Un Récepteur à Réaction - Le Sauteur de Bayou

Cajun French for "The Bayou Jumper"

(*a play on "Ocean Hopper" and homage to the French heritage in Louisiana)*
A regenerative receiver designed for the CW segment of the 40 meter ham band
Based on a design by Charles Kitchin, N1TEV
Adapted by Jim Giammanco, N5IB
revised 20 Aug 2016

Yahoo Group: *https://groups.yahoo.com/neo/groups/Bayou_Regen_Rx/info*

Tuning range approximately 120 to 150 kHz – enough to cover from a portion of the Extra Class CW band into the old "Novice Band."

One knob tuning – no bandset/bandspread needed.

Only one toroid to wind.

Varactor tuning employing readily available Schottky diodes as varactor diodes.

Regeneration control also employs a "Schottky varactor" as the throttle capacitor.

Use of potentiometers controlling only the varactor DC bias for tuning and regeneration means the controls are not "hot" with RF, so "hand effect" detuning is minimized.

Only a few feet of wire needed as an antenna.

Optional RF attenuator control, which is useful when employed with full-scale antennas.

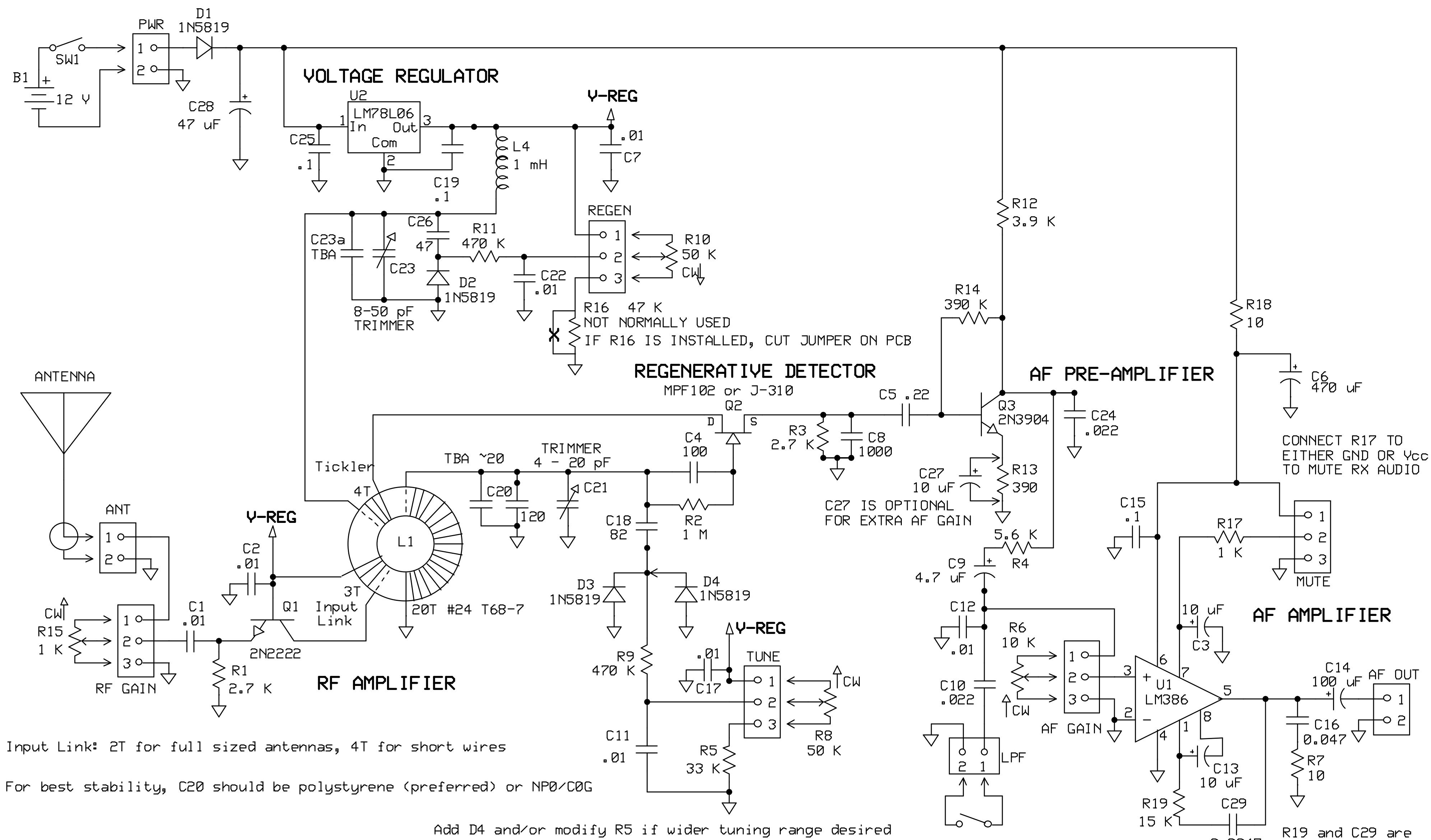
Optional receiver audio muting for use with a transmitter.

Robust headphone audio, and will drive a small speaker with modest volume.

Best operated from 12 V supply, but will operate on a 9 V battery. Current drain about 20 mA.

Should be adaptable for 80, or 30 meters. Possible companion receiver for a ColorBurst transmitter. Rev 1.9 schematic has some preliminary notes for 30 meters.

Shown at right is the prototype, housed in a wood box obtained from Hobby Lobby. The panel is made from copper clad PCB stock. A frequency calibration card is inside the top cover.



Input Link: 2T for full sized antennas, 4T for short wires

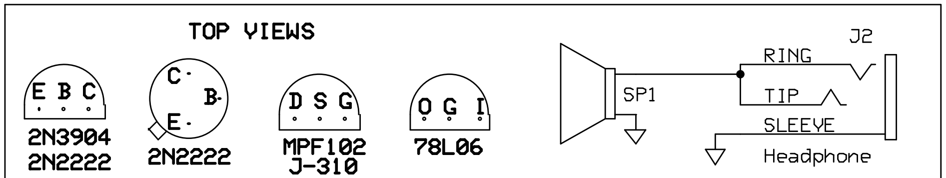
For best stability, C20 should be polystyrene (preferred) or NP0/C0G

Add D4 and/or modify R5 if wider tuning range desired
Use smaller R5 (not less than 22 K) for wider range.

