

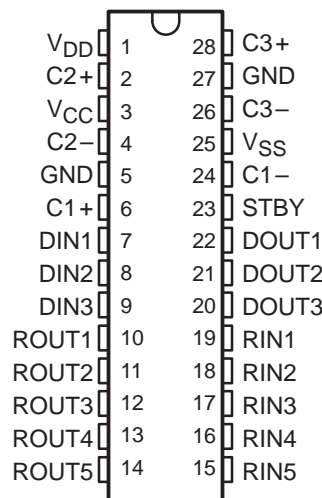
# SN75LV4735

## 3.3-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER

SLLS135E – FEBRUARY 1992 – REVISED MAY 1995

- **Meets or Exceeds the Requirements of ANSI EIA/TIA-232-E and ITU V.28**
- **Operates With Single 3.3-V Power Supply**
- **LinBiCMOS™ Process Technology**
- **Three Drivers and Five Receivers**
- **±30-V Input Levels (Receiver)**
- **ESD Protection on RS-232 Lines Exceeds 6 kV Per MIL-STD-883C, Method 3015**
- **Applications**
  - EIA/TIA-232 Interface
  - Battery-Powered Systems
  - Notebook PC
  - Computers
  - Terminals
  - Modems
- **Voltage Converter Operates With Low Capacitance . . . 0.47 μF Min**
- **Functionally Compatible With the SN75LV4737A**

**DB PACKAGE  
(TOP VIEW)**



† The DB package is only available in left-end taped and reeled (SN75LV4735DBLE).

### description

The SN75LV4735† is a low-power 3.3-V multichannel RS-232 line driver/receiver. It includes three independent RS-232 drivers and five independent RS-232 receivers. It is designed to operate off a single 3.3-V supply and has an internal switched-capacitor voltage converter to generate the RS-232 output levels. The SN75LV4735 provides a single chip, single 3.3-V supply interface between the asynchronous communications element (ACE or UART) and the serial-port connector of the data terminal equipment (DTE). This device has been designed to conform to standard ANSI EIA/TIA-232-E.

The switched-capacitor voltage converter of the SN75LV4735 uses five small external capacitors to generate the positive and negative voltages required by EIA/TIA-232-E line drivers from a single 3.3-V input. The drivers feature output slew-rate limiting to eliminate the need for external filter capacitors. The receivers can accept ±30 V without damage.

The device also features a reduced power or standby mode that cuts the quiescent power to the integrated circuits when not transmitting data between the CPU and peripheral equipment. The STBY input is driven high for standby (reduced power) mode and driven low for normal operating mode. When in the standby mode, all driver outputs (DOUT1–3) and receiver outputs (ROUT1–5) are in the high-impedance state. If the standby feature is not used in an application, STBY should be tied to GND.

The SN75LV4735 has been designed using LinBiCMOS™ technology and cells contained in the Texas Instruments LinASIC™ library. The SN75LV4735 is characterized for operation from 0°C to 70°C.



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.

† Patent-pending design

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**TEXAS  
INSTRUMENTS**

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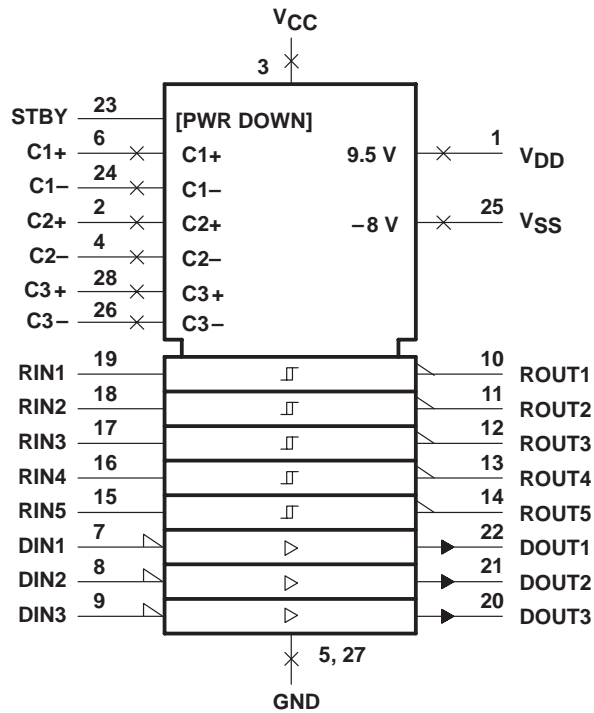
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# SN75LV4735

