

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.

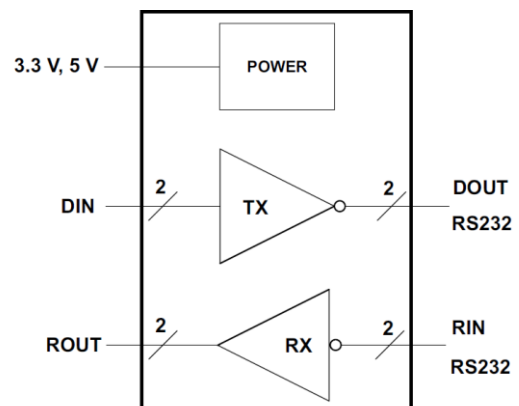
The BL13232E meets the requirements of TIA/EIA-232-F and provides the electrical interface between an asynchronous communication controller and the serial-port connector. The charge pump and four small external capacitors allow operation from a single 3V to 5.5V supply. The device operates at data signaling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



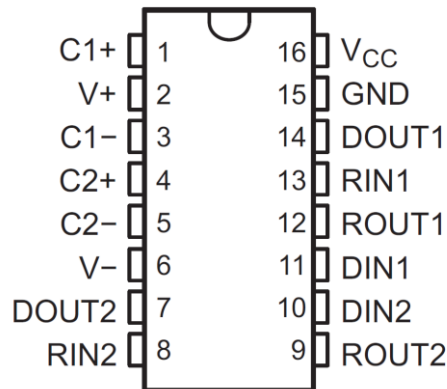
Applications

- 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 _{CC} | Supply voltage | -0.3 | 6 | V | |
| V ₊ | Positive output supply voltage | -0.3 | 7 | V | |
| V ₋ | Negative output supply voltage | 0.3 | -7 | V | |
| V ₊ - V ₋ | Supply voltage difference | | 13 | V | |
| V _I | Input voltage | Drivers | -0.3 | 6 | V |
| | | Receivers | -25 | 25 | V |
| V _O | Output voltage | Drivers | -13.2 | 13.2 | V |
| | | Receivers | -0.3 | V _{CC} + 0.3 | V |
| T _J | Operating virtual junction temperature | | 150 | °C | |
| T _{stg} | 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_{CC} = 3.3V±0.3V; C1 = 0.047μF, C2–C4 = 0.33μF at V_{CC} = 5V±0.5V)

| | | MIN | NOM | MAX | UNIT | |
|-----------------|---------------------------------|-----|-------------------------|-----|------|---|
| Supply voltage | V _{CC} = 3.3 V | 3 | 3.3 | 3.6 | V | |
| | V _{CC} = 5 V | 4.5 | 5 | 5.5 | | |
| V _{IH} | Driver high-level input voltage | DIN | V _{CC} = 3.3 V | 2 | 5.5 | V |
| | | | V _{CC} = 5 V | 2.4 | 5.5 | |
| V _{IL} | Driver low-level input | DIN | 0 | 0.8 | V | |
| V _I | Receiver input voltage | RIN | -25 | 25 | V | |
| T _A | Operating free-air temperature | | -40 | 125 | °C | |

Electrical Characteristics

(Test conditions: C1–C4 = 0.1μF at V_{CC} = 3.3V±0.3V; C1 = 0.047μF, C2–C4 = 0.33μF at V_{CC} = 5V±0.5V, T_A = -40~125°C, unless otherwise noted. Typical values are at T_A = +25°C.)

