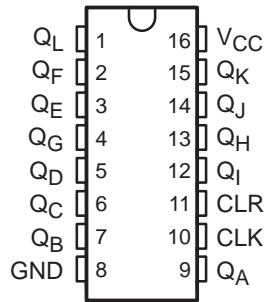


# SN54HC4040, SN74HC4040 12-BIT ASYNCHRONOUS BINARY COUNTERS

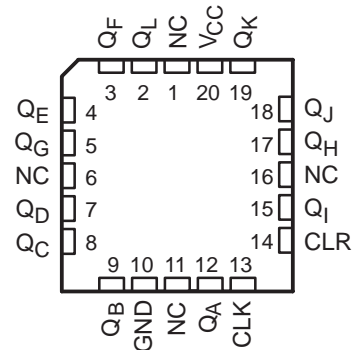
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- Wide Operating Voltage Range of 2 V to 6 V
- Outputs Can Drive Up To 10 LSTTL Loads
- Low Power Consumption, 80- $\mu$ A Max  $I_{CC}$
- Typical  $t_{pd} = 12$  ns
- $\pm 4$ -mA Output Drive at 5 V
- Low Input Current of 1  $\mu$ A Max

SN54HC4040 . . . J OR W PACKAGE  
SN74HC4040 . . . D, DB, N, NS, OR PW PACKAGE  
(TOP VIEW)



SN54HC4040 . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

## description/ordering information

The 'HC4040 devices are 12-stage asynchronous binary counters, with the outputs of all stages available externally. A high level at the clear (CLR) input asynchronously clears the counter and resets all outputs low. The count is advanced on a high-to-low transition at the clock (CLK) input. Applications include time-delay circuits, counter controls, and frequency-dividing circuits.

## ORDERING INFORMATION

$T_A$	PACKAGE†	PACKAGE†	ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	PDIP – N	Tube of 25	SN74HC4040N	SN74HC4040N
	SOIC – D	Tube of 40	SN74HC4040D	HC4040
		Reel of 2500	SN74HC4040DR	
		Reel of 250	SN74HC4040DT	
	SOP – NS	Reel of 2000	SN74HC4040NSR	HC4040
	SSOP – DB	Reel of 2000	SN74HC4040DBR	HC4040
	TSSOP – PW	Tube of 90	SN74HC4040PW	HC4040
Reel of 2000		SN74HC4040PWR		
Reel of 250		SN74HC4040PWT		
-55°C to 125°C	CDIP – J	Tube of 25	SNJ54HC4040J	SNJ54HC4040J
	CFP – W	Tube of 150	SNJ54HC4040W	SNJ54HC4040W
	LCCC – FK	Tube of 55	SNJ54HC4040FK	SNJ54HC4040FK

† 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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 **TEXAS  
INSTRUMENTS**

