

# SN54LV4051A, SN74LV4051A 8-CHANNEL ANALOG MULTIPLEXERS/DEMULTIPLEXERS

SCLS428H – MAY 1999 – REVISED APRIL 2005

- 2-V to 5.5-V  $V_{CC}$  Operation
- Support Mixed-Mode Voltage Operation on All Ports
- High On-Off Output-Voltage Ratio
- Low Crosstalk Between Switches
- Individual Switch Controls
- Extremely Low Input Current
- 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)

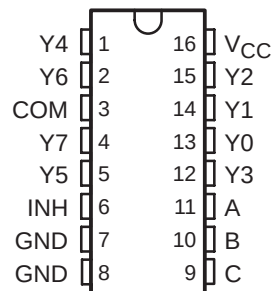
## description/ordering information

These 8-channel CMOS analog multiplexers/demultiplexers are designed for 2-V to 5.5-V  $V_{CC}$  operation.

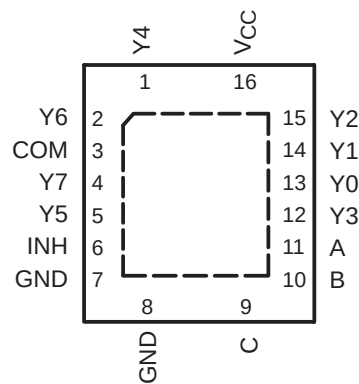
The 'LV4051A devices handle both analog and digital signals. Each channel permits signals with amplitudes up to 5.5 V (peak) to be transmitted in either direction.

Applications include signal gating, chopping, modulation or demodulation (modem), and signal multiplexing for analog-to-digital and digital-to-analog conversion systems.

SN54LV4051A . . . J OR W PACKAGE  
SN74LV4051A . . . D, DB, DGV, N, NS, OR PW PACKAGE  
(TOP VIEW)



SN74LV4051A . . . RGY PACKAGE  
(TOP VIEW)



## ORDERING INFORMATION

| $T_A$          | PACKAGE†    |              | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|-------------|--------------|-----------------------|------------------|
| –40°C to 85°C  | PDIP – N    | Tube of 25   | SN74LV4051AN          | SN74LV4051AN     |
|                | QFN – RGY   | Reel of 1000 | SN74LV4051ARGYR       | LW051A           |
|                | SOIC – D    | Tube of 40   | SN74LV4051AD          | LV4051A          |
|                |             | Reel of 2500 | SN74LV4051ADR         |                  |
|                | SOP – NS    | Reel of 2000 | SN74LV4051ANSR        | 74LV4051A        |
|                | SSOP – DB   | Reel of 2000 | SN74LV4051ADBR        | LW051A           |
|                | TSSOP – PW  | Tube of 90   | SN74LV4051APW         | LW051A           |
|                |             | Reel of 2000 | SN74LV4051APWR        |                  |
|                |             | Reel of 250  | SN74LV4051APWT        |                  |
| –55°C to 125°C | TVSOP – DGV | Reel of 2000 | SN74LV4051ADGVR       | LW051A           |
|                | CDIP – J    | Tube of 25   | SNJ54LV4051AJ         | SNJ54LV4051AJ    |
|                | CFP – W     | Tube of 150  | SNJ54LV4051AW         | SNJ54LV4051AW    |

† 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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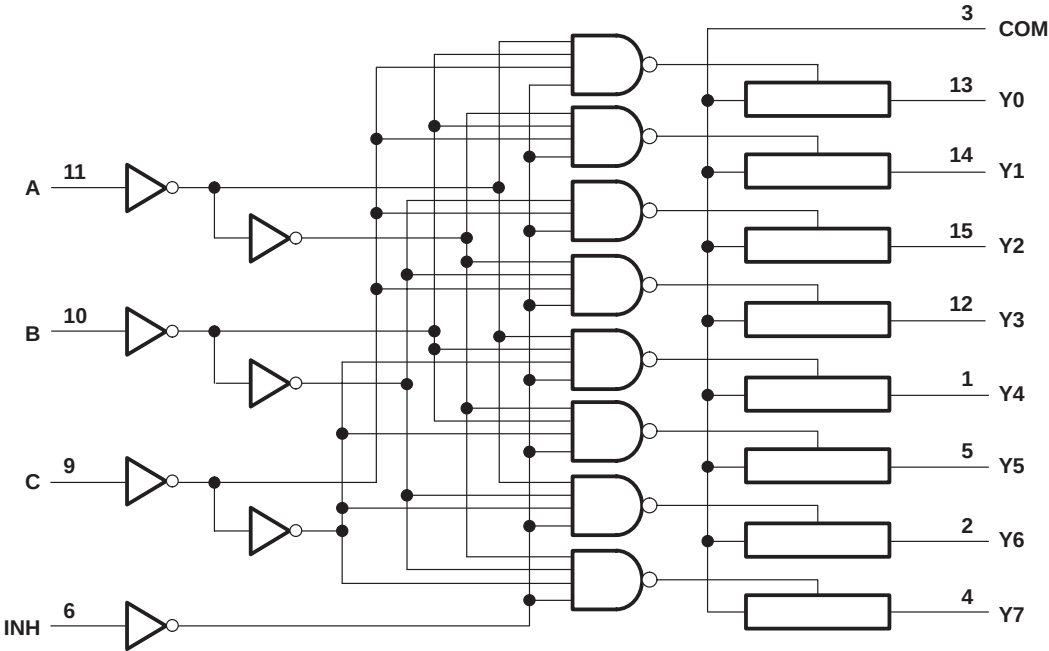
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SN54LV4051A, SN74LV4051A  
8-CHANNEL ANALOG MULTIPLEXERS/DEMULTIPLEXERS

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| FUNCTION TABLE |   |   |   |            |
|----------------|---|---|---|------------|
| INPUTS         |   |   |   | ON CHANNEL |
| INH            | C | B | A |            |
| L              | L | L | L | Y0         |
| L              | L | L | H | Y1         |
| L              | L | H | L | Y2         |
| L              | L | H | H | Y3         |
| L              | H | L | L | Y4         |
| L              | H | L | H | Y5         |
| L              | H | H | L | Y6         |
| L              | H | H | H | Y7         |
| H              | X | X | X | None       |

logic diagram (positive logic)



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## 8-CHANNEL ANALOG MULTIPLEXERS/DEMULTIPLEXERS

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

|                                                                  |                            |
|------------------------------------------------------------------|----------------------------|
| Supply voltage range, $V_{CC}$                                   | –0.5 V to 7.0 V            |
| Input voltage range, $V_I$ (see Note 1)                          | –0.5 V to 7.0 V            |
| Switch I/O voltage range, $V_{IO}$ (see Notes 1 and 2)           | –0.5 V to $V_{CC} + 0.5$ V |
| Input clamp current, $I_{IK}$ ( $V_I < 0$ )                      | –20 mA                     |
| I/O diode current, $I_{IOK}$ ( $V_{IO} < 0$ )                    | –50 mA                     |
| Switch through current, $I_T$ ( $V_{IO} = 0$ to $V_{CC}$ )       | ±25 mA                     |
| Continuous current through $V_{CC}$ or GND                       | ±50 mA                     |
| Package thermal impedance, $\theta_{JA}$ (see Note 3): D package | 73°C/W                     |
| (see Note 3): DB package                                         | 82°C/W                     |
| (see Note 3): DGV package                                        | 120°C/W                    |
| (see Note 3): N package                                          | 67°C/W                     |
| (see Note 3): NS package                                         | 64°C/W                     |
| (see Note 3): PW package                                         | 108°C/W                    |
| (see Note 4): RGY package                                        | 39°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 and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.
  2. This value is limited to 5.5 V maximum.
  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 (see Note 5)

|                     |                                          | SN54LV4051A               |                     | SN74LV4051A         |          | UNIT |
|---------------------|------------------------------------------|---------------------------|---------------------|---------------------|----------|------|
|                     |                                          | MIN                       | MAX                 | MIN                 | MAX      |      |
| $V_{CC}$            | Supply voltage                           | 2 <sup>‡</sup>            | 5.5                 | 2 <sup>‡</sup>      | 5.5      | V    |
| $V_{IH}$            | High-level input voltage, control inputs | $V_{CC} = 2$ V            | 1.5                 | 1.5                 |          | V    |
|                     |                                          | $V_{CC} = 2.3$ V to 2.7 V | $V_{CC} \times 0.7$ | $V_{CC} \times 0.7$ |          |      |
|                     |                                          | $V_{CC} = 3$ V to 3.6 V   | $V_{CC} \times 0.7$ | $V_{CC} \times 0.7$ |          |      |
|                     |                                          | $V_{CC} = 4.5$ V to 5.5 V | $V_{CC} \times 0.7$ | $V_{CC} \times 0.7$ |          |      |
| $V_{IL}$            | Low-level input voltage, control inputs  | $V_{CC} = 2$ V            | 0.5                 | 0.5                 |          | V    |
|                     |                                          | $V_{CC} = 2.3$ V to 2.7 V | $V_{CC} \times 0.3$ | $V_{CC} \times 0.3$ |          |      |
|                     |                                          | $V_{CC} = 3$ V to 3.6 V   | $V_{CC} \times 0.3$ | $V_{CC} \times 0.3$ |          |      |
|                     |                                          | $V_{CC} = 4.5$ V to 5.5 V | $V_{CC} \times 0.3$ | $V_{CC} \times 0.3$ |          |      |
| $V_I$               | Control input voltage                    | 0                         | 5.5                 | 0                   | 5.5      | V    |
| $V_{IO}$            | Input/output voltage                     | 0                         | $V_{CC}$            | 0                   | $V_{CC}$ | V    |
| $\Delta t/\Delta v$ | Input transition rise or fall rate       | $V_{CC} = 2.3$ V to 2.7 V | 200                 | 200                 |          | ns/V |
|                     |                                          | $V_{CC} = 3$ V to 3.6 V   | 100                 | 100                 |          |      |
|                     |                                          | $V_{CC} = 4.5$ V to 5.5 V | 20                  | 20                  |          |      |
| $T_A$               | Operating free-air temperature           | –55                       | 125                 | –40                 | 85       | °C   |

<sup>‡</sup> With supply voltages at or near 2 V, the analog switch on-state resistance becomes very nonlinear. It is recommended that only digital signals be transmitted at these low supply voltages.

