

# SN54AC241, SN74AC241 OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCAS513E – JUNE 1995 – REVISED OCTOBER 2003

- 2-V to 6-V  $V_{CC}$  Operation
- Inputs Accept Voltages to 6 V
- Max  $t_{pd}$  of 7.5 ns at 5 V

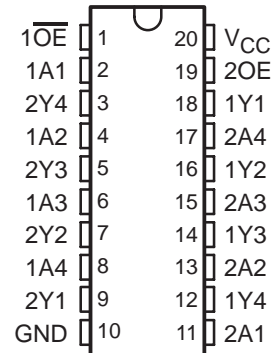
## description/ordering information

These octal buffers and line drivers are designed specifically to improve the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters.

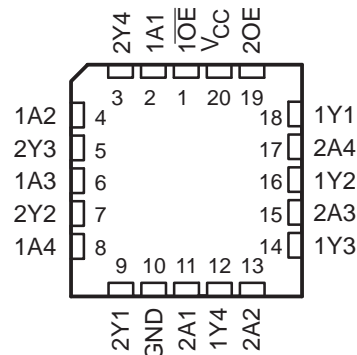
The 'AC241 devices are organized as two 4-bit buffers/drivers with separate complementary output-enable ( $1OE$  and  $2OE$ ) inputs. When  $1OE$  is low or  $2OE$  is high, the device passes noninverted data from the A inputs to the Y outputs. When  $1OE$  is high or  $2OE$  is low, the outputs are in the high-impedance state.

To ensure the high-impedance state during power up or power down, OE should be tied to  $V_{CC}$  through a pullup resistor and OE should be tied to GND through a pulldown resistor; the minimum value of the resistor is determined by the current-sinking or the current-sourcing capability of the driver.

## SN54AC241 . . . J OR W PACKAGE SN54AC241 . . . DB, DW, N, NS, OR PW PACKAGE (TOP VIEW)



## SN54AC241 . . . FK PACKAGE (TOP VIEW)



## ORDERING INFORMATION

$T_A$	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	PDIP – N	Tube	SN74AC241N	SN74AC241N
	SOIC – DW	Tube	SN74AC241DW	AC241
		Tape and reel	SN74AC241DWR	
	SOP – NS	Tape and reel	SN74AC241NSR	AC241
	SSOP – DB	Tape and reel	SN74AC241DBR	AC241
	TSSOP – PW	Tube	SN74AC241PW	AC241
Tape and reel		SN74AC241PWR		
-55°C to 125°C	CDIP – J	Tube	SNJ54AC241J	SNJ54AC241J
	CFP – W	Tube	SNJ54AC241W	SNJ54AC241W
	LCCC – FK	Tube	SNJ54AC241FK	SNJ54AC241FK

† 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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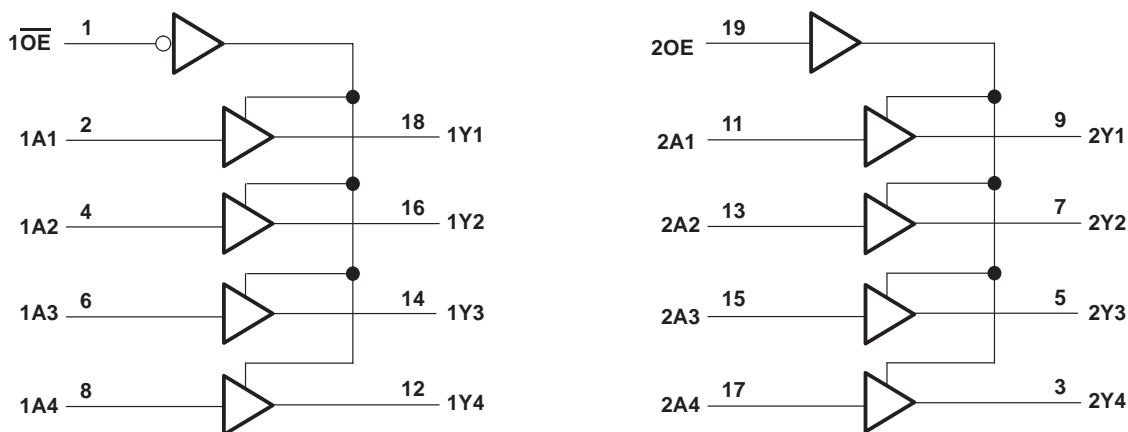
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## FUNCTION TABLES

