

- Single-Chip and Single-Supply Interface for IBM PC/AT™ Serial Port
- Meets or Exceeds the Requirements of TIA/EIA-232-F and ITU v.11 Standards
- Operates With 3.3-V or 5-V Supplies
- One Receiver Remains Active During Standby (Wake-up Mode)
- Designed to Operate at 128 kbit/s Over a 3-m Cable
- Low Standby Current . . . 5 μ A Max
- ESD Protection on RS-232 Pins Meets or Exceeds 4 kV (HBM) and 1.5 kV (HBM) on All Pins Per MIL-STD-883, Method 3015
- External Capacitors . . . 0.1 μ F (V_{CC} = 3.3 V . . . Five External Capacitors) (V_{CC} = 5 V . . . Four External Capacitors)
- Accepts 5-V Logic Input With 3.3-V Supply
- Applications
 - RS-232 Interface
 - Battery-Powered Systems, PDAs
 - Notebook, Laptop, and Palmtop PCs
 - External Modems and Hand-Held Terminals
- Packaged in Shrink Small-Outline Package

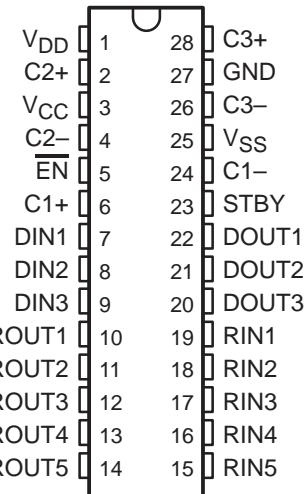
description

The SN75LV4737A[†] consists of three line drivers, five line receivers, and a charge-pump circuit. It provides the electrical interface between an asynchronous communication controller and the serial-port connector, and meets the requirements of TIA/EIA-232-F. This combination of drivers and receivers matches those needed for the typical serial port used in an IBM PC/AT or compatibles. The charge pump and five small external capacitors allow operation from a single 3.3-V supply, and four capacitors allow operation from a 5-V supply.

The device has flexible control options for power management when the serial port is inactive. A common disable for all of the drivers and receivers is provided with the active-high STBY input. The active-low EN input is an enable for one receiver to implement a wake-up feature for the serial port. All the logic inputs can accept signals from controllers operating from a 5-V supply, even though the SN75LV4737A is operating from 3.3 V.

The SN75LV4737A is characterized for operation over the temperature range of 0°C to 70°C.

DB PACKAGE[†]
(TOP VIEW)



[†]The DB package is only available in left-ended tape and reel (order part number SN75LV4737ADBR).



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[†]Patent-pending design

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SN75LV4737A

3.3-V/5-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER

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Function Tables

EACH DRIVER

INPUTS		OUTPUT
DIN	STBY	DOUT
X	H	Z
L	L	H
H	L	L
Open	L	L

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

EACH RECEIVER

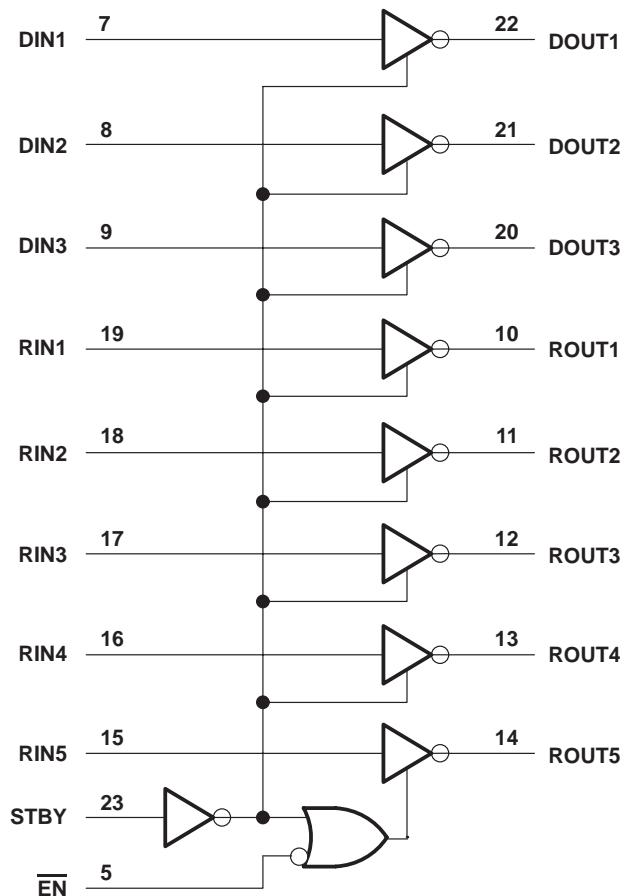
INPUTS				OUTPUTS	
STBY	EN	RIN5	RIN1–RIN4	ROUT5	ROUT1–ROUT4
H	H	X	X	Z	Z
H	L	H	X	L	Z
H	L	L	X	H	Z
L	X	L	L	H	H
L	X	H	H	L	L

