

MAX3243 3-V to 5.5-V Multichannel RS-232 Line Driver/Receiver With ± 15 -kV ESD (HBM) Protection

1 Features

- Operates With 3-V to 5.5-V V_{CC} Supply
- Single-Chip and Single-Supply Interface for IBM™ PC/AT™ Serial Port
- RS-232 Bus-Pin ESD Protection of ± 15 kV Using Human-Body Model (HBM)
- Meets or Exceeds the Requirements of TIA/EIA-232-F and ITU V.28 Standards
- Three Drivers and Five Receivers
- Operates Up To 250 kbit/s
- Low Active Current: 300 μ A Typical
- Low Standby Current: 1 μ A Typical
- External Capacitors: 4 \times 0.1 μ F
- Accepts 5-V Logic Input With 3.3-V Supply
- Always-Active Noninverting Receiver Output (ROUT2B)
- Operating Temperature
 - MAX3243C: 0°C to 70°C
 - MAX3243I: –40°C to 85°C
- Serial-Mouse Driveability
- Auto-Powerdown Feature to Disable Driver Outputs When No Valid RS-232 Signal Is Sensed

2 Applications

- Battery-Powered Systems
- Tablets
- Notebooks
- Laptops
- Hand-Held Equipment

3 Description

The MAX3243 device consists of three line drivers, five line receivers which is ideal for DE-9 DTE interface. ± 15 -kV ESD (HBM) protection pin to pin (serial- port connection pins, including GND). Flexible power features saves power automatically. Special outputs ROUT2B and INVALID are always enabled to allow checking for ring indicator and valid RS232 input.

Device Information⁽¹⁾

| PART NUMBER | PACKAGE (PIN) | BODY SIZE |
|-------------|---------------|---------------------------|
| MAX3243 | SSOP (28) | 10.29 mm \times 5.30 mm |
| | SOIC (28) | 17.90 mm \times 7.50 mm |
| | TSSOP (28) | 9.70 mm \times 4.40 mm |

(1) For all available packages, see the orderable addendum at the end of the data sheet.

4 Simplified Diagram

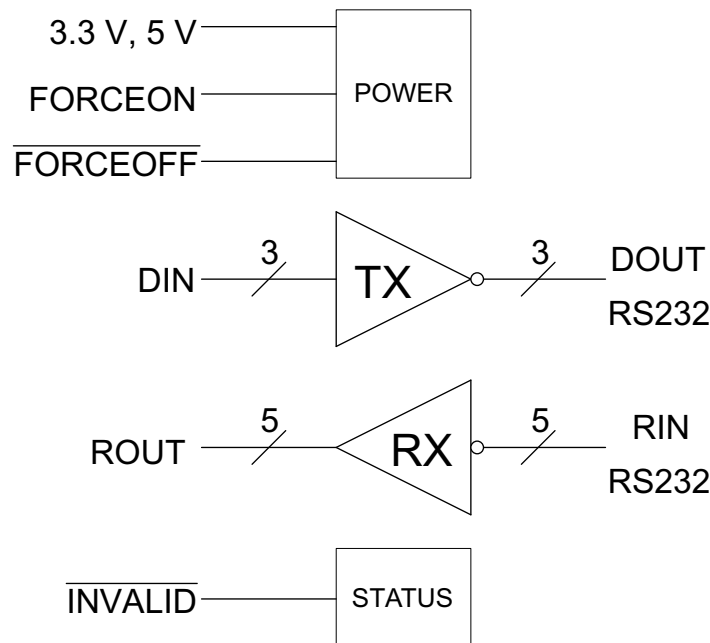


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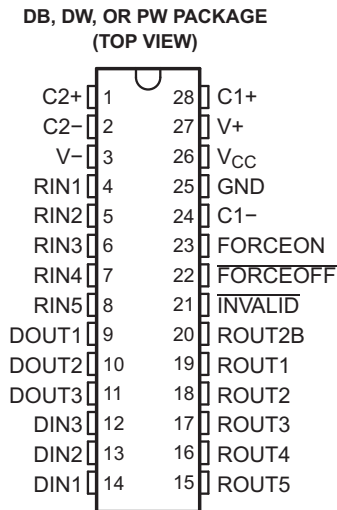
5 Revision History

Changes from Revision N (May 2009) to Revision O

Page

- Added *Applications*, *Device Information* table, *Pin Functions* table, *ESD Ratings* table, *Thermal Information* table, *Typical Characteristics*, *Feature Description* section, *Device Functional Modes*, *Application and Implementation* section, *Power Supply Recommendations* section, *Layout* section, *Device and Documentation Support* section, and *Mechanical, Packaging, and Orderable Information* section. **1**
- Deleted *Ordering Information* table. **1**

6 Pin Configuration and Functions



Pin Functions

| PIN | | TYPE | DESCRIPTION |
|-----------------|--------------------|------|---|
| NAME | NO. | | |
| C2+ | 1 | — | Positive lead of C2 capacitor |
| C2- | 2 | — | Negative lead of C2 capacitor |
| V- | 3 | O | Negative charge pump output for storage capacitor only |
| RIN1:RIN5 | 4, 5, 6, 7, 8 | I | RS232 line data input (from remote RS232 system) |
| DOUT1:DOUT3 | 9, 10, 11 | O | RS232 line data output (to remote RS232 system) |
| DIN3:DIN1 | 12, 13, 14 | I | Logic data input (from UART) |
| ROUT5:ROUT1 | 15, 16, 17, 18, 19 | O | Logic data output (to UART) |
| ROUT2B | 20 | O | Always Active non-inverting output for RIN2 (normally used for ring indicator) |
| INVALID | 21 | O | Active low output when all RIN are unpowered |
| FORCEOFF | 22 | I | Low input forces DOUT1-5, ROUT1-5 high Z per Device Functional Modes |
| FORCEON | 23 | I | High forces drivers on. Low is automatic mode per Device Functional Modes |
| C1- | 24 | — | Negative lead on C1 capacitor |
| GND | 25 | — | Ground |
| V _{CC} | 26 | — | Supply Voltage, Connect to 3V to 5.5V power supply |
| V+ | 27 | O | Positive charge pump output for storage capacitor only |
| C1+ | 28 | — | Positive lead of C1 capacitor |

7 Specifications

7.1 Absolute Maximum Ratings

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

| | | MIN | MAX | UNIT | |
|------------------|---|--|-------|-----------------------|---|
| V _{CC} | Supply voltage range ⁽²⁾ | -0.3 | 6 | V | |
| V+ | Positive output supply voltage range ⁽²⁾ | -0.3 | 7 | V | |
| V- | Negative output supply voltage range ⁽²⁾ | 0.3 | -7 | V | |
| V+ – V- | Supply voltage difference ⁽²⁾ | | 13 | V | |
| V _I | Input voltage range | Driver, $\overline{\text{FORCEOFF}}$, FORCEON | -0.3 | 6 | V |
| | | Receiver | -25 | 25 | |
| V _O | Output voltage range | Driver | -13.2 | 13.2 | V |
| | | Receiver, $\overline{\text{INVALID}}$ | -0.3 | V _{CC} + 0.3 | |
| T _J | Operating virtual junction temperature | | 150 | °C | |
| T _{stg} | Storage temperature range | -65 | 150 | °C | |

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) All voltages are with respect to network GND.

7.2 ESD Ratings

| | | | MAX | UNIT |
|--------------------|-------------------------|---|-------|------|
| V _(ESD) | Electrostatic discharge | Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 RIN, DOUT, and GND pins ⁽¹⁾ | 15000 | V |
| | | Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 All other pins ⁽¹⁾ | 3000 | |
| | | Charged device model (CDM), per JEDEC specification JESD22-C101, all pins ⁽²⁾ | 1000 | |

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

7.3 Recommended Operating Conditions

⁽¹⁾(See [Figure 8](#))

| | | MIN | NOM | MAX | UNIT | |
|-----------------|---|---|-----|-----|------|----|
| V _{CC} | 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 | DIN, $\overline{\text{FORCEOFF}}$, FORCEON | | | 5.5 | V |
| | | | | | 5.5 | |
| V _{IL} | Driver and control low-level input voltage | DIN, $\overline{\text{FORCEOFF}}$, FORCEON | 0 | | 0.8 | V |
| V _I | Driver and control input voltage | 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 | |

(1) Test conditions are C1–C4 = 0.1 μF at V_{CC} = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2–C4 = 0.33 μF at V_{CC} = 5 V ± 0.5 V.

7.4 Thermal Information

| THERMAL METRIC ⁽¹⁾ | MAX3243 | | | UNIT | |
|-------------------------------|--|---------|---------|------|------|
| | DB | DW | PW | | |
| | 16 PINS | 16 PINS | 16 PINS | | |
| R _{θJA} | Junction-to-ambient thermal resistance | 62 | 46 | 62 | °C/W |

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report ([SPRA953](#)).

