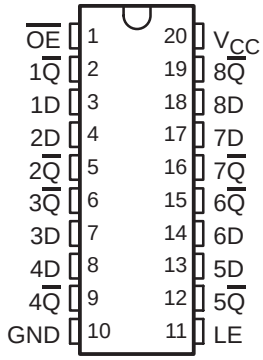
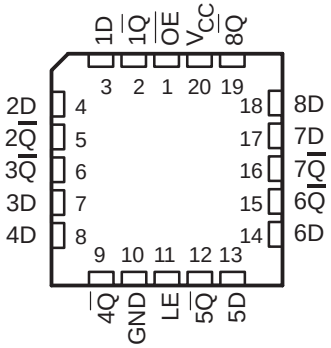
- **2-V to 6-V $V_{CC}$ Operation**
- **Inputs Accept Voltages to 6 V**
- **Max $t_{pd}$ of 10.5 ns at 5 V**
- **3-State Inverting Outputs Drive Bus Lines Directly**
- **Full Parallel Access for Loading**

**SN54AC533 . . . J OR W PACKAGE**
**SN74AC533 . . . DB, DW, N, NS, OR PW PACKAGE**
**(TOP VIEW)**




**SN54AC533 . . . FK PACKAGE**
**(TOP VIEW)**




## description/ordering information

The ’AC533 devices are octal transparent D-type latches with 3-state outputs. When the latch-enable (LE) input is high, the $\overline{Q}$ outputs follow the complements of the data (D) inputs. When LE is taken low, the $\overline{Q}$ outputs are latched at the inverse logic levels set up at the 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 the 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 latches. 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.

**ORDERING INFORMATION**

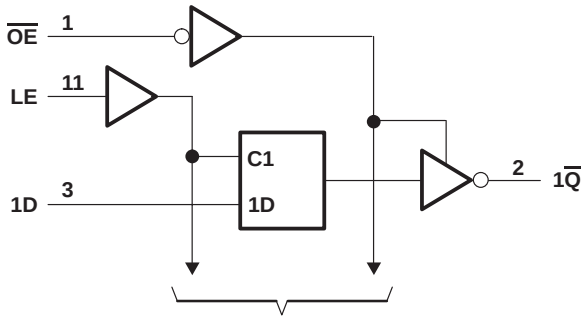
| $T_A$ | PACKAGE† | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---|---|---|---|---|
| −40°C to 85°C | PDIP − N | Tube | SN74AC533N | SN74AC533N |
| | SOIC − DW | Tube | SN74AC533DW | AC533 |
| | | Tape and reel | SN74AC533DWR | |
| | SOP − NS | Tape and reel | SN74AC533NSR | AC533 |
| | SSOP − DB | Tape and reel | SN74AC533DBR | AC533 |
| | TSSOP − PW | Tube | SN74AC533PW | AC533 |
| | | Tape and reel | SN74AC533PWR | |
| −55°C to 125°C | CDIP − J | Tube | SNJ54AC533J | SNJ54AC533J |
| | CFP − W | Tube | SNJ54AC533W | SNJ54AC533W |
| | LCCC − FK | Tube | SNJ54AC533FK | SNJ54AC533FK |

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

**FUNCTION TABLE**
**(each latch)**

| INPUTS | | | OUTPUT |
|---|---|---|---|
| $\overline{OE}$ | LE | D | $\overline{Q}$ |
| L | H | H | L |
| L | H | L | H |
| L | L | X | $\overline{Q}_0$ |
| H | X | X | Z |

## logic diagram (positive logic)




**To Seven Other Channels**

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

Supply voltage range, $V_{CC}$ . . . . . −0.5 V to 7 V
Input voltage range, $V_I$ (see Note 1) . . . . . −0.5 V to $V_{CC}$ + 0.5 V
Output voltage range, $V_O$ (see Note 1) . . . . . −0.5 V to $V_{CC}$ + 0.5 V
Input clamp current, $I_{IK}$ ($V_I$ < 0 or $V_I$ > $V_{CC}$) . . . . . ±20 mA
Output clamp current, $I_{OK}$ ($V_O$ < 0 or $V_O$ > $V_{CC}$) . . . . . ±20 mA
Continuous output current, $I_O$ ($V_O$ = 0 to $V_{CC}$) . . . . . ±50 mA
Continuous current through $V_{CC}$ or GND . . . . . ±200 mA
Package thermal impedance, $\theta_{JA}$ (see Note 2): DB package . . . . . 70°C/W
DW package . . . . . 58°C/W
N package . . . . . 69°C/W
NS package . . . . . 60°C/W
PW package . . . . . 83°C/W
Storage temperature range, $T_{stg}$ . . . . . −65°C to 150°C

† 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 voltage ratings may be exceeded if the input and output current ratings are observed.
2. The package thermal impedance is calculated in accordance with JESD 51-7.

