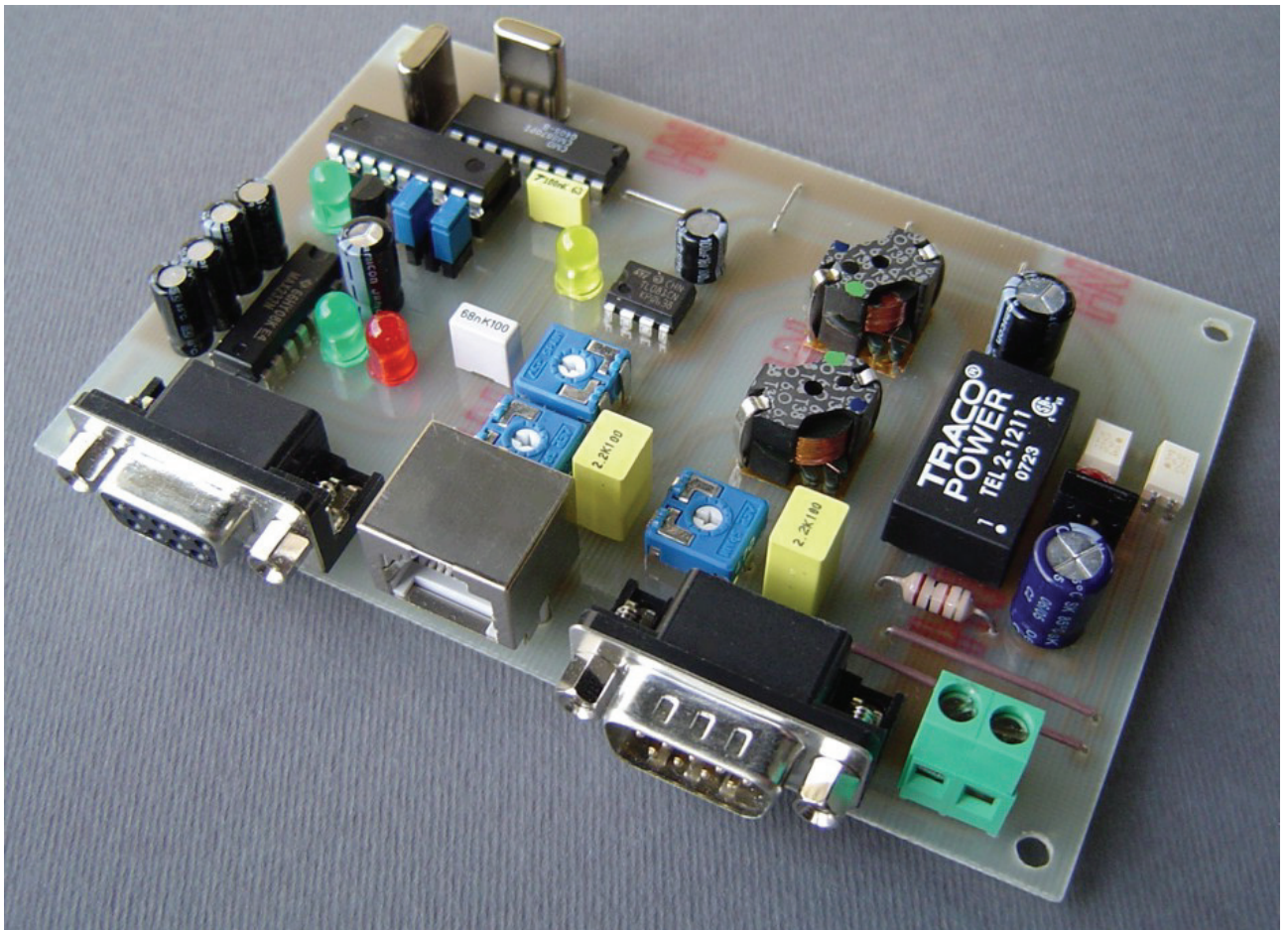


# TRANSCEIVER to PC INTERFACE

*with a hardware DTMF detector and galvanic isolation*

*designed for*

*SVXlink based Echolink gateway*



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**Aleks, s54s**  
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# 1. Circuit description

Both audio paths from transceiver's audio output to the PC sound blaster input as well as from PC soundblaster's output to the transmitter modulation input are galvanically isolated using audio transformers. There are trimpots provided for a hardware audio level adjustment in both directions.

