

MAX3221 3-V to 5.5-V Multichannel RS-232 Line Driver/Receiver With ±15-kV ESD Protection

Check for Samples: [MAX3221](#)

FEATURES

- RS-232 Bus-Pin ESD Protection Exceeds ±15 kV Using Human-Body Model (HBM)
- Meets or Exceeds the Requirements of TIA/EIA-232-F and ITU V.28 Standards
- Operates With 3-V to 5.5-V V_{CC} Supply
- Operates Up To 250 kbit/s
- One Driver and One Receiver
- Low Standby Current: 1 μ A Typical
- External Capacitors: 4 x 0.1 μ F
- Accepts 5-V Logic Input With 3.3-V Supply
- Alternative High-Speed Pin-Compatible Device (1 Mbit/s)
 - SNx5C3221
- Auto-Powerdown Feature Automatically Disables Drivers for Power Savings

APPLICATIONS

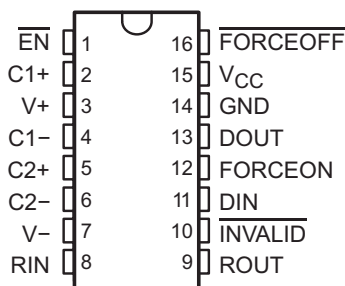
- Battery-Powered, Hand-Held, and Portable Equipment
- PDAs and Palmtop PCs
- Notebooks, Subnotebooks, and Laptops
- Digital Cameras
- Mobile Phones and Wireless Devices

DESCRIPTION

The MAX3221 device consists of one line driver, one line receiver, 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 3-V to 5.5-V supply. These devices operate at data signaling rates up to 250 kbit/s and a maximum of 30-V/ μ s driver output slew rate.

Flexible control options for power management are available when the serial port is inactive. The auto-powerdown feature functions when $\overline{\text{FORCEON}}$ is low and $\overline{\text{FORCEOFF}}$ is high. During this mode of operation, if the device does not sense a valid RS-232 signal on the receiver input, the driver output is disabled. If $\overline{\text{FORCEOFF}}$ is set low and EN is high, both the driver and receiver are shut off, and the supply current is reduced to 1 μ A. Disconnecting the serial port or turning off the peripheral drivers causes the auto-powerdown condition to occur. Auto-powerdown can be disabled when $\overline{\text{FORCEON}}$ and $\overline{\text{FORCEOFF}}$ are high. With auto-powerdown enabled, the device is activated automatically when a valid signal is applied to the receiver input. The $\overline{\text{INVALID}}$ output notifies the user if an RS-232 signal is present at the receiver input. $\overline{\text{INVALID}}$ is high (valid data) if the receiver input voltage is greater than 2.7 V or less than -2.7 V, or has been between -0.3 V and 0.3 V for less than 30 μ s. $\overline{\text{INVALID}}$ is low (invalid data) if the receiver input voltage is between -0.3 V and 0.3 V for more than 30 μ s. Refer to [Figure 5](#) for receiver input levels.

DB OR PW PACKAGE
(TOP VIEW)



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This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

Function Tables

Each Driver⁽¹⁾

INPUTS				OUPUT DOUT	DRIVER STATUS
DIN	FORCEON	FORCEOFF	VALID RIN RS-232 LEVEL		
X	X	L	X	Z	Powered off
L	H	H	X	H	Normal operation with auto-powerdown disabled
H	H	H	X	L	
L	L	H	Yes	H	Normal operation with auto-powerdown enabled
H	L	H	Yes	L	
L	L	H	No	Z	Powered off by auto-powerdown feature
H	L	H	No	Z	

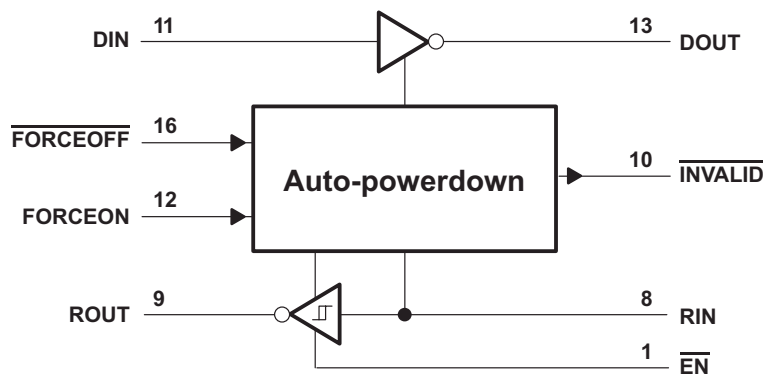
(1) H = high level, L = low level, X = irrelevant, Z = high impedance

