

# SN74AVCB324245

## 32-BIT DUAL-SUPPLY BUS TRANSCEIVER

### WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS

SCES485A – AUGUST 2003 – REVISED JUNE 2004

- Member of the Texas Instruments Widebus+™ Family
- DOC™ Circuitry Dynamically Changes Output Impedance, Resulting in Noise Reduction Without Speed Degradation
- Dynamic Drive Capability Is Equivalent to Standard Outputs With  $I_{OH}$  and  $I_{OL}$  of
  - $\pm 24$  mA at 3-V  $V_{CC}$
  - $\pm 15$  mA at 2.3-V  $V_{CC}$
  - $\pm 9$  mA at 1.65-V  $V_{CC}$
  - $\pm 6$  mA at 1.4-V  $V_{CC}$
- Control Inputs  $V_{IH}/V_{IL}$  Levels are Referenced to  $V_{CCB}$  Voltage
- If Either  $V_{CC}$  Input Is at GND, Both Ports Are in the High-Impedance State
- Inputs/Outputs Can Tolerate Up to 4.6 V, Which Allows Mixed-Voltage-Mode Data Communications
- $I_{off}$  Supports Partial-Power-Down Mode Operation
- Fully Configurable Dual-Rail Design Allows Each Port to Operate Over the Full 1.4-V to 3.6-V Power-Supply Range
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- 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 32-bit noninverting bus transceiver uses two separate configurable power-supply rails. The A port is designed to track  $V_{CCA}$ .  $V_{CCA}$  accepts any supply voltage from 1.4 V to 3.6 V. The B port is designed to track  $V_{CCB}$ .  $V_{CCB}$  accepts any supply voltage from 1.4 V to 3.6 V. This allows for universal low-voltage bidirectional translation between any of the 1.5-V, 1.8-V, 2.5-V, and 3.3-V voltage nodes.

The SN74AVCB324245 is designed for asynchronous communication between data buses. The device transmits data 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 outputs so the buses are effectively isolated.

The SN74AVCB324245 is designed so that the control pins (1DIR, 2DIR,  $1\overline{OE}$ , and  $2\overline{OE}$ ) are supplied by  $V_{CCB}$ .

To ensure the high-impedance state during power up or power down,  $\overline{OE}$  shall be tied to  $V_{CCB}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

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. If either  $V_{CC}$  input is at GND, both ports are in the high-impedance state.

#### ORDERING INFORMATION

| $T_A$         | PACKAGE†              |               | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---------------|-----------------------|---------------|-----------------------|------------------|
| –40°C to 85°C | LFBGA – GKE           | Tape and reel | SN74AVCB324245KR      | WD4245           |
|               | LFBGA – ZKE (Pb-free) |               | 74AVCB324245ZKER      |                  |

† 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).



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GKE OR ZKE PACKAGE  
(TOP VIEW)

123456

A

B

C

D

E

F

G

H

J

K

L

M

N

P

R

T

terminal assignments

|   |     |     |      |      |     |     |
|---|-----|-----|------|------|-----|-----|
|   | 1   | 2   | 3    | 4    | 5   | 6   |
| A | 1B2 | 1B1 | 1DIR | 1OE  | 1A1 | 1A2 |
| B | 1B4 | 1B3 | GND  | GND  | 1A3 | 1A4 |
| C | 1B6 | 1B5 | VCCB | VCCA | 1A5 | 1A6 |
| D | 1B8 | 1B7 | GND  | GND  | 1A7 | 1A8 |
| E | 2B2 | 2B1 | GND  | GND  | 2A1 | 2A2 |
| F | 2B4 | 2B3 | VCCB | VCCA | 2A3 | 2A4 |
| G | 2B6 | 2B5 | GND  | GND  | 2A5 | 2A6 |
| H | 2B7 | 2B8 | 2DIR | 2OE  | 2A8 | 2A7 |
| J | 3B2 | 3B1 | 3DIR | 3OE  | 3A1 | 3A2 |
| K | 3B4 | 3B3 | GND  | GND  | 3A3 | 3A4 |
| L | 3B6 | 3B5 | VCCB | VCCA | 3A5 | 3A6 |
| M | 3B8 | 3B7 | GND  | GND  | 3A7 | 3A8 |
| N | 4B2 | 4B1 | GND  | GND  | 4A1 | 4A2 |
| P | 4B4 | 4B3 | VCCB | VCCA | 4A3 | 4A4 |
| R | 4B6 | 4B5 | GND  | GND  | 4A5 | 4A6 |
| T | 4B7 | 4B8 | 4DIR | 4OE  | 4A8 | 4A7 |

FUNCTION TABLE

(each 8-bit section)

| INPUTS |     | OPERATION       |
|--------|-----|-----------------|
| OE     | DIR |                 |
| L      | L   | B data to A bus |
| L      | H   | A data to B bus |
| H      | X   | Isolation       |

