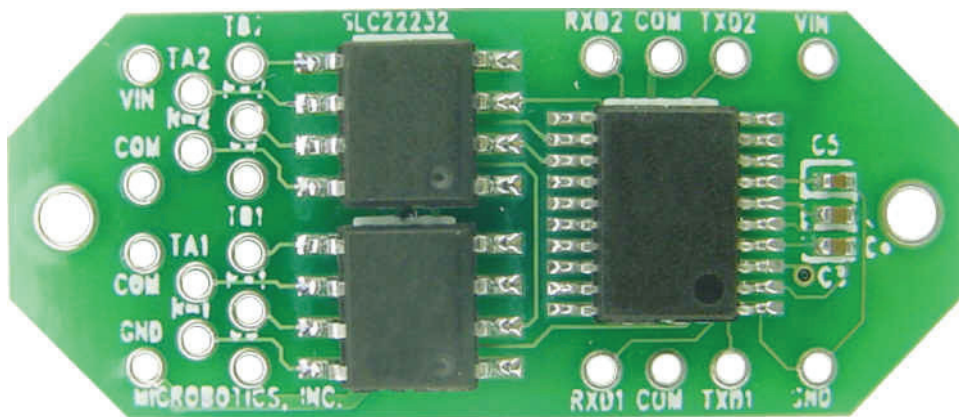


# SLC22232

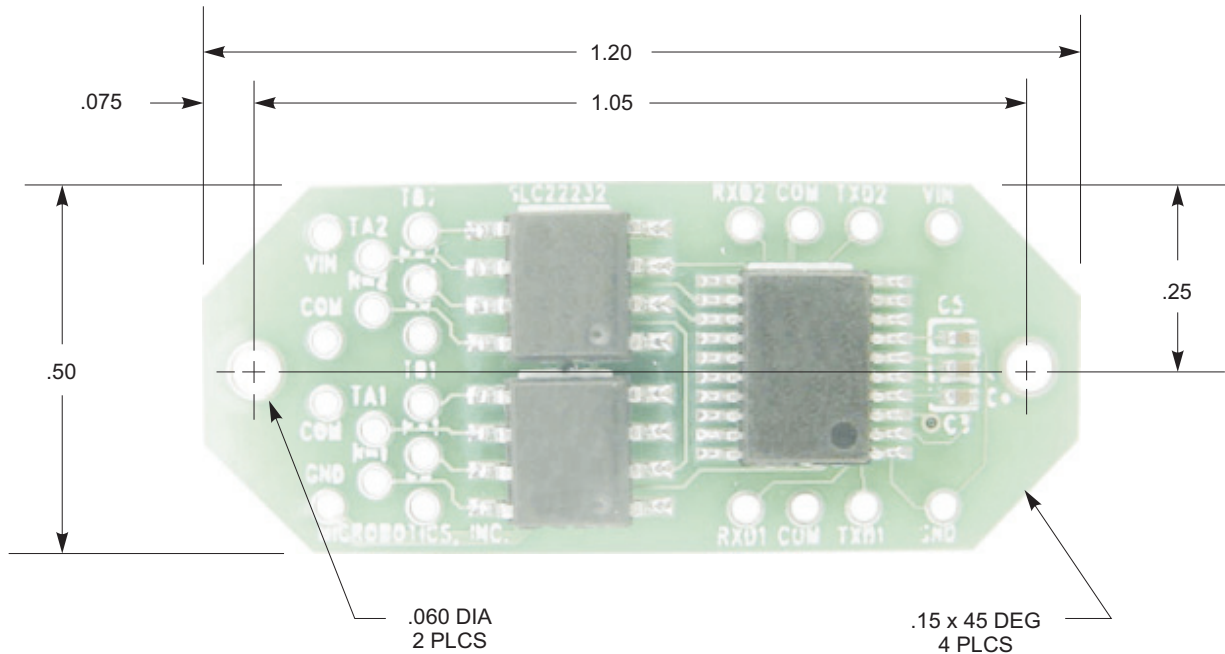
## DUAL-CHANNEL SERIAL VOLTAGE LEVEL CONVERTERS



