

### GENERAL DESCRIPTION

The SP330 is an advanced multiprotocol transceiver supporting RS-232, RS-485, and RS-422 serial standards and featuring a variable low voltage logic interface, down to 1.65V. Full operation requires only four external charge pump capacitors.

The RS-485/RS-232 mode pin selects RS-485 mode when high, and RS-232 mode when low. In RS-485 mode the HALF/FULL pin configures the transceiver as either half or full duplex.

The high speed drivers operate up to 20Mbps in RS-485/422 modes, and up to 1Mbps in RS-232 mode. All drivers can be slew limited to 250kbps in any mode to minimize electromagnetic interference (EMI) by setting the dedicated SLEW pin low.

All transmitter outputs and receiver inputs feature robust electrostatic discharge (ESD) protection to  $\pm 15\text{kV}$  IEC 61000-4-2 Airgap,  $\pm 15\text{kV}$  Human Body Model (HBM) and  $\pm 8\text{kV}$  IEC 61000-4-2 Contact. Each receiver output has full fail-safe protection to avoid system lockup, oscillation, or indeterminate states by defaulting to logic-high output level when the inputs are open, shorted, or terminated but undriven. No external biasing resistors are required.

The RS-232 receiver inputs include a  $5\text{k}\Omega$  pull-down to ground when in RS-232 mode. The RS-485/422 receiver inputs are high impedance ( $>96\text{k}\Omega$ ), allowing up to 256 devices on a single communication bus (1/8th unit load).

The SP330 operates from a single power supply, either 3.3V or 5V, with low idle current. The shutdown mode consumes less than  $1\mu\text{A}$  in low power standby operation with RS-232 receivers enabled.

### FEATURES

- Robust ESD Protection:
  - $\pm 15\text{kV}$  IEC 61000-4-2 Air Gap Discharge
  - $\pm 8\text{kV}$  IEC 61000-4-2 Contact Discharge
  - $\pm 15\text{kV}$  Human Body Model (HBM)
- 20Mbps RS-485 and 1Mbps RS-232 Data Rates
- Pin-Selectable 250kbps Slew Limiting
- Single Supply Operation from +3V to +5.5V
- 1.65V to 5.5V Logic Interface  $V_L$  pin
- 2 Drivers, 2 Receivers RS-232/V.28
- 1 Driver, 1 Receiver RS-485/422
  - Full or Half Duplex Configuration
  - 1/8th Unit Load, up to 256 receivers on bus
- RS-485/422 Enhanced Receiver Fail-safe for open, shorted, or terminated but idle inputs
- 10nA Shutdown Supply Current (typical)
- Small 24 TSSOP package

### TYPICAL APPLICATIONS

- Software Programmable Serial Ports (RS-232, RS-422, RS-485)
- Industrial and Single Board Computers
- Industrial and Process Control Equipment
- Point-Of-Sale Equipment
- HVAC Controls and Networking Equipment
- Building Security and Automation

### ORDERING INFORMATION

PART NUMBER	PACKAGE	OPERATING TEMPERATURE RANGE	DEVICE STATUS
SP330EEY-L	24-pin TSSOP	-40°C to +85°C	Active
SP330EEY-L/TR	24-pin TSSOP	-40°C to +85°C	Active

**NOTE:** SP330EEY-L and SP330EEY-L/TR are Green / RoHS Compliant

## ABSOLUTE MAXIMUM RATINGS

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections to the specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability and cause permanent damage to the device.

Supply Voltage $V_{CC}$	-0.3V to +6.0V
Logic Interface Voltage $V_L$	$V_L \leq V_{CC}$
Voltage at TTL Input Pins	-0.3V to +6.0V
Receiver Input Voltage (from Ground)	$\pm 18V$
Driver Output Voltage (from Ground)	$\pm 18V$
Short Circuit Duration, TX out to Ground	Continuous
Storage Temperature Range	-65°C to +150°C
Lead Temperature (soldering, 10s)	+300°C
Power Dissipation 24-pin TSSOP (derate 26.0mW/°C above +70°C)	900mW

### CAUTION:

ESD (ElectroStatic Discharge) sensitive device. Permanent damage may occur on unconnected devices subject to high energy electrostatic fields. Unused devices must be stored in conductive foam or shunts. Personnel should be properly grounded prior to handling this device. The protective foam should be discharged to the destination socket before devices are removed.

## ESD PROTECTION

		MIN.	TYP.	MAX.	UNITS	
	TX Output & RX Input Pins		$\pm 15$		kV	IEC 61000-4-2 Airgap
			$\pm 8$		kV	IEC 61000-4-2 Contact
			$\pm 15$		kV	Human Body Model (HBM)
	All Other Pins		$\pm 3$		kV	Human Body Model (HBM)

## ELECTRICAL CHARACTERISTICS

UNLESS OTHERWISE NOTED:

$V_{CC} = +3.0V$  to  $+5.5V$ ,  $C1-C4 = 0.1\mu F$ ;  $T_A = T_{MIN}$  to  $T_{MAX}$ . Typical values are at  $V_L = V_{CC} = 3.3V$ ,  $T_A = +25^\circ C$ .

SYMBOL	PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
<b>DC CHARACTERISTICS</b>						
$I_{CC}$	Supply Current (RS-232)		1	2.5	mA	No load, Idle inputs, RS-485/RS-232 = 0V
$I_{CC}$	Supply Current (RS-485/422)		1.8	4.5	mA	No load, Idle inputs, RS-485/RS-232 = $V_{CC}$
$I_{CC}$	Vcc Shutdown Current		0.01	1	$\mu A$	$\overline{SHDN} = 0V$ , Receiver inputs open or grounded
<b>TRANSMITTER and LOGIC INPUTS (PINS 11 - 14 &amp; 18 - 20)</b>						
$V_{IL}$	Logic Input Voltage Low			$\frac{V_L}{3}$	V	
$V_{IH}$	Logic Input Voltage High	$\frac{2V_L}{3}$			V	
$I_{INL}$	Logic Input Leakage Current		$\pm 0.01$	$\pm 1$	$\mu A$	
$I_{INPD}$	Logic Input Pulldown Current		10	50	$\mu A$	$\overline{RE}$ pin 18, $V_{IN} = V_L$
$V_{HYS}$	Logic Input Hysteresis		200		mV	
<b>RS-232 and RS-485/422 RECEIVER OUTPUTS (PINS 8 &amp; 9)</b>						
$V_{OL}$	Receiver Output Voltage Low			0.4	V	$I_{OUT} = 1.5mA$
$V_{OH}$	Receiver Output Voltage High	$V_L - 0.6$			V	$I_{OUT} = -1.5mA$
$I_{OSS}$	Receiver Output Short Circuit Current		$\pm 20$	$\pm 85$	mA	$0 \leq V_O \leq V_L$
$I_{OZ}$	Receiver Output Leakage Current		$\pm 0.05$	$\pm 1$	$\mu A$	$0 \leq V_O \leq V_L$ , Receivers disabled

**ELECTRICAL CHARACTERISTICS (Continued)**

UNLESS OTHERWISE NOTED:

V<sub>CC</sub> = +3.0V to +5.5V, C1-C4 = 0.1μF; T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>. Typical values are at V<sub>CC</sub> = 3.3V, T<sub>A</sub> = +25°C.

