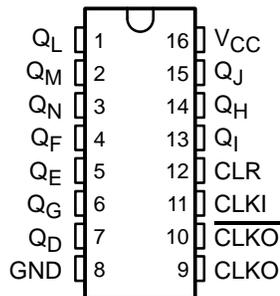


# SN54HC4060, SN74HC4060 14-STAGE ASYNCHRONOUS BINARY COUNTERS AND OSCILLATORS

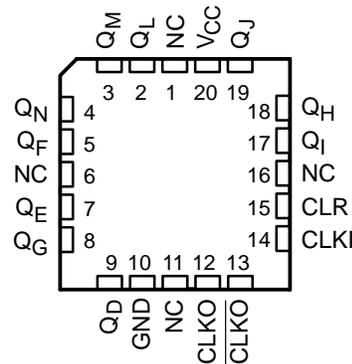
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- Wide Operating Voltage Range of 2 V to 6 V
- Outputs Can Drive Up To 10 LSTTL Loads
- Low Power Consumption, 80- $\mu$ A Max  $I_{CC}$
- Typical  $t_{pd} = 14$  ns
- $\pm 4$ -mA Output Drive at 5 V
- Low Input Current of 1  $\mu$ A Max
- Allow Design of Either RC- or Crystal-Oscillator Circuits

SN54HC4060 . . . J OR W PACKAGE  
SN74HC4060 . . . D, DB, N, NS, OR PW PACKAGE  
(TOP VIEW)



SN54HC4060 . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

## description/ordering information

The 'HC4060 devices consist of an oscillator section and 14 ripple-carry binary counter stages. The oscillator configuration allows design of either RC- or crystal-oscillator circuits. A high-to-low transition on the clock ( $CLKI$ ) input increments the counter. A high level at the clear (CLR) input disables the oscillator ( $CLKO$  goes high and  $CLKO$  goes low) and resets the counter to zero (all Q outputs low).

## ORDERING INFORMATION

$T_A$	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	PDIP – N	Tube	SN74HC4060N	SN74HC4060N
	SOIC – D	Tube	SN74HC4060D	HC4060
		Tape and reel	SN74HC4060DR	
	SOP – NS	Tape and reel	SN74HC4060NSR	HC4060
	SSOP – DB	Tape and reel	SN74HC4060DBR	HC4060
TSSOP – PW	Tape and reel	SN74HC4060PWR	HC4060	
-55°C to 125°C	CDIP – J	Tube	SNJ54HC4060J	SNJ54HC4060J
	CFP – W	Tube	SNJ54HC4060W	SNJ54HC4060W
	LCCC – FK	Tube	SNJ54HC4060FK	SNJ54HC4060FK

† 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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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**

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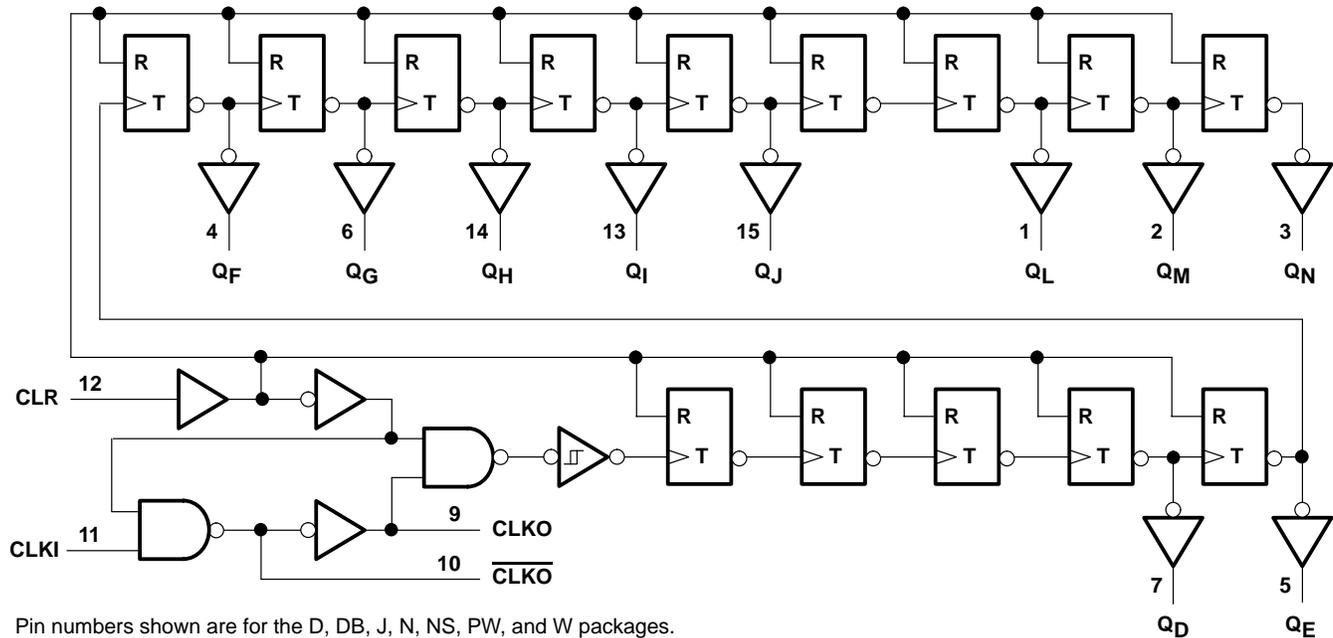
# SN54HC4060, SN74HC4060 14-STAGE ASYNCHRONOUS BINARY COUNTERS AND OSCILLATORS