**logic diagram (positive logic)**



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

|   |                             |
|---|-----------------------------|
| Supply voltage range, $V_{CCA}$ and $V_{CCB}$                                       | –0.5 V to 4.6 V             |
| Input voltage range, $V_I$ (see Note 1): I/O ports (A port)                         | –0.5 V to 4.6 V             |
| I/O ports (B port)  | –0.5 V to 4.6 V             |
| Control inputs  | –0.5 V to 4.6 V             |
| Voltage range applied to any output in the high-impedance or power-off state, $V_O$ |                             |
| (see Note 1): (A port)  | –0.5 V to 4.6 V             |
| (B port)  | –0.5 V to 4.6 V             |
| Voltage range applied to any output in the high or low state, $V_O$                 |                             |
| (see Notes 1 and 2): (A port)   | –0.5 V to $V_{CCA} + 0.5$ V |
| (B port)  | –0.5 V to $V_{CCB} + 0.5$ 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 $V_{CCA}$ , $V_{CCB}$ , or GND pin                  | ±100 mA                     |
| Package thermal impedance, $\theta_{JA}$ (see Note 3): GKE/ZKE package              | 40°C/W                      |
| Storage temperature range, $T_{stg}$  | –65°C to 150°C              |

<sup>†</sup> Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. The input voltage and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.  
 2. The output positive-voltage rating may be exceeded up to 4.6 V maximum if the output current rating is observed.  
 3. The package thermal impedance is calculated in accordance with JESD 51-7.

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**recommended operating conditions (see Notes 4 through 6)**

|                  |                                    |   | V <sub>CCI</sub> | V <sub>CCO</sub> | MIN                     | MAX                     | UNIT |
|------------------|------------------------------------|---|------------------|------------------|-------------------------|-------------------------|------|
| V <sub>CCA</sub> | Supply voltage                     |   |                  |                  | 1.4                     | 3.6                     | V    |
| V <sub>CCB</sub> | Supply voltage                     |   |                  |                  | 1.4                     | 3.6                     | V    |
| V <sub>IH</sub>  | High-level input voltage           | Data inputs   | 1.4 V to 1.95 V  |                  | V <sub>CCI</sub> × 0.65 | 3.6                     | V    |
|                  |                                    |   | 1.95 V to 2.7 V  |                  | 1.7                     | 3.6                     |      |
|                  |                                    |   | 2.7 V to 3.6 V   |                  | 2                       | 3.6                     |      |
| V <sub>IL</sub>  | Low-level input voltage            | Data inputs   | 1.4 V to 1.95 V  |                  | 0                       | V <sub>CCI</sub> × 0.35 | V    |
|                  |                                    |   | 1.95 V to 2.7 V  |                  | 0                       | 0.7                     |      |
|                  |                                    |   | 2.7 V to 3.6 V   |                  | 0                       | 0.8                     |      |
| V <sub>IH</sub>  | High-level input voltage           | Control inputs<br>(Referenced to V <sub>CCB</sub> ) | 1.4 V to 1.95 V  |                  | V <sub>CCB</sub> × 0.65 | V <sub>CCB</sub>        | V    |
|                  |                                    |   | 1.95 V to 2.7 V  |                  | 1.7                     | V <sub>CCB</sub>        |      |
|                  |                                    |   | 2.7 V to 3.6 V   |                  | 2                       | V <sub>CCB</sub>        |      |
| V <sub>IL</sub>  | Low-level input voltage            | Control inputs<br>(Referenced to V <sub>CCB</sub> ) | 1.4 V to 1.95 V  |                  | 0                       | V <sub>CCB</sub> × 0.35 | V    |
|                  |                                    |   | 1.95 V to 2.7 V  |                  | 0                       | 0.7                     |      |
|                  |                                    |   | 2.7 V to 3.6 V   |                  | 0                       | 0.8                     |      |
| V <sub>O</sub>   | Output voltage                     |   |                  |                  | 0                       | V <sub>CCO</sub>        | V    |
| I <sub>OH</sub>  | High-level output current          |   |                  | 1.4 V to 1.6 V   |                         | –2                      | mA   |
|                  |                                    |   |                  | 1.65 V to 1.95 V |                         | –4                      |      |
|                  |                                    |   |                  | 2.3 V to 2.7 V   |                         | –8                      |      |
|                  |                                    |   |                  | 3 V to 3.6 V     |                         | –12                     |      |
| I <sub>OL</sub>  | Low-level output current           |   |                  | 1.4 V to 1.6 V   |                         | 2                       | mA   |
|                  |                                    |   |                  | 1.65 V to 1.95 V |                         | 4                       |      |
|                  |                                    |   |                  | 2.3 V to 2.7 V   |                         | 8                       |      |
|                  |                                    |   |                  | 3 V to 3.6 V     |                         | 12                      |      |
| Δt/Δv            | Input transition rise or fall rate |   |                  |                  |                         | 5                       | ns/V |
| T <sub>A</sub>   | Operating free-air temperature     |   |                  |                  | –40                     | 85                      | °C   |