Each Receiver⁽¹⁾

INPUTS			VALID RIN RS-232 LEVEL	OUTPUT ROUT
RIN	$\overline{\text{EN}}$			
L	L		X	H
H	L		X	L
X	H		X	Z
Open	L		No	H

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

Logic Diagram (Positive Logic)



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⁾	0.3	-7	V	
V+ – V-	Supply voltage difference ⁽²⁾		13	V	
V _I	Input voltage range	Driver ($\overline{\text{FORCEOFF}}$, FORCEON, $\overline{\text{EN}}$)	-0.3	6	V
		Receiver	-25	25	
V _O	Output voltage range	Driver	-13.2	13.2	V
		Receiver ($\overline{\text{INVALID}}$)	-0.3	V _{CC} + 0.3	
θ_{JA}	Package thermal impedance ⁽³⁾⁽⁴⁾	DB package		82	°C/W
		PW package		108	
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.
- (3) 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.
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.

Recommended Operating Conditions

(see [Figure 6](#))⁽¹⁾

		MIN	NOM	MAX	UNIT	
Supply voltage		V _{CC} = 3.3 V	3	3.3	3.6	V
		V _{CC} = 5 V	4.5	5	5.5	
V _{IH}	Driver high-level input voltage	DIN, $\overline{\text{FORCEOFF}}$, FORCEON, $\overline{\text{EN}}$	V _{CC} = 3.3 V	2		V
			V _{CC} = 5 V	2.4		
V _{IL}	Driver low-level input voltage	DIN, $\overline{\text{FORCEOFF}}$, FORCEON, $\overline{\text{EN}}$		0.8	V	
V _I	Driver input voltage	DIN, $\overline{\text{FORCEOFF}}$, FORCEON, $\overline{\text{EN}}$	0	5.5	V	
	Receiver input voltage		-25	25		
T _A	Operating free-air temperature	MAX3221C	0	70	°C	
		MAX3221I	-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.

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Electrical 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
I_i	Input leakage current	$\overline{\text{FORCEOFF}}$, FORCEON, $\overline{\text{EN}}$			±0.01	±1	μA
I_{CC}	Supply current	No load, $V_{CC} = 3.3 \text{ V}$ to 5 V	No load, $\overline{\text{FORCEOFF}}$ and FORCEON at V_{CC}		0.3	1	mA
			No load, $\overline{\text{FORCEOFF}}$ at GND		1	10	μA
			No load, $\overline{\text{FORCEOFF}}$ at V_{CC} , FORCEON at GND, All RIN are open or grounded		1	10	

(1) Test conditions are C1–C4 = 0.1 μF at $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$; C1 = 0.047 μF, C2–C4 = 0.33 μF 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 $T_A = 25^\circ\text{C}$.

Driver Section

Electrical 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
V_{OH}	High-level output voltage	D_{OUT} at $R_L = 3 \text{ k}\Omega$ to GND, $D_{IN} = \text{GND}$		5	5.4		V
V_{OL}	Low-level output voltage	D_{OUT} at $R_L = 3 \text{ k}\Omega$ 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}	Short-circuit output current ⁽³⁾	$V_{CC} = 3.6 \text{ V}$	$V_O = 0 \text{ V}$		±35	±60	mA
		$V_{CC} = 5.5 \text{ V}$	$V_O = 0 \text{ V}$		±35	±60	
r_O	Output resistance	V_{CC} , V_+ , and $V_- = 0 \text{ V}$		300	10M		Ω
I_{off}	Output leakage current	$\overline{\text{FORCEOFF}} = \text{GND}$	$V_O = \pm 12 \text{ V}$, $V_{CC} = 3 \text{ V}$ to 3.6 V			±25	μA
			$V_O = \pm 12 \text{ V}$, $V_{CC} = 4.5 \text{ V}$ to 5.5 V			±25	

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

(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) 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

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	$C_L = 1000 \text{ pF}$, $R_L = 3 \text{ k}\Omega$, See Figure 1		150	250		kbit/s
$t_{sk(p)}$	Pulse skew ⁽³⁾	$C_L = 150$ to 2500 pF , $R_L = 3 \text{ k}\Omega$ to $7 \text{ k}\Omega$, See Figure 2			100		ns
SR(tr)	Slew rate, transition region (see Figure 1)	$V_{CC} = 3.3 \text{ V}$, $R_L = 3 \text{ k}\Omega$ to $7 \text{ k}\Omega$	$C_L = 150$ to 1000 pF	6		30	V/μs
			$C_L = 150$ to 2500 pF	4		30	

(1) Test conditions are C1–C4 = 0.1 μF at $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$; C1 = 0.047 μF, C2–C4 = 0.33 μF 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.