SYMBOL	PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
<b>RS-232 SINGLE-ENDED RECEIVER INPUTS (PINS 16 &amp; 17)</b>						
V <sub>IN</sub>	Input Voltage Range	-15		+15	V	
V <sub>IL</sub>	Input Threshold Low	0.6	1.2		V	V <sub>CC</sub> = 3.3V
		0.8	1.5		V	V <sub>CC</sub> = 5.0V
V <sub>IH</sub>	Input Threshold High		1.5	2.0	V	V <sub>CC</sub> = 3.3V
			1.8	2.4	V	V <sub>CC</sub> = 5.0V
V <sub>HYS</sub>	Input Hysteresis		0.5		V	
R <sub>IN</sub>	Input Resistance	3	5	7	kΩ	-15V ≤ V <sub>IN</sub> ≤ +15V
<b>RS-232 SINGLE-ENDED TRANSMITTER OUTPUTS (PINS 6 &amp; 7)</b>						
V <sub>OUT</sub>	Output Voltage Swing	±5.0	±5.5		V	Outputs loaded with 3kΩ to Gnd
R <sub>OFF</sub>	Output Power Off Impedance	300	10M		Ω	V <sub>CC</sub> = 0V, V <sub>OUT</sub> = ±2V
I <sub>SC</sub>	Output Short Circuit Current		±30	±60	mA	V <sub>OUT</sub> = 0V
I <sub>O</sub>	Output Leakage Current			±125	μA	$\overline{\text{SHDN}}$ = 0V, V <sub>OUT</sub> = ±9V, V <sub>CC</sub> = 0V or 5.5V

## ELECTRICAL CHARACTERISTICS (Continued)

UNLESS OTHERWISE NOTED:

$V_{CC} = +3.0V$  to  $+5.5V$ ,  $C1-C4 = 0.1\mu F$ ;  $T_A = T_{MIN}$  to  $T_{MAX}$ . Typical values are at  $V_{CC} = 3.3V$ ,  $T_A = +25^\circ C$ .

SYMBOL	PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
<b>RS-485/422 DIFFERENTIAL RECEIVER INPUTS (A,B)</b>						
$R_{IN}$	Receiver Input Resistance	96			$k\Omega$	$-7V \leq V_{CM} \leq +12V$
$I_{IN}$	Receiver Input Current			125	$\mu A$	$V_{IN} = +12V$
				-100	$\mu A$	$V_{IN} = -7V$
$V_{TH}$	Receiver Differential Threshold Voltage	-200	-125	-50	mV	$-7V \leq V_{CM} \leq +12V$
$\Delta V_{TH}$	Receiver Input Hysteresis		25		mV	
<b>RS-485/422 DIFFERENTIAL DRIVER OUTPUTS (Y, Z)</b>						
$V_{OD}$	Differential Driver Output	1.5		$V_{CC}$	V	$R_L = 54\Omega$ (RS-485), <a href="#">Figure 4</a>
		1.5		$V_{CC}$	V	$-7V \leq V_{CM} \leq +12V$ , <a href="#">Figure 5</a>
		2		$V_{CC}$	V	$R_L = 100\Omega$ (RS-422), <a href="#">Figure 4</a>
$ \Delta V_{OD} $	Change In Magnitude of Differential Output Voltage			0.2	V	$R_L = 54\Omega$ or $100\Omega$ , <a href="#">Figure 4</a>
$V_{CM}$	Driver Common Mode Output Voltage			3	V	$R_L = 54\Omega$ or $100\Omega$ , <a href="#">Figure 4</a>
$ \Delta V_{CM} $	Change In Magnitude of Common Mode Output Voltage			0.2	V	$R_L = 54\Omega$ or $100\Omega$ , <a href="#">Figure 4</a>
$I_{OSD}$	Driver Output Short Circuit Current			$\pm 250$	mA	$-7V \leq V_Y$ or $V_Z \leq +12V$ , <a href="#">Figure 6</a>
$I_O$	Driver Output Leakage Current			$\pm 125$	$\mu A$	$DE = 0V$ or $\overline{SHDN} = 0V$ , $V_Y$ or $V_Z = -7V$ or $+12V$ , $V_{CC} = 0V$ or $5.5V$

## TIMING CHARACTERISTICS

UNLESS OTHERWISE NOTED:

 $V_{CC} = +3.0V$  to  $+5.5V$ ,  $C1-C4 = 0.1\mu F$ ;  $T_A = T_{MIN}$  to  $T_{MAX}$ . Typical values are at  $V_{CC} = 3.3V$ ,  $T_A = +25^\circ C$ .

SYMBOL	PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
<b>ALL MODES</b>						
$t_{ENABLE}$	Enable from Shutdown		1000		ns	
$t_{SHUTDOWN}$	Enable to Shutdown		1000		ns	
<b>RS-232, DATA RATE = 250kbps (<math>\overline{SLEW} = 0V</math>), ONE TRANSMITTER SWITCHING</b>						
	Maximum Data Rate	250			kbps	$R_L = 3k\Omega$ , $C_L = 1000pF$
$t_{RHL}, t_{RLH}$	Receiver Propagation Delay		100		ns	$C_L = 150pF$ , <a href="#">Figure 7</a>
$ t_{RHL} - t_{RLH} $	Receiver Propagation Delay Skew			100	ns	
$t_{DHL}, t_{DLH}$	Driver Propagation Delay		1400		ns	$R_L = 3k\Omega$ , $C_L = 2500pF$ , <a href="#">Figure 8</a>
$ t_{DHL} - t_{DLH} $	Driver Propagation Delay Skew			600	ns	
$t_{SHL}, t_{SLH}$	Transition Region Slew Rate from +3.0V to -3.0V or -3.0V to +3.0V	6		30	V/ $\mu s$	$V_{CC} = +3.3V$ , $R_L = 3k\Omega$ to $7k\Omega$ , $C_L = 150pF$ to $2500pF$ , $T_A = 25^\circ C$ , <a href="#">Figure 8</a>
$t_{SHL}, t_{SLH}$	Transition Region Slew Rate from +3.0V to -3.0V or -3.0V to +3.0V	4		30	V/ $\mu s$	$V_{CC} = +3.3V$ , $R_L = 3k\Omega$ to $7k\Omega$ , $C_L = 150pF$ to $2500pF$ , <a href="#">Figure 8</a>
<b>RS-232, DATA RATE = 1Mbps (<math>\overline{SLEW} = V_{CC}</math>), ONE TRANSMITTER SWITCHING</b>						
	Maximum Data Rate	1			Mbps	$R_L = 3k\Omega$ , $C_L = 250pF$
$t_{RHL}, t_{RLH}$	Receiver Propagation Delay		100		ns	$C_L = 150pF$ , <a href="#">Figure 7</a>
$ t_{RHL} - t_{RLH} $	Receiver Propagation Delay Skew			100	ns	
$t_{DHL}, t_{DLH}$	Driver Propagation Delay		300		ns	$R_L = 3k\Omega$ , $C_L = 1000pF$ , <a href="#">Figure 8</a>
$ t_{DHL} - t_{DLH} $	Driver Propagation Delay Skew			150	ns	
$t_{SHL}, t_{SLH}$	Transition Region Slew Rate from +3.0V to -3.0V or -3.0V to +3.0V	13		150	V/ $\mu s$	$V_{CC} = +3.3V$ , $R_L = 3k\Omega$ to $7k\Omega$ , $C_L = 150pF$ to $1000pF$ , <a href="#">Figure 8</a>
$t_{SHL}, t_{SLH}$	Transition Region Slew Rate from +3.0V to -3.0V or -3.0V to +3.0V	24		150	V/ $\mu s$	$V_{CC} = +3.3V$ , $R_L = 3k\Omega$ to $7k\Omega$ , $C_L = 150pF$ to $1000pF$ , $T_A = 25^\circ C$ , <a href="#">Figure 8</a>

## TIMING CHARACTERISTICS (Continued)

UNLESS OTHERWISE NOTED:

$V_{CC} = +3.0V$  to  $+5.5V$ ,  $C1-C4 = 0.1\mu F$ ;  $T_A = T_{MIN}$  to  $T_{MAX}$ . Typical values are at  $V_{CC} = 3.3V$ ,  $T_A = +25^\circ C$ .