- NOTES: 4. V<sub>CCI</sub> is the V<sub>CC</sub> associated with the data input port.  
5. V<sub>CCO</sub> is the V<sub>CC</sub> associated with the output port.  
6. All unused data inputs of the device must be held at V<sub>CCI</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted) (see Notes 4 and 5)

| PARAMETER         |  | TEST CONDITIONS   |                                   | V <sub>CCA</sub> | V <sub>CCB</sub> | MIN                   | TYP† | MAX | UNIT |
|-------------------|--|---|-----------------------------------|------------------|------------------|-----------------------|------|-----|------|
| V <sub>OH</sub>   |  | I <sub>OH</sub> = −100 μA   | V <sub>I</sub> = V <sub>IH</sub>  | 1.4 V to 3.6 V   | 1.4 V to 3.6 V   | V <sub>CCO</sub> −0.2 |      |     | V    |
|                   |  | I <sub>OH</sub> = −2 mA   | V <sub>I</sub> = V <sub>IH</sub>  | 1.4 V            | 1.4 V            | 1.05                  |      |     |      |
|                   |  | I <sub>OH</sub> = −4 mA   | V <sub>I</sub> = V <sub>IH</sub>  | 1.65 V           | 1.65 V           | 1.2                   |      |     |      |
|                   |  | I <sub>OH</sub> = −8 mA   | V <sub>I</sub> = V <sub>IH</sub>  | 2.3 V            | 2.3 V            | 1.75                  |      |     |      |
|                   |  | I <sub>OH</sub> = −12 mA  | V <sub>I</sub> = V <sub>IH</sub>  | 3 V              | 3 V              | 2.3                   |      |     |      |
| V <sub>OL</sub>   |  | I <sub>OH</sub> = 100 μA  | V <sub>I</sub> = V <sub>IL</sub>  | 1.4 V to 3.6 V   | 1.4 V to 3.6 V   | 0.2                   |      |     | V    |
|                   |  | I <sub>OH</sub> = 2 mA  | V <sub>I</sub> = V <sub>IL</sub>  | 1.4 V            | 1.4 V            | 0.35                  |      |     |      |
|                   |  | I <sub>OH</sub> = 4 mA  | V <sub>I</sub> = V <sub>IL</sub>  | 1.65 V           | 1.65 V           | 0.45                  |      |     |      |
|                   |  | I <sub>OH</sub> = 8 mA  | V <sub>I</sub> = V <sub>IL</sub>  | 2.3 V            | 2.3 V            | 0.55                  |      |     |      |
|                   |  | I <sub>OH</sub> = 12 mA   | V <sub>I</sub> = V <sub>IL</sub>  | 3 V              | 3 V              | 0.7                   |      |     |      |
| V <sub>OH</sub>   |  | I <sub>OHD</sub> = −6 mA  | V <sub>I</sub> = V <sub>IH</sub>  | 1.4 V            | 1.4 V            | 1.05                  |      |     | V    |
|                   |  | I <sub>OHD</sub> = −9 mA  | V <sub>I</sub> = V <sub>IH</sub>  | 1.65 V           | 1.65 V           | 1.2                   |      |     |      |
|                   |  | I <sub>OHD</sub> = −15 mA   | V <sub>I</sub> = V <sub>IH</sub>  | 2.3 V            | 2.3 V            | 1.75                  |      |     |      |
|                   |  | I <sub>OHD</sub> = −24 mA   | V <sub>I</sub> = V <sub>IH</sub>  | 3 V              | 3 V              | 2.3                   |      |     |      |
| V <sub>OL</sub>   |  | I <sub>OHD</sub> = 6 mA   | V <sub>I</sub> = V <sub>IL</sub>  | 1.4 V            | 1.4 V            | 0.35                  |      |     | V    |
|                   |  | I <sub>OHD</sub> = 9 mA   | V <sub>I</sub> = V <sub>IL</sub>  | 1.65 V           | 1.65 V           | 0.45                  |      |     |      |
|                   |  | I <sub>OHD</sub> = 15 mA  | V <sub>I</sub> = V <sub>IL</sub>  | 2.3 V            | 2.3 V            | 0.55                  |      |     |      |
|                   |  | I <sub>OHD</sub> = 24 mA  | V <sub>I</sub> = V <sub>IL</sub>  | 3 V              | 3 V              | 0.7                   |      |     |      |
| I <sub>I</sub>    | Control inputs   | V <sub>I</sub> = V <sub>CCB</sub> or GND  |                                   | 1.4 V to 3.6 V   | 3.6 V            | ±2.5                  |      |     | μA   |
| I <sub>off</sub>  | A port   | V <sub>I</sub> or V <sub>O</sub> = 0 to 3.6 V   |                                   | 0 V              | 0 to 3.6 V       | ±10                   |      |     | μA   |
|                   | B port   |   |                                   | 0 to 3.6 V       | 0 V              | ±10                   |      |     |      |
| I <sub>OZ</sub> ‡ | A or B ports   | V <sub>O</sub> = V <sub>CCO</sub> or GND,<br>V <sub>I</sub> = V <sub>CCI</sub> or GND | $\overline{OE}$ = V <sub>IH</sub> | 3.6 V            | 3.6 V            | ±12.5                 |      |     | μA   |
|                   | B port   |   | $\overline{OE}$ = don't care      | 0 V              | 3.6 V            | ±12.5                 |      |     |      |
|                   | A port   |   | $\overline{OE}$ = don't care      | 3.6 V            | 0 V              | ±12.5                 |      |     |      |
| I <sub>CCA</sub>  | V <sub>I</sub> = V <sub>CCI</sub> or GND, I <sub>O</sub> = 0 |   |                                   | 1.6 V            | 1.6 V            | 40                    |      |     | μA   |
|                   |  |   |                                   | 1.95 V           | 1.95 V           | 40                    |      |     |      |
|                   |  |   |                                   | 2.7 V            | 2.7 V            | 60                    |      |     |      |
|                   |  |   |                                   | 0 V              | 3.6 V            | −80                   |      |     |      |
|                   |  |   |                                   | 3.6 V            | 0 V              | 80                    |      |     |      |
|                   |  |   |                                   | 3.6 V            | 3.6 V            | 80                    |      |     |      |
| I <sub>CCB</sub>  | V <sub>I</sub> = V <sub>CCI</sub> or GND, I <sub>O</sub> = 0 |   |                                   | 1.6 V            | 1.6 V            | 40                    |      |     | μA   |
|                   |  |   |                                   | 1.95 V           | 1.95 V           | 40                    |      |     |      |
|                   |  |   |                                   | 2.7 V            | 2.7 V            | 60                    |      |     |      |
|                   |  |   |                                   | 0 V              | 3.6 V            | 80                    |      |     |      |
|                   |  |   |                                   | 3.6 V            | 0 V              | −80                   |      |     |      |
|                   |  |   |                                   | 3.6 V            | 3.6 V            | 80                    |      |     |      |
| C <sub>i</sub>    | Control inputs   | V <sub>I</sub> = 3.3 V or GND   |                                   | 3.3 V            | 3.3 V            | 4                     |      |     | pF   |
| C <sub>io</sub>   | A or B ports   | V <sub>O</sub> = 3.3 V or GND   |                                   | 3.3 V            | 3.3 V            | 5                     |      |     | pF   |