7.5 Electrical Characteristics — Auto Power Down

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)⁽¹⁾ (see [Figure 8](#))

| PARAMETER | | TEST CONDITIONS | MIN | TYP ⁽²⁾ | MAX | UNIT |
|------------------|--|--|-----|-----------------------|-----|------|
| I _{CC} | Supply current Auto-powerdown disabled | No load, $\overline{\text{FORCEOFF}}$ and FORCEON at V _{CC} . T _A = 25°C | | 0.3 | 1 | mA |
| | Supply current Powered off | No load, $\overline{\text{FORCEOFF}}$ at GND. T _A = 25°C | | 1 | 10 | μA |
| | Supply current Auto-powerdown enabled | No load, $\overline{\text{FORCEOFF}}$ at V _{CC} , FORCEON at GND, All RIN are open or grounded, All DIN are grounded. T _A = 25°C | | 1 | 10 | |
| I _I | Input leakage current of $\overline{\text{FORCEOFF}}$, FORCEON | V _I = V _{CC} or V _I at GND | | ±0.01 | ±1 | μA |
| V _{IT+} | Receiver input threshold for INVALID high-level output voltage | FORCEON = GND, $\overline{\text{FORCEOFF}}$ = V _{CC} | | | 2.7 | V |
| V _{IT-} | Receiver input threshold for INVALID high-level output voltage | FORCEON = GND, $\overline{\text{FORCEOFF}}$ = V _{CC} | | -2.7 | | V |
| V _T | Receiver input threshold for INVALID low-level output voltage | FORCEON = GND, $\overline{\text{FORCEOFF}}$ = V _{CC} | | -0.3 | 0.3 | V |
| V _{OH} | INVALID high-level output voltage | I _{OH} = -1 mA, FORCEON = GND, $\overline{\text{FORCEOFF}}$ = V _{CC} | | V _{CC} - 0.6 | | V |
| V _{OL} | INVALID low-level output voltage | I _{OL} = 1.6 mA, FORCEON = GND, $\overline{\text{FORCEOFF}}$ = V _{CC} | | | 0.4 | V |

(1) Test conditions are C1–C4 = 0.1 μF at V_{CC} = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2–C4 = 0.33 μF at V_{CC} = 5 V ± 0.5 V.

(2) 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.

7.6 Electrical Characteristics — Driver

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)⁽¹⁾ (see [Figure 8](#))

| PARAMETER | | TEST CONDITIONS | MIN | TYP ⁽²⁾ | MAX | UNIT |
|------------------|---|---|--|--------------------|-----|------|
| V _{OH} | High-level output voltage | All DOUT at R _L = 3 kΩ to GND | 5 | 5.4 | | V |
| V _{OL} | Low-level output voltage | All DOUT at R _L = 3 kΩ to GND | -5 | -5.4 | | V |
| V _O | Output voltage (mouse driveability) | DIN1 = DIN2 = GND, DIN3 = V _{CC} , 3-kΩ to GND at DOUT3, DOUT1 = DOUT2 = 2.5 mA | | ±5 | | V |
| I _{IH} | High-level input current | V _I = V _{CC} | | ±0.01 | ±1 | μA |
| I _{IL} | Low-level input current | V _I at GND | | ±0.01 | ±1 | μA |
| V _{hys} | Input hysteresis | | | | ±1 | V |
| I _{OS} | Short-circuit output current ⁽³⁾ | V _{CC} = 3.6 V, V _O = 0 V | | ±35 | ±60 | mA |
| | | V _{CC} = 5.5 V, V _O = 0 V | | | | |
| r _o | Output resistance | V _{CC} , V+, and V- = 0 V, V _O = ±2 V | 300 | 10M | | Ω |
| I _{off} | Output leakage current | $\overline{\text{FORCEOFF}}$ = GND, | V _O = ±12 V, V _{CC} = 3 to 3.6 V | | ±25 | μA |
| | | | V _O = ±10 V, V _{CC} = 4.5 to 5.5 V | | | |

(1) Test conditions are C1–C4 = 0.1 μF at V_{CC} = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2–C4 = 0.33 μF at V_{CC} = 5 V ± 0.5 V.

(2) All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

(3) 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.

7.7 Electrical Characteristics — Receiver

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)⁽¹⁾ (see [Figure 8](#))

| PARAMETER | | TEST CONDITIONS | MIN | TYP ⁽²⁾ | MAX | UNIT |
|------------------|---|--------------------------------|-----------------------|-----------------------|-----|------|
| V _{OH} | High-level output voltage | I _{OH} = -1 mA | V _{CC} - 0.6 | V _{CC} - 0.1 | | V |
| V _{OL} | Low-level output voltage | I _{OH} = 1.6 mA | | | 0.4 | V |
| V _{IT+} | Positive-going input threshold voltage | V _{CC} = 3.3 V | | 1.6 | 2.4 | V |
| | | V _{CC} = 5 V | | 1.9 | 2.4 | |
| V _{IT-} | Negative-going input threshold voltage | V _{CC} = 3.3 V | 0.6 | 1.1 | | V |
| | | V _{CC} = 5 V | 0.8 | 1.4 | | |
| V _{hys} | Input hysteresis (V _{IT+} - V _{IT-}) | | | 0.5 | | V |
| I _{off} | Output leakage current (except ROUT2B) | FORCEOFF = 0 V | | ±0.05 | ±10 | µA |
| r _i | Input resistance | V _i = ±3 V or ±25 V | 3 | 5 | 7 | kΩ |

(1) Test conditions are C1–C4 = 0.1 µF at V_{CC} = 3.3 V ± 0.3 V; C1 = 0.047 µF, C2–C4 = 0.33 µF at V_{CC} = 5 V ± 0.5 V.

(2) All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

7.8 Switching Characteristics — Auto Power Down

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see [Figure 7](#))

| PARAMETER | | TEST CONDITIONS | TYP ⁽¹⁾ | UNIT |
|----------------------|---|-----------------------|--------------------|------|
| t _{valid} | Propagation delay time, low- to high-level output | V _{CC} = 5 V | 1 | µs |
| t _{invalid} | Propagation delay time, high- to low-level output | V _{CC} = 5 V | 30 | µs |
| t _{en} | Supply enable time | V _{CC} = 5 V | 100 | µs |

(1) All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

7.9 Switching Characteristics — Driver

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)⁽¹⁾ (see [Figure 8](#))
MAX3243C, MAX3243I

| PARAMETER | | TEST CONDITIONS | MIN | TYP ⁽²⁾ | MAX | UNIT |
|--------------------|---|--|------------------------------------|--------------------|-----|--------|
| | Maximum data rate | R _L = 3 kΩ One DOUT switching, C _L = 1000 pF See Figure 3 | 150 | 250 | | kbit/s |
| t _{sk(p)} | Pulse skew ⁽³⁾ | R _L = 3 kΩ to 7 kΩ C _L = 150 pF to 2500 pF See Figure 5 | | 100 | | ns |
| SR(tr) | Slew rate, transition region (see Figure 3) | V _{CC} = 3.3 V, R _L = 3 kΩ to 7 kΩ | C _L = 150 pF to 1000 pF | 6 | 30 | V/µs |
| | | | C _L = 150 pF to 2500 pF | 4 | 30 | |

(1) Test conditions are C1–C4 = 0.1 µF at V_{CC} = 3.3 V ± 0.3 V; C1 = 0.047 µF, C2–C4 = 0.33 µF at V_{CC} = 5 V ± 0.5 V.

(2) All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

(3) Pulse skew is defined as |t_{PLH} - t_{PHL}| of each channel of the same device.

7.10 Switching Characteristics — Receiver

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)⁽¹⁾

| PARAMETER | | TEST CONDITIONS | TYP ⁽²⁾ | UNIT |
|--------------------|---|---|------------------------------|------|
| t _{PLH} | Propagation delay time, low- to high-level output | C _L = 150 pF, See Figure 5 | 150 | ns |
| t _{PHL} | Propagation delay time, high- to low-level output | | 150 | ns |
| t _{en} | Output enable time | C _L = 150 pF, R _L = 3 kΩ, See Figure 6 | 200 | ns |
| t _{dis} | Output disable time | | 200 | ns |
| t _{sk(p)} | Pulse skew ⁽³⁾ | | See Figure 5 | 50 |