ESD Protection

TERMINAL		TEST CONDITIONS	TYP	UNIT
NAME	NO			
DOUT	13	HBM	±15	kV

Receiver Section

Electrical 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
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	1.1		V
		V _{CC} = 5 V	0.8	1.4		
V _{hys}	Input hysteresis (V _{IT+} - V _{IT-})			0.5		V
I _{off}	Output leakage current	FORCEOFF = 0 V		±0.05	±10	µA
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.

Switching Characteristics

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)⁽¹⁾ (see [Figure 3](#))

PARAMETER		TEST CONDITIONS	MIN	TYP ⁽²⁾	MAX	UNIT
t _{PLH}	Propagation delay time, low- to high-level output	C _L = 150 pF, See Figure 3		150		ns
t _{PHL}	Propagation delay time, high- to low-level output	C _L = 150 pF, See Figure 3		150		ns
t _{en}	Output enable time	C _L = 150 pF, R _L = 3kΩ, See Figure 4		200		ns
t _{dis}	Output disable time	C _L = 150 pF, R _L = 3kΩ, See Figure 4		200		ns
t _{sk(p)}	Pulse skew ⁽³⁾	See Figure 3		50		ns

(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.

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

ESD Protection

TERMINAL		TEST CONDITIONS	TYP	UNIT
NAME	NO			
RIN	13	HBM	±15	kV

Auto-Powerdown Section

Electrical Characteristics

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)⁽¹⁾ (see [Figure 5](#))

PARAMETER		TEST CONDITIONS	MIN	MAX	UNIT
$V_{T+(valid)}$	Receiver input threshold for $\overline{INVALID}$ high-level output voltage	$\overline{FORCEON} = GND,$ $\overline{FORCEOFF} = V_{CC}$		2.7	V
$V_{T-(valid)}$	Receiver input threshold for $\overline{INVALID}$ high-level output voltage	$\overline{FORCEON} = GND,$ $\overline{FORCEOFF} = V_{CC}$	-2.7		V
$V_{T(invalid)}$	Receiver input threshold for $\overline{INVALID}$ low-level output voltage	$\overline{FORCEON} = GND,$ $\overline{FORCEOFF} = V_{CC}$	-0.3	0.3	V
V_{OH}	$\overline{INVALID}$ high-level output voltage	$I_{OH} = -1\text{ mA},$ $\overline{FORCEON} = GND,$ $\overline{FORCEOFF} = V_{CC}$	$V_{CC} - 0.6$		V
V_{OL}	$\overline{INVALID}$ low-level output voltage	$I_{OH} = -1\text{ mA},$ $\overline{FORCEON} = GND,$ $\overline{FORCEOFF} = V_{CC}$		0.4	V

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

Switching Characteristics

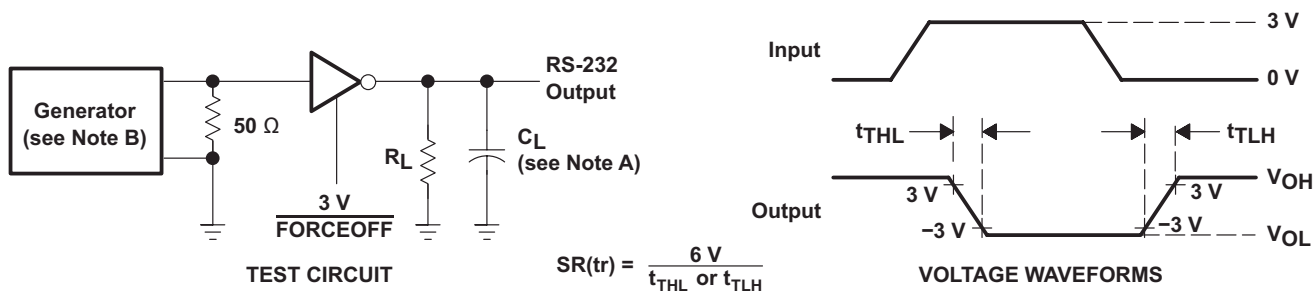
over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)⁽¹⁾ (see [Figure 5](#))

PARAMETER		MIN	TYP ⁽²⁾	MAX	UNIT
t_{valid}	Propagation delay time, low- to high-level output		1		μs
$t_{invalid}$	Propagation delay time, high- to low-level output		30		μs
t_{en}	Supply enable time		100		μs

