

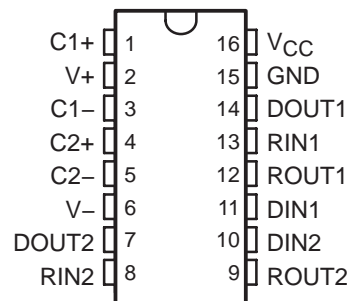
# MAX3232

## 3-V TO 5.5-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER WITH $\pm 15$ -kV ESD PROTECTION

SLLS410I – JANUARY 2000 – REVISED JANUARY 2004

- RS-232 Bus-Pin ESD Protection Exceeds  $\pm 15$  kV Using Human-Body Model (HBM)
- Meets or Exceeds the Requirements of TIA/EIA-232-F and ITU v.28 Standards
- Operates With 3-V to 5.5-V  $V_{CC}$  Supply
- Operates Up To 250 kbit/s
- Two Drivers and Two Receivers
- Low Supply Current . . . 300  $\mu$ A Typical
- External Capacitors . . .  $4 \times 0.1 \mu$ F
- Accepts 5-V Logic Input With 3.3-V Supply
- Alternative High-Speed Pin-Compatible Device (1 Mbit/s)
  - SNx5C3232
- Applications
  - Battery-Powered Systems, PDAs, Notebooks, Laptops, Palmtop PCs, and Hand-Held Equipment

D, DB, DW, OR PW PACKAGE  
(TOP VIEW)



### description/ordering information

#### ORDERING INFORMATION

| $T_A$         | PACKAGE†   |              | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---------------|------------|--------------|-----------------------|------------------|
| –0°C to 70°C  | SOIC (D)   | Tube of 40   | MAX3232CD             | MAX3232C         |
|               |            | Reel of 2500 | MAX3232CDR            |                  |
|               | SOIC (DW)  | Tube of 40   | MAX3232CDW            | MAX3232C         |
|               |            | Reel of 2000 | MAX3232CDWR           |                  |
|               | SSOP (DB)  | Tube of 80   | MAX3232CDB            | MA3232C          |
|               |            | Reel of 2000 | MAX3232CDBR           |                  |
|               | TSSOP (PW) | Tube of 90   | MAX3232CPW            | MA3232C          |
|               |            | Reel of 2000 | MAX3232CPWR           |                  |
| –40°C to 85°C | SOIC (D)   | Tube of 40   | MAX3232ID             | MAX3232I         |
|               |            | Reel of 2500 | MAX3232IDR            |                  |
|               | SOIC (DW)  | Tube of 40   | MAX3232IDW            | MAX3232I         |
|               |            | Reel of 2000 | MAX3232IDWR           |                  |
|               | SSOP (DB)  | Tube of 80   | MAX3232IDB            | MB3232I          |
|               |            | Reel of 2000 | MAX3232IDBR           |                  |
|               | TSSOP (PW) | Tube of 90   | MAX3232IPW            | MB3232I          |
|               |            | Reel of 2000 | MAX3232IPWR           |                  |

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



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**TEXAS  
INSTRUMENTS**

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**MAX3232**  
**3-V TO 5.5-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER**  
**WITH ±15-kV ESD PROTECTION**

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**description/ordering information (continued)**

The MAX3232 device consists of two line drivers, two line receivers, and a dual charge-pump circuit with ±15-kV ESD protection pin to pin (serial-port connection pins, including GND). The device meets the requirements of TIA/EIA-232-F and provides the electrical interface between an asynchronous communication controller and the serial-port connector. The charge pump and four small external capacitors allow operation from a single 3-V to 5.5-V supply. The devices operate at data signaling rates up to 250 kbit/s and a maximum of 30-V/μs driver output slew rate.

**Function Tables**

**EACH DRIVER**

| INPUT<br>DIN | OUTPUT<br>DOUT |
|--------------|----------------|
| L            | H              |
| H            | L              |

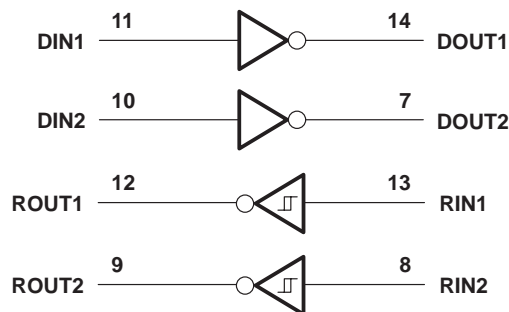
H = high level, L = low level

**EACH RECEIVER**

| INPUT<br>RIN | OUTPUT<br>ROUT |
|--------------|----------------|
| L            | H              |
| H            | L              |
| Open         | H              |