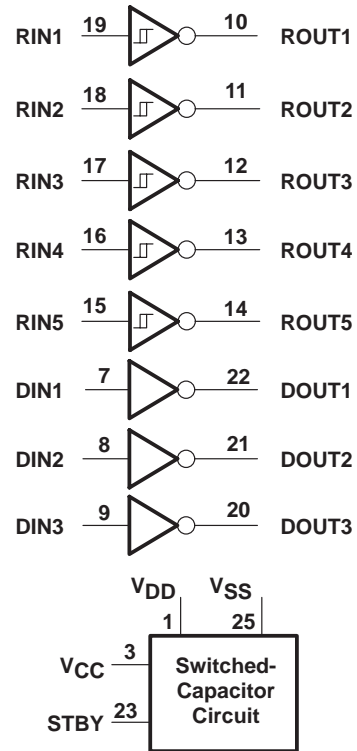
## 3.3-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER

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### logic symbol†



### logic diagram (positive logic)



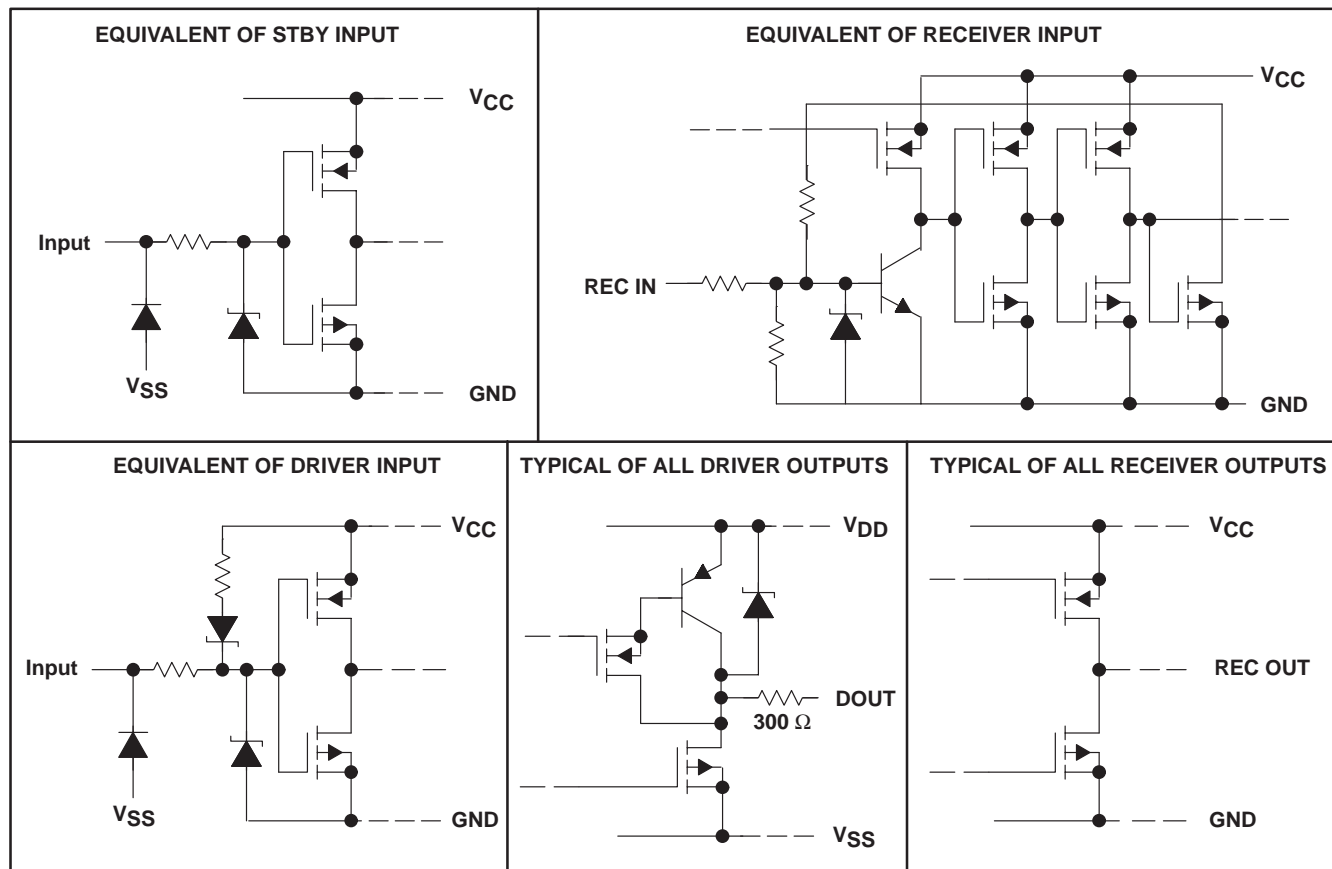
† This symbol is in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.