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

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## 8-CHANNEL ANALOG MULTIPLEXERS/DEMULTIPLEXERS

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

| PARAMETER                                                           | TEST CONDITIONS                                                                                                                                                             | V <sub>CC</sub> | T <sub>A</sub> = 25°C |      |      | SN54LV4051A |     | SN74LV4051A |     | UNIT |
|---------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------------------|------|------|-------------|-----|-------------|-----|------|
|                                                                     |                                                                                                                                                                             |                 | MIN                   | TYP  | MAX  | MIN         | MAX | MIN         | MAX |      |
| r <sub>on</sub> On-state switch resistance                          | I <sub>T</sub> = 2 mA,<br>V <sub>I</sub> = V <sub>CC</sub> or GND,<br>V <sub>INH</sub> = V <sub>IL</sub><br>(see Figure 1)                                                  | 2.3 V           |                       | 38   | 180  |             | 225 |             | 225 | Ω    |
|                                                                     |                                                                                                                                                                             | 3 V             |                       | 30   | 150  |             | 190 |             | 190 |      |
|                                                                     |                                                                                                                                                                             | 4.5 V           |                       | 22   | 75   |             | 100 |             | 100 |      |
| r <sub>on(p)</sub> Peak on-state resistance                         | I <sub>T</sub> = 2 mA,<br>V <sub>I</sub> = V <sub>CC</sub> to GND,<br>V <sub>INH</sub> = V <sub>IL</sub>                                                                    | 2.3 V           |                       | 113  | 500  |             | 600 |             | 600 | Ω    |
|                                                                     |                                                                                                                                                                             | 3 V             |                       | 54   | 180  |             | 225 |             | 225 |      |
|                                                                     |                                                                                                                                                                             | 4.5 V           |                       | 31   | 100  |             | 125 |             | 125 |      |
| Δr <sub>on</sub> Difference in on-state resistance between switches | I <sub>T</sub> = 2 mA,<br>V <sub>I</sub> = V <sub>CC</sub> to GND,<br>V <sub>INH</sub> = V <sub>IL</sub>                                                                    | 2.3 V           |                       | 2.1  | 30   |             | 40  |             | 40  | Ω    |
|                                                                     |                                                                                                                                                                             | 3 V             |                       | 1.4  | 20   |             | 30  |             | 30  |      |
|                                                                     |                                                                                                                                                                             | 4.5 V           |                       | 1.3  | 15   |             | 20  |             | 20  |      |
| I <sub>I</sub> Control input current                                | V <sub>I</sub> = 5.5 V or GND                                                                                                                                               | 0 to 5.5 V      |                       |      | ±0.1 |             | ±1  |             | ±1  | μA   |
| I <sub>S(off)</sub> Off-state switch leakage current                | V <sub>I</sub> = V <sub>CC</sub> and V <sub>O</sub> = GND, or V <sub>I</sub> = GND and V <sub>O</sub> = V <sub>CC</sub> , V <sub>INH</sub> = V <sub>IH</sub> (see Figure 2) | 5.5 V           |                       |      | ±0.1 |             | ±1  |             | ±1  | μA   |
| I <sub>S(on)</sub> On-state switch leakage current                  | V <sub>I</sub> = V <sub>CC</sub> or GND, V <sub>INH</sub> = V <sub>IL</sub> (see Figure 3)                                                                                  | 5.5 V           |                       |      | ±0.1 |             | ±1  |             | ±1  | μA   |
| I <sub>CC</sub> Supply current                                      | V <sub>I</sub> = V <sub>CC</sub> or GND                                                                                                                                     | 5.5 V           |                       |      |      |             | 20  |             | 20  | μA   |
| C <sub>IC</sub> Control input capacitance                           | f = 10 MHz                                                                                                                                                                  | 3.3 V           |                       | 2    |      |             |     |             |     | pF   |
| C <sub>IS</sub> Common terminal capacitance                         |                                                                                                                                                                             | 3.3 V           |                       | 23.4 |      |             |     |             |     | pF   |
| C <sub>OS</sub> Switch terminal capacitance                         |                                                                                                                                                                             | 3.3 V           |                       | 5.7  |      |             |     |             |     | pF   |
| C <sub>F</sub> Feedthrough capacitance                              |                                                                                                                                                                             | 3.3 V           |                       | 0.5  |      |             |     |             |     | pF   |

switching characteristics over recommended operating free-air temperature range, V<sub>CC</sub> = 2.5 V ± 0.2 V (unless otherwise noted)

| PARAMETER                               | FROM (INPUT)          | TO (OUTPUT)           | TEST CONDITIONS                        | T <sub>A</sub> = 25°C |      |     | SN54LV4051A |     | SN74LV4051A |     | UNIT |
|-----------------------------------------|-----------------------|-----------------------|----------------------------------------|-----------------------|------|-----|-------------|-----|-------------|-----|------|
|                                         |                       |                       |                                        | MIN                   | TYP  | MAX | MIN         | MAX | MIN         | MAX |      |
| t <sub>PLH</sub> Propagation delay time | COM or Y <sub>n</sub> | Y <sub>n</sub> or COM | C <sub>L</sub> = 15 pF, (see Figure 4) |                       | 1.9  | 10  |             | 16  |             | 16  | ns   |
| t <sub>PZH</sub> Enable delay time      | INH                   | COM or Y <sub>n</sub> | C <sub>L</sub> = 15 pF, (see Figure 5) |                       | 6.6  | 18  |             | 23  |             | 23  | ns   |
| t <sub>PZL</sub> Disable delay time     | INH                   | COM or Y <sub>n</sub> | C <sub>L</sub> = 15 pF, (see Figure 5) |                       | 7.4  | 18  |             | 23  |             | 23  | ns   |
| t <sub>PHZ</sub> Propagation delay time | COM or Y <sub>n</sub> | Y <sub>n</sub> or COM | C <sub>L</sub> = 50 pF, (see Figure 5) |                       | 3.8  | 12  |             | 18  |             | 18  | ns   |
| t <sub>PZH</sub> Enable delay time      | INH                   | COM or Y <sub>n</sub> | C <sub>L</sub> = 50 pF, (see Figure 5) |                       | 7.8  | 28  |             | 35  |             | 35  | ns   |
| t <sub>PZL</sub> Disable delay time     | INH                   | COM or Y <sub>n</sub> | C <sub>L</sub> = 50 pF, (see Figure 5) |                       | 11.5 | 28  |             | 35  |             | 35  | ns   |

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# SN54LV4051A, SN74LV4051A

## 8-CHANNEL ANALOG MULTIPLEXERS/DEMULTIPLEXERS

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**switching characteristics over recommended operating free-air temperature range,  
V<sub>CC</sub> = 3.3 V ± 0.3 V (unless otherwise noted)**

| PARAMETER                            | FROM<br>(INPUT)           | TO<br>(OUTPUT)        | TEST<br>CONDITIONS    | T <sub>A</sub> = 25°C                     |     |     | SN54LV4051A |     | SN74LV4051A |     | UNIT |
|--------------------------------------|---------------------------|-----------------------|-----------------------|-------------------------------------------|-----|-----|-------------|-----|-------------|-----|------|
|                                      |                           |                       |                       | MIN                                       | TYP | MAX | MIN         | MAX | MIN         | MAX |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation<br>delay time | COM or Y <sub>n</sub> | Y <sub>n</sub> or COM | C <sub>L</sub> = 15 pF,<br>(see Figure 4) |     |     | 1.2         |     | 6           |     | ns   |
| t <sub>PZH</sub><br>t <sub>PZL</sub> | Enable<br>delay time      | INH                   | COM or Y <sub>n</sub> | C <sub>L</sub> = 15 pF,<br>(see Figure 5) |     |     | 4.7         |     | 12          |     | ns   |
| t <sub>PHZ</sub><br>t <sub>PLZ</sub> | Disable<br>delay time     | INH                   | COM or Y <sub>n</sub> | C <sub>L</sub> = 15 pF,<br>(see Figure 5) |     |     | 5.7         |     | 12          |     | ns   |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation<br>delay time | COM or Y <sub>n</sub> | Y <sub>n</sub> or COM | C <sub>L</sub> = 50 pF,<br>(see Figure 4) |     |     | 2.5         |     | 9           |     | ns   |
| t <sub>PZH</sub><br>t <sub>PZL</sub> | Enable<br>delay time      | INH                   | COM or Y <sub>n</sub> | C <sub>L</sub> = 50 pF,<br>(see Figure 5) |     |     | 5.5         |     | 20          |     | ns   |
| t <sub>PHZ</sub><br>t <sub>PLZ</sub> | Disable<br>delay time     | INH                   | COM or Y <sub>n</sub> | C <sub>L</sub> = 50 pF,<br>(see Figure 5) |     |     | 8.8         |     | 20          |     | ns   |

