1st 2J55 System/ PFN Modulator Prototype

By Vaughn P. McDowell

Built Early 2010

NE bulb RF Excited by Magnetron

My 1st PFN pulse modulator of the x band 50KW class is described here:

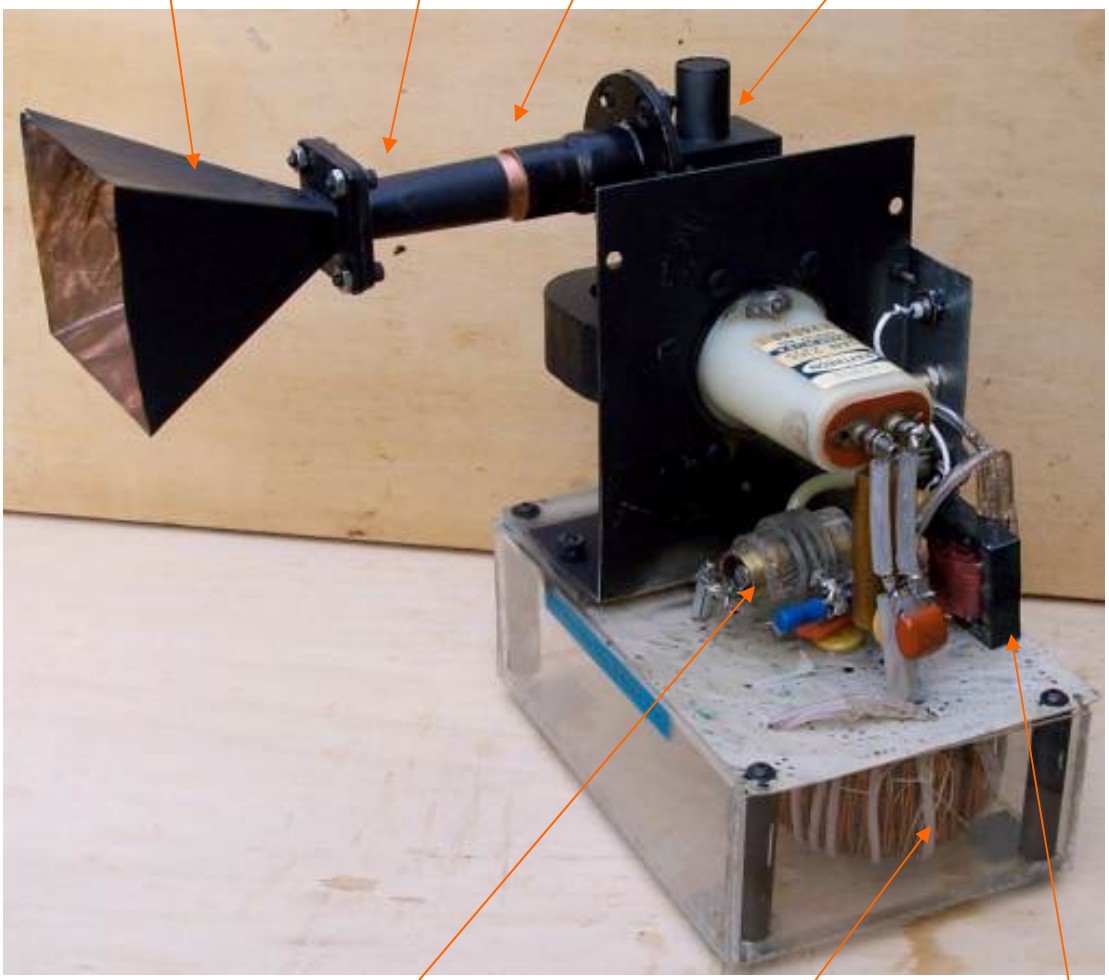
I have lost my notes regarding this project; decided to reverse engineer what I have done where possible.

Rectangular-to-circular waveguide

Circular -to- rectangular waveguide

Horn Antenna

2J55 Magnetron



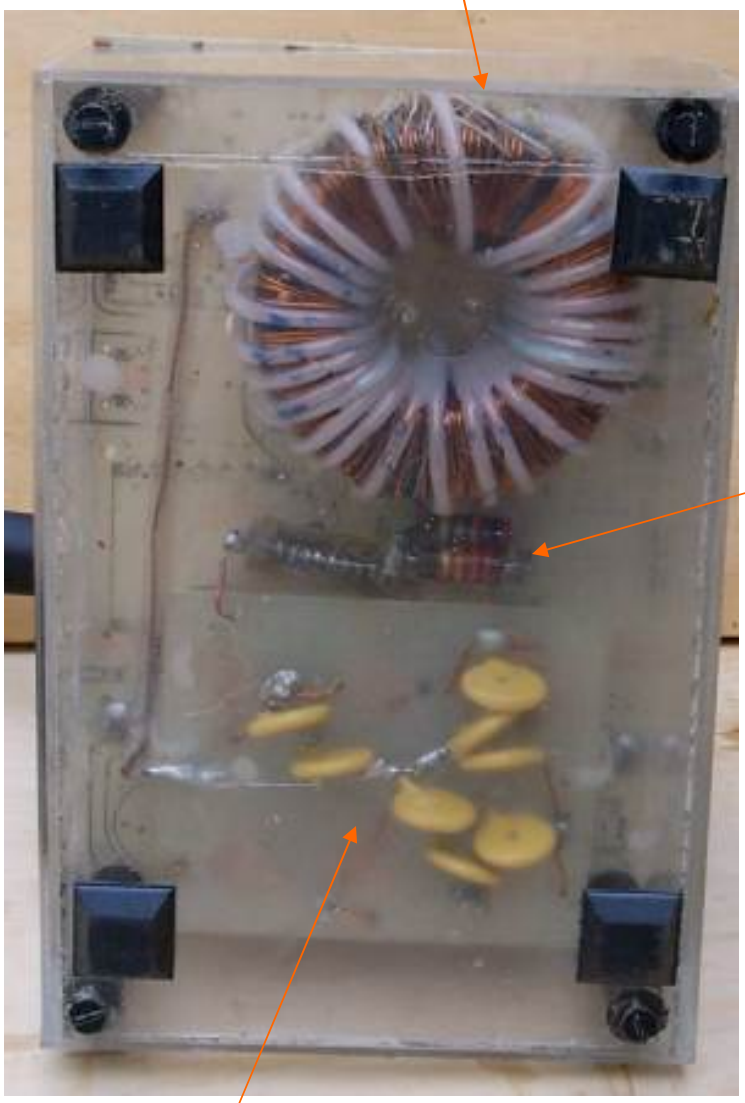
Mid-plane triggered spark gap

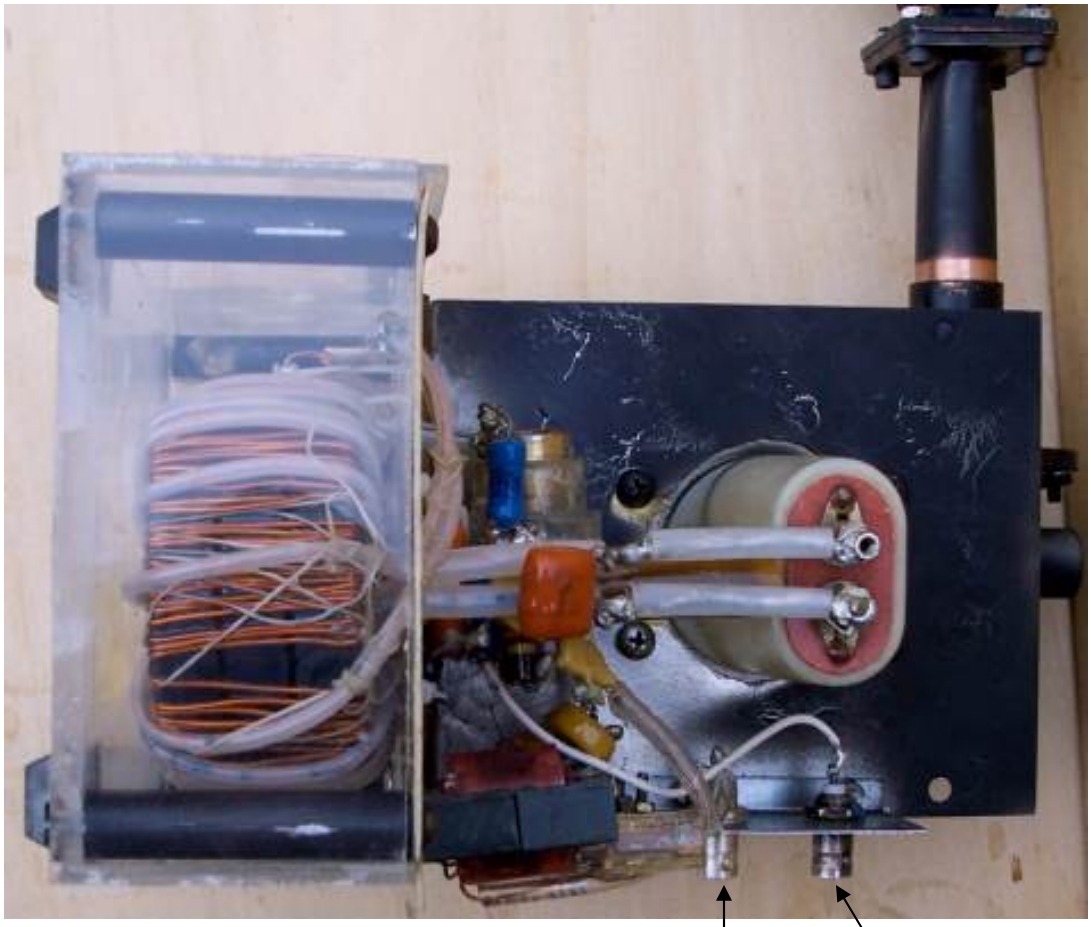
Pulse Transformer; 3.3:1;
sec.=>50T; pri.=>12T;
three ferrite torroids
<< see

