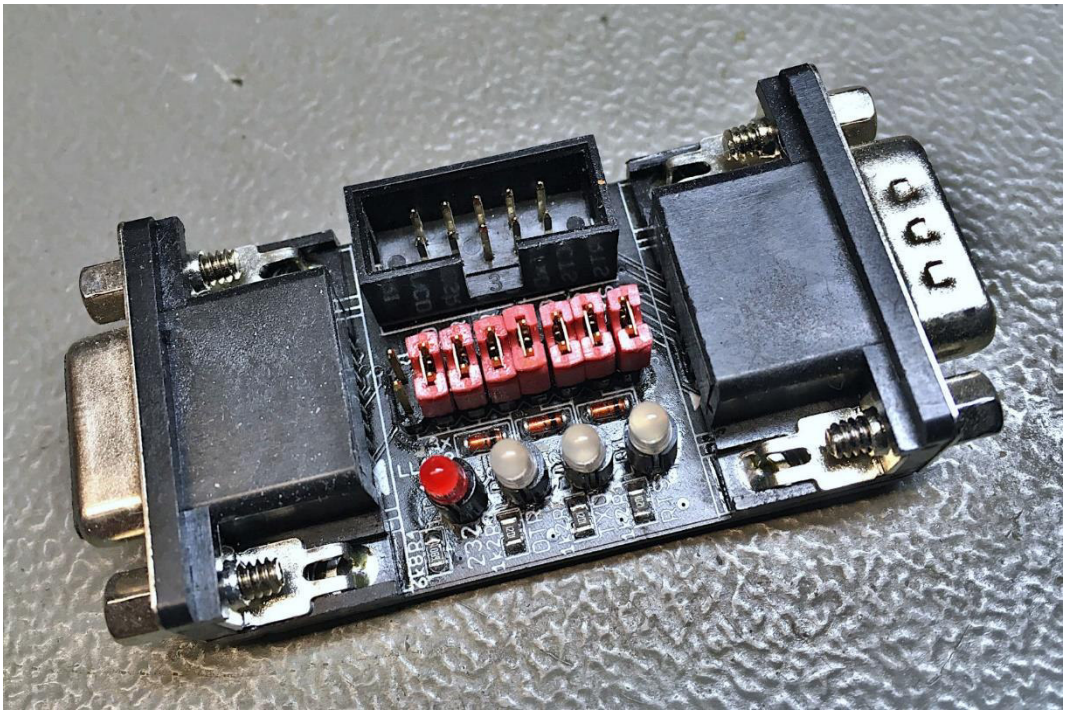
Project Documentation

RS-232 Loopback

Project number: 183

Revision: 0

Date: 27.04.2022



RS-232 Loopback Rev.0

Module description

Introduction

The RS-232 loopback is a tool for testing or sniffing an RS-232/TTL serial interface. It has a female (DTE/computer side) D-Sub (9 pins) connector, a male (DCE/modem side) D-Sub (9 pin) and a 2x5 box connector/pin header, which is configured for connecting the RS232 via a ribbon cable.

There are three feedbacks, that can be jumpered. The status of each feedback is indicated with a bi-color LED.

