

RS-232 Isolated Interface

INTRODUCTION

Sipex's SP3222/SP3232 transceivers allow creating isolated RS-232 interface with up to 2kVrms isolation that can support up to 250 kbps data rate communication using only few external components.

FEATURES

- +5V Single Supply Operation
- ESD Protection for Bus-pins ($\pm 15\text{kV}$ Air-Gap Discharge and Human Body Model and $\pm 8\text{kV}$ Contact Discharge)
- Tri-state driver output at power off and shutdown mode

APPLICATION

- Low Power RS232 Systems
- DTE-DCE Interface
- Local Area Networks
- Industrial Process Control
- Building Automation

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 of the specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

Supply Voltage (V_{cc}) + 6.0V
Input voltage at input pins (SHDN, EN) - 0.3V to + ($V_{cc} + 0.3\text{V}$)
Receiver input voltage (R_{xin}) $\pm 25\text{V}$
Output voltages
Txout $\pm 13.2\text{V}$
Rxout - 0.3V to ($V_{cc} + 0.3\text{V}$)

All other parameters are limited by used components and should be referenced at appropriate data sheets.

GENERAL DESCRIPTION

The Sipex's family of RS-232 transceivers contains devices with different number of transmitters/receivers that can work with Vcc voltages from 3.3V to 5.5V.

The schematic diagrams in Figure 1 shows the component connection for a two-channel isolated RS-232 transceiver based on two identical ICs that use the internal charge pump of the primary IC to create an isolated power supply for the secondary stage.

Table 1 contains information about components value and manufacturers.

The isolated power supply on the base of SP3232 charge pump and isolation transformer U6982-C (Coilcraft) provide power to secondary stage of the transceiver with isolation up to 1500Vrms. The output voltage of the power supply varies in the range of 3.3 to 5.5V depends from the load of the output driver but it is in the range of allowed voltages for SP3232 used in the output stage. Input voltage of the primary stage should be in the range 4.5 – 5.5V.