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|------------------|---|--|-----------------------|-----------------------|-----|------|
| I _{CC} | Supply current | No load, V _{CC} = 3.3 V or 5 V | | 1.5 | | mA |
| Driver | | | | | | |
| V _{OH} | High-level output voltage | DO _{UT} at R _L = 3 kΩ to GND, DIN = GND | 5 | 5.4 | | V |
| V _{OL} | Low-level output voltage | DO _{UT} at R _L = 3 kΩ to GND, DIN = V _{CC} | -5 | -5.4 | | V |
| I _{IH} | High-level input current | V _I = V _{CC} | | ±0.01 | ±1 | μA |
| I _{IL} | Low-level input current | V _I at GND | | ±0.01 | ±1 | μA |
| I _{OS} | Short-circuit output current | V _{CC} = 3.6 V, V _O = 0 V | | ±30 | ±60 | mA |
| | | V _{CC} = 5.5 V, V _O = 0 V | | | | |
| r _o | Output resistance | V _{CC} , V ₊ , and V ₋ = 0 V, V _O = ±2 V | 300 | 10M | | Ω |
| Receiver | | | | | | |
| V _{OH} | High-level output voltage | I _{OH} = -1 mA | V _{CC} - 0.6 | V _{CC} - 0.1 | | V |
| V _{OL} | Low-level output voltage | I _{OL} = 1.6 mA | | | 0.4 | V |
| V _{IT+} | Positive-going input threshold voltage | V _{CC} = 3.3 V | | 1.5 | 2.4 | V |
| | | V _{CC} = 5 V | | 2.0 | 2.4 | |
| V _{IT-} | Negative-going input threshold voltage | V _{CC} = 3.3 V | 0.6 | 1.1 | | V |
| | | V _{CC} = 5 V | 0.8 | 1.5 | | |
| V _{hys} | Input hysteresis (V _{IT+} - V _{IT-}) | | | 0.4 | | V |
| r _i | Input resistance | V _I = ±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_{CC}=3.3V±0.3V; C1=0.047μF, C2–C4=0.33μF at V_{CC}=5V±0.5V, T_A = -40~125°C, unless otherwise noted. Typical values are at T_A = +25°C.)

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

Note 3: Pulse skew is defined as |t_{PLH} – t_{PHL}| of each channel of the same device.

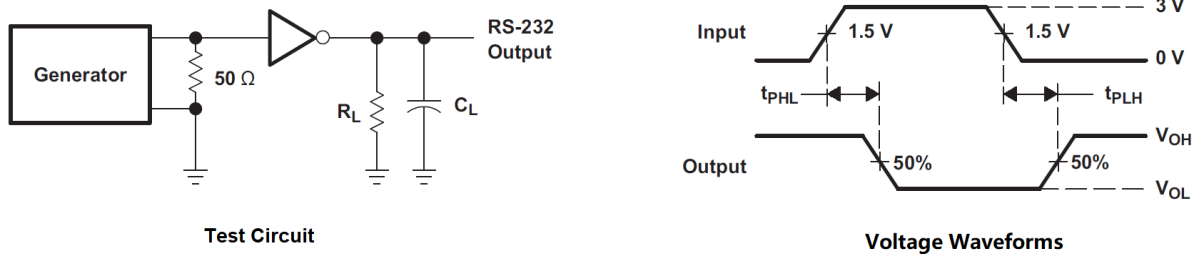


Figure 1. Driver Pulse Skew

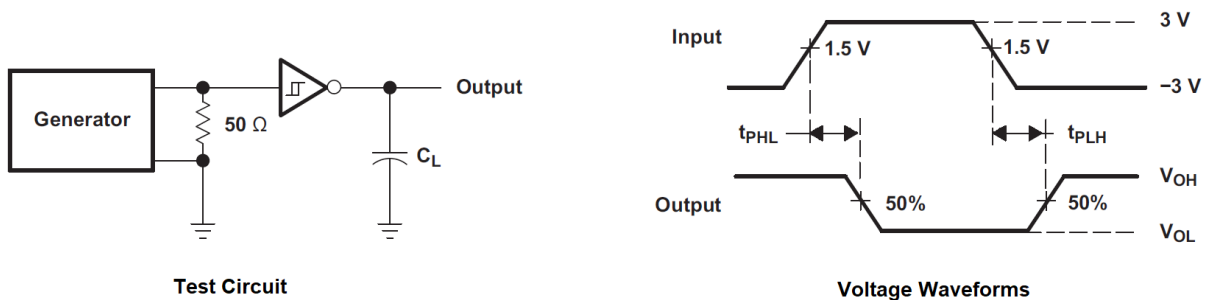
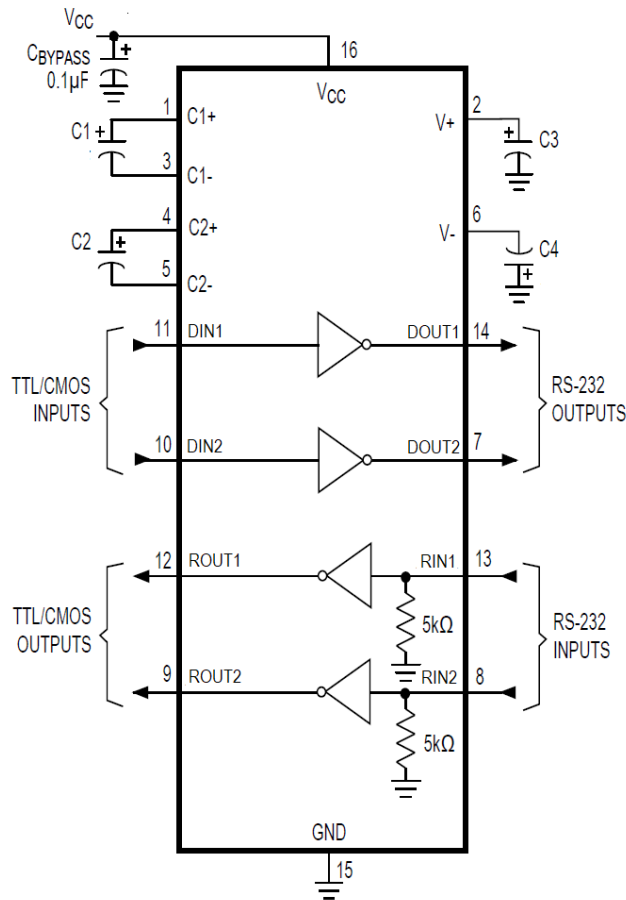