Trig. Trans
(see)

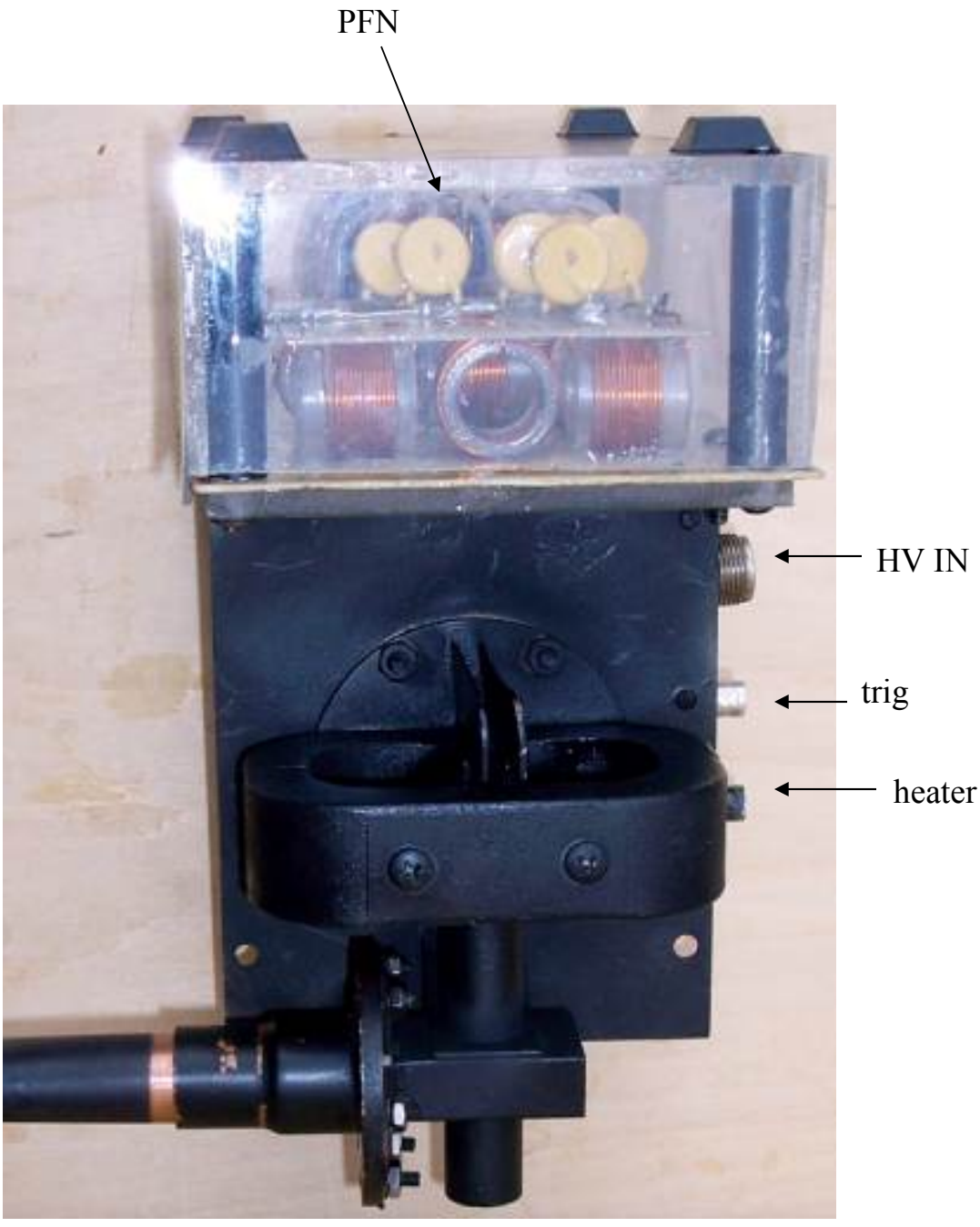
http://vaughns_page.50webs.com/Magnetron/pulsetrans725B/pulsetrans725b.html

http://vaughns_page.50webs.com/HV/transformer/flybk_A/flybk_a.html

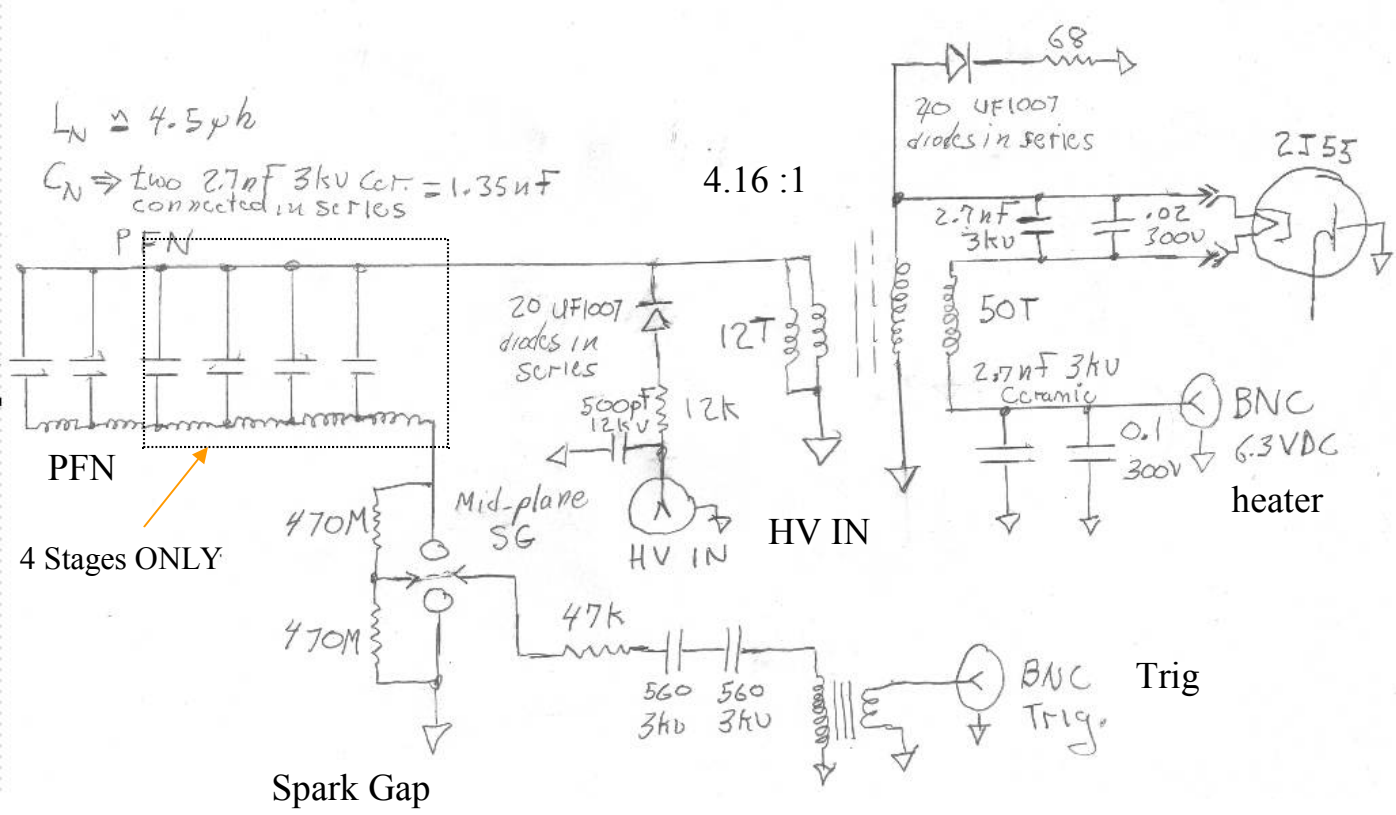

Pulse trans.
HV INPUT
(see schematic)..
6 stage PFN


heater
Trig.


Damp reversal at SEC.
2J55 heater/
cath. INPUT
SEC.
Capacitor
heater shunt
Mid-plane
SG


PFN
HV IN
trig
heater

2J55 SYS/MOD Schematic



Magnetron => 1Kohm operational Z

Pulse Transformer 4.16:1 turns ratio ; $N^2 = 17.36$; PRI. Z => 1000ohm/17.36 = 57.6 ohms

Original PFN was designed for 6 stages

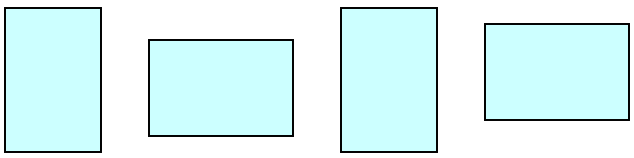
PFN => about 900ns pulse width => ~ 450ns one way ; n => number of stages ; ~57.6 ohms

