

MAX3232 3-V to 5.5-V Multichannel RS-232 Line Driver/Receiver With ± 15 -kV ESD Protection

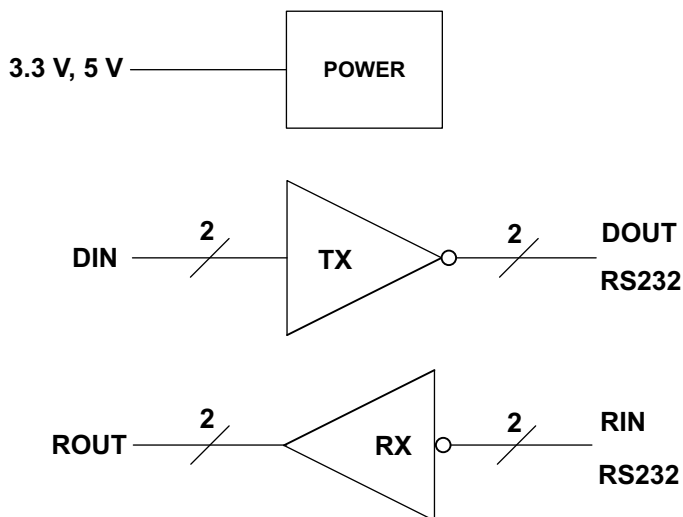
1 Features

- RS-232 Bus-Terminal 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
- Two Drivers and Two Receivers
- Low Supply Current: 300 μ A Typical
- External Capacitors: $4 \times 0.1 \mu$ F
- Accepts 5-V Logic Input With 3.3-V Supply
- Alternative High-Speed Terminal-Compatible Devices (1 Mbit/s)
 - SN65C3232 (-40°C to 85°C)
 - SN75C3232 (0°C to 70°C)

2 Applications

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

4 Simplified Schematic



3 Description

The MAX3232 device consists of two line drivers, two line receivers, and a dual charge-pump circuit with ± 15 -kV ESD protection terminal to terminal (serial-port connection terminals, 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 3-V to 5.5-V supply. The devices operate at data signaling rates up to 250 kbit/s and a maximum of 30-V/ μ s driver output slew rate.

Device Information⁽¹⁾

PART NUMBER	PACKAGE (PIN)	BODY SIZE
MAX3232	SOIC (16)	9.90 mm \times 3.91 mm
	SSOP (16)	6.20 mm \times 5.30 mm
	SOIC (16)	10.30 mm \times 7.50 mm
	TSSOP (16)	5.00 mm \times 4.40 mm

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



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5 Revision History

Changes from Revision J (January 2014) to Revision K

Page

<ul style="list-style-type: none"> Added <i>Applications</i>, <i>Device Information</i> table, <i>Pin Functions</i> table, <i>ESD Ratings</i> table, <i>Thermal Information</i> table, <i>Typical Characteristics</i>, <i>Feature Description</i> section, <i>Device Functional Modes</i>, <i>Application and Implementation</i> section, <i>Power Supply Recommendations</i> section, <i>Layout</i> section, <i>Device and Documentation Support</i> section, and <i>Mechanical, Packaging, and Orderable Information</i> section. 	1
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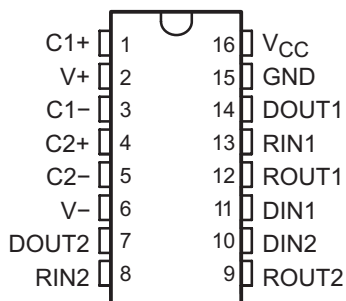
Changes from Revision I (January 2004) to Revision J

Page

<ul style="list-style-type: none"> Updated document to new TI data sheet format - no specification changes. Deleted <i>Ordering Information</i> table. Added ESD warning. 	1 1 13
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6 Pin Configuration and Functions

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



Pin Functions

PIN		TYPE	DESCRIPTION
NAME	NO.		
C1+	1	—	Positive lead of C1 capacitor
V+	2	O	Positive charge pump output for storage capacitor only
C1–	3	—	Negative lead of C1 capacitor
C2+	4	—	Positive lead of C2 capacitor
C2–	5	—	Negative lead of C2 capacitor
V–	6	O	Negative charge pump output for storage capacitor only
DOUT2, DOUT1	7, 14	O	RS232 line data output (to remote RS232 system)
RIN2, RIN1	8, 13	I	RS232 line data input (from remote RS232 system)
ROUT2, ROUT1	9, 12	O	Logic data output (to UART)
DIN2, DIN1	10, 11	I	Logic data input (from UART)
GND	15	—	Ground
VCC	16	—	Supply Voltage, Connect to external 3 V to 5.5 V power supply

7 Specifications

7.1 Absolute Maximum Ratings

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

			MIN	MAX	UNIT
V _{CC}	Supply voltage range ⁽²⁾		–0.3	6	V
V ₊	Positive output supply voltage range ⁽²⁾		–0.3	7	V
V _–	Negative output supply voltage range ⁽²⁾		–7	0.3	V
V ₊ – V _–	Supply voltage difference ⁽²⁾			13	V
V _I	Input voltage range	Drivers	–0.3	6	V
		Receivers	–25	25	
V _O	Output voltage range	Drivers	–13.2	13.2	V
		Receivers	–0.3	V _{CC} + 0.3	
T _J	Operating virtual junction temperature			150	°C
T _{stg}	Storage temperature range		–65	150	°C

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

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

7.2 ESD Ratings

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

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

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

7.3 Recommended Operating Conditions

(see Figure 6)⁽¹⁾

			MIN	NOM	MAX	UNIT
V _{CC}	Supply voltage	V _{CC} = 3.3 V	3	3.3	3.6	V
		V _{CC} = 5 V	4.5	5	5.5	
V _{IH}	Driver high-level input voltage	DIN	V _{CC} = 3.3 V	2		V
			V _{CC} = 5 V	2.4		
V _{IL}	Driver low-level input voltage	DIN			0.8	V
V _I	Driver input voltage	DIN	0		5.5	V
	Receiver input voltage	RIN	–25		25	
T _A	Operating free-air temperature	MAX3232C	0		70	°C
		MAX3232I	–40		85	

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

7.4 Thermal Information

THERMAL METRIC ⁽¹⁾		MAX3232				UNIT
		SOIC	SSOP	SOIC	TSSOP	
		16 PINS				
R _{θJA}	Junction-to-ambient thermal resistance	73	82	57	108	°C/W

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

7.5 Electrical Characteristics — Device

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)⁽¹⁾ (see Figure 6)

PARAMETER	TEST CONDITIONS	MIN	TYP ⁽²⁾	MAX	UNIT
I _{CC} Supply current	No load, V _{CC} = 3.3 V to 5 V		0.3	1	mA

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

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

7.6 Electrical Characteristics — Driver

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)⁽¹⁾ (see Figure 6)

PARAMETER	TEST CONDITIONS	MIN	TYP ⁽²⁾	MAX	UNIT
V _{OH} High-level output voltage	D _{OUT} at R _L = 3 kΩ to GND, D _{IN} = GND	5	5.4		V
V _{OL} Low-level output voltage	D _{OUT} at R _L = 3 kΩ to GND, D _{IN} = V _{CC}	–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} ⁽³⁾ 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				
r _O Output resistance	V _{CC} , V ₊ , and V _– = 0 V V _O = ±2 V	300	10M		Ω

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

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

(3) Short-circuit durations should be controlled to prevent exceeding the device absolute power dissipation ratings, and not more than one output should be shorted at a time.

