



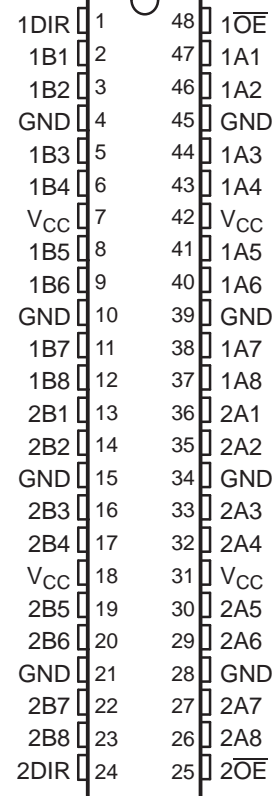
**THE DATASHEET OF  
74LVTH162245DGGRG4**



## FEATURES

- Members of the Texas Instruments Widebus™ Family
- A-Port Outputs Have Equivalent 22-Ω Series Resistors, So No External Resistors Are Required
- Support Mixed-Mode Signal Operation (5-V Input and Output Voltages With 3.3-V  $V_{CC}$ )
- Support Unregulated Battery Operation Down to 2.7 V
- Typical  $V_{OLP}$  (Output Ground Bounce) <0.8 V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- $I_{off}$  and Power-Up 3-State Support Hot Insertion
- Bus Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown Resistors
- Distributed  $V_{CC}$  and GND Pins Minimize High-Speed Switching Noise
- Flow-Through Architecture Optimizes PCB Layout
- Latch-Up Performance Exceeds 500 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)

SN54LVTH162245 . . . WD PACKAGE  
SN74LVTH162245 . . . DGG OR DL PACKAGE  
(TOP VIEW)



## DESCRIPTION/ORDERING INFORMATION

The 'LVTH162245 devices are 16-bit (dual-octal) noninverting 3-state transceivers designed for low-voltage (3.3-V)  $V_{CC}$  operation, but with the capability to provide a TTL interface to a 5-V system environment.

These devices can be used as two 8-bit transceivers or one 16-bit transceiver. The devices 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 direction-control (DIR) input. The output-enable ( $\overline{OE}$ ) input can be used to disable the device so that the buses are effectively isolated.

The logic levels of the direction-control (DIR) input and the output-enable ( $\overline{OE}$ ) input activate either the B-port outputs or the A-port outputs or place both output ports into the high-impedance mode. The device transmits data from the A bus to the B bus when the B-port outputs are activated, and from the B bus to the A bus when the A-port outputs are activated. The input circuitry on both A and B ports is always active and must have a logic HIGH or LOW level applied to prevent excess  $I_{CC}$  and  $I_{CCZ}$ .

Active bus-hold circuitry holds unused or undriven inputs at a valid logic state. Use of pullup or pulldown resistors with the bus-hold circuitry is not recommended.

The A-port outputs, which are designed to source or sink up to 12 mA, include equivalent 22-Ω series resistors to reduce overshoot and undershoot.



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.

# SN54LVTH162245, SN74LVTH162245 3.3-V ABT 16-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

SCBS260Q–JUNE 1993–REVISED NOVEMBER 2006

## DESCRIPTION/ORDERING INFORMATION (CONTINUED)

When  $V_{CC}$  is between 0 and 1.5 V, the devices are in the high-impedance state during power up or power down. However, to ensure the high-impedance state above 1.5 V,  $\overline{OE}$  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.

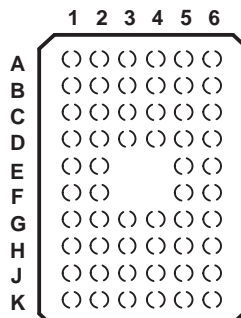
These devices are fully specified for hot-insertion applications using  $I_{off}$  and power-up 3-state. The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the devices when they are powered down. The power-up 3-state circuitry places the outputs in the high-impedance state during power up and power down, which prevents driver conflict.

## ORDERING INFORMATION

| $T_A$                 | PACKAGE <sup>(1)</sup> |              | ORDERABLE PART NUMBER | TOP-SIDE MARKING  |
|-----------------------|------------------------|--------------|-----------------------|-------------------|
| –40°C to 85°C         | FBGA – GRD             | Reel of 1000 | 74LVTH162245GRDR      | LL2245            |
|                       | FBGA – ZRD (Pb-free)   |              | 74LVTH162245ZRDR      |                   |
|                       | SSOP – DL              | Tube of 25   | SN74LVTH162245DL      | LVTH162245        |
|                       |                        |              | SN74LVTH162245DLG4    |                   |
|                       |                        | Reel of 1000 | SN74LVTH162245DLR     |                   |
|                       |                        |              | 74LVTH162245DLRG4     |                   |
|                       | TSSOP – DGG            | Reel of 2000 | SN74LVTH162245DGGR    | LVTH162245        |
|                       |                        |              | 74LVTH162245DGGRG4    |                   |
|                       |                        |              | 74LVTH162245GRE4      |                   |
|                       | VFBGA – GQL            | Reel of 1000 | SN74LVTH162245KR      | LL2245            |
| VFBGA – ZQL (Pb-free) |                        |              | 74LVTH162245ZQLR      |                   |
| –55°C to 125°C        | CFP – WD               | Tube         | SNJ54LVTH162245WD     | SNJ54LVTH162245WD |

(1) 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).

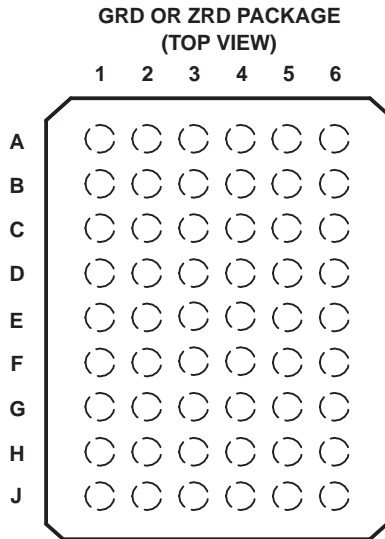
GQL OR ZQL PACKAGE  
(TOP VIEW)



