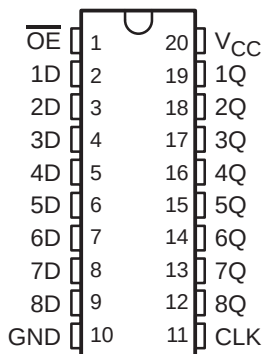


# SN54LV574A, SN74LV574A OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

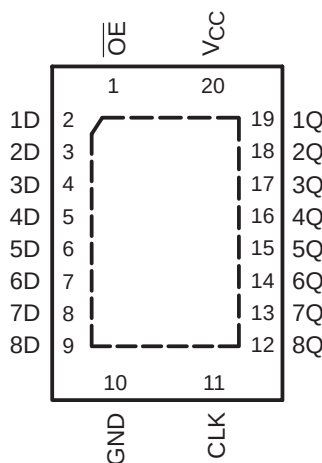
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- 2-V to 5.5-V  $V_{CC}$  Operation
- Max  $t_{pd}$  of 10 ns at 5 V
- Typical  $V_{OLP}$  (Output Ground Bounce)  $<0.8$  V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- Typical  $V_{OHV}$  (Output  $V_{OH}$  Undershoot)  $>2.3$  V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- Support Mixed-Mode Voltage Operation on All Ports
- $I_{off}$  Supports Partial-Power-Down Mode Operation
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

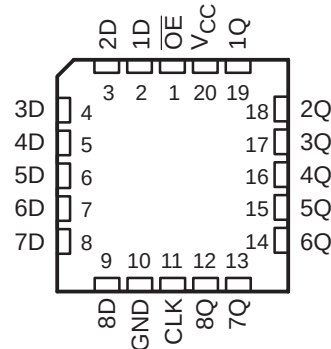
SN54LV574A . . . J OR W PACKAGE  
SN74LV574A . . . DB, DGV, DW, NS,  
OR PW PACKAGE  
(TOP VIEW)



SN74LV574A . . . RGY PACKAGE  
(TOP VIEW)



SN54LV574A . . . FK PACKAGE  
(TOP VIEW)



## description/ordering information

### ORDERING INFORMATION

| $T_A$          | PACKAGE†    |              | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|-------------|--------------|-----------------------|------------------|
| –40°C to 85°C  | QFN – RGY   | Reel of 1000 | SN74LV574ARGYR        | LV574A           |
|                | SOIC – DW   | Tube of 25   | SN74LV574ADW          | LV574A           |
|                |             | Reel of 2000 | SN74LV574ADWR         |                  |
|                | SOP – NS    | Reel of 2000 | SN74LV574ANSR         | 74LV574A         |
|                | SSOP – DB   | Reel of 2000 | SN74LV574ADBR         | LV574A           |
|                | TSSOP – PW  | Tube of 70   | SN74LV574APW          | LV574A           |
|                |             | Reel of 2000 | SN74LV574APWR         |                  |
|                |             | Reel of 250  | SN74LV574APWT         |                  |
| –55°C to 125°C | TVSOP – DGV | Reel of 2000 | SN74LV574ADGVR        | LV574A           |
|                | VFBGA – GQN | Reel of 1000 | SN74LV574AGQNR        | LV574A           |
|                | CDIP – J    | Tube of 20   | SNJ54LV574AJ          | SNJ54LV574AJ     |
|                | CFP – W     | Tube of 85   | SNJ54LV574AW          | SNJ54LV574AW     |
|                | LCCC – FK   | Tube of 55   | SNJ54LV574AFK         | SNJ54LV574AFK    |

† 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  
INSTRUMENTS**

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SN54LV574A, SN74LV574A  
OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS  
WITH 3-STATE OUTPUTS

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description/ordering information (continued)

The 'LV574A devices are octal edge-triggered D-type flip-flops designed for 2-V to 5.5-V  $V_{CC}$  operation.

These devices feature 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. The devices are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

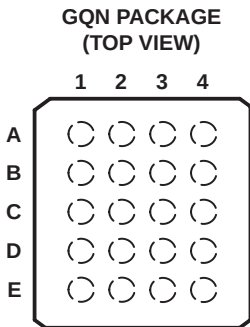
On the positive transition of the clock (CLK) input, the Q outputs are set to the logic levels set up at the data (D) inputs.

A buffered output-enable ( $\overline{OE}$ ) input can be used to place the eight outputs in either a normal logic state (high or low logic levels) or high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased drive provide the capability to drive bus lines without need for interface or pullup components.

$\overline{OE}$  does not affect the internal operations of the flip-flops. Old data can be retained or new data can be entered while 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.

These devices are fully specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the devices when they are powered down.



terminal assignments

|   | 1   | 2               | 3        | 4  |
|---|-----|-----------------|----------|----|
| A | 1D  | $\overline{OE}$ | $V_{CC}$ | 1Q |
| B | 3D  | 3Q              | 2D       | 2Q |
| C | 5D  | 4D              | 5Q       | 4Q |
| D | 7D  | 7Q              | 6D       | 6Q |
| E | GND | 8D              | CLK      | 8Q |

FUNCTION TABLE  
(each flip-flop)

| INPUTS          |        |   | OUTPUT<br>Q |
|-----------------|--------|---|-------------|
| $\overline{OE}$ | CLK    | D |             |
| L               | ↑      | H | H           |
| L               | ↑      | L | L           |
| L               | H or L | X | $Q_0$       |
| H               | X      | X | Z           |