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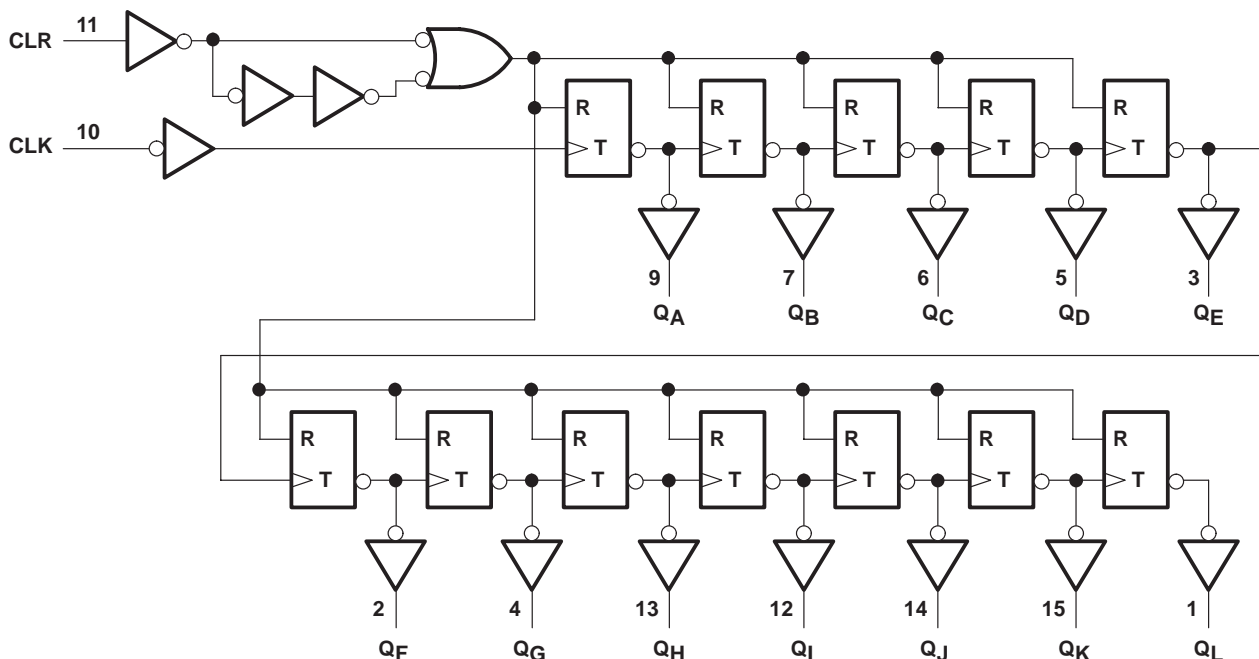
# SN54HC4040, SN74HC4040 12-BIT ASYNCHRONOUS BINARY COUNTERS

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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
Continuous current through $V_{CC}$ or GND	$\pm 50$ 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.



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# SN54HC4040, SN74HC4040

## 12-BIT ASYNCHRONOUS BINARY COUNTERS

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### recommended operating conditions (see Note 3)

		SN54HC4040			SN74HC4040			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 <sup>†</sup>	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	

<sup>†</sup> If this device is used in the threshold region (from V<sub>ILmax</sub> = 0.5 V to V<sub>IHmin</sub> = 1.5 V), there is a potential to go into the wrong state from induced grounding, causing double clocking. Operating with the inputs at t<sub>r</sub> = 1000 ns and V<sub>CC</sub> = 2 V does not damage the device; however, functionally, the CLK inputs are not ensured while in the shift, count, or toggle operating modes.

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			SN54HC4040		SN74HC4040		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V <sub>OH</sub>	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		
		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>	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		V	
			4.5 V		0.001	0.1		0.1			
			6 V		0.001	0.1		0.1			
		I <sub>OL</sub> = 4 mA	4.5 V		0.17	0.26		0.4			0.33
		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



# SN54HC4040, SN74HC4040 12-BIT ASYNCHRONOUS BINARY COUNTERS

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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		SN54HC4040		SN74HC4040		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>	CLK high or low	2 V	90		135		115		ns
		4.5 V	18		27		23		
		6 V	15		23		20		
	CLR high	2 V	70		105		90		
		4.5 V	14		21		18		
		6 V	12		18		15		
t <sub>su</sub>	Setup time, CLR inactive before CLK↓	2 V	60		90		75		ns
		4.5 V	12		18		15		
		6 V	10		15		13		

