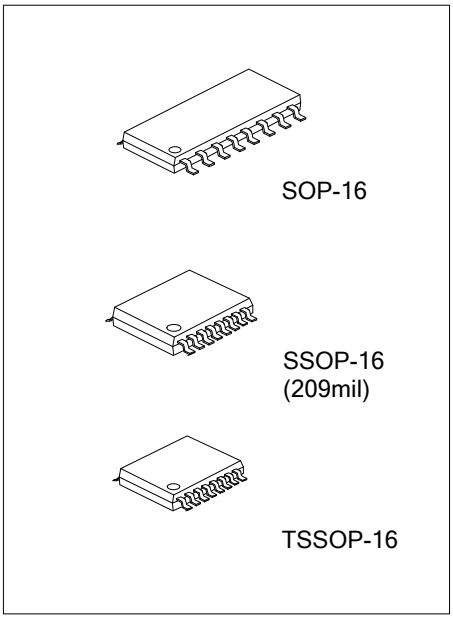
# 3.0V TO 5.5V LOW POWER MULTICHANNEL RS-232 LINE TRANSCEIVERS USING FOR 0.1μF EXTERNAL CAPACITORS




## ■ DESCRIPTION

The UTC **UT3232** has two receivers and two drivers, and a dual charge-pump circuit. The device 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 3.0V to 5.5V supply. The device operates at data signaling rates up to 250kbit/s and a maximum of 35V/μs driver output slew rate.

## ■ FEATURES

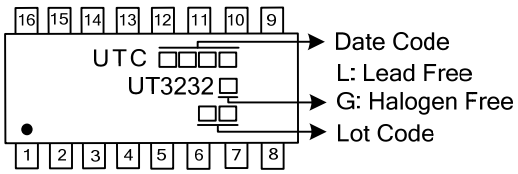
* Exceeds ±8KV ESD Protection(HBM) for RS-232 I/O Pins
* Meets the Requirements of TIA/EIA-232-F and ITU V.28 Standards
* Operates With 3.0V to 5.5V $V_{CC}$ Supply
* Operates Up To 250kbit/s Data Rate
* Two Drivers and Two Receivers
* External Capacitors 4×0.1μF
* Accepts 5.0V Logic Input With 3.3V Supply

## ■ ORDERING INFORMATION

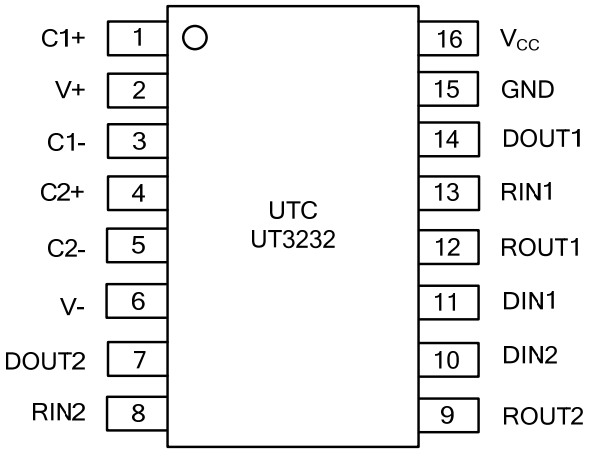
| Ordering Number | | Package | Packing |
|---|---|---|---|
| Lead Free | Halogen Free | | |
| UT3232L-S16-R | UT3232G-S16-R | SOP-16 | Tape Reel |
| UT3232L-R16-R | UT3232G-R16-R | SSOP-16 | Tape Reel |
| UT3232L-P16-R | UT3232G-P16-R | TSSOP-16 | Tape Reel |

| | |
|---|---|
| UT3232G-S16-R<br>(1)Packing Type<br>(2)Package Type<br>(3)Green Package | (1) R: Tape Reel<br>(2) S16: SOP-16, R16: SSOP-16, P16: TSSOP-16<br>(3) G: Halogen Free and Lead Free, L: Lead Free |

