TEXAS NSTRUMENTS

DB OR PW PACKAGE

(TOP VIEW)

C2+∏

GND 2

C2-[]3

DOUT1 15

DOUT2[6

DOUT3

RIN1 8

RIN2

RIN3 11

DOUT5 12

FORCEON 13

FORCEOFF 14

 $V - \Pi 4$

28 C1+

27 V+

26 Vcc

25 C1-

24 DIN1

23 DIN2

22 DIN3 21 ROUT1

19 DIN4

17 DIN5

20 ROUT2

18 ROUT3

16 ROUT1B

15 INVALID

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
- Five Drivers and Three Receivers
- Low Standby Current . . . 1 µA Typical
- External Capacitors . . . 4 \times 0.1 μF
- 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)
 - TRSF3238

APPLICATIONS

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

DESCRIPTION/ORDERING INFORMATION

The TRS3238 consists of five line drivers, three line receivers, and a dual charge-pump circuit with \pm 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. The TRS3238 operates 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 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. Refer to Figure 5 for receiver input levels.



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ORDERING INFORMATION

Texas

STRUMENTS www.ti.com

T _A	PACI	KAGE ⁽¹⁾⁽²⁾	ORDERABLE PART NUMBER	TOP-SIDE MARKING	
	SSOP – DB	Tube of 50	TRS3238CDB	- TRS3238C	
0°C to 70°C	330F - DB	Reel of 2000	TRS3238CDBR	1832300	
		Tube of 50	TRS3238CPW	DC20C	
	TSSOP – PW	Reel of 2000	TRS3238CPWR	- RS38C	
	SSOP – DB	Tube of 50	TRS3238IDB	TDC0000	
–40°C to 85°C	550P - DB	Reel of 2000	TRS3238IDBR	- TRS3238I	
-40°C 10 85°C		Tube of 50	TRS3238IPW	TDC201	
	TSSOP – PW	Reel of 2000	TRS3238IPWR	TRS38I	

(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.

FUNCTION TABLES

Each Driver⁽¹⁾

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

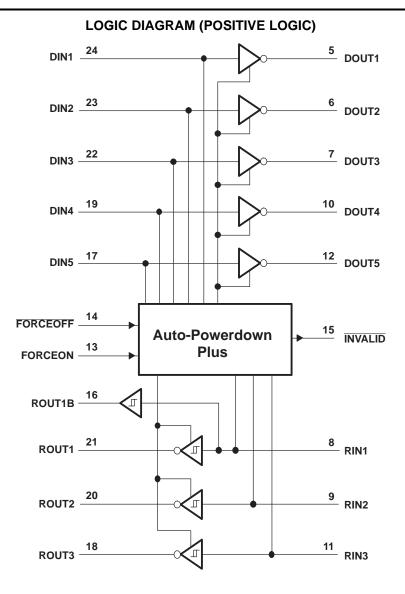
(1) H = high level, L = low level, X = irrelevant, Z = high impedance

Each Receiver⁽¹⁾

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

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

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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 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	Driver (FORCEOFF, FORCEON)	-0.3	6	V	
VI		Receiver	-25	25		
N/		Driver	-13.2	13.2	V	
Vo	Output voltage range	Receiver (INVALID)	-0.3	$V_{CC} + 0.3$	V	
0	Deckers thermal impedance $(3)(4)$	DB package				
θ_{JA}	Package thermal impedance ⁽³⁾⁽⁴⁾	PW package		62	°C/W	
TJ	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.

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

Maximum power dissipation is a function of $T_J(max)$, θ_{JA} , and T_A . The maximum allowable power dissipation at any allowable ambient (3) 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.