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

‡ For I/O ports, the parameter I<sub>OZ</sub> includes the input leakage current.

NOTES: 4. V<sub>CCI</sub> is the V<sub>CC</sub> associated with the input port.

5. V<sub>CCO</sub> is the V<sub>CC</sub> associated with the output port.

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switching characteristics over recommended operating free-air temperature range,  
 $V_{CCA} = 1.5 \text{ V} \pm 0.1 \text{ V}$  (see Figure 2)

| PARAMETER | FROM<br>(INPUT) | TO<br>(OUTPUT) | $V_{CCB} = 1.5 \text{ V} \pm 0.1 \text{ V}$ |     | $V_{CCB} = 1.8 \text{ V} \pm 0.15 \text{ V}$ |     | $V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$ |     | $V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$ |     | UNIT |
|-----------|-----------------|----------------|---|-----|--|-----|---|-----|---|-----|------|
|           |                 |                | MIN   | MAX | MIN  | MAX | MIN   | MAX | MIN   | MAX |      |
| $t_{pd}$  | A               | B              | 1.7   | 6.7 | 1.9  | 6.4 | 1.8   | 5.5 | 1.5   | 5.8 | ns   |
|           | B               | A              | 1.8   | 6.8 | 1.7  | 6.2 | 1.6   | 5.9 | 1.5   | 5.9 |      |
| $t_{en}$  | $\overline{OE}$ | A              | 2.1   | 9   | 2.9  | 9.8 | 3.2   | 10  | 3   | 9.8 | ns   |
|           |                 | B              | 2.5   | 8.4 | 2.4  | 8   | 2.3   | 7.6 | 2.2   | 7.5 |      |
| $t_{dis}$ | $\overline{OE}$ | A              | 2.1   | 7.1 | 2.3  | 6.4 | 1.7   | 5.1 | 1.6   | 4.8 | ns   |
|           |                 | B              | 2.2   | 6.9 | 1.8  | 6.4 | 1.1   | 5.8 | 1.8   | 5.7 |      |

switching characteristics over recommended operating free-air temperature range,  
 $V_{CCA} = 1.8 \text{ V} \pm 0.15 \text{ V}$  (see Figure 2)

| PARAMETER | FROM<br>(INPUT) | TO<br>(OUTPUT) | $V_{CCB} = 1.5 \text{ V} \pm 0.1 \text{ V}$ |     | $V_{CCB} = 1.8 \text{ V} \pm 0.15 \text{ V}$ |     | $V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$ |     | $V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$ |     | UNIT |
|-----------|-----------------|----------------|---|-----|--|-----|---|-----|---|-----|------|
|           |                 |                | MIN   | MAX | MIN  | MAX | MIN   | MAX | MIN   | MAX |      |
| $t_{pd}$  | A               | B              | 1.7   | 6.4 | 1.8  | 6   | 1.7   | 4.7 | 1.6   | 4.3 | ns   |
|           | B               | A              | 2   | 6.6 | 1.8  | 6   | 1.8   | 5.6 | 1.8   | 5.5 |      |
| $t_{en}$  | $\overline{OE}$ | A              | 1.8   | 7.6 | 2.6  | 7.7 | 2.6   | 7.6 | 2.6   | 7.4 | ns   |
|           |                 | B              | 2.5   | 8.2 | 2.5  | 7.5 | 2.4   | 7.4 | 2.3   | 7.2 |      |
| $t_{dis}$ | $\overline{OE}$ | A              | 1.8   | 7   | 2.5  | 6.3 | 1.8   | 4.7 | 1.7   | 4.4 | ns   |
|           |                 | B              | 2.5   | 6.7 | 2.3  | 6.1 | 2.2   | 5.5 | 1.3   | 5.3 |      |