C = T/nZ = 4.5E-7 / 6 * 57.6 = 1.3nF

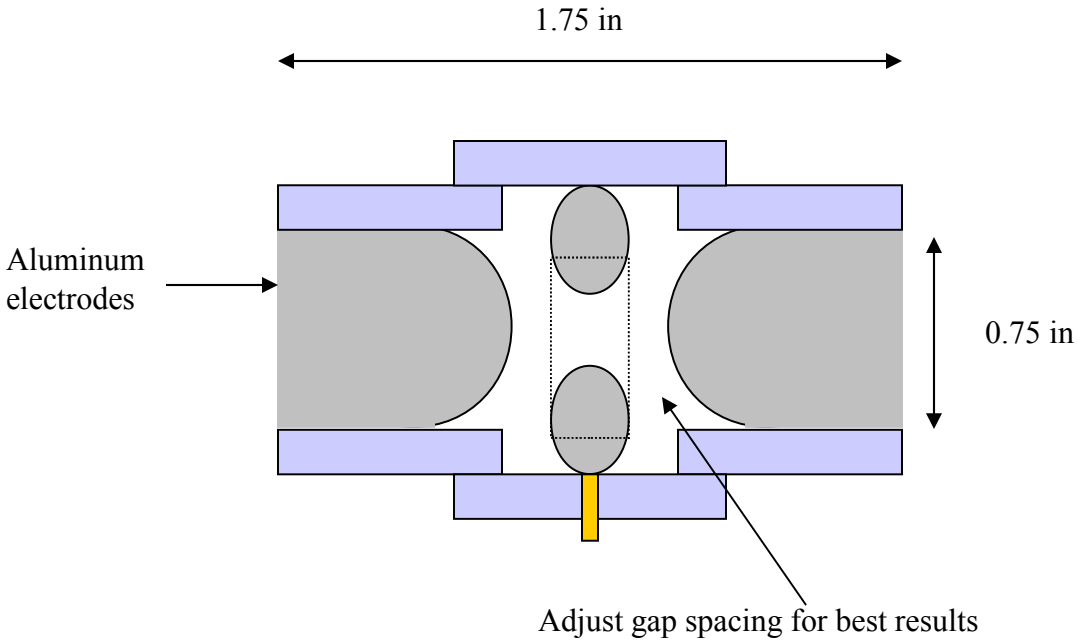
L = Z T / n = 57.6 * 4.5E-7 / 6 = 4.3 uH

PFN now uses only 4 stages ~ => 600nsec

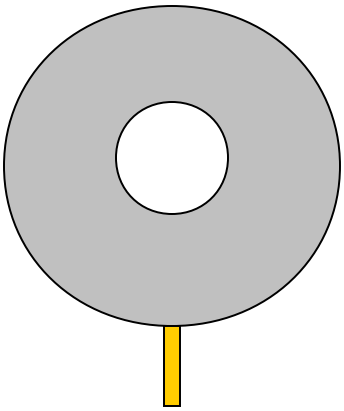
Note that the PFN inductors are arranged physically to reduce coupling.



Triggered Spark Gap



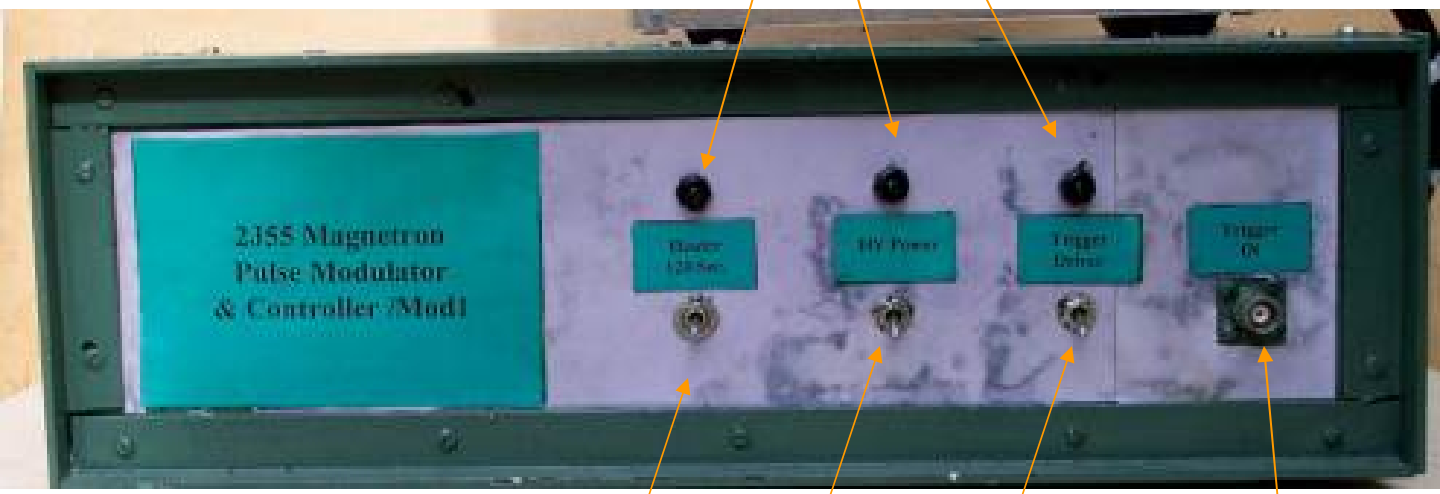
Mid-plane electrode (aluminum)



CONTROLLER/ PWR

Cables => heater, trig., HV

Controller Panel



HV PWR is switched OFF until the heater PWR SW is ON

6.3 VDC magnetron switch mode PS

HV switch mode PS

Power supply for SCR trigger generator see:

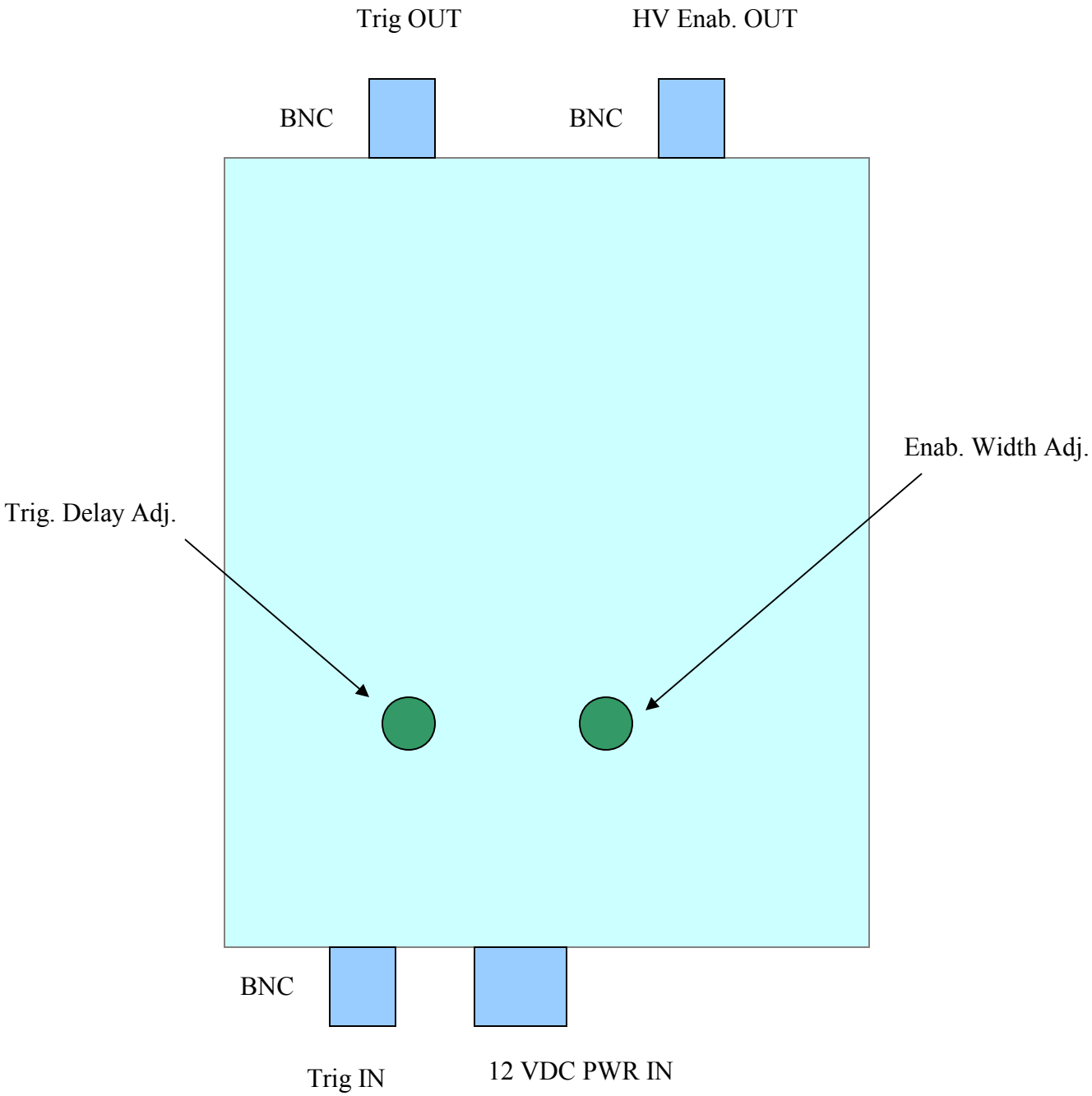
controller

SCR Trig. Gen.

