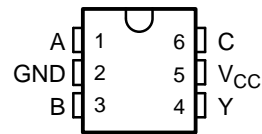


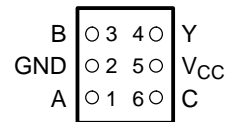
FEATURES

- Available in the Texas Instruments NanoStar™ and NanoFree™ Packages
- Supports 5-V V_{CC} Operation
- Inputs Accept Voltages to 5.5 V
- I_{off} Supports Partial-Power-Down Mode Operation
- 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)

DBV OR DCK PACKAGE
(TOP VIEW)



YEP OR YZP PACKAGE
(BOTTOM VIEW)



DESCRIPTION/ORDERING INFORMATION

The SN74LVC1G386 performs the Boolean function $Y = A \oplus B \oplus C$ in positive logic.

NanoStar™ and NanoFree™ package technology is a major breakthrough in IC packaging concepts, using the die as the package.

This device is fully specified for partial-power-down applications using I_{off} . The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

ORDERING INFORMATION

| T_A | PACKAGE ⁽¹⁾ | | ORDERABLE PART NUMBER | TOP-SIDE MARKING ⁽²⁾ |
|---------------|--|---------------|-----------------------|---------------------------------|
| –40°C to 85°C | NanoStar™ – WCSP (DSBGA) 0.23-mm Large Bump – YEP | Tape and reel | SN74LVC1G386YEPR | _ _ _C8_ |
| | NanoFree™ – WCSP (DSBGA) 0.23-mm Large Bump – YZP (Pb-free) | | SN74LVC1G386YZPR | |
| | SOT (SOT-23) – DBV | Tape and reel | SN74LVC1G386DBVR | CC6_ |
| | SOT (SC-70) – DCK | Tape and reel | SN74LVC1G386DCKR | C8_ |

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

(2) DBV/DCK: The actual top-side marking has one additional character that designates the assembly/test site.
YEP/YZP: The actual top-side marking has three preceding characters to denote year, month, and sequence code, and one following character to designate the assembly/test site. Pin 1 identifier indicates solder-bump composition (1 = SnPb, . = Pb-free).

FUNCTION TABLE

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



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of the Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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SN74LVC1G386

SINGLE 3-INPUT POSITIVE-XOR GATE

SCES439C–APRIL 2003–REVISED APRIL 2005

LOGIC DIAGRAM (POSITIVE LOGIC)



Absolute Maximum Ratings⁽¹⁾

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

| | | MIN | MAX | UNIT |
|---------------|---|-----------------|----------------|---------|
| V_{CC} | Supply voltage range | –0.5 | 6.5 | V |
| V_I | Input voltage range ⁽²⁾ | –0.5 | 6.5 | V |
| V_O | Voltage range applied to any output in the high-impedance or power-off state ⁽²⁾ | –0.5 | 6.5 | V |
| V_O | Voltage range applied to any output in the high or low state ^{(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 |
| θ_{JA} | Package thermal impedance ⁽⁴⁾ | DBV package | | 165 |
| | | DCK package | | 259 |
| | | YEP/YZP package | | 123 |
| T_{stg} | Storage temperature range | –65 | 150 | °C |

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

Recommended Operating Conditions⁽¹⁾

| | | MIN | MAX | UNIT |
|-----------------|------------------------------------|---|------------------------|------|
| V _{CC} | Supply voltage | Operating | 1.65 | 5.5 |
| | | Data retention only | 1.5 | V |
| V _{IH} | High-level input voltage | V _{CC} = 1.65 V to 1.95 V | 0.65 × V _{CC} | V |
| | | V _{CC} = 2.3 V to 2.7 V | 1.7 | |
| | | V _{CC} = 3 V to 3.6 V | 2 | |
| | | V _{CC} = 4.5 V to 5.5 V | 0.7 × V _{CC} | |
| V _{IL} | Low-level input voltage | V _{CC} = 1.65 V to 1.95 V | 0.35 × V _{CC} | V |
| | | V _{CC} = 2.3 V to 2.7 V | 0.7 | |
| | | V _{CC} = 3 V to 3.6 V | 0.8 | |
| | | V _{CC} = 4.5 V to 5.5 V | 0.3 × V _{CC} | |
| V _I | Input voltage | 0 | 5.5 | 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 | –8 | |
| | | V _{CC} = 3 V | –16 | |
| | | V _{CC} = 4.5 V | –24 | |
| I _{OL} | Low-level output current | V _{CC} = 1.65 V | 4 | mA |
| | | V _{CC} = 2.3 V | 8 | |
| | | V _{CC} = 3 V | 16 | |
| | | V _{CC} = 4.5 V | 24 | |
| Δt/Δv | Input transition rise or fall rate | V _{CC} = 1.8 V ± 0.15 V, 2.5 V ± 0.2 V | 20 | ns/V |
| | | V _{CC} = 3.3 V ± 0.3 V | 10 | |
| | | V _{CC} = 5 V ± 0.5 V | 5 | |
| 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.