(4)

Recommended Operating Conditions⁽¹⁾

See Figure 6

				MIN	NOM	MAX	UNIT
	Supply veltage	V _{CC} = 3.3 V		3	3.3	3.6	V
	Supply voltage	$V_{CC} = 5 V$		4.5	5	5.5	v
V	Driver and control high level input veltage	ge DIN, FORCEOFF, FORCEON	$V_{CC} = 3.3 V$	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				0.8	V
v	Driver and control input voltage	DIN, FORCEOFF, FORCEON		0		5.5	V
VI	Receiver input voltage			-25		25	v
т	T O i i i i i i i	TRS3238C		0		70	°C
T _A	Operating free-air temperature	TRS3238I		-40		85	-U

(1) Testing supply conditions are C1–C4 = 0.1 μ F at V_{CC} = 3.3 V ± 0.15 V; C1–C4 = 0.22 μ F at V_{CC} = 3.3 V ± 0.3 V; and C1 = 0.047 μ F and C2–C4 = 0.33 μ F 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 6)

	PAR	AMETER	TEST CONDITIONS	MIN	TYP ⁽²⁾	MAX	UNIT
I _I	Input leakage current	FORCEOFF, FORCEON			±0.01	±1	μA
	Auto-powerdown plus disabled	No load, FORCEOFF and FORCEON at V _{CC}		0.5	2	mA	
I _{CC}	$(1_A = 25^{\circ}C)$	Powered off	No load, FORCEOFF at GND		1	10	
		Auto-powerdown plus enabled	No load, FORCEOFF at V _{CC} , FORCEON at GND, All RIN are open or grounded		1	10	μΑ

(1) Testing supply conditions are C1–C4 = 0.1 μ F at V_{CC} = 3.3 V ± 0.15 V; C1–C4 = 0.22 μ F at V_{CC} = 3.3 V ± 0.3 V; and C1 = 0.047 μ F and 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 $T_A = 25^{\circ}C$.

DRIVER SECTION

Electrical Characteristics⁽¹⁾

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

	PARAMETER	TE	ST CONDITIONS	6	MIN	TYP ⁽²⁾	MAX	UNIT
V _{OH}	High-level output voltage	All DOUT at $R_L = 3 \text{ k}\Omega$ to (All DOUT at $R_L = 3 \text{ k}\Omega$ to GND			5.4		V
V _{OL}	Low-level output voltage	All DOUT at $R_L = 3 \text{ k}\Omega$ to GND			-5	-5.4		V
I _{IH}	High-level input current	$V_{I} = V_{CC}$				±0.01	±1	μA
IIL	Low-level input current	V _I at GND				±0.01	±1	μA
	Short-circuit output	V _{CC} = 3.6 V,	$V_{O} = 0 V$			±35	±60	
IOS	current ⁽³⁾	V _{CC} = 5.5 V,	$V_{O} = 0 V$			±40	±100	mA
r _o	Output resistance	V_{CC} , V+, and V- = 0 V,	$V_0 = \pm 2 V$		300	10M		Ω
1	Output lookage ourrant	FORCEOFF = GND	$V_0 = \pm 12 V$,	V_{CC} = 3 V to 3.6 V			±25	
l _{off}	Oulput leakage current	Output leakage current FORCEOFF = GND	$V_O = \pm 10 V$,	V_{CC} = 4.5 V to 5.5 V			±25	μA

(1) Testing supply conditions are C1–C4 = 0.1 μ F at V_{CC} = 3.3 V ± 0.15 V; C1–C4 = 0.22 μ F at V_{CC} = 3.3 V ± 0.3 V; and C1 = 0.047 μ F and C2–C4 = 0.33 μF 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 $T_A = 25^{\circ}$ 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 6)

	PARAMETER	TEST CC	TEST CONDITIONS		TYP ⁽²⁾	MAX	UNIT
	Maximum data rate	C _L = 1000 pF, One DOUT switching,	R _L = 3 kΩ, See Figure 1	150	250		kbit/s
t _{sk(p)}	Pulse skew ⁽³⁾	$C_L = 150 \text{ pF to } 2500 \text{ pF},$ See Figure 2	$R_L = 3 \ k\Omega \text{ to } 7 \ k\Omega,$		100		ns
SR(tr)	Slew rate, transition region	V _{CC} = 3.3 V,	$C_{L} = 150 \text{ pF} \text{ to } 1000 \text{ pF}$	6		30	1//110
SK(II)	(see Figure 1)	$R_L = 3 k\Omega$ to 7 k Ω	$C_{L} = 150 \text{ pF} \text{ to } 2500 \text{ pF}$	4		30	V/µs

