

FEATURES

- Member of the Texas Instruments Widebus™ Family
- Operates From 1.65 V to 3.6 V
- Max t_{pd} of 2 ns at 3.3 V
- ± 12 -mA Output Drive at 3.3 V
- Ideal for Use in PC100 Register DIMM, Revision 1.1
- Output Port Has Equivalent 26- Ω Series Resistors, So No External Resistors Are Required
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Exceeds JESD 22
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)
 - 1000-V Charged-Device Model (C101)

DESCRIPTION/ORDERING INFORMATION

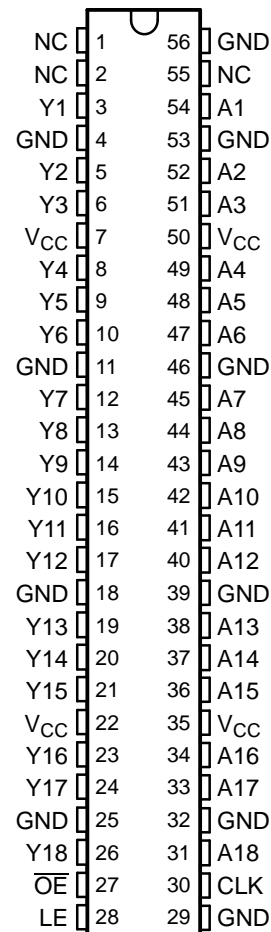
This 18-bit universal bus driver is designed for 1.65-V to 3.6-V V_{CC} operation.

Data flow from A to Y is controlled by the output-enable (\overline{OE}) input. The device operates in the transparent mode when the latch-enable (LE) input is high. When LE is low, the A data is latched if the clock (CLK) input is held at a high or low logic level. If LE is low, the A data is stored in the latch/flip-flop on the low-to-high transition of CLK. When \overline{OE} is high, the outputs are in the high-impedance state.

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 output port includes equivalent 26- Ω series resistors to reduce overshoot and undershoot.

DGG, DGV, OR DL PACKAGE (TOP VIEW)



NC – No internal connection

ORDERING INFORMATION

| T_A | PACKAGE ⁽¹⁾ | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---------------|------------------------|---------------|-----------------------|------------------|
| -40°C to 85°C | SSOP - DL | Tube | SN74ALVC162835DL | ALVC162835 |
| | | Tape and reel | SN74ALVC162835DLR | |
| | TSSOP - DGG | Tape and reel | SN74ALVC162835DGGR | ALVC162835 |
| | TVSOP - DGV | Tape and reel | SN74ALVC162835DGV | VC2835 |

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at 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.

SN74ALVC162835
18-BIT UNIVERSAL BUS DRIVER
WITH 3-STATE OUTPUTS

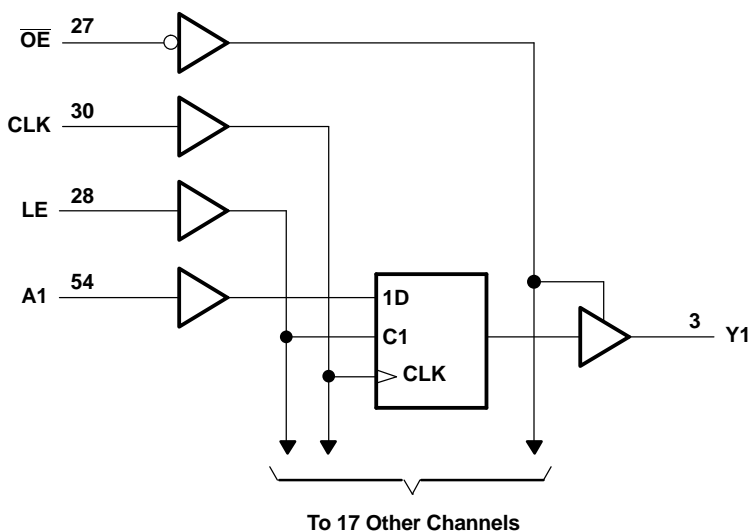
SCES126H—FEBRUARY 1998—REVISED SEPTEMBER 2004

