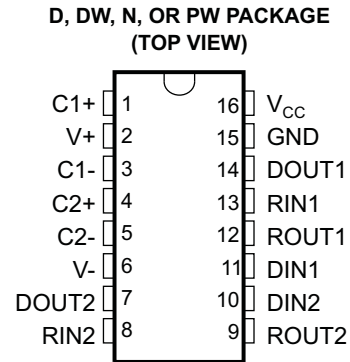


FEATURES

- ESD Protection for RS-232 Bus Pins
 - ± 15 -kV – Human-Body Model
- Meets or Exceeds the Requirements of TIA/EIA-232-F and ITU v.28 Standards
- Operates at 5-V V_{CC} Supply
- Operates Up to 120 kbit/s
- External Capacitors . . . $4 \times 0.1 \mu\text{F}$
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II

APPLICATIONS

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



DESCRIPTION/ORDERING INFORMATION

The MAX202 device consists of two line drivers, two line receivers, and a dual charge-pump circuit with ± 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 device operates at data signaling rates up to 120 kbit/s and a maximum of 30-V/ μs driver output slew rate.

ORDERING INFORMATION

T_A	PACKAGE ⁽¹⁾⁽²⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	PDIP – N	Tube of 25	MAX202CN	MAX202CN
		SOIC – D	Tube of 40	MAX202CD
		Reel of 2500	MAX202CDR	
	SOIC – DW	Tube of 40	MAX202CDW	MAX202C
		Reel of 2000	MAX202CDWR	
	TSSOP – PW	Tube of 90	MAX202CPW	MA202C
Reel of 2000		MAX202CPWR		
–40°C to 85°C	PDIP – N	Tube of 25	MAX202IN	MAX202IN
		SOIC – D	Tube of 40	MAX202ID
	Reel of 2500		MAX202IDR	
	SOIC – DW	Tube of 40	MAX202IDW	MAX202I
		Reel of 2000	MAX202IDWR	
	TSSOP – PW	Tube of 90	MAX202IPW	MB202I
		Reel of 2000	MAX202IPWR	

- (1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.
- (2) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at www.ti.com.



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.

Function Tables

EACH DRIVER⁽¹⁾

INPUT D_{IN}	OUTPUT D_{OUT}
L	H
H	L

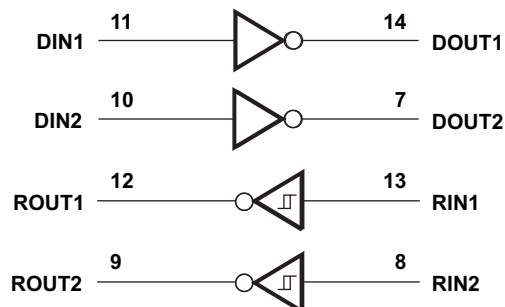
(1) H = high level, L = low level

EACH RECEIVER⁽¹⁾

INPUT R_{IN}	OUTPUT R_{OUT}
L	H
H	L
Open	H

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

LOGIC DIAGRAM (POSITIVE LOGIC)



Absolute Maximum Ratings⁽¹⁾

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

		MIN	MAX	UNIT
V _{CC}	Supply voltage range ⁽²⁾	–0.3	6	V
V+	Positive charge pump voltage range ⁽²⁾	V _{CC} – 0.3	14	V
V–	Negative charge pump voltage range ⁽²⁾	–14	0.3	V
V _I	Input voltage range	Drivers	V+ + 0.3	V
		Receivers	±30	
V _O	Output voltage range	Drivers	V – –0.3	V
		Receivers	–0.3	
D _{OUT}	Short-circuit duration	Continuous		
θ _{JA}	Package thermal impedance ⁽³⁾⁽⁴⁾	D package	73	°C/W
		DW package	57	
		N package	67	
		PW package	108	
T _J	Operating virtual junction temperature		150	°C
T _{stg}	Storage temperature range	–65	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.
- All voltages are with respect to network GND.
- Maximum power dissipation is a function of T_J(max), θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is P_D = (T_J(max) – T_A)/θ_{JA}. Operating at the absolute maximum T_J of 150°C can affect reliability.
- The package thermal impedance is calculated in accordance with JESD 51-7.

Recommended Operating Conditions⁽¹⁾

(see [Figure 4](#))

		MIN	NOM	MAX	UNIT
Supply voltage		4.5	5	5.5	V
V _{IH}	Driver high-level input voltage	D _{IN}	2		V
V _{IL}	Driver low-level input voltage	D _{IN}		0.8	V
V _I	Driver input voltage	D _{IN}	0	5.5	V
	Receiver input voltage		–30	30	
T _A	Operating free-air temperature	MAX202C	0	70	°C
		MAX202I	–40	85	

- Test conditions are C1–C4 = 0.1 μF at V_{CC} = 5 V ± 0.5 V.

Electrical Characteristics⁽¹⁾

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see [Figure 4](#))

PARAMETER	TEST CONDITIONS	MIN	TYP ⁽²⁾	MAX	UNIT	
I _{CC}	Supply current	No load, V _{CC} = 5 V		8	15	mA

- Test conditions are C1–C4 = 0.1 μF at V_{CC} = 5 V ± 0.5 V.
- All typical values are at V_{CC} = 5 V, and T_A = 25°C.