TERMINAL ASSIGNMENTS<sup>(1)</sup>  
(56-Ball GQL/ZQL Package)

|   | 1    | 2   | 3        | 4        | 5   | 6                |
|---|------|-----|----------|----------|-----|------------------|
| A | 1DIR | NC  | NC       | NC       | NC  | $1\overline{OE}$ |
| B | 1B2  | 1B1 | GND      | GND      | 1A1 | 1A2              |
| C | 1B4  | 1B3 | $V_{CC}$ | $V_{CC}$ | 1A3 | 1A4              |
| D | 1B6  | 1B5 | GND      | GND      | 1A5 | 1A6              |
| E | 1B8  | 1B7 |          |          | 1A7 | 1A8              |
| F | 2B1  | 2B2 |          |          | 2A2 | 2A1              |
| G | 2B3  | 2B4 | GND      | GND      | 2A4 | 2A3              |
| H | 2B5  | 2B6 | $V_{CC}$ | $V_{CC}$ | 2A6 | 2A5              |
| J | 2B7  | 2B8 | GND      | GND      | 2A8 | 2A7              |
| K | 2DIR | NC  | NC       | NC       | NC  | $2\overline{OE}$ |

(1) NC – No internal connection



TERMINAL ASSIGNMENTS<sup>(1)</sup>  
(54-Ball GRD/ZRD Package)

|   | 1   | 2   | 3               | 4                 | 5   | 6   |
|---|-----|-----|-----------------|-------------------|-----|-----|
| A | 1B1 | NC  | 1DIR            | 1 $\overline{OE}$ | NC  | 1A1 |
| B | 1B3 | 1B2 | NC              | NC                | 1A2 | 1A3 |
| C | 1B5 | 1B4 | V <sub>CC</sub> | V <sub>CC</sub>   | 1A4 | 1A5 |
| D | 1B7 | 1B6 | GND             | GND               | 1A6 | 1A7 |
| E | 2B1 | 1B8 | GND             | GND               | 1A8 | 2A1 |
| F | 2B3 | 2B2 | GND             | GND               | 2A2 | 2A3 |
| G | 2B5 | 2B4 | V <sub>CC</sub> | V <sub>CC</sub>   | 2A4 | 2A5 |
| H | 2B7 | 2B6 | NC              | NC                | 2A6 | 2A7 |
| J | 2B8 | NC  | 2DIR            | 2 $\overline{OE}$ | NC  | 2A8 |

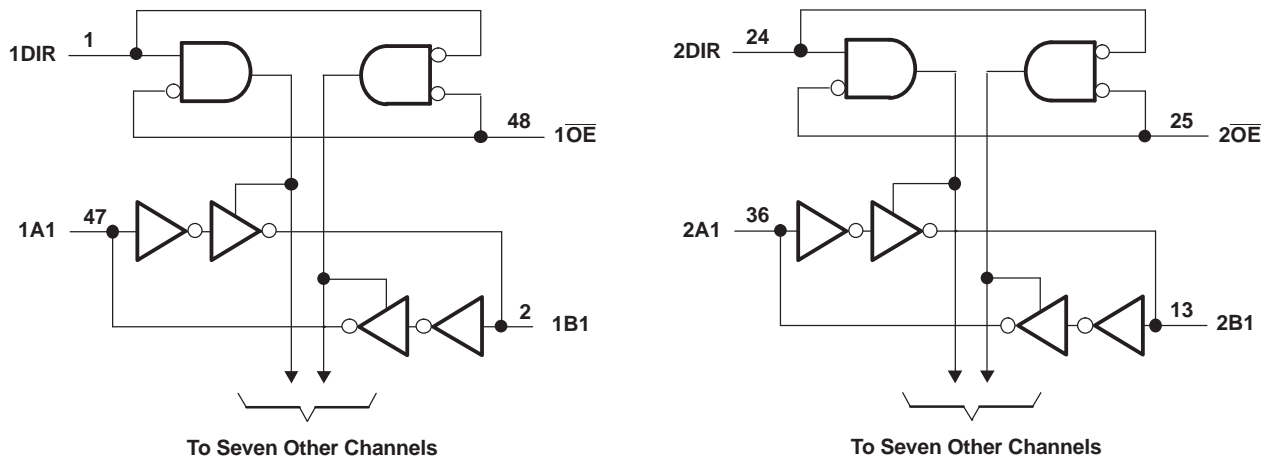
(1) NC – No internal connection

FUNCTION TABLE<sup>(1)</sup>  
(EACH 8-BIT SECTION)

| CONTROL INPUTS  |     | OUTPUT CIRCUITS |         | OPERATION       |
|-----------------|-----|-----------------|---------|-----------------|
| $\overline{OE}$ | DIR | A PORT          | B PORT  |                 |
| L               | L   | Enabled         | Hi-Z    | B data to A bus |
| L               | H   | Hi-Z            | Enabled | A data to B bus |
| H               | X   | Hi-Z            | Hi-Z    | Isolation       |

(1) Input circuits of the data I/Os always are active.

LOGIC DIAGRAM (POSITIVE LOGIC)



# SN54LVTH162245, SN74LVTH162245 3.3-V ABT 16-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

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## Absolute Maximum Ratings<sup>(1)</sup>

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 <sup>(2)</sup>  | –0.5                    | 7              | V    |
| $V_O$         | Voltage range applied to any output in the high-impedance or power-off state <sup>(2)</sup> | –0.5                    | 7              | V    |
| $V_O$         | Voltage range applied to any output in the high state <sup>(2)</sup>                        | –0.5                    | $V_{CC} + 0.5$ | V    |
| $I_O$         | Current into any output in the low state  | SN54LVTH162245 (B port) | 96             | mA   |
|               |   | SN74LVTH162245 (B port) | 128            |      |
|               |   | A port                  | 30             |      |
| $I_O$         | Current into any output in the high state <sup>(3)</sup>                                    | SN54LVTH162245 (B port) | 48             | mA   |
|               |   | SN74LVTH162245 (B port) | 64             |      |
|               |   | A port                  | 30             |      |
| $I_{IK}$      | Input clamp current   | $V_I < 0$               | –50            | mA   |
| $I_{OK}$      | Output clamp current  | $V_O < 0$               | –50            | mA   |
| $\theta_{JA}$ | Package thermal impedance <sup>(4)</sup>  | DGG package             | 70             | °C/W |
|               |   | DL package              | 63             |      |
|               |   | GQL/ZQL package         | 42             |      |
|               |   | GRD/ZRD package         | 36             |      |
| $T_{stg}$     | 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 and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- (3) This current flows only when the output is in the high state and  $V_O > V_{CC}$ .
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.