SYMBOL	PARAMETERS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
RS-485/RS-422, DATA RATE = 250kbps ( $\overline{SLEW} = 0V$ ), ONE TRANSMITTER SWITCHING						
	Maximum Data Rate	250			kbps	$R_L = 54\Omega$ , $C_L = 50pF$
$t_{RPHL}, t_{RPLH}$	Receiver Propagation Delay		50	150	ns	$C_L = 15pF$ , <a href="#">Figure 9</a>
$ t_{RPHL} - t_{RPLH} $	Receiver Propagation Delay Skew			10	ns	
$t_{DPHL}, t_{DPLH}$	Driver Propagation Delay		500	1000	ns	$R_L = 54\Omega$ , $C_L = 50pF$ , <a href="#">Figure 10</a>
$ t_{DPHL} - t_{DPLH} $	Driver Propagation Delay Skew			100	ns	
$t_{DR}, t_{DF}$	Driver Rise and Fall Time	300	650	1200	ns	
$t_{RZH}, t_{RZL}$	Receiver Output Enable Time			200	ns	$C_L = 15pF$ , <a href="#">Figure 11</a>
$t_{RHZ}, t_{RLZ}$	Receiver Output Disable Time			200	ns	
$t_{DZH}, t_{DZL}$	Driver Output Enable Time			1000	ns	$R_L = 500\Omega$ , $C_L = 50pF$ , <a href="#">Figure 12</a>
$t_{DHZ}, t_{DLZ}$	Driver Output Disable Time			200	ns	
RS-485/RS-422, DATA RATE = 20Mbps ( $\overline{SLEW} = V_{CC}$ ), ONE TRANSMITTER SWITCHING						
	Maximum Data Rate	20			Mbps	$R_L = 54\Omega$ , $C_L = 50pF$
$t_{RPHL}, t_{RPLH}$	Receiver Propagation Delay		50	150	ns	$C_L = 15pF$ , <a href="#">Figure 9</a>
$ t_{RPHL} - t_{RPLH} $	Receiver Propagation Delay Skew			10	ns	
$t_{DPHL}, t_{DPLH}$	Driver Propagation Delay		30	100	ns	$R_L = 54\Omega$ , $C_L = 50pF$ , <a href="#">Figure 10</a>
$ t_{DPHL} - t_{DPLH} $	Driver Propagation Delay Skew			10	ns	
$t_{DR}, t_{DF}$	Driver Rise and Fall Time		10	20	ns	
$t_{RZH}, t_{RZL}$	Receiver Output Enable Time			200	ns	$C_L = 15pF$ , <a href="#">Figure 11</a>
$t_{RHZ}, t_{RLZ}$	Receiver Output Disable Time			200	ns	
$t_{DZH}, t_{DZL}$	Driver Output Enable Time			200	ns	$R_L = 500\Omega$ , $C_L = 50pF$ , <a href="#">Figure 12</a>
$t_{DHZ}, t_{DLZ}$	Driver Output Disable Time			200	ns	

## PIN DESCRIPTIONS

Pin	Name	RS-232	RS-485 Full Duplex	RS-485 Half Duplex
1	C1+	Charge pump cap 1 positive lead, 0.1μF		
2	VL	Logic Supply for TTL Inputs and Outputs, V <sub>L</sub> = +1.65V to +5.5V or tie to V <sub>CC</sub>		
3	VCC	Main Supply, V <sub>CC</sub> = +3.0V to +5.5V, bypass to ground with 1.0μF		
4	C1-	Charge pump cap 1 negative lead		
5	GND	Ground		
6	T1OUT, B/Z	Transmitter 1 Output	Z Driver Neg Output	B/Z Neg Input/Output
7	T2OUT, A/Y	Transmitter 2 Output	Y Driver Pos Output	A/Y Pos Input/Output
8	R1OUT	Receiver 1 Output	X	X
9	R2OUT, RO	Receiver 2 Output	Receiver TTL Output	Receiver TTL Output
10				
11	$\overline{\text{SHDN}}$	Low power shutdown mode when low		
12	$\overline{\text{SLEW}}$	Data rate limited to 250kbps when low		
13	RS-485/ $\overline{\text{RS-232}}$	0	1	1
14	$\overline{\text{HALF/FULL}}$	X	0	1
15	GND	Ground		
16	R2IN, A	Receiver 2 Input	A Pos Receiver Input	X
17	R1IN, B	Receiver 1 Input	B Neg Receiver Input	X
18	$\overline{\text{RE}}$	X	Receiver enabled when low	
19	T2IN, DE	Transmitter 2 Input	Driver enabled when high	
20	T1IN, DI	Transmitter 1 Input	Driver TTL Input	
21	V-	Charge pump negative supply, 0.1μF from ground		
22	C2-	Charge pump cap 2 negative lead		
23	C2+	Charge pump cap 2 positive lead, 0.1μF		
24	V+	Charge pump positive supply, 0.1μF to ground		