## SCLS412G – APRIL 1998 – REVISED AUGUST 2003

# SN54LV574A, SN74LV574A

## OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS

### WITH 3-STATE OUTPUTS

SCLS412G – APRIL 1998 – REVISED AUGUST 2003

#### recommended operating conditions (see Note 5)

|                 |                                    |                                  | SN54LV574A            |                 | SN74LV574A            |                 | UNIT |
|-----------------|------------------------------------|----------------------------------|-----------------------|-----------------|-----------------------|-----------------|------|
|                 |                                    |                                  | MIN                   | MAX             | MIN                   | MAX             |      |
| V <sub>CC</sub> | Supply voltage                     |                                  | 2                     | 5.5             | 2                     | 5.5             | V    |
| V <sub>IH</sub> | High-level input voltage           | V <sub>CC</sub> = 2 V            | 1.5                   |                 | 1.5                   |                 | V    |
|                 |                                    | V <sub>CC</sub> = 2.3 V to 2.7 V | V <sub>CC</sub> × 0.7 |                 | V <sub>CC</sub> × 0.7 |                 |      |
|                 |                                    | V <sub>CC</sub> = 3 V to 3.6 V   | V <sub>CC</sub> × 0.7 |                 | V <sub>CC</sub> × 0.7 |                 |      |
|                 |                                    | V <sub>CC</sub> = 4.5 V to 5.5 V | V <sub>CC</sub> × 0.7 |                 | V <sub>CC</sub> × 0.7 |                 |      |
| V <sub>IL</sub> | Low-level input voltage            | V <sub>CC</sub> = 2 V            | 0.5                   |                 | 0.5                   |                 | V    |
|                 |                                    | V <sub>CC</sub> = 2.3 V to 2.7 V | V <sub>CC</sub> × 0.3 |                 | V <sub>CC</sub> × 0.3 |                 |      |
|                 |                                    | V <sub>CC</sub> = 3 V to 3.6 V   | V <sub>CC</sub> × 0.3 |                 | V <sub>CC</sub> × 0.3 |                 |      |
|                 |                                    | V <sub>CC</sub> = 4.5 V to 5.5 V | V <sub>CC</sub> × 0.3 |                 | V <sub>CC</sub> × 0.3 |                 |      |
| V <sub>I</sub>  | Input voltage                      |                                  | 0                     | 5.5             | 0                     | 5.5             | V    |
| V <sub>O</sub>  | Output voltage                     | High or low state                | 0                     | V <sub>CC</sub> | 0                     | V <sub>CC</sub> | V    |
|                 |                                    | 3-state                          | 0                     | 5.5             | 0                     | 5.5             |      |
| I <sub>OH</sub> | High-level output current          | V <sub>CC</sub> = 2 V            | −50                   |                 | −50                   |                 | μA   |
|                 |                                    | V <sub>CC</sub> = 2.3 V to 2.7 V | −2                    |                 | −2                    |                 | mA   |
|                 |                                    | V <sub>CC</sub> = 3 V to 3.6 V   | −8                    |                 | −8                    |                 |      |
|                 |                                    | V <sub>CC</sub> = 4.5 V to 5.5 V | −16                   |                 | −16                   |                 |      |
| I <sub>OL</sub> | Low-level output current           | V <sub>CC</sub> = 2 V            | 50                    |                 | 50                    |                 | μA   |
|                 |                                    | V <sub>CC</sub> = 2.3 V to 2.7 V | 2                     |                 | 2                     |                 | mA   |
|                 |                                    | V <sub>CC</sub> = 3 V to 3.6 V   | 8                     |                 | 8                     |                 |      |
|                 |                                    | V <sub>CC</sub> = 4.5 V to 5.5 V | 16                    |                 | 16                    |                 |      |
| Δt/Δv           | Input transition rise or fall rate | V <sub>CC</sub> = 2.3 V to 2.7 V | 200                   |                 | 200                   |                 | ns/V |
|                 |                                    | V <sub>CC</sub> = 3 V to 3.6 V   | 100                   |                 | 100                   |                 |      |
|                 |                                    | V <sub>CC</sub> = 4.5 V to 5.5 V | 20                    |                 | 20                    |                 |      |
| T <sub>A</sub>  | Operating free-air temperature     |                                  | −55                   | 125             | −40                   | 85              | °C   |

NOTE 5: All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

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

| PARAMETER        | TEST CONDITIONS                                             | V <sub>CC</sub> | SN54LV574A           |     |     | SN74LV574A           |     |     | UNIT |
|------------------|-------------------------------------------------------------|-----------------|----------------------|-----|-----|----------------------|-----|-----|------|
|                  |                                                             |                 | MIN                  | TYP | MAX | MIN                  | TYP | MAX |      |
| V <sub>OH</sub>  | I <sub>OH</sub> = −50 μA                                    | 2 V to 5.5 V    | V <sub>CC</sub> −0.1 |     |     | V <sub>CC</sub> −0.1 |     |     | V    |
|                  | I <sub>OH</sub> = −2 mA                                     | 2.3 V           | 2                    |     |     | 2                    |     |     |      |
|                  | I <sub>OH</sub> = −8 mA                                     | 3 V             | 2.48                 |     |     | 2.48                 |     |     |      |
|                  | I <sub>OH</sub> = −16 mA                                    | 4.5 V           | 3.8                  |     |     | 3.8                  |     |     |      |
| V <sub>OL</sub>  | I <sub>OL</sub> = 50 μA                                     | 2 V to 5.5 V    | 0.1                  |     |     | 0.1                  |     |     | V    |
|                  | I <sub>OL</sub> = 2 mA                                      | 2.3 V           | 0.4                  |     |     | 0.4                  |     |     |      |
|                  | I <sub>OL</sub> = 8 mA                                      | 3 V             | 0.44                 |     |     | 0.44                 |     |     |      |
|                  | I <sub>OL</sub> = 16 mA                                     | 4.5 V           | 0.55                 |     |     | 0.55                 |     |     |      |
| I <sub>I</sub>   | V <sub>I</sub> = 5.5 V or GND                               | 0 to 5.5 V      | ±1                   |     |     | ±1                   |     |     | μA   |
| I <sub>OZ</sub>  | V <sub>O</sub> = V <sub>CC</sub> or GND                     | 5.5 V           | ±5                   |     |     | ±5                   |     |     | μA   |
| I <sub>CC</sub>  | V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0 | 5.5 V           | 20                   |     |     | 20                   |     |     | μA   |
| I <sub>off</sub> | V <sub>I</sub> or V <sub>O</sub> = 0 to 5.5 V               | 0               | 5                    |     |     | 5                    |     |     | μA   |
| C <sub>i</sub>   | V <sub>I</sub> = V <sub>CC</sub> or GND                     | 3.3 V           | 1.8                  |     |     | 1.8                  |     |     | pF   |

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# SN54LV574A, SN74LV574A

## OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS

### WITH 3-STATE OUTPUTS

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timing requirements over recommended operating free-air temperature range,  $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$  (unless otherwise noted) (see Figure 1)

| PARAMETER |                |                                   | $T_A = 25^\circ\text{C}$ |     | SN54LV574A |     | SN74LV574A |     | UNIT |
|-----------|----------------|-----------------------------------|--------------------------|-----|------------|-----|------------|-----|------|
|           |                |                                   | MIN                      | MAX | MIN        | MAX | MIN        | MAX |      |
| $t_W$     | Pulse duration | CLK high or low                   | 7                        |     | 7          |     | 7          |     | ns   |
| $t_{SU}$  | Setup time     | High or low before CLK $\uparrow$ | 5.5                      |     | 5.5        |     | 5.5        |     | ns   |
| $t_H$     | Hold time      | Data after CLK $\uparrow$         | 2                        |     | 2          |     | 2          |     | ns   |

timing requirements over recommended operating free-air temperature range,  $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$  (unless otherwise noted) (see Figure 1)

| PARAMETER |                |                                   | $T_A = 25^\circ\text{C}$ |     | SN54LV574A |     | SN74LV574A |     | UNIT |
|-----------|----------------|-----------------------------------|--------------------------|-----|------------|-----|------------|-----|------|
|           |                |                                   | MIN                      | MAX | MIN        | MAX | MIN        | MAX |      |
| $t_W$     | Pulse duration | CLK high or low                   | 5                        |     | 5          |     | 5          |     | ns   |
| $t_{SU}$  | Setup time     | High or low before CLK $\uparrow$ | 3.5                      |     | 3.5        |     | 3.5        |     | ns   |
| $t_H$     | Hold time      | Data after CLK $\uparrow$         | 1.5                      |     | 1.5        |     | 1.5        |     | ns   |