## Recommended Operating Conditions<sup>(1)</sup>

|                          |                                    | SN54LVTH162245 |     | SN74LVTH162245 |     | UNIT |
|--------------------------|------------------------------------|----------------|-----|----------------|-----|------|
|                          |                                    | MIN            | MAX | MIN            | MAX |      |
| $V_{CC}$                 | Supply voltage                     | 2.7            | 3.6 | 2.7            | 3.6 | 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                      |                | 5.5 |                | 5.5 | V    |
| $I_{OH}$                 | High-level output current          | A port         | –12 |                | –12 | mA   |
|                          |                                    | B port         |     | –24            |     |      |
| $I_{OL}$                 | Low-level output current           | A port         |     | 12             |     | mA   |
|                          |                                    | B port         |     | 48             |     |      |
| $\Delta t/\Delta v$      | Input transition rise or fall rate |                | 10  |                | 10  | ns/V |
| $\Delta t/\Delta V_{CC}$ | Power-up ramp rate                 | 200            |     | 200            |     | μs/V |
| $T_A$                    | Operating free-air temperature     | –55            | 125 | –40            | 85  | °C   |

- (1) 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.

**Electrical Characteristics**

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

| PARAMETER                      |   | TEST CONDITIONS  |   | SN54LVTH162245           |                    |           | SN74LVTH162245 |                    |               | UNIT          |               |  |
|--------------------------------|---|--|---|--------------------------|--------------------|-----------|----------------|--------------------|---------------|---------------|---------------|--|
|                                |   |  |   | MIN                      | TYP <sup>(1)</sup> | MAX       | MIN            | TYP <sup>(1)</sup> | MAX           |               |               |  |
| $V_{IK}$                       |   | $V_{CC} = 2.7\text{ V}$ , $I_I = -18\text{ mA}$  |   | -1.2                     |                    |           | -1.2           |                    |               | V             |               |  |
| $V_{OH}$                       | A port  | $V_{CC} = 2.7\text{ V to }3.6\text{ V}$ , $I_{OH} = -100\text{ }\mu\text{A}$   |   | $V_{CC} - 0.2$           |                    |           | $V_{CC} - 0.2$ |                    |               | V             |               |  |
|                                |   | $V_{CC} = 3\text{ V}$ , $I_{OH} = -12\text{ mA}$   |   | 2                        |                    |           | 2              |                    |               |               |               |  |
|                                | B port  | $V_{CC} = 2.7\text{ V to }3.6\text{ V}$ , $I_{OH} = -100\text{ }\mu\text{A}$   |   | $V_{CC} - 0.2$           |                    |           | $V_{CC} - 0.2$ |                    |               |               |               |  |
|                                |   | $V_{CC} = 2.7\text{ V}$ , $I_{OH} = -8\text{ mA}$  |   | 2.4                      |                    |           | 2.4            |                    |               |               |               |  |
|                                |   | $V_{CC} = 3\text{ V}$  | $I_{OH} = -24\text{ mA}$                              |                          | 2                  |           |                |                    |               |               |               |  |
|                                |   |  | $I_{OH} = -32\text{ mA}$                              |                          |                    |           |                | 2                  |               |               |               |  |
| $V_{OL}$                       | A port  | $V_{CC} = 2.7\text{ V to }3.6\text{ V}$ , $I_{OL} = 100\text{ }\mu\text{A}$  |   | 0.2                      |                    |           | 0.2            |                    |               | V             |               |  |
|                                |   | $V_{CC} = 3\text{ V}$ , $I_{OL} = 12\text{ mA}$  |   | 0.8                      |                    |           | 0.8            |                    |               |               |               |  |
|                                | B port  | $V_{CC} = 2.7\text{ V}$  | $I_{OL} = 100\text{ }\mu\text{A}$                     |                          | 0.2                |           |                | 0.2                |               |               |               |  |
|                                |   |  | $I_{OL} = 24\text{ mA}$                               |                          | 0.5                |           |                | 0.5                |               |               |               |  |
|                                |   | $V_{CC} = 3\text{ V}$  | $I_{OL} = 16\text{ mA}$                               |                          | 0.4                |           |                | 0.4                |               |               |               |  |
|                                |   |  | $I_{OL} = 32\text{ mA}$                               |                          | 0.5                |           |                | 0.5                |               |               |               |  |
|                                |   |  | $I_{OL} = 48\text{ mA}$                               |                          | 0.55               |           |                |                    |               |               |               |  |
|                                |   |  | $I_{OL} = 64\text{ mA}$                               |                          |                    |           |                | 0.55               |               |               |               |  |
|                                | $I_I$   | Control inputs   | $V_{CC} = 3.6\text{ V}$ , $V_I = V_{CC}$ or GND       |                          | $\pm 1$            |           |                | $\pm 1$            |               |               | $\mu\text{A}$ |  |
|                                |   |  | $V_{CC} = 0$ or $3.6\text{ V}$ , $V_I = 5.5\text{ V}$ |                          | 10                 |           |                | 10                 |               |               |               |  |
| A or B port <sup>(2)</sup>     |   | $V_{CC} = 3.6\text{ V}$  | $V_I = 5.5\text{ V}$                                  |                          | 20                 |           |                | 20                 |               |               |               |  |
|                                |   |  | $V_I = V_{CC}$  |                          | 5                  |           |                | 5                  |               |               |               |  |
|                                |   |  | $V_I = 0$   |                          | -10                |           |                | -10                |               |               |               |  |
| $I_{off}$                      | $V_{CC} = 0$ , $V_I$ or $V_O = 0$ to $4.5\text{ V}$               |  |   |                          |                    | $\pm 100$ |                |                    | $\mu\text{A}$ |               |               |  |
| $I_{I(\text{hold})}$           | A or B port   | $V_{CC} = 3\text{ V}$  | $V_I = 0.8\text{ V}$                                  |                          | 75                 |           |                | 75                 |               |               | $\mu\text{A}$ |  |
|                                |   |  | $V_I = 2\text{ V}$                                    |                          | -75                |           |                | -75                |               |               |               |  |
|                                |   | $V_{CC} = 3.6\text{ V}$ , <sup>(3)</sup> $V_I = 0$ to $3.6\text{ V}$   |   |                          |                    |           | 500<br>-750    |                    |               |               |               |  |
| $I_{OZPU}$                     |   | $V_{CC} = 0$ to $1.5\text{ V}$ , $V_O = 0.5\text{ V to }3\text{ V}$ ,<br>$\overline{OE} = \text{don't care}$         |   | $\pm 100$ <sup>(4)</sup> |                    |           | $\pm 100$      |                    |               | $\mu\text{A}$ |               |  |
| $I_{OZPD}$                     |   | $V_{CC} = 1.5\text{ V to }0$ , $V_O = 0.5\text{ V to }3\text{ V}$ ,<br>$\overline{OE} = \text{don't care}$           |   | $\pm 100$ <sup>(4)</sup> |                    |           | $\pm 100$      |                    |               | $\mu\text{A}$ |               |  |
| $I_{CC}$                       | $V_{CC} = 3.6\text{ V}$ ,<br>$I_O = 0$ ,<br>$V_I = V_{CC}$ or GND |  | Outputs high  |                          | 0.19               |           |                | 0.19               |               |               | mA            |  |
|                                |   |  | Outputs low   |                          | 5                  |           |                | 5                  |               |               |               |  |
|                                |   |  | Outputs disabled                                      |                          | 0.19               |           |                | 0.19               |               |               |               |  |
| $\Delta I_{CC}$ <sup>(5)</sup> |   | $V_{CC} = 3\text{ V to }3.6\text{ V}$ ,<br>One input at $V_{CC} - 0.6\text{ V}$ ,<br>Other inputs at $V_{CC}$ or GND |   | 0.3                      |                    |           | 0.2            |                    |               | mA            |               |  |
| $C_I$                          |   | $V_I = 3\text{ V or }0$  |   | 4                        |                    |           | 4              |                    |               | pF            |               |  |
| $C_{Io}$                       |   | $V_O = 3\text{ V or }0$  |   | 10                       |                    |           | 10             |                    |               | pF            |               |  |