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

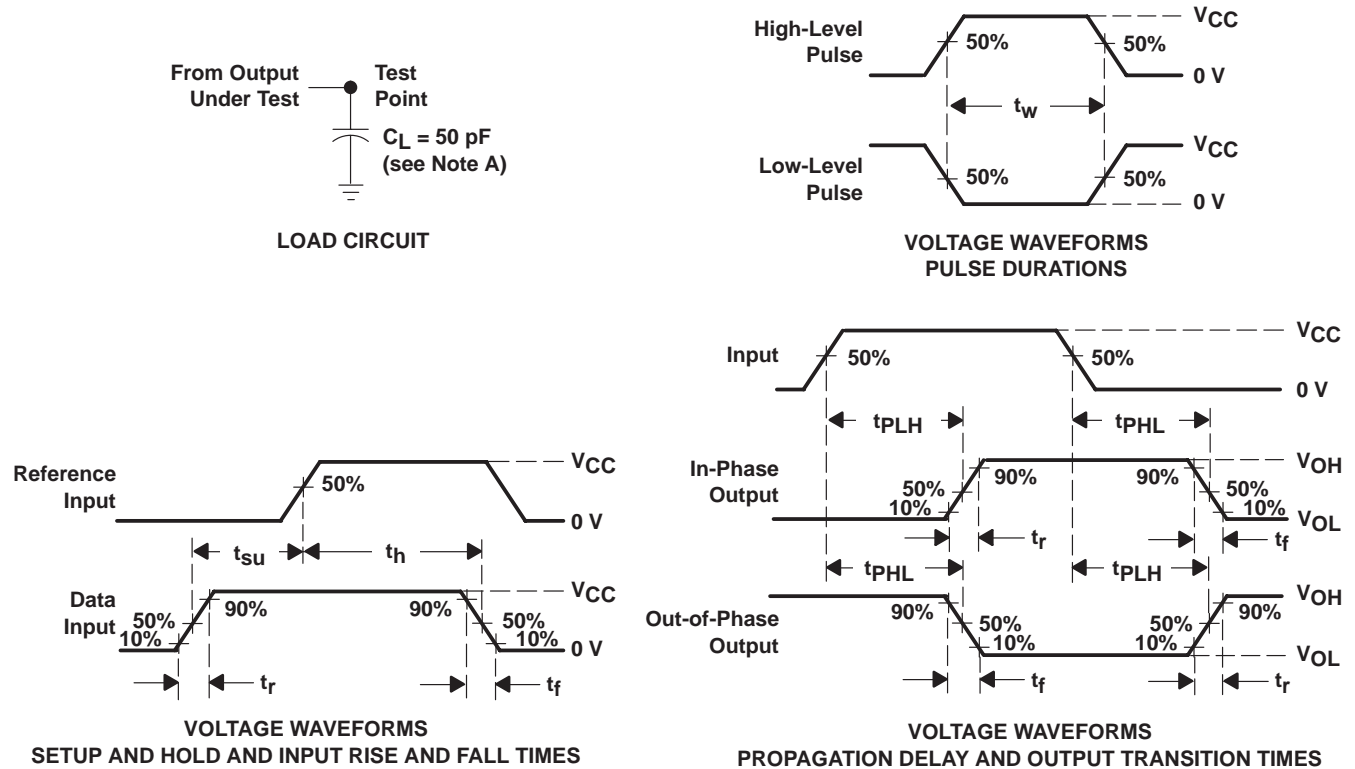
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub>	T <sub>A</sub> = 25°C			SN54HC4040		SN74HC4040		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f <sub>max</sub>			2 V	5.5	10		3.7		4.3	MHz	
			4.5 V	28	45		19		22		
			6 V	33	53		22		25		
t <sub>pd</sub>	CLK	Q <sub>A</sub>	2 V		62	150		225		190	ns
			4.5 V		16	30		45		38	
			6 V		12	26		38		32	
t <sub>PHL</sub>	CLR	Any	2 V		63	140		210		175	ns
			4.5 V		17	28		42		35	
			6 V		13	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	13		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



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:  $PRR \leq 1 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r = 6 \text{ ns}$ ,  $t_f = 6 \text{ ns}$ .
  - 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

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)