MAX202

5-V DUAL RS-232 LINE DRIVER/RECEIVER WITH ± 15 -kV ESD PROTECTION

SLLS576E–JULY 2003–REVISED APRIL 2007

DRIVER SECTION

Electrical Characteristics⁽¹⁾

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see [Figure 4](#))

PARAMETER		TEST CONDITIONS	MIN	TYP ⁽²⁾	MAX	UNIT
V _{OH}	High-level output voltage	D _{OUT} at R _L = 3 k Ω to GND, D _{IN} = GND	5	9		V
V _{OL}	Low-level output voltage	D _{OUT} at R _L = 3 k Ω to GND, D _{IN} = V _{CC}	–5	–9		V
I _{IH}	High-level input current	V _I = V _{CC}		15	200	μ A
I _{IL}	Low-level input current	V _I at 0 V		–15	–200	μ A
I _{OS} ⁽³⁾	Short-circuit output current	V _{CC} = 5.5 V V _O = 0 V		± 10	± 60	mA
r _O	Output resistance	V _{CC} , V ₊ , and V _– = 0 V V _O = ± 2 V	300			Ω

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

(2) All typical values are at 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.

Switching Characteristics⁽¹⁾

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see [Figure 4](#))

PARAMETER		TEST CONDITIONS	MIN	TYP ⁽²⁾	MAX	UNIT
	Maximum data rate	C _L = 50 to 1000 pF, R _L = 3 k Ω to 7 k Ω , One D _{OUT} switching, See Figure 1	120			kbit/s
t _{PLH(D)}	Propagation delay time, low- to high-level output	C _L = 2500 pF, R _L = 3 k Ω , All drivers loaded, See Figure 1		2		μ s
t _{PHL(D)}	Propagation delay time, high- to low-level output	C _L = 2500 pF, R _L = 3 k Ω , All drivers loaded, See Figure 1		2		μ s
t _{sk(p)}	Pulse skew ⁽³⁾	C _L = 150 to 2500 pF, R _L = 3 k Ω to 7 k Ω , See Figure 2		300		ns
SR(tr)	Slew rate, transition region (see Figure 1)	C _L = 50 to 1000 pF, R _L = 3 k Ω to 7 k Ω , V _{CC} = 5 V	3	6	30	V/ μ s

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

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

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

ESD Protection

PIN	TEST CONDITIONS	TYP	UNIT
D _{OUT} , R _{IN}	Human-body model	± 15	kV

RECEIVER SECTION

Electrical Characteristics⁽¹⁾

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see [Figure 4](#))

PARAMETER		TEST CONDITIONS	MIN	TYP ⁽²⁾	MAX	UNIT
V _{OH}	High-level output voltage	I _{OH} = -1 mA	3.5	V _{CC} - 0.4		V
V _{OL}	Low-level output voltage	I _{OL} = 1.6 mA			0.4	V
V _{IT+}	Positive-going input threshold voltage	V _{CC} = 5 V, T _A = 25°C		1.7	2.4	V
V _{IT-}	Negative-going input threshold voltage	V _{CC} = 5 V, T _A = 25°C	0.8	1.2		V
V _{hys}	Input hysteresis (V _{IT+} - V _{IT-})		0.2	0.5	1	V
r _i	Input resistance	V _I = ± 3 V to ± 25 V	3	5	7	k Ω

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

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

Switching Characteristics⁽¹⁾

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see [Figure 3](#))

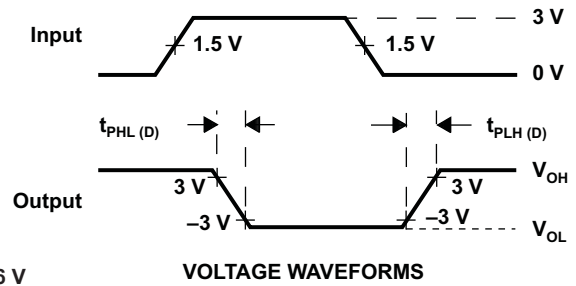
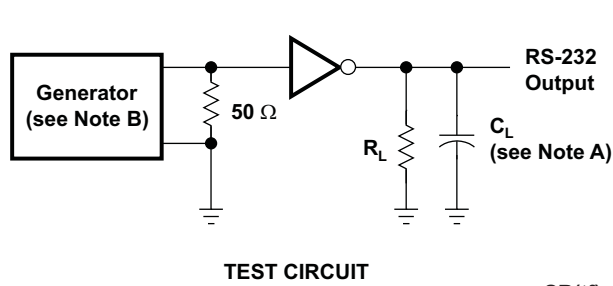
PARAMETER		TEST CONDITIONS	MIN	TYP ⁽²⁾	MAX	UNIT
t _{PLH(R)}	Propagation delay time, low- to high-level output	C _L = 150 pF		0.5	10	μ s
t _{PHL(R)}	Propagation delay time, high- to low-level output	C _L = 150 pF		0.5	10	μ s
t _{sk(p)}	Pulse skew ⁽³⁾			300		ns