 (1) All typical values are at  $V_{CC} = 3.3\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

 (2) Unused pins at  $V_{CC}$  or GND

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

(4) On products compliant to MIL-PRF-38535, this parameter is not production tested.

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

# SN54LVTH162245, SN74LVTH162245 3.3-V ABT 16-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

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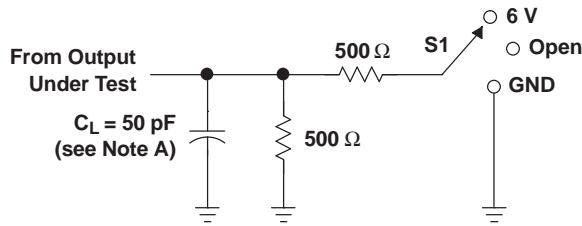
## Switching Characteristics

over recommended operating free-air temperature range,  $C_L = 50$  pF (unless otherwise noted) (see [Figure 1](#))

| PARAMETER    | FROM<br>(INPUT) | TO<br>(OUTPUT) | SN54LVTH162245                  |     |                  |     | SN74LVTH162245                  |                    |     |                  | UNIT |     |
|--------------|-----------------|----------------|---------------------------------|-----|------------------|-----|---------------------------------|--------------------|-----|------------------|------|-----|
|              |                 |                | $V_{CC} = 3.3$ V<br>$\pm 0.3$ V |     | $V_{CC} = 2.7$ V |     | $V_{CC} = 3.3$ V<br>$\pm 0.3$ V |                    |     | $V_{CC} = 2.7$ V |      |     |
|              |                 |                | MIN                             | MAX | MIN              | MAX | MIN                             | TYP <sup>(1)</sup> | MAX | MIN              |      | MAX |
| $t_{PLH}$    | A               | B              | 1                               | 3.5 | 4                |     | 1                               | 2.3                | 3.3 | 3.7              |      | ns  |
| $t_{PHL}$    |                 |                | 1                               | 3.5 | 3.9              |     | 1                               | 2.2                | 3.3 | 3.5              |      |     |
| $t_{PLH}$    | B               | A              | 1                               | 4.3 | 5.3              |     | 1                               | 2.8                | 4   | 4.6              |      | ns  |
| $t_{PHL}$    |                 |                | 1                               | 4.2 | 4.5              |     | 1                               | 2.5                | 3.4 | 3.6              |      |     |
| $t_{PZH}$    | $\overline{OE}$ | B              | 1                               | 4.8 | 5.9              |     | 1                               | 2.8                | 4.6 | 5.4              |      | ns  |
| $t_{PZL}$    |                 |                | 1                               | 4.8 | 5.5              |     | 1                               | 3                  | 4.6 | 5.2              |      |     |
| $t_{PZH}$    | $\overline{OE}$ | A              | 1                               | 5.5 | 7.2              |     | 1                               | 3.3                | 5.3 | 6.3              |      | ns  |
| $t_{PZL}$    |                 |                | 1                               | 5.4 | 6.4              |     | 1                               | 3.3                | 5.1 | 5.8              |      |     |
| $t_{PHZ}$    | $\overline{OE}$ | B              | 1.5                             | 5.5 | 5.8              |     | 1.5                             | 3.8                | 5.2 | 5.5              |      | ns  |
| $t_{PLZ}$    |                 |                | 1.5                             | 5.5 | 5.8              |     | 1.5                             | 3.5                | 5.1 | 5.4              |      |     |
| $t_{PHZ}$    | $\overline{OE}$ | A              | 1.5                             | 5.8 | 6.5              |     | 1.5                             | 4                  | 5.6 | 5.9              |      | ns  |
| $t_{PLZ}$    |                 |                | 1.2                             | 6.3 | 6.3              |     | 1.5                             | 3.8                | 5.5 | 5.5              |      |     |
| $t_{sk(LH)}$ |                 |                |                                 |     |                  |     |                                 | 0.5                |     |                  | ns   |     |
| $t_{sk(HL)}$ |                 |                |                                 |     |                  |     |                                 | 0.5                |     |                  |      |     |

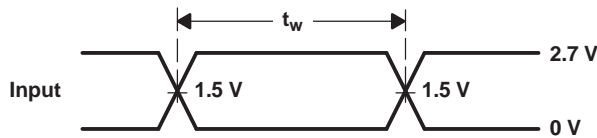
(1) All typical values are at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$ .