The control signals paths (PTT, squelch detect) are isolated using optocouplers OC1 and OC2.

DTMF decoder is built around a MT8870 single chip DTMF detector. Detected tones are processed with a PIC microcontroller and sent to the hosting PC via a serial RS-232 line. DTMF decoding / processing circuit needs to be supplied with power (5V DC). There is usually a suitable 12V DC power source present on the transceiver side of the interface therefore an isolated DC/DC converter is implemented to supply the active parts of the circuit at PC side of the interface and maintain galvanic separation of both interface sides at the same time. There are 5 LEDs of different colours on the board for visual signalling of some important control signal conditions as described in Table 1.

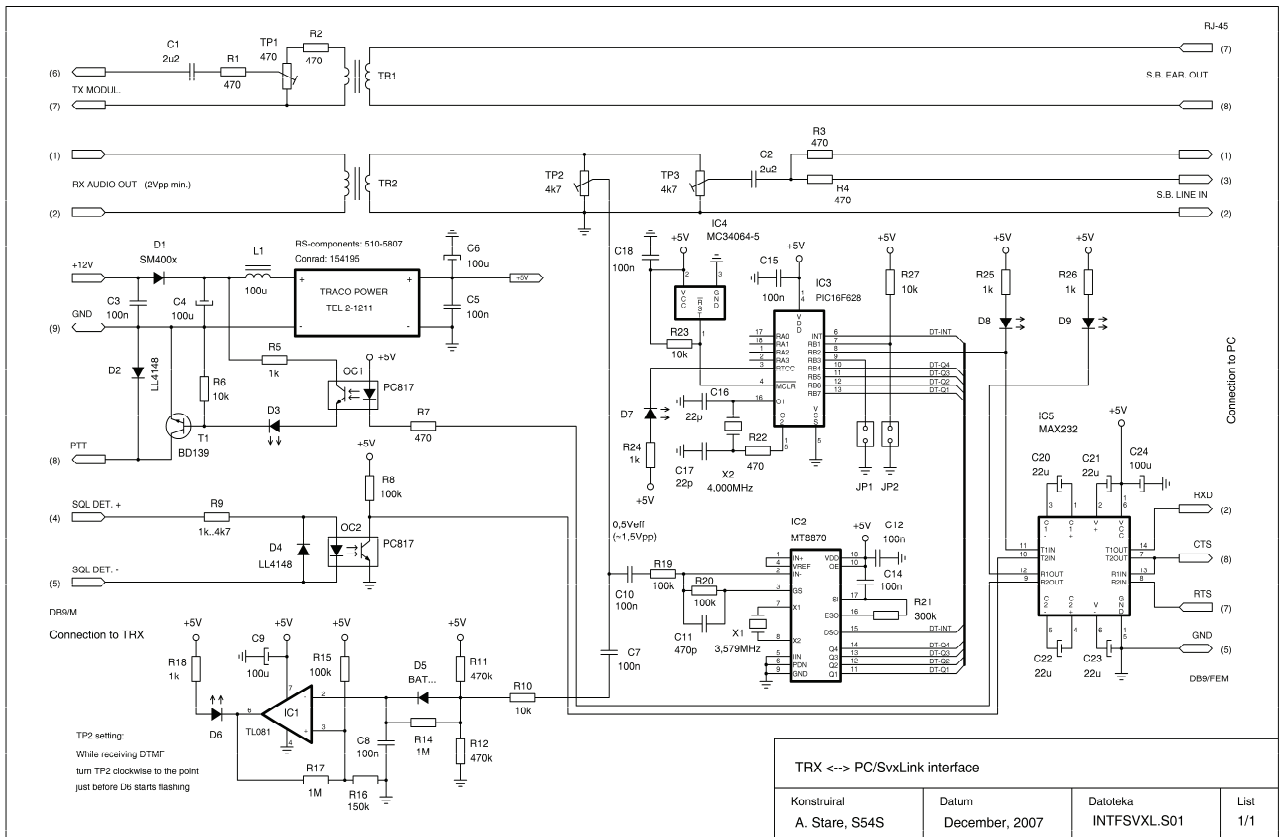


Figure 1 - Circuit schematic

LED	Signalling
D3	PTT (TX control) activated
D6	DTMF level detector
D7	DTMF tone detected and decoded
D8	Transmission of serial data via RS-232 to the host PC
D9	Squelch detect (active receiving)

Table 1 – LED signalling

## **2. Component selection**

All resistors and most capacitors should be SMD type while ICs and other components in more conventional housing for through-hole mounting shall be used.

Audio transformers may be general audio isolation transformers like phone line transformers obtained from analogue dial-up modem equipment or similar. There is a broad selection of suitable transformers on the market. For optimal DTMF decoding one should pay attention to the frequency characteristic of the selected transformers to be as flat as possible in the frequency range from 500 Hz to 2 kHz.

The audio transformers may be abandoned if one estimates the galvanic isolation would not be necessary in his/her transceiver/PC setup.

The DC/DC converter with (9..18)V input and 5V output is manufactured by "Traco power" and available from Conrad (154195), RS components (510-5807) as well as some other electronic parts distributors across the Europe.

The components list is included in attachment 1.

## **3. Assembly**

TRX to PC SVXlink interface is built on a single-sided PCB. The PCB is designed to be easily made at home using a basic amateur-grade photo / etching equipment.

Some precautions are to be made when building interface into a metal housing. Both DB9 connectors (RS-232 and TRX connections) have metal shields which are in a direct electrical contact when built in a metal housing. Use an RS-232 cable without connection between connector shields at both cable sides to maintain a truly galvanic isolation between the transceiver and the PC

Both audio transformers may be replaced by a direct wire connection if one estimates they are not necessary in his / her TRX/PC setup.

The IC4 reset circuit may be abandoned in case one does not expect strong transients, slow voltage raise conditions at power-on or other disturbances on the 5V power supply line.