H = high level, L = low level, Open = input disconnected or connected driver off

**logic diagram (positive logic)**



# MAX3232

## 3-V TO 5.5-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER WITH $\pm 15$ -kV ESD PROTECTION

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

|   |                            |
|---|----------------------------|
| Supply voltage range, $V_{CC}$ (see Note 1)                             | –0.3 V to 6 V              |
| Positive output supply voltage range, $V+$ (see Note 1)                 | –0.3 V to 7 V              |
| Negative output supply voltage range, $V-$ (see Note 1)                 | 0.3 V to –7 V              |
| Supply voltage difference, $V+ - V-$ (see Note 1)                       | 13 V                       |
| Input voltage range, $V_I$ : Drivers                                    | –0.3 V to 6 V              |
| Receivers   | –25 V to 25 V              |
| Output voltage range, $V_O$ : Drivers                                   | –13.2 V to 13.2 V          |
| Receivers   | –0.3 V to $V_{CC} + 0.3$ V |
| Package thermal impedance, $\theta_{JA}$ (see Notes 2 and 3): D package | 73°C/W                     |
| DB package  | 82°C/W                     |
| DW package  | 57°C/W                     |
| PW package  | 108°C/W                    |
| Operating virtual junction temperature, $T_J$                           | 150°C                      |
| 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. All voltages are with respect to network GND.  
 2. Maximum power dissipation is a function of  $T_J(\max)$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(\max) - T_A)/\theta_{JA}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability.  
 3. The package thermal impedance is calculated in accordance with JESD 51-7.

### recommended operating conditions (see Note 4 and Figure 4)

|                |                                 | MIN              | NOM  | MAX | UNIT |   |
|----------------|---------------------------------|------------------|--|-----|------|---|
| Supply voltage |                                 | $V_{CC} = 3.3$ V | 3  | 3.3 | 3.6  | V |
|                |                                 | $V_{CC} = 5$ V   | 4.5  | 5   | 5.5  |   |
| $V_{IH}$       | Driver high-level input voltage | DIN              | $V_{CC} = 3.3$ V<br>2<br>$V_{CC} = 5$ V<br>2.4 |     | V    |   |
| $V_{IL}$       | Driver low-level input voltage  | DIN              |  | 0.8 | V    |   |
| $V_I$          | Driver input voltage            | DIN              | 0  | 5.5 | V    |   |
|                | Receiver input voltage          |                  | –25  | 25  |      |   |
| $T_A$          | Operating free-air temperature  | MAX3232C         | 0  | 70  | °C   |   |
|                |                                 | MAX3232I         | –40  | 85  |      |   |

NOTE 4: Test conditions are C1–C4 = 0.1  $\mu$ F at  $V_{CC} = 3.3$  V  $\pm$  0.3 V; C1 = 0.047  $\mu$ F, C2–C4 = 0.33  $\mu$ F at  $V_{CC} = 5$  V  $\pm$  0.5 V.

### electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 4 and Figure 4)

| PARAMETER               | TEST CONDITIONS                  | MIN | TYP <sup>‡</sup> | MAX | UNIT |
|-------------------------|----------------------------------|-----|------------------|-----|------|
| $I_{CC}$ Supply current | No load, $V_{CC} = 3.3$ V or 5 V |     | 0.3              | 1   | mA   |

<sup>‡</sup> All typical values are at  $V_{CC} = 3.3$  V or  $V_{CC} = 5$  V, and  $T_A = 25^\circ$ C.

NOTE 4: Test conditions are C1–C4 = 0.1  $\mu$ F at  $V_{CC} = 3.3$  V  $\pm$  0.3 V; C1 = 0.047  $\mu$ F, C2–C4 = 0.33  $\mu$ F at  $V_{CC} = 5$  V  $\pm$  0.5 V.



**MAX3232****3-V TO 5.5-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER  
WITH ±15-kV ESD PROTECTION**

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**DRIVER SECTION****electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 4 and Figure 4)**

| PARAMETER         |                              | TEST CONDITIONS   | MIN | TYP†  | MAX | UNIT |
|-------------------|------------------------------|---|-----|-------|-----|------|
| V <sub>OH</sub>   | High-level output voltage    | DOUT at R <sub>L</sub> = 3 kΩ to GND, DIN = GND             | 5   | 5.4   |     | V    |
| V <sub>OL</sub>   | Low-level output voltage     | DOUT at R <sub>L</sub> = 3 kΩ to GND, DIN = V <sub>CC</sub> | -5  | -5.4  |     | V    |
| I <sub>IH</sub>   | High-level input current     | V <sub>I</sub> = V <sub>CC</sub>                            |     | ±0.01 | ±1  | μA   |
| I <sub>IL</sub>   | Low-level input current      | V <sub>I</sub> at GND                                       |     | ±0.01 | ±1  | μA   |
| I <sub>OS</sub> ‡ | Short-circuit output current | V <sub>CC</sub> = 3.6 V, V <sub>O</sub> = 0 V               |     | ±35   | ±60 | mA   |
|                   |                              | V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 0 V               |     |       |     |      |
| r <sub>o</sub>    | Output resistance            | V <sub>CC</sub> , V+, and V- = 0 V, V <sub>O</sub> = ±2 V   | 300 | 10M   |     | Ω    |

† All typical values are at V<sub>CC</sub> = 3.3 V or V<sub>CC</sub> = 5 V, and T<sub>A</sub> = 25°C.