FUNCTION TABLE

| INPUTS | | | | OUTPUT Y |
|-----------------|----|--------|---|-------------|
| \overline{OE} | LE | CLK | A | |
| H | X | X | X | Z |
| L | H | X | L | L |
| L | H | X | H | H |
| L | L | ↑ | L | L |
| L | L | ↑ | H | H |
| L | L | L or H | X | $Y_0^{(1)}$ |

(1) Output level before the indicated steady-state input conditions were established

LOGIC DIAGRAM (POSITIVE LOGIC)



ABSOLUTE MAXIMUM RATINGS⁽¹⁾

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

| | | MIN | MAX | UNIT |
|---------------|---|-------------|----------------|------|
| V_{CC} | Supply voltage range | -0.5 | 4.6 | V |
| V_I | Input voltage range ⁽²⁾ | -0.5 | 4.6 | V |
| V_O | Output voltage range ⁽²⁾⁽³⁾ | -0.5 | $V_{CC} + 0.5$ | V |
| I_{IK} | Input clamp current | $V_I < 0$ | -50 | mA |
| I_{OK} | Output clamp current | $V_O < 0$ | -50 | mA |
| I_O | Continuous output current | | ±50 | mA |
| | Continuous current through each V_{CC} or GND | | ±100 | mA |
| θ_{JA} | Package thermal impedance ⁽⁴⁾ | DGG package | 64 | °C/W |
| | | DGV package | 48 | |
| | | DL package | 56 | |
| T_{stg} | Storage temperature range | -65 | 150 | °C |

- (1) 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.
- (2) The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) This value is limited to 4.6 V maximum.
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.

RECOMMENDED OPERATING CONDITIONS⁽¹⁾

| | | MIN | MAX | UNIT |
|-----------------|------------------------------------|------------------------------------|------------------------|------|
| V _{CC} | Supply voltage | 1.65 | 3.6 | V |
| V _{IH} | High-level input voltage | V _{CC} = 1.65 V to 1.95 V | 0.65 × V _{CC} | V |
| | | V _{CC} = 2.3 V to 2.7 V | 1.7 | |
| | | V _{CC} = 2.7 V to 3.6 V | 2 | |
| V _{IL} | Low-level input voltage | V _{CC} = 1.65 V to 1.95 V | 0.35 × V _{CC} | V |
| | | V _{CC} = 2.3 V to 2.7 V | 0.7 | |
| | | V _{CC} = 2.7 V to 3.6 V | 0.8 | |
| V _I | Input voltage | 0 | 3.6 | V |
| V _O | Output voltage | 0 | V _{CC} | V |
| I _{OH} | High-level output current | V _{CC} = 1.65 V | -2 | mA |
| | | V _{CC} = 2.3 V | -6 | |
| | | V _{CC} = 2.7 V | -8 | |
| | | V _{CC} = 3 V | -12 | |
| I _{OL} | Low-level output current | V _{CC} = 1.65 V | 2 | mA |
| | | V _{CC} = 2.3 V | 6 | |
| | | V _{CC} = 2.7 V | 8 | |
| | | V _{CC} = 3 V | 12 | |
| Δt/Δv | Input transition rise or fall rate | | 10 | ns/V |
| T _A | Operating free-air temperature | -40 | 85 | °C |

(1) 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.