## ■ MARKING



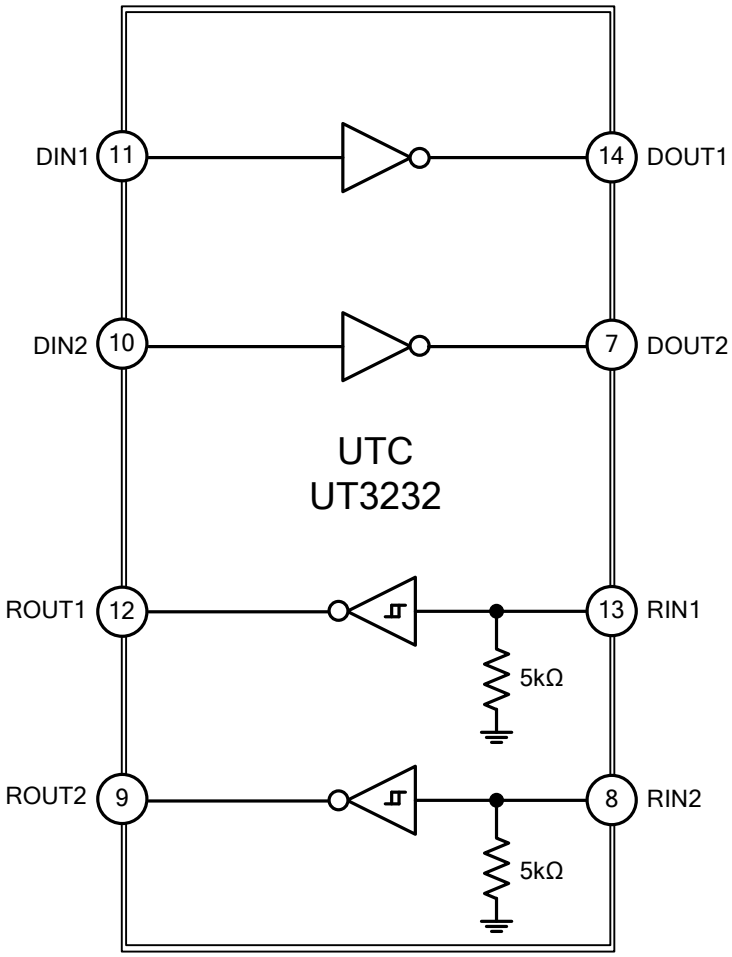
## ■ PIN CONFIGURATION




## ■ PIN DESCRIPTION

| PIN NO. | PIN NAME | DESCRIPTION |
|---|---|---|
| 1 | C1+ | Positive Terminal of Voltage-Doubler Charge-Pump Capacitor |
| 2 | V+ | +5.5V Generated by the Charge Pump |
| 3 | C1- | Negative Terminal of Voltage-Doubler Charge-Pump Capacitor |
| 4 | C2+ | Positive Terminal of Inverting Charge-Pump Capacitor |
| 5 | C2- | Negative Terminal of Inverting Charge-Pump Capacitor |
| 6 | V- | -5.5V Generated by the Charge Pump |
| 7 | DOUT2 | RS-232 Driver Outputs |
| 8 | RIN2 | RS-232 Receiver Inputs |
| 9 | ROUT2 | TTL/CMOS Receiver Outputs |
| 10 | DIN2 | TTL/CMOS Driver Inputs |
| 11 | DIN1 | TTL/CMOS Driver Inputs |
| 12 | ROUT1 | TTL/CMOS Receiver Outputs |
| 13 | RIN1 | RS-232 Receiver Inputs |
| 14 | DOUT1 | RS-232 Driver Outputs |
| 15 | GND | Ground |
| 16 | $V_{CC}$ | +3.0V to +5.5V Supply Voltage |

## ■ BLOCK DIAGRAM



## ■ ABSOLUTE MAXIMUM RATING [Over operating free-air temperature range (unless otherwise noted)]

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Supply Voltage Range | | $V_{CC}$ | -0.3 ~ +6.0 | V |
| Positive Output Supply Voltage Range (Note 2) | | V+ | -0.3 ~ +7.0 | V |
| Negative Output Supply Voltage Range (Note 2) | | V- | +0.3 ~ -7.0 | V |
| Supply Voltage Difference (Note 2) | | V+ - V- | +13 | V |
| Input Voltage | Drivers | $V_{IN}$ | -0.3 ~ +6.0 | V |
| | Receivers | | -25 ~ +25 | V |
| Output Voltage | Drivers | $V_{OUT}$ | -13.2 ~ +13.2 | V |
| | Receivers | | -0.3 ~ $V_{CC}$+0.3 | V |
| Operating Virtual Junction Temperature | | $T_J$ | +150 | °C |
| Storage Temperature | | $T_{STG}$ | -65 ~ +150 | °C |

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. All voltages are with respect to network GND.

## ■ THERMAL DATA

| PARAMETER | | SYMBOL | RATING | UNIT |
|---|---|---|---|---|
| Junction to Ambient | SOP-16 | $\theta_{JA}$ | 130 | °C/W |
| | SSOP-16<br>TSSOP-16 | | 160 | |

## ■ RECOMMENDED OPERATING CONDITIONS (See Note & Table 1)

| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| Supply Voltage | $V_{CC}$ | $V_{CC}$=3.3V | | 3.0 | 3.3 | 3.6 | V |
| | | $V_{CC}$=5.0V | | 4.5 | 5.0 | 5.5 | V |
| Driver and Control High-level Input Voltage | $V_{IH}$ | DIN | $V_{CC}$=3.3V | 2.0 | | | V |
| | | | $V_{CC}$=5.5V | 2.4 | | | |
| Driver and Control Low-level Input Voltage | $V_{IL}$ | DIN | | | | 0.8 | V |
| Driver and Control Input Voltage | $V_{IN}$ | DIN | | | | 5.5 | V |
| Receiver Input Voltage | $V_{RIN}$ | | | -25 | | 25 | V |
| Operating Free-Air Temperature | $T_A$ | | | -40 | | 85 | °C |

Notes: Test conditions are C1~C4=0.1μF at $V_{CC}$=3.3V±0.3V; C1=0.047μF, C2~C4=0.33μF at $V_{CC}$=5.0V±0.5V.

