



**THE DATASHEET OF
SN74ALVCH16863DGGR**

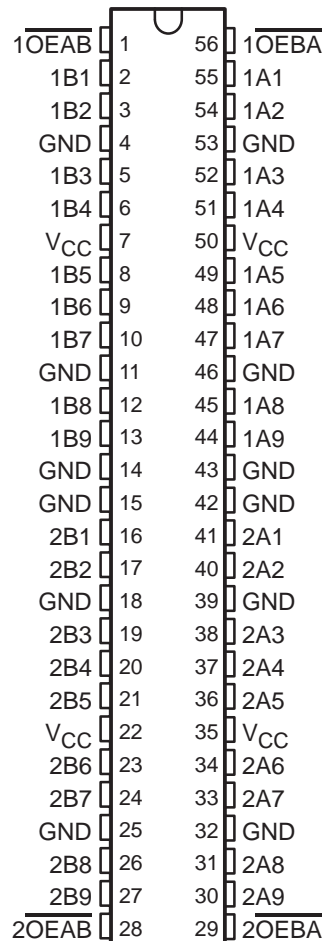


SN74ALVCH16863 18-BIT TRANSCEIVER WITH 3-STATE OUTPUTS

SCES060B – DECEMBER 1995 – REVISED FEBRUARY 1999

- Member of the Texas Instruments *Widebus™* Family
- *EPIC™* (Enhanced-Performance Implanted CMOS) Submicron Process
- ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model (C = 200 pF, R = 0)
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- Bus Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown Resistors
- Package Options Include Plastic 300-mil Shrink Small-Outline (DL) and Thin Shrink Small-Outline (DGG) Packages

DGG OR DL PACKAGE
(TOP VIEW)



description

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

The SN74ALVCH16863 is an 18-bit noninverting transceiver designed for synchronous communication between data buses. The control-function implementation minimizes external timing requirements.

The SN74ALVCH16863 can be used as two 9-bit transceivers or one 18-bit transceiver. They allow data transmission from the A bus to the B bus or from the B bus to the A bus, depending on the logic level at the output-enable (\overline{OEAB} or \overline{OEBA}) 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.

Active bus-hold circuitry is provided to hold unused or floating data inputs at a valid logic level.

The SN74ALVCH16863 is characterized for operation from -40°C to 85°C .

FUNCTION TABLE
(each 9-bit section)

| INPUTS | | OPERATION |
|-------------------|-------------------|-----------------|
| \overline{OEAB} | \overline{OEBA} | |
| H | L | B data to A bus |
| L | H | A data to B bus |
| H | H | Isolation |



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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.

**TEXAS
INSTRUMENTS**

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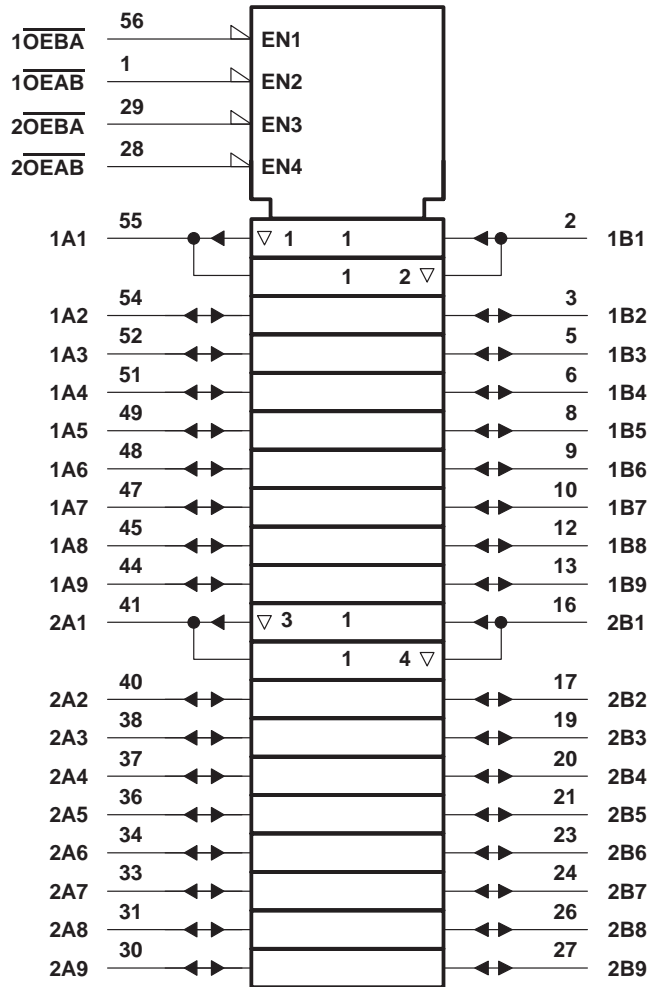
SN74ALVCH16863