### USER MANUAL (October 2008)



**1 Introduction.** The Microbotics SLC22232 is a dual-channel full-duplex serial voltage converter supporting RS-232 ⇔ RS-422 and RS-232 ⇔ TTL voltage level conversions. The board's small size allows it to be mounted directly in the user wiring harness, and the SLC22232 can be powered by any convenient DC source of 4 to 40 VDC, thus reducing the real estate needed to effect these voltage level conversions. Each board has a pair of RS-232 receivers connected to their respective RS-422 output drivers, and a pair of RS-422 receivers connected to their respective RS-232 output drivers. Each receiver-driver set is independent except for common ground and power connections. A 1.65V reference is provided by the SLC22232 in order to bias the RS-422 receiver in order to operate the RS-422 receiver as a TTL-level receiver. **NOTE THAT THE SLC22232 IS STRICTLY A VOLTAGE LEVEL CONVERTER – THE BOARD DOES NOT PERFORM ANY DATA RECLOCKING OR DATA FORMAT CONVERSIONS.**



**Figure 1. SLC22232 Physical Dimensions.**

**2 Wiring the SLC22232 to the User System.** Connections to the SLC22232 are normally made via direct wiring to the holes on the board. *Extreme care should be taken when soldering to the board to prevent damage to the pads or adjacent components.* The RS-422 signals are grouped at one end of the board (Figure 2), while the RS-232 signals are grouped at the other end (Figure 3). Power input and return lines are available at both groups of signals. The signal pads for the SLC22232 are:

**Common Signals:**

- VIN** Board Power (4V to 40V Input) (Two pads provided)
- GND** Power Ground (negative side) (Two pads provided)
- VR** Voltage supplied by SLC22232 when needed to bias **RA1** or **RA2** for TTL-level receipts (Two pads provided)

**Channel 1 RS-422 Port:**

- RA1** RS-422 negative data **receipt into SLC22232** (MARK Low) – data passed to **TXD1**
- RB1** RS-422 positive data **receipt into SLC22232** (MARK High) – data passed to **TXD1**
- TA1** RS-422 negative data **transmit from SLC22232** (MARK Low) – data passed from **RXD1**
- TB1** RS-422 positive data **transmit from SLC22232** (MARK High) – data passed from **RXD1**
- COM** Ground return for the RS-422 signals – Tie to Ground of User RS-422 Port

**Channel 1 RS-232 Port:**

- RXD1** RS-232 data **receipt into SLC22232** (MARK negative) – data passed to **TA1/TB1**
- TXD1** RS-232 data **transmit from SLC22232** (MARK negative) – data passed from **RA1/RB1**
- COM** Ground return for the RS-232 signals – Tie to Ground of User RS-232 Port

**Channel 2 RS-422 Port:**

- RA2** RS-422 negative data **receipt into SLC22232** (MARK Low) – data passed to **TXD2**
- RB2** RS-422 positive data **receipt into SLC22232** (MARK High) – data passed to **TXD2**
- TA2** RS-422 negative data **transmit from SLC22232** (MARK Low) – data passed from **RXD2**
- TB2** RS-422 positive data **transmit from SLC22232** (MARK High) – data passed from **RXD2**
- COM** Ground return for the RS-422 signals – Tie to Ground of User RS-422 Port

**Channel 2 RS-232 Port:**

- RXD2** RS-232 data **receipt into SLC22232** (MARK negative) – data passed to **TA2/TB2**
- TXD2** RS-232 data **transmit from SLC22232** (MARK negative) – data passed from **RA2/RB2**
- COM** Ground return for the RS-232 signals – Tie to Ground of User RS-232 Port