http://vaughns_page.50webs.com/HV/HVPS/hvps1.html

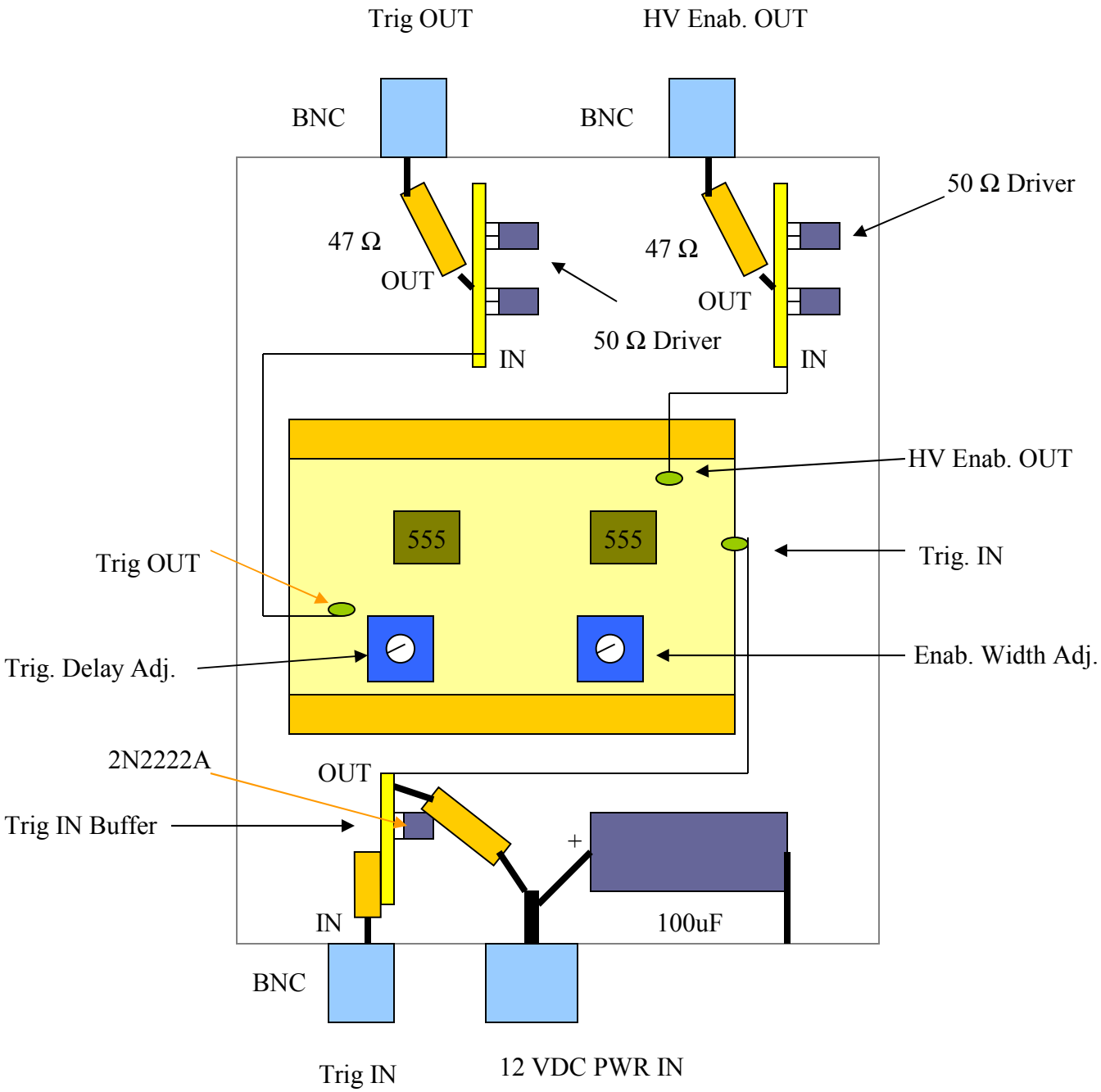
Controller

Top View

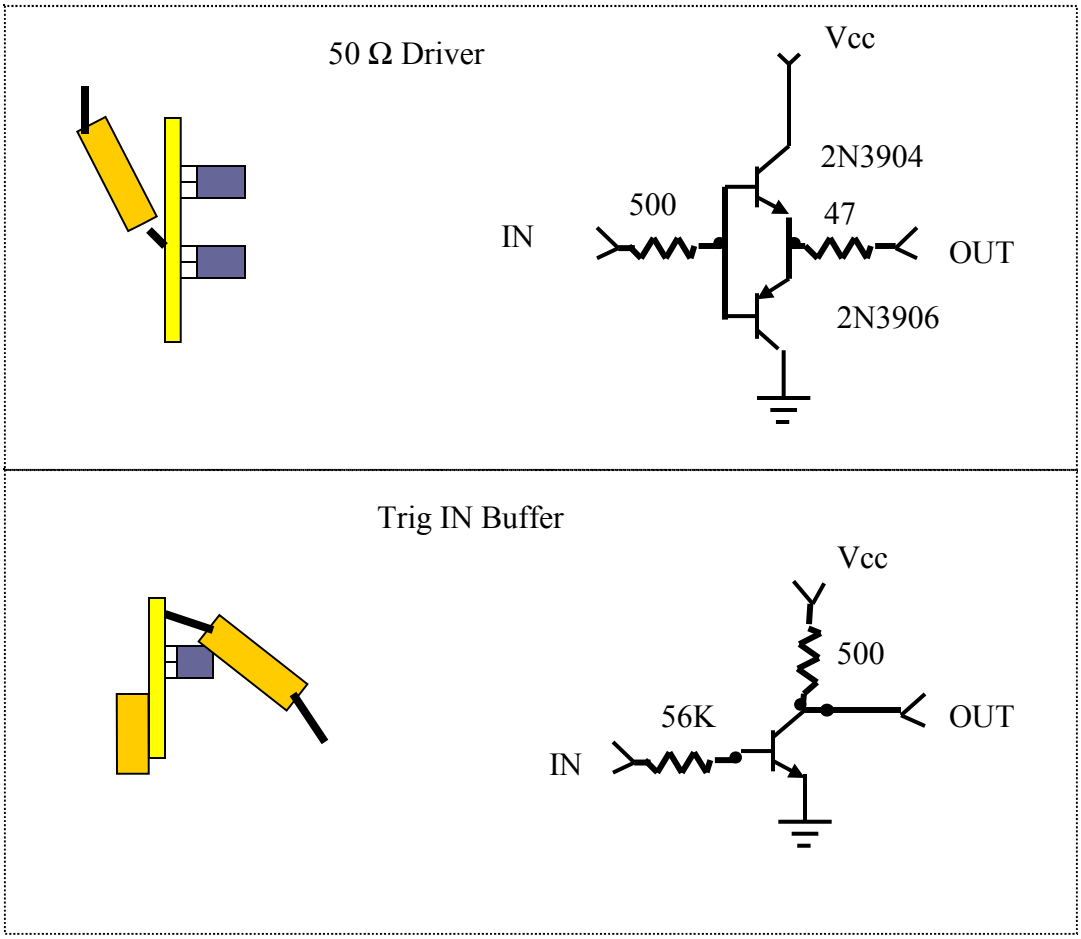


Controller

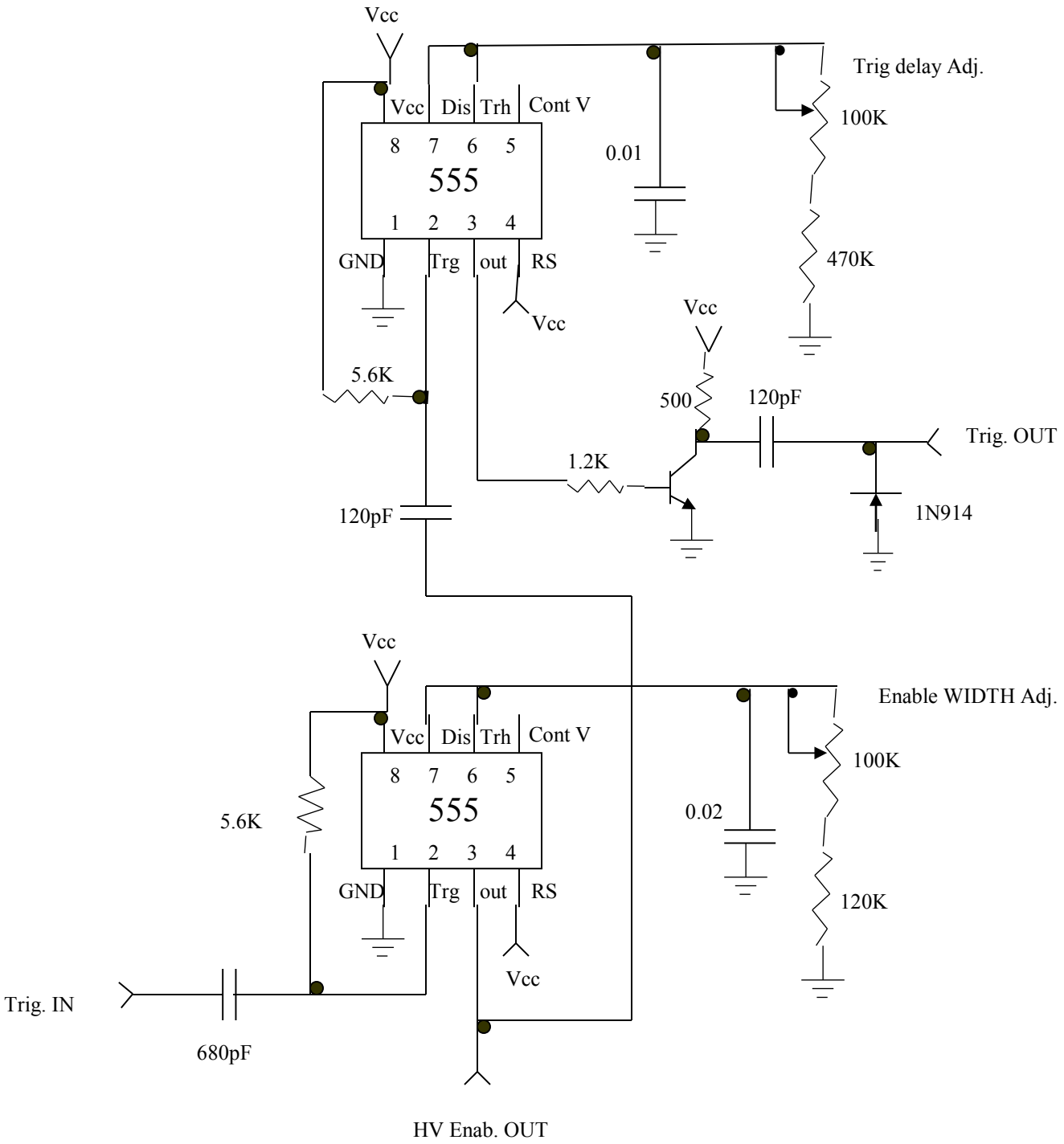
Top View / Inside



Controller

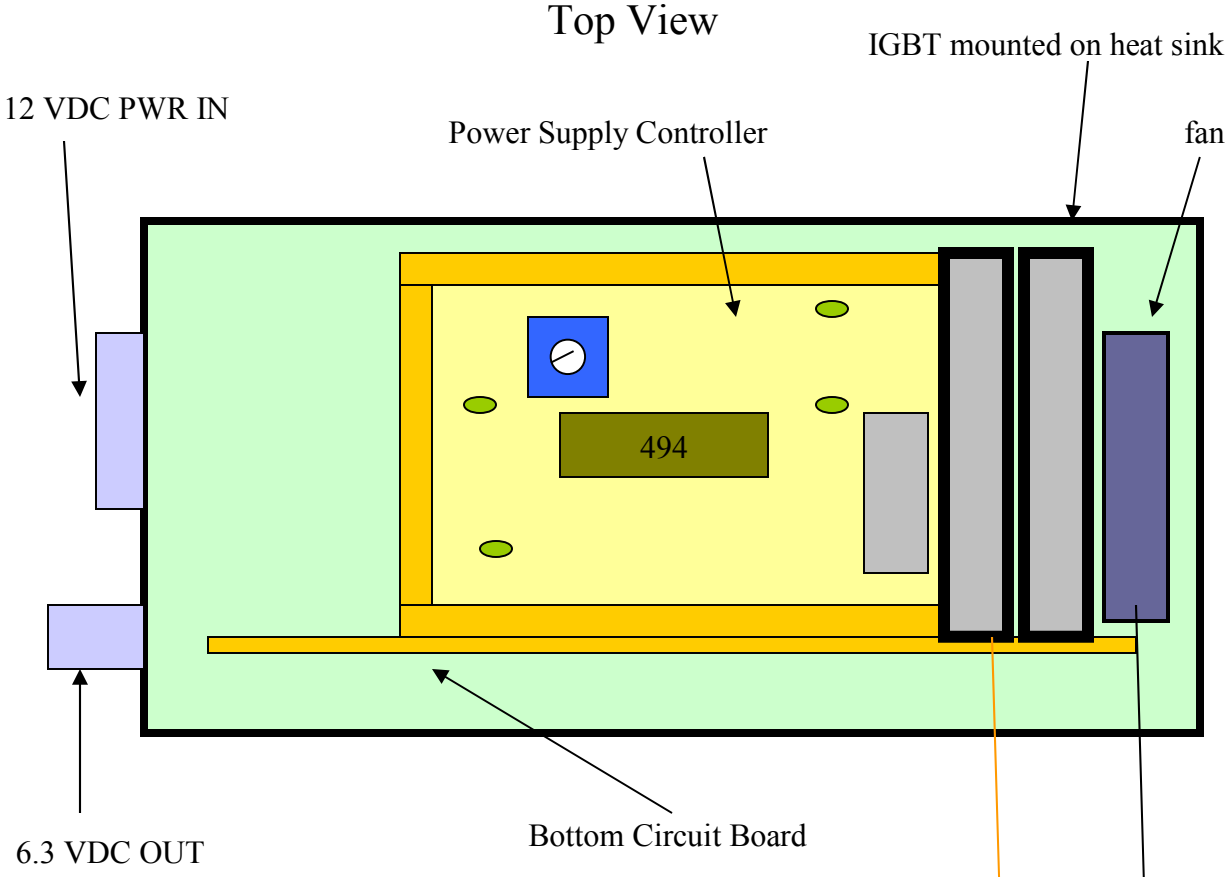

50 Ω Driver
Vcc
2N3904
500
47
IN
OUT
2N3906
Trig IN Buffer