**switching characteristics over recommended operating free-air temperature range,  
V<sub>CC</sub> = 5 V ± 0.5 V (unless otherwise noted)**

| PARAMETER                            | FROM<br>(INPUT)           | TO<br>(OUTPUT)        | TEST<br>CONDITIONS    | T <sub>A</sub> = 25°C                     |     |     | SN54LV4051A |     | SN74LV4051A |     | UNIT |
|--------------------------------------|---------------------------|-----------------------|-----------------------|-------------------------------------------|-----|-----|-------------|-----|-------------|-----|------|
|                                      |                           |                       |                       | MIN                                       | TYP | MAX | MIN         | MAX | MIN         | MAX |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation<br>delay time | COM or Y <sub>n</sub> | Y <sub>n</sub> or COM | C <sub>L</sub> = 15 pF,<br>(see Figure 4) |     |     | 0.6         |     | 4           |     | ns   |
| t <sub>PZH</sub><br>t <sub>PZL</sub> | Enable<br>delay time      | INH                   | COM or Y <sub>n</sub> | C <sub>L</sub> = 15 pF,<br>(see Figure 5) |     |     | 3.5         |     | 8           |     | ns   |
| t <sub>PHZ</sub><br>t <sub>PLZ</sub> | Disable<br>delay time     | INH                   | COM or Y <sub>n</sub> | C <sub>L</sub> = 15 pF,<br>(see Figure 5) |     |     | 4.4         |     | 8           |     | ns   |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation<br>delay time | COM or Y <sub>n</sub> | Y <sub>n</sub> or COM | C <sub>L</sub> = 50 pF,<br>(see Figure 4) |     |     | 1.5         |     | 6           |     | ns   |
| t <sub>PZH</sub><br>t <sub>PZL</sub> | Enable<br>delay time      | INH                   | COM or Y <sub>n</sub> | C <sub>L</sub> = 50 pF,<br>(see Figure 5) |     |     | 4           |     | 14          |     | ns   |
| t <sub>PHZ</sub><br>t <sub>PLZ</sub> | Disable<br>delay time     | INH                   | COM or Y <sub>n</sub> | C <sub>L</sub> = 50 pF,<br>(see Figure 5) |     |     | 6.2         |     | 14          |     | ns   |

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## 8-CHANNEL ANALOG MULTIPLEXERS/DEMULTIPLEXERS

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

| PARAMETER                                  | FROM (INPUT)          | TO (OUTPUT)           | TEST CONDITIONS                                                                                                        | V <sub>CC</sub>                       | T <sub>A</sub> = 25°C |     |     | UNIT |
|--------------------------------------------|-----------------------|-----------------------|------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-----------------------|-----|-----|------|
|                                            |                       |                       |                                                                                                                        |                                       | MIN                   | TYP | MAX |      |
| Frequency response (switch on)             | COM or Y <sub>n</sub> | Y <sub>n</sub> or COM | C <sub>L</sub> = 50 pF,<br>R <sub>L</sub> = 600 Ω,<br>f <sub>IN</sub> = 1 MHz (sine wave)<br>(see Note 6 and Figure 6) | 2.3 V                                 |                       | 20  |     | MHz  |
|                                            |                       |                       |                                                                                                                        | 3 V                                   |                       | 25  |     |      |
|                                            |                       |                       |                                                                                                                        | 4.5 V                                 |                       | 35  |     |      |
| Crosstalk (control input to signal output) | INH                   | COM or Y <sub>n</sub> | C <sub>L</sub> = 50 pF,<br>R <sub>L</sub> = 600 Ω,<br>f <sub>IN</sub> = 1 MHz (square wave)<br>(see Figure 7)          | 2.3 V                                 |                       | 20  |     | mV   |
|                                            |                       |                       |                                                                                                                        | 3 V                                   |                       | 35  |     |      |
|                                            |                       |                       |                                                                                                                        | 4.5 V                                 |                       | 60  |     |      |
| Feedthrough attenuation (switch off)       | COM or Y <sub>n</sub> | Y <sub>n</sub> or COM | C <sub>L</sub> = 50 pF,<br>R <sub>L</sub> = 600 Ω,<br>f <sub>IN</sub> = 1 MHz<br>(see Note 7 and Figure 8)             | 2.3 V                                 |                       | –45 |     | dB   |
|                                            |                       |                       |                                                                                                                        | 3 V                                   |                       | –45 |     |      |
|                                            |                       |                       |                                                                                                                        | 4.5 V                                 |                       | –45 |     |      |
| Sine-wave distortion                       | COM or Y <sub>n</sub> | Y <sub>n</sub> or COM | C <sub>L</sub> = 50 pF,<br>R <sub>L</sub> = 10 kΩ,<br>f <sub>IN</sub> = 1 kHz (sine wave)<br>(see Figure 9)            | V <sub>I</sub> = 2 V <sub>p-p</sub>   | 2.3 V                 |     | 0.1 | %    |
|                                            |                       |                       |                                                                                                                        | V <sub>I</sub> = 2.5 V <sub>p-p</sub> | 3 V                   |     | 0.1 |      |
|                                            |                       |                       |                                                                                                                        | V <sub>I</sub> = 4 V <sub>p-p</sub>   | 4.5 V                 |     | 0.1 |      |

NOTES: 6. Adjust f<sub>IN</sub> voltage to obtain 0-dBm output. Increase f<sub>IN</sub> frequency until dB meter reads –3 dB.  
7. Adjust f<sub>IN</sub> voltage to obtain 0-dBm input.

operating characteristics, V<sub>CC</sub> = 3.3 V, T<sub>A</sub> = 25°C

| PARAMETER                                     | TEST CONDITIONS                    | TYP | UNIT |
|-----------------------------------------------|------------------------------------|-----|------|
| C <sub>pd</sub> Power dissipation capacitance | C <sub>L</sub> = 50 pF, f = 10 MHz | 5.9 | pF   |

### PARAMETER MEASUREMENT INFORMATION

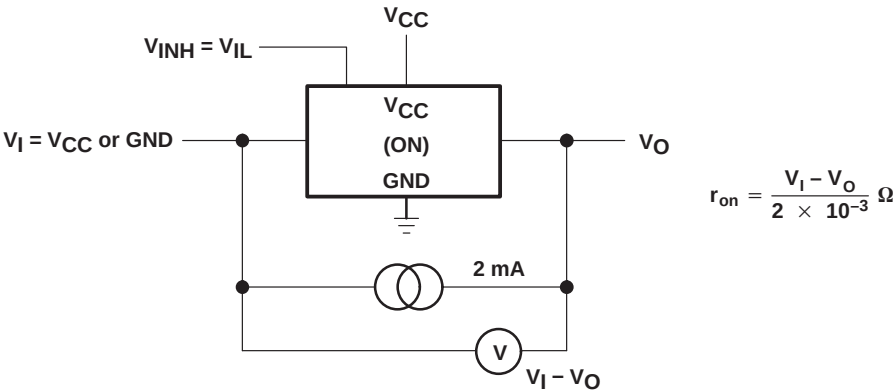
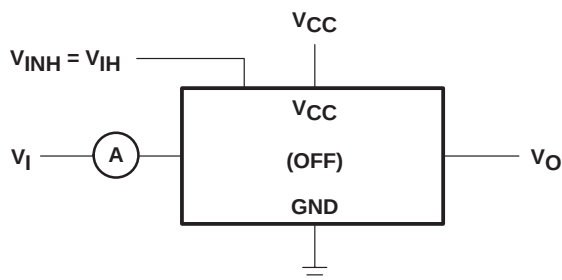


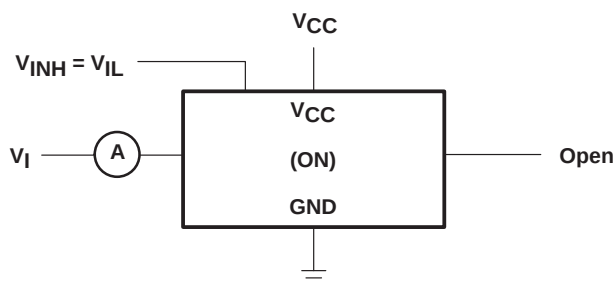
Figure 1. On-State Resistance Test Circuit

### PARAMETER MEASUREMENT INFORMATION



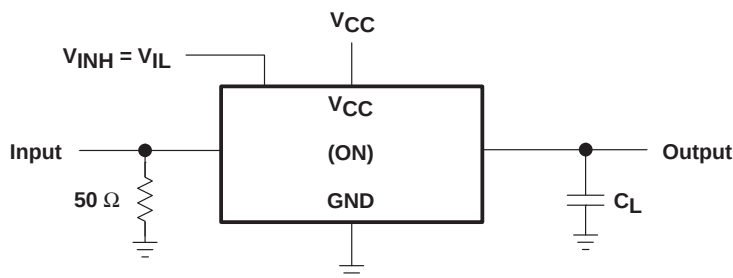
Condition 1:  $V_I = 0, V_O = V_{CC}$   
 Condition 2:  $V_I = V_{CC}, V_O = 0$

