

## 3V to 5.5V, 250kbps RS-232 Transceivers

### Description

The BL13232E consists of two drivers, two receivers, and a dual charge-pump circuit with  $\pm 12\text{kV}$  IEC 61000-4-2 Contact Discharge ESD protection.

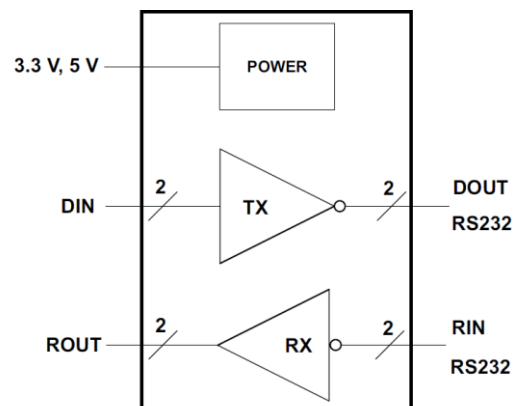
The BL13232E meets the requirements of TIA/EIA-232-F and provides the electrical interface between an asynchronous communication controller and the serial-port connector. The charge pump and four small external capacitors allow operation from a single 3V to 5.5V supply. The device operates at data signaling rates up to 250 kbps.

The BL13232E is available in SOP16 and TSSOP16 package.

### Features

- ESD protection for RS-232 Bus Pins
  - $\pm 12\text{kV}$  (IEC61000-4-2, Contact Discharge)
  - $\pm 15\text{kV}$  (IEC61000-4-2, Air-Gap Discharge)
- Meets the Requirements of TIA/EIA-232-F standard
- Wide Power Supply Range: Single +3V to +5.5V
- Operates up to 250kbps
- Two Drivers and Two Receivers
- External Capacitors:  $4 \times 0.1 \mu\text{F}$
- Accepts 5V Logic Input With 3.3V Supply

### Function Block



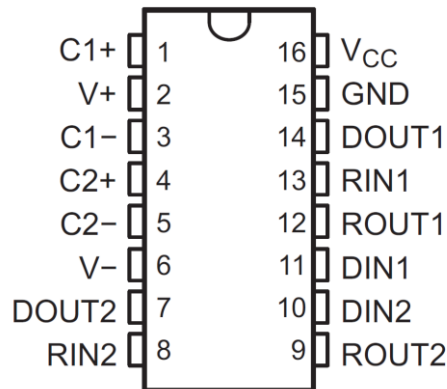
### Applications

- Battery-Powered Equipment
- Industry Human Machine Interface
- Notebook, Computers
- Printers

## Ordering Information

Part Number	Package	Operation Temp.
BL13232ESO	SOP16	-40~ + 125°C
BL13232ETS	TSSOP16	-40~ + 125°C

## Pin Configuration and Functions



PIN NO.	NAME	I/O	DESCRIPTION
1	C1+	—	Positive lead of C1 capacitor
2	V+	O	Positive charge pump output for storage capacitor only
3	C1-	—	Negative lead of C1 capacitor
4	C2+	—	Positive lead of C2 capacitor
5	C2-	—	Negative lead of C2 capacitor
6	V-	O	Negative charge pump output for storage capacitor only
7	DOUT2	O	RS232 Driver Output
8	RIN2	I	RS232 Receiver Input
9	ROUT2	O	TTL/CMOS Receiver Output
10	DIN2	I	TTL/CMOS Driver Input
11	DIN1	I	TTL/CMOS Driver Input
12	ROUT1	O	TTL/CMOS Receiver Output
13	RIN1	I	RS232 Receiver Input
14	DOUT1	O	RS232 Driver Output
15	GND	—	Ground
16	VCC	—	Supply Voltage

## Absolute Maximum Ratings

		MIN	MAX	UNIT	
V <sub>CC</sub>	Supply voltage	-0.3	6	V	
V <sub>+</sub>	Positive output supply voltage	-0.3	7	V	
V <sub>-</sub>	Negative output supply voltage	0.3	-7	V	
V <sub>+</sub> - V <sub>-</sub>	Supply voltage difference		13	V	
V <sub>I</sub>	Input voltage	Drivers	-0.3	6	V
		Receivers	-25	25	V
V <sub>O</sub>	Output voltage	Drivers	-13.2	13.2	V
		Receivers	-0.3	V <sub>CC</sub> + 0.3	V
T <sub>J</sub>	Operating virtual junction temperature		150	°C	
T <sub>stg</sub>	Storage temperature	-65	150	°C	

Note 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.

