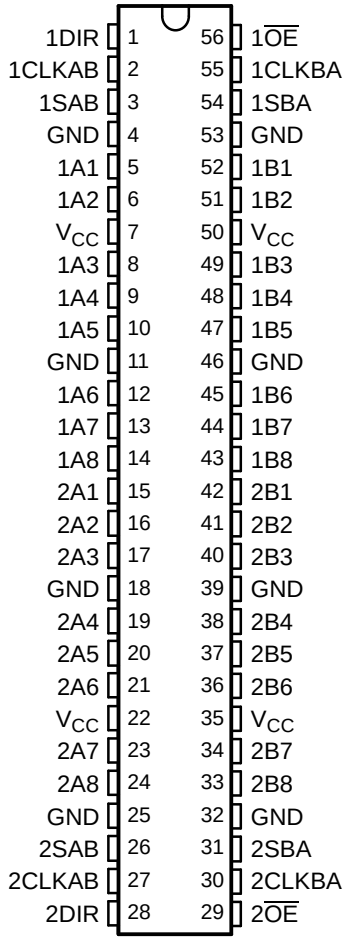
# SN74LVC16646A
# 16-BIT BUS TRANSCEIVER AND REGISTER WITH 3-STATE OUTPUTS

SCES408B–AUGUST 2002–REVISED APRIL 2005

## FEATURES

- **Member of the Texas Instruments Widebus™ Family**
- **Operates From 1.65 V to 3.6 V**
- **Inputs Accept Voltages to 5.5 V**
- **In Transparent Mode, Max $t_{pd}$ of 5.2 ns at 3.3 V**
- **Typical $V_{OLP}$ (Output Ground Bounce) < 0.8 V at $V_{CC}$ = 3.3 V, $T_A$ = 25°C**
- **Typical $V_{OHV}$ (Output $V_{OH}$ Undershoot) > 2 V at $V_{CC}$ = 3.3 V, $T_A$ = 25°C**
- **Supports Mixed-Mode Signal Operation on All Ports (5-V Input/Output Voltage With 3.3-V $V_{CC}$)**
- **$I_{off}$ Supports Partial-Power-Down Mode Operation**
- **Latch-Up Performance Exceeds 250 mA Per JESD 17**
- **ESD Protection Exceeds JESD 22**
  - **– 2000-V Human-Body Model (A114-A)**
  - **– 1000-V Charged-Device Model (C101)**

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




## DESCRIPTION/ORDERING INFORMATION

This 16-bit bus transceiver and register is designed for 1.65-V to 3.6-V $V_{CC}$ operation.

The SN74LVC16646A can be used as two 8-bit transceivers or one 16-bit transceiver. The device consists of bus transceiver circuits, D-type flip-flops, and control circuitry arranged for multiplexed transmission of data directly from the input bus or from the internal registers.

**ORDERING INFORMATION**

| $T_A$ | PACKAGE(1) | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---|---|---|---|---|
| –40°C to 85°C | SSOP – DL | Tube | SN74LVC16646ADL | LVC16646A |
| | | Tape and reel | SN74LVC16646ADLR | |
| | TSSOP – DGG | Tape and reel | SN74LVC16646ADGGR | LVC16646A |
| | TVSOP – DGV | Tape and reel | SN74LVC16646ADGVR | LD646A |

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

## DESCRIPTION/ORDERING INFORMATION (CONTINUED)

Data on the A or B bus is clocked into the registers on the low-to-high transition of the appropriate clock (CLKAB or CLKBA) input. Figure 1 illustrates the four fundamental bus-management functions that can be performed with the SN74LVC16646A.

Output-enable ($\overline{OE}$) and direction-control (DIR) inputs control the transceiver functions. In the transceiver mode, data present at the high-impedance port can be stored in either register or in both. The select-control (SAB and SBA) inputs can multiplex stored and real-time (transparent mode) data. The circuitry used for select control eliminates the typical decoding glitch that occurs in a multiplexer during the transition between stored and real-time data. DIR determines which bus receives data when $\overline{OE}$ is low. In the isolation mode ($\overline{OE}$ high), A data can be stored in one register and/or B data can be stored in the other register.

This device is fully specified for partial-power-down applications using $I_{off}$. The $I_{off}$ circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

When an output function is disabled, the input function still is enabled and can be used to store and transmit data. Only one of the two buses, A or B, can be driven at a time.

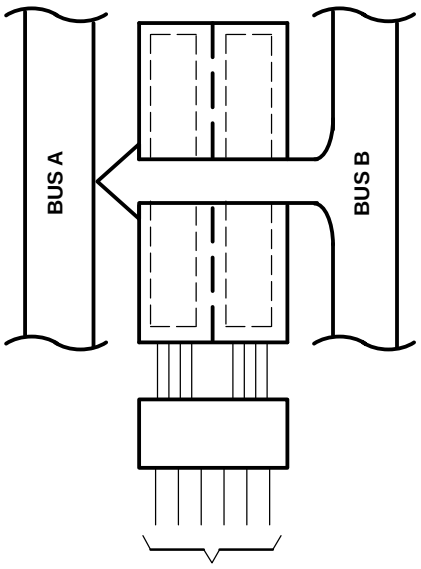
Inputs can be driven from either 3.3-V or 5-V devices. This feature allows the use of these devices as translators in a mixed 3.3-V/5-V system environment.

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.

