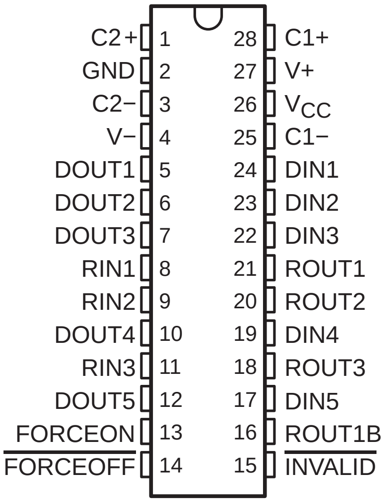
# SN65C3238, SN75C3238
# 3-V TO 5.5-V MULTICHANNEL RS-232 COMPATIBLE LINE DRIVER/RECEIVER

SLLS352F − JUNE 1999 − REVISED OCTOBER 2004

- **Auto-powerdown Plus**
- **Operate With 3-V to 5.5-V $V_{CC}$ Supply**
- **Always-Active Noninverting Receiver Output (ROUT1B)**
- **Support Operation From 250 kbit/s to 1 Mbit/s**
- **Low Standby Current . . . 1 μA Typ**
- **External Capacitors . . . 4 × 0.1 μF**
- **Accept 5-V Logic Input With 3.3-V Supply**
- **Inter-Operable With SN65C3243, SN75C3243**
- **RS-232 Bus-Pin ESD Protection Exceeds ±15-kV Using Human-Body Model (HBM)**
- **Applications**
  - **Battery-Powered Systems, PDAs, Notebooks, Sub-Notebooks, Laptops, Palmtop PCs, Hand-Held Equipment, Modems, and Printers**

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



## description/ordering information

The ’C3238 devices consist of five line drivers, three line receivers, and a dual charge-pump circuit with ±15-kV ESD protection pin to pin (serial-port connection pins, including GND). The charge pump and four small external capacitors allow operation from a single 3-V to 5.5-V supply. In addition, these devices include an always-active noninverting output (ROUT1B), which allows applications using the ring indicator to transmit data while the device is powered down. These devices operate at data signaling rates up to 1 Mbit/s and at an increased slew-rate range of 24 V/μs to 150 V/μs.

**ORDERING INFORMATION**

| $T_A$ | PACKAGE[†] | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---|---|---|---|---|
| −0°C to 70°C | SOIC (DW) | Tube of 20 | SN75C3238DW | 75C3238 |
| | | Reel of 1000 | SN75C3238DWR | |
| | SSOP (DB) | Reel of 2000 | SN75C3238DBR | 75C3238 |
| | TSSOP (PW) | Tube of 50 | SN75C3238PW | CA3238 |
| | | Reel of 2000 | SN75C3238PWR | |
| −40°C to 85°C | SOIC (DW) | Tube of 20 | SN65C3238DW | 65C3238 |
| | | Reel of 1000 | SN65C3238DWR | |
| | SSOP (DB) | Reel of 2000 | SN65C3238DBR | 65C3238 |
| | TSSOP (PW) | Tube of 50 | SN65C3238PW | CB3238 |
| | | Reel of 2000 | SN65C3238PWR | |

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

## description/ordering information (continued)

Flexible control options for power management are featured when the serial-port and driver inputs are inactive. The auto-powerdown plus feature functions when FORCEON is low and $\overline{\text{FORCEOFF}}$ is high. During this mode of operation, if the device does not sense valid signal transitions on all receiver and driver inputs for 30 s, the built-in charge-pump and drivers are powered down, reducing the supply current to 1 μA. By disconnecting the serial port or placing the peripheral drivers off, auto-powerdown plus will occur if there is no activity in the logic levels for the driver inputs. Auto-powerdown plus can be disabled when FORCEON and $\overline{\text{FORCEOFF}}$ are high. With auto-powerdown plus enabled, the device automatically activates once a valid signal is applied to any receiver or driver 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 μs. $\overline{\text{INVALID}}$ is low (invalid data) if all receiver input voltages are between −0.3 V and 0.3 V for more than 30 μs. Refer to Figure 5 for receiver input levels.

### Function Tables

**EACH DRIVER**

| INPUTS | | | | OUTPUT | DRIVER STATUS |
|---|---|---|---|---|---|
| DIN | FORCEON | $\overline{\text{FORCEOFF}}$ | TIME ELAPSED SINCE LAST RIN OR DIN TRANSITION | DOUT | |
| X | X | L | X | Z | Powered off |
| L | H | H | X | H | Normal operation with auto-powerdown plus disabled |
| H | H | H | X | L | |
| L | L | H | <30 s | H | Normal operation with auto-powerdown plus enabled |
| H | L | H | <30 s | L | |
| L | L | H | >30 s | Z | Powered off by auto-powerdown plus feature |
| H | L | H | >30 s | Z | |

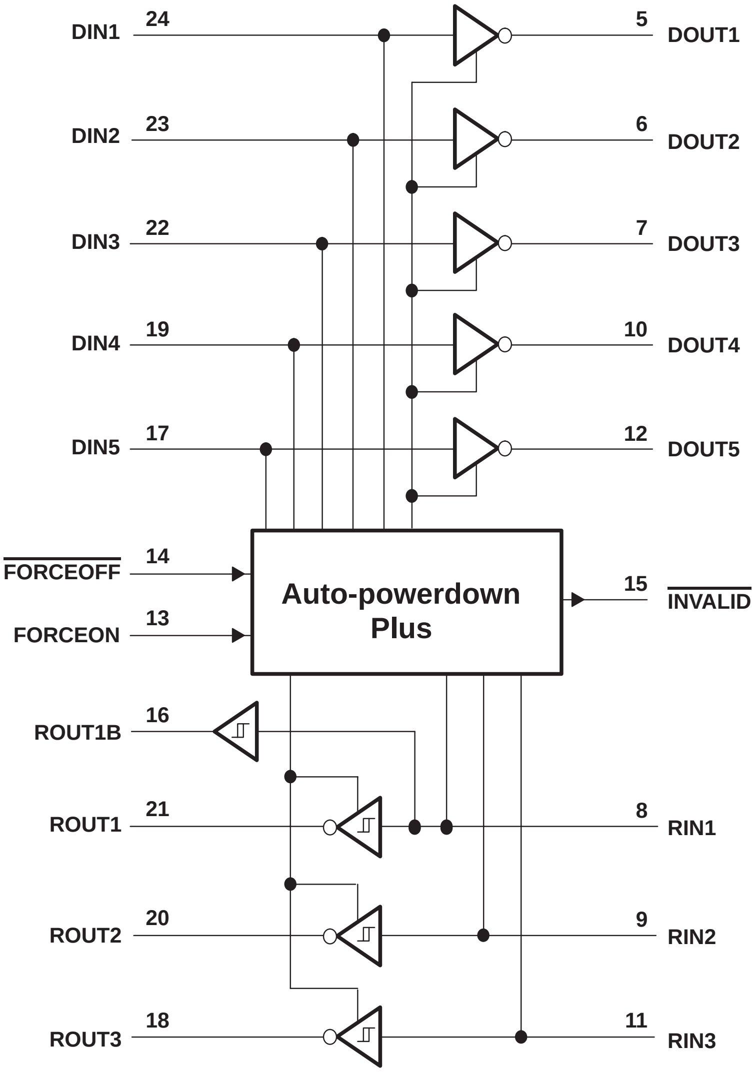
H = high level, L = low level, X = irrelevant, Z = high impedance

**EACH RECEIVER**

| INPUTS | | | | OUTPUTS | | RECEIVER STATUS |
|---|---|---|---|---|---|---|
| RIN2 | RIN1, RIN3−RIN5 | $\overline{\text{FORCEOFF}}$ | TIME ELAPSED SINCE LAST RIN OR DIN TRANSITION | ROUT1B | ROUT | |
| L | X | L | X | L | Z | Powered off while ROUT1B is active |
| H | X | L | X | H | Z | |
| L | L | H | <30 s | L | H | Normal operation with auto-powerdown plus disabled/enabled |
| L | H | H | <30 s | L | L | |
| H | L | H | <30 s | H | H | |
| H | H | H | <30 s | H | L | |
| Open | Open | H | >30 s | 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)



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

| | |
|---|---|
| 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 ($\overline{\text{INVALID}}$) | −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 |

† 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 $P_D = (T_J(\text{max}) - T_A)/\theta_{JA}$. Operating at the absolute maximum $T_J$ of 150°C can affect reliability.