**Figure 2. Off-State Switch Leakage-Current Test Circuit**



$V_I = V_{CC} \text{ or } GND$

**Figure 3. On-State Switch Leakage-Current Test Circuit**



**Figure 4. Propagation Delay Time, Signal Input to Signal Output**

# SN54LV4051A, SN74LV4051A 8-CHANNEL ANALOG MULTIPLEXERS/DEMULTIPLEXERS

SCLS428H – MAY 1999 – REVISED APRIL 2005

## PARAMETER MEASUREMENT INFORMATION

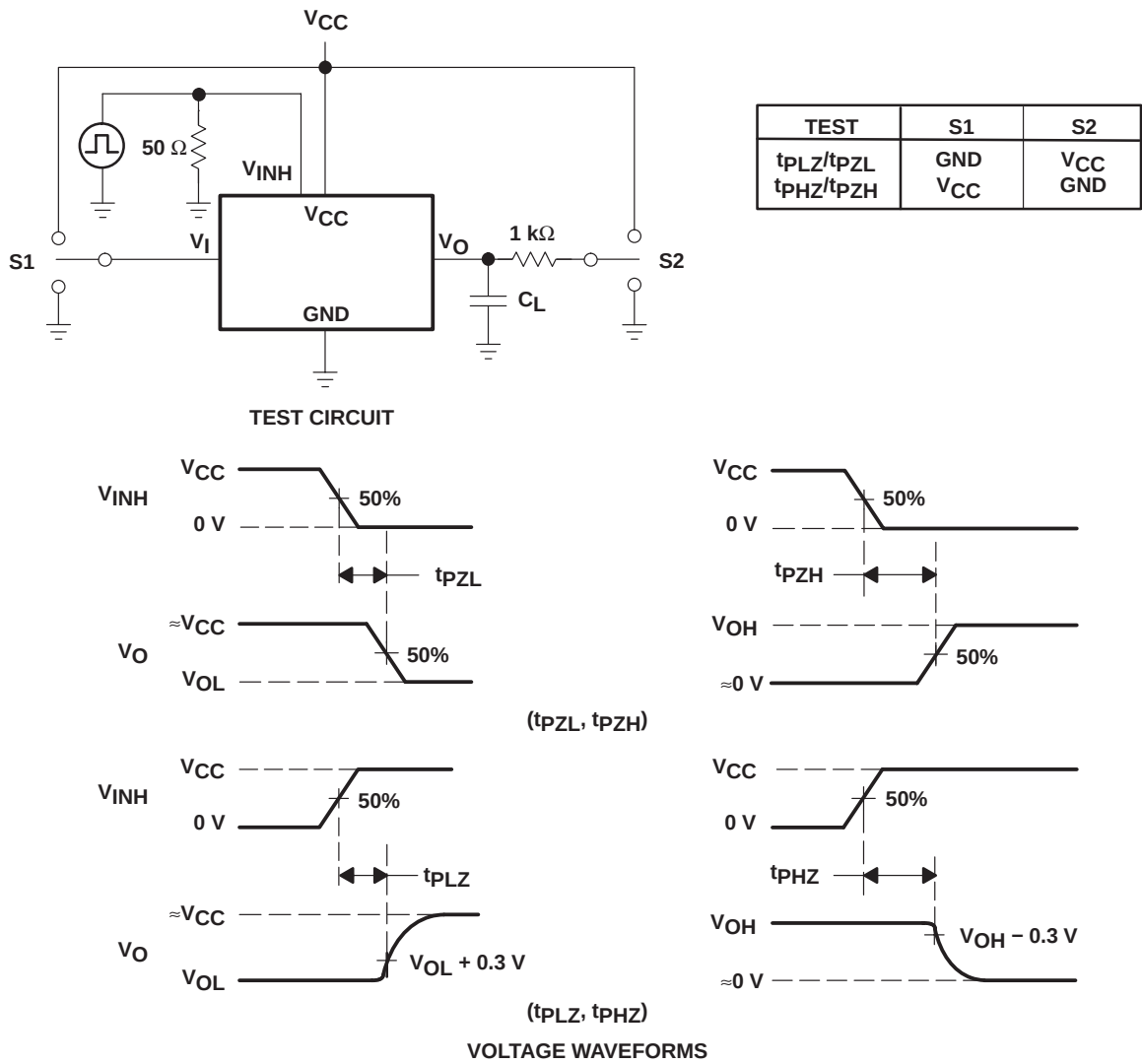
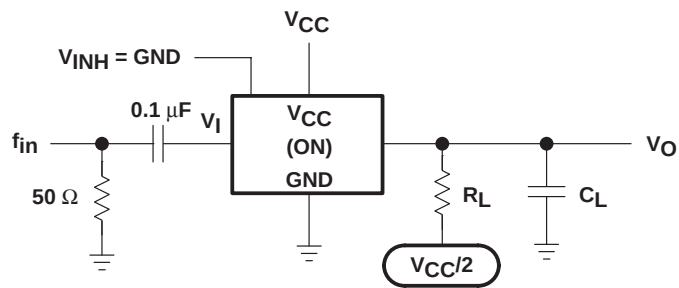


Figure 5. Switching Time ( $t_{PZL}$ ,  $t_{PLZ}$ ,  $t_{PHZ}$ ,  $t_{PHZ}$ ), Control to Signal Output



NOTE A:  $f_{in}$  is a sine wave.

Figure 6. Frequency Response (Switch On)



### PARAMETER MEASUREMENT INFORMATION

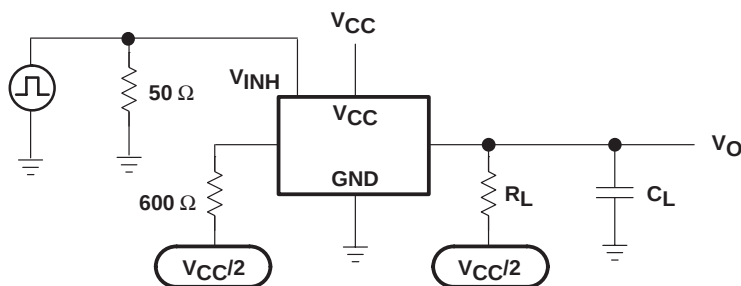


Figure 7. Crosstalk (Control Input, Switch Output)

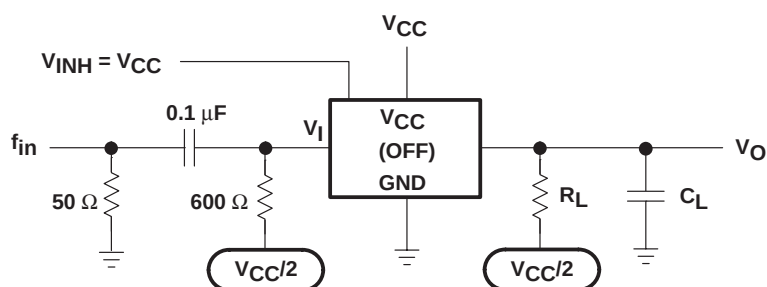


Figure 8. Feedthrough Attenuation (Switch Off)

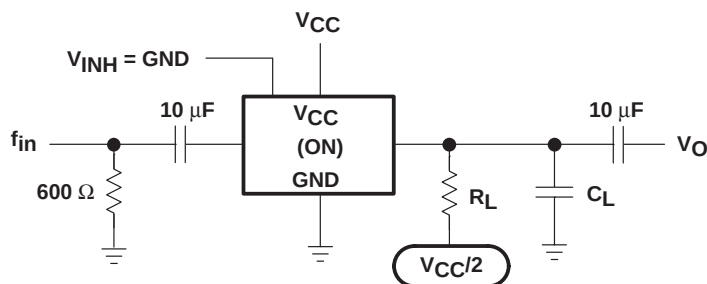


Figure 9. Sine-Wave Distortion

**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> |
|-------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| SN74LV4051AD      | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051ADBR    | ACTIVE                | SSOP         | DB              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051ADBRE4  | ACTIVE                | SSOP         | DB              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051ADBRG4  | ACTIVE                | SSOP         | DB              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051ADE4    | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051ADG4    | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051ADGVR   | ACTIVE                | TVSOP        | DGV             | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051ADGVRE4 | ACTIVE                | TVSOP        | DGV             | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051ADGVRG4 | ACTIVE                | TVSOP        | DGV             | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051ADR     | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051ADRE4   | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051ADRG4   | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051AN      | ACTIVE                | PDIP         | N               | 16   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| SN74LV4051ANE4    | ACTIVE                | PDIP         | N               | 16   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| SN74LV4051ANSR    | ACTIVE                | SO           | NS              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051ANSRE4  | ACTIVE                | SO           | NS              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051ANSRG4  | ACTIVE                | SO           | NS              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051APW     | ACTIVE                | TSSOP        | PW              | 16   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051APWE4   | ACTIVE                | TSSOP        | PW              | 16   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051APWG4   | ACTIVE                | TSSOP        | PW              | 16   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051APWR    | ACTIVE                | TSSOP        | PW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051APWRE4  | ACTIVE                | TSSOP        | PW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051APWRG4  | ACTIVE                | TSSOP        | PW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051APWT    | ACTIVE                | TSSOP        | PW              | 16   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051APWTE4  | ACTIVE                | TSSOP        | PW              | 16   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |

| 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> |
|-------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| SN74LV4051APWTG4  | ACTIVE                | TSSOP        | PW              | 16   | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LV4051ARGYR   | ACTIVE                | QFN          | RGY             | 16   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1 YEAR          |
| SN74LV4051ARGYRG4 | ACTIVE                | QFN          | RGY             | 16   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-2-260C-1 YEAR          |

<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.

**OBSELETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), 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.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<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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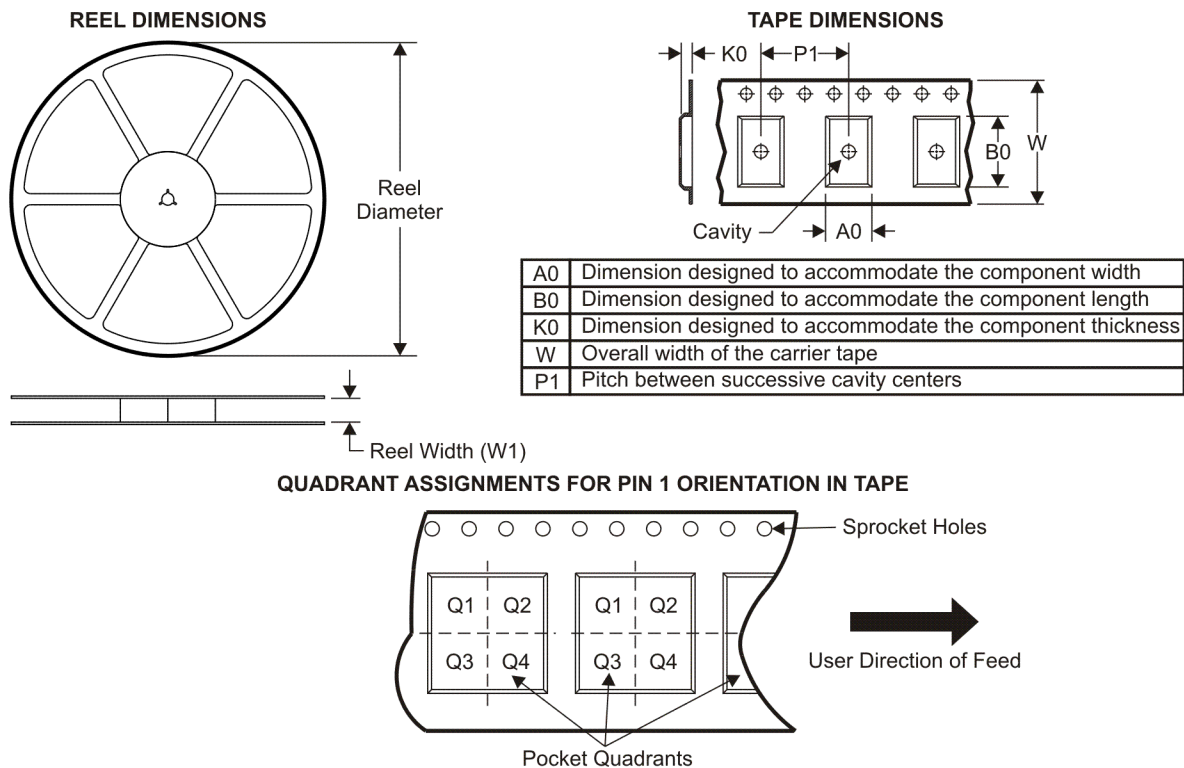
## OTHER QUALIFIED VERSIONS OF SN74LV4051A :

- Automotive: [SN74LV4051A-Q1](#)
- Enhanced Product: [SN74LV4051A-EP](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

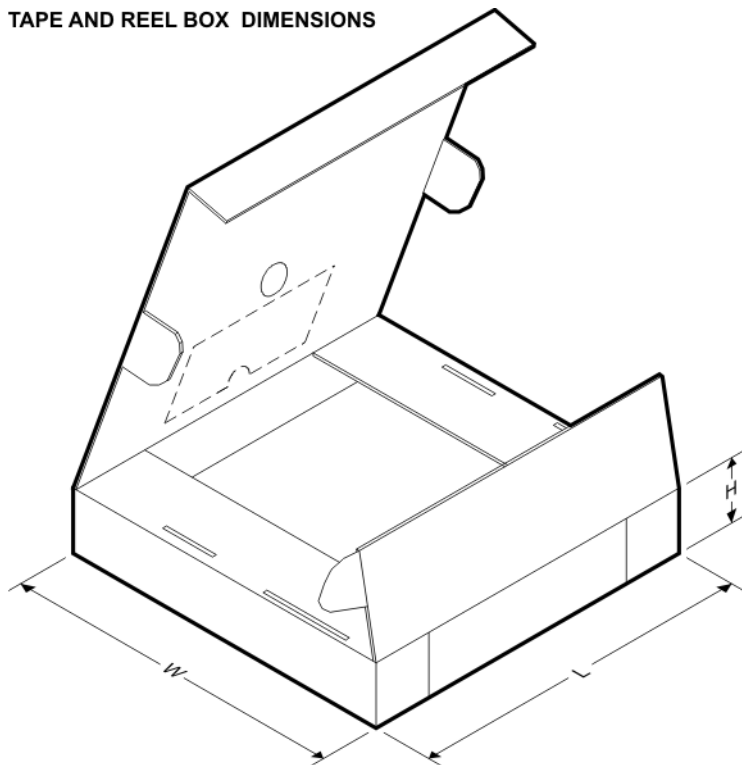
**TAPE AND REEL INFORMATION**



\*All dimensions are nominal

| Device          | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LV4051ADBR  | SSOP         | DB              | 16   | 2000 | 330.0              | 16.4               | 8.2     | 6.6     | 2.5     | 12.0    | 16.0   | Q1            |
| SN74LV4051ADGVR | TVSOP        | DGV             | 16   | 2000 | 330.0              | 12.4               | 6.8     | 4.0     | 1.6     | 8.0     | 12.0   | Q1            |
| SN74LV4051ADR   | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |
| SN74LV4051ANSR  | SO           | NS              | 16   | 2000 | 330.0              | 16.4               | 8.2     | 10.5    | 2.5     | 12.0    | 16.0   | Q1            |
| SN74LV4051APWR  | TSSOP        | PW              | 16   | 2000 | 330.0              | 12.4               | 7.0     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| SN74LV4051ARGYR | QFN          | RGY             | 16   | 1000 | 180.0              | 12.4               | 3.8     | 4.3     | 1.5     | 8.0     | 12.0   | Q1            |

**TAPE AND REEL BOX DIMENSIONS**



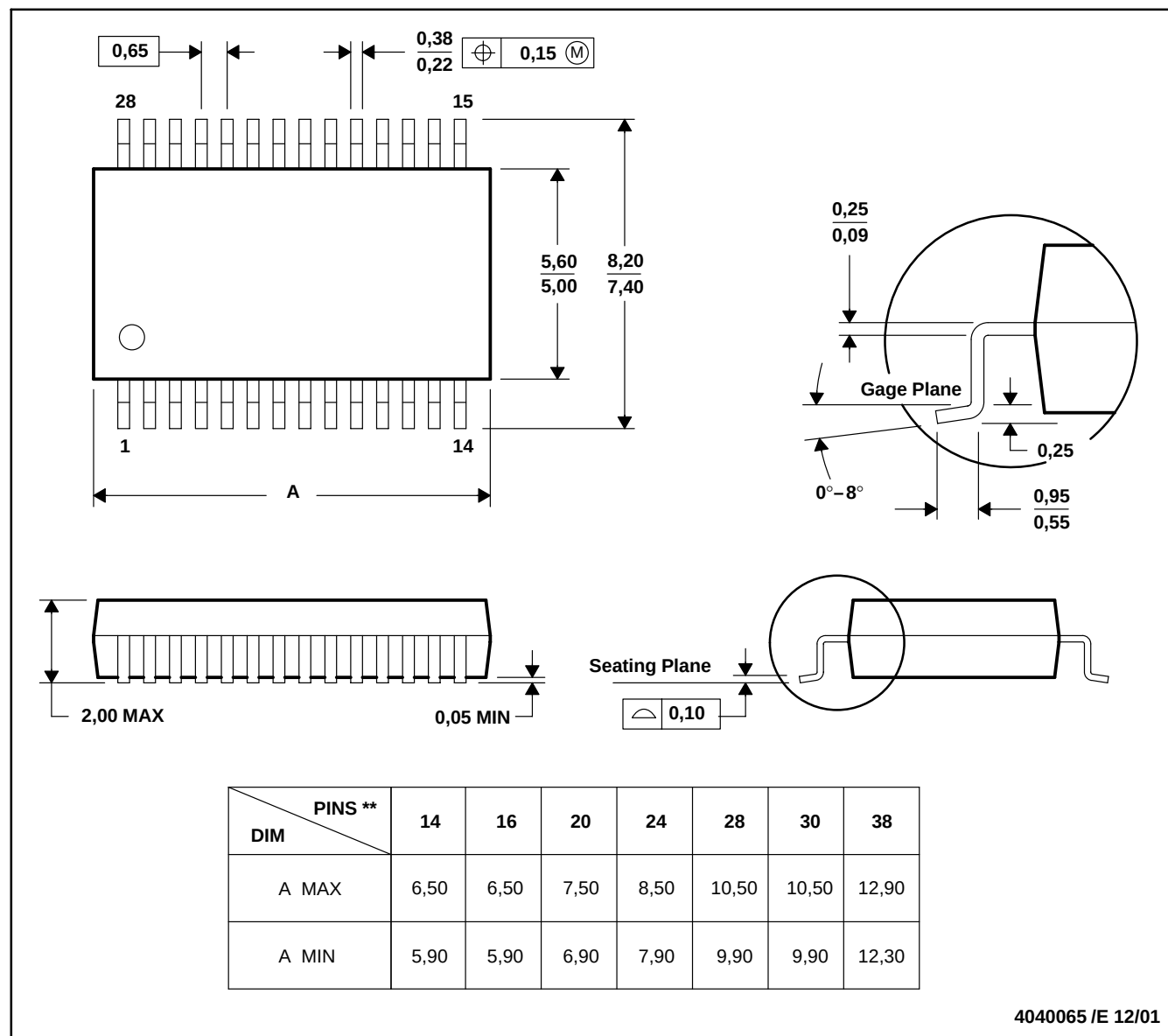
\*All dimensions are nominal

| Device          | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LV4051ADBR  | SSOP         | DB              | 16   | 2000 | 346.0       | 346.0      | 33.0        |
| SN74LV4051ADGVR | TVSOP        | DGV             | 16   | 2000 | 346.0       | 346.0      | 29.0        |
| SN74LV4051ADR   | SOIC         | D               | 16   | 2500 | 333.2       | 345.9      | 28.6        |
| SN74LV4051ANSR  | SO           | NS              | 16   | 2000 | 346.0       | 346.0      | 33.0        |
| SN74LV4051APWR  | TSSOP        | PW              | 16   | 2000 | 346.0       | 346.0      | 29.0        |
| SN74LV4051ARGYR | QFN          | RGY             | 16   | 1000 | 190.5       | 212.7      | 31.8        |