## Recommended Operating Conditions

(Test conditions: C1–C4 = 0.1μF at V<sub>CC</sub> = 3.3V±0.3V; C1 = 0.047μF, C2–C4 = 0.33μF at V<sub>CC</sub> = 5V±0.5V)

		MIN	NOM	MAX	UNIT	
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 <sub>IH</sub>	Driver high-level input voltage	DIN	V <sub>CC</sub> = 3.3 V	2	5.5	V
			V <sub>CC</sub> = 5 V	2.4	5.5	
V <sub>IL</sub>	Driver low-level input	DIN	0	0.8	V	
V <sub>I</sub>	Receiver input voltage	RIN	-25	25	V	
T <sub>A</sub>	Operating free-air temperature		-40	125	°C	

## Electrical Characteristics

(Test conditions: C1–C4 = 0.1μF at V<sub>CC</sub> = 3.3V±0.3V; C1 = 0.047μF, C2–C4 = 0.33μF at V<sub>CC</sub> = 5V±0.5V, T<sub>A</sub> = -40~125°C, unless otherwise noted. Typical values are at T<sub>A</sub> = +25°C.)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
I <sub>CC</sub>	Supply current	No load, V <sub>CC</sub> = 3.3 V or 5 V		1.5		mA
<b>Driver</b>						
V <sub>OH</sub>	High-level output voltage	DO <sub>UT</sub> at R <sub>L</sub> = 3 kΩ to GND, DIN = GND	5	5.4		V
V <sub>OL</sub>	Low-level output voltage	DO <sub>UT</sub> at R <sub>L</sub> = 3 kΩ to GND, DIN = V <sub>CC</sub>	-5	-5.4		V
I <sub>IH</sub>	High-level input current	V <sub>I</sub> = V <sub>CC</sub>		±0.01	±1	μA
I <sub>IL</sub>	Low-level input current	V <sub>I</sub> at GND		±0.01	±1	μA
I <sub>OS</sub>	Short-circuit output current	V <sub>CC</sub> = 3.6 V, V <sub>O</sub> = 0 V		±30	±60	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>+</sub> , and V <sub>-</sub> = 0 V, V <sub>O</sub> = ±2 V	300	10M		Ω
<b>Receiver</b>						
V <sub>OH</sub>	High-level output voltage	I <sub>OH</sub> = -1 mA	V <sub>CC</sub> - 0.6	V <sub>CC</sub> - 0.1		V
V <sub>OL</sub>	Low-level output voltage	I <sub>OL</sub> = 1.6 mA			0.4	V
V <sub>IT+</sub>	Positive-going input threshold voltage	V <sub>CC</sub> = 3.3 V		1.5	2.4	V
		V <sub>CC</sub> = 5 V		2.0	2.4	
V <sub>IT-</sub>	Negative-going input threshold voltage	V <sub>CC</sub> = 3.3 V	0.6	1.1		V
		V <sub>CC</sub> = 5 V	0.8	1.5		
V <sub>hys</sub>	Input hysteresis (V <sub>IT+</sub> - V <sub>IT-</sub> )			0.4		V
r <sub>i</sub>	Input resistance	V <sub>I</sub> = ±3 V to ±25 V	3	5	7	kΩ

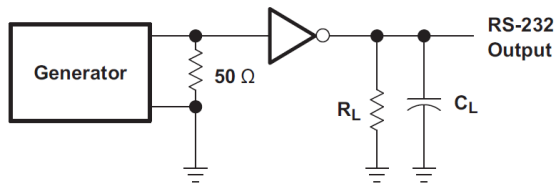
Note 2: Short-circuit durations should be controlled to prevent exceeding the device absolute power dissipation ratings, and not more than one output should be shorted at a time.