switching characteristics over recommended operating free-air temperature range,  
 $V_{CCA} = 2.5 \text{ V} \pm 0.2 \text{ V}$  (see Figure 2)

| PARAMETER | FROM<br>(INPUT) | TO<br>(OUTPUT) | $V_{CCB} = 1.5 \text{ V} \pm 0.1 \text{ V}$ |     | $V_{CCB} = 1.8 \text{ V} \pm 0.15 \text{ V}$ |     | $V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$ |     | $V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$ |     | UNIT |
|-----------|-----------------|----------------|---|-----|--|-----|---|-----|---|-----|------|
|           |                 |                | MIN   | MAX | MIN  | MAX | MIN   | MAX | MIN   | MAX |      |
| $t_{pd}$  | A               | B              | 1.6   | 6   | 1.8  | 5.6 | 1.5   | 4   | 1.5   | 3.4 | ns   |
|           | B               | A              | 1.7   | 5.4 | 1.7  | 4.6 | 1.5   | 4   | 1.5   | 3.7 |      |
| $t_{en}$  | $\overline{OE}$ | A              | 1.7   | 5.7 | 2.2  | 5.5 | 2.2   | 5.3 | 2.2   | 5.1 | ns   |
|           |                 | B              | 3.1   | 6.1 | 2.5  | 5.6 | 2.2   | 5.3 | 1.9   | 4.2 |      |
| $t_{dis}$ | $\overline{OE}$ | A              | 1.2   | 5.8 | 1.9  | 5   | 1.4   | 3.6 | 1.3   | 3.3 | ns   |
|           |                 | B              | 2.4   | 6   | 3  | 5.2 | 1.4   | 3.6 | 1.2   | 3   |      |

switching characteristics over recommended operating free-air temperature range,  
 $V_{CCA} = 3.3 \text{ V} \pm 0.3 \text{ V}$  (see Figure 2)

| PARAMETER | FROM<br>(INPUT) | TO<br>(OUTPUT) | $V_{CCB} = 1.5 \text{ V} \pm 0.1 \text{ V}$ |     | $V_{CCB} = 1.8 \text{ V} \pm 0.15 \text{ V}$ |     | $V_{CCB} = 2.5 \text{ V} \pm 0.2 \text{ V}$ |     | $V_{CCB} = 3.3 \text{ V} \pm 0.3 \text{ V}$ |     | UNIT |
|-----------|-----------------|----------------|---|-----|--|-----|---|-----|---|-----|------|
|           |                 |                | MIN   | MAX | MIN  | MAX | MIN   | MAX | MIN   | MAX |      |
| $t_{pd}$  | A               | B              | 1.5   | 5.9 | 1.7  | 5.4 | 1.5   | 3.7 | 1.4   | 3.1 | ns   |
|           | B               | A              | 1.5   | 5.8 | 1.5  | 4.2 | 1.5   | 3.3 | 1.4   | 3.1 |      |
| $t_{en}$  | $\overline{OE}$ | A              | 1.6   | 4.9 | 2  | 4.5 | 2   | 4.3 | 1.9   | 4.1 | ns   |
|           |                 | B              | 2   | 5.1 | 2  | 4.6 | 2.2   | 5.2 | 1.9   | 4.1 |      |
| $t_{dis}$ | $\overline{OE}$ | A              | 1.3   | 6.9 | 2.1  | 5.5 | 1.6   | 3.8 | 1.5   | 3.5 | ns   |
|           |                 | B              | 2.3   | 5.5 | 1.9  | 4.5 | 1.3   | 3.5 | 1.2   | 3.5 |      |

operating characteristics,  $V_{CCA}$  and  $V_{CCB} = 3.3 \text{ V}$ ,  $T_A = 25^\circ\text{C}$

| PARAMETER                  |   |                  | TEST CONDITIONS                  | TYP | UNIT |
|----------------------------|---|------------------|----------------------------------|-----|------|
| $C_{pdA}$<br>( $V_{CCA}$ ) | Power-dissipation capacitance per transceiver,<br>A-port input, B-port output | Outputs enabled  | $C_L = 0$ , $f = 10 \text{ MHz}$ | 14  | pF   |
|                            |   | Outputs disabled |                                  | 7   |      |
|                            | Power-dissipation capacitance per transceiver,<br>B-port input, A-port output | Outputs enabled  |                                  | 20  |      |
|                            |   | Outputs disabled |                                  | 7   |      |
| $C_{pdB}$<br>( $V_{CCB}$ ) | Power-dissipation capacitance per transceiver,<br>A-port input, B-port output | Outputs enabled  | $C_L = 0$ , $f = 10 \text{ MHz}$ | 20  | pF   |
|                            |   | Outputs disabled |                                  | 7   |      |
|                            | Power-dissipation capacitance per transceiver,<br>B-port input, A-port output | Outputs enabled  |                                  | 14  |      |
|                            |   | Outputs disabled |                                  | 7   |      |