3. The package thermal impedance is calculated in accordance with JESD 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 | 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 | DIN, $\overline{\text{FORCEOFF}}$, FORCEON | | | | 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 | | SN75C3238 | 0 | | 70 | °C |
| | | | SN65C3238 | −40 | | 85 | |

NOTE 4: Testing supply conditions are C1−C4 = 0.1 µF at $V_{CC}$ = 3.3 V ± 0.15 V; C1−C4 = 0.22 µF at $V_{CC}$ = 3.3 V ± 0.3 V; and C1 = 0.047 µF and C2−C4 = 0.33 µF at $V_{CC}$ = 5 V ± 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‡ | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| $I_I$ | Input leakage current | $\overline{\text{FORCEOFF}}$, FORCEON | | | ±0.01 | ±1 | µA |
| $I_{CC}$ | Supply current | Auto-powerdown plus disabled | No load, $\overline{\text{FORCEOFF}}$ and FORCEON at $V_{CC}$ | | 0.5 | 2 | mA |
| | | Powered off | No load, $\overline{\text{FORCEOFF}}$ at GND | | 1 | 10 | µA |
| | | Auto-powerdown plus enabled | No load, $\overline{\text{FORCEOFF}}$ at $V_{CC}$,<br>FORCEON at GND,<br>All RIN are open or grounded | | 1 | 10 | |

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

NOTE 4: Testing supply conditions are C1−C4 = 0.1 µF at $V_{CC}$ = 3.3 V ± 0.15 V; C1−C4 = 0.22 µF at $V_{CC}$ = 3.3 V ± 0.3 V; and C1 = 0.047 µF and C2−C4 = 0.33 µF at $V_{CC}$ = 5 V ± 0.5 V.

## 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[†] | 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 |
| $I_{IH}$ | 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 |
| $I_{OS}$ | Short-circuit output current[‡] | $V_{CC}$ = 3.6 V, | $V_O$ = 0 V | | ±35 | ±60 | mA |
| | | $V_{CC}$ = 5.5 V, | $V_O$ = 0 V | | ±40 | ±90 | |
| $r_o$ | 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 V to 3.6 V | | | ±25 | μA |
| | | | $V_O$ = ±10 V, $V_{CC}$ = 4.5 V to 5.5 V | | | ±25 | |

[†] All typical values are at $V_{CC}$ = 3.3 V or $V_{CC}$ = 5 V, and $T_A$ = 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: Testing supply conditions are C1−C4 = 0.1 μF at $V_{CC}$ = 3.3 V ± 0.15 V; C1−C4 = 0.22 μF at $V_{CC}$ = 3.3 V ± 0.3 V; and C1 = 0.047 μF and C2−C4 = 0.33 μF at $V_{CC}$ = 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 6)

| PARAMETER | | TEST CONDITIONS | | MIN | TYP[†] | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| | Maximum data rate (see Figure 1) | $R_L$ = 3 kΩ,<br>One DOUT switching | $C_L$ = 1000 pF | 250 | | | kbit/s |
| | | | $C_L$ = 250 pF, $V_{CC}$ = 3 V to 4.5 V | 1000 | | | |
| | | | $C_L$ = 1000 pF, $V_{CC}$ = 4.5 V to 5.5 V | 1000 | | | |
| $t_{sk(p)}$ | Pulse skew[§] | $C_L$ = 150 pF to 2500 pF, $R_L$ = 3 kΩ to 7 kΩ, See Figure 2 | | | 25 | | ns |
| SR(tr) | Slew rate, transition region (see Figure 1) | $C_L$ = 150 pF to 1000 pF, $R_L$ = 3 kΩ to 7 kΩ, $V_{CC}$ = 3.3 V | | 18 | | 150 | V/μs |

[†] All typical values are at $V_{CC}$ = 3.3 V or $V_{CC}$ = 5 V, and $T_A$ = 25°C.

[§] Pulse skew is defined as $|t_{PLH} - t_{PHL}|$ of each channel of the same device.

NOTE 4: Testing supply conditions are C1−C4 = 0.1 μF at $V_{CC}$ = 3.3 V ± 0.15 V; C1−C4 = 0.22 μF at $V_{CC}$ = 3.3 V ± 0.3 V; and C1 = 0.047 μF and C2−C4 = 0.33 μF at $V_{CC}$ = 5 V ± 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[†] | MAX | UNIT |
|---|---|---|---|---|---|---|
| $V_{OH}$ | High-level output voltage | $I_{OH} = -1$ mA | $V_{CC} - 0.6$ V | $V_{CC} - 0.1$ V | | V |
| $V_{OL}$ | Low-level output voltage | $I_{OL} = 1.6$ mA | | | 0.4 | V |
| $V_{IT+}$ | Positive-going input threshold voltage | $V_{CC} = 3.3$ V | | 1.5 | 2.4 | V |
| | | $V_{CC} = 5$ V | | 1.8 | 2.4 | |
| $V_{IT-}$ | Negative-going input threshold voltage | $V_{CC} = 3.3$ V | 0.6 | 1.2 | | V |
| | | $V_{CC} = 5$ V | 0.8 | 1.5 | | |
| $V_{hys}$ | Input hysteresis ($V_{IT+} - V_{IT-}$) | | | 0.3 | | V |
| $I_{off}$ | Output leakage current (except ROUT1B) | $\overline{\text{FORCEOFF}} = 0$ V | | ±0.05 | ±10 | μA |
| $r_i$ | Input resistance | $V_I = \pm 3$ V to $\pm 25$ V | 3 | 5 | 7 | kΩ |

[†] All typical values are at $V_{CC} = 3.3$ V or $V_{CC} = 5$ V, and $T_A = 25°C$.

NOTE 4: Testing supply conditions are C1−C4 = 0.1 μF at $V_{CC} = 3.3\ V \pm 0.15$ V; C1−C4 = 0.22 μF at $V_{CC} = 3.3\ V \pm 0.3$ V; and C1 = 0.047 μF and C2−C4 = 0.33 μF at $V_{CC} = 5\ V \pm 0.5$ V.

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

| PARAMETER | | TEST CONDITIONS | MIN | TYP[†] | MAX | UNIT |
|---|---|---|---|---|---|---|
| $t_{PLH}$ | Propagation delay time, low- to high-level output | $C_L = 150$ pF, See Figure 3 | | 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 4 | | 200 | | ns |
| $t_{dis}$ | Output disable time | | | 200 | | ns |
| $t_{sk(p)}$ | Pulse skew[‡] | See Figure 3 | | 50 | | ns |

[†] All typical values are at $V_{CC} = 3.3$ V or $V_{CC} = 5$ V, and $T_A = 25°C$.

[‡] Pulse skew is defined as $|t_{PLH} - t_{PHL}|$ of each channel of the same device.

NOTE 4: Testing supply conditions are C1−C4 = 0.1 μF at $V_{CC} = 3.3\ V \pm 0.15$ V; C1−C4 = 0.22 μF at $V_{CC} = 3.3\ V \pm 0.3$ V; and C1 = 0.047 μF and C2−C4 = 0.33 μF at $V_{CC} = 5\ V \pm 0.5$ V.

