EMPGUN1 Electromagnetic Pulse (EMP) Gun

Fig 12-1

Figure 12-1 shows the construction of a low power pulse gun that will provide kilowatts of peak power at frequencies up to 100 MHz with harmonics. The unit is shown battery powered and uses the NEON21 high voltage plasma generator plans included in this data. A higher powered more functional device is being developed in our labs and will be ready by mid 2006. This is an advanced level project requiring basic high frequency electronic skills. A spectrum analyzer can be a very valuable tool in set up but is not necessary. Expect to spend $50 to $100. All parts are readily available with specialized parts through Information Unlimited (www.amazing1.com) and are listed in Table 12-1.

Basic Theory Simplified

The ability of a signal to disrupt sensitive circuitry requires several properties. Most micro processors consist of field effect transistors (FET) operating at very low voltages. Once these voltages are exceeded, catastrophic failure becomes imminent. Forgiveness to an over voltage fault is practically non-existence due to a micro thin metal oxide between controlling elements. Any over voltage generated across these elements consequently produces permanent damage or in some less severe cases cause de-programming. To generate these damaging voltages from an external source requires a wave that can produce a standing wave of energy across circuit board traces, components and other key points. The external signal energy therefore must be high enough for the circuitry geometry to be a significant part of energy at the wavelength. Therefore microwave having fast rise times (high Fourier equivalents) and burst duration are all figures of merit for maximizing the effect. The energy required also must be sufficient to enhance damage. A good figure of merit would be the quotient of energy/wavelength.

A high power pulse of microwaves can be generated in several ways:
Explosive flux compression driven virtual cathode oscillators and their generics relatives can produce giga-watts of peak power from hundreds of kilojoules. This is where a seed current is pulsed into an inductor and at its peak being compressed by a shaped explosive charge trapping the flux creating a source of high energy. The coil must be compressed both axially and along its radius using high detonation velocity explosive such as the cyclo-trimethyltrinitramine or its derivatives PETN, or other equivalent energetic explosive. This trapped flux now produces an energy gain that is conditioned into the final peak powered pulse of microwave power (HEPM) Flux compression like that of a nuclear initiation requires precise timing of the explosive chargers. Krytron switches or similar can be used for

flux compression instead of the more radiation hardened Sprytrons used in nuclear initiations where ionizing radiation is produced from the inherent fissionable materials.

A virtual cathode oscillator can also easily be energized form a small Marx impulse generator generating 200 to 400 kilo-volts. The fast current rise and high peak power can produce a powerful burst of microwaves.

Other methods are exploding wires where energy is allowed to flow into a LCR circuit and then rapidly disrupted by the explosion of the feed wire as it vaporizes at near the peak injection current. A very fast and energetic pulse is produced capable of generating an EMP pulse.

Micro wave pulses are excellent candidates for damaging sensitive electronic circuitry, but much lower frequencies are better to disrupt power grids and other similar sized systems as now the lengths of the conductive elements are more conducive to generate the high standing voltage waves. Obviously more energy is now required as breakers, switches, transformers require more energetic pulses

Circuit Description

Our circuit as shown in Figure 12 -2 provides a simple demonstration showing a method of obtaining a high power pulse with Fourier equivalents above 100 MHz. Even though the power and frequency are relatively low, close range effects are possible on many target circuits.

The project utilizes a high frequency plasma source that is converted to a direct current charging source that is short circuit functional by use of lossless reactive ballasting. This means that the capacitor can be charged without the use of an energy robbing resistor as only the real part of the complex current is seen by the battery supply.

The modified source now supplies a current charge to the reservoir capacitor (C1) to a value where spark gaps (SG1). Current through (L1) rapidly rises to a value and rings along with the circuit and lumped capacitance (C2). Spark gap SG1 must turn off and allow energy to circulate in the discharge in order to generate a resonant peak of power that is now coupled into the system emitter. Experimentation of the gap settings and pulse damping is necessary to obtain optimum effect.

Circuit Assembly

1. Fabricate a piece of lexan plastic or G10 circuit board as shown in figure 12-3 to a 7 x 2” for (PL1) plate.

Locate the two ¼” spark gap holder (SGH1, 2) screws holes and locate as shown. Holes are spaced 2 ¾” from one another.

