



75232

LINEAR INTEGRATED CIRCUIT

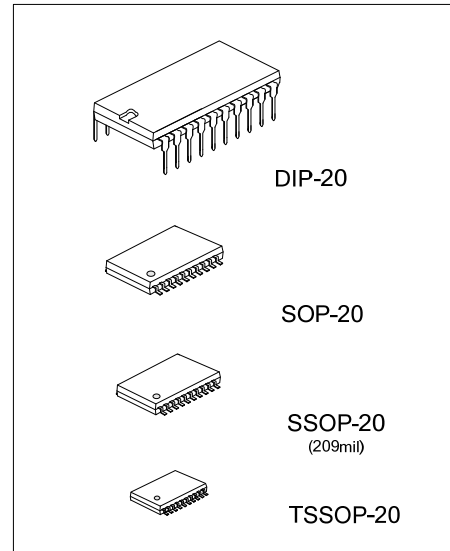
## MULTIPLE RS-232 DRIVERS AND RECEIVERS

### DESCRIPTION

The UTC **75232** is a monolithic IC containing three independent drivers and five receivers which comply with the requirements of the TIA/EIA232-F standards.

### FEATURES

- \* Single chip with easy interconnection of the UART and serial-port connector of personal computer.
- \* Meets standard TIA/EIA-232-F and ITU V.28
- \* Up to 120 kbps data rate
- \* 20-pin SOP/ DIP/SSOP/TSSOP packages



### ORDERING INFORMATION

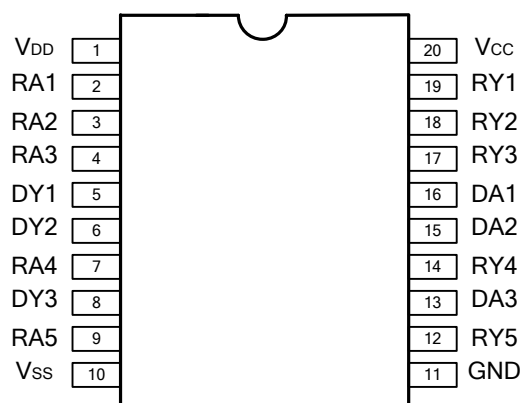
| Ordering Number |              | Package  | Packing   |
|-----------------|--------------|----------|-----------|
| Lead Free       | Halogen Free |          |           |
| 75232L-D20-T    | 75232G-D20-T | DIP-20   | Tube      |
| -               | 75232G-P20-R | TSSOP-20 | Tape Reel |
| -               | 75232G-R20-R | SSOP-20  | Tape Reel |
| -               | 75232G-S20-R | SOP-20   | Tape Reel |

|                                                                                        |                                                                                                                                                    |
|----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>75232L-D20-T</p> <p>(1) Packing Type<br/>(2) Package Type<br/>(3) Green Package</p> | <p>(1) R: Tape Reel, T: Tube<br/>(2) D20: DIP-20, S20: SOP-20, R20: SSOP-20, P20: TSSOP-20<br/>(3) G: Halogen Free and Lead Free, L: Lead Free</p> |
|----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|

### MARKING

| DIP-20                                                                                                                                                          | SOP-20 / SSOP-20 / TSSOP-20                                                                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| <p>20 19 18 17 16 15 14 13 12 11<br/>UTC □ □ □ □ → Date Code<br/>75232 □ → L: Lead Free<br/>□ → G: Halogen Free<br/>□ □ → Lot Code<br/>1 2 3 4 5 6 7 8 9 10</p> | <p>20 19 18 17 16 15 14 13 12 11<br/>UTC □ □ □ □ → Date Code<br/>75232G □ □ → Lot Code<br/>1 2 3 4 5 6 7 8 9 10</p> |

## ■ PIN CONFIGURATION



## ■ PIN DESCRIPTION

| PIN NO. | PIN NAME        | FUNCTION               |
|---------|-----------------|------------------------|
| 1       | V <sub>DD</sub> | Supply voltage         |
| 2       | RA1             | First receiver input   |
| 3       | RA2             | Second receiver input  |
| 4       | RA3             | Third receiver input   |
| 5       | DY1             | First driver output    |
| 6       | DY2             | Second driver output   |
| 7       | RA4             | Fourth receiver input  |
| 8       | DY3             | Third driver output    |
| 9       | RA5             | Fifth receiver input   |
| 10      | V <sub>SS</sub> | Supply voltage         |
| 11      | GND             | Ground                 |
| 12      | RY5             | Fifth receiver output  |
| 13      | DA3             | Third driver input     |
| 14      | RY4             | Fourth receiver output |
| 15      | DA2             | Second driver input    |
| 16      | DA1             | First driver input     |
| 17      | RY3             | Third receiver output  |
| 18      | RY2             | Second receiver output |
| 19      | RY1             | First receiver output  |
| 20      | V <sub>CC</sub> | Supply voltage         |