R19 and C29 are optional

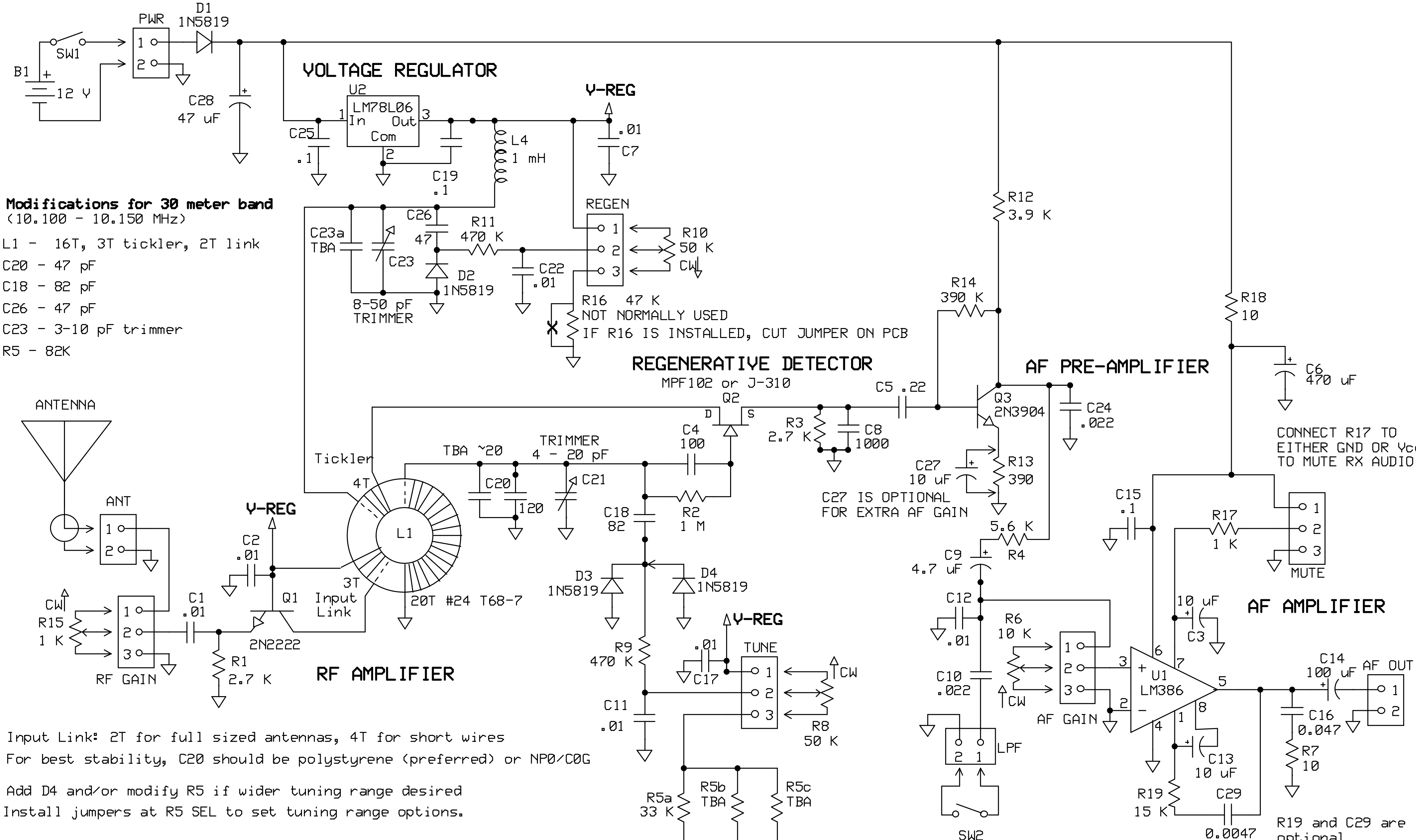
ADAPTED FROM A DESIGN BY CHARLES KITCHIN, N1TEV

MATCHES rev1.61, rev1.70, rev1.72 and rev1.74 PCBs
R19 and C29 are used on rev1.72 and rev1.74 PCBs only



40 Meter Regenerative RX

Jim Giammanco N5IB	Rev 1.72 / 20 Nov 2015	Page 1 of 2



Modifications for 30 meter band
(10.100 - 10.150 MHz)

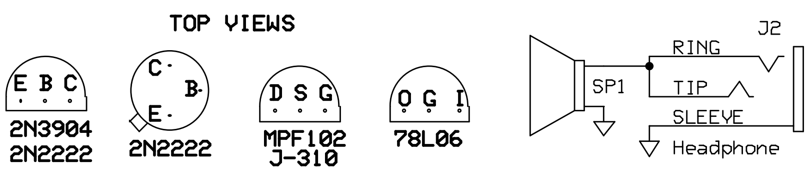
L1 - 16T, 3T tickler, 2T link
C20 - 47 pF
C18 - 82 pF
C26 - 47 pF
C23 - 3-10 pF trimmer
R5 - 82K

Input Link: 2T for full sized antennas, 4T for short wires
For best stability, C20 should be polystyrene (preferred) or NP0/C0G

Add D4 and/or modify R5 if wider tuning range desired
Install jumpers at R5 SEL to set tuning range options.