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

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

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

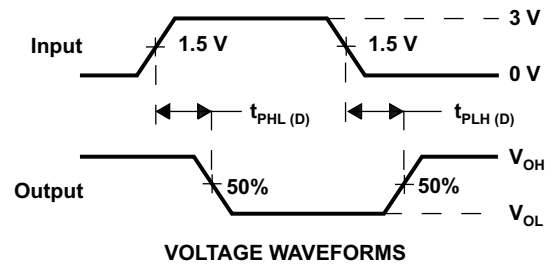
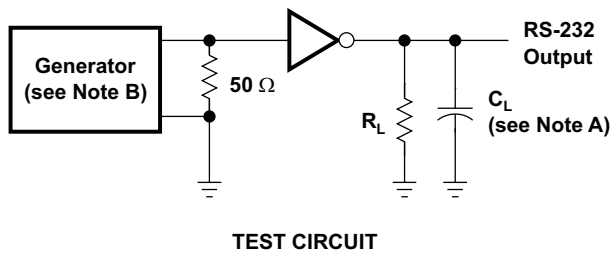
PARAMETER MEASUREMENT INFORMATION



$$SR(tf) = \frac{6\text{ V}}{t_{PHL(D)} \text{ or } t_{PLH(D)}}$$

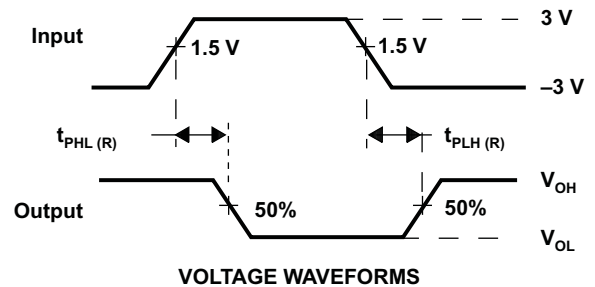
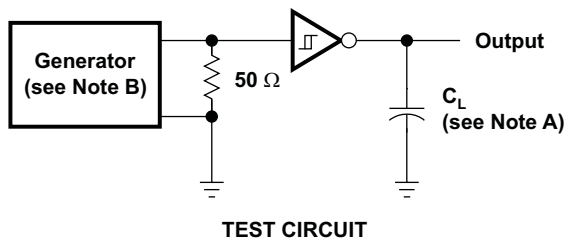
- NOTES: A. C_L includes probe and jig capacitance.
B. The pulse generator has the following characteristics: PRR = 120 kbit/s, $Z_O = 50\ \Omega$, 50% duty cycle, $t_r \leq 10\text{ ns}$, $t_f \leq 10\text{ ns}$.

Figure 1. Driver Slew Rate



- NOTES: A. C_L includes probe and jig capacitance.
B. The pulse generator has the following characteristics: PRR = 120 kbit/s, $Z_O = 50\ \Omega$, 50% duty cycle, $t_r \leq 10\text{ ns}$, $t_f \leq 10\text{ ns}$.

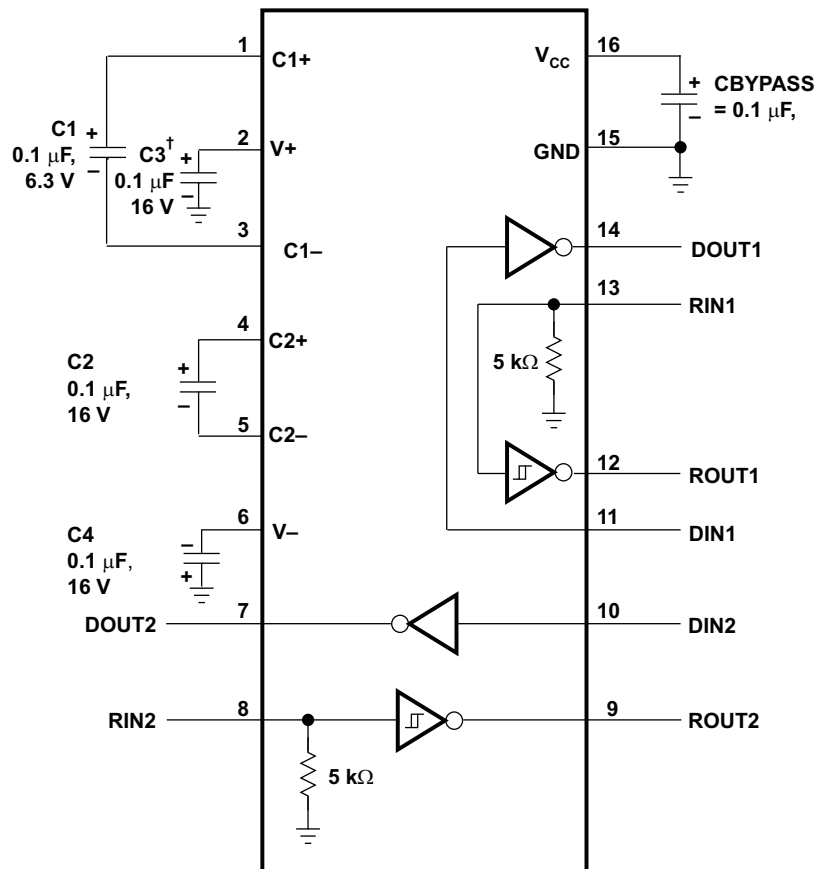
Figure 2. Driver Pulse Skew



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

Figure 3. Receiver Propagation Delay Times

APPLICATION INFORMATION



† 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 4. Typical Operating Circuit and Capacitor Values

Capacitor Selection

The capacitor type used for C1–C4 is not critical for proper operation. The MAX202 requires 0.1- μ F capacitors, although capacitors up to 10 μ F can be used without harm. Ceramic dielectrics are suggested for the 0.1- μ F capacitors. When using the minimum recommended capacitor values, make sure the capacitance value does not degrade excessively as the operating temperature varies. If in doubt, use capacitors with a larger (e.g., 2 \times) nominal value. The capacitors' effective series resistance (ESR), which usually rises at low temperatures, influences the amount of ripple on V+ and V–.