**SN74AVCB324245**  
**32-BIT DUAL-SUPPLY BUS TRANSCEIVER**  
**WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS**

SCES485A – AUGUST 2003 – REVISED JUNE 2004

## output description

The dynamic output control (DOC™) circuitry is implemented, which, during the transition, initially lowers the output impedance to effectively drive the load and, subsequently, raises the impedance to reduce noise. Figure 1 shows typical  $V_{OL}$  vs  $I_{OL}$  and  $V_{OH}$  vs  $I_{OH}$  curves to illustrate the output impedance and drive capability of the circuit. At the beginning of the signal transition, the DOC circuit provides a maximum dynamic drive that is equivalent to a high-drive standard-output device. For more information, refer to the TI application reports, *AVC Logic Family Technology and Applications*, literature number SCEA006, and *Dynamic Output Control (DOC™) Circuitry Technology and Applications*, literature number SCEA009.

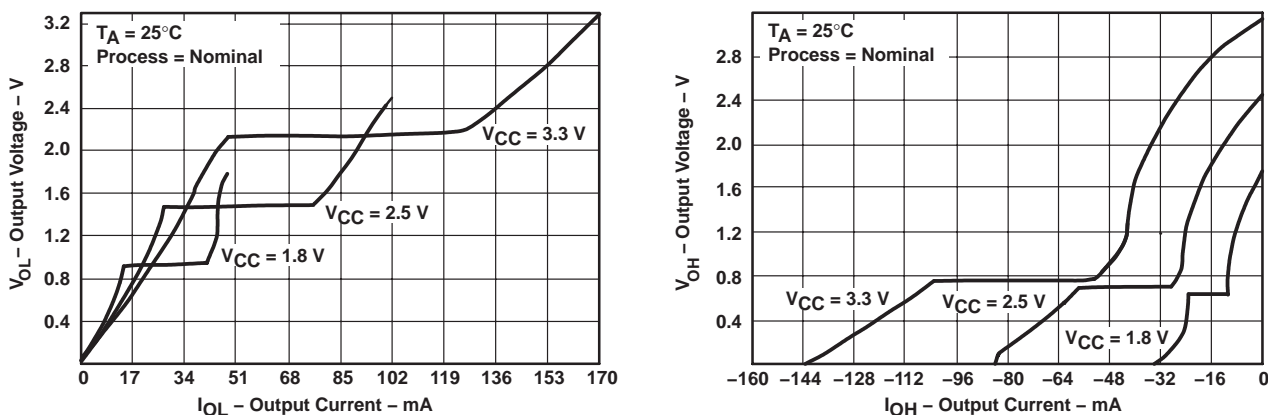
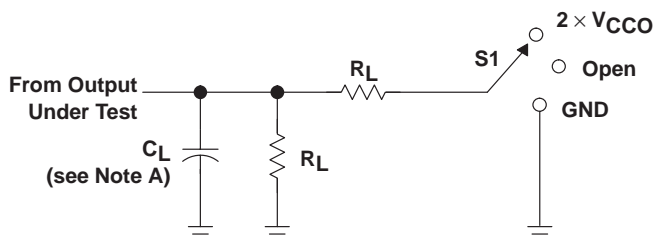
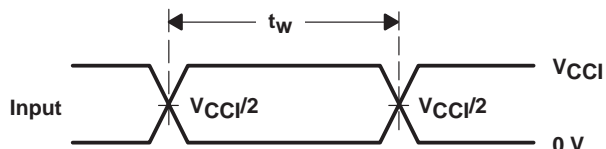
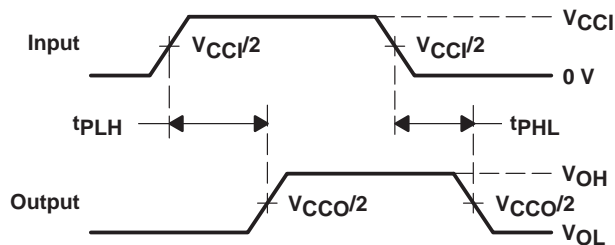
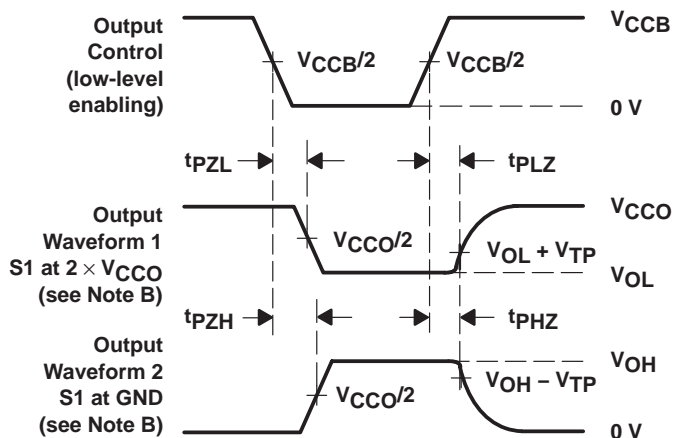