## Switching Characteristics

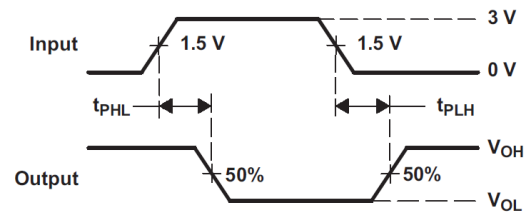
(Test conditions: C1–C4=0.1μF at V<sub>CC</sub>=3.3V±0.3V; C1=0.047μF, C2–C4=0.33μF at V<sub>CC</sub>=5V±0.5V, T<sub>A</sub> = -40~125°C, unless otherwise noted. Typical values are at T<sub>A</sub> = +25°C.)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Maximum data rate	R <sub>L</sub> = 3 kΩ, C <sub>L</sub> = 1000 pF, One DOUT switching	250			kbps
t <sub>sk(p)</sub> Driver pulse skew	R <sub>L</sub> = 3 kΩ to 7 kΩ, C <sub>L</sub> = 150 pF to 2500 pF, see Figure 1		100		ns
SR(tr) Driver slew rate, transition region	R <sub>L</sub> = 3 kΩ to 7 kΩ, C <sub>L</sub> = 150 pF to 1000 pF	6		30	V/μs
	V <sub>CC</sub> = 3.3 V, C <sub>L</sub> = 150 pF to 2500 pF	4		30	
t <sub>PLH</sub> Receiver propagation delay time, low- to high-level output	C <sub>L</sub> = 150 pF see Figure 2		150		ns
t <sub>PHL</sub> Receiver propagation delay time, high- to low-level output			150		ns
t <sub>sk(p)</sub> Receiver pulse skew			60		ns

Note 3: Pulse skew is defined as |t<sub>PLH</sub> – t<sub>PHL</sub>| of each channel of the same device.

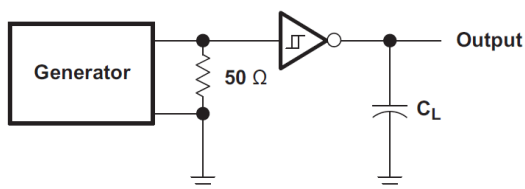


Test Circuit

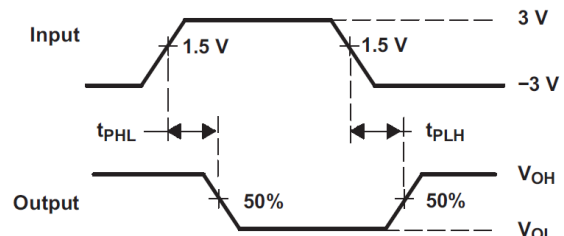


Voltage Waveforms

Figure 1. Driver Pulse Skew



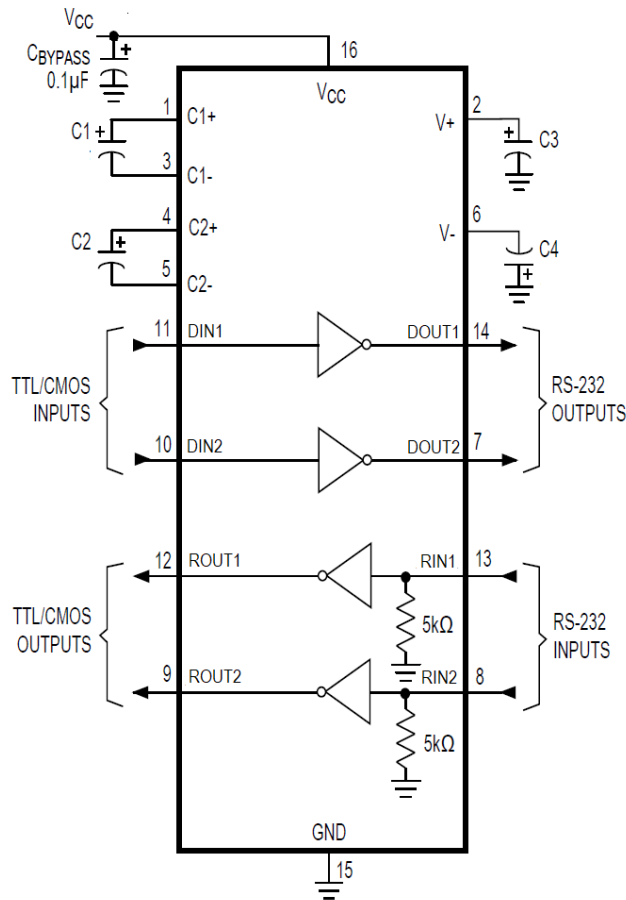
Test Circuit



Voltage Waveforms

Figure 2. Receiver Propagation Delay Times

**Typical Application**



Nonpolarized ceramic capacitors are acceptable. If polarized tantalum or electrolytic capacitors are used, they should be connected as shown.

