MAX3221E 3-V TO 5.5-V SINGLE-CHANNEL RS-232 LINE DRIVER/RECEIVER WITH 15-kV IEC ESD PROTECTION

SLLS686A-OCTOBER 2005-REVISED MAY 2006

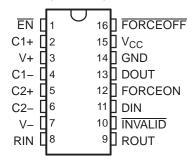
FEATURES

- ESD Protection for RS-232 Pins
 - ±15 kV Human-Body Model (HBM)
 - ±8 kV (IEC 61000-4-2, Contact Discharge)
 - ±15 kV (IEC 61000-4-2, Air-Gap Discharge)
- 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 μA Typ
- External Capacitors . . . 4 × 0.1 μF
- Accepts 5-V Logic Input With 3.3-V Supply
- Alternative High-Speed Pin-Compatible Device (1 Mbit/s)
 - SN75C3221E and SN65C3221E
- 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

DB OR PW PACKAGE (TOP VIEW)



DESCRIPTION/ORDERING INFORMATION

The MAX3221E is a single driver, single receiver RS-232 solution operating from a single V_{CC} supply. The RS-232 pins provide IEC G1000-4-2 ESD Protection. 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 FORCEON is low and $\overline{FORCEOFF}$ 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 $\overline{FORCEOFF}$ is set low and \overline{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 FORCEON and $\overline{FORCEOFF}$ are high. With auto-powerdown enabled, the device is activated automatically when a valid signal is applied to the receiver input. The $\overline{INVALID}$ output notifies the user if an RS-232 signal is present at the receiver input. $\overline{INVALID}$ 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. $\overline{INVALID}$ 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.



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3-V TO 5.5-V SINGLE-CHANNEL RS-232 LINE DRIVER/RECEIVER WITH 15-kV IEC ESD PROTECTION





ORDERING INFORMATION

T _A	PACKA	PACKAGE ⁽¹⁾ ORDERABLE PART NUMBER		TOP-SIDE MARKING	
	SSOP – DB	Tube of 80	MAX3221ECDB	MP221EC	
−0°C to 70°C	330F - DB	Reel of 2000	MAX3221ECDBR	IMF221EC	
	TSSOP – PW	Tube of 90	MAX3221ECPW	MD224EC	
	1330P – PW	Reel of 2000	MAX3221ECPWR	MP221EC	
	2000 00	Tube of 80	MAX3221EIDB	MP221EI	
-40°C to 85°C	SSOP – DB	Reel of 2000	MAX3221EIDBR	MP221EI	
-40 C to 65 C	TCCOD DW	Tube of 90	MAX3221EIPW	MP221EI	
	TSSOP – PW Reel of 2000		MAX3221EIPWR	WF2ZTEI	

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

FUNCTION TABLES

EACH DRIVER(1)

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

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

EACH RECEIVER(1)

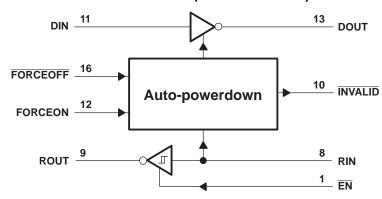
	INPUTS		OUTPUT
RIN	EN	VALID RIN RS-232 LEVEL	ROUT
L	L	X	Н
Н	L	X	L
X	Н	X	Z
Open	L	No	Н

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

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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)			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	Input voltage range	DIN, FORCEOFF, FORCEON, EN	-0.3	6	V
VI	Input voltage range	RIN	-25	25	V
V	Output valtage range	DOUT	-13.2	13.2	V
Vo	Output voltage range	ROUT, ĪNVALID	-0.3	V _{CC} + 0.3	V
0	Deckage thermal impedance (3)(4)	DB package		82	°C/W
θ_{JA}	Package thermal impedance (3) (4) PW package			108	C/VV
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.