PARAMETER MEASUREMENT INFORMATION

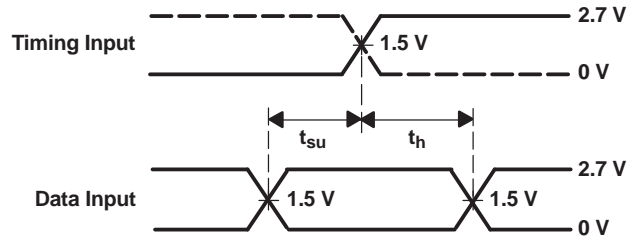


LOAD CIRCUIT

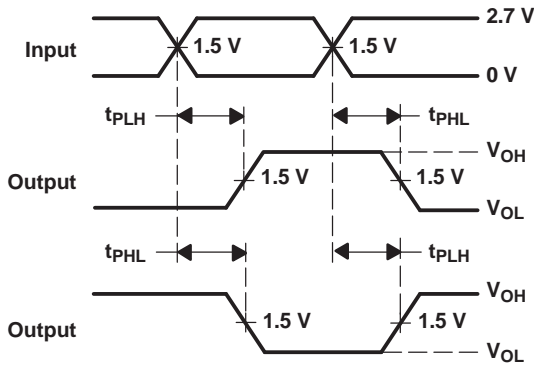
| TEST              | S1   |
|-------------------|------|
| $t_{PLH}/t_{PHL}$ | Open |
| $t_{PLZ}/t_{PZL}$ | 6 V  |
| $t_{PHZ}/t_{PZH}$ | GND  |



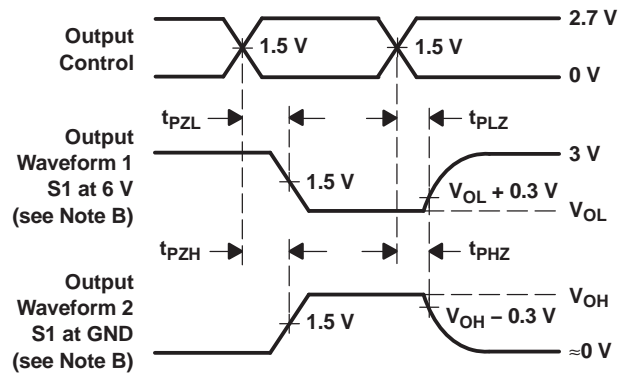
VOLTAGE WAVEFORMS  
PULSE DURATION



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:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5 \text{ ns}$ ,  $t_f \leq 2.5 \text{ ns}$ .  
 D. The outputs are measured one at a time, with one transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

**PACKAGING INFORMATION**

| Orderable Device   | Status<br>(1) | Package Type               | Package Drawing | Pins | Package Qty | Eco Plan<br>(2)            | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5)                      | Samples                 |
|--------------------|---------------|----------------------------|-----------------|------|-------------|----------------------------|-------------------------|----------------------|--------------|--|-------------------------|
| 5962-9678001QXA    | ACTIVE        | CFP                        | WD              | 48   | 1           | TBD                        | A42                     | N / A for Pkg Type   | -55 to 125   | 5962-9678001QX<br>A<br>SNJ54LVTH16224<br>5WD | <a href="#">Samples</a> |
| 5962-9678001VXA    | ACTIVE        | CFP                        | WD              | 48   | 1           | TBD                        | A42                     | N / A for Pkg Type   | -55 to 125   | 5962-9678001VX<br>A<br>SNV54LVTH16224<br>5WD | <a href="#">Samples</a> |
| 74LVTH162245DGGRG4 | ACTIVE        | TSSOP                      | DGG             | 48   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | LVTH162245                                   | <a href="#">Samples</a> |
| 74LVTH162245GRE4   | ACTIVE        | TSSOP                      | DGG             | 48   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | LVTH162245                                   | <a href="#">Samples</a> |
| 74LVTH162245ZQLR   | ACTIVE        | BGA<br>MICROSTAR<br>JUNIOR | ZQL             | 56   | 1000        | Green (RoHS<br>& no Sb/Br) | SNAGCU                  | Level-1-260C-UNLIM   | -40 to 85    | LL2245                                       | <a href="#">Samples</a> |
| 74LVTH162245ZRDR   | ACTIVE        | BGA<br>MICROSTAR<br>JUNIOR | ZRD             | 54   | 1000        | Green (RoHS<br>& no Sb/Br) | SNAGCU                  | Level-1-260C-UNLIM   | -40 to 85    | LL2245                                       | <a href="#">Samples</a> |
| SN74LVTH162245DGGR | ACTIVE        | TSSOP                      | DGG             | 48   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | LVTH162245                                   | <a href="#">Samples</a> |
| SN74LVTH162245DL   | ACTIVE        | SSOP                       | DL              | 48   | 25          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | LVTH162245                                   | <a href="#">Samples</a> |
| SN74LVTH162245DLG4 | ACTIVE        | SSOP                       | DL              | 48   | 25          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | LVTH162245                                   | <a href="#">Samples</a> |
| SN74LVTH162245DLR  | ACTIVE        | SSOP                       | DL              | 48   | 1000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | LVTH162245                                   | <a href="#">Samples</a> |
| SNJ54LVTH162245WD  | ACTIVE        | CFP                        | WD              | 48   | 1           | TBD                        | A42                     | N / A for Pkg Type   | -55 to 125   | 5962-9678001QX<br>A<br>SNJ54LVTH16224<br>5WD | <a href="#">Samples</a> |

(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/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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**OTHER QUALIFIED VERSIONS OF SN54LVTH162245, SN54LVTH162245-SP, SN74LVTH162245 :**

- Catalog: [SN74LVTH162245](#), [SN54LVTH162245](#)
- Enhanced Product: [SN74LVTH162245-EP](#), [SN74LVTH162245-EP](#)
- Military: [SN54LVTH162245](#)
- Space: [SN54LVTH162245-SP](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

- Enhanced Product - Supports Defense, Aerospace and Medical Applications
- Military - QML certified for Military and Defense Applications
- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