7.7 Electrical Characteristics — Receiver

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)⁽¹⁾ (see Figure 6)

PARAMETER	TEST CONDITIONS	MIN	TYP ⁽²⁾	MAX	UNIT
V _{OH} High-level output voltage	I _{OH} = –1 mA	V _{CC} – 0.6	V _{CC} – 0.1		V
V _{OL} Low-level output voltage	I _{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
r _I Input resistance	V _I = ±3 V to ±25 V	3	5	7	kΩ

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

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

7.8 Switching Characteristics

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)⁽¹⁾ (see [Figure 6](#))

PARAMETER	TEST CONDITIONS	MIN	TYP ⁽²⁾	MAX	UNIT
Maximum data rate	$R_L = 3\text{ k}\Omega$, One D _{OUT} switching, $C_L = 1000\text{ pF}$ See Figure 3	150	250		kbit/s
$t_{sk(p)}$ Driver Pulse skew ⁽³⁾	$R_L = 3\text{ k}\Omega$ to $7\text{ k}\Omega$, $C_L = 150$ to 2500 pF See Figure 4		300		ns
SR(tr) Slew rate, transition region (see Figure 3)	$R_L = 3\text{ k}\Omega$ to $7\text{ k}\Omega$, $V_{CC} = 5\text{ V}$	$C_L = 150$ to 1000 pF		6	V/ μ s
		$C_L = 150$ to 2500 pF		4	
$t_{PLH\oplus}$ Propagation delay time, low- to high-level output	$C_L = 150\text{ pF}$			300	ns
$t_{PHL\oplus}$ Propagation delay time, high- to low-level output				300	
$t_{sk(p)}$ Receiver Pulse skew ⁽¹⁾				300	

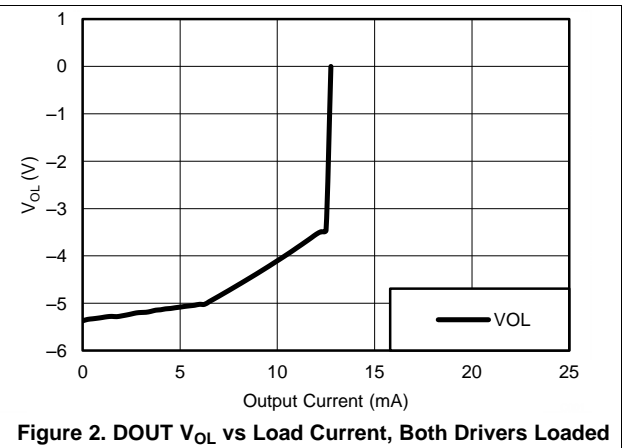
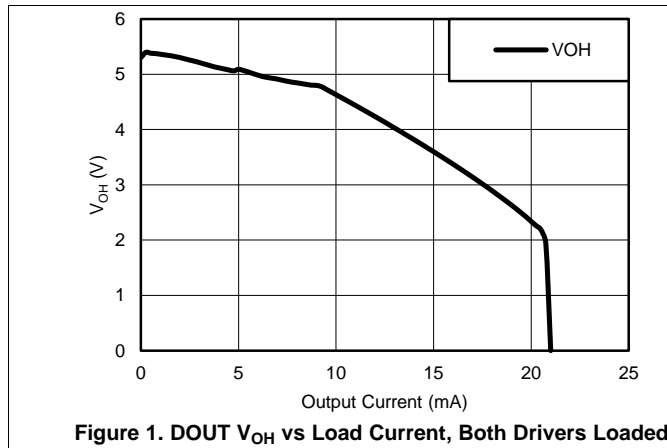
(1) Test conditions are C_1 – $C_4 = 0.1\text{ }\mu\text{F}$ at $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$; $C_1 = 0.047\text{ }\mu\text{F}$, C_2 – $C_4 = 0.33\text{ }\mu\text{F}$ at $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$.

(2) All typical values are at $V_{CC} = 3.3\text{ V}$ or $V_{CC} = 5\text{ V}$, and $T_A = 25^\circ\text{C}$.

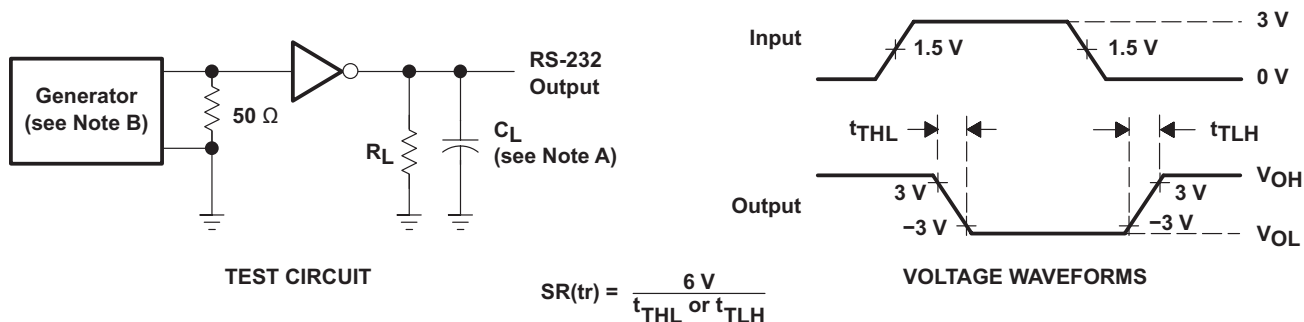
(3) Pulse skew is defined as $|t_{PLH} - t_{PHL}|$ of each channel of the same device.

7.9 Typical Characteristics

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

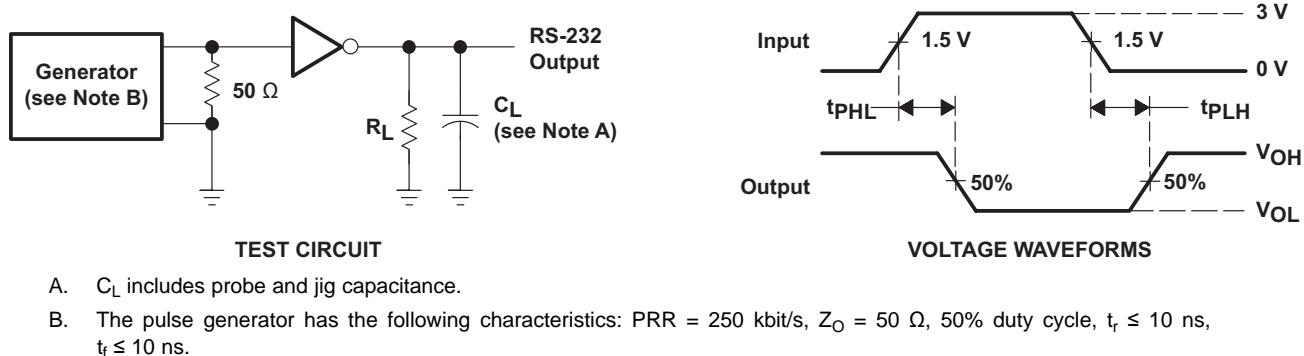


8 Parameter Measurement Information



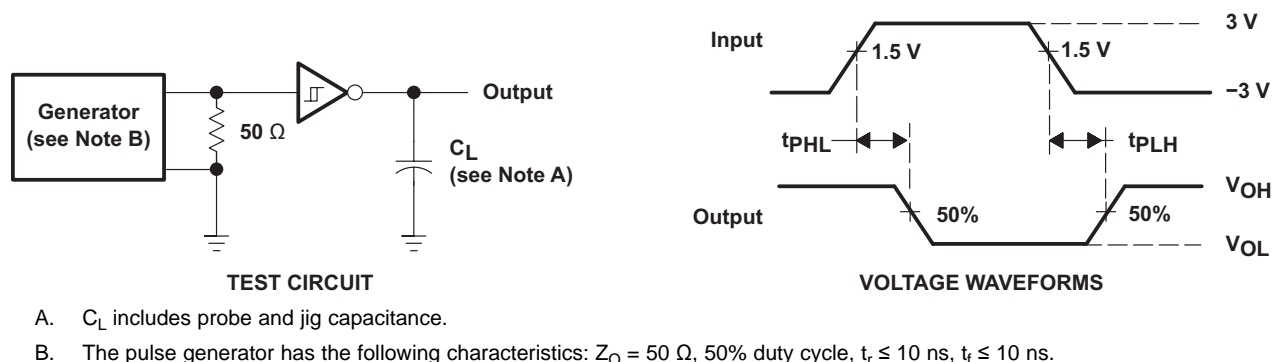
- A. C_L includes probe and jig capacitance.
- B. The pulse generator has the following characteristics: PRR = 250 kbit/s, $Z_O = 50\ \Omega$, 50% duty cycle, $t_r \leq 10\text{ ns}$, $t_f \leq 10\text{ ns}$.

