

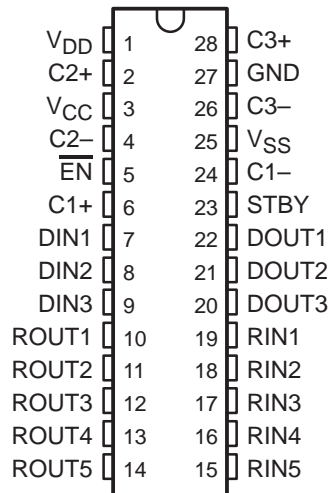
# SN75LV4737A

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

SLLS178D – APRIL 1994 – REVISED FEBRUARY 2000

- **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  $\mu$ 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  $\mu$ 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**

**DB PACKAGE†  
(TOP VIEW)**



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

### 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  $\overline{EN}$  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.



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‡ Patent-pending design

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# SN75LV4737A

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

SLLS178D – APRIL 1994 – REVISED FEBRUARY 2000

### 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

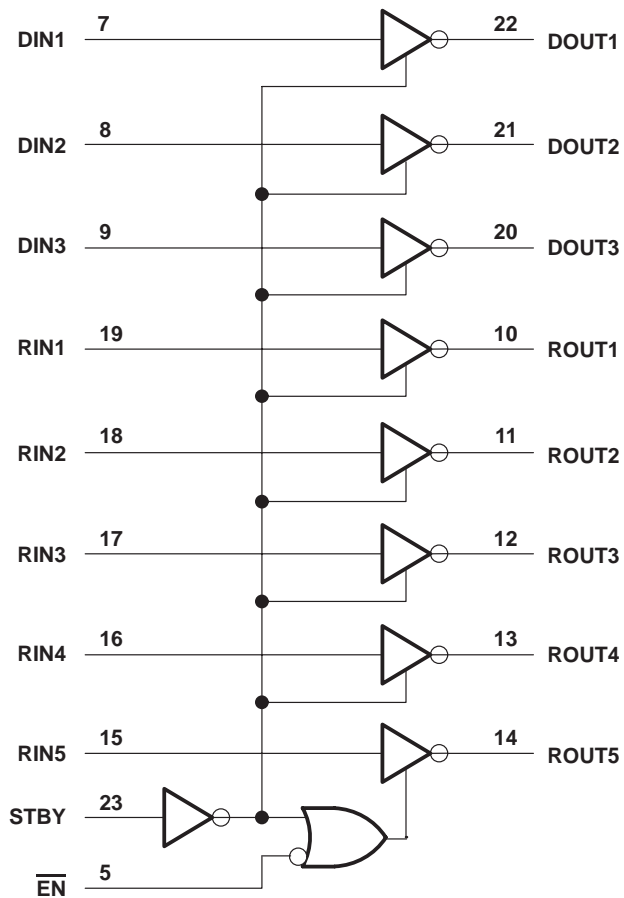
INPUTS				OUTPUTS	
STBY	$\overline{\text{EN}}$	RIN5	RIN1–RIN4	ROUT5	ROUT1–ROUT4
H	H	X	X	Z	Z
H	L	H	X	L	Z
H	L	L	X	H	Z
L	X	L	L	H	H
L	X	H	H	L	L

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

SN75LV4737A  
3.3-V/5-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER

SLLS178D – APRIL 1994 – REVISED FEBRUARY 2000

logic diagram (positive logic)