SN74ALVC162835
18-BIT UNIVERSAL BUS DRIVER
WITH 3-STATE OUTPUTS

SCES126H–FEBRUARY 1998–REVISED SEPTEMBER 2004

ELECTRICAL CHARACTERISTICS

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

| PARAMETER | TEST CONDITIONS | V _{CC} | MIN | TYP ⁽¹⁾ | MAX | UNIT | |
|--------------------------|--|---|-----------------------|--------------------|------|------|----|
| V _{OH} | I _{OH} = -100 μA | 1.65 V to 3.6 V | V _{CC} - 0.2 | | | V | |
| | I _{OH} = -2 mA | 1.65 V | 1.2 | | | | |
| | I _{OH} = -4 mA | 2.3 V | 1.9 | | | | |
| | I _{OH} = -6 mA | 2.3 V | 1.7 | | | | |
| | | 3 V | 2.4 | | | | |
| | I _{OH} = -8 mA | 2.7 V | 2 | | | | |
| I _{OH} = -12 mA | 3 V | 2 | | | | | |
| V _{OL} | I _{OL} = 100 μA | 1.65 V to 3.6 V | | | 0.2 | V | |
| | I _{OL} = 2 mA | 1.65 V | | | 0.45 | | |
| | I _{OL} = 4 mA | 2.3 V | | | 0.4 | | |
| | I _{OL} = 6 mA | 2.3 V | | | 0.55 | | |
| | | 3 V | | | 0.55 | | |
| | I _{OL} = 8 mA | 2.7 V | | | 0.6 | | |
| I _{OL} = 12 mA | 3 V | | | 0.8 | | | |
| I _I | V _I = V _{CC} or GND | 3.6 V | | | ±5 | μA | |
| I _{OZ} | V _O = V _{CC} or GND | 3.6 V | | | ±10 | μA | |
| I _{CC} | V _I = V _{CC} or GND, I _O = 0 | 3.6 V | | | 40 | μA | |
| ΔI _{CC} | One input at V _{CC} - 0.6 V, Other inputs at V _{CC} or GND | 3 V to 3.6 V | | | 750 | μA | |
| C _i | Control inputs | V _I = V _{CC} or GND | | | 3.5 | pF | |
| | Data inputs | | | | 5 | | |
| C _o | Outputs | V _O = V _{CC} or GND | 3.3 V | | | 7 | pF |

(1) All typical values are at V_{CC} = 3.3 V, T_A = 25°C.

TIMING REQUIREMENTS

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

| | | V _{CC} = 1.8 V | | V _{CC} = 2.5 V ± 0.2 V | | V _{CC} = 2.7 V | | V _{CC} = 3.3 V ± 0.3 V | | UNIT | |
|--------------------|-----------------|-------------------------|-----------------|---------------------------------|-----|-------------------------|-----|---------------------------------|-----|------|--|
| | | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | | |
| f _{clock} | Clock frequency | (1) | | 150 | | 150 | | 150 | | MHz | |
| t _w | Pulse duration | LE high | | (1) | | 3.3 | | 3.3 | | ns | |
| | | CLK high or low | | (1) | | 3.3 | | 3.3 | | | |
| t _{su} | Setup time | Data before CLK↑ | | (1) | | 2.2 | | 2.1 | | ns | |
| | | Data before LE↓ | CLK high | | (1) | | 1.9 | | 1.6 | | |
| | | | CLK low | | (1) | | 1.3 | | 1.1 | | |
| t _h | Hold time | Data after CLK↑ | | (1) | | 0.6 | | 0.6 | | ns | |
| | | Data after LE↓ | CLK high or low | | (1) | | 1.4 | | 1.7 | | |

(1) This information was not available at the time of publication.

SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $V_{CC} = 1.8\text{ V}$ | | $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$ | | $V_{CC} = 2.7\text{ V}$ | | $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ | | UNIT |
|-----------|-----------------|----------------|-------------------------|-----|--|-----|-------------------------|-----|--|-----|------|
| | | | MIN | TYP | MIN | MAX | MIN | MAX | MIN | MAX | |
| f_{max} | | | (1) | | 150 | | 150 | | 150 | | MHz |
| t_{pd} | A | Y | (1) | | 1 5 | | 5 | | 1 4.2 | | ns |
| | LE | | (1) | | 1.3 5.9 | | 5.8 | | 1.3 5.1 | | |
| | CLK | | (1) | | 1.4 6.3 | | 6.1 | | 1.4 5.4 | | |
| t_{en} | \overline{OE} | Y | (1) | | 1.4 6.3 | | 6.5 | | 1.1 5.5 | | ns |
| t_{dis} | \overline{OE} | Y | (1) | | 1 4.9 | | 4.9 | | 1.3 4.5 | | ns |

(1) This information was not available at the time of publication.