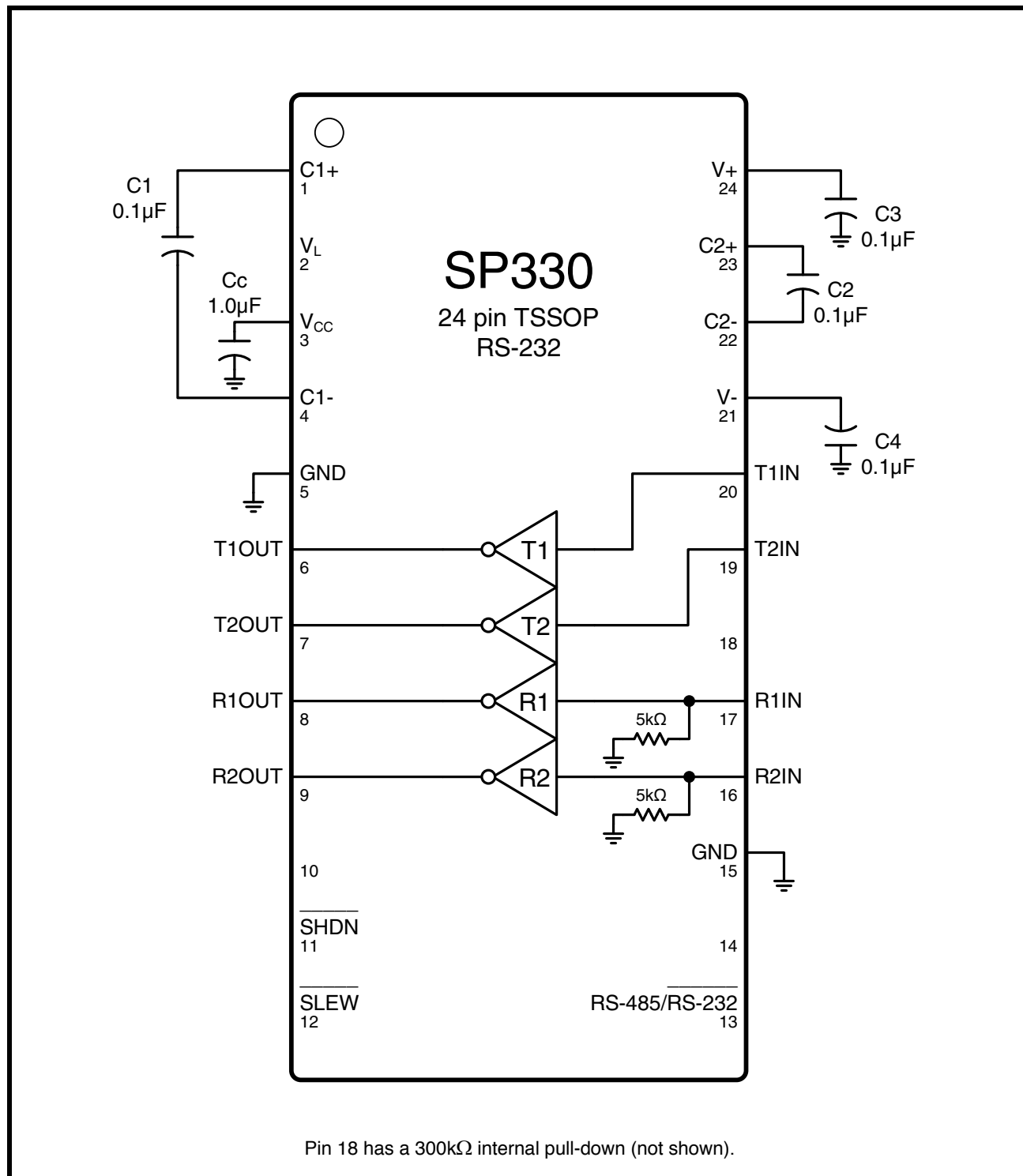


**SUGGESTED DB9 CONNECTOR PINOUT**

DB9 Pin	RS-232	RS-485 Full Duplex	RS-485 Half Duplex
1			
2	RXD	RX+	
3	TXD	TX-	Data-
4			
5	Ground		
6			
7	RTS	TX+	Data+
8	CTS	RX-	
9			

## BLOCK DIAGRAMS

FIGURE 1. RS-232 MODE



**FIGURE 2. RS-485 FULL DUPLEX MODE**

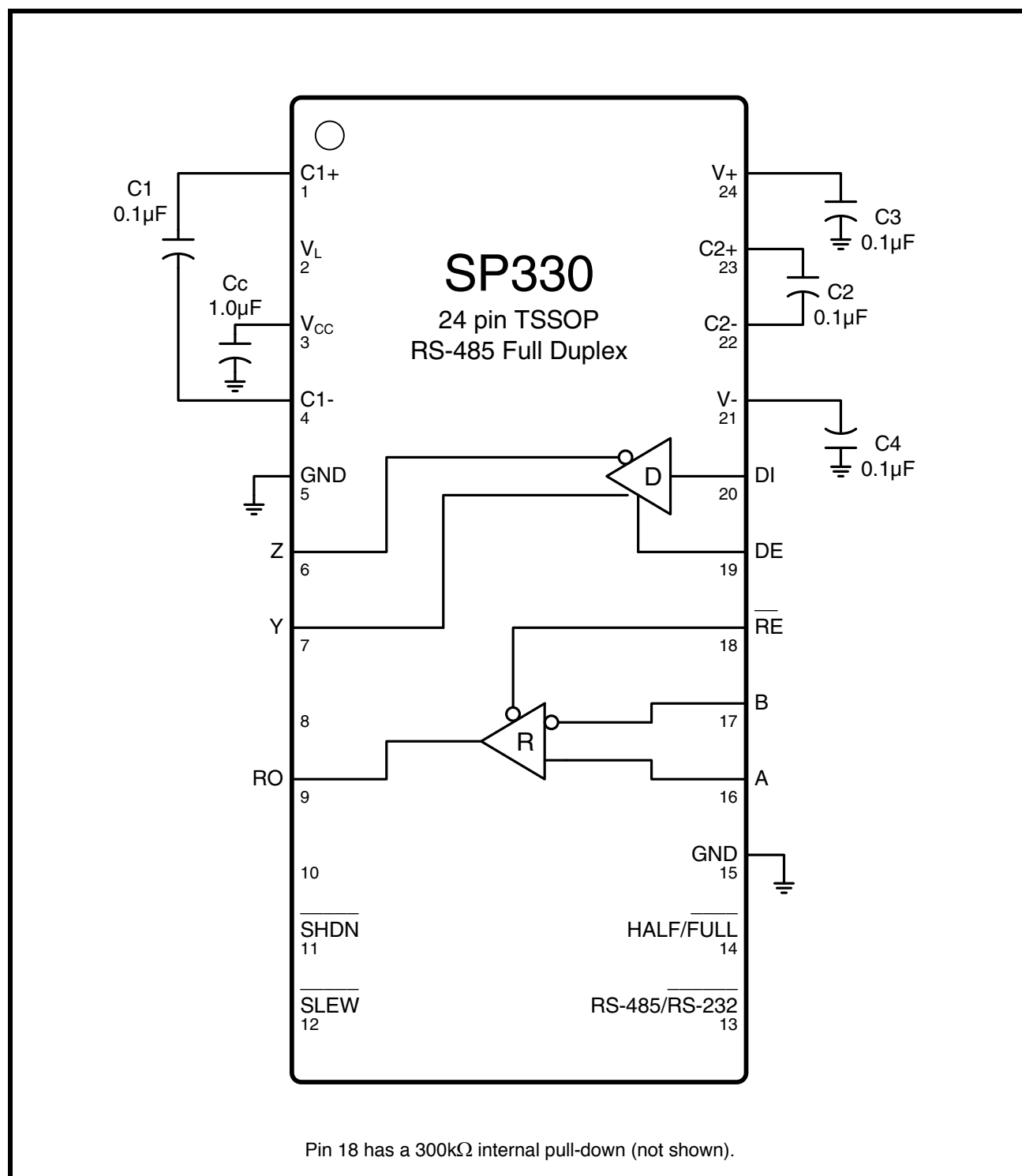
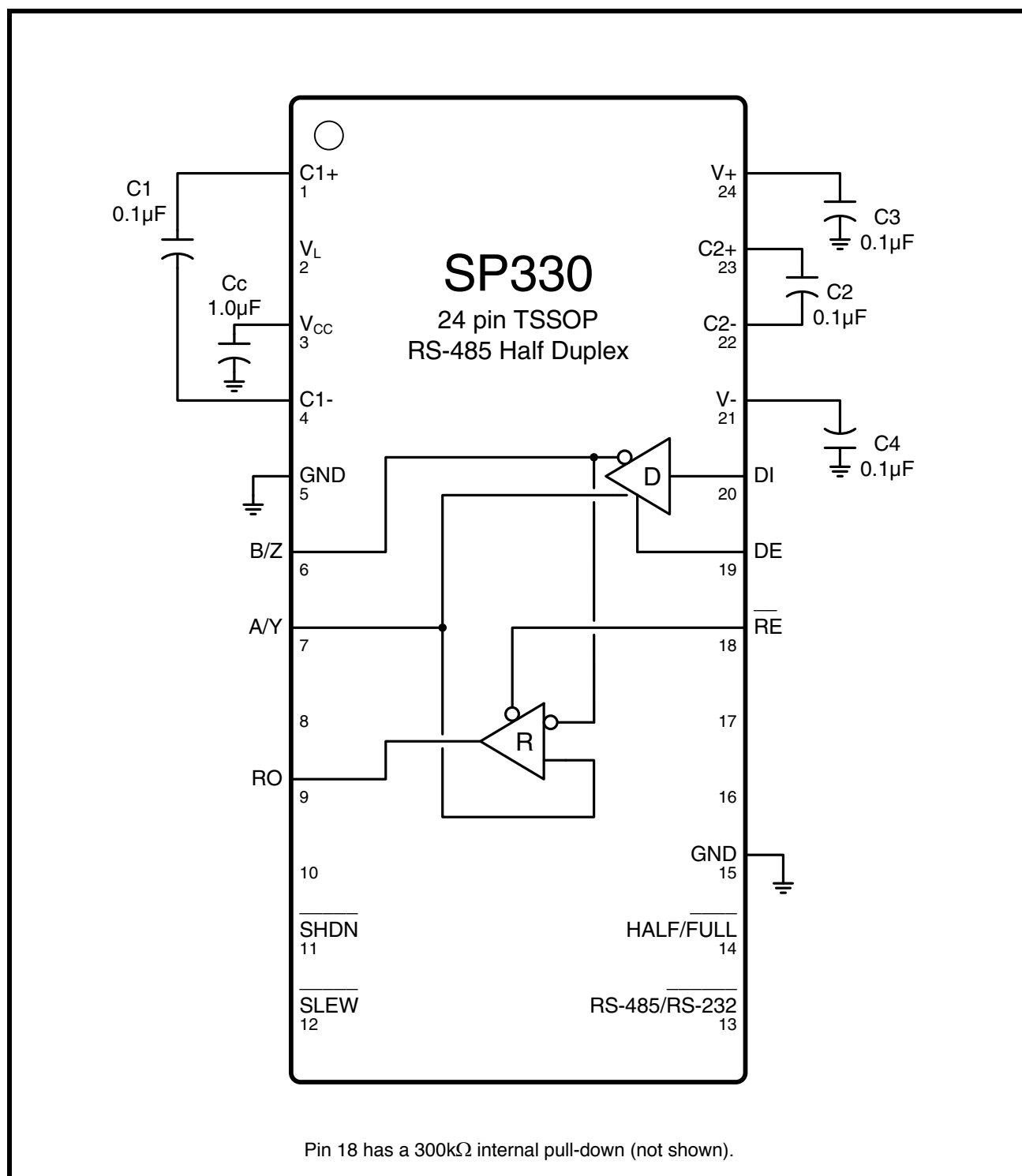
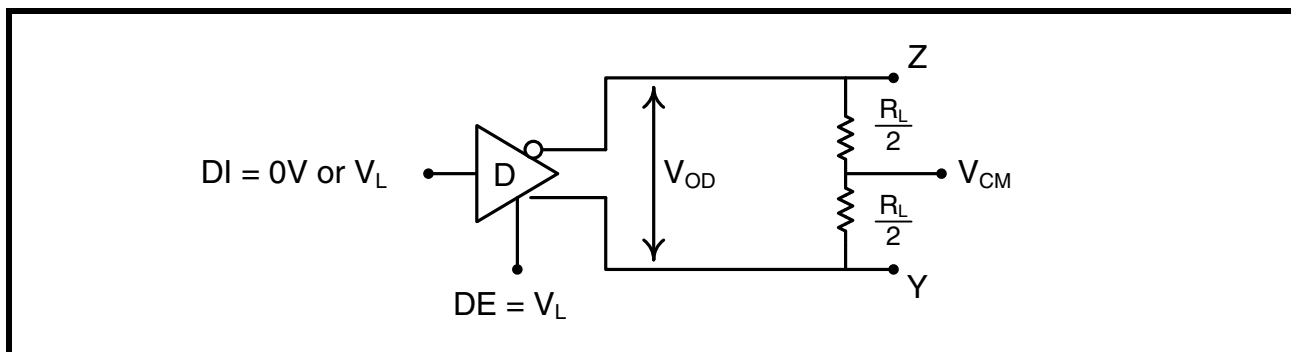