‡ Short-circuit durations should be controlled to prevent exceeding the device absolute power dissipation ratings, and not more than one output should be shorted at a time.

NOTE 4: Test conditions are C1–C4 = 0.1 μF at V<sub>CC</sub> = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2–C4 = 0.33 μF at V<sub>CC</sub> = 5 V ± 0.5 V.**switching characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 4 and Figure 4)**

| PARAMETER          |  | TEST CONDITIONS  | MIN | TYP† | MAX | UNIT   |
|--------------------|--|--|-----|------|-----|--------|
|                    | Maximum data rate                              | C <sub>L</sub> = 1000 pF, R <sub>L</sub> = 3 kΩ,<br>One DOUT switching, See Figure 1       | 150 | 250  |     | kbit/s |
| t <sub>sk(p)</sub> | Pulse skew§                                    | C <sub>L</sub> = 150 pF to 2500 pF, R <sub>L</sub> = 3 kΩ to 7 kΩ,<br>See Figure 2         |     | 300  |     | ns     |
| SR(tr)             | Slew rate, transition region<br>(see Figure 1) | R <sub>L</sub> = 3 kΩ to 7 kΩ, V <sub>CC</sub> = 3.3 V, C <sub>L</sub> = 150 pF to 1000 pF | 6   |      | 30  | V/μs   |
|                    |  | C <sub>L</sub> = 150 pF to 2500 pF   | 4   |      | 30  |        |

† All typical values are at V<sub>CC</sub> = 3.3 V or V<sub>CC</sub> = 5 V, and T<sub>A</sub> = 25°C.§ Pulse skew is defined as |t<sub>pLH</sub> - t<sub>pHL</sub>| of each channel of the same device.NOTE 4: Test conditions are C1–C4 = 0.1 μF at V<sub>CC</sub> = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2–C4 = 0.33 μF at V<sub>CC</sub> = 5 V ± 0.5 V.

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**RECEIVER SECTION**

**electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 4 and Figure 4)**

| PARAMETER  | TEST CONDITIONS                | MIN                   | TYP†                  | MAX | UNIT |
|--|--------------------------------|-----------------------|-----------------------|-----|------|
| V <sub>OH</sub> High-level output voltage                                | I <sub>OH</sub> = -1 mA        | V <sub>CC</sub> -0.6V | V <sub>CC</sub> -0.1V |     | V    |
| V <sub>OL</sub> Low-level output voltage                                 | I <sub>OL</sub> = 1.6 mA       |                       |                       | 0.4 | V    |
| V <sub>IT+</sub> Positive-going input threshold voltage                  | V <sub>CC</sub> = 3.3 V        |                       | 1.5                   | 2.4 | V    |
|  | V <sub>CC</sub> = 5 V          |                       | 1.8                   | 2.4 |      |
| V <sub>IT-</sub> Negative-going input threshold voltage                  | V <sub>CC</sub> = 3.3 V        | 0.6                   | 1.2                   |     | V    |
|  | V <sub>CC</sub> = 5 V          | 0.8                   | 1.5                   |     |      |
| V <sub>hys</sub> Input hysteresis (V <sub>IT+</sub> - V <sub>IT-</sub> ) |                                |                       | 0.3                   |     | V    |
| r <sub>i</sub> Input resistance  | V <sub>I</sub> = ±3 V to ±25 V | 3                     | 5                     | 7   | kΩ   |

† All typical values are at V<sub>CC</sub> = 3.3 V or V<sub>CC</sub> = 5 V, and T<sub>A</sub> = 25°C.

NOTE 4: Test conditions are C1-C4 = 0.1 μF at V<sub>CC</sub> = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2-C4 = 0.33 μF at V<sub>CC</sub> = 5 V ± 0.5 V.

**switching characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 4 and Figure 3)**

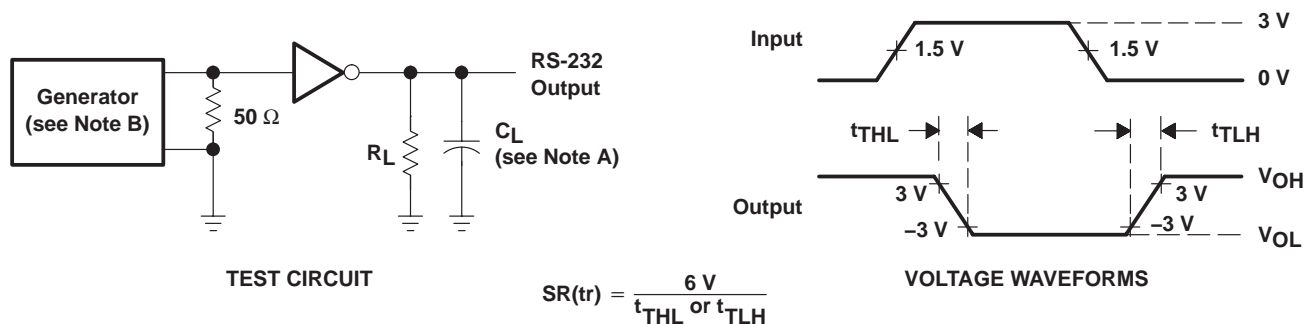
| PARAMETER  | TEST CONDITIONS         | MIN | TYP† | MAX | UNIT |
|--|-------------------------|-----|------|-----|------|
| t <sub>PLH</sub> Propagation delay time, low- to high-level output | C <sub>L</sub> = 150 pF |     | 300  |     | ns   |
| t <sub>PHL</sub> Propagation delay time, high- to low-level output |                         |     | 300  |     | ns   |
| t <sub>sk(p)</sub> Pulse skew‡                                     |                         |     |      | 300 |      |