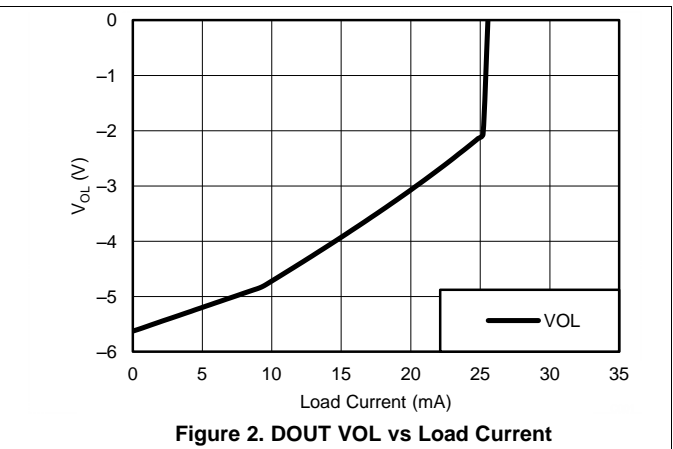
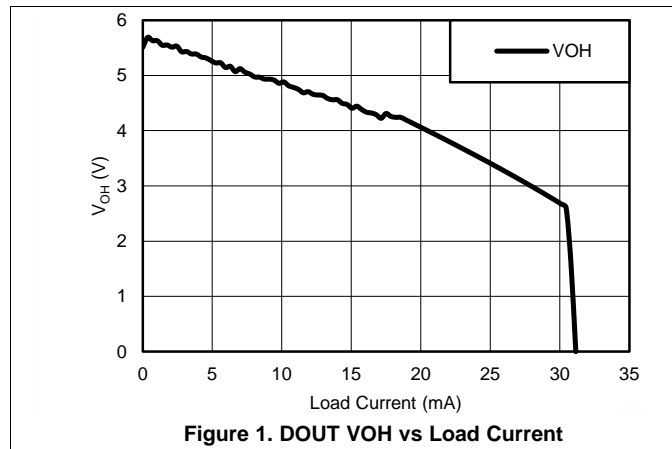
(1) Test conditions are C1–C4 = 0.1 µF at V_{CC} = 3.3 V ± 0.3 V; C1 = 0.047 µF, C2–C4 = 0.33 µF at V_{CC} = 5 V ± 0.5 V.

(2) All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

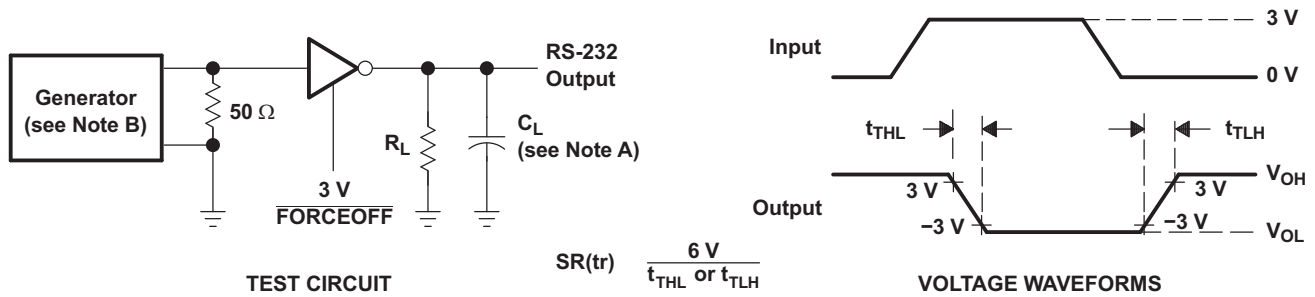
(3) Pulse skew is defined as |t_{PLH} - t_{PHL}| of each channel of the same device.

7.11 Typical Characteristics

$V_{CC} = 3.3\text{ V}$

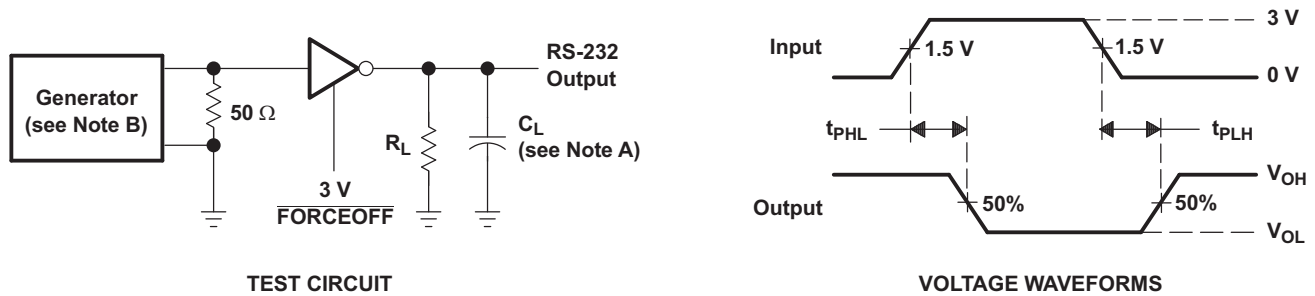


8 Parameter Measurement Information



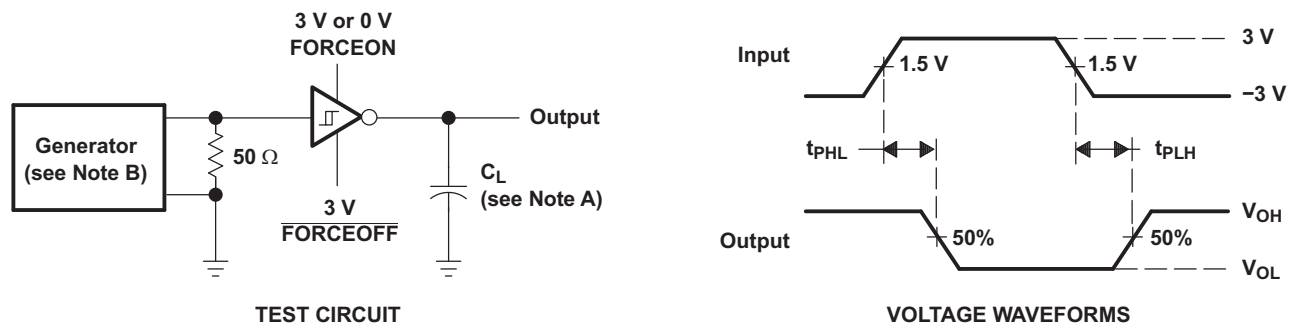
NOTES: A. C_L includes probe and jig capacitance.
 B. The pulse generator has the following characteristics: PRR = 250 kbit/s (MAX3243C/I) and 1 Mbit/s (MAX3243FC/I), $Z_O = 50 \Omega$, 50% duty cycle, $t_r \leq 10$ ns, $t_f \leq 10$ ns.

Figure 3. Driver Slew Rate



NOTES: A. C_L includes probe and jig capacitance.
 B. The pulse generator has the following characteristics: PRR = 250 kbit/s (MAX3243C/I) and 1 Mbit/s (MAX3243FC/I), $Z_O = 50 \Omega$, 50% duty cycle, $t_r \leq 10$ ns, $t_f \leq 10$ ns.

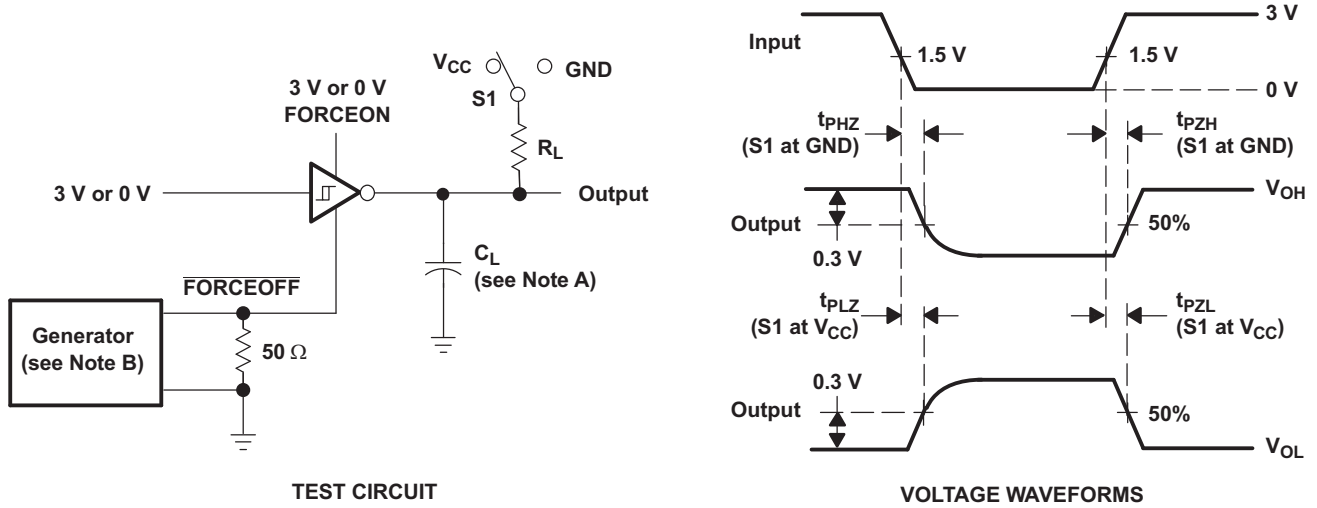
Figure 4. Driver Pulse Skew



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 5. Receiver Propagation Delay Times

