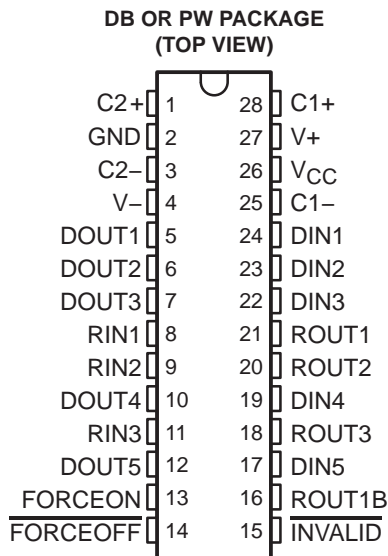


MAX3238

3-V TO 5.5-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER WITH ± 15 -kV ESD (HBM) PROTECTION

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- **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**
- **Five Drivers and Three Receivers**
- **Low Standby Current . . . 1 μ A Typical**
- **External Capacitors . . . $4 \times 0.1 \mu$ F**
- **Accepts 5-V Logic Input With 3.3-V Supply**
- **Always-Active Noninverting Receiver Output (ROUT1B)**
- **Alternative High-Speed Pin-Compatible Device (1 Mbit/s)**
 - SNx5C3238
- **Applications**
 - Battery-Powered Systems, PDAs, Notebooks, Subnotebooks, Laptops, Palmtop PCs, Hand-Held Equipment, Modems, and Printers



description/ordering information

The MAX3238 consists of five line drivers, three line receivers, and a dual charge-pump circuit with ± 15 -kV ESD (HBM) 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 notebook and subnotebook computer applications. The charge pump and four small external capacitors allow operation from a single 3-V to 5.5-V supply. In addition, the device includes an always-active noninverting output (ROUT1B), which allows applications using the ring indicator to transmit data while the device is powered down. These devices operate at data signaling rates up to 250 kbit/s and a maximum of 30-V/ μ s driver output slew rate.

ORDERING INFORMATION

T _A	PACKAGE†	ORDERABLE PART NUMBER	TOP-SIDE MARKING
–0°C to 70°C	SSOP (DB)	Tube of 50	MAX3238CDB
		Reel of 2000	MAX3238CDBR
	TSSOP (PW)	Tube of 50	MAX3238CPW
		Reel of 2000	MAX3238CPWR
–40°C to 85°C	SSOP (DB)	Tube of 50	MAX3238IDB
		Reel of 2000	MAX3238IDBR
	TSSOP (PW)	Tube of 50	MAX3238IPW
		Reel of 2000	MAX3238IPWR

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



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.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

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MAX3238**3-V TO 5.5-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER****WITH ±15-kV ESD (HBM) PROTECTION**

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description/ordering information (continued)

Flexible control options for power management are featured when the serial port and driver inputs are inactive. The auto-powerdown plus feature functions when FORCEON is low and FORCEOFF is high. During this mode of operation, if the device does not sense valid signal transitions on all receiver and driver inputs for approximately 30 s, the built-in charge pump and drivers are powered down, reducing the supply current to 1 μ A. By disconnecting the serial port or placing the peripheral drivers off, auto-powerdown plus occurs if there is no activity in the logic levels for the driver inputs. Auto-powerdown plus can be disabled when FORCEON and FORCEOFF are high. With auto-powerdown plus enabled, the device activates automatically when a valid signal is applied to any receiver or driver input. INVALID is high (valid data) if any 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. INVALID is low (invalid data) if all receiver input voltages are between -0.3 V and 0.3 V for more than 30 μ s. Refer to Figure 5 for receiver input levels.

Function Tables**EACH DRIVER**

INPUTS				OUTPUT DOUT	DRIVER STATUS
DIN	FORCEON	FORCEOFF	TIME ELAPSED SINCE LAST RIN OR DIN TRANSITION		
X	X	L	X	Z	Powered off
L	H	H	X	H	Normal operation with auto-powerdown plus disabled
H	H	H	X	L	
L	L	H	<30 s	H	Normal operation with auto-powerdown plus enabled
H	L	H	<30 s	L	
L	L	H	>30 s	Z	Powered off by auto-powerdown plus feature
H	L	H	>30 s	Z	