### Function Tables

EACH DRIVER			EACH RECEIVER		
INPUTS		OUTPUT	INPUTS		OUTPUT
DIN	STBY		RIN	STBY	
X	H	Z	X	H	Z
L	L	H	L	L	H
H	L	L	H	L	L
Open	L	L	Open	L	H

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

**schematics of inputs and outputs**



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

Supply voltage, V <sub>CC</sub>	4 V
Positive output supply voltage, V <sub>DD</sub> (see Note 1)	15 V
Negative output supply voltage, V <sub>SS</sub>	-15 V
Input voltage range, V <sub>I</sub> : DIN1–DIN3, STBY	-0.3 V to 7 V
RIN1–RIN5	-30 V to 30 V
Output voltage range, V <sub>O</sub> : DOUT1–DOUT3	V <sub>SS</sub> - 0.3 V to V <sub>DD</sub> + 0.3 V
ROUT1–ROUT5	-0.3 V to 7 V
Continuous total power dissipation	See Dissipation Rating Table
Operating free-air temperature range, T <sub>A</sub>	0°C to 70°C
Storage temperature range, T <sub>stg</sub>	-65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°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.

NOTE 1: All voltages are with respect to network GND.

**DISSIPATION RATING TABLE**

PACKAGE	T <sub>A</sub> ≤ 25°C POWER RATING	DERATING FACTOR ABOVE T <sub>A</sub> = 25°C	T <sub>A</sub> = 70°C POWER RATING
DB	668 mW	5.3 mW/°C	430 mW

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## 3.3-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER

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### recommended operating conditions

		MIN	NOM	MAX	UNIT
Supply voltage, $V_{CC}$		3	3.3	3.6	V
Positive output supply voltage, $V_{DD}$		8	10		V
Negative output supply voltage, $V_{SS}$		-7	-8		V
Input voltage, $V_I$ (see Note 2)	RIN(1-5)			±30	V
High-level input voltage, $V_{IH}$	DIN(1-3), STBY	2		0.8	V
Low-level input voltage, $V_{IL}$					
External capacitor		0.47	1		μF
Operating free-air temperature, $T_A$		0		70	°C

NOTE 2: The algebraic convention, where the more positive (less negative) limit is designated as maximum, is used in this data sheet for logic levels only. For example, if -10 V is a maximum, the typical value is a more negative voltage.

### supply currents

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$I_{CC}$	Supply current from $V_{CC}$ (normal operating mode)	No load, STBY AT 0 V, All other inputs open		8.5	20	mA
$I_{CC(SB)}$	Supply current (standby mode)	No load, STBY at $V_{CC}$ , All other inputs open			10	μA



### DRIVER SECTION

**electrical characteristics over operating free-air temperature range,  $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$  (unless otherwise noted)**

PARAMETER		TEST CONDITIONS	MIN	TYP†	MAX	UNIT
$V_{OH}$	High-level output voltage	$R_L = 3\text{ k}\Omega$	5.5	7		V
$V_{OL}$	Low-level output voltage (see Note 2)	$R_L = 3\text{ k}\Omega$		-5.5	-5	V
$I_{IH}$	High-level input current	$V_I$ at $V_{CC}$			1	$\mu\text{A}$
$I_{IL}$	Low-level input current	STBY			-1	$\mu\text{A}$
		Other inputs			-10	$\mu\text{A}$
$I_{OS(H)}$	High-level short-circuit output current (see Note 3)	$V_{CC} = 3.6\text{ V}$ , $V_O = 0$		-10	-20	mA
$I_{OS(L)}$	Low-level short-circuit output current (see Note 3)	$V_{CC} = 3.6\text{ V}$ , $V_O = 0$		10	20	mA
$r_O$	Output resistance	$V_{CC} = V_{DD} = V_{SS} = 0$ , $V_O = -2\text{ V to } 2\text{ V}$ , See Note 4	300			$\Omega$

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

- NOTES:
2. The algebraic convention, where the more positive (less negative) limit is designated as maximum, is used in this data sheet for logic levels only.
  3. Not more than one output should be shorted at one time.
  4. Test conditions are those specified by EIA/TIA-232-E.