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



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logic diagram (positive logic)

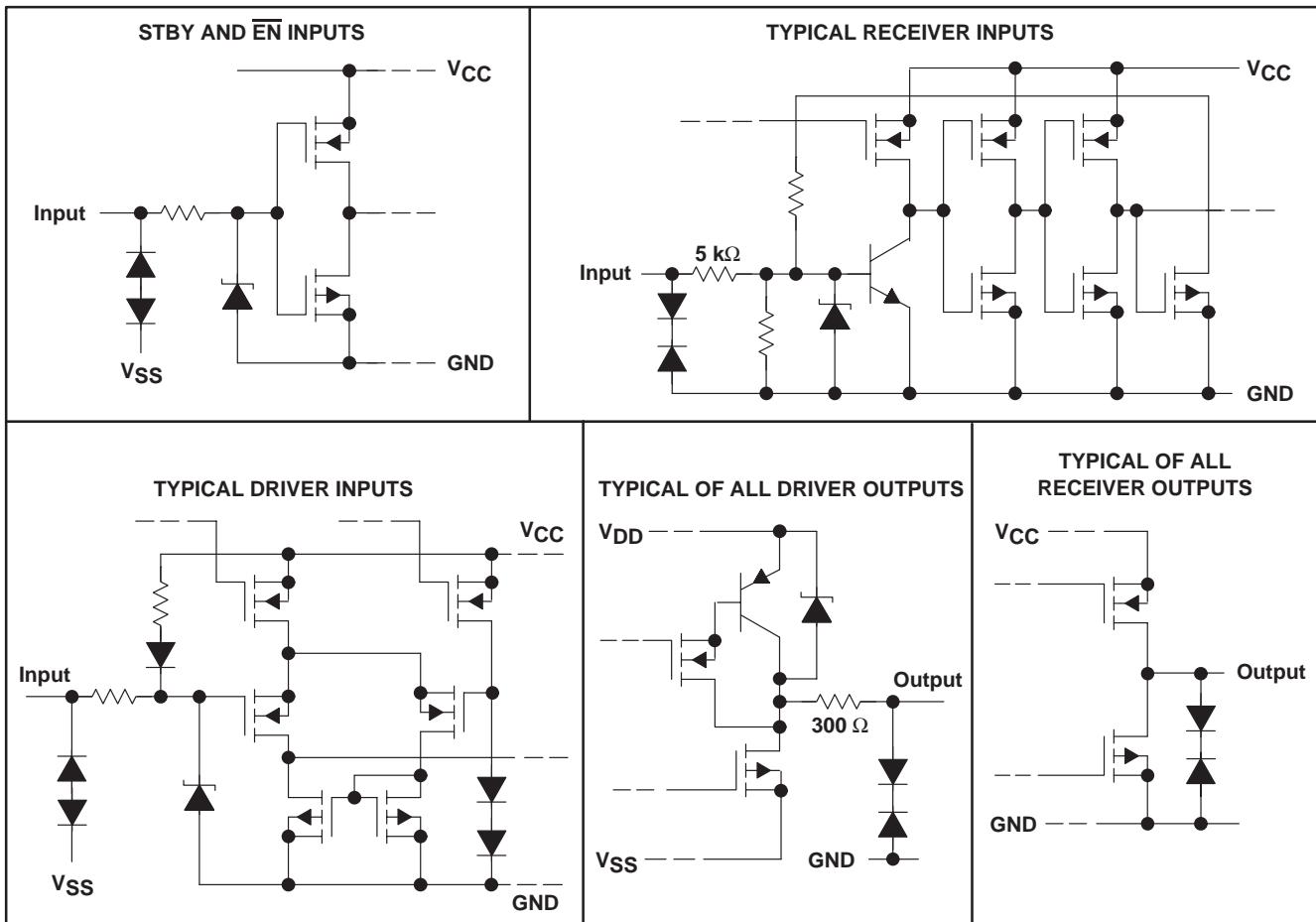


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3.3-V/5-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER

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schematics of inputs and outputs



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

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

2. The package thermal impedance is calculated in accordance with JESD 51.

recommended operating conditions

			MIN	NOM	MAX	UNIT		
V _{CC}	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 high-level input voltage		DIN, <u>EN</u> , STBY	V _{CC} = 3.3 V	2		V	
			DIN	V _{CC} = 5 V	2			
			<u>EN</u> , STBY		2.5			
V _{IL}	Driver low-level input voltage		DIN, <u>EN</u> , STBY				0.8	V
V _I	Receiver input voltage						±30	V
External capacitor		3.3-V operation (C1, C2, C3, C4, C5), 5-V operation (C1, C3, C4, C5), See Note 3 and Figures 6 and 7				0.1	μF	
T _A	Operating free-air temperature			0	70	°C		

NOTE 3: C2 is needed only for 3.3-V operation.

electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (see Figures 6 and 7) (unless otherwise noted)

PARAMETER	TEST CONDITIONS	V _{CC} = 3.3 V			V _{CC} = 5 V			UNIT		
		MIN	TYP†	MAX	MIN	TYP†	MAX			
V _{DD}	Positive supply voltage	No load	8	10	7	8.7		V		