18-BIT TRANSCEIVER

WITH 3-STATE OUTPUTS

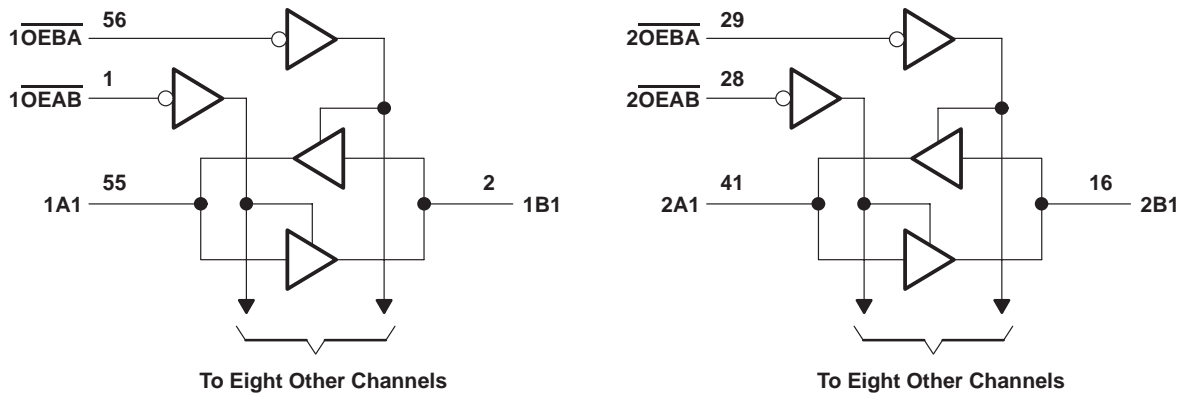
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logic symbol†



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

logic diagram (positive logic)



SN74ALVCH16863
18-BIT TRANSCEIVER
WITH 3-STATE OUTPUTS

SCES060B – DECEMBER 1995 – REVISED FEBRUARY 1999

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

| | |
|--------------------------------------------------------------------------|----------------------------|
| Supply voltage range, V_{CC} | –0.5 V to 4.6 V |
| Input voltage range, V_I : Except I/O ports (see Note 1) | –0.5 V to 4.6 V |
| I/O ports (see Notes 1 and 2) | –0.5 V to $V_{CC} + 0.5$ V |
| Output voltage range, V_O (see Notes 1 and 2) | –0.5 V to $V_{CC} + 0.5$ V |
| Input clamp current, I_{IK} ($V_I < 0$) | –50 mA |
| Output clamp current, I_{OK} ($V_O < 0$) | –50 mA |
| Continuous output current, I_O | ±50 mA |
| Continuous current through each V_{CC} or GND | ±100 mA |
| Package thermal impedance, θ_{JA} (see Note 3): DGG package | 81°C/W |
| DL package | 74°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 negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. This value is limited to 4.6 V maximum.
3. The package thermal impedance is calculated in accordance with JESD 51.

recommended operating conditions (see Note 4)

| | | 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 | $0.65 \times V_{CC}$ | 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 | $0.35 \times V_{CC}$ | 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 | V_{CC} | V |
| V_O | Output voltage | 0 | V_{CC} | V |
| I_{OH} | High-level output current | $V_{CC} = 1.65$ V | –4 | mA |
| | | $V_{CC} = 2.3$ V | –12 | |
| | | $V_{CC} = 2.7$ V | –12 | |
| | | $V_{CC} = 3$ V | –24 | |
| I_{OL} | Low-level output current | $V_{CC} = 1.65$ V | 4 | mA |
| | | $V_{CC} = 2.3$ V | 12 | |
| | | $V_{CC} = 2.7$ V | 12 | |
| | | $V_{CC} = 3$ V | 24 | |
| $\Delta t/\Delta v$ | Input transition rise or fall rate | | 10 | ns/V |
| T_A | Operating free-air temperature | –40 | 85 | °C |

NOTE 4: All unused control 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.