† All typical values are at V<sub>CC</sub> = 3.3 V or V<sub>CC</sub> = 5 V, and T<sub>A</sub> = 25°C.

‡ Pulse skew is defined as |t<sub>PLH</sub> - t<sub>PHL</sub>| of each channel of the same device.

NOTE 4: Test conditions are C1-C4 = 0.1 μF at V<sub>CC</sub> = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2-C4 = 0.33 μF at V<sub>CC</sub> = 5 V ± 0.5 V.

**PARAMETER MEASUREMENT INFORMATION**



NOTES: A. C<sub>L</sub> includes probe and jig capacitance.

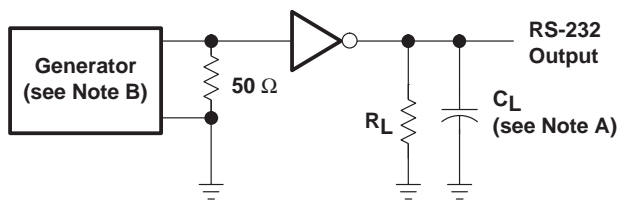
B. The pulse generator has the following characteristics: PRR = 250 kbit/s, Z<sub>O</sub> = 50 Ω, 50% duty cycle, t<sub>r</sub> ≤ 10 ns, t<sub>f</sub> ≤ 10 ns.

**Figure 1. Driver Slew Rate**

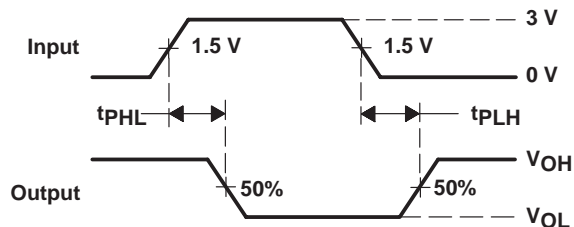
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**PARAMETER MEASUREMENT INFORMATION**



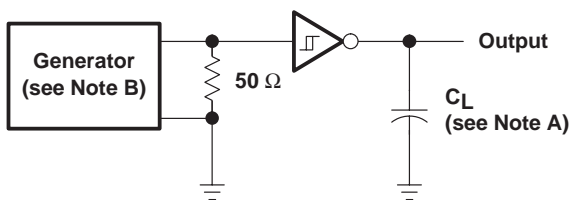
**TEST CIRCUIT**



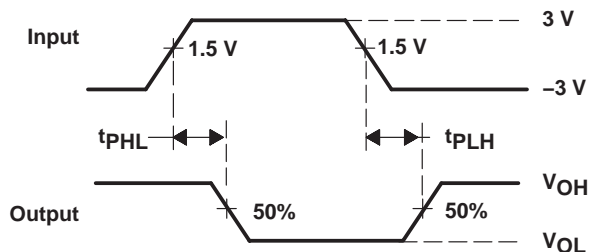
**VOLTAGE WAVEFORMS**

- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. The pulse generator has the following characteristics: PRR = 250 kbit/s,  $Z_O = 50 \Omega$ , 50% duty cycle,  $t_r \leq 10$  ns,  $t_f \leq 10$  ns.