SN74LVC1G386

SINGLE 3-INPUT POSITIVE-XOR GATE

SCES439C–APRIL 2003–REVISED APRIL 2005

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 5.5 V | V _{CC} − 0.1 | | | V |
| | | I _{OH} = −4 mA | 1.65 V | 1.2 | | | |
| | | I _{OH} = −8 mA | 2.3 V | 1.9 | | | |
| | | I _{OH} = −16 mA | 3 V | 2.4 | | | |
| | | I _{OH} = −24 mA | | 2.3 | | | |
| | | I _{OH} = −32 mA | 4.5 V | 3.8 | | | |
| V _{OL} | | I _{OL} = 100 μA | 1.65 V to 5.5 V | | | 0.1 | V |
| | | I _{OL} = 4 mA | 1.65 V | | | 0.45 | |
| | | I _{OL} = 8 mA | 2.3 V | | | 0.3 | |
| | | I _{OL} = 16 mA | 3 V | | | 0.4 | |
| | | I _{OL} = 24 mA | | | | 0.55 | |
| | | I _{OL} = 32 mA | 4.5 V | | | 0.55 | |
| I _I | All inputs | V _I = 5.5 V or GND | 0 to 5.5 V | | | ±5 | μA |
| I _{off} | | V _I or V _O = 5.5 V | 0 | | | ±10 | μA |
| I _{CC} | | V _I = 5.5 V or GND, I _O = 0 | 1.65 V to 5.5 V | | | 10 | μA |
| ΔI _{CC} | | One input at V _{CC} − 0.6 V, Other inputs at V _{CC} or GND | 3 V to 5.5 V | | | 500 | μA |
| C _i | | V _I = V _{CC} or GND | 3.3 V | | | 3.5 | 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, C_L = 15 pF (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} = 3.3 V ± 0.3 V | | V _{CC} = 5 V ± 0.5 V | | UNIT |
|-----------------|-----------------|----------------|-------------------------------------|-----|------------------------------------|-----|------------------------------------|-----|----------------------------------|-----|------|
| | | | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | |
| t _{pd} | A, B, or C | Y | 3 | 9.4 | 1.3 | 5 | 0.8 | 4.5 | 0.5 | 3.5 | ns |

Switching Characteristics

over recommended operating free-air temperature range, C_L = 30 pF or 50 pF (unless otherwise noted) (see Figure 2)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | V _{CC} = 1.8 V ± 0.15 V | | V _{CC} = 2.5 V ± 0.2 V | | V _{CC} = 3.3 V ± 0.3 V | | V _{CC} = 5 V ± 0.5 V | | UNIT |
|-----------------|-----------------|----------------|-------------------------------------|-----|------------------------------------|-----|------------------------------------|-----|----------------------------------|-----|------|
| | | | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | |
| t _{pd} | A, B, or C | Y | 3.5 | 12 | 1.8 | 5.5 | 1.3 | 5 | 1 | 4 | 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 | V _{CC} = 5 V | UNIT |
|-----------------|-------------------------------|-----------------|-------------------------|-------------------------|-------------------------|-----------------------|------|
| | | | TYP | TYP | TYP | TYP | |
| C _{pd} | Power dissipation capacitance | f = 10 MHz | 17.5 | 18 | 19 | 22 | pF |