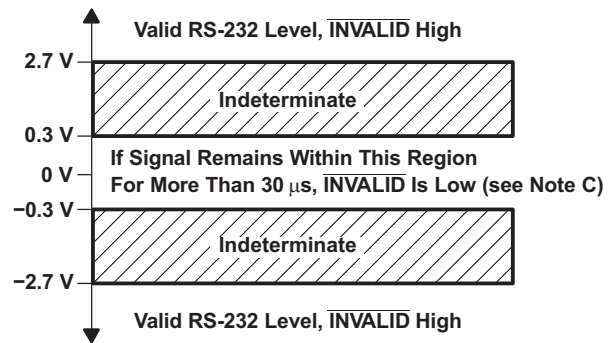
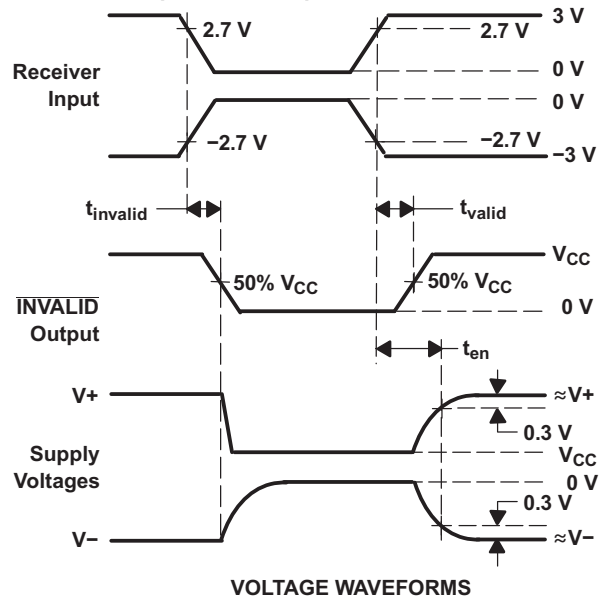
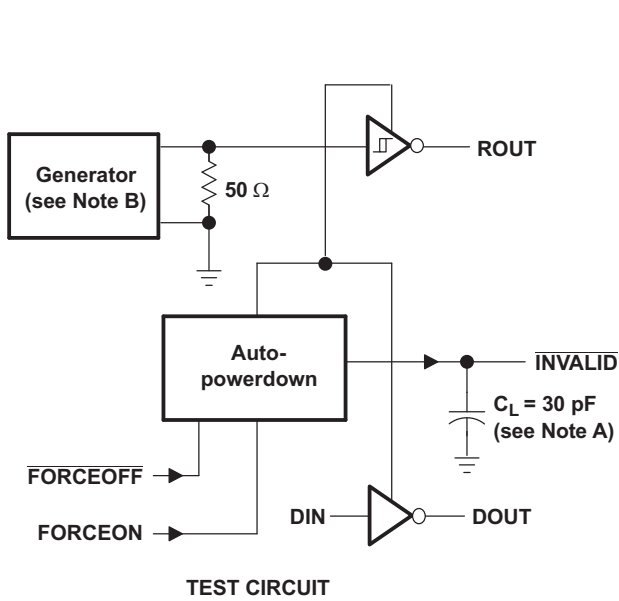
Parameter Measurement Information (continued)



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

Parameter Measurement Information (continued)



- 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.
 C. Auto-powerdown disables drivers and reduces supply current to $1 \mu A$.

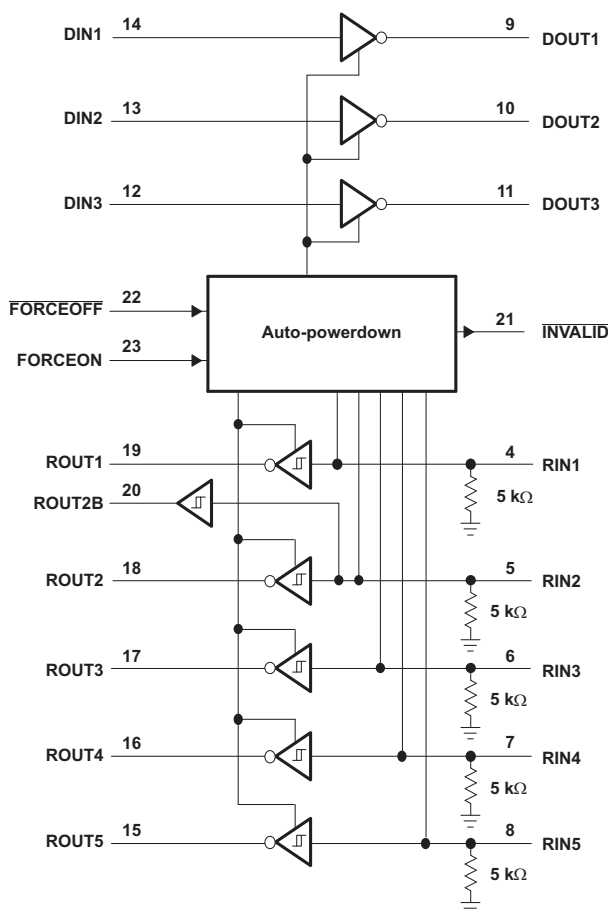
Figure 7. $\overline{\text{INVALID}}$ Propagation Delay Times and Supply Enabling Time

9 Detailed Description

9.1 Overview

The MAX3243 device consists of three line drivers, five line receivers, and a dual charge-pump circuit with ± 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. Flexible control options for power management are available. When the serial port is inactive, the auto-power-down feature functions when FORCEON is low and 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 FORCEOFF is set low, both drivers and receivers (except ROUT2B) are shut off, and the supply current is reduced to 1 μ A. Disconnecting the serial port or turning off the peripheral drivers causes the auto-power-down condition to occur. Auto-powerdown can be disabled when FORCEON and 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 INVALID output is used to notify the user if an RS-232 signal is present at any receiver input. 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 μ s. INVALID is low (invalid data) if all receiver input voltages are between -0.3 V and 0.3 V for more than 30 μ s.

9.2 Functional Block Diagram



9.3 Feature Description

9.3.1 Auto-Power-Down

Auto-Power-Down can be used to automatically save power when the receivers are unconnected or connected to a powered down remote RS232 port. FORCEON being high will override Auto power down and the drivers will be active. $\overline{\text{FORCEOFF}}$ being low will override FORCEON and will power down all outputs except for ROUT2B and $\overline{\text{INVALID}}$.

9.3.2 Charge Pump

The charge pump increases, inverts, and regulates voltage at V+ and V– pins and requires four external capacitors.

9.3.3 RS232 Driver

Three drivers interface standard logic level to RS232 levels. All DIN inputs must be valid high or low.

9.3.4 RS232 Receiver

Five receivers interface RS232 levels to standard logic levels. An open input will result in a high output on ROUT. Each RIN input includes an internal standard RS232 load.

9.3.5 ROUT2B Receiver

ROUT2B is an always-active noninverting output of RIN2 input, which allows applications using the ring indicator to transmit data while the device is powered down.

9.3.6 Invalid Input Detection

The $\overline{\text{INVALID}}$ output goes active low when all RIN inputs are unpowered. The $\overline{\text{INVALID}}$ output goes inactive high when any RIN input is connected to an active RS232 voltage level.

9.4 Device Functional Modes

Table 1. Each Driver⁽¹⁾

| INPUTS | | | | OUTPUT | DRIVER STATUS |
|--------|---------|------------------------------|------------------------|--------|---|
| DIN | FORCEON | $\overline{\text{FORCEOFF}}$ | VALID RIN RS-232 LEVEL | DOUT | |
| 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 | |
| X | L | H | NO | Z | Power off by auto-powerdown feature |

(1) H = high level, L = low level, X = irrelevant, Z = high impedance, YES = any RIN valid, NO = all RIN invalid

Table 2. Each Receiver⁽¹⁾

| INPUTS | | | OUTPUTS | RECEIVER STATUS |
|--------|---------|------------------------------|---------|------------------|
| RIN | FORCEON | $\overline{\text{FORCEOFF}}$ | ROUT | |
| X | X | L | Z | Powered off |
| L | X | H | H | Normal operation |
| H | X | H | L | |
| Open | X | H | H | |

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

Table 3. $\overline{\text{INVALID}}$ and ROUT2B Outputs⁽¹⁾

| INPUTS | | | | OUTPUTS | | OUTPUT STATUS |
|------------------------|------|---------|------------------------------|-----------------------------|--------|---------------|
| VALID RIN RS-232 LEVEL | RIN2 | FORCEON | $\overline{\text{FORCEOFF}}$ | $\overline{\text{INVALID}}$ | ROUT2B | |
| YES | L | X | X | H | L | Always Active |
| YES | H | X | X | H | H | |
| YES | OPEN | X | X | H | L | Always Active |
| NO | OPEN | X | X | L | L | |

(1) H = high level, L = low level, X = irrelevant, Z = high impedance (off), OPEN = input disconnected or connected driver off, YES = any RIN valid, NO = all RIN invalid