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

## PLASTIC SMALL-OUTLINE

28 PINS SHOWN

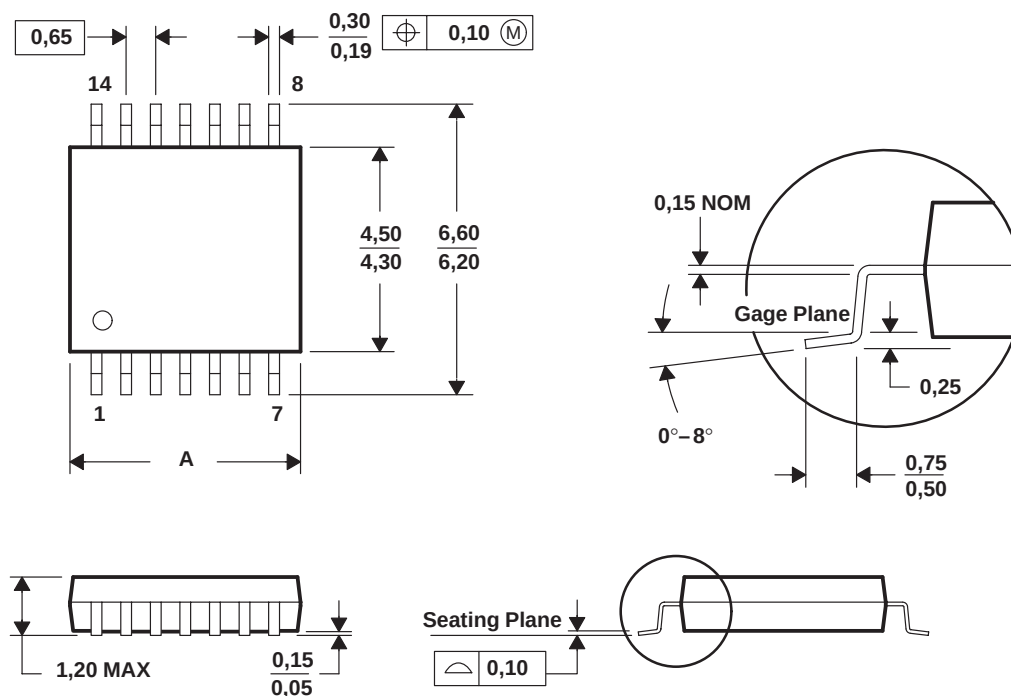


- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-150

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

## PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



| PINS **<br>DIM | 8    | 14   | 16   | 20   | 24   | 28   |
|----------------|------|------|------|------|------|------|
| A MAX          | 3,10 | 5,10 | 5,10 | 6,60 | 7,90 | 9,80 |
| A MIN          | 2,90 | 4,90 | 4,90 | 6,40 | 7,70 | 9,60 |

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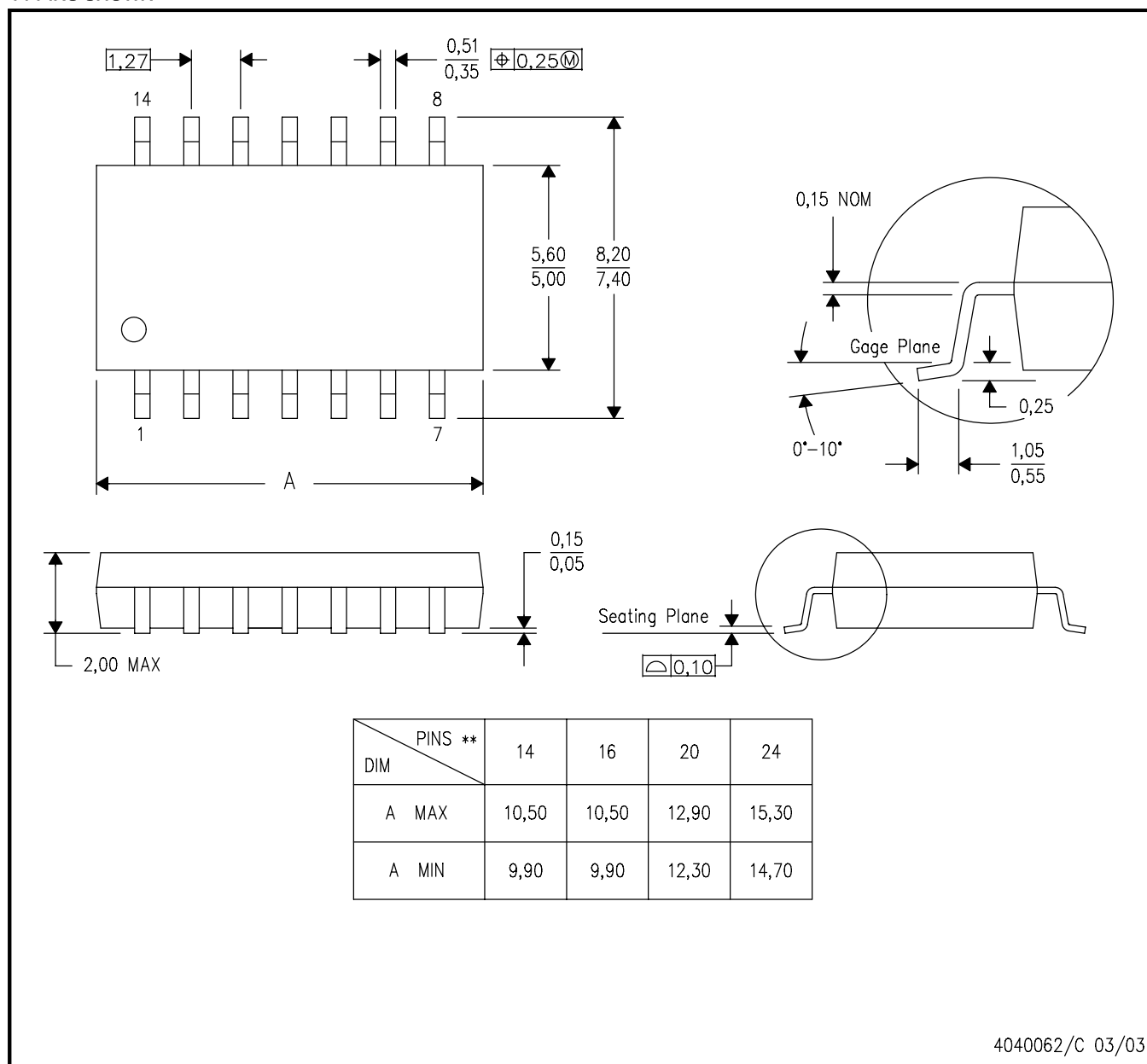
- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-153

# MECHANICAL DATA

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

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



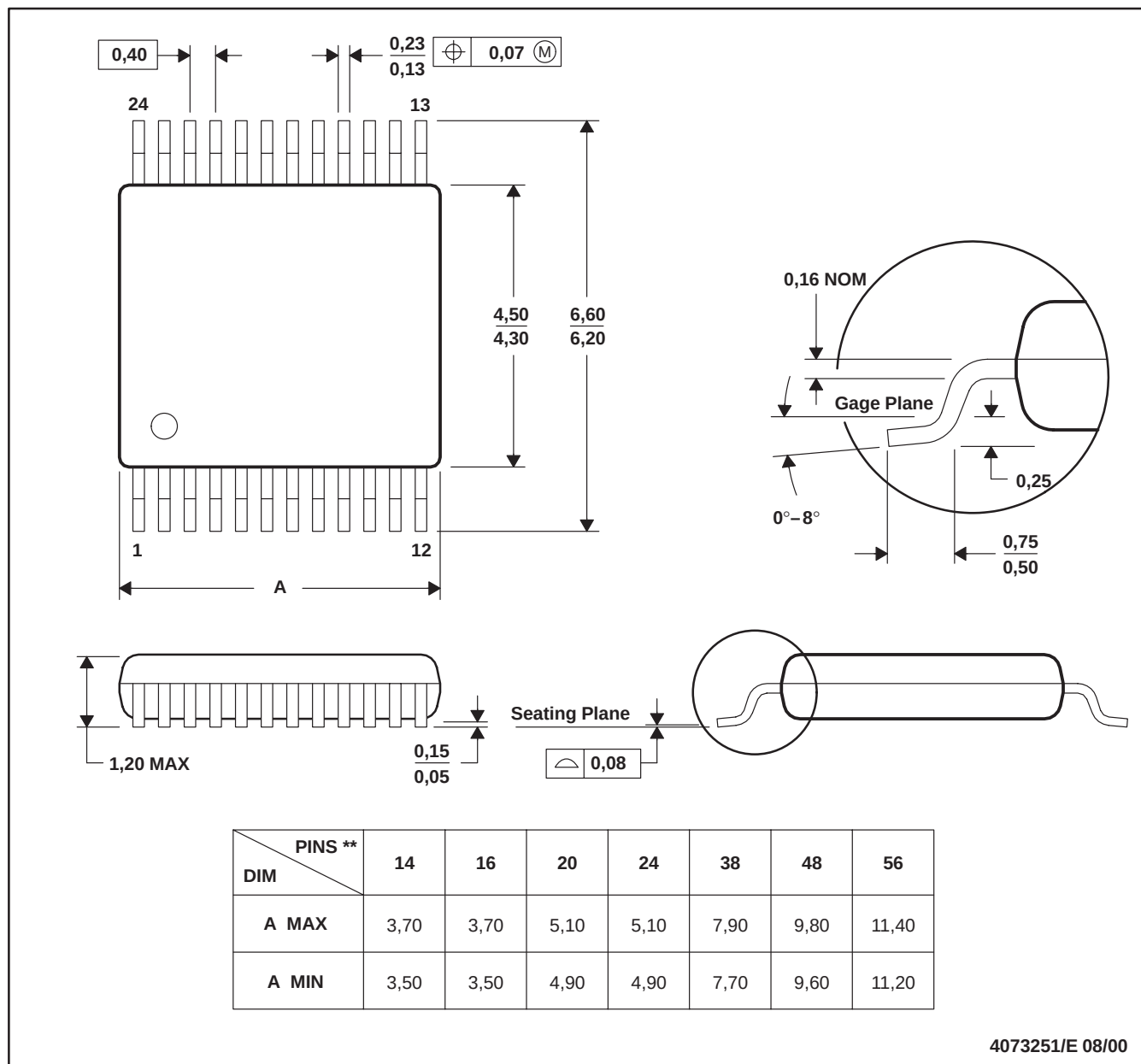
- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.