## recommended operating conditions (see Note 3)

| | | | SN54AC533 | | SN74AC533 | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | MIN | MAX | MIN | MAX | |
| $V_{CC}$ | Supply voltage | | 2 | 6 | 2 | 6 | V |
| $V_{IH}$ | High-level input voltage | $V_{CC}$ = 3 V | 2.1 | | 2.1 | | V |
| | | $V_{CC}$ = 4.5 V | 3.15 | | 3.15 | | |
| | | $V_{CC}$ = 5.5 V | 3.85 | | 3.85 | | |
| $V_{IL}$ | Low-level input voltage | $V_{CC}$ = 3 V | | 0.9 | | 0.9 | V |
| | | $V_{CC}$ = 4.5 V | | 1.35 | | 1.35 | |
| | | $V_{CC}$ = 5.5 V | | 1.65 | | 1.65 | |
| $V_I$ | Input voltage | | 0 | $V_{CC}$ | 0 | $V_{CC}$ | V |
| $V_O$ | Output voltage | | 0 | $V_{CC}$ | 0 | $V_{CC}$ | V |
| $I_{OH}$ | High-level output current | $V_{CC}$ = 3 V | | −12 | | −12 | mA |
| | | $V_{CC}$ = 4.5 V | | −24 | | −24 | |
| | | $V_{CC}$ = 5.5 V | | −24 | | −24 | |
| $I_{OL}$ | Low-level output current | $V_{CC}$ = 3 V | | 12 | | 12 | mA |
| | | $V_{CC}$ = 4.5 V | | 24 | | 24 | |
| | | $V_{CC}$ = 5.5 V | | 24 | | 24 | |
| $\Delta t/\Delta v$ | Input transition rise or fall rate | | | 8 | | 8 | ns/V |
| $T_A$ | Operating free-air temperature | | −55 | 125 | −40 | 85 | °C |

NOTE 3: 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 | $V_{CC}$ | $T_A$ = 25°C | | | SN54AC533 | | SN74AC533 | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| $V_{OH}$ | $I_{OH}$ = −50 μA | 3 V | 2.9 | | | 2.9 | | 2.9 | | V |
| | | 4.5 V | 4.4 | | | 4.4 | | 4.4 | | |
| | | 5.5 V | 5.4 | | | 5.4 | | 5.4 | | |
| | $I_{OH}$ = −12 mA | 3 V | 2.56 | | | 2.4 | | 2.46 | | |
| | $I_{OH}$ = −24 mA | 4.5 V | 3.86 | | | 3.7 | | 3.76 | | |
| | | 5.5 V | 4.86 | | | 4.7 | | 4.76 | | |
| $V_{OL}$ | $I_{OL}$ = 50 μA | 3 V | | | 0.1 | | 0.1 | | 0.1 | V |
| | | 4.5 V | | | 0.1 | | 0.1 | | 0.1 | |
| | | 5.5 V | | | 0.1 | | 0.1 | | 0.1 | |
| | $I_{OL}$ = 12 mA | 3 V | | | 0.36 | | 0.5 | | 0.44 | |
| | $I_{OL}$ = 24 mA | 4.5 V | | | 0.36 | | 0.5 | | 0.44 | |
| | | 5.5 V | | | 0.36 | | 0.5 | | 0.44 | |
| $I_{OZ}$ | $V_O$ = $V_{CC}$ or GND | 5.5 V | | | ±0.25 | | ±5 | | ±2.5 | μA |
| $I_I$ | $V_I$ = $V_{CC}$ or GND | 5.5 V | | | ±0.1 | | ±1 | | ±1 | μA |
| $I_{CC}$ | $V_I$ = $V_{CC}$ or GND, $I_O$ = 0 | 5.5 V | | | 4 | | 80 | | 40 | μA |
| $C_i$ | $V_I$ = $V_{CC}$ or GND | 5 V | | 4.5 | | | | | | pF |

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

| | | $T_A$ = 25°C | | SN54AC533 | | SN74AC533 | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | MIN | MAX | MIN | MAX | MIN | MAX | |
| $t_w$ | Pulse duration, LE high | 6 | | 8 | | 6.5 | | ns |
| $t_{su}$ | Setup time, data before LE↓ | 5.5 | | 7.5 | | 6 | | ns |
| $t_h$ | Hold time, data after LE↓ | 1.5 | | 2.5 | | 1 | | ns |

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

| | | $T_A$ = 25°C | | SN54AC533 | | SN74AC533 | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | MIN | MAX | MIN | MAX | MIN | MAX | |
| $t_w$ | Pulse duration, LE high | 4.5 | | 6.5 | | 5 | | ns |
| $t_{su}$ | Setup time, data before LE↓ | 4 | | 6 | | 4.5 | | ns |
| $t_h$ | Hold time, data after LE↓ | 1.5 | | 2.5 | | 1 | | ns |