**switching characteristics,  $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ ,  $T_A = 0^\circ\text{C to } 70^\circ\text{C}$**

PARAMETER		TEST CONDITIONS	MIN	TYP†	MAX	UNIT
$t_{PLH}$	Propagation delay time, low- to high-level output	$R_L = 3\text{ k}\Omega$ to GND, $C_L = 50\text{ pF}$ , See Figure 2	200	400	600	ns
$t_{PHL}$	Propagation delay time, high- to low-level output		100	200	350	ns
$t_{PZL}$	Output enable time to low level (see Note 5)	$R_L = 3\text{ k}\Omega$ to GND, $C_L = 50\text{ pF}$ , See Figure 3		3	7	ms
$t_{PZH}$	Output enable time to high level (see Note 5)			1	5	ms
$t_{PHZ}$	Output disable time from high level (see Note 5)			1	3	$\mu\text{s}$
$t_{PLZ}$	Output disable time from low level (see Note 5)			0.5	3	$\mu\text{s}$
SR	Output slew rate (see Note 6)	$R_L = 3\text{ k}\Omega$ to $7\text{ k}\Omega$ , $C_L = 50\text{ pF}$ , See Figure 2	3		30	$\text{V}/\mu\text{s}$
SR(tr)	Transition-region slew rate	$R_L = 3\text{ k}\Omega$ to GND, $C_L = 2500\text{ pF}$ , See Figure 4		3		$\text{V}/\mu\text{s}$

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

- NOTES:
5. Output enable occurs when STBY is driven low. Output disable occurs when STBY is driven high.
  6. Measured between 3-V and -3-V points of output waveform (EIA/TIA-232-E conditions); all unused inputs are tied either high or low.

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## 3.3-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER

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### RECEIVER SECTION

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

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT	
V <sub>IT+</sub>	Positive-going input threshold voltage		2.2	2.6	V	
V <sub>IT-</sub>	Negative-going input threshold voltage	0.6	1		V	
V <sub>hys</sub>	Input hysteresis voltage (V <sub>IT+</sub> – V <sub>IT-</sub> )	0.5	1.2	1.8	V	
V <sub>OH</sub>	High-level output voltage	I <sub>OH</sub> = –2 mA, See Note 7	2.4	2.6	V	
V <sub>OL</sub>	Low-level output voltage	I <sub>OL</sub> = 2 mA	0.2	0.4	V	
r <sub>I</sub>	Input resistance	V <sub>I</sub> = ±3 V to ±25 V	3	5	7	kΩ

† All typical values are at V<sub>CC</sub> = 3.3 V, T<sub>A</sub> = 25°C.

NOTE 7: If the inputs are left unconnected, the receiver interprets this as an input low, and the receiver outputs remain in the high state.

**switching characteristics over recommended ranges of supply voltage and operating free-air temperature, C<sub>L</sub> = 50 pF**

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
t <sub>PLH</sub>	Propagation delay time, low- to high-level output	45	80	130	ns
t <sub>PHL</sub>	Propagation delay time, high- to low-level output	70	100	170	ns
t <sub>PZL</sub>	Output enable time to low level (see Note 5)		160	250	ns
t <sub>PZH</sub>	Output enable time to high level (see Note 5)		4	10	μs
t <sub>PHZ</sub>	Output disable time from high level (see Note 5)		300	500	ns
t <sub>PLZ</sub>	Output disable time from low level (see Note 5)		140	200	ns

† All typical values are at V<sub>CC</sub> = 3.3 V, T<sub>A</sub> = 25°C.

NOTE 5: Output enable occurs when STBY is driven low. Output disable occurs when STBY input is driven high.