Figure 1. Typical Output Voltage vs Output Current

**PARAMETER MEASUREMENT INFORMATION**

**LOAD CIRCUIT**

| $V_{CCO}$                        | $C_L$ | $R_L$        | $V_{TP}$ |
|----------------------------------|-------|--------------|----------|
| $1.5\text{ V} \pm 0.1\text{ V}$  | 15 pF | 2 k $\Omega$ | 0.1 V    |
| $1.8\text{ V} \pm 0.15\text{ V}$ | 30 pF | 1 k $\Omega$ | 0.15 V   |
| $2.5\text{ V} \pm 0.2\text{ V}$  | 30 pF | 500 $\Omega$ | 0.15 V   |
| $3.3\text{ V} \pm 0.3\text{ V}$  | 30 pF | 500 $\Omega$ | 0.3 V    |

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

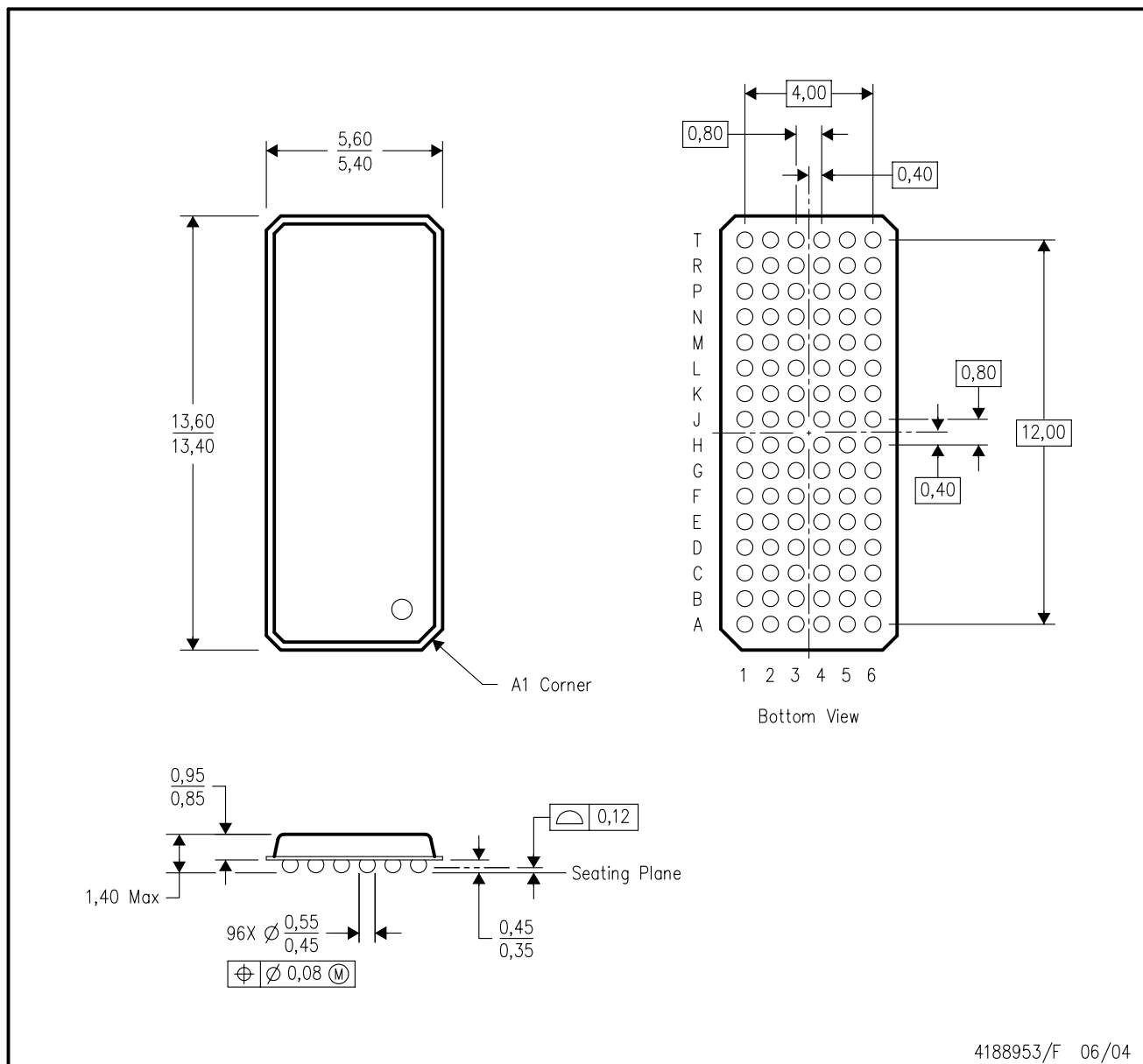

**VOLTAGE WAVEFORMS  
PULSE DURATION**

**VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES**

**VOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES**

- NOTES:
- $C_L$  includes probe and jig capacitance.
  - 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.
  - All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10\text{ MHz}$ ,  $Z_O = 50\ \Omega$ ,  $dv/dt \geq 1\text{ V/ns}$ .
  - The outputs are measured one at a time with one transition per measurement.
  - $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .
  - $V_{CCI}$  is the  $V_{CC}$  associated with the input port.
  - $V_{CCO}$  is the  $V_{CC}$  associated with the output port.