(1) Testing supply conditions are C1–C4 = 0.1 μ F at V_{CC} = 3.3 V ± 0.15 V; C1–C4 = 0.22 μ F at V_{CC} = 3.3 V ± 0.3 V; and C1 = 0.047 μ F at V_{CC} = 3.3 V ± 0.3 V; and C1 = 0.047 μ F at V_{CC} = 3.3 V ± 0.15 V; C1–C4 = 0.22 μ F at V_{CC} = 3.3 V ± 0.3 V; and C1 = 0.047 μ F at V_{CC} = 3.3 V ± 0.15 V; C1–C4 = 0.22 μ F at V_{CC} = 3.3 V ± 0.3 V; and C1 = 0.047 μ F at V_{CC} = 3.3 V ± 0.15 V; C1–C4 = 0.22 μ F at V_{CC} = 3.3 V ± 0.3 V; and C1 = 0.047 μ F at V_{CC} = 0.15 V; C1–C4 = 0.22 μ F at V_{CC} = 3.3 V ± 0.3 V; and C1 = 0.047 μ F at V_{CC} = 0.047 μ F at V and C2–C4 = 0.33 μF 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 $T_A = 25^{\circ}$ C. (3) Pulse skew is defined as $|t_{PLH} - t_{PHL}|$ of each channel of the same device.

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 mA	$V_{CC} - 0.6$	V _{CC} – 0.1		V
V _{OL}	Low-level output voltage	I _{OH} = 1.6 mA			0.4	V
V	Positive-going input threshold voltage			1.5	2.4	V
V _{IT+} I	rositive-going input threshold voltage	$V_{CC} = 5 V$		1.8	2.4	v
V	Negative going input threshold voltage	$V_{CC} = 3.3 V$	0.6	1.2		V
V _{IT-}	Negative-going input threshold voltage	$V_{CC} = 5 V$	0.8	1.5		v
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 _l	Input resistance	$V_1 = \pm 3 \text{ V to } \pm 25 \text{ V}$	3	5	7	kΩ

(1) 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 at V_{CC} = 3.3 V \pm 0.3 V; and C1 = 0.047 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 at V_{CC} = 3.3 V \pm 0.15 V; C1–C4 = 0.22 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 0.15 V; C1–C4 = 0.22 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 0.15 V; C1–C4 = 0.22 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 0.15 V; C1–C4 = 0.22 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 0.15 V; C1–C4 = 0.22 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 at V_{CC} = 3.3 V \pm 0.15 V; C1–C4 = 0.22 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 0.15 V; C1–C4 = 0.22 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 0.15 V; C1–C4 = 0.22 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 at V_{CC} = 3.3 V \pm 0.15 V; C1–C4 = 0.22 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 0.15 V; C1–C4 = 0.22 μ F at V_{CC} = 3.3 V \pm 0.3 V; and C1 = 0.047 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 at V_{CC} = 3.3 V \pm 0.15 V; C1–C4 = 0.22 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 0.15 V; C1–C4 = 0.22 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 0.15 V; C1–C4 = 0.22 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 0.15 V; C1–C4 = 0.22 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 0.15 V; C1–C4 = 0.22 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 0.15 V; C1–C4 = 0.22 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 0.15 V; C1–C4 = 0.22 μ F at V_{CC} = 3. and C2–C4 = 0.33 μ F at V_{CC} = 5 V ± 0.5 V. All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

(2)

Switching Characteristics⁽¹⁾

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

	PARAMETER		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, See Figure 4	$R_L = 3 k\Omega$,	200	ns
t _{dis}	Output disable time	C _L = 150 pF,	$R_L = 3 k\Omega$, See Figure 4	200	ns
t _{sk(p)}	Pulse skew ⁽³⁾	See Figure 3		50	ns

(1) 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 ± 0.5 V. All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

(2)

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

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

Switching Characteristics

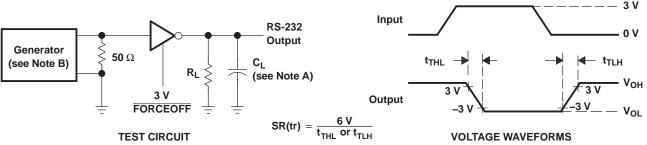
over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 5)

	PARAMETER	MIN	TYP ⁽¹⁾	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

(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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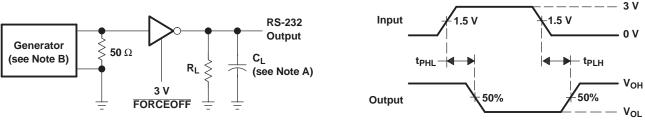
PARAMETER MEASUREMENT INFORMATION



- **TEST CIRCUIT**
- A. C_L includes probe and jig capacitance.