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

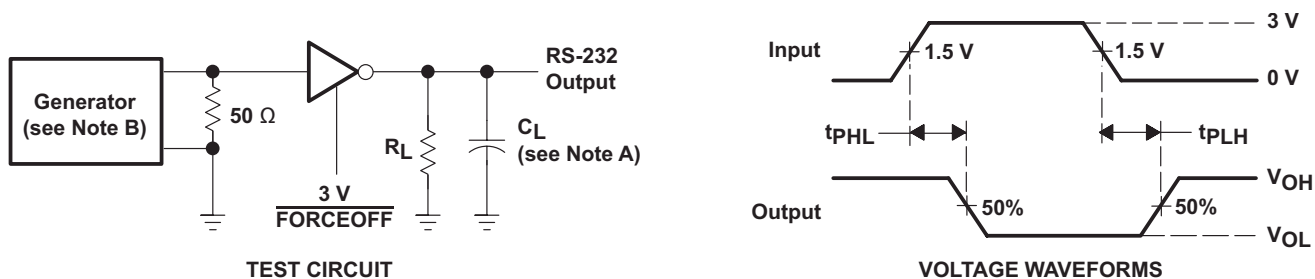
(2) All typical values are at $V_{CC} = 3.3\text{ V}$ or $V_{CC} = 5\text{ V}$, and $T_A = 25^\circ\text{C}$.

Parameter Measurement Information



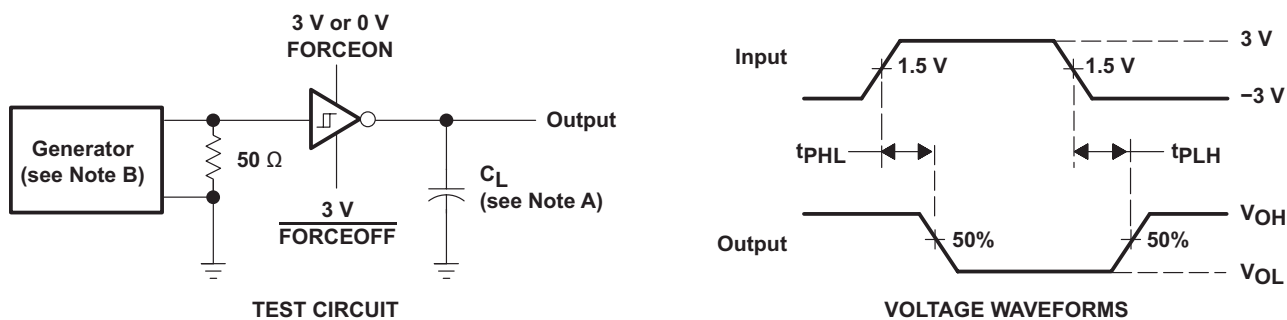
- A. C_L includes probe and jig capacitance.
- B. The pulse generator has the following characteristics: PRR = 250 kbit/s, Z_O = 50 Ω, 50% duty cycle, t_r ≤ 10 ns, t_f ≤ 10 ns.

Figure 1. Driver Slew Rate



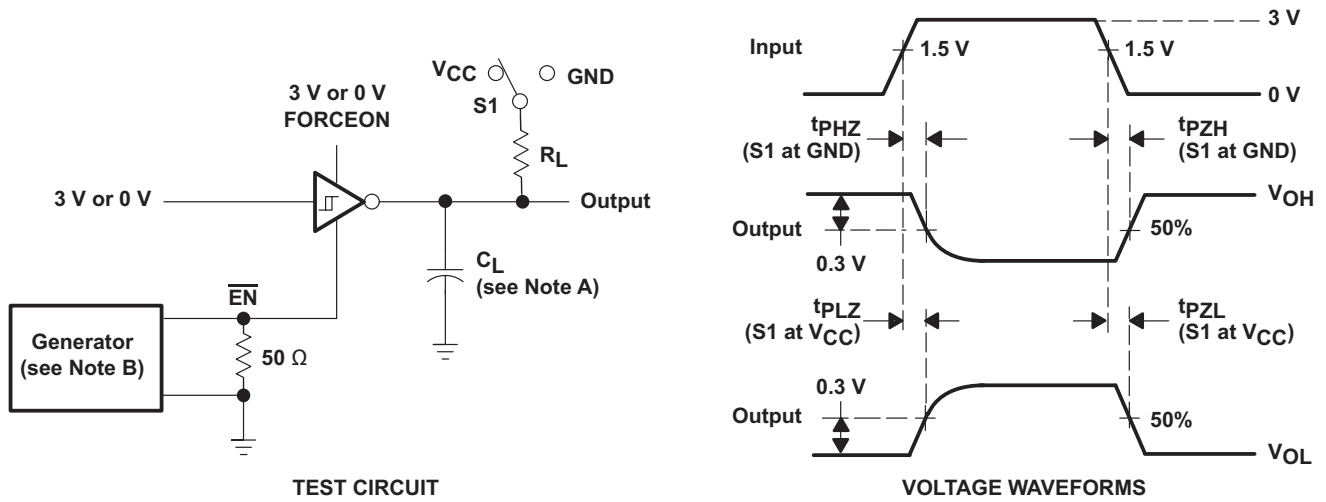
- A. C_L includes probe and jig capacitance.
- B. The pulse generator has the following characteristics: PRR = 250 kbit/s, Z_O = 50 Ω, 50% duty cycle, t_r ≤ 10 ns, t_f ≤ 10 ns.