**Figure 2. Load Circuit and Voltage Waveforms**

GKE (R-PBGA-N96)

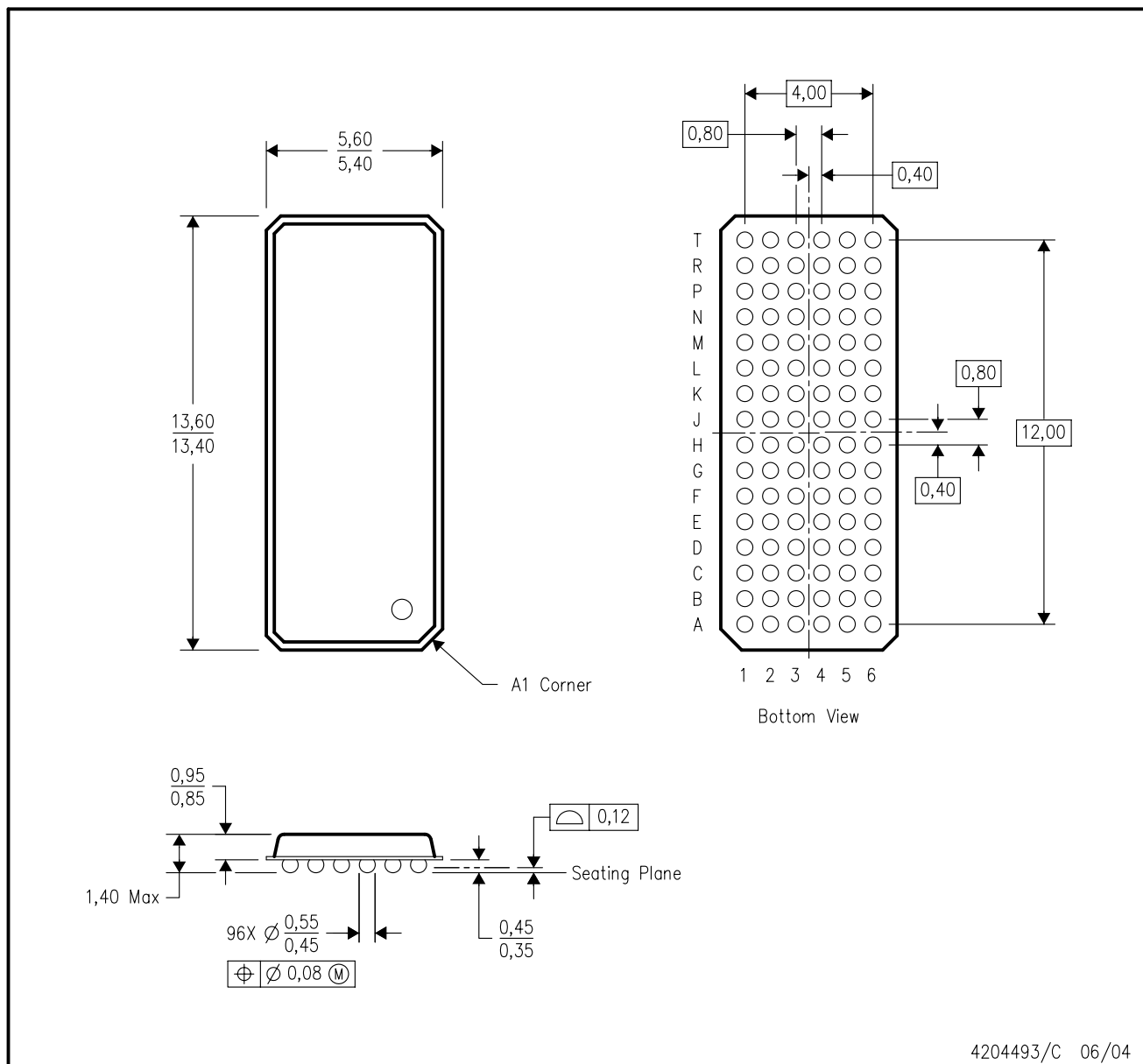
PLASTIC BALL GRID ARRAY



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Falls within JEDEC MO-205 variation CC.
  - D. This package is tin-lead (SnPb). Refer to the 96 ZKE package (drawing 4204493) for lead-free.

ZKE (R-PBGA-N96)

PLASTIC BALL GRID ARRAY



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Falls within JEDEC MO-205 variation CC.
  - D. This package is lead-free. Refer to the 96 GKE package (drawing 4188953) for tin-lead (SnPb).

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