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FEATURES

- Operates With 3-V to 5.5-V V_{CC} Supply
- Operates up to 1 Mbit/s
- 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
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- RS-232 Bus-Pin ESD Protection Exceeds ± 15 kV Using Human-Body Model (HBM)

APPLICATIONS

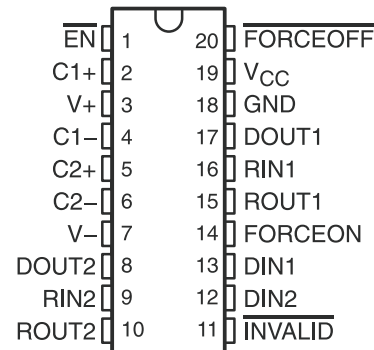
- Battery-Powered Systems
- PDAs
- Notebooks
- Laptops
- Palmtop PCs
- Hand-Held Equipment

DESCRIPTION/ORDERING INFORMATION

The TRSF3223 consists of two line drivers, two line receivers, and a dual charge-pump circuit with ± 15 -kV ESD protection pin to pin (serial-port connection pins, including GND). The device 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. The device operates at data signaling rates up to 1 Mbit/s and a driver output slew rate of 24 V/ μ s to 150 V/ μ s.

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, the driver outputs are disabled. If $\overline{\text{FORCEOFF}}$ is set low and enable ($\overline{\text{EN}}$) is high, both drivers and receivers are shut off, and the supply current is reduced to 1 μ A. Disconnecting the serial port or turning off the peripheral drivers causes auto-powerdown 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 any receiver input. The $\overline{\text{INVALID}}$ output is used to notify the user if an RS-232 signal is present at any receiver input. $\overline{\text{INVALID}}$ 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. $\overline{\text{INVALID}}$ 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 4](#) for receiver input levels.

DB, DW, OR PW PACKAGE
(TOP VIEW)



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TRSF3223
3-V TO 5.5-V MULTICHANNEL RS-232 COMPATIBLE
LINE DRIVER/RECEIVER

SLLS854–AUGUST 2007

ORDERING INFORMATION

| T _A | PACKAGE ⁽¹⁾⁽²⁾ | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|---------------------------|--------------|-----------------------|------------------|
| 0°C to 70°C | SOIC – DW | Tube of 25 | TRSF3223CDW | TRSF3223C |
| | | Reel of 2000 | TRSF3223CDWR | |
| | SSOP – DB | Tube of 70 | TRSF3223CDB | RT23C |
| | | Reel of 2000 | TRSF3223CDBR | |
| | TSSOP – PW | Tube of 70 | TRSF3223CPW | RT23C |
| | | Reel of 2000 | TRSF3223CPWR | |
| –40°C to 85°C | SOIC – DW | Tube of 25 | TRSF3223IDW | TRSF3223I |
| | | Reel of 2000 | TRSF3223IDWR | |
| | SSOP – DB | Tube of 70 | TRSF3223IDB | RT23I |
| | | Reel of 2000 | TRSF3223IDBR | |
| | TSSOP – PW | Tube of 70 | TRSF3223IPW | RT23I |
| | | Reel of 2000 | TRSF3223IPWR | |

- (1) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.
(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⁾

