

# SN54ALS241C, SN54AS241A, SN74ALS241C, SN74AS241A OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SDAS153E – DECEMBER 1982 – REVISED AUGUST 1995

- 3-State Outputs Drive Bus Lines or Buffer Memory Address Registers
- pnp Inputs Reduce dc Loading
- Package Options Include Plastic Small-Outline (DW) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs

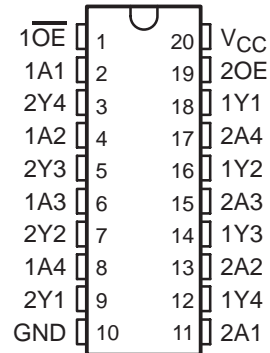
## description

These octal buffers/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 designer has a choice of selected combinations of inverting and noninverting outputs, symmetrical active-low output-enable ( $\overline{OE}$ ) inputs, and complementary OE and  $\overline{OE}$  inputs. These devices feature high fan-out and improved fan-in.

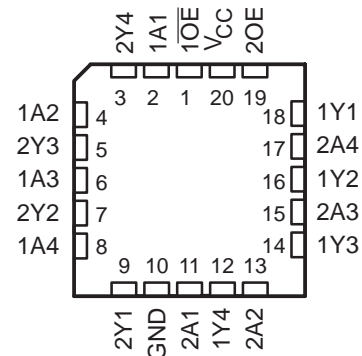
The -1 version of SN74ALS241C is identical to the standard version, except that the recommended maximum  $I_{OL}$  of the -1 version is 48 mA. There is no -1 version of the SN54ALS241C.

The SN54ALS241C and SN54AS241A are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74ALS241C and SN74AS241A are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

SN54ALS241C, SN54AS241A . . . J PACKAGE  
SN74ALS241C, SN74AS241A . . . DW OR N PACKAGE  
(TOP VIEW)



SN54ALS241C, SN54AS241A . . . FK PACKAGE  
(TOP VIEW)



## FUNCTION TABLES

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

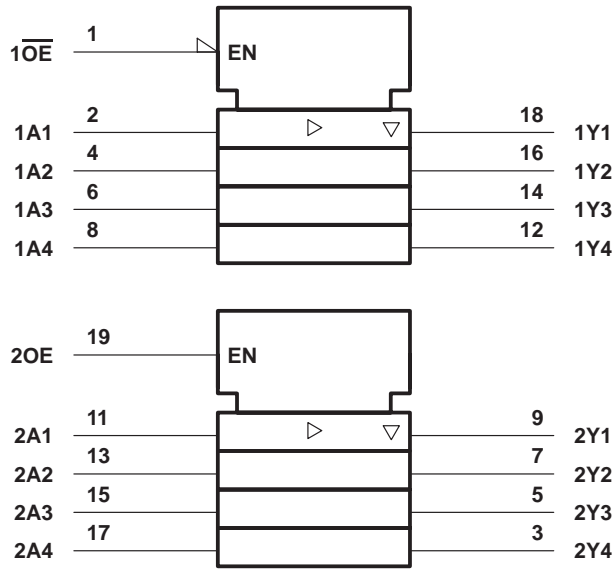
INPUTS		OUTPUT
2OE	2A	2Y
H	H	H
H	L	L
L	X	Z

# SN54ALS241C, SN54AS241A, SN74ALS241C, SN74AS241A

## OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

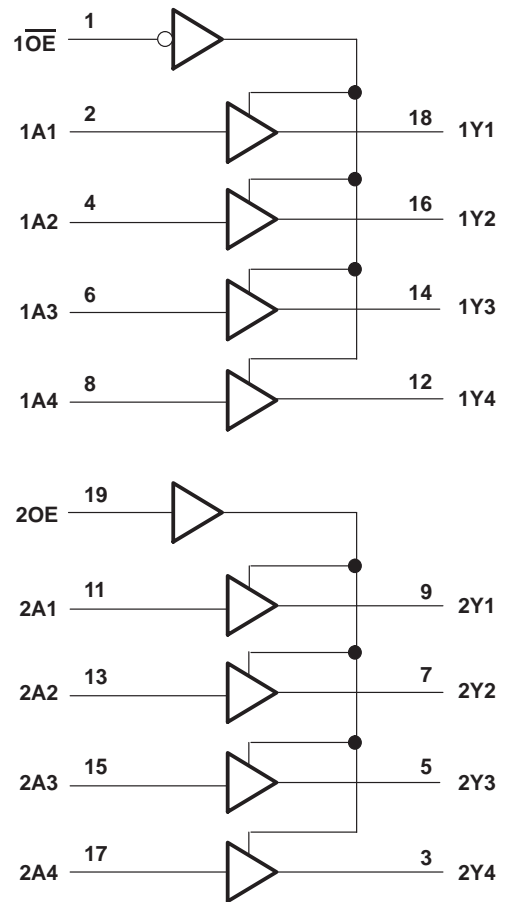
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### logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

### logic diagram (positive logic)



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

Supply voltage, $V_{CC}$	7 V
Input voltage, $V_I$	7 V
Voltage applied to a disabled 3-state output	5.5 V
Operating free-air temperature range, $T_A$ : SN54ALS241C	-55°C to 125°C
SN74ALS241C	0°C to 70°C
Storage temperature range	-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.

# SN54ALS241C, SN54AS241A, SN74ALS241C, SN74AS241A OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

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## recommended operating conditions

		SN54ALS241C			SN74ALS241C			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC}$	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
$V_{IH}$	High-level input voltage	2			2			V
$V_{IL}$	Low-level input voltage			0.7			0.8	V
$I_{OH}$	High-level output current			-12			-15	mA
$I_{OL}$	Low-level output current			12			24	mA
							48†	
$T_A$	Operating free-air temperature	-55		125	0		70	°C

† Applies only to the -1 version and only if  $V_{CC}$  is between 4.75 V and 5.25 V

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

PARAMETER	TEST CONDITIONS	SN54ALS241C			SN74ALS241C			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
$V_{IK}$	$V_{CC} = 4.5$ V, $I_I = -18$ mA			-1.2			-1.2	V
$V_{OH}$	$V_{CC} = 4.5$ V to 5.5 V, $I_{OH} = -0.4$ mA	$V_{CC} - 2$		$V_{CC} - 2$				V
	$V_{CC} = 4.5$ V			2.4	3.2	2.4	3.2	
				2				
						2		
$V_{OL}$	$V_{CC} = 4.5$ V			0.25	0.4	0.25	0.4	V
						0.35	0.5	
						0.35	0.5	
$I_{OZH}$	$V_{CC} = 5.5$ V, $V_O = 2.7$ V			20		20		μA
$I_{OZL}$	$V_{CC} = 5.5$ V, $V_O = 0.4$ V			-20		-20		μA
$I_I$	$V_{CC} = 5.5$ V, $V_I = 7$ V			0.1		0.1		mA
$I_{IH}$	$V_{CC} = 5.5$ V, $V_I = 2.7$ V			20		20		μA
$I_{IL}$	$V_{CC} = 5.5$ V, $V_I = 0.4$ V			-0.1		-0.1		mA
$I_{O}^{\S}$	$V_{CC} = 5.5$ V, $V_O = 2.25$ V	-20		-112	-30		-112	mA
$I_{CC}$	$V_{CC} = 5.5$ V	Outputs high	9	17	9	18	mA	
		Outputs low	15	28	15	26		
		Outputs disabled	17	32	17	30		

‡ All typical values are at  $V_{CC} = 5$  V,  $T_A = 25^\circ\text{C}$ .

§ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .

# SN54ALS241C, SN54AS241A, SN74ALS241C, SN74AS241A

## OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

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### switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 4.5 V to 5.5 V, C <sub>L</sub> = 50 pF, R <sub>1</sub> = 500 Ω, R <sub>2</sub> = 500 Ω, T <sub>A</sub> = MIN to MAX†				UNIT
			SN54ALS241C		SN74ALS241C		
			MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	A	Y	3	31	2	11	ns
t <sub>PHL</sub>			1	17	3	10	
t <sub>PZH</sub>	$\overline{1OE}$	Y	3	33	3	21	ns
t <sub>PZL</sub>			3	27	4	21	
t <sub>PHZ</sub>	$\overline{1OE}$	Y	2	17	1	10	ns
t <sub>PLZ</sub>			2	32	2	15	
t <sub>PZH</sub>	2OE	Y	3	38	4	21	ns
t <sub>PZL</sub>			3	30	5	21	
t <sub>PHZ</sub>	2OE	Y	2	17	2	10	ns
t <sub>PLZ</sub>			3	35	3	15	

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

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

Supply voltage, V <sub>CC</sub>	7 V
Input voltage, V <sub>I</sub>	7 V
Voltage applied to a disabled 3-state output	5.5 V
Operating free-air temperature range, T <sub>A</sub> : SN54AS241A	–55°C to 125°C
SN74AS241A	0°C to 70°C
Storage temperature range	–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.

### recommended operating conditions

		SN54AS241A			SN74AS241A			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub>	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
V <sub>IH</sub>	High-level input voltage	2			2			V
V <sub>IL</sub>	Low-level input voltage			0.8			0.8	V
I <sub>OH</sub>	High-level output current			–12			–15	mA
I <sub>OL</sub>	Low-level output current			48			64	mA
T <sub>A</sub>	Operating free-air temperature	–55		125	0		70	°C

# SN54ALS241C, SN54AS241A, SN74ALS241C, SN74AS241A 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		SN54AS241A		SN74AS241A		UNIT	
			MIN	TYP†	MAX	MIN		TYP†
$V_{IK}$	$V_{CC} = 4.5\text{ V}$ ,	$I_I = -18\text{ mA}$			-1.2		-1.2	V
$V_{OH}$	$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ ,	$I_{OH} = -2\text{ mA}$	$V_{CC} - 2$		$V_{CC} - 2$		V	
	$V_{CC} = 4.5\text{ V}$	$I_{OH} = -3\text{ mA}$	2.4	3.4	2.4	3.4		
		$I_{OH} = -12\text{ mA}$	2.4					
$V_{OL}$	$V_{CC} = 4.5\text{ V}$	$I_{OL} = -15\text{ mA}$			2.4		V	
		$I_{OL} = 48\text{ mA}$	0.27	0.55				
		$I_{OL} = 64\text{ mA}$			0.31	0.55		
$I_{OZH}$	$V_{CC} = 5.5\text{ V}$ ,	$V_O = 2.7\text{ V}$			50		50	$\mu\text{A}$
$I_{OZL}$	$V_{CC} = 5.5\text{ V}$ ,	$V_O = 0.4\text{ V}$			-50		-50	$\mu\text{A}$
$I_I$	$V_{CC} = 5.5\text{ V}$ ,	$V_I = 7\text{ V}$			0.1		0.1	mA
$I_{IH}$	$V_{CC} = 5.5\text{ V}$ ,	$V_I = 2.7\text{ V}$			20		20	$\mu\text{A}$
$I_{IL}$	$V_{CC} = 5.5\text{ V}$ ,	$V_I = 0.4\text{ V}$			-1		-1	mA
$I_{O\ddagger}$	$V_{CC} = 5.5\text{ V}$ ,	$V_O = 2.25\text{ V}$	-50		-150	-50	-150	mA
$I_{CC}$	$V_{CC} = 5.5\text{ V}$	Outputs high	22	35	22	35	mA	
		Outputs low	61	90	61	90		
		Outputs disabled	35	56	35	56		

† All typical values are at  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

‡ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .

## switching characteristics (see Figure 1)

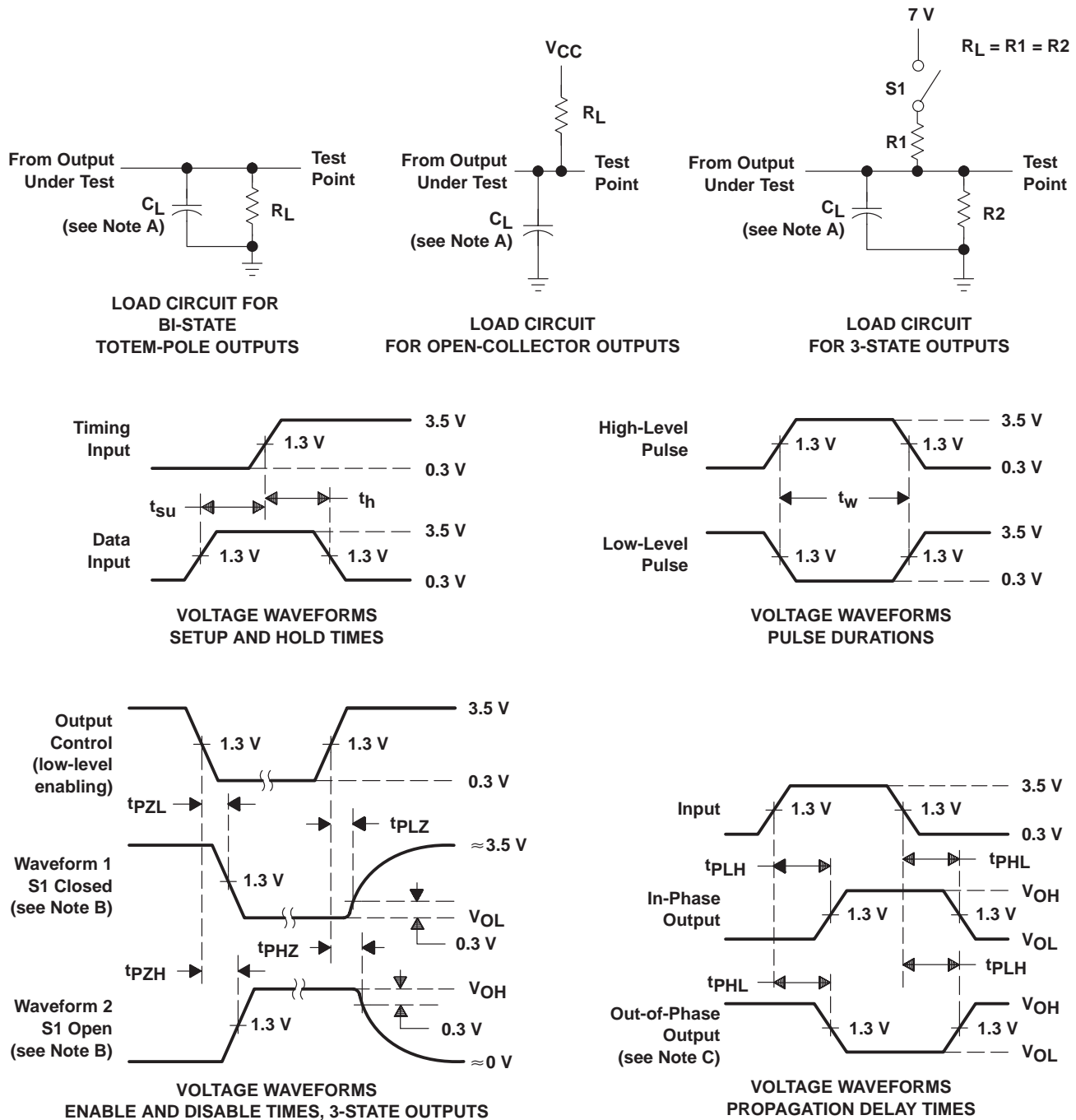
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ , $C_L = 50\text{ pF}$ , $R_1 = 500\ \Omega$ , $R_2 = 500\ \Omega$ , $T_A = \text{MIN to MAX}\S$				UNIT
			SN54AS241A		SN74AS241A		
			MIN	MAX	MIN	MAX	
$t_{PLH}$	A	Y	2	9	2	6.2	ns
$t_{PHL}$			1	7	1	6.2	
$t_{PZH}$	$\overline{1OE}$	Y	1	10	1	9	ns
$t_{PZL}$			2	8	2	7.5	
$t_{PHZ}$	$\overline{1OE}$	Y	1	6.5	1	6	ns
$t_{PLZ}$			1	10.5	1	9	
$t_{PZH}$	2OE	Y	2	11	2	10.5	ns
$t_{PZL}$			3	9.5	3	8.5	
$t_{PHZ}$	2OE	Y	1	7	1	7	ns
$t_{PLZ}$			2	12	2	12	

§ For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

# SN54ALS241C, SN54AS241A, SN74ALS241C, SN74AS241A OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

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## PARAMETER MEASUREMENT INFORMATION SERIES 54ALS/74ALS AND 54AS/74AS DEVICES



- 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. When measuring propagation delay items of 3-state outputs, switch S1 is open.  
 D. All input pulses have the following characteristics:  $PRR \leq 1$  MHz,  $t_r = t_f = 2$  ns, duty cycle = 50%.  
 E. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
5962-8859602SA	ACTIVE	CFP	W	20	1	TBD	Call TI	N / A for Pkg Type
JM38510/38302B2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
JM38510/38302BRA	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type
SN54ALS241CJ	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type
SN54AS241AJ	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type
SN74ALS241C-1DW	OBSOLETE	SOIC	DW	20		TBD	Call TI	Call TI
SN74ALS241C-1DWR	OBSOLETE	SOIC	DW	20		TBD	Call TI	Call TI
SN74ALS241C-1N	OBSOLETE	PDIP	N	20		TBD	Call TI	Call TI
SN74ALS241CDW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS241CDWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS241CDWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS241CDWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS241CDWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS241CDWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS241CN	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS241CNE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ALS241CNSR	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS241CNSRE4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS241CNSRG4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS241AN	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74AS241ANE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SNJ54ALS241CFK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54ALS241CJ	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type
SNJ54ALS241CW	ACTIVE	CFP	W	20	1	TBD	Call TI	N / A for Pkg Type
SNJ54AS241AFK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54AS241AJ	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type
SNJ54AS241AW	ACTIVE	CFP	W	20	1	TBD	Call TI	N / A for Pkg Type

<sup>(1)</sup> 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.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), 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.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**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)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74ALS241CDWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1
SN74ALS241CNSR	SO	NS	20	2000	330.0	24.4	8.2	13.0	2.5	12.0	24.0	Q1

**TAPE AND REEL BOX DIMENSIONS**



\*All dimensions are nominal

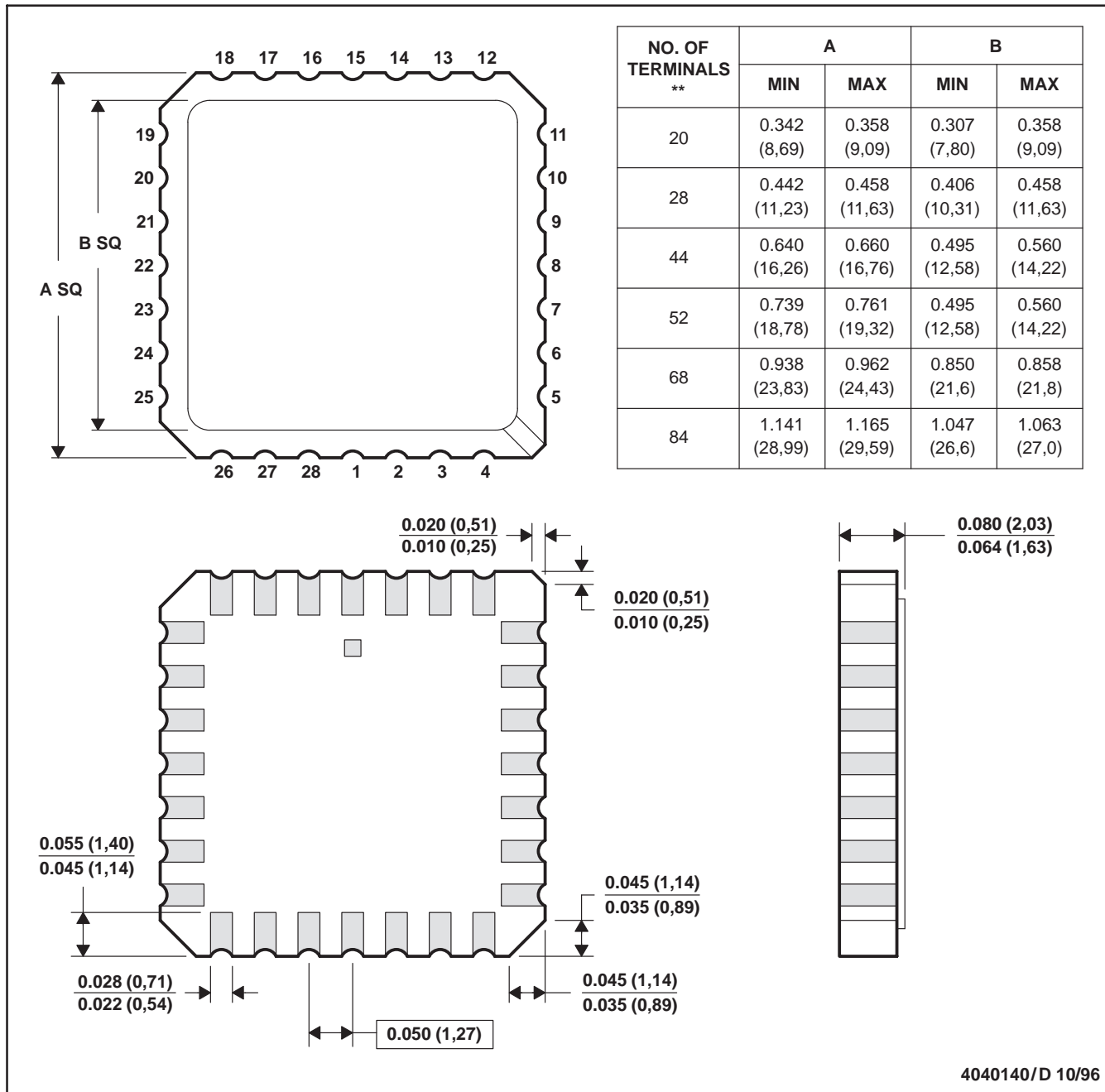
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74ALS241CDWR	SOIC	DW	20	2000	346.0	346.0	41.0
SN74ALS241CNSR	SO	NS	20	2000	346.0	346.0	41.0



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

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



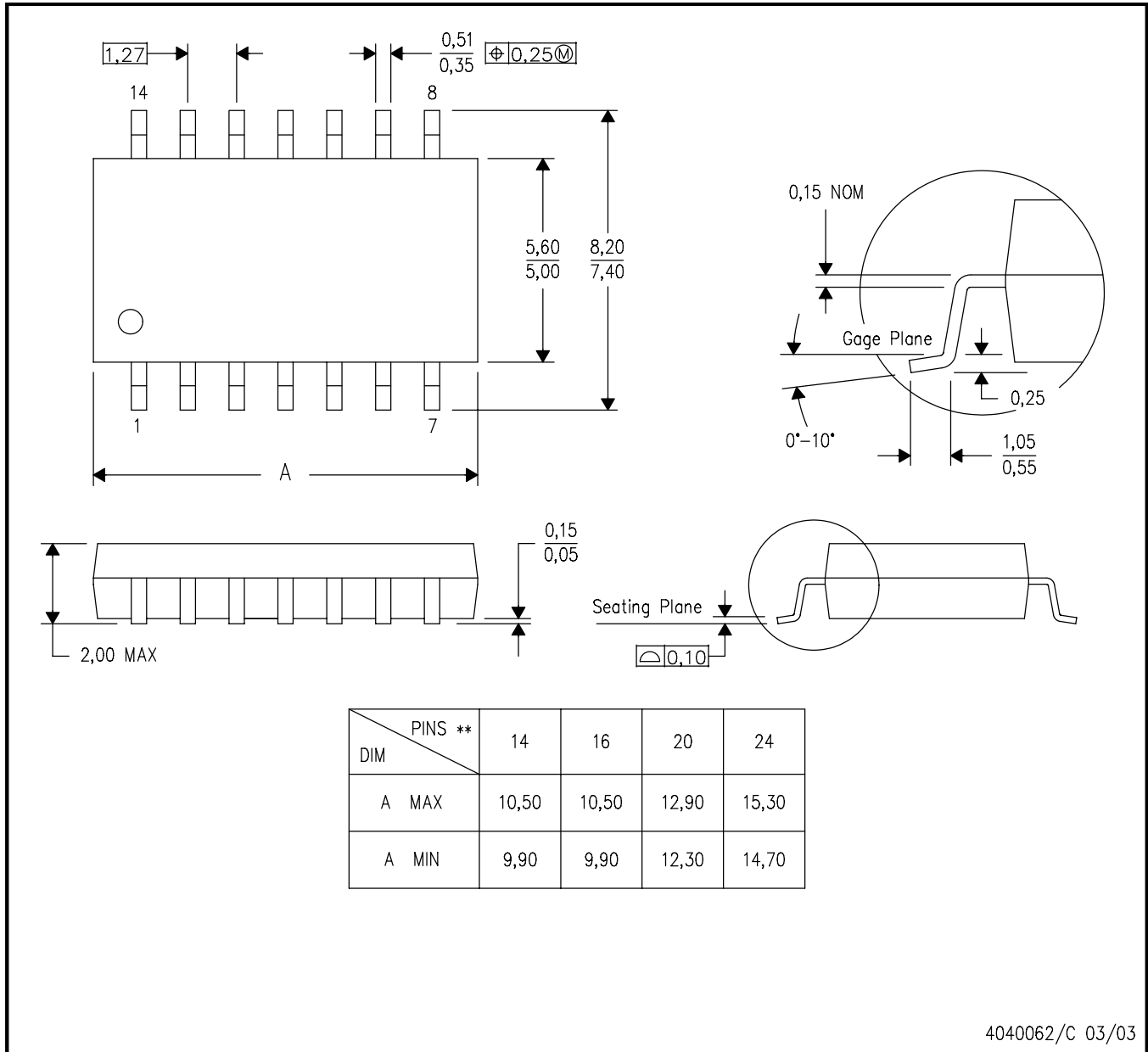
- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a metal lid.
  - D. The terminals are gold plated.
  - E. Falls within JEDEC MS-004

# MECHANICAL DATA

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

PLASTIC SMALL-OUTLINE PACKAGE

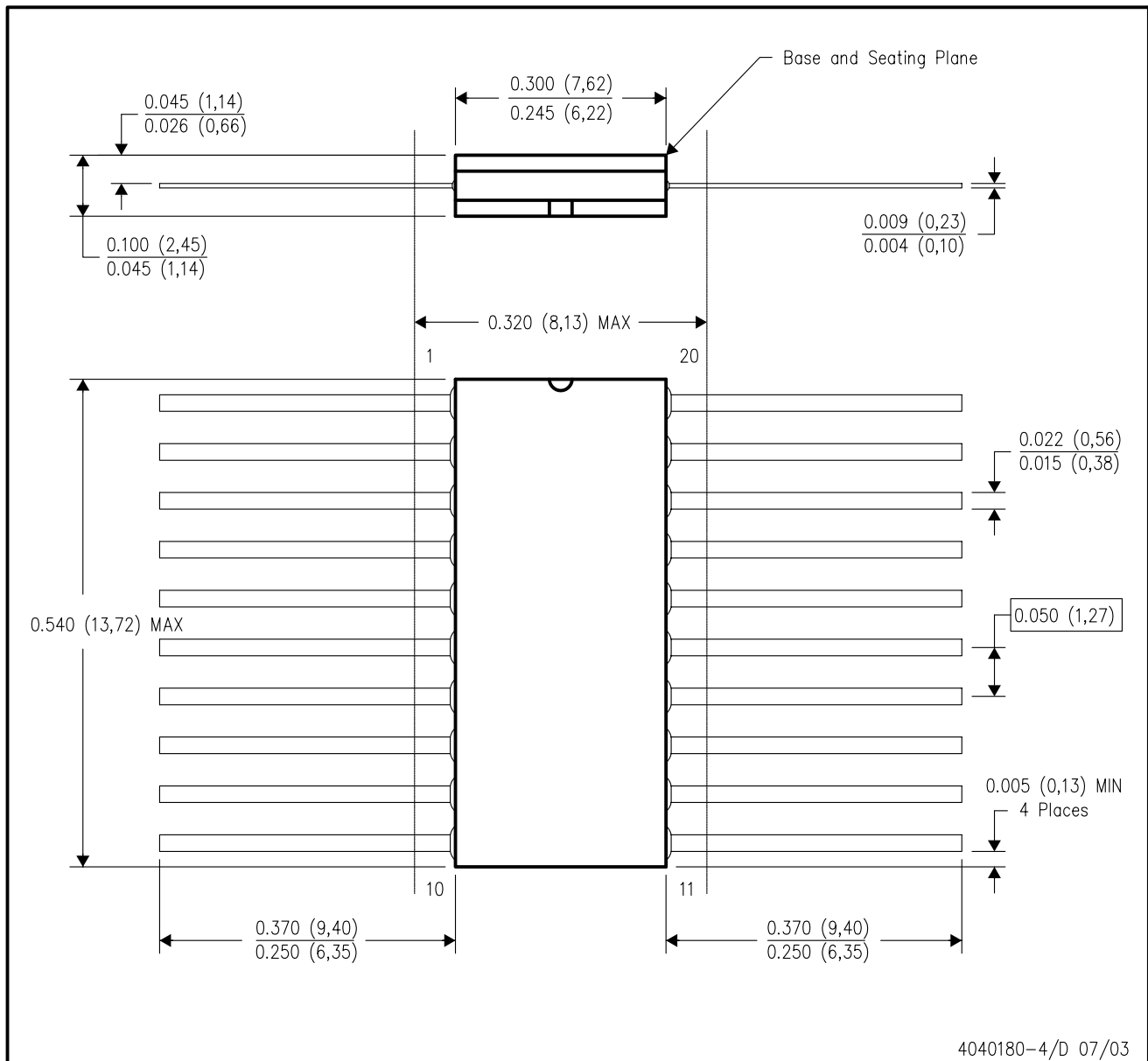
14-PINS SHOWN



- 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.

W (R-GDFP-F20)

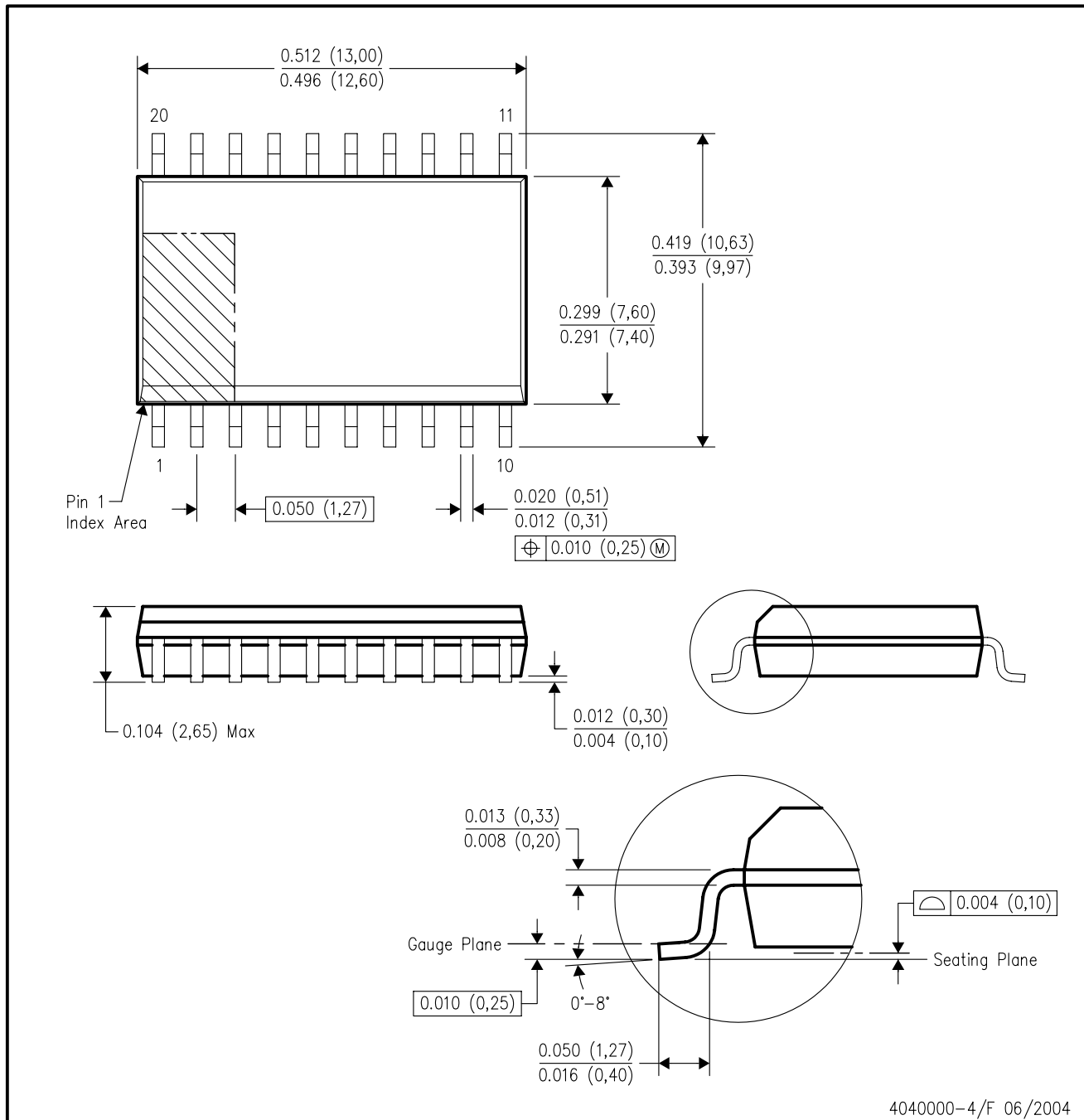
CERAMIC DUAL FLATPACK



- 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 GDFP2-F20

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE

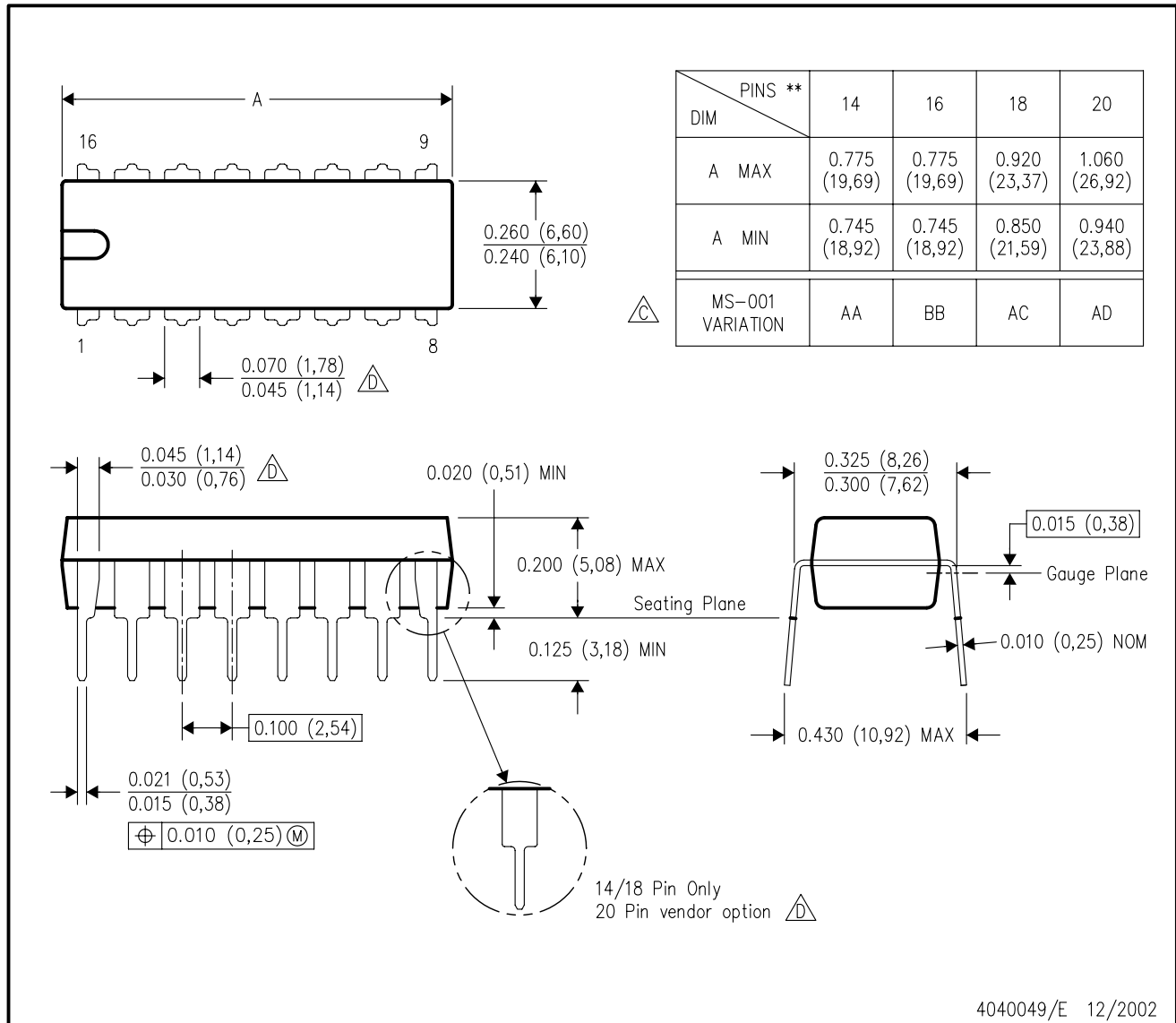


- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - D. Falls within JEDEC MS-013 variation AC.

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.
  - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - The 20 pin end lead shoulder width is a vendor option, either half or full width.



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