## ■ ABSOLUTE MAXIMUM RATINGS

| PARAMETER                         |          | SYMBOL    | RATINGS    | UNIT |
|-----------------------------------|----------|-----------|------------|------|
| Supply Voltage (Note 2)           |          | $V_{DD}$  | 15         | V    |
|                                   |          | $V_{SS}$  | -15        | V    |
|                                   |          | $V_{CC}$  | 10         | V    |
| Input Voltage Range               | Driver   | $V_{IN}$  | -15 ~ 7    | V    |
|                                   | Receiver |           | -30 ~ 30   | V    |
| Driver Output Voltage Range       |          | $V_{OUT}$ | -15 ~ 15   | V    |
| Receiver Low Level Output Current |          | $I_{OUT}$ | 20         | mA   |
| Operation Temperature             |          | $T_{OPR}$ | 0 ~ +70    | °C   |
| Storage Temperature               |          | $T_{STG}$ | -40 ~ +150 | °C   |

Note: 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 the network ground terminal.

## ■ THERMAL DATA

| PARAMETER           |          | SYMBOL        | RATINGS | UNIT |
|---------------------|----------|---------------|---------|------|
| Junction-to-Ambient | DIP-20   | $\theta_{JA}$ | 70      | °C/W |
|                     | SOP-20   |               | 100     |      |
|                     | SSOP-20  |               | 115     |      |
|                     | TSSOP-20 |               | 115     |      |

## ■ RECOMMENDED OPERATING RATINGS

| PARAMETER                         |          | SYMBOL   | MIN  | TYP | MAX  | UNIT |
|-----------------------------------|----------|----------|------|-----|------|------|
| Supply Voltage                    |          | $V_{DD}$ | 7.5  | 9   | 15   | V    |
|                                   |          | $V_{SS}$ | -7.5 | -9  | -15  | V    |
|                                   |          | $V_{CC}$ | 4.5  | 5   | 5.5  | V    |
| Level Input Voltage (driver only) | High     | $V_{IH}$ | 1.9  |     |      | V    |
|                                   | Low      | $V_{IL}$ |      |     | 0.8  | V    |
| High Level Output Current         | Driver   | $I_{OH}$ |      |     | -6.0 | mA   |
|                                   | Receiver |          |      |     | -0.5 |      |
| Low Level Output Current          | Driver   | $I_{OL}$ |      |     | 6    | mA   |
|                                   | Receiver |          |      |     | 16   |      |

## ■ ELECTRICAL CHARACTERISTICS

(Over recommended supply voltage and operating temperature ranges, unless otherwise specified)

| PARAMETER                    | SYMBOL   | TEST CONDITIONS                        | MIN                      | TYP | MAX  | UNIT |
|------------------------------|----------|----------------------------------------|--------------------------|-----|------|------|
| <b>SUPPLY CURRENTS</b>       |          |                                        |                          |     |      |      |
| Supply Current from $V_{DD}$ | $I_{DD}$ | No load.<br>All inputs at 1.9V         | $V_{DD}=9V, V_{SS}=-9V$  |     | 15   | mA   |
|                              |          |                                        | $V_{DD}=12, V_{SS}=-12V$ |     | 19   |      |
|                              |          |                                        | $V_{DD}=15, V_{SS}=-15V$ |     | 25   |      |
|                              |          | No load.<br>All inputs at 0.8V         | $V_{DD}=9V, V_{SS}=-9V$  |     | 4.5  | mA   |
|                              |          |                                        | $V_{DD}=12, V_{SS}=-12V$ |     | 5.5  |      |
|                              |          |                                        | $V_{DD}=15, V_{SS}=-15V$ |     | 9    |      |
| Supply Current from $V_{SS}$ | $I_{SS}$ | No load.<br>All inputs at 1.9V         | $V_{DD}=9V, V_{SS}=-9V$  |     | -15  | mA   |
|                              |          |                                        | $V_{DD}=12, V_{SS}=-12V$ |     | -19  |      |
|                              |          |                                        | $V_{DD}=15, V_{SS}=-15V$ |     | -25  |      |
|                              |          | No load.<br>All inputs at 0.8V         | $V_{DD}=9V, V_{SS}=-9V$  |     | -3.2 | mA   |
|                              |          |                                        | $V_{DD}=12, V_{SS}=-12V$ |     | -3.2 |      |
|                              |          |                                        | $V_{DD}=15, V_{SS}=-15V$ |     | -3.2 |      |
| Supply Current from $V_{CC}$ | $I_{CC}$ | No load. All inputs at 5V, $V_{CC}=5V$ |                          |     | 30   | mA   |