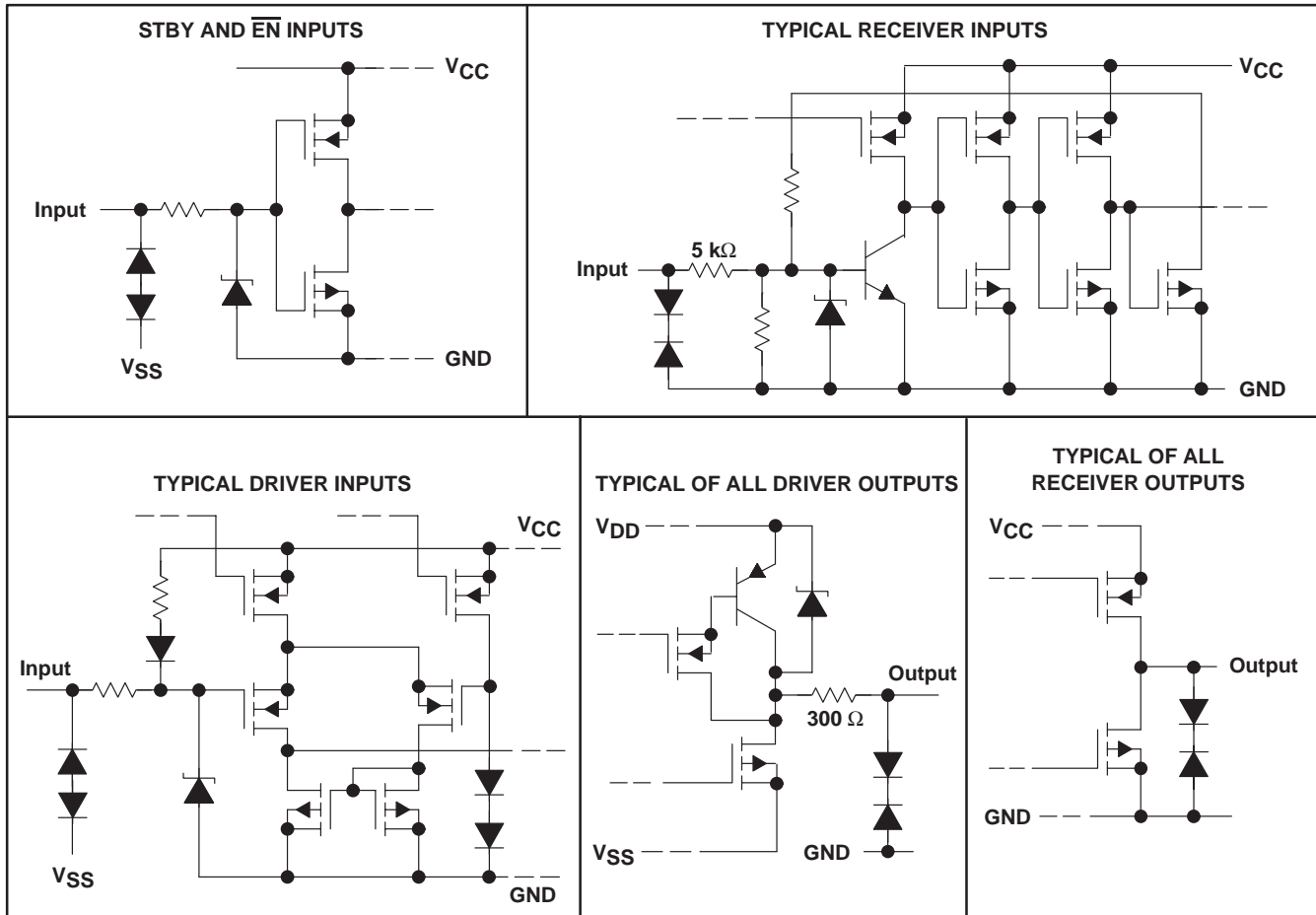


# SN75LV4737A

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

SLLS178D – APRIL 1994 – REVISED FEBRUARY 2000

### schematics of inputs and outputs



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

Supply voltage, $V_{CC}$	7 V
Positive output supply voltage, $V_{DD}$ (see Note 1)	15 V
Negative output supply voltage, $V_{SS}$	-15 V
Input voltage range, $V_I$ : Driver	-3 V to 7 V
Receiver	-30 V to 30 V
Output voltage range, $V_O$ : Driver	$V_{SS} - 0.3\text{ V}$ to $V_{DD} + 0.3\text{ V}$
Receiver	-0.3 V to 7 V
Package thermal impedance, $\theta_{JA}$ (see Note 2)	62°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°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: 1. All voltages are with respect to network GND.  
2. The package thermal impedance is calculated in accordance with JESD 51.

# SN75LV4737A

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

SLLS178D – APRIL 1994 – REVISED FEBRUARY 2000

### recommended operating conditions

			MIN	NOM	MAX	UNIT	
V <sub>CC</sub>	Supply voltage	V <sub>CC</sub> = 3.3 V	3	3.3	3.6	V	
		V <sub>CC</sub> = 5 V	4.5	5	5.5	V	
V <sub>IH</sub>	Driver high-level input voltage	DIN, $\overline{\text{EN}}$ , STBY	V <sub>CC</sub> = 3.3 V			V	
		DIN	2				
		$\overline{\text{EN}}$ , STBY	V <sub>CC</sub> = 5 V				
V <sub>IL</sub>	Driver low-level input voltage	DIN, $\overline{\text{EN}}$ , STBY			0.8	V	
V <sub>I</sub>	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 <sub>A</sub>	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 <sub>CC</sub> = 3.3 V			V <sub>CC</sub> = 5 V			UNIT		
			MIN	TYP†	MAX	MIN	TYP†	MAX			
V <sub>DD</sub>	Positive supply voltage	No load	8	10		7	8.7		V		
V <sub>SS</sub>	Negative supply voltage	No load			-9.5	-7		-8	-6	V	
I <sub>I</sub>	Input current ( $\overline{\text{EN}}$ , STBY)	See Notes 4 and 5						±2	±2	μA	
I <sub>CC</sub>	Supply current	No load, Inputs open	STBY at GND, $\overline{\text{EN}}$ at V <sub>CC</sub> or GND		8.4	10	18	10	12	20.7	mA
	Supply current (standby mode) (see Note 4)		$\overline{\text{EN}}$ , STBY at V <sub>CC</sub>				5			5	μA
	Supply current (wake-up mode) (see Note 5)		$\overline{\text{EN}}$ at GND, STBY at V <sub>CC</sub>				10			10	

† All typical values are at V<sub>CC</sub> = 3.3 V or V<sub>CC</sub> = 5 V, and T<sub>A</sub> = 25°C.