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FUNCTION TABLE  
(each buffer)

INPUTS		FUNCTION
CLK	CLR	
↑	L	No change
↓	L	Advance to next stage
X	H	All outputs L

## Logic diagram (positive logic)



Pin numbers shown are for the D, DB, J, N, 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 clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ ) (see Note 1) .....	$\pm 20$ mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ ) (see Note 1) .....	$\pm 20$ mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ ) .....	$\pm 25$ mA
Package thermal impedance, $\theta_{JA}$ (see Note 2): D package .....	73°C/W
DB package .....	82°C/W
N package .....	67°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 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.

# SN54HC4060, SN74HC4060 14-STAGE ASYNCHRONOUS BINARY COUNTERS AND OSCILLATORS

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## recommended operating conditions (see Note 3)

		SN54HC4060			SN74HC4060			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub>	Supply voltage	2	5	6	2	5	6	V
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 2 V		1.5	1.5		V	
		V <sub>CC</sub> = 4.5 V		3.15	3.15			
		V <sub>CC</sub> = 6 V		4.2	4.2			
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 2 V			0.5	0.5	V	
		V <sub>CC</sub> = 4.5 V			1.35	1.35		
		V <sub>CC</sub> = 6 V			1.8	1.8		
V <sub>I</sub>	Input voltage	0		V <sub>CC</sub>	0	V <sub>CC</sub>	V	
V <sub>O</sub>	Output voltage	0		V <sub>CC</sub>	0	V <sub>CC</sub>	V	
Δt/Δv	Input transition rise/fall time	V <sub>CC</sub> = 2 V			1000	1000	ns	
		V <sub>CC</sub> = 4.5 V			500	500		
		V <sub>CC</sub> = 6 V			400	400		
T <sub>A</sub>	Operating free-air temperature	-55		125	-40	85	°C	

NOTE 3: 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>	T <sub>A</sub> = 25°C			SN54HC4060		SN74HC4060		UNIT
					MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V <sub>OH</sub>	All outputs	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> , I <sub>OH</sub> = -20 μA		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		
	Q outputs	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>		I <sub>OH</sub> = -4 mA	4.5 V	3.98	4.3		3.7			3.84
I <sub>OH</sub> = -5.2 mA				6 V	5.48	5.8		5.2		5.34		
V <sub>OL</sub>	All outputs	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> , I <sub>OL</sub> = 20 μA		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	
	Q outputs	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>		I <sub>OL</sub> = 4 mA	4.5 V		0.17	0.26		0.4		
I <sub>OL</sub> = 5.2 mA				6 V		0.15	0.26		0.4		0.33	
I <sub>I</sub>	V <sub>I</sub> = V <sub>CC</sub> or 0		6 V		±0.1	±100		±1000		±1000	nA	
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or 0, I <sub>O</sub> = 0		6 V			8		160		80	μA	
C <sub>i</sub>			2 V to 6 V		3	10		10		10	pF	



# SN54HC4060, SN74HC4060 14-STAGE ASYNCHRONOUS BINARY COUNTERS AND OSCILLATORS

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timing requirements over recommended operating free-air temperature range (unless otherwise noted)

		V <sub>CC</sub>	T <sub>A</sub> = 25°C		SN54HC4060		SN74HC4060		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
f <sub>clock</sub>	Clock frequency	2 V	5.5		3.7		4.3		MHz
		4.5 V	28		19		22		
		6 V	33		22		25		
t <sub>w</sub>	Pulse duration	CLKI high or low	2 V	90	135		115		ns
			4.5 V	18	27		23		
			6 V	15	23		20		
	CLR high	2 V	90	135		115			
		4.5 V	18	27		23			
		6 V	15	23		20			
t <sub>su</sub>	Setup time, CLR inactive before CLKI↓	2 V	160	240		200		ns	
		4.5 V	32	48		40			
		6 V	27	41		34			