## ■ ELECTRICAL CHARACTERISTICS(Cont.)

| PARAMETER                                                                                         |          | SYMBOL       | TEST CONDITIONS                                           | MIN   | TYP  | MAX   | UNIT     |
|---------------------------------------------------------------------------------------------------|----------|--------------|-----------------------------------------------------------|-------|------|-------|----------|
| <b>DRIVER SECTION (<math>V_{DD}=9V</math>, <math>V_{SS}=-9V</math>, <math>V_{CC}=5V</math>)</b>   |          |              |                                                           |       |      |       |          |
| Output Voltage Level<br>(Figure. 1)                                                               | High     | $V_{OH}$     | $V_{IL}=0.8V$ , $R_L=3\text{ k}\Omega$                    | 6     | 7.5  |       | V        |
|                                                                                                   | Low      | $V_{OL}$     | $V_{IH}=1.9V$ , $R_L=3\text{ k}\Omega$ (Note 1)           |       | -7.5 | -6    | V        |
| Input Current Level<br>(Figure. 2)                                                                | High     | $I_{IH}$     | $V_{IN}=5V$                                               |       |      | 10    | $\mu A$  |
|                                                                                                   | Low      | $I_{IL}$     | $V_{IN}=0V$                                               |       |      | -1.6  | mA       |
| Short Circuit Output<br>Current (Figure. 1)                                                       | High     | $I_{OH(SC)}$ | $V_{IL}=0.8V$ , $V_{OUT}=0V$ (Note 2)                     | -8.5  | -12  | -19.5 | mA       |
|                                                                                                   | Low      | $I_{OL(SC)}$ | $V_{IH}=2.0V$ , $V_{OUT}=0V$                              | 8.5   | 12   | 19.5  | mA       |
| Output Resistance (Note 3)                                                                        |          | $R_{OUT}$    | $V_{DD}=V_{SS}=V_{CC}=0V$ , $V_{OUT}=-2V\sim 2V$          | 300   |      |       | $\Omega$ |
| <b>RECEIVER SECTION (<math>V_{DD}=9V</math>, <math>V_{SS}=-9V</math>, <math>V_{CC}=5V</math>)</b> |          |              |                                                           |       |      |       |          |
| Going Threshold Voltage                                                                           | Positive | $V_{T+}$     | $T_A=25^\circ C$ (Figure. 5)                              | 1.75  | 1.9  | 2.3   | V        |
|                                                                                                   | Negative | $V_{T-}$     | $T_A=0^\circ C \sim 70^\circ C$ (Figure. 5)               | 1.55  |      | 2.3   |          |
| Input Hysteresis( $V_{T+} - V_{T-}$ )                                                             |          | $V_{HYS}$    |                                                           | 0.5   |      |       | V        |
| Output Voltage Level                                                                              | High     | $V_{OH}$     | $I_{OH}=-0.5mA$ $V_{IH}=0.75V$                            | 2.6   | 4    | 5     | V        |
|                                                                                                   | Low      | $V_{OL}$     | $V_{IN}=3V$ , $I_{OL}=10mA$ $V_{IH}=0.75V$<br>Inputs Open | 2.6   |      |       |          |
| Input Current Level<br>(Figure. 5)                                                                | High     | $I_{IH}$     | $V_{IN}=25V$                                              | 3.6   |      | 8.3   | mA       |
|                                                                                                   |          |              | $V_{IN}=3V$                                               | 0.43  |      |       |          |
|                                                                                                   | Low      | $I_{IL}$     | $V_{IN}=-25V$                                             | -3.6  |      | -8.3  | mA       |
|                                                                                                   |          |              | $V_{IN}=-3V$                                              | -0.43 |      |       |          |
| Short-Circuit Output Current                                                                      |          | $I_{O(SC)}$  | (Fig. 4)                                                  |       | -3.4 | -12   | mA       |

Note. 1. For voltage logic levels, the more positive (less negative) limit is designated as maximum, (e.g. if -10V is a maximum, the typical value is a more negative voltage).

2: Output short circuit conditions must maintain the total power dissipation below absolute maximum ratings and the sign is used to indicate direction.

3: Test conditions are those specified by TIA/EIA232-F and as listed above.

■ SWITCHING CHARACTERISTICS ( $T_A=25^\circ C$ )