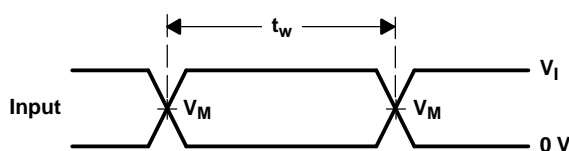
PARAMETER MEASUREMENT INFORMATION



LOAD CIRCUIT

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

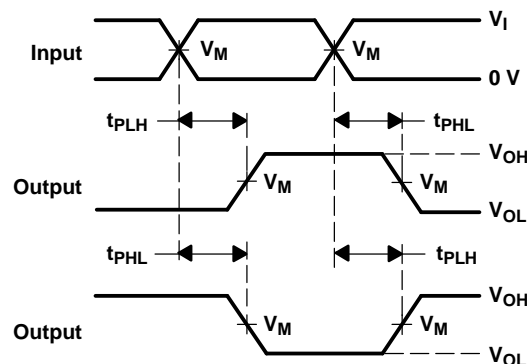
| V_{CC} | INPUTS | | V_M | V_{LOAD} | C_L | R_L | V_{Δ} |
|----------------------------------|----------|----------------------|------------|-------------------|-------|--------------|--------------|
| | V_I | t_r/t_f | | | | | |
| $1.8\text{ V} \pm 0.15\text{ V}$ | V_{CC} | $\leq 2\text{ ns}$ | $V_{CC}/2$ | $2 \times V_{CC}$ | 15 pF | 1 M Ω | 0.15 V |
| $2.5\text{ V} \pm 0.2\text{ V}$ | V_{CC} | $\leq 2\text{ ns}$ | $V_{CC}/2$ | $2 \times V_{CC}$ | 15 pF | 1 M Ω | 0.15 V |
| $3.3\text{ V} \pm 0.3\text{ V}$ | 3 V | $\leq 2.5\text{ ns}$ | 1.5 V | 6 V | 15 pF | 1 M Ω | 0.3 V |
| $5\text{ V} \pm 0.5\text{ V}$ | V_{CC} | $\leq 2.5\text{ ns}$ | $V_{CC}/2$ | $2 \times V_{CC}$ | 15 pF | 1 M Ω | 0.3 V |



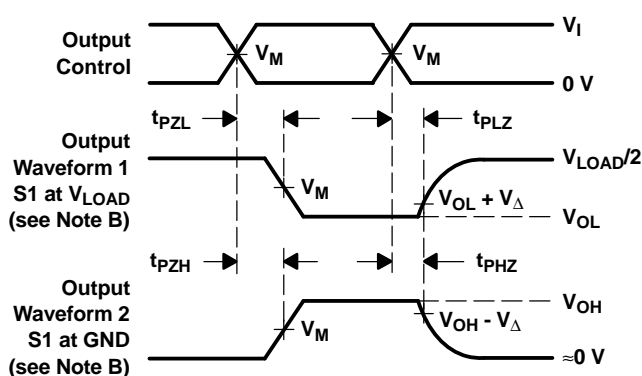
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

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

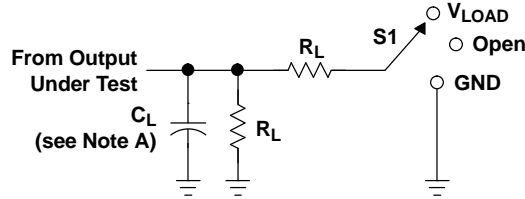
Figure 1. Load Circuit and Voltage Waveforms