Figure 3. Driver Slew Rate



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

Figure 4. Driver Pulse Skew



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

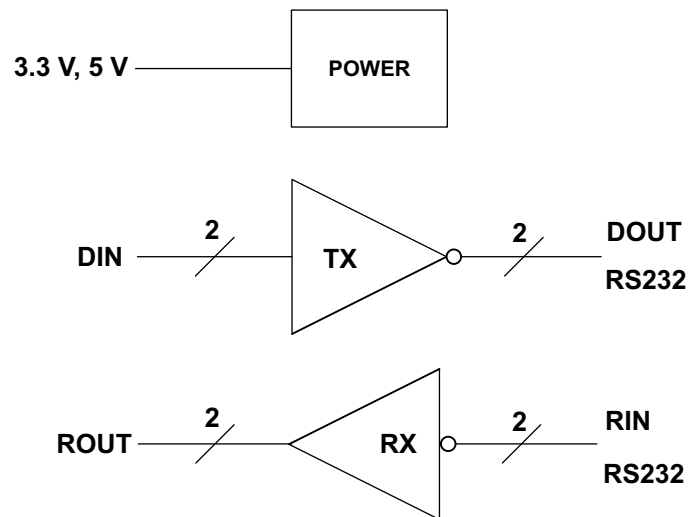
Figure 5. Receiver Propagation Delay Times

9 Detailed Description

9.1 Overview

The MAX3232 device consists of two line drivers, two line receivers, and a dual charge-pump circuit with ± 15 -kV ESD protection terminal to terminal (serial-port connection terminals, 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 3-V to 5.5-V supply. The device operates at data signaling rates up to 250 kbit/s and a maximum of 30-V/ μ s driver output slew rate. Outputs are protected against shorts to ground.

9.2 Functional Block Diagram



9.3 Feature Description

9.3.1 Power

The power block increases, inverts, and regulates voltage at V+ and V- pins using a charge pump that requires four external capacitors.

9.3.2 RS232 Driver

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

9.3.3 RS232 Receiver

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

9.4 Device Functional Modes

Table 1. Each Driver⁽¹⁾

INPUT DIN	OUTPUT DOUT
L	H
H	L

(1) H = high level, L = low level

Table 2. Each Receiver⁽¹⁾

INPUT RIN	OUTPUT ROUT
L	H
H	L
Open	H

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

9.4.1 V_{CC} powered by 3 V to 5.5 V

The device will be in normal operation.

9.4.2 V_{CC} unpowered, $V_{CC} = 0$ V

When MAX3232 is unpowered, it can be safely connected to an active remote RS232 device.

10 Applications and Implementation

NOTE

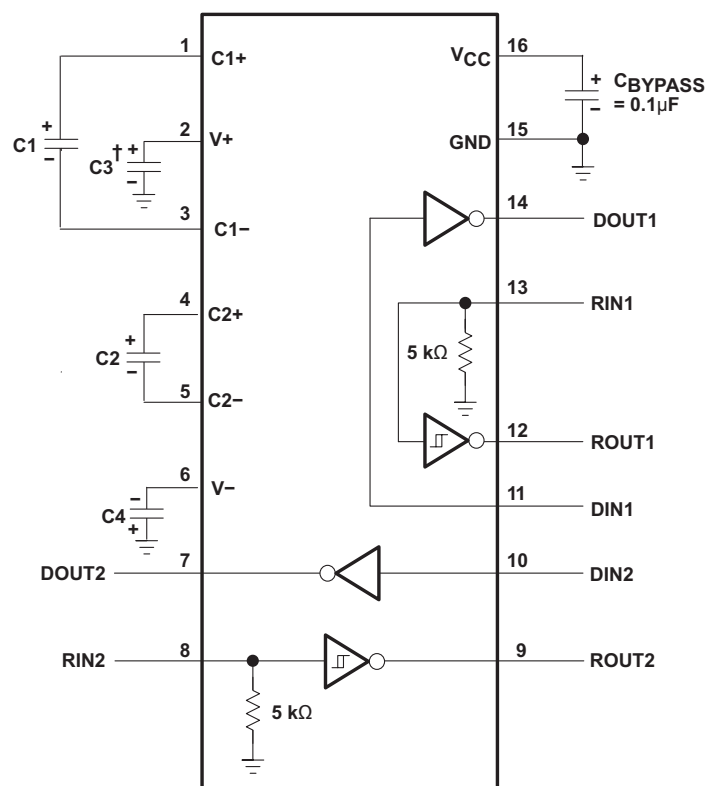
Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation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

10.1 Application Information

For proper operation, add capacitors as shown in [Figure 6](#).

10.2 Standard Application

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



† C3 can be connected to VCC 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.

VCC vs CAPACITOR VALUES

VCC	C1	C2, C3, C4
3.3 V ± 0.3 V	0.1 μF	0.1 μF
5 V ± 0.5 V	0.047 μF	0.33 μF
3 V to 5.5 V	0.1 μF	0.47 μF

Figure 6. Typical Operating Circuit and Capacitor Values

Standard Application (continued)

10.2.1 Design Requirements

- Recommended V_{CC} is 3.3 V or 5 V. 3 V to 5.5 V is also possible
- Maximum recommended bit rate is 250 kbit/s.

10.2.2 Detailed Design Procedure

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

10.2.3 Application Curves

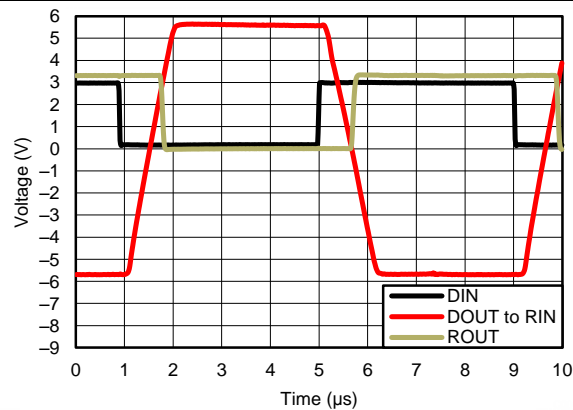


Figure 7. 250 kbit/s Driver to Receiver Loopback Timing Waveform,
 $V_{CC} = 3.3 \text{ V}$

11 Power Supply Recommendations

V_{CC} should be between 3 V and 5.5 V. Charge pump capacitors should be chosen using table in [Figure 6](#).