APPLICATION INFORMATION

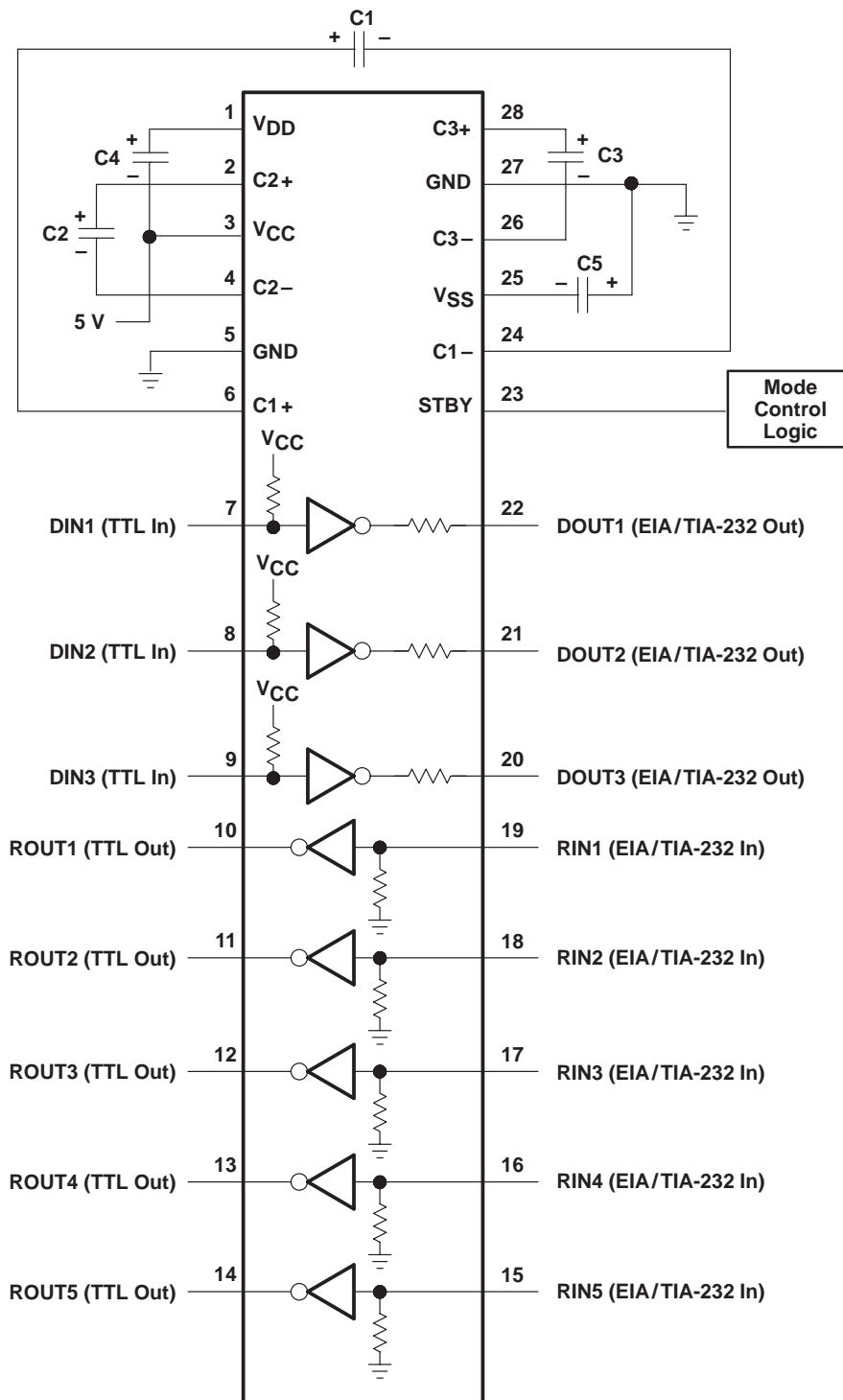


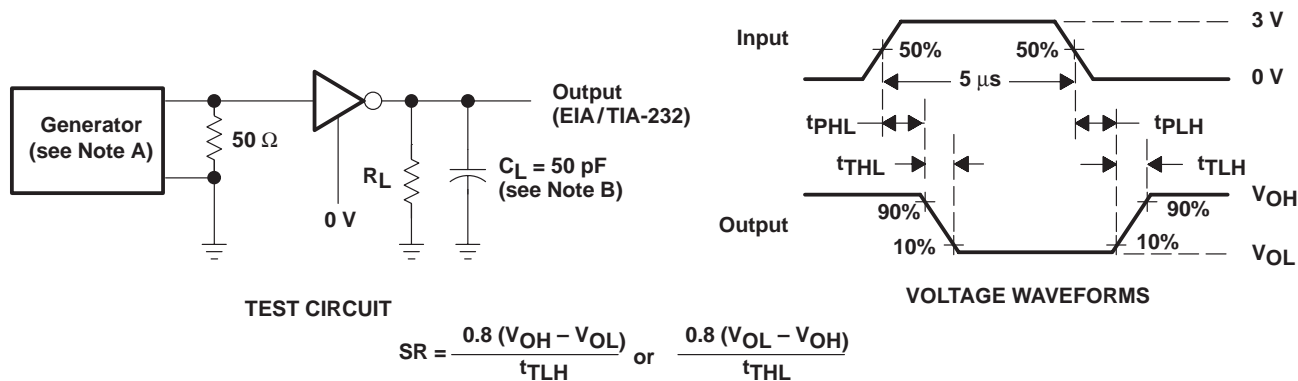
Figure 1. Typical Operating Circuit

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## 3.3-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER

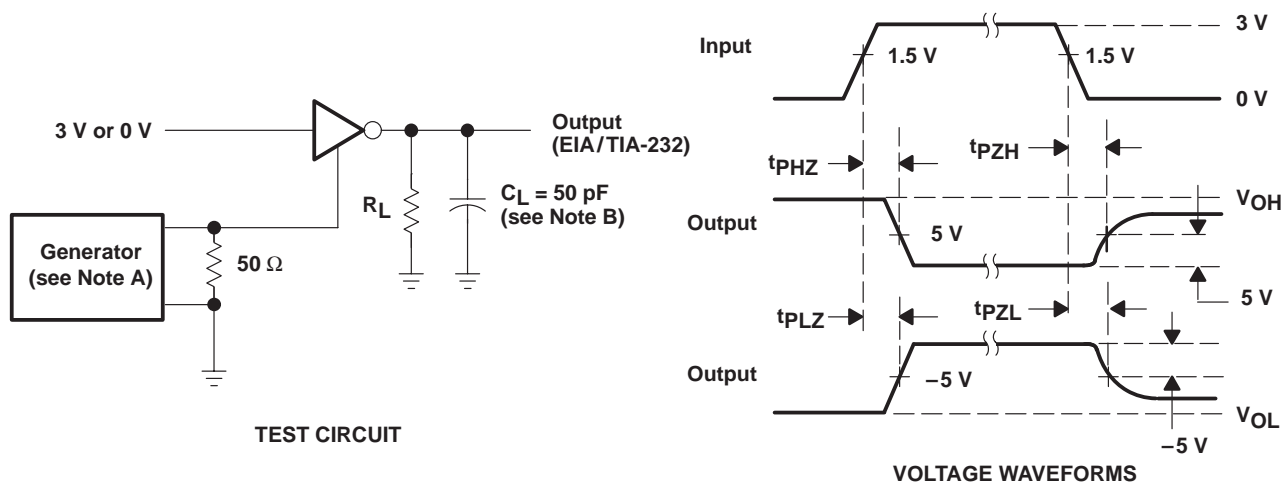