V _{SS}	Negative supply voltage	No load	–9.5	–7	–8	–6		V		
I _I	Input current (<u>EN</u> , STBY)	See Notes 4 and 5		±2			±2	μA		
I _{CC}	Supply current	No load, Inputs open	STBY at GND, <u>EN</u> at V _{CC} or GND	8.4	10	18	10	12	20.7	mA
	Supply current (standby mode) (see Note 4)		<u>EN</u> , STBY at V _{CC}			5			5	μA
	Supply current (wake-up mode) (see Note 5)		EN at GND, STBY at V _{CC}			10			10	

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

NOTES: 4. When standby mode is not used, STBY input must be taken low.
5. When wake-up mode is not used, EN input must be taken high.

DRIVER 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_{OH} High-level output voltage	$R_L = 3 \text{ k}\Omega$	5.5	7		V
V_{OL} Low-level output voltage	$R_L = 3 \text{ k}\Omega$		-6	-5	V
I_{IH} High-level input current	$V_I = V_{CC}$		1		μA
I_{IL} Low-level input current	V_I at GND		-10		μA
I_{OS} Short-circuit output current (see Note 6)	$V_{CC} = 3.6 \text{ V}, V_O = 0 \text{ V}$	± 15	± 40		mA
	$V_{CC} = 5.5 \text{ V}, V_O = 0 \text{ V}$				
r_o Output resistance	$V_{CC} = V_{DD} = V_{SS} = 0 \text{ V}, V_O = \pm 2 \text{ V}$	300	500		Ω

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

NOTE 6: Short-circuit durations should be controlled to prevent exceeding the device absolute maximum power dissipation ratings, and not more than one output should be shorted at a time.