timing requirements over recommended operating free-air temperature range,  $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$  (unless otherwise noted) (see Figure 1)

| PARAMETER |                |                                   | $T_A = 25^\circ\text{C}$ |     | SN54LV574A |     | SN74LV574A |     | UNIT |
|-----------|----------------|-----------------------------------|--------------------------|-----|------------|-----|------------|-----|------|
|           |                |                                   | MIN                      | MAX | MIN        | MAX | MIN        | MAX |      |
| $t_W$     | Pulse duration | CLK high or low                   | 5                        |     | 5          |     | 5          |     | ns   |
| $t_{SU}$  | Setup time     | High or low before CLK $\uparrow$ | 3.5                      |     | 3.5        |     | 3.5        |     | ns   |
| $t_H$     | Hold time      | Data after CLK $\uparrow$         | 1.5                      |     | 1.5        |     | 1.5        |     | ns   |

switching characteristics over recommended operating free-air temperature range,  $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$  (unless otherwise noted) (see Figure 1)

| PARAMETER   | FROM (INPUT)    | TO (OUTPUT) | LOAD CAPACITANCE     | $T_A = 25^\circ\text{C}$ |       |     | SN54LV574A |     | SN74LV574A |     | UNIT |
|-------------|-----------------|-------------|----------------------|--------------------------|-------|-----|------------|-----|------------|-----|------|
|             |                 |             |                      | MIN                      | TYP   | MAX | MIN        | MAX | MIN        | MAX |      |
| $f_{max}$   |                 |             | $C_L = 15\text{ pF}$ | 60*                      | 100*  |     | 50*        |     | 50         |     | MHz  |
|             |                 |             | $C_L = 50\text{ pF}$ | 50                       | 85    |     | 40         |     | 40         |     |      |
| $t_{pd}$    | CLK             | Q           | $C_L = 15\text{ pF}$ | 9.6*                     | 16.6* |     | 1*         | 20* | 1          | 20  | ns   |
| $t_{en}$    | $\overline{OE}$ | Q           |                      | 9.2*                     | 16.1* |     | 1*         | 19* | 1          | 19  |      |
| $t_{dis}$   | $\overline{OE}$ | Q           |                      | 6.5*                     | 12.8* |     | 1*         | 15* | 1          | 15  |      |
| $t_{pd}$    | CLK             | Q           | $C_L = 50\text{ pF}$ | 11.6                     | 19.6  |     | 1          | 23  | 1          | 23  | ns   |
| $t_{en}$    | $\overline{OE}$ | Q           |                      | 10.9                     | 19    |     | 1          | 22  | 1          | 22  |      |
| $t_{dis}$   | $\overline{OE}$ | Q           |                      | 8.4                      | 17.5  |     | 1          | 20  | 1          | 20  |      |
| $t_{sk(o)}$ |                 |             |                      |                          | 2     |     |            |     |            | 2   |      |

\* On products compliant to MIL-PRF-38535, this parameter is not production tested.

# SN54LV574A, SN74LV574A

## OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS

### WITH 3-STATE OUTPUTS

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switching characteristics over recommended operating free-air temperature range,  
 $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$  (unless otherwise noted) (see Figure 1)

| PARAMETER          | FROM<br>(INPUT)        | TO<br>(OUTPUT) | LOAD<br>CAPACITANCE  | $T_A = 25^\circ\text{C}$ |       |     | SN54LV574A |       | SN74LV574A |      | UNIT |
|--------------------|------------------------|----------------|----------------------|--------------------------|-------|-----|------------|-------|------------|------|------|
|                    |                        |                |                      | MIN                      | TYP   | MAX | MIN        | MAX   | MIN        | MAX  |      |
| $f_{\text{max}}$   |                        |                | $C_L = 15\text{ pF}$ | 80*                      | 145*  |     | 65*        |       | 65         |      | MHz  |
|                    |                        |                | $C_L = 50\text{ pF}$ | 50                       | 120   |     | 45         |       | 45         |      |      |
| $t_{\text{pd}}$    | CLK                    | Q              | $C_L = 15\text{ pF}$ | 6.8*                     | 13.2* |     | 1*         | 15.5* | 1          | 15.5 | ns   |
| $t_{\text{en}}$    | $\overline{\text{OE}}$ | Q              |                      | 6.4*                     | 12.8* |     | 1*         | 15*   | 1          | 15   |      |
| $t_{\text{dis}}$   | $\overline{\text{OE}}$ | Q              |                      | 4.8*                     | 13*   |     | 1*         | 15*   | 1          | 15   |      |
| $t_{\text{pd}}$    | CLK                    | Q              | $C_L = 50\text{ pF}$ | 8.1                      | 16.7  |     | 1          | 19    | 1          | 19   | ns   |
| $t_{\text{en}}$    | $\overline{\text{OE}}$ | Q              |                      | 7.7                      | 16.3  |     | 1          | 18.5  | 1          | 18.5 |      |
| $t_{\text{dis}}$   | $\overline{\text{OE}}$ | Q              |                      | 6.1                      | 15    |     | 1          | 17    | 1          | 17   |      |
| $t_{\text{sk(o)}}$ |                        |                |                      |                          | 1.5   |     |            |       |            | 1.5  |      |

\* On products compliant to MIL-PRF-38535, this parameter is not production tested.

switching characteristics over recommended operating free-air temperature range,  
 $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$  (unless otherwise noted) (see Figure 1)

| PARAMETER          | FROM<br>(INPUT)        | TO<br>(OUTPUT) | LOAD<br>CAPACITANCE  | $T_A = 25^\circ\text{C}$ |      |     | SN54LV574A |       | SN74LV574A |      | UNIT |
|--------------------|------------------------|----------------|----------------------|--------------------------|------|-----|------------|-------|------------|------|------|
|                    |                        |                |                      | MIN                      | TYP  | MAX | MIN        | MAX   | MIN        | MAX  |      |
| $f_{\text{max}}$   |                        |                | $C_L = 15\text{ pF}$ | 130*                     | 205* |     | 110*       |       | 110        |      | MHz  |
|                    |                        |                | $C_L = 50\text{ pF}$ | 85                       | 175  |     | 75         |       | 75         |      |      |
| $t_{\text{pd}}$    | CLK                    | Q              | $C_L = 15\text{ pF}$ | 4.8*                     | 8.6* |     | 1*         | 10*   | 1          | 10   | ns   |
| $t_{\text{en}}$    | $\overline{\text{OE}}$ | Q              |                      | 4.6*                     | 9*   |     | 1*         | 10.5* | 1          | 10.5 |      |
| $t_{\text{dis}}$   | $\overline{\text{OE}}$ | Q              |                      | 3.5*                     | 9*   |     | 1*         | 10.5* | 1          | 10.5 |      |
| $t_{\text{pd}}$    | CLK                    | Q              | $C_L = 50\text{ pF}$ | 5.7                      | 10.6 |     | 1          | 12    | 1          | 12   | ns   |
| $t_{\text{en}}$    | $\overline{\text{OE}}$ | Q              |                      | 5.5                      | 11   |     | 1          | 12.5  | 1          | 12.5 |      |
| $t_{\text{dis}}$   | $\overline{\text{OE}}$ | Q              |                      | 4.1                      | 10.1 |     | 1          | 11.5  | 1          | 11.5 |      |
| $t_{\text{sk(o)}}$ |                        |                |                      |                          | 1    |     |            |       |            | 1    |      |