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### PARAMETER MEASUREMENT INFORMATION



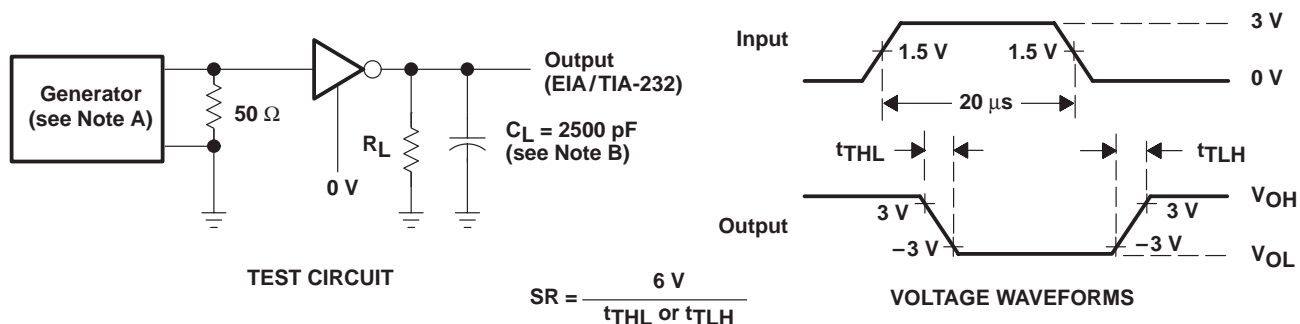
NOTES: A. The pulse generator has the following characteristics: 50% duty cycle,  $t_r \leq 10$  ns,  $t_f = 10$  ns.  
 B.  $C_L$  includes probe and jig capacitance.