Vcc
500
56K
OUT
IN

Controller

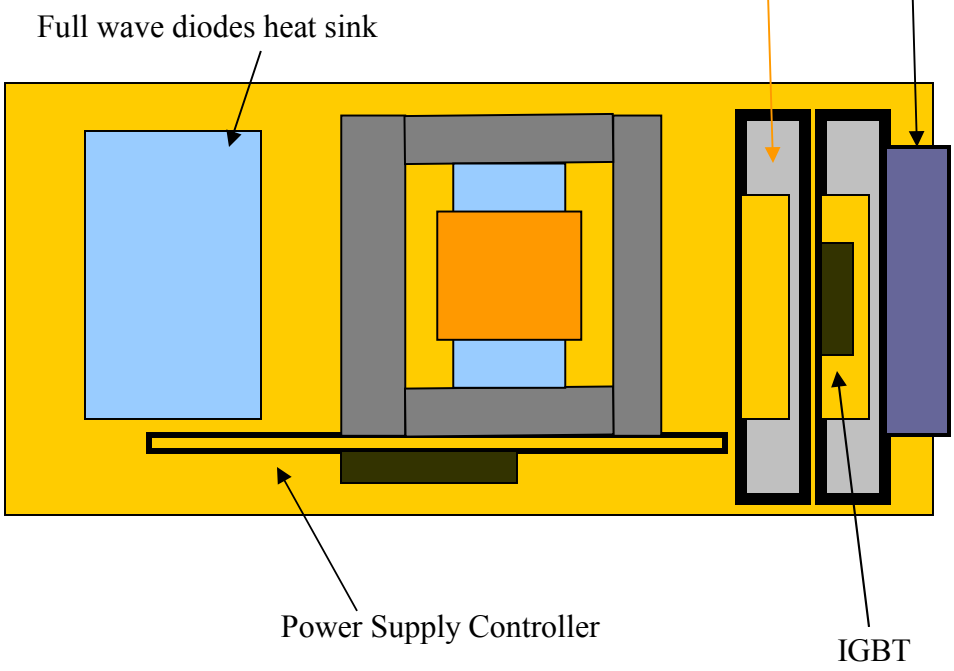

Vcc
Vcc
Dis
Trh
Cont V
8 7 6 5
555
1 2 3 4
GND
Trg
out
RS
Vcc
0.01
Trig delay Adj.
100K
470K
Vcc
5.6K
500
120pF
Trig. OUT
1.2K
120pF
1N914
Vcc
Vcc
Dis
Trh
Cont V
8 7 6 5
555
1 2 3 4
GND
Trg
out
RS
Vcc
5.6K
Enable WIDTH Adj.
100K
0.02
120K
Trig. IN
680pF
HV Enab. OUT