- NOTES: 4. When standby mode is not used, STBY input must be taken low.  
5. When wake-up mode is not used,  $\overline{\text{EN}}$  input must be taken high.



# SN75LV4737A

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

SLLS178D – APRIL 1994 – REVISED FEBRUARY 2000

### 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 <sub>OH</sub>	High-level output voltage	R <sub>L</sub> = 3 kΩ	5.5	7		V
V <sub>OL</sub>	Low-level output voltage	R <sub>L</sub> = 3 kΩ		-6	-5	V
I <sub>IH</sub>	High-level input current	V <sub>I</sub> = V <sub>CC</sub>			1	μA
I <sub>IL</sub>	Low-level input current	V <sub>I</sub> at GND			-10	μA
I <sub>OS</sub>	Short-circuit output current (see Note 6)	V <sub>CC</sub> = 3.6 V, V <sub>O</sub> = 0 V		±15	±40	mA
		V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 0 V				
r <sub>o</sub>	Output resistance	V <sub>CC</sub> = V <sub>DD</sub> = V <sub>SS</sub> = 0 V, V <sub>O</sub> = ±2 V	300	500		Ω

† All typical values are at V<sub>CC</sub> = 3.3 V or V<sub>CC</sub> = 5 V, and T<sub>A</sub> = 25°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 <sub>PLH</sub>	Propagation delay time, low- to high-level output	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 3 kΩ to 7 kΩ, See Figure 1	V <sub>CC</sub> = 3.3 V	100	500	850	ns
			V <sub>CC</sub> = 5 V	100	500	850	
t <sub>PHL</sub>	Propagation delay time, high- to low-level output		V <sub>CC</sub> = 3.3 V	100	500	850	ns
			V <sub>CC</sub> = 5 V	100	500	850	
t <sub>PZH</sub>	Output enable time to high level	C <sub>L</sub> = 50 pF, See Figure 2	R <sub>L</sub> = 3 kΩ to 7 kΩ,		1	5	ms
t <sub>PZL</sub>	Output enable time to low level				3	7	ms
t <sub>PHZ</sub>	Output disable time from high level	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 3 kΩ to 7 kΩ, See Figure 2	V <sub>CC</sub> = 3.3 V		0.9	3	μs
			V <sub>CC</sub> = 5 V		0.6	3	
t <sub>PLZ</sub>	Output disable time from low level		V <sub>CC</sub> = 3.3 V		0.5	3	μs
			V <sub>CC</sub> = 5 V		0.3	3	
SR	Slew rate	C <sub>L</sub> = 50 pF, See Figure 1	R <sub>L</sub> = 3 kΩ to 7 kΩ,	4		30	V/μs
SR(tr)	Slew rate, transition region	C <sub>L</sub> = 2500 pF, See Figure 3	R <sub>L</sub> = 3 kΩ to 7 kΩ,	3		30	V/μs

† All typical values are at V<sub>CC</sub> = 3.3 V or V<sub>CC</sub> = 5 V, and T<sub>A</sub> = 25°C.



# SN75LV4737A

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

SLLS178D – APRIL 1994 – REVISED FEBRUARY 2000

### 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>OH</sub>	High-level output voltage	I <sub>OH</sub> = -2 mA	V <sub>CC</sub> = 3.3 V	2.4	3	V
			V <sub>CC</sub> = 5 V	3.5	5	
V <sub>OL</sub>	Low-level output voltage	I <sub>OL</sub> = 2 mA		0.2	0.4	V
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 (V <sub>IT+</sub> - V <sub>IT-</sub> )		0.5	1.2	1.8	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 or V<sub>CC</sub> = 5 V, and T<sub>A</sub> = 25°C.