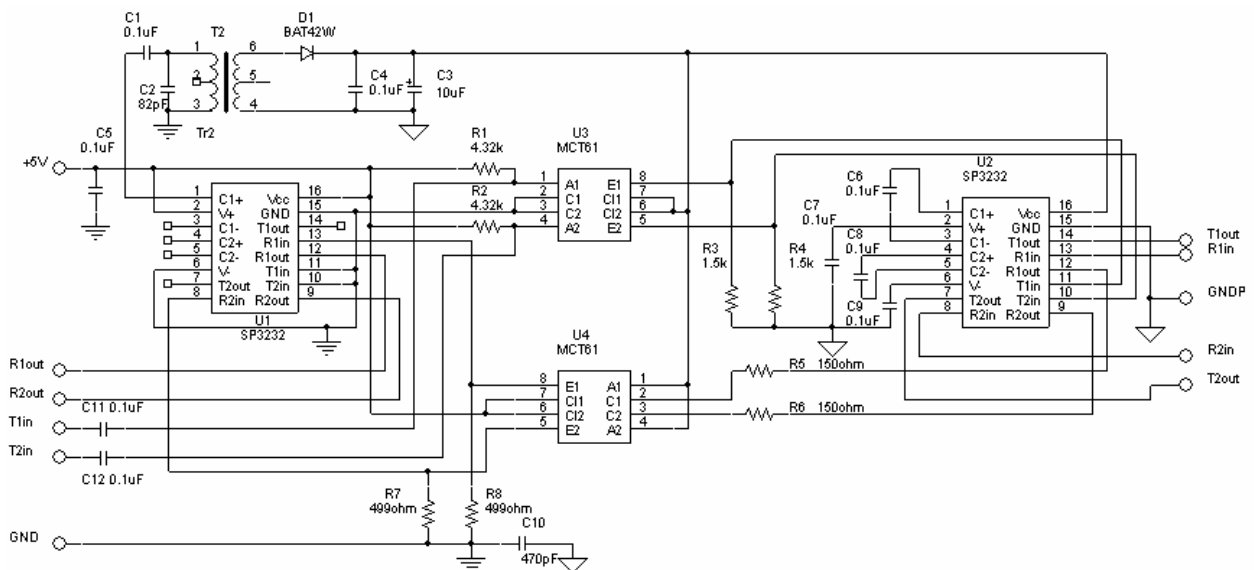


Figure 1. RS-232 interface schematic diagram for 250kbps data speed

Capacitor C2 is optional and is used to reduce the level of electromagnetic emission only. Capacitor C8 is used to protect device from ESD discharge between primary and secondary grounds and should be rated at 2kV or higher voltage.

Relative inexpensive optocouplers MCT61 from Fairchild Semiconductor are TTL compatible and can support up to 250kbps data communication. Resistors R1 and R2 may be adjusted in the range from 4 to 5k to achieve the best performance depends at the driver output load and data speed.

Transformer U6982-C1 may be replaced with a standard 10Base-T /Ethernet isolation transformer like EP9531-6 from PCA (Isolation up to 2kVrms) or any other manufacturer with primary inductance $100 \pm 20 \mu\text{H}$ (PE64503 from Pulse or T-10905 from Rhombus Industries in a DIP16 package or EP9531G-X from PCA or identical in SMD package). The schematic diagram of RS-232 interface with this transformer is shown in Figure 2.

The EP9531-6 contains three identical transformers in one package. Primary windings on these transformers are connected in parallel and secondary windings are connected in series to provide output voltages above 3.5V at full load. If you do not have a full load at the driver's output you may save power by connecting only two primary windings in parallel and two secondary windings in series.

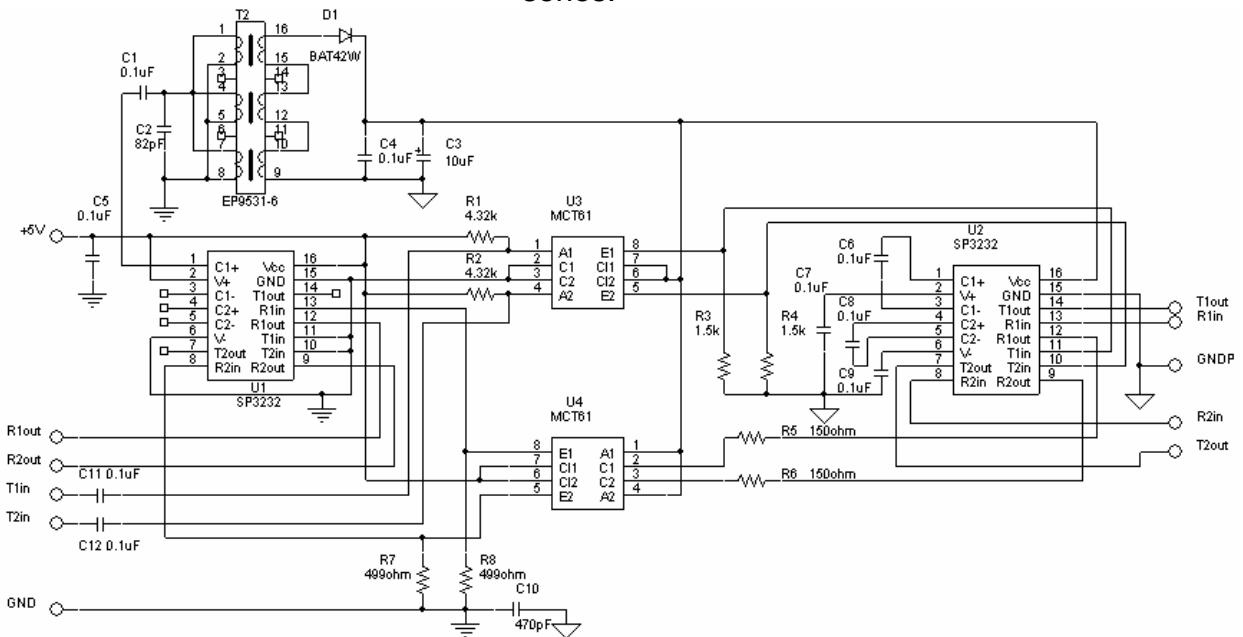


Figure 2. RS-232 interface schematic diagram for 250kbps data speed with 10-Base-T/Ethernet isolation transformer

