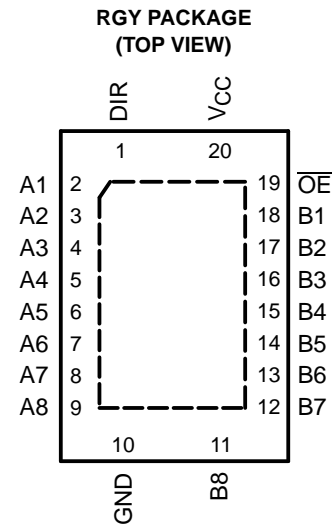


## FEATURES

- Optimized for 1.8-V Operation and Is 3.6-V I/O Tolerant to Support Mixed-Mode Signal Operation
- $I_{off}$  Supports Partial-Power-Down Mode Operation
- Sub-1-V Operable
- Max  $t_{pd}$  of 1.7 ns at 1.8 V
- Low Power Consumption, 20- $\mu$ A Max  $I_{CC}$
- $\pm 8$ -mA Output Drive at 1.8 V
- 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 octal bus transceiver is operational at 0.8-V to 2.7-V  $V_{CC}$ , but is designed specifically for 1.65-V to 1.95-V  $V_{CC}$  operation.

The SN74AUC245 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 device so the buses are effectively isolated.

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.

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.

## ORDERING INFORMATION

| $T_A$         | PACKAGE <sup>(1)</sup> |               | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---------------|------------------------|---------------|-----------------------|------------------|
|               | QFN – RGY              | Tape and reel |                       |                  |
| –40°C to 85°C | VFBGA – GQN            | Tape and reel | SN74AUC245RGYR        | MS245            |
|               |                        |               | SN74AUC245GQNR        | MS245            |

(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).

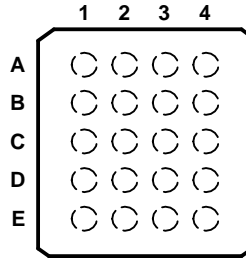


Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

**SN74AUC245**  
**OCTAL BUS TRANSCEIVER**  
**WITH 3-STATE OUTPUTS**

SCES419A—JANUARY 2003—REVISED MARCH 2005

**GQN PACKAGE**  
**(TOP VIEW)**



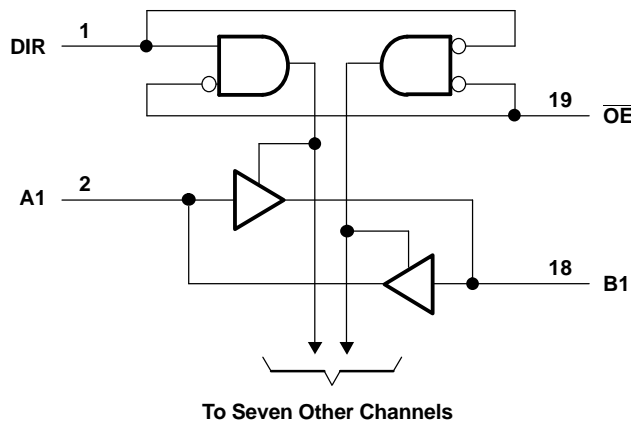
**TERMINAL ASSIGNMENTS**

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

**FUNCTION TABLE**

| INPUTS          |     | OPERATION       |
|-----------------|-----|-----------------|
| $\overline{OE}$ | DIR |                 |
| L               | L   | B data to A bus |
| L               | H   | A data to B bus |
| H               | X   | Isolation       |

**LOGIC DIAGRAM (POSITIVE LOGIC)**



Pin numbers shown are for the RGY package.

### 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                       | 3.6            | V    |
| $V_I$         | Input voltage range <sup>(2)</sup>                                                          | –0.5                       | 3.6            | V    |
| $V_O$         | Voltage range applied to any output in the high-impedance or power-off state <sup>(2)</sup> | –0.5                       | 3.6            | V    |
| $V_O$         | Output voltage range <sup>(2)</sup>                                                         | –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                                                                   |                            | ±20            | mA   |
|               | Continuous current through $V_{CC}$ or GND                                                  |                            | ±100           | mA   |
| $\theta_{JA}$ | Package thermal impedance                                                                   | GQN package <sup>(3)</sup> | 78             | °C/W |
|               |                                                                                             | RGY package <sup>(4)</sup> | 37             |      |
| $T_{stg}$     | 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 package thermal impedance is calculated in accordance with JESD 51-7.
- (4) The package thermal impedance is calculated in accordance with JESD 51-5.

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

|                     |                                    | MIN                        | MAX                  | UNIT                 |
|---------------------|------------------------------------|----------------------------|----------------------|----------------------|
| $V_{CC}$            | Supply voltage                     | 0.8                        | 2.7                  | V                    |
| $V_{IH}$            | High-level input voltage           | $V_{CC} = 0.8$ V           | $V_{CC}$             | 3.6                  |
|                     |                                    | $V_{CC} = 1.1$ V to 1.95 V | $0.65 \times V_{CC}$ | 3.6                  |
|                     |                                    | $V_{CC} = 2.3$ V to 2.7 V  | 1.7                  | 3.6                  |
| $V_{IL}$            | Low-level input voltage            | $V_{CC} = 0.8$ V           | 0                    | 0                    |
|                     |                                    | $V_{CC} = 1.1$ V to 1.95 V | 0                    | $0.35 \times V_{CC}$ |
|                     |                                    | $V_{CC} = 2.3$ V to 2.7 V  | 0                    | 0.7                  |
| $V_O$               | Output voltage                     | Active state               | 0                    | $V_{CC}$             |
|                     |                                    | 3-state                    | 0                    | 3.6                  |
| $I_{OH}$            | High-level output current          | $V_{CC} = 0.8$ V           |                      | –0.7                 |
|                     |                                    | $V_{CC} = 1.1$ V           |                      | –3                   |
|                     |                                    | $V_{CC} = 1.4$ V           |                      | –5                   |
|                     |                                    | $V_{CC} = 1.65$ V          |                      | –8                   |
|                     |                                    | $V_{CC} = 2.3$ V           |                      | –9                   |
| $I_{OL}$            | Low-level output current           | $V_{CC} = 0.8$ V           |                      | 0.7                  |
|                     |                                    | $V_{CC} = 1.1$ V           |                      | 3                    |
|                     |                                    | $V_{CC} = 1.4$ V           |                      | 5                    |
|                     |                                    | $V_{CC} = 1.65$ V          |                      | 8                    |
|                     |                                    | $V_{CC} = 2.3$ V           |                      | 9                    |
| $\Delta t/\Delta v$ | Input transition rise or fall rate |                            | 20                   | 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.

# SN74AUC245 OCTAL BUS TRANSCEIVER WITH 3-STATE OUTPUTS

SCES419A–JANUARY 2003–REVISED MARCH 2005

## Electrical Characteristics

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

| PARAMETER                      |            | TEST CONDITIONS                                             | V <sub>CC</sub> | MIN                   | TYP <sup>(1)</sup> | MAX  | UNIT |
|--------------------------------|------------|-------------------------------------------------------------|-----------------|-----------------------|--------------------|------|------|
| V <sub>OH</sub>                |            | I <sub>OH</sub> = -100 μA                                   | 0.8 V to 2.7 V  | V <sub>CC</sub> - 0.1 |                    |      | V    |
|                                |            | I <sub>OH</sub> = -0.7 mA                                   | 0.8 V           | 0.55                  |                    |      |      |
|                                |            | I <sub>OH</sub> = -3 mA                                     | 1.1 V           | 0.8                   |                    |      |      |
|                                |            | I <sub>OH</sub> = -5 mA                                     | 1.4 V           | 1                     |                    |      |      |
|                                |            | I <sub>OH</sub> = -8 mA                                     | 1.65 V          | 1.2                   |                    |      |      |
|                                |            | I <sub>OH</sub> = -9 mA                                     | 2.3 V           | 1.8                   |                    |      |      |
| V <sub>OL</sub>                |            | I <sub>OL</sub> = 100 μA                                    | 0.8 V to 2.7 V  |                       |                    | 0.2  | V    |
|                                |            | I <sub>OL</sub> = 0.7 mA                                    | 0.8 V           | 0.25                  |                    |      |      |
|                                |            | I <sub>OL</sub> = 3 mA                                      | 1.1 V           |                       |                    | 0.3  |      |
|                                |            | I <sub>OL</sub> = 5 mA                                      | 1.4 V           |                       |                    | 0.4  |      |
|                                |            | I <sub>OL</sub> = 8 mA                                      | 1.65 V          |                       |                    | 0.45 |      |
|                                |            | I <sub>OL</sub> = 9 mA                                      | 2.3 V           |                       |                    | 0.6  |      |
| I <sub>I</sub>                 | All inputs | V <sub>I</sub> = V <sub>CC</sub> or GND                     | 0 to 2.7 V      |                       |                    | ±5   | μA   |
| I <sub>off</sub>               |            | V <sub>I</sub> or V <sub>O</sub> = 2.7 V                    | 0               |                       |                    | ±10  | μA   |
| I <sub>OZ</sub> <sup>(2)</sup> |            | V <sub>O</sub> = V <sub>CC</sub> or GND                     | 2.7 V           |                       |                    | ±10  | μA   |
| I <sub>CC</sub>                |            | V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0 | 0.8 V to 2.7 V  |                       |                    | 20   | μA   |
| C <sub>i</sub>                 |            | V <sub>I</sub> = V <sub>CC</sub> or GND                     | 2.5 V           | 2.5                   |                    | 3    | pF   |
| C <sub>io</sub>                |            | V <sub>O</sub> = V <sub>CC</sub> or GND                     | 2.5 V           | 7.5                   |                    | 8    | pF   |

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

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

## Switching Characteristics

over recommended operating free-air temperature range, C<sub>L</sub> = 15 pF (unless otherwise noted) (see Figure 1)

| PARAMETER        | FROM (INPUT)    | TO (OUTPUT) | V <sub>CC</sub> = 0.8 V | V <sub>CC</sub> = 1.2 V ± 0.1 V |     | V <sub>CC</sub> = 1.5 V ± 0.1 V |     | V <sub>CC</sub> = 1.8 V ± 0.15 V |     |     | V <sub>CC</sub> = 2.5 V ± 0.2 V |     | UNIT |
|------------------|-----------------|-------------|-------------------------|---------------------------------|-----|---------------------------------|-----|----------------------------------|-----|-----|---------------------------------|-----|------|
|                  |                 |             | TYP                     | MIN                             | MAX | MIN                             | MAX | MIN                              | TYP | MAX | MIN                             | MAX |      |
| t <sub>pd</sub>  | A or B          | B or A      | 5                       | 1                               | 3.2 | 0.6                             | 2   | 0.5                              | 1   | 1.7 | 0.4                             | 1.4 | ns   |
| t <sub>en</sub>  | $\overline{OE}$ | A or B      | 9                       | 1.2                             | 4.9 | 1                               | 3   | 0.8                              | 1.2 | 2.4 | 0.6                             | 1.8 | ns   |
| t <sub>dis</sub> | $\overline{OE}$ | A or B      | 9.5                     | 1.9                             | 5.7 | 1.2                             | 4   | 0.9                              | 1.9 | 4.1 | 0.6                             | 2.9 | ns   |

## Switching Characteristics

over recommended operating free-air temperature range, C<sub>L</sub> = 30 pF (unless otherwise noted) (see Figure 1)

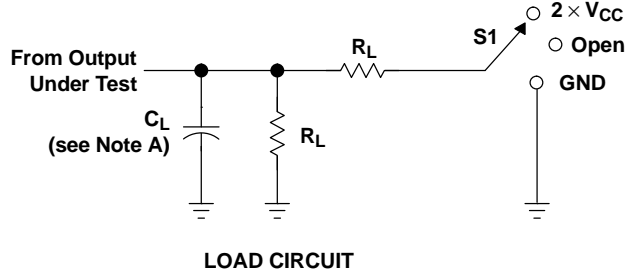
| PARAMETER        | FROM (INPUT)    | TO (OUTPUT) | V <sub>CC</sub> = 1.8 V ± 0.15 V |     |     | V <sub>CC</sub> = 2.5 V ± 0.2 V |     | UNIT |
|------------------|-----------------|-------------|----------------------------------|-----|-----|---------------------------------|-----|------|
|                  |                 |             | MIN                              | TYP | MAX | MIN                             | MAX |      |
| t <sub>pd</sub>  | A or B          | B or A      | 0.6                              | 1.3 | 2.2 | 0.5                             | 1.8 | ns   |
| t <sub>en</sub>  | $\overline{OE}$ | A or B      | 1.1                              | 1.5 | 3   | 1.1                             | 2.4 | ns   |
| t <sub>dis</sub> | $\overline{OE}$ | A or B      | 1.6                              | 2.2 | 4   | 0.8                             | 2.6 | ns   |

## Operating Characteristics

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

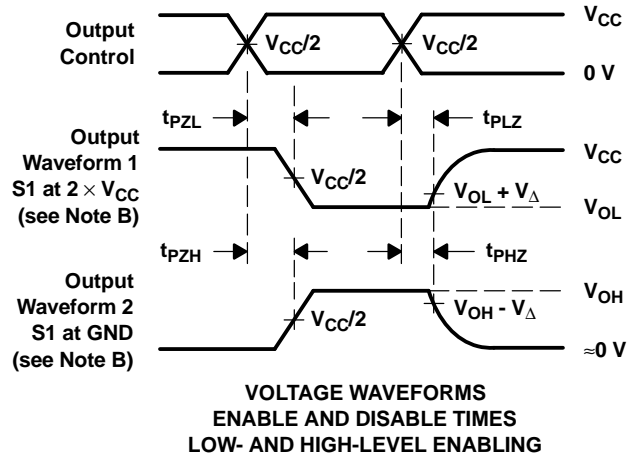
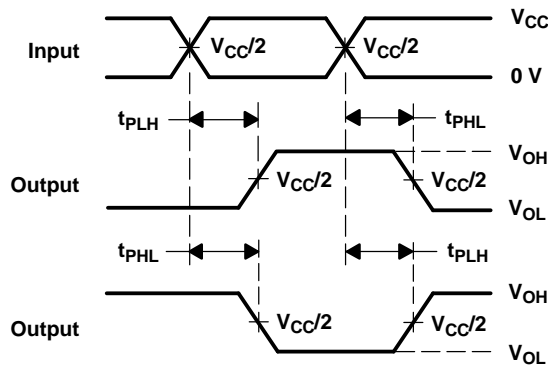
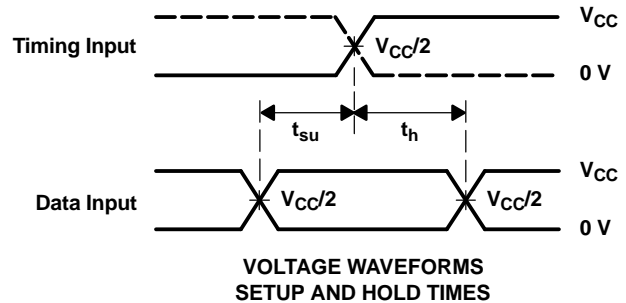
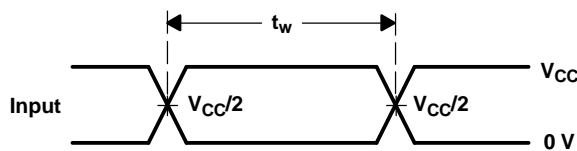
| PARAMETER |                               | TEST CONDITIONS | $V_{CC} = 0.8\text{ V}$ | $V_{CC} = 1.2\text{ V}$ | $V_{CC} = 1.5\text{ V}$ | $V_{CC} = 1.8\text{ V}$ | $V_{CC} = 2.5\text{ V}$ | UNIT |    |
|-----------|-------------------------------|-----------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|------|----|
|           |                               |                 | TYP                     | TYP                     | TYP                     | TYP                     | TYP                     |      |    |
| $C_{pd}$  | Power dissipation capacitance | Outputs enabled | f = 10 MHz              | 20                      | 21                      | 21                      | 23                      | 27   | pF |
|           |                               |                 |                         | Outputs disabled        | 1                       | 1                       | 1                       | 1    |    |

PARAMETER MEASUREMENT INFORMATION



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

| $V_{CC}$           | $C_L$ | $R_L$        | $V_{\Delta}$ |
|--------------------|-------|--------------|--------------|
| 0.8 V              | 15 pF | 2 k $\Omega$ | 0.1 V        |
| 1.2 V $\pm$ 0.1 V  | 15 pF | 2 k $\Omega$ | 0.1 V        |
| 1.5 V $\pm$ 0.1 V  | 15 pF | 2 k $\Omega$ | 0.1 V        |
| 1.8 V $\pm$ 0.15 V | 15 pF | 2 k $\Omega$ | 0.15 V       |
| 2.5 V $\pm$ 0.2 V  | 15 pF | 2 k $\Omega$ | 0.15 V       |
| 1.8 V $\pm$ 0.15 V | 30 pF | 1 k $\Omega$ | 0.15 V       |
| 2.5 V $\pm$ 0.2 V  | 30 pF | 500 $\Omega$ | 0.15 V       |



- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.  
 C. All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  10 MHz,  $Z_O = 50 \Omega$ , slew rate  $\geq$  1 V/ns.  
 D. The outputs are measured one at a time, with one transition per measurement.  
 E.  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .  
 F.  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .  
 G.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .  
 H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

**PACKAGING INFORMATION**

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| SN74AUC245GQNR   | ACTIVE                | VFBGA        | GQN             | 20   | 1000        | TBD                     | SNPB             | Level-1-240C-UNLIM           |
| SN74AUC245RGYR   | ACTIVE                | QFN          | RGY             | 20   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1YEAR           |
| SN74AUC245ZQNR   | ACTIVE                | VFBGA        | ZQN             | 20   | 1000        | Green (RoHS & no Sb/Br) | SNAGCU           | Level-1-260C-UNLIM           |

<sup>(1)</sup> 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.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

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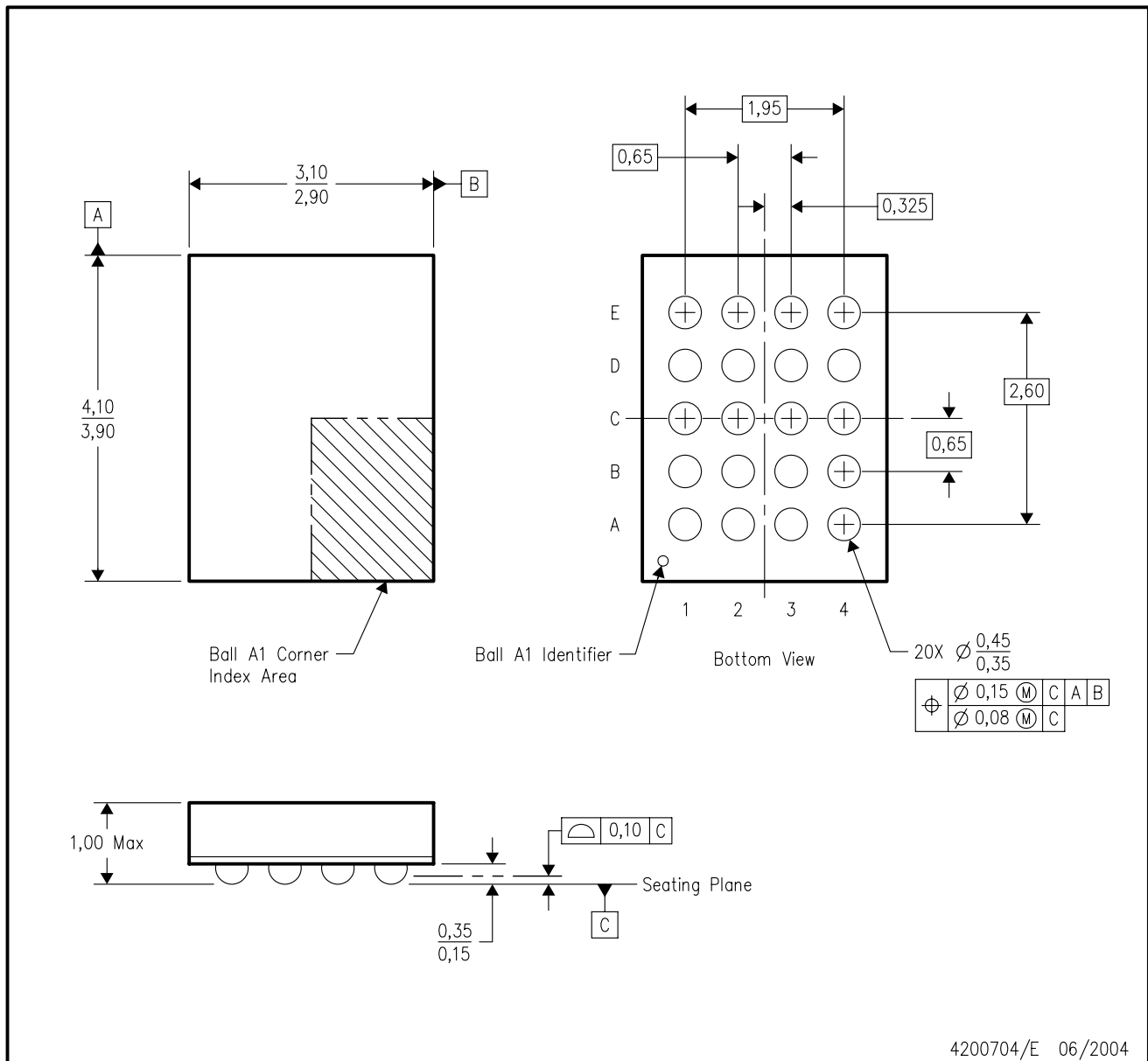
<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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GQN (R-PBGA-N20)

PLASTIC BALL GRID ARRAY

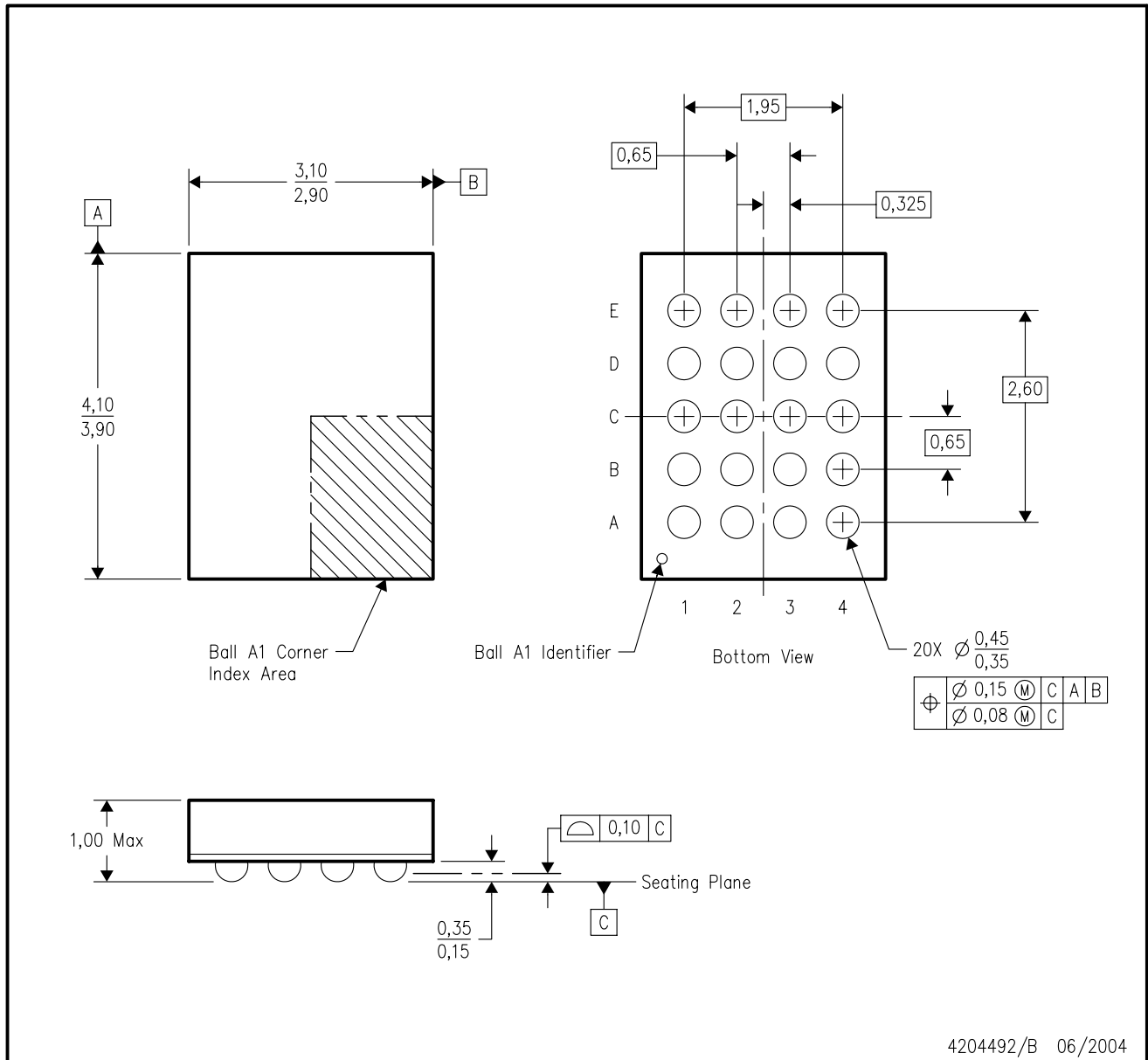


- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Falls within JEDEC MO-225 variation BC.
  - D. This package is tin-lead (SnPb). Refer to the 20 ZQN package (drawing 4204492) for lead-free.



ZQN (R-PBGA-N20)

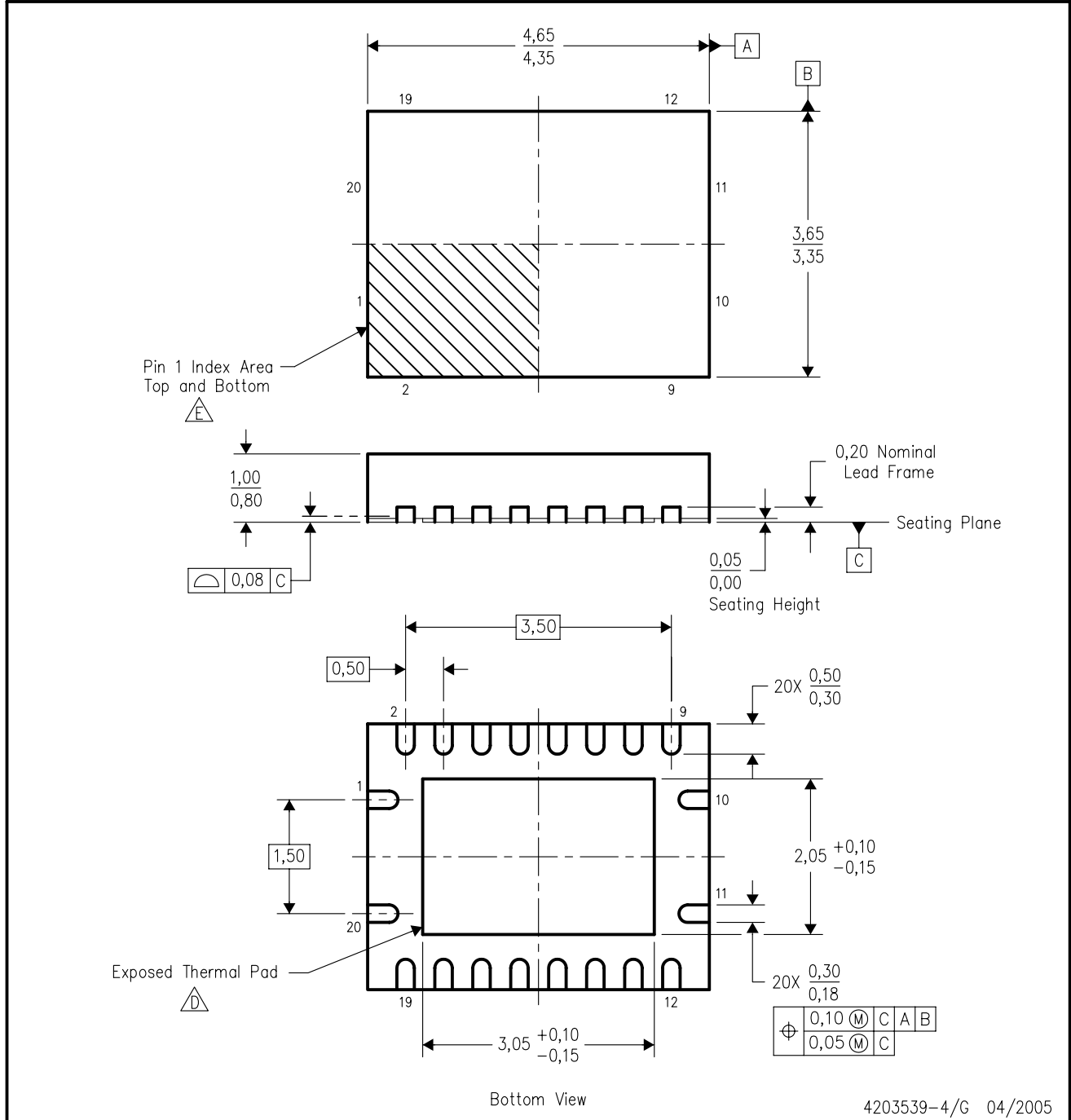
PLASTIC BALL GRID ARRAY



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Falls within JEDEC MO-225 variation BC.
  - D. This package is lead-free. Refer to the 20 GQN package (drawing 4200704) for tin-lead (SnPb).

RGY (R-PQFP-N20)

PLASTIC QUAD FLATPACK



4203539-4/G 04/2005

- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. QFN (Quad Flatpack No-Lead) package configuration.
  - The package thermal pad must be soldered to the board for thermal and mechanical performance.
  - Pin 1 identifiers are located on both top and bottom of the package and within the zone indicated. The Pin 1 identifiers are either a molded, marked, or metal feature.
  - F. Package complies to JEDEC MO-241 variation BC.

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