6.3 VDC magnetron switch mode PS

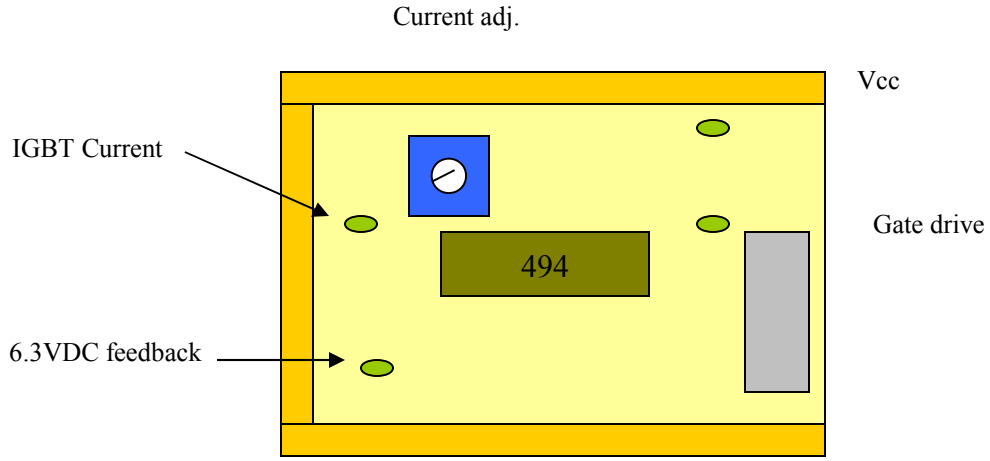
Top View

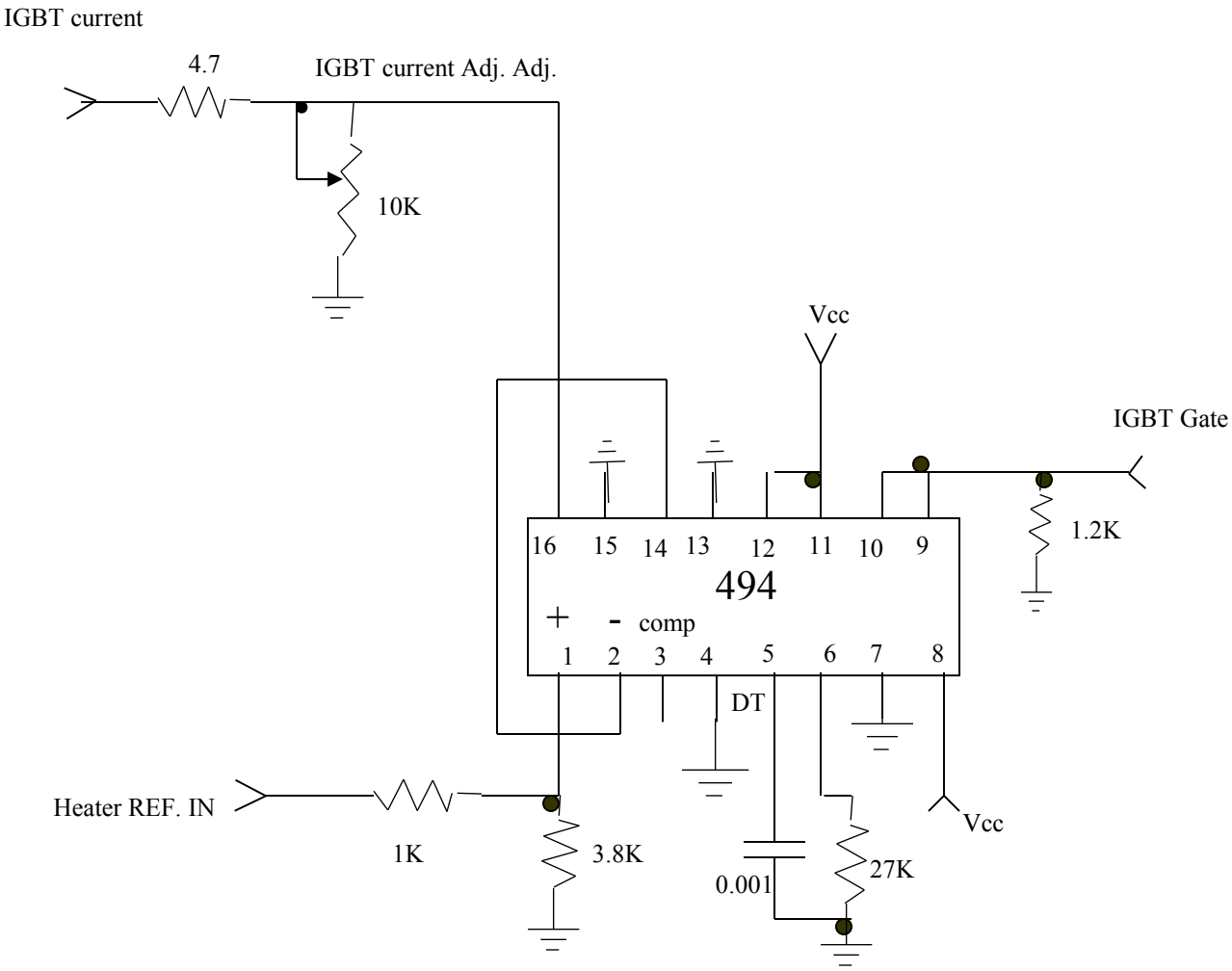


Top View of Bottom Circuit Board

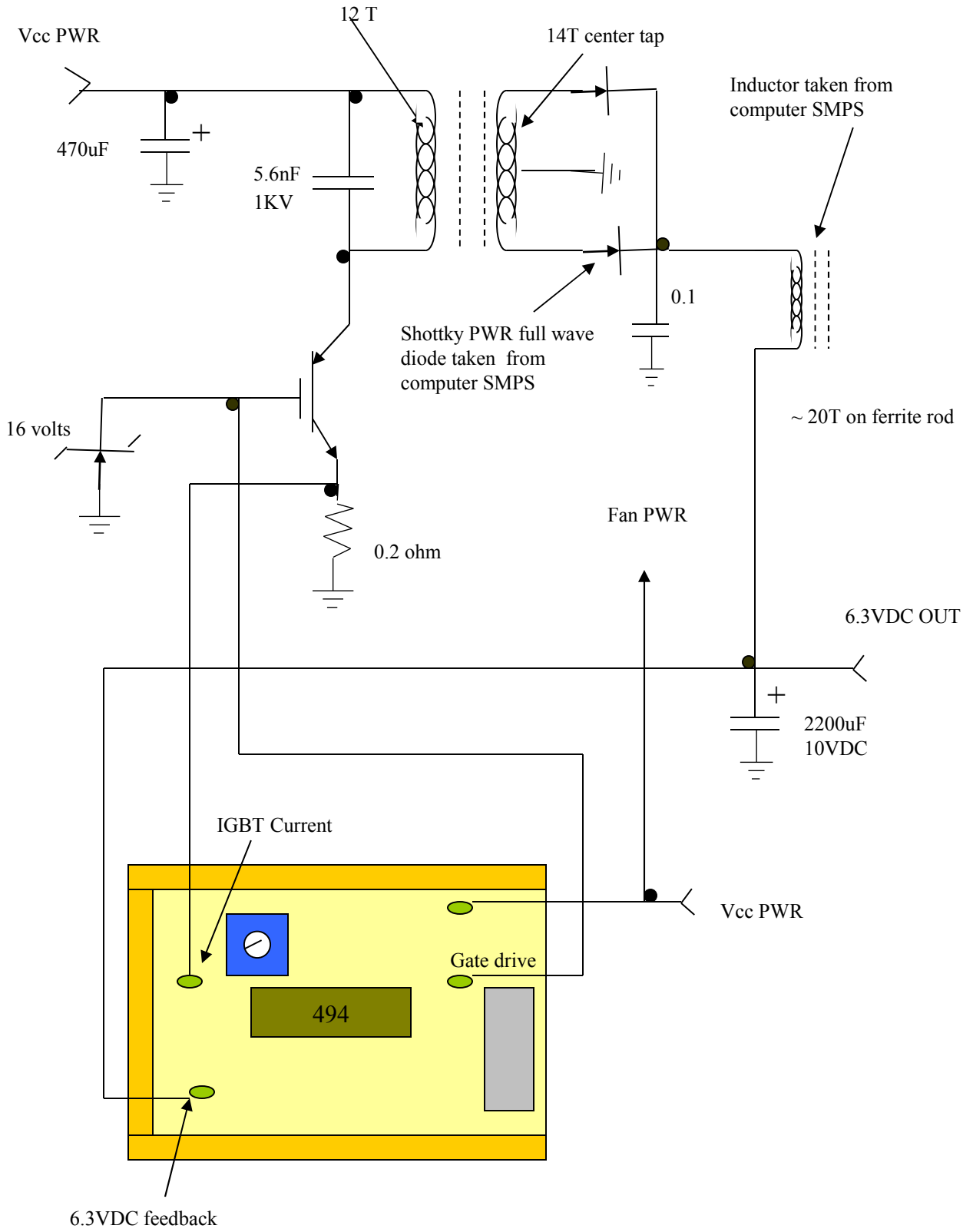


6.3 VDC magnetron switch mode PS



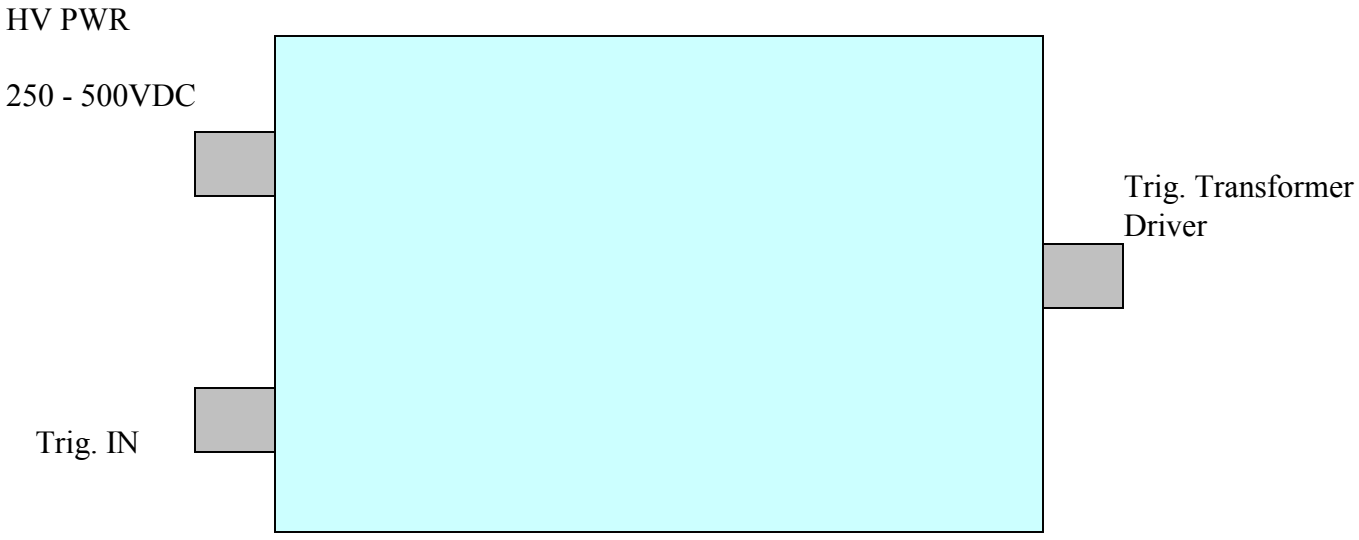


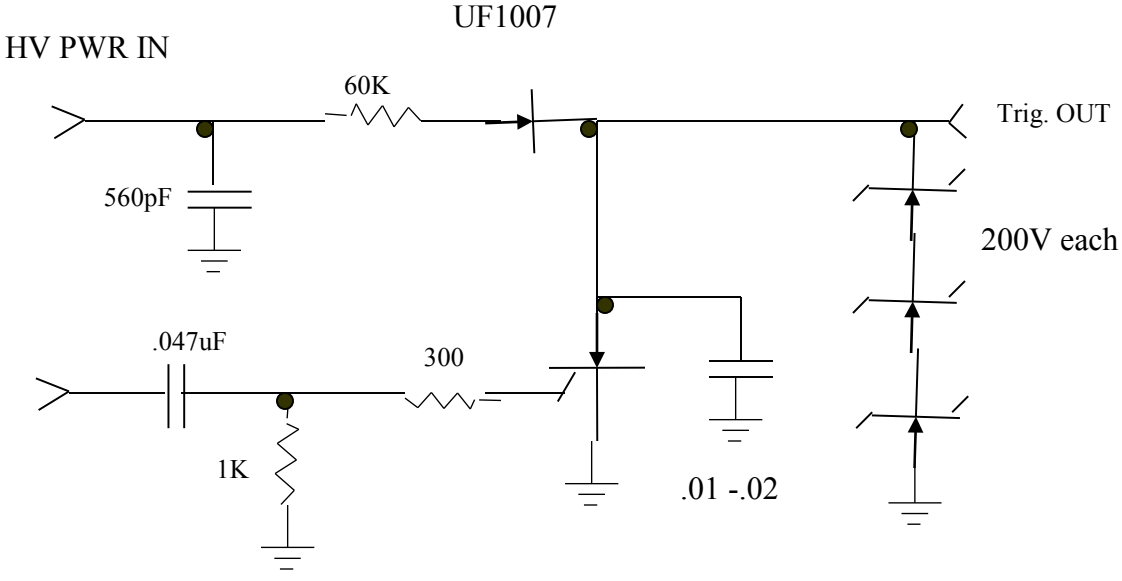