INPUTS		OUTPUT
$\overline{1OE}$	1A	1Y
L	H	H
L	L	L
H	X	Z

INPUTS		OUTPUT
2OE	2A	2Y
H	H	H
H	L	L
L	X	Z

### logic diagram (positive logic)



### 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 $V_{CC} + 0.5$ V
Output voltage range, $V_O$ (see Note 1)	-0.5 V to $V_{CC} + 0.5$ V
Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ )	$\pm 20$ mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ )	$\pm 20$ mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )	$\pm 50$ mA
Continuous current through $V_{CC}$ or GND	$\pm 200$ mA
Package thermal impedance, $\theta_{JA}$ (see Note 2):	
DB package	70°C/W
DW package	58°C/W
N package	69°C/W
NS package	60°C/W
PW package	83°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.

# SN54AC241, SN74AC241 OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

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## recommended operating conditions (see Note 3)

		SN54AC241		SN74AC241		UNIT
		MIN	MAX	MIN	MAX	
V <sub>CC</sub>	Supply voltage	2	6	2	6	V
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 3 V		2.1		V
		V <sub>CC</sub> = 4.5 V		3.15		
		V <sub>CC</sub> = 5.5 V		3.85		
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 3 V		0.9		V
		V <sub>CC</sub> = 4.5 V		1.35		
		V <sub>CC</sub> = 5.5 V		1.65		
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
I <sub>OH</sub>	High-level output current	V <sub>CC</sub> = 3 V		-12		mA
		V <sub>CC</sub> = 4.5 V		-24		
		V <sub>CC</sub> = 5.5 V		-24		
I <sub>OL</sub>	Low-level output current	V <sub>CC</sub> = 3 V		12		mA
		V <sub>CC</sub> = 4.5 V		24		
		V <sub>CC</sub> = 5.5 V		24		
Δt/Δv	Input transition rise or fall rate	8		8		ns/V
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.

# SN54AC241, SN74AC241 OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

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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			SN54AC241		SN74AC241		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V <sub>OH</sub>	I <sub>OH</sub> = -50 μA	3 V	2.9			2.9		2.9	V	
		4.5 V	4.4			4.4		4.4		
		5.5 V	5.4			5.4		5.4		
	I <sub>OH</sub> = -12 mA	3 V	2.56			2.4		2.46		
		4.5 V	3.86			3.7		3.76		
	I <sub>OH</sub> = -24 mA	4.5 V	3.86			3.7		3.76		
		5.5 V	4.86			4.7		4.76		
I <sub>OH</sub> = -50 mA <sup>†</sup>	5.5 V				3.85					
I <sub>OH</sub> = -75 mA <sup>†</sup>	5.5 V						3.85			
V <sub>OL</sub>	I <sub>OL</sub> = 50 μA	3 V			0.1		0.1	0.1	V	
		4.5 V			0.1		0.1	0.1		
		5.5 V			0.1		0.1	0.1		
	I <sub>OL</sub> = 12 mA	3 V			0.36		0.5	0.44		
		4.5 V			0.36		0.5	0.44		
	I <sub>OL</sub> = 24 mA	4.5 V			0.36		0.5	0.44		
		5.5 V			0.36		0.5	0.44		
I <sub>OL</sub> = 50 mA <sup>†</sup>	5.5 V					1.65				
I <sub>OL</sub> = 75 mA <sup>†</sup>	5.5 V						1.65			
I <sub>I</sub>	Data inputs	V <sub>I</sub> = V <sub>CC</sub> or GND			±0.1		±1	±1	μA	
	Control inputs	V <sub>I</sub> = V <sub>CC</sub> or GND			±0.1		±1	±1		
I <sub>OZ</sub>		V <sub>O</sub> = V <sub>CC</sub> or GND, V <sub>I(OE)</sub> = V <sub>IL</sub> or V <sub>IH</sub>			±0.25		±5	±2.5	μA	
I <sub>CC</sub>		V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0			4		80	40	μA	
C <sub>i</sub>		V <sub>I</sub> = V <sub>CC</sub> or GND			2.5				pF	