SWITCHING CHARACTERISTICS

from 0°C to 85°C, $C_L = 0\text{ pF}$

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $V_{CC} = 3.3\text{ V} \pm 0.15\text{ V}$ | | UNIT |
|----------------|-----------------|----------------|---|-----|------|
| | | | MIN | MAX | |
| $t_{pd}^{(1)}$ | A | Y | 0.9 | 2 | ns |
| | CLK | | 1.4 | 2.9 | |

(1) Texas Instruments SPICE simulation data

SWITCHING CHARACTERISTICS

from 0°C to 65°C, $C_L = 50\text{ pF}$

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $V_{CC} = 3.3\text{ V} \pm 0.15\text{ V}$ | | UNIT |
|-----------|-----------------|----------------|---|-----|------|
| | | | MIN | MAX | |
| t_{pd} | A | Y | 1 | 4 | ns |
| | CLK | | 1.9 | 5 | |

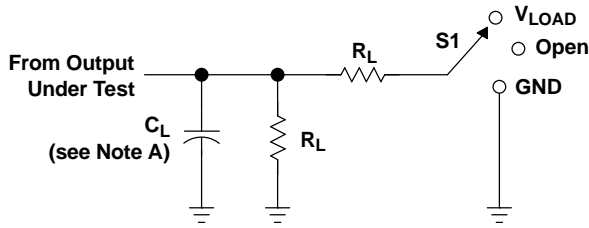
OPERATING CHARACTERISTICS

$T_A = 25^\circ\text{C}$

| PARAMETER | | TEST CONDITIONS | $V_{CC} = 1.8\text{ V}$ | $V_{CC} = 2.5\text{ V}$ | $V_{CC} = 3.3\text{ V}$ | UNIT |
|-----------|-------------------------------|------------------|-------------------------|-------------------------|-------------------------|------|
| | | | TYP | TYP | TYP | |
| C_{pd} | Power dissipation capacitance | Outputs enabled | (1) | 35.5 | 40 | pF |
| | | Outputs disabled | (1) | 12.5 | 14 | |

(1) This information was not available at the time of publication.

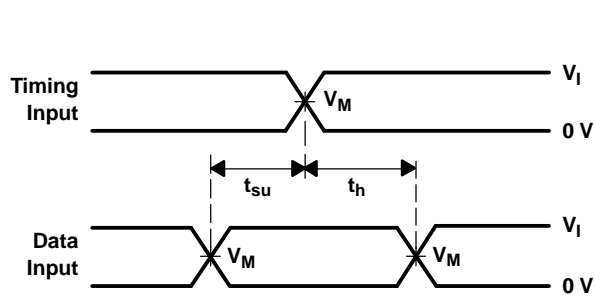
PARAMETER MEASUREMENT INFORMATION



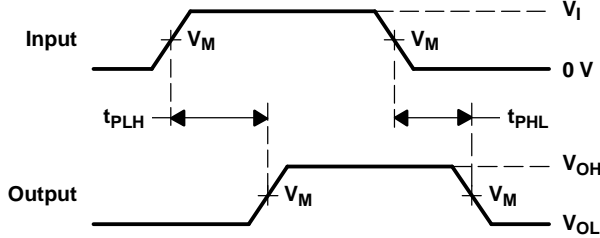
| TEST | S1 |
|--|---------------------------|
| t_{pd} t_{PLZ}/t_{PZL} t_{PHZ}/t_{PZH} | Open V_{LOAD} GND |

LOAD CIRCUIT

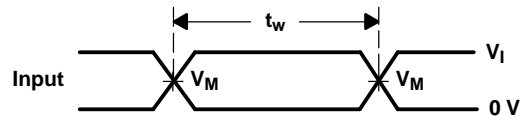
| V_{CC} | INPUT | | V_M | V_{LOAD} | C_L | R_L | V_{Δ} |
|-------------------|----------|---------------|------------|-------------------|-------|--------------|--------------|
| | V_I | t_r/t_f | | | | | |
| 1.8 V | V_{CC} | ≤ 2 ns | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 1 k Ω | 0.15 V |
| $2.5 V \pm 0.2 V$ | V_{CC} | ≤ 2 ns | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 500 Ω | 0.15 V |
| 2.7 V | 2.7 V | ≤ 2.5 ns | 1.5 V | 6 V | 50 pF | 500 Ω | 0.3 V |
| $3.3 V \pm 0.3 V$ | 2.7 V | ≤ 2.5 ns | 1.5 V | 6 V | 50 pF | 500 Ω | 0.3 V |