**FUNCTION TABLE**

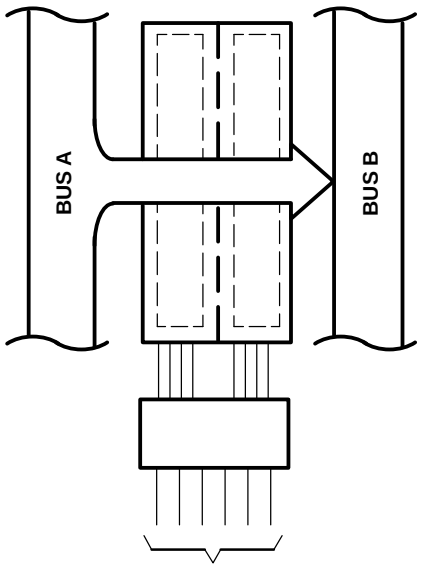
| INPUTS | | | | | | DATA I/O(1) | | OPERATION OR FUNCTION |
|---|---|---|---|---|---|---|---|---|
| $\overline{OE}$ | DIR | CLKAB | CLKBA | SAB | SBA | A1-A8 | B1-B8 | |
| X | X | ↑ | X | X | X | Input | Unspecified | Store A, B unspecified(1) |
| X | X | X | ↑ | X | X | Unspecified | Input | Store B, A unspecified(1) |
| H | X | ↑ | ↑ | X | X | Input | Input | Store A and B data |
| H | X | H or L | H or L | X | X | Input | Input | Isolation, hold storage |
| L | L | X | X | X | L | Output | Input | Real-time B data to A bus |
| L | L | X | H or L | X | H | Output | Input | Stored B data to A bus |
| L | H | X | X | L | X | Input | Output | Real-time A data to B Bus |
| L | H | H or L | X | H | X | Input | Output | Stored A data to bus |

(1) The data-output functions can be enabled or disabled by various signals at $\overline{OE}$ or DIR. Data-input functions always are enabled, i.e., data at the bus terminals is stored on every low-to-high transition of the clock inputs.



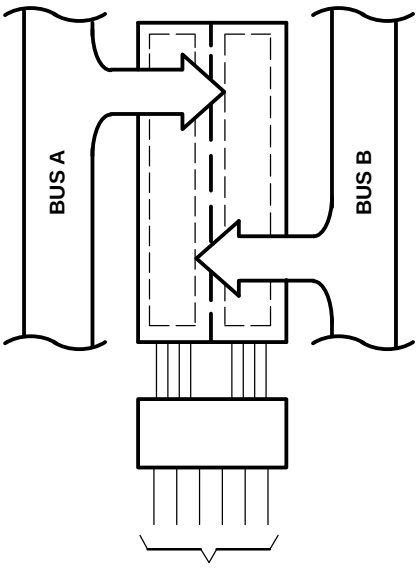

| $\overline{OE}$ | DIR | CLKAB | CLKBA | SAB | SBA |
|---|---|---|---|---|---|
| L | L | X | X | X | L |

**REAL-TIME TRANSFER**
**BUS B TO BUS A**



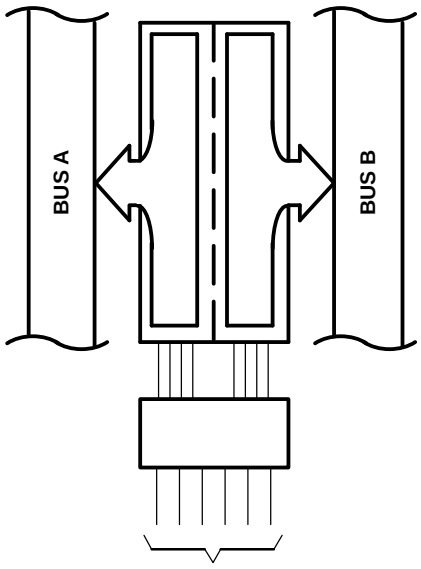

| $\overline{OE}$ | DIR | CLKAB | CLKBA | SAB | SBA |
|---|---|---|---|---|---|
| L | H | X | X | L | X |

**REAL-TIME TRANSFER**
**BUS A TO BUS B**




| $\overline{OE}$ | DIR | CLKAB | CLKBA | SAB | SBA |
|---|---|---|---|---|---|
| X | X | ↑ | X | X | X |
| X | X | X | ↑ | X | X |
| H | X | ↑ | ↑ | X | X |