6.3 VDC magnetron switch mode PS



SCR Trig. Driver

Top View

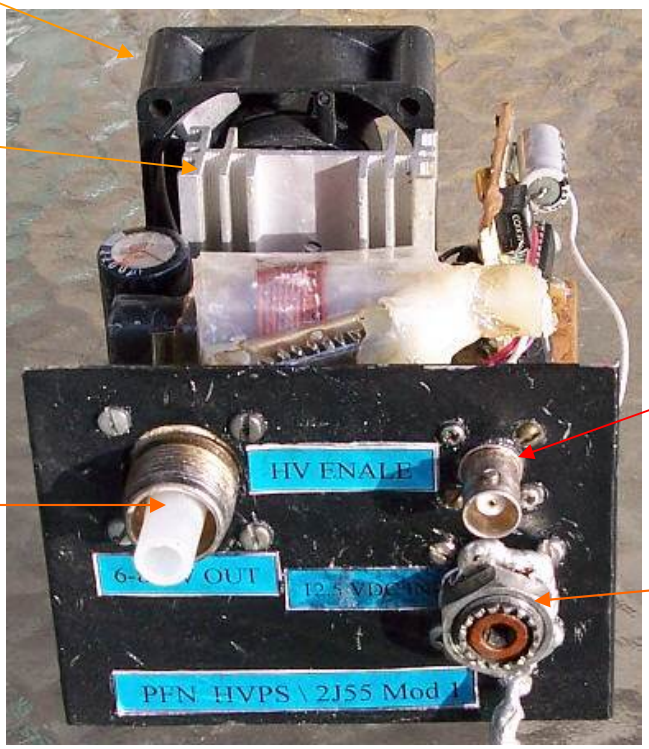




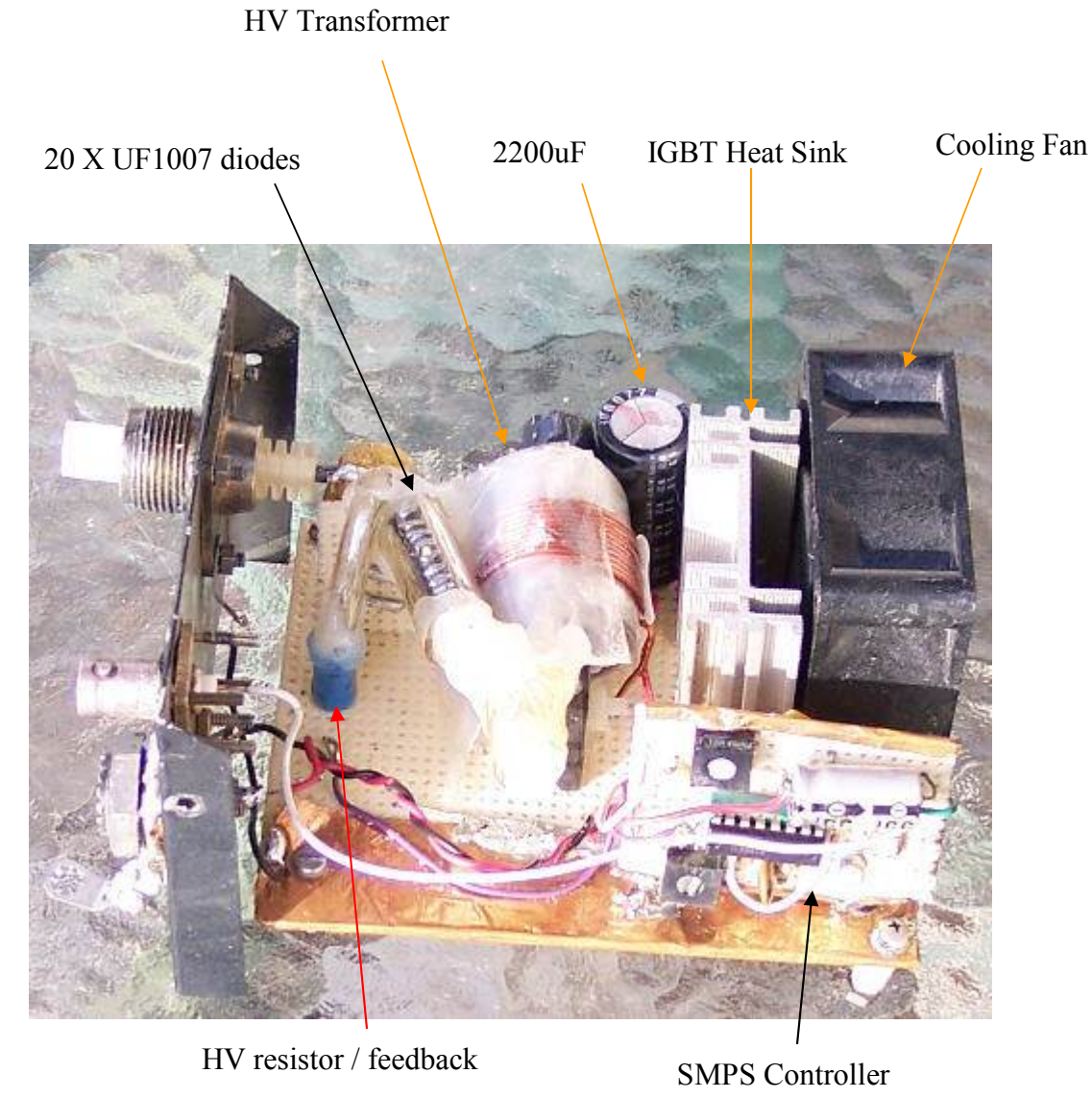
HV Power Supply

I have not been able to easily reverse engineer (lost my notes) the HV SMPS for the 1st 2J55 prototype ; some portions are my best guess , especially the HV transformer.