FIGURE 3. RS-485 HALF DUPLEX MODE

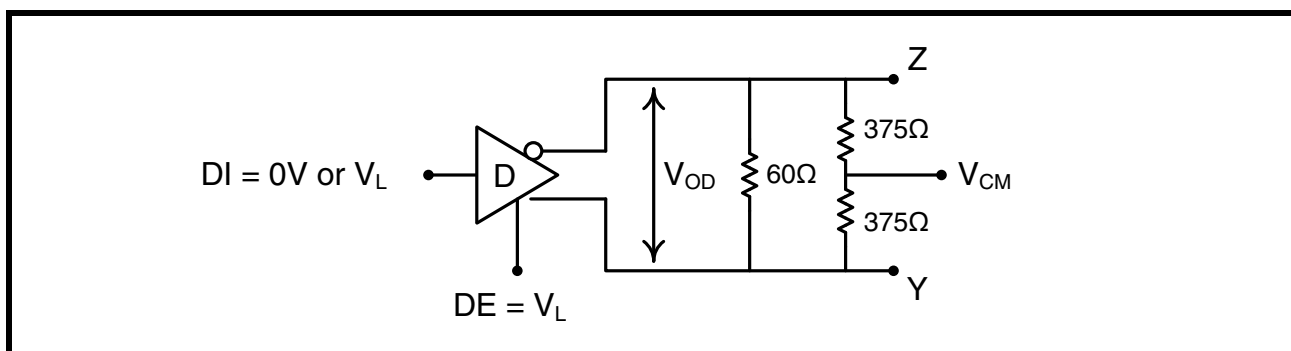


## TEST CIRCUITS

**FIGURE 4. RS-485/422 DIFFERENTIAL DRIVER OUTPUT VOLTAGE**



**FIGURE 5. RS-485/422 DIFFERENTIAL DRIVER OUTPUT VOLTAGE OVER COMMON MODE**



**FIGURE 6. RS-485/422 DRIVER OUTPUT SHORT