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

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT	
t_{PLH} Propagation delay time, low- to high-level output	$C_L = 50 \text{ pF}, R_L = 3 \text{ k}\Omega$ to $7 \text{ k}\Omega$, See Figure 1	$V_{CC} = 3.3 \text{ V}$	100	500	850	
		$V_{CC} = 5 \text{ V}$	100	500	850	
		$V_{CC} = 3.3 \text{ V}$	100	500	850	
		$V_{CC} = 5 \text{ V}$	100	500	850	
t_{PHL} Propagation delay time, high- to low-level output	$C_L = 50 \text{ pF}, R_L = 3 \text{ k}\Omega$ to $7 \text{ k}\Omega$, See Figure 2	$R_L = 3 \text{ k}\Omega$ to $7 \text{ k}\Omega$,	1	5	ms	
t_{PZH} Output enable time to high level			3	7	ms	
t_{PZL} Output enable time to low level		$C_L = 50 \text{ pF}, R_L = 3 \text{ k}\Omega$ to $7 \text{ k}\Omega$, See Figure 2	0.9	3	μs	
t_{PHZ} Output disable time from high level			0.6	3	μs	
t_{PLZ} Output disable time from low level		$V_{CC} = 3.3 \text{ V}$	0.5	3	μs	
		$V_{CC} = 5 \text{ V}$	0.3	3	μs	
SR Slew rate	$C_L = 50 \text{ pF}, R_L = 3 \text{ k}\Omega$ to $7 \text{ k}\Omega$, See Figure 1	4	30	$\text{V}/\mu\text{s}$		
$SR(\text{tr})$ Slew rate, transition region						

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

RECEIVER SECTION

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

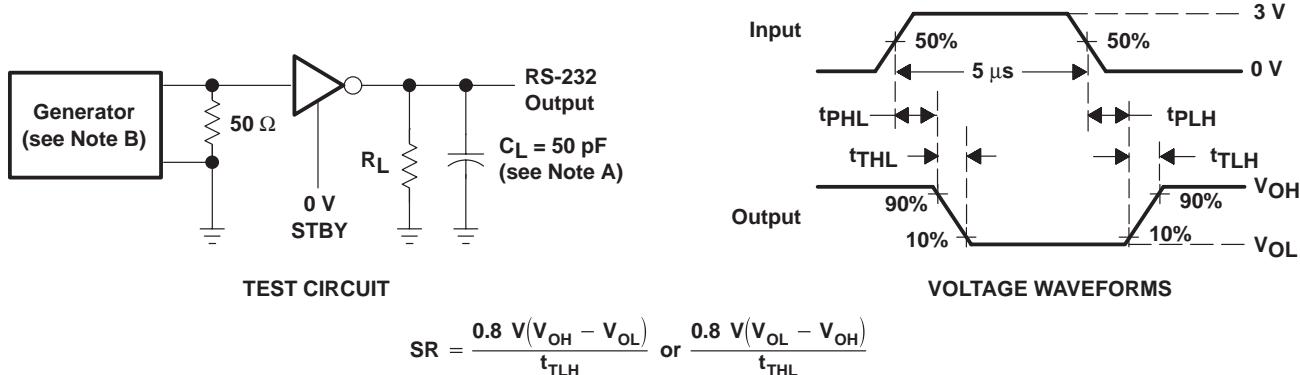
PARAMETER		TEST CONDITIONS			MIN	TYP†	MAX	UNIT
V _{OH}	High-level output voltage	I _{OH} = -2 mA	V _{CC} = 3.3 V		2.4	3		V
			V _{CC} = 5 V		3.5	5		
V _{OL}	Low-level output voltage	I _{OL} = 2 mA				0.2	0.4	V
V _{IT+}	Positive-going input threshold voltage				2.2		2.6	V
V _{IT-}	Negative-going input threshold voltage				0.6		1	V
V _{hys}	Input hysteresis (V _{IT+} - V _{IT-})				0.5	1.2	1.8	V
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.

switching characteristics over recommended ranges of supply voltage and operating free-air temperature, C_L = 50 pF, R_L = 3 kΩ to GND

PARAMETER	TEST CONDITIONS	V _{CC} = 3.3 V			V _{CC} = 5 V			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
t _{PLH}	See Figure 4	10	70	200	10	70	200	ns
t _{PHL}		10	60	200	10	55	200	ns
t _{PLH}		40		200	40		200	μs
t _{PHL}		90		500	70		500	ns
t _{PZH}	See Figure 5	3		10	1.2		10	μs
t _{PZL}		100		250	60		250	ns
t _{PHZ}		100	200	600	100	150	600	ns
t _{PZL}		130		250	60		250	ns