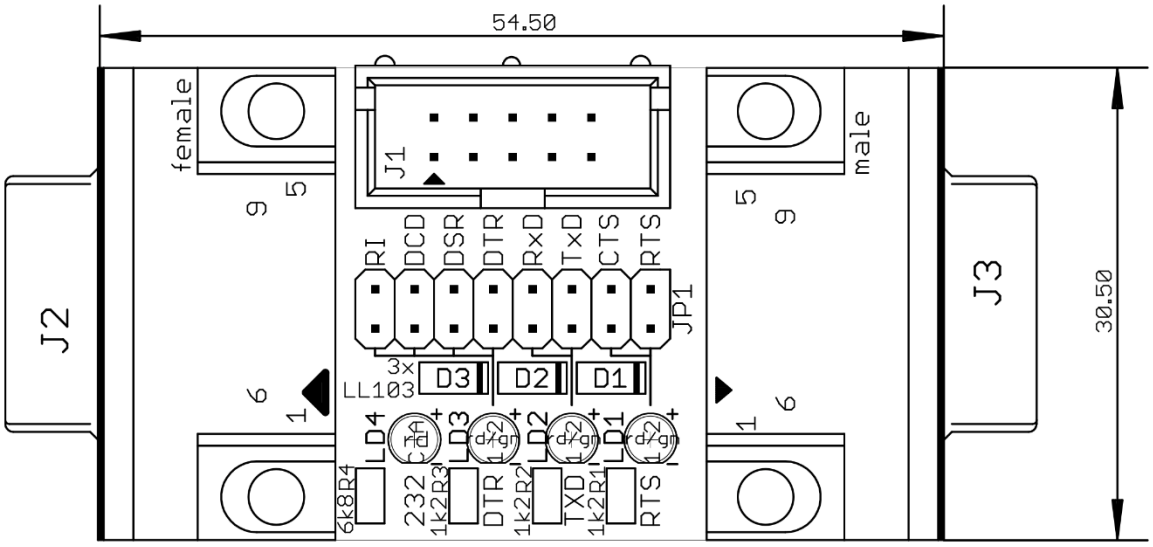


Figure 1: Dimensions of the RS-232 Loopback

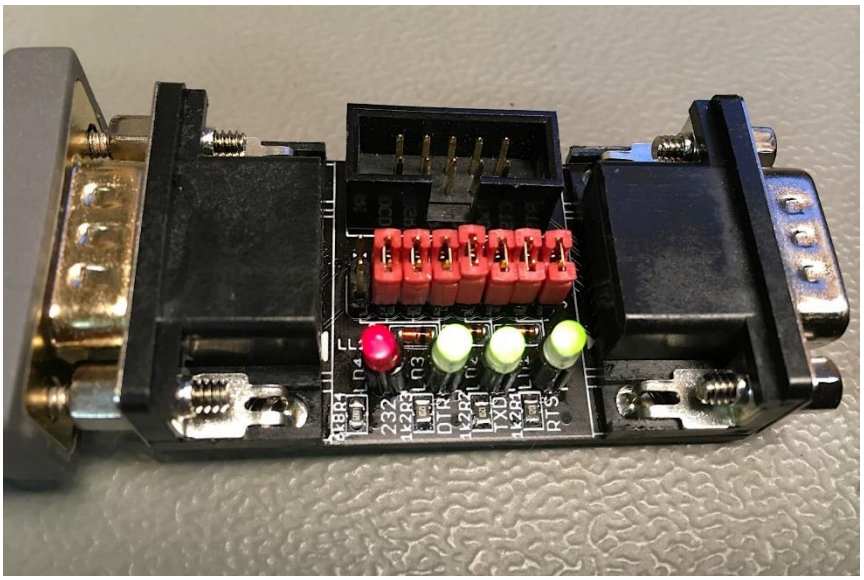


Figure 2: Connected RS-232 loopback

Feedbacks /Jumper/Indicators

Jumper J1

Feedback	Signals	Jumper JP1	LED
RTS	RTS CTS	1-2 3-4	LD1
TXD	TxD RxD	5-6 7-8	LD2
DTR	DTR DSR DCD RI	9-10 11-12 13-14 15-16	LD3

LEDs

RS-232

RxD, TxD: The voltage level for a logic "0" (aka "space") is +3V to +15V, for logic "1" (aka "mark") it is -3V to -15V. voltages between -3V to +3V are an "illegal state". For the handshake signals (RTS, CTS, DTR, DSR, DCD and RI) active is a positive +3V to +15V, while not active is negative -3V to -15V).

The RTS and DTR LEDs are **red while active** and **green while not active**. When idle, the TxD LED LD2 is green (indicating a negative voltage level) and blinking while data is being transferred.

TTL

The RTS and DTR LEDs are **off while active** (LOW) and **red while not active** (HIGH). These signals are active low in TTL level). While idle, the TxD LED (LD2) is on.

Level Indicator

There is a 4th LED (LD4) indicating the level: RS-232 (on), TTL (off).

Connectors

J1 (Box connector to DTE/Computer)

This is a **2x5 pin box connector**. It is configured to fit a ribbon cable to a 2.54mm pitch pin header on a motherboard of a computer or to connect a D-Sub connector

Signal	Pin	Pin	Signal
DCD	1	2	DSR
RxD	3	4	RTS
TxD	5	6	CTS
DTR	7	8	RI
GND	9	10	-

J2 (to DTE/Computer)

This is a **female 9 pin D-Sub connector**. It has the standard pinout of a modem side and fits directly or via a modem cable into the serial port of a computer.

Signal	Pin	Pin	Signal
DCD	1	6	DSR

RxD	2	7	RTS
TxD	3	8	CTS
DTR	4	9	RI
GND	5		

J3 (to DCE/modem)

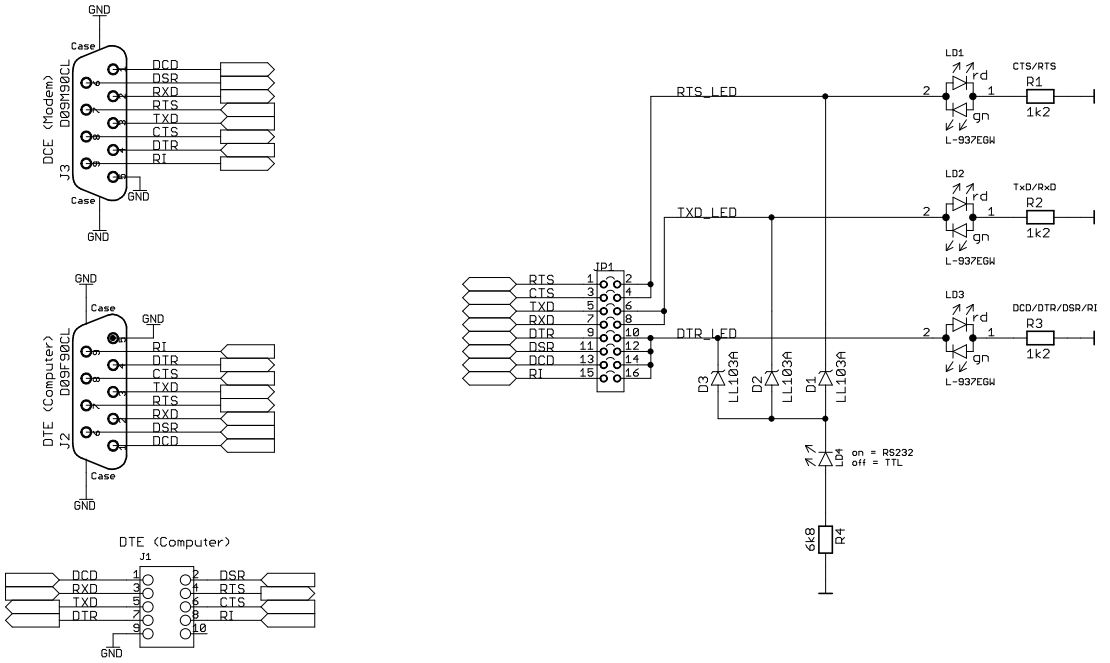
This is a **male 9 pin D-Sub connector**. It has the standard pinout of the serial interface of a computer/DTE and fits directly or via a modem cable into the serial port of a modem/DCE.

