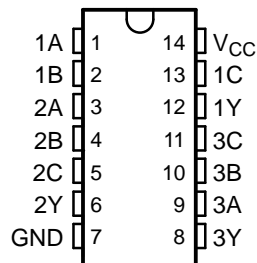## FEATURES

- **Operates From 1.65 V to 3.6 V**
- **Max $t_{pd}$ of 3 ns at 3.3 V**
- **$\pm$24-mA Output Drive at 3.3 V**
- **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)**

**D, DGV, NS, OR PW PACKAGE**
**(TOP VIEW)**

| | | | |
|---|---|---|---|
| 1A | 1 | 14 | $V_{CC}$ |
| 1B | 2 | 13 | 1C |
| 2A | 3 | 12 | 1Y |
| 2B | 4 | 11 | 3C |
| 2C | 5 | 10 | 3B |
| 2Y | 6 | 9 | 3A |
| GND | 7 | 8 | 3Y |

## DESCRIPTION/ORDERING INFORMATION

This triple 3-input positive-NAND gate is designed for 1.65-V to 3.6-V $V_{CC}$ operation.

The SN74ALVC10 performs the Boolean function $Y = \overline{A \bullet B \bullet C}$ or $Y = \overline{A} + \overline{B} + \overline{C}$ in positive logic.

### ORDERING INFORMATION

| $T_A$ | PACKAGE[1] | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---|---|---|---|---|
| -40°C to 85°C | SOIC - D | Tube | SN74ALVC10D | ALVC10 |
| | | Tape and reel | SN74ALVC10DR | |
| | SOP - NS | Tape and reel | SN74ALVC10NSR | ALVC10 |
| | TSSOP - PW | Tape and reel | SN74ALVC10PWR | VA10 |
| | TVSOP - DGV | Tape and reel | SN74ALVC10DGVR | VA10 |

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

### FUNCTION TABLE
### (each gate)

| INPUTS | | | OUTPUT Y |
|---|---|---|---|
| A | B | C | |
| H | H | H | L |
| L | X | X | H |
| X | L | X | H |
| X | X | L | H |

### LOGIC DIAGRAM, EACH GATE (POSITIVE LOGIC)



---
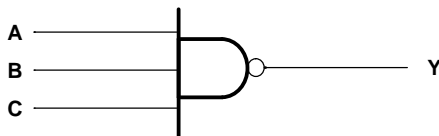
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## ABSOLUTE MAXIMUM RATINGS[1]

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

| | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply voltage range | | -0.5 | 4.6 | V |
| $V_I$ | Input voltage range[2] | | -0.5 | 4.6 | V |
| $V_O$ | Output voltage range[2][3] | | -0.5 | $V_{CC}$ + 0.5 | V |
| $I_{IK}$ | Input clamp current | $V_I < 0$ | | -50 | mA |
| $I_{OK}$ | Output clamp current | $V_O < 0$ | | -50 | mA |
| $I_O$ | Continuous output current | | | ±50 | mA |
| | Continuous current through $V_{CC}$ or GND | | | ±100 | mA |
| $\theta_{JA}$ | Package thermal impedance[4] | D package | | 86 | °C/W |
| | | DGV package | | 127 | |
| | | NS package | | 76 | |
| | | PW package | | 113 | |
| $T_{stg}$ | Storage temperature range | | -65 | 150 | °C |

(1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
(3) This value is limited to 4.6 V maximum.
(4) The package thermal impedance is calculated in accordance with JESD 51-7.

## RECOMMENDED OPERATING CONDITIONS[1]

| | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply voltage | | 1.65 | 3.6 | V |
| $V_{IH}$ | High-level input voltage | $V_{CC}$ = 1.65 V to 1.95 V | $0.65 \times V_{CC}$ | | V |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 1.7 | | |
| | | $V_{CC}$ = 2.7 V to 3.6 V | 2 | | |
| $V_{IL}$ | Low-level input voltage | $V_{CC}$ = 1.65 V to 1.95 V | | $0.35 \times V_{CC}$ | V |
| | | $V_{CC}$ = 2.3 V to 2.7 V | | 0.7 | |
| | | $V_{CC}$ = 2.7 V to 3.6 V | | 0.8 | |
| $V_I$ | Input voltage | | 0 | 3.6 | V |
| $V_O$ | Output voltage | | 0 | $V_{CC}$ | V |
| $I_{OH}$ | High-level output current | $V_{CC}$ = 1.65 V | | -4 | mA |
| | | $V_{CC}$ = 2.3 V | | -12 | |
| | | $V_{CC}$ = 2.7 V | | -12 | |
| | | $V_{CC}$ = 3 V | | -24 | |
| $I_{OL}$ | Low-level output current | $V_{CC}$ = 1.65 V | | 4 | mA |
| | | $V_{CC}$ = 2.3 V | | 12 | |
| | | $V_{CC}$ = 2.7 V | | 12 | |
| | | $V_{CC}$ = 3 V | | 24 | |
| $\Delta t/\Delta v$ | Input transition rise or fall rate | | | 5 | ns/V |
| $T_A$ | Operating free-air temperature | | -40 | 85 | °C |