10 Application and Implementation

NOTE

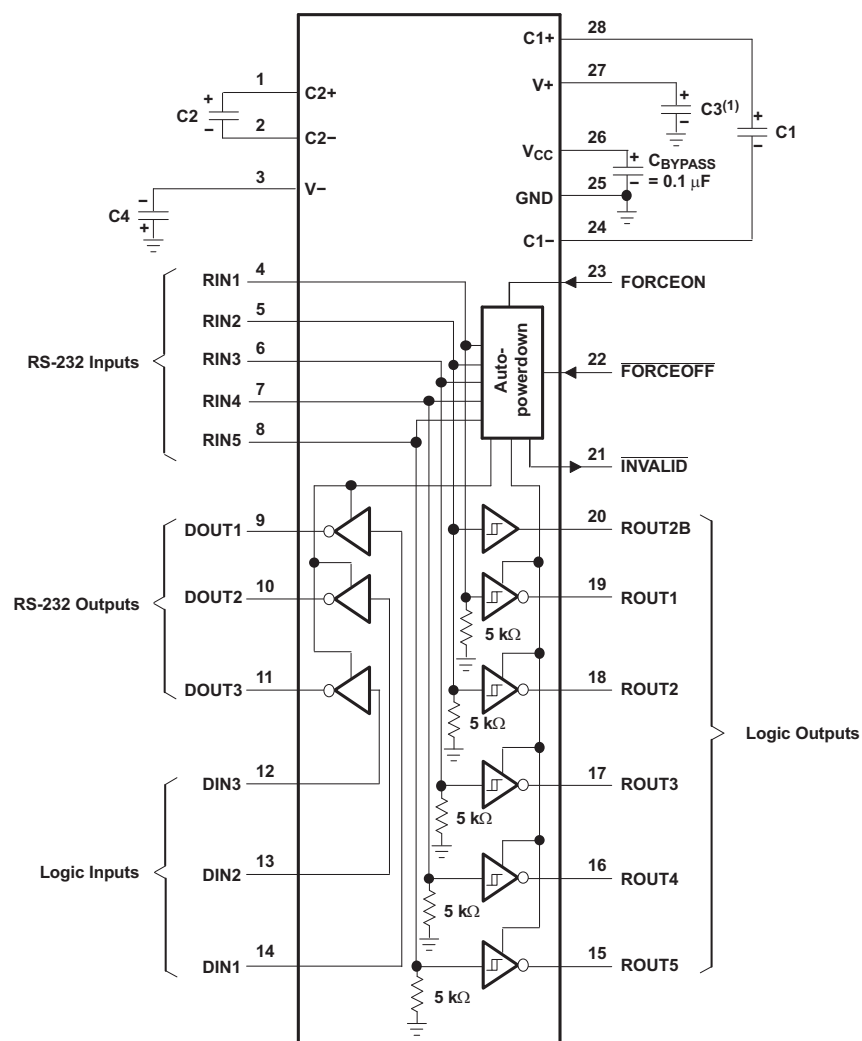
Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

10.1 Application Information

It is recommended to add capacitors as shown in [Figure 8](#).

10.2 Typical Application

ROUT and DIN connect to UART or general purpose logic lines. RIN and DOUT lines connect to a RS232 connector or cable.



(1) 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 ± 0.3 V | 0.1 μF | 0.1 μF |
| 5 V ± 0.5 V | 0.047 μF | 0.33 μF |
| 3 V to 5.5 V | 0.1 μF | 0.47 μF |

Figure 8. Typical Operating Circuit and Capacitor Values

Typical Application (continued)

10.2.1 Design Requirements

- V_{CC} minimum is 3 V and maximum is 5.5V.
- Maximum recommended bit rate is 250 kbit/s.

10.2.2 Detailed Design Procedure

- All DIN, FORCEOFF and FORCEON inputs must be connected to valid low or high logic levels.
- Select capacitor values based on V_{CC} level for best performance.

10.2.3 Application Curves

$V_{CC} = 3.3\text{ V}$

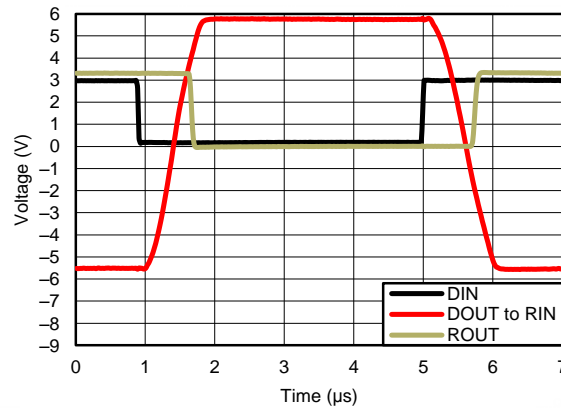


Figure 9. Driver to Receiver Loopback Timing Waveform

11 Power Supply Recommendations

V_{CC} should be between 3 V and 5.5 V. Charge pump capacitors should be chosen using table in [Figure 8](#).

12 Layout

12.1 Layout Guidelines

Keep the external capacitor traces short. This is more important on C1 and C2 nodes that have the fastest rise and fall times.

In the [Layout Example](#) diagram, only critical layout sections are shown. Input and output traces will vary in shape and size depending on the customer application. FORCEON and /FORCEOFF should be pulled up to VCC or GND via a pullup resistor, depending on which configuration the user desires upon power-up.

12.2 Layout Example

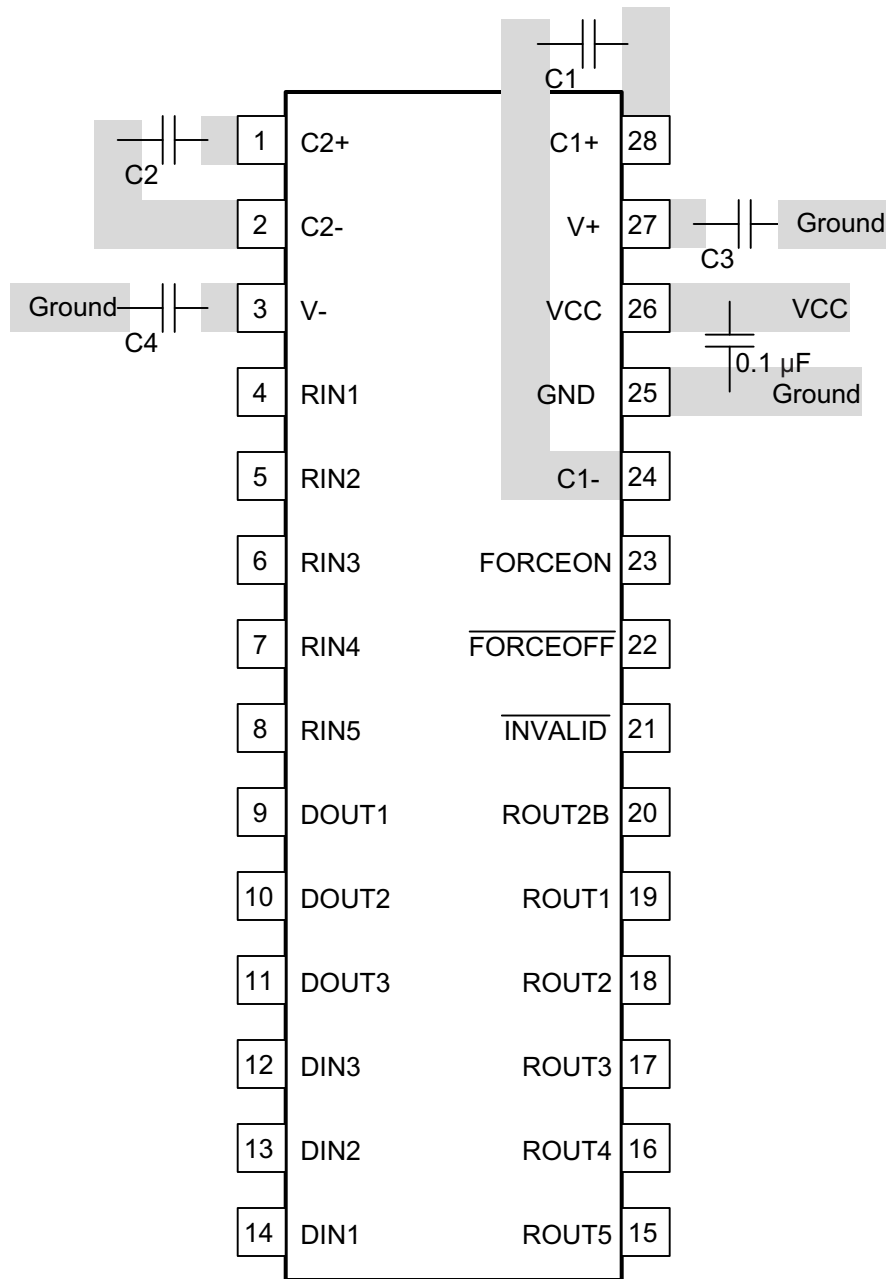


Figure 10. Layout Diagram

13 Device and Documentation Support

13.1 Trademarks

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13.2 Electrostatic Discharge Caution