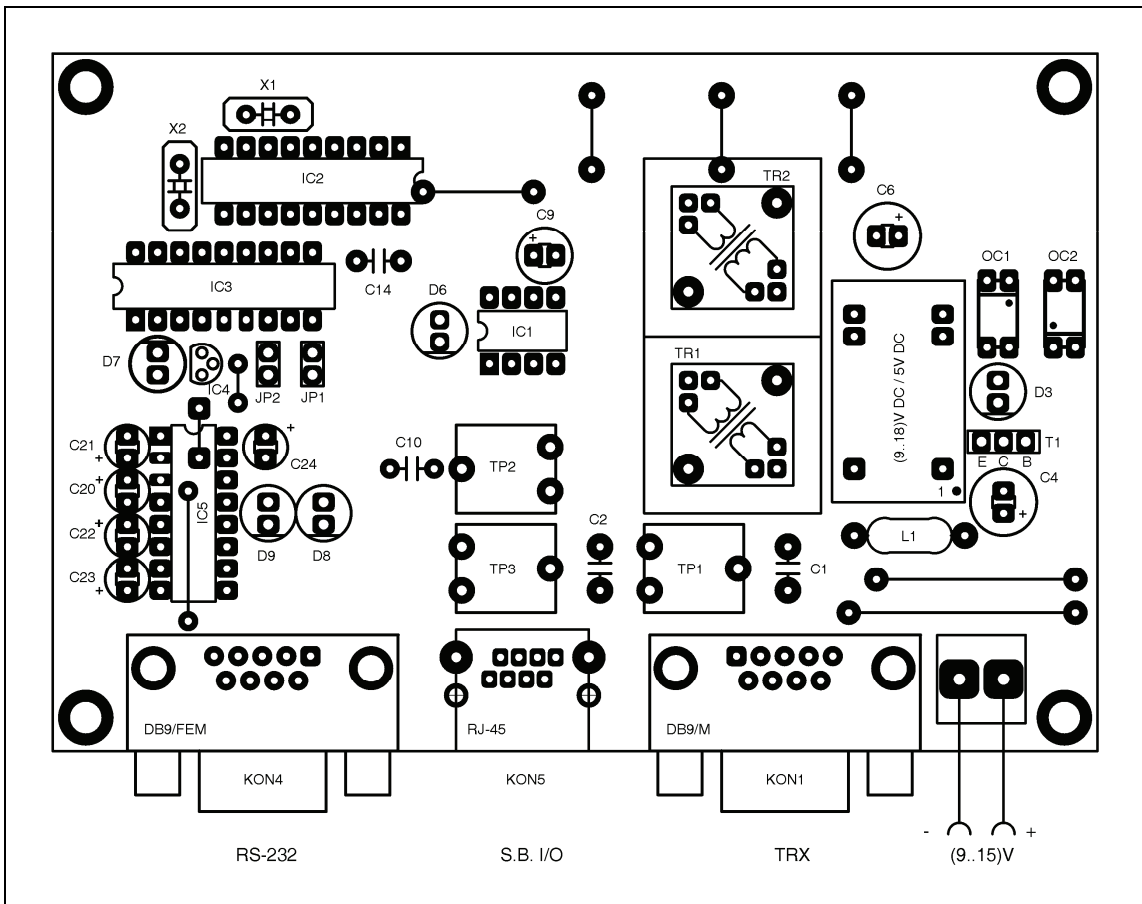


Figure 2 - PCB assembly, top side

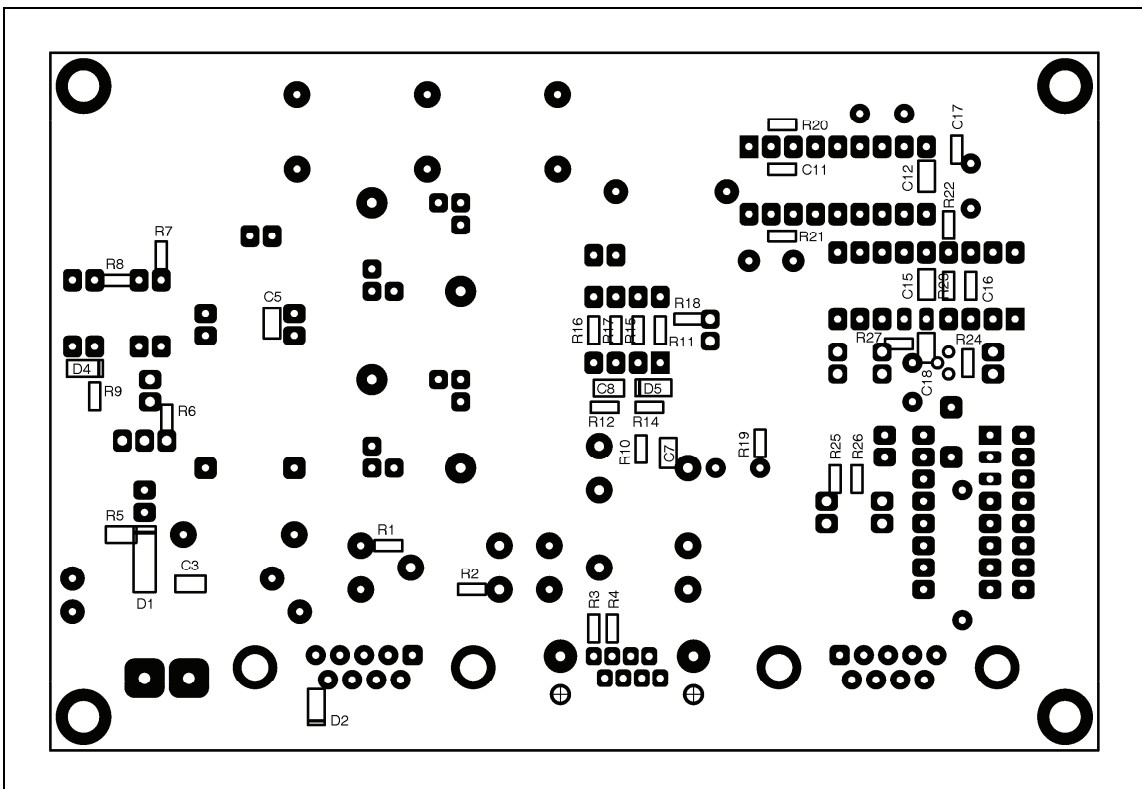


Figure 3 - PCB assembly, SMT components side

#### 4. Audio signal level adjustments

After proper connection to the PC and TRX the following adjustments have to be done:

1. While receiving a DTMF tone adjust TP2 to the position when D6 just starts flashing and then turn slightly back until flashing just stops. This will ensure a proper signal level at DTMF detector input for optimal detection of DTMF tones in noisy conditions.
2. Adjust TP3 for proper input level at the soundblaster line-in input.
3. Adjust TP1 for proper signal level at TX modulation input.

The level of the signal from RX audio output to interface input (TR2) should have an amplitude of 1,5Vpp (0,5Veff) or greater if an 1:1 transformer is being used. Impedance of the RX audio output is not critical and may be anything between 0 and 600 Ohm. A typical speaker output of an amateur FM TRX should do the job just fine.

#### 5. Software supported DTMF detection filtering

JP1 enables / disables software DTMF detection filtering. For most cases this jumper is recommended to be closed. This will make the decoder to detect a tone in approximately 30 to 50ms. The delay (pause) of some 25ms or more is required between DTMF tones for proper detection of tone sequence. If JP1 is left opened, a software supported DTMF detection filtering is enabled. In this case a **time delay** of approximately **150ms** or more is required **between two sequential DTMF tones** for the second tone to be detected and decoded. If the delay is shorter, the second tone will be ignored. This feature improves the unwanted multiple detection of a single DTMF tone in conditions of strong received signal fading particularly when the user is sending tones with long duration while expecting more reliable tone detection. As already said, the JP1 should be kept closed in most circumstances. There are more sophisticated methods implemented in SVXlink software itself to solve the multiple tone detection problem out.

JP1	JP2	Setting
Open	X	SW supported DTMF detection filtering enabled
Closed	X	Disabled
X	Open	RS-232 com. receiver address: RX1
X	Closed	RS-232 com. receiver address: RX0

Table 2 – JP1 and JP2 settings

## 6. Interface to PC data communication protocol

The TRX to PC/SVXlink interface described uses asynchronous serial RS-232 line interface (9k6bps, 8N1) communication for event based signalling of the decoded DTMF tone data to the hosting computer. Each event is being coded by one single byte and sent to the PC via serial communication line. The coding scheme is as follows:

MSB	b6	b5	b4	b3	b2	b1	LSB
a	f2	f1	f0	d3	d2	d1	d0

### 6.1. Address field (a)

a	RS-232 communication address of the receiver
0	RX0
1	RX1

### 6.2. Function field (f2 ... f0)

f2	f1	f0	Function
0	0	0	DTMF tone detection idle
0	0	1	DTMF tone detected

### 6.7. Data field (d3 ... d0)

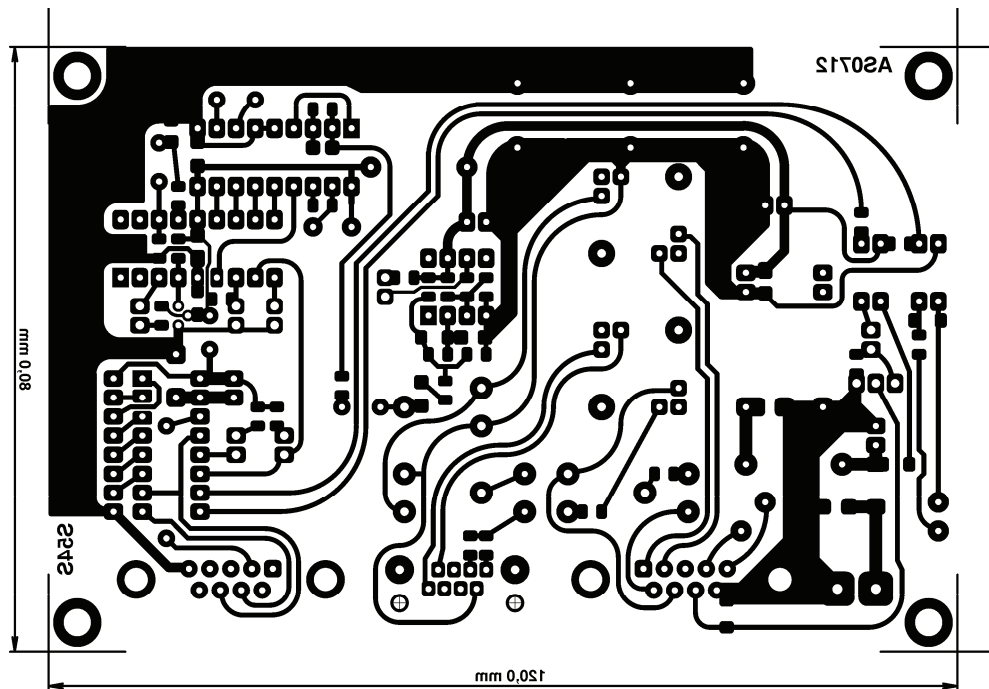
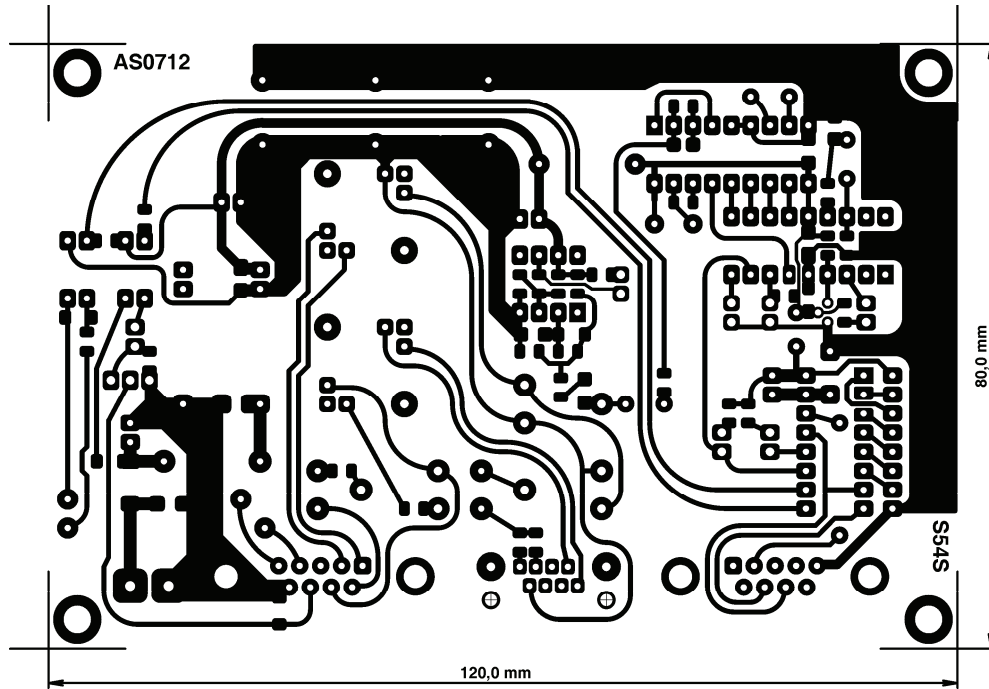
d3	d2	d1	d0	DTMF tone coding
0	0	0	0	D
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	0
1	0	1	1	*
1	1	0	0	#
1	1	0	1	A
1	1	1	0	B
1	1	1	1	C