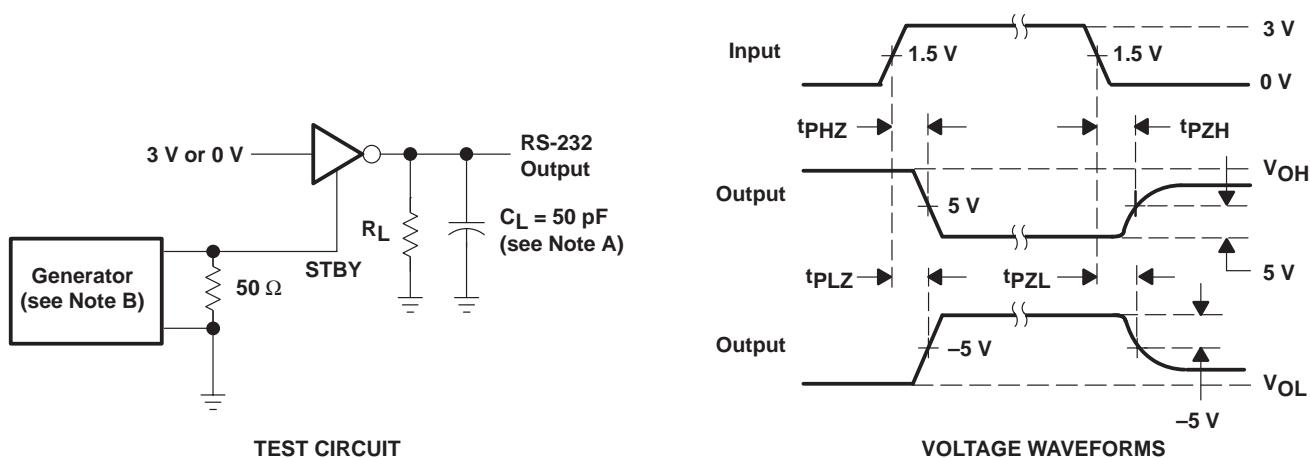
PARAMETER MEASUREMENT INFORMATION



NOTES: A. C_L includes probe and jig capacitance.

B. The pulse generator has the following characteristics: $Z_O = 50 \Omega$, 50% duty cycle, $t_r \leq 10 \text{ ns}$, $t_f \leq 10 \text{ ns}$.

Figure 1. Driver Propagation Delay Times and Slew Rate (5-μs Input)

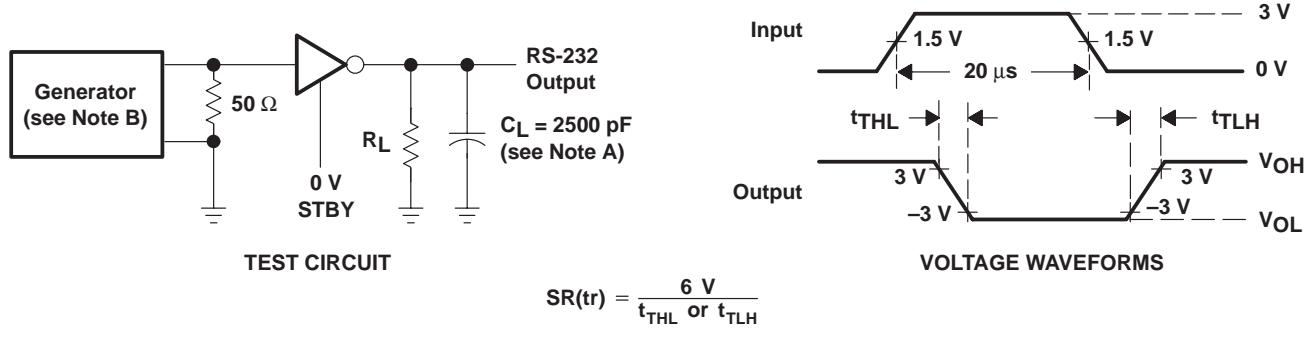


NOTES: A. C_L includes probe and jig capacitance.

B. The pulse generator has the following characteristics: $Z_O = 50 \Omega$, 50% duty cycle, $t_r \leq 10 \text{ ns}$, $t_f \leq 10 \text{ ns}$.