Recommended Operating Conditions⁽¹⁾

See Figure 6

				MIN	NOM	MAX	UNIT
	Supply voltage		V _{CC} = 3.3 V	3	3.3	3.6	V
			V _{CC} = 5 V	4.5	5	5.5	V
V _{IH}	Driver and control high-level input voltage	DIN, FORCEOFF, FORCEON, EN	$V_{CC} = 3.3 \text{ V}$	2			V
VIH	Driver and control high-level input voltage		$V_{CC} = 5 V$	2.4			V
V_{IL}	Driver and control low-level input voltage	DIN, FORCEOFF, FORCEON, EN				0.8	V
V_{I}	Driver and control input voltage	DIN, FORCEOFF, FORCEON		0		5.5	V
V_{I}	V _I Receiver input voltage			-25		25	V
т	Operating free air temperature	MAX3221EC		0		70	°C
T _A	Operating free-air temperature	MAX3221EI		-40		85	C

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

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 $P_D = (T_J(max) - T_A)/\theta_{JA}$. 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.

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Electrical Characteristics (1)

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

	PARAMETE	ER .	TEST CONDITIONS		MIN	TYP ⁽²⁾	MAX	UNIT
I	Input leakage current	FORCEOFF, FORCEON, EN				±0.01	±1	μΑ
		Auto-powerdown disabled		No load, FORCEOFF and FORCEON at V _{CC}		0.3	1	mA
I _{CC}	Supply current	Powered off	$V_{CC} = 3.3 \text{ V or 5 V},$ $T_A = 25^{\circ}\text{C}$	No load, FORCEOFF at GND		1	10	
		Auto-powerdown enabled		No load, FORCEOFF at V _{CC} , FORCEON at GND, All RIN are open or grounded		1	10	μΑ

Test conditions are C1–C4 = 0.1 μ F at V_{CC} = 3.3 V \pm 0.3 V; C1 = 0.047 μ F, C2–C4 = 0.33 μ F at V_{CC} = 5 V \pm 0.5 V. All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

Driver Section Electrical Characteristics(1)

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

	PARAMETER	TEST	CONDITIONS		MIN	TYP ⁽²⁾	MAX	UNIT
V_{OH}	High-level output voltage	DOUT at $R_L = 3 \text{ k}\Omega$ to GND,	DIN = GND		5	5.4		V
V_{OL}	Low-level output voltage	DOUT at $R_L = 3 \text{ k}\Omega$ to GND,	$DIN = V_{CC}$		- 5	-5.4		V
I _{IH}	High-level input current	$V_I = V_{CC}$				±0.01	±1	μΑ
I _{IL}	Low-level input current	V _I = GND				±0.01	±1	μΑ
	Short-circuit	$V_{CC} = 3.6 \text{ V},$	$V_O = 0 V$			±35	±60	mA
Ios	output current ⁽³⁾	$V_{CC} = 5.5 \text{ V},$	$V_O = 0 V$			±35	±60	ША
r _o	Output resistance	V_{CC} , V+, and V- = 0 V,	V _O = ±2 V		300	10M		Ω
	Output lookage ourrent	FORCEOFF = GND	$V_0 = \pm 12 \text{ V},$	V _{CC} = 3 V to 3.6 V			±25	^
I _{off}	Output leakage current	FURGEOFF = GND	$V_{O} = \pm 10 \text{ V},$	V _{CC} = 4.5 V to 5.5 V			±25	μА

Test conditions are C1–C4 = 0.1 μ F at V_{CC} = 3.3 V \pm 0.3 V; C1 = 0.047 μ F, C2–C4 = 0.33 μ F at V_{CC} = 5 V \pm 0.5 V. All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

Driver Section Switching Characteristics(1)

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

	PARAMETER	TE	ST CONDITIONS		MIN	TYP ⁽²⁾	MAX	UNIT
	Maximum data rate	C _L = 1000 pF,	$R_L = 3 k\Omega$,	See Figure 1	150	250		kbit/s
t _{sk(p)}	Pulse skew ⁽³⁾	$C_L = 150 \text{ pF to } 2500 \text{ pF},$	$R_L = 3 \text{ k}\Omega \text{ to } 7 \text{ k}\Omega,$	See Figure 2		100		ns
	Slew rate,	V _{CC} = 3.3 V,	C _L = 150 pF to 1000	pF	6		30	
SR(tr)	transition region (see Figure 1)	$R_L = 3 \text{ k}\Omega \text{ to } 7 \text{ k}\Omega$	C _L = 150 pF to 2500	pF	4		30	V/μs

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

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.

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Receiver Section Electrical Characteristics⁽¹⁾

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

	PARAMETER	TEST CONDITIONS	MIN	TYP ⁽²⁾	MAX	UNIT
V_{OH}	High-level output voltage	$I_{OH} = -1 \text{ mA}$	V _{CC} - 0.6	V _{CC} – 0.1		V
V_{OL}	Low-level output voltage	I _{OL} = 1.6 mA			0.4	V
\ <u>\</u>	/ _{IT+} Positive-going input threshold voltage	V _{CC} = 3.3 V		1.6	2.4	V
VIT+	Fositive-going input timeshold voltage	V _{CC} = 5 V		1.9	2.4	V
\ <u>\</u>	Negative-going input threshold voltage	V _{CC} = 3.3 V	0.6	1.1		V
V _{IT}	Negative-going input tilleshold voltage	$V_{CC} = 5 V$	0.8	1.4		V
V_{hys}	Input hysteresis (V _{IT+} - V _{IT-})			0.5		V
I _{off}	Output leakage current	$\overline{EN} = V_{CC}$		±0.05	±10	μΑ
r _i	Input resistance	$V_I = \pm 3 \text{ V to } \pm 25 \text{ V}$	3	5	7	kΩ

⁽¹⁾ Test conditions are C1–C4 = 0.1 μ F at V_{CC} = 3.3 V \pm 0.3 V; C1 = 0.047 μ F, C2–C4 = 0.33 μ F at V_{CC} = 5 V \pm 0.5 V. (2) All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

Receiver Section Switching Characteristics⁽¹⁾

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

	PARAMETER	TEST CONDITIONS	TYP ⁽²⁾	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 = 3 k Ω , See Figure 4	200	ns
t _{dis}	Output disable time	C_L = 150 pF, R_L = 3 k Ω , See Figure 4	200	ns
t _{sk(p)}	Pulse skew ⁽³⁾	See Figure 3	50	ns

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

NAME	TEST CONDITIONS	TYP	UNIT
	НВМ	±15	
R _{IN} /D _{OUT}	IEC G1000-4-2 Contact Discharge	±8	kV
	IEC G1000-4-2 Air-Gap Discharge	±15	

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Auto-Powerdown Section Electrical Characteristics

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

	PARAMETER	TEST CONDITIONS	MIN	MAX	UNIT
V _{T+(valid)}	Receiver input threshold for INVALID high-level output voltage	FORCEON = GND, $\overline{\text{FORCEOFF}} = V_{CC}$		2.7	V
V _{T-(valid)}	Receiver input threshold for INVALID high-level output voltage	FORCEON = GND, $\overline{\text{FORCEOFF}} = V_{CC}$	-2.7		V
V _{T(invalid)}	Receiver input threshold for INVALID low-level output voltage	FORCEON = GND, $\overline{\text{FORCEOFF}} = V_{CC}$	-0.3	0.3	V
V _{OH}	INVALID high-level output voltage	I _{OH} = -1 mA, FORCEON = GND, FORCEOFF = V _{CC}	V _{CC} - 0.6		V
V _{OL}	INVALID low-level output voltage	I _{OL} = 1.6 mA, FORCEON = GND, FORCEOFF = V _{CC}		0.4	V

Auto-Powerdown Section Switching Characteristics

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

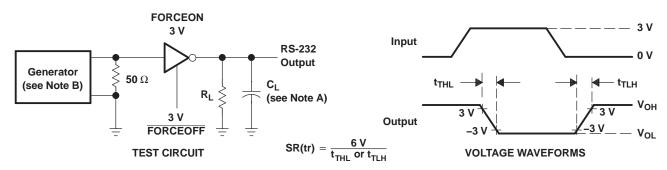
	PARAMETER	TYP ⁽¹⁾	UNIT
t _{valid}	Propagation delay time, low- to high-level output	1	μs
t _{invalid}	Propagation delay time, high- to low-level output	30	μs
t _{en}	Supply enable time	100	μs

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

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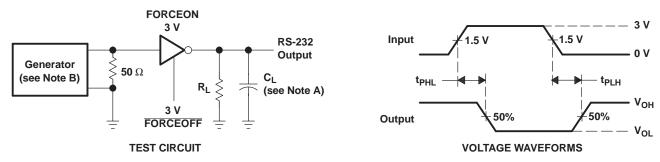
PARAMETER MEASUREMENT INFORMATION



NOTES: A. C_I includes probe and jig capacitance.