**STORAGE FROM**
**A, B, OR A AND B**

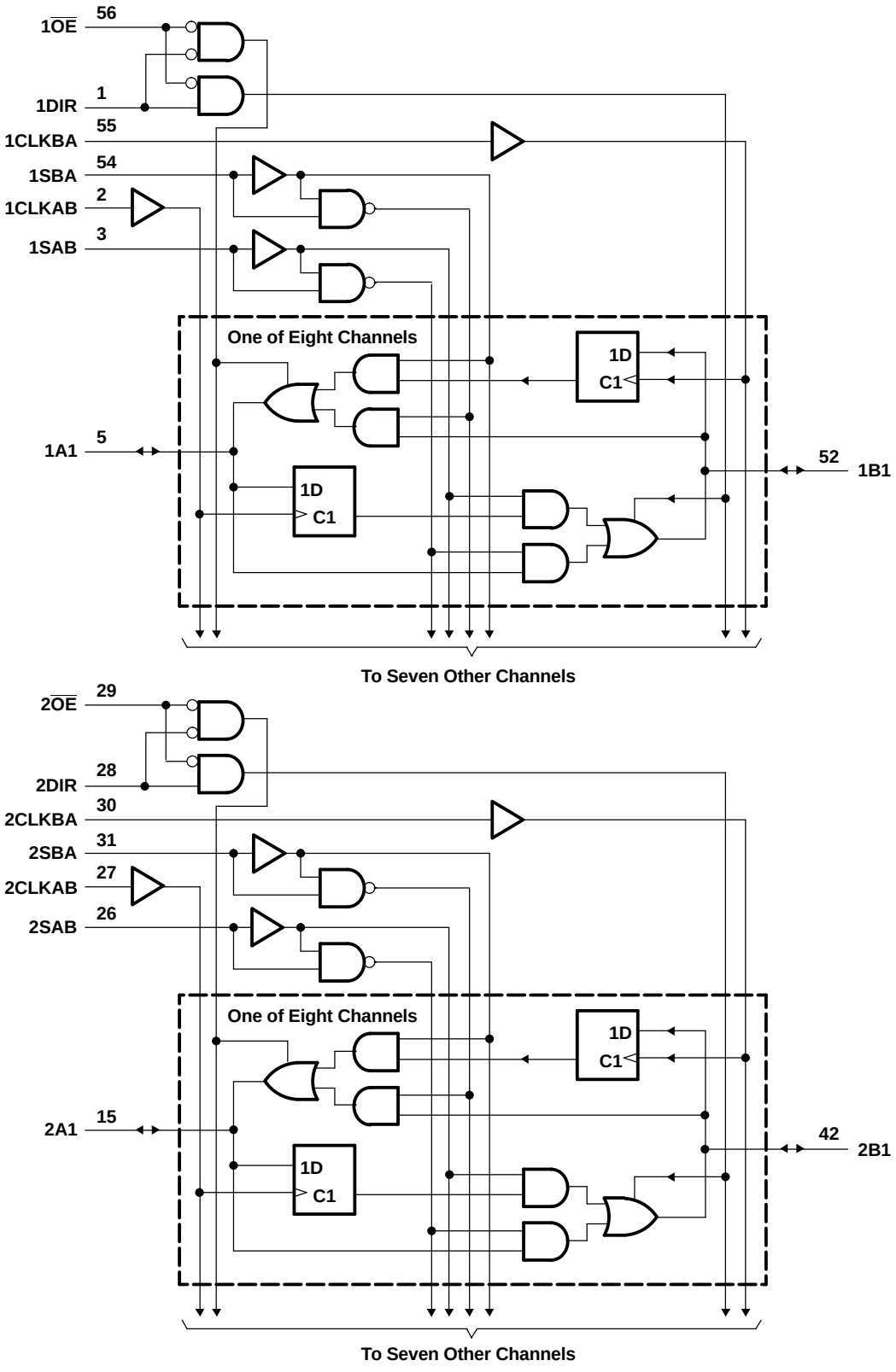



| $\overline{OE}$ | DIR | CLKAB | CLKBA | SAB | SBA |
|---|---|---|---|---|---|
| L | L | X | H or L | X | H |
| L | H | H or L | X | H | X |

**TRANSFER STORED DATA**
**TO A AND/OR B**

**Figure 1. Bus-Management Functions**

## 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 | 6.5 | V |
| $V_I$ | Input voltage range(2) | | –0.5 | 6.5 | V |
| $V_O$ | Voltage range applied to any output in the high-impedance or power-off state(2) | | –0.5 | 6.5 | V |
| $V_O$ | Voltage range applied to any output in the high or low state(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 |
| $\theta_{JA}$ | 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) The value of $V_{CC}$ is provided in the recommended operating conditions table.
(4) The package thermal impedance is calculated in accordance with JESD 51-7.

## Recommended Operating Conditions(1)

| | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply voltage | Operating | 1.65 | 3.6 | V |
| | | Data retention only | 1.5 | | |
| $V_{IH}$ | 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 | 5.5 | V |
| $V_O$ | Output voltage | High or low state | 0 | $V_{CC}$ | V |
| | | 3-state | 0 | 5.5 | |
| $I_{OH}$ | High-level output current | $V_{CC}$ = 1.65 V | | –4 | mA |
| | | $V_{CC}$ = 2.3 V | | –8 | |
| | | $V_{CC}$ = 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 | | 8 | |
| | | $V_{CC}$ = 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 |

(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.

## 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 |
| | | $I_{OH}$ = –4 mA | | 1.65 V | 1.2 | | | |
| | | $I_{OH}$ = –8 mA | | 2.3 V | 1.7 | | | |
| | | $I_{OH}$ = –12 mA | | 2.7 V | 2.2 | | | |
| | | | | 3 V | 2.4 | | | |
| | | $I_{OH}$ = –24 mA | | 3 V | 2.2 | | | |
| $V_{OL}$ | | $I_{OL}$ = 100 µA | | 1.65 V to 3.6 V | | | 0.2 | V |
| | | $I_{OL}$ = 4 mA | | 1.65 V | | | 0.45 | |
| | | $I_{OL}$ = 8 mA | | 2.3 V | | | 0.7 | |
| | | $I_{OL}$ = 12 mA | | 2.7 V | | | 0.4 | |
| | | $I_{OL}$ = 24 mA | | 3 V | | | 0.55 | |
| $I_I$ | Control inputs | $V_I$ = 0 to 5.5 V | | 3.6 V | | | ±5 | µA |
| $I_{off}$ | | $V_I$ or $V_O$ = 5.5 V | | 0 | | | ±10 | µA |
| $I_{OZ}$(2) | | $V_O$ = 0 to 5.5 V | | 3.6 V | | | ±10 | µA |
| $I_{CC}$ | | $V_I$ = $V_{CC}$ or GND | $I_O$ = 0 | 3.6 V | | | 20 | µA |
| | | 3.6 V ≤ $V_I$ ≤ 5.5 V(3) | | | | | 20 | |
| $\Delta I_{CC}$ | | One input at $V_{CC}$ – 0.6 V, Other inputs at $V_{CC}$ or GND | | 2.7 V to 3.6 V | | | 500 | µA |
| $C_i$ | Control inputs | $V_I$ = $V_{CC}$ or GND | | 3.3 V | | 5 | | pF |
| $C_{io}$ | A or B ports | $V_O$ = $V_{CC}$ or GND | | 3.3 V | | 8.5 | | pF |