switching characteristics over recommended operating free-air temperature range, C<sub>L</sub> = 50 pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub>	T <sub>A</sub> = 25°C			SN54HC4060		SN74HC4060		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f <sub>max</sub>			2 V	5.5	10		3.7		4.3	MHz	
			4.5 V	28	45		19		22		
			6 V	33	53		22		25		
t <sub>pd</sub>	CLKI	Q <sub>D</sub>	2 V		240	490		735		615	ns
			4.5 V		58	98		147		123	
			6 V		42	83		125		105	
t <sub>PHL</sub>	CLR	Any Q	2 V		66	140		210		175	ns
			4.5 V		18	28		42		35	
			6 V		14	24		36		30	
t <sub>t</sub>		Any	2 V		28	75		110		95	ns
			4.5 V		8	15		22		19	
			6 V		6	30		19		16	

operating characteristics, T<sub>A</sub> = 25°C

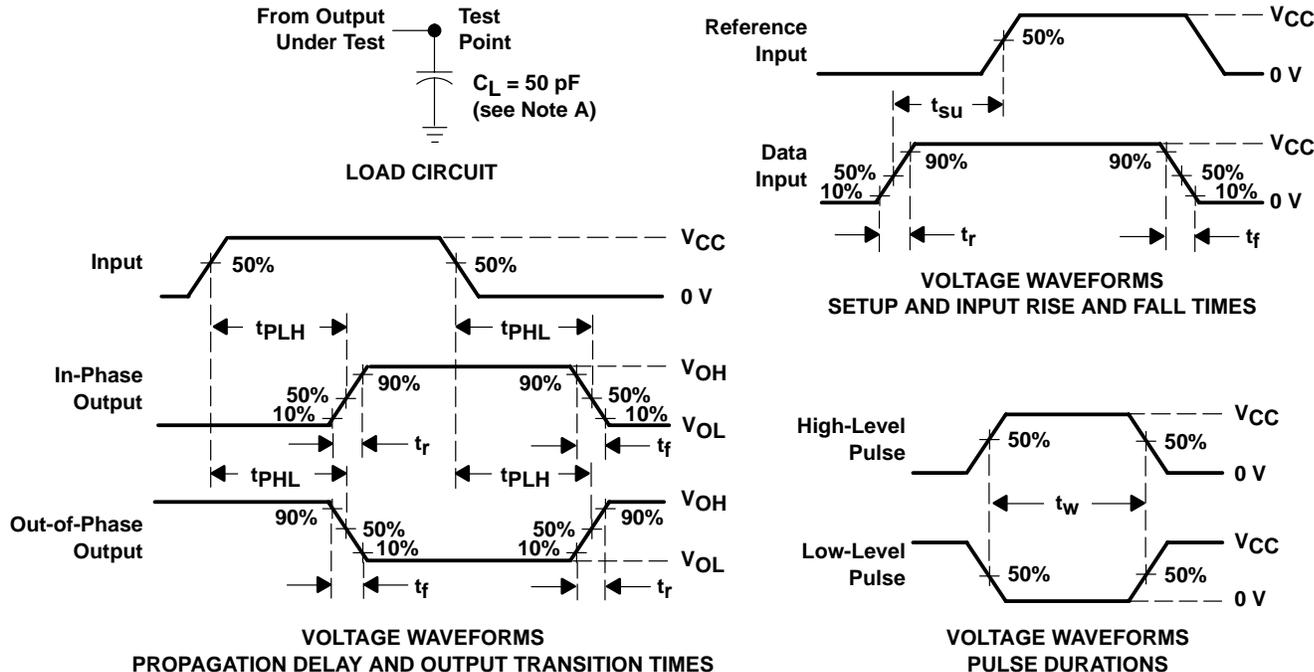
PARAMETER		TEST CONDITIONS	TYP	UNIT
C <sub>pd</sub>	Power dissipation capacitance	No load	88	pF



# SN54HC4060, SN74HC4060 14-STAGE ASYNCHRONOUS BINARY COUNTERS AND OSCILLATORS

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## PARAMETER MEASUREMENT INFORMATION



- 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:  $PRR \leq 1$  MHz,  $Z_O = 50 \Omega$ ,  $t_r = 6$  ns,  $t_f = 6$  ns.
  - C. For clock inputs,  $f_{max}$  is measured when the input duty cycle is 50%.
  - D. The outputs are measured one at a time with one input transition per measurement.
  - E.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .

**Figure 1. Load Circuit and Voltage Waveforms**

# SN54HC4060, SN74HC4060 14-STAGE ASYNCHRONOUS BINARY COUNTERS AND OSCILLATORS

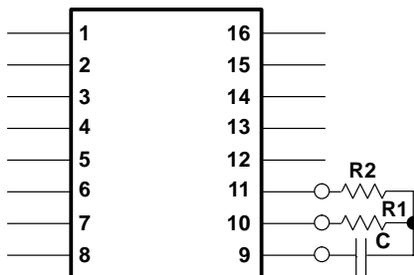
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## CONNECTING AN RC-OSCILLATOR CIRCUIT TO THE 'HC4060 DEVICES

The 'HC4060 devices consist of an oscillator section and 14 ripple-carry binary counter stages. The oscillator configuration allows design of either RC- or crystal-oscillator circuits.