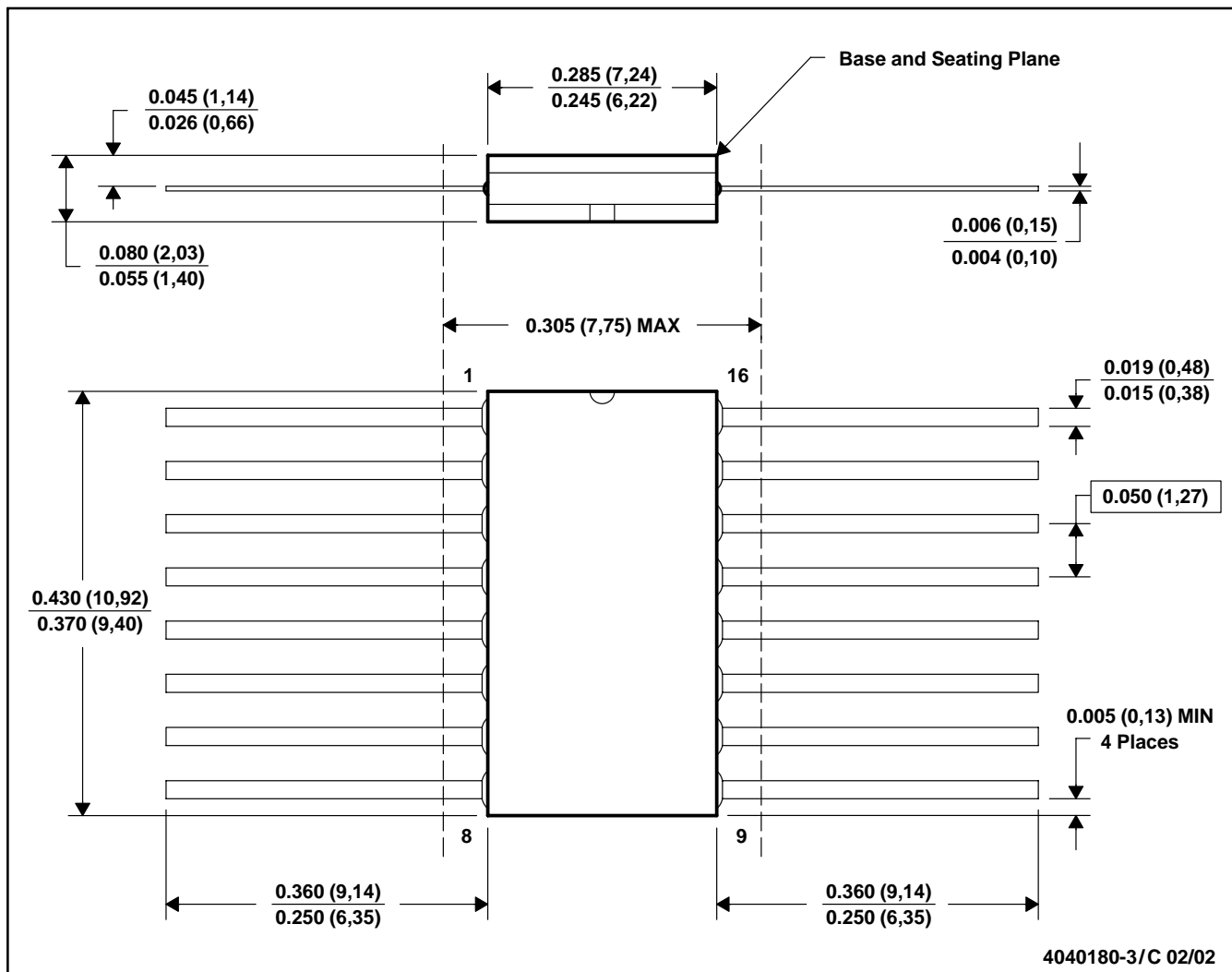


4040083/F 03/03

- 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-F16)

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 GDFP-1F16 and JEDEC MO-092AC