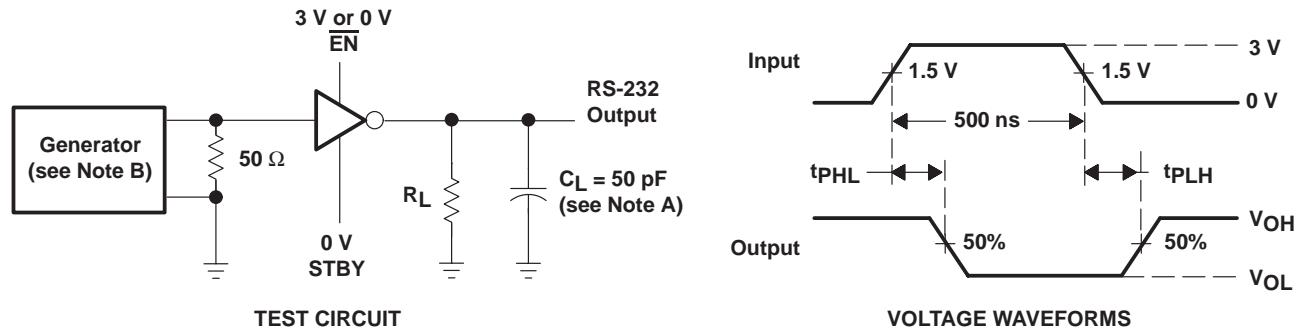
Figure 2. Driver Enable and Disable Test Times

PARAMETER MEASUREMENT INFORMATION



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

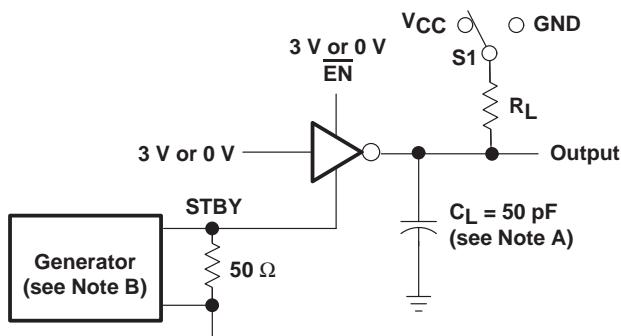
Figure 3. Driver Transition Times and Slew Rate (20- μs Input)



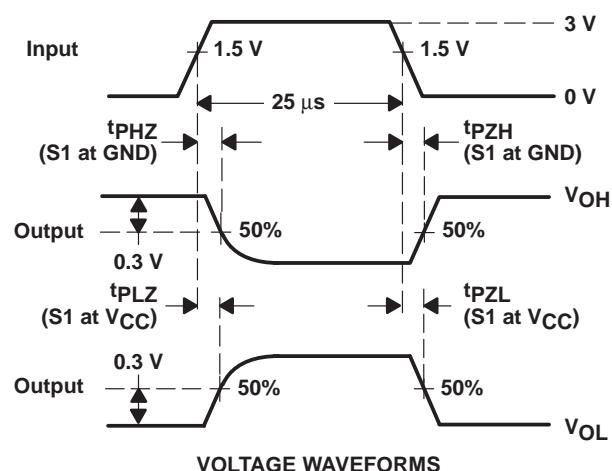
NOTES: A. C_L includes probe and jig capacitance.
B. The pulse generator has the following characteristics: PRR = 1 MHz, $Z_O = 50 \Omega$, 50% duty cycle, $t_r \leq 10 \text{ ns}$, $t_f \leq 10 \text{ ns}$.