SN74LVC1G386

SINGLE 3-INPUT POSITIVE-XOR GATE

SCES439C—APRIL 2003—REVISED APRIL 2005

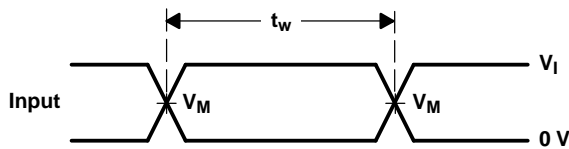
PARAMETER MEASUREMENT INFORMATION



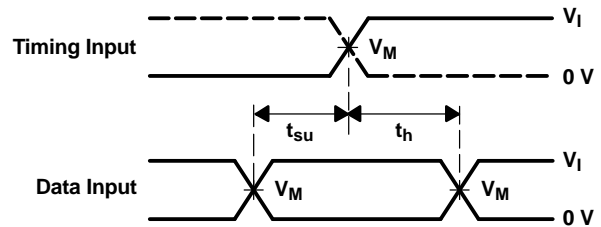
LOAD CIRCUIT

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

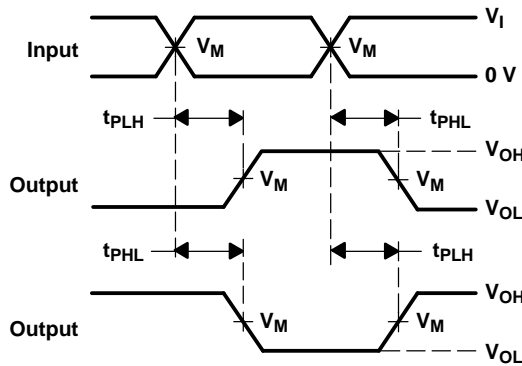
| V_{CC} | INPUTS | | V_M | V_{LOAD} | C_L | R_L | V_{Δ} |
|----------------------------------|----------|----------------------|------------|-------------------|-------|--------------|--------------|
| | V_I | t_r/t_f | | | | | |
| $1.8\text{ V} \pm 0.15\text{ V}$ | V_{CC} | $\leq 2\text{ ns}$ | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 1 k Ω | 0.15 V |
| $2.5\text{ V} \pm 0.2\text{ V}$ | V_{CC} | $\leq 2\text{ ns}$ | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 500 Ω | 0.15 V |
| $3.3\text{ V} \pm 0.3\text{ V}$ | 3 V | $\leq 2.5\text{ ns}$ | 1.5 V | 6 V | 50 pF | 500 Ω | 0.3 V |
| $5\text{ V} \pm 0.5\text{ V}$ | V_{CC} | $\leq 2.5\text{ ns}$ | $V_{CC}/2$ | $2 \times V_{CC}$ | 50 pF | 500 Ω | 0.3 V |



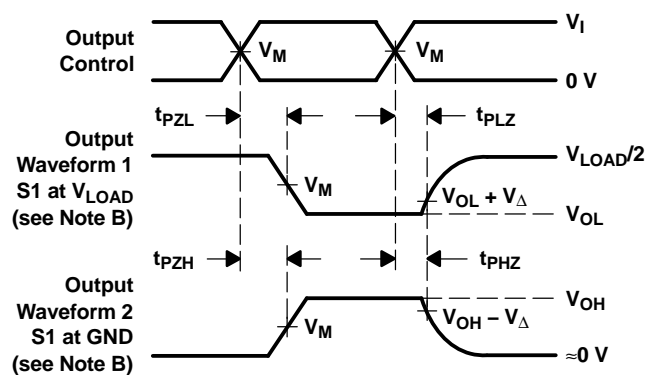
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

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

Figure 2. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| 74LVC1G386DCKRG4 | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVC1G386DBVR | ACTIVE | SOT-23 | DBV | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVC1G386DCKR | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVC1G386YEPR | ACTIVE | WCSP | YEP | 6 | 3000 | TBD | SNPB | Level-1-260C-UNLIM |
| SN74LVC1G386YZPR | ACTIVE | WCSP | YZP | 6 | 3000 | Pb-Free (RoHS) | SNAGCU | 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) 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.

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)