Use larger capacitors (up to 10 μ F) to reduce the output impedance at V+ and V–.

Bypass V_{CC} to ground with at least 0.1 μ F. In applications sensitive to power-supply noise generated by the charge pumps, decouple V_{CC} to ground with a capacitor the same size as (or larger than) the charge-pump capacitors (C1–C4).

ESD Protection

TI MAX202 devices have standard ESD protection structures incorporated on the pins to protect against electrostatic discharges encountered during assembly and handling. In addition, the RS232 bus pins (driver outputs and receiver inputs) of these devices have an extra level of ESD protection. Advanced ESD structures were designed to successfully protect these bus pins against ESD discharge of ± 15 -kV when powered down.

APPLICATION INFORMATION (continued)

ESD Test Conditions

Stringent ESD testing is performed by TI, based on various conditions and procedures. Please contact TI for a reliability report that documents test setup, methodology, and results.

Human-Body Model (HBM)

The HBM of ESD testing is shown in Figure 5. Figure 6 shows the current waveform that is generated during a discharge into a low impedance. The model consists of a 100-pF capacitor, charged to the ESD voltage of concern, and subsequently discharged into the device under test (DUT) through a 1.5-k Ω resistor.

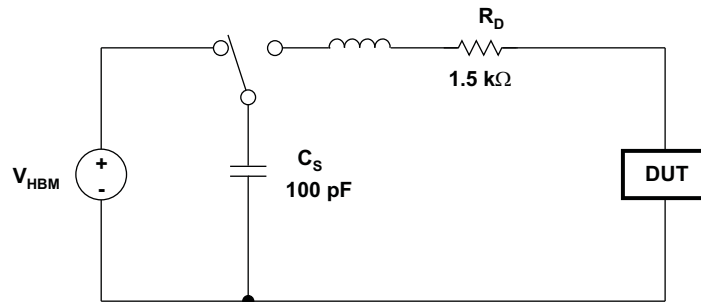


Figure 5. HBM ESD Test Circuit

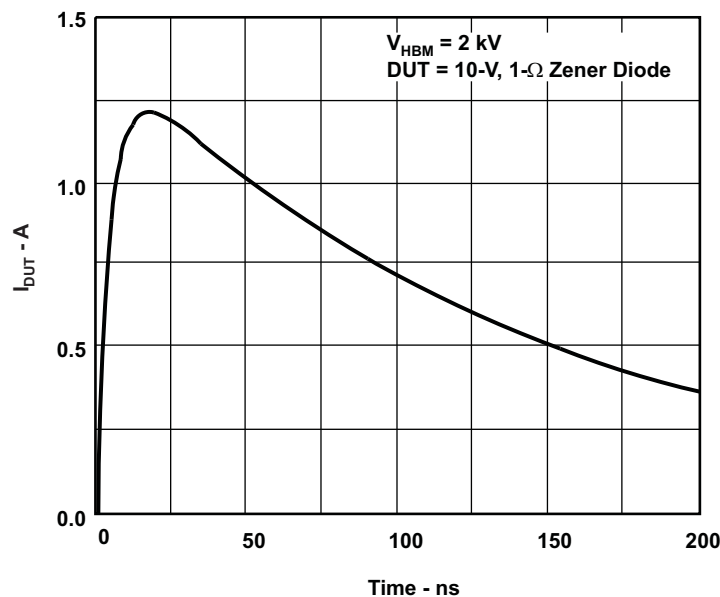


Figure 6. Typical HBM Current Waveform

Machine Model (MM)

The MM ESD test applies to all pins using a 200-pF capacitor with no discharge resistance. The purpose of the MM test is to simulate possible ESD conditions that can occur during the handling and assembly processes of manufacturing. In this case, ESD protection is required for all pins, not just RS-232 pins. However, after PC board assembly, the MM test no longer is as pertinent to the RS-232 pins.