Figure 4. Receiver Propagation Delay Times

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



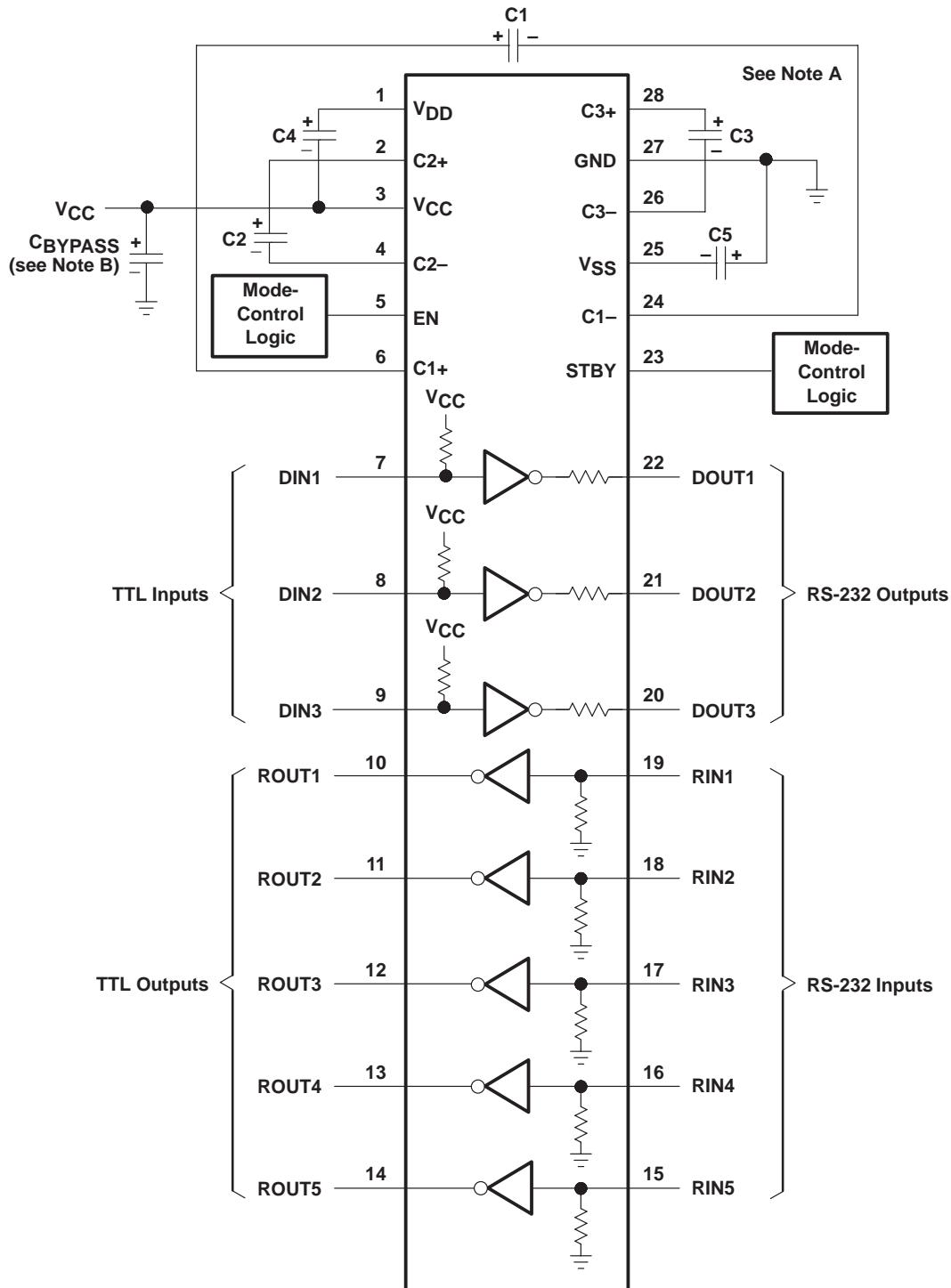
VOLTAGE WAVEFORMS

NOTES: A. C_L includes probe and jig capacitance.

B. The pulse generator has the following characteristics: PRR = 1 MHz, $Z_O = 50 \Omega$, 50% duty cycle, $t_r \leq 10$ ns, $t_f \leq 10$ ns.