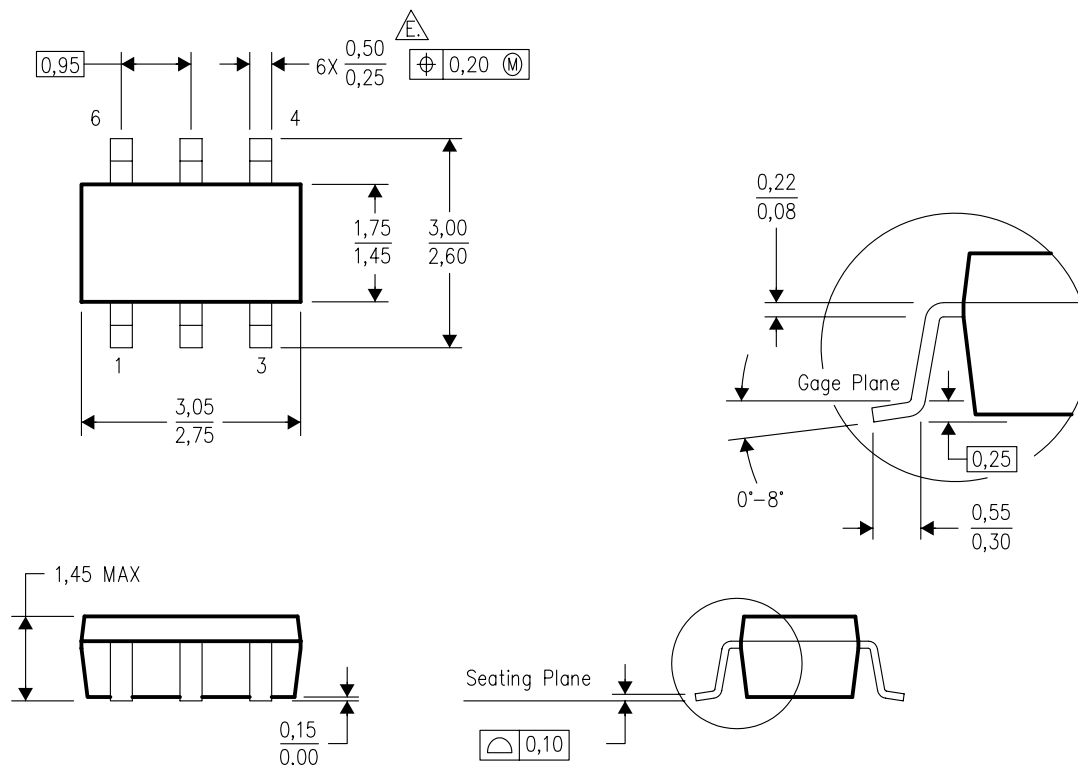
⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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DBV (R-PDSO-G6)