B. The pulse generator has the following characteristics: PRR = 250 kbit/s, $Z_O = 50 \Omega$, 50% duty cycle, $t_f \le 10$ ns, $t_f \le 10$ ns.

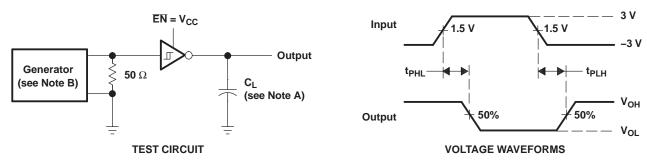
Figure 1. Driver Slew Rate



NOTES: 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, $t_f \le 10$ ns, $t_f \le 10$ ns.

Figure 2. Driver Pulse Skew



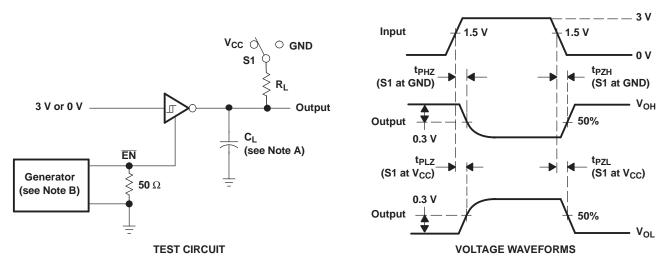
NOTES: A. C_L includes probe and jig capacitance.

B. The pulse generator has the following characteristics: $Z_O = 50 \ \Omega$, 50% duty cycle, $t_f \le 10 \ ns$, $t_f \le 10 \ ns$.

Figure 3. Receiver Propagation Delay Times



PARAMETER MEASUREMENT INFORMATION



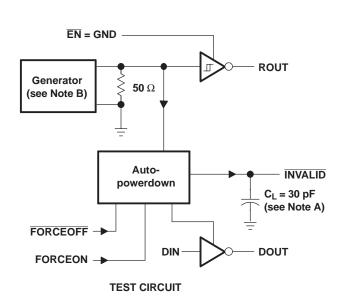
NOTES: A. C_L includes probe and jig capacitance.

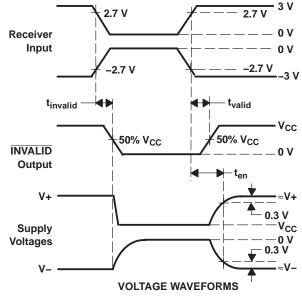
- B. The pulse generator has the following characteristics: $Z_0 = 50 \Omega$, 50% duty cycle, $t_r \le 10$ ns. $t_f \le 10$ ns.
- C. t_{PLZ} and t_{PHZ} are the same as t_{dis} .
- D. t_{PZL} and t_{PZH} are the same as t_{en} .

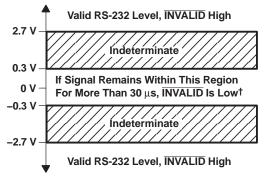
Figure 4. Receiver Enable and Disable Times

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PARAMETER MEASUREMENT INFORMATION







 $^{^\}dagger$ Auto-powerdown disables drivers and reduces supply current to 1 μ A.

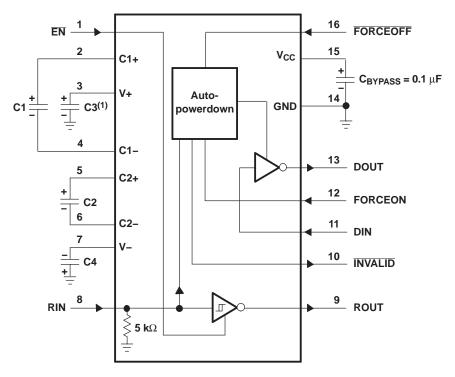
NOTES: A. C_L includes probe and jig capacitance.