**switching characteristics over recommended ranges of supply voltage and operating free-air temperature, C<sub>L</sub> = 50 pF, R<sub>L</sub> = 3 kΩ to GND**

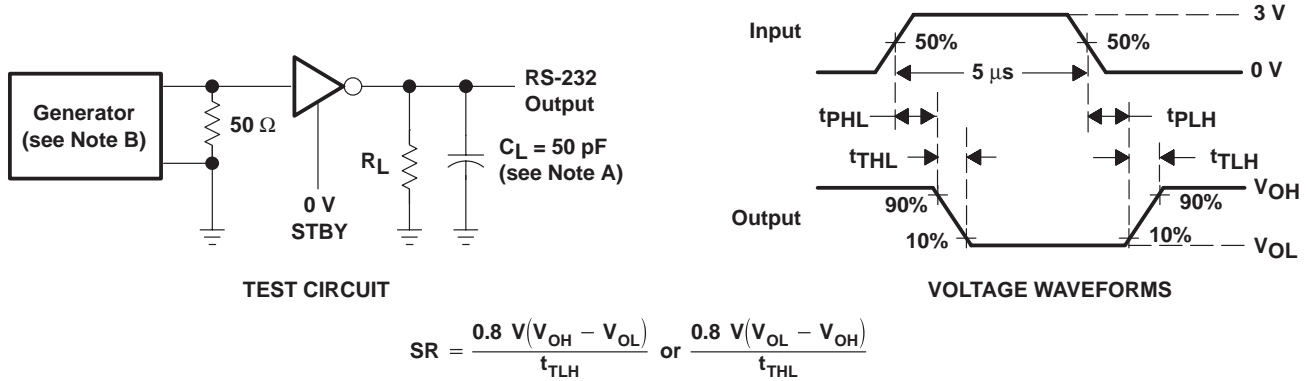
PARAMETER	TEST CONDITIONS	V <sub>CC</sub> = 3.3 V			V <sub>CC</sub> = 5 V			UNIT		
		MIN	TYP	MAX	MIN	TYP	MAX			
t <sub>PLH</sub>	Propagation delay time, low- to high-level output	See Figure 4	10	70	200	10	70	200	ns	
t <sub>PHL</sub>	Propagation delay time, high- to low-level output		10	60	200	10	55	200	ns	
t <sub>PLH</sub>	Propagation delay time, low- to high-level output (wake-up mode)		40	200		40	200	μs		
t <sub>PHL</sub>	Propagation delay time, high- to low-level output (wake-up mode)		90	500		70	500	ns		
t <sub>pZH</sub>	Output enable time to high level		See Figure 5	3	10		1.2	10	μs	
t <sub>pZL</sub>	Output enable time to low level			100	250		60	250	ns	
t <sub>PHZ</sub>	Output disable time from high level			100	200	600	100	150	600	ns
t <sub>PLZ</sub>	Output disable time from low level			130	250		60	250	ns	

# SN75LV4737A

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

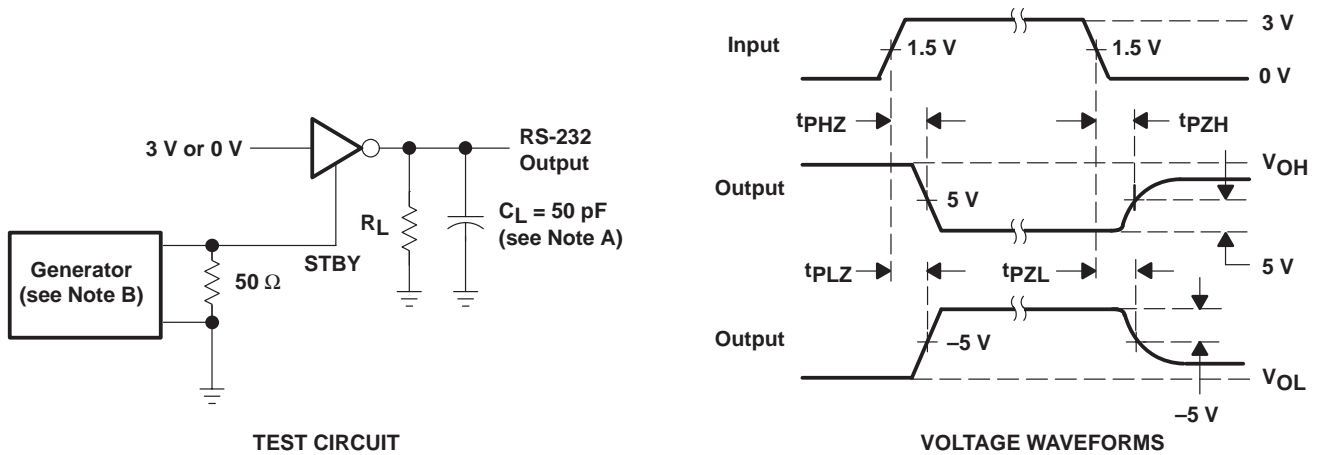
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### PARAMETER MEASUREMENT INFORMATION



