

## FEATURES

- ESD Protection for RS-232 Bus Pins  
–  $\pm 15$ -kV Human-Body Model (HBM)
- Meets or Exceeds the Requirements of TIA/EIA-232-F and ITU v.28 Standards
- Operates at 5-V  $V_{CC}$  Supply
- Four Drivers and Five Receivers
- Operates up to 120 kbit/s
- Low Supply Current in Shutdown Mode . . . 15  $\mu$ A Typ
- External Capacitors . . .  $4 \times 0.1$  F
- Designed to Be Interchangeable With Maxim MAX213
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II

## APPLICATIONS

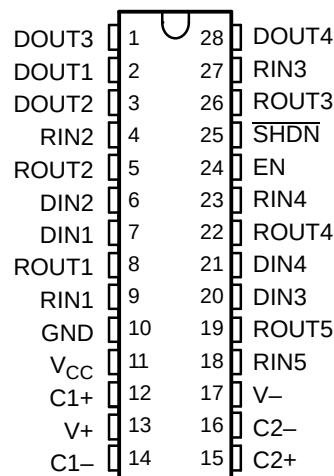
- Battery-Powered Systems
- PDAs
- Notebooks
- Laptops
- Palmtop PCs
- Hand-Held Equipment

## DESCRIPTION/ ORDER INFORMATION

The MAX213 device consists of four line drivers, five line receivers, and a dual charge-pump circuit with  $\pm 15$ -kV ESD protection pin to pin (serial-port connection pins, including GND). The device meets the requirements of TIA/EIA-232-F and provides the electrical interface between an asynchronous communication controller and the serial-port connector. The charge pump and four small external capacitors allow operation from a single 5-V supply. The devices operate at data signaling rates up to 120 kbit/s and a maximum of 30-V/ $\mu$ s driver output slew rate.

The MAX213 has an active-low shutdown ( $\overline{\text{SHDN}}$ ) and an active-high enable control (EN). In shutdown mode, the charge pumps are turned off,  $V+$  is pulled down to  $V_{CC}$ ,  $V-$  is pulled to GND, and the transmitter outputs are disabled. This reduces supply current typically to 1  $\mu$ A. Two receivers of the MAX213 are active during shutdown.

DB, DW, OR PW PACKAGE  
(TOP VIEW)



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.

**MAX213**  
**5-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER**  
**WITH  $\pm 15$ -kV ESD PROTECTION**

SLLS680–DECEMBER 2005

**ORDERING INFORMATION**

| $T_A$         | PACKAGE <sup>(1)</sup> |               | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---------------|------------------------|---------------|-----------------------|------------------|
| 0°C to 70°C   | SOIC – DW              | Tube of 20    | MAX213CDW             |                  |
|               |                        | Reel of 1000  | MAX213CDWR            |                  |
|               | SSOP – DB              | Tube of 50    | MAX213CDB             |                  |
|               |                        | Reel of 2000  | MAX213CDBR            |                  |
|               | TSSOP – PW             | Tape and reel | MAX213CPWR            |                  |
| –40°C to 85°C | SOIC – DW              | Tube of 20    | MAX213IDW             |                  |
|               |                        | Reel of 1000  | MAX213IDWR            |                  |
|               | SSOP – DB              | Tube of 50    | MAX213IDB             |                  |
|               |                        | Reel of 2000  | MAX213IDBR            |                  |
|               | TSSOP – PW             | Tape and reel | MAX213IPWR            |                  |

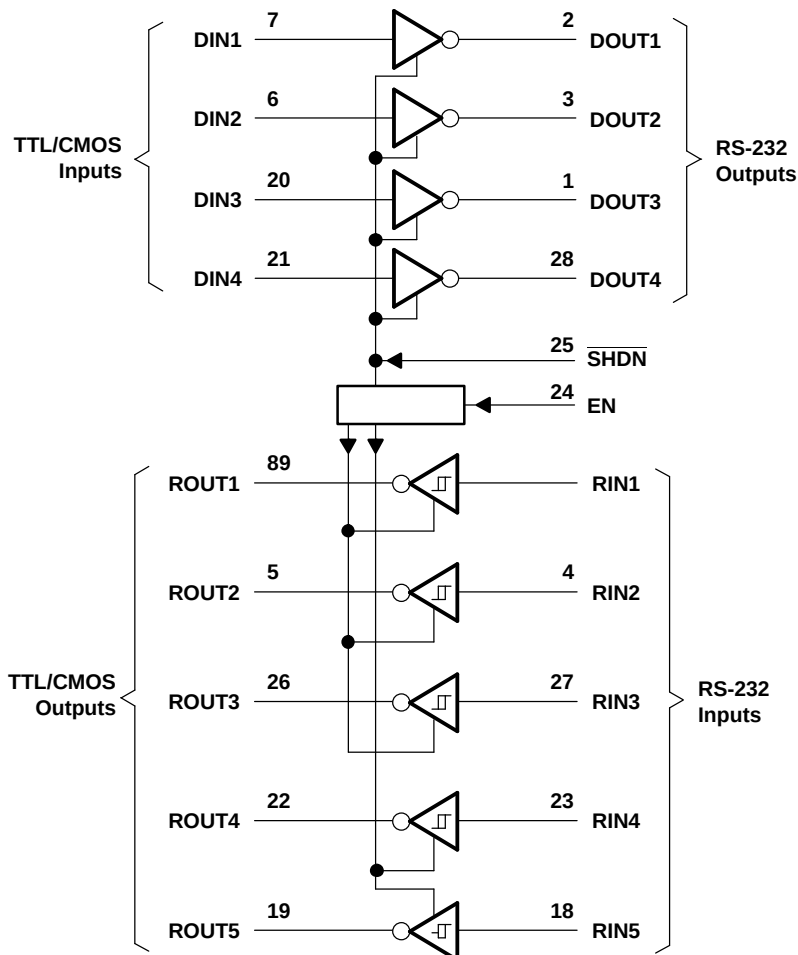
(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

**FUNCTION TABLE**

| INPUTS                   |    | DRIVER<br>D1–D4 | RECEIVER |                       | DEVICE STATUS    |
|--------------------------|----|-----------------|----------|-----------------------|------------------|
| $\overline{\text{SHDN}}$ | EN |                 | R1–R3    | R4–R5                 |                  |
| L                        | L  | Z               | Z        | Z                     | Shutdown         |
| L                        | H  | Z               | Z        | Active <sup>(1)</sup> | Shutdown         |
| H                        | L  | All active      | Z        | Z                     | Normal operation |
| H                        | H  | All active      | Active   | Active                | Normal operation |

(1) See the  $V_{IT+}$  and  $V_{IT-}$  change in the *Electrical Characteristics* table.

LOGIC DIAGRAM (POSITIVE LOGIC)



# MAX213

## 5-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER

### WITH $\pm 15$ -kV ESD PROTECTION

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#### Absolute Maximum Ratings<sup>(1)</sup>

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

|                  |                                                   |            | MIN                   | MAX                   | UNIT |
|------------------|---------------------------------------------------|------------|-----------------------|-----------------------|------|
| V <sub>CC</sub>  | Supply voltage range                              |            | −0.3                  | 6                     | V    |
| V+               | Positive charge-pump voltage range <sup>(2)</sup> |            | V <sub>CC</sub> − 0.3 | 14                    | V    |
| V−               | Negative charge-pump voltage range <sup>(2)</sup> |            | 0.3                   | −14                   | V    |
| V <sub>I</sub>   | Input voltage range                               | Drivers    | −0.3                  | V+ + 0.3              | V    |
|                  |                                                   | Receivers  | ±30                   |                       |      |
| V <sub>O</sub>   | Output voltage range                              | Drivers    | V− − 0.3              | V+ + 0.3              | V    |
|                  |                                                   | Receivers  | −0.3                  | V <sub>CC</sub> + 0.3 |      |
| DOUT             | Short-circuit duration                            |            | Continuous            |                       |      |
| θ <sub>JA</sub>  | Package thermal impedance <sup>(3)(4)</sup>       | DB package | 62                    |                       | C°/W |
|                  |                                                   | DW package | 46                    |                       |      |
|                  |                                                   | PW package |                       |                       |      |
| T <sub>J</sub>   | Operating virtual junction temperature            |            | 150                   |                       | C°   |
| T <sub>stg</sub> | 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.
- (3) Maximum power dissipation is a function of  $T_J(\text{max})$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(\text{max}) - T_A)/\theta_{JA}$ . Operating at the absolute maximum  $T_J$  of 150 $^{\circ}\text{C}$  can affect reliability.
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.

#### Recommended Operating Conditions<sup>(1)</sup>

See [Figure 4](#)

|          |                                            |                                   | MIN | NOM | MAX | UNIT               |
|----------|--------------------------------------------|-----------------------------------|-----|-----|-----|--------------------|
|          | Supply voltage                             |                                   | 4.5 | 5   | 5.5 | V                  |
| $V_{IH}$ | Driver high-level input voltage            | DIN                               | 2   |     |     | V                  |
|          | Control high-level input voltage           | EN, $\overline{\text{SHDN}}$      | 2.4 |     |     |                    |
| $V_{IL}$ | Driver and control low-level input voltage | DIN, EN, $\overline{\text{SHDN}}$ |     |     | 0.8 | V                  |
| $V_I$    | Driver and control input voltage           | DIN, EN, $\overline{\text{SHDN}}$ | 0   |     | 5.5 | V                  |
|          | Receiver input voltage                     | RIN                               | –30 |     | 30  |                    |
| $T_A$    | Operating free-air temperature             | MAX213C                           | 0   |     | 70  | $^{\circ}\text{C}$ |
|          |                                            | MAX213I                           | –40 |     | 85  |                    |

- (1) Test conditions are C1–C4 = 0.1  $\mu\text{F}$  at  $V_{CC} = 5 \text{ V} \pm 0.5 \text{ V}$ .

#### Electrical Characteristics<sup>(1)</sup>

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

| PARAMETER         | TEST CONDITIONS         | MIN                                                       | TYP <sup>(2)</sup> | MAX | UNIT          |
|-------------------|-------------------------|-----------------------------------------------------------|--------------------|-----|---------------|
| $I_{CC}$          | Supply current          | No load, See <a href="#">Figure 6</a>                     | 14                 | 20  | mA            |
| $I_{\text{SHDN}}$ | Shutdown supply current | $T_A = 25^{\circ}\text{C}$ , See <a href="#">Figure 1</a> | 15                 | 50  | $\mu\text{A}$ |

- (1) Test conditions are C1–C4 = 0.1  $\mu\text{F}$  at  $V_{CC} = 5 \text{ V} \pm 0.5 \text{ V}$ .
- (2) All typical values are at  $V_{CC} = 5 \text{ V}$ , and  $T_A = 25^{\circ}\text{C}$ .

## DRIVER SECTION

### Electrical Characteristics<sup>(1)</sup>

over operating free-air temperature range (unless otherwise noted) (see [Figure 4](#))

| PARAMETER                      |                                  | TEST CONDITIONS                                                                         | MIN | TYP <sup>(2)</sup> | MAX      | UNIT     |
|--------------------------------|----------------------------------|-----------------------------------------------------------------------------------------|-----|--------------------|----------|----------|
| V <sub>OH</sub>                | High-level output voltage        | DOUT at R <sub>L</sub> = 3 k $\Omega$ to GND                                            | 5   | 9                  |          | V        |
| V <sub>OL</sub>                | Low-level output voltage         | DOUT at R <sub>L</sub> = 3 k $\Omega$ to GND                                            | –5  | –9                 |          | V        |
| I <sub>IH</sub>                | Control high-level input current | EN, $\overline{\text{SHDN}}$ = 5 V                                                      |     | 3                  | 10       | $\mu$ A  |
| I <sub>IL</sub>                | Driver low-level input current   | DIN = 0 V                                                                               |     | –15                | –200     | $\mu$ A  |
|                                | Control low-level input current  | EN, $\overline{\text{SHDN}}$ = 0 V                                                      |     | –3                 | –10      |          |
| I <sub>OS</sub> <sup>(3)</sup> | Short-circuit output current     | V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 0 V                                           |     | $\pm 10$           | $\pm 60$ | mA       |
| r <sub>o</sub>                 | Output resistance                | V <sub>CC</sub> , V <sub>+</sub> , and V <sub>–</sub> = 0 V, V <sub>O</sub> = $\pm 2$ V | 300 |                    |          | $\Omega$ |

(1) Test conditions are C1–C4 = 0.1  $\mu$ F at V<sub>CC</sub> = 5 V  $\pm$  0.5 V

(2) All typical values are at V<sub>CC</sub> = 5 V, and T<sub>A</sub> = 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.

### Switching Characteristics<sup>(1)</sup>

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

| PARAMETER           |                                                              | TEST CONDITIONS                                                                                                                     | MIN | TYP <sup>(2)</sup> | MAX | UNIT       |
|---------------------|--------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-----|--------------------|-----|------------|
| Maximum data rate   |                                                              | C <sub>L</sub> = 50 pF to 1000 pF, One DOUT switching, R <sub>L</sub> = 3 k $\Omega$ to 7 k $\Omega$ , See <a href="#">Figure 3</a> | 120 |                    |     | kbit/s     |
| t <sub>PLH(D)</sub> | Propagation delay time, low- to high-level output            | C <sub>L</sub> = 2500 pF, All drivers loaded, R <sub>L</sub> = 3 k $\Omega$ , See <a href="#">Figure 3</a>                          |     | 2                  |     | $\mu$ s    |
| t <sub>PHL(D)</sub> | Propagation delay time, high- to low-level output            | C <sub>L</sub> = 2500 pF, All drivers loaded, R <sub>L</sub> = 3 k $\Omega$ , See <a href="#">Figure 3</a>                          |     | 2                  |     | $\mu$ s    |
| t <sub>sk(p)</sub>  | Pulse skew <sup>(3)</sup>                                    | C <sub>L</sub> = 150 pF to 2500 pF, R <sub>L</sub> = 3 k $\Omega$ to 7 k $\Omega$ , See <a href="#">Figure 3</a>                    |     | 300                |     | ns         |
| SR(tr)              | Slew rate, transition region (see <a href="#">Figure 2</a> ) | C <sub>L</sub> = 50 pF to 1000 pF, V <sub>CC</sub> = 5 V, R <sub>L</sub> = 3 k $\Omega$ to 7 k $\Omega$                             | 3   | 6                  | 30  | V/ $\mu$ s |

(1) Test conditions are C1–C4 = 0.1  $\mu$ F at V<sub>CC</sub> = 5 V  $\pm$  0.5 V.

(2) All typical values are at V<sub>CC</sub> = 5 V, and T<sub>A</sub> = 25°C.

(3) Pulse skew is defined as (t<sub>PLH</sub> – t<sub>PHL</sub>) of each channel of the same device.

## ESD Protection

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

| PIN  | TEST CONDITIONS  | TYP      | UNIT |
|------|------------------|----------|------|
| DOUT | Human-Body Model | $\pm 15$ | kV   |

# MAX213

## 5-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER

### WITH $\pm 15$ -kV ESD PROTECTION

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## RECEIVER SECTION

### Electrical Characteristics<sup>(1)</sup>

over operating free-air temperature range (unless otherwise noted) (see [Figure 6](#))

| PARAMETER                                                                               | TEST CONDITIONS                                          | MIN                   | TYP <sup>(2)</sup> | MAX | UNIT |
|-----------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------|--------------------|-----|------|
| V <sub>OH</sub> High-level output voltage                                               | I <sub>OH</sub> = –1 mA                                  | V <sub>CC</sub> – 0.4 |                    |     | V    |
| V <sub>OL</sub> Low-level output voltage                                                | I <sub>OH</sub> = 1.6 mA                                 | 0.4                   |                    |     | V    |
| V <sub>IT+</sub> Positive-going input threshold voltage                                 | V <sub>CC</sub> = 5 V, T <sub>A</sub> = 25°C             | Active mode           |                    | 1.7 | 2.4  |
|                                                                                         |                                                          | Shutdown mode (R4–R5) |                    | 1.5 | 2.4  |
| V <sub>IT–</sub> Negative-going input threshold voltage                                 | V <sub>CC</sub> = 5 V, T <sub>A</sub> = 25°C             | Active mode           |                    | 0.8 | 1.2  |
|                                                                                         |                                                          | Shutdown mode (R4–R5) |                    | 0.6 | 1.5  |
| V <sub>hys</sub> <sup>(3)</sup> Input hysteresis (V <sub>IT+</sub> , V <sub>IT–</sub> ) | V <sub>CC</sub> = 5 V                                    | 0.5                   |                    | 1   | V    |
| r <sub>i</sub> Input resistance                                                         | V <sub>CC</sub> = 5 V, T <sub>A</sub> = 25°C             | 3                     | 5                  | 7   | kΩ   |
| Output leakage current                                                                  | EN = 0 V, 0 ≤ R <sub>OUT</sub> ≤ V <sub>CC</sub> , R1–R3 | ±0.05                 |                    | ±10 | μA   |

(1) Test conditions are C1–C4 = 0.1 μF at V<sub>CC</sub> = 5 V ± 0.5 V.

(2) All typical values are at V<sub>CC</sub> = 5 V, and T<sub>A</sub> = 25°C.

(3) No hysteresis in shutdown mode

### Switching Characteristics<sup>(1)</sup>

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

| PARAMETER                                                             | TEST CONDITIONS                                       | MIN                                   | TYP <sup>(2)</sup> | MAX | UNIT |
|-----------------------------------------------------------------------|-------------------------------------------------------|---------------------------------------|--------------------|-----|------|
| t <sub>PLH(R)</sub> Propagation delay time, low- to high-level output | C <sub>L</sub> = 150 pF, See <a href="#">Figure 4</a> | $\overline{\text{SHDN}} = V_{CC}$     |                    | 0.5 | 10   |
|                                                                       |                                                       | $\overline{\text{SHDN}} = 0$ V, R4–R5 |                    | 4   | 40   |
| t <sub>PHL(R)</sub> Propagation delay time, high- to low-level output | C <sub>L</sub> = 150 pF, See <a href="#">Figure 4</a> | 0.5                                   |                    | 10  | μs   |
| t <sub>en</sub> Output enable time                                    | C <sub>L</sub> = 150 pF, See <a href="#">Figure 5</a> | 600                                   |                    |     | ns   |
| t <sub>dis</sub> Output disable time                                  | C <sub>L</sub> = 150 pF, See <a href="#">Figure 5</a> | 200                                   |                    |     | ns   |

(1) Test conditions are C1–C4 = 0.1 μF at V<sub>CC</sub> = 5 V ± 0.5 V.

(2) All typical values are at V<sub>CC</sub> = 5 V, and T<sub>A</sub> = 25°C.

## ESD Protection

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

| PIN | TEST CONDITIONS  | TYP | UNIT |
|-----|------------------|-----|------|
| RIN | Human-Body Model | ±15 | kV   |

# PARAMETER MEASUREMENT INFORMATION

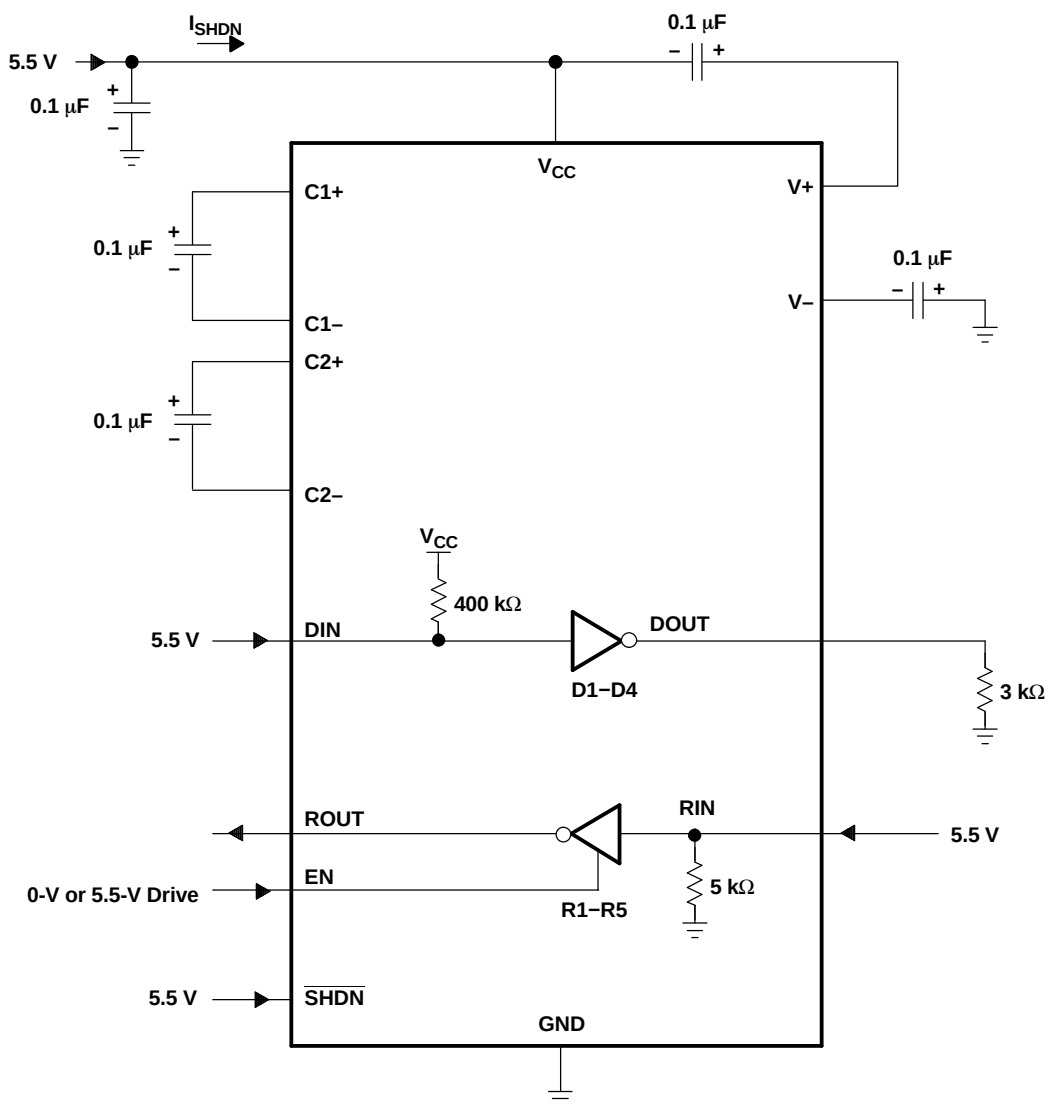
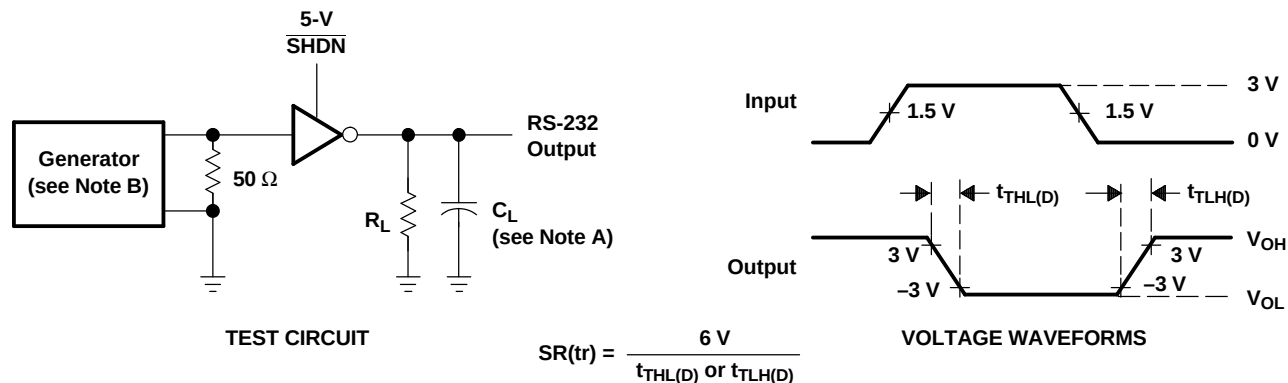


Figure 1. Shutdown Current Test Circuit

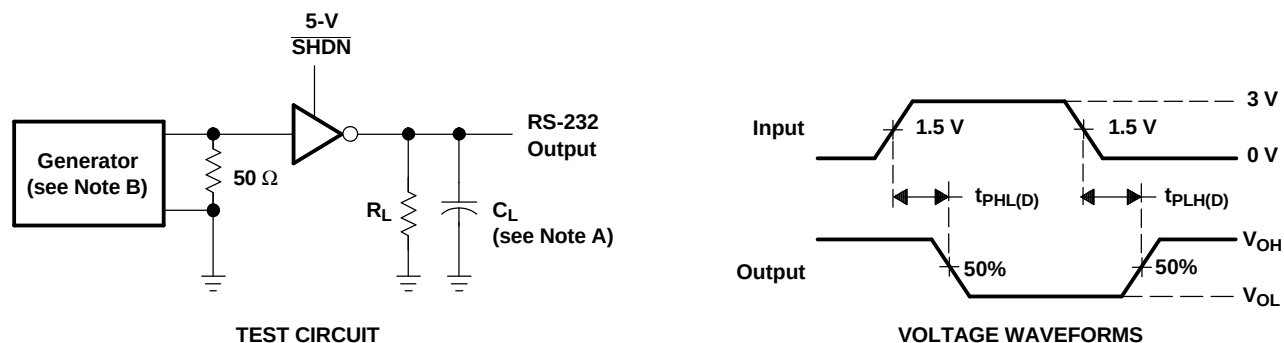
**PARAMETER MEASUREMENT INFORMATION (continued)**



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

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

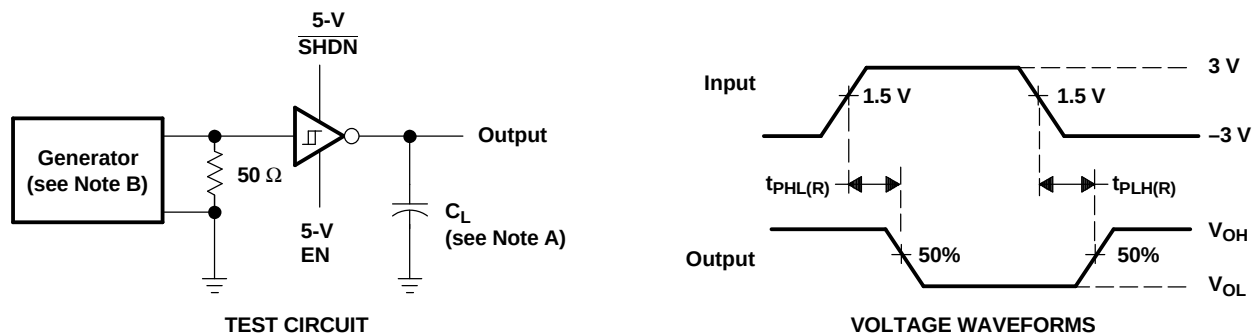
**Figure 2. Driver Slew Rate**



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

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

**Figure 3. Driver Pulse Skew and Propagation Delay Times**

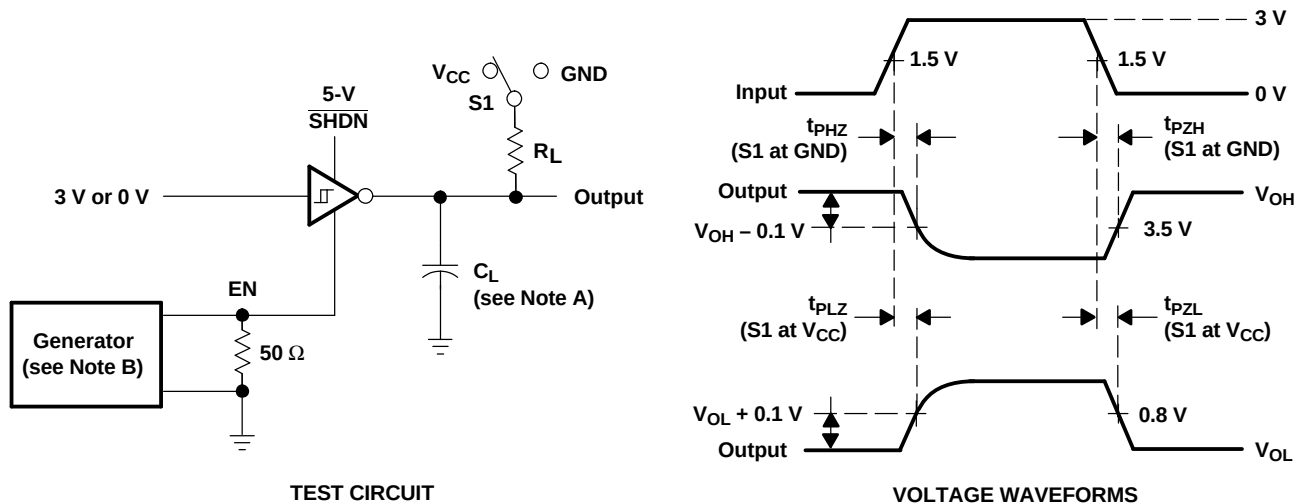


NOTES: A.  $C_L$  includes probe and jig capacitance.

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

**Figure 4. 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,  $t_r \leq 10$  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 5. Receiver Enable and Disable Times



## PACKAGING INFORMATION

| Orderable part number      | Status<br>(1) | Material type<br>(2) | Package   Pins | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|----------------------------|---------------|----------------------|----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| <a href="#">MAX213CDB</a>  | Obsolete      | Production           | SSOP (DB)   28 | -                     | -           | Call TI                              | Call TI                           | 0 to 70      | MAX213C             |
| <a href="#">MAX213CDBR</a> | Obsolete      | Production           | SSOP (DB)   28 | -                     | -           | Call TI                              | Call TI                           | 0 to 70      | MAX213C             |
| <a href="#">MAX213CDW</a>  | Active        | Production           | SOIC (DW)   28 | 20   TUBE             | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | MAX213C             |
| MAX213CDW.A                | Active        | Production           | SOIC (DW)   28 | 20   TUBE             | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | MAX213C             |
| <a href="#">MAX213CDWR</a> | Active        | Production           | SOIC (DW)   28 | 1000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | MAX213C             |
| MAX213CDWR.A               | Active        | Production           | SOIC (DW)   28 | 1000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | 0 to 70      | MAX213C             |
| <a href="#">MAX213IDB</a>  | Obsolete      | Production           | SSOP (DB)   28 | -                     | -           | Call TI                              | Call TI                           | -40 to 85    | MAX213I             |
| <a href="#">MAX213IDBR</a> | Obsolete      | Production           | SSOP (DB)   28 | -                     | -           | Call TI                              | Call TI                           | -40 to 85    | MAX213I             |
| <a href="#">MAX213IDWR</a> | Active        | Production           | SOIC (DW)   28 | 1000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | MAX213I             |
| MAX213IDWR.A               | Active        | Production           | SOIC (DW)   28 | 1000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -40 to 85    | MAX213I             |

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts 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.

<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

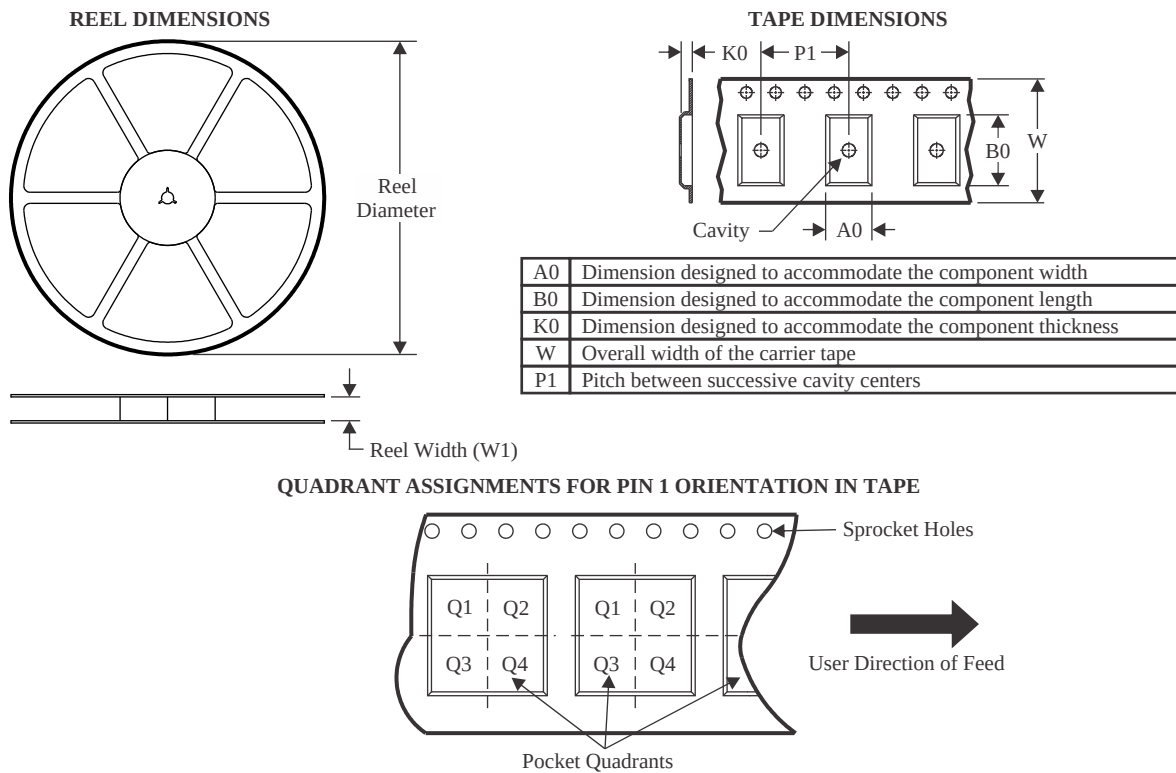
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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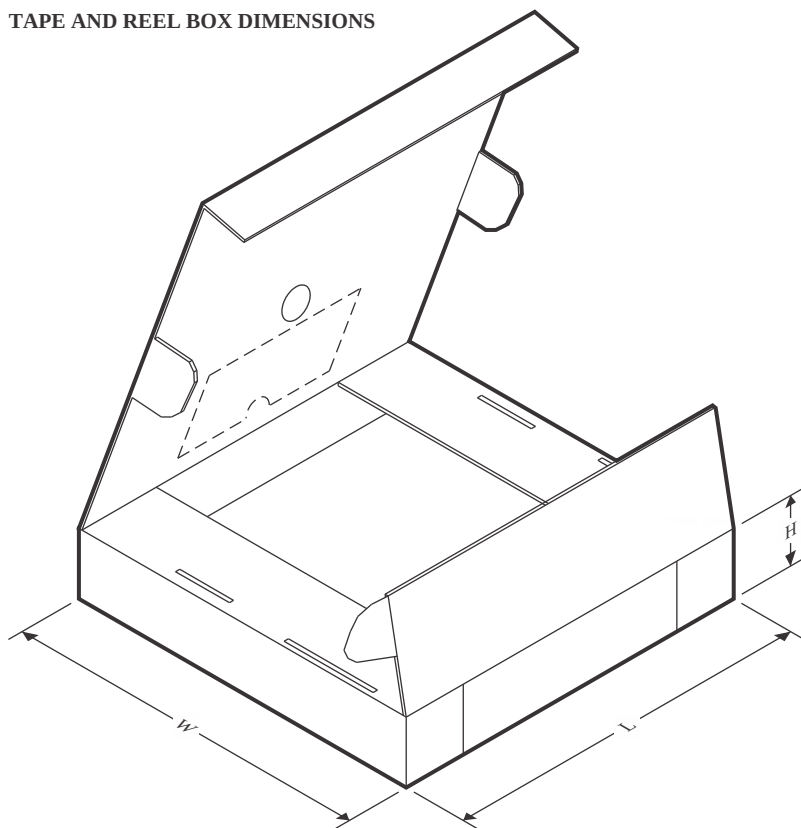
## TAPE AND REEL INFORMATION



\*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 |
|------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| MAX213CDWR | SOIC         | DW              | 28   | 1000 | 330.0              | 32.4               | 11.35   | 18.67   | 3.1     | 16.0    | 32.0   | Q1            |
| MAX213IDWR | SOIC         | DW              | 28   | 1000 | 330.0              | 32.4               | 11.35   | 18.67   | 3.1     | 16.0    | 32.0   | Q1            |

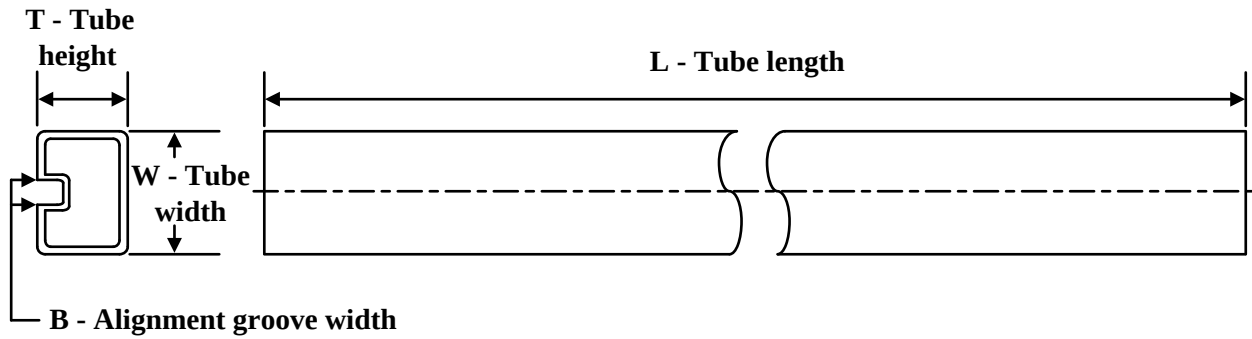
## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

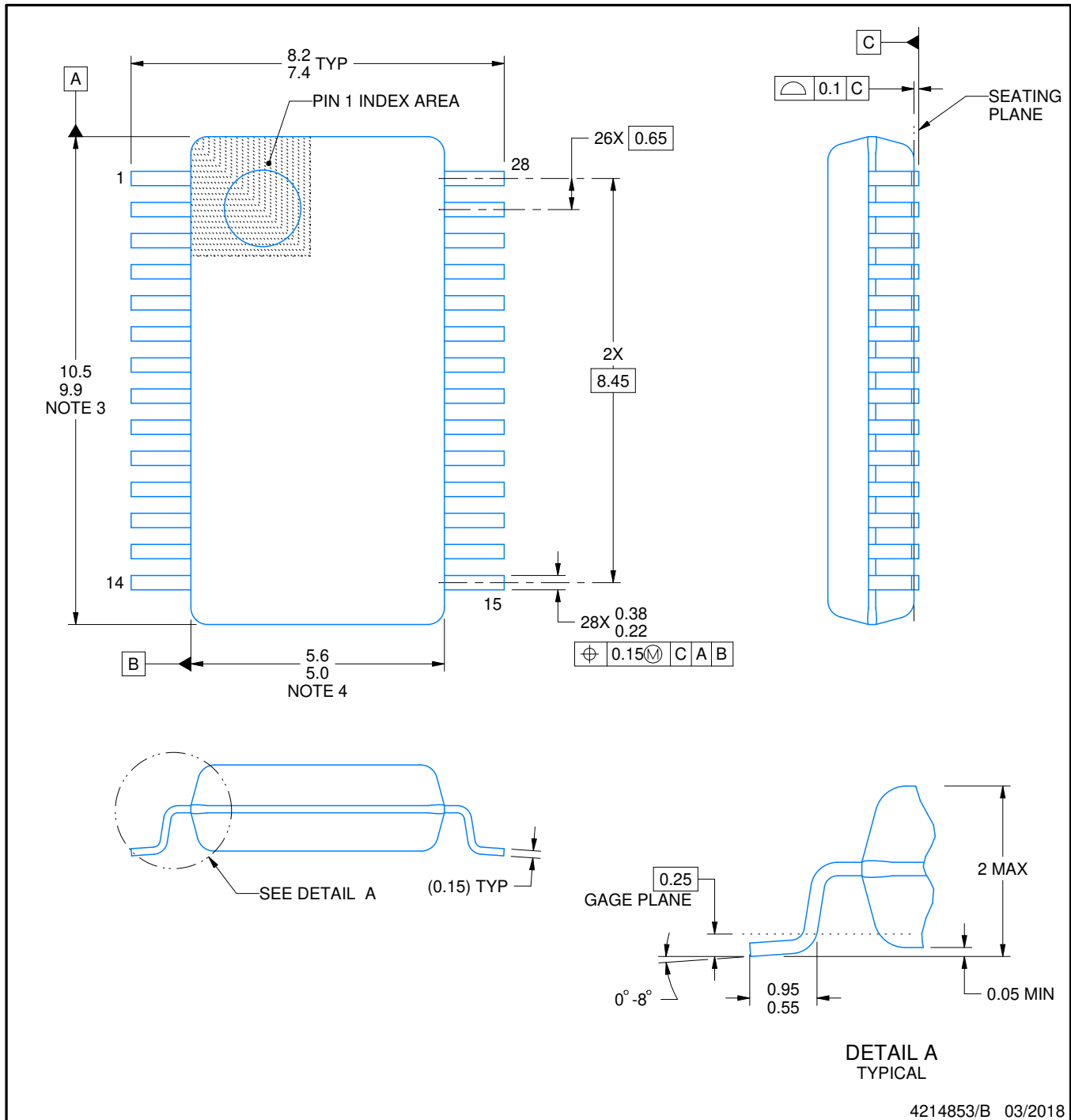
| Device     | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|------------|--------------|-----------------|------|------|-------------|------------|-------------|
| MAX213CDWR | SOIC         | DW              | 28   | 1000 | 350.0       | 350.0      | 66.0        |
| MAX213IDWR | SOIC         | DW              | 28   | 1000 | 350.0       | 350.0      | 66.0        |

## TUBE



\*All dimensions are nominal

| Device      | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|-------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| MAX213CDW   | DW           | SOIC         | 28   | 20  | 506.98 | 12.7   | 4826   | 6.6    |
| MAX213CDW.A | DW           | SOIC         | 28   | 20  | 506.98 | 12.7   | 4826   | 6.6    |



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## NOTES:

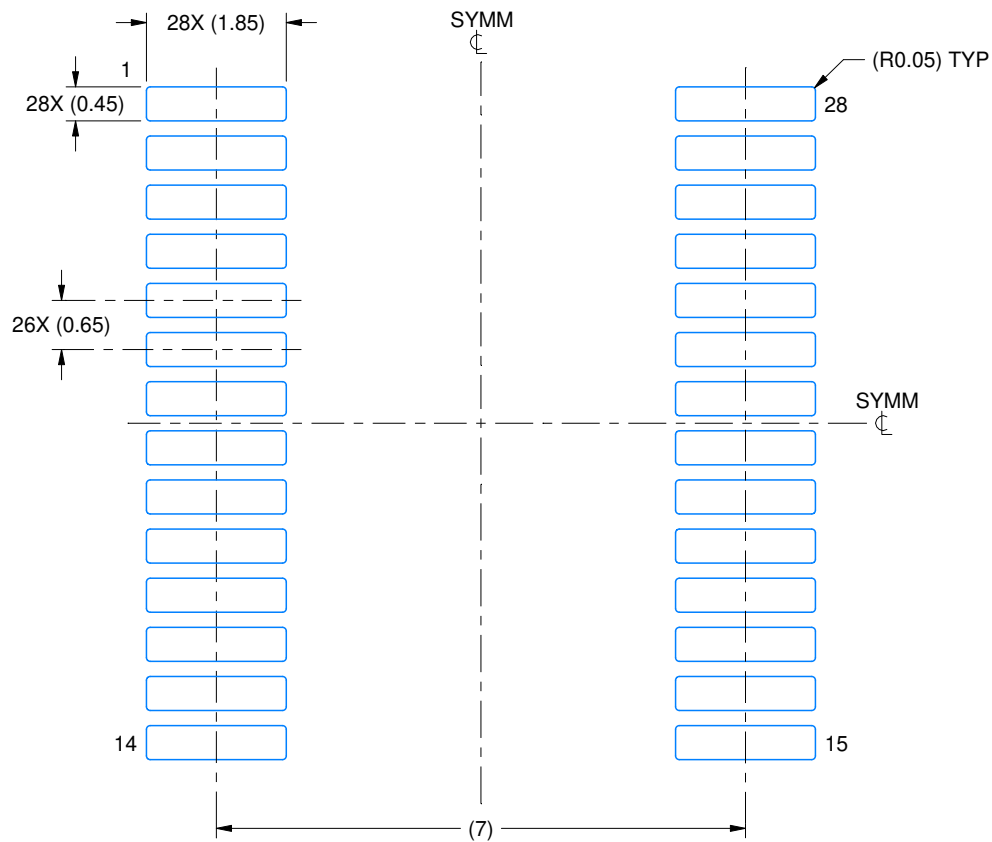
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or 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.

# EXAMPLE BOARD LAYOUT

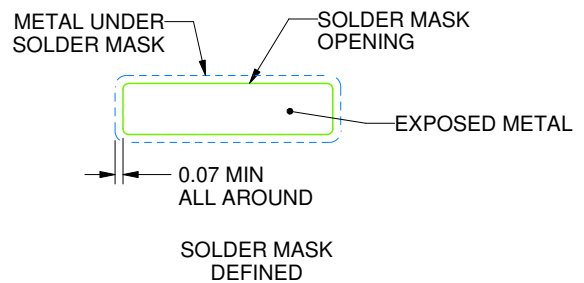
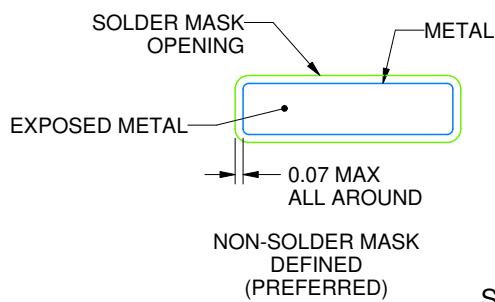
DB0028A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



SOLDER MASK DETAILS

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NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

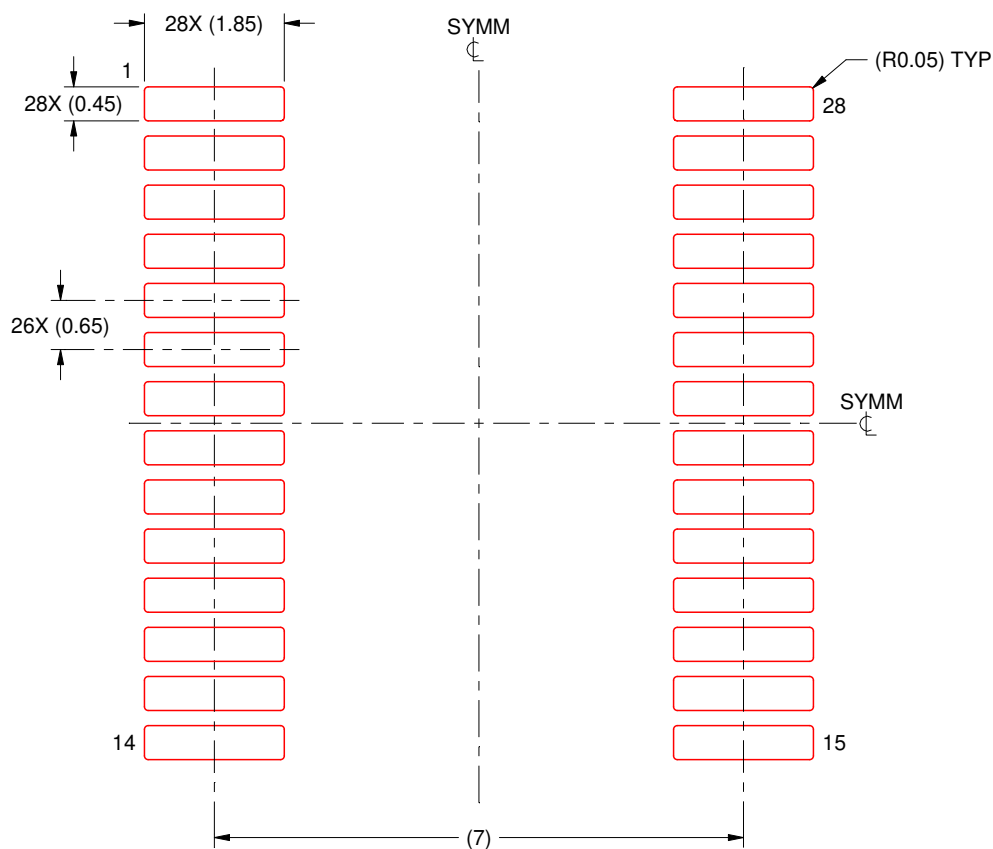
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DB0028A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



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

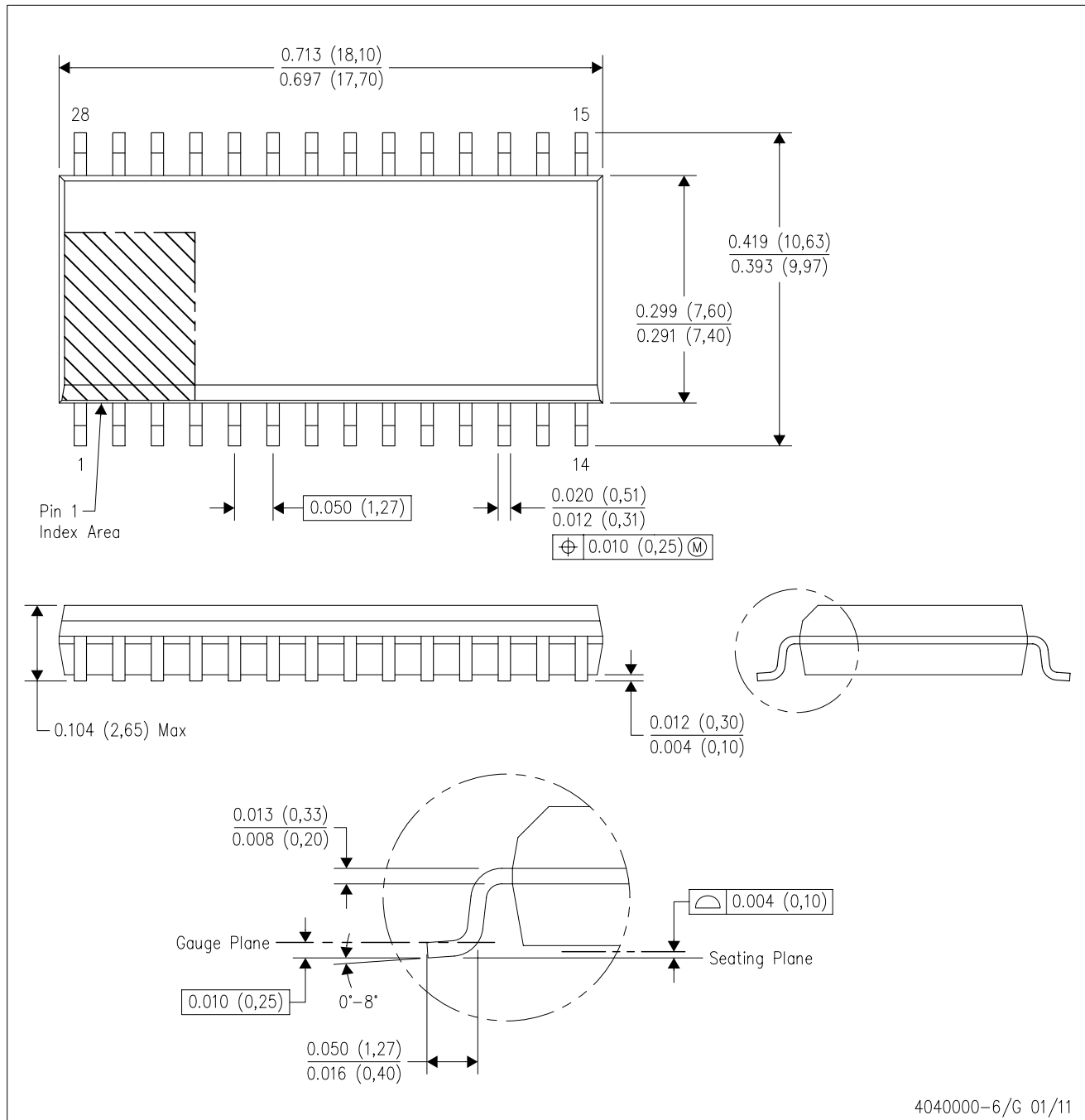
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NOTES: (continued)

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.

DW (R-PDSO-G28)

PLASTIC SMALL OUTLINE



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

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