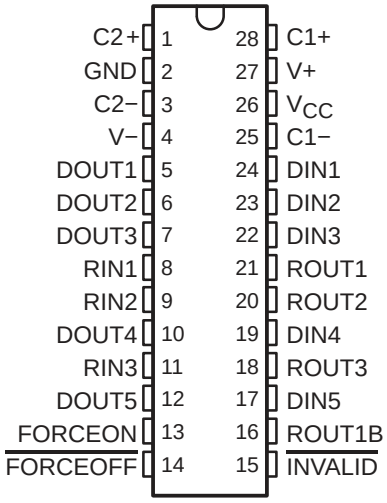
- **RS-232 Bus-Pin ESD Protection Exceeds ±15 kV Using Human-Body Model (HBM)**
- **Meets or Exceeds the Requirements of TIA/EIA-232-F and ITU v.28 Standards**
- **Operates With 3-V to 5.5-V $V_{CC}$ Supply**
- **Operates Up To 250 kbit/s**
- **Five Drivers and Three Receivers**
- **Low Standby Current . . . 1 μA Typical**
- **External Capacitors . . . 4 × 0.1 μF**
- **Accepts 5-V Logic Input With 3.3-V Supply**
- **Always-Active Noninverting Receiver Output (ROUT1B)**
- **Alternative High-Speed Pin-Compatible Device (1 Mbit/s)**
  - **SNx5C3238**
- **Applications**
  - **Battery-Powered Systems, PDAs, Notebooks, Subnotebooks, Laptops, Palmtop PCs, Hand-Held Equipment, Modems, and Printers**

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




## description/ordering information

The MAX3238 consists of five line drivers, three 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 notebook and subnotebook computer applications. 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 (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 250 kbit/s and a maximum of 30-V/μs driver output slew rate.

**ORDERING INFORMATION**

| $T_A$ | PACKAGE† | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---|---|---|---|---|
| −0°C to 70°C | SSOP (DB) | Tube of 50 | MAX3238CDB | MAX3238C |
| | | Reel of 2000 | MAX3238CDBR | |
| | TSSOP (PW) | Tube of 50 | MAX3238CPW | MA3238C |
| | | Reel of 2000 | MAX3238CPWR | |
| −40°C to 85°C | SSOP (DB) | Tube of 50 | MAX3238IDB | MAX3238I |
| | | Reel of 2000 | MAX3238IDBR | |
| | TSSOP (PW) | Tube of 50 | MAX3238IPW | MB3238I |
| | | Reel of 2000 | MAX3238IPWR | |

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

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

## 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 approximately 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 occurs 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 activates automatically when 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 | |

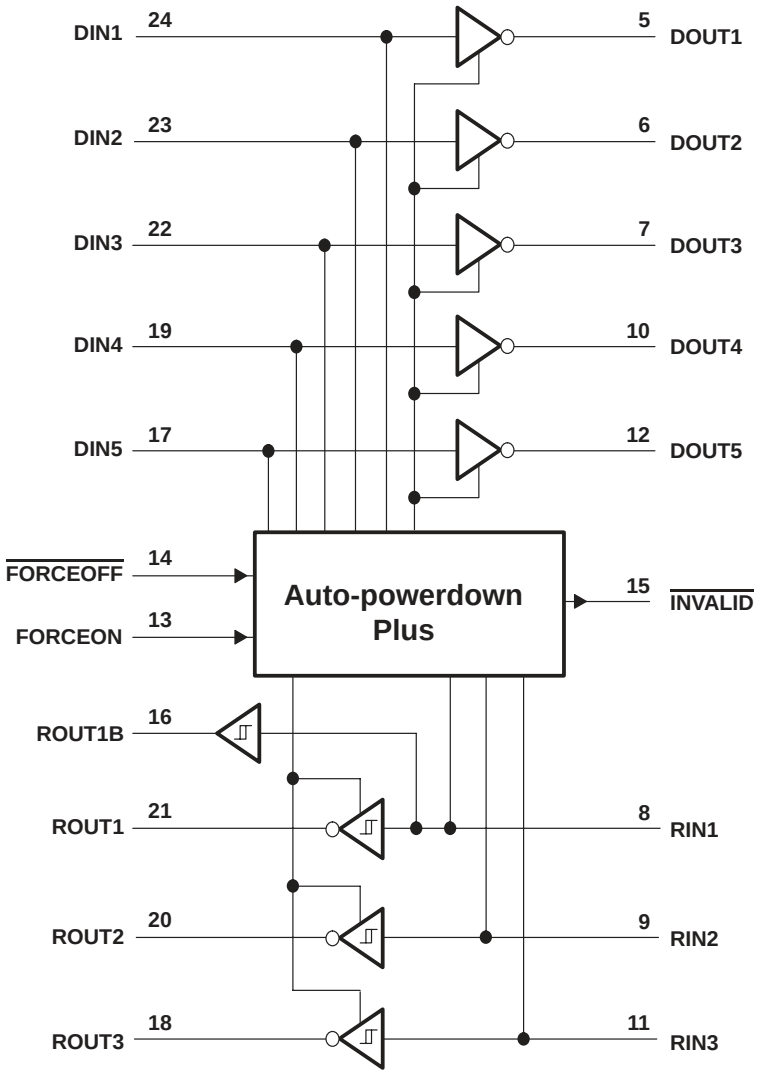
H = high level, L = low level, X = irrelevant, Z = high impedance

**EACH RECEIVER**

| INPUTS | | | | OUTPUTS | | RECEIVER STATUS |
|---|---|---|---|---|---|---|
| RIN1 | RIN2−RIN3 | $\overline{\text{FORCEOFF}}$ | 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
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 $P_D = (T_J(max) - T_A)/\theta_{JA}$. 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 | | MAX3238C | 0 | | 70 | °C |
| | | | MAX3238I | −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 ($T_A$ = 25°C) | 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 $V_{CC}$, FORCEON at GND, 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 | ±100 | |
| $r_o$ | 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 | $C_L$ = 1000 pF, One DOUT switching, | $R_L$ = 3 kΩ, See Figure 1 | 150 | 250 | | kbit/s |
| $t_{sk(p)}$ | Pulse skew§ | $C_L$ = 150 pF to 2500 pF | $R_L$ = 3 kΩ to 7 kΩ, See Figure 2 | | 100 | | ns |
| SR(tr) | Slew rate, transition region (see Figure 1) | $V_{CC}$ = 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 | |

† 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 | $V_I$ = ±3 V to ±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 ± 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)

| 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 ± 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.