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)**

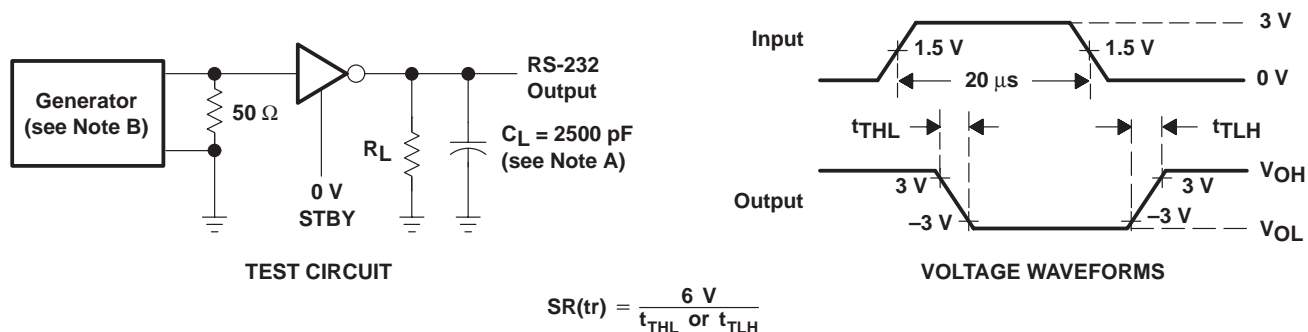


NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. The pulse generator has the following characteristics:  $Z_O = 50 \Omega$ , 50% duty cycle,  $t_r \leq 10 \text{ ns}$ ,  $t_f \leq 10 \text{ ns}$ .

**Figure 2. Driver Enable and Disable Test Times**

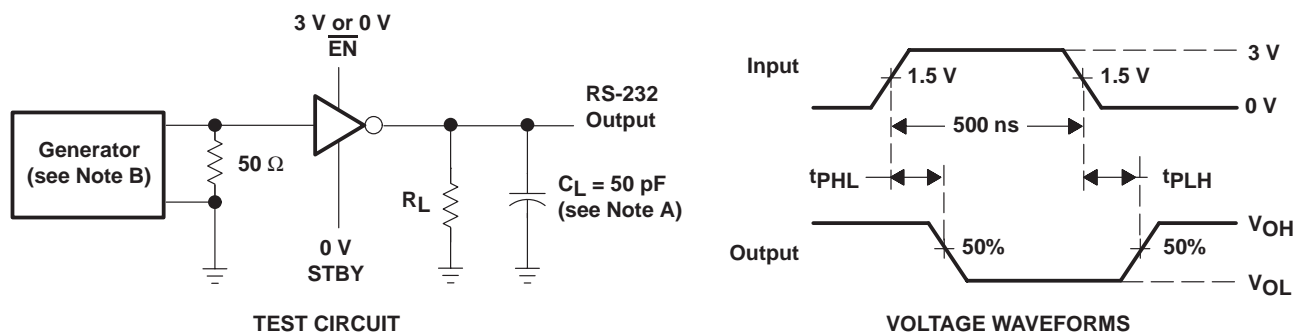


**PARAMETER MEASUREMENT INFORMATION**



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,  $t_r \leq 10 \text{ ns}$ ,  $t_f \leq 10 \text{ ns}$ .

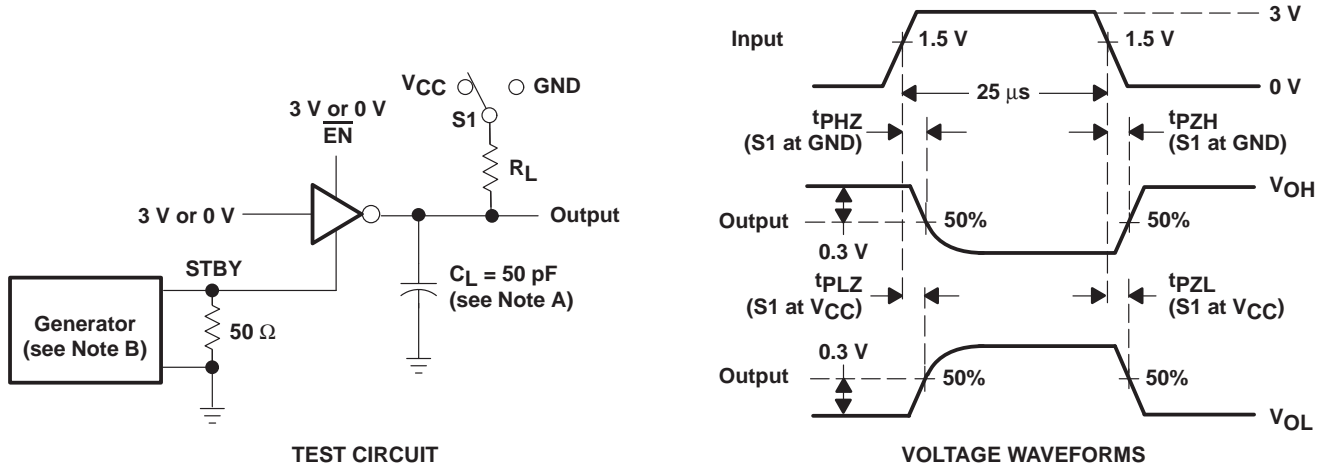
**Figure 4. Receiver Propagation Delay Times**