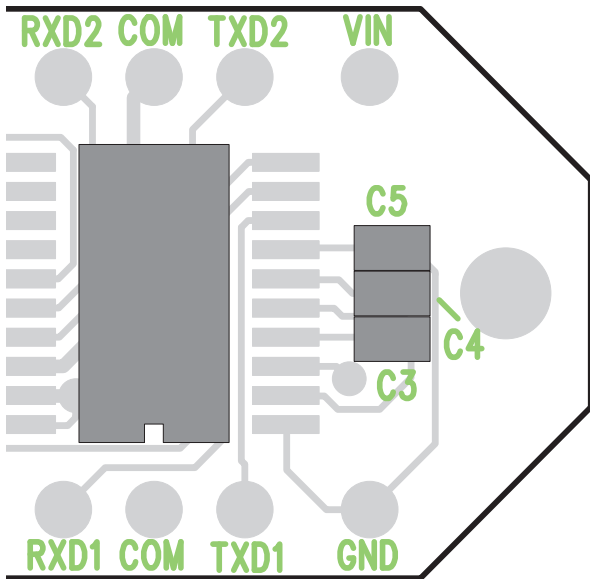


Figure 2. RS-232 Signals.

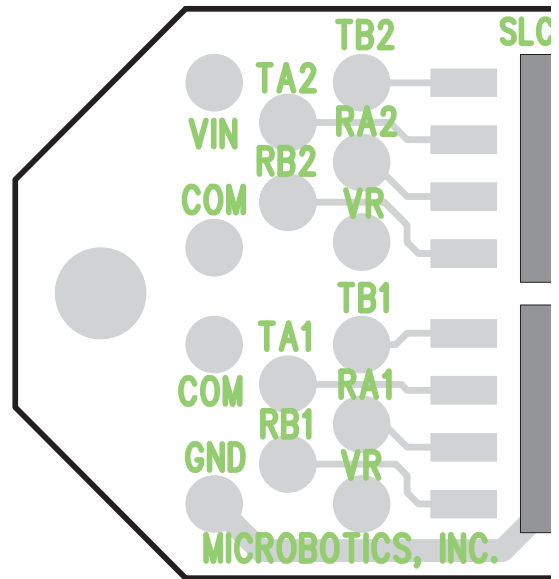


Figure 3. RS-422 Signals.