В. The pulse generator has the following characteristics: PRR = 250 kbit/s, Z_0 = 50 Ω , 50% duty cycle, $t_r \le$ 10 ns, $t_f \leq 10$ ns.

Figure 1. Driver Slew Rate

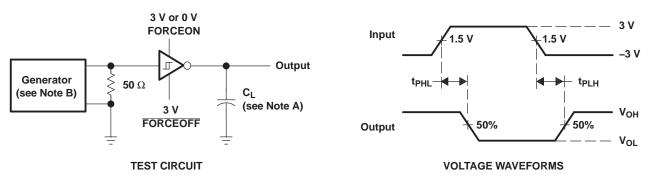


TEST CIRCUIT

VOLTAGE WAVEFORMS

- C_L includes probe and jig capacitance. Α.
- The pulse generator has the following characteristics: PRR = 250 kbit/s, Z_0 = 50 Ω , 50% duty cycle, $t_r \le 10$ ns, Β. $t_f \leq 10 \text{ ns.}$

Figure 2. Driver Pulse Skew

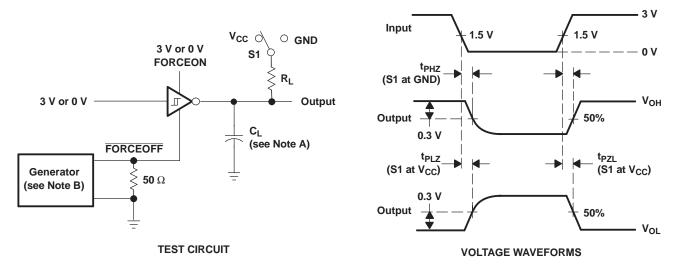


- C₁ includes probe and jig capacitance. Α.
- The pulse generator has the following characteristics: Z₀ = 50 Ω , 50% duty cycle, t_r ≤ 10 ns, t_f ≤ 10 ns. В.

Figure 3. Receiver Propagation Delay Times

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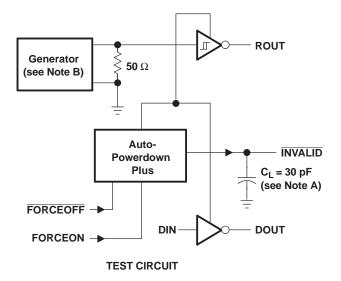


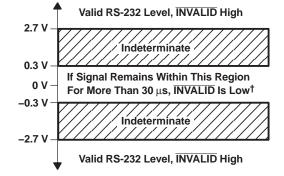
- A. C_L includes probe and jig capacitance.
- B. The pulse generator has the following characteristics: $Z_0 = 50 \Omega$, 50% duty cycle, $t_r \le 10 \text{ ns}$.
- C. t_{PLZ} and t_{PHZ} are the same as t_{dis} .
- D. t_{PZL} and t_{PZH} are the same as t_{en} .

Figure 4. Receiver Enable and Disable Times

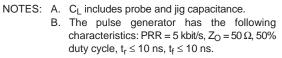
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PARAMETER MEASUREMENT INFORMATION (continued)