Figure 2. Driver Pulse Skew



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

Figure 3. Receiver Propagation Delay Times

Parameter Measurement Information (continued)


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

Figure 4. Receiver Enable and Disable Times

Parameter Measurement Information (continued)

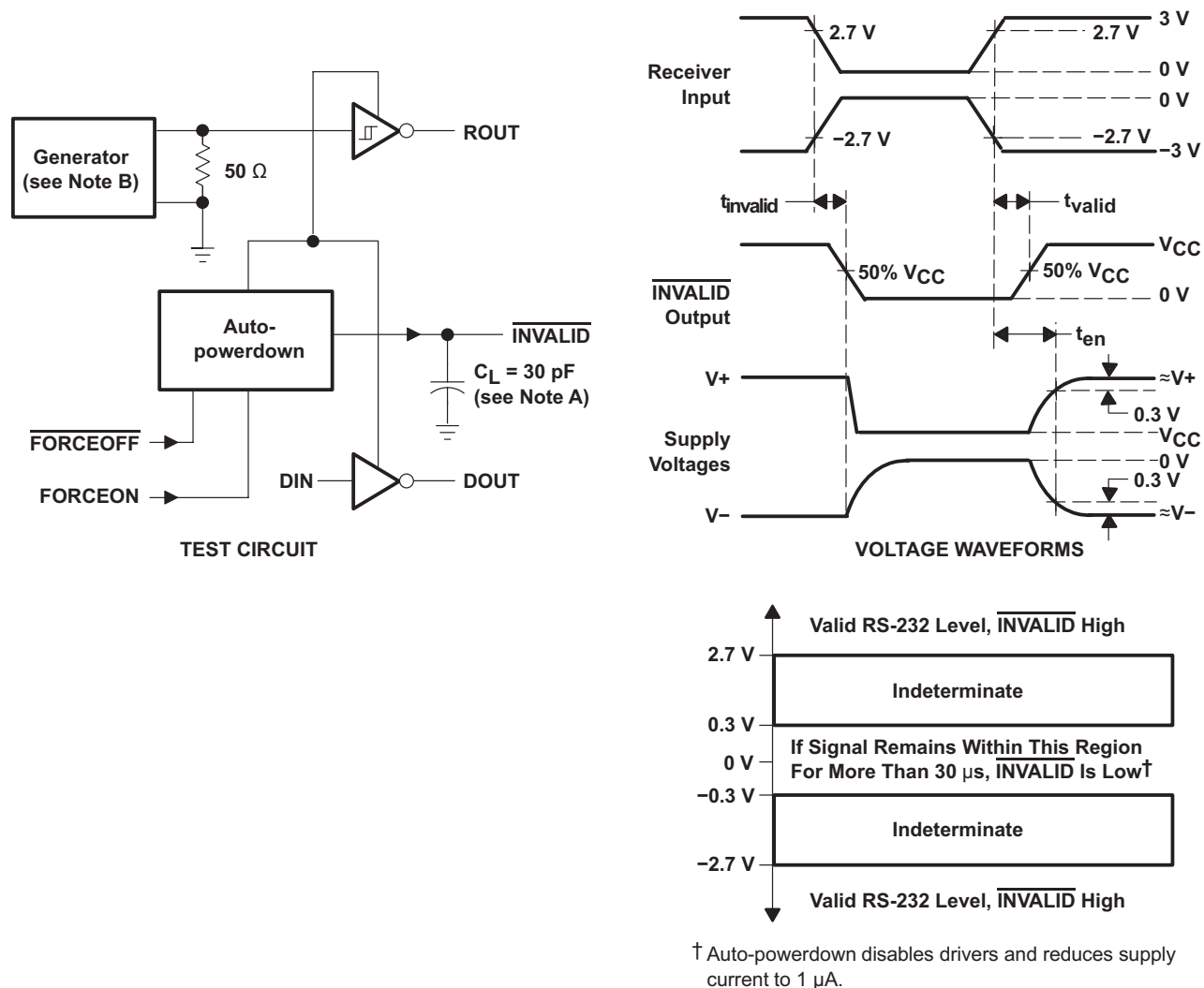
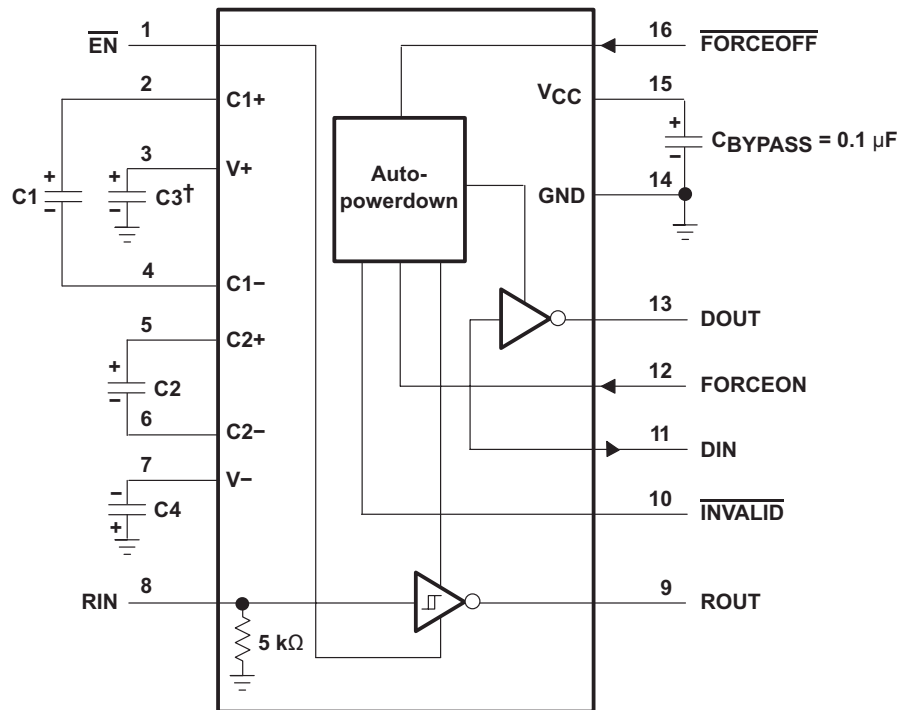