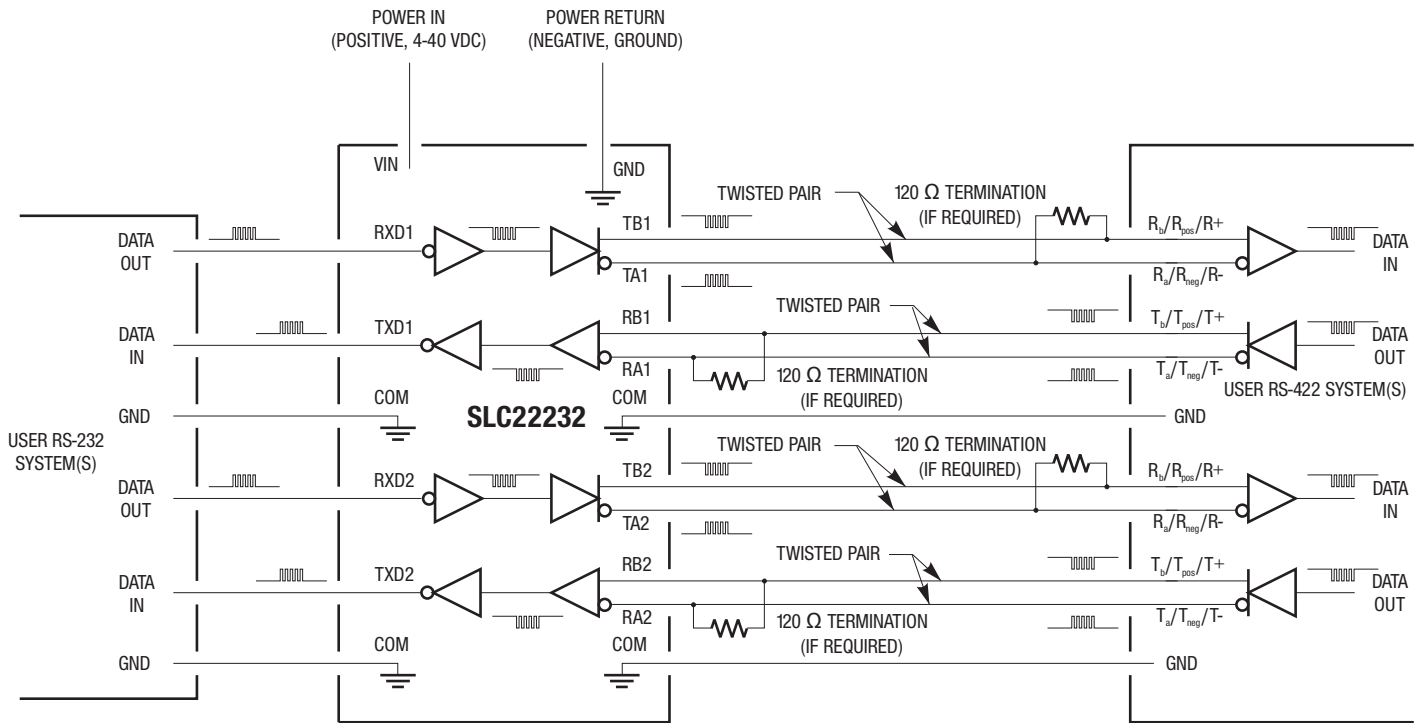
**2.1 Power Connections.** Any voltage between 4VDC and 40VDC may be used to power the SLC22232. The positive side of the power source is connected to either of the **VIN** pads, while the negative side of the power source is connected to either of the **GND** pads. While all **GND** and **COM** signals are electrically connected to the board Ground, the **COM** lines are not designed nor sized for returning the power supply current. **DO NOT USE THE COM LINES FOR POWER RETURN.**

There are two pads each for **VIN** and **GND**, one set near the RS-232 signal pads, and one set near the RS-422 signal pads. Either pad may be used for its associated power connection. The **VIN** and **GND** pad pairs can also be used to pass power from one side of the board to the other in order to improve cable wiring (this would eliminate one pair of wires in the cable). If the **VIN** and **GND** pad pairs are used to pass power through the board, the current must be limited to less than 100 milliamps. **FAILURE TO LIMIT THE CURRENT TO LESS THAN 100 MILLIAMPS WHEN USING THE SLC22232 TO PASS THE POWER RAILS (VIN AND GND) MAY CAUSE ELECTRICAL FAILURE OF THE SLC22232 BOARD AND VOIDS THE BOARD WARRANTY.**

**2.2 RS-232 Connections.** Six signal lines are used for RS-232 connections (Figure 2). The **RXD1** line is the RS-232 signal **received by the SLC22232** from the user system, which is then passed to the **TA1** and **TB1** outputs. The **TXD1** line is the RS-232 signal **transmitted by the SLC22232** to the user system, having been passed from the **RA1** and **RB1** inputs. The **RXD2** line is the RS-232 signal **received by the SLC22232** from the user system, which is then passed to the **TA2** and **TB2** outputs. The **TXD2** line is the RS-232 signal **transmitted by the SLC22232** to the user system, having been passed from the **RA2** and **RB2** inputs. The **COM** lines are signal Ground returns for the RS-232 signals, and **must** be connected to the Grounds of **each** of the user RS-232 Ports. Figure 4 shows a typical connection for the RS-232 signals, while Figure 5 shows a typical channel connection to a user PC. **FAILURE TO CONNECT THE COM LINES TO EACH OF THE USER PORT GROUNDS MAY CAUSE ELECTRICAL FAILURE OF THE SLC22232 AND VOIDS THE BOARD WARRANTY.**