The type of RS-232 transceivers U1 and U2 depend on desired data rate and can be selected from the following list:

U3 Type	Data speed, kbps	Comments
SP3222H/EH*, SP3223H/EH*, SP323H/EH	300	Limited by MCT61
SP3222B/EB*, SP3223B/EB*,	250	

SP3232B/EB		
SP3222C/E*, SP3223C/E*, SP3232C/E	120	
SP385A/E*	120	

*) This device has additional driver/receiver tri-state enable lines and should be connected according schematic diagram in Figure 3.

The schematic of the interface in Figure 3 is identical to the previous example except for connection of the first driver, which has two additional inputs EN and SHDN. Logic zero at EN input puts the receiver's output into tri-state condition that allows to share the same communication lines with different receivers. Logic zero at SHDN input puts the transceiver into shutdown mode. In this mode driver, receiver, and charge pump of the first stage are turned off, which automatically turns off the secondary stage and puts its outputs into tri-state mode. To restore a normal operation both inputs should be teed to +5V.

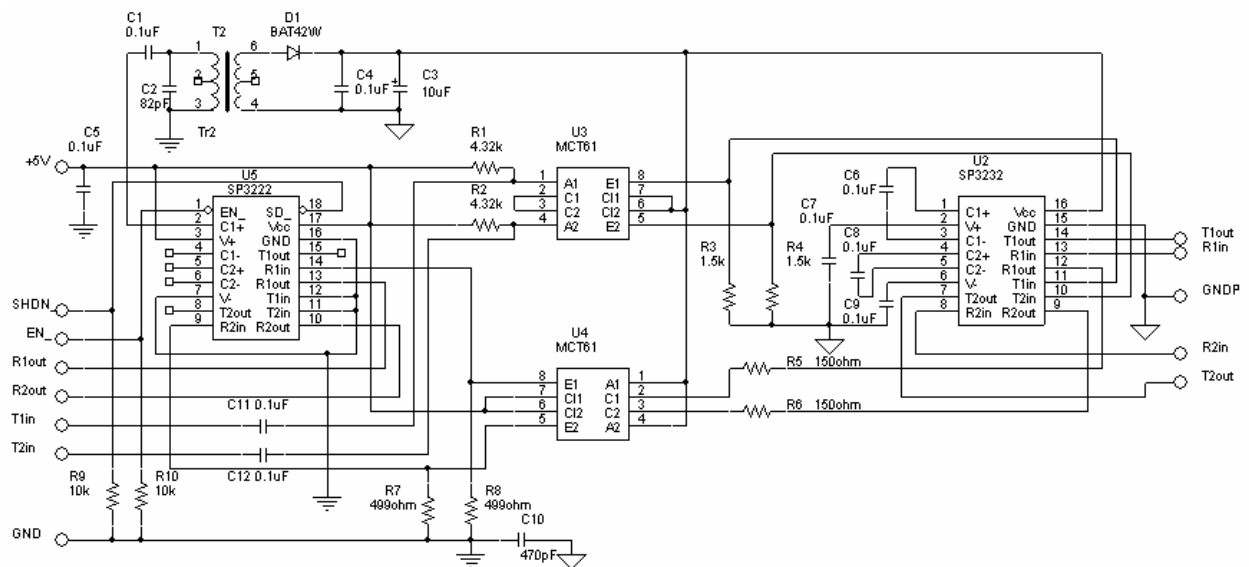


Figure 3. RS-232 interface schematic diagram for 250kbps data speed interface with additional driver/receiver tri-state enable lines