Figure 5. $\overline{\text{INVALID}}$ Propagation Delay Times and Driver Enabling Time

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.

 V_{CC} vs CAPACITOR VALUES

V_{CC}	C1	C2, C3, and C4
3.3 V \pm 0.3 V	0.1 μ F	0.1 μ F
5 V \pm 0.5 V	0.047 μ F	0.33 μ F
3 V to 5.5 V	0.1 μ F	0.47 μ F

Figure 6. Typical Operating Circuit and Capacitor Values

REVISION HISTORY

Changes from Revision M (March 2004) to Revision N	Page
• Updated document to new TI data sheet format - no specification changes.	1
• Deleted Ordering Information table.	1
• Added ESD warning.	2

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
MAX3221CDB	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3221C	Samples
MAX3221CDBE4	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3221C	Samples
MAX3221CDBG4	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3221C	Samples
MAX3221CDBR	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3221C	Samples
MAX3221CDBRG4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3221C	Samples
MAX3221CPW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3221C	Samples
MAX3221CPWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3221C	Samples
MAX3221CPWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3221C	Samples
MAX3221CPWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3221C	Samples
MAX3221CPWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3221C	Samples
MAX3221CPWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	MA3221C	Samples
MAX3221IDB	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3221I	Samples
MAX3221IDBE4	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3221I	Samples
MAX3221IDBG4	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3221I	Samples
MAX3221IDBR	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3221I	Samples
MAX3221IDBRE4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3221I	Samples
MAX3221IDBRG4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3221I	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
MAX3221IPW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3221I	Samples
MAX3221IPWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3221I	Samples
MAX3221IPWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3221I	Samples
MAX3221IPWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU CU SN	Level-1-260C-UNLIM	-40 to 85	MB3221I	Samples
MAX3221IPWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3221I	Samples
MAX3221IPWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	MB3221I	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.