When an RC-oscillator circuit is implemented, two resistors and a capacitor are required. The components are attached to the terminals as shown:



To determine the values of capacitance and resistance necessary to obtain a specific oscillator frequency (f), use this formula:

$$f = \frac{1}{2(R1)(C)\left(\frac{0.405 R2}{R1 + R2} + 0.693\right)}$$

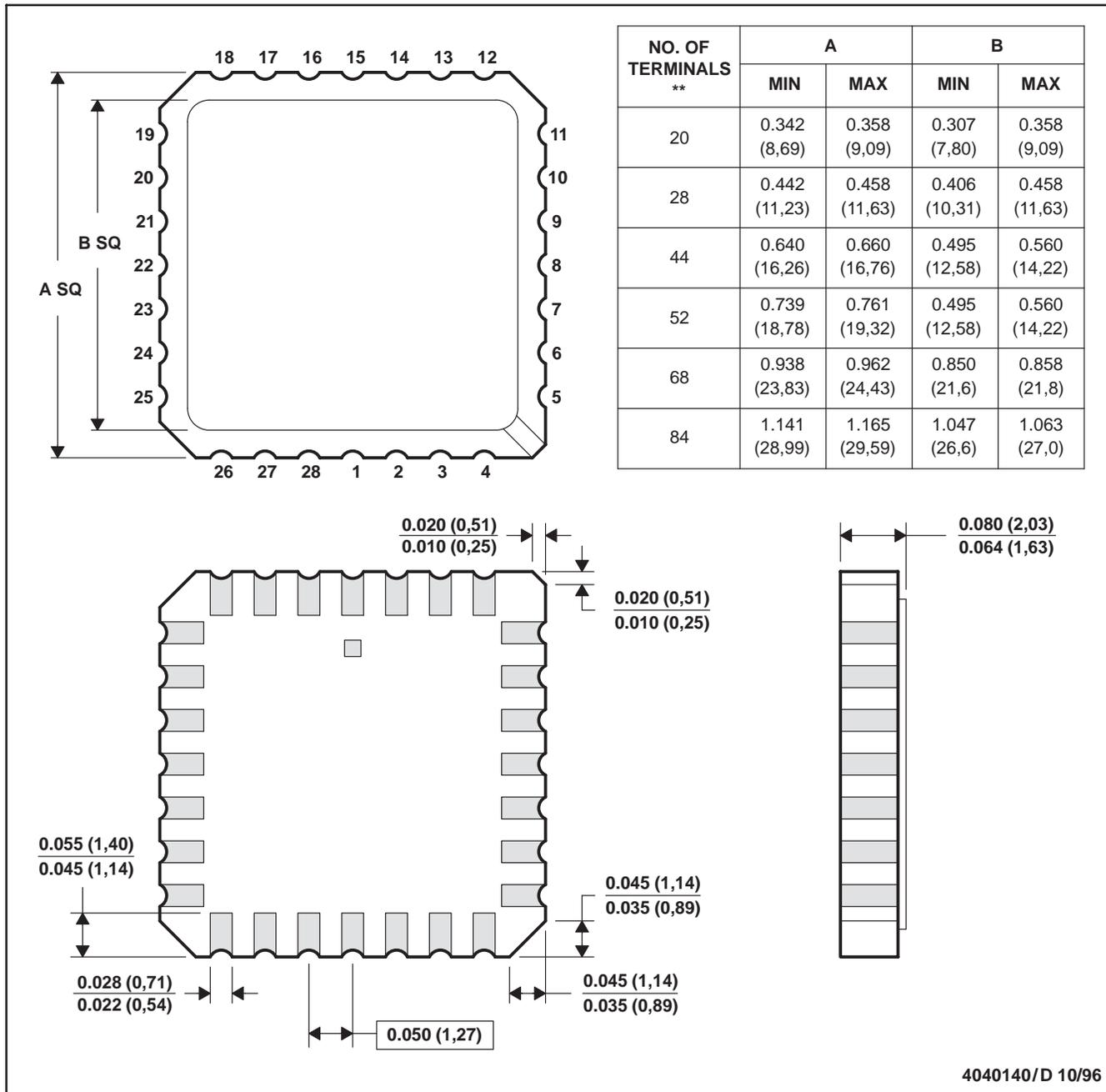
If  $R2 \gg R1$  (i.e.,  $R2 = 10R1$ ), the above formula simplifies to:

$$f = \frac{0.455}{RC}$$

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

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN

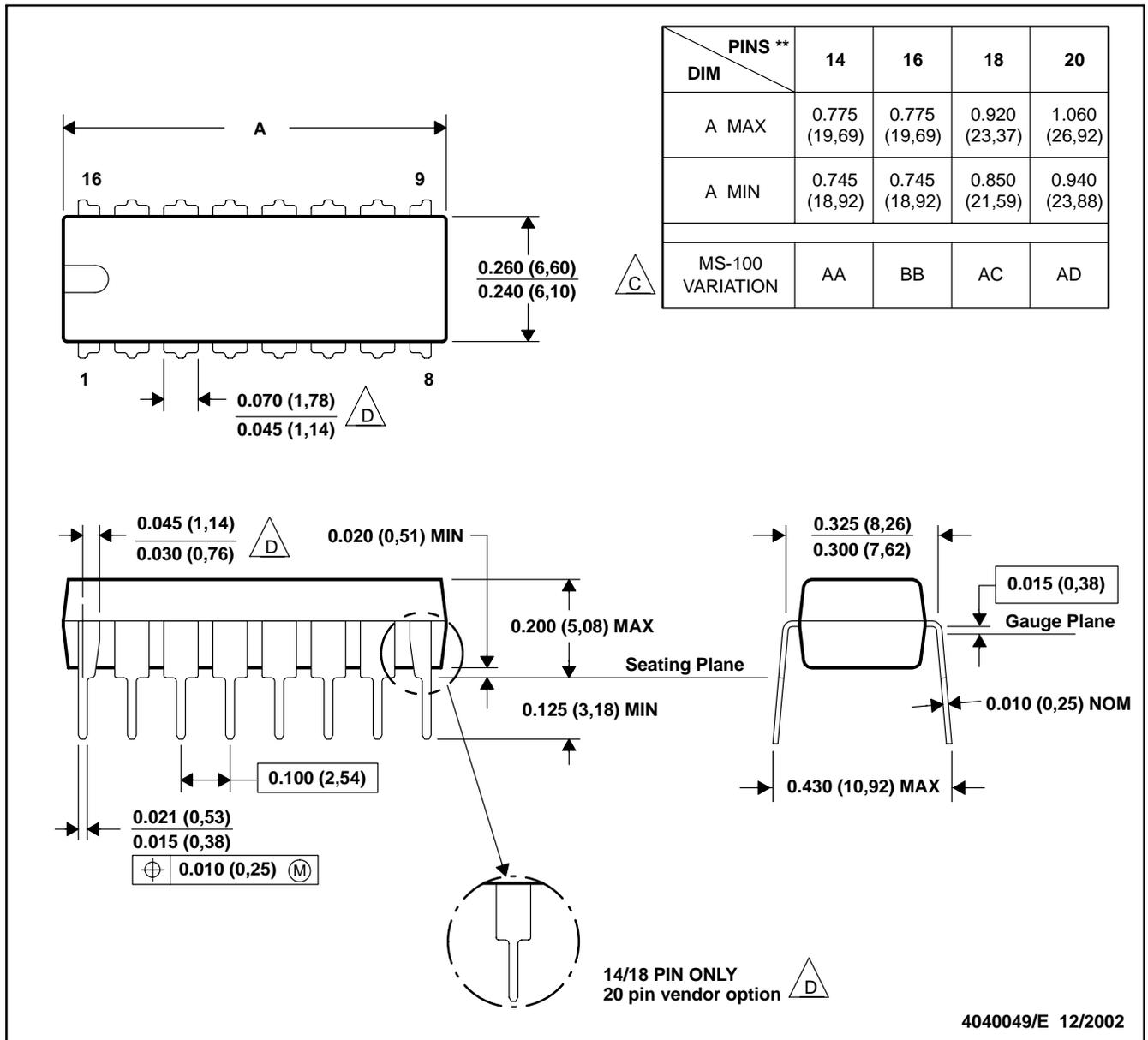


- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a metal lid.
  - D. The terminals are gold plated.
  - E. Falls within JEDEC MS-004