## ■ ELECTRICAL CHARACTERISTICS [(over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 3 & Table 1)]

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP (Note 1) | MAX | UNIT |
|---|---|---|---|---|---|---|
| Supply Current | $I_{CC}$ | No load | | 0.3 | 1.0 | mA |
| **DRIVER SECTION** | | | | | | |
| High-Level Output Voltage | $V_{OH}$ | DOUT at $R_L$=3kΩ to GND, DIN=GND | +5.0 | +5.4 | | V |
| Low-Level Output Voltage | $V_{OL}$ | DOUT at $R_L$=3kΩ to GND, DIN=$V_{CC}$ | -5.0 | -5.4 | | V |
| High-Level Input Current | $I_{OH}$ | $V_I$=$V_{CC}$ | | ±0.01 | ±1 | μA |
| Low-Level Input Current | $I_{OL}$ | $V_I$ at GND | | ±0.01 | ±1 | μA |
| Short-Circuit Output Current (Note 2) | $I_{OS}$ | $V_{CC}$=3.6V, $V_{OUT}$=0V | | ±35 | ±60 | mA |
| | | $V_{CC}$=5.5V, $V_{OUT}$=0V | | ±35 | ±60 | mA |
| Output Resistance | $r_O$ | $V_{CC}$, V+ and V- =0V, $V_{OUT}$=±2.0V | 300 | 10M | | Ω |
| **RECEIVER SECTION** | | | | | | |
| High-Level Output Voltage | $V_{OH}$ | $I_{OH}$=-1.0mA | $V_{CC}$-0.6V | $V_{CC}$- 0.1V | | V |
| Low-Level Output Voltage | $V_{OL}$ | $I_{OL}$=1.6mA | | | 0.4 | V |
| Positive-Going Input Threshold Voltage | $V_{IT+}$ | $V_{CC}$=3.3V | | 1.5 | 2.4 | V |
| | | $V_{CC}$=5.0V | | 1.8 | 2.4 | V |
| Negative-Going Input Threshold Voltage | $V_{IT-}$ | $V_{CC}$=3.3V | 0.6 | 1.2 | | V |
| | | $V_{CC}$=5.0V | 0.8 | 1.5 | | V |
| Input Hysteresis | $V_{HYS}$ | $V_{IT+}$~$V_{IT-}$ | | 0.3 | | V |
| Input Resistance | $R_I$ | $V_I$=±3.0V~±25V | 3 | 5 | 7 | kΩ |