| PARAMETER                                                                                           |  | SYMBOL    | TEST CONDITIONS                              | MIN | TYP | MAX | UNIT    |
|-----------------------------------------------------------------------------------------------------|--|-----------|----------------------------------------------|-----|-----|-----|---------|
| <b>DRIVER SECTION (<math>V_{DD}=12V</math>, <math>V_{SS}=-12V</math>, <math>V_{CC}=5V</math>)</b>   |  |           |                                              |     |     |     |         |
| Propagation Delay Time                                                                              |  | $t_{PLH}$ | $R_L=3 \sim 7\text{ k}\Omega$ , $C_L=15pF$   |     | 315 | 500 | ns      |
|                                                                                                     |  | $t_{PHL}$ | (Figure. 3)                                  |     | 75  | 175 | ns      |
| Transition Time                                                                                     |  | $t_{TLH}$ | $R_L=3 \sim 7\text{ k}\Omega$ , $C_L=15pF$   |     | 60  | 100 | ns      |
|                                                                                                     |  | $t_{THL}$ |                                              |     | 40  | 75  | ns      |
|                                                                                                     |  | $t_{TLH}$ | $R_L=3 \sim 7\text{ k}\Omega$ , $C_L=2500pF$ |     | 1.7 | 2.5 | $\mu s$ |
|                                                                                                     |  | $t_{THL}$ | (Figure. 3, Note)                            |     | 1.5 | 2.5 | $\mu s$ |
| <b>RECEIVER SECTION (<math>V_{DD}=12V</math>, <math>V_{SS}=-12V</math>, <math>V_{CC}=5V</math>)</b> |  |           |                                              |     |     |     |         |
| Propagation Delay Time (Figure. 6)                                                                  |  | $t_{PLH}$ | $R_L=5\text{ k}\Omega$ , $C_L=50pF$          |     | 107 | 250 | ns      |
|                                                                                                     |  | $t_{PHL}$ |                                              |     | 42  | 150 | ns      |
|                                                                                                     |  | $t_{PLH}$ | $R_L=1.5\text{ k}\Omega$ , $C_L=15pF$        |     | 100 | 160 | ns      |
|                                                                                                     |  | $t_{PHL}$ |                                              |     | 60  | 100 | ns      |
| Transition Time (Figure. 6)                                                                         |  | $t_{TLH}$ | $R_L=5\text{ k}\Omega$ , $C_L=50pF$          |     | 175 | 350 | ns      |
|                                                                                                     |  | $t_{THL}$ |                                              |     | 16  | 60  | ns      |
|                                                                                                     |  | $t_{TLH}$ | $R_L=1.5\text{ k}\Omega$ , $C_L=15pF$        |     | 90  | 175 | ns      |
|                                                                                                     |  | $t_{THL}$ |                                              |     | 15  | 50  | ns      |

Note: Measured points of the output waveform (TIA/EIA-232-F conditions) as below, all unused inputs are tied.

- Low to High level: between -3V and 3V.

- High to Low level: between 3V and -3V.