OBSELETE: 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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OTHER QUALIFIED VERSIONS OF MAX3221 :

- Enhanced Product: [MAX3221-EP](#)

NOTE: Qualified Version Definitions:

- Enhanced Product - Supports Defense, Aerospace and Medical Applications

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
MAX3221CDBR	SSOP	DB	16	2000	330.0	16.4	8.2	6.6	2.5	12.0	16.0	Q1
MAX3221CPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
MAX3221IDBR	SSOP	DB	16	2000	330.0	16.4	8.2	6.6	2.5	12.0	16.0	Q1
MAX3221IPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
MAX3221IPWR	TSSOP	PW	16	2000	330.0	12.4	7.0	5.6	1.6	8.0	12.0	Q1
MAX3221IPWRG4	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS

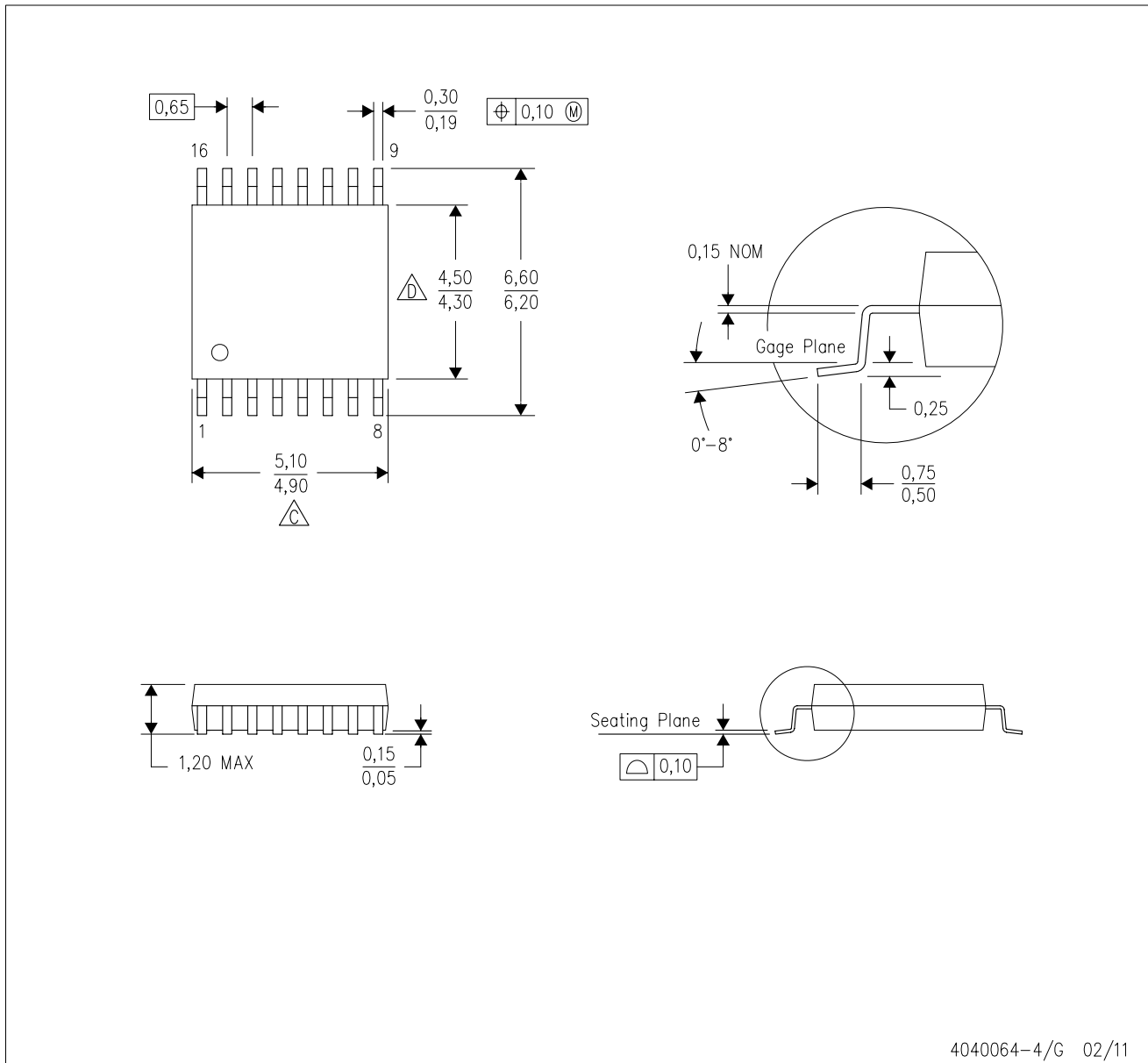

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
MAX3221CDBR	SSOP	DB	16	2000	367.0	367.0	38.0
MAX3221CPWR	TSSOP	PW	16	2000	367.0	367.0	35.0
MAX3221IDBR	SSOP	DB	16	2000	367.0	367.0	38.0
MAX3221IPWR	TSSOP	PW	16	2000	367.0	367.0	35.0
MAX3221IPWR	TSSOP	PW	16	2000	364.0	364.0	27.0
MAX3221IPWRG4	TSSOP	PW	16	2000	367.0	367.0	35.0