ADAPTED FROM A DESIGN BY CHARLES KITCHIN, N1TEV

TOP VIEWS

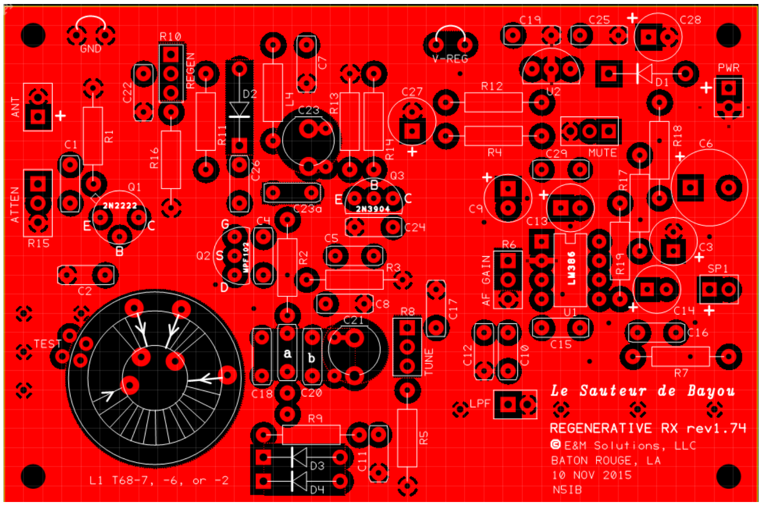


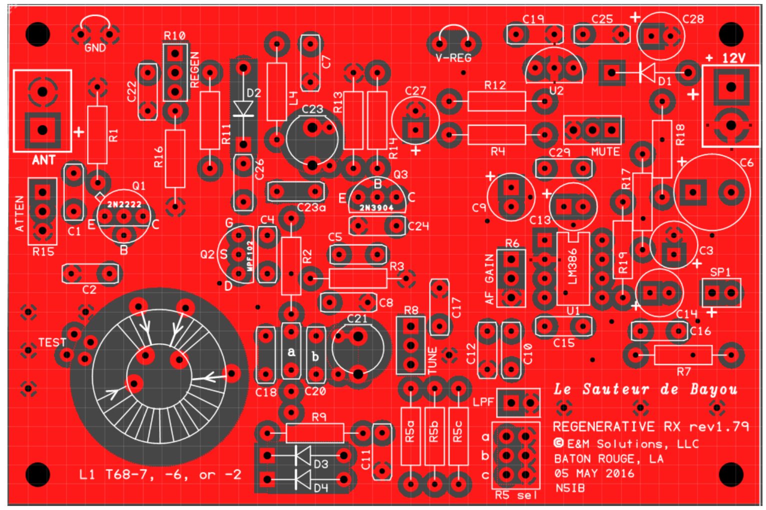
MATCHES rev1.61, 1.70, 1.72, 1.74, and rev1.75 PCBs
R19 and C29 are used on rev1.72, 1.74, and 1.75 PCBs only

40 Meter Regenerative RX

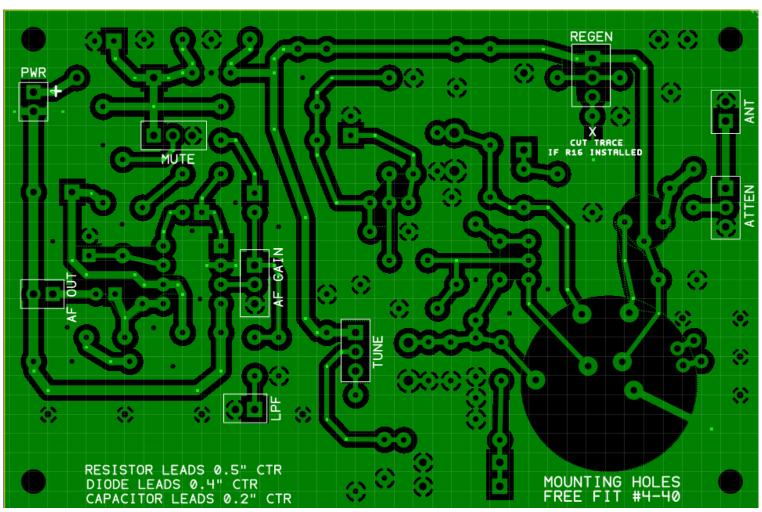
Jim Giammanco N5IB	Rev 1.79 05 MAY 2016	Page 1 of 2

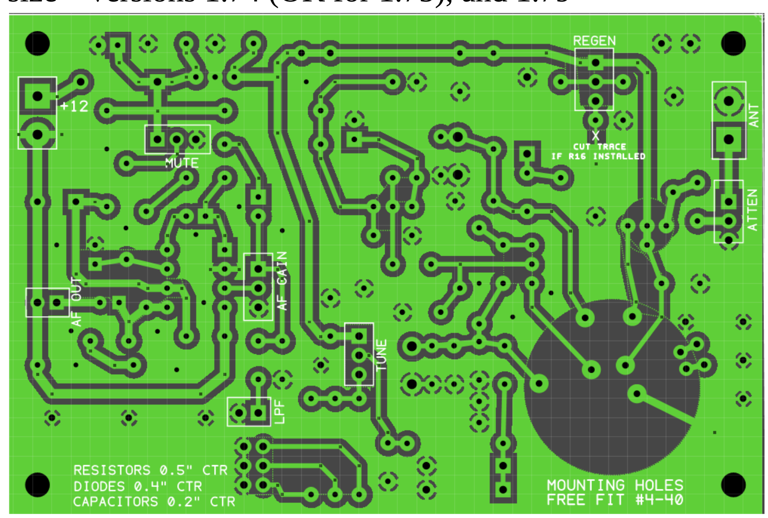
TOP COPPER – approximately actual size – versions 1.74 (OK for 1.75), and 1.79



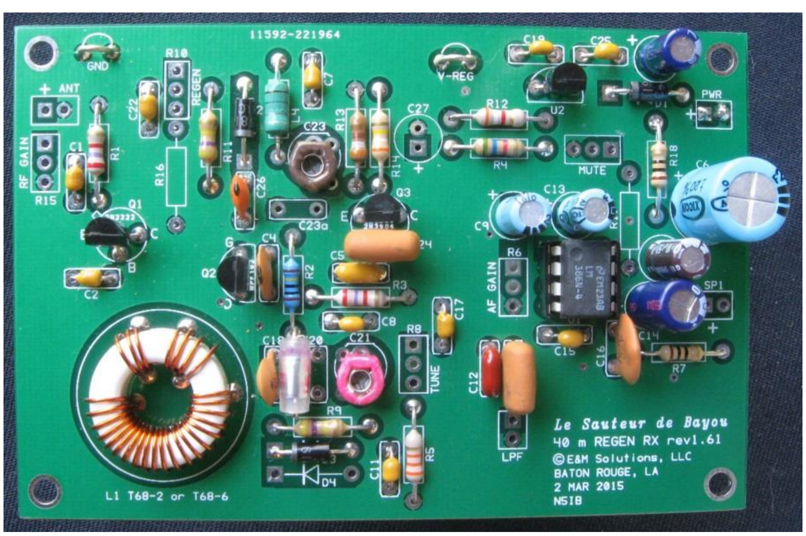


BOTTOM COPPER – approximately actual size – versions 1.74 (OK for 1.75), and 1.79