B. The pulse generator has the following characteristics: PRR = 5 kbit/s, $Z_O = 50 \Omega$, 50% duty cycle, $t_r \le 10$ ns. $t_f \le 10$ ns.

Figure 5. INVALID Propagation Delay Times and Driver Enabling Time



APPLICATION INFORMATION



- (1) 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
$\begin{array}{c} 3.3 \text{ V} \pm 0.3 \text{ V} \\ 5 \text{ V} \pm 0.5 \text{ V} \\ 3 \text{ V to } 5.5 \text{ V} \end{array}$	0.1 μF 0.047 μF 0.1 μF	0.1 μF 0.33 μF 0.47 μF

Figure 6. Typical Operating Circuit and Capacitor Values







PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	e Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
MAX3221ECDB	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3221ECDBG4	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3221ECDBR	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3221ECDBRG4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3221ECPW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3221ECPWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3221ECPWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3221ECPWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3221ECPWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3221ECPWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3221EIDB	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3221EIDBG4	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3221EIDBR	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3221EIDBRG4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3221EIPW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3221EIPWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3221EIPWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3221EIPWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3221EIPWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3221EIPWRG4	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.



PACKAGE OPTION ADDENDUM

28-May-2007

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.

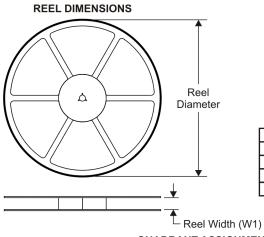
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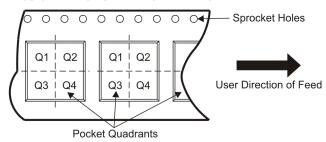
TAPE AND REEL INFORMATION





	Dimension designed to accommodate the component width
В0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device		Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
MAX3221ECDBR	SSOP	DB	16	2000	330.0	16.4	8.2	6.6	2.5	12.0	16.0	Q1
MAX3221ECPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
MAX3221EIDBR	SSOP	DB	16	2000	330.0	16.4	8.2	6.6	2.5	12.0	16.0	Q1
MAX3221EIPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

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*All dimensions are nominal

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Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
MAX3221ECDBR	SSOP	DB	16	2000	346.0	346.0	33.0
MAX3221ECPWR	TSSOP	PW	16	2000	346.0	346.0	29.0
MAX3221EIDBR	SSOP	DB	16	2000	346.0	346.0	33.0
MAX3221EIPWR	TSSOP	PW	16	2000	346.0	346.0	29.0

PW (R-PDSO-G16)

PLASTIC SMALL OUTLINE



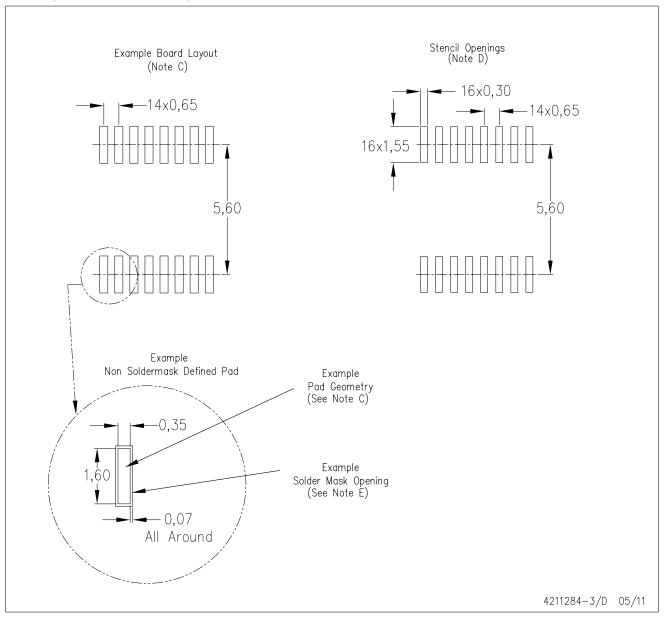
NOTES:

- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M—1994.
- B. This drawing is subject to change without notice.
- Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
- 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:

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



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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