Item	Quantity	Reference	Value	Manufacturer	Comments
1	9	C1,C4 -C9, C11, C12	0.1uF		Ceramic
2	1	C2	82pF		Ceramic
3	1	C3	10uF		Tantalum
4	1	C10	470pF x 2kV		Ceramic
5	1	D1	BAT42W	Diodes Inc	
6	2	R1, R2	4.32k±1%		0.063W
7	2	R3, R4	1.5k±10%		0.063W
8	2	R5, R6	150ohm±1%		0.063W
9	2	R7, R8	499ohm±1%		0.063W
10	2	R9, R10	10k±10%		0.063W
11	1	T1	U6982-C1	Coilcraft	
12	1	T2	EP9531-6	PCA Electronics Inc.	
13	1	U1, U2	SP3232	Sipex	
14	2	U3, U4	MCT61	Fairchild Semicond.	
15	1	U5	SP3222	Sipex.	

Table 1. Components Specification

BOARD LAYOUT AND GROUNDING

To obtain the best performance of transceiver, a printed circuit board with ground planes is required. Primary and secondary ground planes should be separated with a wide enough space to prevent high voltage breakdown.

Ground pins of IC and optocouplers should be connected to the appropriate ground plane. High quality, low series resistance ceramic 0.1uF bypass capacitors C4 and C5 should be used at the Vcc pins. These capacitors must be located as close to the pins as possible. The traces connecting the pins to the ground plane, Vcc, and bypass capacitors must be kept short and should be made as wide as possible. Rules for a charge pump capacitors selection are disclosed in the SP3232 data sheet.

The suggested layout of printed circuit board for an isolated RS-232 interface is shown in Figure 4 (See the schematic diagram in Figure 1).

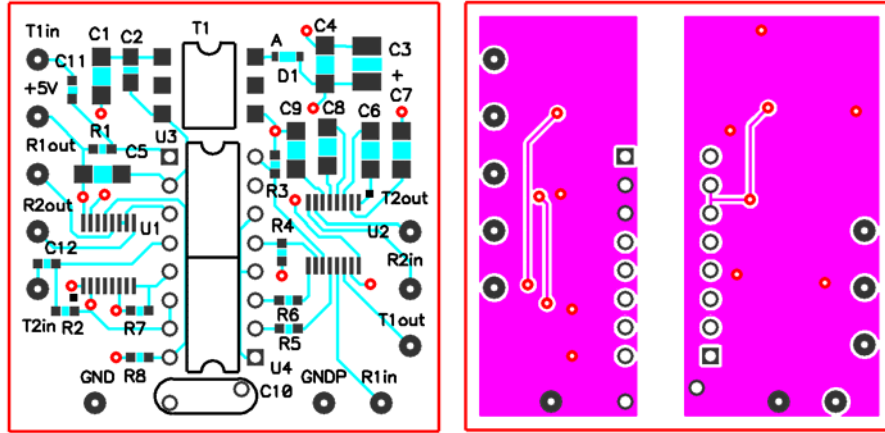


Figure 4. Top and bottom layers of an isolated RS-232 interface evaluation board

For further assistance:

Email: Sipexsupport@sipex.com
 WWW Support page: <http://www.sipex.com/content.aspx?p=support>
 Live Technical Chat: <http://www.geolink-group.com/sipex/>
 Sipex Application Notes: <http://www.sipex.com/applicationNotes.aspx>



Sipex Corporation
Headquarters and
Sales Office
 233 South Hillview Drive
 Milpitas, CA95035
 tel: (408) 934-7500
 faX: (408) 935-7600

Sipex Corporation reserves the right to make changes to any products described herein. Sipex does not assume any liability arising out of the application or use of any product or circuit described herein; neither does it convey any license under its patent rights nor the rights of others.