**Figure 2. Driver Pulse Skew**



**TEST CIRCUIT**



**VOLTAGE WAVEFORMS**

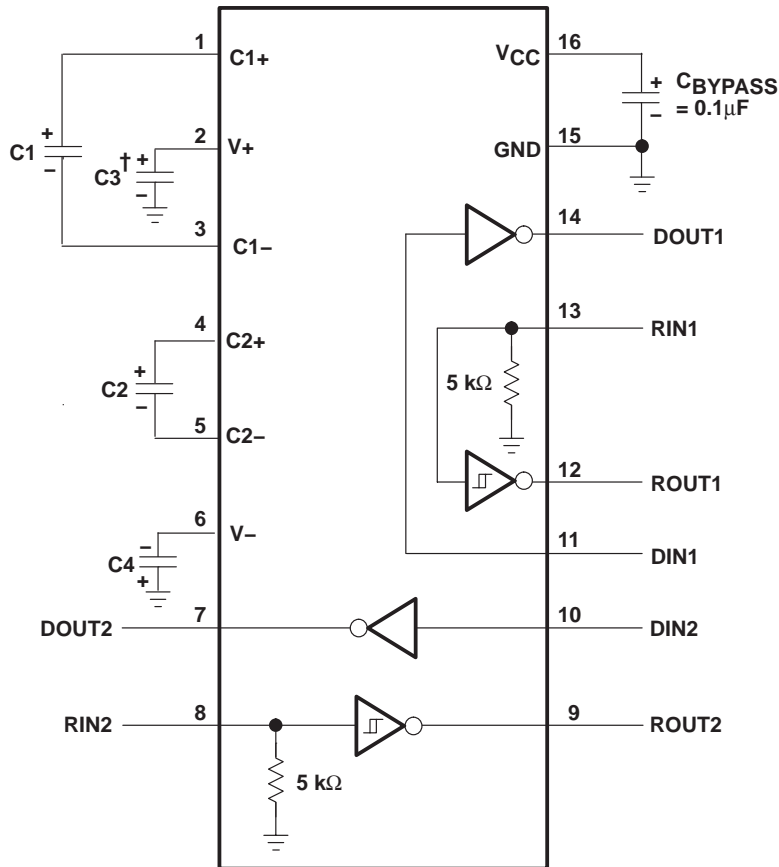
- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. The pulse generator has the following characteristics:  $Z_O = 50 \Omega$ , 50% duty cycle,  $t_r \leq 10$  ns,  $t_f \leq 10$  ns.

**Figure 3. Receiver Propagation Delay Times**

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**APPLICATION INFORMATION**



† C3 can be connected to VCC or GND.

NOTES: A. Resistor values shown are nominal.

B. Nonpolarized ceramic capacitors are acceptable. If polarized tantalum or electrolytic capacitors are used, they should be connected as shown.

**VCC vs CAPACITOR VALUES**

| VCC               | C1            | C2, C3, C4   |
|-------------------|---------------|--------------|
| 3.3 V $\pm$ 0.3 V | 0.1 $\mu$ F   | 0.1 $\mu$ F  |
| 5 V $\pm$ 0.5 V   | 0.047 $\mu$ F | 0.33 $\mu$ F |
| 3 V to 5.5 V      | 0.1 $\mu$ F   | 0.47 $\mu$ F |

**Figure 4. Typical Operating Circuit and Capacitor Values**

**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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| MAX3232CD        | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232CDB       | ACTIVE                | SSOP         | DB              | 16   | 80          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232CDBE4     | ACTIVE                | SSOP         | DB              | 16   | 80          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232CDBG4     | ACTIVE                | SSOP         | DB              | 16   | 80          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232CDBR      | ACTIVE                | SSOP         | DB              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232CDBRE4    | ACTIVE                | SSOP         | DB              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232CDBRG4    | ACTIVE                | SSOP         | DB              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232CDE4      | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232CDG4      | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232CDR       | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232CDRE4     | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232CDRG4     | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232CDW       | ACTIVE                | SOIC         | DW              | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232CDWG4     | ACTIVE                | SOIC         | DW              | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232CDWR      | ACTIVE                | SOIC         | DW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232CDWRG4    | ACTIVE                | SOIC         | DW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232CPW       | ACTIVE                | TSSOP        | PW              | 16   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232CPWE4     | ACTIVE                | TSSOP        | PW              | 16   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232CPWG4     | ACTIVE                | TSSOP        | PW              | 16   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232CPWR      | ACTIVE                | TSSOP        | PW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232CPWRE4    | ACTIVE                | TSSOP        | PW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232CPWRG4    | ACTIVE                | TSSOP        | PW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232ID        | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232IDB       | ACTIVE                | SSOP         | DB              | 16   | 80          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232IDBE4     | ACTIVE                | SSOP         | DB              | 16   | 80          | 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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| MAX3232IDBG4     | ACTIVE                | SSOP         | DB              | 16   | 80          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232IDBR      | ACTIVE                | SSOP         | DB              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232IDBRE4    | ACTIVE                | SSOP         | DB              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232IDBRG4    | ACTIVE                | SSOP         | DB              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232IDE4      | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232IDG4      | ACTIVE                | SOIC         | D               | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232IDR       | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232IDRE4     | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232IDRG4     | ACTIVE                | SOIC         | D               | 16   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232IDW       | ACTIVE                | SOIC         | DW              | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232IDWE4     | ACTIVE                | SOIC         | DW              | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232IDWG4     | ACTIVE                | SOIC         | DW              | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232IDWR      | ACTIVE                | SOIC         | DW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232IDWRE4    | ACTIVE                | SOIC         | DW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232IDWRG4    | ACTIVE                | SOIC         | DW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232IPW       | ACTIVE                | TSSOP        | PW              | 16   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232IPWE4     | ACTIVE                | TSSOP        | PW              | 16   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232IPWG4     | ACTIVE                | TSSOP        | PW              | 16   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232IPWR      | ACTIVE                | TSSOP        | PW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232IPWRE4    | ACTIVE                | TSSOP        | PW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3232IPWRG4    | ACTIVE                | TSSOP        | PW              | 16   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |

<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.

