

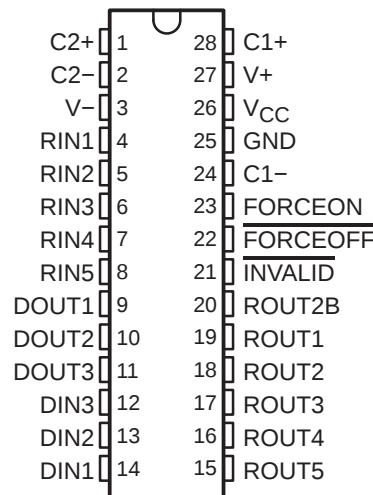
# MAX3243

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

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- Single-Chip and Single-Supply Interface for IBM™ PC/AT™ Serial Port
- 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
- Three Drivers and Five Receivers
- Operates Up To 250 kbit/s
- Designed to Transmit at a Data Rate of 250 kbit/s
- Low Standby Current . . . 1  $\mu$ A Typical
- External Capacitors . . .  $4 \times 0.1 \mu$ F
- Accepts 5-V Logic Input With 3.3-V Supply
- Always-Active Noninverting Receiver Output (ROUT2B)
- Alternative High-Speed Pin-Compatible Device (1 Mbit/s)
  - SNx5C3243
- Serial-Mouse Driveability
- Auto-Powerdown Feature to Disable Driver Outputs When No Valid RS-232 Signal Is Sensed
- Applications
  - Battery-Powered Systems, PDAs, Notebooks, Laptops, Palmtop PCs, and Hand-Held Equipment

DB, DW, OR PW PACKAGE  
(TOP VIEW)



### description/ordering information

The MAX3243 consists of three line drivers, five line receivers, and a dual charge-pump circuit with  $\pm 15$ -kV ESD (HBM) 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. This combination of drivers and receivers matches that needed for the typical serial port used in an IBM PC/AT, or compatible. The charge pump and four small external capacitors allow operation from a single 3-V to 5.5-V supply. In addition, the device includes an always-active noninverting output (ROUT2B), which allows applications using the ring indicator to transmit data while the device is powered down. The device operates at data signaling rates up to 250 kbit/s and a maximum of 30-V/ $\mu$ s driver output slew rate.



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**description/ordering information (continued)**

Flexible control options for power management are available when the serial port is inactive. The auto-powerdown feature functions when  $\overline{\text{FORCEON}}$  is low and  $\overline{\text{FORCEOFF}}$  is high. During this mode of operation, if the device does not sense a valid RS-232 signal, the driver outputs are disabled. If  $\overline{\text{FORCEOFF}}$  is set low, both drivers and receivers (except ROUT2B) are shut off, and the supply current is reduced to 1  $\mu\text{A}$ . Disconnecting the serial port or turning off the peripheral drivers causes the auto-powerdown condition to occur.

Auto-powerdown can be disabled when  $\overline{\text{FORCEON}}$  and  $\overline{\text{FORCEOFF}}$  are high and should be done when driving a serial mouse. With auto-powerdown enabled, the device is activated automatically when a valid signal is applied to any receiver input. The  $\overline{\text{INVALID}}$  output is used to notify the user if an RS-232 signal is present at any receiver input.  $\overline{\text{INVALID}}$  is high (valid data) if any receiver input voltage is greater than 2.7 V or less than  $-2.7$  V or has been between  $-0.3$  V and 0.3 V for less than 30  $\mu\text{s}$ .  $\overline{\text{INVALID}}$  is low (invalid data) if all receiver input voltages are between  $-0.3$  V and 0.3 V for more than 30  $\mu\text{s}$ . Refer to Figure 5 for receiver input levels.

**ORDERING INFORMATION**

| TA            | PACKAGE†   |              | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---------------|------------|--------------|-----------------------|------------------|
| 0°C to 70°C   | SOIC (DW)  | Tube of 20   | MAX3243CDW            | MAX3243C         |
|               |            | Reel of 1000 | MAX3243CDWR           |                  |
|               | SSOP (DB)  | Tube of 50   | MAX3243CDB            | MAX3243C         |
|               |            | Reel of 2000 | MAX3243CDBR           |                  |
|               | TSSOP (PW) | Tube of 50   | MAX3243CPW            | MA3243C          |
|               |            | Reel of 2000 | MAX3243CPWR           |                  |
| -40°C to 85°C | SOIC (DW)  | Tube of 20   | MAX3243IDW            | MAX3243I         |
|               |            | Reel of 1000 | MAX3243IDWR           |                  |
|               | SSOP (DB)  | Tube of 50   | MAX3243IDB            | MAX3243I         |
|               |            | Reel of 2000 | MAX3243IDBR           |                  |
|               | TSSOP (PW) | Tube of 50   | MAX3243IPW            | MB3243I          |
|               |            | Reel of 2000 | MAX3243IPWR           |                  |

† 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).