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
MAX202CD	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202CDE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202CDG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202CDR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202CDRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202CDRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202CDW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202CDWE4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202CDWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202CDWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202CDWRE4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202CDWRG4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202CPW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202CPWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202CPWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202CPWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202CPWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202CPWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202ID	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202IDE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202IDG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202IDR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202IDRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202IDRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202IDW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
MAX202IDWE4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202IDWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202IDWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202IDWRE4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202IDWRG4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202IPW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202IPWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202IPWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202IPWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202IPWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX202IPWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

⁽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.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
MAX202CDR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
MAX202CDWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
MAX202CPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
MAX202IDR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
MAX202IDWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
MAX202IPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

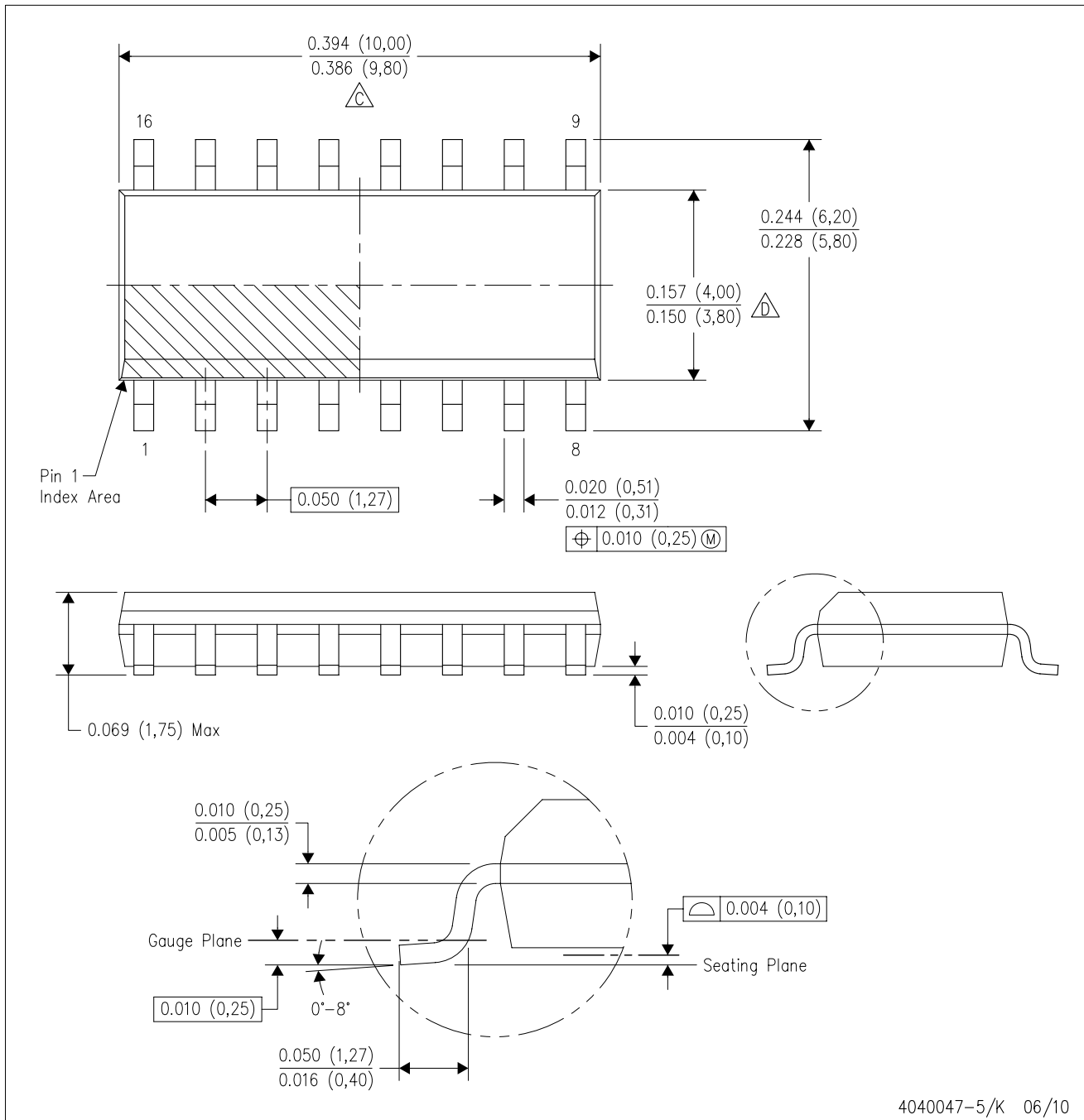
TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
MAX202CDR	SOIC	D	16	2500	333.2	345.9	28.6
MAX202CDWR	SOIC	DW	16	2000	346.0	346.0	33.0
MAX202CPWR	TSSOP	PW	16	2000	346.0	346.0	29.0
MAX202IDR	SOIC	D	16	2500	333.2	345.9	28.6
MAX202IDWR	SOIC	DW	16	2000	346.0	346.0	33.0
MAX202IPWR	TSSOP	PW	16	2000	346.0	346.0	29.0