## 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 $\overline{INVALID}$ high-level output voltage | $\overline{FORCEON}$ = GND, $\overline{FORCEOFF}$ = $V_{CC}$ | | | 2.7 | V |
| $V_{T-(valid)}$ | Receiver input threshold for $\overline{INVALID}$ high-level output voltage | $\overline{FORCEON}$ = GND, $\overline{FORCEOFF}$ = $V_{CC}$ | −2.7 | | | V |
| $V_{T(invalid)}$ | Receiver input threshold for $\overline{INVALID}$ low-level output voltage | $\overline{FORCEON}$ = GND, $\overline{FORCEOFF}$ = $V_{CC}$ | −0.3 | | 0.3 | V |
| $V_{OH}$ | $\overline{INVALID}$ high-level output voltage | $I_{OH}$ = −1 mA, FORCEON = GND, $\overline{FORCEOFF}$ = $V_{CC}$ | $V_{CC}$–0.6 | | | V |
| $V_{OL}$ | $\overline{INVALID}$ low-level output voltage | $I_{OL}$ = 1.6 mA, FORCEON = GND, $\overline{FORCEOFF}$ = $V_{CC}$ | | | 0.4 | V |

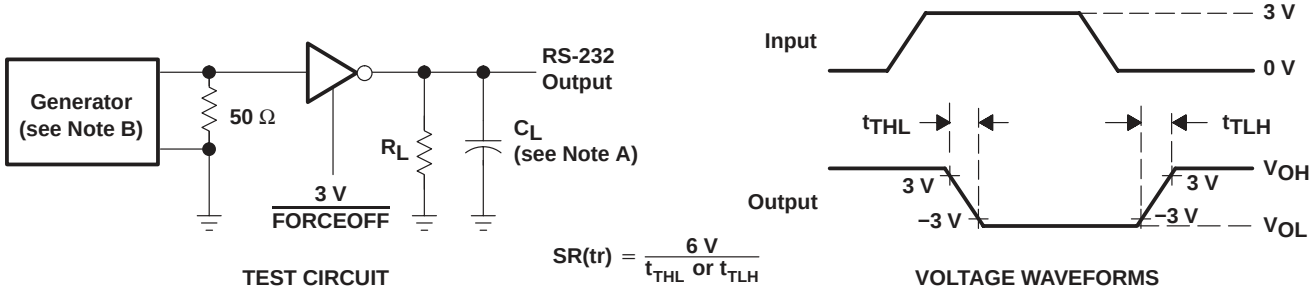
† All typical values are at $V_{CC}$ = 3.3 V or $V_{CC}$ = 5 V, and $T_A$ = 25°C.