SN74ALVCH16863
18-BIT TRANSCEIVER
WITH 3-STATE OUTPUTS

SCES060B – DECEMBER 1995 – REVISED FEBRUARY 1999

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

| PARAMETER | TEST CONDITIONS | V _{CC} | MIN | TYP† | MAX | UNIT |
|-------------------------|------------------------------------------------------------------------------|-----------------------------------------|----------------------|------|------|------|
| V _{OH} | I _{OH} = -100 μA | 1.65 V to 3.6 V | V _{CC} -0.2 | | | V |
| | I _{OH} = -4 mA | 1.65 V | 1.2 | | | |
| | I _{OH} = -6 mA | 2.3 V | 2 | | | |
| | I _{OH} = -12 mA | 2.3 V | 1.7 | | | |
| | | 2.7 V | 2.2 | | | |
| | I _{OH} = -24 mA | 3 V | 2.4 | | | |
| V _{OL} | I _{OL} = 100 μA | 1.65 V to 3.6 V | | | 0.2 | V |
| | I _{OL} = 4 mA | 1.65 V | | | 0.45 | |
| | I _{OL} = 6 mA | 2.3 V | | | 0.4 | |
| | I _{OL} = 12 mA | 2.3 V | | | 0.7 | |
| | | 2.7 V | | | 0.4 | |
| I _{OL} = 24 mA | 3 V | | | 0.55 | | |
| I _I | V _I = V _{CC} or GND | 3.6 V | | | ±5 | μA |
| I _I (hold) | V _I = 0.58 V | 1.65 V | 25 | | | μA |
| | V _I = 1.07 V | 1.65 V | -25 | | | |
| | V _I = 0.7 V | 2.3 V | 45 | | | |
| | V _I = 1.7 V | 2.3 V | -45 | | | |
| | V _I = 0.8 V | 3 V | 75 | | | |
| | V _I = 2 V | 3 V | -75 | | | |
| | V _I = 0 to 3.6 V‡ | 3.6 V | | | ±500 | |
| 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 | 3.3 V | | 3.5 | pF |
| | Data inputs | | | | 6 | |
| C _o | Outputs | V _O = V _{CC} or GND | 3.3 V | | 7.5 | pF |

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

‡ This is the bus-hold maximum dynamic current. It is the minimum overdrive current required to switch the input from one state to another.

switching characteristics over recommended operating free-air temperature range (unless otherwise noted) (see Figures 1 through 3)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | 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 |
|------------------|----------------------------------------|-------------|-------------------------|---------------------------------|-----|-------------------------|-----|---------------------------------|-----|------|
| | | | TYP | MIN | MAX | MIN | MAX | MIN | MAX | |
| t _{pd} | A or B | B or A | § | 1 | 4.1 | 4 | | 1 | 3.4 | ns |
| t _{en} | \overline{OEAB} or \overline{OEBA} | A or B | § | 1 | 5.7 | 5.8 | | 1 | 4.7 | ns |
| t _{dis} | \overline{OEAB} or \overline{OEBA} | A or B | § | 1.3 | 5.5 | 4.7 | | 1.4 | 4.2 | ns |

§ This information was not available at the time of publication.

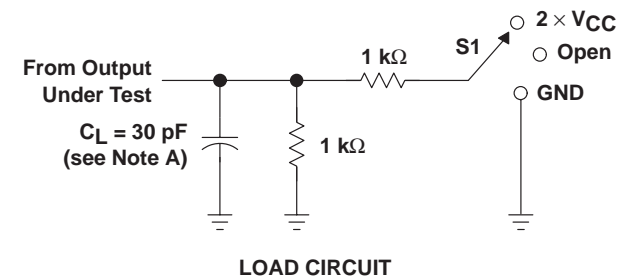


operating characteristics, $T_A = 25^\circ\text{C}$

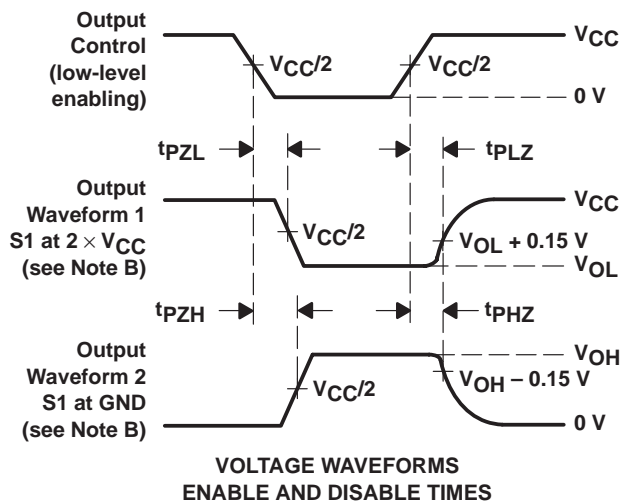
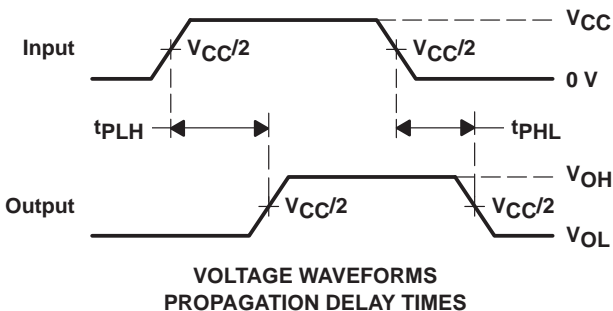
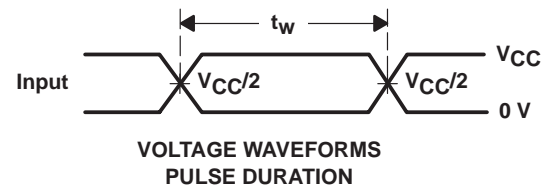
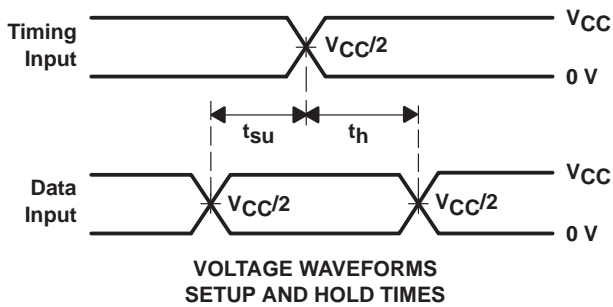
| PARAMETER | | TEST CONDITIONS | $V_{CC} = 1.8\text{ V}$ | $V_{CC} = 2.5\text{ V}$ | $V_{CC} = 3.3\text{ V}$ | UNIT |
|----------------------------------------|------------------|-----------------------------------------|-------------------------|-------------------------|-------------------------|------|
| | | | TYP | TYP | TYP | |
| C_{pd} Power dissipation capacitance | Outputs enabled | $C_L = 50\text{ pF}, f = 10\text{ MHz}$ | † | 21 | 30 | pF |
| | Outputs disabled | | † | 2 | 3 | |

† This information was not available at the time of publication.

PARAMETER MEASUREMENT INFORMATION
 $V_{CC} = 1.8\text{ V}$



| TEST | S1 |
|-------------------|--------------|
| t_{pd} | Open |
| t_{PLZ}/t_{PZL} | 2 × V_{CC} |
| t_{PHZ}/t_{PZH} | GND |



- 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 $\leq 10\text{ MHz}$, $Z_O = 50\ \Omega$, $t_r \leq 2\text{ ns}$, $t_f \leq 2\text{ ns}$.
 - 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} .

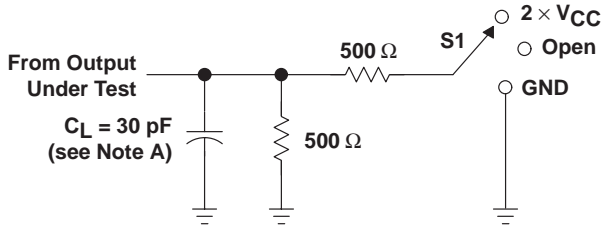
Figure 1. Load Circuit and Voltage Waveforms

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SCES060B – DECEMBER 1995 – REVISED FEBRUARY 1999

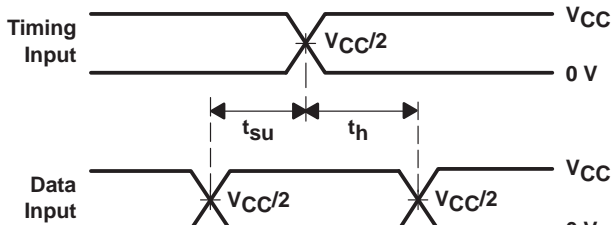
PARAMETER MEASUREMENT INFORMATION

$V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$

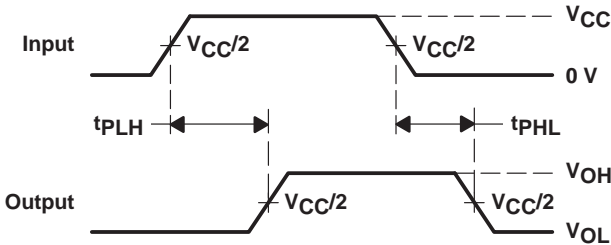


LOAD CIRCUIT

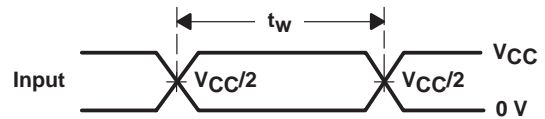
| TEST | S1 |
|-------------------|-------------------|
| t_{pd} | Open |
| t_{PLZ}/t_{PZL} | 2 $\times V_{CC}$ |
| t_{PHZ}/t_{PZH} | GND |



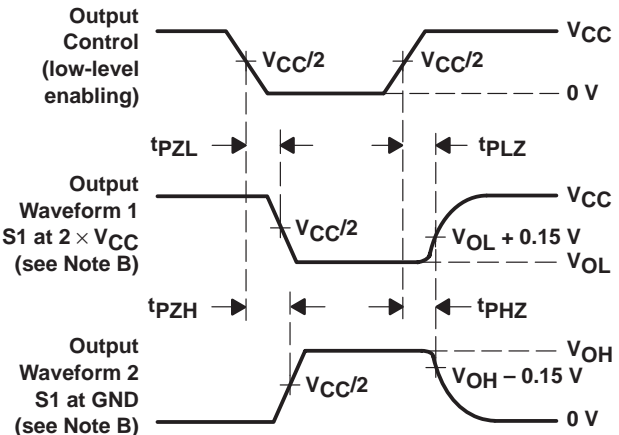
**VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES**



**VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES**



**VOLTAGE WAVEFORMS
PULSE DURATION**



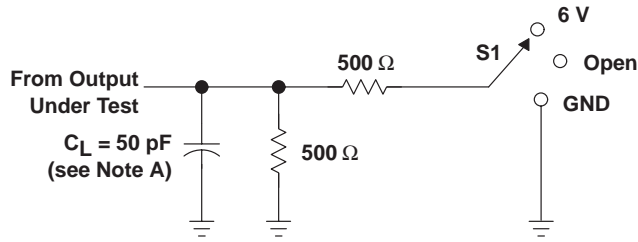
**VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES**

- 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: $PRR \leq 10\text{ MHz}$, $Z_O = 50\ \Omega$, $t_r \leq 2\text{ ns}$, $t_f \leq 2\text{ ns}$.
 - 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 2. Load Circuit and Voltage Waveforms

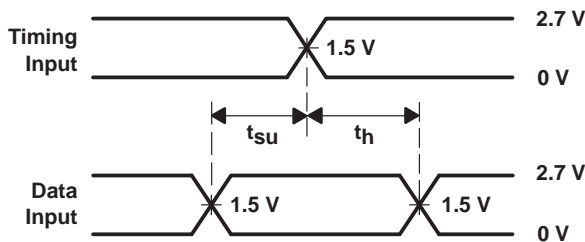
PARAMETER MEASUREMENT INFORMATION

$V_{CC} = 2.7 \text{ V}$ AND $3.3 \text{ V} \pm 0.3 \text{ V}$

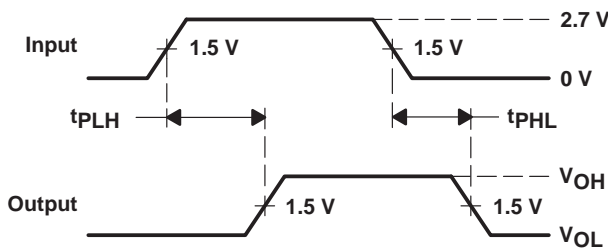


| TEST | S1 |
|-------------------|------|
| t_{pd} | Open |
| t_{PLZ}/t_{PZL} | 6 V |
| t_{PHZ}/t_{PZH} | GND |

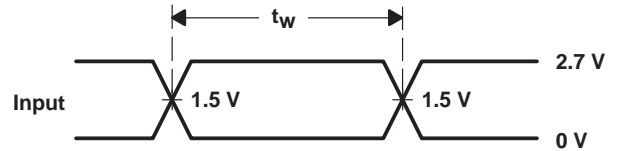
LOAD CIRCUIT



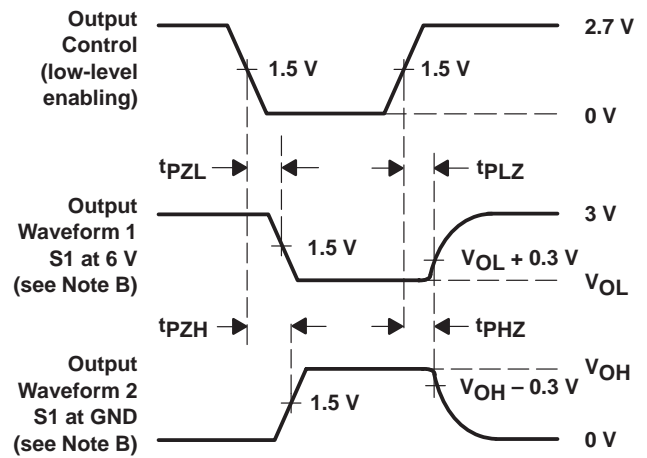
VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



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: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 2.5 \text{ ns}$, $t_f \leq 2.5 \text{ ns}$.
 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 3. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|--------------------|---------------|--------------|--------------------|------|----------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|----------------|
| SN74ALVCH16863DGGR | ACTIVE | TSSOP | DGG | 56 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | ALVCH16863 | 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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

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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 |
|--------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74ALVCH16863DGGR | TSSOP | DGG | 56 | 2000 | 330.0 | 24.4 | 8.6 | 15.6 | 1.8 | 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) |
|--------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74ALVCH16863DGGR | TSSOP | DGG | 56 | 2000 | 367.0 | 367.0 | 45.0 |

