

- Operating Voltage Range of 4.5 V to 5.5 V
- State-of-the-Art BiCMOS Design
Significantly Reduces I_{CCZ}
- Output Ports Have Equivalent 33- Ω Series
Resistors, So No External Resistors Are
Required
- 3-State Outputs Drive Bus Lines or Buffer
Memory Address Registers
- ESD Protection Exceeds JESD 22
– 2000-V Human-Body Model (A114-A)

description/ordering information

This SN74BCT2241 is designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters. Together with the 'BCT2240 and 'BCT2244 devices, this device provides the choice of selected combinations of inverting and noninverting outputs, symmetrical active-low output-enable (\overline{OE}) inputs, and complementary OE and \overline{OE} inputs. This device features high fan-out and improved fan-in.

To ensure the high-impedance state during power up or power down, \overline{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/current-sourcing capability of the driver.

The outputs, which are designed to source or sink up to 12 mA, include 33- Ω series resistors to reduce overshoot and undershoot.

ORDERING INFORMATION

T_A	PACKAGE [†]		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	PDIP – N	Tube	SN74BCT2241N	SN74BCT2241N
	SOIC – DW	Tube	SN74BCT2241DW	BCT2241
		Tape and reel	SN74BCT2241DWR	
	SOP – NS	Tape and reel	SN74BCT2241NSR	BCT2241

[†] Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

FUNCTION TABLES

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

INPUTS		OUTPUT
\overline{OE}	2A	2Y
H	H	H
H	L	L
L	X	Z

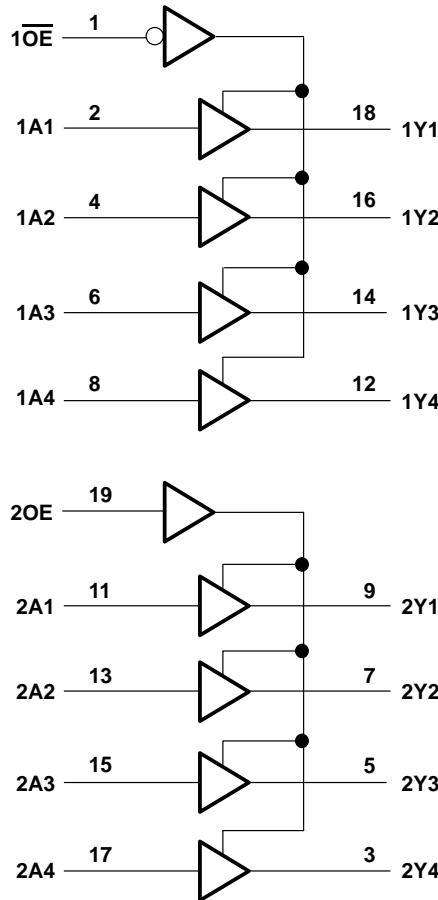
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.



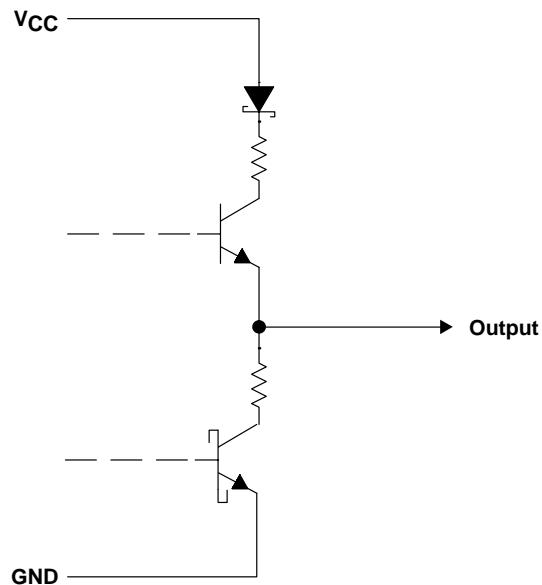
SN74BCT2241
OCTAL BUFFER AND LINE/MOS DRIVER
WITH 3-STATE OUTPUTS

SCBS035D – SEPTEMBER 1988 – REVISED MARCH 2003

logic diagram (positive logic)



schematic of Y outputs



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

† 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.

recommended operating conditions (see Note 3)

		MIN	NOM	MAX	UNIT
V _{CC}	Supply voltage	4.5	5	5.5	V
V _{IH}	High-level input voltage	2			V
V _{IL}	Low-level input voltage			0.8	V
I _{IK}	Input clamp current			-18	mA
I _{OH}	High-level output current			-12	mA
I _{OL}	Low-level output current			12	mA
T _A	Operating free-air temperature	0	70		°C

NOTE 3: 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.

SN74BCT2241**OCTAL BUFFER AND LINE/MOS DRIVER
WITH 3-STATE OUTPUTS**

SCBS035D – SEPTEMBER 1988 – REVISED MARCH 2003

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

PARAMETER	TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V_{IK}	$V_{CC} = 4.5 \text{ V}$, $I_I = -18 \text{ mA}$				-1.2	V
V_{OH}	$V_{CC} = 4.5 \text{ V}$	$I_{OH} = -1 \text{ mA}$	2.4	3.3		V
		$I_{OH} = -12 \text{ mA}$	2			
$V_{CC} = 4.75 \text{ V}$, $I_{OH} = -3 \text{ mA}$			2.7			
V_{OL}	$V_{CC} = 4.5 \text{ V}$	$I_{OL} = 1 \text{ mA}$	0.15	0.5		V
		$I_{OL} = 12 \text{ mA}$	0.42	0.8		
I_I	$V_{CC} = 5.5 \text{ V}$, $V_I = 7 \text{ V}$			0.1		mA
I_{IH}	$V_{CC} = 5.5 \text{ V}$, $V_I = 2.7 \text{ V}$			20		μA
I_{IL}	$V_{CC} = 5.5 \text{ V}$, $V_I = 0.5 \text{ V}$			-1		mA
I_{OZH}	$V_{CC} = 5.5 \text{ V}$, $V_O = 2.7 \text{ V}$			50		μA
I_{OZL}	$V_{CC} = 5.5 \text{ V}$, $V_O = 0.5 \text{ V}$			-50		μA
I_{OS}^\ddagger	$V_{CC} = 5.5 \text{ V}$, $V_O = 0$		-100	-225		mA
I_{CCH}	$V_{CC} = 5.5 \text{ V}$, Outputs open			23	37	mA
I_{CCL}	$V_{CC} = 5.5 \text{ V}$, Outputs open			48	76	mA
I_{CCZ}	$V_{CC} = 5.5 \text{ V}$, Outputs open			6	9	mA
C_I	$V_{CC} = 5 \text{ V}$, $V_I = 2.5 \text{ V} \text{ or } 0.5 \text{ V}$			6		pF
C_O	$V_{CC} = 5 \text{ V}$, $V_O = 2.5 \text{ V} \text{ or } 0.5 \text{ V}$			11		pF

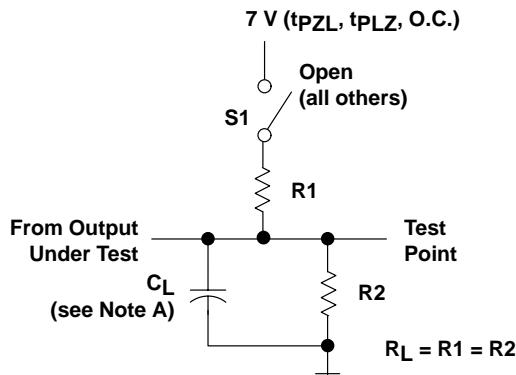
† All typical values are at $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$.