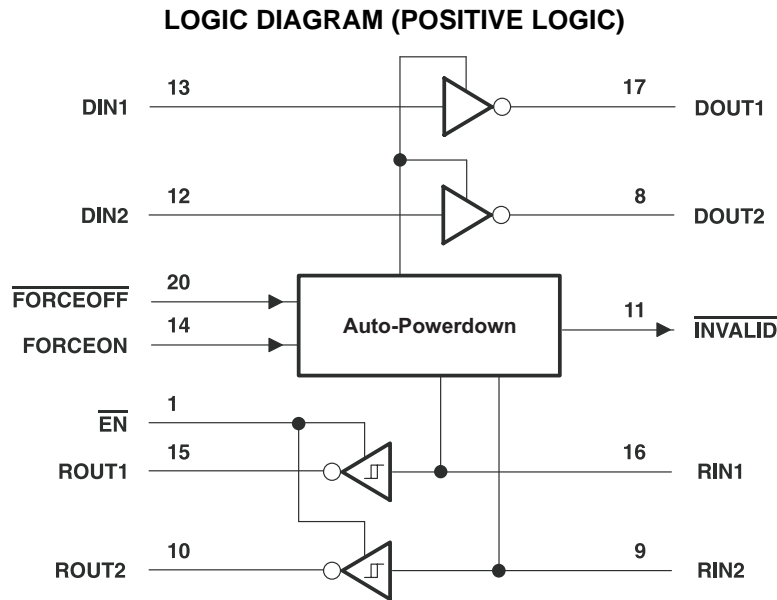
| INPUTS | | | | OUTPUT DOUT | DRIVER STATUS |
|--------|---------|----------|------------------------|-------------|---|
| DIN | FORCEON | FORCEOFF | VALID RIN RS-232 LEVEL | | |
| X | X | L | X | Z | Powered off |
| L | H | H | X | H | Normal operation with auto-powerdown disabled |
| H | H | H | X | 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 | | | OUTPUT ROUT |
|--------|----|------------------------|-------------|
| RIN | EN | VALID RIN RS-232 LEVEL | |
| 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 = input disconnected or connected driver off



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 _I | Input voltage range | Driver (FORCEOFF, FORCEON, EN) | | V |
| | | Receiver | | |
| V _O | Output voltage range | Driver | | V |
| | | Receiver (INVALID) | | |
| θ _{JA} | Package thermal impedance ⁽³⁾⁽⁴⁾ | DB package | | °C/W |
| | | DW package | | |
| | | PW package | | |
| 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.

TRSF3223
3-V TO 5.5-V MULTICHANNEL RS-232 COMPATIBLE
LINE DRIVER/RECEIVER

SLLS854–AUGUST 2007

Recommended Operating Conditions⁽¹⁾

See [Figure 6](#)

| | | | MIN | NOM | MAX | UNIT |
|----------------|---|--|-------------------------|-----|-----|------|
| Supply voltage | | $V_{CC} = 3.3\text{ V}$ | 3 | 3.3 | 3.6 | V |
| | | $V_{CC} = 5\text{ V}$ | 4.5 | 5 | 5.5 | |
| V_{IH} | Driver and control high-level input voltage | DIN, \overline{EN} , FORCEOFF, FORCEON | $V_{CC} = 3.3\text{ V}$ | 2 | | V |
| | | | $V_{CC} = 5\text{ V}$ | 2.4 | | |
| V_{IL} | Driver and control low-level input voltage | DIN, \overline{EN} , FORCEOFF, FORCEON | | | 0.8 | V |
| V_I | Driver and control input voltage | DIN, \overline{EN} , FORCEOFF, FORCEON | 0 | | 5.5 | V |
| | Receiver input voltage | | -25 | | 25 | |
| T_A | Operating free-air temperature | TRSF3223C | 0 | | 70 | °C |
| | | TRSF3223I | -40 | | 85 | |

(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 $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$.

Electrical Characteristics⁽¹⁾

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

| PARAMETER | | TEST CONDITIONS | MIN | TYP ⁽²⁾ | MAX | UNIT | |
|-----------|-----------------------|-------------------------------------|--|--------------------|---------|---------------|---------------|
| I_I | Input leakage current | \overline{EN} , FORCEOFF, FORCEON | ± 0.01 | | ± 1 | μA | |
| I_{CC} | Supply current | Auto-powerdown disabled | No load, FORCEOFF, FORCEON at V_{CC} | | 0.3 | 1 | mA |
| | | Powered off | 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 | μA |

(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⁽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 kΩ to GND | 5 | 5.4 | | V |
| V _{OL} | Low-level output voltage | 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 ⁽³⁾ | V _{CC} = 3.6 V, V _O = 0 V | | ±35 | ±60 | mA |
| | | V _{CC} = 5.5 V, V _O = 0 V | | ±35 | ±90 | |
| 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 | |

(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) 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 CONDITIONS | | MIN | TYP ⁽²⁾ | MAX | UNIT |
|--|--|---|-----|--------------------|-----|--------|
| Maximum data rate (see Figure 1) | R _L = 3 kΩ, One DOUT switching | C _L = 1000 pF | | 250 | | kbit/s |
| | | C _L = 250 pF, V _{CC} = 3 V to 4.5 V | | 1000 | | |
| | | C _L = 1000 pF, V _{CC} = 4.5 V to 5.5 V | | 1000 | | |
| t _{sk(p)} | Pulse skew ⁽³⁾ | C _L = 150 pF to 2500 pF, R _L = 3 kΩ to 7 kΩ, See Figure 2 | | 300 | | 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 | | 18 | 150 | V/μs |

(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.