## PARAMETER MEASUREMENT INFORMATION

### DRIVER TEST CIRCUITS:

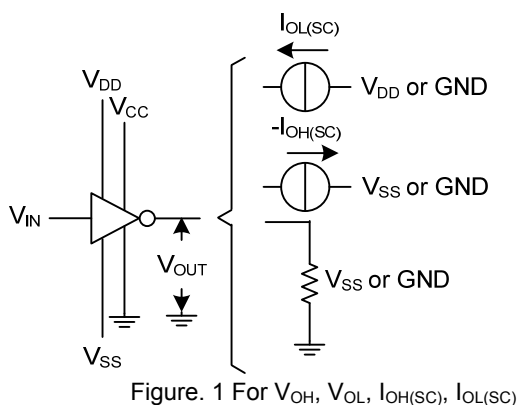


Figure. 1 For  $V_{OH}$ ,  $V_{OL}$ ,  $I_{OH(SC)}$ ,  $I_{OL(SC)}$

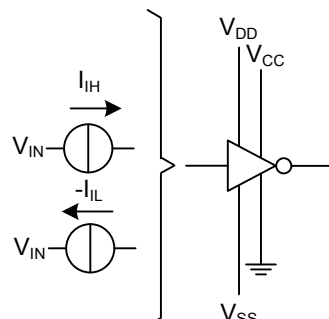


Figure. 2 For  $I_{IH}$ ,  $I_{IL}$

### DRIVER VOLTAGE WAVEFORMS:

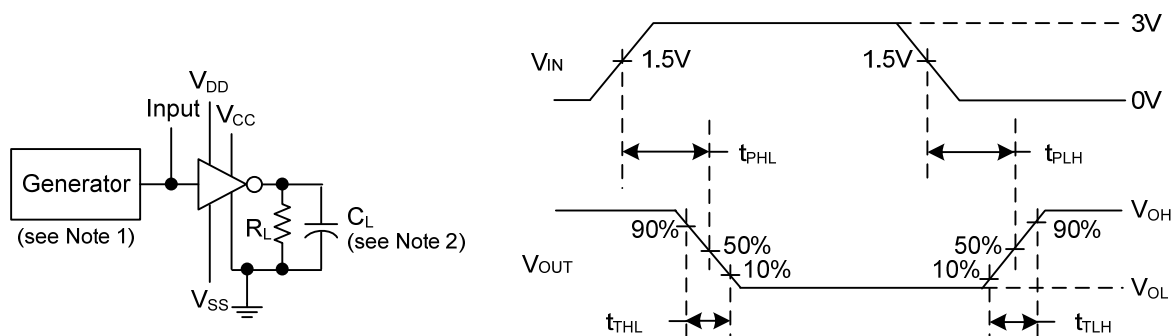


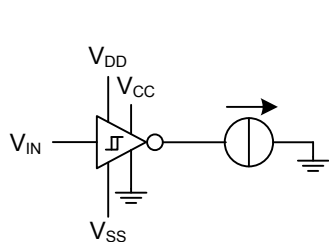
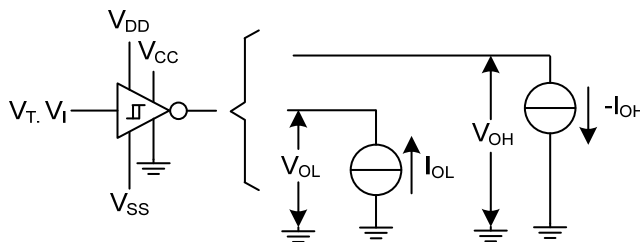
Figure. 3

Note: 1. The pulse generator characteristics:  $t_W=25\mu s$ ,  $PRR=20kHz$ ,  $Z_O=50\Omega$ ,  $t_R=t_F<50ns$ .

2.  $C_L$  includes probe and jig capacitance.

## PARAMETER MEASUREMENT INFORMATION (Cont.)

### RECEIVER TEST CIRCUITS:

Figure 4.  $I_{O(SC)}$ Figure 5  $V_T, V_{OH}, V_{OL}$ 

### RECEIVER PROPAGATION AND TRANSITION TIMES:

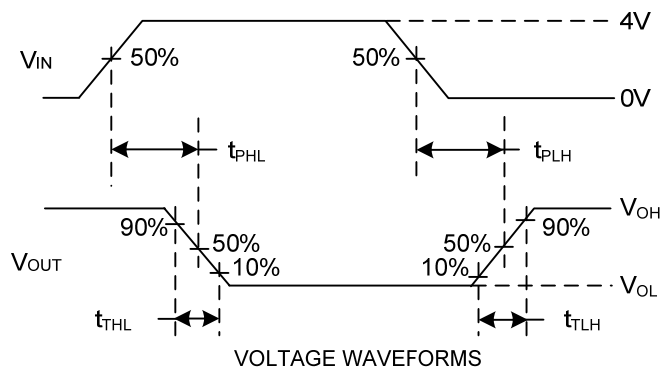
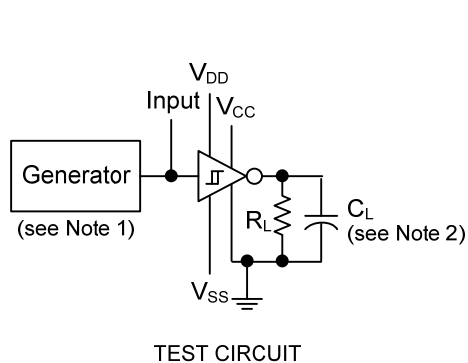


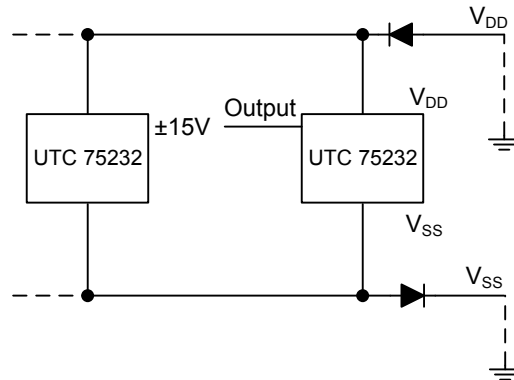
Figure 6.

Note: 1. The pulse generator characteristics:  $t_W=25\mu s$ ,  $PRR=20kHz$ ,  $Z_O=50\Omega$ ,  $t_R=t_F<50ns$ .  
 2.  $C_L$  includes probe and jig capacitance.