(1) All typical values are at $V_{CC}$ = 3.3 V, $T_A$ = 25°C.
(2) For I/O ports, the parameter $I_{OZ}$ includes the input leakage current, but not $I_{I(hold)}$.
(3) This applies in the disabled state only.

## Timing Requirements

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 2)

| | | $V_{CC}$ = 1.8 V ± 0.15 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 | | 85 | | 125 | | 150 | | 150 | MHz |
| $t_w$ | Pulse duration, CLK high or low | 5 | | 4 | | 3.3 | | 3.3 | | ns |
| $t_{su}$ | Setup time, A or B before CLKAB↑ or CLKBA↑ | 6.5 | | 3.5 | | 3 | | 2.7 | | ns |
| $t_h$ | Hold time, A or B after CLKAB↑ or CLKBA↑ | 0 | | 0 | | 0 | | 0.3 | | ns |

## Switching Characteristics

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 2)

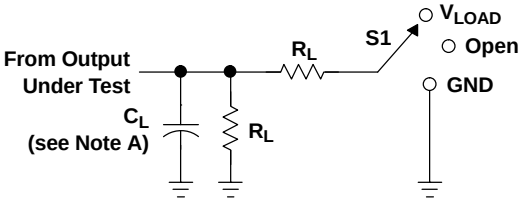
| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $V_{CC}$ = 1.8 V ± 0.15 V | | $V_{CC}$ = 2.5 V ± 0.2 V | | $V_{CC}$ = 2.7 V | | $V_{CC}$ = 3.3 V ± 0.3 V | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | |
| $f_{max}$ | | | 85 | | 125 | | 150 | | 150 | | MHz |
| $t_{pd}$ | A or B | B or A | | 11.3 | | 6.2 | | 6 | 0.5 | 5.2 | ns |
| | CLKAB or CLKBA | A or B | | 12.4 | | 7.2 | | 7 | 1.8 | 6 | |
| | SAB or SBA | | | 13.5 | | 7.3 | | 7 | 1.7 | 6.1 | |
| $t_{en}$ | $\overline{OE}$ | A or B | | 13 | | 9.5 | | 8.5 | 1.3 | 6.9 | ns |
| $t_{dis}$ | | | | 12 | | 8.5 | | 7.7 | 2.1 | 6.9 | |
| $t_{en}$ | DIR | A or B | | 13 | | 9.5 | | 8.5 | 1.4 | 7.2 | ns |
| $t_{dis}$ | | | | 12 | | 8.5 | | 7.8 | 2 | 7 | |
| $t_{sk(o)}$ | | | | | | 1 | | 1 | | 1 | ns |

## Operating Characteristics

$T_A$ = 25°C

| PARAMETER | | | TEST CONDITIONS | $V_{CC}$ = 1.8 V | $V_{CC}$ = 2.5 V | $V_{CC}$ = 3.3 V | UNIT |
|---|---|---|---|---|---|---|---|
| | | | | TYP | TYP | TYP | |
| $C_{pd}$ | Power dissipation capacitance per transceiver | Outputs enabled | f = 10 MHz | 53 | 55 | 60 | pF |
| | | Outputs disabled | | 9 | 10 | 12 | |

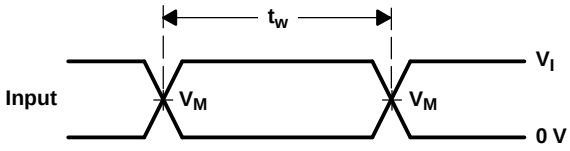
## PARAMETER MEASUREMENT INFORMATION



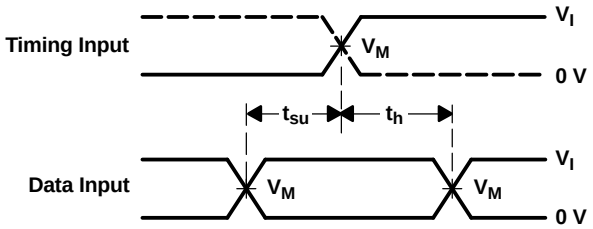

LOAD CIRCUIT

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

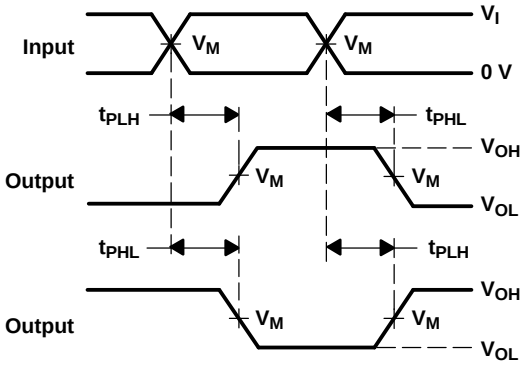
| $V_{CC}$ | INPUTS | | $V_M$ | $V_{LOAD}$ | $C_L$ | $R_L$ | $V_\Delta$ |
|---|---|---|---|---|---|---|---|
| | $V_I$ | $t_r/t_f$ | | | | | |
| 1.8 V ± 0.15 V | $V_{CC}$ | ≤2 ns | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 1 kΩ | 0.15 V |
| 2.5 V ± 0.2 V | $V_{CC}$ | ≤2 ns | $V_{CC}/2$ | $2 \times V_{CC}$ | 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 ± 0.3 V | 2.7 V | ≤2.5 ns | 1.5 V | 6 V | 50 pF | 500 Ω | 0.3 V |



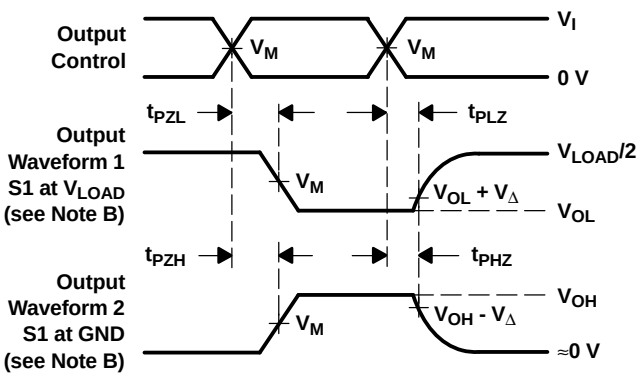

VOLTAGE WAVEFORMS
PULSE DURATION




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: 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 ≤ 10 MHz, $Z_O$ = 50 Ω.
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 2. 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SN74LVC16646ADGGR | ACTIVE | TSSOP | DGG | 56 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LVC16646A | Samples |
| SN74LVC16646ADL | ACTIVE | SSOP | DL | 56 | 20 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LVC16646A | Samples |
| SN74LVC16646ADLR | ACTIVE | SSOP | DL | 56 | 1000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | LVC16646A | 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.

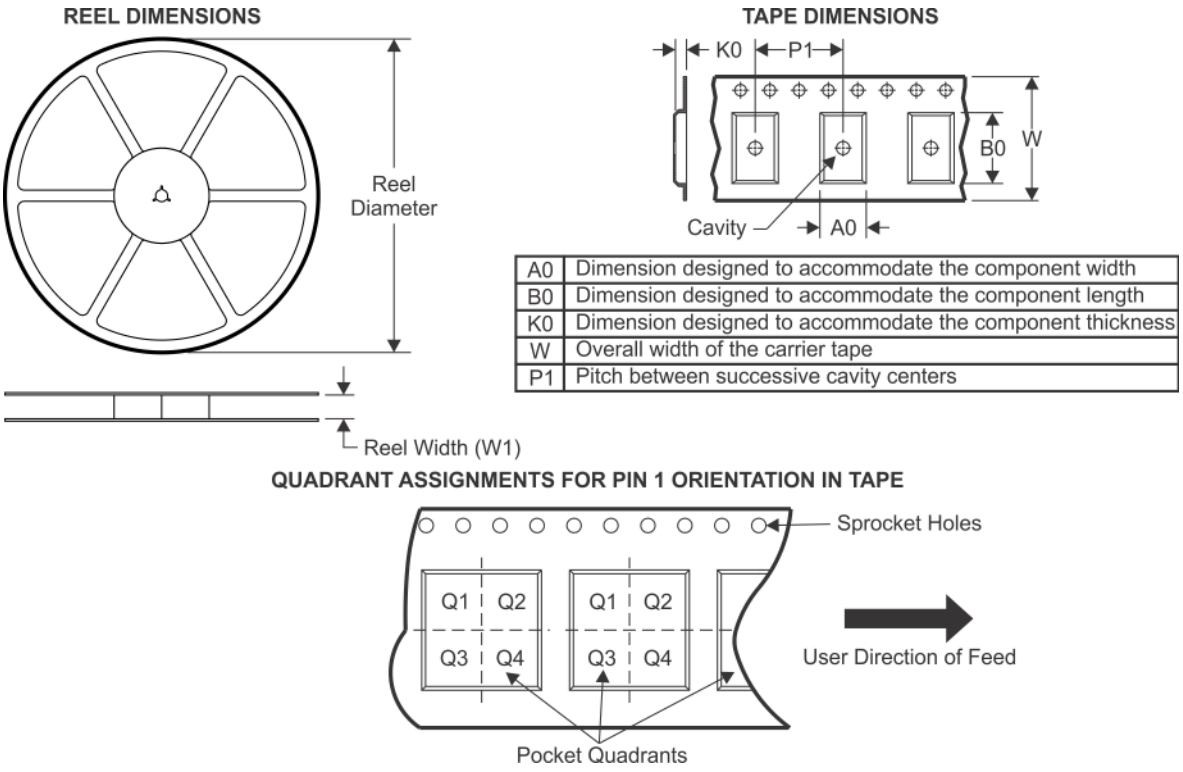
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(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.

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.