Prototype rev1.61 PCB



40 meter Kitchin-style Regenerative Receiver

Bill of Materials for rev1.72, 1.75, and 1.79 schematics and rev1.70, 1.72, 1.74, 1.75 and 1.79 PCBs

Quant	ID	Description	Vendor Catalog Number
7	C1 C2 C7 C11 C12 C17 C22	0.01 uF 50V ceramic X7R .2" LS	Mouser 81-RDER71H103K0M1H3A
3	C15, C19 C25	0.1 uF 50V ceramic X7R .2" LS	Mouser 81-RDER71H104K0K103B
1	C8	1000 pF 50V 5% C0G ceramic .2" LS	Mouser 81-RDE5C1H102J0K1H3B
1	C16	.047 uF 50V ceramic .2" LS	Mouser 581-SR211C473KAR
1	C4	100 pF 50V 5% C0G ceramic .2" LS	Mouser 81-RDE5C1H101J0K1H3B
1	C26	47 pF 50V 5% C0G ceramic .2" LS	Mouser 81-RDE5C1H470J0K1H3B
1	C18	82 pF 50V 5% C0G ceramic .2" LS	Mouser 81-RDE5C1H820J0K1H3B
1	C20a	120 pF 50V 5% C0G ceramic .2" LS or, optionally, polystyrene	Mouser 81-RDE5C1H121J0K1H3B
1	C20b	22 pF 50V 5% C0G ceramic .2" LS	Mouser 81-RDE5C1H220J0K1H3B
1	C5	0.22 uF 10% X7R 50V ceramic .2" LS	Mouser 594-K224K20X7RF53H5
2	C10 C24	0.022 uF 50V 10% X7R ceramic .2" LS	Mouser 594-K223K15X7RF53L2
1	C29	0.0047 uF 50V 10% ceramic or mylar .2" LS	Mouser 594-K472K15X7RF53L2
1	C6	470 uF 25V electrolytic 5mm LS	Mouser 140-REA471M1EBK1012P
2	C9 C27	4.7 uF 25V electrolytic 2mm LS	Mouser 140-REA4R7M1EBK0511P
2	C3 C13	10 uF 25V electrolytic 2mm LS	Mouser 140-REA100M1EBK0511P
1	C14	100 uF 25V electrolytic 2.5mm LS	Mouser 140-RGA101M1EBK0611G
1	C28	47 uF 25V electrolytic 2mm LS	Mouser 140-RGA470M1EBK0511
1	C21	20 pF trimmer	eBay item # 250847960661, $3.58 for 20
1	C23	50 pF trimmer	Kits and Parts #96, bag of 12 for $5 or eBay # 390327607132, $3.58 for 20
3	D1 D2 D3 D4 (D4 optional)	1N5819 Schottky diode	Mouser 821-1N5819
1	L1	T68-2 or T68-6 ot T68-7 toroid core	Kits and Parts #198 (T68-2) or #201 (T68-6)
1	L4	1 mH molded RF choke	Mouser 434-23-102-01
1	Q1	2N2222 or 2N2222A NPN BJT	Kits and Parts #112, bag of 50
1	Q2	MPF102 or J-310 N-JFET	Arrow Electronics J310G
1	Q3	2N3904, 2N2222, or 2N4401 NPN BJT	Mouser 512-2N3904BU
2	R1 R3	2.7 K ¼ W, 5%, carbon film	Mouser 291-2.7K-RC
1	R2	1 M ¼ W, 5%, carbon film	Mouser 291-1M-RC
1	R4	5.6 K ¼ W, 5%, carbon film	Mouser 291-5.6K-RC
1	R5 (for rev1.79: R5a, R5b, R5c)	R5 or R5a = 33 K ¼ W, 5%, carbon film (R5b, R5c TBA)	Mouser 291-33K-RC
2	R7, R18	10 Ω ¼ W, 5%, carbon film	Mouser 291-10-RC
1	R19	15 K ¼ W, 5%, carbon film	Mouser 291-15K-RC
1	R17	1 K ¼ W, 5%, carbon film	Mouser 291-1K-RC
2	R9 R11	470 K ¼ W, 5%, carbon film	Mouser 291-470K-RC
1	R12	3.9 K ¼ W, 5%, carbon film	Mouser 291-3.9K-RC
1	R13	390 Ω ¼ W, 5%, carbon film	Mouser 291-390-RC
1	R14	390 K ¼ W, 5%, carbon film	Mouser 291-390K-RC
2	SW1 SW2	SPST (SW1 may be part of R6)	Marlin P Jones #25006 SW
1	U1	LM386-3 or -4	Kits and Parts #102
	U1	alternate source	Mouser 926-LM386N-4/NOPB

1	U2	LM78L06	Mouser 512-KA78L06AZTA
1	R15	1 K linear pot	Mouser 58-P110KV11F25BR1K
1	R6	10 K audio pot (switch optional)	Kits and Parts #316, bag of 3 for $3
2	R8 R10	50 K linear pot	Mouser 858-P110KV10F20BR50K
1	PCB1	Etched Circuit Board	N5IB
1	Antenna	BNC chassis connector	Marlin P Jones #20507 RC
1	Power	2.1 x 5.5 mm DC power connector	Marlin P Jones18549 PL
1	Audio Out	stereo headphone jack	Kits and Parts #313, bag of 4 for $4
		alternate source	Marlin P Jones #25515 PL
1	Wire	#24 enameled wire	Kits and Parts #134 10 ft for $1.50

Circuit information and build notes

Tuning range and bandspreading – If the total tuning range is kept to 150 kHz or less, a band spread or fine-tuning control is not needed. Tuning will be slow enough for both CW and SSB signals.

The tuning range is primarily controlled by C18 and R5. The smaller C18 is made, the smaller will be the effective change in capacitance due to D3, hence the smaller will be the tuning range. Values of C18 between 33 pF and 100 pF have been tried.

Conversely, as R5 is made smaller, a greater range of bias voltage is available on D3, so the tuning range will be increased. R5 should not be smaller than about 10K, to avoid bringing D3 too close to zero bias.

R8 should be connected so that the voltage at its wiper *increases* with *clockwise* rotation. This will have the effect of *dial frequency increasing* with *clockwise* rotation of R11.