D (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE

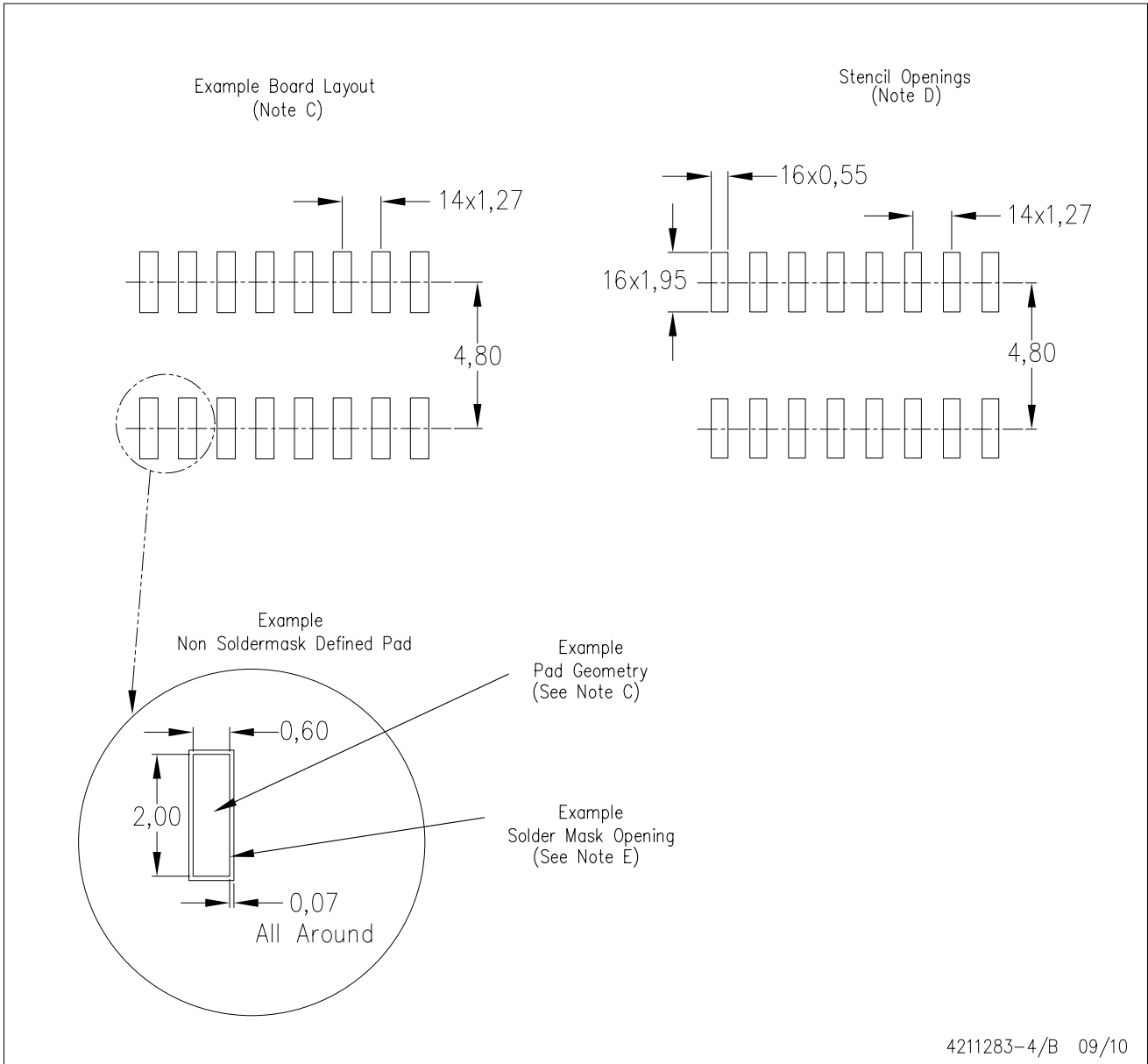


4040047-5/K 06/10

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - 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 .006 (0,15) per end.
 - D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
 - E. Reference JEDEC MS-012 variation AC.

D (R-PDSO-G16)

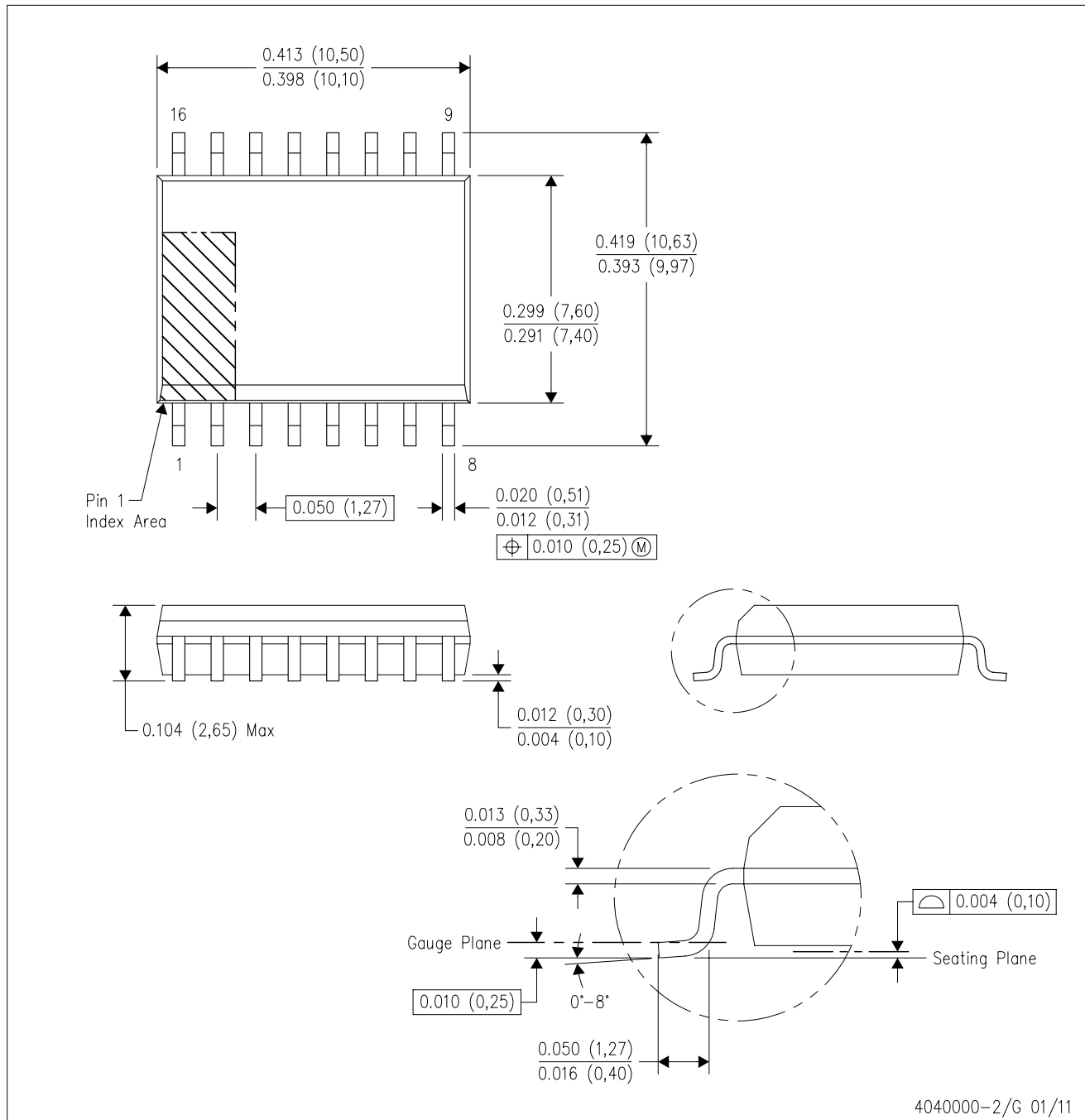
PLASTIC SMALL OUTLINE



- 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.

DW (R-PDSO-G16)