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

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



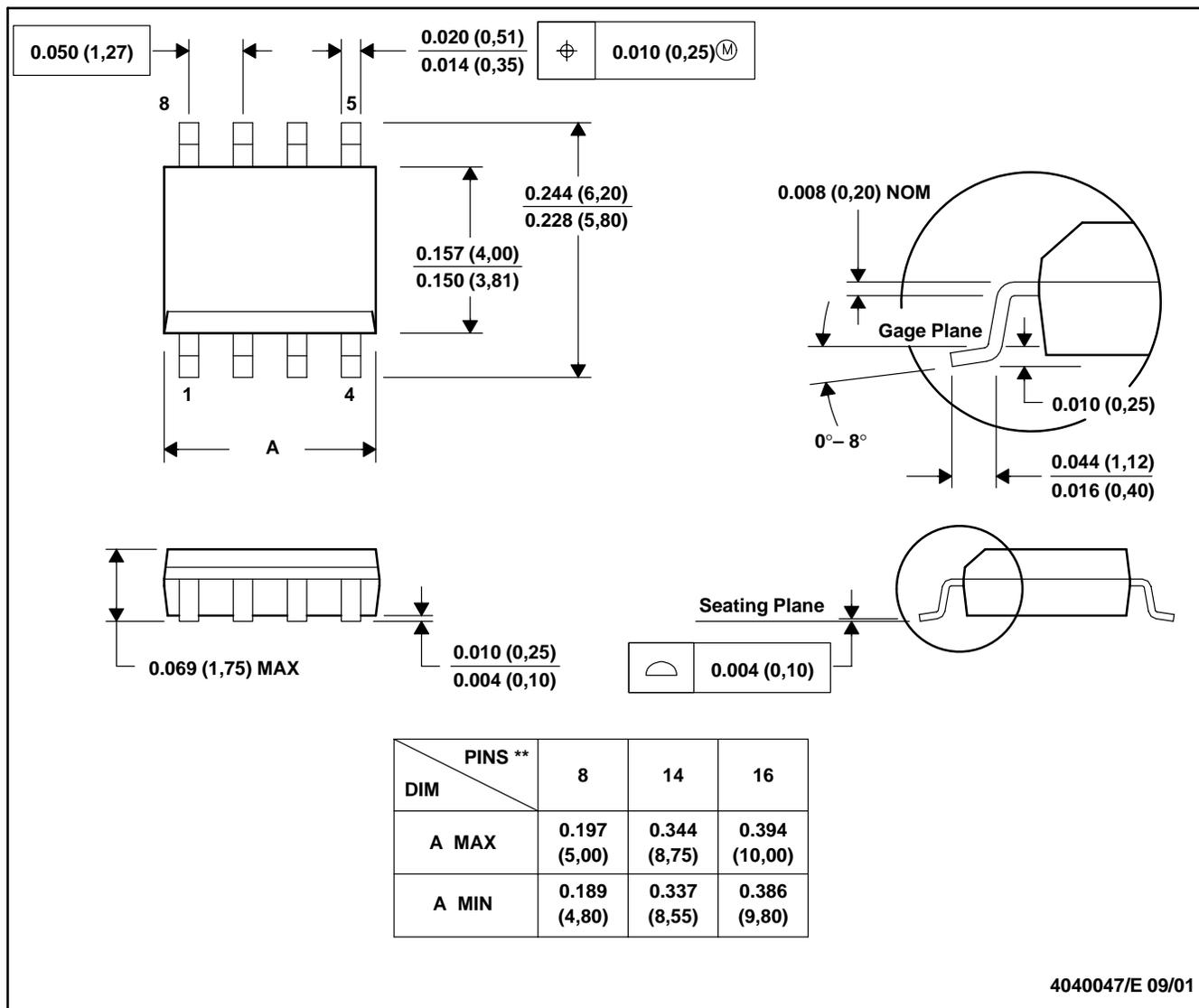
- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).  
 D The 20 pin end lead shoulder width is a vendor option, either half or full width.