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

## PLASTIC SMALL-OUTLINE

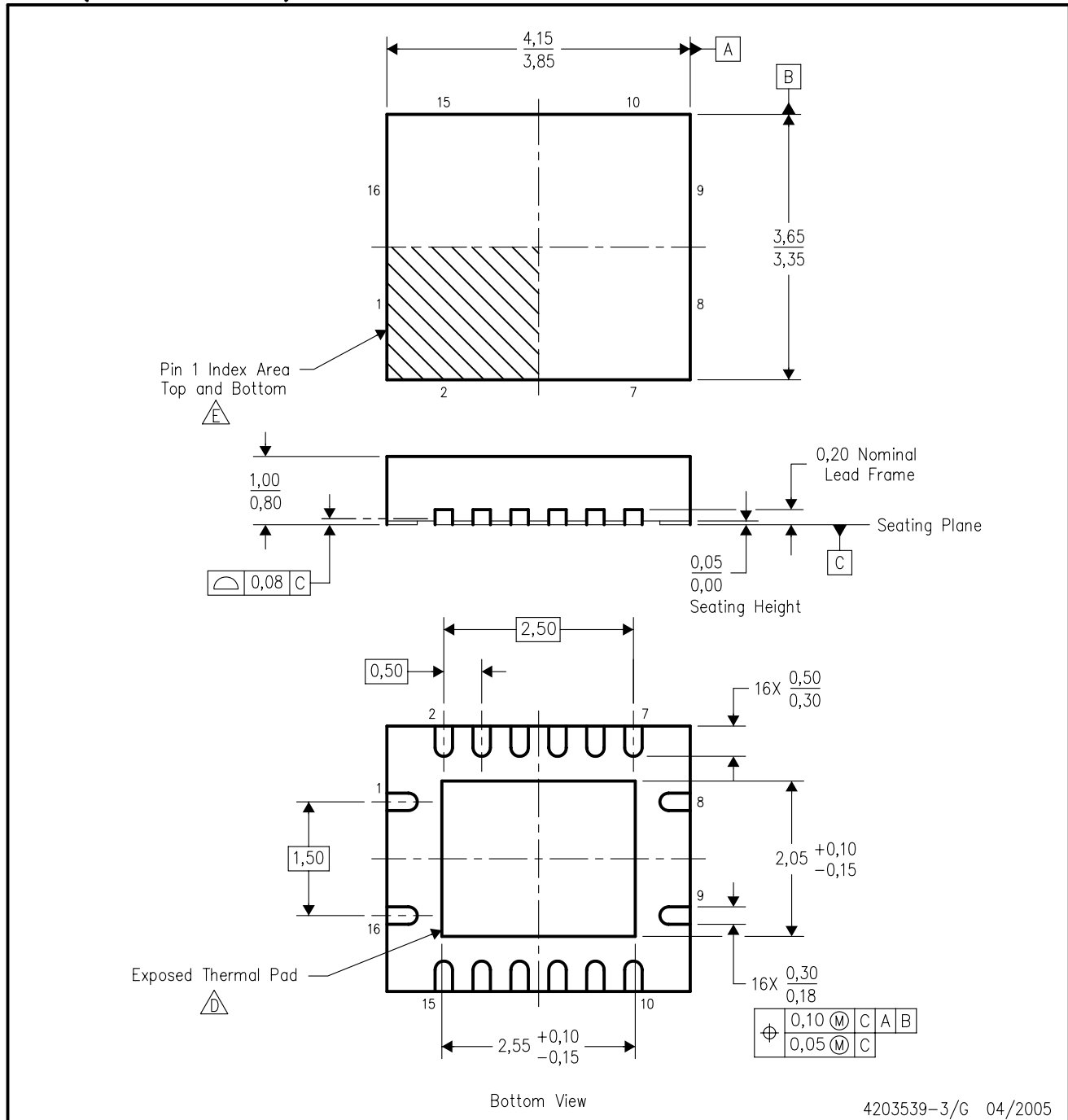
24 PINS SHOWN



- 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-N16)

PLASTIC QUAD FLATPACK



4203539-3/G 04/2005

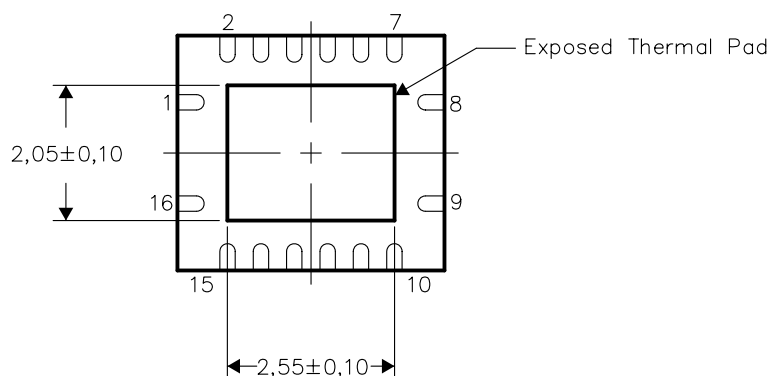
- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. QFN (Quad Flatpack No-Lead) package configuration.
  - The package thermal pad must be soldered to the board for thermal and mechanical 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 BB.

## THERMAL INFORMATION

This package incorporates an exposed thermal pad that is designed to be attached directly to an external heatsink. The thermal pad must be soldered directly to the printed circuit board (PCB). After soldering, the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to the appropriate copper plane shown in the electrical schematic for the device, or alternatively, can be attached to a special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For information on the Quad Flatpack No-Lead (QFN) package and its advantages, refer to Application Report, Quad Flatpack No-Lead Logic Packages, Texas Instruments Literature No. SCBA017. This document is available at [www.ti.com](http://www.ti.com).

The exposed thermal pad dimensions for this package are shown in the following illustration.