## ■ APPLICATION INFORMATION

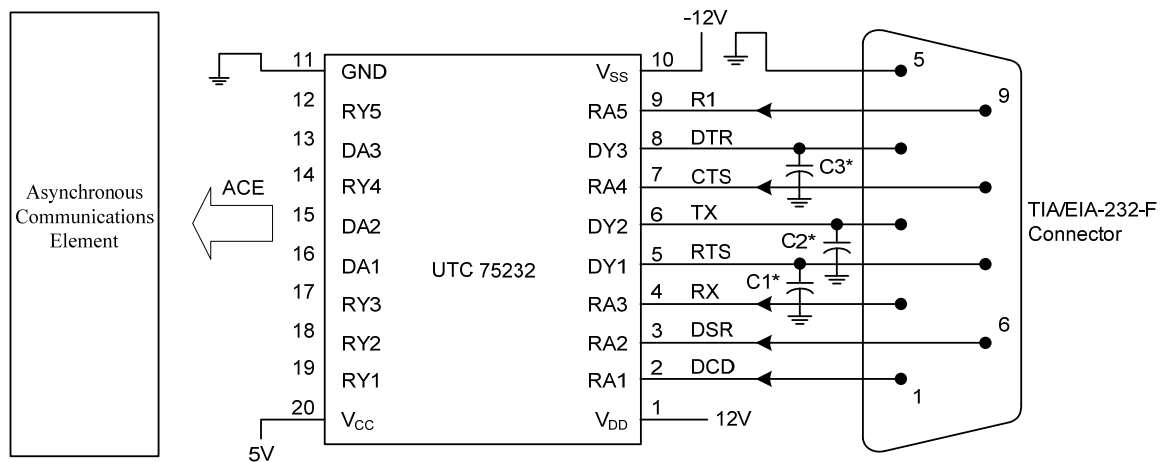
### Power-Supply protection to meet Power-Off fault conditions of TIA/EIA-232-F

Diodes placed in series with the  $V_{DD}$  and  $V_{SS}$  leads protect the device in the fault condition in which the device outputs are shorted to  $\pm 15V$  and the power supplies are at low and provide low-impedance paths to ground.

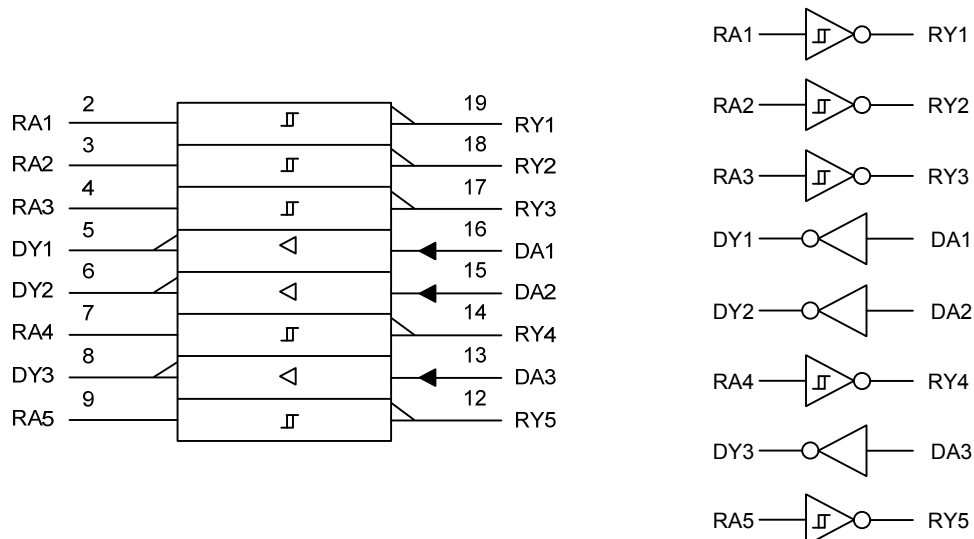


### Typical Connection

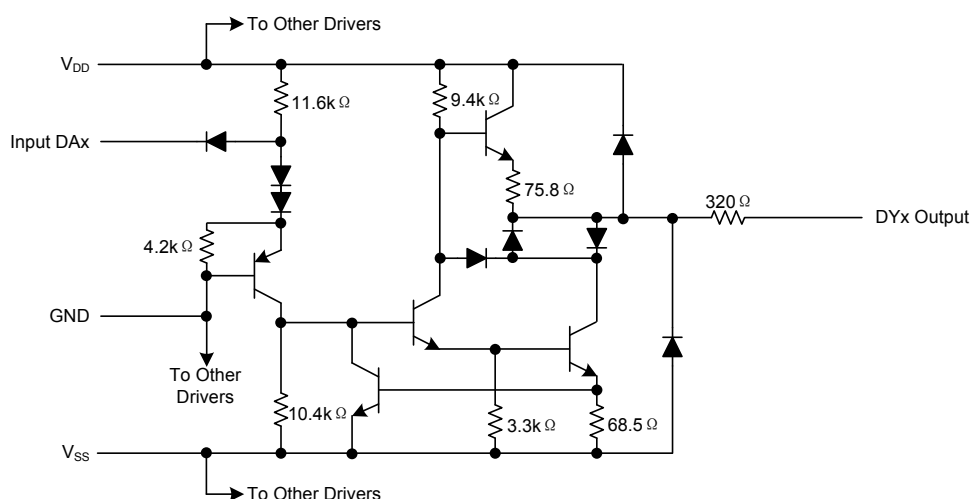
“\*”: Refer Figure 10 to select the correct values for the loading capacitors (C1, C2, and C3), which are required to meet the RS-232 maximum slew-rate requirement of  $30V/\mu s$ . The value of the loading capacitors required depends upon the line length and desired slew rate, but typically is 330 pF.