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

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $T_A$ = 25°C | | SN54AC533 | | SN74AC533 | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | MAX | MIN | MAX | MIN | MAX | |
| $t_{PLH}$ | D | $\overline{Q}$ | 2 | 14 | 1 | 17.5 | 1.5 | 16 | ns |
| $t_{PHL}$ | | | 2 | 13 | 1 | 16 | 1.5 | 14.5 | |
| $t_{PLH}$ | LE | $\overline{Q}$ | 2 | 14.5 | 1 | 18 | 1.5 | 16.5 | ns |
| $t_{PHL}$ | | | 2 | 13 | 1 | 16 | 1.5 | 14.5 | |
| $t_{PZH}$ | $\overline{OE}$ | $\overline{Q}$ | 2 | 12.5 | 1 | 15.5 | 1.5 | 14 | ns |
| $t_{PZL}$ | | | 2 | 12.5 | 1 | 15.5 | 1.5 | 14 | |
| $t_{PHZ}$ | $\overline{OE}$ | $\overline{Q}$ | 2 | 13 | 1 | 16 | 1.5 | 14.5 | ns |
| $t_{PLZ}$ | | | 2 | 13 | 1 | 16 | 1.5 | 14.5 | |

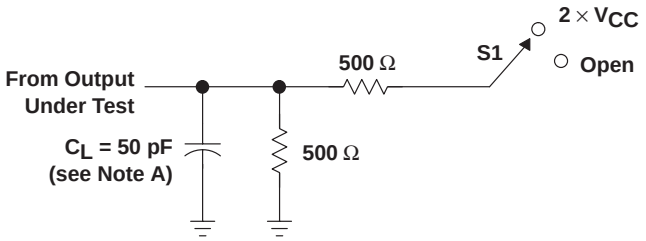
### switching characteristics over recommended operating free-air temperature range, $V_{CC}$ = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $T_A$ = 25°C | | SN54AC533 | | SN74AC533 | | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | MAX | MIN | MAX | MIN | MAX | |
| $t_{PLH}$ | D | $\overline{Q}$ | 2 | 10 | 1 | 12.5 | 1.5 | 11 | ns |
| $t_{PHL}$ | | | 2 | 9.5 | 1 | 12 | 1.5 | 10.5 | |
| $t_{PLH}$ | LE | $\overline{Q}$ | 2 | 10.5 | 1 | 13 | 1.5 | 11.5 | ns |
| $t_{PHL}$ | | | 2 | 10 | 1 | 13 | 1.5 | 11 | |
| $t_{PZH}$ | $\overline{OE}$ | $\overline{Q}$ | 2 | 9.5 | 1 | 12 | 1.5 | 10.5 | ns |
| $t_{PZL}$ | | | 2 | 9.5 | 1 | 12 | 1.5 | 10.5 | |
| $t_{PHZ}$ | $\overline{OE}$ | $\overline{Q}$ | 2 | 10 | 1 | 12.5 | 1.5 | 11 | ns |
| $t_{PLZ}$ | | | 2 | 10 | 1 | 12.5 | 1.5 | 11 | |

### operating characteristics, $V_{CC}$ = 5 V, $T_A$ = 25°C

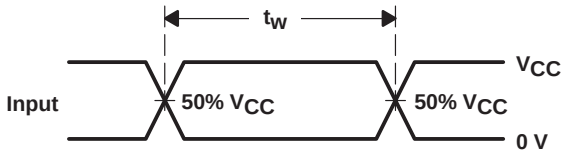
| PARAMETER | | TEST CONDITIONS | TYP | UNIT |
|---|---|---|---|---|
| $C_{pd}$ | Power dissipation capacitance | $C_L$ = 50 pF, f = 1 MHz | 40 | pF |

## PARAMETER MEASUREMENT INFORMATION

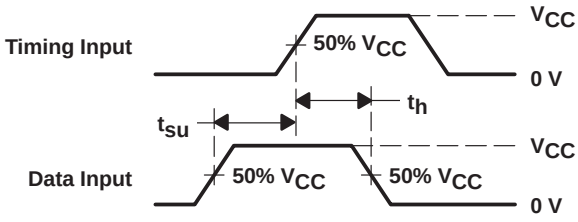



| TEST | S1 |
|---|---|
| $t_{PLH}/t_{PHL}$ | Open |
| $t_{PLZ}/t_{PZL}$ | $2 \times V_{CC}$ |
| $t_{PHZ}/t_{PZH}$ | Open |

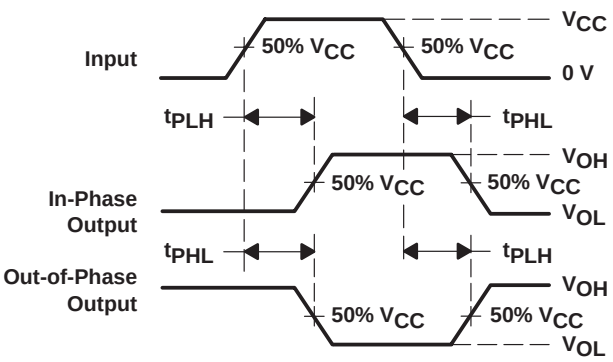
LOAD CIRCUIT



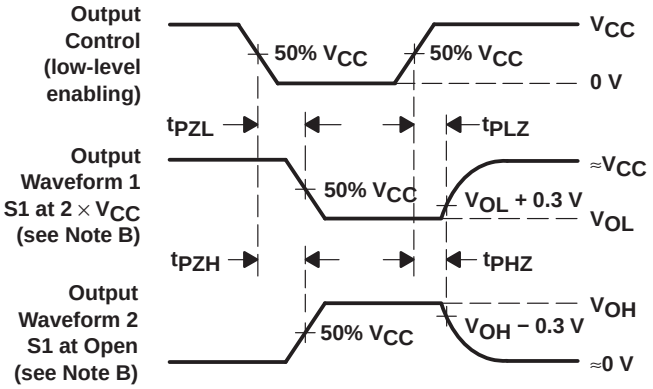

VOLTAGE WAVEFORMS




VOLTAGE WAVEFORMS




VOLTAGE WAVEFORMS




VOLTAGE WAVEFORMS

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 ≤ 1 MHz, $Z_O$ = 50 Ω, $t_r$ ≤ 2.5 ns, $t_f$ ≤ 2.5 ns.
D. The outputs are measured one at a time with one input transition per measurement.