Signal	Pin	Pin	Signal
DSR	6	1	DCD
RTS	7	2	RxD
CTS	8	3	TxD
RI	9	4	DTR
		5	GND

Revision History

Rev. 0

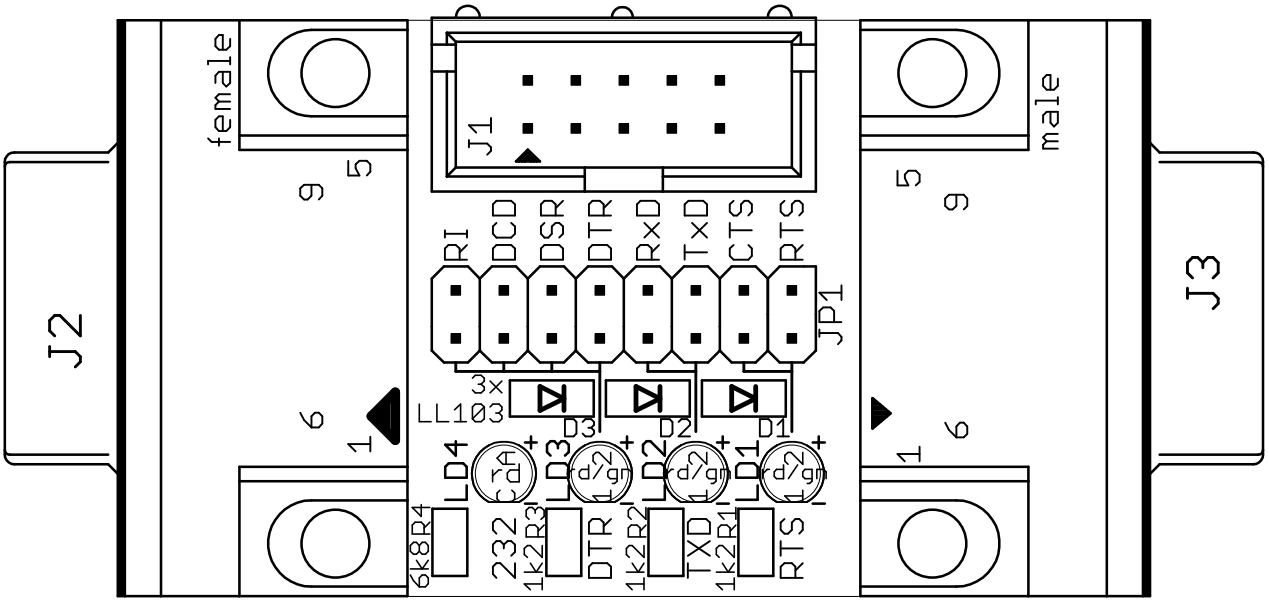
- Prototype: fully functional



Title: RS-232 Loopback	Doc.-No.: 183-1-01-00	
	Draft.: Sven Petersen	
Date: 27.04.2022 16:41	Rev.: 0	Page 1/1
File: RS232 Loopback		
http://github.com/svenpetersen1965		A3

open source hardware

Sven Petersen 2022	Doc.-No.: 183-2-01-00	
	Cu: 35µm	Cu-Layers: 2
RS232 Loopback		
27.04.2022 16:41		Rev.: 0
placement component side		