## TAPE AND REEL INFORMATION

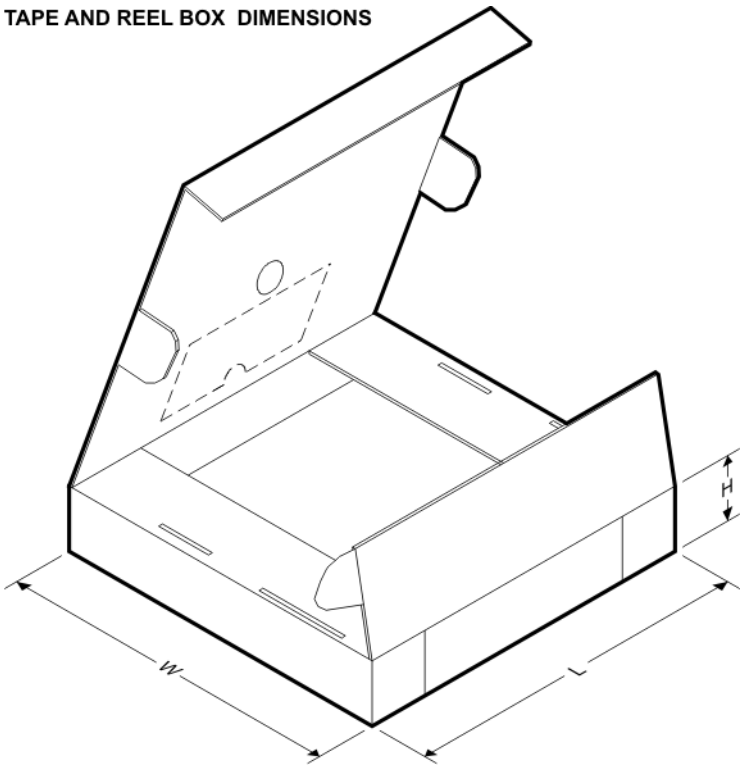



| | |
|---|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

*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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SN74LVC16646ADGGR | TSSOP | DGG | 56 | 2000 | 330.0 | 24.4 | 8.6 | 15.6 | 1.8 | 12.0 | 24.0 | Q1 |
| SN74LVC16646ADLR | SSOP | DL | 56 | 1000 | 330.0 | 32.4 | 11.35 | 18.67 | 3.1 | 16.0 | 32.0 | Q1 |

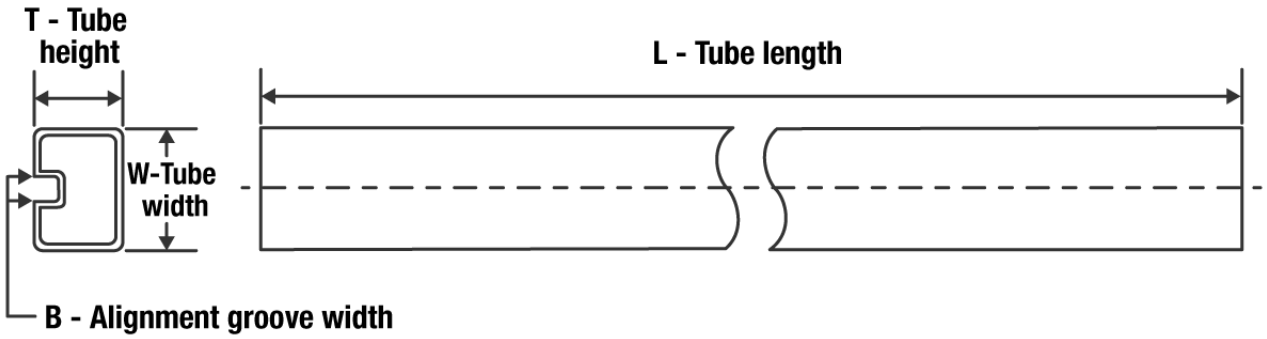
TAPE AND REEL BOX DIMENSIONS




*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| SN74LVC16646ADGGR | TSSOP | DGG | 56 | 2000 | 367.0 | 367.0 | 45.0 |
| SN74LVC16646ADLR | SSOP | DL | 56 | 1000 | 367.0 | 367.0 | 55.0 |