Regeneration range – C23, in parallel with the series combination of C26 and D2, act as the traditional *throttling capacitor* to control the amount of regeneration. Larger capacitance means increased regeneration. In much the same way as in the main tuning control, C26 and R16 (if R16 is actually installed) determine the range of capacitance that can be accomplished by varying the bias on D2.

The object is to adjust C23, so that when the receiver is tuned to its lowest frequency, the detector just begins to oscillate when R11 is advanced about one-fourth to one-third of its range.

R11 should be connected so that the voltage at its wiper *decreases* with *clockwise* rotation. This will have the effect of *regeneration increasing* with *clockwise* rotation of R11.

Tuning and regeneration capacitor options – It is quite possible to omit the tuning diodes D2 and D3 and use conventional variable capacitors, either air-type or polyvaricon. In that case the associated potentiometers, bias resistors, and bypass capacitors are omitted (R5, R8, R9, C11, C17 for tuning, R10, R11, R16, C22, R11 for regeneration) The variable capacitors could be installed at the locations of D3 (tuning) and D2 (regeneration). Extra pads are provided on the circuit board to allow padding with small values of fixed capacitors to tweak the tuning and regeneration ranges. Pads are provided at C20 to accommodate larger capacitors, such as polystyrene or mica parts. It is possible to try out different fixed capacitor values without soldering. Just insert the part so that it makes contact with the pads.

Audio gain – If it is anticipated that the receiver will be used only with headphones, emitter bypass capacitor C27 can be omitted and headphone volume will be quite adequate. Adding C27 will increase the gain of the audio pre-amplifier, which may help when driving a small speaker. Keep in mind that the LM386 audio output stage is not intended to give "room-filling" volume. Shorting the **LPF** pinheader will provide some additional high frequency roll-off that will help when listening to CW signals. A 15K resistor in series with a 0.005 µF capacitor, tacked on between pins 1 and 5 of the LM386, can help suppress some of the high frequencies.

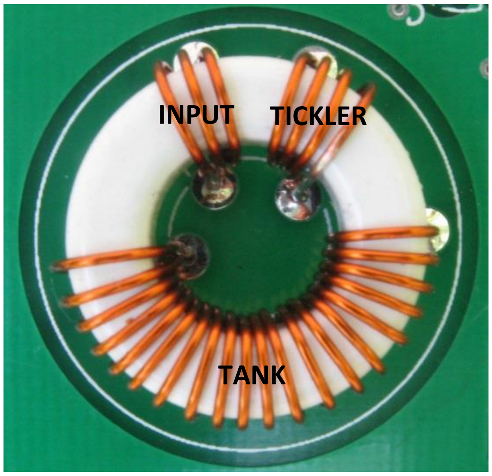
Strong signals / big antennas – Regenerative detectors are usually very sensitive, but prone to bad behavior in the presence of strong signals. R15 acts as an input attenuator and will help. The number of turns on the input coupling link is also important. When a full sized antenna is used, two, or even just one turn will be enough. If, though, the receiver is to be used with just a few feet of wire for an antenna, adding two or three turns may be advisable.

Temperature stability – When installed in an enclosed cabinet, receiver stability is quite adequate. The tuning and regenerating controls are at DC levels only, with no RF present. So *hand effects* are minimal. The circuit board should be behind a metal panel to avoid detuning. The prototype pictured used PC board stock for the panel, and the inside of the wood box is lines with aluminum foil tape – the sort used to seal heating ducts.

There are a couple of experiments that might yield even better stability. Changing the tank inductor core to a T68-7 is one idea. The -7 iron powder formulation has a lower temperature coefficient than the -2 mix. In fact, if a portion of the tank capacitance is implemented with a polystyrene capacitor there may be even more improvement. The temperature coefficient of the polystyrene cap is opposite that of the iron powder, so the two will offset somewhat. Perhaps implementing C20 with 50% of the value in NP0/C0G and the other 50% polystyrene would be a good starting point. Extra pads are provided adjacent to the C20 position.

Use with a transmitter – The receiver is certainly sensitive and stable enough to use to make real QSOs. But some form of receiver muting will be essential, as the strong RF environment near a transmitter will drive the detector into apoplexy. Grounding of the input (right at the R15 side of C1 is probably better than at the antenna jack) is certainly needed, then muting of the audio amplifier by connecting pin 7 of the LM386 to either V+ or ground should also be done. The smaller R17 is made, the more "solid" the muting becomes. A value of 1K is a good starting point. There are slight differences in the level of muting depending on whether the connection is to V+ or to ground. The **MUTE** pinheader allows either option.

Winding sense for L1 – The relative phase of the tank and tickler windings must be correct in order for the detector to oscillate. Refer to the photograph at right for the correct direction of each winding. Disregard the ***number*** of turns pictured. Only the ***direction*** is important. The phase of the input link is not critical, but the direction pictured will allow the leads to match the PCB pad locations.

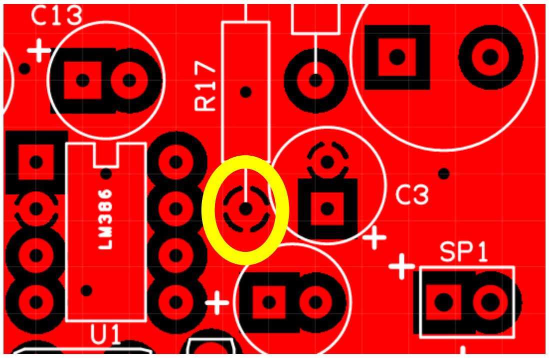


20 August 2015   Sauteur de Bayou Regenerative Receiver PC boards

BUILDER ALERT #1

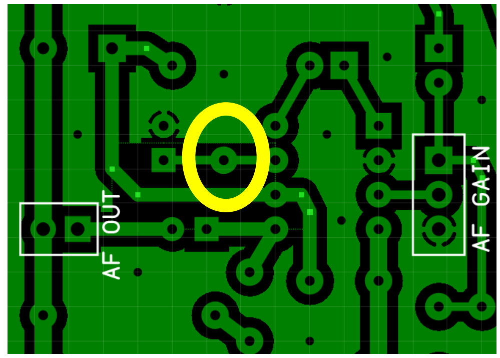
Applies to PC boards rev1.61

top side



The yellow-circled pad should **NOT** be grounded to the top side ground plane. Cut the three small grounding traces with an X-Acto blade, or use a small drill bit (3/32" is best) – finger-twirled – to break the connection between the through-plating and the top side pad and ground plane.