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

13.3 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

14 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

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 |
|------------------|---------------|--------------|-----------------|------|-------------|-------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| MAX3243CDB | ACTIVE | SSOP | DB | 28 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MAX3243C | Samples |
| MAX3243CDBG4 | ACTIVE | SSOP | DB | 28 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MAX3243C | Samples |
| MAX3243CDBR | ACTIVE | SSOP | DB | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MAX3243C | Samples |
| MAX3243CDBRE4 | ACTIVE | SSOP | DB | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MAX3243C | Samples |
| MAX3243CDBRG4 | ACTIVE | SSOP | DB | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MAX3243C | Samples |
| MAX3243CDW | ACTIVE | SOIC | DW | 28 | 20 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MAX3243C | Samples |
| MAX3243CDWE4 | ACTIVE | SOIC | DW | 28 | 20 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MAX3243C | Samples |
| MAX3243CDWG4 | ACTIVE | SOIC | DW | 28 | 20 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MAX3243C | Samples |
| MAX3243CDWR | ACTIVE | SOIC | DW | 28 | 1000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MAX3243C | Samples |
| MAX3243CDWRG4 | ACTIVE | SOIC | DW | 28 | 1000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MAX3243C | Samples |
| MAX3243CPW | ACTIVE | TSSOP | PW | 28 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MA3243C | Samples |
| MAX3243CPWE4 | ACTIVE | TSSOP | PW | 28 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MA3243C | Samples |
| MAX3243CPWG4 | ACTIVE | TSSOP | PW | 28 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MA3243C | Samples |
| MAX3243CPWR | ACTIVE | TSSOP | PW | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MA3243C | Samples |
| MAX3243CPWRE4 | ACTIVE | TSSOP | PW | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MA3243C | Samples |
| MAX3243CPWRG4 | ACTIVE | TSSOP | PW | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MA3243C | Samples |
| MAX3243IDB | ACTIVE | SSOP | DB | 28 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MAX3243I | Samples |

| 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 |
|------------------|---------------|--------------|-----------------|------|-------------|-------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| MAX3243IDBG4 | ACTIVE | SSOP | DB | 28 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MAX3243I | Samples |
| MAX3243IDBR | ACTIVE | SSOP | DB | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MAX3243I | Samples |
| MAX3243IDBRE4 | ACTIVE | SSOP | DB | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MAX3243I | Samples |
| MAX3243IDBRG4 | ACTIVE | SSOP | DB | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MAX3243I | Samples |
| MAX3243IDW | ACTIVE | SOIC | DW | 28 | 20 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MAX3243I | Samples |
| MAX3243IDWG4 | ACTIVE | SOIC | DW | 28 | 20 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MAX3243I | Samples |
| MAX3243IDWR | ACTIVE | SOIC | DW | 28 | 1000 | Green (RoHS & no Sb/Br) | CU NIPDAU CU SN | Level-1-260C-UNLIM | -40 to 85 | MAX3243I | Samples |
| MAX3243IDWRE4 | ACTIVE | SOIC | DW | 28 | 1000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MAX3243I | Samples |
| MAX3243IDWRG4 | ACTIVE | SOIC | DW | 28 | 1000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MAX3243I | Samples |
| MAX3243IPW | ACTIVE | TSSOP | PW | 28 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MB3243I | Samples |
| MAX3243IPWG4 | ACTIVE | TSSOP | PW | 28 | | TBD | Call TI | Call TI | -40 to 85 | | Samples |
| MAX3243IPWR | ACTIVE | TSSOP | PW | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MB3243I | Samples |
| MAX3243IPWRE4 | ACTIVE | TSSOP | PW | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MB3243I | Samples |
| MAX3243IPWRG4 | ACTIVE | TSSOP | PW | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MB3243I | Samples |

(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.

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OTHER QUALIFIED VERSIONS OF MAX3243 :

- Enhanced Product: [MAX3243-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 |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| MAX3243CDBR | SSOP | DB | 28 | 2000 | 330.0 | 16.4 | 8.2 | 10.5 | 2.5 | 12.0 | 16.0 | Q1 |
| MAX3243CDWR | SOIC | DW | 28 | 1000 | 330.0 | 32.4 | 11.35 | 18.67 | 3.1 | 16.0 | 32.0 | Q1 |
| MAX3243CPWR | TSSOP | PW | 28 | 2000 | 330.0 | 16.4 | 6.9 | 10.2 | 1.8 | 12.0 | 16.0 | Q1 |
| MAX3243CPWR | TSSOP | PW | 28 | 2000 | 330.0 | 16.4 | 6.9 | 10.2 | 1.8 | 12.0 | 16.0 | Q1 |
| MAX3243IDBR | SSOP | DB | 28 | 2000 | 330.0 | 16.4 | 8.2 | 10.5 | 2.5 | 12.0 | 16.0 | Q1 |
| MAX3243IDWR | SOIC | DW | 28 | 1000 | 330.0 | 32.4 | 11.35 | 18.67 | 3.1 | 16.0 | 32.0 | Q1 |
| MAX3243IDWRG4 | SOIC | DW | 28 | 1000 | 330.0 | 32.4 | 11.35 | 18.67 | 3.1 | 16.0 | 32.0 | Q1 |
| MAX3243IPWR | TSSOP | PW | 28 | 2000 | 330.0 | 16.4 | 6.9 | 10.2 | 1.8 | 12.0 | 16.0 | Q1 |
| MAX3243IPWR | TSSOP | PW | 28 | 2000 | 330.0 | 16.4 | 6.9 | 10.2 | 1.8 | 12.0 | 16.0 | Q1 |

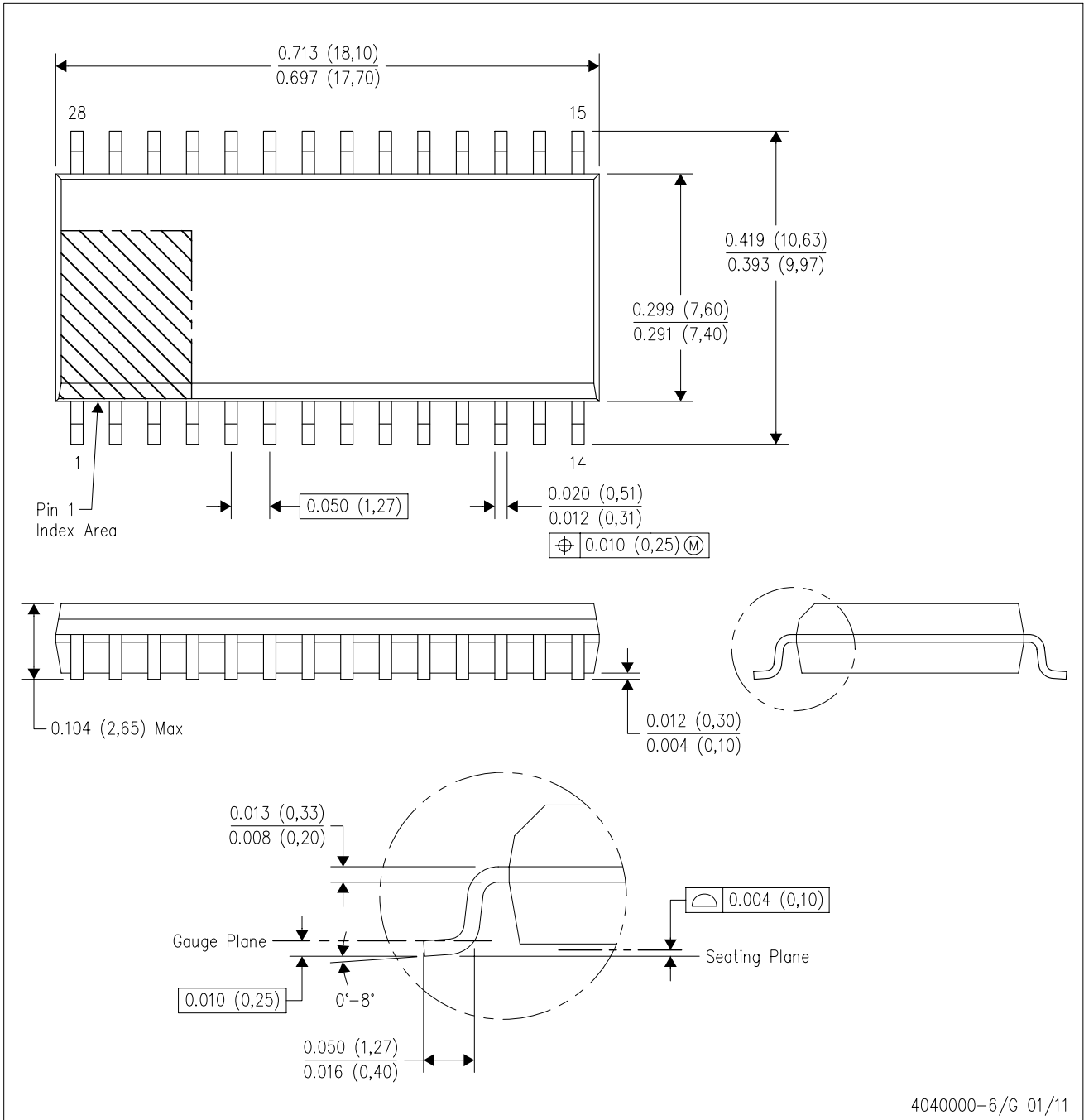
TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| MAX3243CDBR | SSOP | DB | 28 | 2000 | 367.0 | 367.0 | 38.0 |
| MAX3243CDWR | SOIC | DW | 28 | 1000 | 367.0 | 367.0 | 55.0 |
| MAX3243CPWR | TSSOP | PW | 28 | 2000 | 367.0 | 367.0 | 38.0 |
| MAX3243CPWR | TSSOP | PW | 28 | 2000 | 367.0 | 367.0 | 38.0 |
| MAX3243IDBR | SSOP | DB | 28 | 2000 | 367.0 | 367.0 | 38.0 |
| MAX3243IDWR | SOIC | DW | 28 | 1000 | 367.0 | 367.0 | 55.0 |
| MAX3243IDWRG4 | SOIC | DW | 28 | 1000 | 367.0 | 367.0 | 55.0 |
| MAX3243IPWR | TSSOP | PW | 28 | 2000 | 367.0 | 367.0 | 38.0 |
| MAX3243IPWR | TSSOP | PW | 28 | 2000 | 367.0 | 367.0 | 38.0 |

DW (R-PDSO-G28)

PLASTIC SMALL OUTLINE

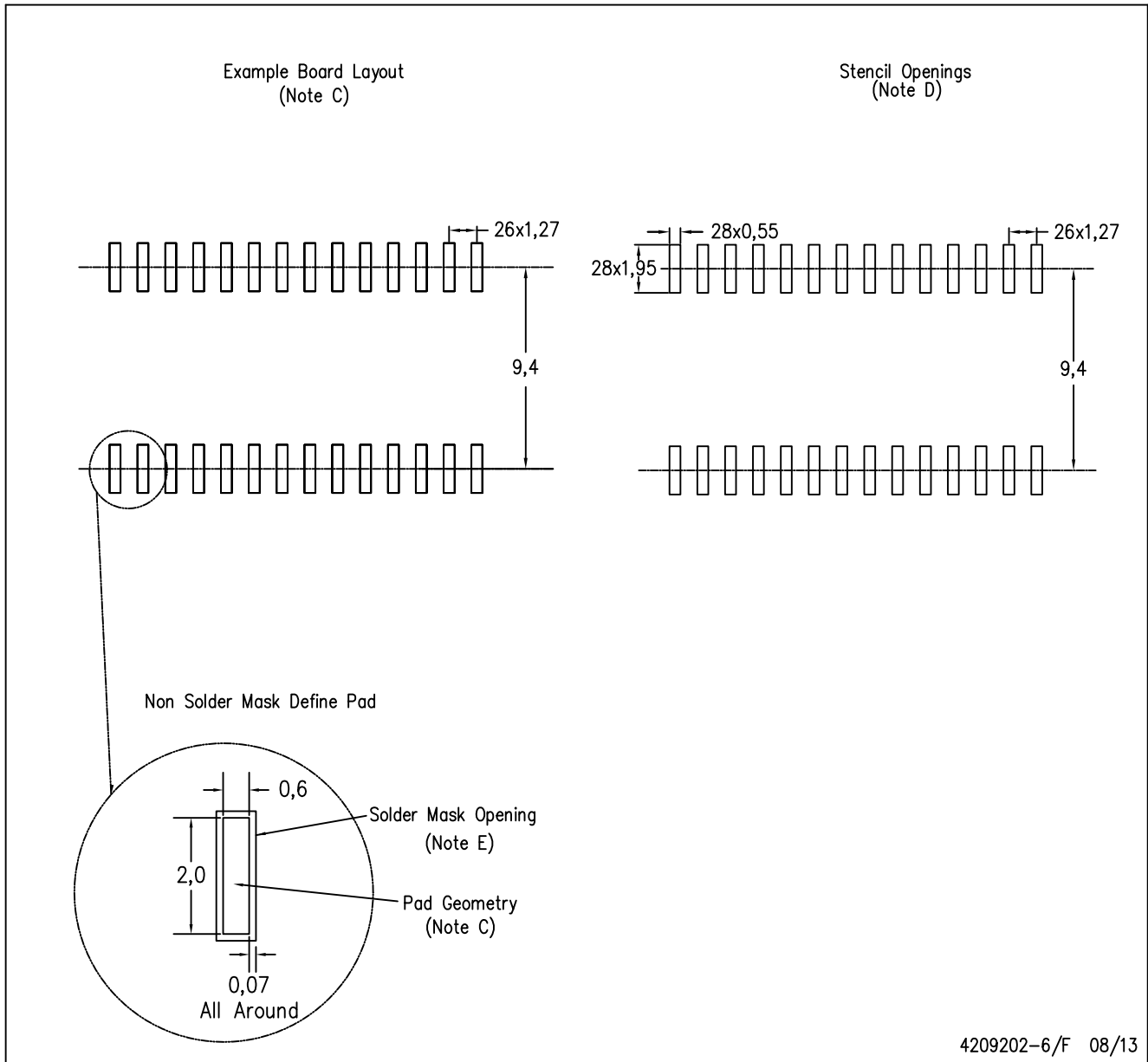


4040000-6/G 01/11

- 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 AE.

DW (R-PDSO-G28)

PLASTIC SMALL OUTLINE



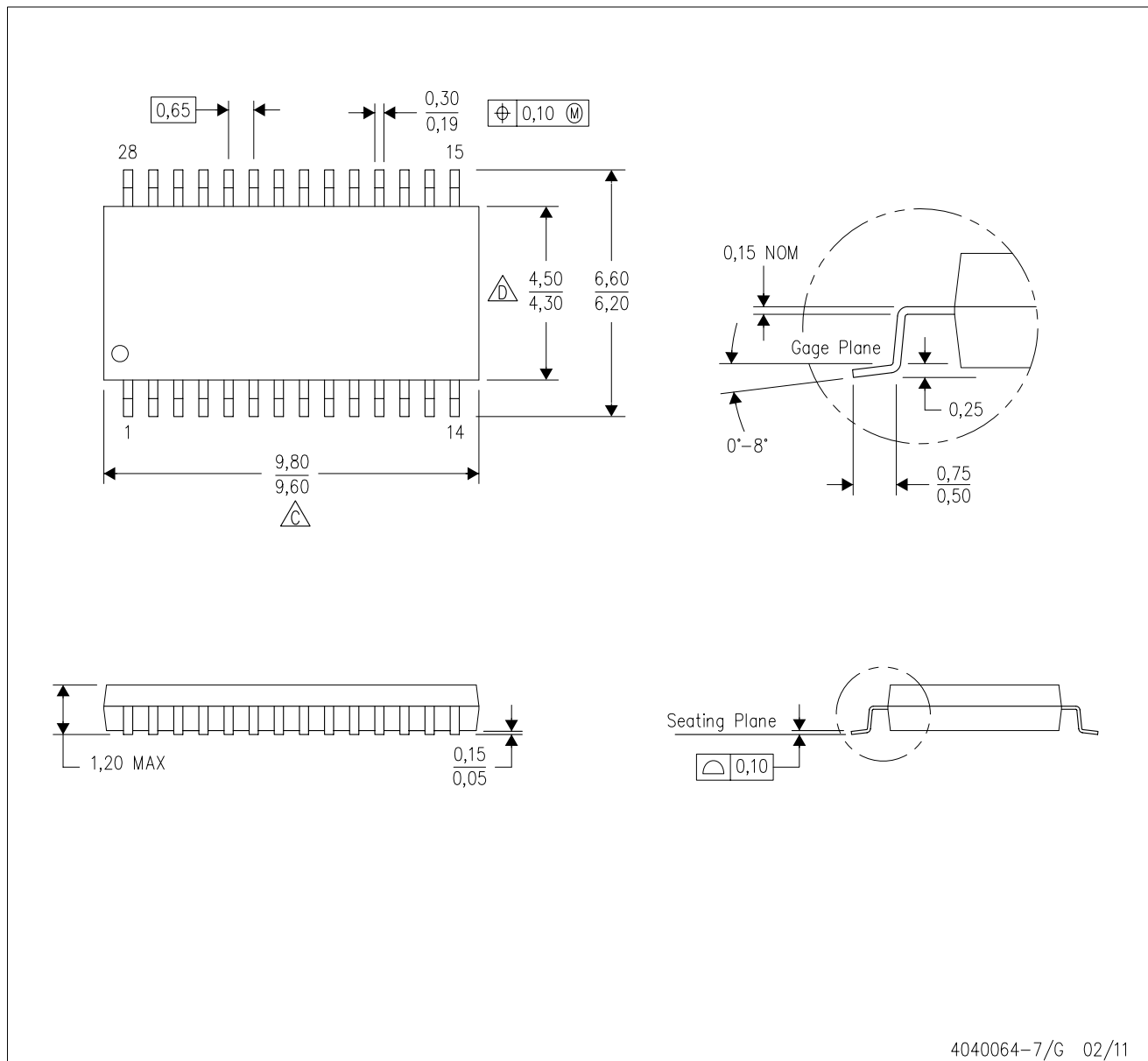
4209202-6/F 08/13

- 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.

MECHANICAL DATA

PW (R-PDSO-G28)

PLASTIC SMALL OUTLINE

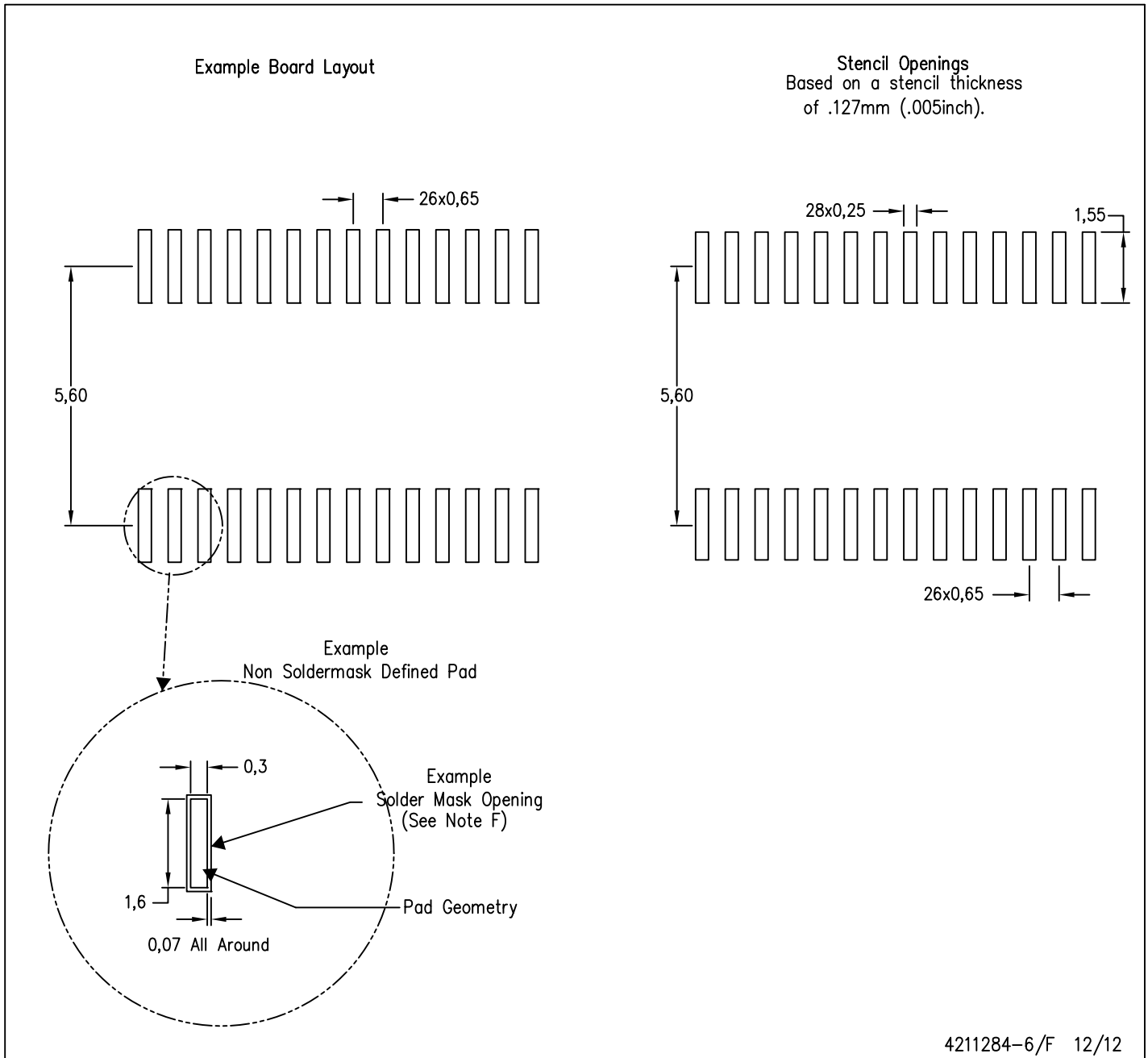


4040064-7/G 02/11

- 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-G28)

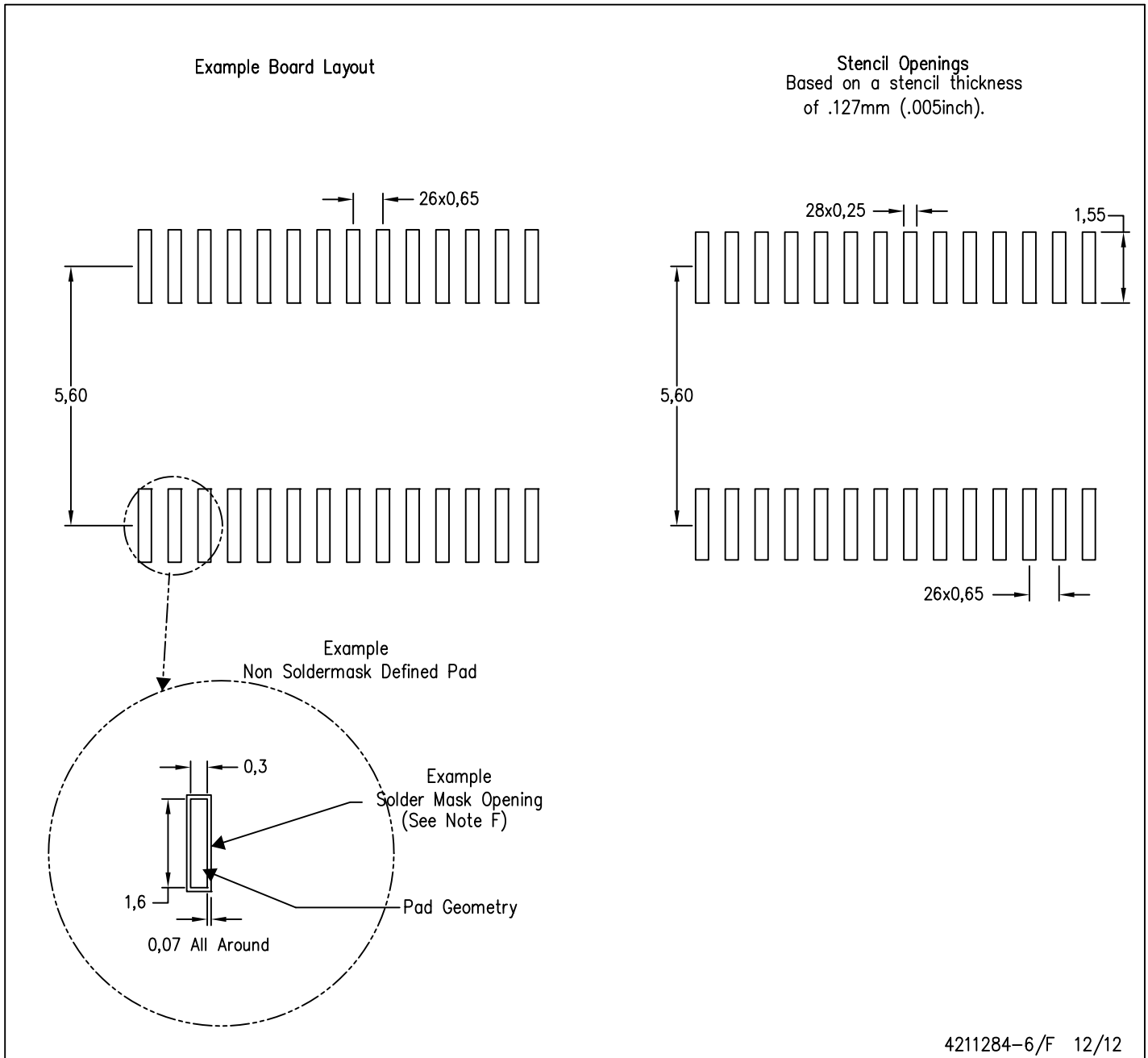
PLASTIC SMALL OUTLINE



- 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.

PW (R-PDSO-G28)

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.

DB (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

28 PINS SHOWN



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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