<sup>†</sup> Not more than one output should be tested at a time, and the duration of the test should not exceed 10 ms.

switching characteristics over recommended operating free-air temperature range,  
V<sub>CC</sub> = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	T <sub>A</sub> = 25°C			SN54AC241		SN74AC241		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	A	Y	1.5	6	9	1	12	1.5	10	ns
t <sub>PHL</sub>			1.5	6	9	1	11.5	1	10.5	
t <sub>PZH</sub>	$\overline{\text{OE}}$ or OE	Y	1.5	6.5	12.5	1	13	1	13	ns
t <sub>PZL</sub>			1.5	7	12	1	13	1.5	13	
t <sub>PHZ</sub>	$\overline{\text{OE}}$ or OE	Y	2	8	12	1	13	2	12.5	ns
t <sub>PLZ</sub>			1.5	7	12.5	1	13	1	13.5	

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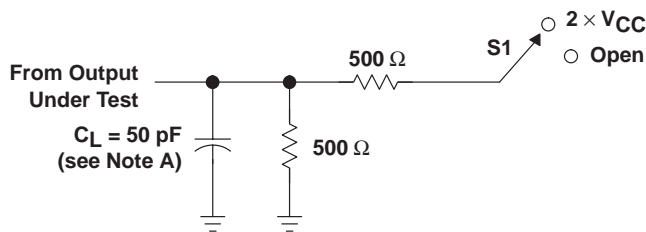
switching characteristics over recommended operating free-air temperature range,  $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$  (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$T_A = 25^\circ\text{C}$			SN54AC241		SN74AC241		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$	A	Y	1.5	5	7	1	9.5	1	7.5	ns
$t_{PHL}$			1.5	4.5	7	1	9	1	7.5	
$t_{PZH}$	$\overline{OE}$ or OE	Y	1.5	5.5	9	1	10	1	9.5	ns
$t_{PZL}$			1.5	5.5	9	1	10	1	9.5	
$t_{PHZ}$	$\overline{OE}$ or OE	Y	1.5	6.5	10	1	11.5	1	10.5	ns
$t_{PLZ}$			1.5	6	10	1	11.5	1	10.5	

operating characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$

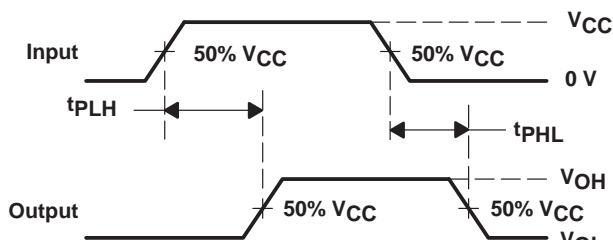
PARAMETER	TEST CONDITIONS	TYP	UNIT
$C_{pd}$ Power dissipation capacitance per buffer/driver	$C_L = 50\text{ pF}$ , $f = 1\text{ MHz}$	45	pF

## PARAMETER MEASUREMENT INFORMATION

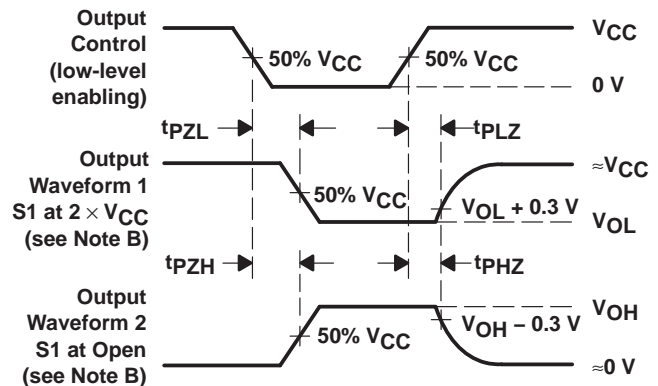


TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$2 \times V_{CC}$
$t_{PHZ}/t_{PZH}$	Open