## AUTO-POWERDOWN PLUS 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† | MAX | UNIT |
|---|---|---|---|---|---|---|
| $V_{T+(valid)}$ | Receiver input threshold for $\overline{\text{INVALID}}$ high-level output voltage | FORCEON = GND,<br>$\overline{\text{FORCEOFF}}$ = $V_{CC}$ | | | 2.7 | V |
| $V_{T-(valid)}$ | Receiver input threshold for $\overline{\text{INVALID}}$ high-level output voltage | FORCEON = GND,<br>$\overline{\text{FORCEOFF}}$ = $V_{CC}$ | −2.7 | | | V |
| $V_{T(invalid)}$ | Receiver input threshold for $\overline{\text{INVALID}}$ low-level output voltage | FORCEON = GND,<br>$\overline{\text{FORCEOFF}}$ = $V_{CC}$ | −0.3 | | 0.3 | V |
| $V_{OH}$ | $\overline{\text{INVALID}}$ high-level output voltage | $I_{OH}$ = −1 mA, FORCEON = GND,<br>$\overline{\text{FORCEOFF}}$ = $V_{CC}$ | $V_{CC}$ − 0.6 | | | V |
| $V_{OL}$ | $\overline{\text{INVALID}}$ low-level output voltage | $I_{OL}$ = 1.6 mA, FORCEON = GND,<br>$\overline{\text{FORCEOFF}}$ = $V_{CC}$ | | | 0.4 | V |

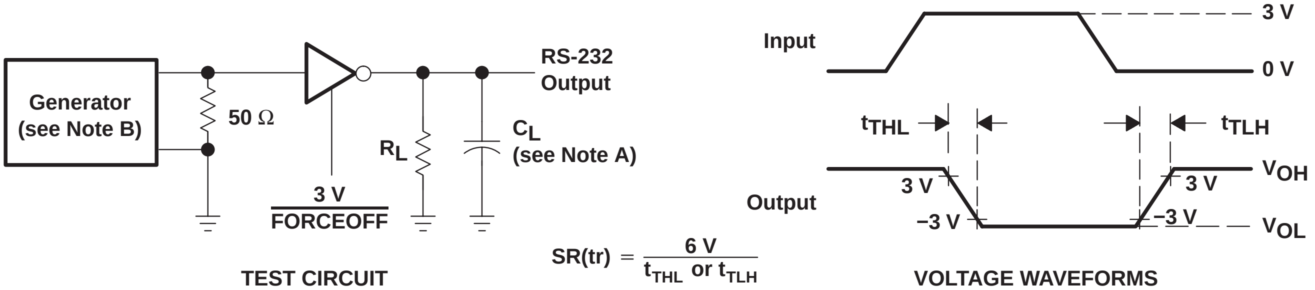
† All typical values are at $V_{CC}$ = 3.3 V or $V_{CC}$ = 5 V, and $T_A$ = 25°C.

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

| PARAMETER | | MIN | TYP† | MAX | UNIT |
|---|---|---|---|---|---|
| $t_{valid}$ | Propagation delay time, low- to high-level output | | 0.1 | | µs |
| $t_{invalid}$ | Propagation delay time, high- to low-level output | | 50 | | µs |
| $t_{en}$ | Supply enable time | | 25 | | µs |
| $t_{dis}$ | Receiver or driver edge to auto-powerdown plus | 15 | 30 | 60 | s |

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

## PARAMETER MEASUREMENT INFORMATION



$$SR(tr) = \frac{6\ V}{t_{THL}\ or\ t_{TLH}}$$

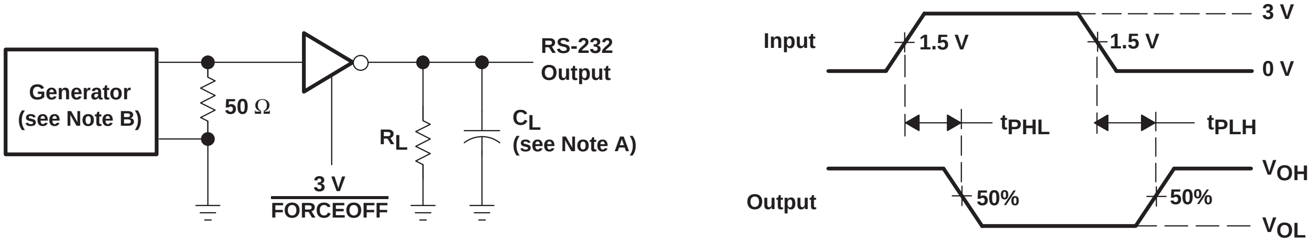
TEST CIRCUIT

VOLTAGE WAVEFORMS

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

B. The pulse generator has the following characteristics: PRR = 1 Mbit/s, $Z_O$ = 50 Ω, 50% duty cycle, $t_r \leq 10$ ns, $t_f \leq 10$ ns.

**Figure 1. Driver Slew Rate**



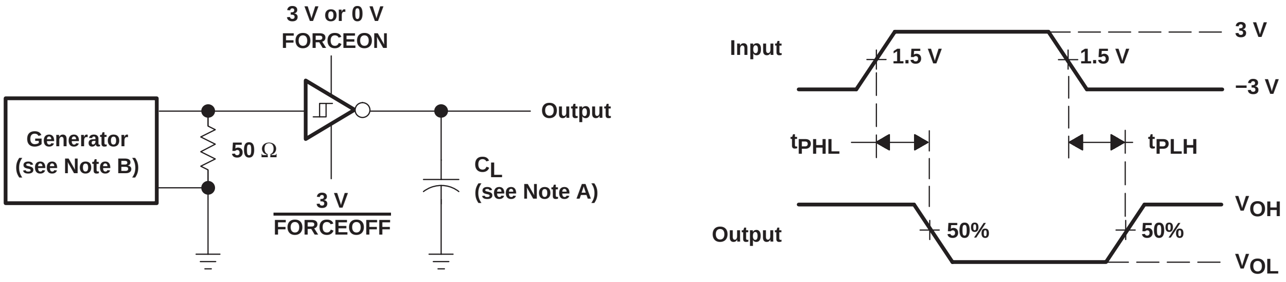
TEST CIRCUIT

VOLTAGE WAVEFORMS

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

B. The pulse generator has the following characteristics: PRR = 1 Mbit/s, $Z_O$ = 50 Ω, 50% duty cycle, $t_r \leq 10$ ns, $t_f \leq 10$ ns.

**Figure 2. Driver Pulse Skew**



TEST CIRCUIT

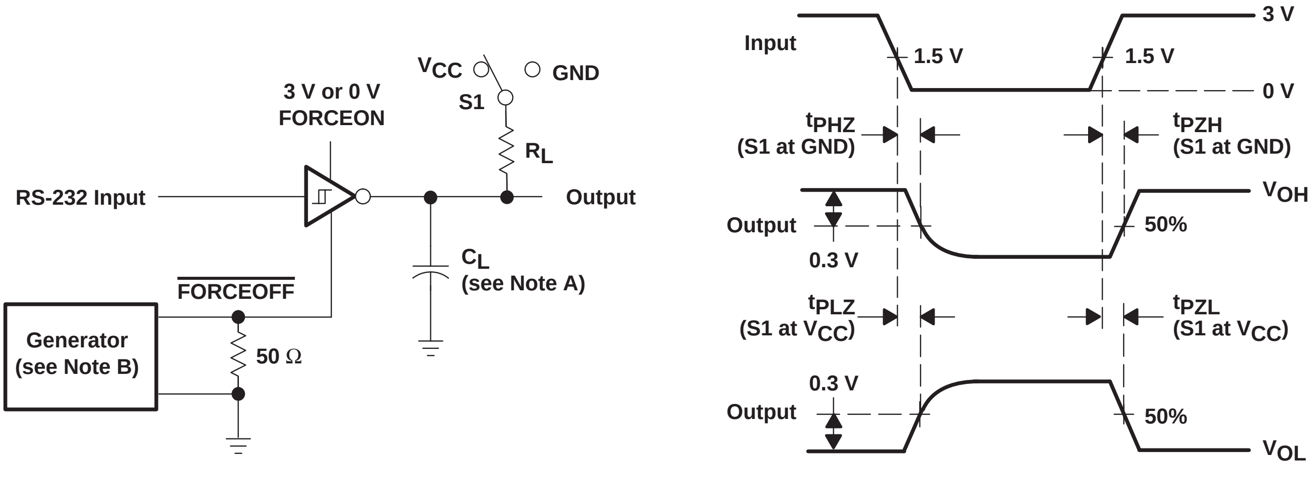
VOLTAGE WAVEFORMS

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

B. The pulse generator has the following characteristics: $Z_O$ = 50 Ω, 50% duty cycle, $t_r \leq 10$ ns, $t_f \leq 10$ ns.

**Figure 3. Receiver Propagation Delay Times**

## PARAMETER MEASUREMENT INFORMATION



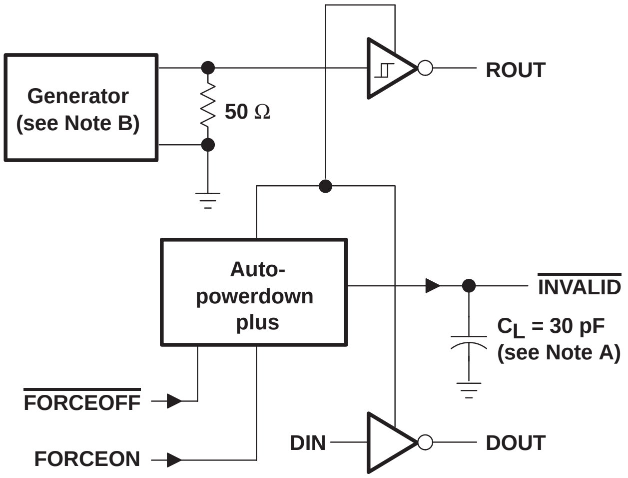
TEST CIRCUIT

VOLTAGE WAVEFORMS

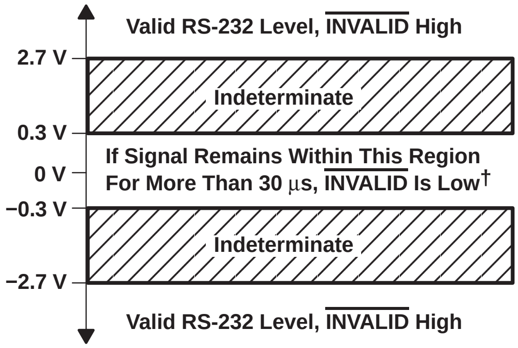
NOTES:
- A. $C_L$ includes probe and jig capacitance.
- B. The pulse generator has the following characteristics: $Z_O = 50\ \Omega$, 50% duty cycle, $t_r \leq 10$ ns, $t_f \leq 10$ ns.
- C. $t_{PLZ}$ and $t_{PHZ}$ are the same as $t_{dis}$.
- D. $t_{PZL}$ and $t_{PZH}$ are the same as $t_{en}$.

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

## PARAMETER MEASUREMENT INFORMATION

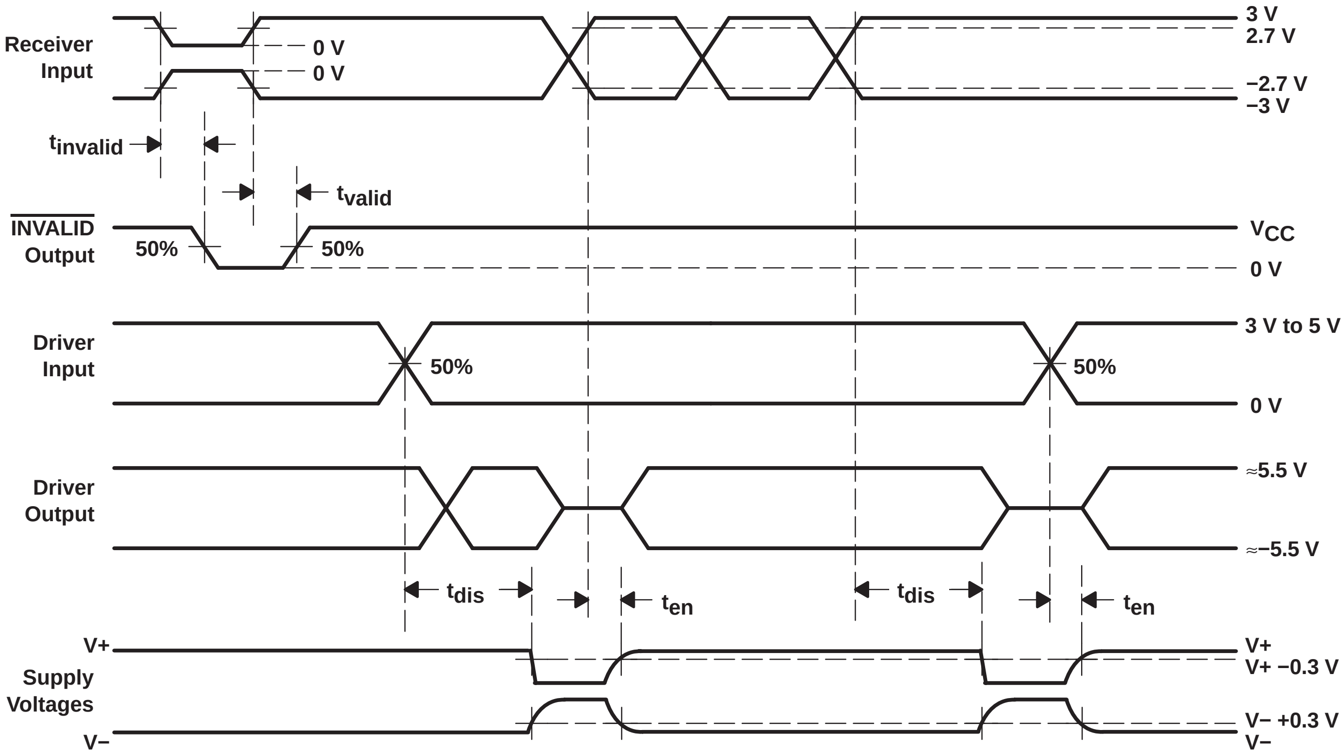


TEST CIRCUIT



† Auto-powerdown plus disables drivers and reduces supply current to 1 µA.

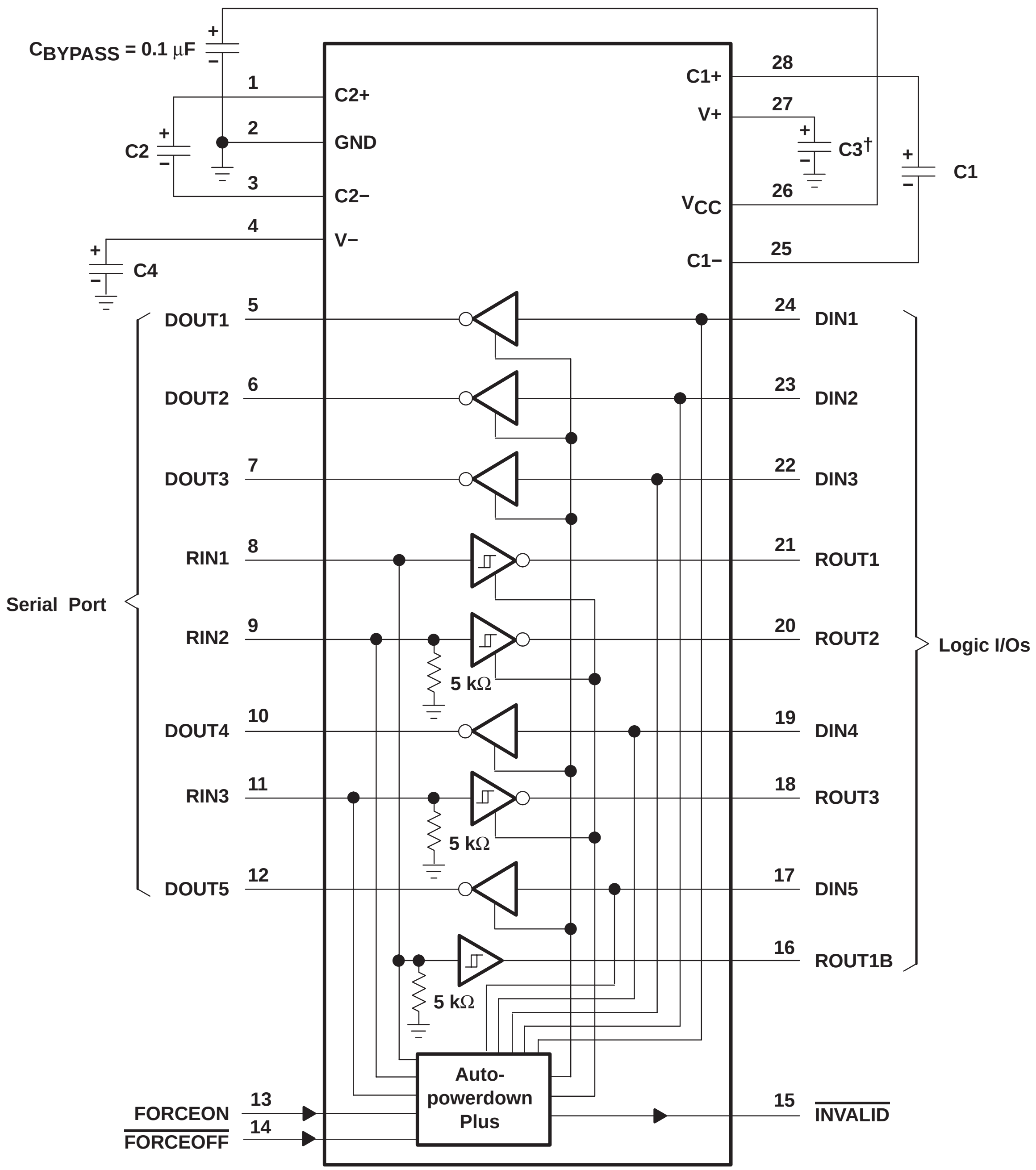
NOTES: A. $C_L$ includes probe and jig capacitance.
B. The pulse generator has the following characteristics: PRR = 5 kbit/s, $Z_O$ = 50 Ω, 50% duty cycle, $t_r \le$ 10 ns, $t_f \le$ 10 ns.



Voltage Waveforms and Timing Diagrams

**Figure 5. INVALID Propagation Delay Times and Supply Enabling Time**

## APPLICATION INFORMATION



† C3 can be connected to $V_{CC}$ or GND.

NOTE A: Resistor values shown are nominal.

**$V_{CC}$ vs CAPACITOR VALUES**

| $V_{CC}$ | C1 | C2, C3, and C4 |
|---|---|---|
| 3.3 V ± 0.15 V | 0.1 μF | 0.1 μF |
| 3.3 V ± 0.3 V | 0.22 μF | 0.22 μF |
| 5 V ± 0.5 V | 0.047 μ F | 0.33 μF |
| 3 V to 5.5 V | 0.22 μF | 1 μF |

**Figure 6. Typical Operating Circuit and Capacitor Values**

## PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SN65C3238DBR | ACTIVE | SSOP | DB | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 65C3238 | Samples |
| SN65C3238DBRE4 | ACTIVE | SSOP | DB | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 65C3238 | Samples |
| SN65C3238DBRG4 | ACTIVE | SSOP | DB | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 65C3238 | Samples |
| SN65C3238DWE4 | ACTIVE | SOIC | DW | 28 |  | TBD | Call TI | Call TI | -40 to 85 | 65C3238 | Samples |
| SN65C3238DWG4 | OBSOLETE | SOIC | DW | 28 |  | TBD | Call TI | Call TI | -40 to 85 | 65C3238 |  |
| SN65C3238DWR | ACTIVE | SOIC | DW | 28 | 1000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 65C3238 | Samples |
| SN65C3238DWRE4 | ACTIVE | SOIC | DW | 28 | 1000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 65C3238 | Samples |
| SN65C3238DWRG4 | ACTIVE | SOIC | DW | 28 | 1000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 65C3238 | Samples |
| SN65C3238PW | ACTIVE | TSSOP | PW | 28 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | CB3238 | Samples |
| SN65C3238PWE4 | ACTIVE | TSSOP | PW | 28 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | CB3238 | Samples |
| SN65C3238PWG4 | ACTIVE | TSSOP | PW | 28 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | CB3238 | Samples |
| SN65C3238PWR | ACTIVE | TSSOP | PW | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | CB3238 | Samples |
| SN65C3238PWRE4 | ACTIVE | TSSOP | PW | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | CB3238 | Samples |
| SN65C3238PWRG4 | ACTIVE | TSSOP | PW | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | CB3238 | Samples |
| SN75C3238DBR | ACTIVE | SSOP | DB | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 75C3238 | Samples |
| SN75C3238DBRE4 | ACTIVE | SSOP | DB | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 75C3238 | Samples |
| SN75C3238DBRG4 | ACTIVE | SSOP | DB | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 75C3238 | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SN75C3238DW | ACTIVE | SOIC | DW | 28 | 20 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 75C3238 | Samples |
| SN75C3238DWE4 | ACTIVE | SOIC | DW | 28 | 20 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 75C3238 | Samples |
| SN75C3238DWG4 | ACTIVE | SOIC | DW | 28 | 20 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 75C3238 | Samples |
| SN75C3238DWR | ACTIVE | SOIC | DW | 28 | 1000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 75C3238 | Samples |
| SN75C3238DWRE4 | ACTIVE | SOIC | DW | 28 | 1000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 75C3238 | Samples |
| SN75C3238DWRG4 | ACTIVE | SOIC | DW | 28 | 1000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 75C3238 | Samples |
| SN75C3238PW | ACTIVE | TSSOP | PW | 28 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | CA3238 | Samples |
| SN75C3238PWE4 | ACTIVE | TSSOP | PW | 28 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | CA3238 | Samples |
| SN75C3238PWG4 | ACTIVE | TSSOP | PW | 28 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | CA3238 | Samples |
| SN75C3238PWR | ACTIVE | TSSOP | PW | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | CA3238 | Samples |
| SN75C3238PWRE4 | ACTIVE | TSSOP | PW | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | CA3238 | Samples |
| SN75C3238PWRG4 | ACTIVE | TSSOP | PW | 28 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | CA3238 | 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.

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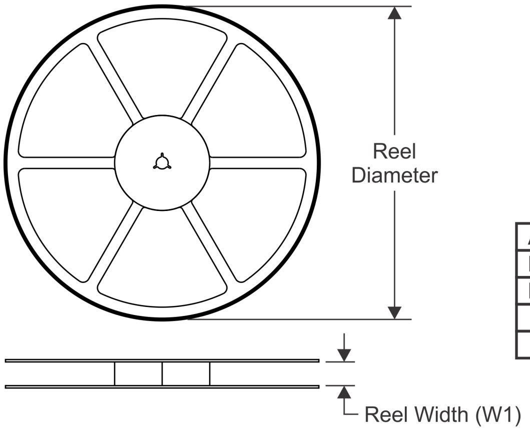
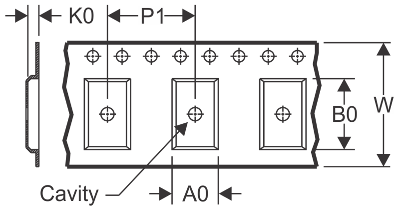
## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

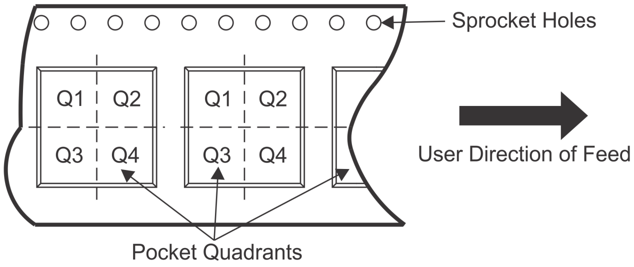


**TAPE DIMENSIONS**



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

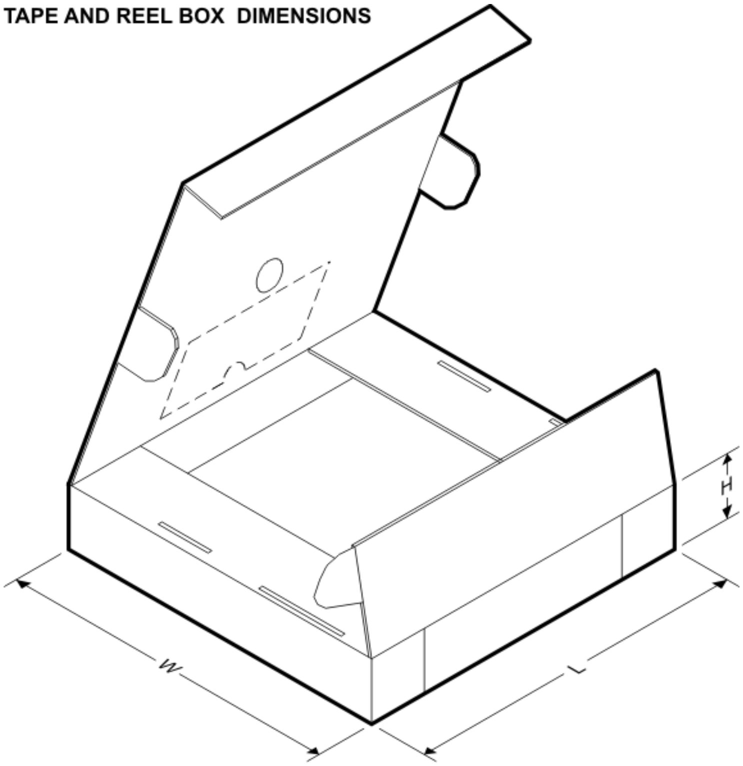
**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**



*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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SN65C3238DBR | SSOP | DB | 28 | 2000 | 330.0 | 16.4 | 8.2 | 10.5 | 2.5 | 12.0 | 16.0 | Q1 |
| SN65C3238DWR | SOIC | DW | 28 | 1000 | 330.0 | 32.4 | 11.35 | 18.67 | 3.1 | 16.0 | 32.0 | Q1 |
| SN65C3238PWR | TSSOP | PW | 28 | 2000 | 330.0 | 16.4 | 6.9 | 10.2 | 1.8 | 12.0 | 16.0 | Q1 |
| SN75C3238DBR | SSOP | DB | 28 | 2000 | 330.0 | 16.4 | 8.2 | 10.5 | 2.5 | 12.0 | 16.0 | Q1 |
| SN75C3238DWR | SOIC | DW | 28 | 1000 | 330.0 | 32.4 | 11.35 | 18.67 | 3.1 | 16.0 | 32.0 | Q1 |
| SN75C3238PWR | TSSOP | PW | 28 | 2000 | 330.0 | 16.4 | 6.9 | 10.2 | 1.8 | 12.0 | 16.0 | Q1 |

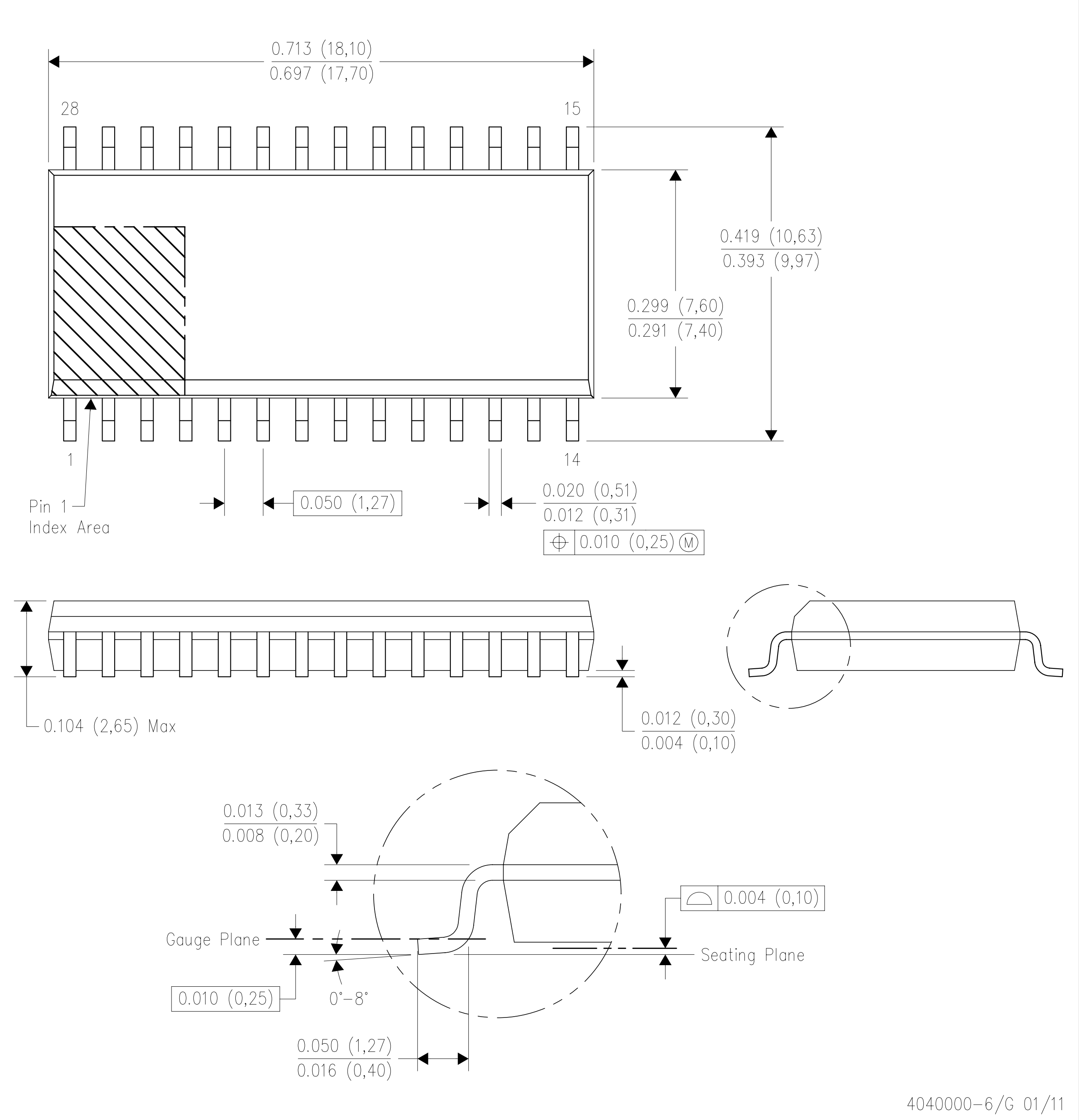
## TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

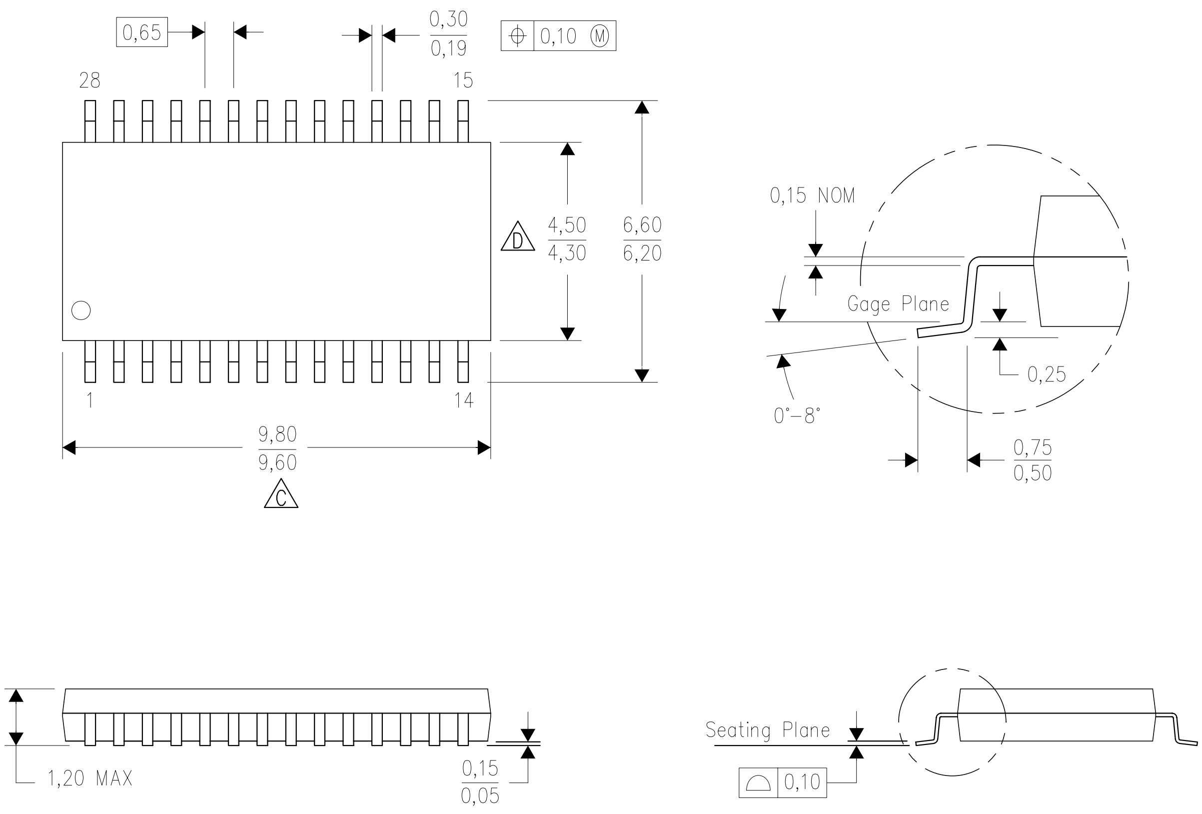
| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| SN65C3238DBR | SSOP | DB | 28 | 2000 | 367.0 | 367.0 | 38.0 |
| SN65C3238DWR | SOIC | DW | 28 | 1000 | 367.0 | 367.0 | 55.0 |
| SN65C3238PWR | TSSOP | PW | 28 | 2000 | 367.0 | 367.0 | 38.0 |
| SN75C3238DBR | SSOP | DB | 28 | 2000 | 367.0 | 367.0 | 38.0 |
| SN75C3238DWR | SOIC | DW | 28 | 1000 | 367.0 | 367.0 | 55.0 |
| SN75C3238PWR | TSSOP | PW | 28 | 2000 | 367.0 | 367.0 | 38.0 |

DW (R-PDSO-G28) PLASTIC SMALL OUTLINE



NOTES:
- A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M–1994.
- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
- D. Falls within JEDEC MS-013 variation AE.

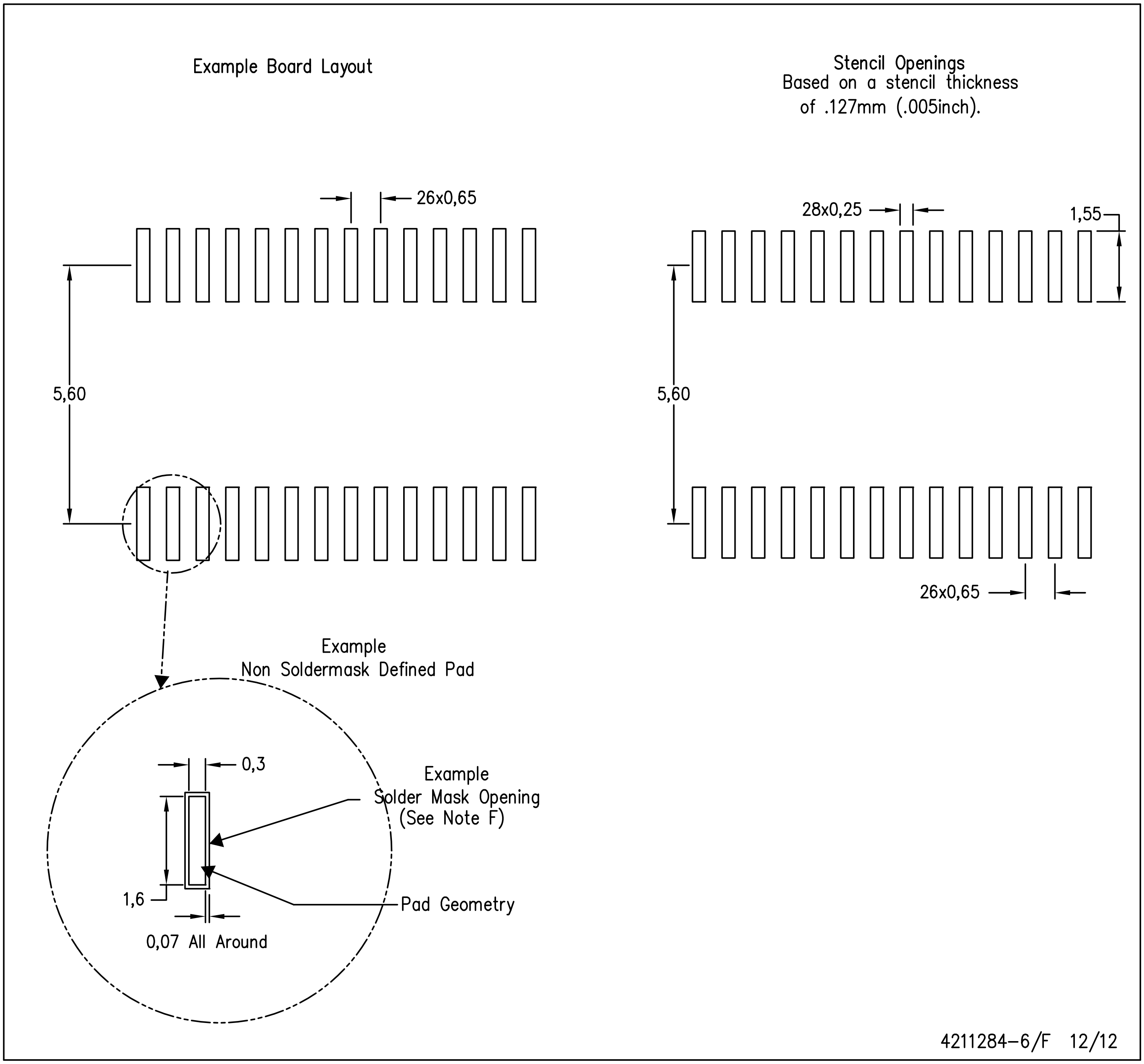
## PW (R–PDSO–G28) PLASTIC SMALL OUTLINE