Figure 2. Driver Test Circuit and Voltage Waveforms, Slew Rate at 5-µs Input



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

Figure 3. Driver Test Circuit and Voltage Waveforms

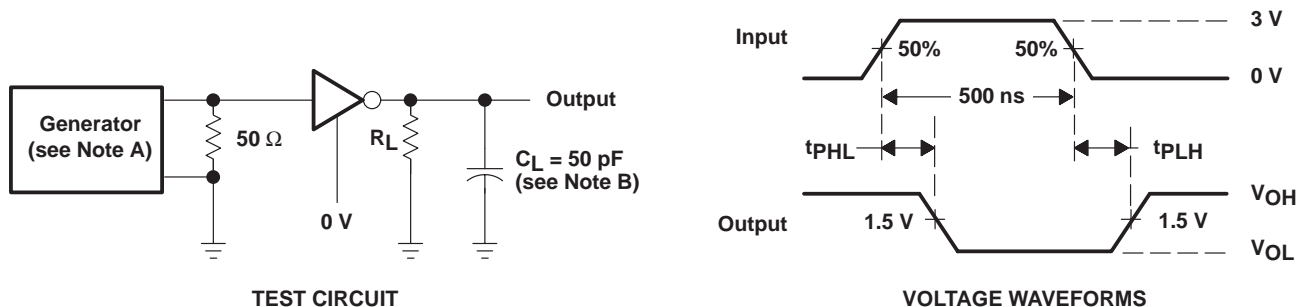


NOTES: A. The pulse generator has the following characteristics: 50% duty cycle,  $t_r \leq 10$  ns,  $t_f = 10$  ns.  
 B.  $C_L$  includes probe and jig capacitance.

Figure 4. Driver Test Circuit and Voltage Waveforms, Slew Rate at 20-µs Input

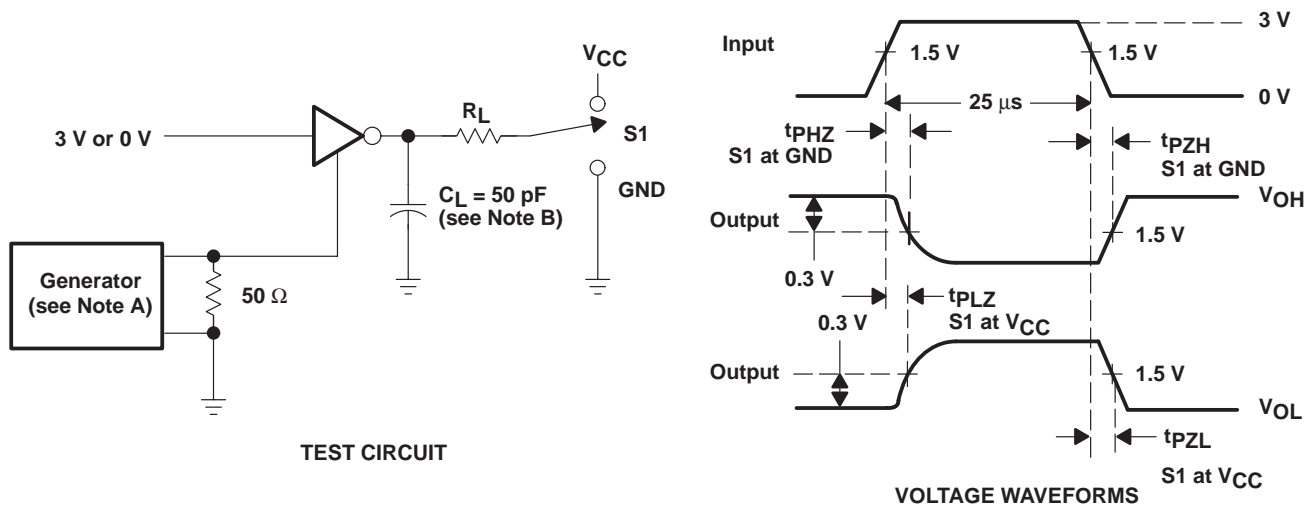


PARAMETER MEASUREMENT INFORMATION



NOTES: A. The pulse generator has the following characteristics: PRR = 1 MHz, 50% duty cycle,  $t_r \leq 10$  ns,  $t_f = 10$  ns.  
B.  $C_L$  includes probe and jig capacitance.