# SN75LV4737A

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

SLLS178D – APRIL 1994 – REVISED FEBRUARY 2000

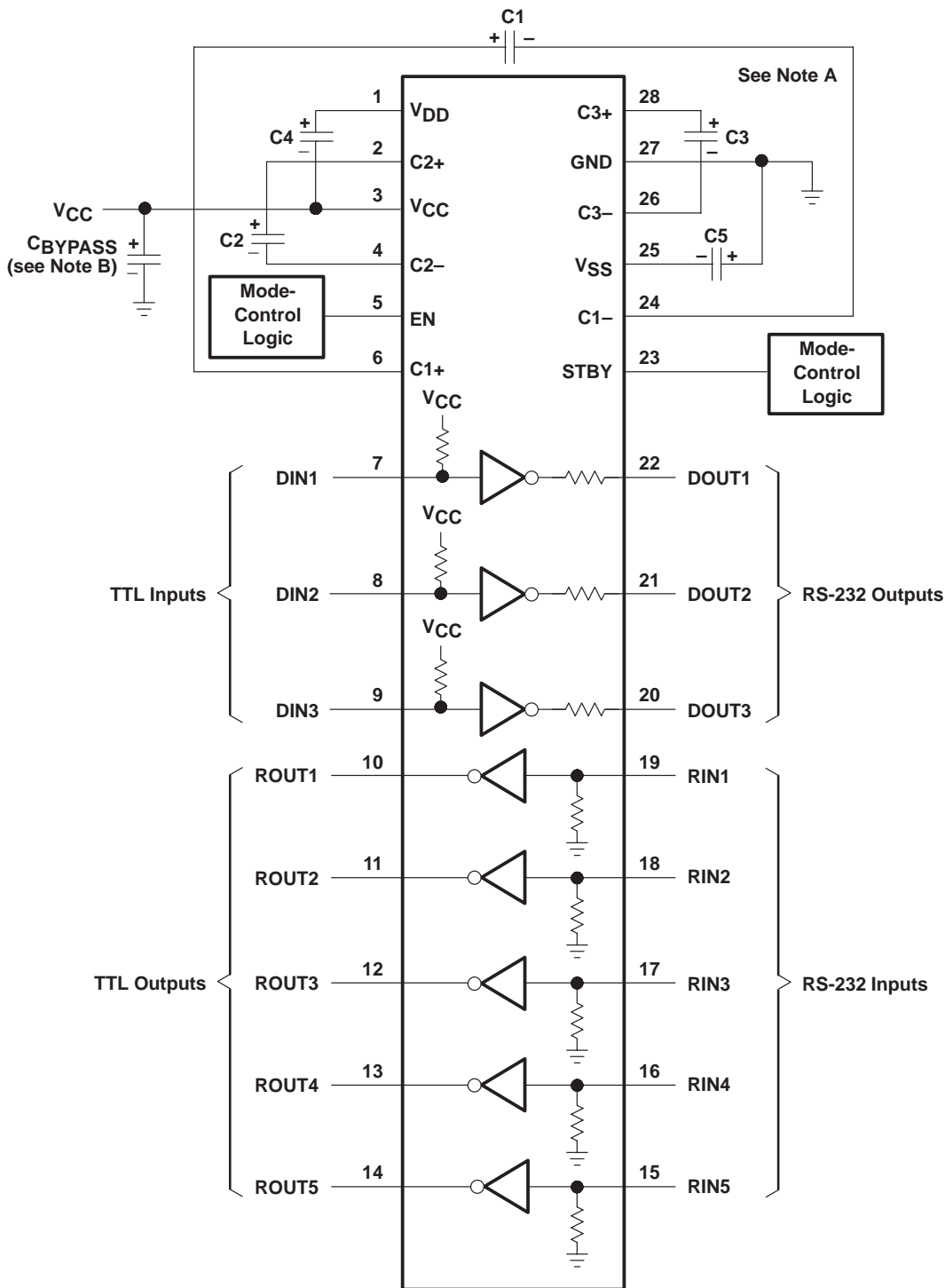
### PARAMETER MEASUREMENT INFORMATION



- 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. C1 = C2 = C3 = C4 = C5 = CBYPASS = 0.1  $\mu$ F  
B. CBYPASS is used as a decoupling capacitor.