**OBSOLETE:** 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 MAX3232 :**

- Enhanced Product: [MAX3232-EP](#)

NOTE: Qualified Version Definitions:

- Enhanced Product - Supports Defense, Aerospace and Medical Applications

**TAPE AND REEL INFORMATION**

**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 |
|-------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| MAX3232CDBR | SSOP         | DB              | 16   | 2000 | 330.0              | 16.4               | 8.2     | 6.6     | 2.5     | 12.0    | 16.0   | Q1            |
| MAX3232CDR  | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |
| MAX3232CDWR | SOIC         | DW              | 16   | 2000 | 330.0              | 16.4               | 10.75   | 10.7    | 2.7     | 12.0    | 16.0   | Q1            |
| MAX3232CPWR | TSSOP        | PW              | 16   | 2000 | 330.0              | 12.4               | 7.0     | 5.6     | 1.6     | 8.0     | 12.0   | Q1            |
| MAX3232IDBR | SSOP         | DB              | 16   | 2000 | 330.0              | 16.4               | 8.2     | 6.6     | 2.5     | 12.0    | 16.0   | Q1            |
| MAX3232IDR  | SOIC         | D               | 16   | 2500 | 330.0              | 16.4               | 6.5     | 10.3    | 2.1     | 8.0     | 16.0   | Q1            |
| MAX3232IDWR | SOIC         | DW              | 16   | 2000 | 330.0              | 16.4               | 10.75   | 10.7    | 2.7     | 12.0    | 16.0   | Q1            |
| MAX3232IPWR | TSSOP        | PW              | 16   | 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) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| MAX3232CDBR | SSOP         | DB              | 16   | 2000 | 346.0       | 346.0      | 33.0        |
| MAX3232CDR  | SOIC         | D               | 16   | 2500 | 333.2       | 345.9      | 28.6        |
| MAX3232CDWR | SOIC         | DW              | 16   | 2000 | 346.0       | 346.0      | 33.0        |
| MAX3232CPWR | TSSOP        | PW              | 16   | 2000 | 346.0       | 346.0      | 29.0        |
| MAX3232IDBR | SSOP         | DB              | 16   | 2000 | 346.0       | 346.0      | 33.0        |
| MAX3232IDR  | SOIC         | D               | 16   | 2500 | 333.2       | 345.9      | 28.6        |
| MAX3232IDWR | SOIC         | DW              | 16   | 2000 | 346.0       | 346.0      | 33.0        |
| MAX3232IPWR | TSSOP        | PW              | 16   | 2000 | 346.0       | 346.0      | 29.0        |

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

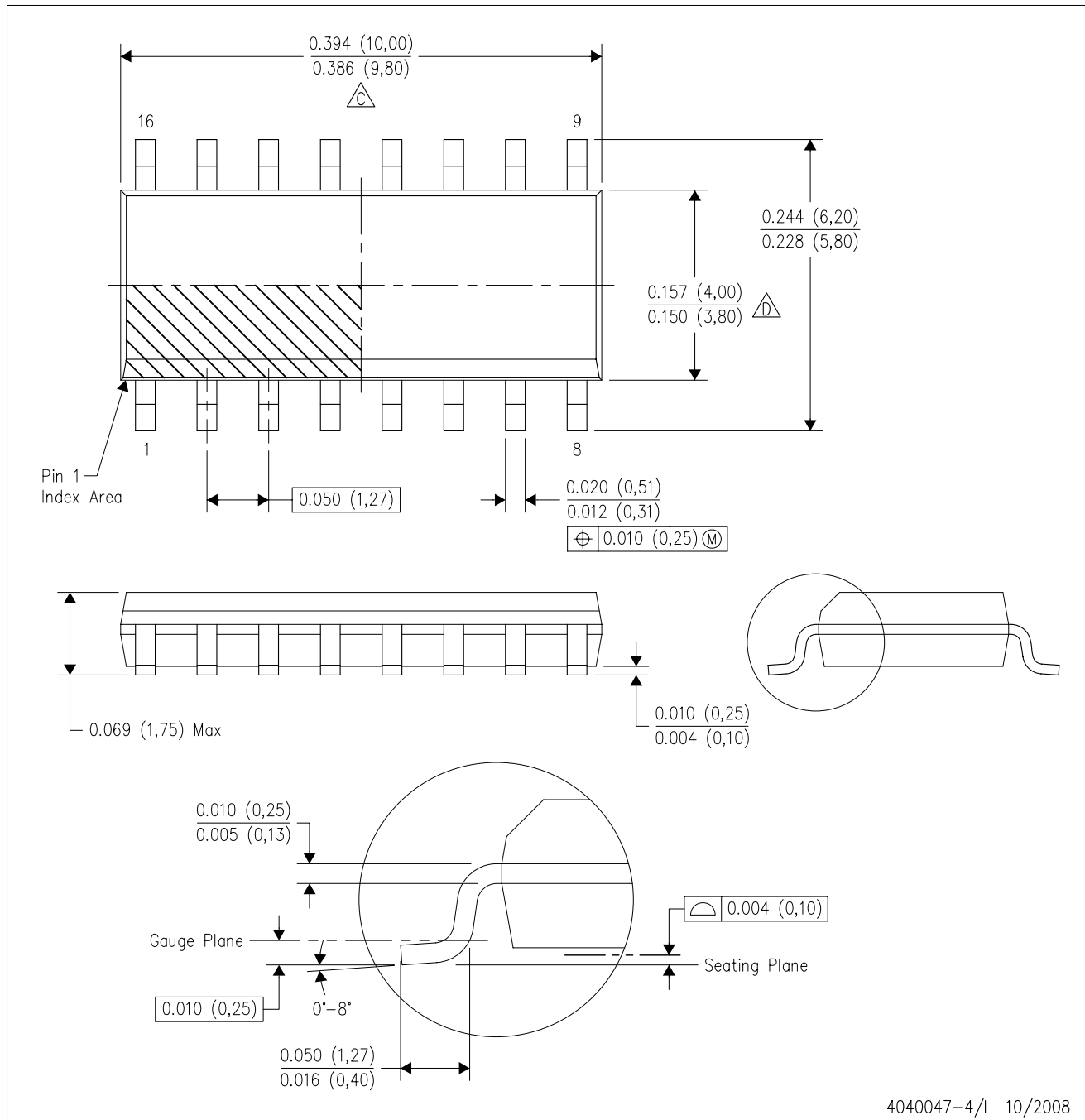


4040064/F 01/97

- 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

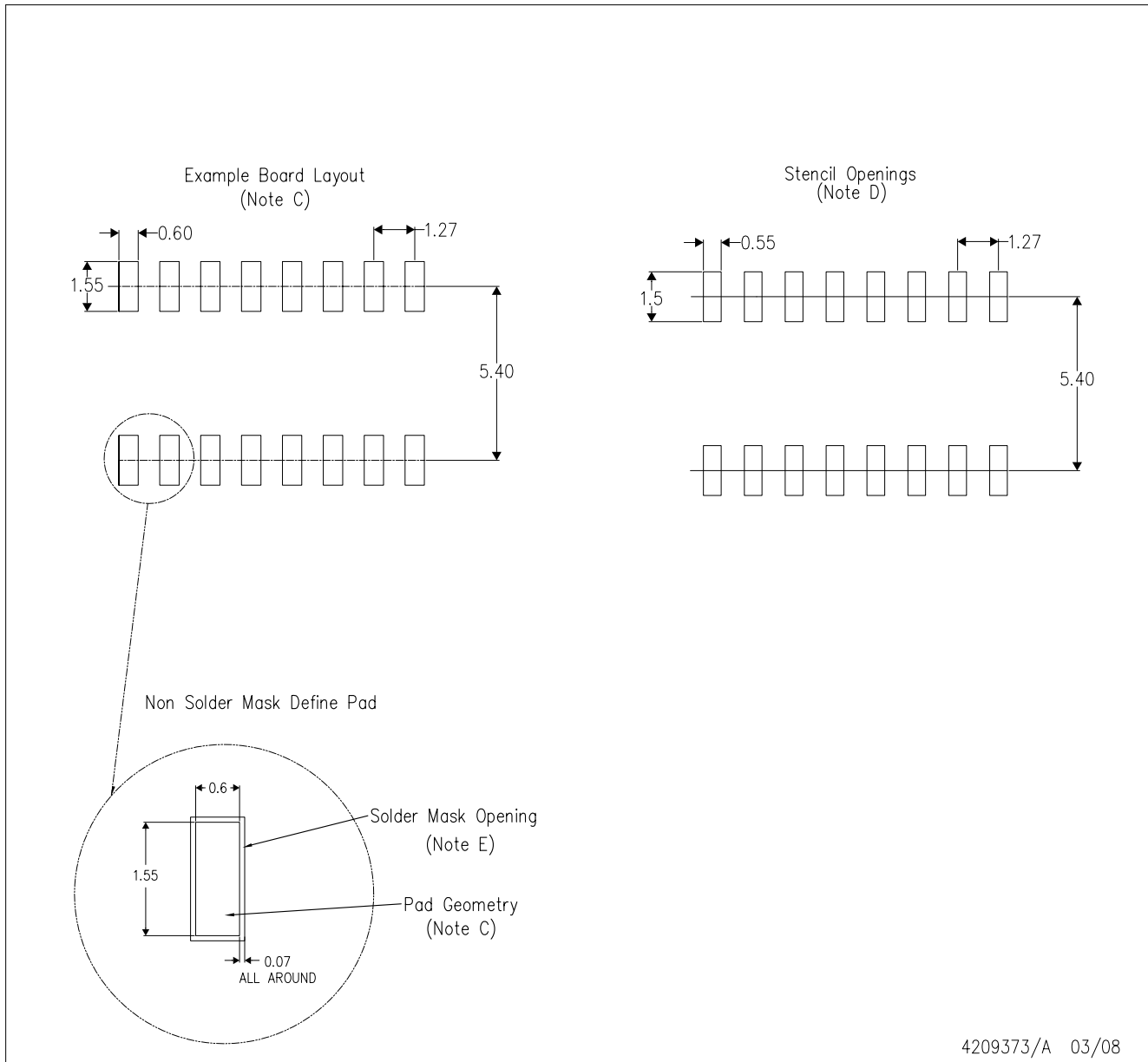
D (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



- 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.

D(R-PDSO-G16)



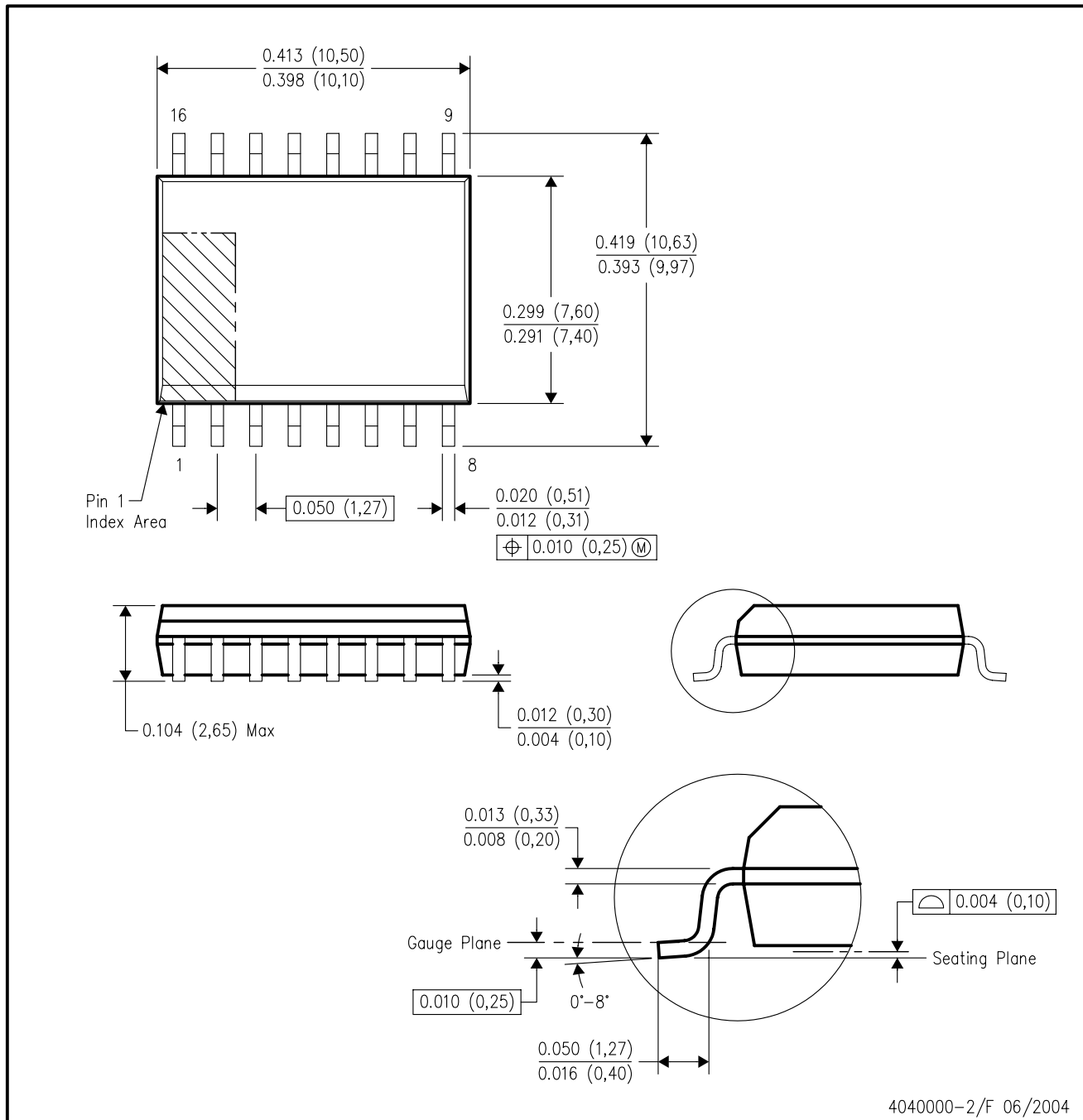
4209373/A 03/08

- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Refer to IPC7351 for alternate board 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
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



DW (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



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

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