Figure 5. Receiver Test Circuit and Voltage Waveforms



NOTES: A. The pulse generator has the following characteristics: PRR = 1 MHz, 50% duty cycle,  $t_r \leq 10$  ns,  $t_f = 10$  ns.  
B.  $C_L$  includes probe and jig capacitance.

Figure 6. Receiver Test Circuit and Voltage Waveforms Enable and Disable Times

# SN75LV4735 3.3-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER

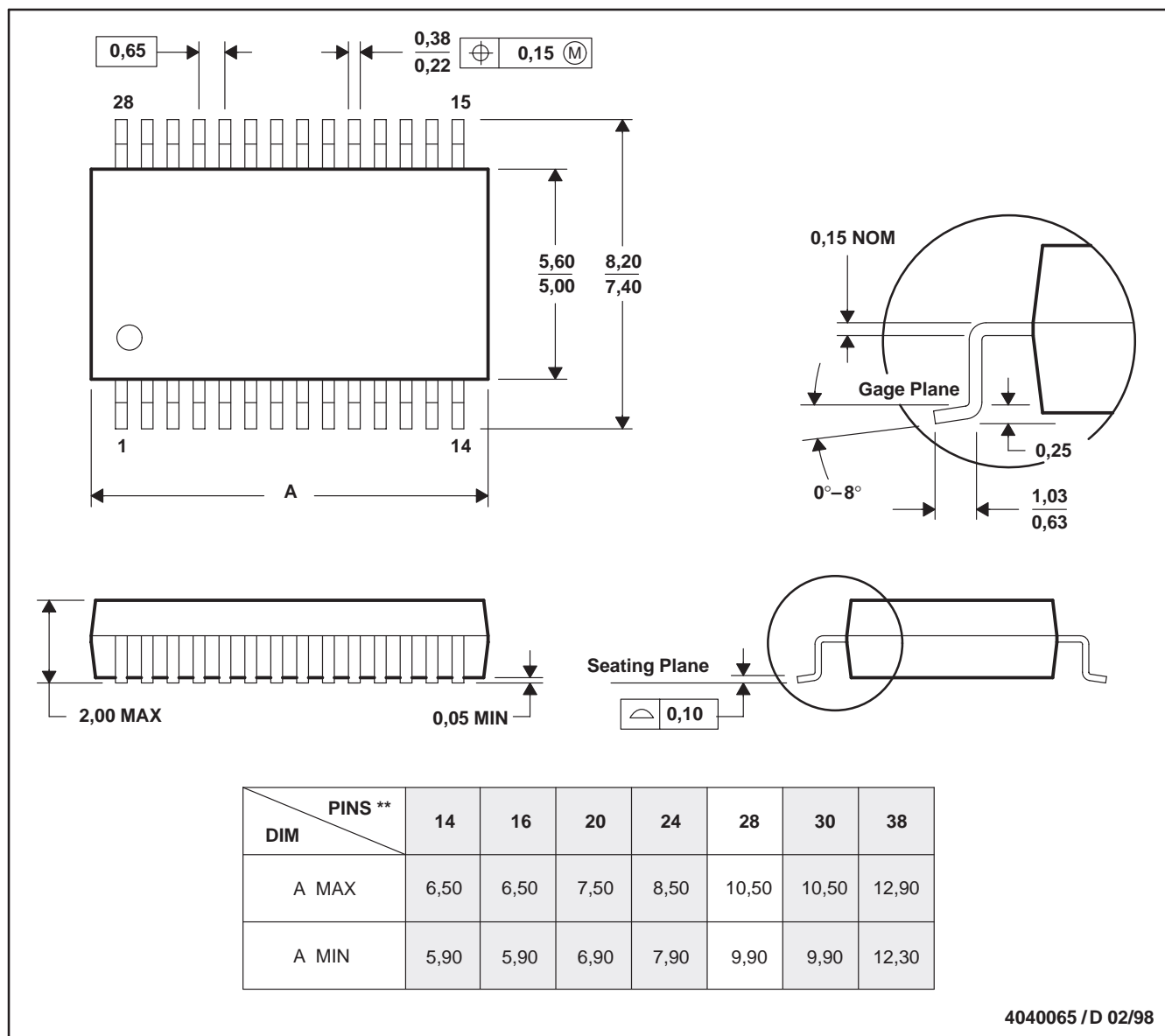
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## MECHANICAL DATA

DB (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

28 PIN 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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