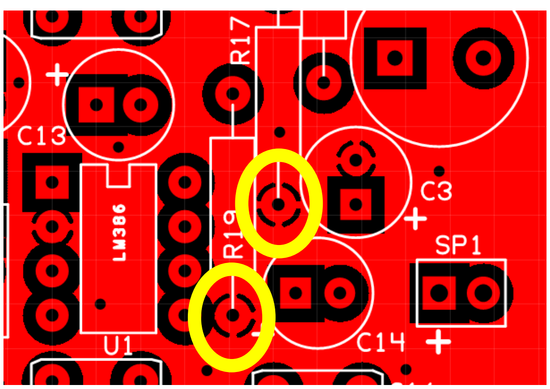
bottom side



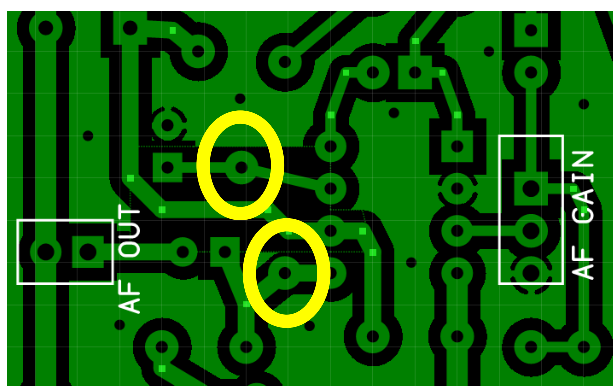
The yellow-circled pad has a too-close clearance to the bottom side ground plane, but it will be OK to leave it that way. Just take care not to create a solder bridge.

BUILDER ALERT #2

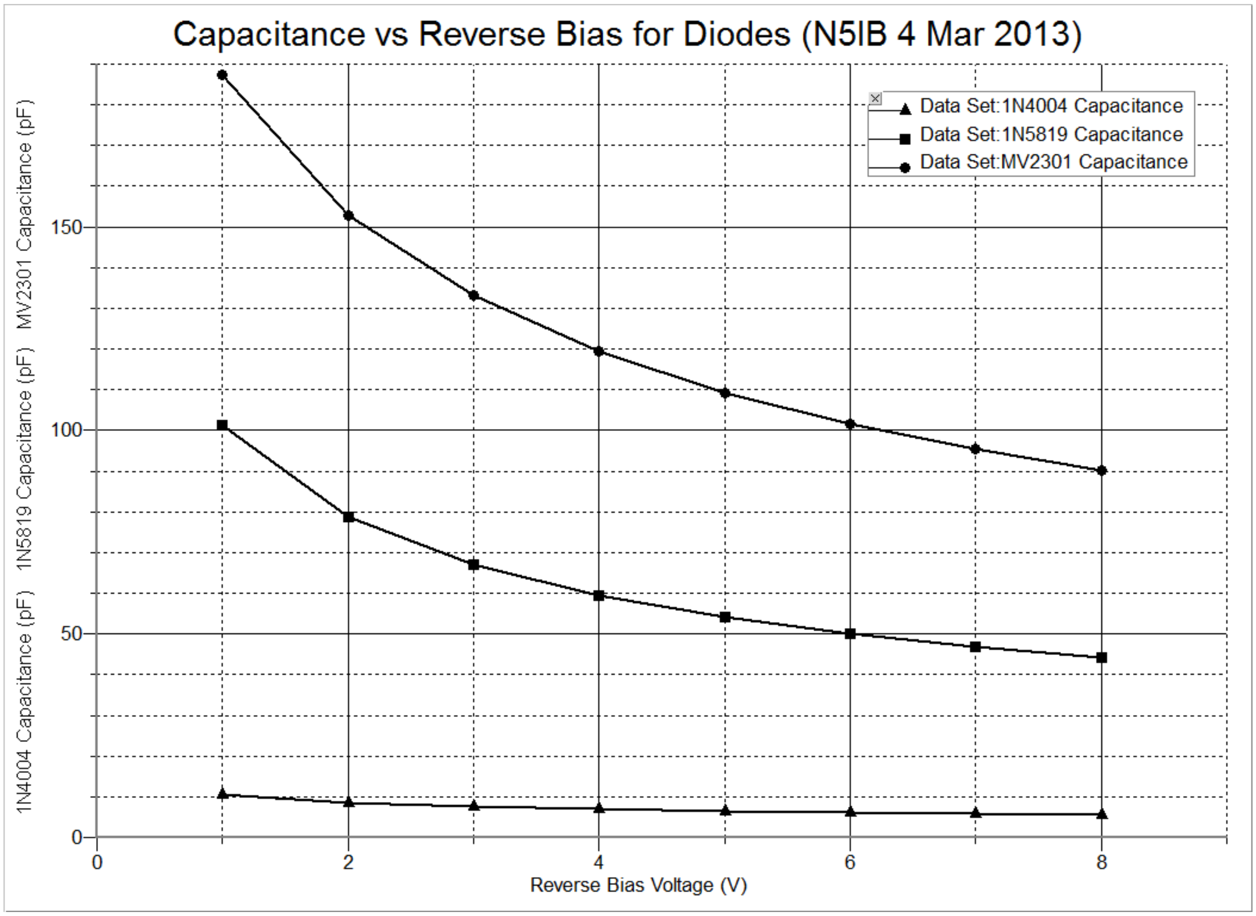
Applies to rev1.70 and early (5 Aug 2015) rev1.72 PC boards (has been fixed in later rev1.72 & 1.74 boards)



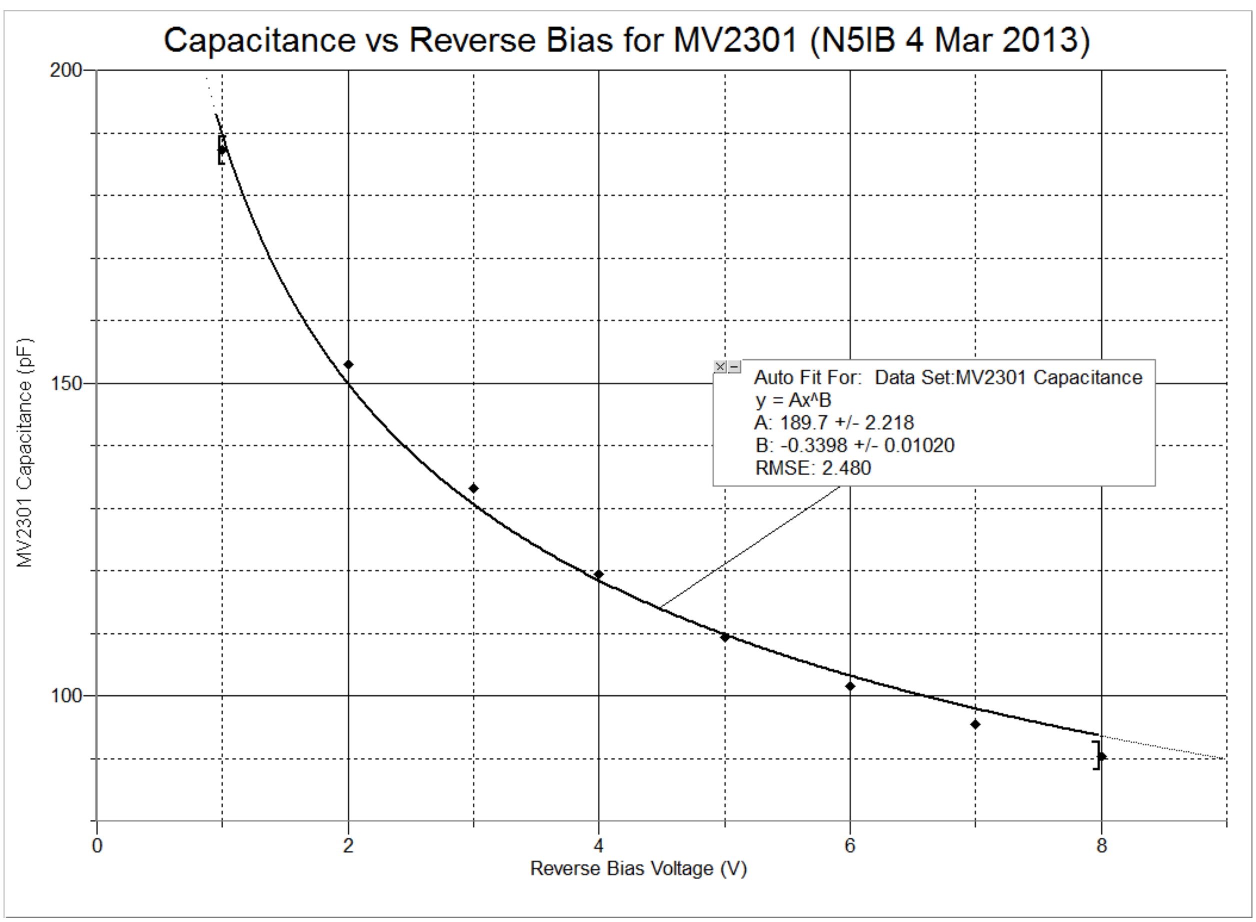
The yellow-circled pads should **NOT** be grounded to the top side ground plane. Cut the two or three small grounding traces with an X-Acto blade, or use a small drill bit (3/32" is best) – finger-twirled – to break the connection between the through-plating and the top side pad and ground plane.



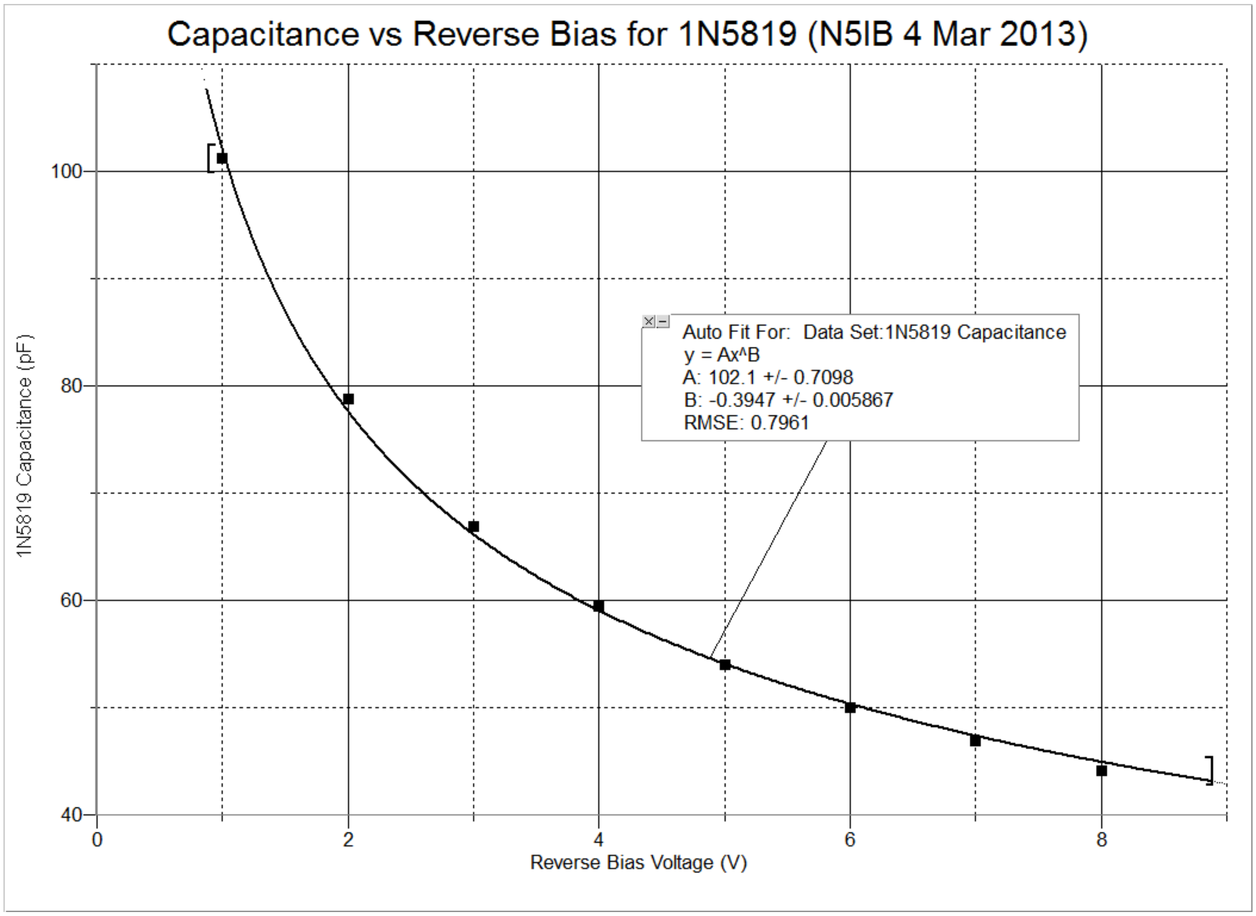
The yellow-circled pads have a too-close clearance to the bottom side ground plane, but it will be OK to leave them that way. Just take care not to create solder bridges.