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

## PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SN74AC533DBLE | OBSOLETE | SSOP | DB | 20 | | TBD | Call TI | Call TI | -40 to 85 | | |
| SN74AC533DBR | OBSOLETE | SSOP | DB | 20 | | TBD | Call TI | Call TI | -40 to 85 | AC533 | |
| SN74AC533DBRE4 | OBSOLETE | SSOP | DB | 20 | | TBD | Call TI | Call TI | -40 to 85 | | |
| SN74AC533DBRG4 | OBSOLETE | SSOP | DB | 20 | | TBD | Call TI | Call TI | -40 to 85 | | |
| SN74AC533DW | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | AC533 | Samples |
| SN74AC533DWG4 | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | AC533 | Samples |
| SN74AC533DWR | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | AC533 | Samples |
| SN74AC533DWRE4 | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | AC533 | Samples |
| SN74AC533DWRG4 | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | AC533 | Samples |
| SN74AC533NSR | OBSOLETE | SO | NS | 20 | | TBD | Call TI | Call TI | -40 to 85 | AC533 | |
| SN74AC533NSRE4 | OBSOLETE | SO | NS | 20 | | TBD | Call TI | Call TI | -40 to 85 | | |
| SN74AC533NSRG4 | OBSOLETE | SO | NS | 20 | | TBD | Call TI | Call TI | -40 to 85 | | |
| SN74AC533PW | ACTIVE | TSSOP | PW | 20 | 70 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | AC533 | Samples |
| SN74AC533PWE4 | ACTIVE | TSSOP | PW | 20 | 70 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | AC533 | Samples |
| SN74AC533PWG4 | ACTIVE | TSSOP | PW | 20 | 70 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | AC533 | Samples |
| SN74AC533PWLE | OBSOLETE | TSSOP | PW | 20 | | TBD | Call TI | Call TI | -40 to 85 | | |

(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.
**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)

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

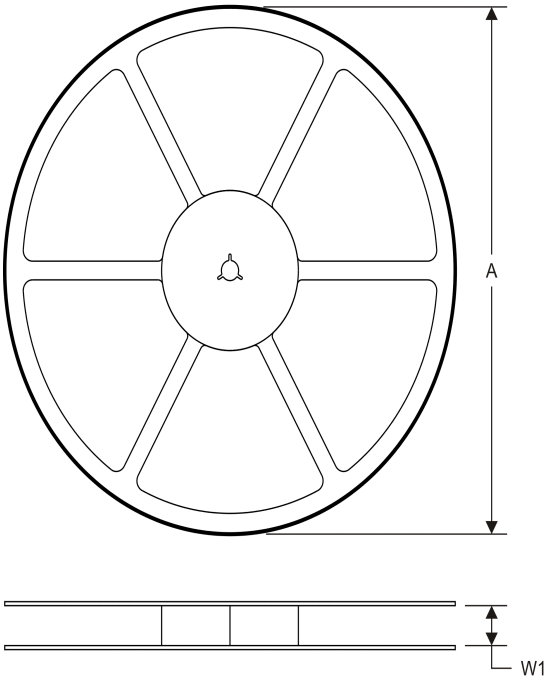
**(4)** There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

**(5)** Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

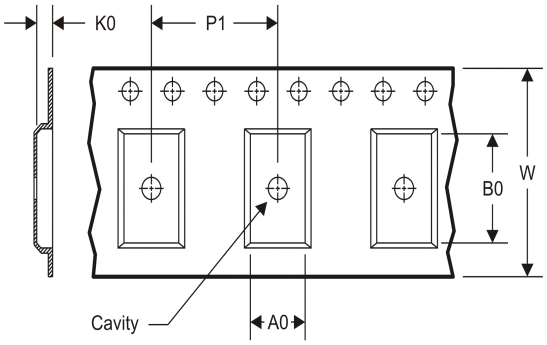
**(6)** Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**