LOAD CIRCUIT



VOLTAGE WAVEFORMS



VOLTAGE WAVEFORMS

- 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:  $PRR \leq 1\text{ MHz}$ ,  $Z_O = 50\ \Omega$ ,  $t_r \leq 2.5\text{ ns}$ ,  $t_f \leq 2.5\text{ ns}$ .  
 D. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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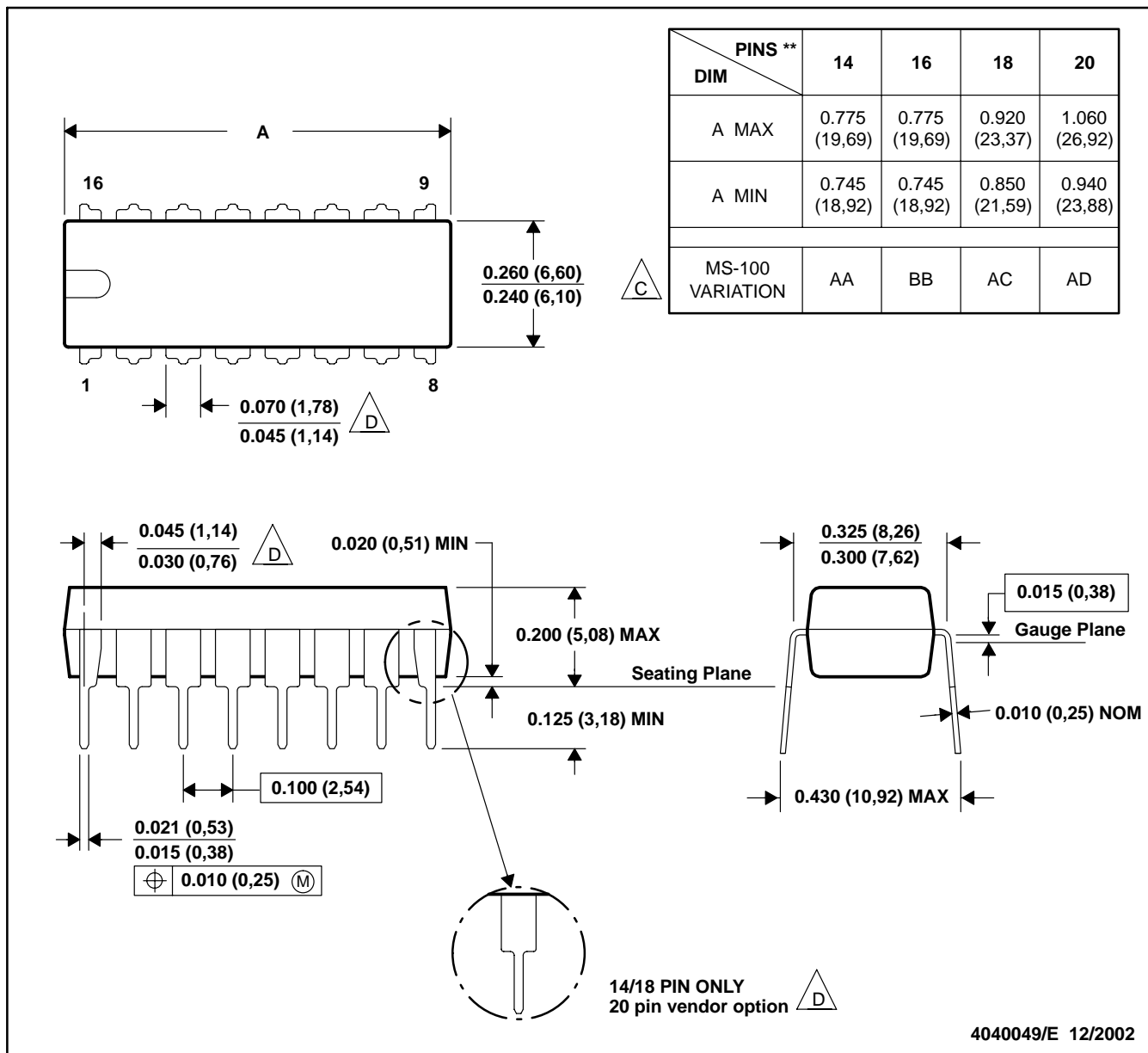