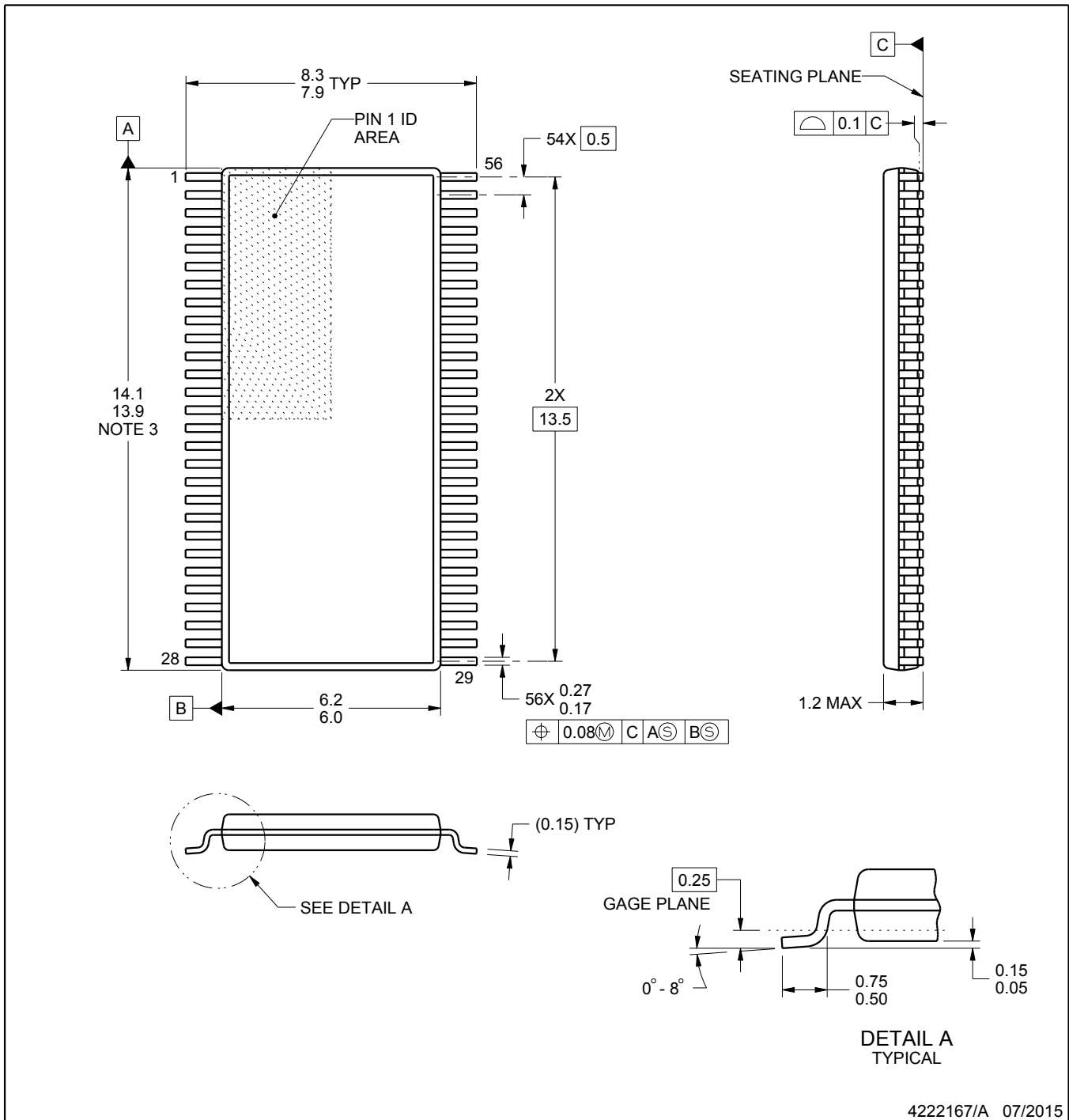
DGG0056A



PACKAGE OUTLINE

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



4222167/A 07/2015

NOTES:

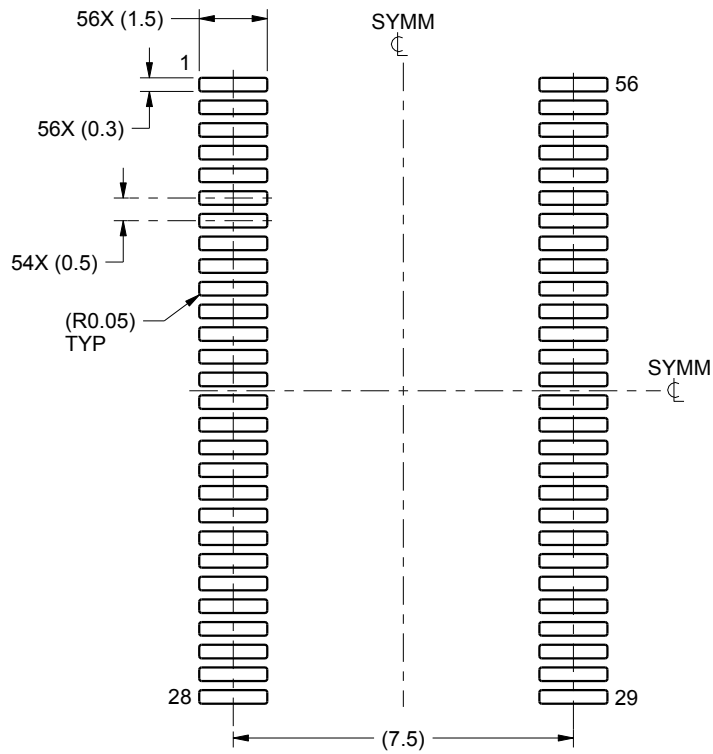
- All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
- This drawing is subject to change without notice.
- This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
- Reference JEDEC registration MO-153.

EXAMPLE BOARD LAYOUT

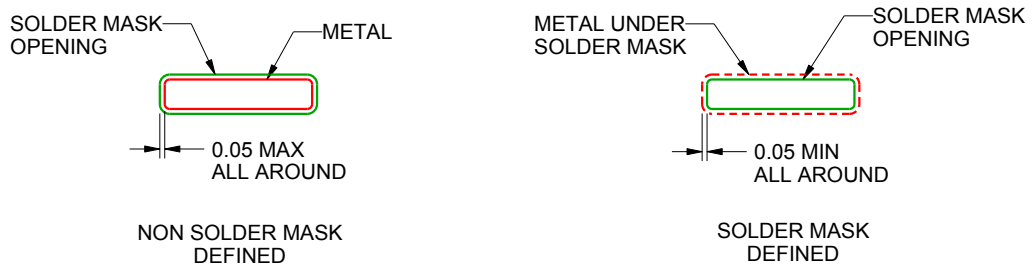
DGG0056A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
SCALE:6X



SOLDER MASK DETAILS

4222167/A 07/2015

NOTES: (continued)

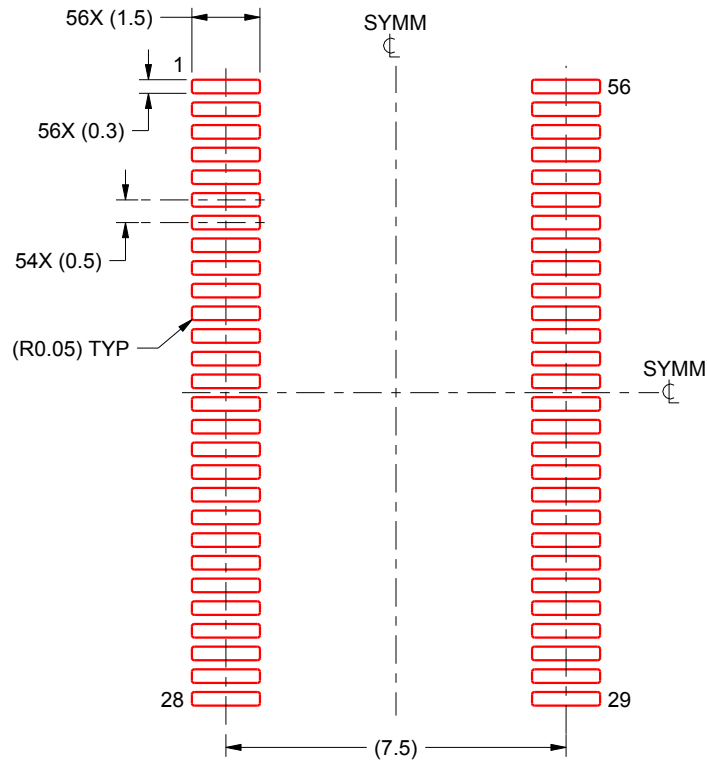
- 5. Publication IPC-7351 may have alternate designs.
- 6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DGG0056A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:6X

4222167/A 07/2015

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

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