\* On products compliant to MIL-PRF-38535, this parameter is not production tested.

noise characteristics,  $V_{CC} = 3.3\text{ V}$ ,  $C_L = 50\text{ pF}$ ,  $T_A = 25^\circ\text{C}$  (see Note 6)

| PARAMETER          |                                               | SN74LV574A |      |      | UNIT |
|--------------------|-----------------------------------------------|------------|------|------|------|
|                    |                                               | MIN        | TYP  | MAX  |      |
| $V_{\text{OL(P)}}$ | Quiet output, maximum dynamic $V_{\text{OL}}$ |            | 0.7  | 0.8  | V    |
| $V_{\text{OL(V)}}$ | Quiet output, minimum dynamic $V_{\text{OL}}$ |            | –0.6 | –0.8 | V    |
| $V_{\text{OH(V)}}$ | Quiet output, minimum dynamic $V_{\text{OH}}$ |            | 2.8  |      | V    |
| $V_{\text{IH(D)}}$ | High-level dynamic input voltage              | 2.31       |      |      | V    |
| $V_{\text{IL(D)}}$ | Low-level dynamic input voltage               |            | 0.99 |      | V    |

NOTE 6: Characteristics are for surface-mount packages only.

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

| PARAMETER       |                               | TEST CONDITIONS |                                            | $V_{CC}$ | TYP  | UNIT |
|-----------------|-------------------------------|-----------------|--------------------------------------------|----------|------|------|
| $C_{\text{pd}}$ | Power dissipation capacitance | Outputs enabled | $C_L = 50\text{ pF}$ , $f = 10\text{ MHz}$ | 3.3 V    | 20.4 | pF   |
|                 |                               |                 |                                            | 5 V      | 23.8 |      |

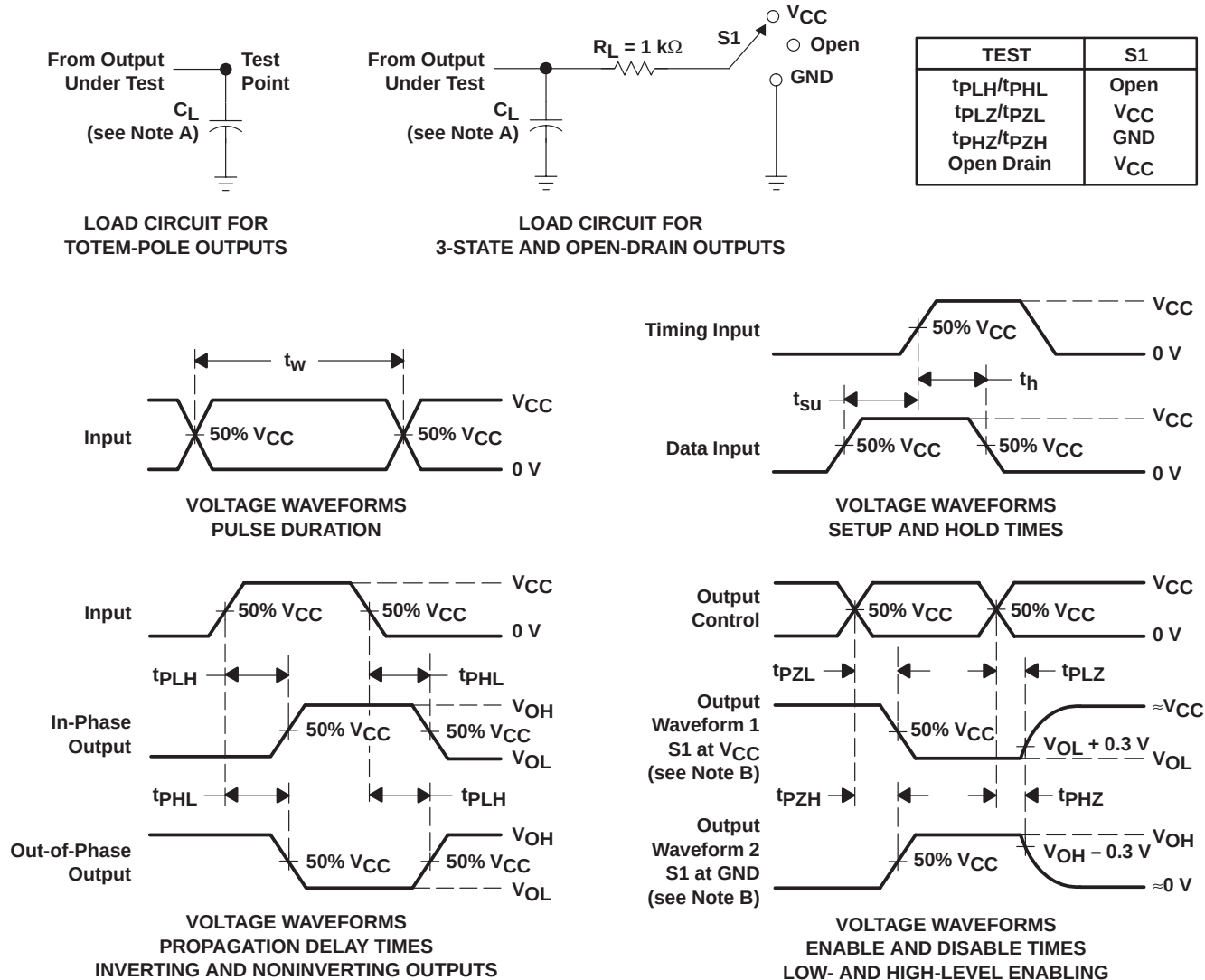
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# SN54LV574A, SN74LV574A OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

SCLS412G – APRIL 1998 – REVISED AUGUST 2003

## PARAMETER MEASUREMENT INFORMATION

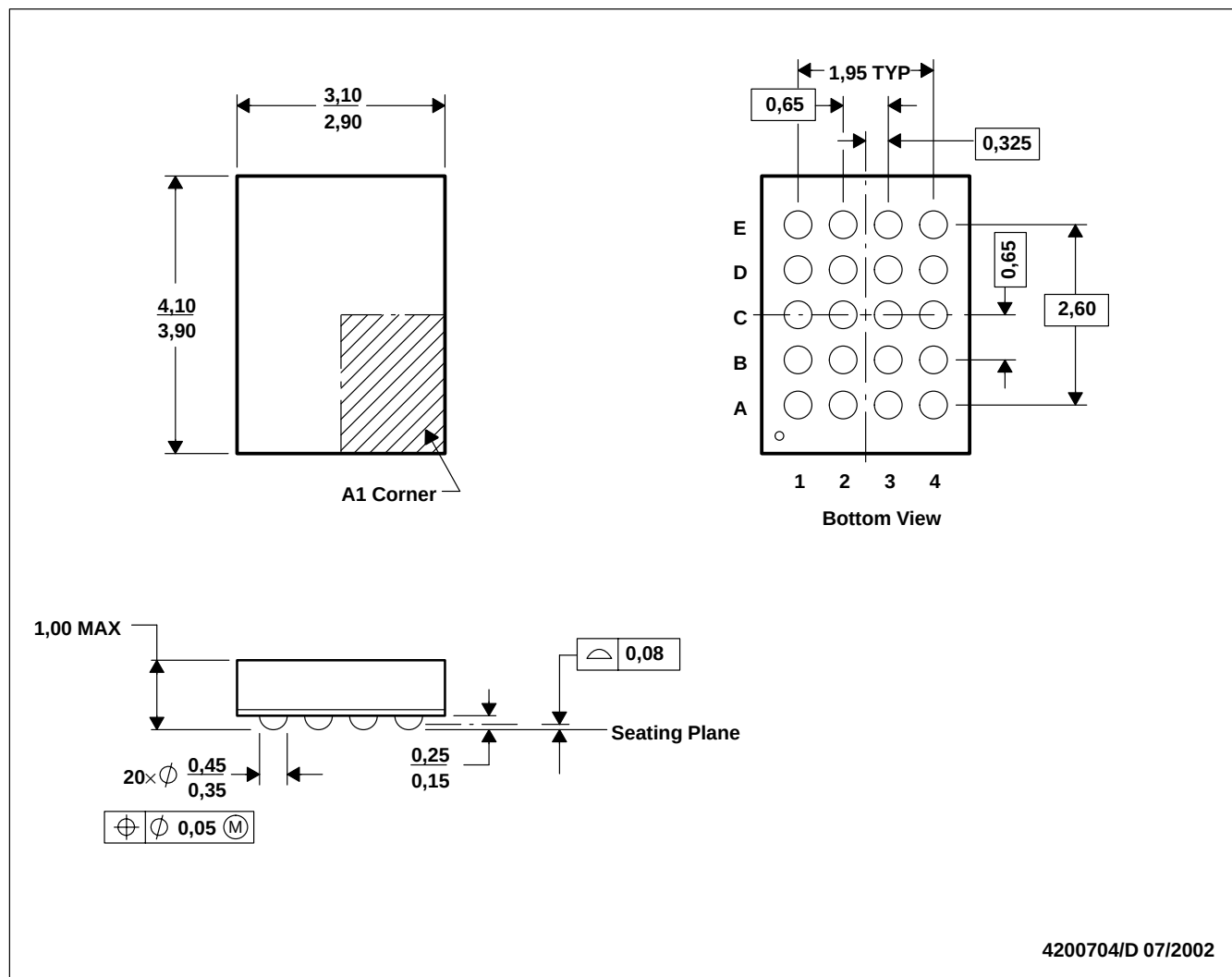


- NOTES: A.  $C_L$  includes probe and jig capacitance.
- B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
- C. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1\text{ MHz}$ ,  $Z_O = 50\ \Omega$ ,  $t_r \leq 3\text{ ns}$ ,  $t_f \leq 3\text{ ns}$ .
- D. The outputs are measured one at a time with one input 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.  $t_{PHL}$  and  $t_{PLH}$  are the same as  $t_{pd}$ .
- H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

## 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. MicroStar Junior™ configuration  
 D. Falls within JEDEC MO-225 variation BC.  
 E. This package is tin-lead (SnPb). Refer to the 20 ZQN package (drawing 4204492) for lead-free.

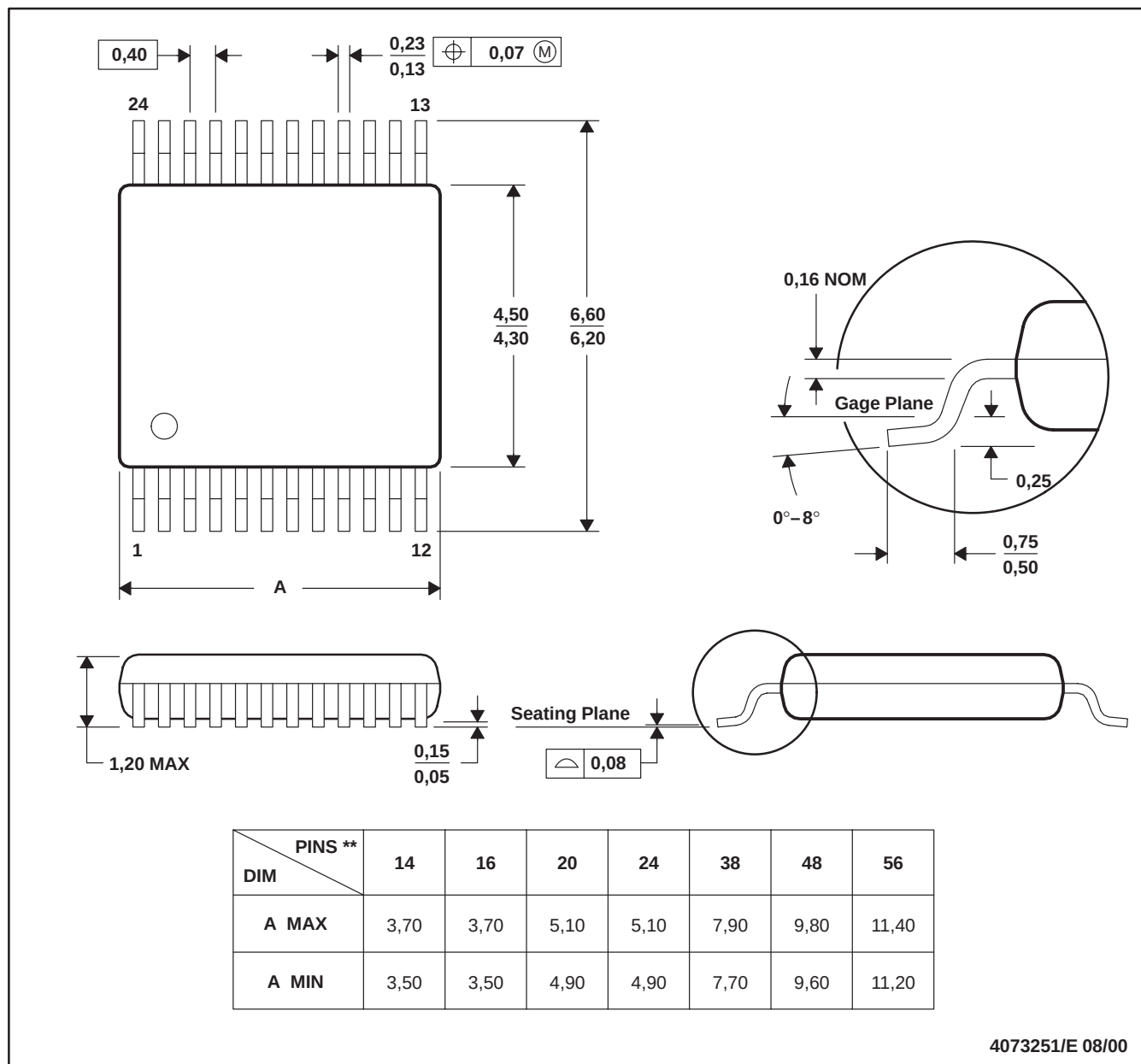
MicroStar Junior is a trademark of Texas Instruments.