MECHANICAL DATA

PW (R-PDSO-G16)

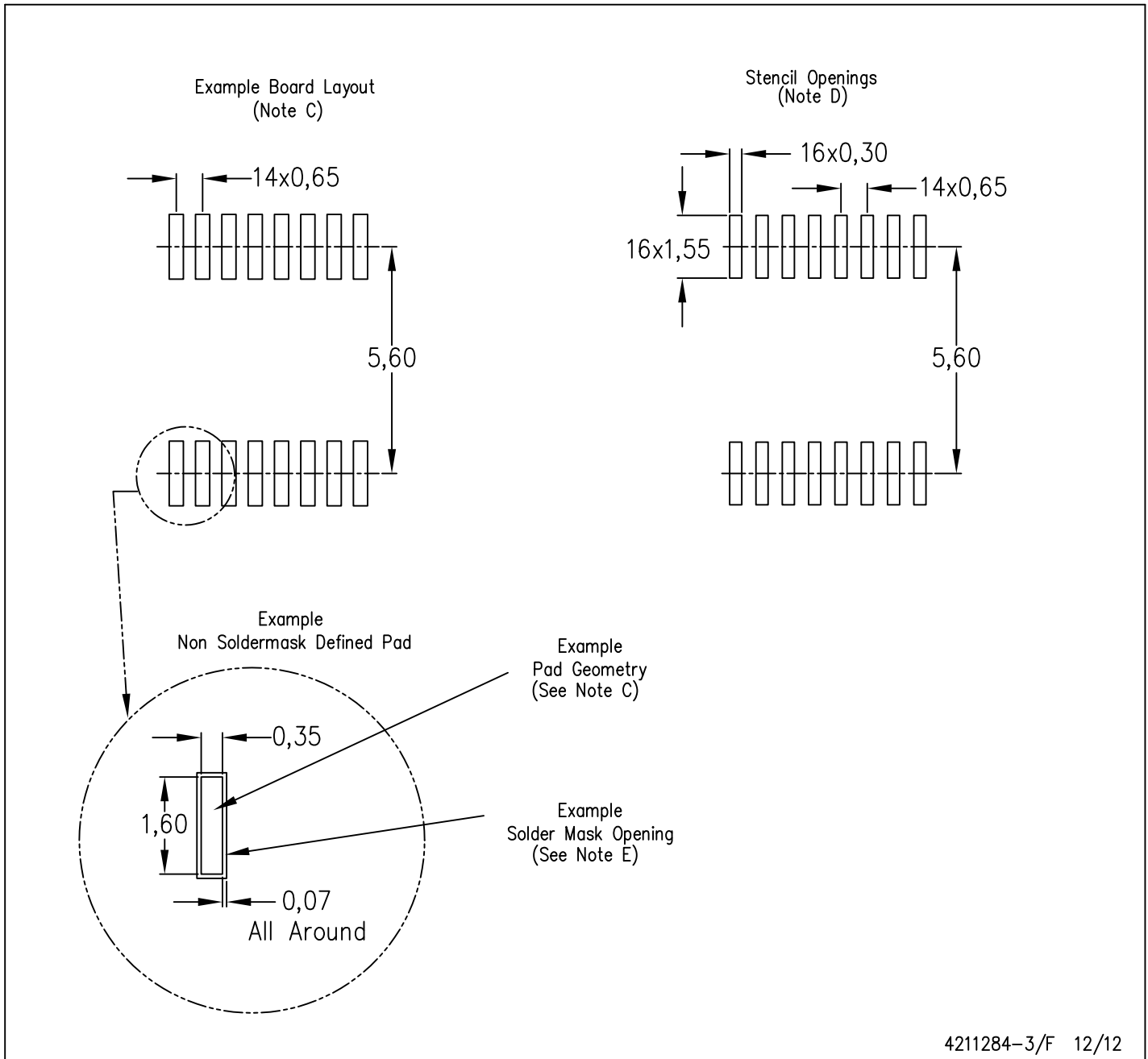
PLASTIC SMALL OUTLINE



- 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

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