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

**TEXAS INSTRUMENTS**
www.ti.com

## ELECTRICAL CHARACTERISTICS

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

| PARAMETER | TEST CONDITIONS | | $V_{CC}$ | MIN | TYP[1] | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| $V_{OH}$ | $I_{OH}$ = -100 μA | | 1.65 V to 3.6 V | $V_{CC}$ - 0.2 | | | V |
| | $I_{OH}$ = -4 mA | | 1.65 V | 1.2 | | | |
| | $I_{OH}$ = -6 mA | | 2.3 V | 2 | | | |
| | $I_{OH}$ = -12 mA | | 2.3 V | 1.7 | | | |
| | | | 2.7 V | 2.2 | | | |
| | | | 3 V | 2.4 | | | |
| | $I_{OH}$ = -24 mA | | 3 V | 2 | | | |
| $V_{OL}$ | $I_{OL}$ = 100 μA | | 1.65 V to 3.6 V | | | 0.2 | V |
| | $I_{OL}$ = 4 mA | | 1.65 V | | | 0.45 | |
| | $I_{OL}$ = 6 mA | | 2.3 V | | | 0.4 | |
| | $I_{OL}$ = 12 mA | | 2.3 V | | | 0.7 | |
| | | | 2.7 V | | | 0.4 | |
| | $I_{OL}$ = 24 mA | | 3 V | | | 0.55 | |
| $I_I$ | $V_I$ = $V_{CC}$ or GND | | 3.6 V | | | ±5 | μA |
| $I_{CC}$ | $V_I$ = $V_{CC}$ or GND, | $I_O$ = 0 | 3.6 V | | | 10 | μA |
| $\Delta I_{CC}$ | One input at $V_{CC}$ - 0.6 V, | Other inputs at $V_{CC}$ or GND | 3 V to 3.6 V | | | 750 | μA |
| $C_i$ | $V_I$ = $V_{CC}$ or GND | | 3.3 V | | 4 | | pF |

(1)   All typical values are at $V_{CC}$ = 3.3 V, $T_A$ = 25°C.

## SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $V_{CC}$ = 1.8 V ± 0.15 V | | $V_{CC}$ = 2.5 V ± 0.2 V | | $V_{CC}$ = 2.7 V | | $V_{CC}$ = 3.3 V ± 0.3 V | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | |
| $t_{pd}$ | A, B, or C | Y | 1.1 | 4.8 | 1 | 3 | | 3.3 | 1 | 3 | ns |

## OPERATING CHARACTERISTICS

$T_A$ = 25°C

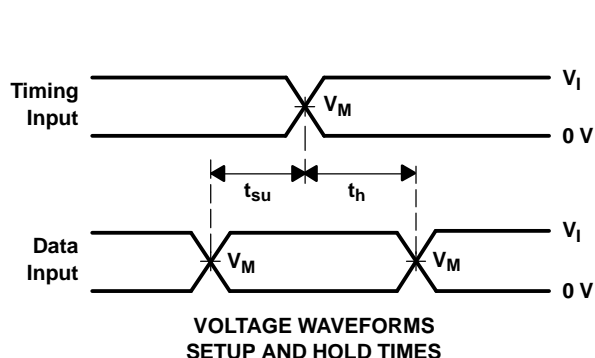| PARAMETER | | TEST CONDITIONS | $V_{CC}$ = 1.8 V | $V_{CC}$ = 2.5 V | $V_{CC}$ = 3.3 V | UNIT |
|---|---|---|---|---|---|---|
| | | | TYP | TYP | TYP | |
| $C_{pd}$ | Power dissipation capacitance per gate | $C_L$ = 0, f = 10 MHz | 23 | 24 | 26 | pF |

