

# SN74CBT16233 16-BIT 1-OF-2 FET MULTIPLEXER/DEMULTIPLEXER

SCDS010K – MAY 1995 – REVISED NOVEMBER 2001

- Member of the Texas Instruments Widebus™ Family
- 5-Ω Switch Connection Between Two Ports
- TTL-Compatible Input Levels

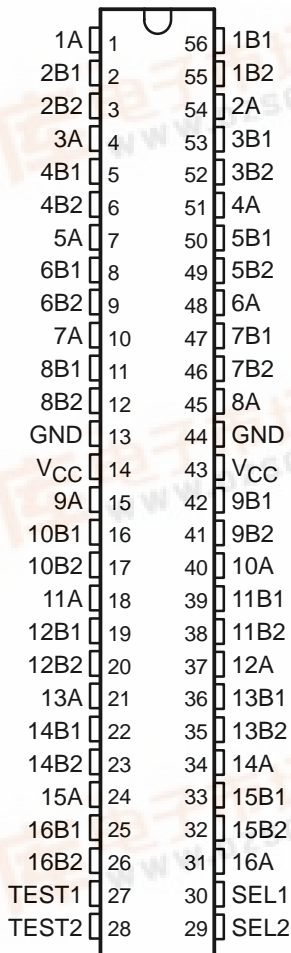
## description

The SN74CBT16233 is a 16-bit 1-of-2 FET multiplexer/demultiplexer used in applications in which two separate data paths must be multiplexed onto, or demultiplexed from, a single path. This device can be used for memory interleaving, where two different banks of memory need to be addressed simultaneously. The device can be used as two 8-bit to 16-bit multiplexers or as one 16-bit to 32-bit multiplexer.

Two select (SEL1 and SEL2) inputs control the data flow. When the TEST inputs are asserted, the A port is connected to both the B1 and the B2 ports. SEL1, SEL2, and the TEST inputs can be driven with a 5-V CMOS, a 5-V TTL, or a low-voltage TTL driver.

This device is designed so it does not have through current when switching directions.

## DGG, DGV, OR DL PACKAGE (TOP VIEW)



## ORDERING INFORMATION

| TA            | PACKAGE†    |               | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---------------|-------------|---------------|-----------------------|------------------|
| –40°C to 85°C | SSOP – DL   | Tube          | SN74CBT16233DL        | CBT16233         |
|               |             | Tape and reel | SN74CBT16233DLR       |                  |
|               | TSSOP – DGG | Tape and reel | SN74CBT16233DGGR      | CBT16233         |
|               | TVSOP – DGV | Tape and reel | SN74CBT16233DGVR      | CY233            |

† 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).

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.

Widebus is a trademark of Texas Instruments.

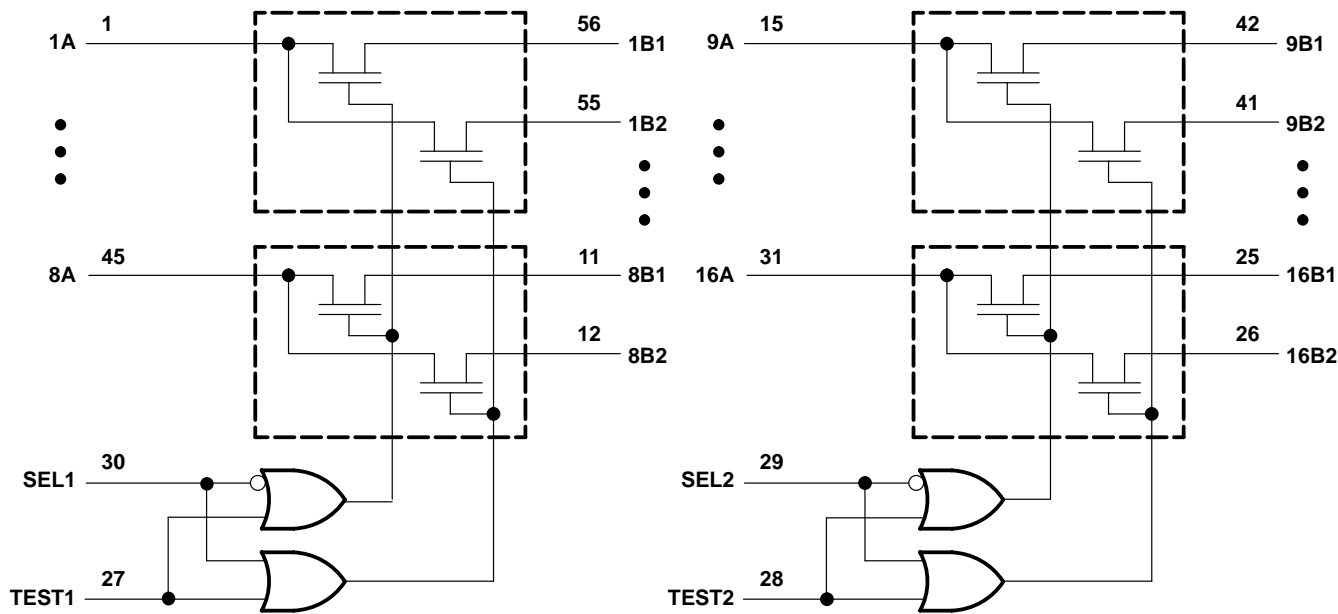
PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

# SN74CBT16233 16-BIT 1-OF-2 FET MULTIPLEXER/DEMULTIPLEXER

SCDS010K – MAY 1995 – REVISED NOVEMBER 2001

| FUNCTION TABLE                   |      |                   |
|----------------------------------|------|-------------------|
| (each multiplexer/demultiplexer) |      |                   |
| INPUTS                           |      | FUNCTION          |
| SEL                              | TEST |                   |
| L                                | L    | A = B1            |
| H                                | L    | A = B2            |
| X                                | H    | A = B1 and A = B2 |

logic diagram (positive logic)



## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

|  |             |                            |
|--|-------------|----------------------------|
| 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 |
| Continuous channel current                             | .....       | 128 mA                     |
| Input clamp current, $I_{IK}$ ( $V_I < 0$ )            | .....       | –50 mA                     |
| Package thermal impedance, $\theta_{JA}$ (see Note 2): | DGG package | 64°C/W                     |
|  | DGV package | 48°C/W                     |
|  | DL package  | 56°C/W                     |
| Storage temperature range, $T_{stg}$                   | .....       | –65°C to 150°C             |

<sup>†</sup> 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 51-7.

# SN74CBT16233

## 16-BIT 1-OF-2 FET MULTIPLEXER/DEMULTIPLEXER

SCDS010K – MAY 1995 – REVISED NOVEMBER 2001

### recommended operating conditions (see Note 3)

|                 |                                  | MIN  | MAX  | UNIT |
|-----------------|----------------------------------|------|------|------|
| V <sub>CC</sub> | Supply voltage                   | 4.75 | 5.25 | V    |
| V <sub>IH</sub> | High-level control input voltage | 2    |      | V    |
| V <sub>IL</sub> | Low-level control input voltage  |      | 0.8  | V    |
| T <sub>A</sub>  | Operating free-air temperature   | –40  | 85   | °C   |

NOTE 3: All unused control 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   |  | MIN | TYP† | MAX  | UNIT |
|-----------------------|----------------|---|--|-----|------|------|------|
| V <sub>IK</sub>       |                | V <sub>CC</sub> = 4.75 V, I <sub>I</sub> = –18 mA                                     |  |     |      | –1.2 | V    |
| I <sub>I</sub>        |                | V <sub>CC</sub> = 0, V <sub>I</sub> = 5.25 V  |  |     |      | 10   | μA   |
|                       |                | V <sub>CC</sub> = 5.25 V, V <sub>I</sub> = 5.25 V or GND                              |  |     |      | ±1   | μA   |
| I <sub>CC</sub>       |                | V <sub>CC</sub> = 5.25 V, I <sub>O</sub> = 0, V <sub>I</sub> = V <sub>CC</sub> or GND |  |     |      | 3    | μA   |
| ΔI <sub>CC</sub> ‡    | Control inputs | V <sub>CC</sub> = 5.25 V, One input at 3.4 V, Other inputs at V <sub>CC</sub> or GND  |  |     |      | 2.5  | mA   |
| C <sub>i</sub>        | Control inputs | V <sub>I</sub> = 3 V or 0   |  |     |      | 4.5  | pF   |
| C <sub>io</sub> (OFF) |                | V <sub>O</sub> = 3 V or 0   |  |     |      | 4    | pF   |
| r <sub>on</sub> §     |                | V <sub>CC</sub> = 4.75 V  | V <sub>I</sub> = 0, I <sub>I</sub> = 64 mA     |     |      | 5    | Ω    |
|                       |                |   | I <sub>I</sub> = 30 mA                         |     |      | 5    |      |
|                       |                |   | V <sub>I</sub> = 2.4 V, I <sub>I</sub> = 15 mA |     |      | 7    |      |

† All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

‡ This is the increase in supply current for each input that is at the specified TTL voltage level rather than V<sub>CC</sub> or GND.

§ Measured by the voltage drop between A and B terminals at the indicated current through the switch. On-state resistance is determined by the lower of the voltages of the two (A or B) terminals.

### 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) | MIN | MAX  | UNIT |
|-------------------|--------------|-------------|-----|------|------|
| t <sub>pd</sub> ¶ | A or B       | B or A      |     | 0.25 | ns   |
| t <sub>pd</sub>   | SEL          | A           | 1.6 | 5.3  | ns   |
| t <sub>en</sub>   | TEST or SEL  | B           | 1.3 | 5.2  | ns   |
| t <sub>dis</sub>  | TEST or SEL  | B           | 1   | 5.3  | ns   |

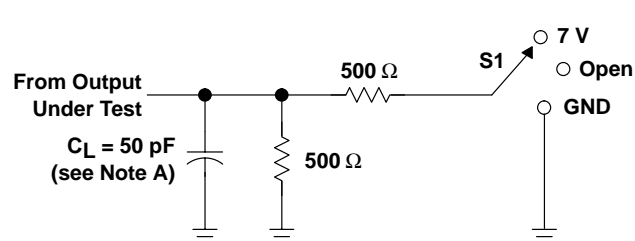
¶ The propagation delay is the calculated RC time constant of the typical on-state resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).

# SN74CBT16233

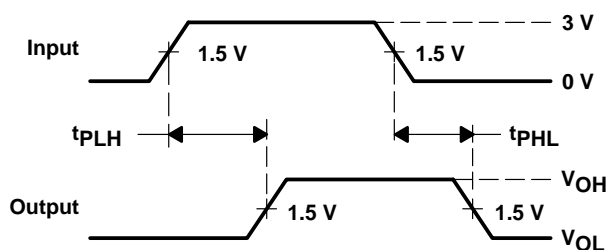
## 16-BIT 1-OF-2 FET MULTIPLEXER/DEMULTIPLEXER

SCDS010K – MAY 1995 – REVISED NOVEMBER 2001

### PARAMETER MEASUREMENT INFORMATION

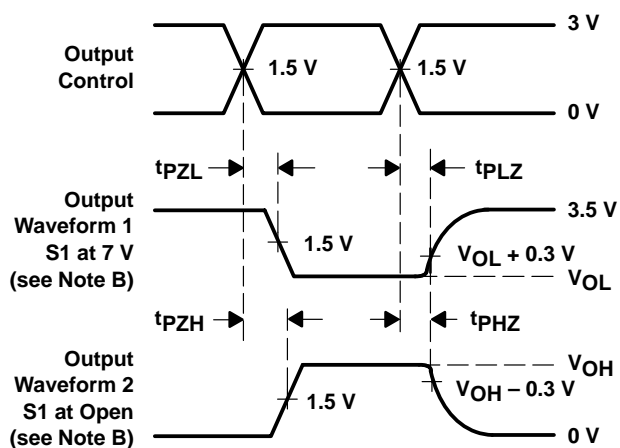


LOAD CIRCUIT



VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES

| TEST              | S1   |
|-------------------|------|
| $t_{pd}$          | Open |
| $t_{PLZ}/t_{PZL}$ | 7 V  |
| $t_{PHZ}/t_{PZH}$ | Open |



VOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES

- 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:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5 \text{ ns}$ ,  $t_f \leq 2.5 \text{ ns}$ .
  - D. The outputs are measured one at a time with one transition per measurement.
  - E.  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - F.  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - G.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .

Figure 1. Load Circuit 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> |
|-------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| 74CBT16233DGGRE4  | ACTIVE                | TSSOP        | DGG             | 56   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| 74CBT16233DGVRE4  | ACTIVE                | TVSOP        | DGV             | 56   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| 74CBT16233DGVRG4  | ACTIVE                | TVSOP        | DGV             | 56   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74CBT16233DGGR  | ACTIVE                | TSSOP        | DGG             | 56   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74CBT16233DGV   | ACTIVE                | TVSOP        | DGV             | 56   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74CBT16233DL    | ACTIVE                | SSOP         | DL              | 56   | 20          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74CBT16233DLG4  | ACTIVE                | SSOP         | DL              | 56   | 20          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74CBT16233DLR   | ACTIVE                | SSOP         | DL              | 56   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74CBT16233DLRG4 | ACTIVE                | SSOP         | DL              | 56   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |

<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.

**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.

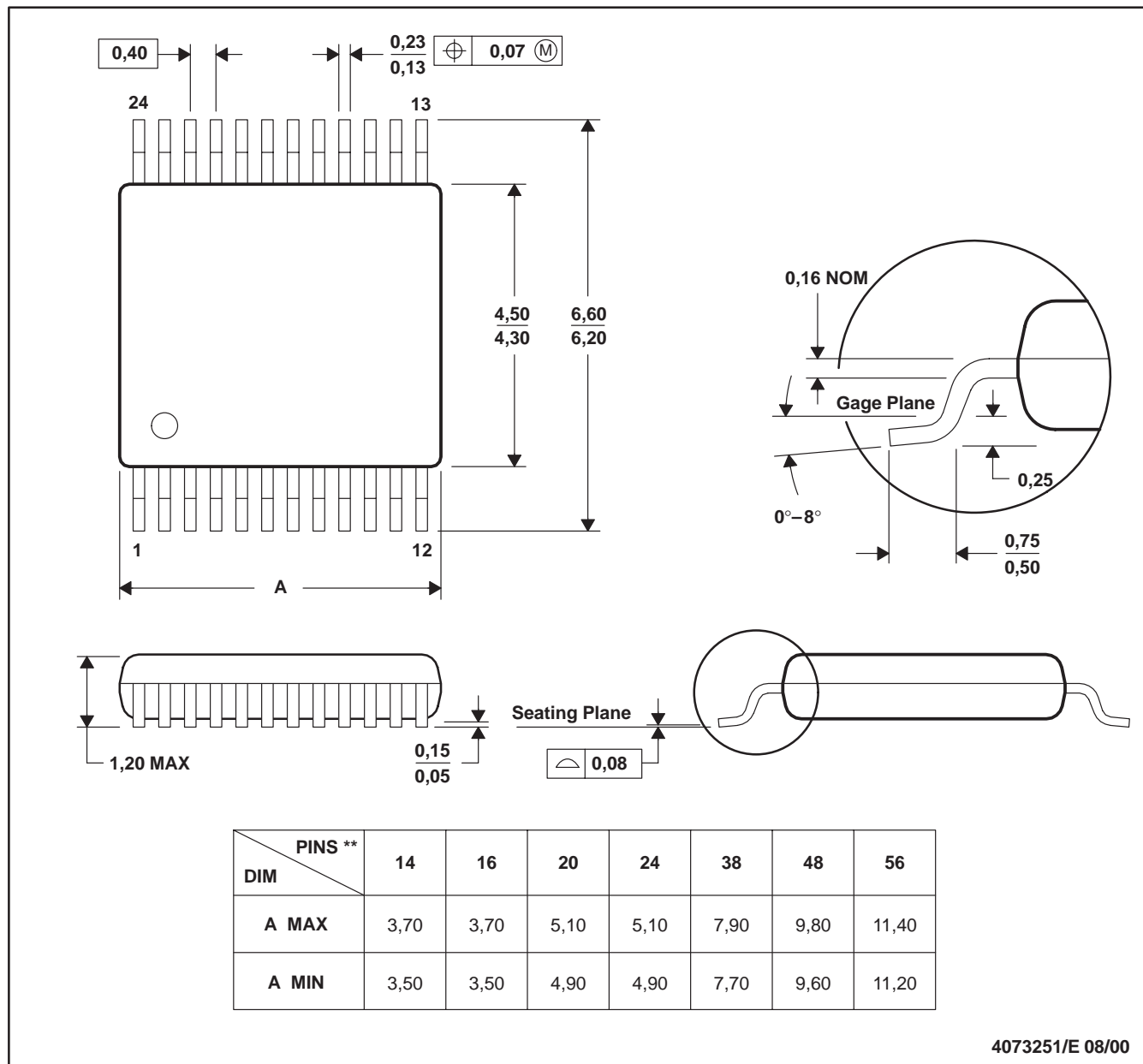
# MECHANICAL DATA

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

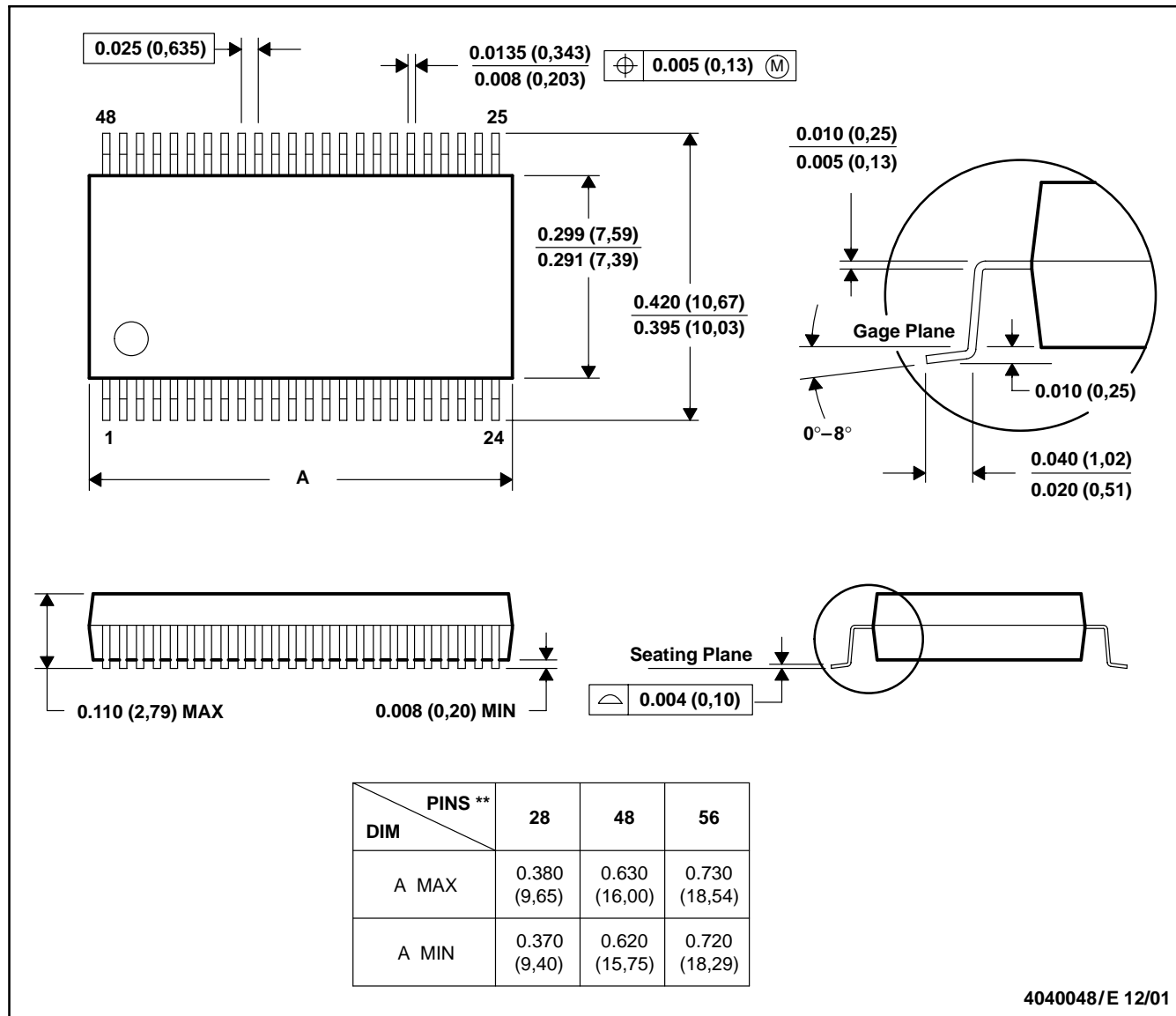
# MECHANICAL DATA

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

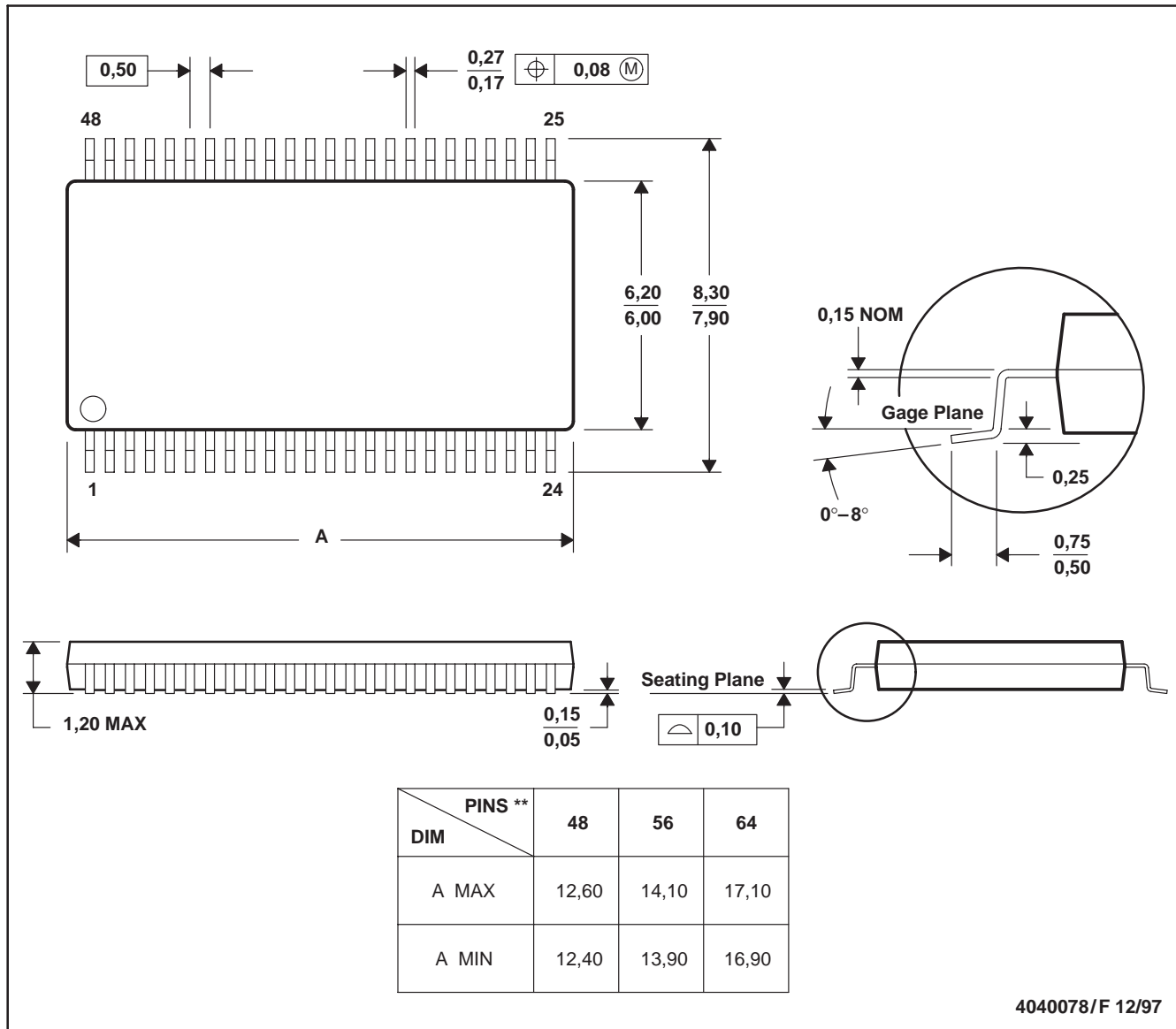
# MECHANICAL DATA

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



## 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

|                    |  |
|--------------------|--|
| Amplifiers         | <a href="http://amplifier.ti.com">amplifier.ti.com</a>             |
| Data Converters    | <a href="http://dataconverter.ti.com">dataconverter.ti.com</a>     |
| DSP                | <a href="http://dsp.ti.com">dsp.ti.com</a>                         |
| Interface          | <a href="http://interface.ti.com">interface.ti.com</a>             |
| Logic              | <a href="http://logic.ti.com">logic.ti.com</a>                     |
| Power Mgmt         | <a href="http://power.ti.com">power.ti.com</a>                     |
| Microcontrollers   | <a href="http://microcontroller.ti.com">microcontroller.ti.com</a> |
| Low Power Wireless | <a href="http://www.ti.com/lpw">www.ti.com/lpw</a>                 |

### Applications

|                    |  |
|--------------------|--|
| Audio              | <a href="http://www.ti.com/audio">www.ti.com/audio</a>                   |
| Automotive         | <a href="http://www.ti.com/automotive">www.ti.com/automotive</a>         |
| Broadband          | <a href="http://www.ti.com/broadband">www.ti.com/broadband</a>           |
| Digital Control    | <a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a> |
| Military           | <a href="http://www.ti.com/military">www.ti.com/military</a>             |
| Optical Networking | <a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a> |
| Security           | <a href="http://www.ti.com/security">www.ti.com/security</a>             |
| Telephony          | <a href="http://www.ti.com/telephony">www.ti.com/telephony</a>           |
| Video & Imaging    | <a href="http://www.ti.com/video">www.ti.com/video</a>                   |
| Wireless           | <a href="http://www.ti.com/wireless">www.ti.com/wireless</a>             |

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