## DGV (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE

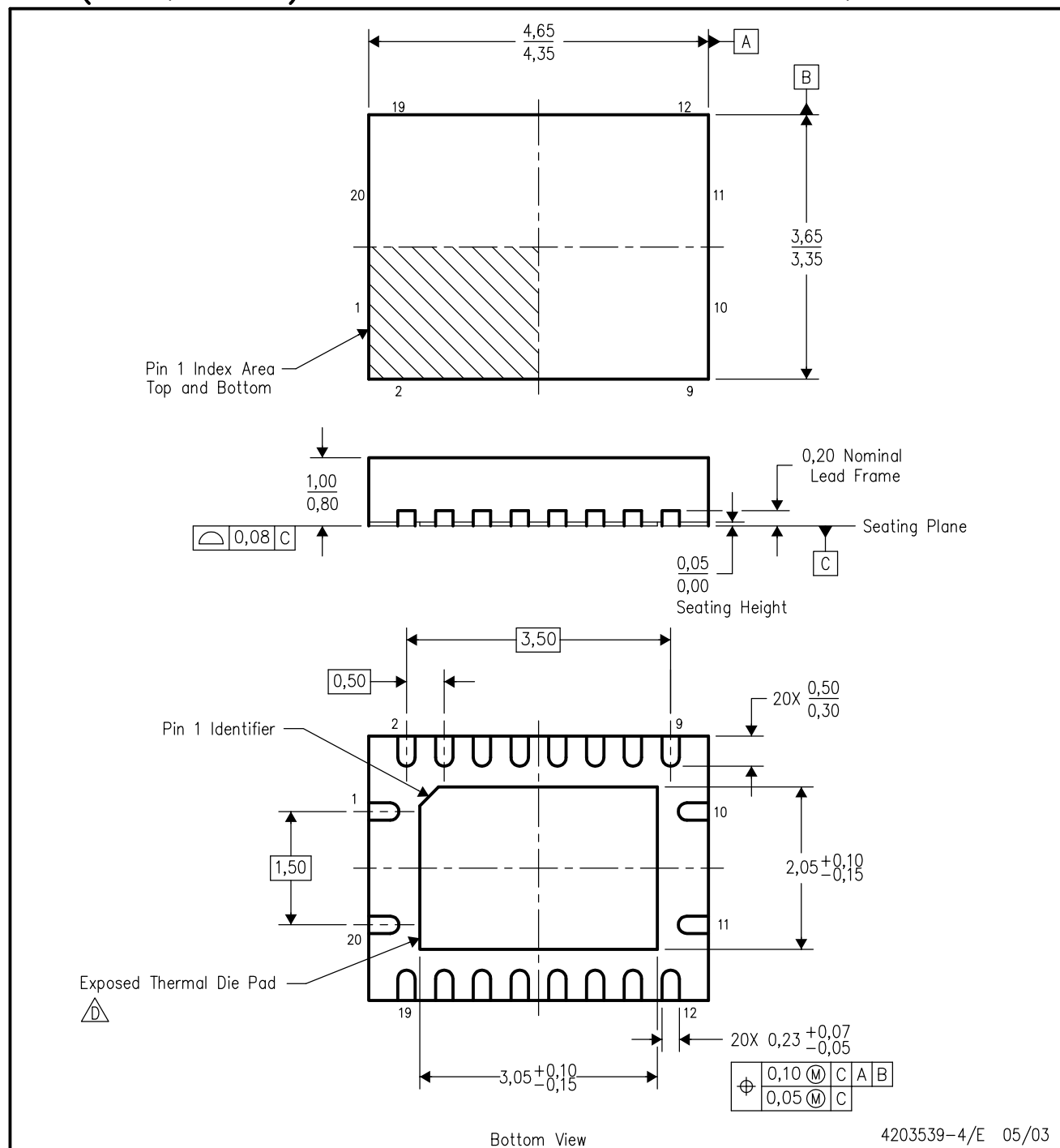
24 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.  
 D. Falls within JEDEC: 24/48 Pins – MO-153  
 14/16/20/56 Pins – MO-194

RGY (R-PQFP-N20)