4040064–7/G 02/11

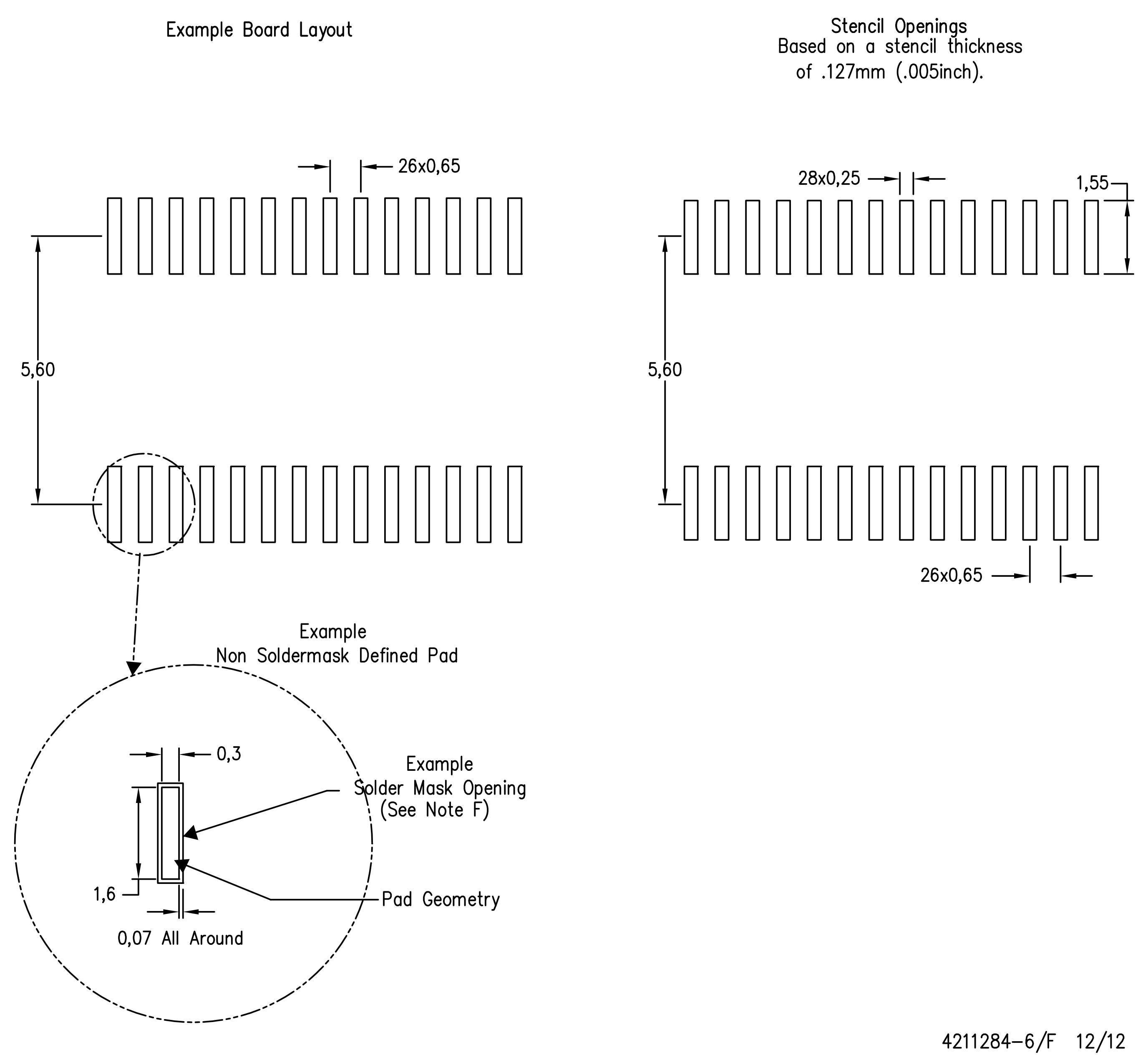
NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M–1994.
- B. This drawing is subject to change without notice.
- C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
- 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

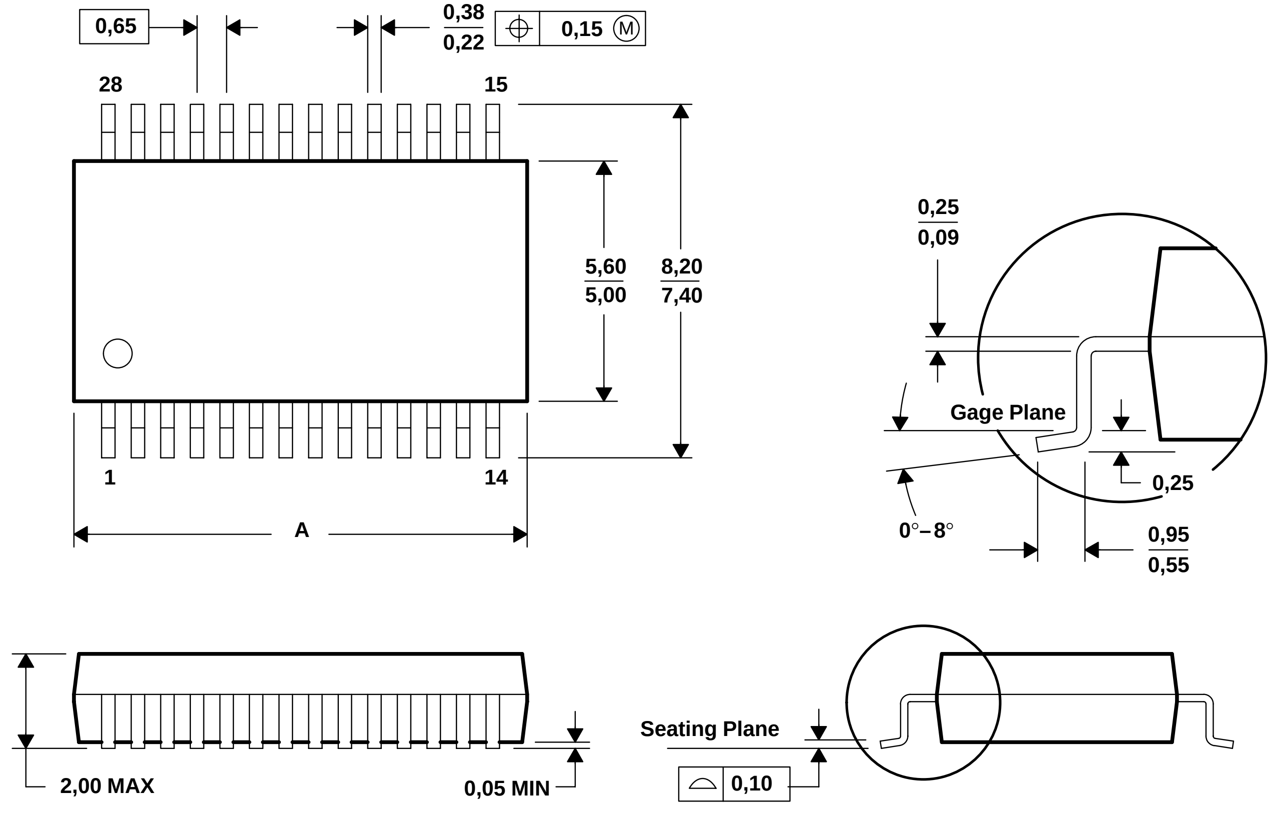


4211284–6/F 12/12

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**



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

4040065 /E 12/01

NOTES:
- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
- D. Falls within JEDEC MO-150

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