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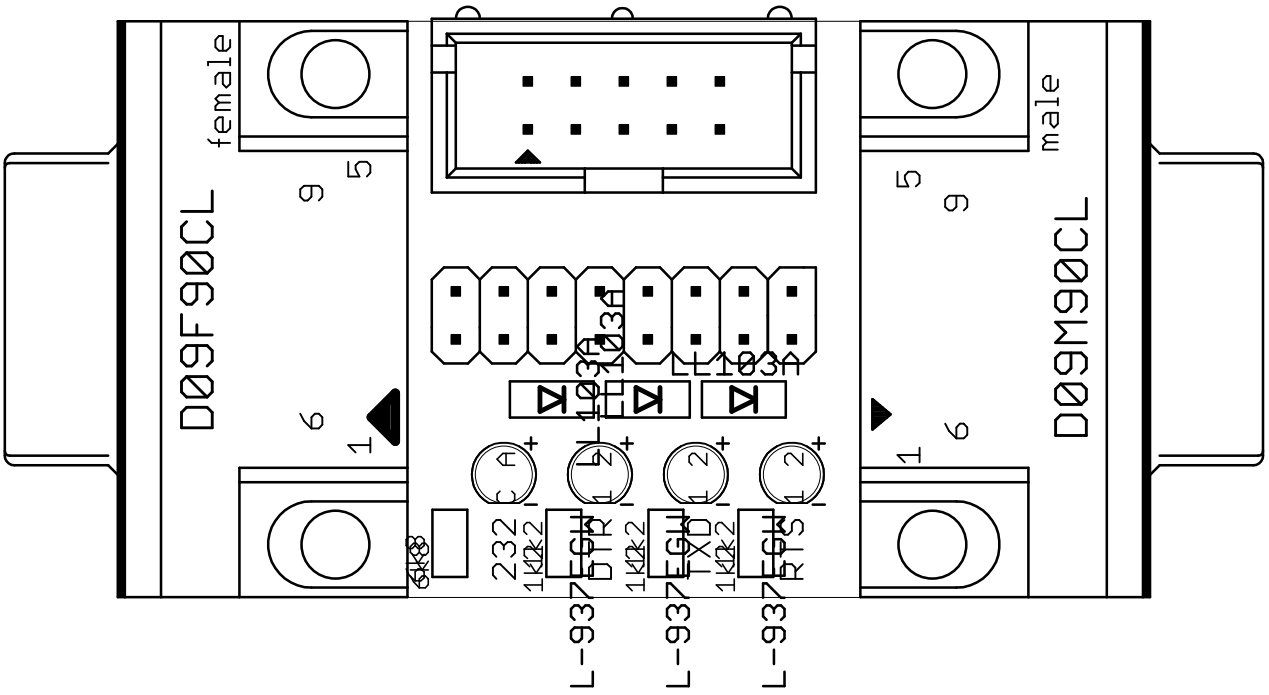
27.04.2022 16:41		Rev.: 0
placement component side		



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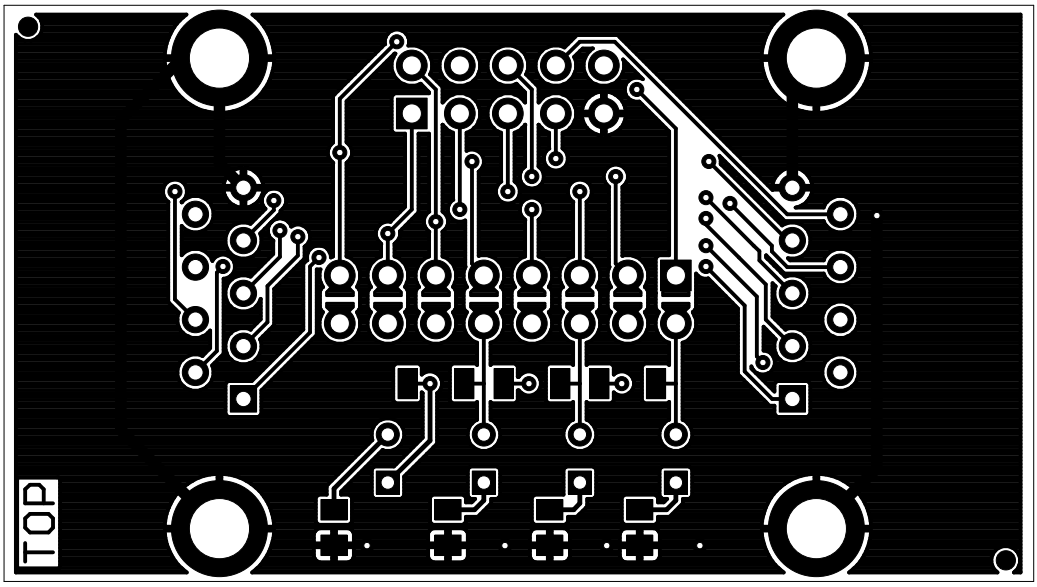

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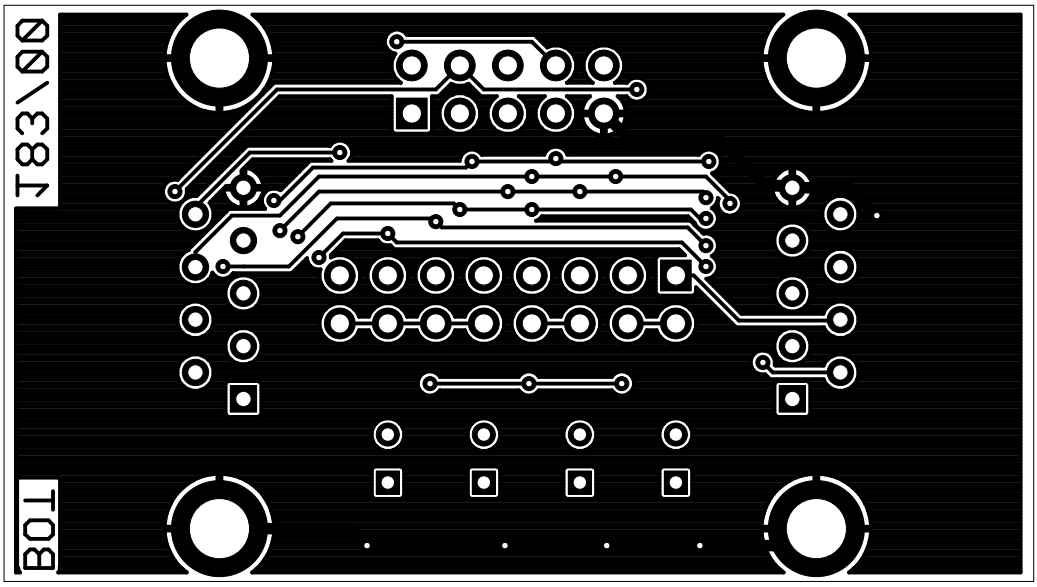

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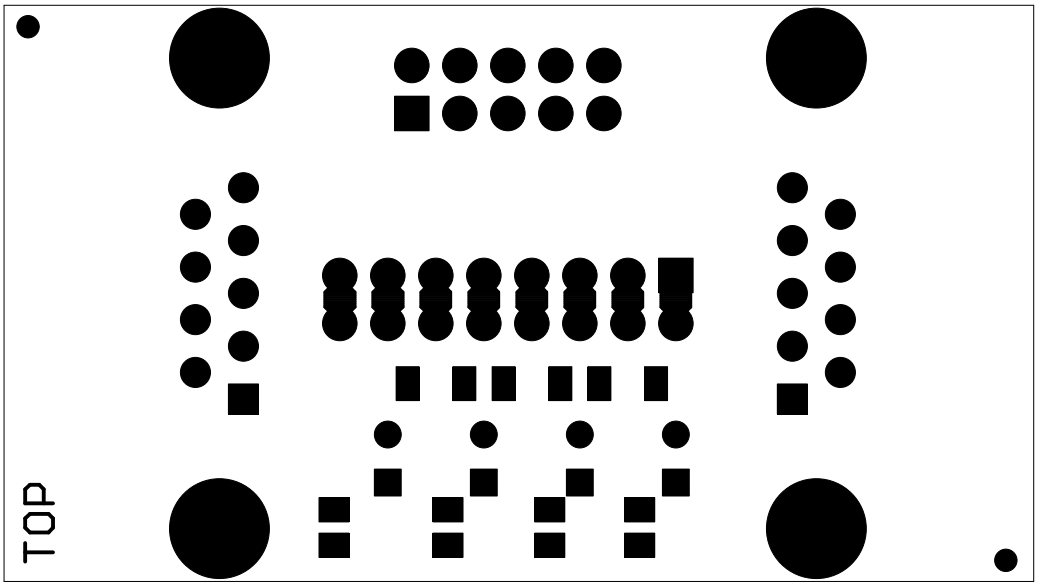
RS232 Loopback		
27.04.2022 16:48		Rev.: 0
stopmask component side		



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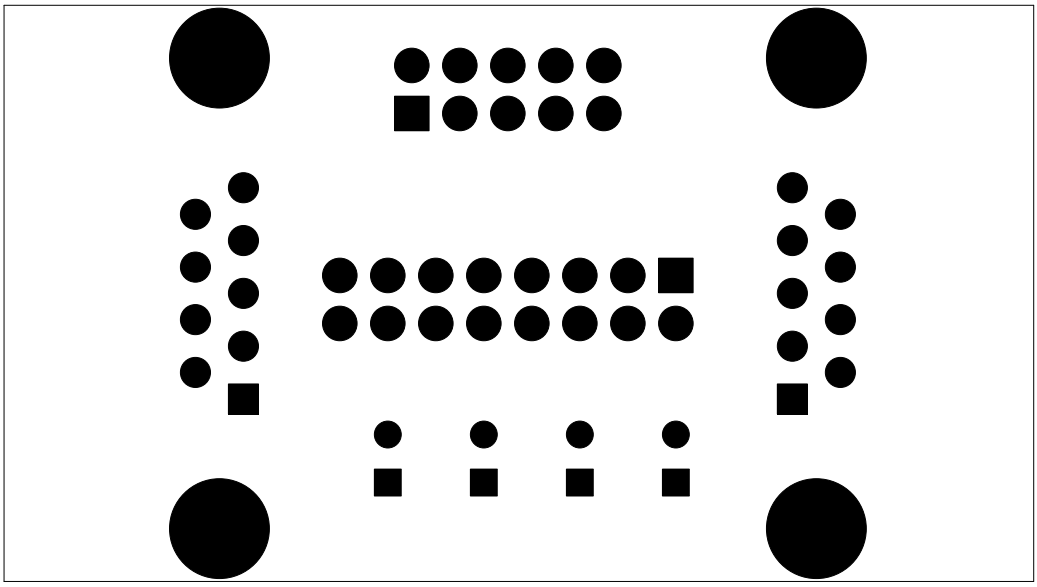
stopmask solder side		



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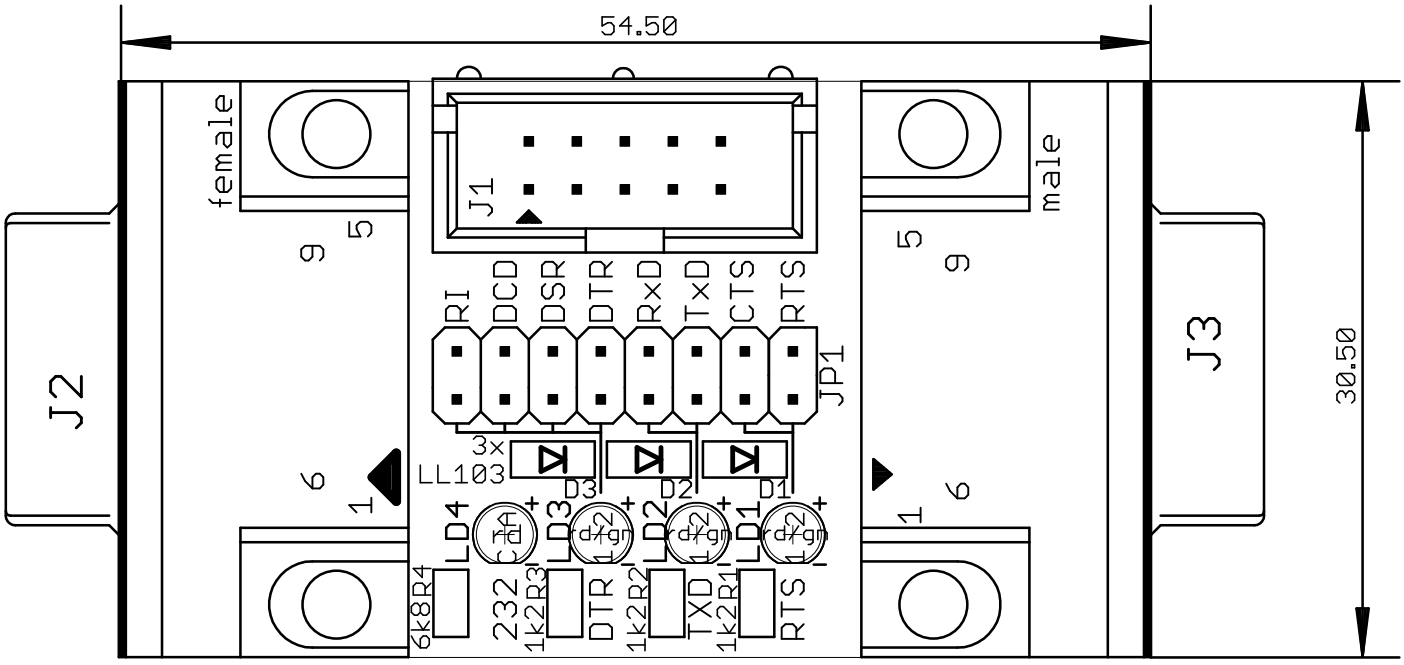
RS232 Loopback		
27.04.2022 16:41		Rev.: 0
placement component sidemeasures		



RS-232 Loopback Rev.0

Testing

Test Setup

1. RS-232 Loopback Rev. 0 (DUT, device under test)
2. USB to RS-232 converter/cable
3. USB to Serial (TTL/3.3V) converter board with FTDI FT232
4. Ribbon cable (Box connector to Dupont)
5. Terminal Software YAT (https://sourceforge.net/projects/y-a-terminal/)

The DUT was either connected via the serial cable or the FTDI board to the computer. The proper COM-port was selected in YAT.

Test Execution

Test via the USB to RS-232

For the test, all jumpers except the RI jumper were placed. The selected (YAT) baud rate was 9600.

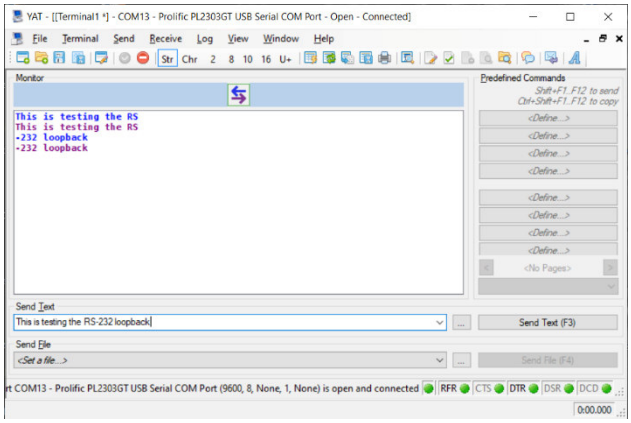


Figure 1: YAT - First test RTS (RFR) and DTS active

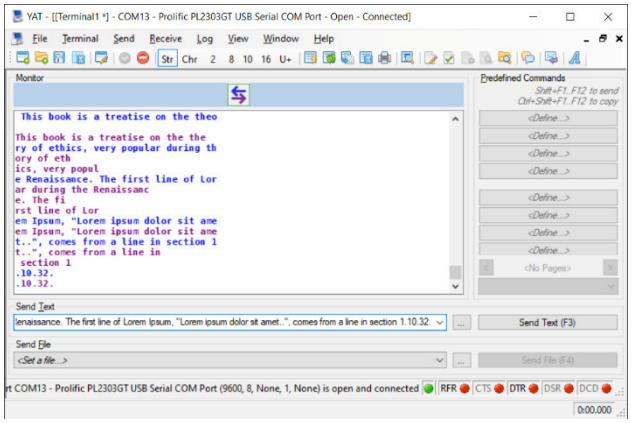


Figure 2: YAT - further testing RTS (RFR) and DTR inactive

While the data (text) is being transferred, the TxD LED LD2 is flickering. The sent text is being echoed by the loopback (as desired). The received (looped back) text is identical with the sent text. The line break is not, which is matter of the software.

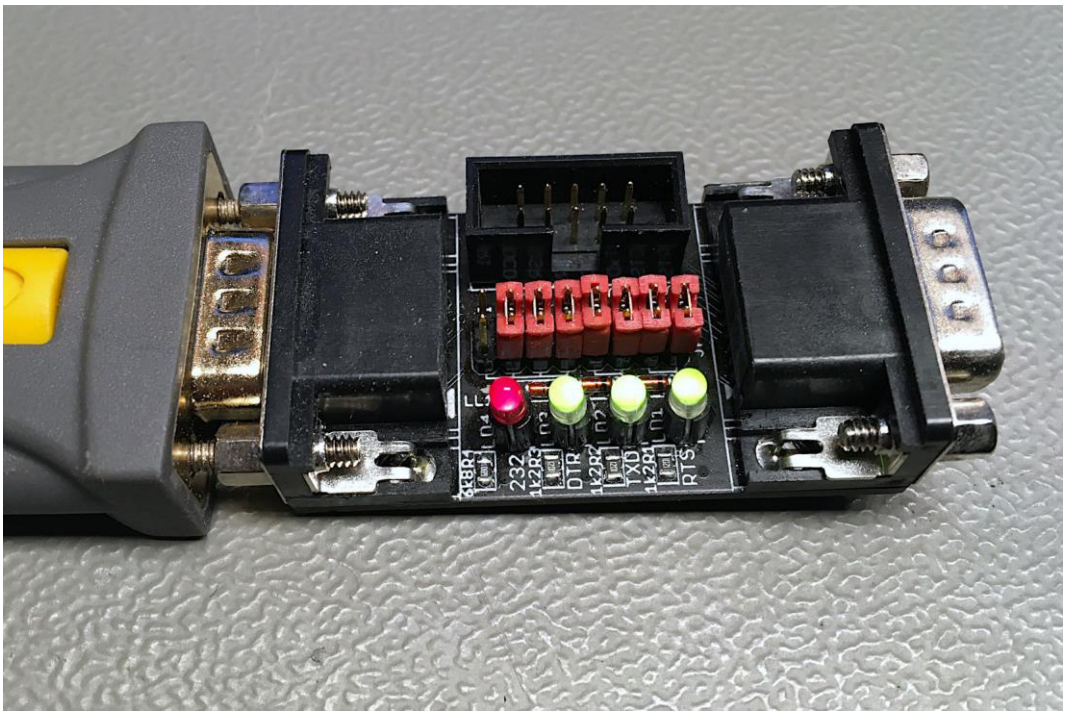


Figure 3: The RS-232 loopback connected to the RS-232 cable, RTS and DTR is inactive

The Level-Indicator LED lights (dim), while inactive and idling, all three bi-color LEDs (LD1-3) are green.

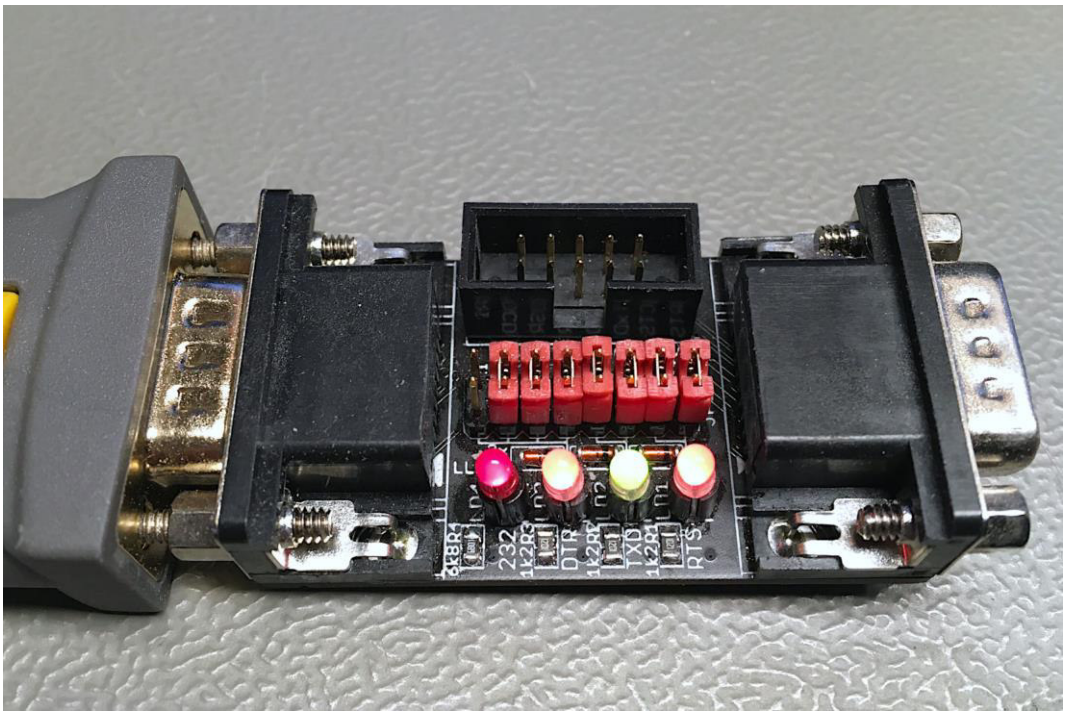


Figure 4: connected to RS-232, RTS and DTR active

When the status of RFR (RTS) is changed, the looped back status on CTS (indicated by YAT) changes accordingly. The same happens with DSR and DCD, if the DTR status is changed.