PLASTIC SMALL-OUTLINE PACKAGE

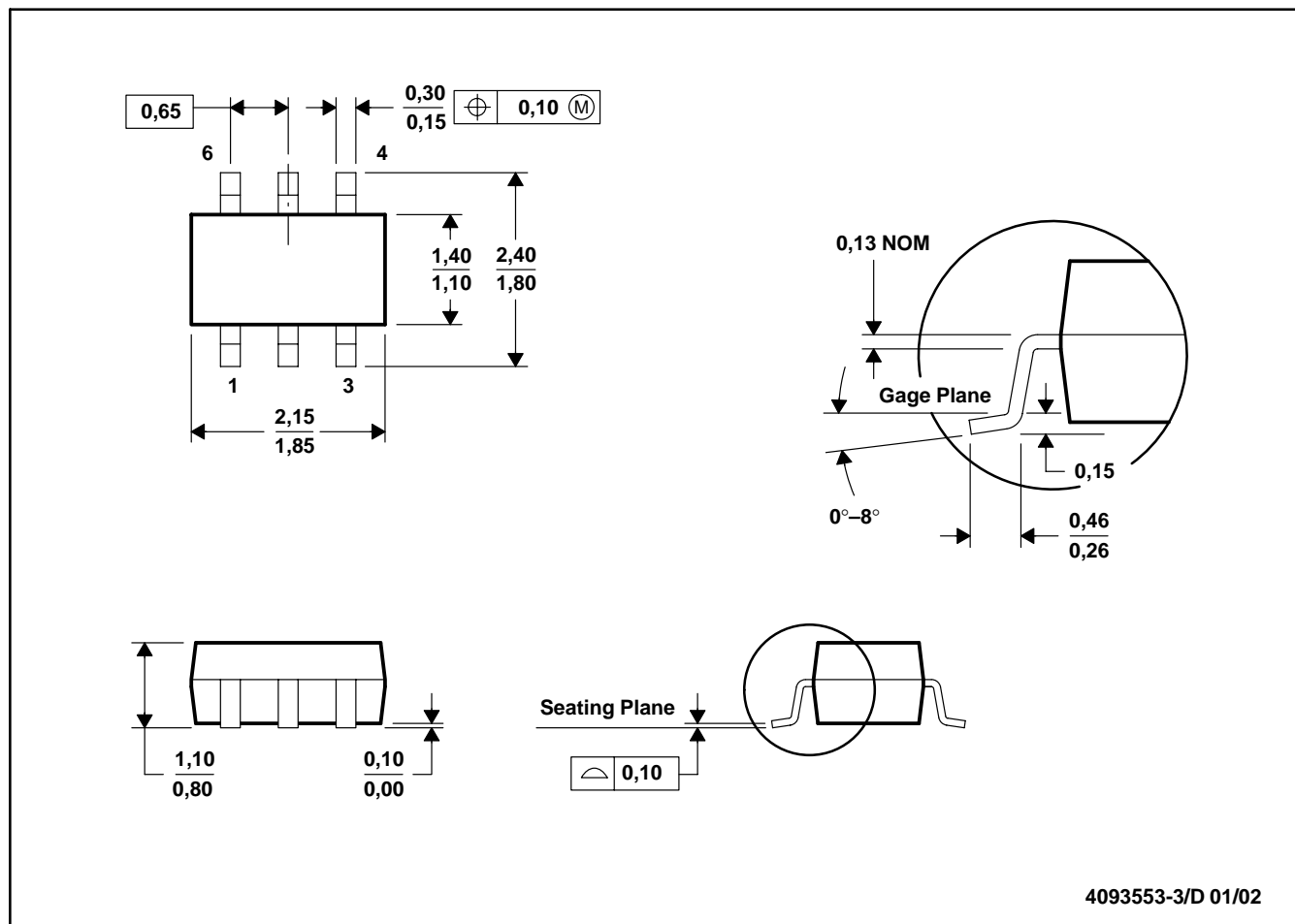


4073253-5/J 10/2005

- 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. Mold flash and protrusion shall not exceed 0.15 per side.
 - D. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
-  Falls within JEDEC MO-178 Variation AB, except minimum lead width.

DCK (R-PDSO-G6)

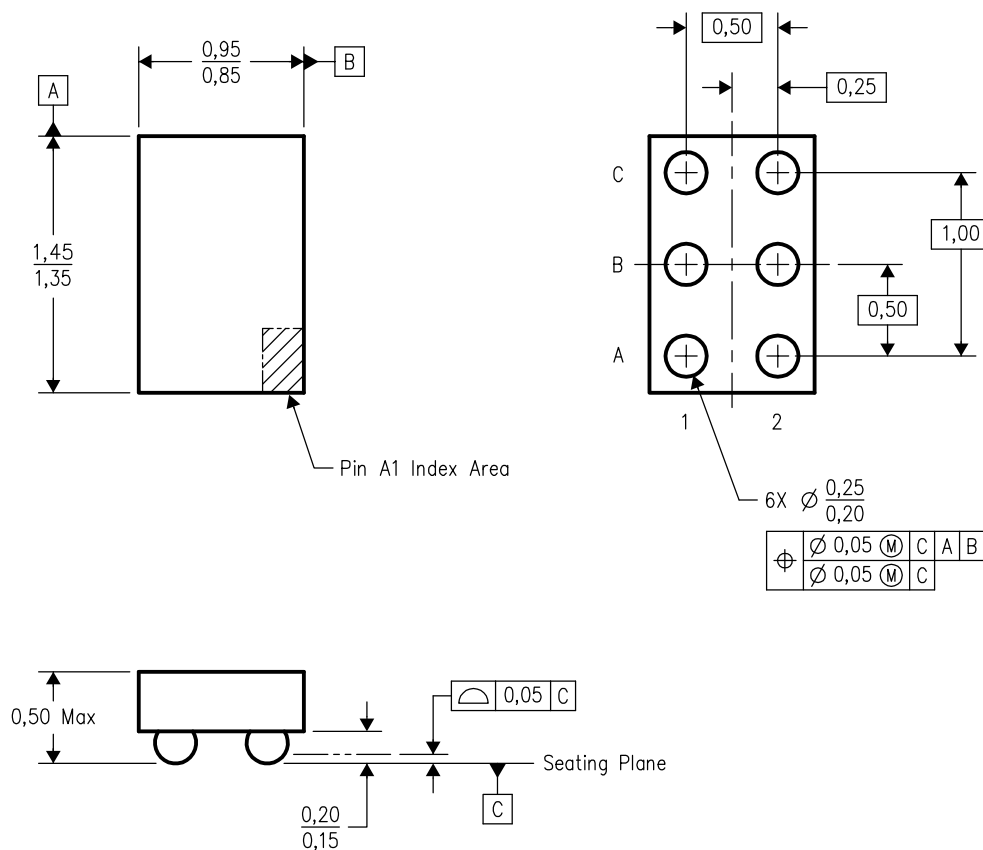
PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion.
 - Falls within JEDEC MO-203