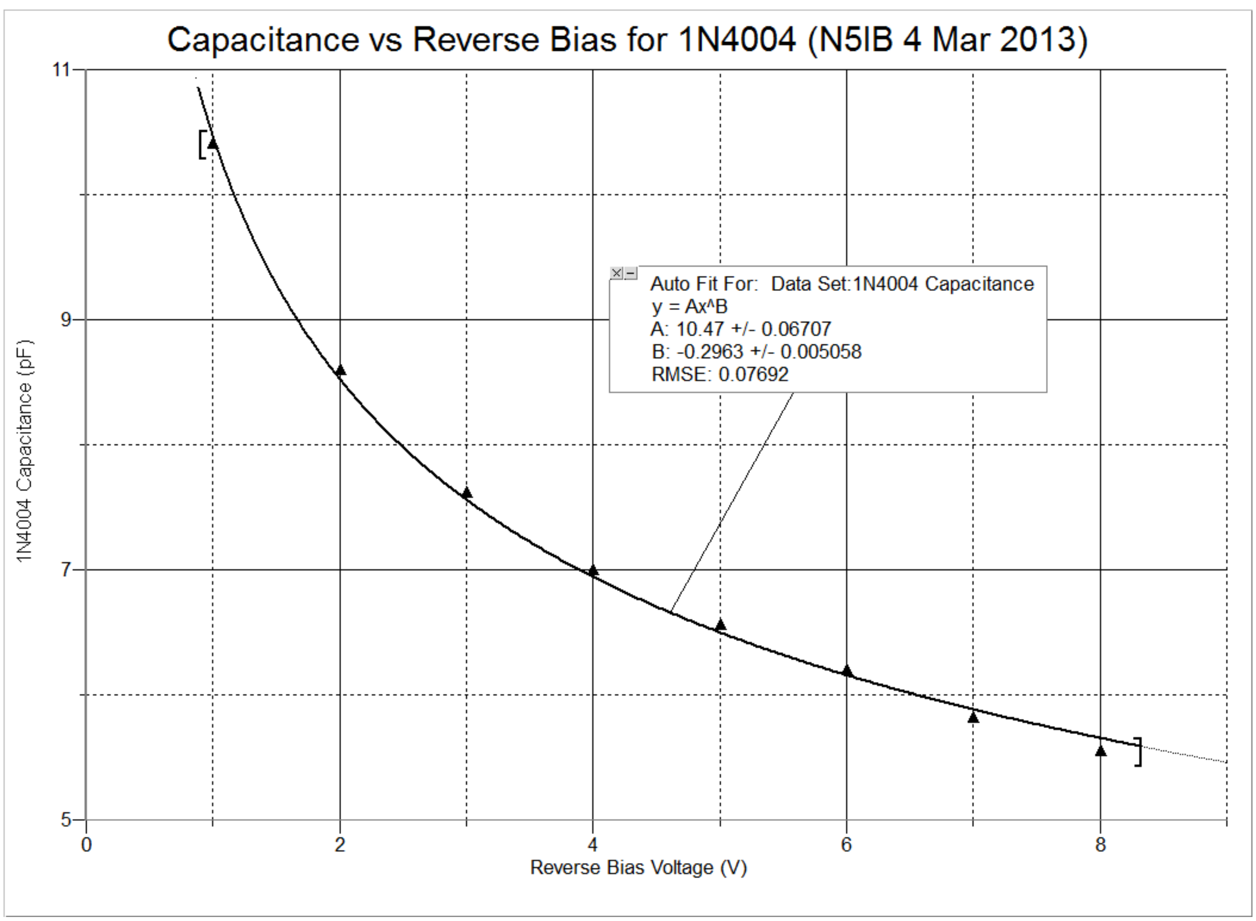
Capacitance vs Reverse Bias for Diodes (N5IB 4 Mar 2013)
Data Set:1N4004 Capacitance
Data Set:1N5819 Capacitance
Data Set:MV2301 Capacitance
1N4004 Capacitance (pF) 1N5819 Capacitance (pF) MV2301 Capacitance (pF)
0
50
100
150
0
2
4
6
8
Reverse Bias Voltage (V)



Capacitance vs Reverse Bias for MV2301 (N5IB 4 Mar 2013)
Auto Fit For: Data Set:MV2301 Capacitance
y = Ax^B
A: 189.7 +/- 2.218
B: -0.3398 +/- 0.01020
RMSE: 2.480
MV2301 Capacitance (pF)
100
150
200
0
2
4
6
8
Reverse Bias Voltage (V)



Capacitance vs Reverse Bias for 1N5819 (N5IB 4 Mar 2013)
Auto Fit For: Data Set:1N5819 Capacitance
y = Ax^B
A: 102.1 +/- 0.7098
B: -0.3947 +/- 0.005867
RMSE: 0.7961
1N5819 Capacitance (pF)
100
80
60
40
0
2
4
6
8
Reverse Bias Voltage (V)



Capacitance vs Reverse Bias for 1N4004 (N5IB 4 Mar 2013)
Auto Fit For: Data Set:1N4004 Capacitance
y = Ax^B
A: 10.47 +/- 0.06707
B: -0.2963 +/- 0.005058
RMSE: 0.07692
1N4004 Capacitance (pF)
11
9
7
5
0
2
4
6
8
Reverse Bias Voltage (V)