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

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



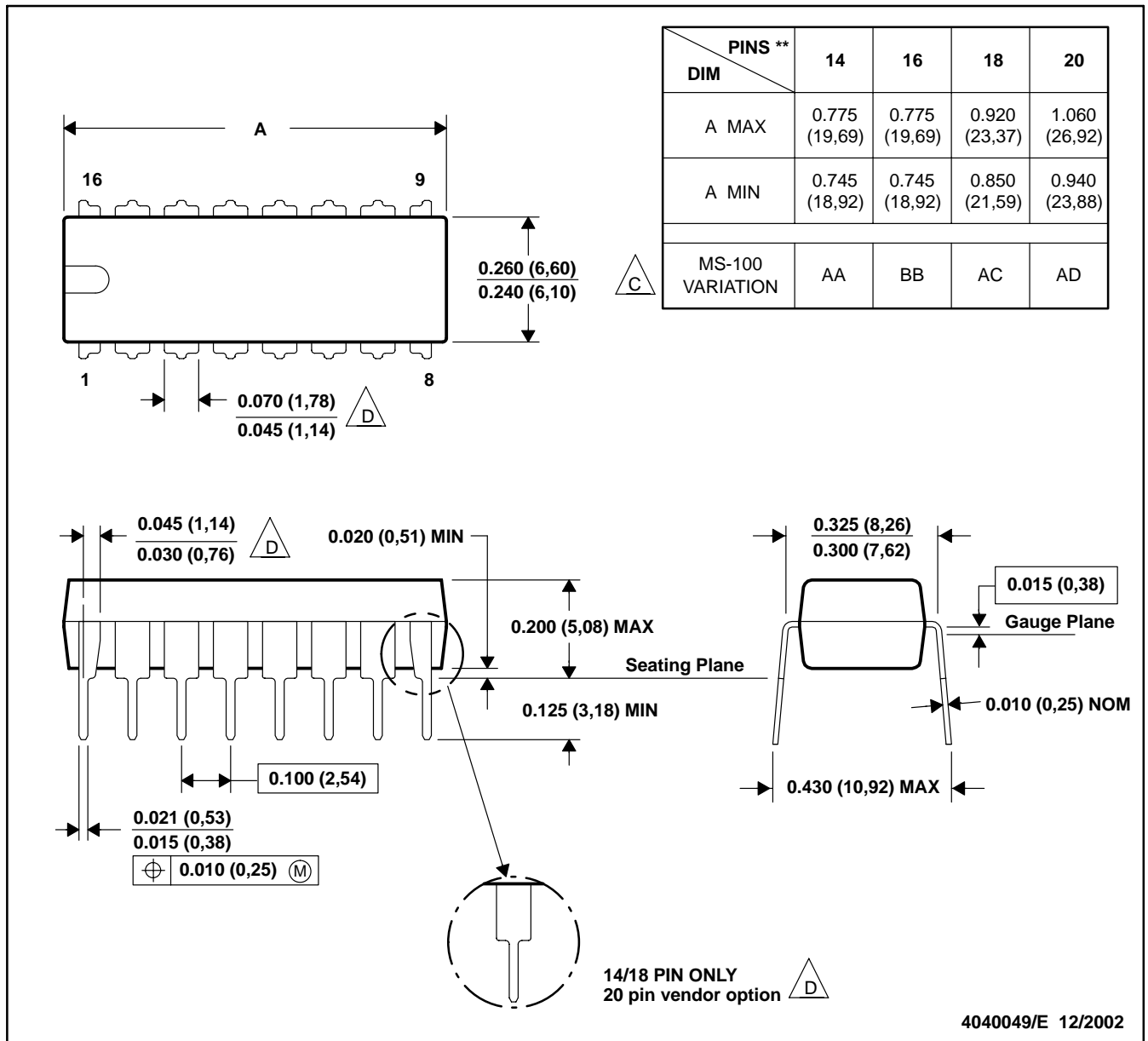
- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a metal lid.
  - D. The terminals are gold plated.
  - E. Falls within JEDEC MS-004



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.

