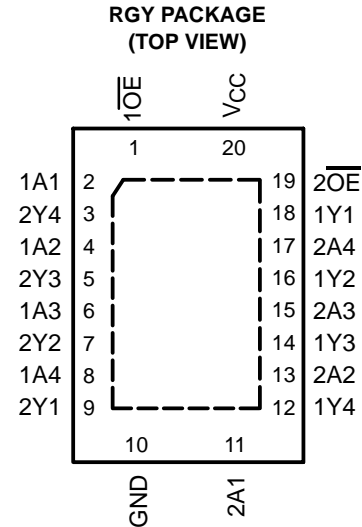


# SN74AUCH240 OCTAL BUFFER/DRIVER WITH 3-STATE OUTPUTS

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- 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
- Bus Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown Resistors
- 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 buffer/driver 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 SN74AUCH240 is designed specifically to improve the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters.

This device is organized as two 4-bit buffers/drivers with separate output-enable ( $\overline{OE}$ ) inputs. When  $\overline{OE}$  is low, the device passes data from the A inputs to the Y outputs. When  $\overline{OE}$  is high, the outputs are in the high-impedance state.

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

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

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†  | ORDERABLE PART NUMBER | TOP-SIDE MARKING |       |
|---------------|-----------|-----------------------|------------------|-------|
| -40°C to 85°C | QFN – RGY | Tape and reel         | SN74AUCH240RGYR  | MT240 |

† 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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 **TEXAS  
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# SN74AUCH240

## OCTAL BUFFER/DRIVER

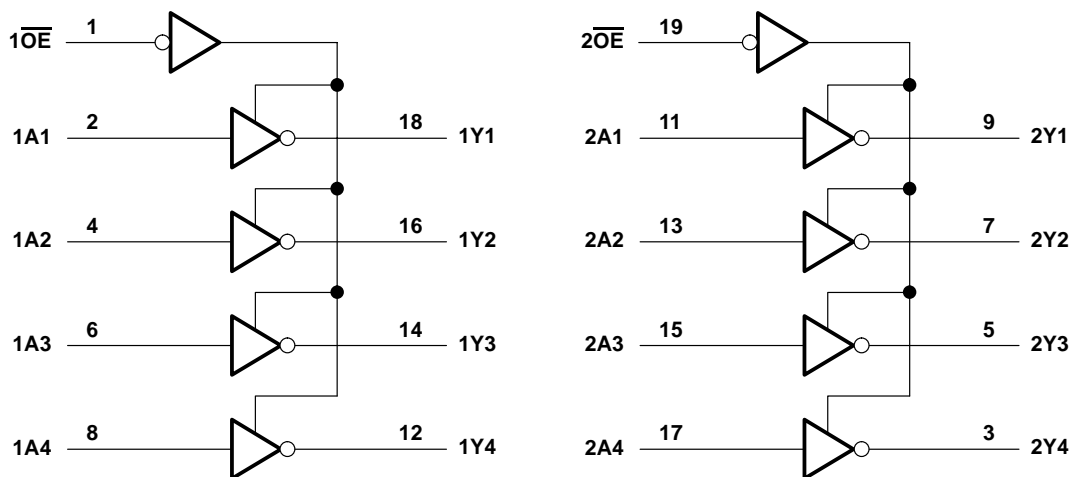
### WITH 3-STATE OUTPUTS

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**FUNCTION TABLE**  
(each 4-bit buffer/driver)

| INPUTS          |   | OUTPUT |
|-----------------|---|--------|
| $\overline{OE}$ | A | Y      |
| L               | H | L      |
| L               | L | H      |
| H               | X | Z      |

#### logic diagram (positive logic)



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

|   |                            |
|---|----------------------------|
| Supply voltage range, $V_{CC}$ .....  | -0.5 V to 3.6 V            |
| Input voltage range, $V_I$ (see Note 1) .....   | -0.5 V to 3.6 V            |
| Voltage range applied to any output in the high-impedance or power-off state, $V_O$<br>(see Note 1) ..... | -0.5 V to 3.6 V            |
| Output voltage range, $V_O$ (see Note 1) .....  | -0.5 V to $V_{CC} + 0.5$ V |
| Input clamp current, $I_{IK}$ ( $V_I < 0$ ) .....   | -50 mA                     |
| Output clamp current, $I_{OK}$ ( $V_O < 0$ ) .....  | -50 mA                     |
| Continuous output current, $I_O$ .....  | $\pm 20$ mA                |
| Continuous current through $V_{CC}$ or GND .....  | $\pm 100$ mA               |
| Package thermal impedance, $\theta_{JA}$ (see Note 2) .....   | 37°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 negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.  
2. The package thermal impedance is calculated in accordance with JESD 51-5.