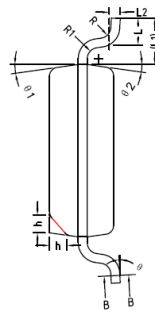
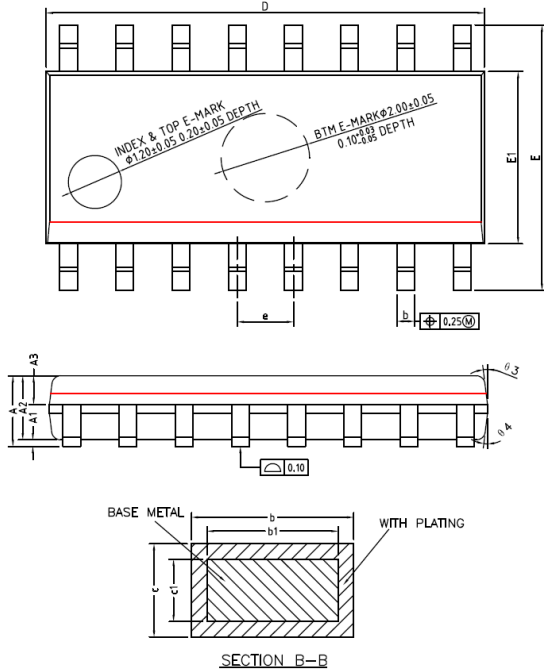
**Figure 3. Typical Operating Circuit**

**Table 1. VCC vs Capacitor Values**

VCC	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

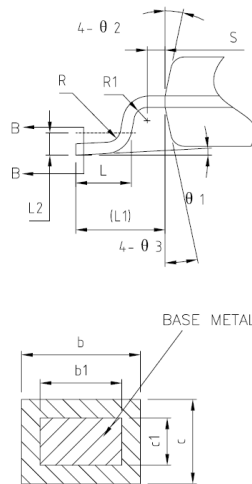
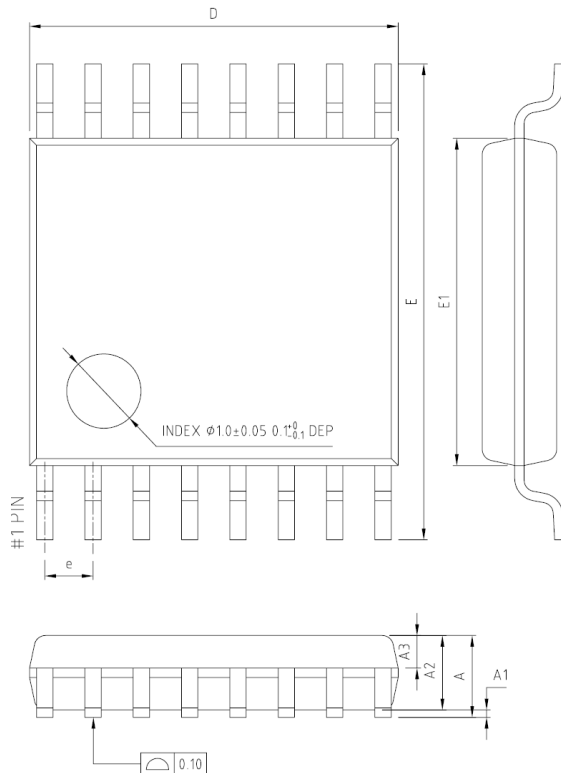
## Package Outline Dimensions

### SOP16


 COMMON DIMENSIONS  
 (UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	—	—	1.75
A1	0.10	0.15	0.25
A2	1.35	1.45	1.55
A3	0.55	0.65	0.75
b	0.36	—	0.51
b1	0.35	0.40	0.45
c	0.18	—	0.25
c1	0.17	0.20	0.23
D	9.80	9.90	10.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.22	1.27	1.32
L	0.45	0.60	0.80
L1	1.04REF		
L2	0.25BSC		
R	0.07	—	—
R1	0.07	—	—
h	0.30	0.40	0.50
θ	0°	—	8°
θ 1	6°	8°	10°
θ 2	6°	8°	10°
θ 3	5°	7°	9°
θ 4	5°	7°	9°

### TSSOP16


 COMMON DIMENSIONS  
 (UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	—	—	1.20
A1	0.05	—	0.15
A2	0.90	1.00	1.05
A3	0.34	0.44	0.54
b	0.20	—	0.28
b1	0.20	0.22	0.24
c	0.10	—	0.19
c1	0.10	0.13	0.15
D	4.86	4.96	5.06
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e	0.65BSC		
L	0.45	0.60	0.75
L1	1.00REF		
L2	0.25BSC		
R	0.09	—	—
R1	0.09	—	—
S	0.20	—	—
θ 1	0°	—	8°
θ 2	10°	12°	14°
θ 3	10°	12°	14°