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 _{OL} = 1.6 mA | | | 0.4 | V |
| V _{IT+} Positive-going input threshold voltage | V _{CC} = 3.3 V | | 1.6 | 2.4 | V |
| | V _{CC} = 5 V | | 1.9 | 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 | $\overline{EN} = V_{CC}$ | | ±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⁽¹⁾

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

| 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 kΩ, See Figure 4 | 200 | ns |
| t _{dis} Output disable time | C _L = 150 pF, R _L = 3 kΩ, 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.

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

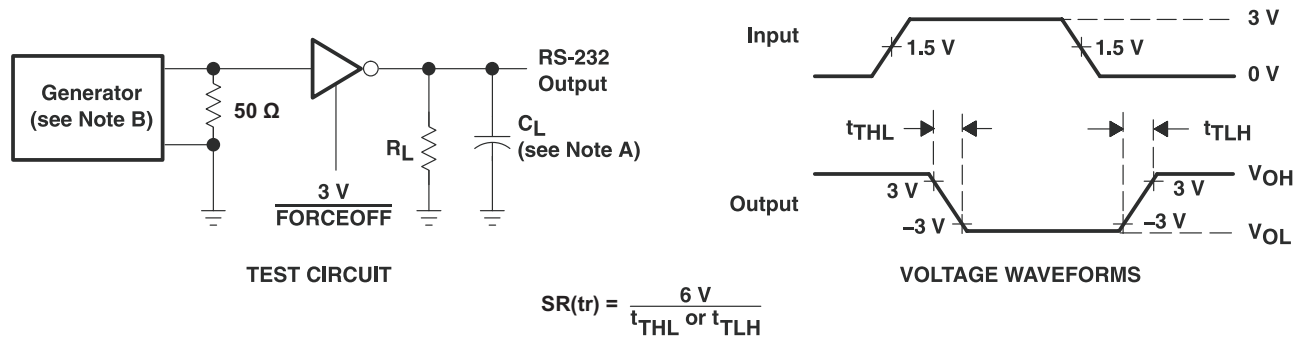
Switching Characteristics

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

| PARAMETER | | 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 |

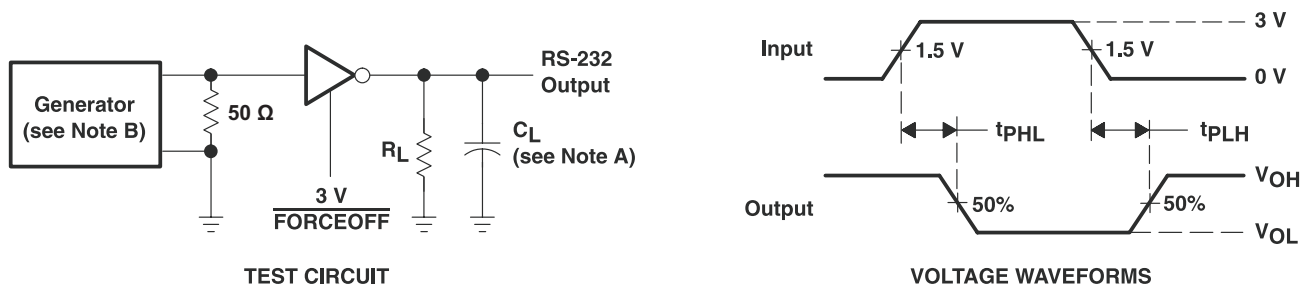
(1) All typical values are at $V_{CC} = 3.3\text{ V}$ or $V_{CC} = 5\text{ V}$, and $T_A = 25^\circ\text{C}$.