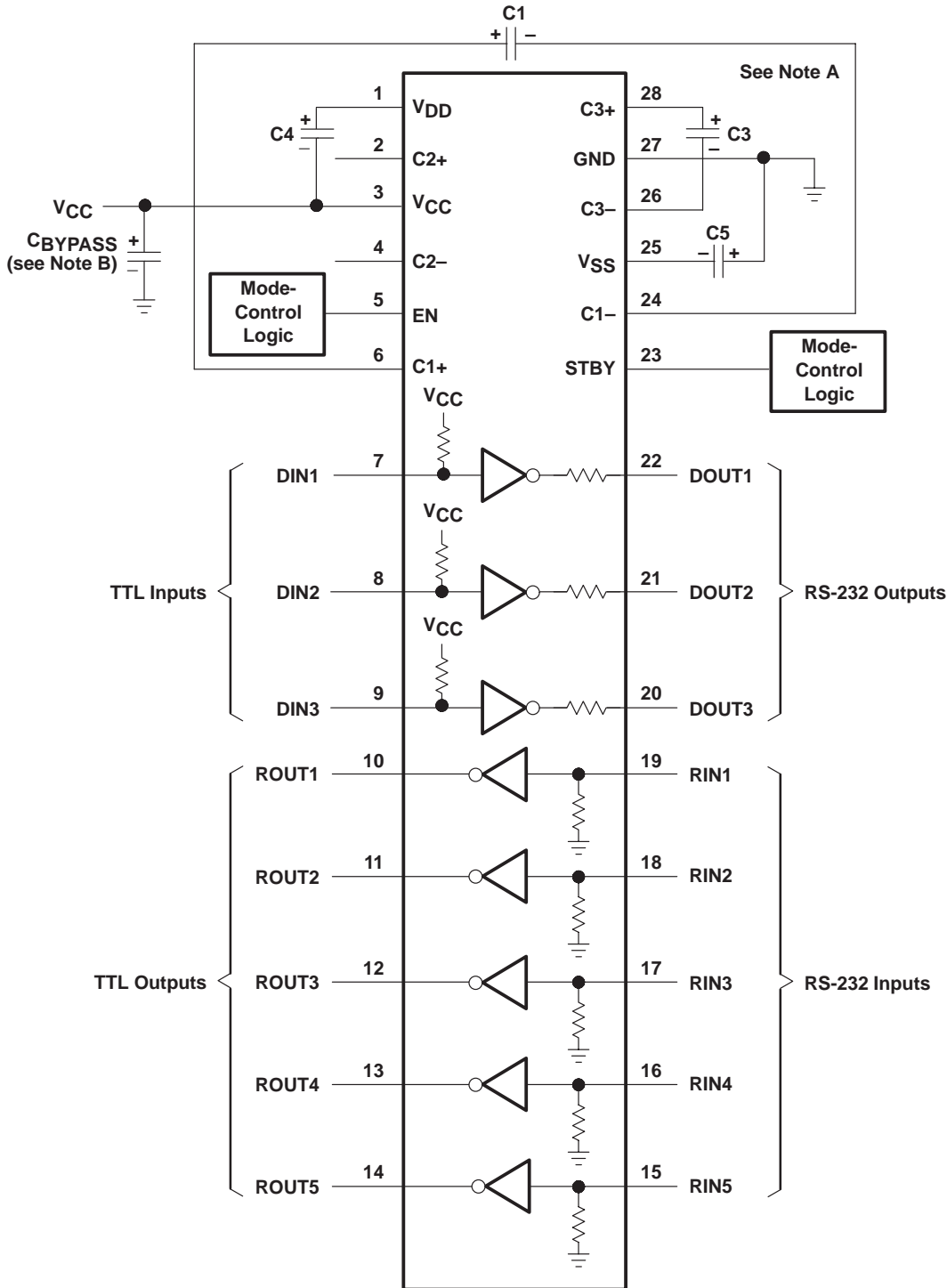
Figure 6. Typical 3.3-V Operating Circuit

# SN75LV4737A

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

SLLS178D – APRIL 1994 – REVISED FEBRUARY 2000

### APPLICATION INFORMATION



NOTES: A. C<sub>2</sub> is not used. C<sub>1</sub> = C<sub>3</sub> = C<sub>4</sub> = C<sub>5</sub> = C<sub>BYPASS</sub> = 0.1 μF  
 B. C<sub>BYPASS</sub> is used as a decoupling capacitor.