**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 |
|--------------------|----------------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| 74LVTH162245ZQLR   | BGA MICROSTAR JUNIOR | ZQL             | 56   | 1000 | 330.0              | 16.4               | 4.8     | 7.3     | 1.5     | 8.0     | 16.0   | Q1            |
| 74LVTH162245ZRDR   | BGA MICROSTAR JUNIOR | ZRD             | 54   | 1000 | 330.0              | 16.4               | 5.8     | 8.3     | 1.55    | 8.0     | 16.0   | Q1            |
| SN74LVTH162245DGGR | TSSOP                | DGG             | 48   | 2000 | 330.0              | 24.4               | 8.6     | 13.0    | 1.8     | 12.0    | 24.0   | Q1            |
| SN74LVTH162245DLR  | SSOP                 | DL              | 48   | 1000 | 330.0              | 32.4               | 11.35   | 16.2    | 3.1     | 16.0    | 32.0   | Q1            |

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

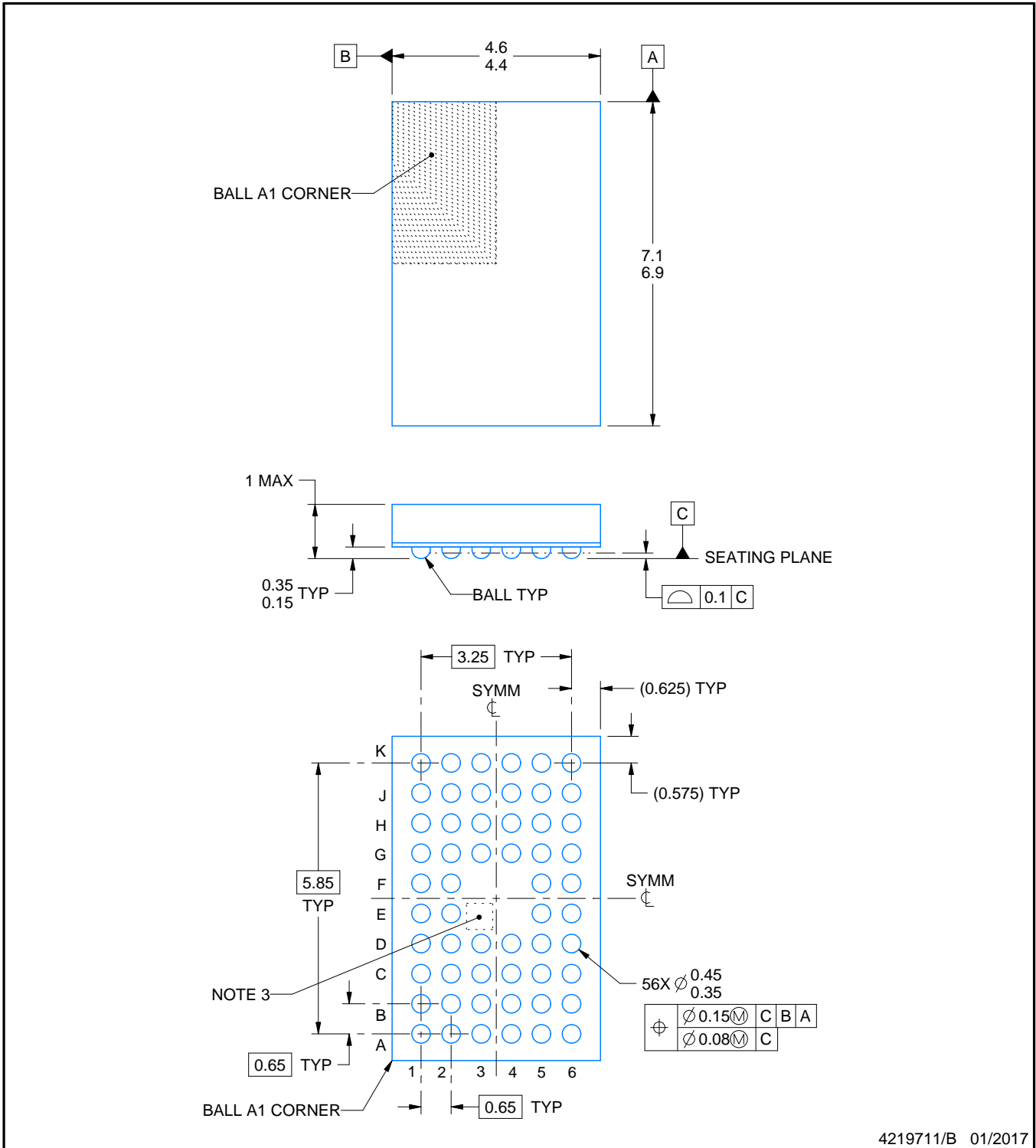
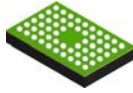
| Device             | Package Type         | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|--------------------|----------------------|-----------------|------|------|-------------|------------|-------------|
| 74LVTH162245ZQLR   | BGA MICROSTAR JUNIOR | ZQL             | 56   | 1000 | 350.0       | 350.0      | 43.0        |
| 74LVTH162245ZRDR   | BGA MICROSTAR JUNIOR | ZRD             | 54   | 1000 | 350.0       | 350.0      | 43.0        |
| SN74LVTH162245DGGR | TSSOP                | DGG             | 48   | 2000 | 367.0       | 367.0      | 45.0        |
| SN74LVTH162245DLR  | SSOP                 | DL              | 48   | 1000 | 367.0       | 367.0      | 55.0        |

DGG (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN





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NOTES:

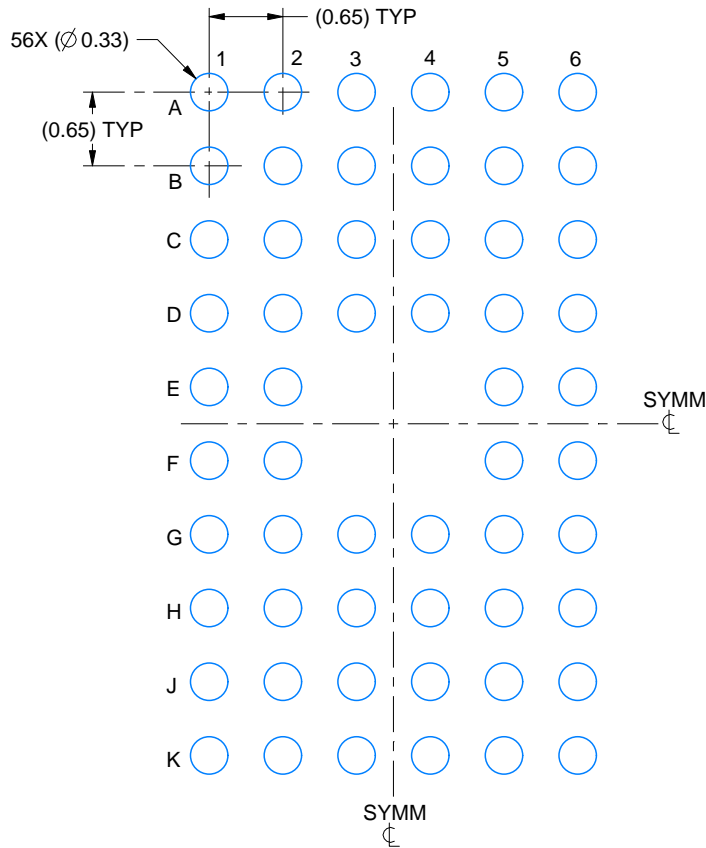
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. No metal in this area, indicates orientation.