PARAMETER MEASUREMENT INFORMATION



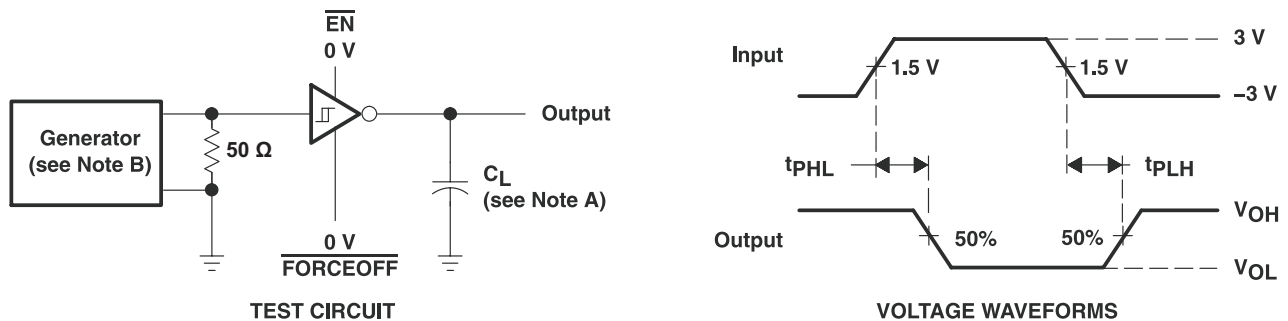
- A. C_L includes probe and jig capacitance.
- B. The pulse generator has the following characteristics: PRR = 250 kbits/s, $Z_O = 50 \Omega$, 50% duty cycle, $t_r \leq 10$ ns, $t_f \leq 10$ ns.