**TAPE DIMENSIONS**



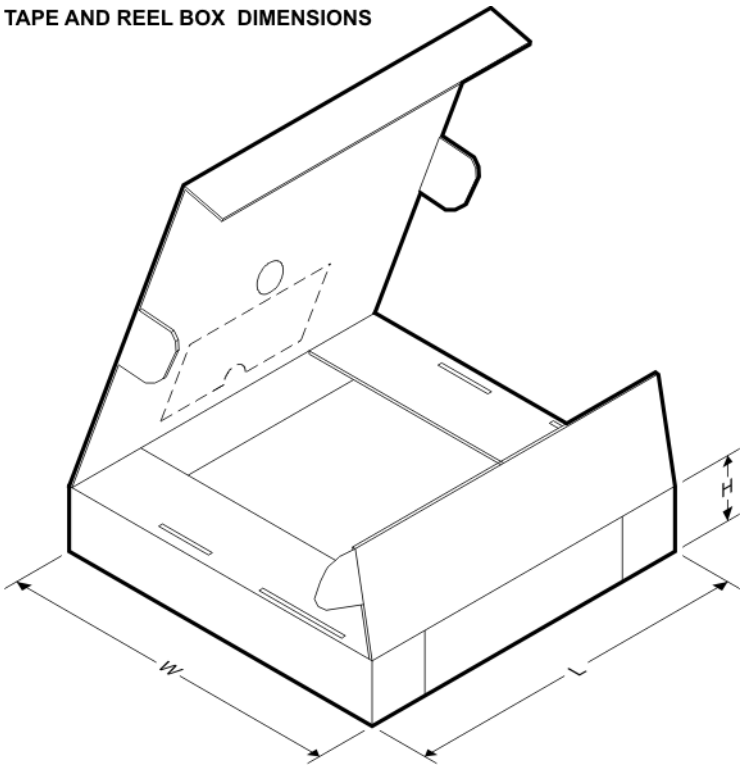

| | |
|---|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

**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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SN74AC533DWR | SOIC | DW | 20 | 2000 | 330.0 | 24.4 | 10.8 | 13.0 | 2.7 | 12.0 | 24.0 | Q1 |

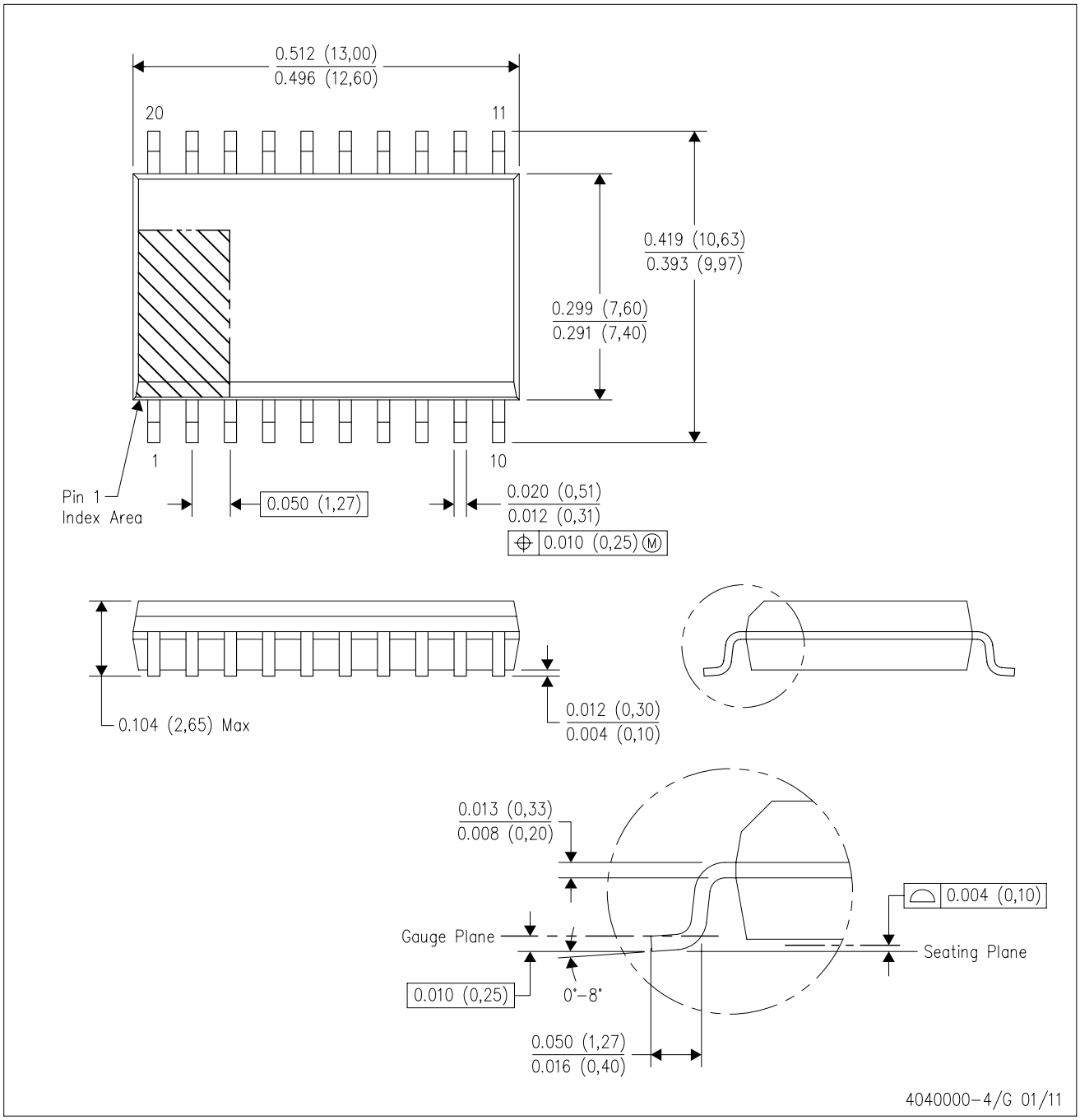
TAPE AND REEL BOX DIMENSIONS




*All dimensions are nominal

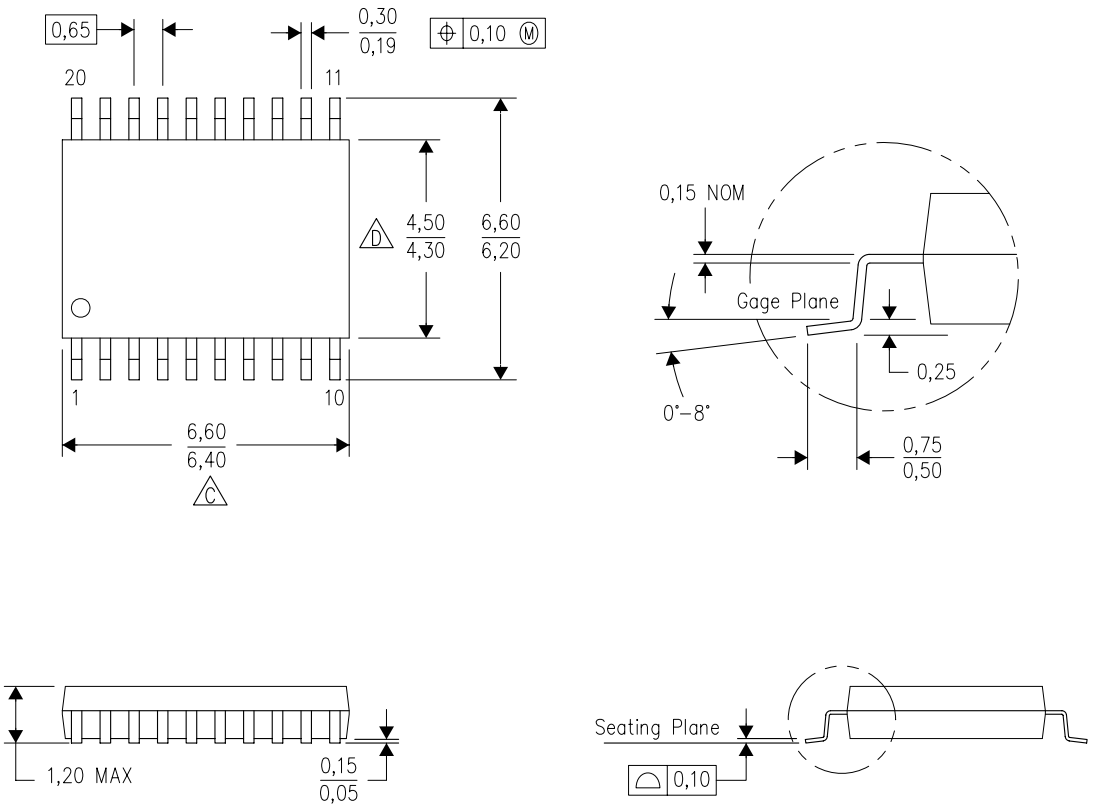
| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| SN74AC533DWR | SOIC | DW | 20 | 2000 | 367.0 | 367.0 | 45.0 |

DW (R–PDSO–G20) PLASTIC SMALL OUTLINE




NOTES:
A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M–1994.
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 variation AC.

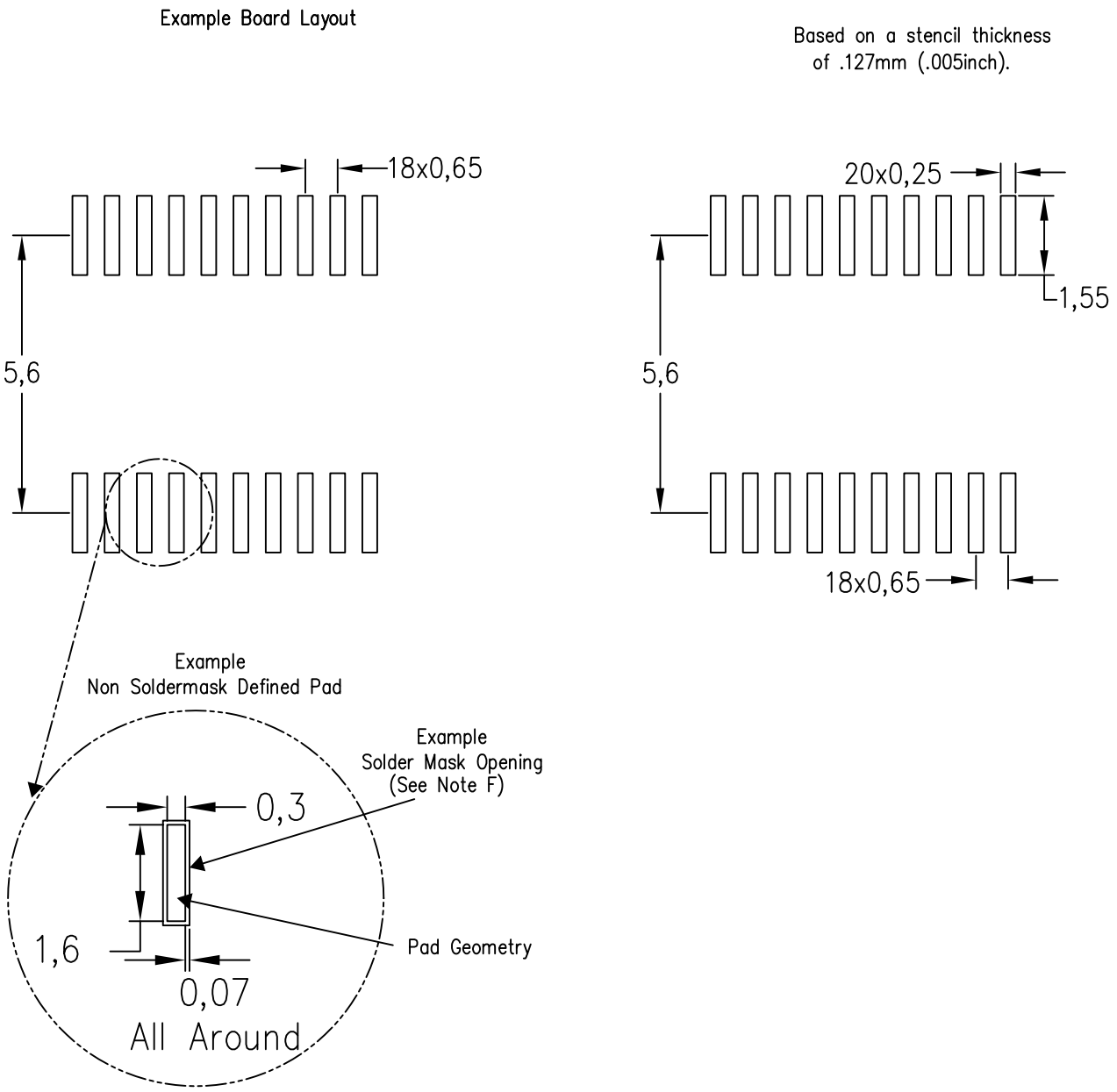
PW (R–PDSO–G20) PLASTIC SMALL OUTLINE




4040064–5/G 02/11

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. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
E. Falls within JEDEC MO–153

PW (R–PDSO–G20) PLASTIC SMALL OUTLINE

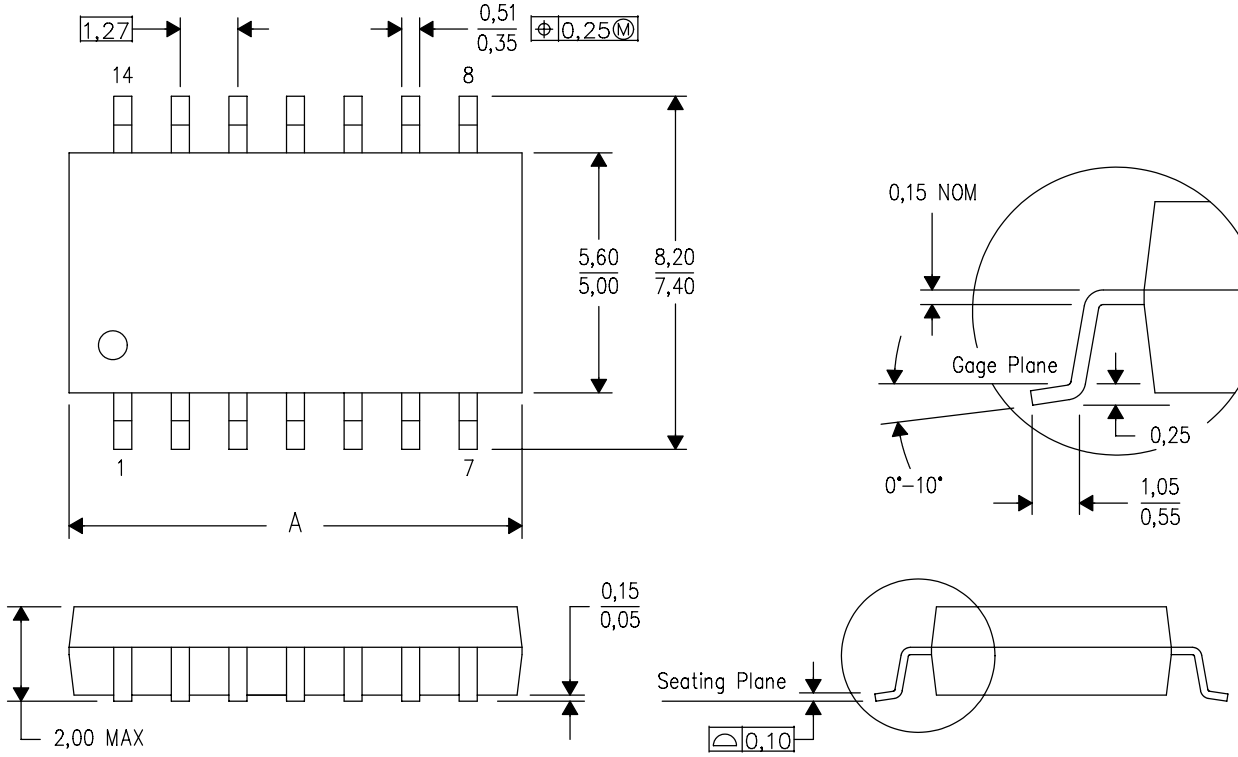



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate design.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC–7525 for other stencil recommendations.
E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