### 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.

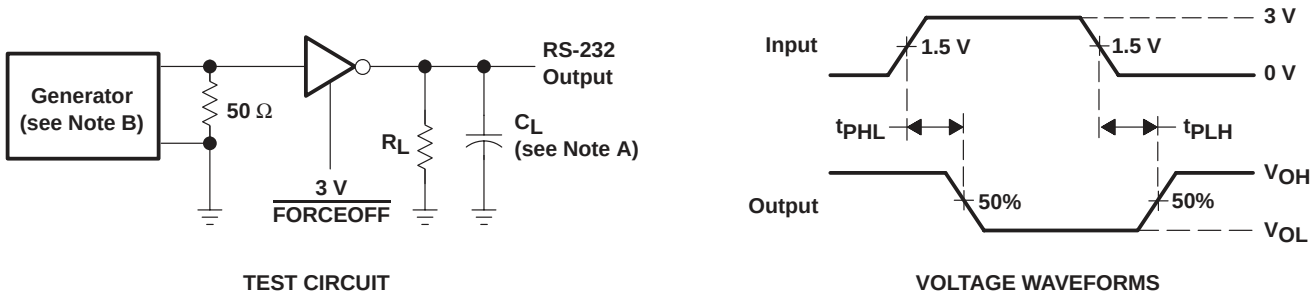
## PARAMETER MEASUREMENT INFORMATION




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

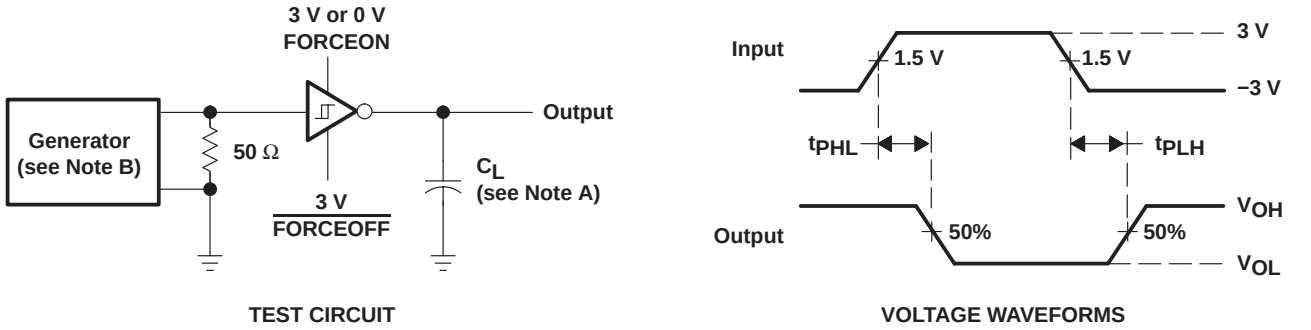
**Figure 1. Driver Slew Rate**

## PARAMETER MEASUREMENT INFORMATION



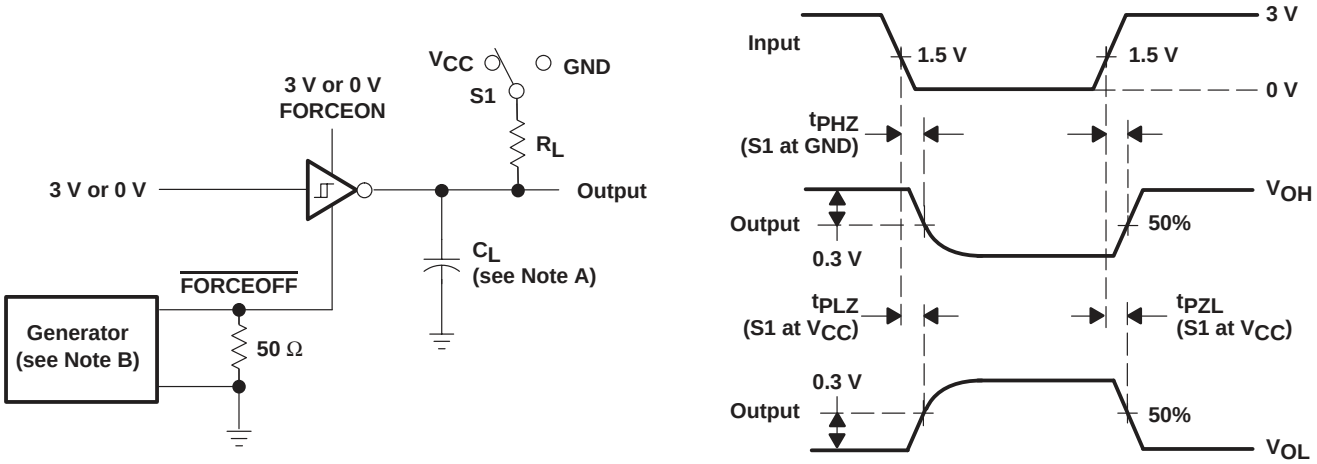

NOTES: A. $C_L$ includes probe and jig capacitance.
B. The pulse generator has the following characteristics: PRR = 250 kbit/s, $Z_O$ = 50 Ω, 50% duty cycle, $t_r \le 10$ ns, $t_f \le 10$ ns.

**Figure 2. Driver Pulse Skew**




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

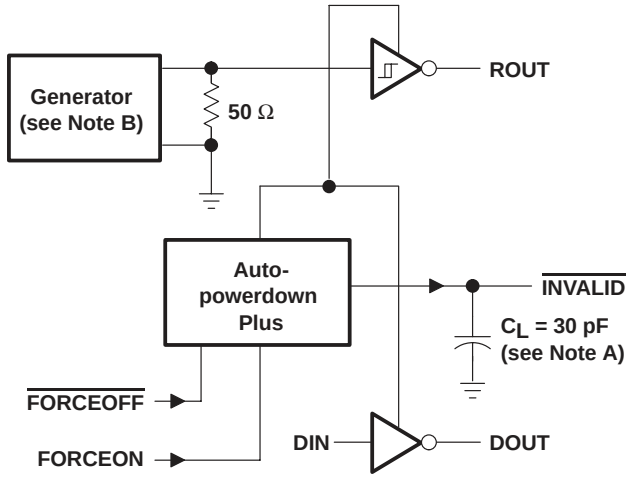
**Figure 3. Receiver Propagation Delay Times**



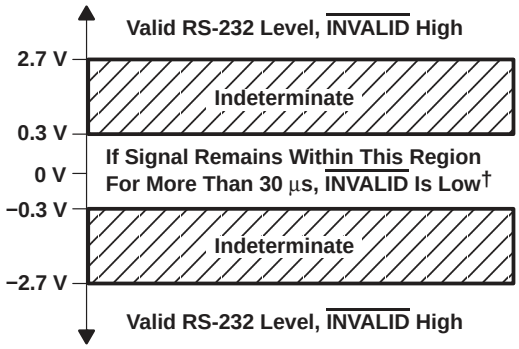

NOTES: A. $C_L$ includes probe and jig capacitance.
B. The pulse generator has the following characteristics: $Z_O$ = 50 Ω, 50% duty cycle, $t_r \le 10$ ns, $t_f \le 10$ ns.
C. $t_{PLZ}$ and $t_{PHZ}$ are the same as $t_{dis}$.
D. $t_{PZL}$ and $t_{PZH}$ are the same as $t_{en}$.

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

## PARAMETER MEASUREMENT INFORMATION

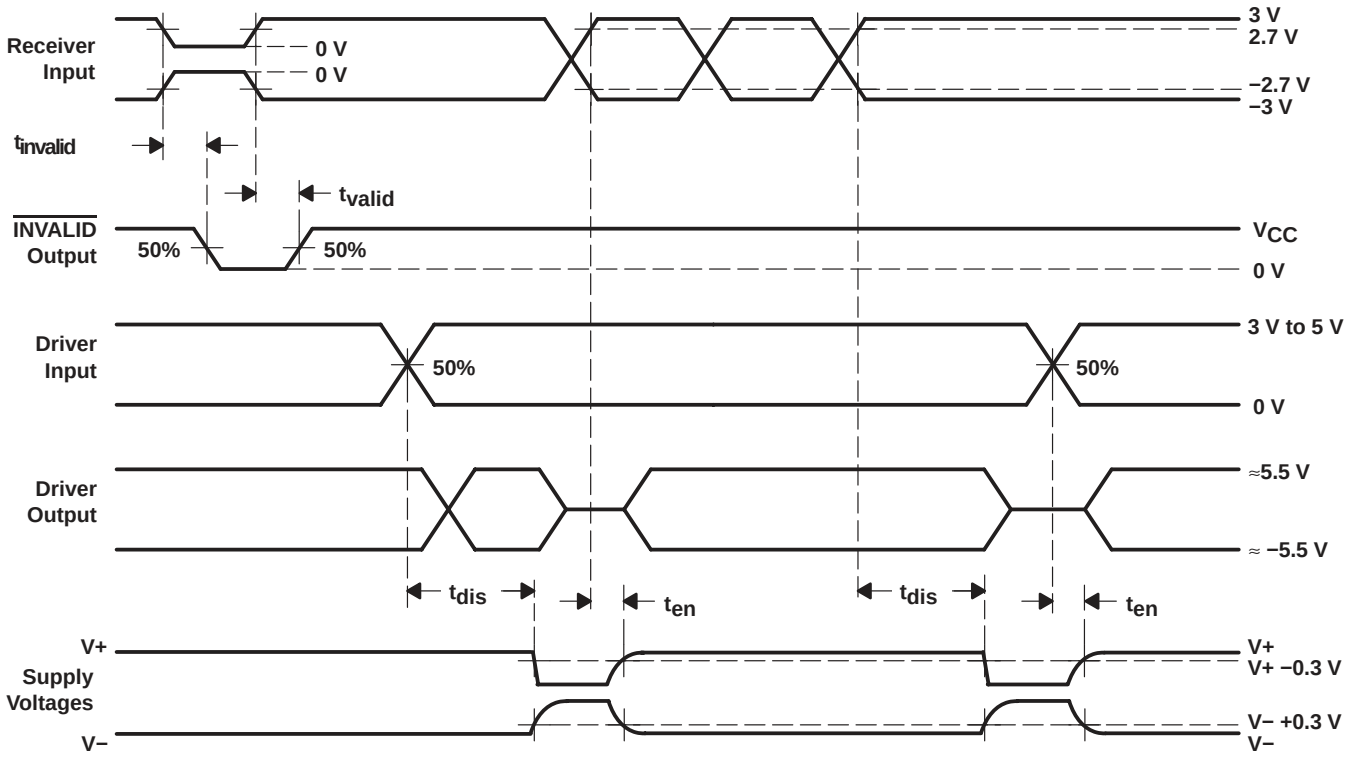



TEST CIRCUIT




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

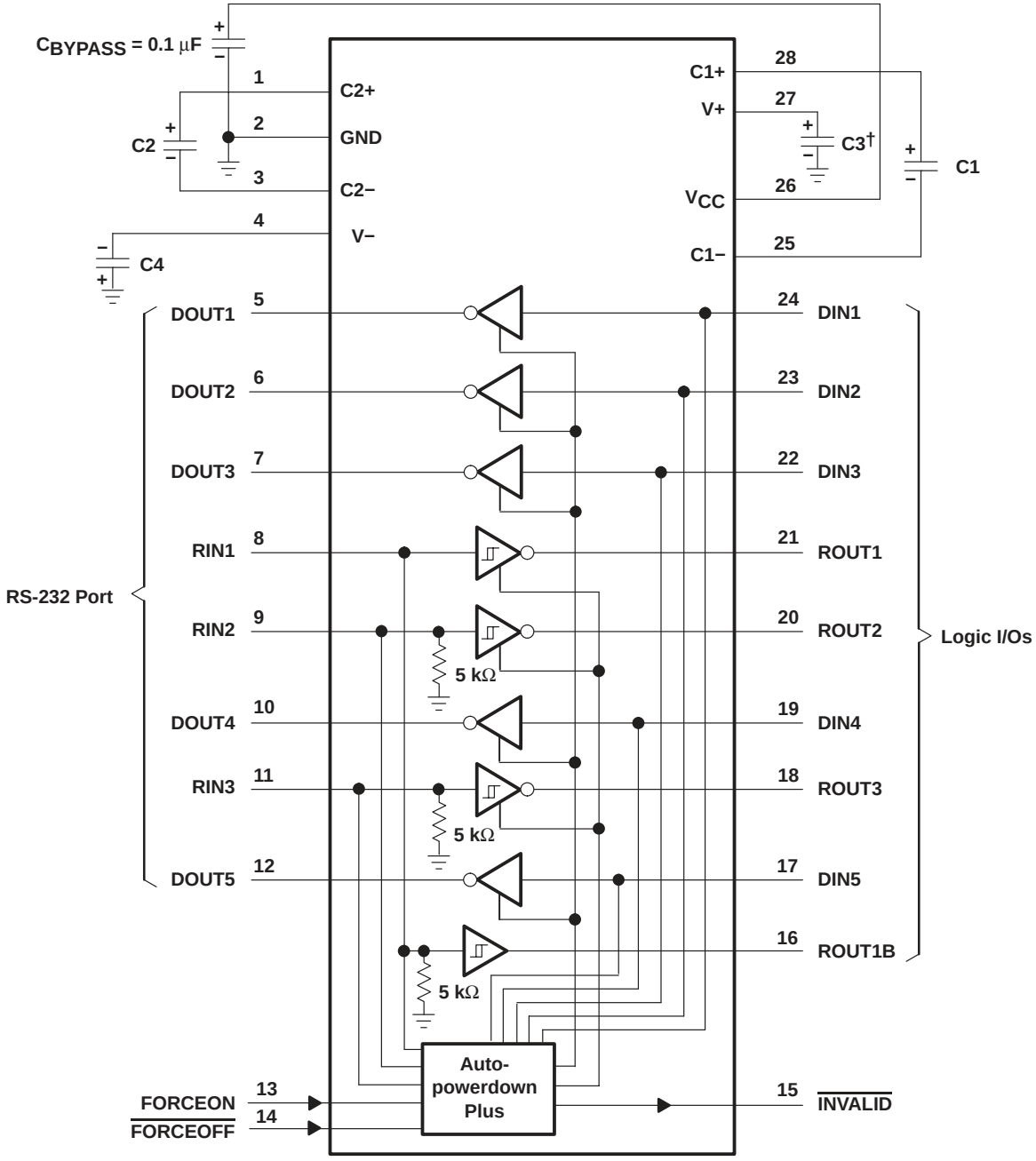
NOTES: A. $C_L$ includes probe and jig capacitance.
B. The pulse generator has the following characteristics: PRR = 5 kbit/s, $Z_O$ = 50 Ω, 50% duty cycle, $t_r \le 10$ ns, $t_f \le 10$ ns.