## 7. Attachments

### 7.1. Bill of material

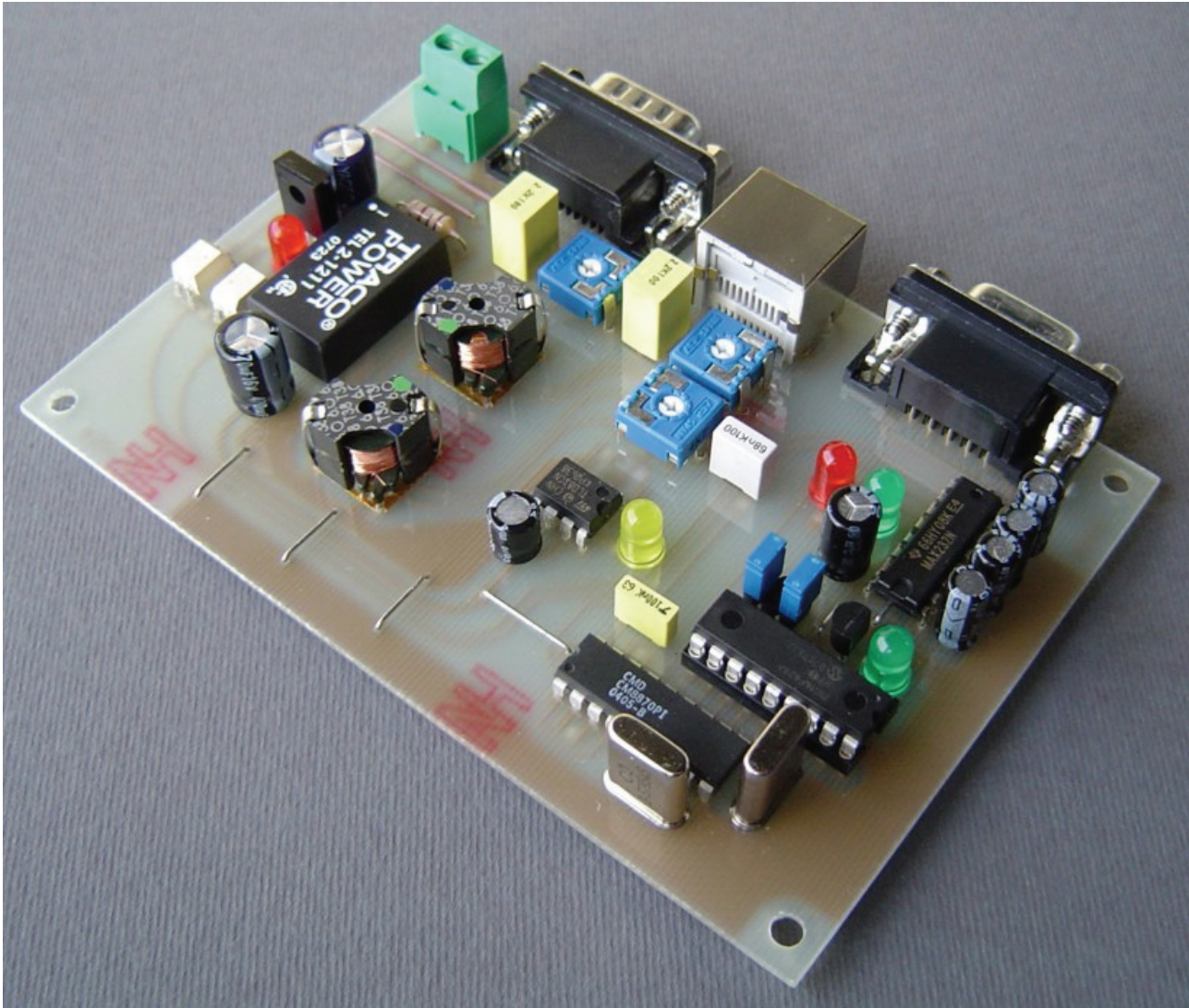
	Ref.	Value	Housing	Qty.	Remarks
1	R1, R2, R3, R4, R7, R22	470 Ohm	SMD 0805	6	
2	R5	1 kOhm	SMD 1206	1	
3	R18, R24, R25, R26	1 kOhm	SMD 0805	4	
4	R6, R23, R10, R27	10 kOhm	SMD 0805	4	
5	R8, R15, R19, R20	100 kOhm	SMD 0805	4	
6	R9	1 ... 4,7 kOhm	SMD 0805	1	Select according to TRX sql. det. output properties
7	R11, R12	470 kOhm	SMD 0805	2	
8	R14, R17	1 MOhm	SMD 0805	2	
9	R16	150 kOhm	SMD 0805	1	
10	R21	300 kOhm	SMD 0805	1	
11	C1, C2	2,2 uF/50V	d = 5mm	2	Polyester
12	C3, C5, C7, C8, C12, C15, C18	100 nF	SMD 1206	7	X7R or similar
14	C4, C6, C9	100 uF /16V	d = 3mm	3	Electrolyte
15	C10, C14	100 nF / 50V	d = 5mm	2	Polyester
16	C11	470 pF	SMD 0805	1	NP0 or COG
17	C16, C17	18 pF .. 22 pF	SMD 0805	2	NP0 or COG
18	TP1	470 Ohm	10mm / 5mm	1	
19	TP2, TP3	4,7 kOhm	10mm / 5mm	2	