**Function Tables****EACH DRIVER**

| INPUTS |         |                              |                        | OUTPUT DOUT | DRIVER STATUS                                 |
|--------|---------|------------------------------|------------------------|-------------|-----------------------------------------------|
| DIN    | FORCEON | $\overline{\text{FORCEOFF}}$ | VALID RIN RS-232 LEVEL |             |                                               |
| X      | X       | L                            | X                      | Z           | Powered off                                   |
| L      | H       | H                            | X                      | H           | Normal operation with auto-powerdown disabled |
| H      | H       | H                            | X                      | L           |                                               |
| L      | L       | H                            | Yes                    | H           | Normal operation with auto-powerdown enabled  |
| H      | L       | H                            | Yes                    | L           |                                               |
| L      | L       | H                            | No                     | Z           | Powered off by auto-powerdown feature         |
| H      | L       | H                            | No                     | Z           |                                               |

H = high level, L = low level, X = irrelevant, Z = high impedance



# MAX3243

## 3-V TO 5.5-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER

### WITH $\pm 15$ -kV ESD (HBM) PROTECTION

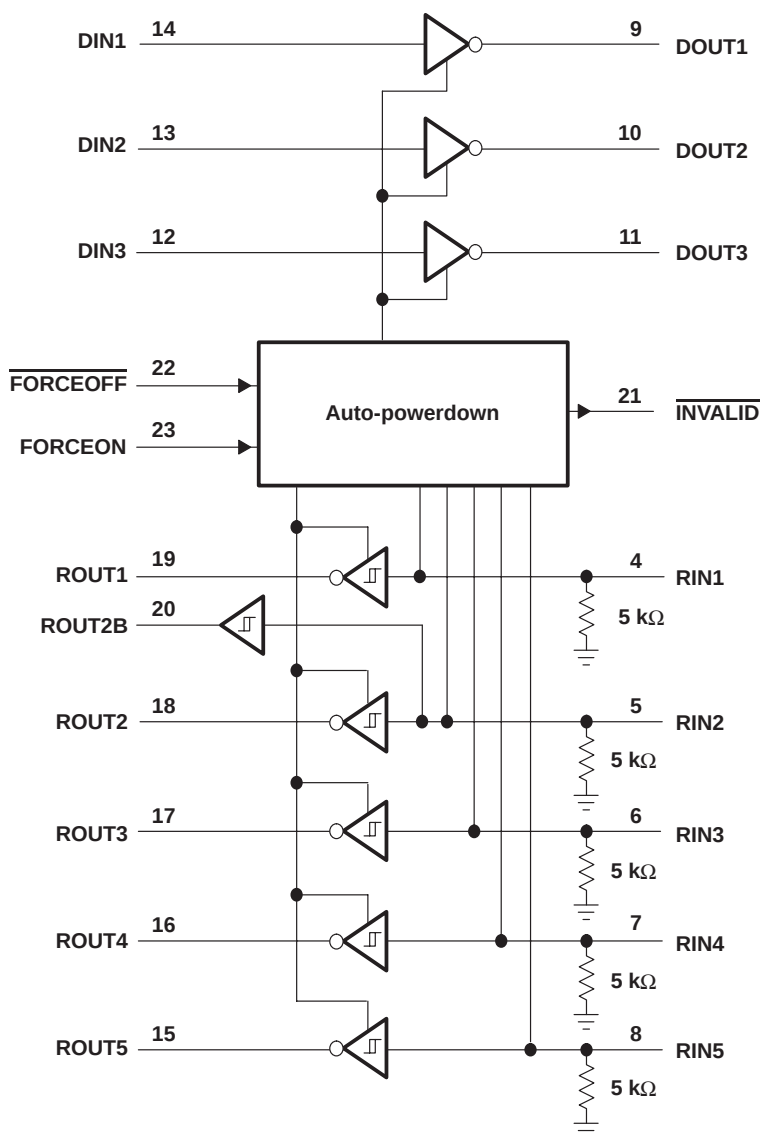
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EACH RECEIVER

| INPUTS |                 |                              |                        | OUTPUTS |      | RECEIVER STATUS                                       |
|--------|-----------------|------------------------------|------------------------|---------|------|-------------------------------------------------------|
| RIN2   | RIN1, RIN3-RIN5 | $\overline{\text{FORCEOFF}}$ | VALID RIN RS-232 LEVEL | ROUT2B  | ROUT |                                                       |
| L      | X               | L                            | X                      | L       | Z    | Powered off while ROUT2B is active                    |
| H      | X               | L                            | X                      | H       | Z    |                                                       |
| L      | L               | H                            | Yes                    | L       | H    | Normal operation with auto-powerdown disabled/enabled |
| L      | H               | H                            | Yes                    | L       | L    |                                                       |
| H      | L               | H                            | Yes                    | H       | H    |                                                       |
| H      | H               | H                            | Yes                    | H       | L    |                                                       |
| Open   | Open            | H                            | No                     | L       | H    |                                                       |

H = high level, L = low level, X = irrelevant, Z = high impedance (off), Open = input disconnected or connected driver off

### logic diagram (positive logic)



**MAX3243****3-V TO 5.5-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER****WITH  $\pm 15$ -kV ESD (HBM) 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, $V_I$ : Driver ( $\overline{\text{FORCEOFF}}$ , FORCEON) | –0.3 V to 6 V              |
| Receiver                                                                      | –25 V to 25 V              |
| Output voltage range, $V_O$ : Driver                                          | –13.2 V to 13.2 V          |
| Receiver (INVALID)                                                            | –0.3 V to $V_{CC} + 0.3$ V |
| Package thermal impedance, $\theta_{JA}$ (see Notes 2 and 3): DB package      | 62°C/W                     |
| DW package                                                                    | 46°C/W                     |
| PW package                                                                    | 62°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  $T_J(\text{max})$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(\text{max}) - T_A)/\theta_{JA}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability.