CIRCUIT CURRENT**

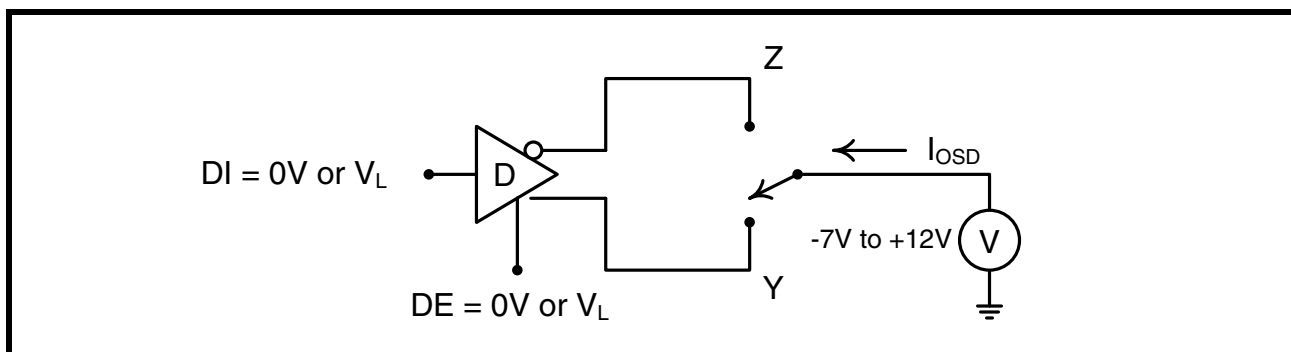


FIGURE 7. RS-232 RECEIVER PROPAGATION DELAY

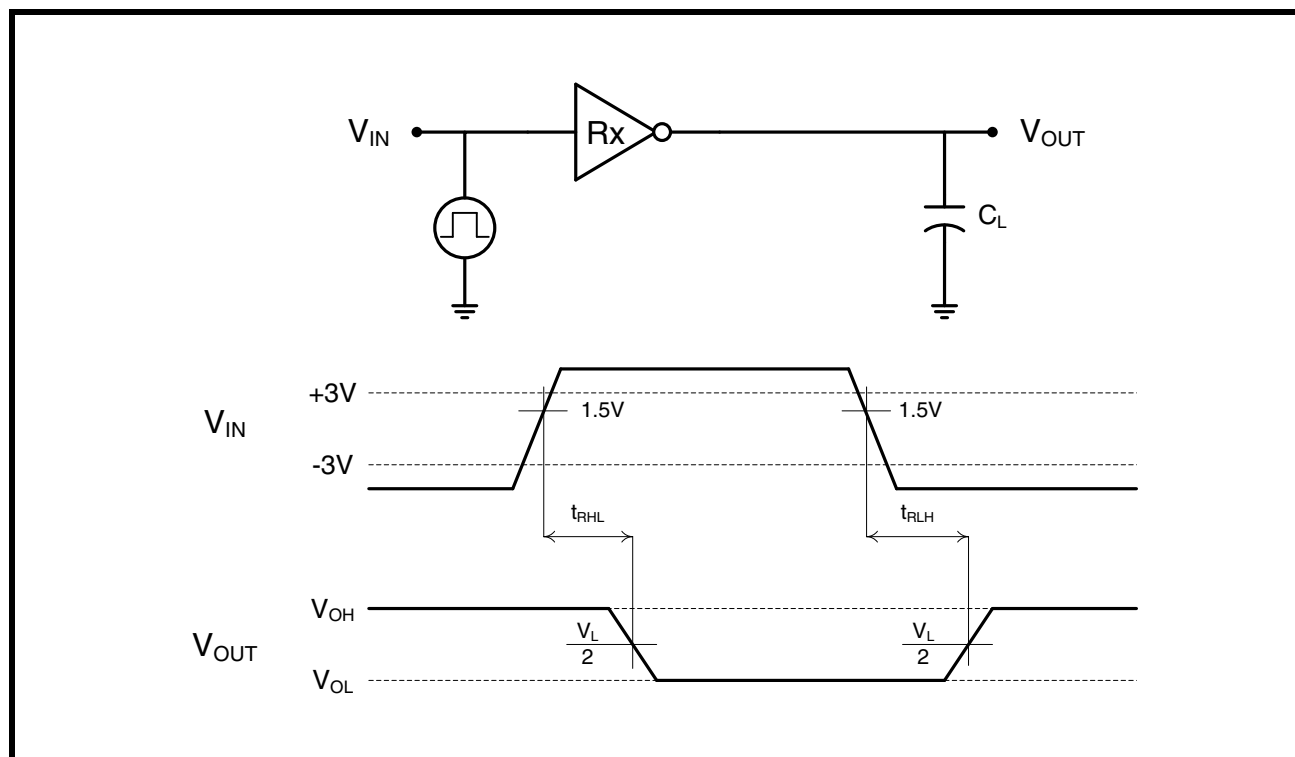


FIGURE 8. RS-232 DRIVER PROPAGATION DELAY

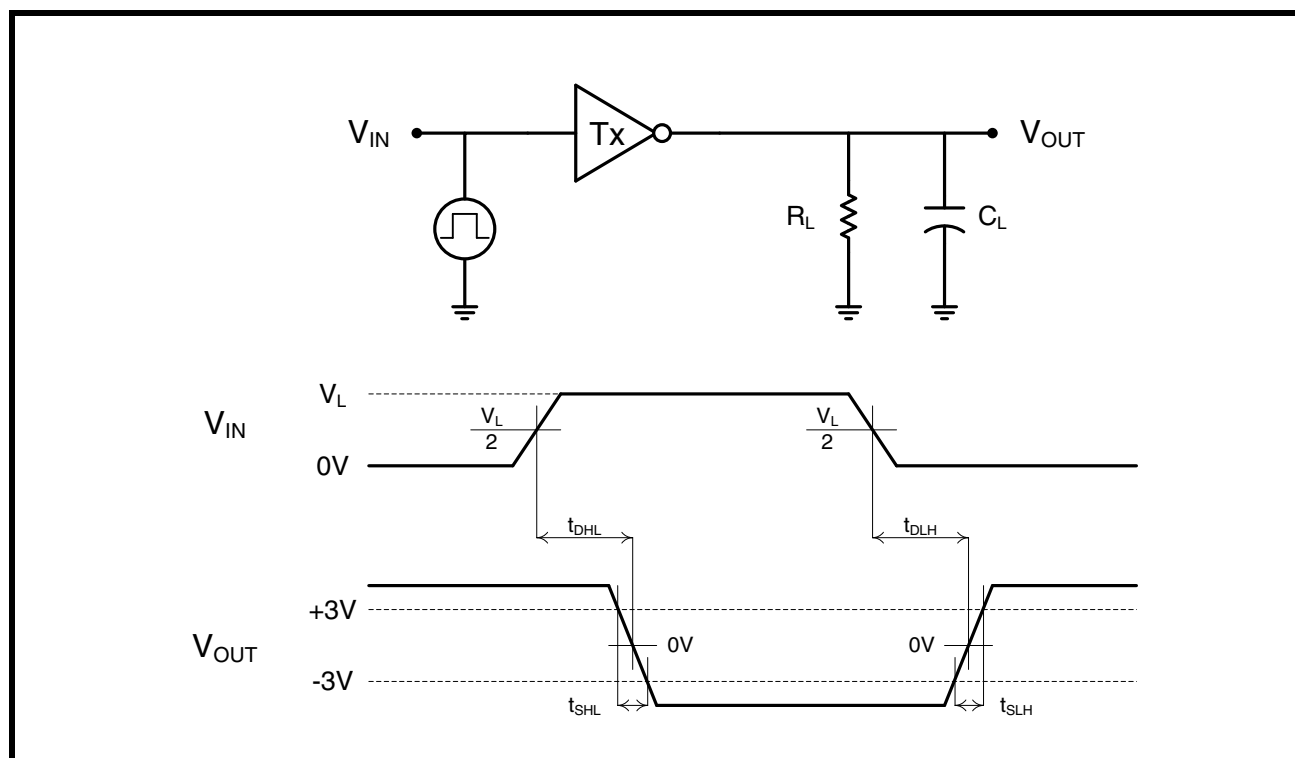
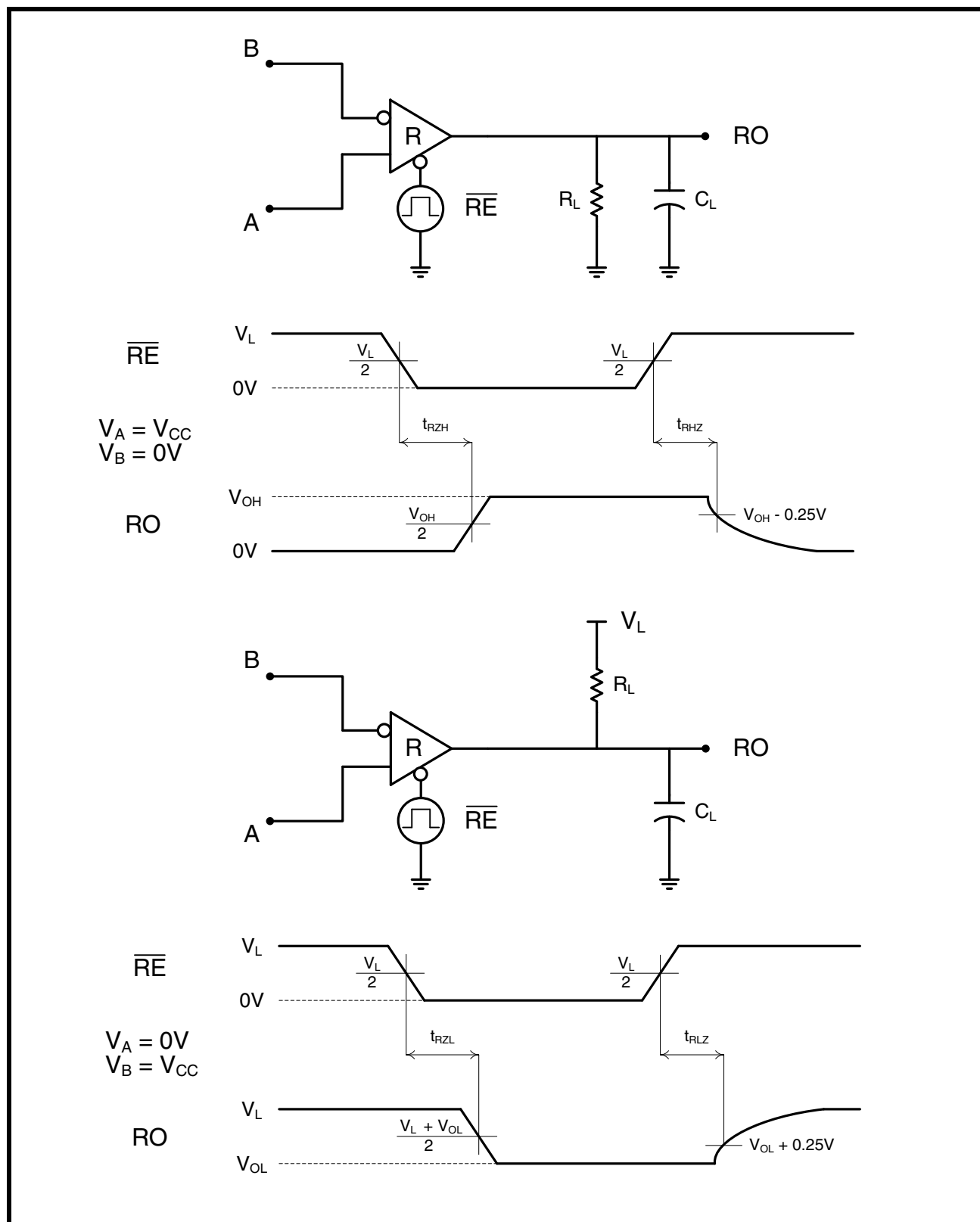