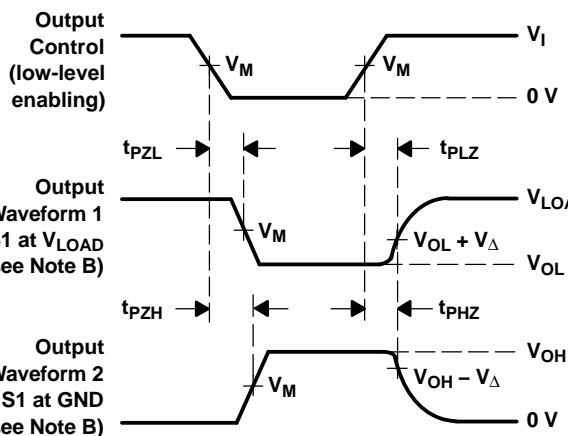
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS
PULSE DURATION



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: $PRR \leq 10$ MHz, $Z_O = 50 \Omega$.
 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} .
 H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

TYPICAL CHARACTERISTICS

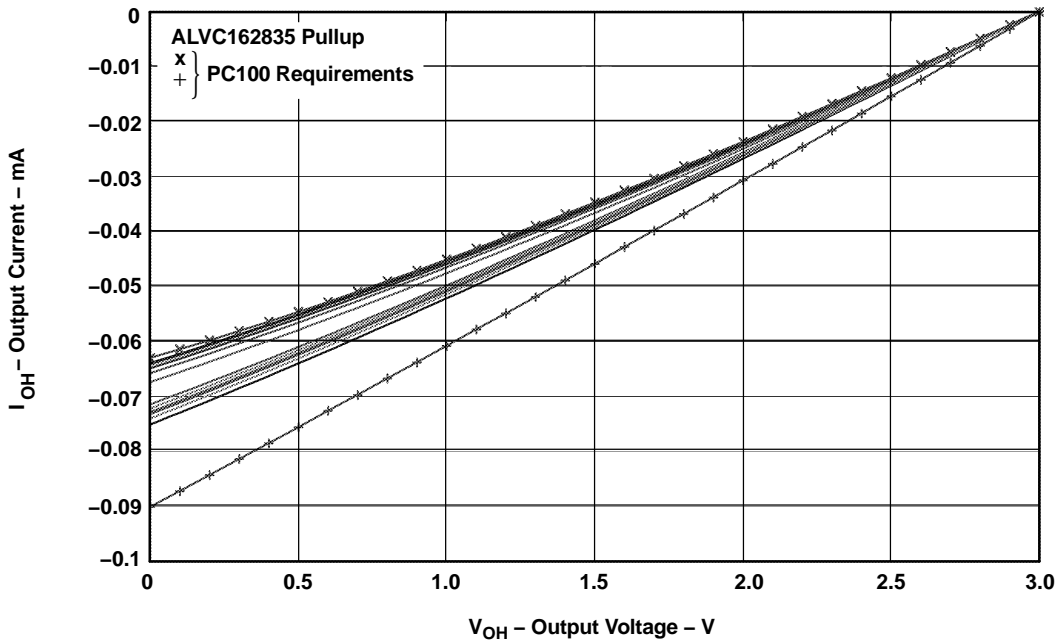


Figure 2. IV Characteristics - Pullup

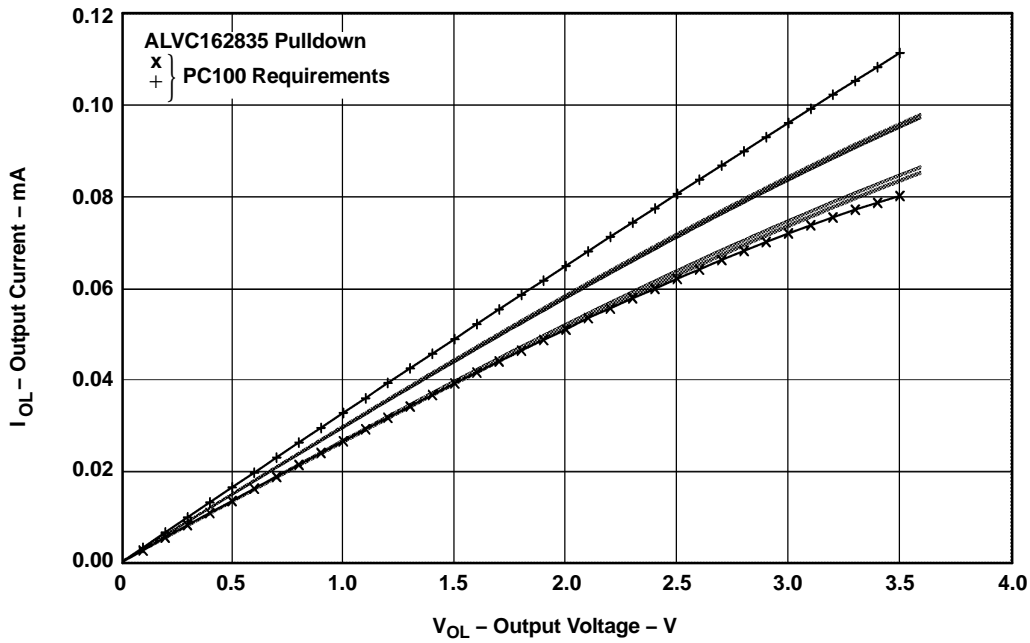


Figure 3. IV Characteristics - Pulldown

PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|--------------------|---------------|--------------|-----------------|------|-------------|-------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| SN74ALVC162835DGGR | ACTIVE | TSSOP | DGG | 56 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | ALVC162835 | Samples |
| SN74ALVC162835DGVR | ACTIVE | TVSOP | DGV | 56 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | VC2835 | Samples |
| SN74ALVC162835DL | ACTIVE | SSOP | DL | 56 | 20 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | ALVC162835 | Samples |