3. The package thermal impedance is calculated in accordance with JEDEC 51-7.

**recommended operating conditions (see Note 4 and Figure 6)**

|                |                                             |                                                                  | 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 and control high-level input voltage | $\overline{\text{DIN}}$ , $\overline{\text{FORCEOFF}}$ , FORCEON | $V_{CC} = 3.3$ V |     | 2   | V    |
|                |                                             |                                                                  | $V_{CC} = 5$ V   |     | 2.4 |      |
| $V_{IL}$       | Driver and control low-level input voltage  | $\overline{\text{DIN}}$ , $\overline{\text{FORCEOFF}}$ , FORCEON |                  |     | 0.8 | V    |
| $V_I$          | Driver and control input voltage            | $\overline{\text{DIN}}$ , $\overline{\text{FORCEOFF}}$ , FORCEON | 0                |     | 5.5 | V    |
| $V_I$          | Receiver input voltage                      |                                                                  | –25              |     | 25  | V    |
| $T_A$          | Operating free-air temperature              | MAX3243C                                                         | 0                |     | 70  | °C   |
|                |                                             | MAX3243I                                                         | –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 6)**

| PARAMETER |                       | TEST CONDITIONS                        |                                                                                                                                 | MIN        | TYP <sup>‡</sup> | MAX     | UNIT    |
|-----------|-----------------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------|------------------|---------|---------|
| $I_I$     | Input leakage current | $\overline{\text{FORCEOFF}}$ , FORCEON |                                                                                                                                 | $\pm 0.01$ |                  | $\pm 1$ | $\mu$ A |
| $I_{CC}$  | Supply current        | Auto-powerdown disabled                | No load, $\overline{\text{FORCEOFF}}$ and FORCEON at $V_{CC}$                                                                   | 0.3        |                  | 1       | mA      |
|           |                       | Powered off                            | $V_{CC} = 3.3$ V or 5 V, $T_A = 25^\circ\text{C}$<br>No load, $\overline{\text{FORCEOFF}}$ at GND                               | 1          |                  | 10      | $\mu$ A |
|           |                       | Auto-powerdown enabled                 | No load, $\overline{\text{FORCEOFF}}$ at $V_{CC}$ ,<br>FORCEON at GND,<br>All RIN are open or grounded,<br>All DIN are grounded | 1          |                  | 10      |         |

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

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.



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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 6)**

| PARAMETER                                                 | TEST CONDITIONS                                                                                                                                                    | MIN     | TYP <sup>†</sup> | MAX                  | UNIT     |
|-----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|------------------|----------------------|----------|
| V <sub>OH</sub> High-level output voltage                 | All DOUT at R <sub>L</sub> = 3 k $\Omega$ to GND                                                                                                                   | 5       | 5.4              |                      | V        |
| V <sub>OL</sub> Low-level output voltage                  | All DOUT at R <sub>L</sub> = 3 k $\Omega$ to GND                                                                                                                   | -5      | -5.4             |                      | V        |
| V <sub>O</sub> Output voltage (mouse driveability)        | DIN1 = DIN2 = GND, DIN3 = V <sub>CC</sub> , 3-k $\Omega$ to GND at DOUT3, DOUT1 = DOUT2 = 2.5 mA                                                                   | $\pm 5$ |                  |                      | V        |
| I <sub>IH</sub> High-level input current                  | V <sub>I</sub> = V <sub>CC</sub>                                                                                                                                   |         | $\pm 0.01$       | $\pm 1$              | $\mu$ A  |
| I <sub>IL</sub> Low-level input current                   | V <sub>I</sub> at GND                                                                                                                                              |         | $\pm 0.01$       | $\pm 1$              | $\mu$ A  |
| I <sub>OS</sub> Short-circuit output current <sup>‡</sup> | V <sub>CC</sub> = 3.6 V, V <sub>O</sub> = 0 V<br>V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 0 V                                                                     |         | $\pm 35$         | $\pm 60$             | mA       |
| r <sub>o</sub> Output resistance                          | V <sub>CC</sub> , V <sub>+</sub> , and V <sub>-</sub> = 0 V, V <sub>O</sub> = $\pm 2$ V                                                                            | 300     | 10M              |                      | $\Omega$ |
| I <sub>off</sub> Output leakage current                   | $\overline{\text{FORCEOFF}}$ = GND<br>V <sub>O</sub> = $\pm 12$ V, V <sub>CC</sub> = 3 V to 3.6 V<br>V <sub>O</sub> = $\pm 10$ V, V <sub>CC</sub> = 4.5 V to 5.5 V |         |                  | $\pm 25$<br>$\pm 25$ | $\mu$ A  |

<sup>†</sup> 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.

<sup>‡</sup> 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  $\mu$ F at V<sub>CC</sub> = 3.3 V  $\pm$  0.3 V; C1 = 0.047  $\mu$ F, C2–C4 = 0.33  $\mu$ F at V<sub>CC</sub> = 5 V  $\pm$  0.5 V.

**switching characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 4 and Figure 6)**

| PARAMETER                                          | TEST CONDITIONS                                                                                                                                    | MIN    | TYP <sup>†</sup> | MAX      | UNIT       |
|----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|--------|------------------|----------|------------|
| Maximum data rate                                  | C <sub>L</sub> = 1000 pF, One DOUT switching, R <sub>L</sub> = 3 k $\Omega$ , See Figure 1                                                         | 150    | 250              |          | kbit/s     |
| t <sub>sk(p)</sub> Pulse skew <sup>§</sup>         | C <sub>L</sub> = 150 pF to 2500 pF, R <sub>L</sub> = 3 k $\Omega$ to 7 k $\Omega$ , See Figure 2                                                   |        | 100              |          | ns         |
| SR(tr) Slew rate, transition region (see Figure 1) | V <sub>CC</sub> = 3.3 V, R <sub>L</sub> = 3 k $\Omega$ to 7 k $\Omega$<br>C <sub>L</sub> = 150 pF to 1000 pF<br>C <sub>L</sub> = 150 pF to 2500 pF | 6<br>4 |                  | 30<br>30 | V/ $\mu$ s |

<sup>†</sup> 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.

<sup>§</sup> 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  $\mu$ F at V<sub>CC</sub> = 3.3 V  $\pm$  0.3 V; C1 = 0.047  $\mu$ F, C2–C4 = 0.33  $\mu$ F at V<sub>CC</sub> = 5 V  $\pm$  0.5 V.



## RECEIVER SECTION

electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 4 and Figure 6)

| PARAMETER                                                                | TEST CONDITIONS                | MIN                     | TYP <sup>†</sup>        | MAX | UNIT |
|--------------------------------------------------------------------------|--------------------------------|-------------------------|-------------------------|-----|------|
| V <sub>OH</sub> High-level output voltage                                | I <sub>OH</sub> = -1 mA        | V <sub>CC</sub> - 0.6 V | V <sub>CC</sub> - 0.1 V |     | 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        |                         | 1.6                     | 2.4 | V    |
|                                                                          | V <sub>CC</sub> = 5 V          |                         | 1.9                     | 2.4 |      |
| V <sub>IT-</sub> Negative-going input threshold voltage                  | V <sub>CC</sub> = 3.3 V        | 0.6                     | 1.1                     |     | V    |
|                                                                          | V <sub>CC</sub> = 5 V          | 0.8                     | 1.4                     |     |      |
| V <sub>hys</sub> Input hysteresis (V <sub>IT+</sub> - V <sub>IT-</sub> ) |                                |                         | 0.5                     |     | V    |
| I <sub>off</sub> Output leakage current (except ROUT2B)                  | FORCEOFF = 0 V                 |                         | ±0.05                   | ±10 | μA   |
| r <sub>i</sub> Input resistance                                          | V <sub>I</sub> = ±3 V to ±25 V | 3                       | 5                       | 7   | kΩ   |

<sup>†</sup> 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)

| PARAMETER                                                          | TEST CONDITIONS                                              | MIN | TYP <sup>†</sup> | MAX | UNIT |
|--------------------------------------------------------------------|--------------------------------------------------------------|-----|------------------|-----|------|
| t <sub>PLH</sub> Propagation delay time, low- to high-level output | C <sub>L</sub> = 150 pF, See Figure 3                        |     | 150              |     | ns   |
| t <sub>PHL</sub> Propagation delay time, high- to low-level output |                                                              |     | 150              |     | ns   |
| t <sub>en</sub> Output enable time                                 | C <sub>L</sub> = 150 pF, R <sub>L</sub> = 3 kΩ, See Figure 4 |     | 200              |     | ns   |
| t <sub>dis</sub> Output disable time                               |                                                              |     | 200              |     | ns   |
| t <sub>sk(p)</sub> Pulse skew <sup>‡</sup>                         | See Figure 3                                                 |     | 50               |     | ns   |

<sup>†</sup> 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.

<sup>‡</sup> 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.

## AUTO-POWERDOWN SECTION

electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 5)

| PARAMETER               | TEST CONDITIONS                                                                                                                 | MIN            | TYP <sup>†</sup> | MAX | UNIT |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------|----------------|------------------|-----|------|
| $V_{T+}(\text{valid})$  | Receiver input threshold for INVALID high-level output voltage<br>$\text{FORCEON} = \text{GND}$ ,<br>$\text{FORCEOFF} = V_{CC}$ |                |                  | 2.7 | V    |
| $V_{T-}(\text{valid})$  | Receiver input threshold for INVALID high-level output voltage<br>$\text{FORCEON} = \text{GND}$ ,<br>$\text{FORCEOFF} = V_{CC}$ | -2.7           |                  |     | V    |
| $V_{T}(\text{invalid})$ | Receiver input threshold for INVALID low-level output voltage<br>$\text{FORCEON} = \text{GND}$ ,<br>$\text{FORCEOFF} = V_{CC}$  | -0.3           |                  | 0.3 | V    |
| $V_{OH}$                | INVALID high-level output voltage<br>$I_{OH} = -1 \text{ mA}$ , $\text{FORCEON} = \text{GND}$ ,<br>$\text{FORCEOFF} = V_{CC}$   | $V_{CC} - 0.6$ |                  |     | V    |
| $V_{OL}$                | INVALID low-level output voltage<br>$I_{OL} = 1.6 \text{ mA}$ , $\text{FORCEON} = \text{GND}$ ,<br>$\text{FORCEOFF} = V_{CC}$   |                |                  | 0.4 | V    |

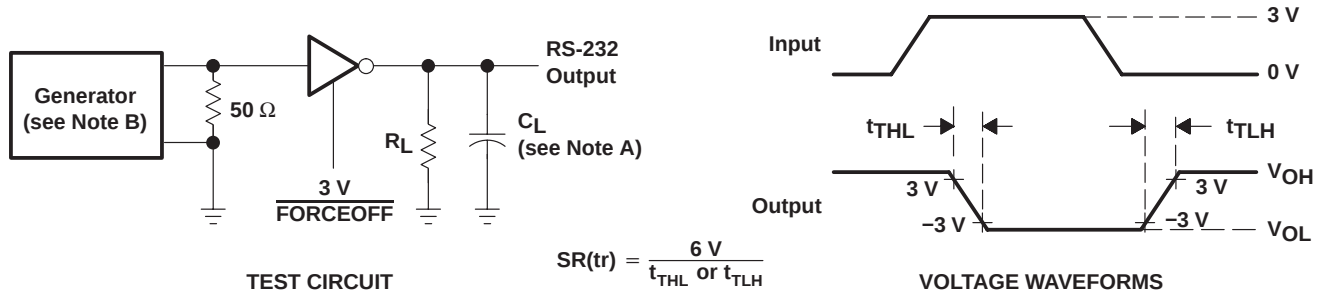
<sup>†</sup> All typical values are at  $V_{CC} = 3.3 \text{ V}$  or  $V_{CC} = 5 \text{ V}$ , and  $T_A = 25^\circ\text{C}$ .

switching characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 5)

| PARAMETER            | MIN | TYP <sup>†</sup> | MAX | UNIT          |
|----------------------|-----|------------------|-----|---------------|
| $t_{\text{valid}}$   |     | 1                |     | $\mu\text{s}$ |
| $t_{\text{invalid}}$ |     | 30               |     | $\mu\text{s}$ |
| $t_{\text{en}}$      |     | 100              |     | $\mu\text{s}$ |

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

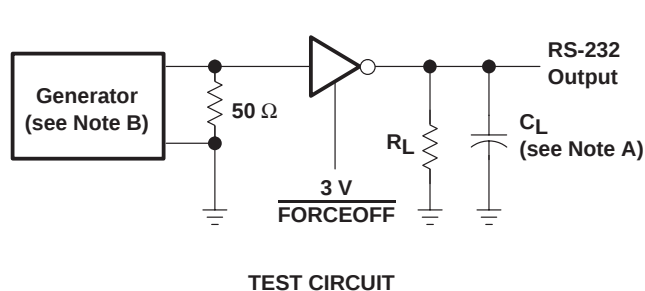
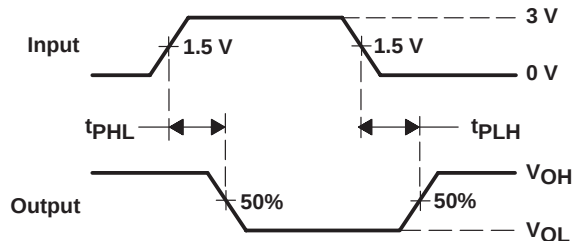
## PARAMETER MEASUREMENT INFORMATION



NOTES: A.  $C_L$  includes probe and jig capacitance.

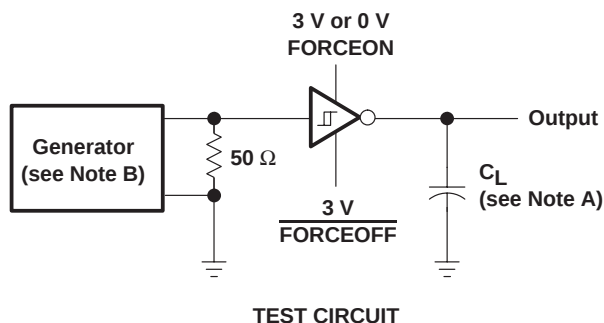
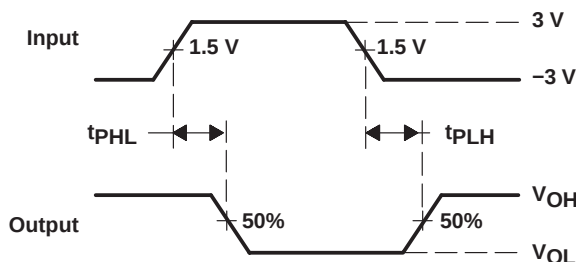
B. The pulse generator has the following characteristics: PRR = 250 kbit/s,  $Z_O = 50 \Omega$ , 50% duty cycle,  $t_r \leq 10 \text{ ns}$ ,  $t_f \leq 10 \text{ ns}$ .

**Figure 1. Driver Slew Rate**

**PARAMETER MEASUREMENT INFORMATION**

**TEST CIRCUIT**

**VOLTAGE WAVEFORMS**

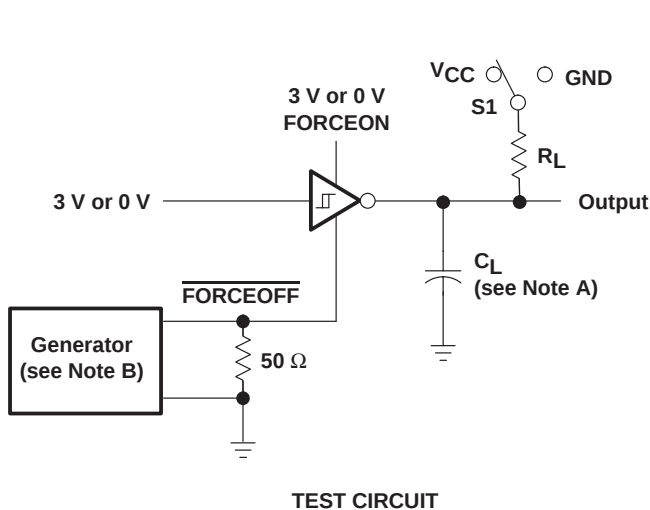
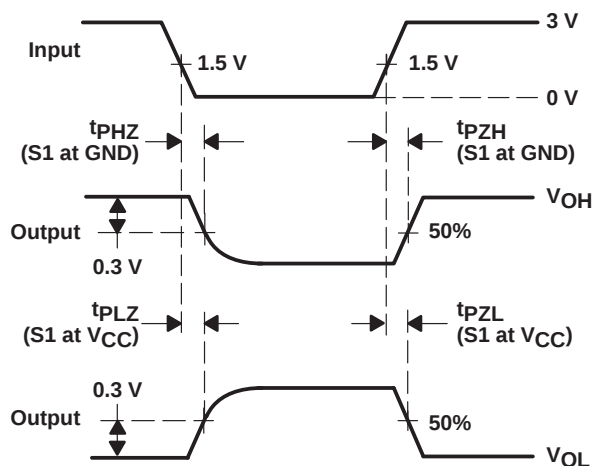
 NOTES: A.  $C_L$  includes probe and jig capacitance.

 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**

**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.

 C.  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .

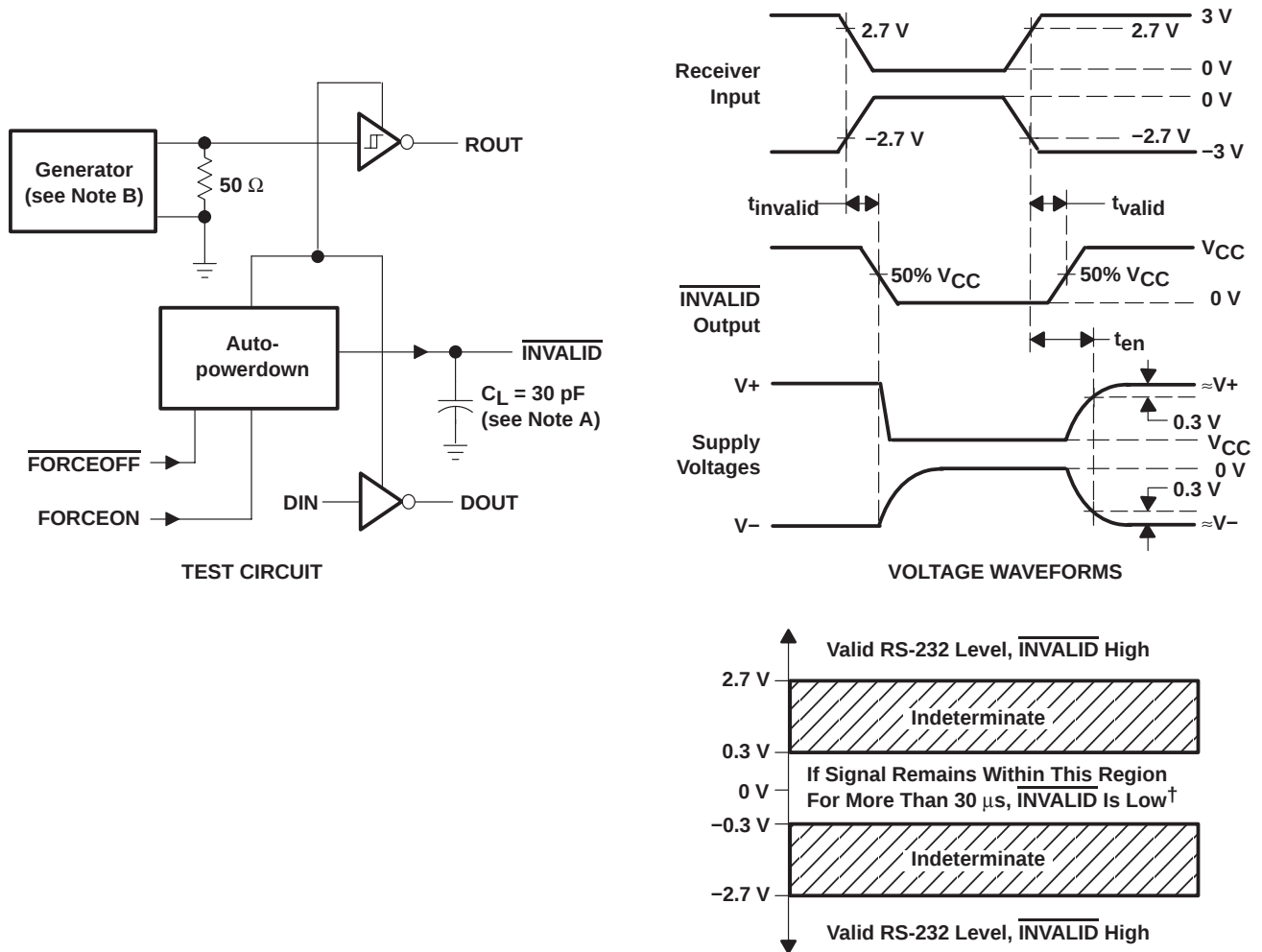
 D.  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .

**Figure 4. Receiver Enable and Disable Times**

**MAX3243**  
**3-V TO 5.5-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER**  
**WITH  $\pm 15$ -kV ESD (HBM) PROTECTION**

SLLS350L – APRIL 1999 – REVISED MARCH 2004

**PARAMETER MEASUREMENT INFORMATION**



<sup>†</sup> Auto-powerdown disables drivers and reduces supply current to 1  $\mu$ A.

NOTES: A.  $C_L$  includes probe and jig capacitance.

B. The pulse generator has the following characteristics: PRR = 5 kbit/s,  $Z_O = 50$   $\Omega$ , 50% duty cycle,  $t_r \leq 10$  ns,  $t_f \leq 10$  ns.

**Figure 5.  $\overline{INVALID}$  Propagation Delay Times and Supply Enabling Time**

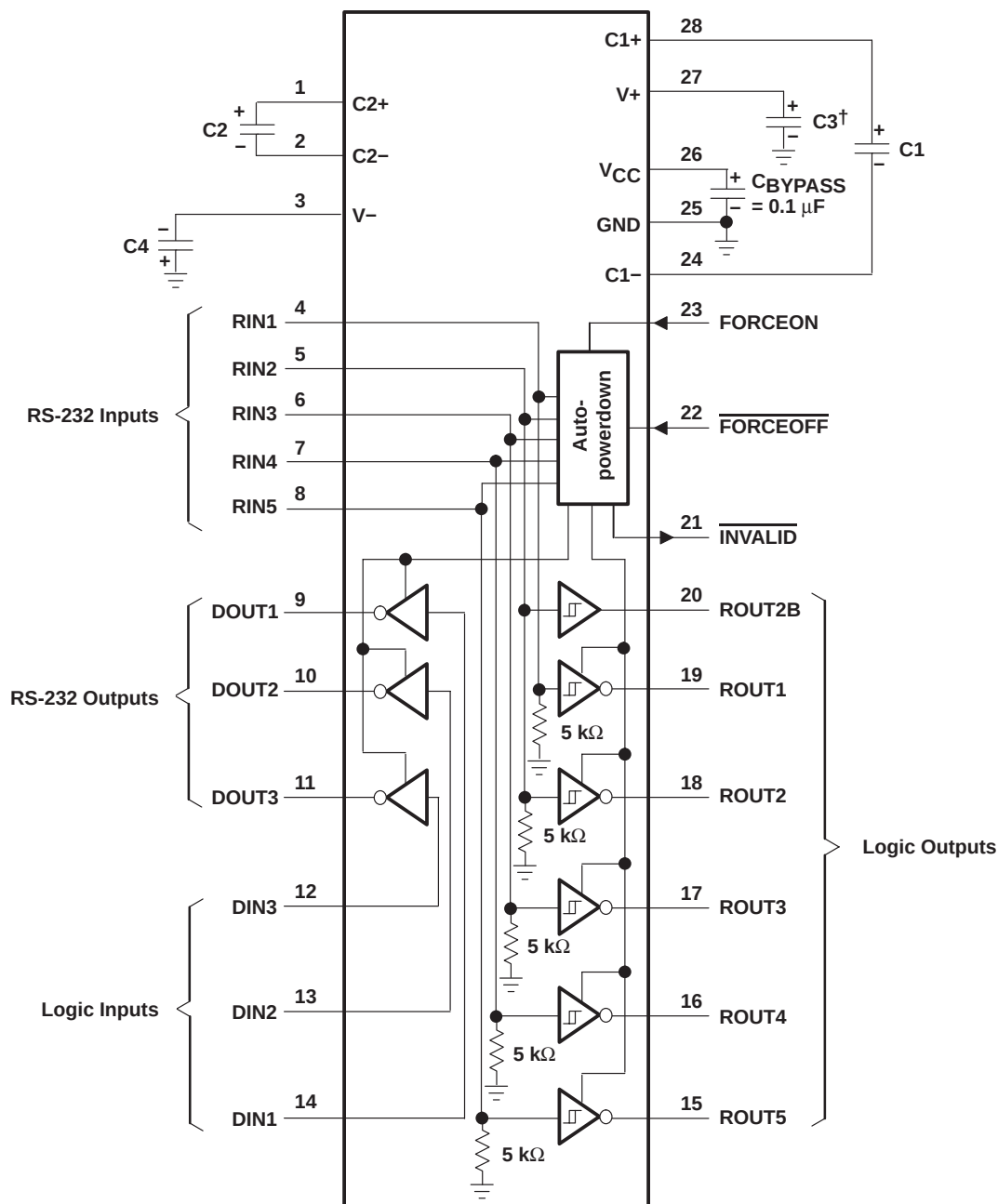
# MAX3243

## 3-V TO 5.5-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER

### WITH $\pm 15$ -kV ESD (HBM) PROTECTION

SLLS350L – APRIL 1999 – REVISED MARCH 2004

#### APPLICATION INFORMATION



† C3 can be connected to  $V_{CC}$  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.

$V_{CC}$  vs CAPACITOR VALUES

| $V_{CC}$          | C1            | C2, C3, and 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 6. 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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| MAX3243CDB       | ACTIVE                | SSOP         | DB              | 28   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243CDBE4     | ACTIVE                | SSOP         | DB              | 28   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243CDBR      | ACTIVE                | SSOP         | DB              | 28   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243CDBRE4    | ACTIVE                | SSOP         | DB              | 28   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243CDBRG4    | ACTIVE                | SSOP         | DB              | 28   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243CDW       | ACTIVE                | SOIC         | DW              | 28   | 20          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243CDWE4     | ACTIVE                | SOIC         | DW              | 28   | 20          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243CDWR      | ACTIVE                | SOIC         | DW              | 28   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243CPW       | ACTIVE                | TSSOP        | PW              | 28   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243CPWE4     | ACTIVE                | TSSOP        | PW              | 28   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243CPWG4     | ACTIVE                | TSSOP        | PW              | 28   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243CPWR      | ACTIVE                | TSSOP        | PW              | 28   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243CPWRE4    | ACTIVE                | TSSOP        | PW              | 28   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243CPWRG4    | ACTIVE                | TSSOP        | PW              | 28   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243IDB       | ACTIVE                | SSOP         | DB              | 28   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243IDBE4     | ACTIVE                | SSOP         | DB              | 28   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243IDBR      | ACTIVE                | SSOP         | DB              | 28   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243IDBRE4    | ACTIVE                | SSOP         | DB              | 28   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243IDBRG4    | ACTIVE                | SSOP         | DB              | 28   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243IDW       | ACTIVE                | SOIC         | DW              | 28   | 20          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243IDWR      | ACTIVE                | SOIC         | DW              | 28   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243IDWRE4    | ACTIVE                | SOIC         | DW              | 28   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243IPW       | ACTIVE                | TSSOP        | PW              | 28   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243IPWG4     | ACTIVE                | TSSOP        | PW              | 28   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243IPWR      | ACTIVE                | TSSOP        | PW              | 28   | 2000        | 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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| MAX3243IPWRE4    | ACTIVE                | TSSOP        | PW              | 28   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| MAX3243IPWRG4    | ACTIVE                | TSSOP        | PW              | 28   | 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)

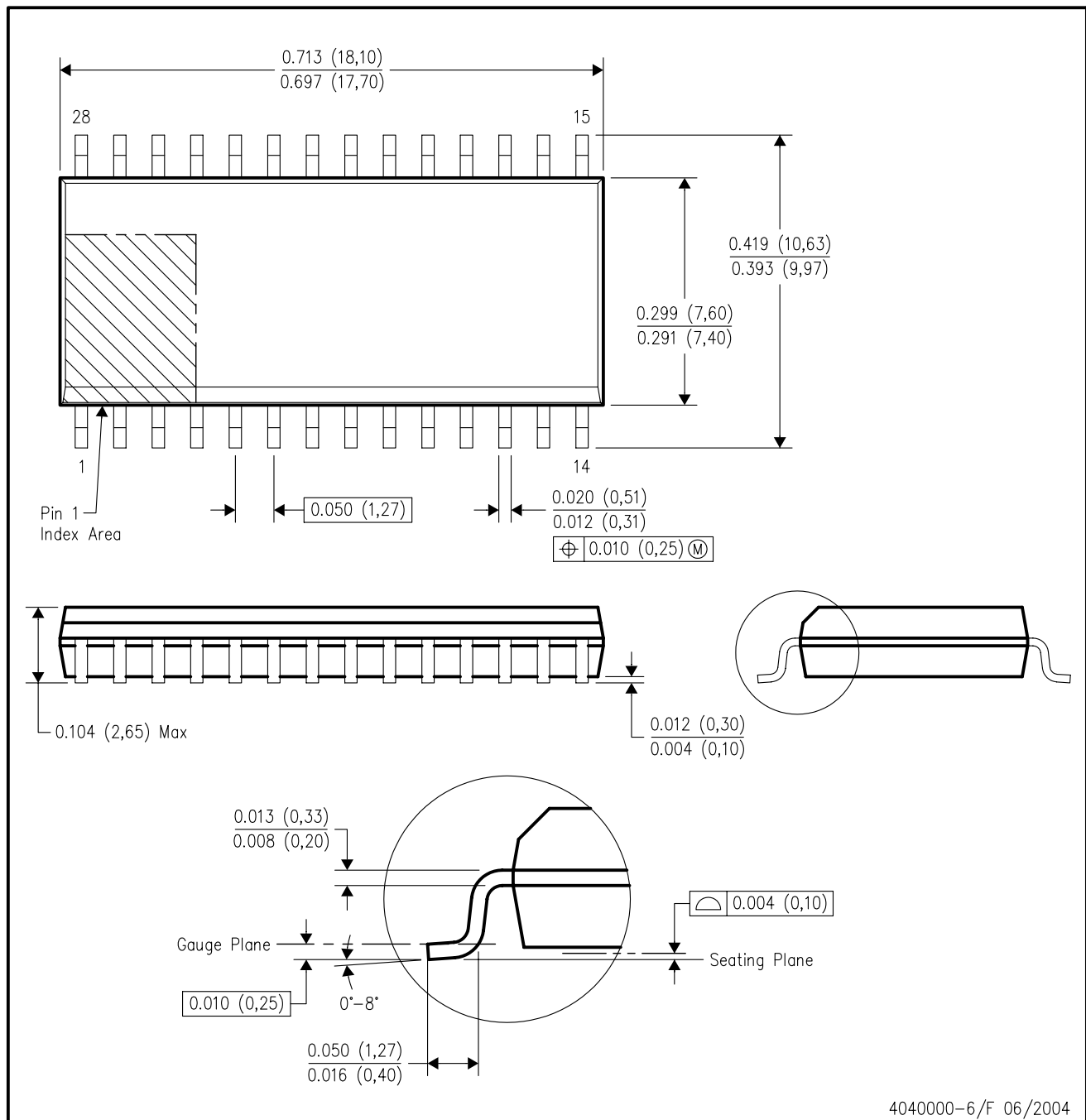
<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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## DW (R-PDSO-G28)

## PLASTIC SMALL-OUTLINE PACKAGE



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

## 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



- 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

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