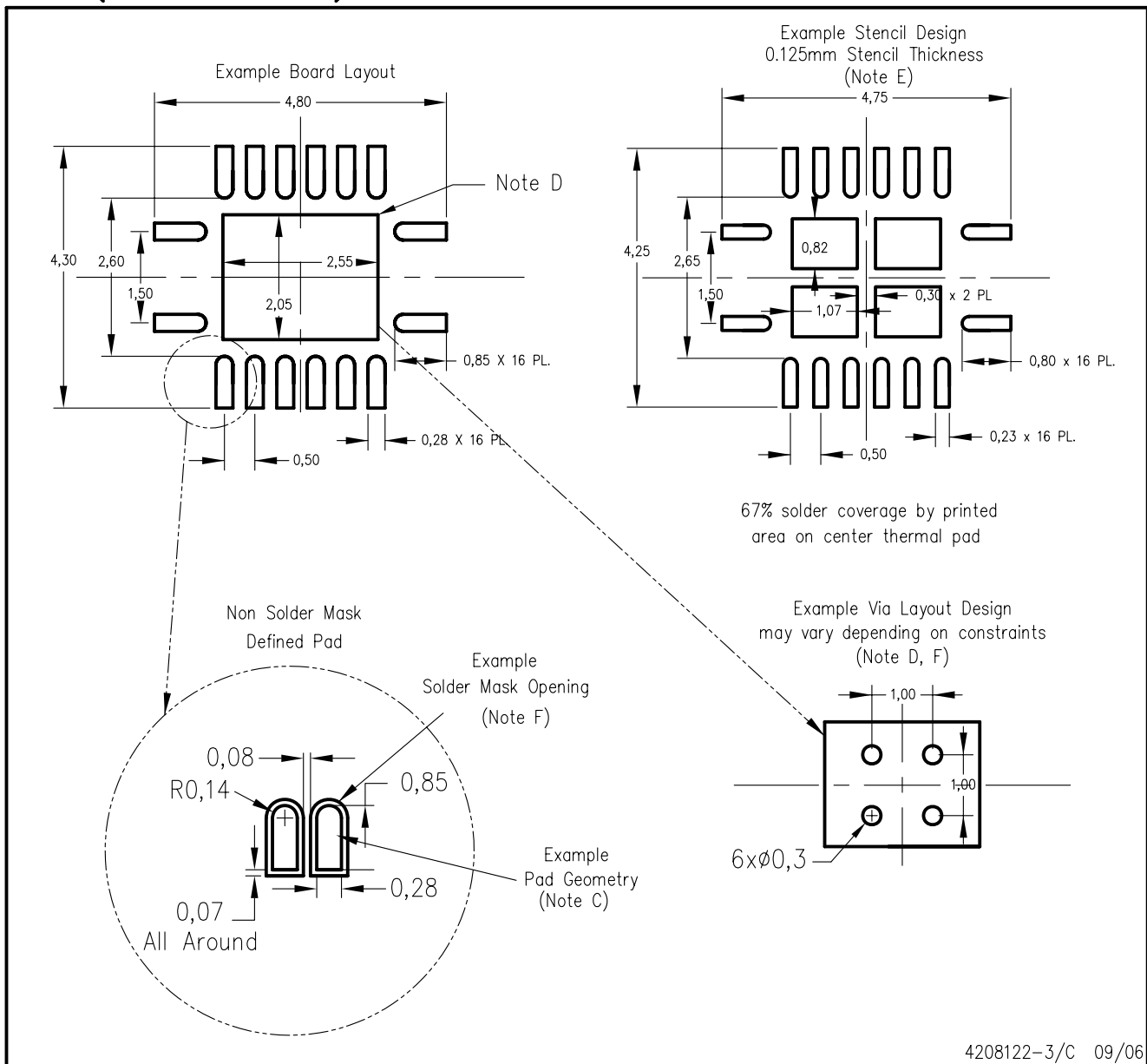


Bottom View

NOTE: All linear dimensions are in millimeters

## Exposed Thermal Pad Dimensions

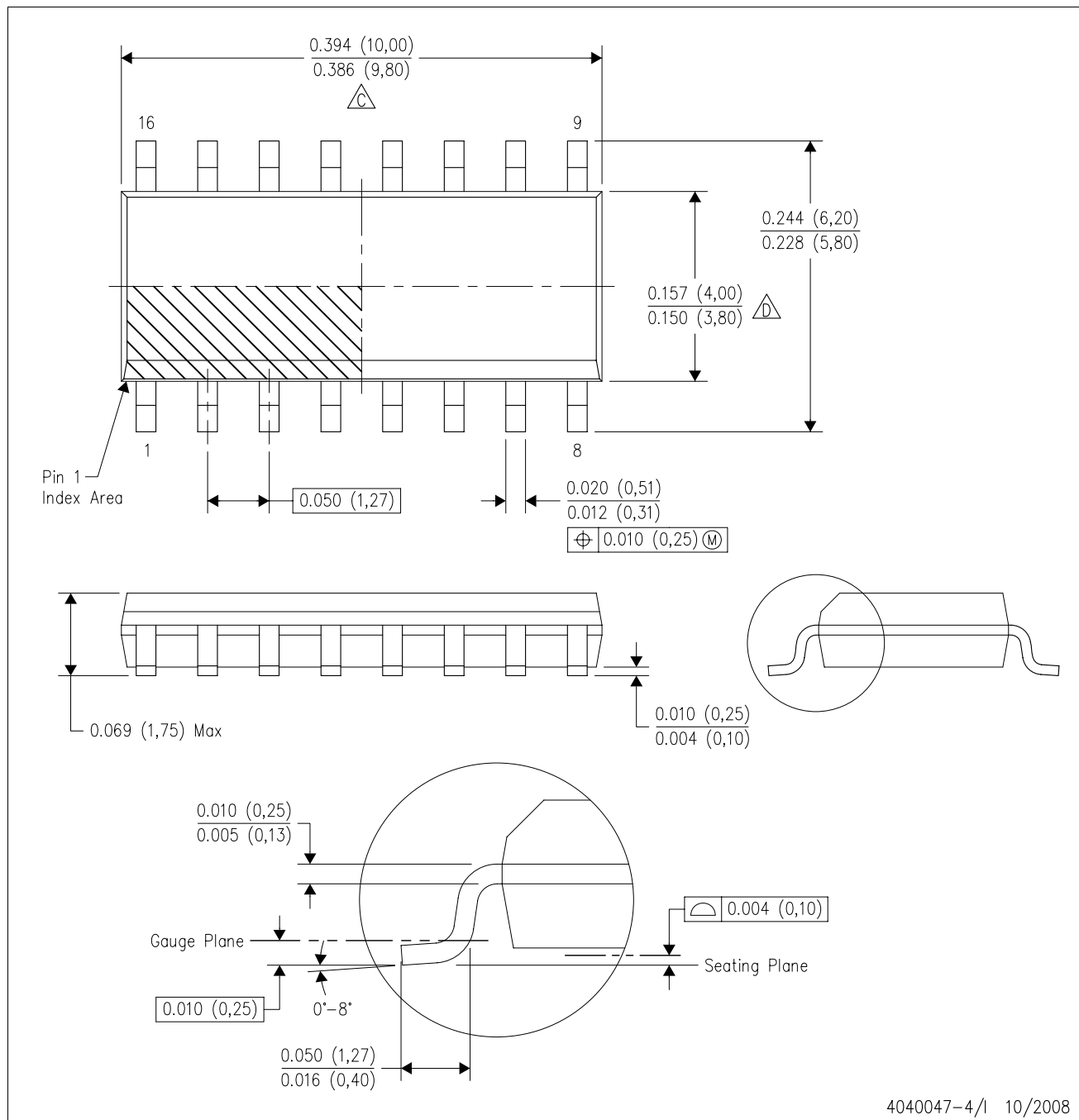
## RGY (R-PQFP-N16)



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. This package is designed to be soldered to a thermal pad on the board. Refer to Application Note, Quad Flat-Pack Packages, Texas Instruments Literature No. SCBA017, SLUA271, and also the Product Data Sheets for specific thermal information, via requirements, and recommended board layout. These documents are available at [www.ti.com](http://www.ti.com) <<http://www.ti.com>>.
  - E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC 7525 for stencil design considerations.
  - F. Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.

D (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



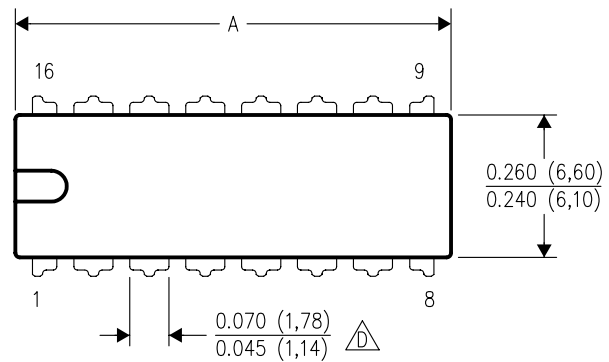
4040047-4/1 10/2008

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
  - E. Reference JEDEC MS-012 variation AC.

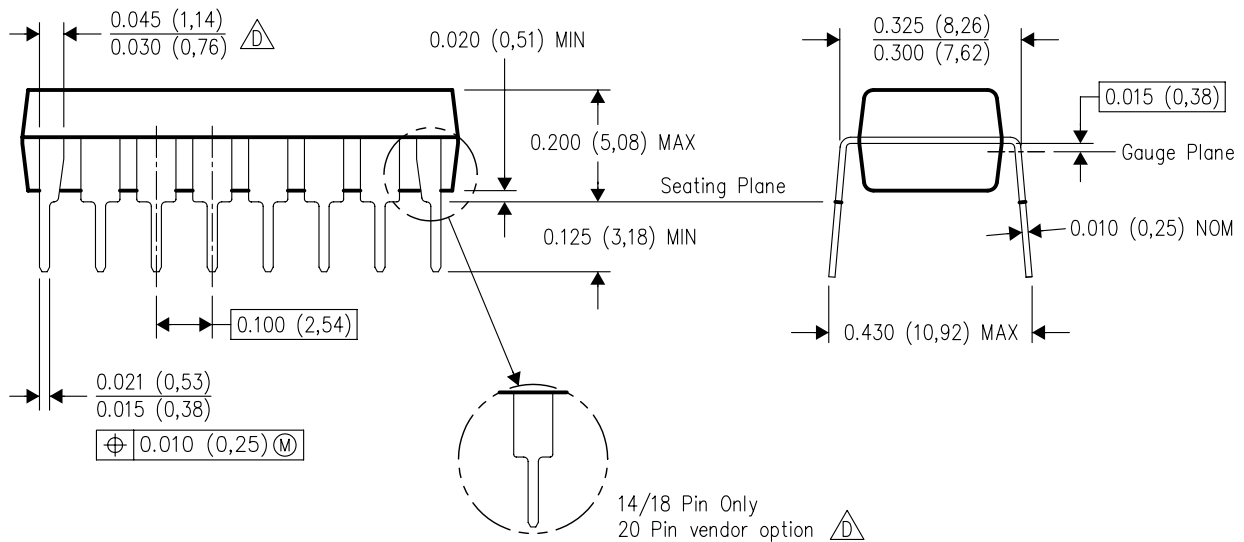
N (R-PDIP-T\*\*)

16 PINS SHOWN

# PLASTIC DUAL-IN-LINE PACKAGE



| DIM \ PINS **       | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| A MAX               | 0.775<br>(19,69) | 0.775<br>(19,69) | 0.920<br>(23,37) | 1.060<br>(26,92) |
| A MIN               | 0.745<br>(18,92) | 0.745<br>(18,92) | 0.850<br>(21,59) | 0.940<br>(23,88) |
| MS-001<br>VARIATION | AA               | BB               | AC               | AD               |



4040049/E 12/2002

NOTES:

- A. All linear dimensions are in inches (millimeters).  
B. This drawing is subject to change without notice.
-  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).  
 The 20 pin end lead shoulder width is a vendor option, either half or full width.

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| DSP                         | <a href="http://dsp.ti.com">dsp.ti.com</a>                         |
| Clocks and Timers           | <a href="http://www.ti.com/clocks">www.ti.com/clocks</a>           |
| Interface                   | <a href="http://interface.ti.com">interface.ti.com</a>             |
| Logic                       | <a href="http://logic.ti.com">logic.ti.com</a>                     |
| Power Mgmt                  | <a href="http://power.ti.com">power.ti.com</a>                     |
| Microcontrollers            | <a href="http://microcontroller.ti.com">microcontroller.ti.com</a> |
| RFID                        | <a href="http://www.ti-rfid.com">www.ti-rfid.com</a>               |
| RF/IF and ZigBee® Solutions | <a href="http://www.ti.com/lprf">www.ti.com/lprf</a>               |

### Applications

|                    |                                                                          |
|--------------------|--------------------------------------------------------------------------|
| Audio              | <a href="http://www.ti.com/audio">www.ti.com/audio</a>                   |
| Automotive         | <a href="http://www.ti.com/automotive">www.ti.com/automotive</a>         |
| Broadband          | <a href="http://www.ti.com/broadband">www.ti.com/broadband</a>           |
| Digital Control    | <a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a> |
| Medical            | <a href="http://www.ti.com/medical">www.ti.com/medical</a>               |
| Military           | <a href="http://www.ti.com/military">www.ti.com/military</a>             |
| Optical Networking | <a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a> |
| Security           | <a href="http://www.ti.com/security">www.ti.com/security</a>             |
| Telephony          | <a href="http://www.ti.com/telephony">www.ti.com/telephony</a>           |
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