Test via the USB to serial board (TTL)

The USB to serial board is connected to the box connector with the ribbon cable.

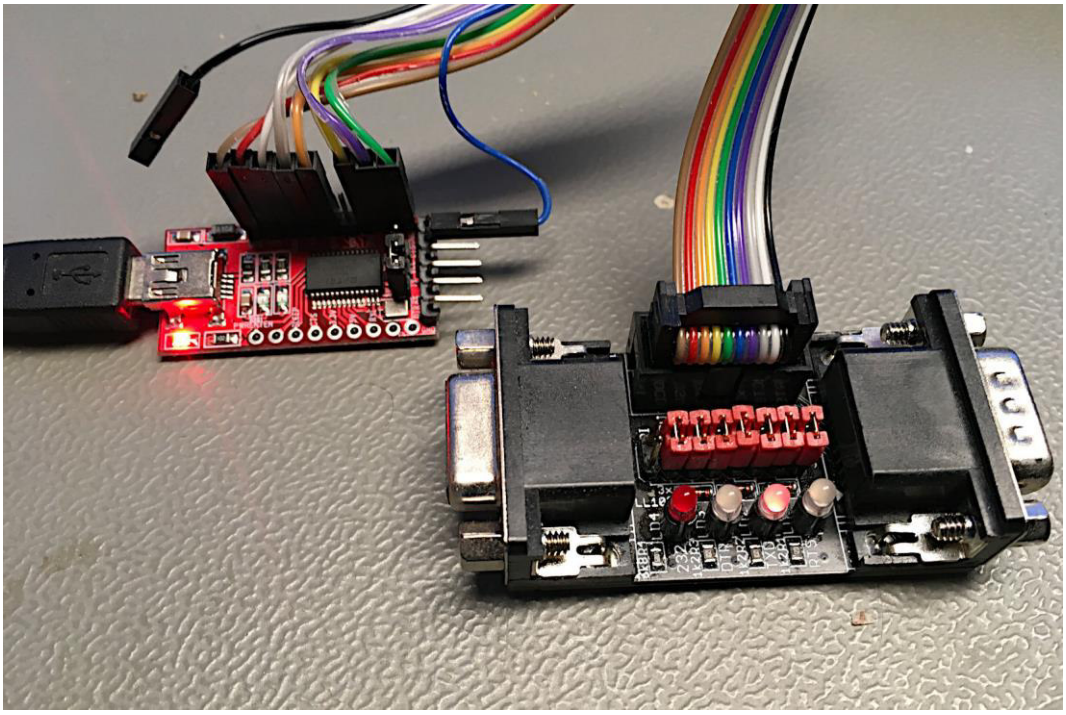


Figure 5: Test with the USB - (TTL) serial converter. Status: idle, RTS and DTR active

The level indicator LED LD4 (left, Figure 5) is off.

While data is being transferred, the TXD LED (LD2) is flickering. The RTS LED (LD1) is off while active and on while RTS is inactive. The DTR LED (LD3) indicated the DTR status correctly, too. The transmitted data is echoed back and the (this way) received text is identical with the transmitted text.

Conclusion

The prototype is fully functional.

RS-232 Loopback Rev. 0
Bill of Material Rev. 0.0

Pos.	Qty	Value	Footprint	Ref.-No.	Comment
1	1	183-2-01-00	2 Layer	PCB Rev. 0	2 layer, Cu 35µ, HASL, 54.5mm x 30.5mm, 1.6mm FR4
2	1	box header, 2x5, 2.54mm	2X05WV	J1	e.g. Reichelt WSL 10G
3	1	LED, 3mm green	3MM	LD4	standard LED
4	3	1k2	805	R1, R2, R3	SMD metal film resistor, 5% or better
5	1	6k8	805	R4	SMD metal film resistor, 5% or better
6	1	COMBI-8X2P	COMBI-8X2	JP1	solder bridges or 2x8 pin header
7	8	Jumper, 2.54mm	jumper	(JP1)	standard jumper (rated 1A or more). E.G. Reichelt: JUMPER 2,54 SW, tme.eu: 63429-202LF
8	1	D09F90CL	D09F90CL	J2	DSUB, 9p, female, 90°. E.g. Reichelt D-SUB BU 09EU
9	1	D09M90CL	D09M90CL	J3	DSUB, 9p, male, 90°. E.g. Reichelt D-SUB ST 09EU
10	3	L-937EGW	LED_3MM_BICOLOR	LD1, LD2, LD3	bi-color 3mm LED (green, red), e.g. Kingbright, e.g. Reichelt LED 3 RG
11	3	LL103A	SOD-80	D1, D2, D3	SMD schottky diode, e.g. Vishay