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## recommended operating conditions (see Note 3)

|                 |                                    | MIN                               | MAX                    | UNIT            |
|-----------------|------------------------------------|-----------------------------------|------------------------|-----------------|
| V <sub>CC</sub> | Supply voltage                     | 0.8                               | 2.7                    | V               |
| V <sub>IH</sub> | High-level input voltage           | V <sub>CC</sub> = 0.8 V           | V <sub>CC</sub>        | V               |
|                 |                                    | V <sub>CC</sub> = 1.1 V to 1.95 V | 0.65 × V <sub>CC</sub> |                 |
|                 |                                    | V <sub>CC</sub> = 2.3 V to 2.7 V  | 1.7                    |                 |
| V <sub>IL</sub> | Low-level input voltage            | V <sub>CC</sub> = 0.8 V           | 0                      | V               |
|                 |                                    | V <sub>CC</sub> = 1.1 V to 1.95 V | 0.35 × V <sub>CC</sub> |                 |
|                 |                                    | V <sub>CC</sub> = 2.3 V to 2.7 V  | 0.7                    |                 |
| V <sub>I</sub>  | Input voltage                      | 0                                 | 3.6                    | V               |
| V <sub>O</sub>  | Output voltage                     | Active state                      | 0                      | V <sub>CC</sub> |
|                 |                                    | 3-state                           | 0                      | 3.6             |
| I <sub>OH</sub> | High-level output current          | V <sub>CC</sub> = 0.8 V           | –0.7                   | mA              |
|                 |                                    | V <sub>CC</sub> = 1.1 V           | –3                     |                 |
|                 |                                    | V <sub>CC</sub> = 1.4 V           | –5                     |                 |
|                 |                                    | V <sub>CC</sub> = 1.65 V          | –8                     |                 |
|                 |                                    | V <sub>CC</sub> = 2.3 V           | –9                     |                 |
| I <sub>OL</sub> | Low-level output current           | V <sub>CC</sub> = 0.8 V           | 0.7                    | mA              |
|                 |                                    | V <sub>CC</sub> = 1.1 V           | 3                      |                 |
|                 |                                    | V <sub>CC</sub> = 1.4 V           | 5                      |                 |
|                 |                                    | V <sub>CC</sub> = 1.65 V          | 8                      |                 |
|                 |                                    | V <sub>CC</sub> = 2.3 V           | 9                      |                 |
| Δt/Δv           | Input transition rise or fall rate |                                   | 20                     | ns/V            |
| T <sub>A</sub>  | Operating free-air temperature     | –40                               | 85                     | °C              |

NOTE 3: All unused control inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

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

| PARAMETER           |                                       | TEST CONDITIONS   | V <sub>CC</sub> | MIN                  | TYP† | 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>      | A and $\overline{OE}$ inputs          | V <sub>I</sub> = V <sub>CC</sub> or GND                     | 0 to 2.7 V      |                      |      | ±5   | μA   |
| I <sub>BHL</sub> ‡  |                                       | V <sub>I</sub> = 0.35 V                                     | 1.1 V           | 10                   |      |      | μA   |
|                     |                                       | V <sub>I</sub> = 0.47 V                                     | 1.4 V           | 15                   |      |      |      |
|                     |                                       | V <sub>I</sub> = 0.57 V                                     | 1.65 V          | 20                   |      |      |      |
|                     |                                       | V <sub>I</sub> = 0.7 V                                      | 2.3 V           | 40                   |      |      |      |
| I <sub>BHH</sub> §  |                                       | V <sub>I</sub> = 0.8 V                                      | 1.1 V           | -10                  |      |      | μA   |
|                     |                                       | V <sub>I</sub> = 0.9 V                                      | 1.4 V           | -15                  |      |      |      |
|                     |                                       | V <sub>I</sub> = 1.07 V                                     | 1.65 V          | -20                  |      |      |      |
|                     |                                       | V <sub>I</sub> = 1.7 V                                      | 2.3 V           | -40                  |      |      |      |
| I <sub>BHLO</sub> ¶ | V <sub>I</sub> = 0 to V <sub>CC</sub> |   | 1.3 V           | 75                   |      |      | μA   |
|                     |                                       |   | 1.6 V           | 125                  |      |      |      |
|                     |                                       |   | 1.95 V          | 175                  |      |      |      |
|                     |                                       |   | 2.7 V           | 275                  |      |      |      |
| I <sub>BHHO</sub> # | V <sub>I</sub> = 0 to V <sub>CC</sub> |   | 1.3 V           | -75                  |      |      | μA   |
|                     |                                       |   | 1.6 V           | -125                 |      |      |      |
|                     |                                       |   | 1.95 V          | -175                 |      |      |      |
|                     |                                       |   | 2.7 V           | -275                 |      |      |      |
| I <sub>off</sub>    |                                       | V <sub>I</sub> or V <sub>O</sub> = 2.7 V                    | 0               |                      |      | ±10  | μA   |
| I <sub>OZ</sub>     |                                       | 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           | 3                    | 4    |      | pF   |
| C <sub>o</sub>      |                                       | V <sub>O</sub> = V <sub>CC</sub> or GND                     | 2.5 V           | 5.5                  | 6    |      | pF   |

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

‡ The bus-hold circuit can sink at least the minimum low sustaining current at V<sub>IL</sub> max. I<sub>BHL</sub> should be measured after lowering V<sub>IN</sub> to GND and then raising it to V<sub>IL</sub> max.

§ The bus-hold circuit can source at least the minimum high sustaining current at V<sub>IH</sub> min. I<sub>BHH</sub> should be measured after raising V<sub>IN</sub> to V<sub>CC</sub> and then lowering it to V<sub>IH</sub> min.

¶ An external driver must source at least I<sub>BHLO</sub> to switch this node from low to high.

# An external driver must sink at least I<sub>BHHO</sub> to switch this node from high to low.



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**switching characteristics over recommended operating free-air temperature range,  $C_L = 15$  pF (unless otherwise noted) (see Figure 1)**

| PARAMETER | FROM (INPUT)    | TO (OUTPUT) | $V_{CC} = 0.8$ V | $V_{CC} = 1.2$ V<br>$\pm 0.1$ V |     | $V_{CC} = 1.5$ V<br>$\pm 0.1$ V |     | $V_{CC} = 1.8$ V<br>$\pm 0.15$ V |     |     | $V_{CC} = 2.5$ V<br>$\pm 0.2$ V |     | UNIT |
|-----------|-----------------|-------------|------------------|---------------------------------|-----|---------------------------------|-----|----------------------------------|-----|-----|---------------------------------|-----|------|
|           |                 |             | TYP              | MIN                             | MAX | MIN                             | MAX | MIN                              | TYP | MAX | MIN                             | MAX |      |
| $t_{pd}$  | A               | Y           | 4.8              | 1.2                             | 3.3 | 0.8                             | 2   | 0.7                              | 1.1 | 1.7 | 0.6                             | 1.3 | ns   |
| $t_{en}$  | $\overline{OE}$ | Y           | 6.4              | 1.4                             | 4   | 0.9                             | 2.6 | 0.8                              | 1.2 | 2.1 | 0.7                             | 1.5 | ns   |
| $t_{dis}$ | $\overline{OE}$ | Y           | 8.7              | 2                               | 5.8 | 1.8                             | 3.9 | 1.8                              | 2.5 | 4   | 0.3                             | 3   | ns   |

**switching characteristics over recommended operating free-air temperature range,  $C_L = 30$  pF (unless otherwise noted) (see Figure 1)**

| PARAMETER | FROM (INPUT)    | TO (OUTPUT) | $V_{CC} = 1.8$ V<br>$\pm 0.15$ V |     |     | $V_{CC} = 2.5$ V<br>$\pm 0.2$ V |     | UNIT |
|-----------|-----------------|-------------|----------------------------------|-----|-----|---------------------------------|-----|------|
|           |                 |             | MIN                              | TYP | MAX | MIN                             | MAX |      |
| $t_{pd}$  | A               | Y           | 1                                | 1.4 | 2.1 | 0.9                             | 1.6 | ns   |
| $t_{en}$  | $\overline{OE}$ | Y           | 1.1                              | 1.7 | 2.7 | 1                               | 2   | ns   |
| $t_{dis}$ | $\overline{OE}$ | Y           | 1.9                              | 2.5 | 4   | 1                               | 2   | ns   |

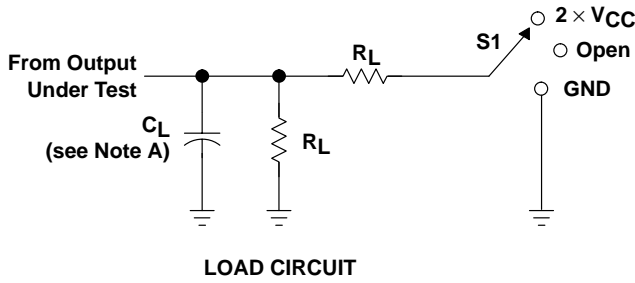
**operating characteristics,  $T_A = 25^\circ\text{C}$**

| PARAMETER |                               | TEST CONDITIONS               | $V_{CC} = 0.8$ V | $V_{CC} = 1.2$ V | $V_{CC} = 1.5$ V | $V_{CC} = 1.8$ V | $V_{CC} = 2.5$ V | UNIT |
|-----------|-------------------------------|-------------------------------|------------------|------------------|------------------|------------------|------------------|------|
|           |                               |                               | TYP              | TYP              | TYP              | TYP              | TYP              |      |
| $C_{pd}$  | Power dissipation capacitance | Outputs enabled<br>f = 10 MHz | 21               | 21               | 22               | 23               | 27               | pF   |
|           | Outputs disabled              |                               | 3                | 3                | 3                | 4                | 6                |      |

# SN74AUCH240 OCTAL BUFFER/DRIVER WITH 3-STATE OUTPUTS

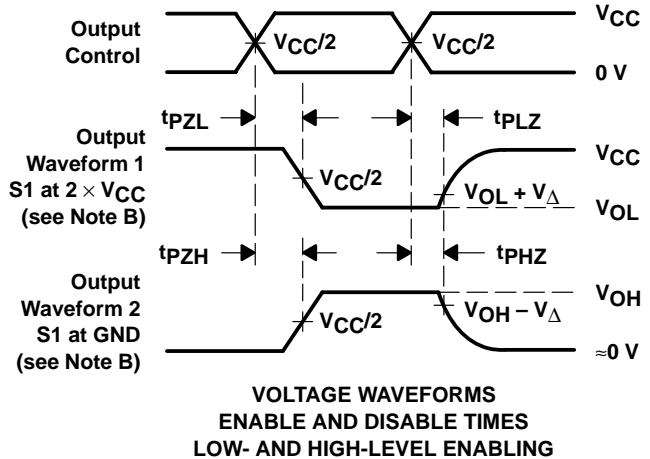
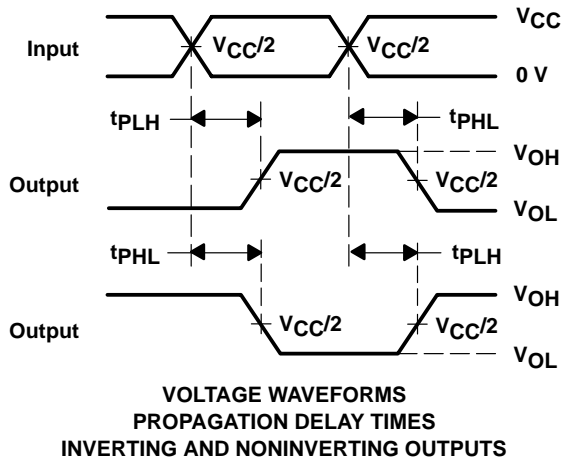
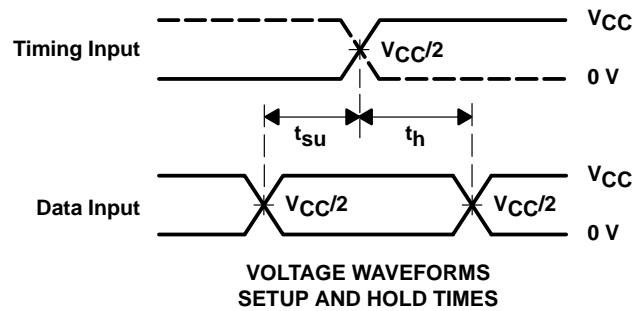
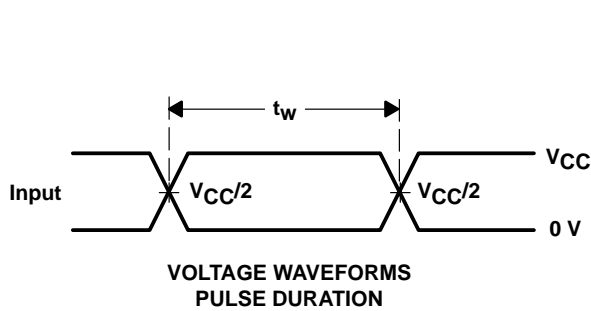
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## PARAMETER MEASUREMENT INFORMATION



| 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       |

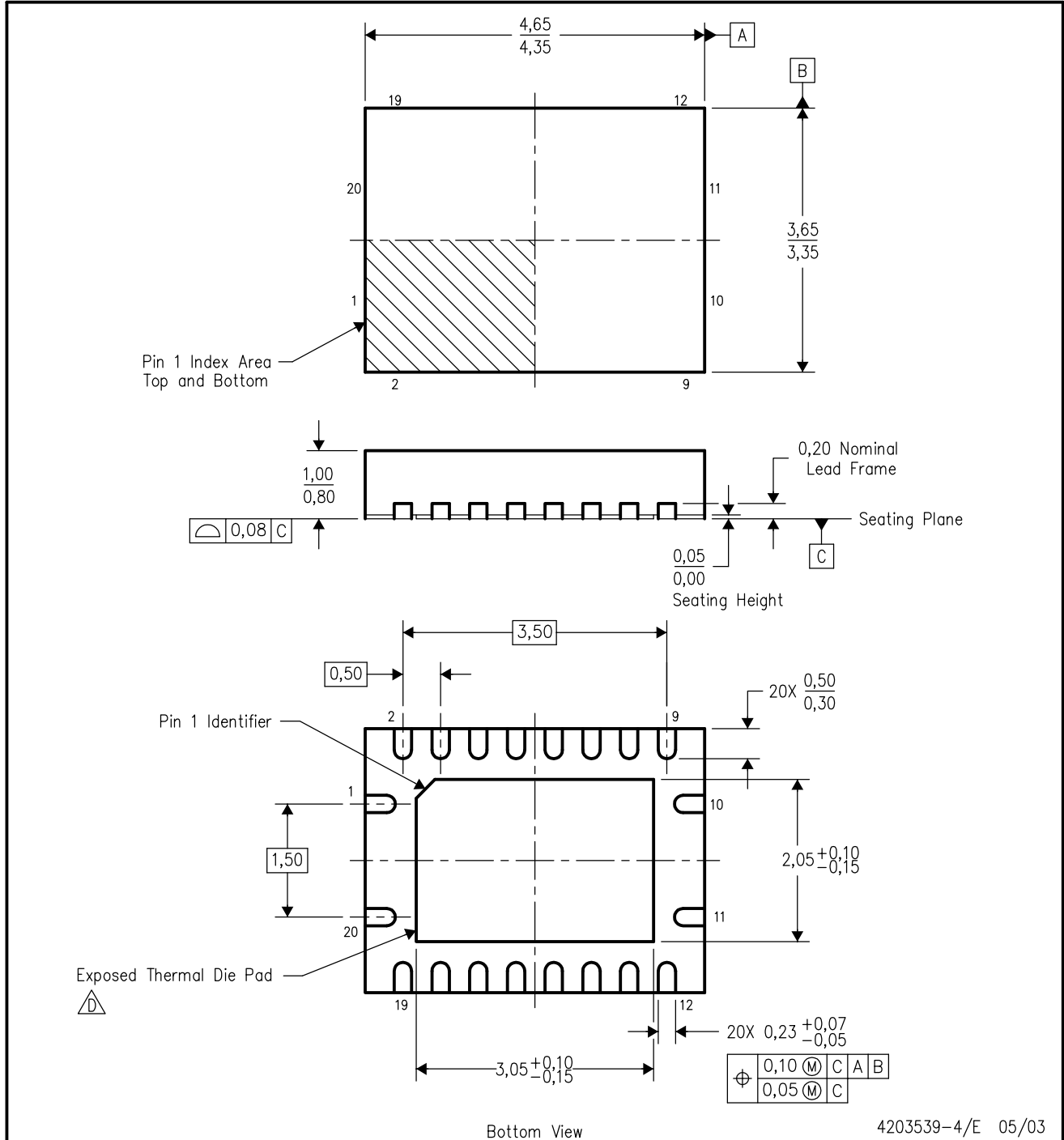



- NOTES:
- $C_L$  includes probe and jig capacitance.
  - Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
  - All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  10 MHz,  $Z_O = 50 \Omega$ , slew rate  $\geq 1$  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  $t_{pd}$ .
  - All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

RGY (R-PQFP-N20)

PLASTIC QUAD FLATPACK



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. QFN (Quad Flatpack No-Lead) package configuration.
  -  The package thermal performance may be enhanced by bonding the thermal die pad to an external thermal plane. This pad is electrically and thermally connected to the backside of the die and possibly selected ground leads.
  - E. Package complies to JEDEC MO-241 variation BC.

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