# EXAMPLE BOARD LAYOUT

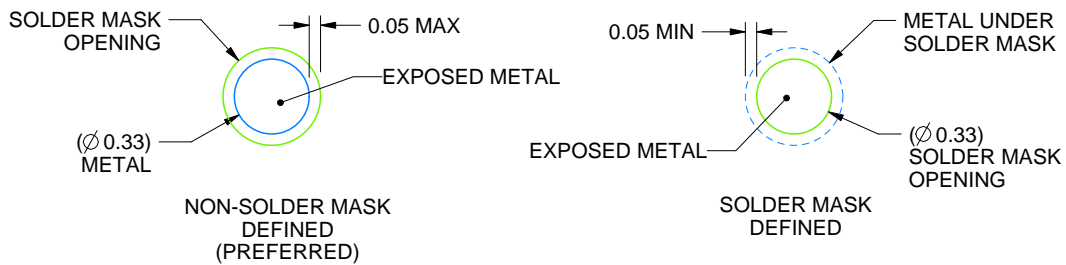
ZQL0056A

JRBGA - 1 mm max height

PLASTIC BALL GRID ARRAY



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:15X



SOLDER MASK DETAILS  
NOT TO SCALE

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NOTES: (continued)

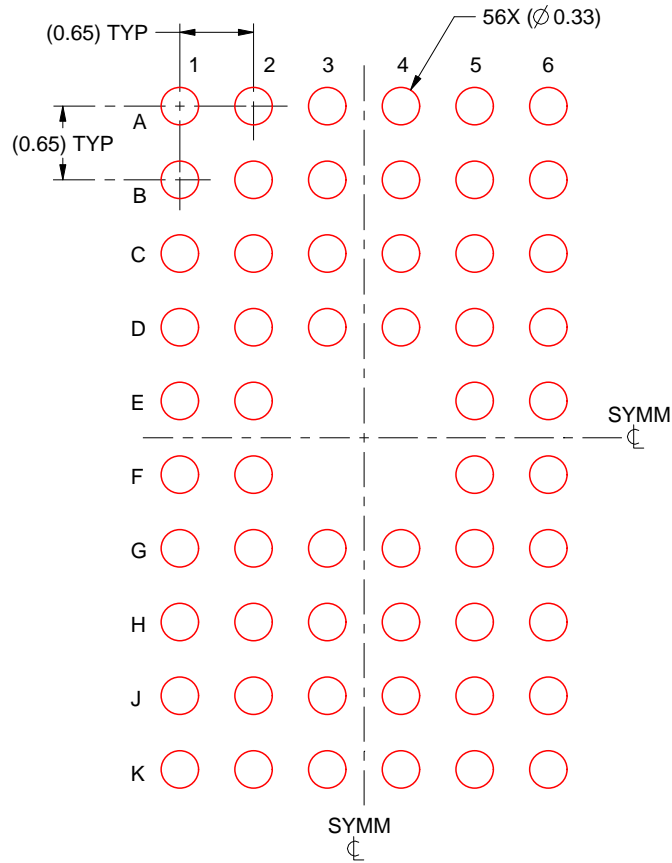
- Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints. For information, see Texas Instruments literature number SPRAA99 ([www.ti.com/lit/spraa99](http://www.ti.com/lit/spraa99)).

# EXAMPLE STENCIL DESIGN

ZQL0056A

JRBGA - 1 mm max height

PLASTIC BALL GRID ARRAY



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:15X

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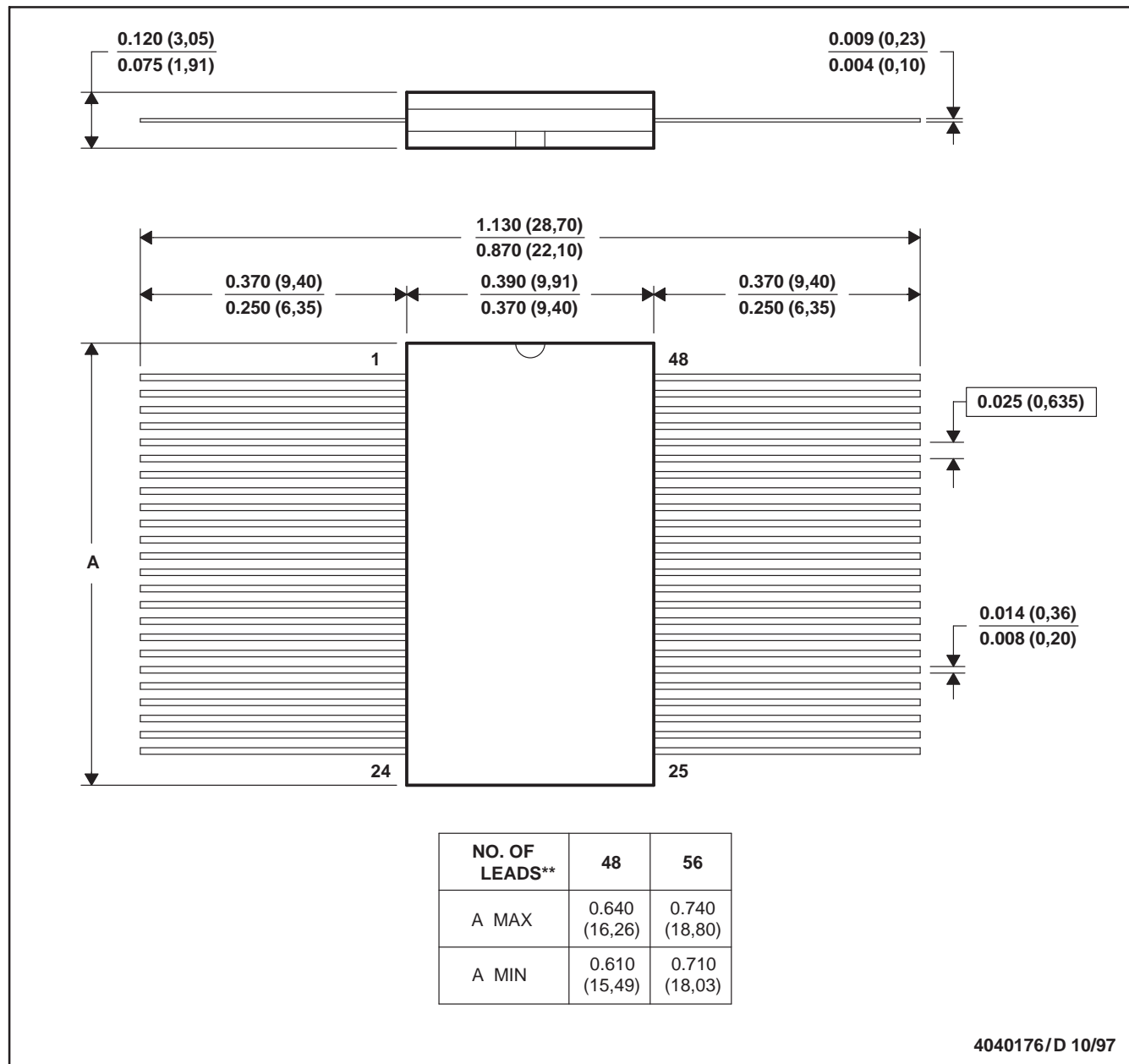
NOTES: (continued)

5. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release.

WD (R-GDFP-F\*\*)

CERAMIC DUAL FLATPACK

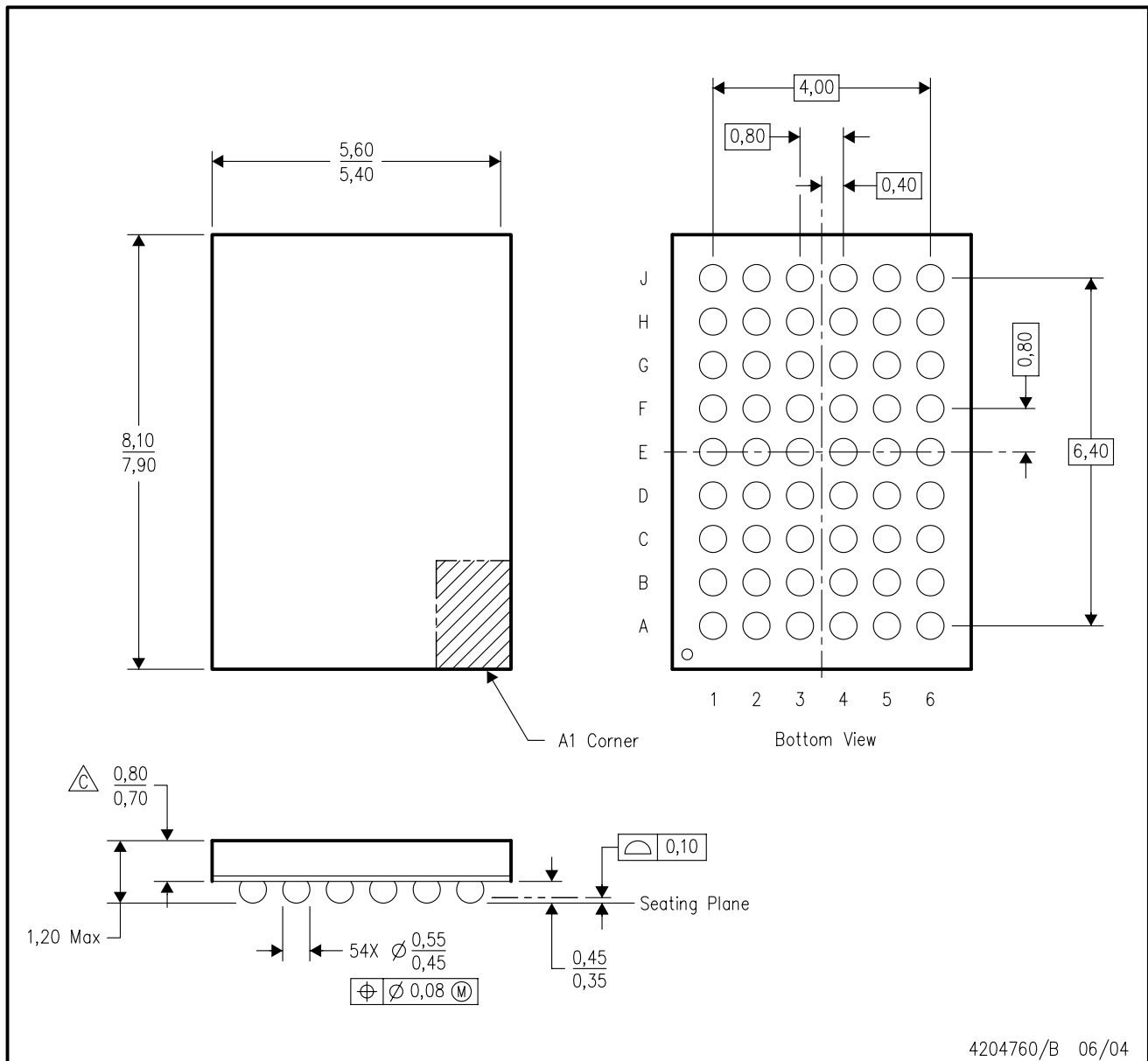
48 LEADS SHOWN




- 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

ZRD (R-PBGA-N54)

PLASTIC BALL GRID ARRAY



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  -  Falls within JEDEC MO-205 variation DD.
  - D. This package is lead-free. Refer to the 54 GRD package (drawing 4204759) for tin-lead (SnPb).

# MECHANICAL DATA

DL (R-PDSO-G48)

PLASTIC SMALL-OUTLINE PACKAGE



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

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