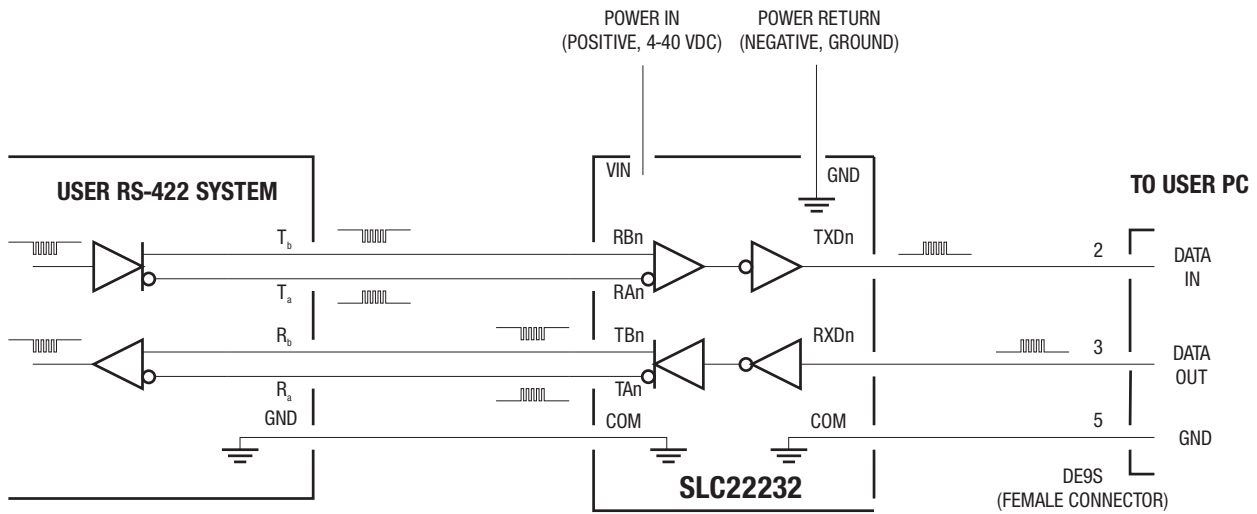
**2.3 RS-422 Connections.** Ten signal lines are used for RS-422 connections (Figure 3). The **TA1** and **TB1** pair is the differential signal *transmitted from the SLC22232* to the user system, having been passed from the **RXD1** input. The **RA1** and **RB1** pair is the differential signal *received by the SLC22232* from the user system, which is then passed to the **TXD1** output. The **TA2** and **TB2** pair is the differential signal *transmitted from the SLC22232* to the user system, having been passed from the **RXD2** input. The **RA2** and **RB2** pair is the differential signal *received by the SLC22232* from the user system, which is then passed to the **TXD2** output. Note that, in both transmitter and receiver signals, the ‘**A**’ references the *negative* signals, while the ‘**B**’ references the *positive* signal. The **COM** lines are signal Ground returns for the RS-422 signals, and *must* be connected to the Grounds of *each* of the user RS-422 ports. Figure 4 shows a typical connection for the RS-422 signals. **FAILURE TO CONNECT THE COM LINES TO EACH OF THE USER PORT GROUNDS MAY CAUSE ELECTRICAL FAILURE OF THE SLC22232 AND VOIDS THE BOARD WARRANTY.**

RS-422 differential transmissions, when using twisted pair cabling, drastically reduces electrical noise generated by the transmitted signals while rejecting electrical noise induced into the receiving signals. When data rates are high or the cable lengths are long, signal reflection can become an issue in transmissions. In these cases, a 120Ω termination resistor is placed across the twisted pair lines as close to the RS-422 receiver as possible.