20	D1	SM400x	SMD MELF	1	Any of the SM400x family would be OK (SM4001, SM4002, ... SM4007)
21	D2, D4	LL4148	SMD MiniMELF	2	
22	D3, D8	LED 3mm, red	d = 2,5mm	2	
23	D5	BAT...	SMD MiniMELF	1	Any small SMD BAT Schottky
24	D6,	LED 3mm, yellow	d = 2,5mm	1	
25	D7, D9	LED 3mm, green	d = 2,5mm	2	
26	T1	BD139		1	
27	TR1, TR2	600 Ohm, 1:1 ... 1:2		2	See text
28	OC1, OC2	PC817	4 pin DIL	2	Or similar 4 pin DIL opto coupler
29	DCC1	(9..18)V / 5V	DIL16	1	TRACO POWER TEL 2-1211
30	IC1	TL081	DIL8	1	
31	IC2	MT8870	DIL18	1	Or equivalent (KT3170, CM8870, ...)
32	IC3	PIC16F628/P	DIL18	1	Either of 4 MHz or 20MHz versions will do the job just fine
33	IC4	MC34064-5	TO-92	1	
34	L1	100uH		1	250mA min., size of 1/2W resistor
35	KON1	DB9 male	PCB, 90 deg	1	
36	KON4	DB9 female	PCB, 90 deg	1	
37	KON5	RJ-45	PCB	1	

7.2. PCB





7.3. Photos



S54S: Transceiver to PC/SVXlink interface