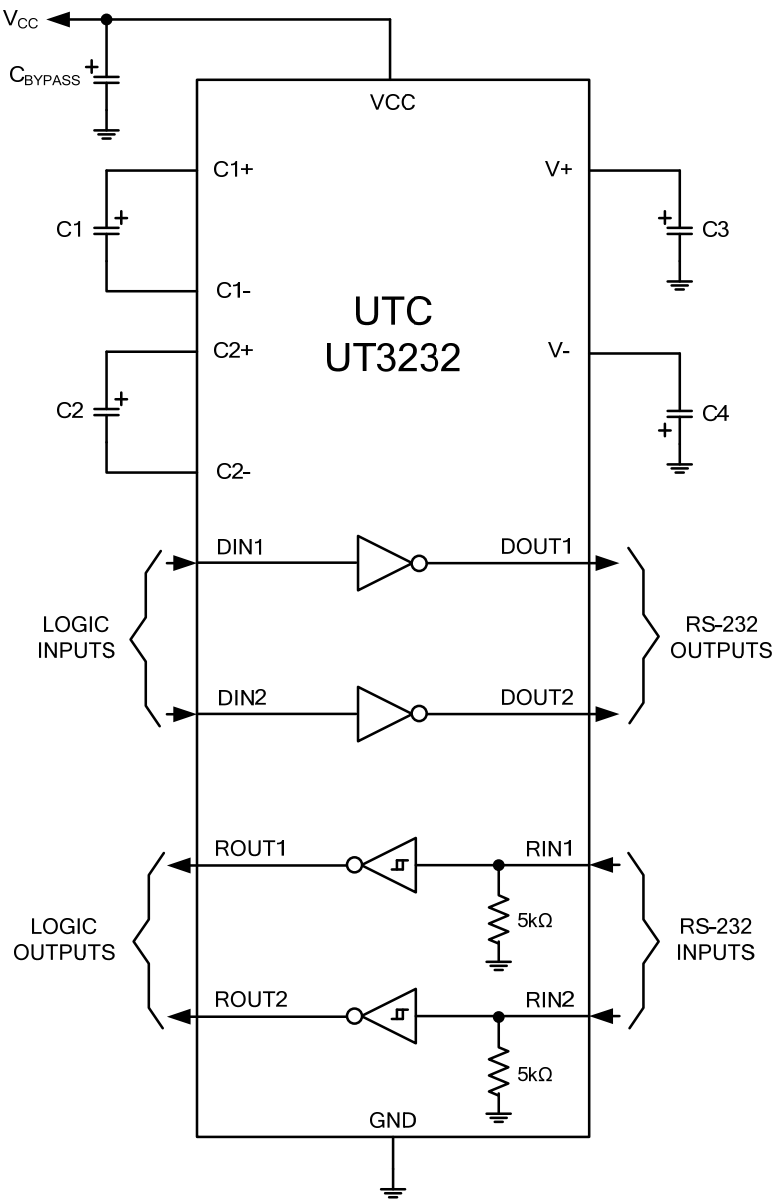
Notes: 1. All typical values are at $V_{CC}$=3.3V or $V_{CC}$=5.0V, and $T_A$=25°C.
2. Short-circuit durations should be controlled to prevent exceeding the device absolute power-dissipation ratings, and not more than one output should be shorted at a time.
3. Test conditions are C1~C4=0.1μF at $V_{CC}$=3.3V±0.3V; C1=0.047μF, C2~C4=0.33μF at $V_{CC}$=5.0V±0.5V.
4. Pulse skew is defined as $|t_{PLH}-t_{PHL}|$ of each channel of the same device.

## ■ SWITCHING CHARACTERISTICS [over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 3 and Table 1)]

| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN | TYP (Note 1) | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| **DRIVER SECTION** | | | | | | | |
| Maximum Data Rate | | $C_L$=1000pF, $R_L$=3kΩ, One Driver Switching | | 250 | | | Kbit/s |
| Pulse Skew (Note 4) | $t_{SK(p)}$ | $C_L$=220pF~2500pF, $R_L$ =3kΩ~7kΩ | | | 300 | | ns |
| Slew Rate, Transition Region | SR(tr) | $R_L$ =3kΩ~7kΩ, $V_{CC}$=3.3V | $C_L$=220pF~1000pF | 5 | | 35 | V/μs |
| | | | $C_L$=220pF~2500pF | 3 | | 35 | |
| **RECEIVER SECTION** | | | | | | | |
| Propagation Delay Time, Low-to High-Level Output | $t_{PLH}$ | $C_L$=150pF | | | 300 | | ns |
| Propagation Delay Time, High-to Low-Level Output | $t_{PHL}$ | $C_L$=150pF | | | 300 | | ns |
| Output Enable Time | $t_{EN}$ | $C_L$=150pF, $R_L$=3kΩ | | | 200 | | ns |
| Output Disable Time | $t_{DIS}$ | $C_L$=150pF, $R_L$=3kΩ | | | 200 | | ns |
| Pulse Skew (Note 4) | $t_{SK(P)}$ | $\|t_{PLH}-t_{PHL}\|$ | | | 300 | | ns |

Notes: 1. All typical values are at $V_{CC}$=3.3V or $V_{CC}$=5.0V, and $T_A$=25°C.
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.
3. Test conditions are C1~C4=0.1μF at $V_{CC}$=3.3V±0.3V; C1=0.047μF, C2~C4=0.33μF at $V_{CC}$=5.0V±0.5V.
4. Pulse skew is defined as $|t_{PLH}-t_{PHL}|$ of each channel of the same device.

## ■ TYPICAL APPLICATION CIRCUIT




Notes: 1. C3 can be connected to $V_{CC}$ or GND.
2. Resistor values shown are nominal.
3. NC: No internal connection.
4. Nonpolarized ceramic capacitors are acceptable. If polarized tantalum or electrolytic capacitors are used, they should be connected as shown.

Table1. Typical Operating Circuit and Capacitor Values

| $V_{CC}$ (V) | C1 (μF) | C2, C3, C4 (μF) | $C_{BYPASS}$ (μF) |
|---|---|---|---|
| 3.0~3.6 | 0.22 | 0.22 | 0.22 |
| 3.15~3.6 | 0.1 | 0.1 | 0.1 |
| 4.5~5.5 | 0.047 | 0.33 | 0.047 |
| 3.0~5.5 | 0.22 | 1.0 | 0.22 |