PLASTIC QUAD FLATPACK

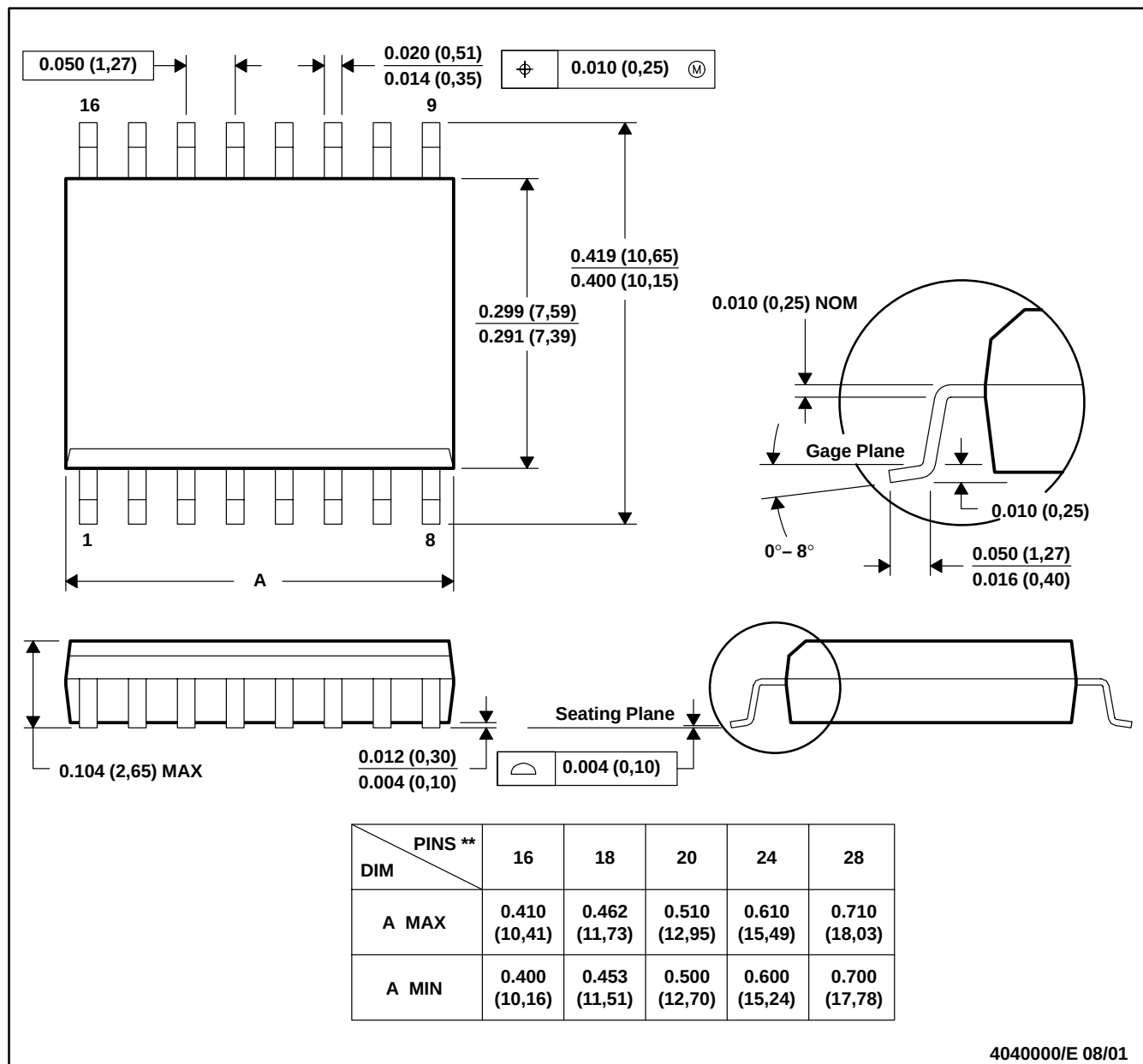


- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - QFN (Quad Flatpack No-Lead) package configuration.
  - The package thermal performance may be enhanced by bonding the thermal die pad to an external thermal plane. This pad is electrically and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

## DW (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE PACKAGE

16 PINS SHOWN



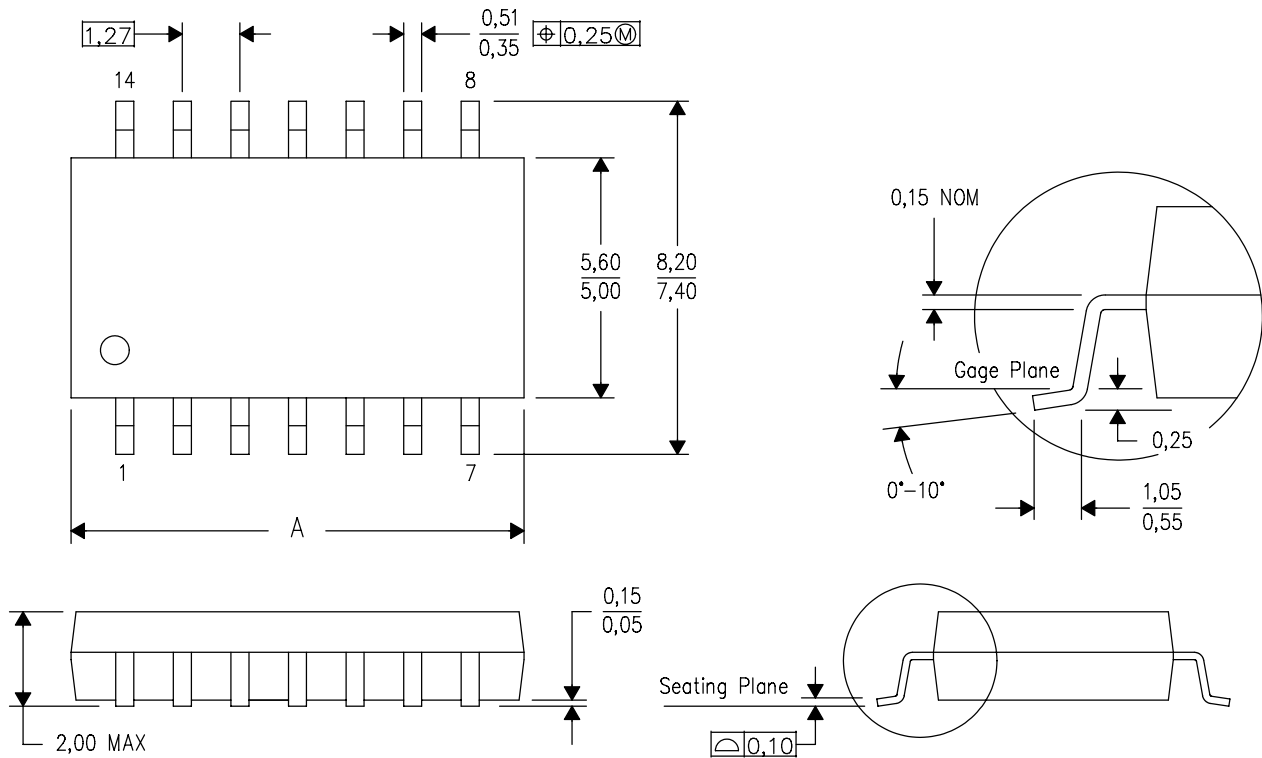
- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).  
 D. Falls within JEDEC MS-013

# MECHANICAL DATA

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

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



| DIM \ PINS ** | 14    | 16    | 20    | 24    |
|---------------|-------|-------|-------|-------|
| A MAX         | 10,50 | 10,50 | 12,90 | 15,30 |
| A MIN         | 9,90  | 9,90  | 12,30 | 14,70 |