4040049/E 12/2002

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

PLASTIC SMALL-OUTLINE PACKAGE

8 PINS SHOWN

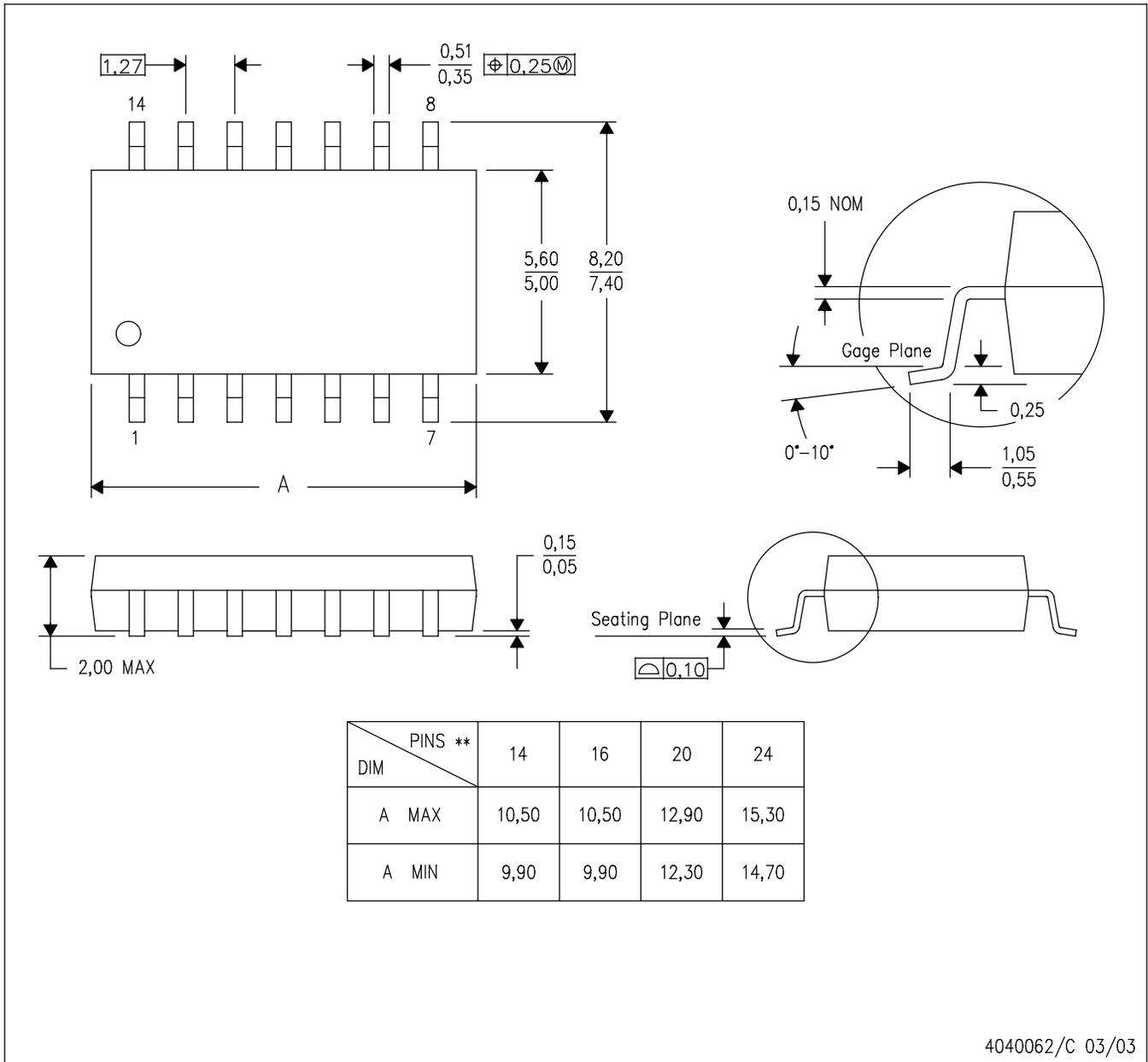


4040047/E 09/01

- 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

NS (R-PDSO-G\*\*)   
 14-PIN SHOWN

PLASTIC SMALL-OUTLINE PACKAGE