Figure 7. Typical 5-V Operating Circuit



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## PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN75LV4737ADB	ACTIVE	SSOP	DB	28	50	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	75LV4737A	<a href="#">Samples</a>
SN75LV4737ADBR	ACTIVE	SSOP	DB	28	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	75LV4737A	<a href="#">Samples</a>
SN75LV4737ADBRG4	ACTIVE	SSOP	DB	28	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	75LV4737A	<a href="#">Samples</a>

(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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN75LV4737ADBR	SSOP	DB	28	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN75LV4737ADBR	SSOP	DB	28	2000	356.0	356.0	35.0



**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN75LV4737ADB	DB	SSOP	28	50	530	10.5	4000	4.1

# DB0028A



# PACKAGE OUTLINE

## SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



4214853/B 03/2018

### NOTES:

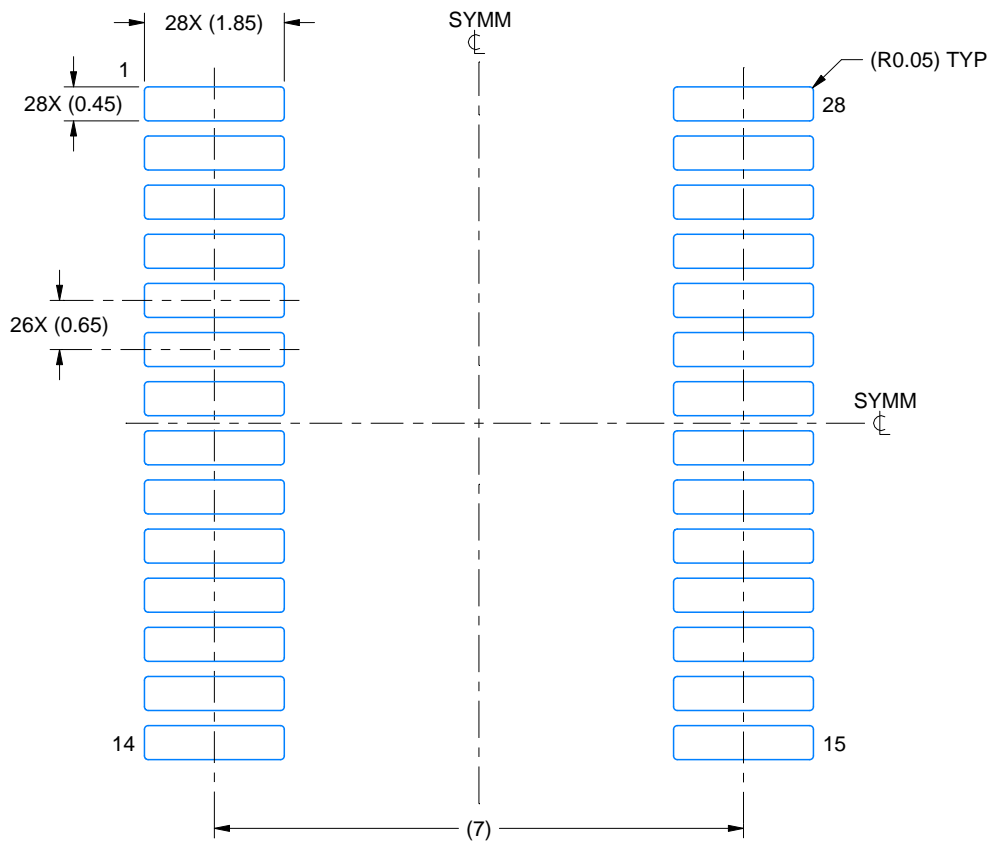
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-150.

# EXAMPLE BOARD LAYOUT

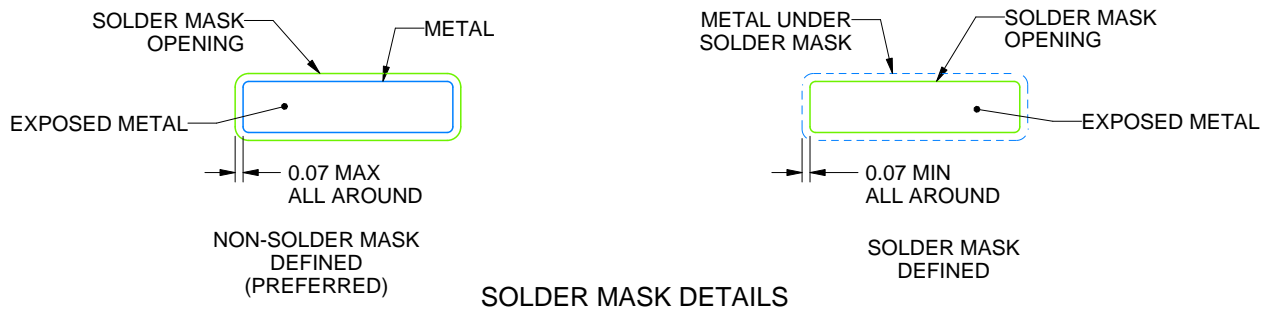
DB0028A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



4214853/B 03/2018

NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DB0028A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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