Voltage Waveforms and Timing Diagrams

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

## APPLICATION INFORMATION




**$V_{CC}$ 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 μF | 0.33 μF |
| 3 V to 5.5 V | 0.22 μF | 1 μF |

† 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.

**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 finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MAX3238CDBR | ACTIVE | SSOP | DB | 28 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MAX3238C | Samples |
| MAX3238CDBRE4 | ACTIVE | SSOP | DB | 28 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MAX3238C | Samples |
| MAX3238CPWR | ACTIVE | TSSOP | PW | 28 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MA3238C | Samples |
| MAX3238IDBR | ACTIVE | SSOP | DB | 28 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MAX3238I | Samples |
| MAX3238IPWR | ACTIVE | TSSOP | PW | 28 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MB3238I | 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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

**OTHER QUALIFIED VERSIONS OF MAX3238 :**

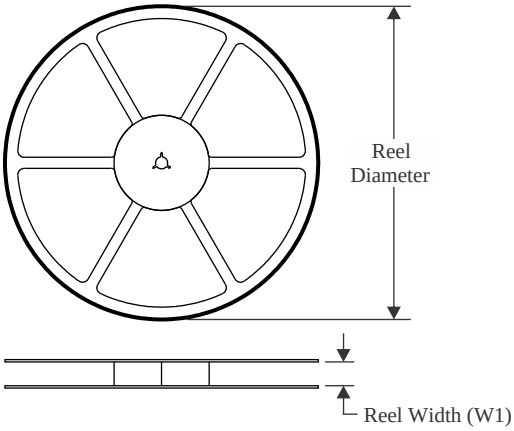
- Automotive : MAX3238-Q1

NOTE: Qualified Version Definitions:

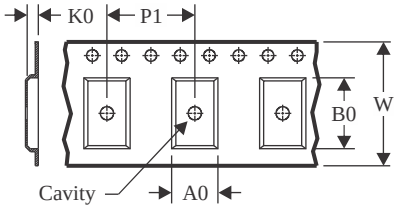
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

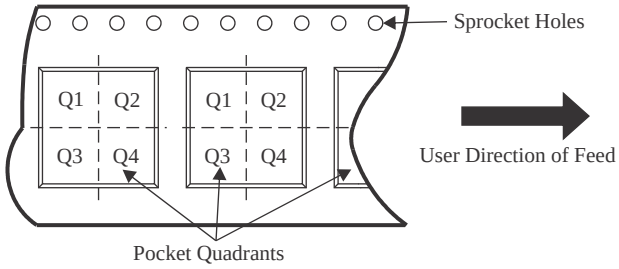



**TAPE DIMENSIONS**




| | |
|---|---|
| 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 |

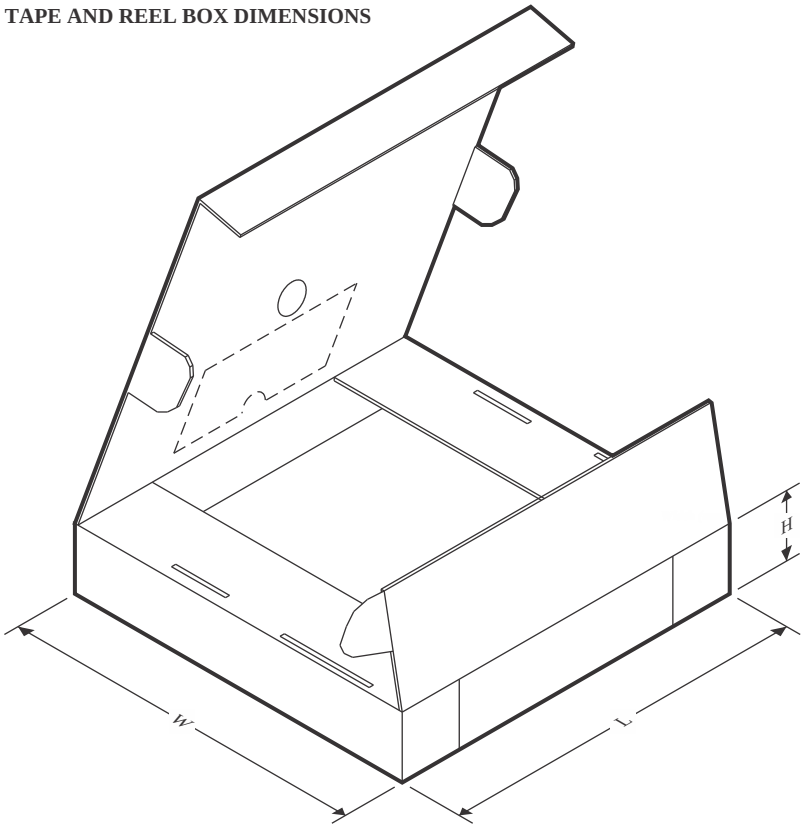
**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**




*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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAX3238CDBR | SSOP | DB | 28 | 2000 | 330.0 | 16.4 | 8.2 | 10.5 | 2.5 | 12.0 | 16.0 | Q1 |
| MAX3238CPWR | TSSOP | PW | 28 | 2000 | 330.0 | 16.4 | 6.9 | 10.2 | 1.8 | 12.0 | 16.0 | Q1 |
| MAX3238IDBR | SSOP | DB | 28 | 2000 | 330.0 | 16.4 | 8.2 | 10.5 | 2.5 | 12.0 | 16.0 | Q1 |
| MAX3238IPWR | TSSOP | PW | 28 | 2000 | 330.0 | 16.4 | 6.9 | 10.2 | 1.8 | 12.0 | 16.0 | Q1 |

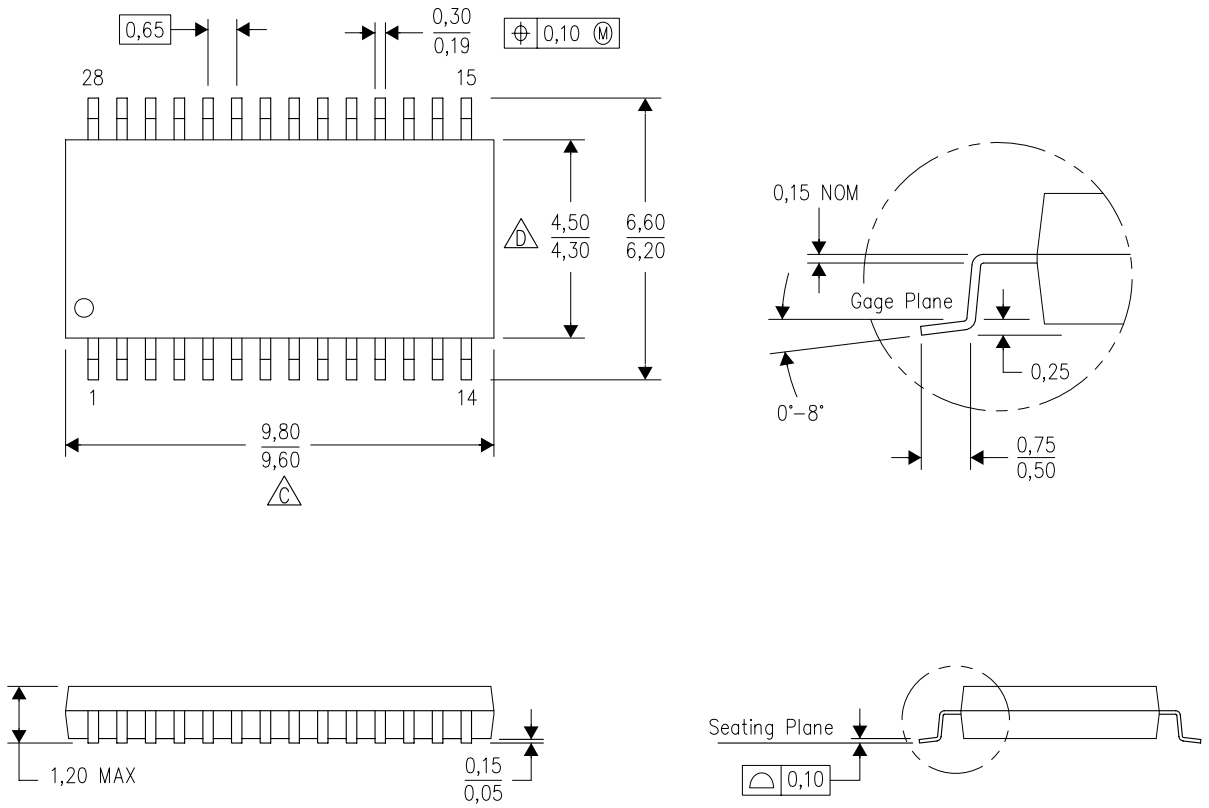
TAPE AND REEL BOX DIMENSIONS




*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| MAX3238CDBR | SSOP | DB | 28 | 2000 | 356.0 | 356.0 | 35.0 |
| MAX3238CPWR | TSSOP | PW | 28 | 2000 | 356.0 | 356.0 | 35.0 |
| MAX3238IDBR | SSOP | DB | 28 | 2000 | 356.0 | 356.0 | 35.0 |
| MAX3238IPWR | TSSOP | PW | 28 | 2000 | 356.0 | 356.0 | 35.0 |

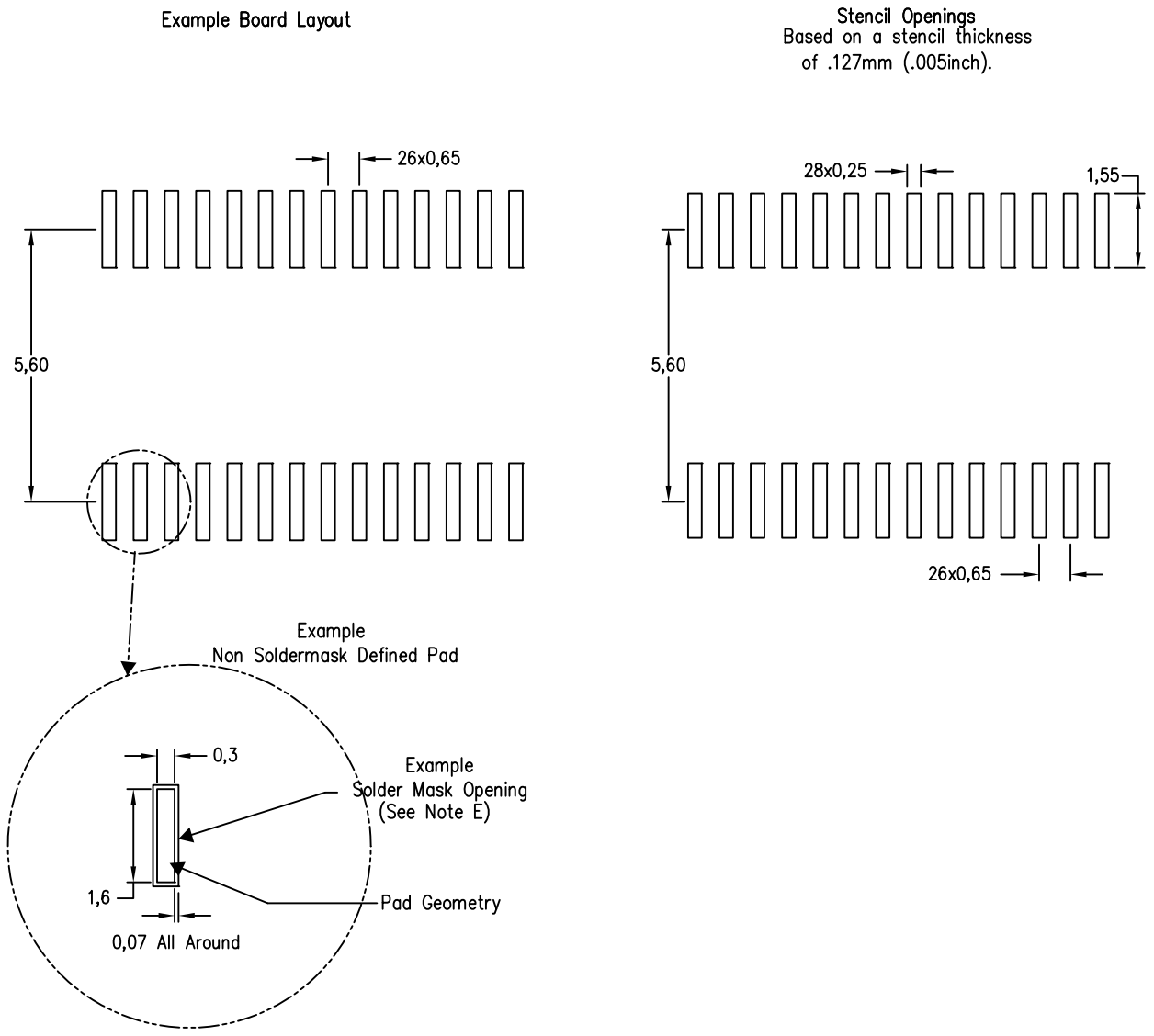
PW (R–PDSO–G28) PLASTIC SMALL OUTLINE




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



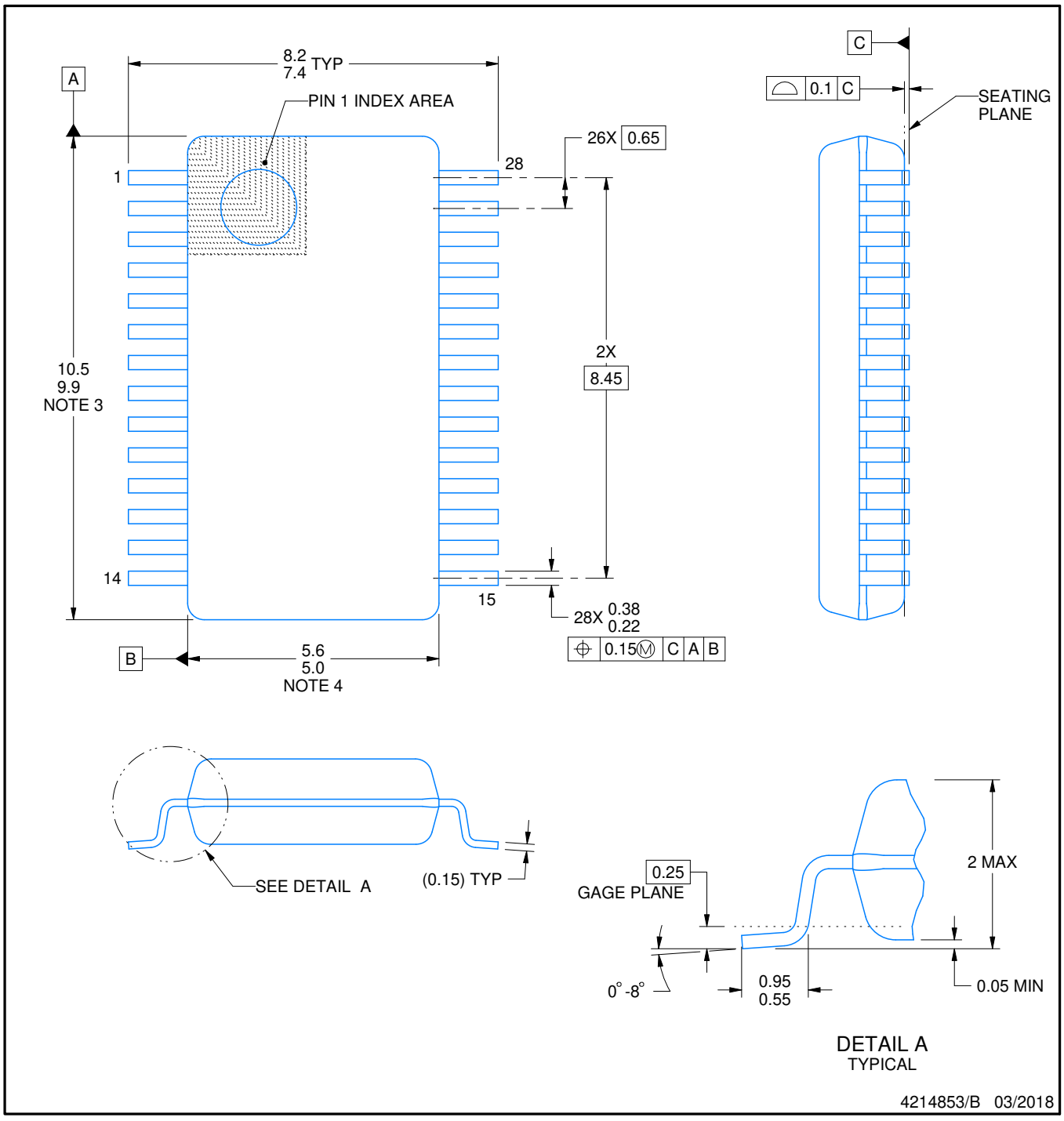

NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate design.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their 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.

# PACKAGE OUTLINE

## DB0028A

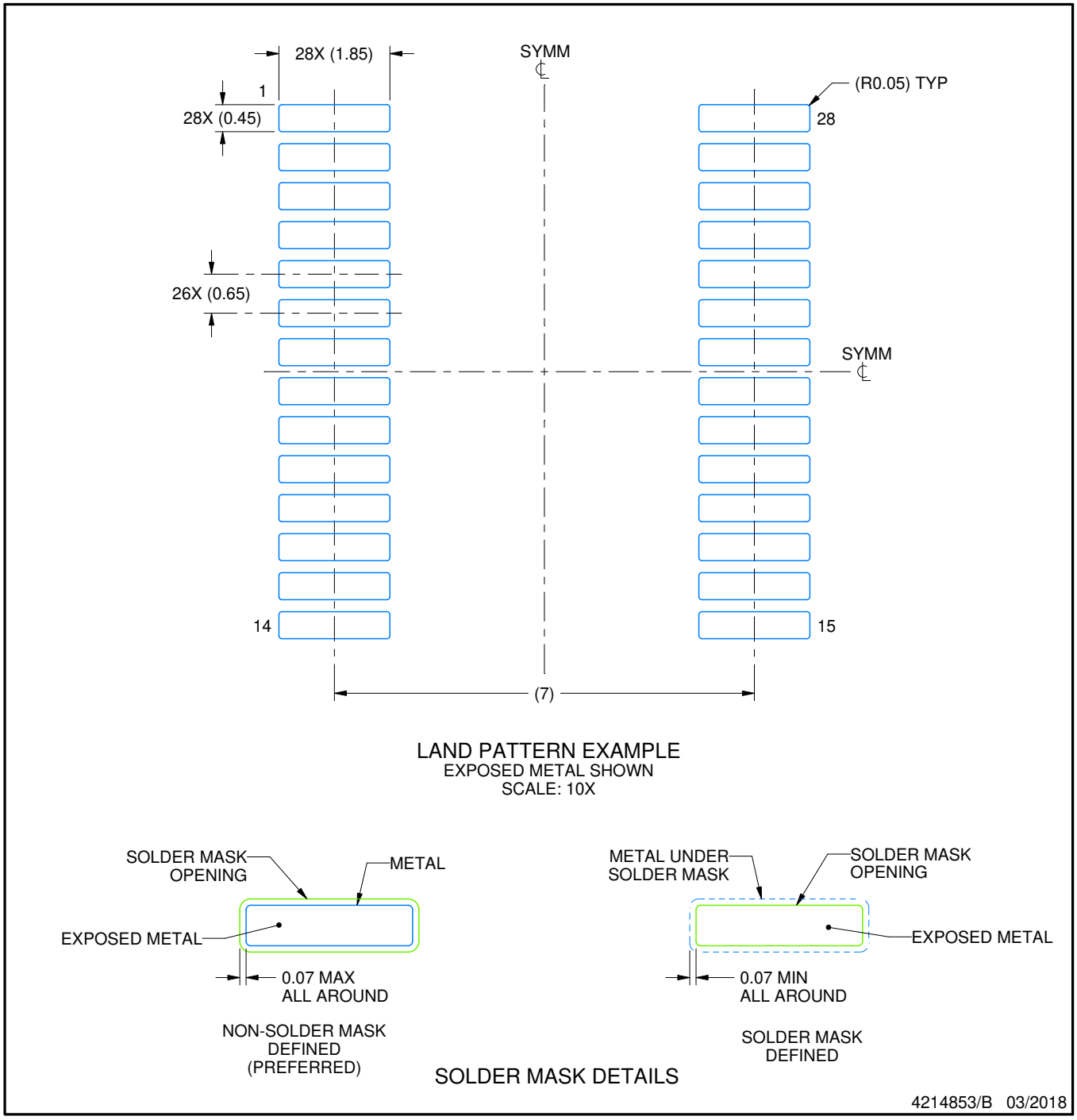
## SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



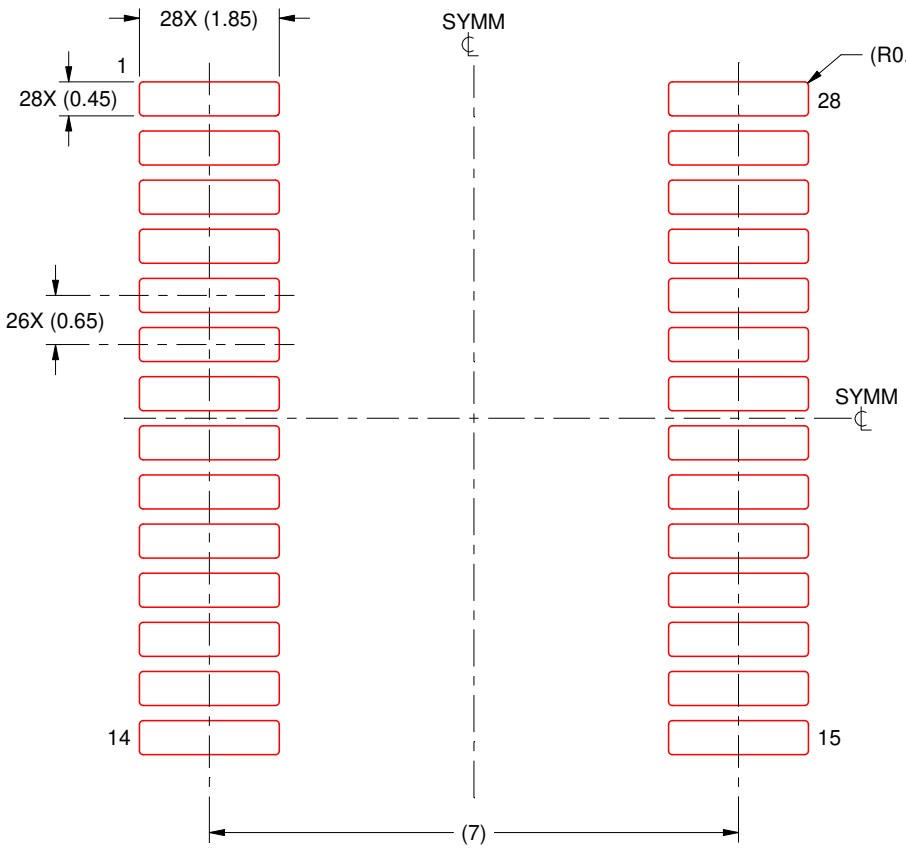

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-150.




NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.




SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4214853/B 03/2018

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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