12 Layout

12.1 Layout Guidelines

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

12.2 Layout Example

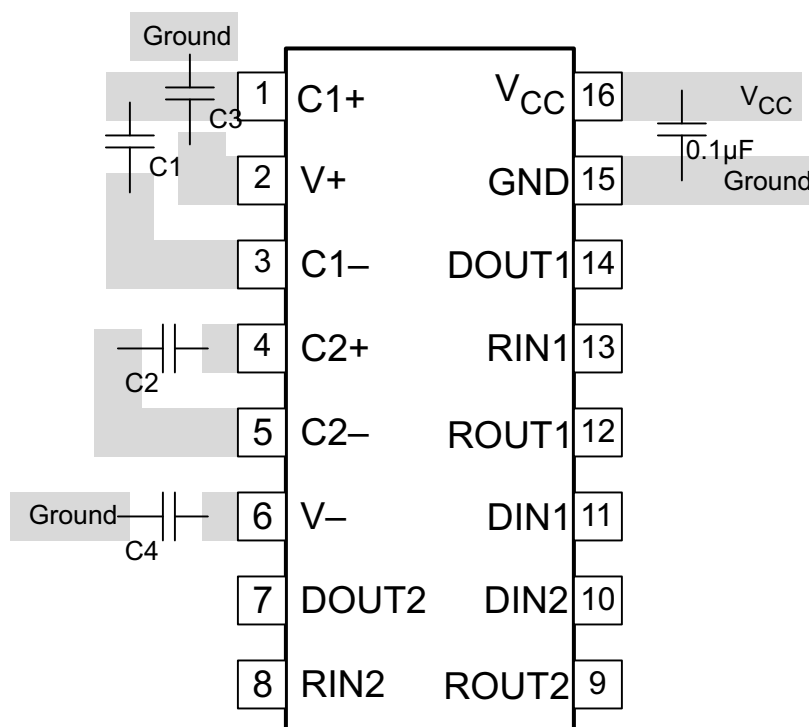


Figure 8. Layout Diagram

13 Device and Documentation Support

13.1 Trademarks

All trademarks are the property of their respective owners.

13.2 Electrostatic Discharge Caution



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

13.3 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms and definitions.

14 Mechanical, Packaging, and Orderable Information

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

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
MAX3232CD	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MAX3232C	Samples
MAX3232CDB	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3232C	Samples
MAX3232CDBE4	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3232C	Samples
MAX3232CDBG4	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3232C	Samples
MAX3232CDBR	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3232C	Samples
MAX3232CDBRE4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3232C	Samples
MAX3232CDBRG4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3232C	Samples
MAX3232CDE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MAX3232C	Samples
MAX3232CDG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MAX3232C	Samples
MAX3232CDR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU CU SN	Level-1-260C-UNLIM	0 to 70	MAX3232C	Samples
MAX3232CDRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MAX3232C	Samples
MAX3232CDRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MAX3232C	Samples
MAX3232CDW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MAX3232C	Samples
MAX3232CDWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MAX3232C	Samples
MAX3232CDWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU CU SN	Level-1-260C-UNLIM	0 to 70	MAX3232C	Samples
MAX3232CDWRE4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MAX3232C	Samples
MAX3232CDWRG4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MAX3232C	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
MAX3232CPW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3232C	Samples
MAX3232CPWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3232C	Samples
MAX3232CPWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3232C	Samples
MAX3232CPWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU CU SN	Level-1-260C-UNLIM	0 to 70	MA3232C	Samples
MAX3232CPWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3232C	Samples
MAX3232CPWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3232C	Samples
MAX3232ID	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MAX3232I	Samples
MAX3232IDB	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3232I	Samples
MAX3232IDBE4	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3232I	Samples
MAX3232IDBG4	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3232I	Samples
MAX3232IDBR	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3232I	Samples
MAX3232IDBRE4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3232I	Samples
MAX3232IDBRG4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3232I	Samples
MAX3232IDE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MAX3232I	Samples
MAX3232IDG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MAX3232I	Samples
MAX3232IDR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU CU SN	Level-1-260C-UNLIM	-40 to 85	MAX3232I	Samples
MAX3232IDRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MAX3232I	Samples
MAX3232IDRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MAX3232I	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
MAX3232IDW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MAX3232I	Samples
MAX3232IDWE4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MAX3232I	Samples
MAX3232IDWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MAX3232I	Samples
MAX3232IDWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU CU SN	Level-1-260C-UNLIM	-40 to 85	MAX3232I	Samples
MAX3232IDWRE4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MAX3232I	Samples
MAX3232IDWRG4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MAX3232I	Samples
MAX3232IPW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3232I	Samples
MAX3232IPWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3232I	Samples
MAX3232IPWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3232I	Samples
MAX3232IPWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU CU SN	Level-1-260C-UNLIM	-40 to 85	MB3232I	Samples
MAX3232IPWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3232I	Samples
MAX3232IPWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3232I	Samples
SN003232CPWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3232C	Samples

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBsolete: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

⁽⁴⁾ There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

⁽⁵⁾ Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

⁽⁶⁾ Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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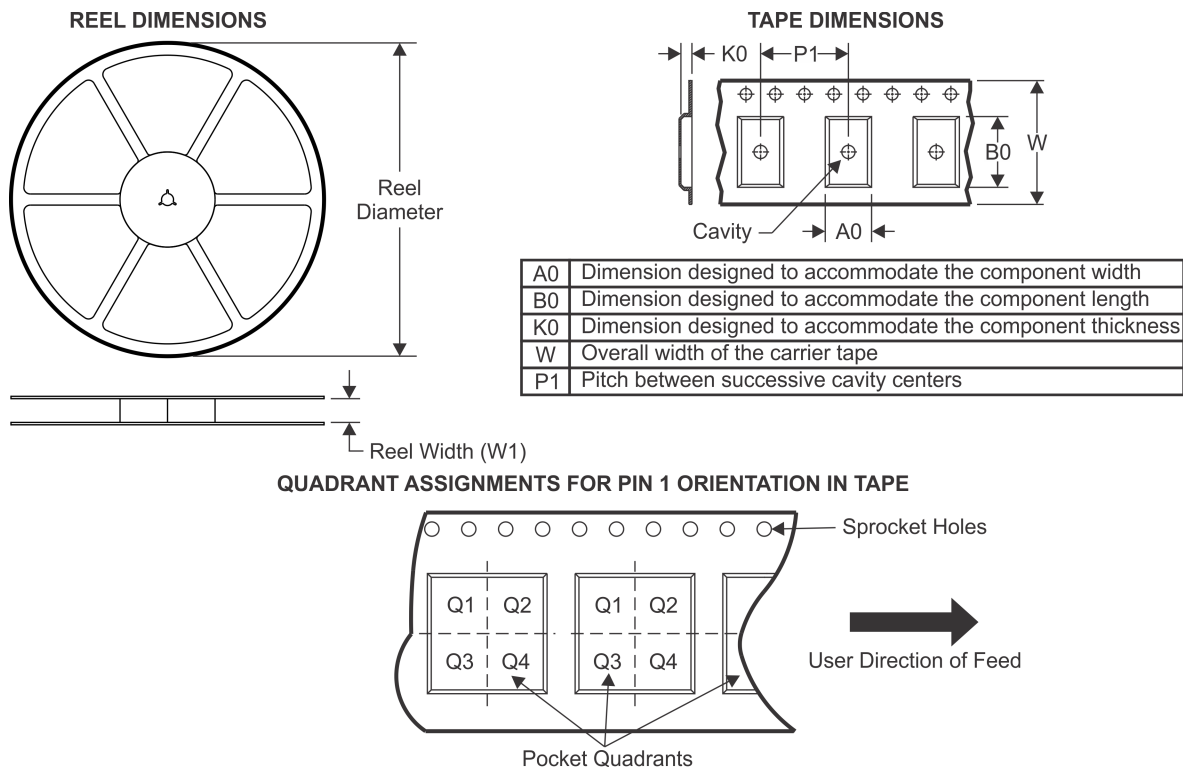
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OTHER QUALIFIED VERSIONS OF MAX3232 :

- Enhanced Product: [MAX3232-EP](#)

NOTE: Qualified Version Definitions:

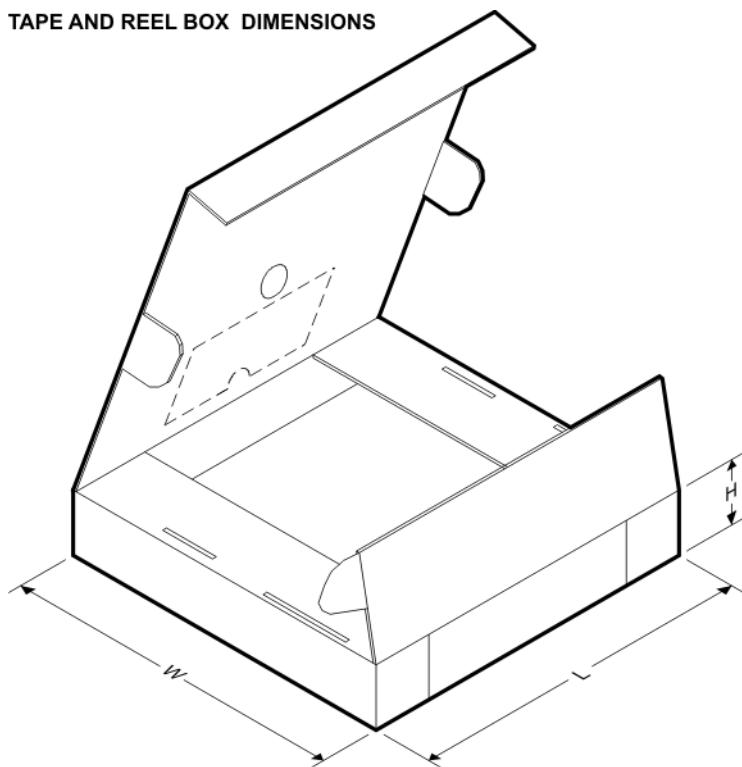
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

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
MAX3232CDR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
MAX3232CDRG4	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
MAX3232CDWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
MAX3232CDWRG4	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
MAX3232CPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
MAX3232CPWRG4	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
MAX3232IDBR	SSOP	DB	16	2000	330.0	16.4	8.2	6.6	2.5	12.0	16.0	Q1
MAX3232IDR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
MAX3232IDRG4	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
MAX3232IDWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
MAX3232IDWRG4	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
MAX3232IPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS

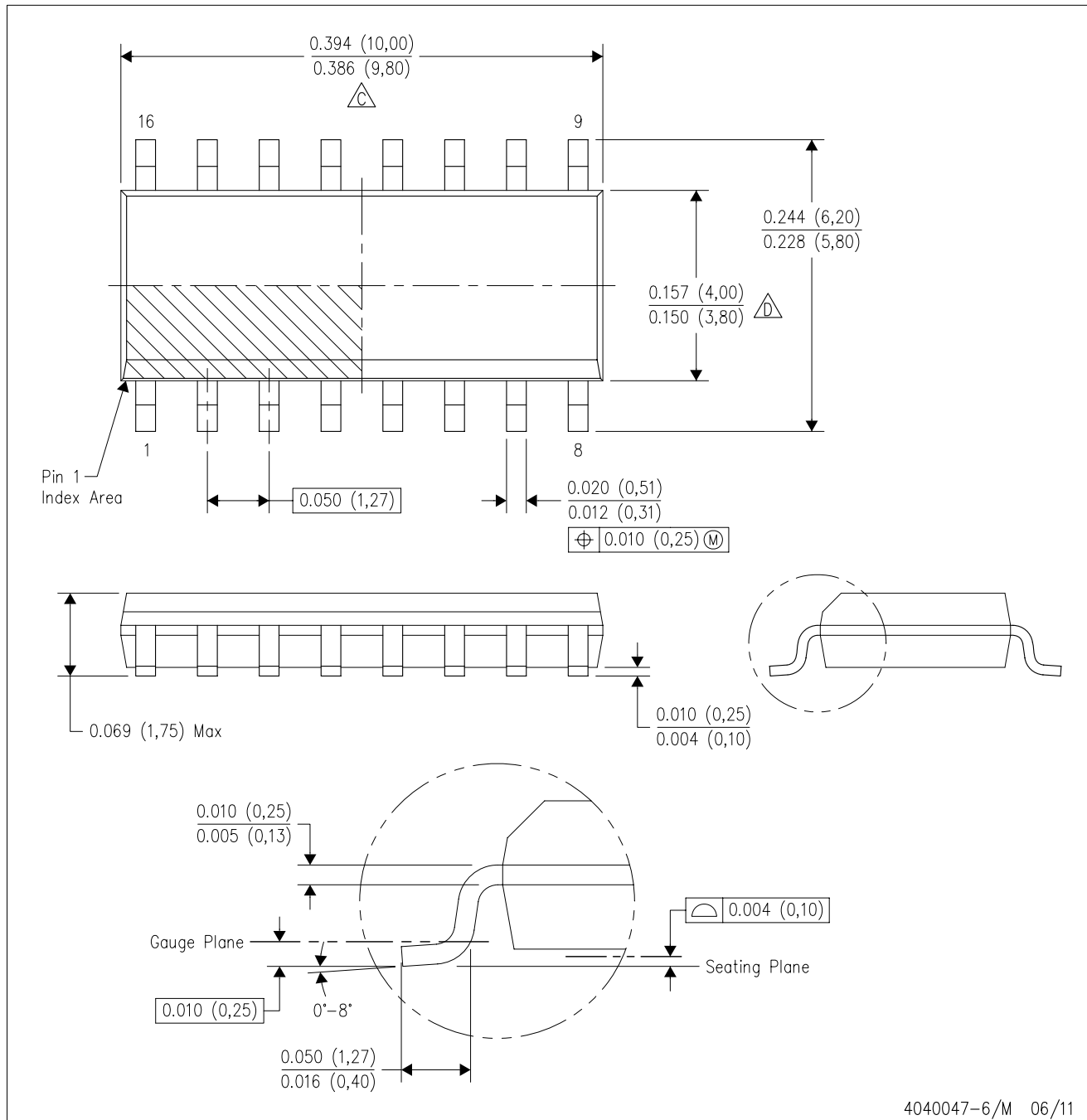


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
MAX3232CDR	SOIC	D	16	2500	333.2	345.9	28.6
MAX3232CDRG4	SOIC	D	16	2500	333.2	345.9	28.6
MAX3232CDWR	SOIC	DW	16	2000	367.0	367.0	38.0
MAX3232CDWRG4	SOIC	DW	16	2000	367.0	367.0	38.0
MAX3232CPWR	TSSOP	PW	16	2000	367.0	367.0	35.0
MAX3232CPWRG4	TSSOP	PW	16	2000	367.0	367.0	35.0
MAX3232IDBR	SSOP	DB	16	2000	367.0	367.0	38.0
MAX3232IDR	SOIC	D	16	2500	333.2	345.9	28.6
MAX3232IDRG4	SOIC	D	16	2500	333.2	345.9	28.6
MAX3232IDWR	SOIC	DW	16	2000	367.0	367.0	38.0
MAX3232IDWRG4	SOIC	DW	16	2000	367.0	367.0	38.0
MAX3232IPWR	TSSOP	PW	16	2000	367.0	367.0	35.0

D (R-PDSO-G16)

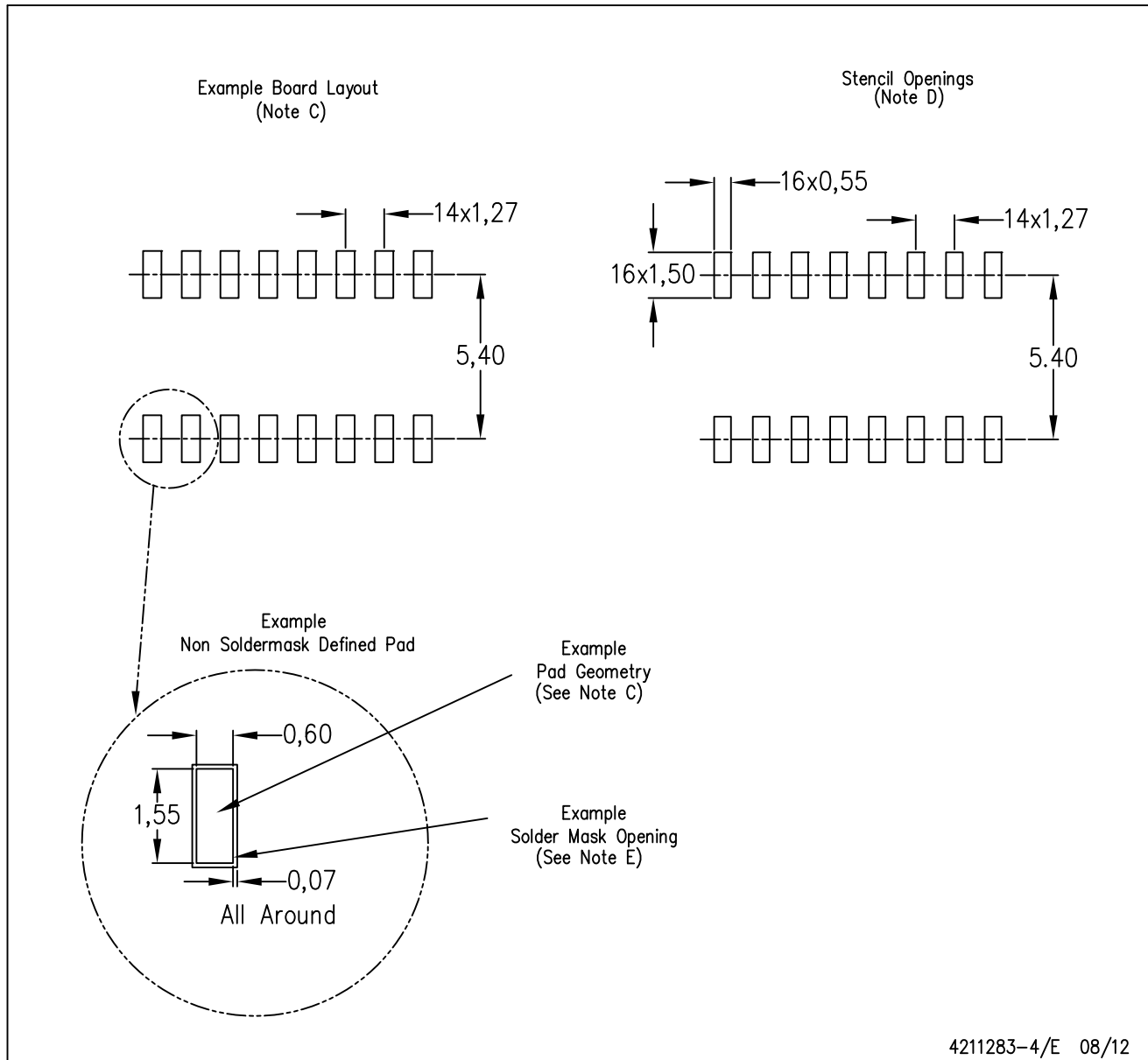
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - $\triangle C$ Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 - $\triangle D$ Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AC.

D (R-PDSO-G16)

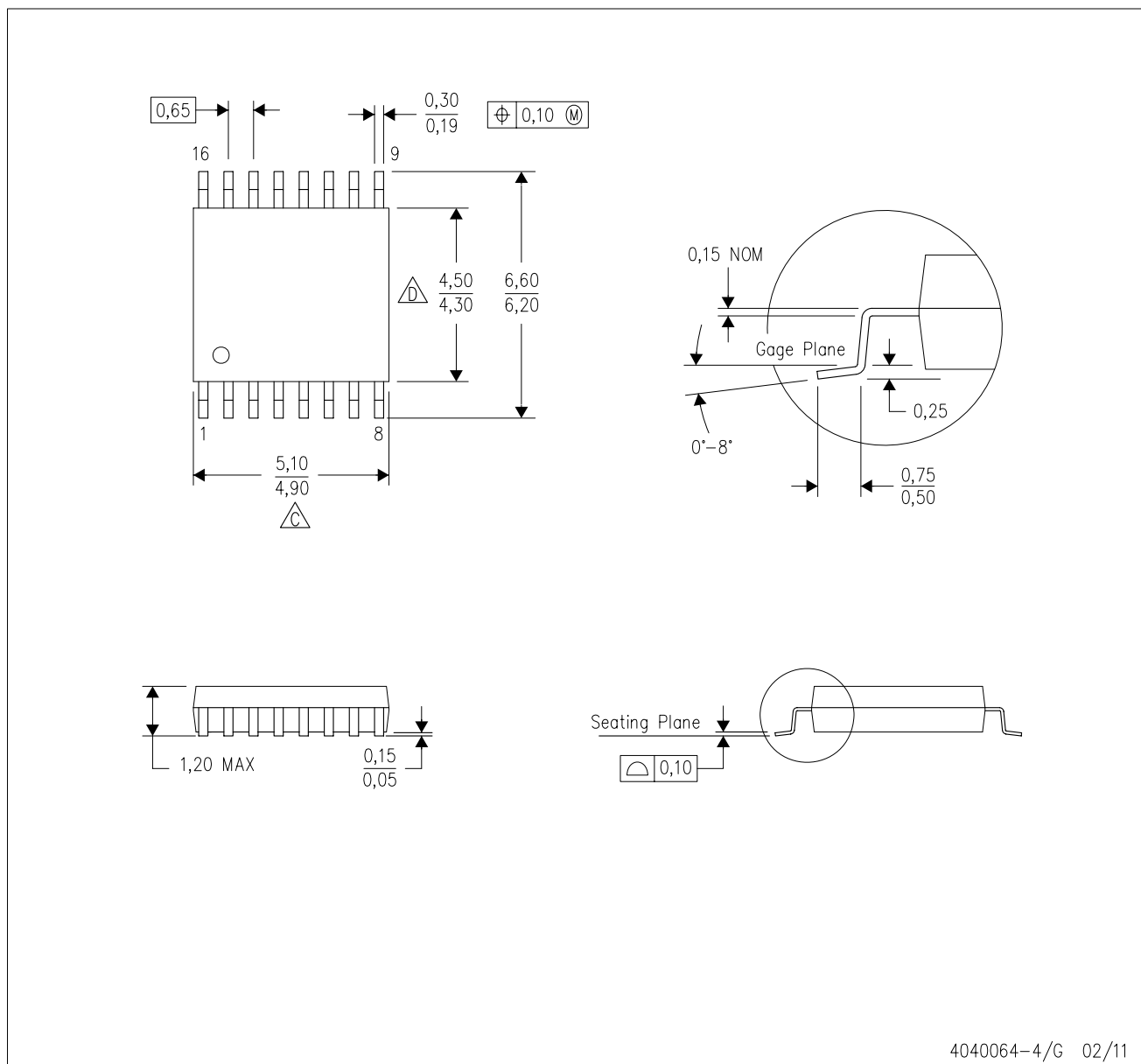
PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - 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.
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

PW (R-PDSO-G16)

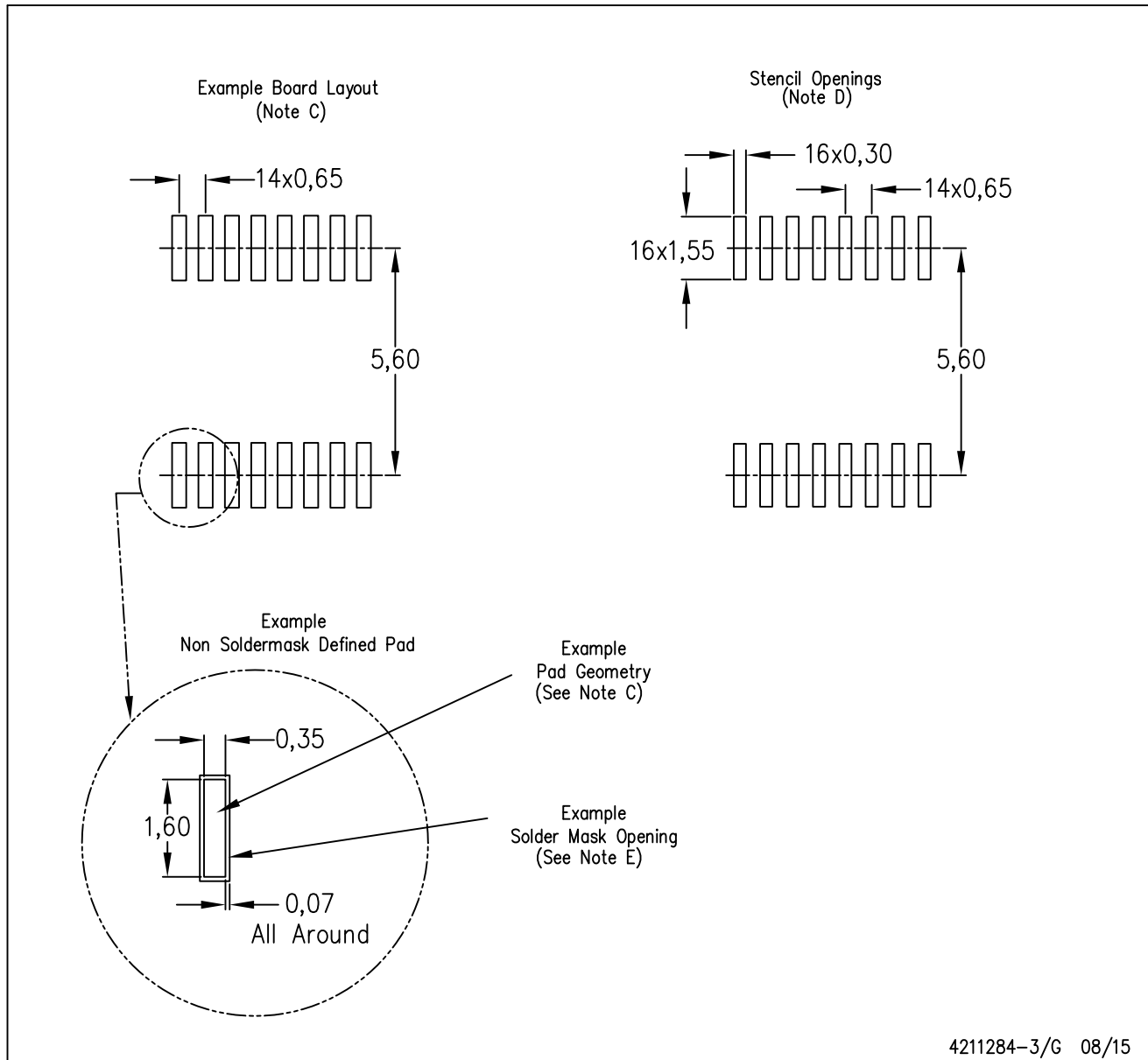
PLASTIC SMALL OUTLINE



- 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-G16)

PLASTIC SMALL OUTLINE

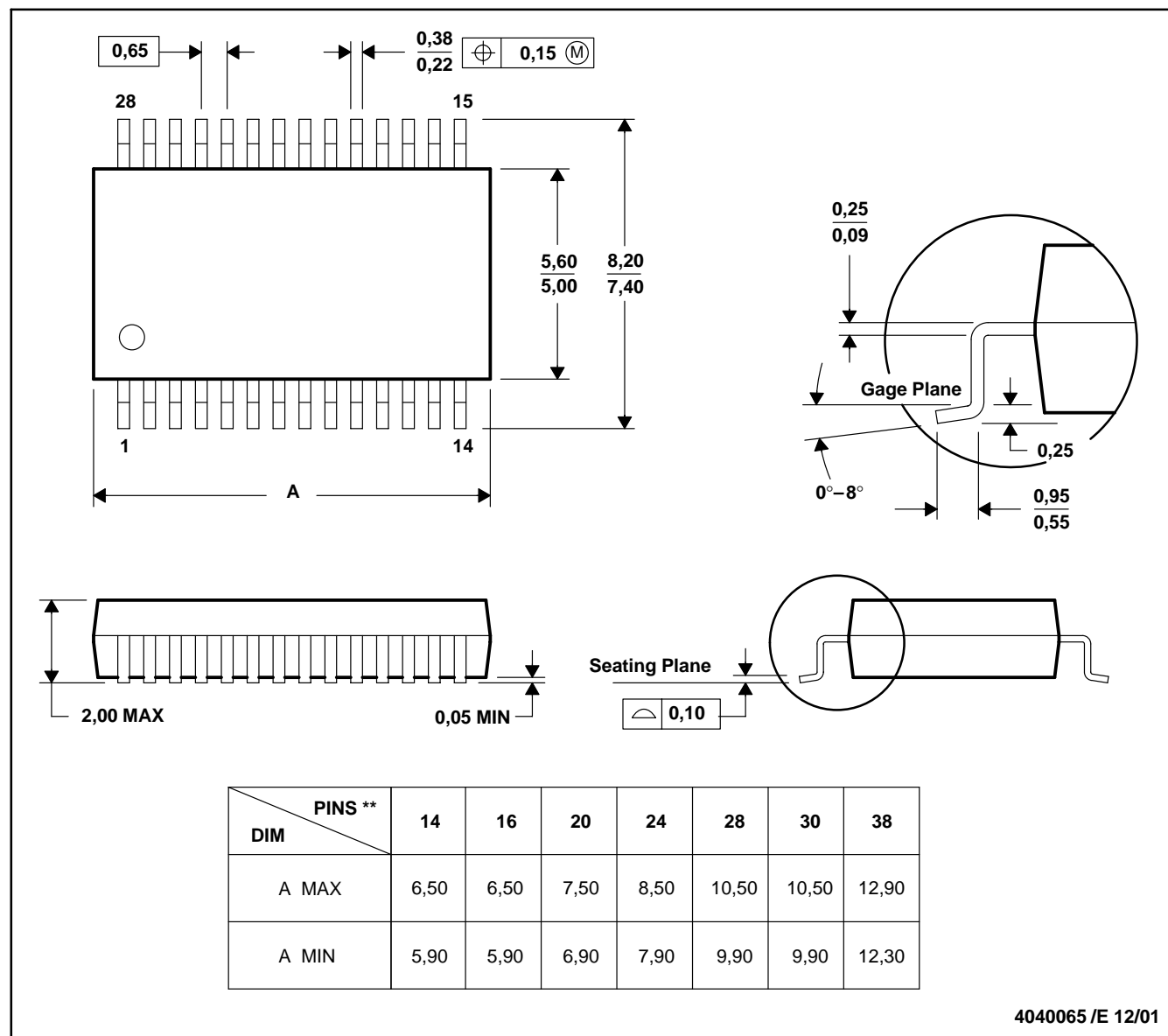


- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

DB (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

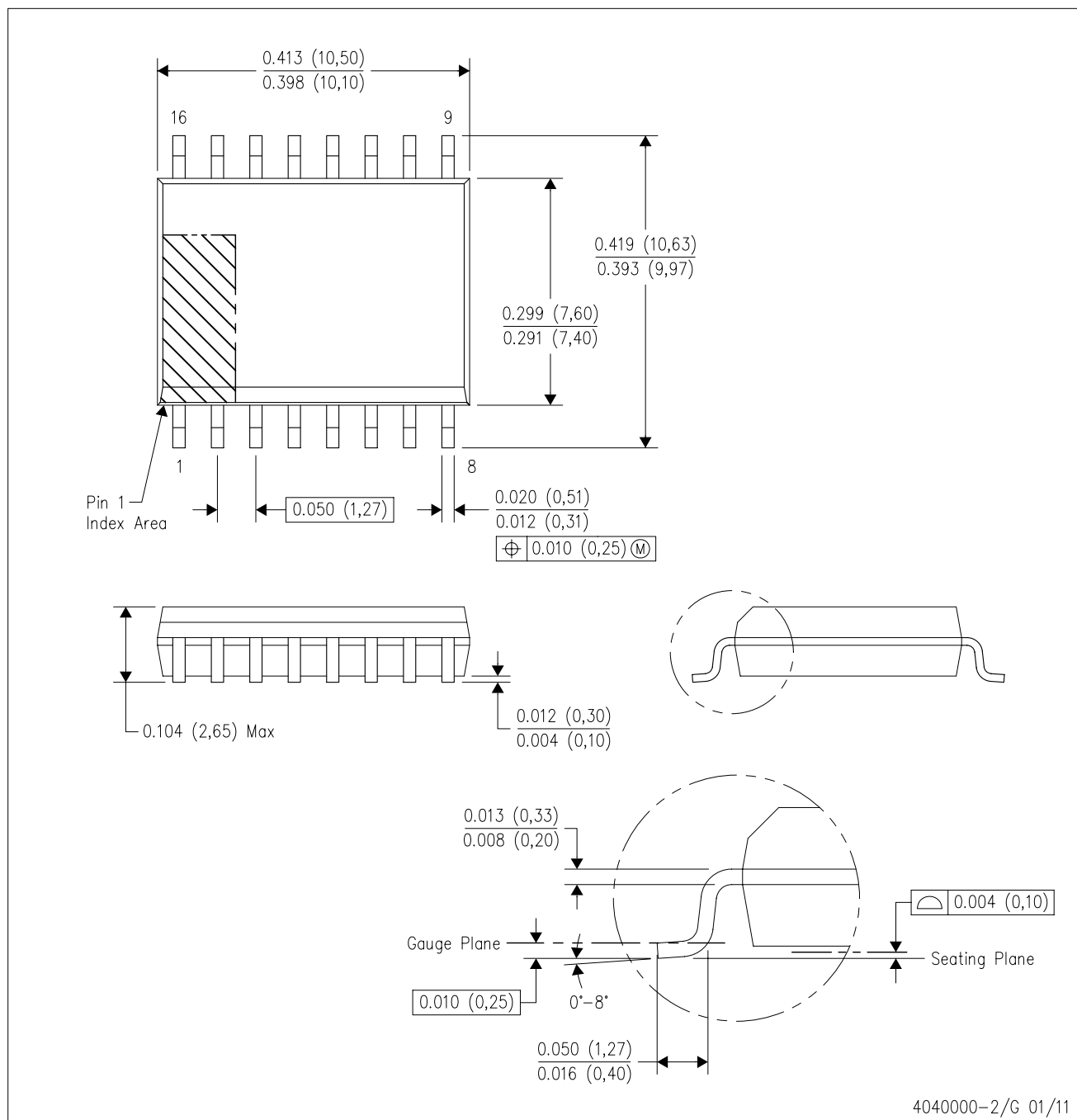
28 PINS SHOWN



- 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

DW (R-PDSO-G16)

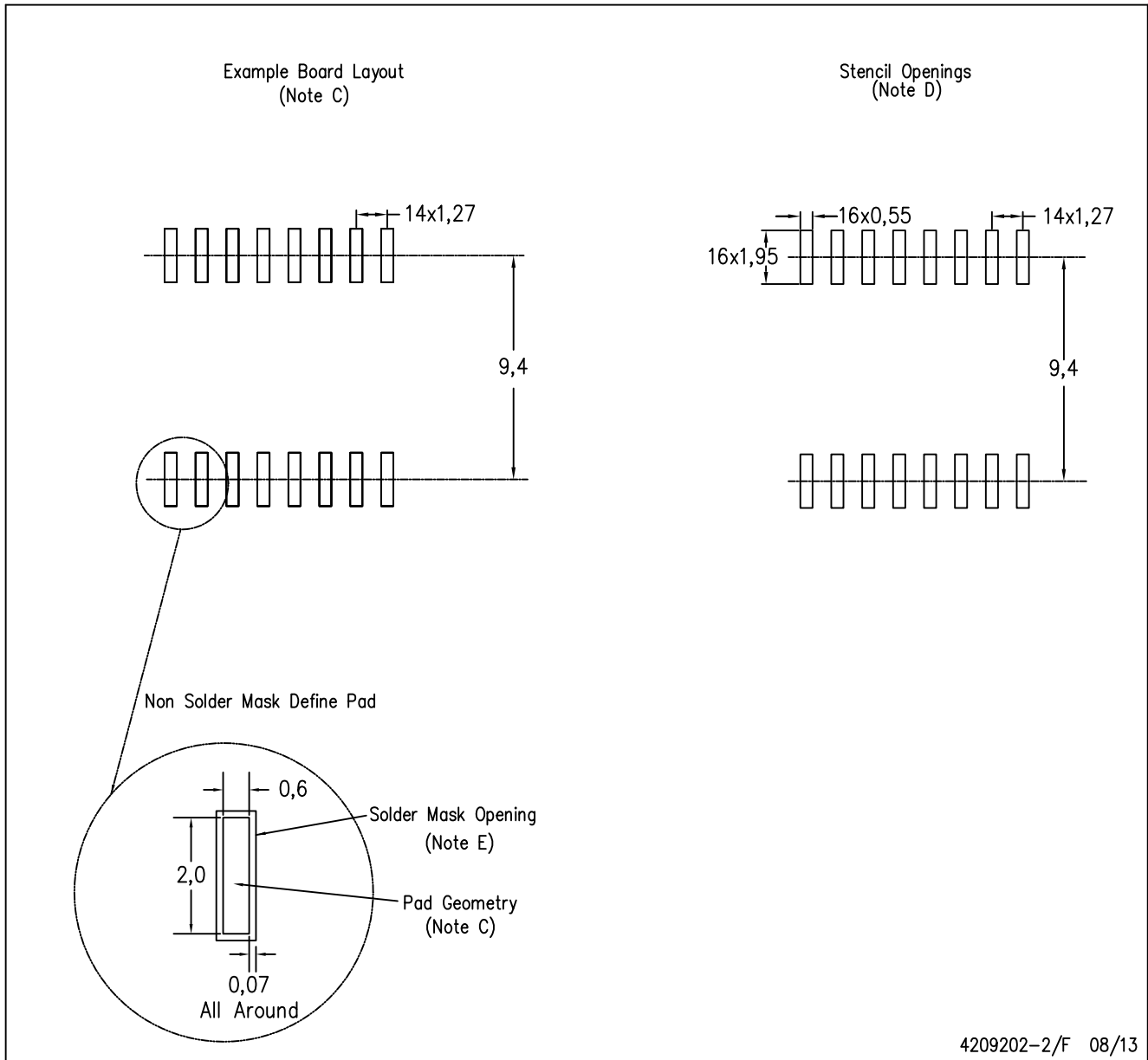
PLASTIC SMALL OUTLINE



- 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 AA.

DW (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Refer to IPC7351 for alternate board design.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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