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N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



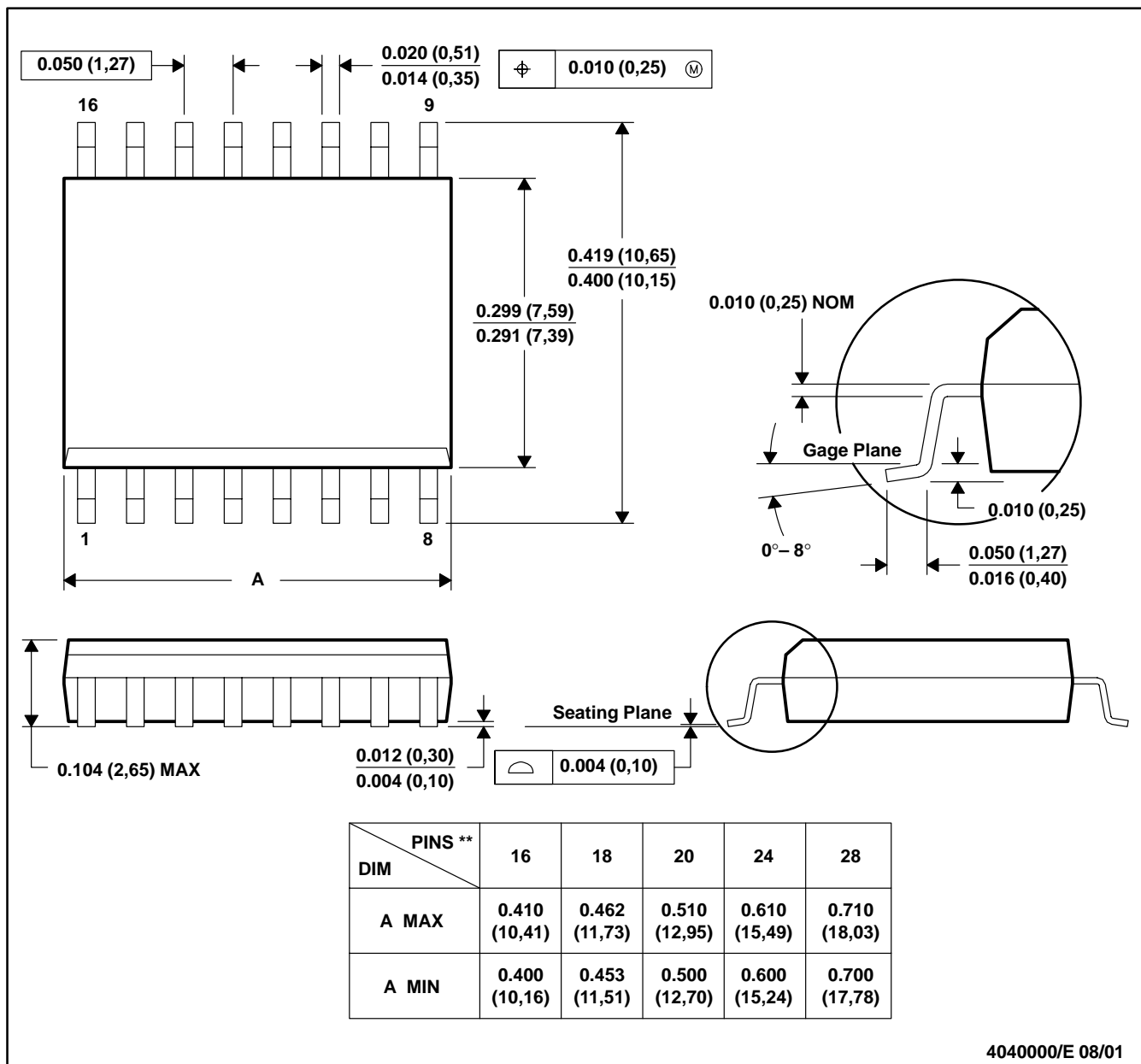
- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).  
 D The 20 pin end lead shoulder width is a vendor option, either half or full width.