(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.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

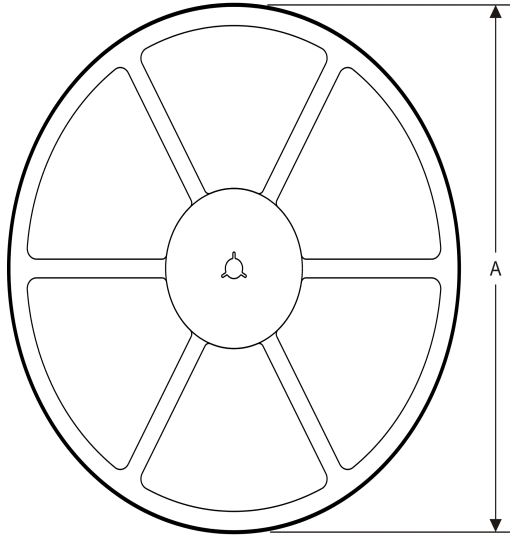
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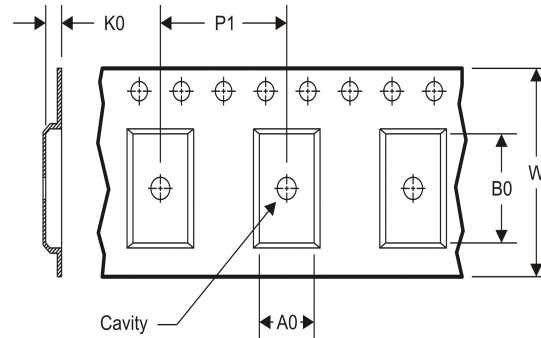
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TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



| | |
|----|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

TAPE AND REEL INFORMATION

*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 |
|--------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74ALVC162835DGGR | TSSOP | DGG | 56 | 2000 | 330.0 | 24.4 | 8.6 | 15.6 | 1.8 | 12.0 | 24.0 | Q1 |
| SN74ALVC162835DGVR | TVSOP | DGV | 56 | 2000 | 330.0 | 24.4 | 6.8 | 11.7 | 1.6 | 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) |
|--------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74ALVC162835DGGR | TSSOP | DGG | 56 | 2000 | 367.0 | 367.0 | 45.0 |
| SN74ALVC162835DGVR | TVSOP | DGV | 56 | 2000 | 367.0 | 367.0 | 45.0 |

DGV (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

24 PINS SHOWN

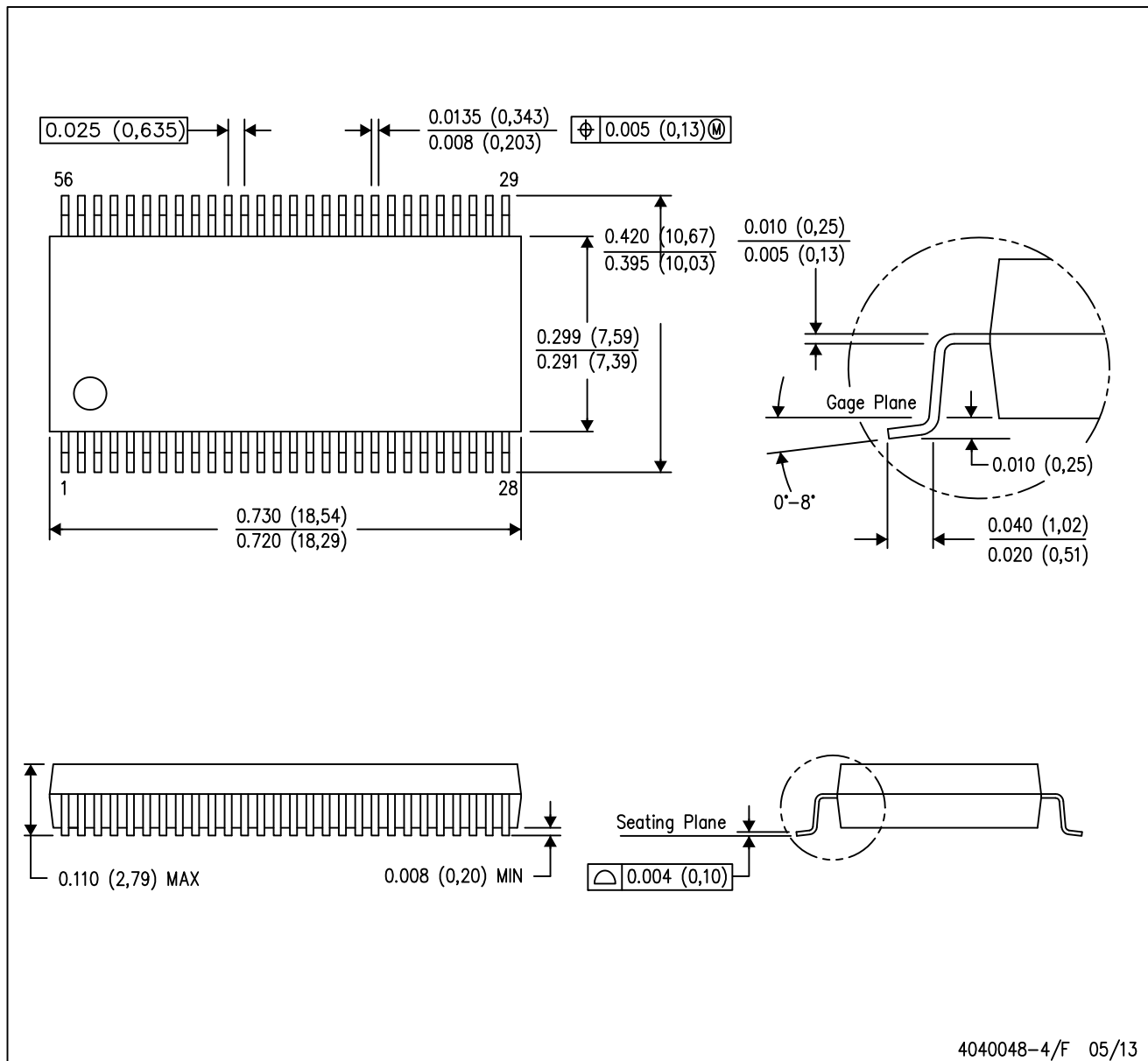


- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.
 D. Falls within JEDEC: 24/48 Pins – MO-153
 14/16/20/56 Pins – MO-194

MECHANICAL DATA

DL (R-PDSO-G56)

PLASTIC SMALL-OUTLINE PACKAGE



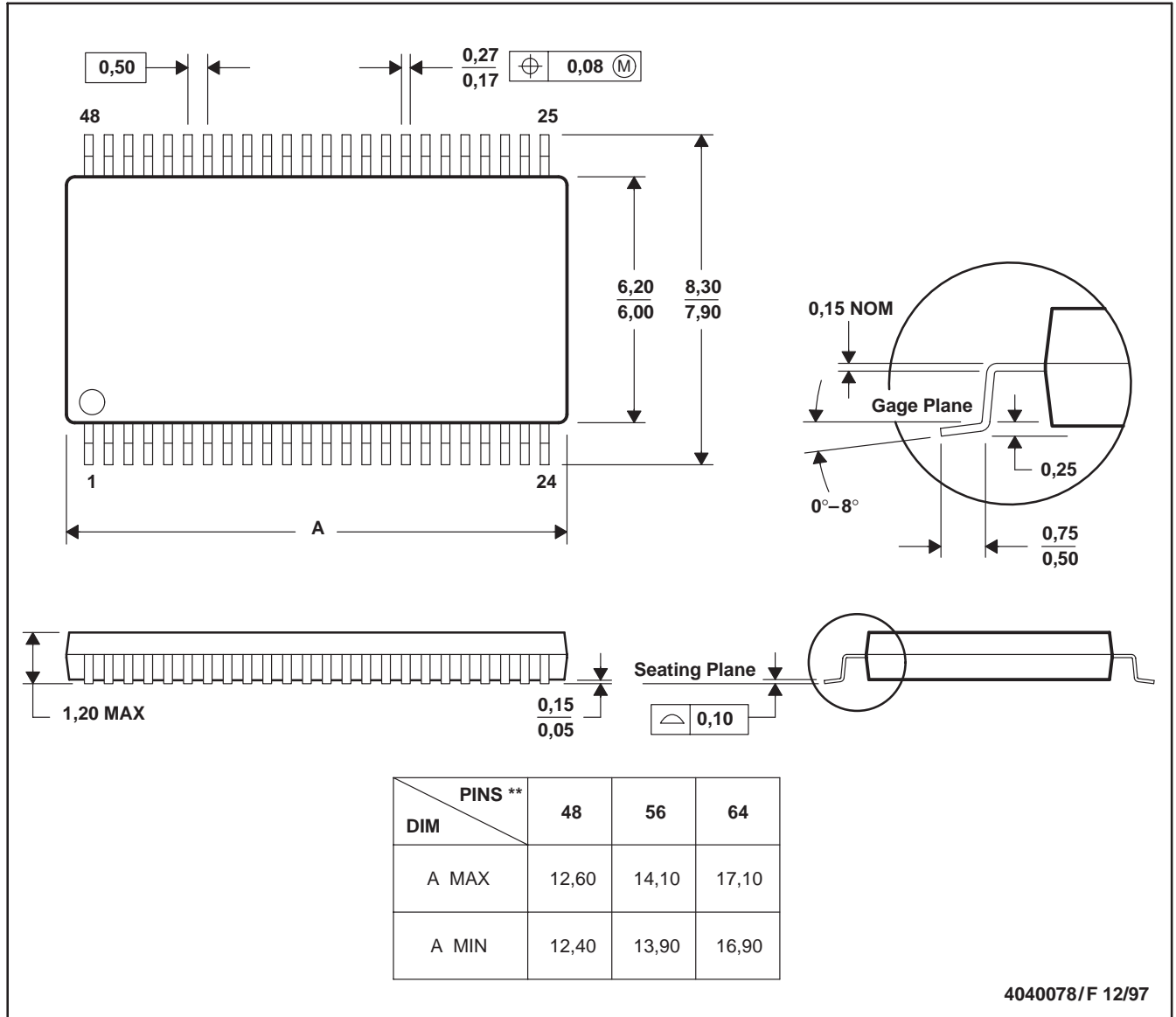
- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - D. Falls within JEDEC MO-118

PowerPAD is a trademark of Texas Instruments.

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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