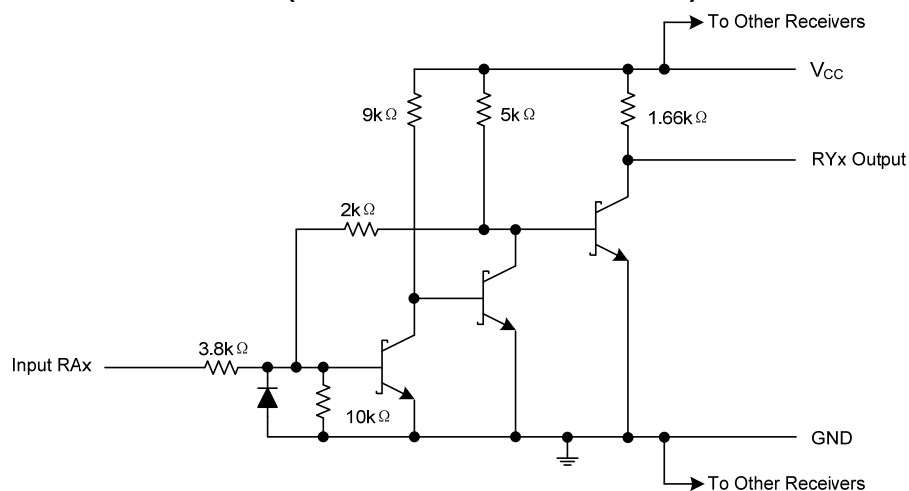
# ■ LOGIC SYMBOL AND LOGIC DIAGRAM



## CIRCUIT OF DRIVERS (Resistor value shown are nominal.)



## CIRCUIT OF EACH RECEIVER (Resistor value shown are nominal.)



# ■ TYPICAL CHARACTERISTICS(DRIVER)

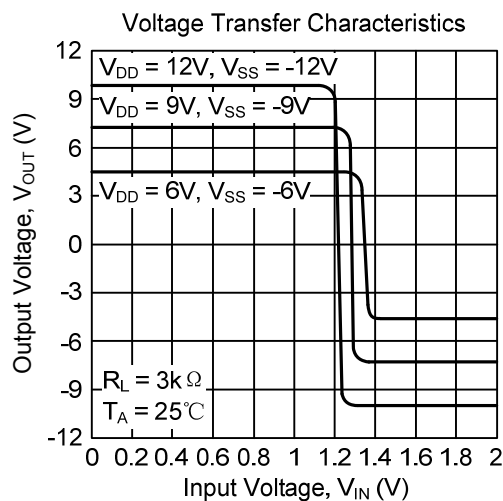


Figure 7

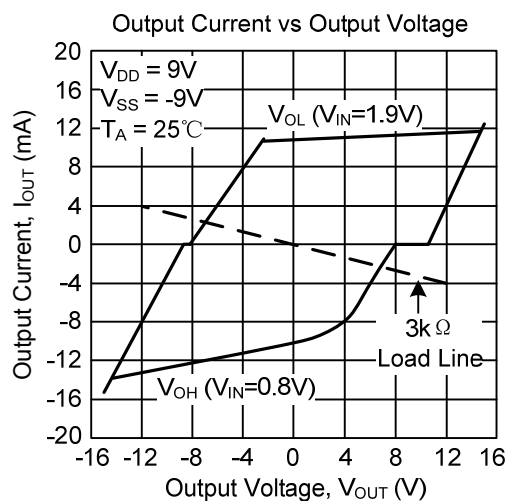


Figure 8

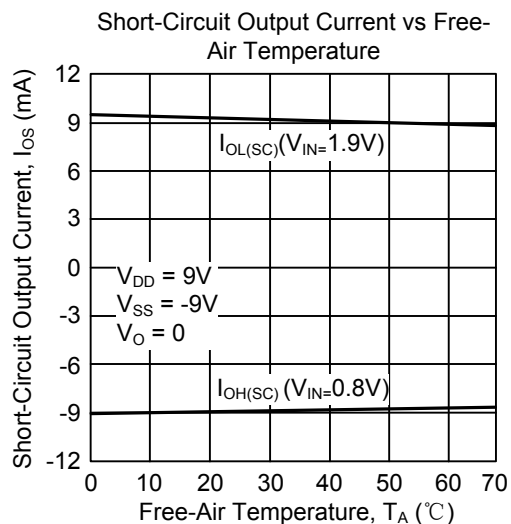


Figure 9

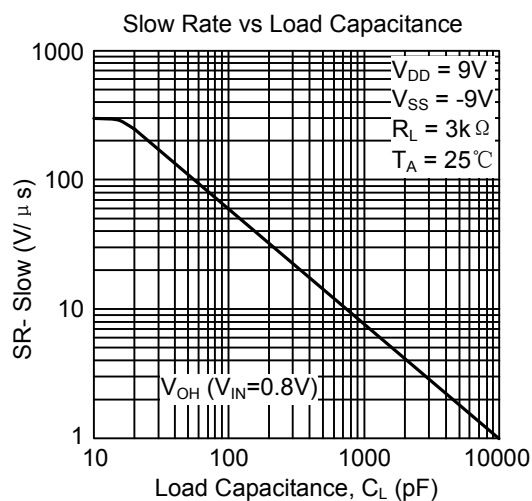


Figure 10

# ■ TYPICAL CHARACTERISTICS(RECEIVER)

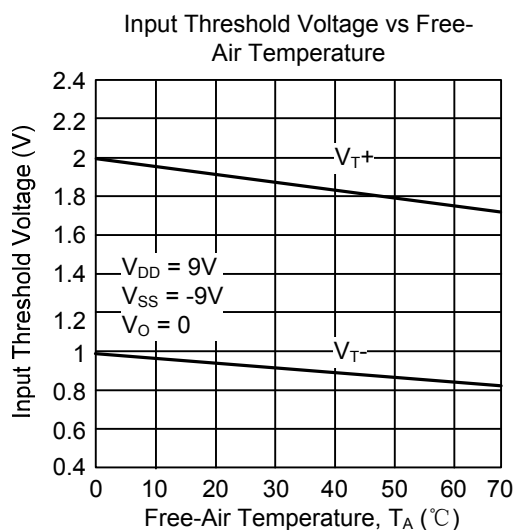