H = high level, L = low level, X = irrelevant, Z = high impedance

EACH RECEIVER

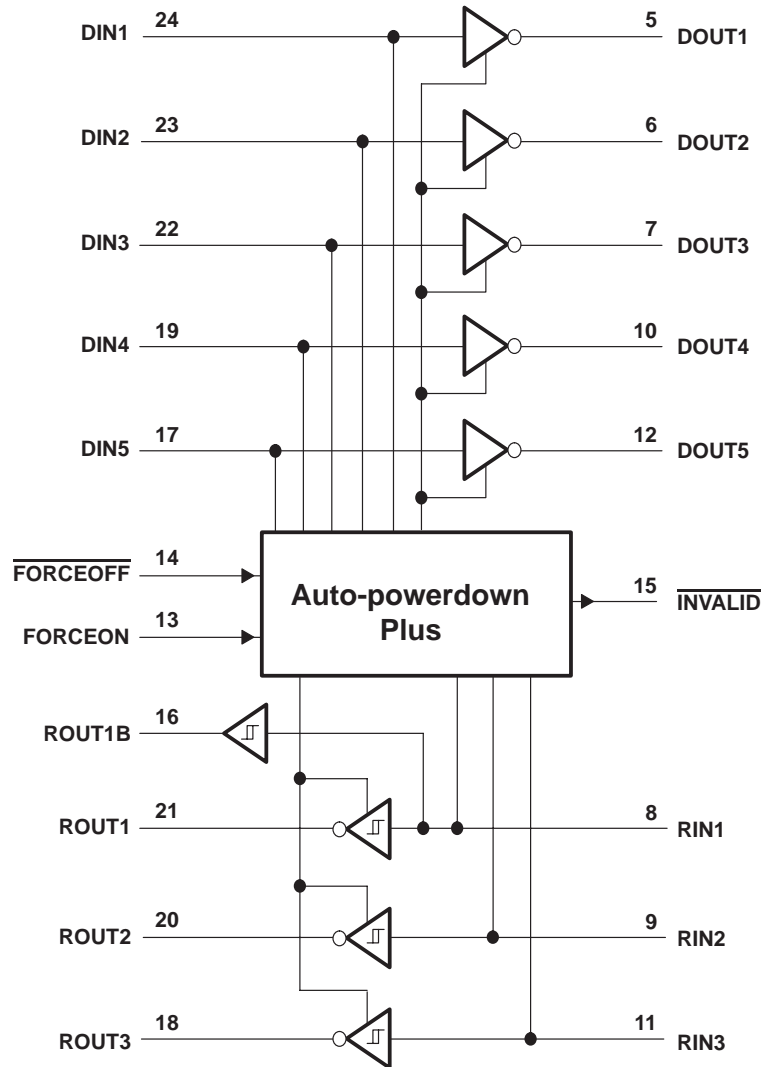
INPUTS				OUTPUTS		RECEIVER STATUS
RIN1	RIN2-RIN3	FORCEOFF	TIME ELAPSED SINCE LAST RIN OR DIN TRANSITION	ROUT1B	ROUT	
L	X	L	X	L	Z	Powered off while ROUT1B is active
H	X	L	X	H	Z	
L	L	H	<30 s	L	H	Normal operation with auto-powerdown plus disabled/enabled
L	H	H	<30 s	L	L	
H	L	H	<30 s	H	H	
H	H	H	<30 s	H	L	
Open	Open	H	>30 s	L	H	

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



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logic diagram (positive logic)



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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, V_{CC} (see Note 1)	–0.3 V to 6 V
Positive output supply voltage range, V_+ (see Note 1)	–0.3 V to 7 V
Negative output supply voltage range, V_- (see Note 1)	0.3 V to –7 V
Supply voltage difference, $V_+ - V_-$ (see Note 1)	13 V
Input voltage range, V_I : Driver ($\overline{\text{FORCEOFF}}$, FORCEON)	–0.3 V to 6 V
Receiver	–25 V to 25 V
Output voltage range, V_O : Driver	–13.2 V to 13.2 V
Receiver (INVALID)	–0.3 V to $V_{CC} + 0.3$ V
Package thermal impedance, θ_{JA} (see Notes 2 and 3): DB package	62°C/W
PW package	62°C/W
Operating virtual junction temperature, T_J	150°C
Storage temperature range, T_{stg}	–65°C to 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.

- NOTES:
- All voltages are with respect to network GND.
 - Maximum power dissipation is a function of $T_J(\text{max})$, θ_{JA} , and T_A . The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(\text{max}) - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
 - The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 4 and 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_{IH} Driver and control high-level input voltage	DIN, $\overline{\text{FORCEOFF}}$, FORCEON	$V_{CC} = 3.3$ V		2	V	
		$V_{CC} = 5$ V		2.4		
V_{IL} Driver and control low-level input voltage	DIN, $\overline{\text{FORCEOFF}}$, FORCEON			0.8	V	
V_I Driver and control input voltage	DIN, $\overline{\text{FORCEOFF}}$, FORCEON	0			5.5	V
V_I Receiver input voltage		–25			25	V
T_A Operating free-air temperature	MAX3238C	0			70	°C
	MAX3238I	–40			85	

NOTE 4: Testing supply conditions are C1–C4 = 0.1 μ F at $V_{CC} = 3.3$ V \pm 0.15 V; C1–C4 = 0.22 μ F at $V_{CC} = 3.3$ V \pm 0.3 V; and C1 = 0.047 μ F and C2–C4 = 0.33 μ F at $V_{CC} = 5$ V \pm 0.5 V.

electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 4 and Figure 6)

PARAMETER		TEST CONDITIONS	MIN	TYP‡	MAX	UNIT	
I_I	Input leakage current	$\overline{\text{FORCEOFF}}$, FORCEON		\pm 0.01	\pm 1	μ A	
I_{CC}	Supply current ($T_A = 25^\circ\text{C}$)	Auto-powerdown plus disabled	No load, $\overline{\text{FORCEOFF}}$ and FORCEON at V_{CC}		0.5	2	mA
		Powered off	No load, $\overline{\text{FORCEOFF}}$ at GND		1	10	
		Auto-powerdown plus enabled	No load, $\overline{\text{FORCEOFF}}$ at V_{CC} , FORCEON at GND, All RIN are open or grounded		1	10	μ A

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

NOTE 4: Testing supply conditions are C1–C4 = 0.1 μ F at $V_{CC} = 3.3$ V \pm 0.15 V; C1–C4 = 0.22 μ F at $V_{CC} = 3.3$ V \pm 0.3 V; and C1 = 0.047 μ F and C2–C4 = 0.33 μ F at $V_{CC} = 5$ V \pm 0.5 V.



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WITH ±15-kV ESD (HBM) PROTECTION

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DRIVER SECTION

electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 4 and Figure 6)

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
V _{OH} High-level output voltage	All DOUT at R _L = 3 kΩ to GND	5	5.4		V
V _{OL} Low-level output voltage	All DOUT at R _L = 3 kΩ to GND	-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‡	V _{CC} = 3.6 V, V _O = 0 V		±35	±60	mA
	V _{CC} = 5.5 V, V _O = 0 V		±40	±100	
r _o Output resistance	V _{CC} , V ₊ , and V ₋ = 0 V, V _O = ±2 V	300	10M		Ω
I _{off} Output leakage current	FORCEOFF = GND	V _O = ±12 V, V _{CC} = 3 V to 3.6 V		±25	μA
		V _O = ±10 V, V _{CC} = 4.5 V to 5.5 V		±25	

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

‡ 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.

NOTE 4: Testing supply conditions are C1–C4 = 0.1 μF at V_{CC} = 3.3 V ± 0.15 V; C1–C4 = 0.22 μF at V_{CC} = 3.3 V ± 0.3 V; and C1 = 0.047 μF and C2–C4 = 0.33 μF at V_{CC} = 5 V ± 0.5 V.

switching characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 4 and Figure 6)

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
Maximum data rate	C _L = 1000 pF, R _L = 3 kΩ, One DOUT switching, See Figure 1	150	250		kbit/s
t _{sk(p)} Pulse skew§	C _L = 150 pF to 2500 pF, R _L = 3 kΩ to 7 kΩ, See Figure 2		100		ns
SR(tr) Slew rate, transition region (see Figure 1)	V _{CC} = 3.3 V, R _L = 3 kΩ to 7 kΩ	C _L = 150 pF to 1000 pF	6	30	V/μs
		C _L = 150 pF to 2500 pF	4	30	

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

§ Pulse skew is defined as |t_{PLH} – t_{PHL}| of each channel of the same device.

NOTE 4: Testing supply conditions are C1–C4 = 0.1 μF at V_{CC} = 3.3 V ± 0.15 V; C1–C4 = 0.22 μF at V_{CC} = 3.3 V ± 0.3 V; and C1 = 0.047 μF and C2–C4 = 0.33 μF at V_{CC} = 5 V ± 0.5 V.

MAX3238**3-V TO 5.5-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER
WITH ±15-kV ESD (HBM) PROTECTION**

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RECEIVER SECTION**electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 4 and Figure 6)**

PARAMETER		TEST CONDITIONS	MIN	TYP†	MAX	UNIT
V _{OH}	High-level output voltage	I _{OH} = -1 mA	V _{CC} -0.6 V	V _{CC} -0.1 V		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
I _{off}	Output leakage current (except ROUT1B)	FORCEOFF = 0 V		±0.05	±10	µA
r _i	Input resistance	V _I = ±3 V to ±25 V	3	5	7	kΩ

† All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.NOTE 4: Testing supply conditions are C1-C4 = 0.1 µF at V_{CC} = 3.3 V ± 0.15 V; C1-C4 = 0.22 µF at V_{CC} = 3.3 V ± 0.3 V; and C1 = 0.047 µF and C2-C4 = 0.33 µF at V_{CC} = 5 V ± 0.5 V.**switching characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 4)**

PARAMETER		TEST CONDITIONS	MIN	TYP†	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			150		ns
t _{en}	Output enable time	C _L = 150 pF, R _L = 3 kΩ, See Figure 4		200		ns
t _{dis}	Output disable time			200		ns
t _{sk(p)}	Pulse skew‡	See Figure 3		50		ns

† All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.‡ Pulse skew is defined as |t_{PLH} - t_{PHL}| of each channel of the same device.NOTE 4: Testing supply conditions are C1-C4 = 0.1 µF at V_{CC} = 3.3 V ± 0.15 V; C1-C4 = 0.22 µF at V_{CC} = 3.3 V ± 0.3 V; and C1 = 0.047 µF and C2-C4 = 0.33 µF at V_{CC} = 5 V ± 0.5 V.

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AUTO-POWERDOWN PLUS SECTION

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

PARAMETER		TEST CONDITIONS	MIN	TYP†	MAX	UNIT
V _{T+(valid)}	Receiver input threshold for INVALID high-level output voltage	FORCEON = GND, FORCEOFF = V _{CC}			2.7	V
V _{T-(valid)}	Receiver input threshold for INVALID high-level output voltage	FORCEON = GND, FORCEOFF = V _{CC}	-2.7			V
V _{T(invalid)}	Receiver input threshold for INVALID low-level output voltage	FORCEON = GND, 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

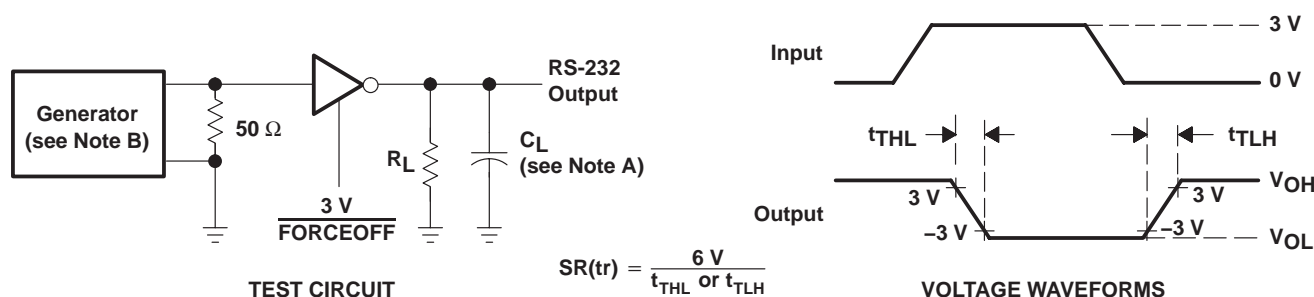
† All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

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

PARAMETER		MIN	TYP†	MAX	UNIT
t _{valid}	Propagation delay time, low- to high-level output		0.1		μs
t _{invalid}	Propagation delay time, high- to low-level output		50		μs
t _{en}	Supply enable time		25		μs
t _{dis}	Receiver or driver edge to auto-powerdown plus	15	30	60	s

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

PARAMETER MEASUREMENT INFORMATION



NOTES: A. C_L includes probe and jig capacitance.

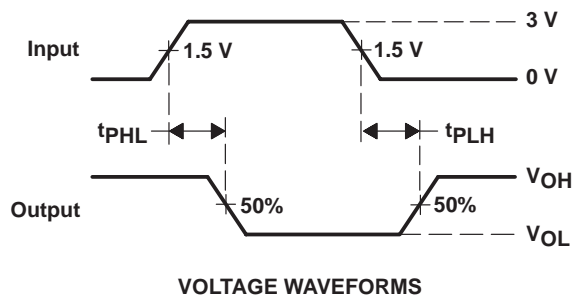
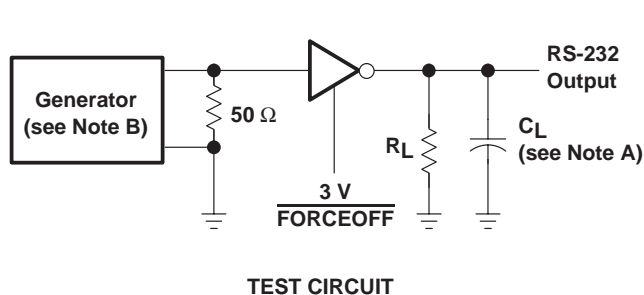
B. The pulse generator has the following characteristics: PRR = 250 kbit/s, Z_O = 50 Ω, 50% duty cycle, t_r ≤ 10 ns, t_f ≤ 10 ns.

Figure 1. Driver Slew Rate

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PARAMETER MEASUREMENT INFORMATION

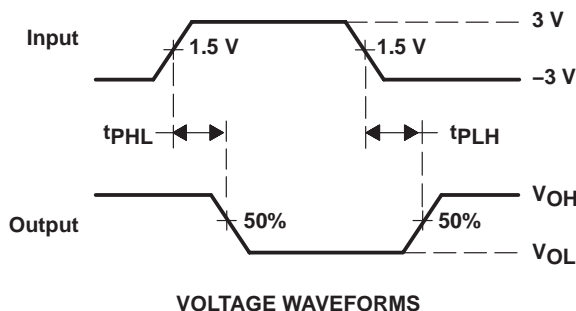
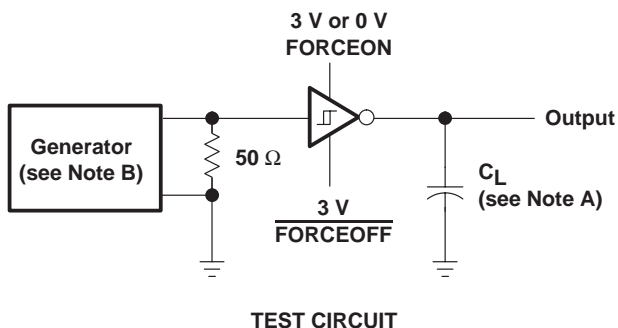


TEST CIRCUIT

VOLTAGE WAVEFORMS

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, $t_r \leq 10$ ns, $t_f \leq 10$ ns.

Figure 2. Driver Pulse Skew

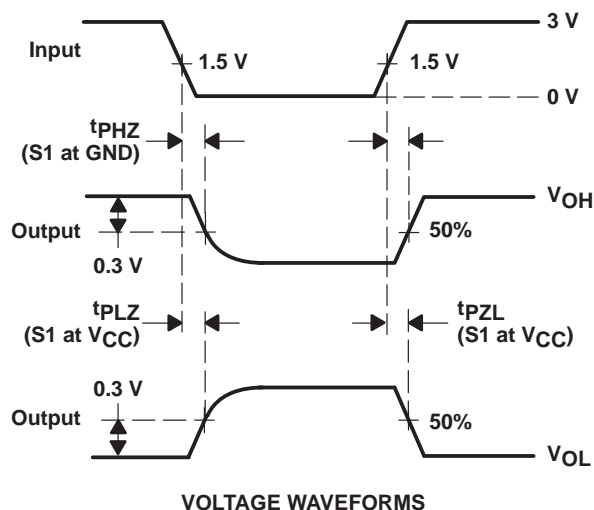
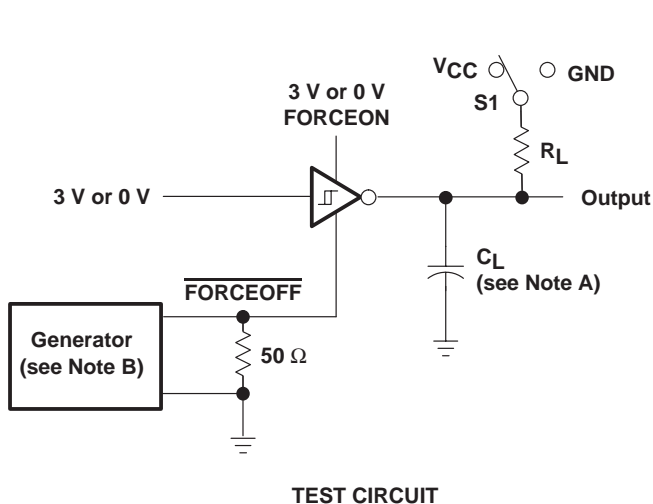


TEST CIRCUIT

VOLTAGE WAVEFORMS

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

Figure 3. Receiver Propagation Delay Times



TEST CIRCUIT

VOLTAGE WAVEFORMS

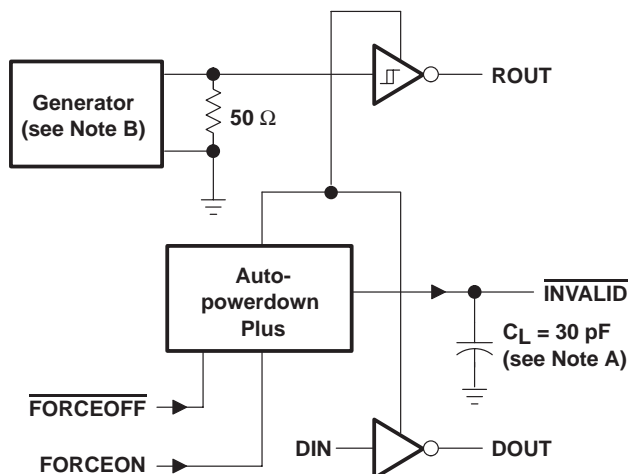
NOTES: A. C_L includes probe and jig capacitance.
 B. The pulse generator has the following characteristics: $Z_O = 50 \Omega$, 50% duty cycle, $t_r \leq 10$ ns, $t_f \leq 10$ ns.
 C. t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 D. t_{PZL} and t_{PZH} are the same as t_{en} .

Figure 4. Receiver Enable and Disable Times

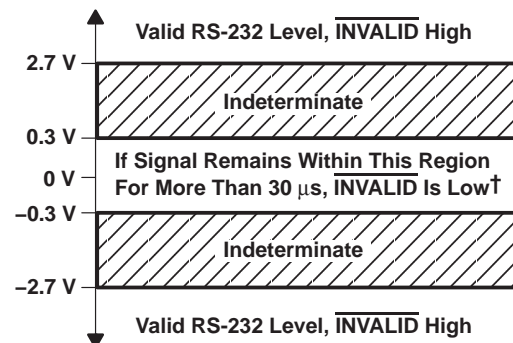
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PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



† Auto-powerdown plus 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, $t_r \leq 10$ ns, $t_f \leq 10$ ns.

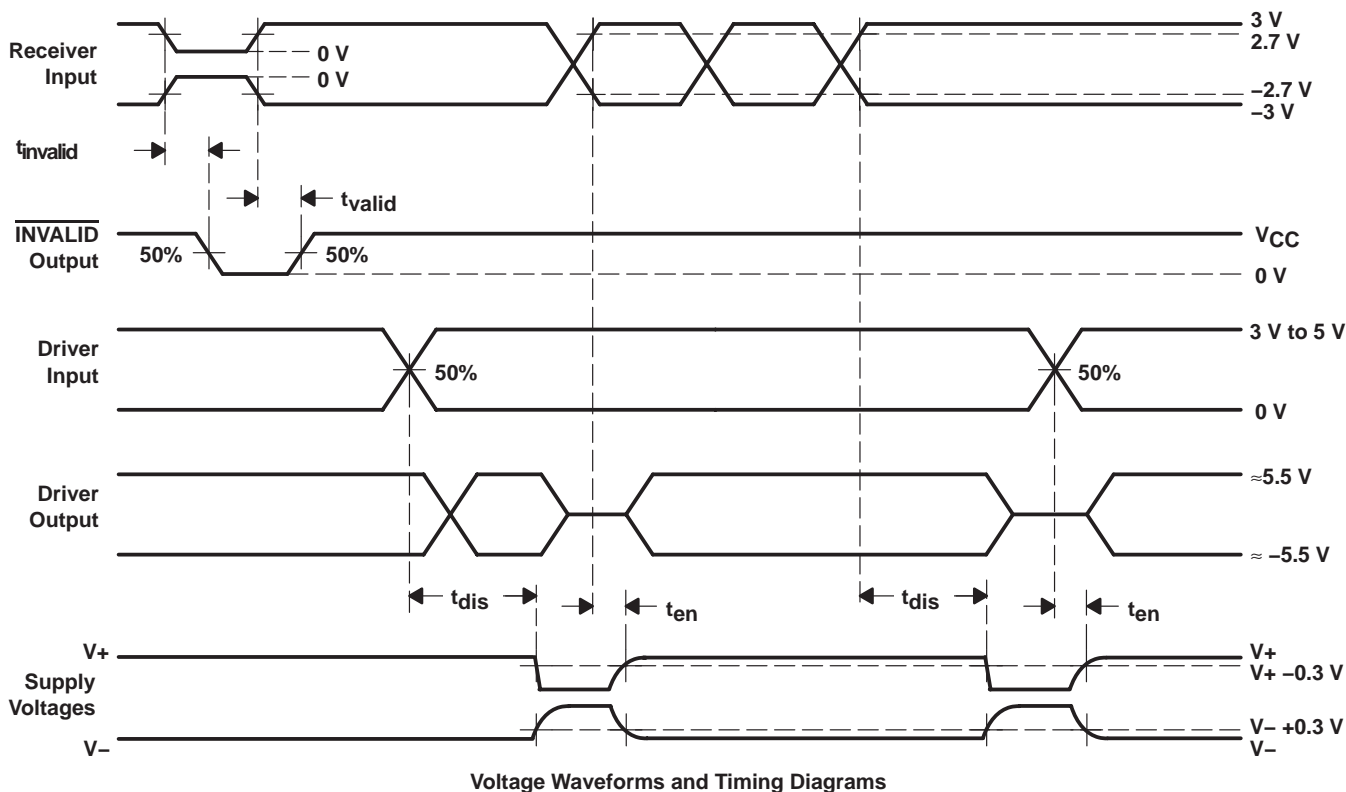
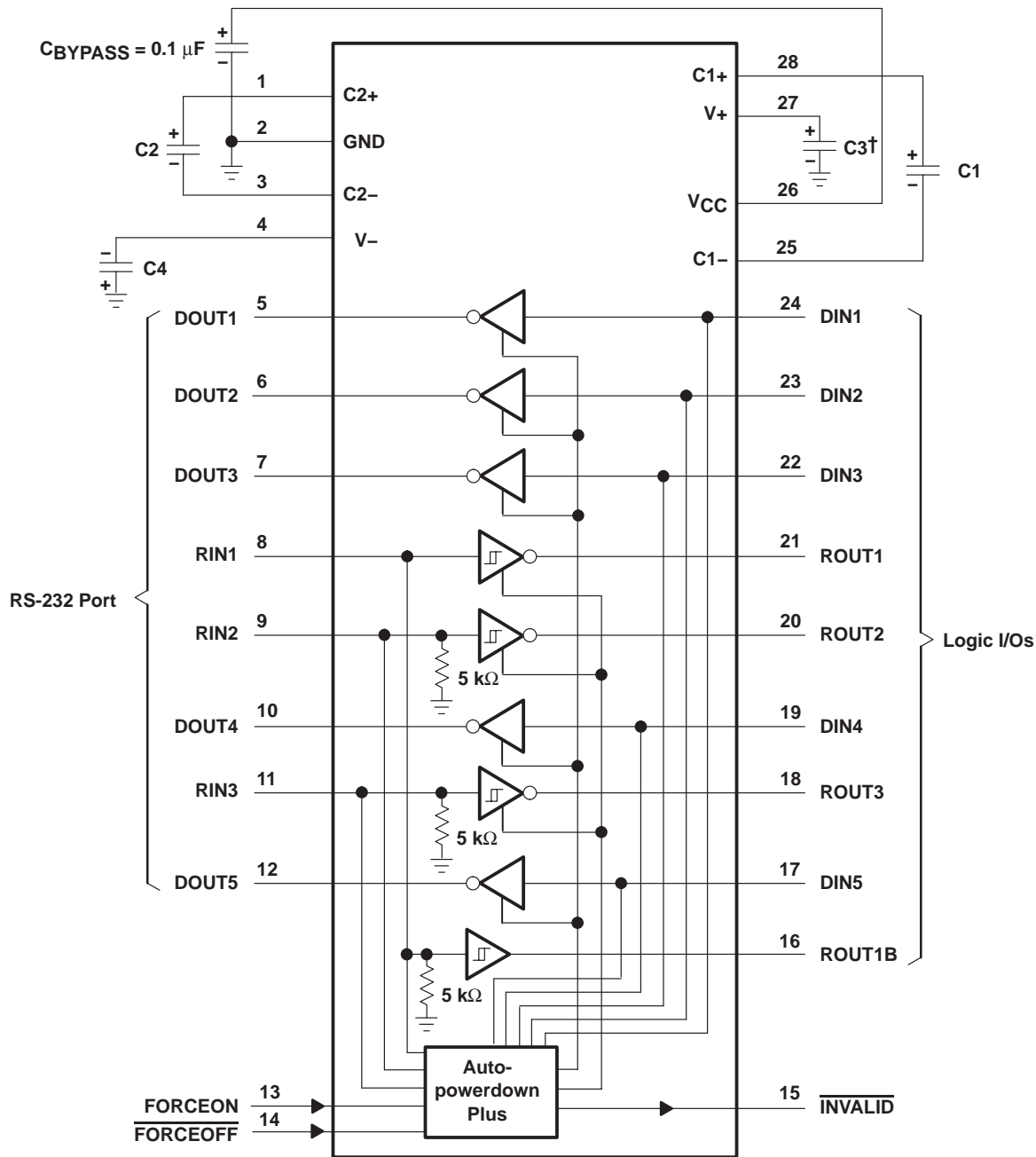


Figure 5. $\overline{\text{INVALID}}$ Propagation-Delay Times and Supply-Enabling Time