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## PARAMETER MEASUREMENT INFORMATION
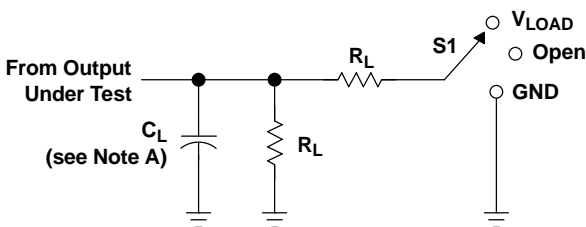
**LOAD CIRCUIT**

| TEST | S1 |
|------|-----|
| $t_{pd}$ | Open |
| $t_{PLZ}/t_{PZL}$ | $V_{LOAD}$ |
| $t_{PHZ}/t_{PZH}$ | GND |

| $V_{CC}$ | INPUT | | $V_M$ | $V_{LOAD}$ | $C_L$ | $R_L$ | $V_\Delta$ |
|----------|-------|------|-------|-----------|-------|-------|-----------|
| | $V_I$ | $t_r/t_f$ | | | | | |
| 1.8 V ± 0.15 V | $V_{CC}$ | ≤2 ns | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 1 kΩ | 0.15 V |
| 2.5 V ± 0.2 V | $V_{CC}$ | ≤2 ns | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 500 Ω | 0.15 V |
| 2.7 V | 2.7 V | ≤2.5 ns | 1.5 V | 6 V | 50 pF | 500 Ω | 0.3 V |
| 3.3 V ± 0.3 V | 2.7 V | ≤2.5 ns | 1.5 V | 6 V | 50 pF | 500 Ω | 0.3 V |

**VOLTAGE WAVEFORMS**
**SETUP AND HOLD TIMES**

**VOLTAGE WAVEFORMS**
**PULSE DURATION**

**VOLTAGE WAVEFORMS**
**PROPAGATION DELAY TIMES**

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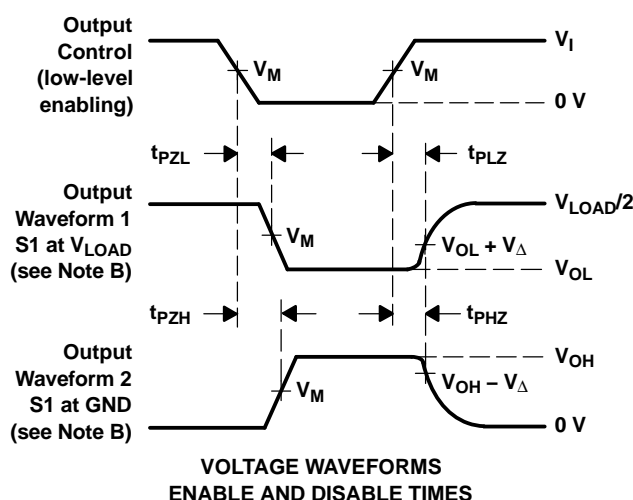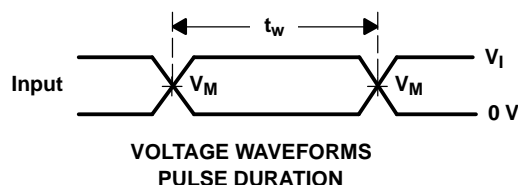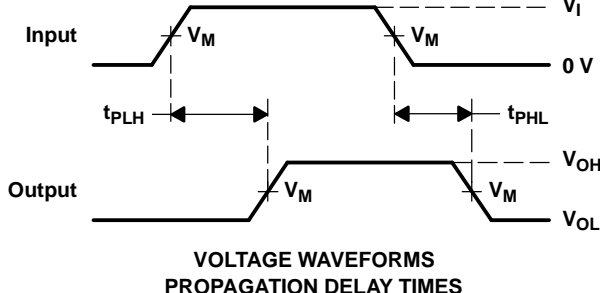
NOTES: A. $C_L$ includes probe and jig capacitance.
   B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control.
      Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the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

**Figure 1. Load Circuit and Voltage Waveforms**

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| | | Video & Imaging | www.ti.com/video |
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## PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish | MSL Peak Temp (3) |
|---|---|---|---|---|---|---|---|---|
| SN74ALVC10D | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74ALVC10DE4 | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74ALVC10DG4 | ACTIVE | SOIC | D | 14 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74ALVC10DGVR | ACTIVE | TVSOP | DGV | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74ALVC10DGVRE4 | ACTIVE | TVSOP | DGV | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74ALVC10DGVRG4 | ACTIVE | TVSOP | DGV | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74ALVC10DR | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74ALVC10DRE4 | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74ALVC10DRG4 | ACTIVE | SOIC | D | 14 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74ALVC10NSR | ACTIVE | SO | NS | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74ALVC10NSRE4 | ACTIVE | SO | NS | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74ALVC10NSRG4 | ACTIVE | SO | NS | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74ALVC10PWR | ACTIVE | TSSOP | PW | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74ALVC10PWRE4 | ACTIVE | TSSOP | PW | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74ALVC10PWRG4 | ACTIVE | TSSOP | PW | 14 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |

**(1)** The marketing status values are defined as follows:
**ACTIVE:** Product device recommended for new designs.
**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.
**OBSOLETE:** TI has discontinued the production of the device.

**(2)** 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.
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**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)

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

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## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

**TAPE DIMENSIONS**

| | |
|---|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**

*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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SN74ALVC10DGVR | TVSOP | DGV | 14 | 2000 | 330.0 | 12.4 | 6.8 | 4.0 | 1.6 | 8.0 | 12.0 | Q1 |
| SN74ALVC10DR | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| SN74ALVC10NSR | SO | NS | 14 | 2000 | 330.0 | 16.4 | 8.2 | 10.5 | 2.5 | 12.0 | 16.0 | Q1 |
| SN74ALVC10PWR | TSSOP | PW | 14 | 2000 | 330.0 | 12.4 | 7.0 | 5.6 | 1.6 | 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) |
|---|---|---|---|---|---|---|---|
| SN74ALVC10DGVR | TVSOP | DGV | 14 | 2000 | 346.0 | 346.0 | 29.0 |
| SN74ALVC10DR | SOIC | D | 14 | 2500 | 346.0 | 346.0 | 33.0 |
| SN74ALVC10NSR | SO | NS | 14 | 2000 | 346.0 | 346.0 | 33.0 |
| SN74ALVC10PWR | TSSOP | PW | 14 | 2000 | 346.0 | 346.0 | 29.0 |

**PW (R-PDSO-G\*\*)**                                    **PLASTIC SMALL-OUTLINE PACKAGE**

**14 PINS SHOWN**

0,65

0,30
0,19

⊕ 0,10 Ⓜ

14          8

4,50
4,30

6,60
6,20

1          7

A

0,15 NOM

Gage Plane

0°−8°

0,25

0,75
0,50

1,20 MAX

0,15
0,05

Seating Plane

◁ 0,10

| DIM \ PINS ** | 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 |

**4040064/F 01/97**

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

PLASTIC SMALL-OUTLINE PACKAGE



| 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.

**D (R−PDSO−G14)**         **PLASTIC SMALL−OUTLINE PACKAGE**



0.344 (8,75)
0.337 (8,55)

0.244 (6,20)
0.228 (5,80)

0.157 (4,00)
0.150 (3,80)

0.050 (1,27)

0.020 (0,51)
0.012 (0,31)

⊕ 0.010 (0,25) Ⓜ

Pin 1 Index Area

0.069 (1,75) Max

0.010 (0,25)
0.004 (0,10)

0.010 (0,25)
0.007 (0,17)

Gauge Plane

0.004 (0,10)

Seating Plane

0.010 (0,25)

0°–8°

0.050 (1,27)
0.016 (0,40)

4040047−3/H   11/2006

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 AB.

**DGV (R-PDSO-G\*\*)**                                           **PLASTIC SMALL-OUTLINE**

**24 PINS SHOWN**

0,40

0,23
0,13    ⊕    0,07 Ⓜ

24                          13

4,50        6,60
4,30        6,20

0,16 NOM

Gage Plane

0,25

0°−8°

0,75
0,50

1                           12

A

1,20 MAX

0,15
0,05

Seating Plane

⌒ 0,08

| DIM \ PINS \*\* | 14 | 16 | 20 | 24 | 38 | 48 | 56 |
|---|---|---|---|---|---|---|---|
| A MAX | 3,70 | 3,70 | 5,10 | 5,10 | 7,90 | 9,80 | 11,40 |
| A MIN | 3,50 | 3,50 | 4,90 | 4,90 | 7,70 | 9,60 | 11,20 |

4073251/E 08/00

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

TEXAS
INSTRUMENTS
POST OFFICE BOX 655303 ● DALLAS, TEXAS 75265