Figure 1. Driver Slew Rate



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

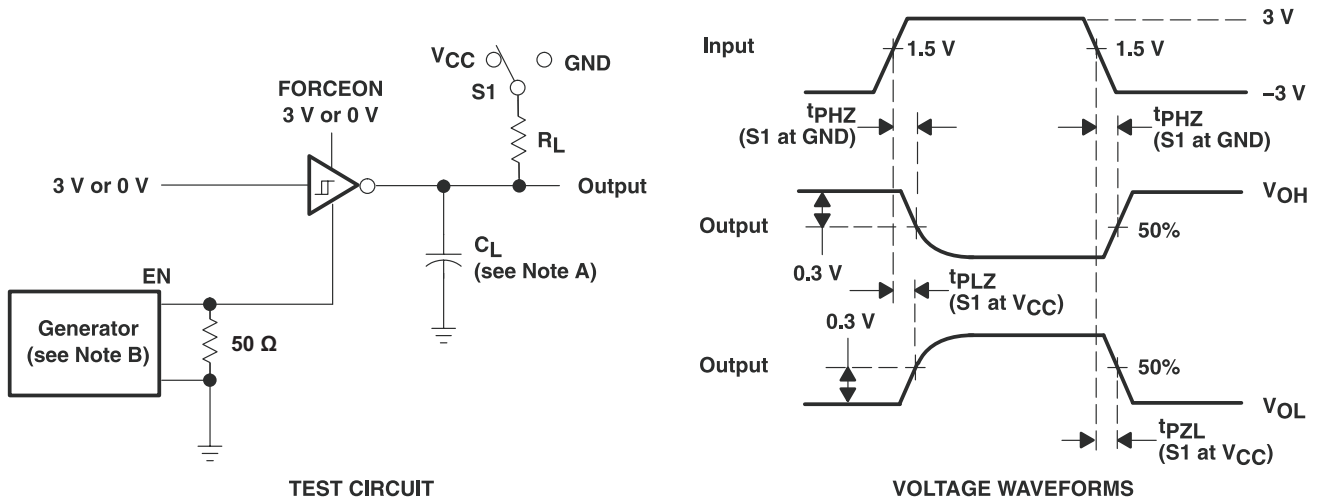
Figure 2. Driver Pulse Skew



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

Figure 3. Receiver Propagation Delay Times

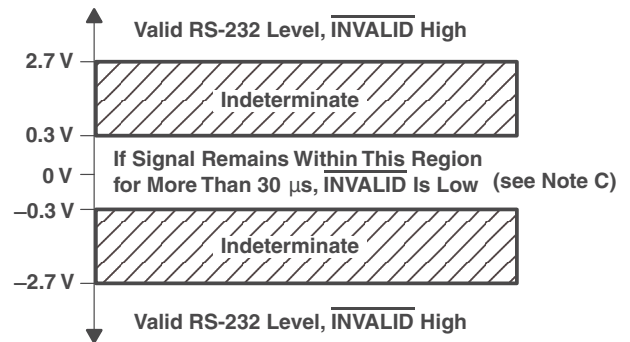
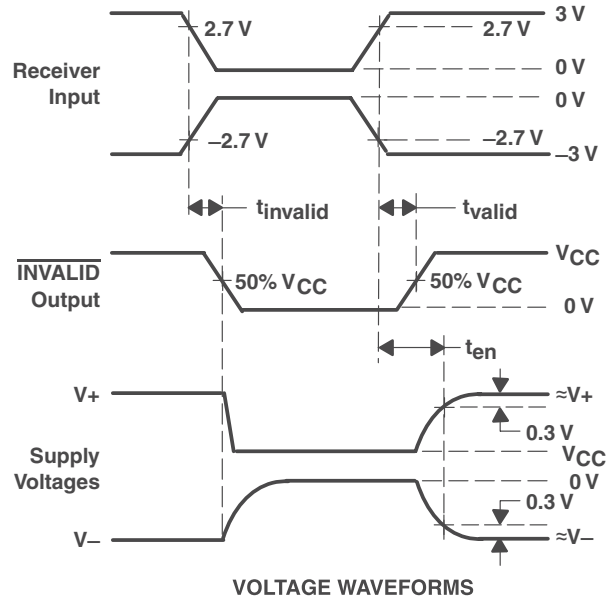
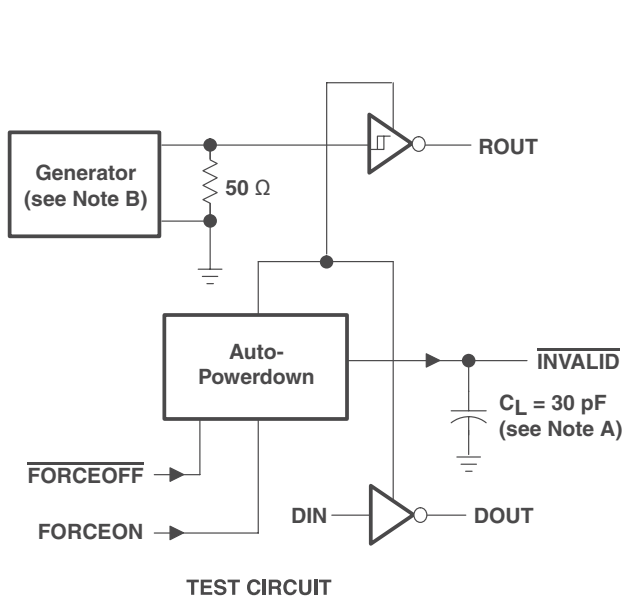
PARAMETER MEASUREMENT INFORMATION (continued)