YZP (R-XBGA-N6)

DIE-SIZE BALL GRID ARRAY



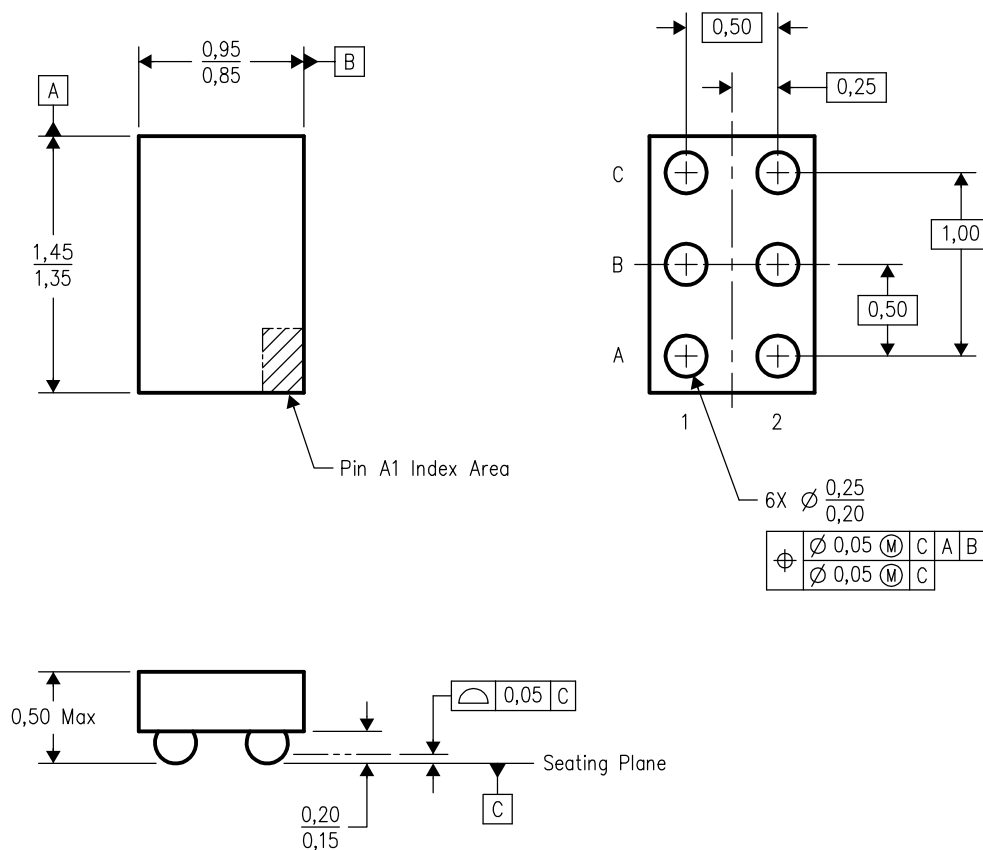
4204741-3/A 10/2002

- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. NanoFree™ package configuration.
 - D. This package is lead-free. Refer to the 6 YEP package (drawing 4204725) for tin-lead (SnPb).

NanoFree is a trademark of Texas Instruments.

YEP (R-XBGA-N6)

DIE-SIZE BALL GRID ARRAY



4204725-3/A 10/2002

- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. NanoStar™ package configuration.
 - D. This package is tin-lead (SnPb). Refer to the 6 YZP package (drawing 4204741) for lead-free.

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| DSP | dsp.ti.com | Broadband | www.ti.com/broadband |
| Interface | interface.ti.com | Digital Control | www.ti.com/digitalcontrol |
| Logic | logic.ti.com | Military | www.ti.com/military |
| Power Mgmt | power.ti.com | Optical Networking | www.ti.com/opticalnetwork |
| Microcontrollers | microcontroller.ti.com | Security | www.ti.com/security |
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