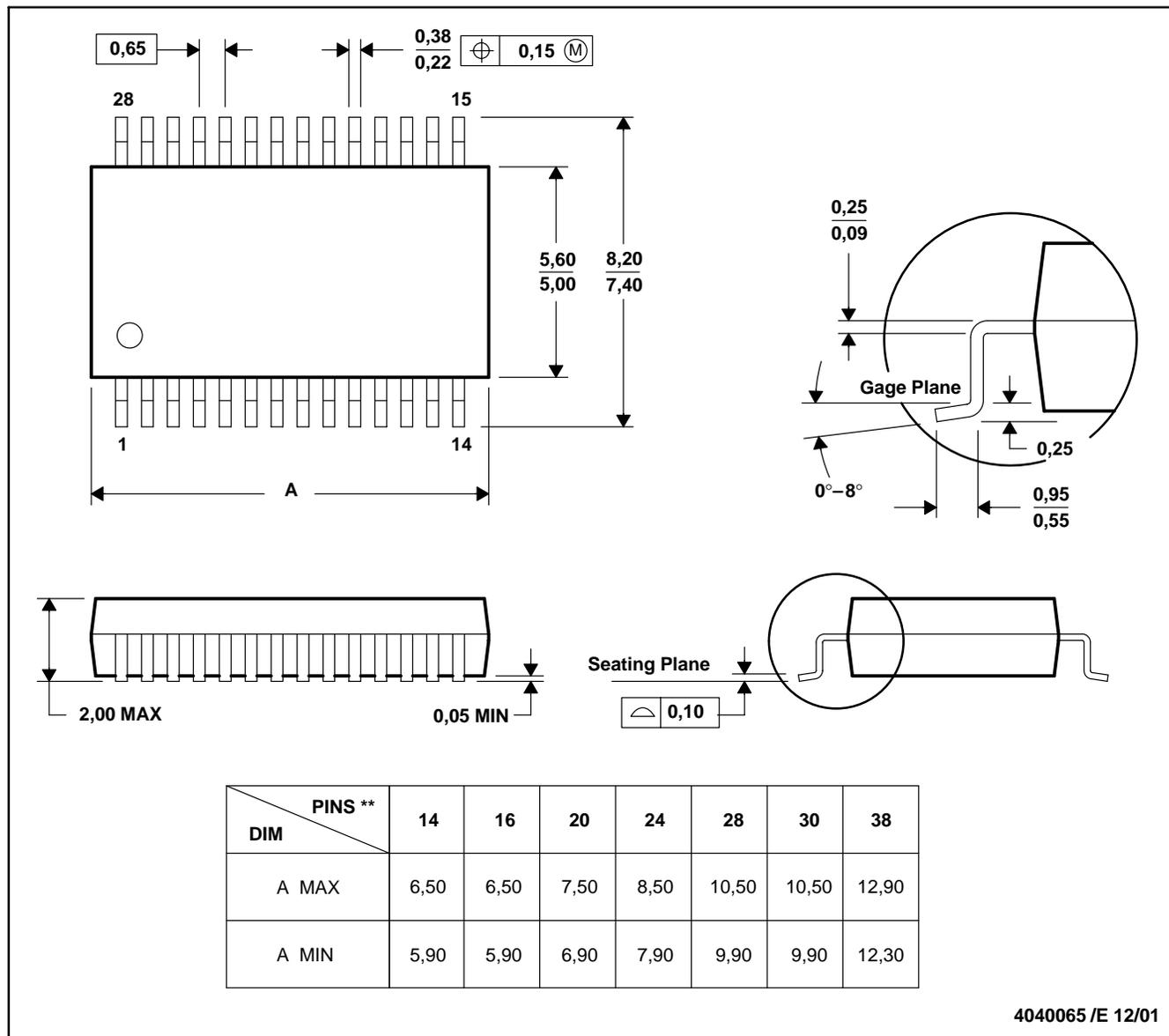
4040062/C 03/03

- 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

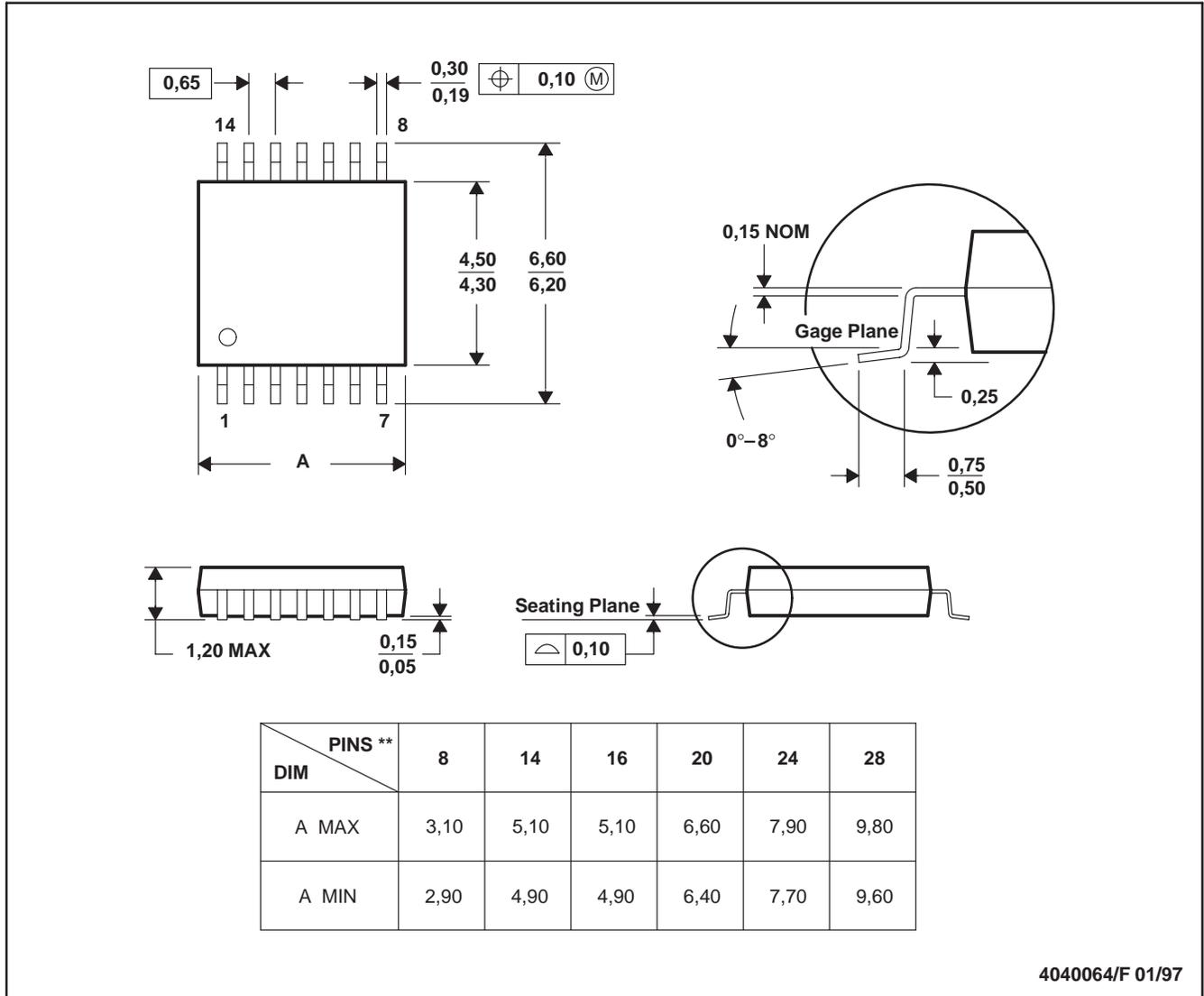


- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-150

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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