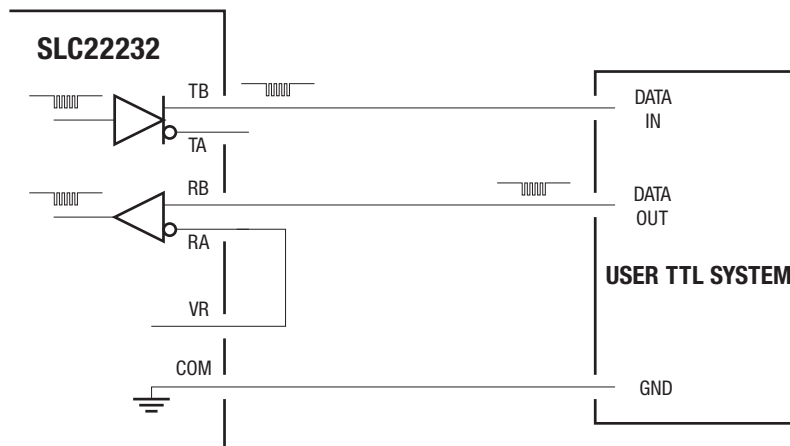


**Figure 4. Typical User Connections to the SLC22232 Board.**

**2.4 TTL-Level Connections Using the RS-422 Port.** An RS-422 Port of the SLC22232 may be used to interface TTL-level signals, effectively creating a TTL ↔ RS-232 converter (Figure 6). In this case the **TB** signal of one of the SLC22232 channels is used as the TTL-level output to the user system, while the **TA** signal is unused. The **RB** signal of that port is used to receive the TTL-Level signal from the user system (note that, in this case, the default state of the **RB** signal with no input is ‘**LOW**’). To force the RS-422 receiver to “see” the TTL-level signal at the **RB** input as a differential signal, the **RA** input of that port must be biased by connecting it to the on-board 1.65V **VR** output. The other RS-422 channel of the SLC22232 may still be used in the usual manner.



**Figure 5. Using a Channel of the SLC22232 to Interface a PC to an RS-422 System.**



**Figure 6. Using an RS-422 Port for TTL-Level Signals.**

## GENERAL SPECIFICATIONS, SLC22232

(August 2008)

*All specifications subject to change without notice*

	Max	Typ	Min	
<b>Power</b>				
Input Voltage	40		4	V
Input Current	1.5	4		ma
<b>Signal Rate</b>				
Baud Rate	250		DC	KBaud
<b>RS-422 Signals</b>				
Differential Driver Output (No Termination)		3.3		V
Differential Driver Output (120Ω Termination)			2.0	V
Receiver Input Voltage	12.0		-7.0	V
Receiver Differential Threshold	200		-200	mV
Receiver Input Hysteresis		50		mV
Input Resistance			12	KΩ
<b>TTL-Level Conversions</b>				
<b>VR</b> Out (Connected to <b>RA</b> _)		1.65		V
V <sub>IH</sub> ( <b>RB</b> _)	5.5		2.0	V
V <sub>IL</sub> ( <b>RB</b> _)	.8		0	V
V <sub>OH</sub> ( <b>TB</b> _)	3.3		2.0	V
V <sub>OL</sub> ( <b>TB</b> _)	.4		0	V
I <sub>OH</sub> ( <b>TB</b> _)	8			ma
I <sub>OL</sub> ( <b>TB</b> _)	-8			ma
<b>RS-232 Signals</b>				
Input Range	25		-25	V
Input Threshold High	2.4	1.5		V
Input Threshold Low		1.2	.6	V
Input Hysteresis		.5		V
Input Resistance	7	5	3	KΩ
Output Voltage Swing		±5.4	±3.7	V
<b>Physical</b>				
Size	1.2" [30.48 mm] L x .5" [12.70 mm] W x .22" [5.59 mm] T			
Weight	1.5 g [.053 oz]			
<b>Environment</b>				
Operating Temperature	-40 to +85 °C			
Storage Temperature	-55 to +125 °C			
Vibration	6 g <sub>rms</sub>			
Shock	100 g, 8 ms, ½ sine			







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