‡ Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

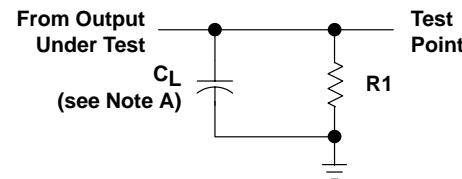
switching characteristics over recommended ranges of supply voltage and operating free-air temperature, $C_L = 50 \text{ pF}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$			MIN	MAX	UNIT		
			MIN	TYP	MAX					
t_{PLH}	A	Y	1.1	3	4.4	1.1	4.9	ns		
			2.9	4.9	6.6	2.9	6.9			
t_{PHL}	OE or \overline{OE}	Y	2.7	6	7.8	2.7	8.9	ns		
			4.1	7.7	9.4	4.1	10.3			
t_{PZH}	OE or \overline{OE}	Y	2.5	5.2	7.2	2.5	8.7	ns		
			3.2	7.1	9.5	3.2	11.3			
t_{PZL}										
t_{PHZ}										
t_{PLZ}										

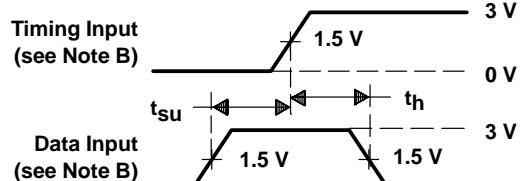
PARAMETER MEASUREMENT INFORMATION



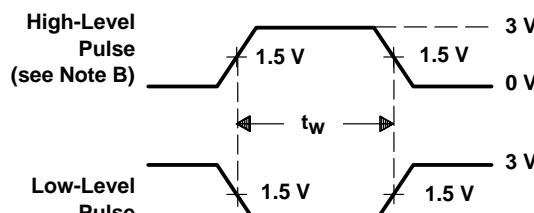
LOAD CIRCUIT FOR
3-STATE AND OPEN-COLLECTOR OUTPUTS



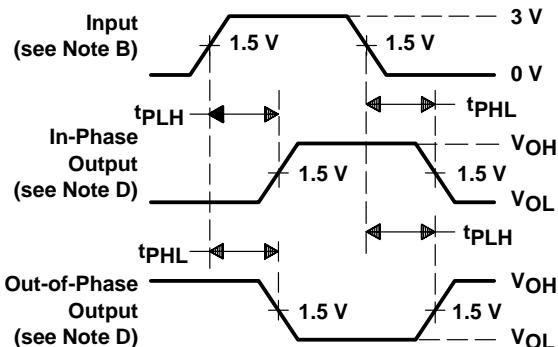
LOAD CIRCUIT FOR
TOTEM-POLE OUTPUTS



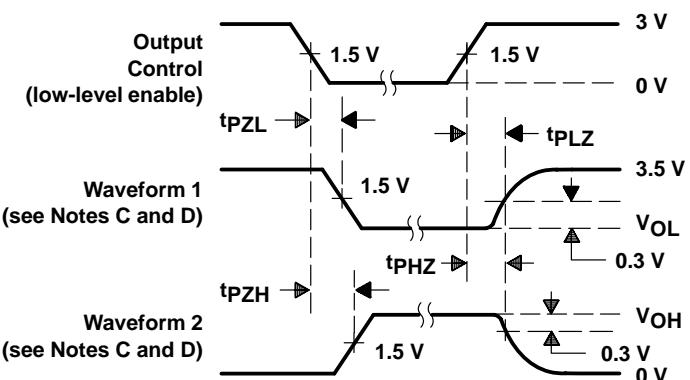
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES (see Note D)



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES, 3-STATE OUTPUTS

NOTES:

- CL includes probe and jig capacitance.
- All input pulses are supplied by generators having the following characteristics: PRR \leq 10 MHz, $t_r = t_f \leq 2.5$ ns, duty cycle = 50%.
- 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.
- The outputs are measured one at a time with one transition per measurement.
- When measuring propagation delay times of 3-state outputs, switch S1 is open.
- All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SN74BCT2241DW	ACTIVE	SOIC	DW	20	25	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/Level-1-235C-UNLIM
SN74BCT2241DWR	ACTIVE	SOIC	DW	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/Level-1-235C-UNLIM
SN74BCT2241N	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74BCT2241NSR	ACTIVE	SO	NS	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/Level-1-235C-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 - May not be currently available - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

None: Not yet available Lead (Pb-Free).

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" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDECindustry standard classifications, and peak solder temperature.

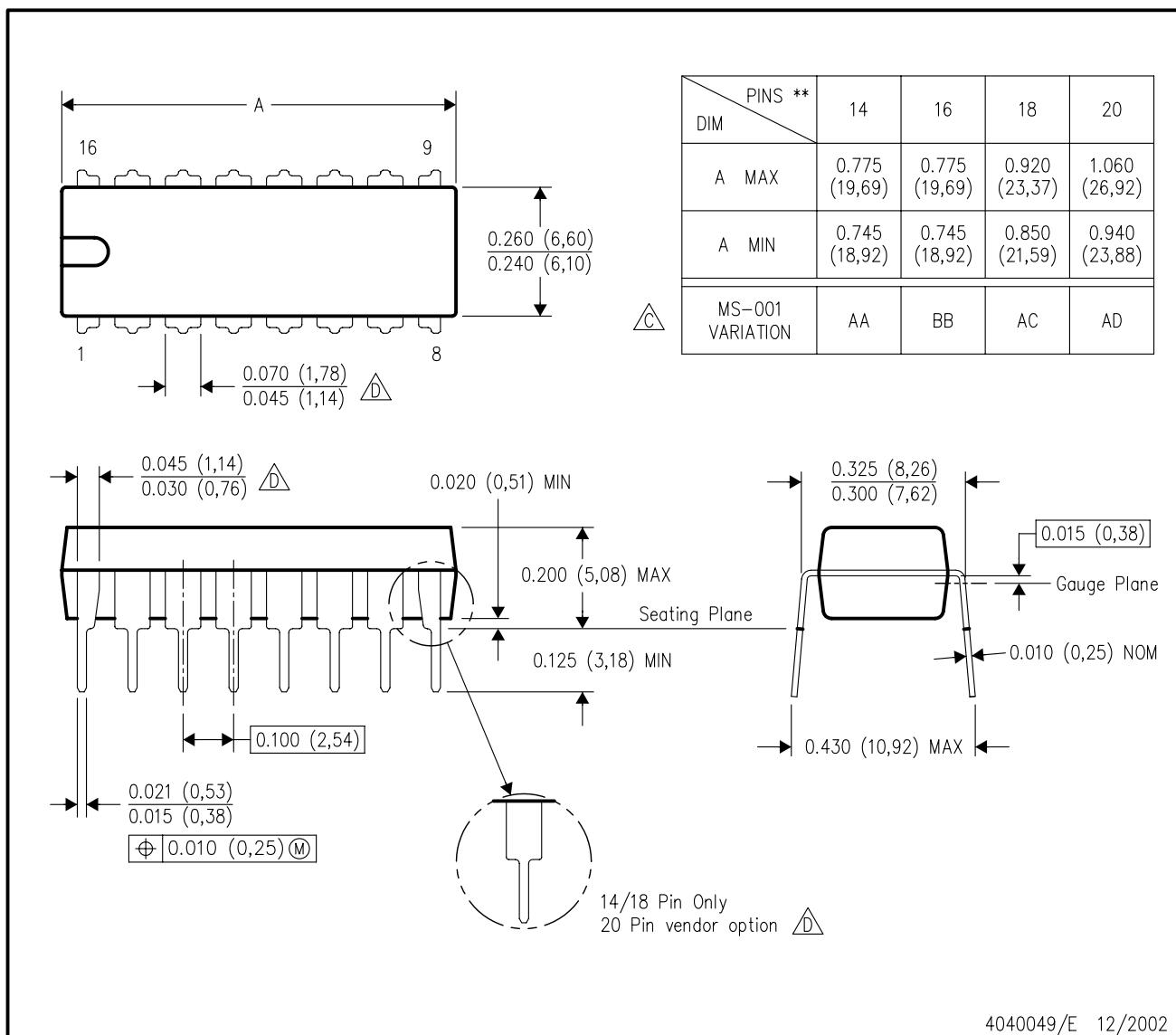
Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



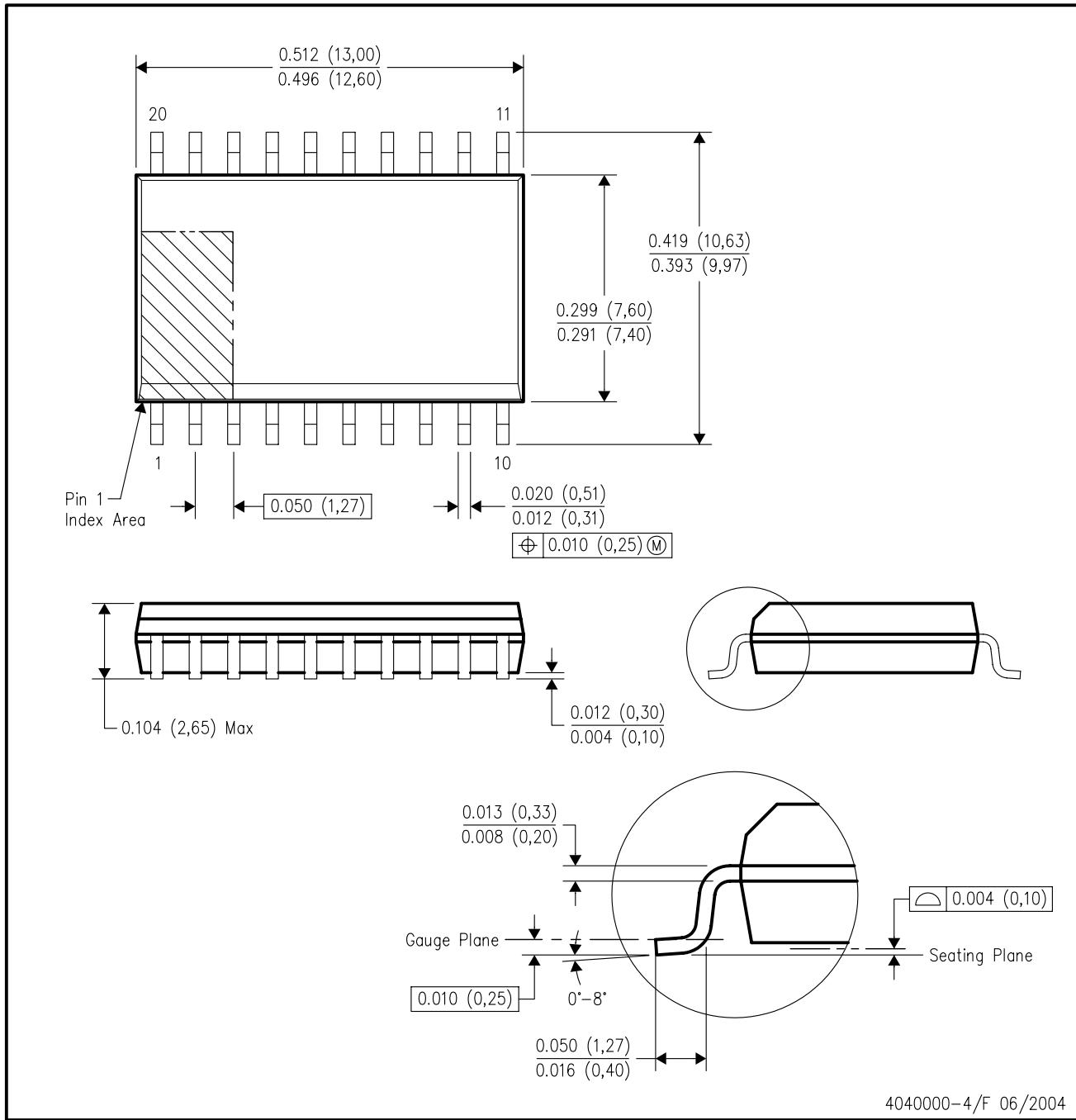
NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.

△ 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.

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE



NOTES:

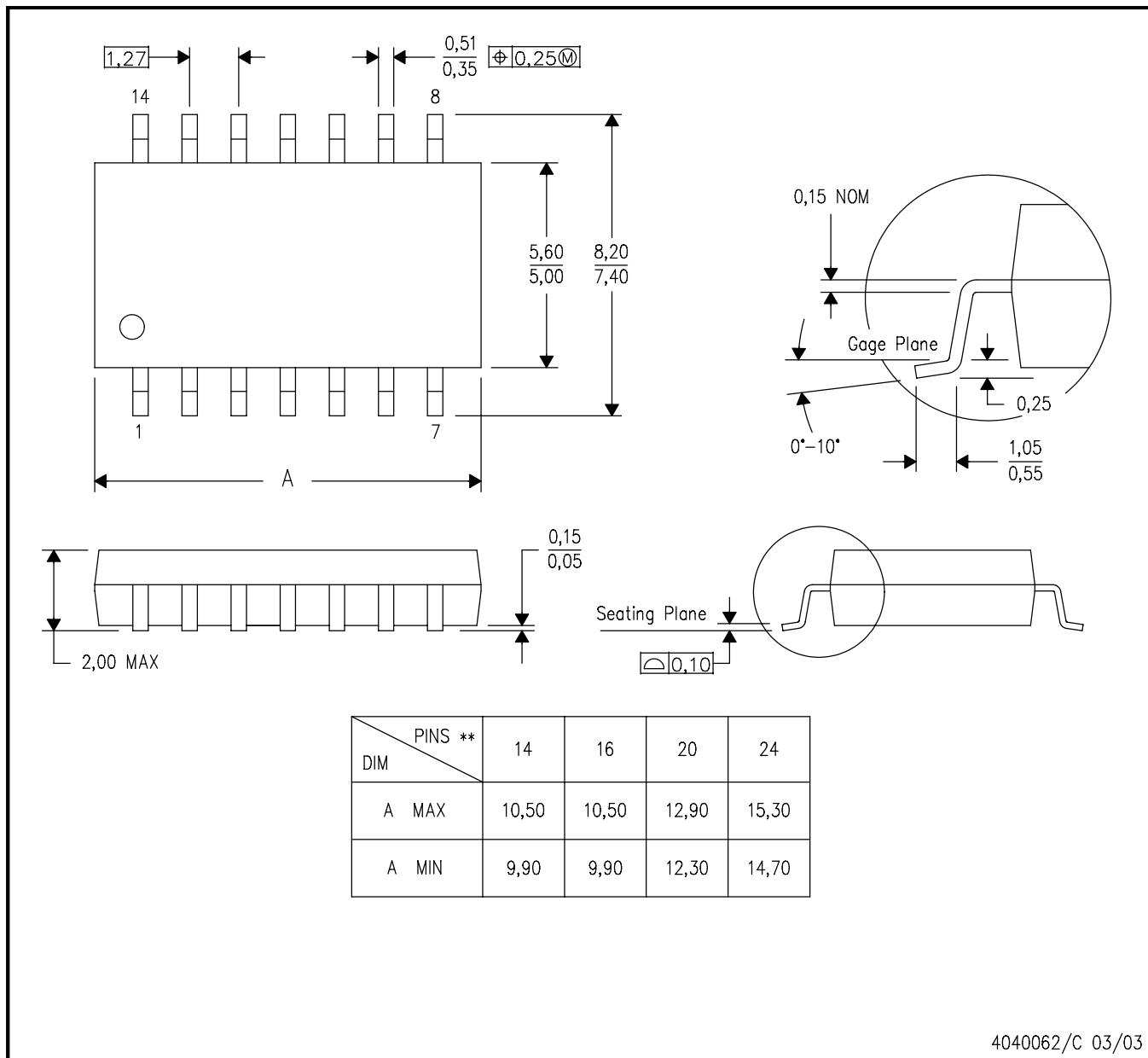
- All linear dimensions are in inches (millimeters).
- This drawing is subject to change without notice.
- Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
- Falls within JEDEC MS-013 variation AC.

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.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265

Copyright © 2005, Texas Instruments Incorporated