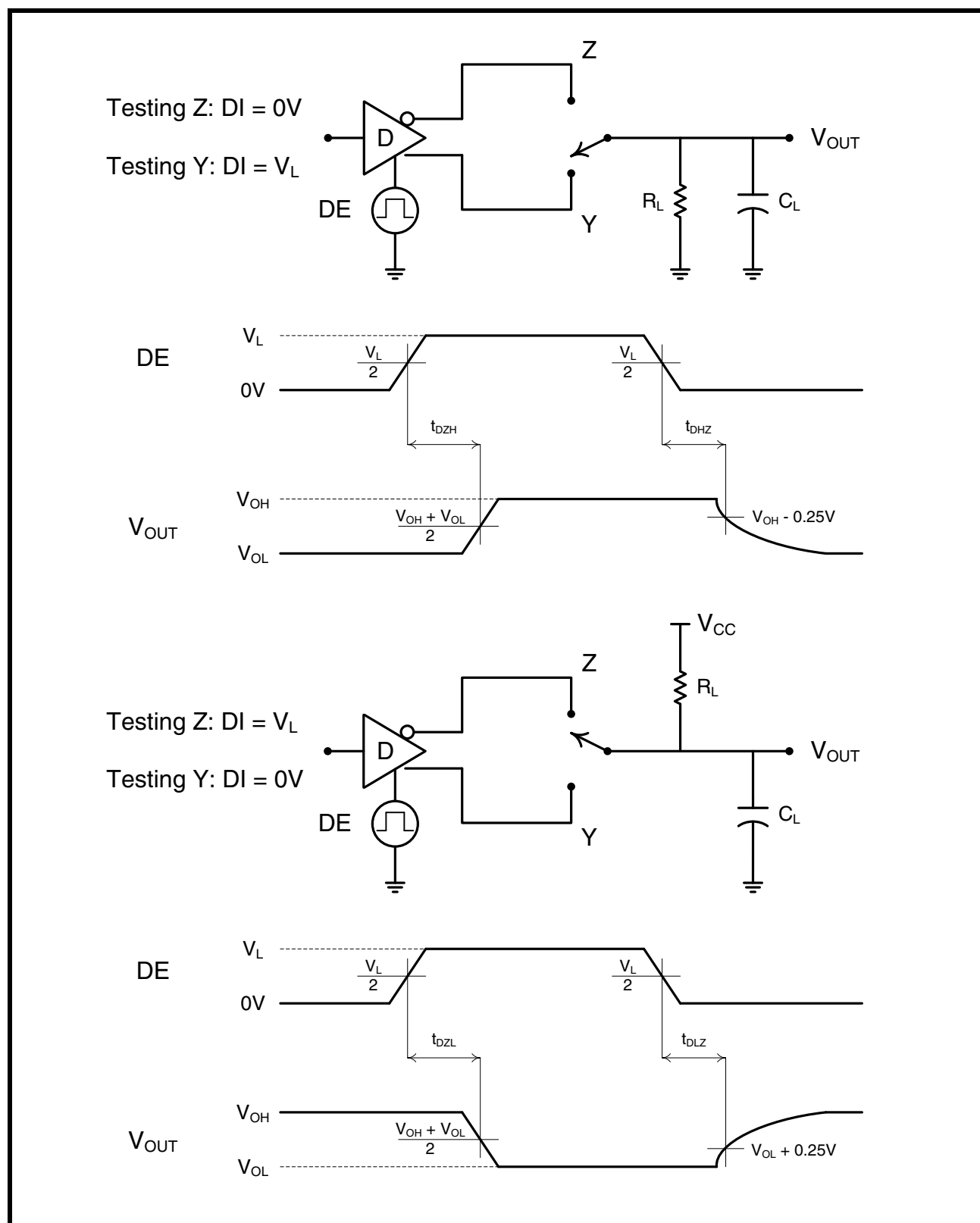


FIGURE 11. RS-485/422 RECEIVER OUTPUT ENABLE/DISABLE TIMES





**FIGURE 12. RS-485/422 DRIVER OUTPUT ENABLE/DISABLE TIMES**



## **PRODUCT SUMMARY**

The SP330 is an advanced multiprotocol transceiver supporting RS-232, RS-485, and RS-422 serial standards. The multiple configuration modes allow all three protocols to be used interchangeably over a single cable or connector with no additional switching components. Full operation requires only four external charge pump capacitors.

## **ENHANCED FAILSAFE**

The enhanced failsafe feature of the SP330 guarantees a logic-high receiver output when the receiver inputs are open, shorted, or terminated but idle/undriven. The enhanced failsafe interprets 0V differential as a logic high with a minimum 50mV noise margin, while maintaining compliance with the EIA/TIA-485 standard of  $\pm 200\text{mV}$ . No external biasing resistors are required, further easing the usage of multiple protocols over a single connector.

## **$\pm 15\text{kV}$ ESD PROTECTION**

ESD protection structures are incorporated on all pins to protect against electrostatic discharges encountered during handling and assembly. The bus pins (driver outputs and receiver inputs) have extra protection structures, which have been tested up to  $\pm 15\text{kV}$  without damage. These structures withstand high ESD in all states: normal operation, in shutdown, and when powered off.

ESD protection is tested in various ways. Exar uses the following methods to qualify the protection structures designed into SP330:

- $\pm 8\text{kV}$  using IEC 61000-4-2 Contact Discharge

- $\pm 15\text{kV}$  using IEC 61000-4-2 Airgap Discharge

- $\pm 15\text{kV}$  using the Human Body Model (HBM)

The IEC 61000-4-2 standard is more rigorous than HBM, resulting in lower voltage levels compared with HBM for the same level of ESD protection. Because IEC 61000-4-2 specifies a lower series resistance, the peak current is higher than HBM. The SP330 has passed both HBM and IEC 61000-4-2 testing without damage.