## 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.

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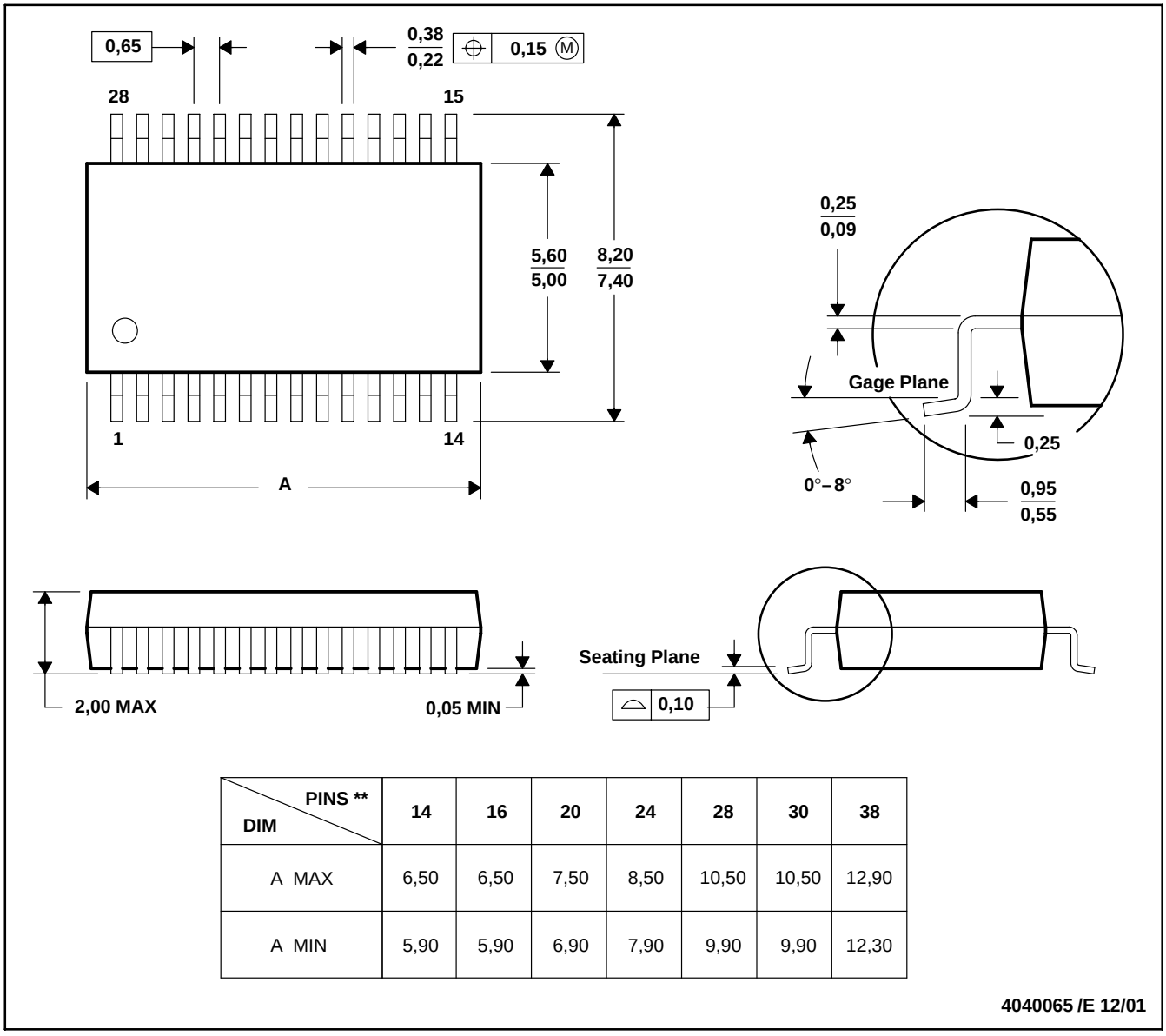
**DB (R-PDSO-G**)** **PLASTIC SMALL-OUTLINE**

**28 PINS SHOWN**




| DIM \ PINS ** | 14 | 16 | 20 | 24 | 28 | 30 | 38 |
|---|---|---|---|---|---|---|---|
| A MAX | 6,50 | 6,50 | 7,50 | 8,50 | 10,50 | 10,50 | 12,90 |
| A MIN | 5,90 | 5,90 | 6,90 | 7,90 | 9,90 | 9,90 | 12,30 |

**4040065 /E 12/01**

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

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