Figure 11

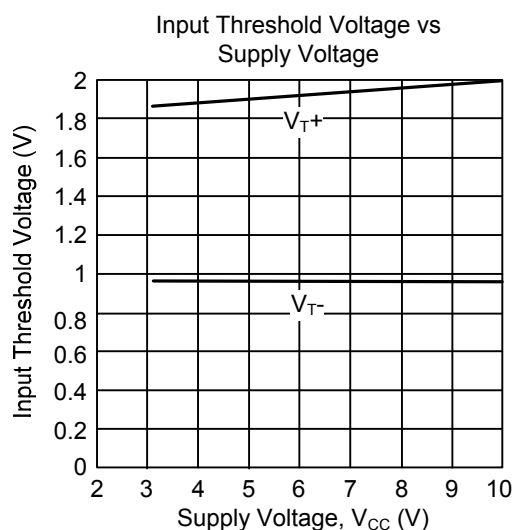


Figure 12

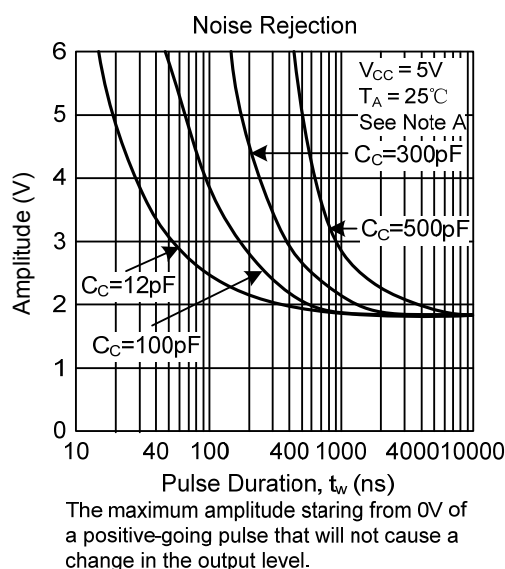


Figure 13

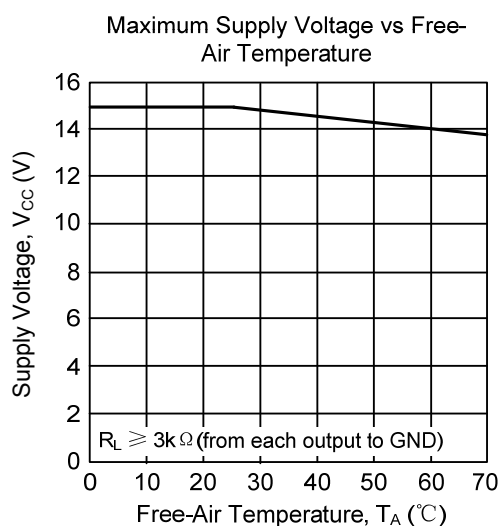


Figure 14

UTC assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all UTC products described or contained herein. UTC products are not designed for use in life support appliances, devices or systems where malfunction of these products can be reasonably expected to result in personal injury. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice.