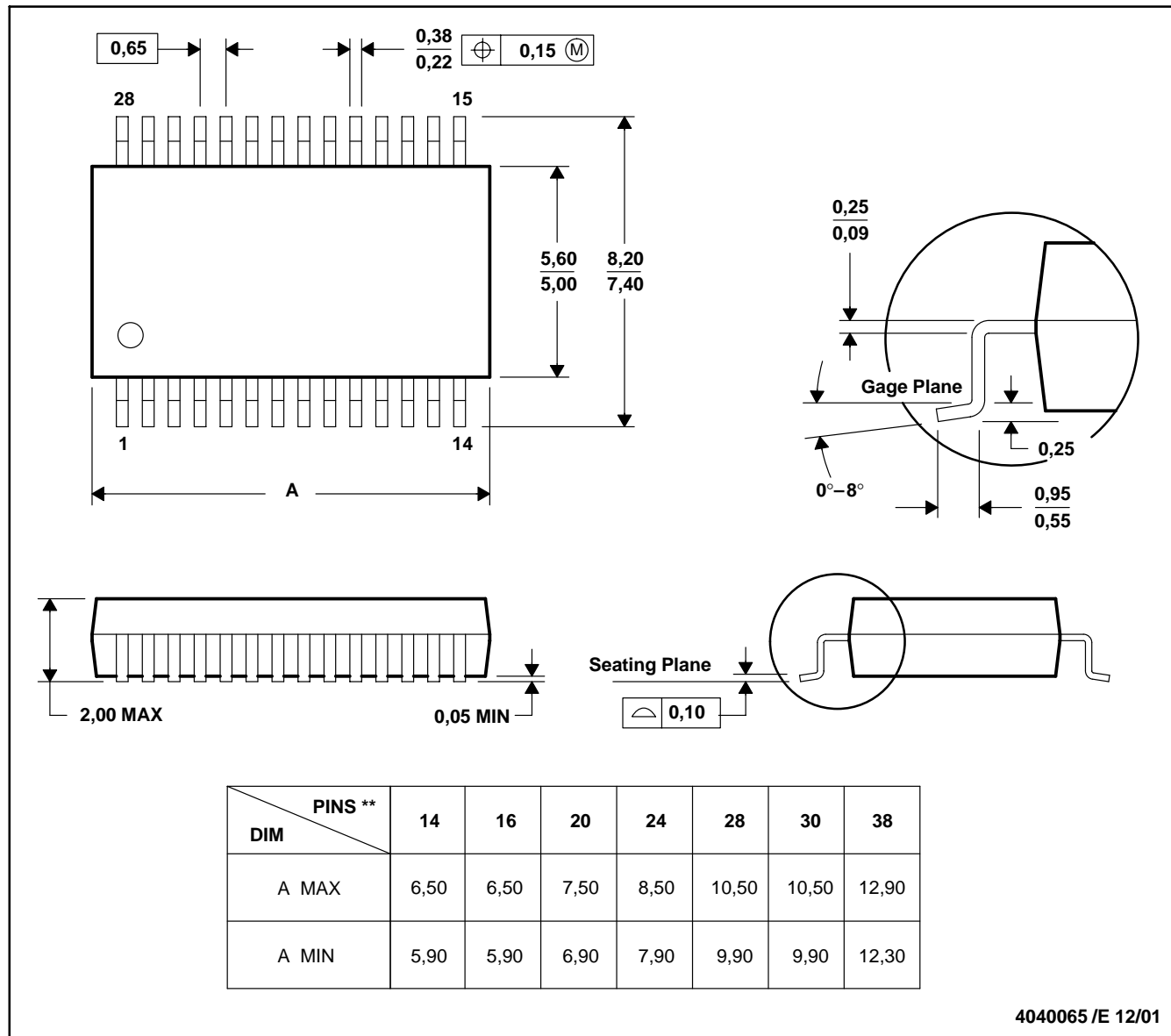   C.   Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
         D.   Falls within JEDEC MS−012 variation AC.

MECHANICAL DATA

1,27

$\frac{0,51}{0,35}$ ⊕ 0,25 Ⓜ

14   8

$\frac{5,60}{5,00}$ $\frac{8,20}{7,40}$

1   7

A

0,15 NOM

Gage Plane

0°–10°   0,25

$\frac{1,05}{0,55}$

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

2,00 MAX

Seating Plane

◁ 0,10

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 ** DIM	14	16	20	24	28	30	38
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.
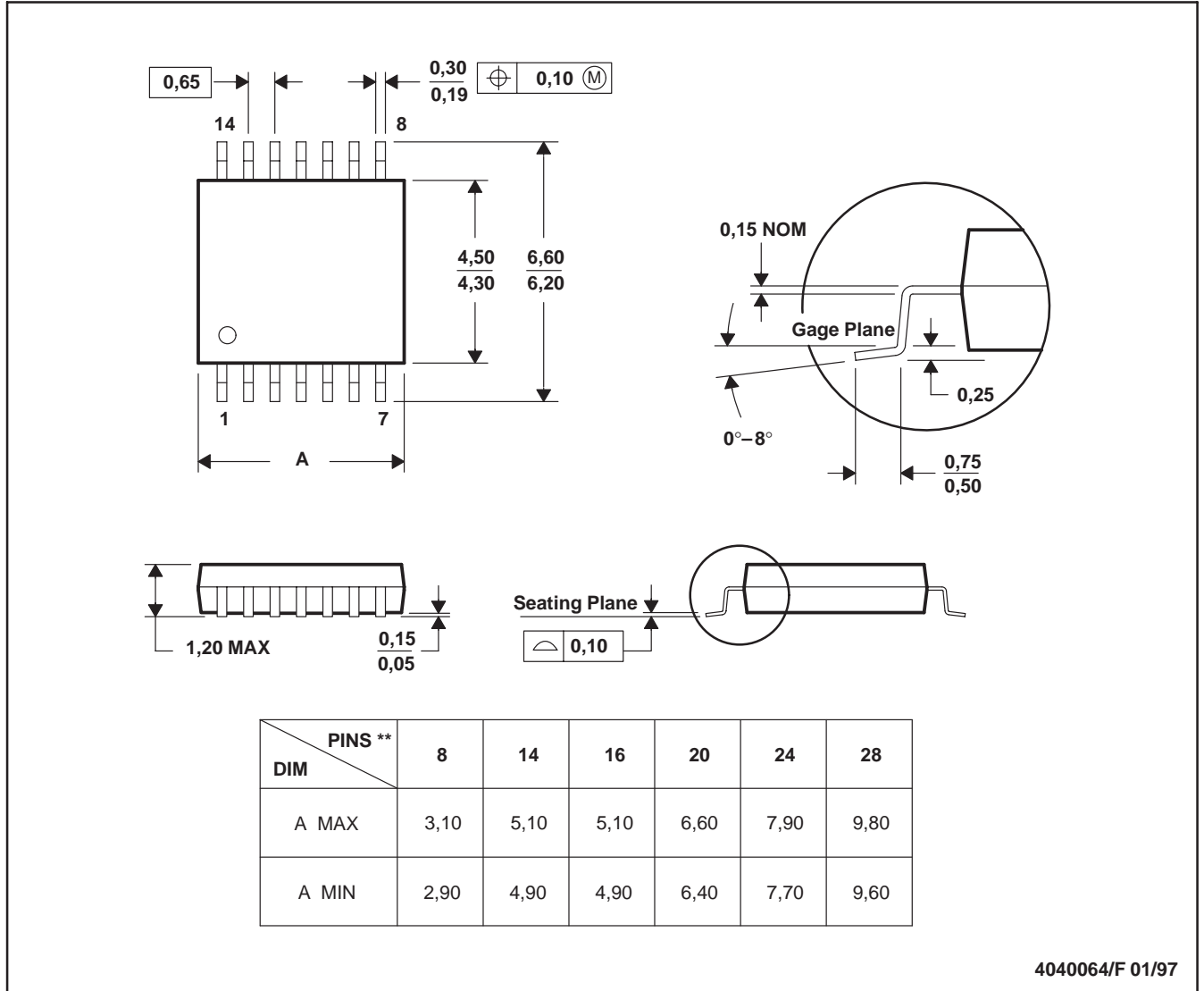   D. Falls within JEDEC MO-150

TEXAS
INSTRUMENTS

PW (R-PDSO-G**)　　　　　　　　　　　　　　　　　　　　**PLASTIC SMALL-OUTLINE PACKAGE**

14 PINS SHOWN

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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