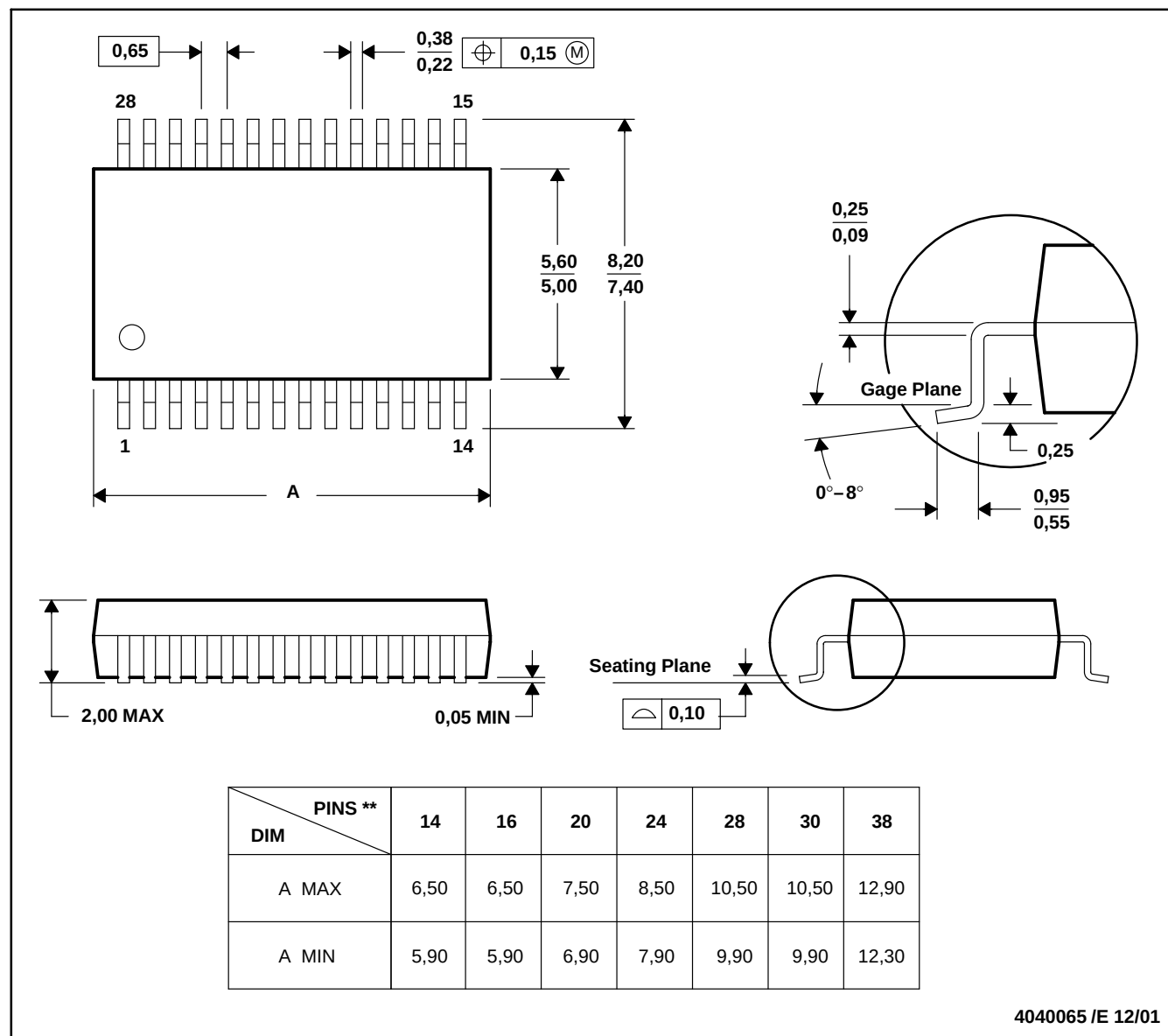
4040062/C 03/03

- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

## DB (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE

28 PINS SHOWN

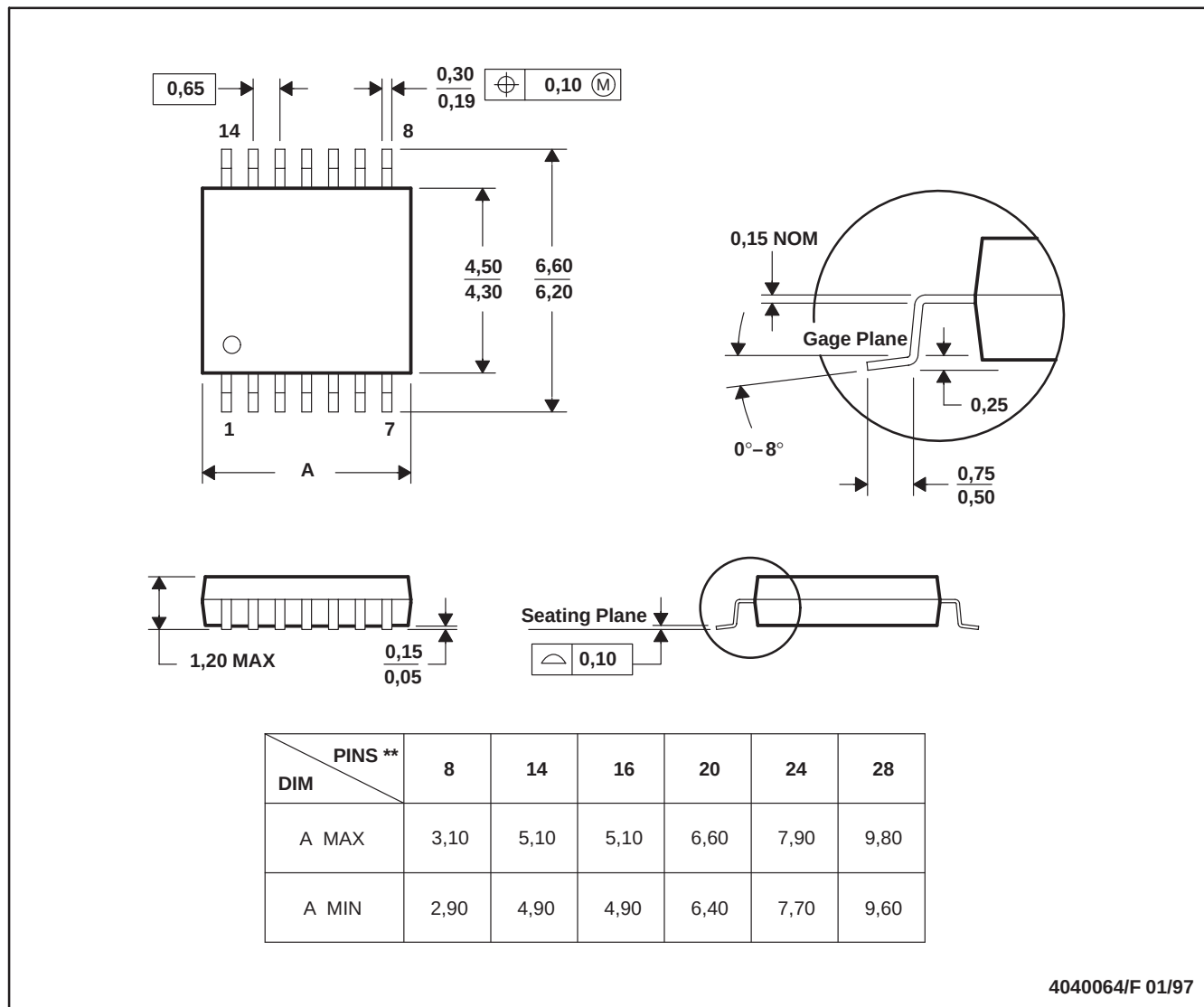


- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion not to exceed 0,15.
  - Falls within JEDEC MO-150

## PW (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-153

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