## **VARIABLE LOGIC LEVEL VOLTAGE**

The SP330 includes a  $V_L$  pin which reduces the logic level thresholds to interface with processors operating at reduced supply voltages. This pin should be connected to the supply voltage of the processor or UART block, or can be connected to  $V_{CC}$  for typical logic levels.

## TRUTH TABLES

TABLE 1: RS-232 TX TRUTH TABLE

INPUTS			OUTPUTS
$\overline{\text{SHDN}}$	RS-485/ $\overline{\text{RS-232}}$	DI/T1IN, DE/T2IN	Z(B)/T1OUT, Y(A)/T2OUT
0	X	X	1/8th unit load
1	0	0	1
1	0	1	0
1	1	X	RS-485 Mode

TABLE 2: RS-232 RX TRUTH TABLE

INPUTS			OUTPUTS
$\overline{\text{SHDN}}$	RS-485/ $\overline{\text{RS-232}}$	B/R1IN, A/R2IN	R1OUT, RO/R2OUT
X	0	0	1
X	0	1	0
X	0	Inputs open	1
X	1	X	R1OUT High-Z, RO/R2OUT in RS-485 Mode

TABLE 3: RS-485/422 TX TRUTH TABLE

INPUTS				OUTPUTS	
$\overline{\text{SHDN}}$	RS-485/ $\overline{\text{RS-232}}$	DE/T2IN	DI/T1IN	Z(B)/T1OUT	Y(A)/T2OUT
0	X	X	X	1/8th unit load	1/8th unit load
1	1	0	X	1/8th unit load	1/8th unit load
1	1	1	0	1	0
1	1	1	1	0	1
X	0	X	X	RS-232 Mode	

TABLE 4: RS-485/422 RX TRUTH TABLE

INPUTS						OUTPUT
RS-485/ $\overline{\text{RS-232}}$	$\overline{\text{SHDN}}$	HALF/ $\overline{\text{FULL}}$	$\overline{\text{RE}}$	(A-B)	(Y-Z)	RO/R2OUT
1	0	X	X	X	X	High-Z
1	1	0	0	$\geq -50\text{mV}$	X	1
1	1	0	0	$\leq -200\text{mV}$	X	0
1	1	0	0	Floating	X	1
1	1	1	0	X	$\geq -50\text{mV}$	1
1	1	1	0	X	$\leq -200\text{mV}$	0
1	1	1	0	X	Floating	1
1	1	X	1	X	X	High-Z
0	X	X	X	X	X	RS-232 Mode

# PACKAGE DRAWINGS

**FIGURE 13. TSSOP 24 DRAWING**

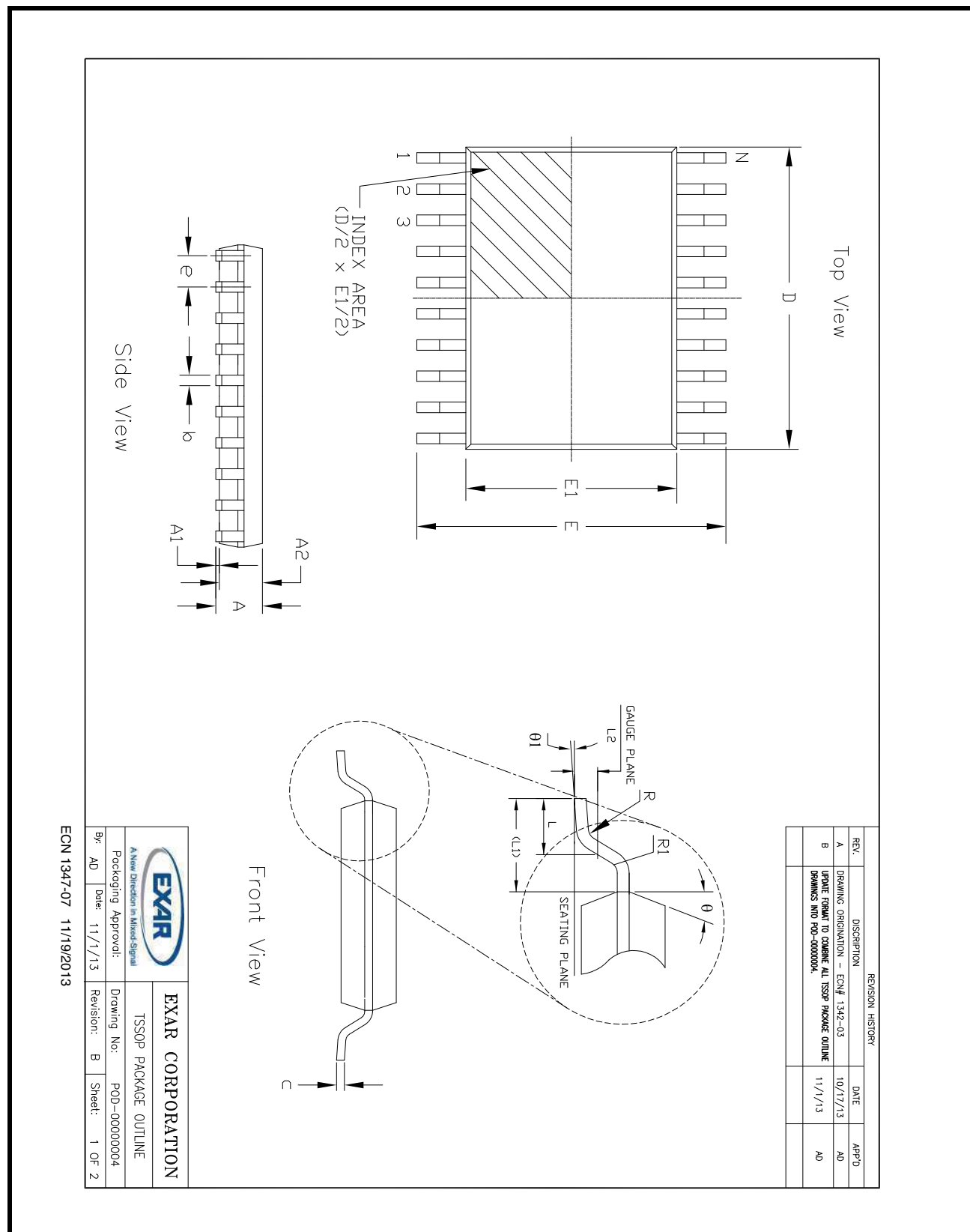


FIGURE 14. TSSOP 24 DIMENSIONS

24 Pin TSSOP JEDEC MO-153 Variation AD						
SYMBOLS	DIMENSIONS IN MM (Control Unit)			DIMENSIONS IN INCH (Reference Unit)		
	MIN	NOM	MAX	MIN	NOM	MAX
A	—	—	1.20	—	—	0.047
A1	0.05	—	0.15	0.002	—	0.006
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19	—	0.30	0.007	—	0.012
c	0.09	—	0.20	0.004	—	0.008
E	6.40 BSC			0.252 BSC		
E1	4.30	4.40	4.50	0.169	0.173	0.177
e	0.65 BSC			0.026 BSC		
L	0.45	0.60	0.75	0.018	0.024	0.030
L1	1.00 REF			0.039 REF		
L2	0.25 BSC			0.010 BSC		
R	0.09	—	—	0.035	—	—
R1	0.09	—	—	0.035	—	—
θ	12° REF			12° REF		
θ1	0°	—	8°	0°	—	8°
D	7.70	7.80	7.90	0.303	0.307	0.311
N	24			24		

**REVISION HISTORY**

DATE	REVISION	DESCRIPTION
Nov 2013	1.0.0	Production Release

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