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APPLICATION INFORMATION



V_{CC} vs CAPACITOR VALUES

V _{CC}	C1	C2, C3, and C4
3.3 V ± 0.15 V	0.1 μF	0.1 μF
3.3 V ± 0.3 V	0.22 μF	0.22 μF
5 V ± 0.5 V	0.047 μF	0.33 μF
3 V to 5.5 V	0.22 μF	1 μF

† 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 6. Typical Operating Circuit and Capacitor Values



PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
MAX3238CDB	ACTIVE	SSOP	DB	28	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3238CDBE4	ACTIVE	SSOP	DB	28	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3238CDBG4	ACTIVE	SSOP	DB	28	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3238CDBR	ACTIVE	SSOP	DB	28	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3238CDBRE4	ACTIVE	SSOP	DB	28	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3238CDBRG4	ACTIVE	SSOP	DB	28	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3238CPW	ACTIVE	TSSOP	PW	28	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3238CPWG4	ACTIVE	TSSOP	PW	28	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3238CPWR	ACTIVE	TSSOP	PW	28	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3238CPWRG4	ACTIVE	TSSOP	PW	28	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3238IDB	ACTIVE	SSOP	DB	28	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3238IDBE4	ACTIVE	SSOP	DB	28	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3238IDBG4	ACTIVE	SSOP	DB	28	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3238IDBR	ACTIVE	SSOP	DB	28	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3238IDBRE4	ACTIVE	SSOP	DB	28	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3238IDBRG4	ACTIVE	SSOP	DB	28	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3238IPW	ACTIVE	TSSOP	PW	28	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3238IPWE4	ACTIVE	TSSOP	PW	28	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3238IPWG4	ACTIVE	TSSOP	PW	28	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3238IPWR	ACTIVE	TSSOP	PW	28	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3238IPWRE4	ACTIVE	TSSOP	PW	28	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3238IPWRG4	ACTIVE	TSSOP	PW	28	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.

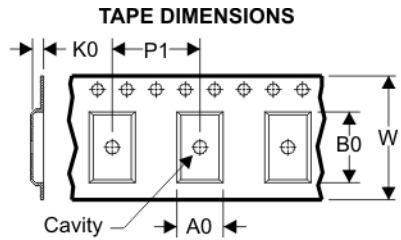
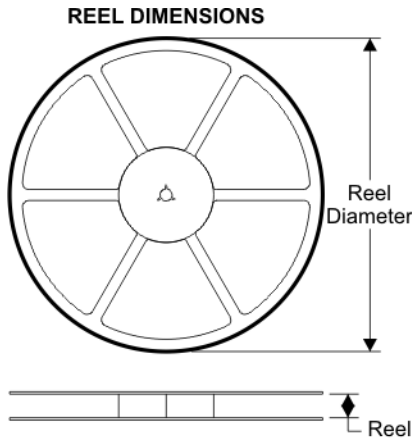
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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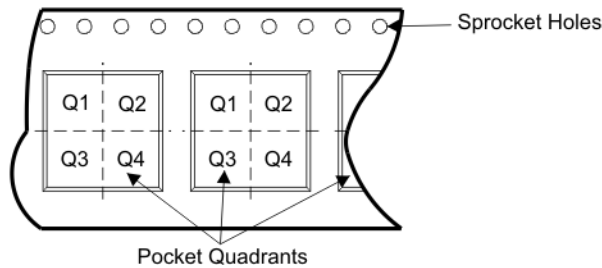
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TAPE AND REEL BOX INFORMATION



A0	Dimension designed to accommodate the component width
B0	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



Device	Package	Pins	Site	Reel Diameter (mm)	Reel Width (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
MAX3238CDBR	DB	28	SITE 41	330	16	8.2	10.5	2.5	12	16	Q1
MAX3238CPWR	PW	28	SITE 60	330	16	6.9	10.2	1.8	12	16	Q1
MAX3238IDBR	DB	28	SITE 41	330	16	8.2	10.5	2.5	12	16	Q1
MAX3238IPWR	PW	28	SITE 60	330	16	6.9	10.2	1.8	12	16	Q1

TAPE AND REEL BOX DIMENSIONS



Device	Package	Pins	Site	Length (mm)	Width (mm)	Height (mm)
MAX3238CDBR	DB	28	SITE 41	346.0	346.0	33.0
MAX3238CPWR	PW	28	SITE 60	346.0	346.0	33.0
MAX3238IDBR	DB	28	SITE 41	346.0	346.0	33.0
MAX3238IPWR	PW	28	SITE 60	346.0	346.0	33.0

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

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- NOTES: A. All linear dimensions are in millimeters.
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 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-153

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