

16-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCBS095G – DECEMBER 1991 – REVISED OCTOBER 1998

- **Members of the Texas Instruments *Widebus*™ Family**
- **State-of-the-Art *EPIC-II B*™ BiCMOS Design Significantly Reduces Power Dissipation**
- **Typical V_{OLP} (Output Ground Bounce) < 1 V at $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$**
- **Distributed V_{CC} and GND Pin Configuration Minimizes High-Speed Switching Noise**
- **Flow-Through Architecture Optimizes PCB Layout**
- **High-Drive Outputs ($-32\text{-mA } I_{OH}$, $64\text{-mA } I_{OL}$)**
- **Latch-Up Performance Exceeds 500 mA Per JESD 17**
- **ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model ($C = 200$ pF, $R = 0$)**
- **Package Options Include Plastic Shrink Small-Outline (DL), Thin Shrink Small-Outline (DGG), and Thin Very Small-Outline (DGV) Packages and 380-mil Fine-Pitch Ceramic Flat (WD) Package Using 25-mil Center-to-Center Spacings**

description

The 'ABT16240A devices are 16-bit buffers and line drivers designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters.

These devices can be used as four 4-bit buffers, two 8-bit buffers, or one 16-bit buffer. These devices provide inverting outputs and symmetrical active-low output-enable (\overline{OE}) inputs.

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

The SN54ABT16240A is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74ABT16240A is characterized for operation from -40°C to 85°C .

SN54ABT16240A . . . WD PACKAGE
SN74ABT16240A . . . DGG, DGV, OR DL PACKAGE
(TOP VIEW)

$\overline{1OE}$	1	48	$\overline{2OE}$
1Y1	2	47	1A1
1Y2	3	46	1A2
GND	4	45	GND
1Y3	5	44	1A3
1Y4	6	43	1A4
V_{CC}	7	42	V_{CC}
2Y1	8	41	2A1
2Y2	9	40	2A2
GND	10	39	GND
2Y3	11	38	2A3
2Y4	12	37	2A4
3Y1	13	36	3A1
3Y2	14	35	3A2
GND	15	34	GND
3Y3	16	33	3A3
3Y4	17	32	3A4
V_{CC}	18	31	V_{CC}
4Y1	19	30	4A1
4Y2	20	29	4A2
GND	21	28	GND
4Y3	22	27	4A3
4Y4	23	26	4A4
$\overline{4OE}$	24	25	$\overline{3OE}$

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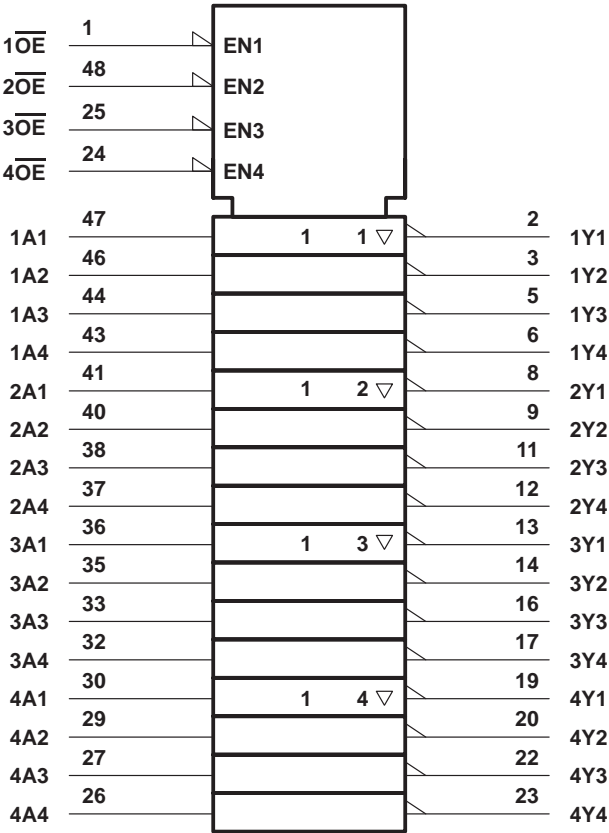
SN54ABT16240A, SN74ABT16240A
16-BIT BUFFERS/DRIVERS
WITH 3-STATE OUTPUTS

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FUNCTION TABLE
(each 4-bit buffer)

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

logic symbol†

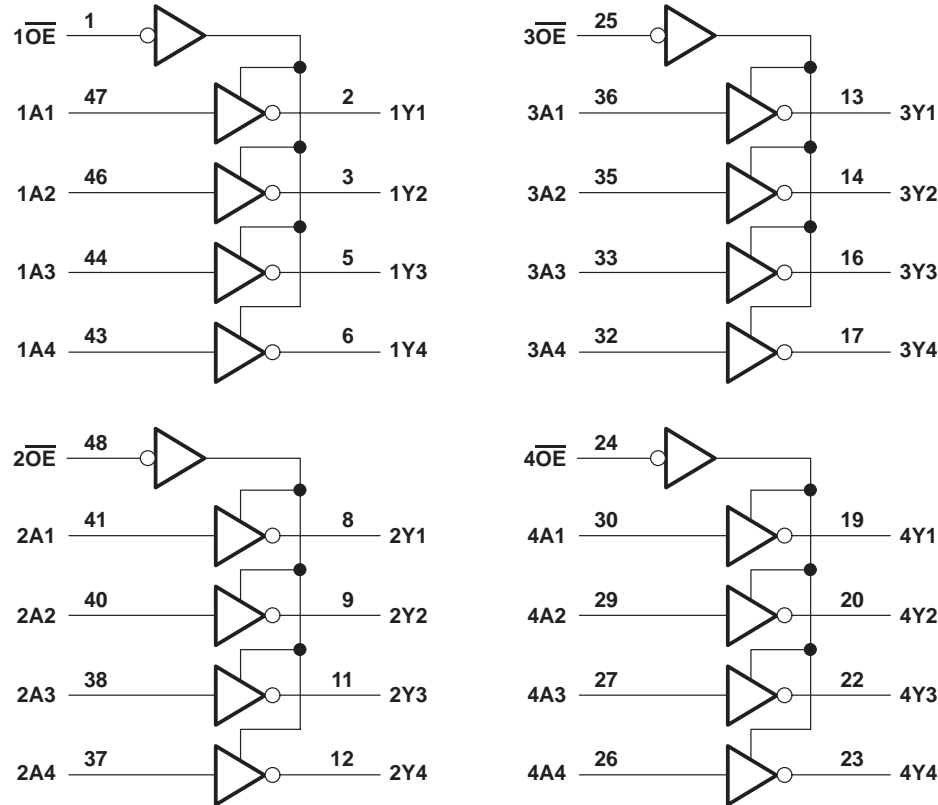


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

SN54ABT16240A, SN74ABT16240A 16-BIT BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

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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 7 V
Voltage range applied to any output in the high or power-off state, V_O	–0.5 V to 5.5 V
Current into any output in the low state, I_O : SN54ABT16240A	96 mA
SN74ABT16240A	128 mA
Input clamp current, I_{IK} ($V_I < 0$)	–18 mA
Output clamp current, I_{OK} ($V_O < 0$)	–50 mA
Package thermal impedance, θ_{JA} (see Note 2): DGG package	89°C/W
DGV package	93°C/W
DL package	94°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 negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. The package thermal impedance is calculated in accordance with JESD 51.

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recommended operating conditions (see Note 3)

			SN54ABT16240A		SN74ABT16240A		UNIT
			MIN	MAX	MIN	MAX	
V _{CC}	Supply voltage		4.5	5.5	4.5	5.5	V
V _{IH}	High-level input voltage		2		2		V
V _{IL}	Low-level input voltage			0.8		0.8	V
V _I	Input voltage		0	V _{CC}	0	V _{CC}	V
I _{OH}	High-level output current			–24		–32	mA
I _{OL}	Low-level output current			48		64	mA
Δt/Δv	Input transition rise or fall rate	Outputs enabled		10		10	ns/V
T _A	Operating free-air temperature		–55	125	–40	85	°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.

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

PARAMETER		TEST CONDITIONS	T _A = 25°C			SN54ABT16240A		SN74ABT16240A		UNIT
			MIN	TYP†	MAX	MIN	MAX	MIN	MAX	
V _{IK}		V _{CC} = 4.5 V, I _I = –18 mA			–1.2		–1.2		–1.2	V
V _{OH}		V _{CC} = 4.5 V, I _{OH} = –3 mA	2.5			2.5		2.5		V
		V _{CC} = 5 V, I _{OH} = –3 mA	3			3		3		
	V _{CC} = 4.5 V	I _{OH} = –24 mA	2			2				
		I _{OH} = –32 mA	2*					2		
V _{OL}	V _{CC} = 4.5 V	I _{OL} = 48 mA			0.55		0.55			V
		I _{OL} = 64 mA			0.55*				0.55	
V _{hys}				100						mV
I _I		V _{CC} = 5.5 V, V _I = V _{CC} or GND			±1		±1		±1	μA
I _{OZH}		V _{CC} = 5.5 V, V _O = 2.7 V			10		10		10	μA
I _{OZL}		V _{CC} = 5.5 V, V _O = 0.5 V			–10		–10		–10	μA
I _{off}		V _{CC} = 0, V _I or V _O ≤ 4.5 V			±100				±100	μA
I _{CEX}		V _{CC} = 5.5 V, V _O = 5.5 V, Outputs high			50		50		50	μA
I _{O‡}		V _{CC} = 5.5 V, V _O = 2.5 V	–50	–100	–180	–50	–180	–50	–180	mA
I _{CC}	V _{CC} = 5.5 V, I _O = 0, V _I = V _{CC} or GND	Outputs high			3		3		3	mA
		Outputs low			34		34		34	
		Outputs disabled			3		3		3	
ΔI _{CC} §	Data inputs	V _{CC} = 5.5 V, One input at 3.4 V, Other inputs at V _{CC} or GND			1		1.5		1	mA
		Outputs enabled			0.05		1		0.05	
	Control inputs	V _{CC} = 5.5 V, One input at 3.4 V, Other inputs at V _{CC} or GND			1.5		1.5		1.5	
C _i		V _I = 2.5 V or 0.5 V			3.5					pF
C _O		V _O = 2.5 V or 0.5 V			7.5					pF

* On products compliant to MIL-PRF-38535, this parameter does not apply.

† All typical values are at V_{CC} = 5 V.

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

§ This is the increase in supply current for each input that is at the specified TTL voltage level rather than V_{CC} or GND.

SN54ABT16240A, SN74ABT16240A
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switching characteristics over recommended ranges of supply voltage and operating free-air temperature, $C_L = 50$ pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54ABT16240A					UNIT
			V _{CC} = 5 V, T _A = 25°C			MIN	MAX	
			MIN	TYP	MAX			
t _{PLH}	A	Y	0.8	2.7	3.8	0.8	4.8	ns
t _{PHL}			1.1	3.1	4.3	1.1	4.9	
t _{PZH}	\overline{OE}	Y	1.3	3.3	4.3	1.3	5.4	ns
t _{PZL}			1.4	3.4	6.2	1.4	7.2	
t _{PHZ}	\overline{OE}	Y	1.6	3.6	6.2	1.6	7.2	ns
t _{PLZ}			1.4	3	5.1	1.4	5.7	

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN74ABT16240A					UNIT
			V _{CC} = 5 V, T _A = 25°C			MIN	MAX	
			MIN	TYP	MAX			
t _{PLH}	A	Y	1	2.7	3.8	1	4.7	ns
t _{PHL}			1.1	3.1	4.3	1.1	4.8	
t _{PZH}	OE	Y	1.3	3.3	4.3	1.3	5.3	ns
t _{PZL}			1.4	3.4	6.2	1.4	7.1	
t _{PHZ}	OE	Y	1.6	3.6	4.8	1.6	6.1	ns
t _{PLZ}			1.4	3	5.1	1.4	5.6	

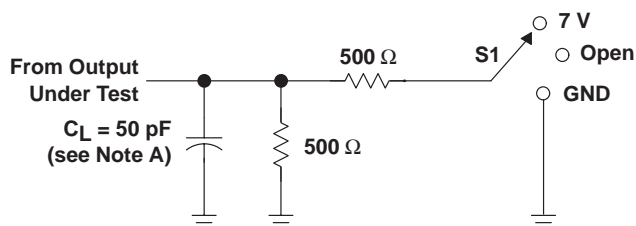
SN54ABT16240A, SN74ABT16240A

16-BIT BUFFERS/DRIVERS

WITH 3-STATE OUTPUTS

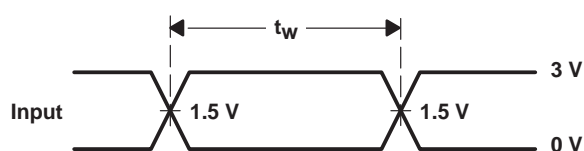
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PARAMETER MEASUREMENT INFORMATION

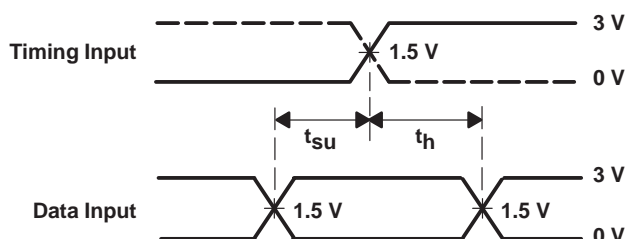


LOAD CIRCUIT

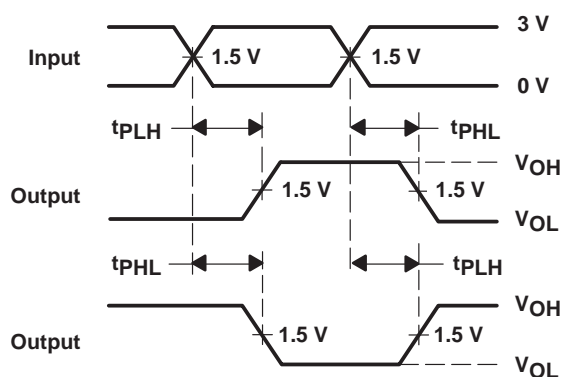
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	7 V
t_{PHZ}/t_{PZH}	Open



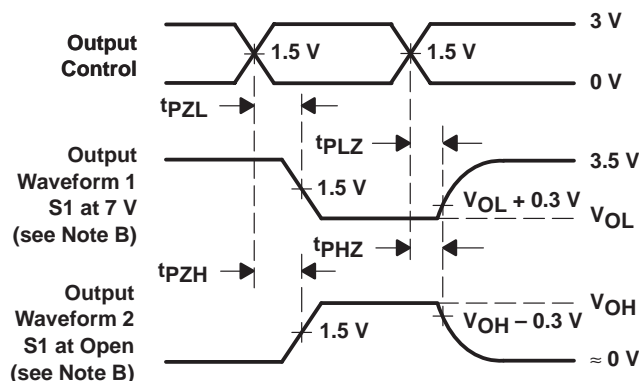
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

- NOTES:
- C_L includes probe and jig capacitance.
 - 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.
 - All input pulses are supplied by generators having the following characteristics: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 2.5 \text{ ns}$, $t_f \leq 2.5 \text{ ns}$.
 - The outputs are measured one at a time with one transition per measurement.

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⁾
5962-9319901MXA	ACTIVE	CFP	WD	48	1	TBD	A42 SNPB	N / A for Pkg Type
74ABT16240ADGGRE4	ACTIVE	TSSOP	DGG	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ABT16240ADGGRG4	ACTIVE	TSSOP	DGG	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74ABT16240ADGVRE4	ACTIVE	TVSOP	DGV	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT16240ADGGR	ACTIVE	TSSOP	DGG	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT16240ADGGRG	ACTIVE	TSSOP	DGG	48		TBD	Call TI	Call TI
SN74ABT16240ADGVR	ACTIVE	TVSOP	DGV	48	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT16240ADL	ACTIVE	SSOP	DL	48	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT16240ADLG4	ACTIVE	SSOP	DL	48	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT16240ADLR	ACTIVE	SSOP	DL	48	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT16240ADLRG4	ACTIVE	SSOP	DL	48	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SNJ54ABT16240AWD	ACTIVE	CFP	WD	48	1	TBD	A42 SNPB	N / A for Pkg Type

⁽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 - 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)

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

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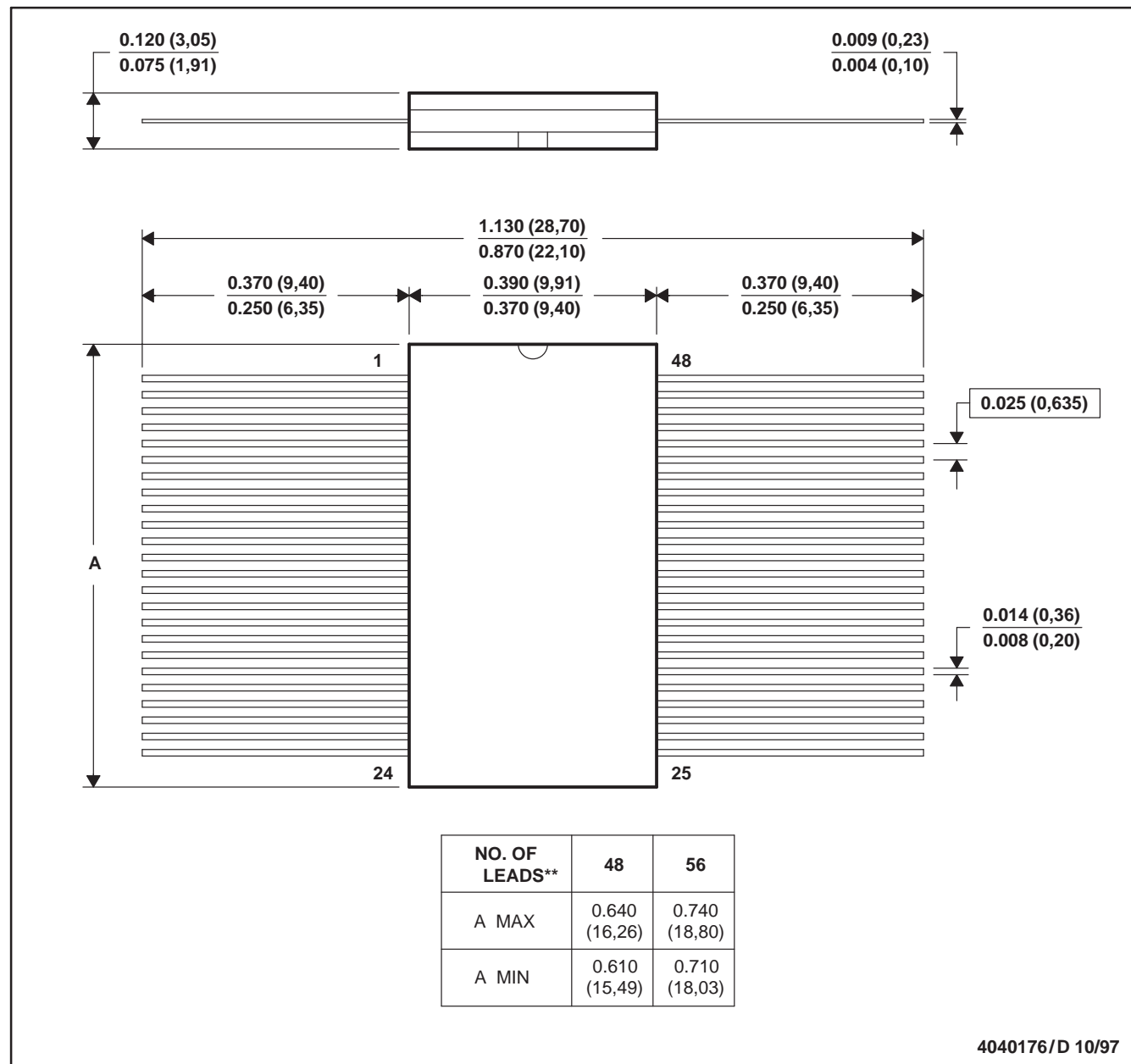
MECHANICAL DATA

MCFP010B – JANUARY 1995 – REVISED NOVEMBER 1997

WD (R-GDFP-F**)

CERAMIC DUAL FLATPACK

48 LEADS 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 ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only
 - E. Falls within MIL STD 1835: GDFP1-F48 and JEDEC MO-146AA
GDFP1-F56 and JEDEC MO-146AB

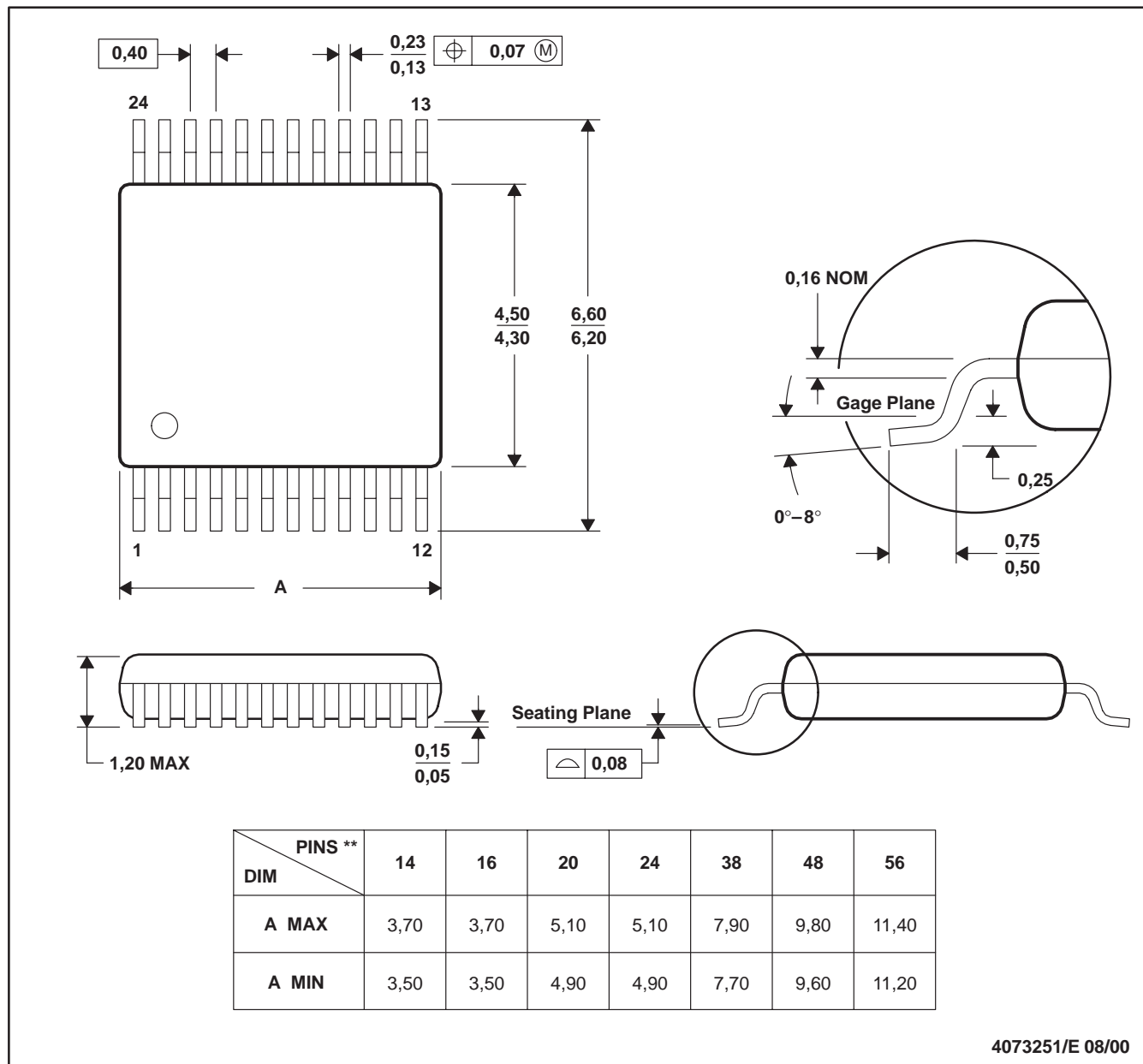
MECHANICAL DATA

MPDS006C – FEBRUARY 1996 – REVISED AUGUST 2000

DGV (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

24 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 per side.
 D. Falls within JEDEC: 24/48 Pins – MO-153
 14/16/20/56 Pins – MO-194

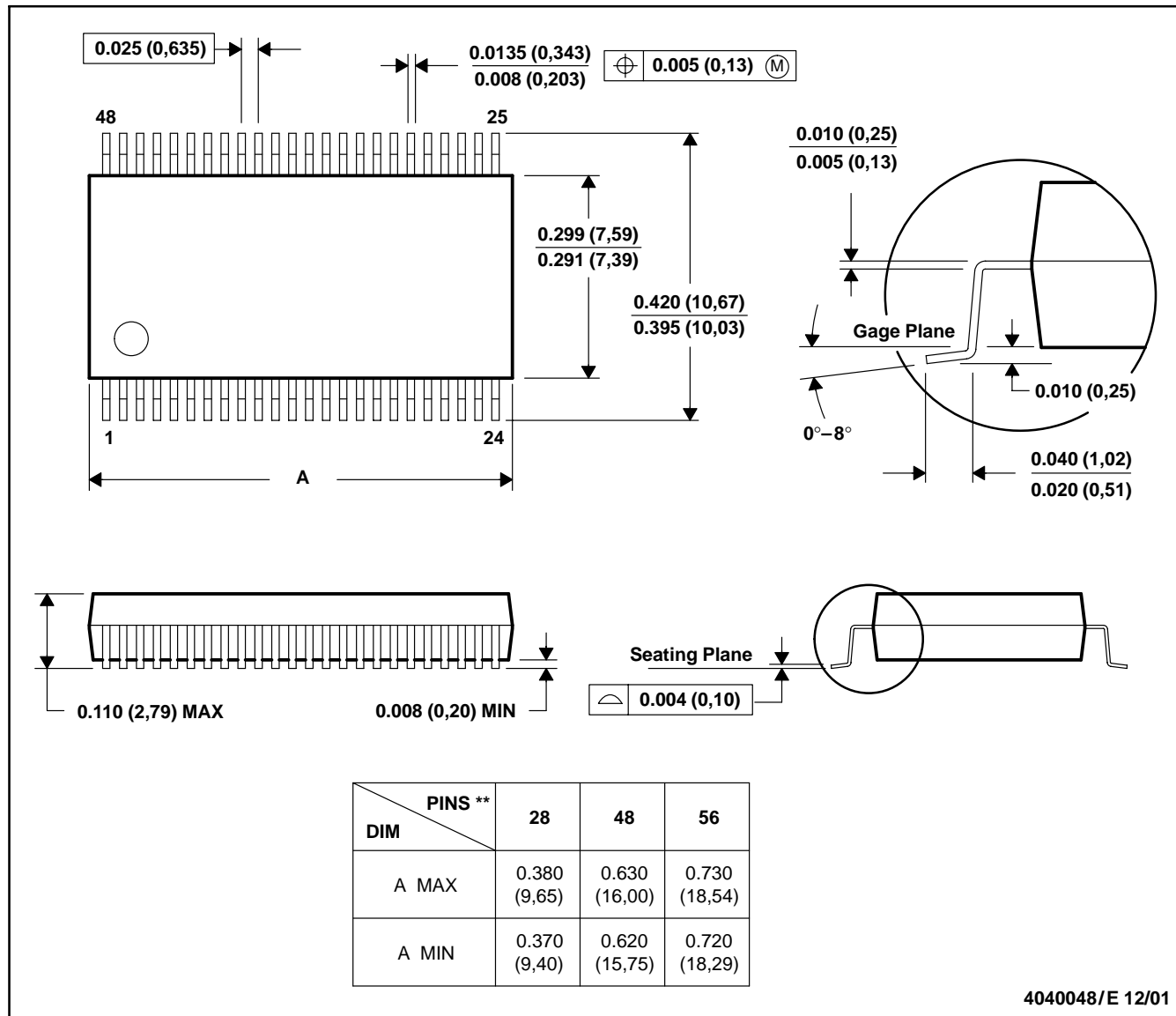
MECHANICAL DATA

MSS0001C – JANUARY 1995 – REVISED DECEMBER 2001

DL (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

48 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 MO-118

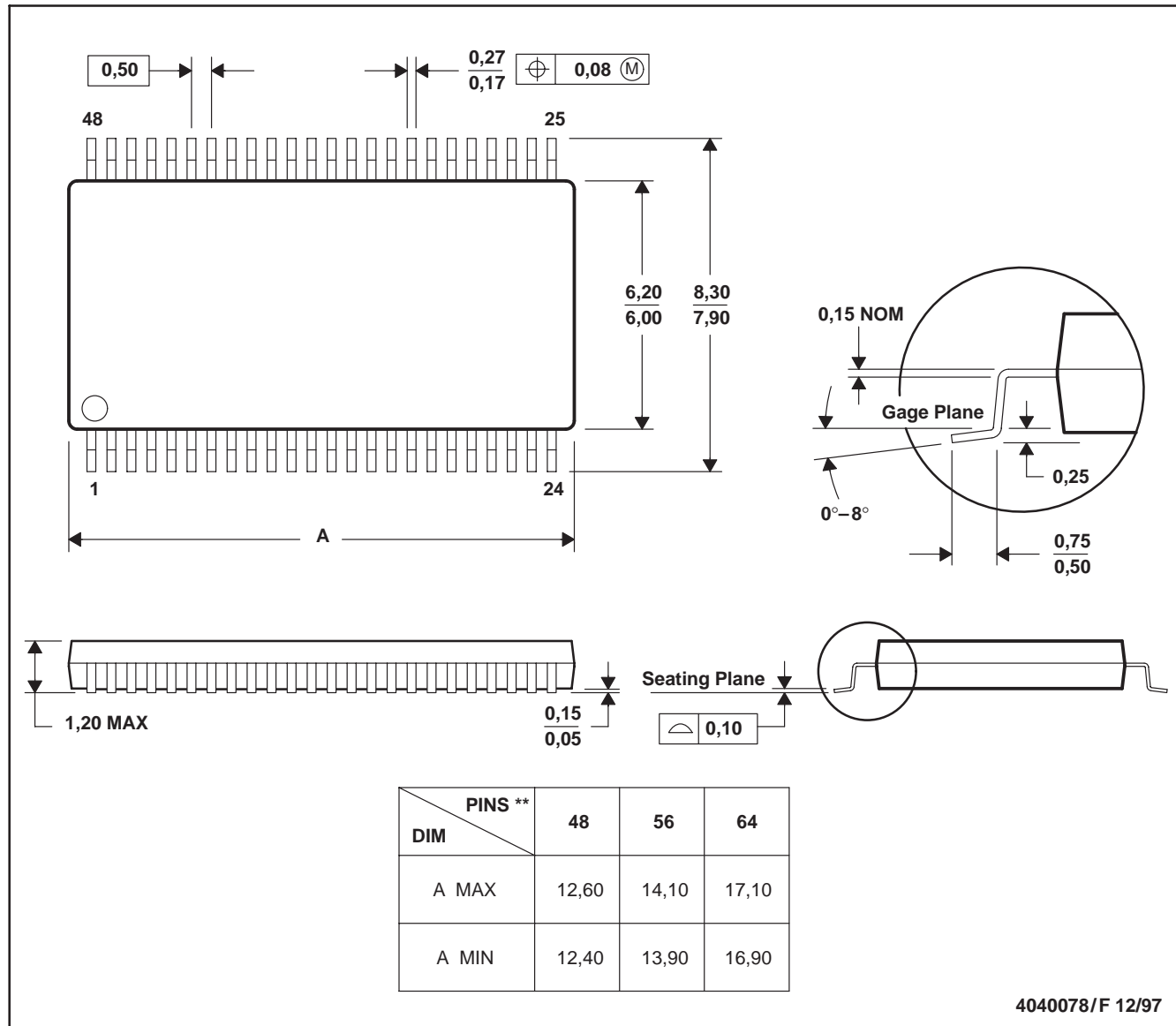
MECHANICAL DATA

MTSS003D – JANUARY 1995 – REVISED JANUARY 1998

DGG (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

48 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 protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-153

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