Figure 2. Receiver Propagation Delay Times

Typical Application



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

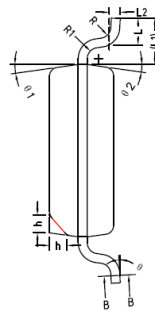
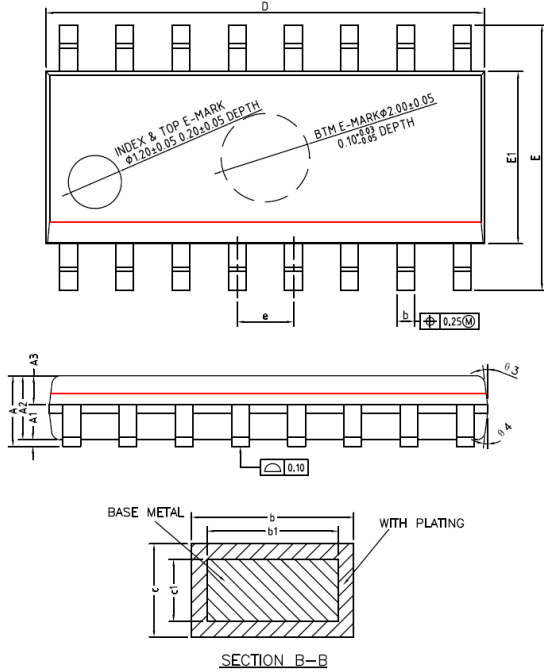
Figure 3. Typical Operating Circuit

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 |

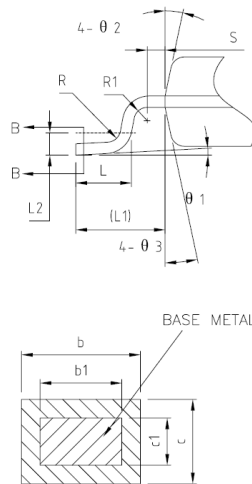
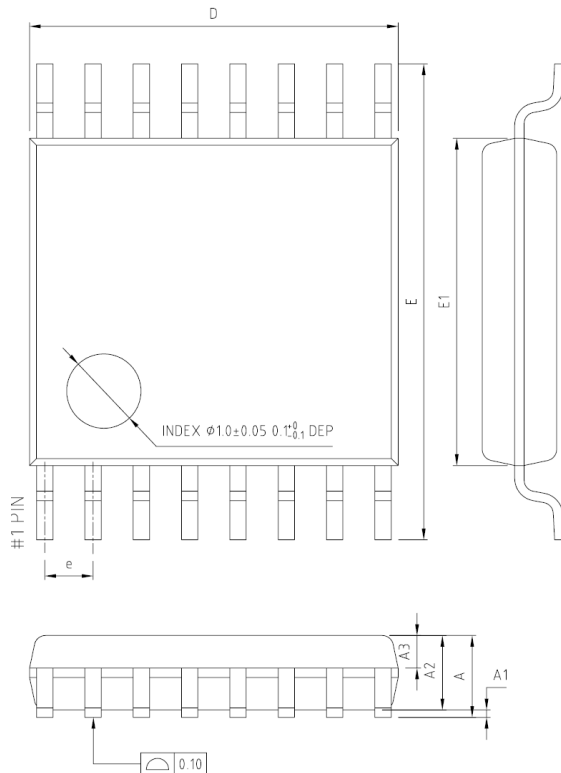
Package Outline Dimensions

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° |