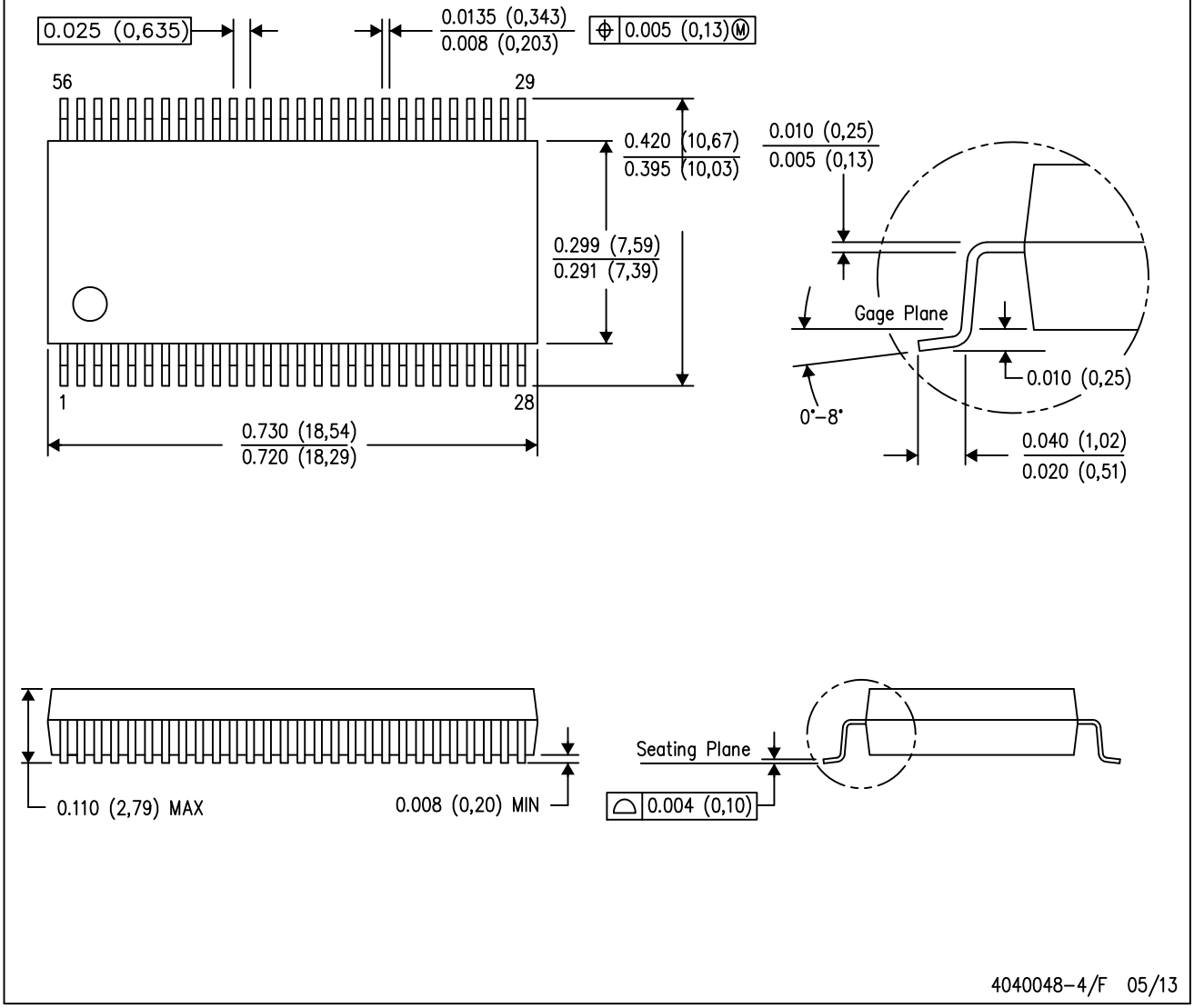
## TUBE




*All dimensions are nominal

| Device | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (µm) | B (mm) |
|---|---|---|---|---|---|---|---|---|
| SN74LVC16646ADL | DL | SSOP | 56 | 20 | 473.7 | 14.24 | 5110 | 7.87 |

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

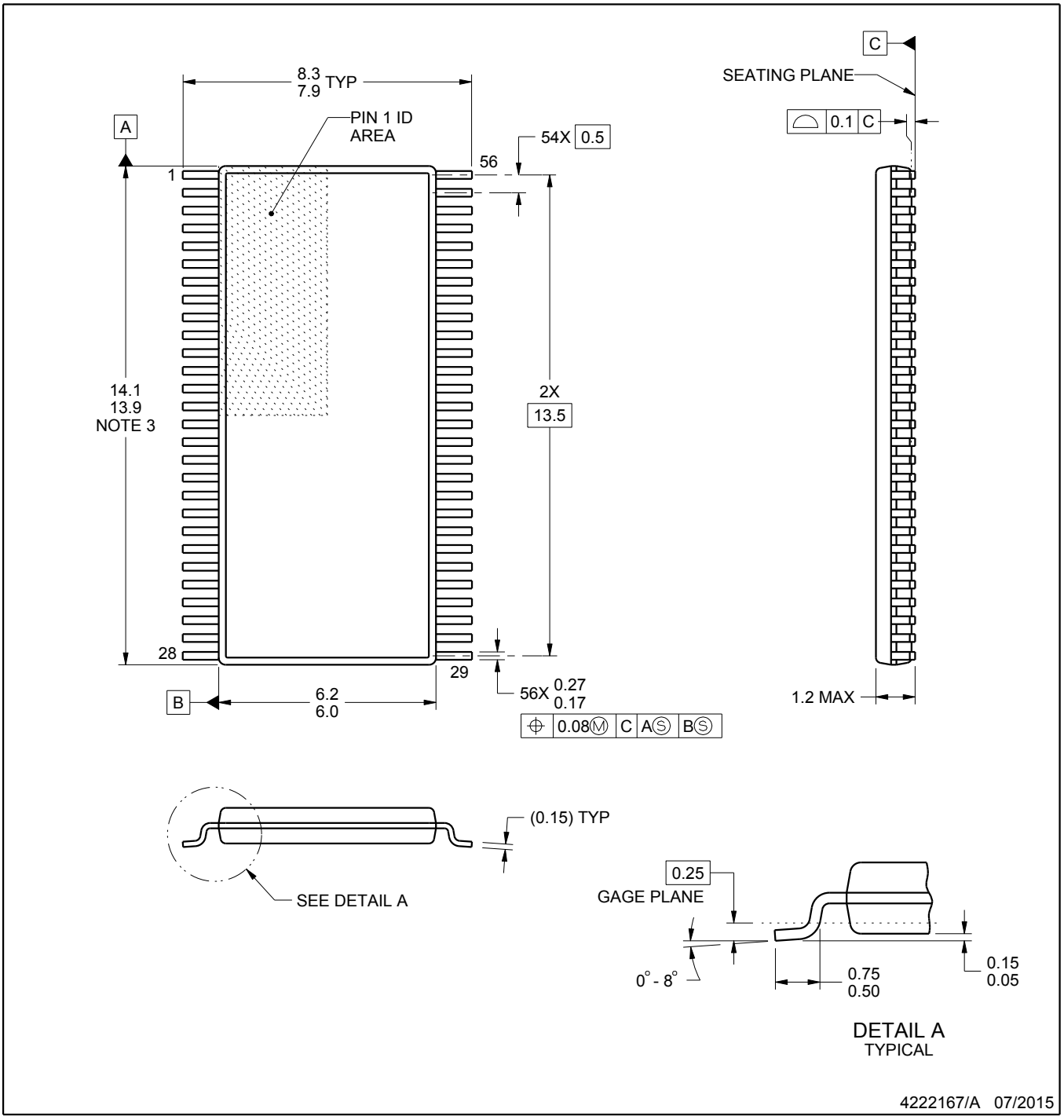
PowerPAD is a trademark of Texas Instruments.