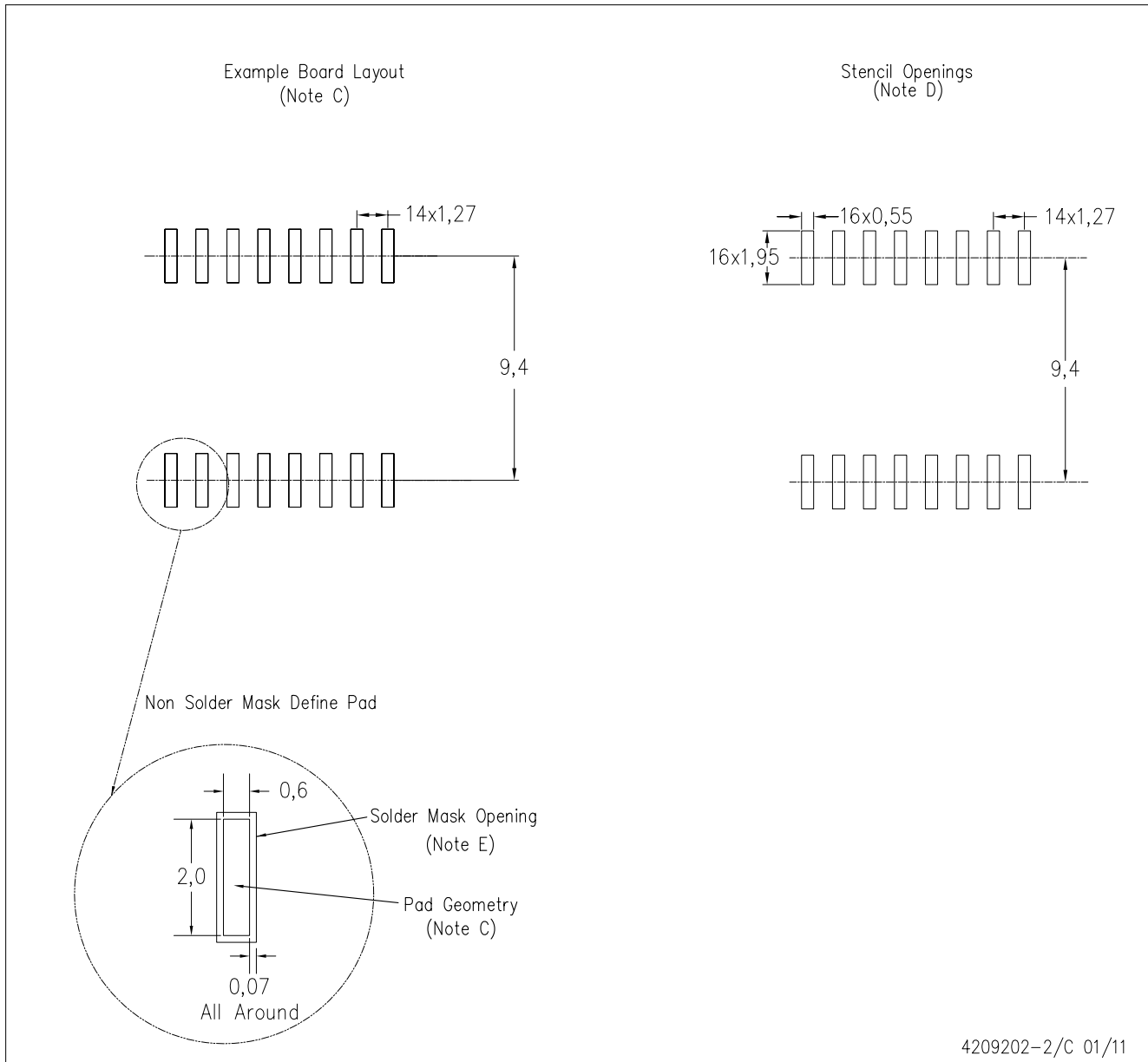
PLASTIC SMALL OUTLINE



- 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:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Refer to IPC7351 for alternate board design.
 - 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
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN

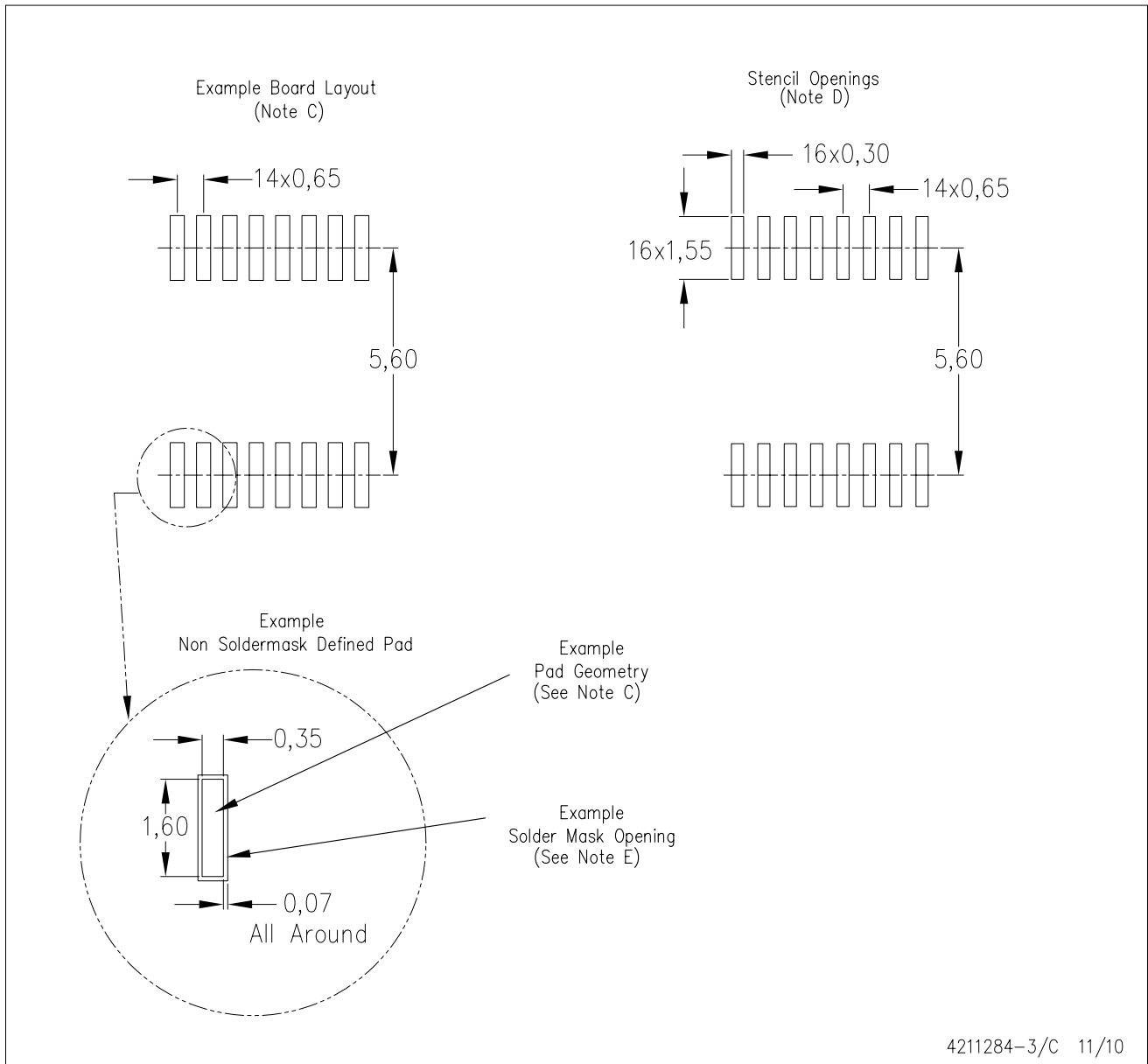


4040064/F 01/97

- 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-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.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
RF/IF and ZigBee® Solutions	www.ti.com/lprf

Applications

Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Transportation and Automotive	www.ti.com/automotive
Video and Imaging	www.ti.com/video
Wireless	www.ti.com/wireless-apps

TI E2E Community Home Page

e2e.ti.com

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2011, Texas Instruments Incorporated