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

PLASTIC SMALL-OUTLINE PACKAGE

8 PINS SHOWN

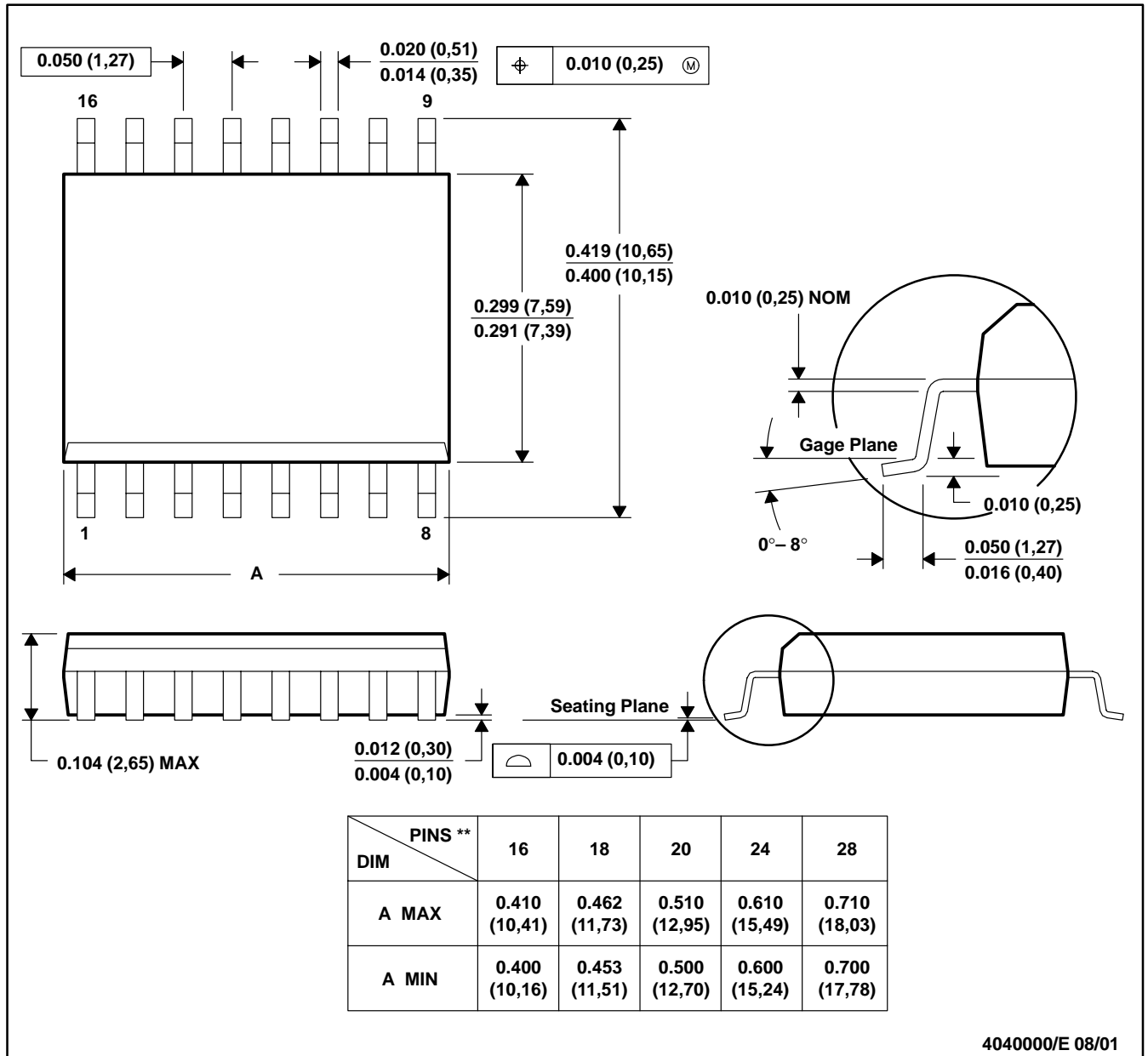


- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).  
 D. Falls within JEDEC MS-012

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

PLASTIC SMALL-OUTLINE PACKAGE

16 PINS SHOWN



4040000/E 08/01

- 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-013

# 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

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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