# PACKAGE OUTLINE

## DGG0056A

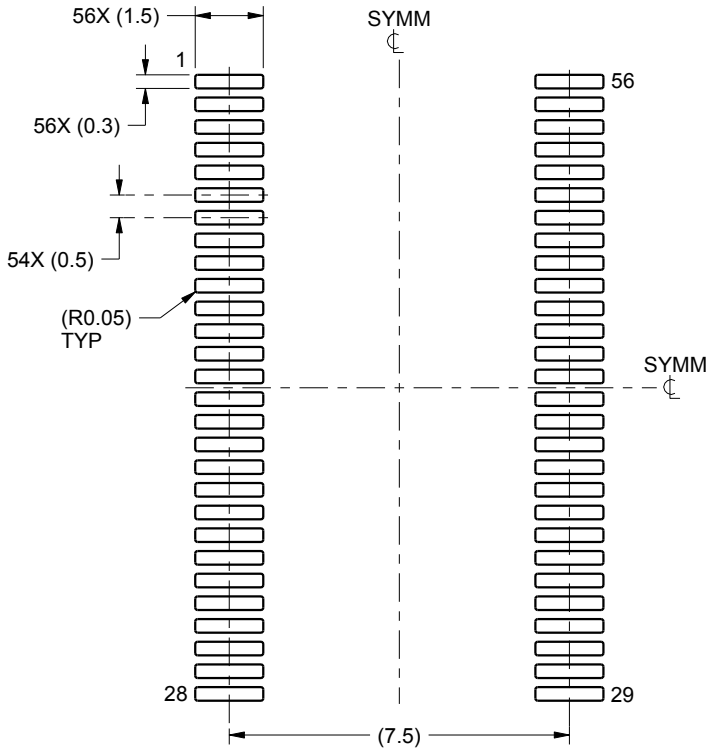
## TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

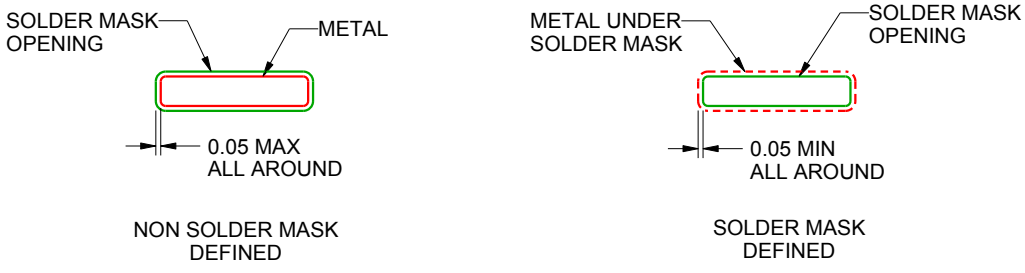



NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. 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.
4. Reference JEDEC registration MO-153.




LAND PATTERN EXAMPLE
SCALE:6X




SOLDER MASK DETAILS

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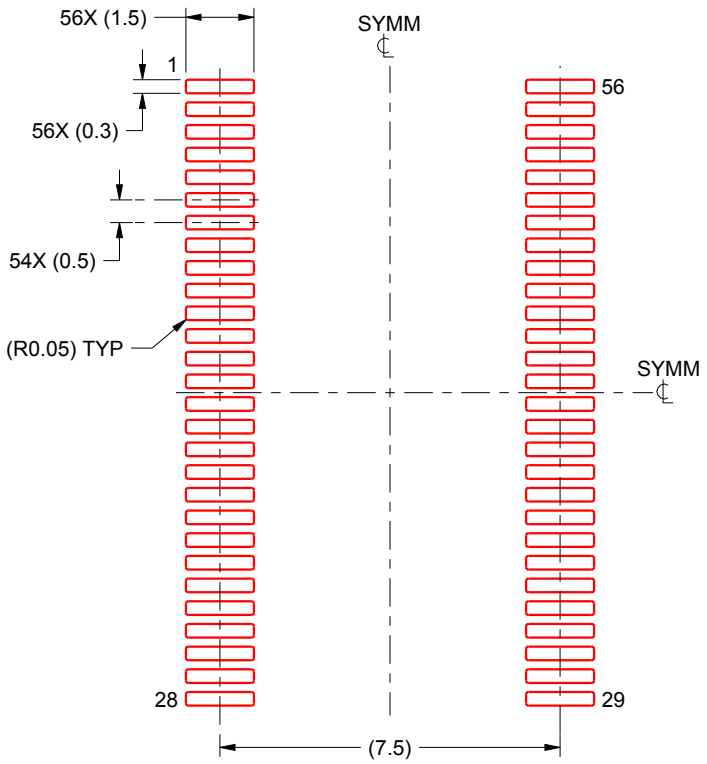
NOTES: (continued)

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




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

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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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