Figure 5. Receiver Enable and Disable Times

APPLICATION INFORMATION



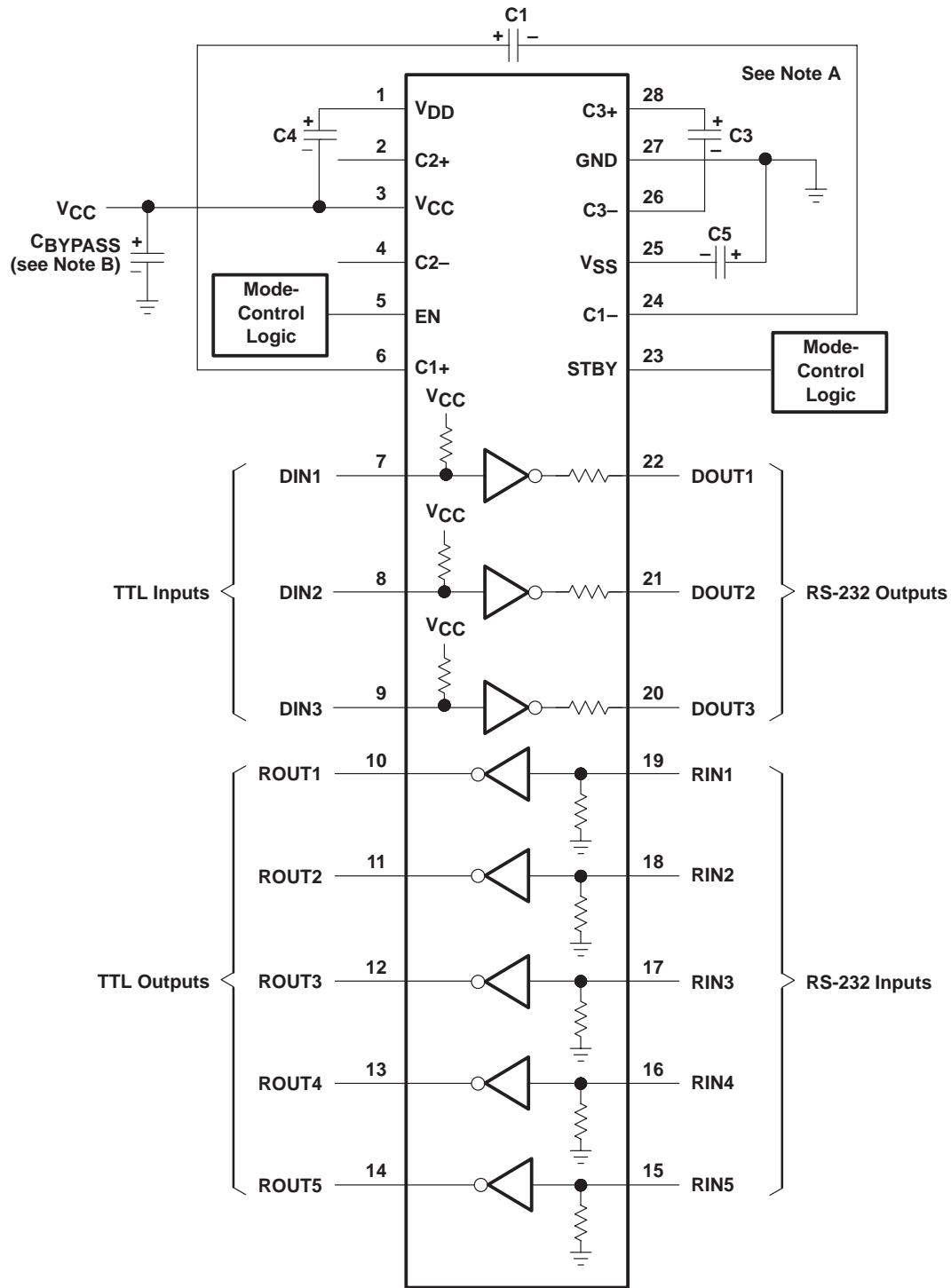
NOTES: A. $C_1 = C_2 = C_3 = C_4 = C_5 = C_{\text{BYPASS}} = 0.1 \mu\text{F}$
 B. C_{BYPASS} is used as a decoupling capacitor.

Figure 6. Typical 3.3-V Operating Circuit

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APPLICATION INFORMATION



NOTES: A. C2 is not used. C1 = C3 = C4 = C5 = $C_{BYPASS} = 0.1 \mu F$
 B. C_{BYPASS} is used as a decoupling capacitor.

Figure 7. Typical 5-V Operating Circuit

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