4040049/E 12/2002

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

PLASTIC SMALL-OUTLINE PACKAGE

16 PINS SHOWN



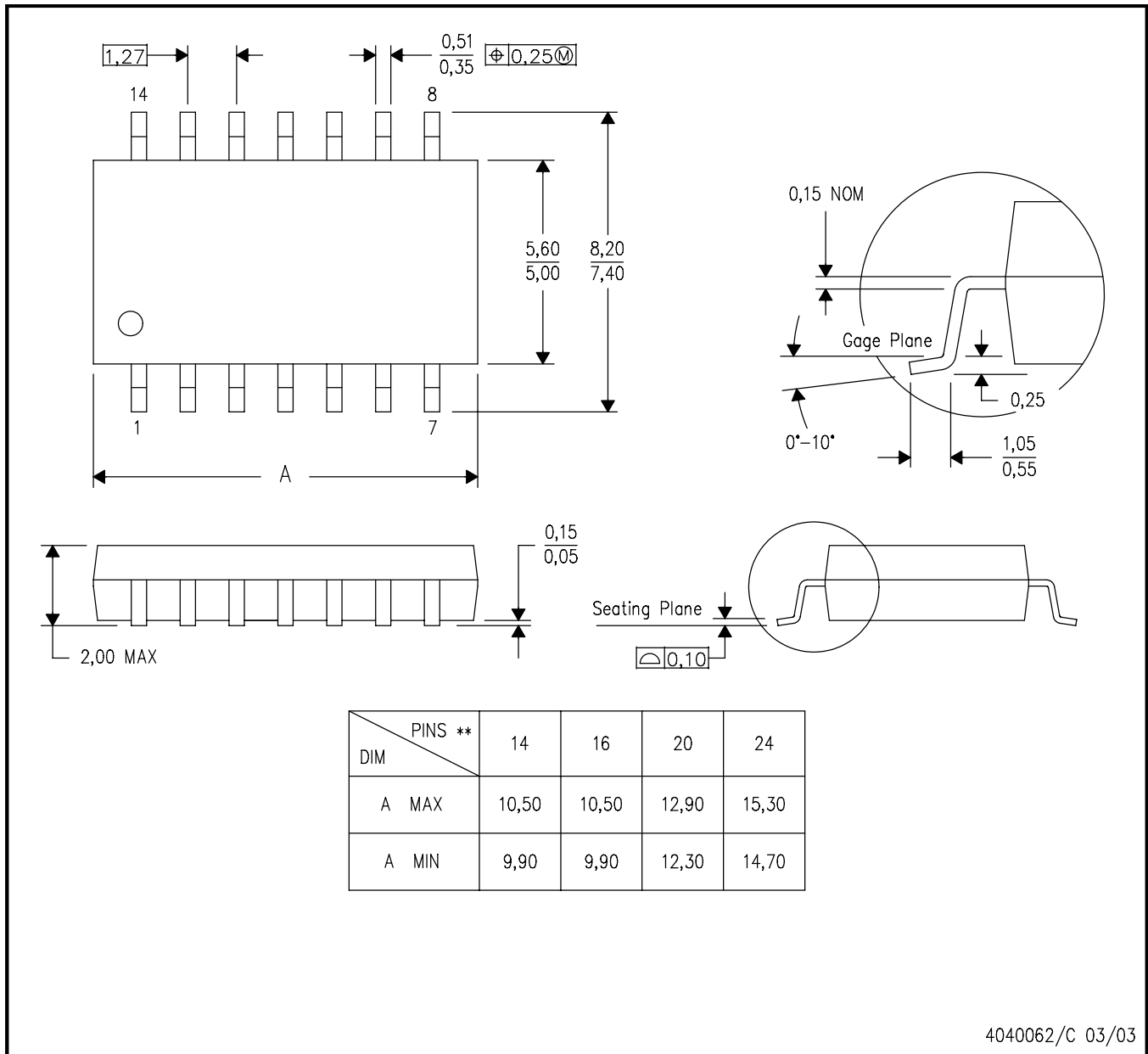
- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).  
 D. Falls within JEDEC MS-013

# 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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