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

Figure 4. Receiver Enable and Disable Times

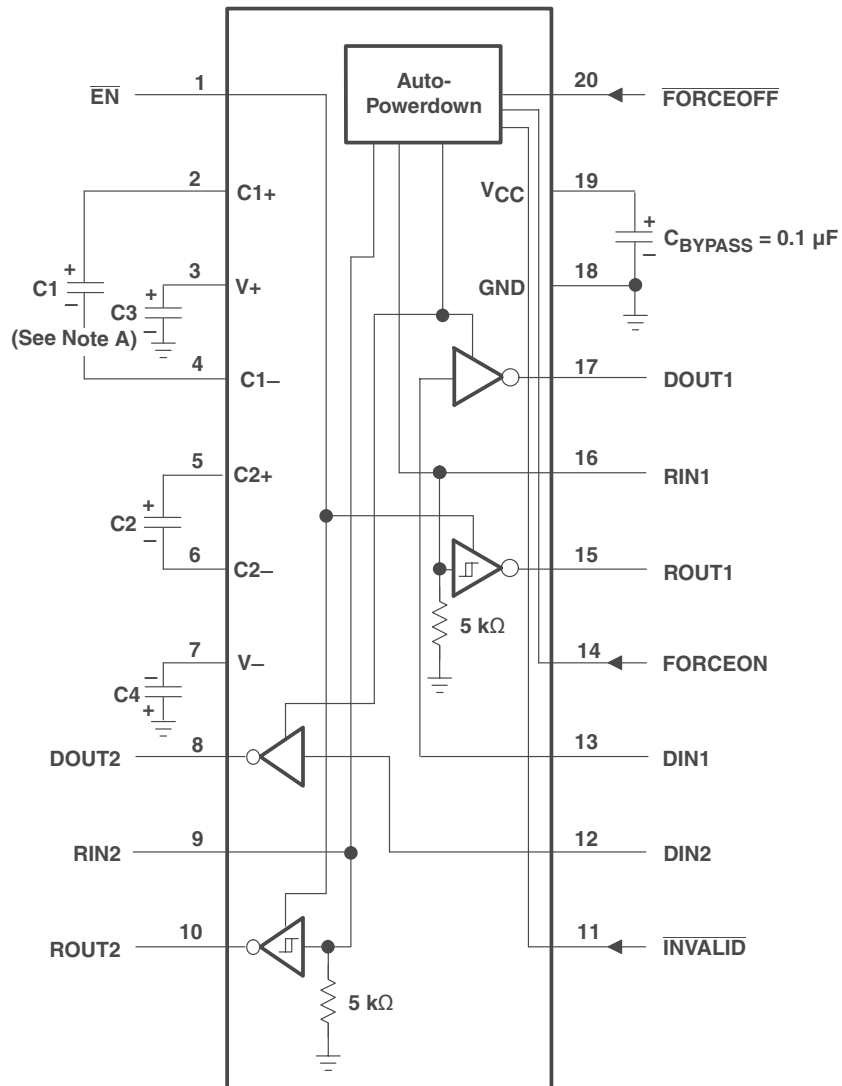
PARAMETER MEASUREMENT INFORMATION (continued)



- A. C_L includes probe and jig capacitance.
- B. The pulse generator has the following characteristics: PRR = 5 kbits/s, $Z_O = 50 \Omega$, 50% duty cycle, $t_r \leq 10$ ns, $t_f \leq 10$ ns.
- C. Auto-powerdown disables drivers and reduces supply current to 1 μ A.

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

APPLICATION INFORMATION



V_{CC} vs CAPACITOR VALUES

| V _{CC} | C1 | C2, C3, C4 |
|-----------------|----------|------------|
| 3.3 V ± 0.3 V | 0.1 μF | 0.1 μF |
| 5 V ± 0.5 V | 0.047 μF | 0.33 μF |
| 3 V to 5.5 V | 0.1 μF | 0.47 μF |

- A. C3 can be connected to V_{CC} or GND.
- B. Resistor values shown are nominal.

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⁾ | Samples (Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|----------------------|------------------------------|----------------------------------|
| TRSF3223CDB | ACTIVE | SSOP | DB | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223CDBG4 | ACTIVE | SSOP | DB | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223CDBR | ACTIVE | SSOP | DB | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223CDBRG4 | ACTIVE | SSOP | DB | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223CDW | ACTIVE | SOIC | DW | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223CDWG4 | ACTIVE | SOIC | DW | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223CDWR | ACTIVE | SOIC | DW | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223CDWRG4 | ACTIVE | SOIC | DW | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223CPW | ACTIVE | TSSOP | PW | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223CPWG4 | ACTIVE | TSSOP | PW | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223CPWR | ACTIVE | TSSOP | PW | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223CPWRG4 | ACTIVE | TSSOP | PW | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223IDB | ACTIVE | SSOP | DB | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223IDBG4 | ACTIVE | SSOP | DB | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223IDBR | ACTIVE | SSOP | DB | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223IDBRG4 | ACTIVE | SSOP | DB | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223IDW | ACTIVE | SOIC | DW | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223IDWG4 | ACTIVE | SOIC | DW | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223IDWR | ACTIVE | SOIC | DW | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223IDWRG4 | ACTIVE | SOIC | DW | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223IPW | ACTIVE | TSSOP | PW | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223IPWG4 | ACTIVE | TSSOP | PW | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223IPWR | ACTIVE | TSSOP | PW | 20 | | TBD | Call TI | Call TI | Purchase Samples |
| TRSF3223IPWRG4 | ACTIVE | TSSOP | PW | 20 | | TBD | Call TI | Call TI | Purchase 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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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.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-153

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