 † Auto-powerdown plus disables drivers and reduces supply current to 1 $\mu A.$



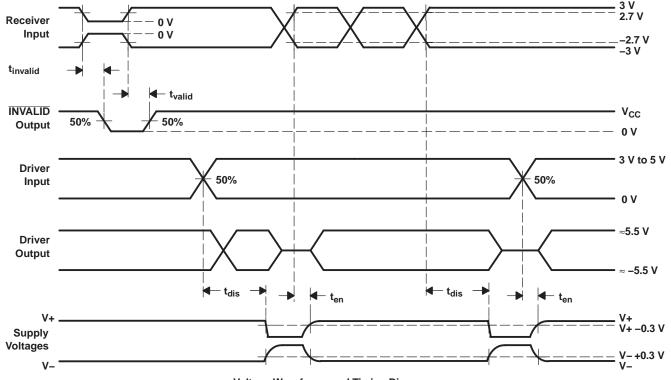
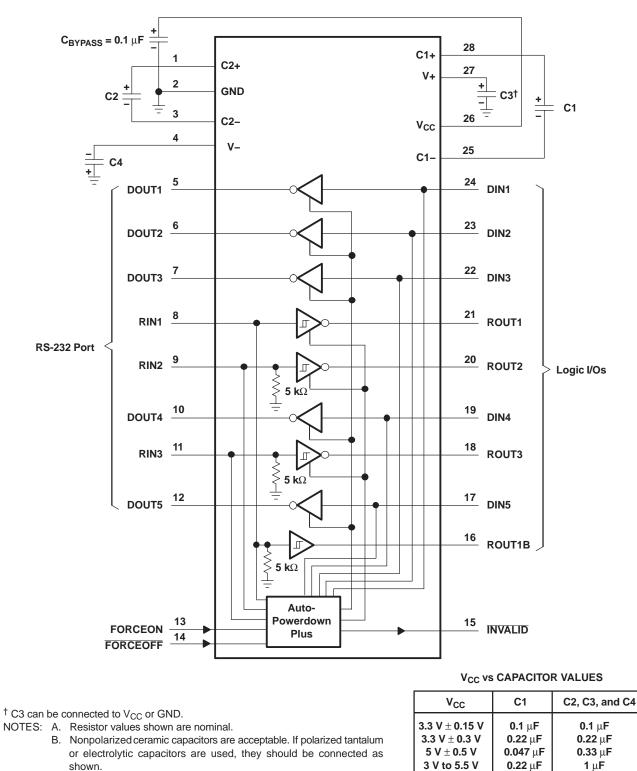




Figure 5. INVALID Propagation-Delay Times and Supply-Enabling Time

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APPLICATION INFORMATION

Figure 6. Typical Operating Circuit and Capacitor Values



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PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/ Ball Finish	MSL Peak Temp ⁽³⁾	Samples (Requires Login)
TRS3238CPWR	ACTIVE	TSSOP	PW	28	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Request Free Samples
TRS3238CPWRG4	ACTIVE	TSSOP	PW	28	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Request Free Samples
TRS3238IPWR	ACTIVE	TSSOP	PW	28	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Request Free Samples
TRS3238IPWRG4	ACTIVE	TSSOP	PW	28	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Request Free Samples

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

ACTIVE: Product device recommended for new designs.

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

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

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

OBSOLETE: TI has discontinued the production of the device.

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

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

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

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

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

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

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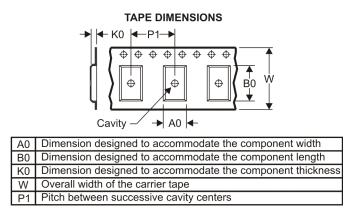
PACKAGE MATERIALS INFORMATION

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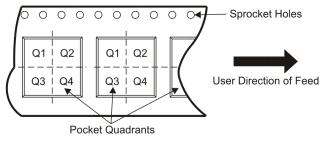
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TAPE AND REEL INFORMATION





QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*A	Il dimensions are nominal												
	Device	Package Type	Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
	TRS3238CPWR	TSSOP	PW	28	2000	330.0	16.4	7.1	10.4	1.6	12.0	16.0	Q1
	TRS3238IPWR	TSSOP	PW	28	2000	330.0	16.4	7.1	10.4	1.6	12.0	16.0	Q1

TEXAS INSTRUMENTS

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PACKAGE MATERIALS INFORMATION

8-Jul-2011



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TRS3238CPWR	TSSOP	PW	28	2000	346.0	346.0	33.0
TRS3238IPWR	TSSOP	PW	28	2000	346.0	346.0	33.0

PW (R-PDSO-G28)

PLASTIC SMALL OUTLINE



All finited dimensions die in finite cers. Dimensioning e
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



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