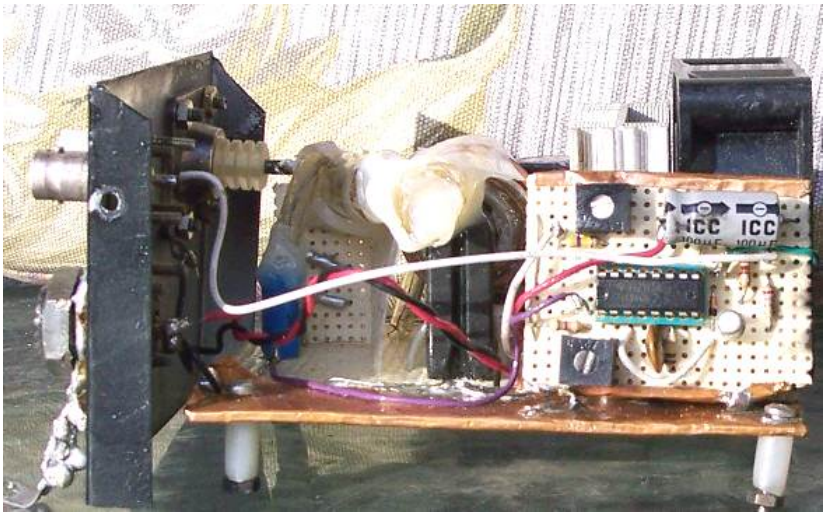
Front View / top lid taken off



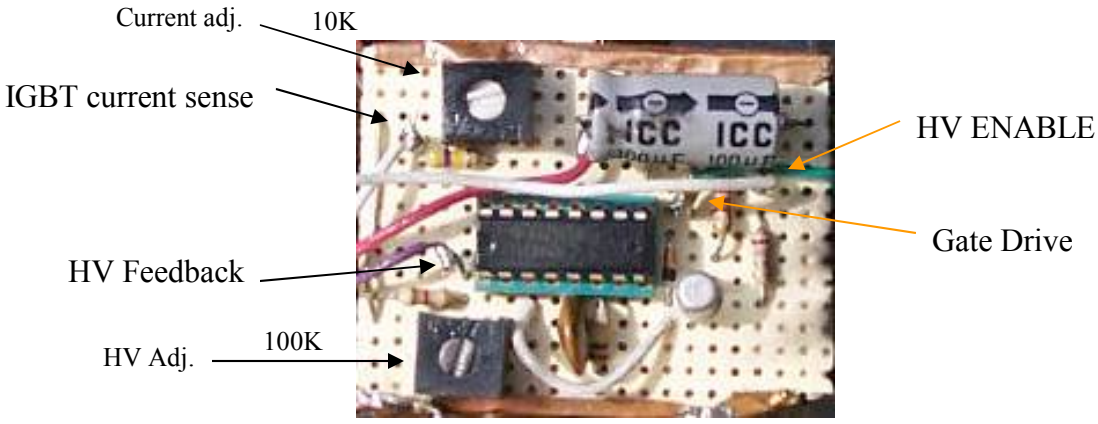
HV Power Supply



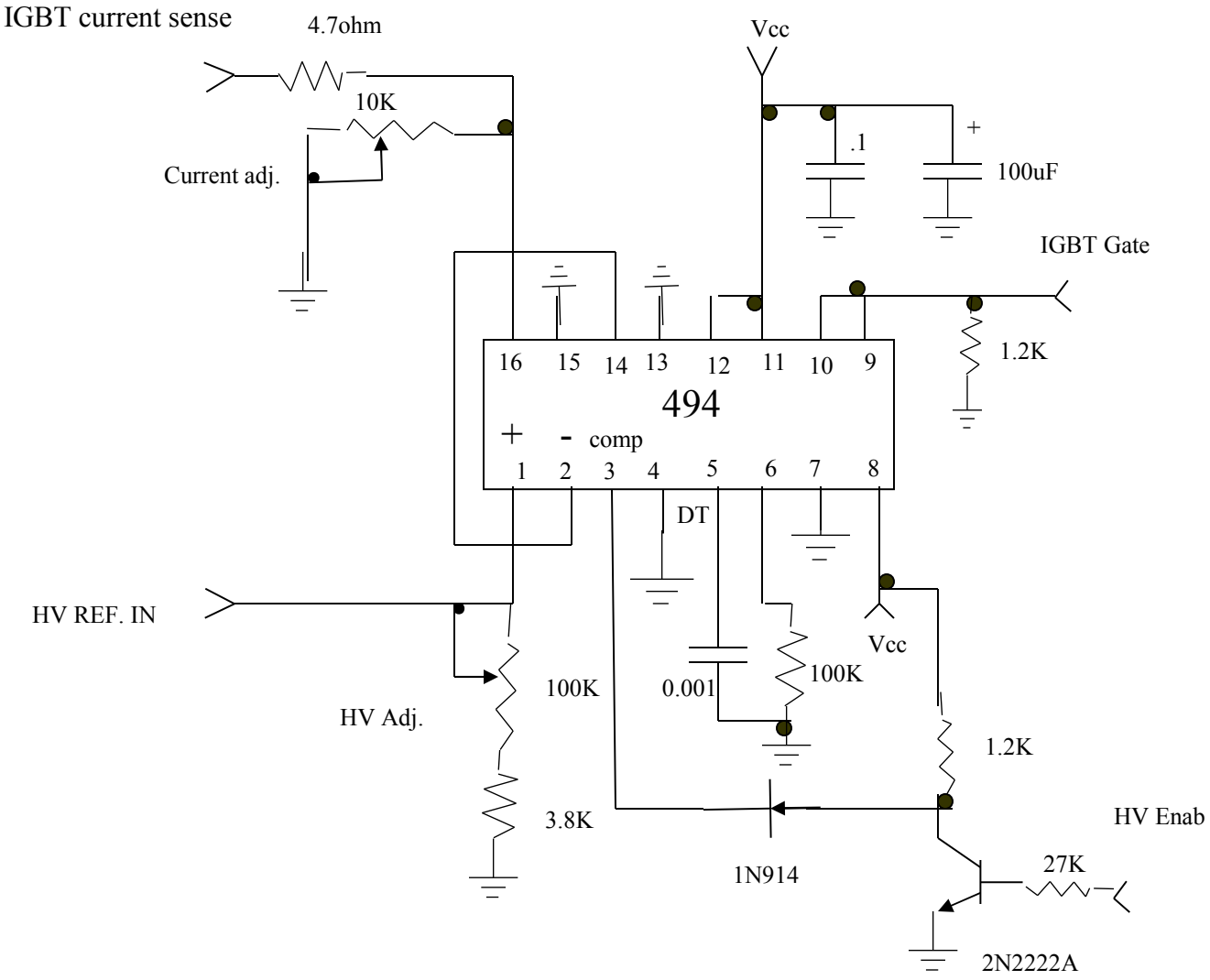
Side View showing controller board



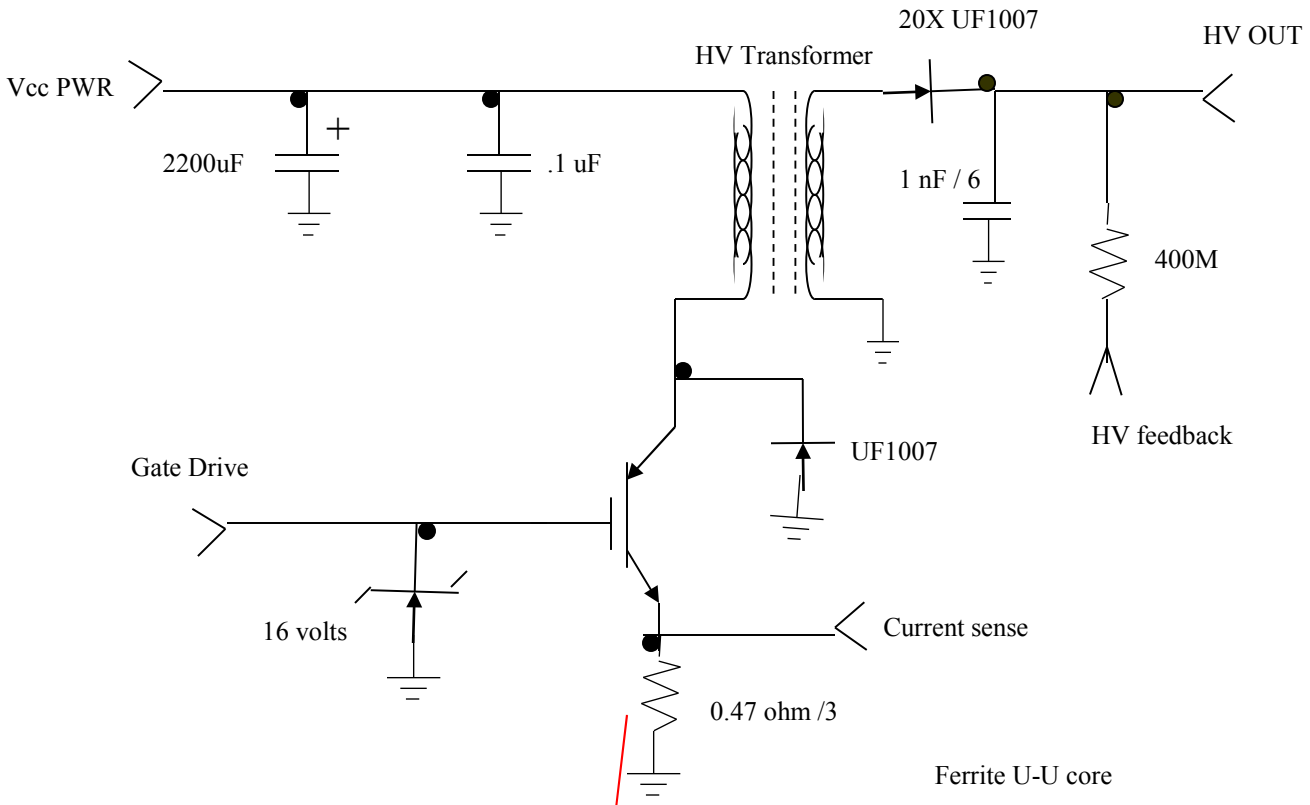
HV Power Supply



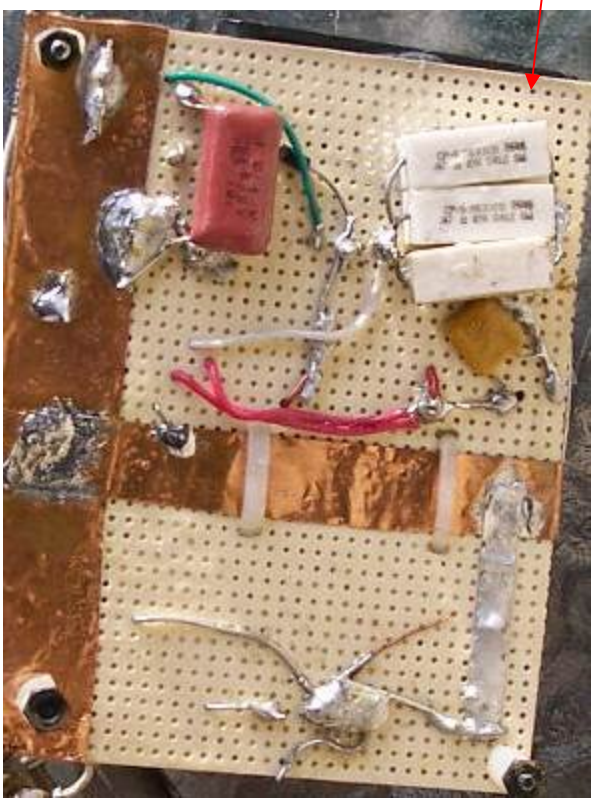
IGBT current Adj. Adj.



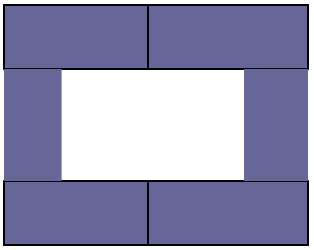
HV Power Supply



Bottom View of Main Circuit Board



Ferrite U-U core



HV Transformer