2. Form a 3 turn 1" diameter coil (L1) from ½" sheet copper or #14 solid copper wire as shown in figure 12-4. Note the leads as attached to the capacitor (C1) and end gap holder.

3. Connect an output port at the junction of C1 and L1 as shown. This point is now considered the output and can be connected to the radiating emitter.

4. Connect the generator to the NEON21 plasma driver as shown in figure 12-2 schematic. Note the added diodes D1, 2 for converting the output to direct current.

5. You will note a coil (L2) connected in series with the output lead. This inductor tunes out the capacitive reactance of the lead and the end capacitance. Experiment using a radio or absorption wave meter to determine the resonant frequency of L1/C1. Select a value for L2 to provide maximum radiation from a distance.

6. Experiment on various electronic devices and observe the effects at various distances.

7. Install in a gun like enclosure using your own ingenuity

Notes:

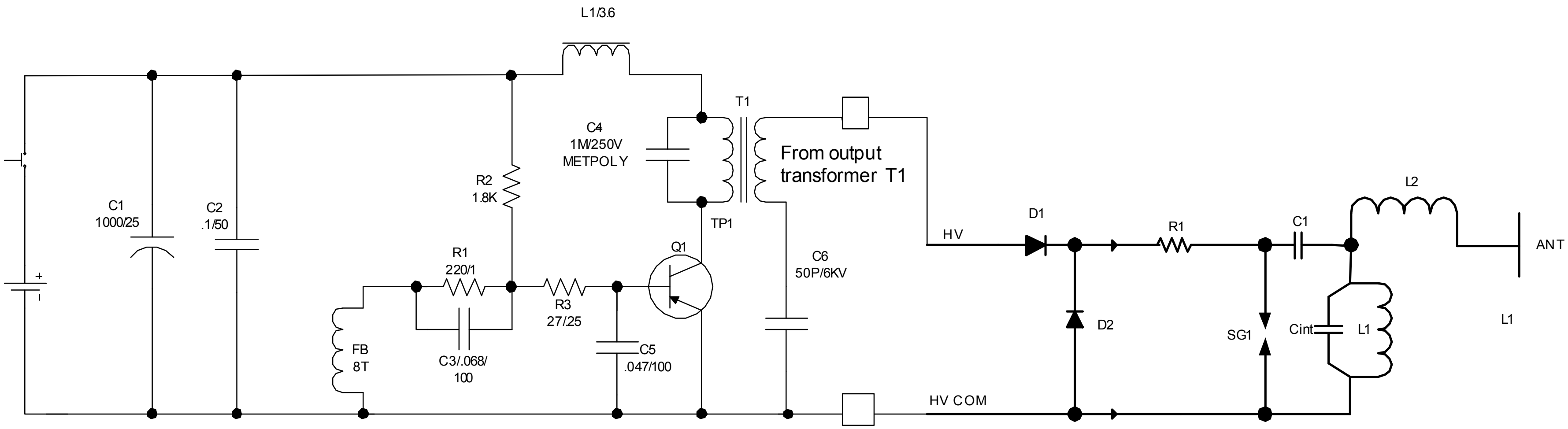
A low cost spectrum analyzer would be a great aid in setting up this system for wave damping etc

Please note this is a low power device intended as an introductory project for those desiring in experimenting with shock pulse and EMP research. Several more functional and sophisticated devices will be featured in the next book in this series.

Table 12-1 EMP Gun Parts List

Ref#	Qty	Description	DB#
R1	3	47K 1 watt resistor (yel-pur-or) connected in series	
D1,2	2	16 KV 10 ma fast recovery high voltage rectifiers	#VG16
C1		.05 mfd 5 KV strip line capacitor	#.05M/5KV
L1		Inductor 3 turns 1" diameter use #12 copper wire	
L2		Inductor wind as directed in text	
ELECTTRODES	2	½ X 1" pure tungsten electrodes	#TUNG141B
PL1		7 x 2" x .063 Lexan or G10 plastic	
TYE1		10" nylon tie wraps	
SW1/NU1	2	¼ X 1" brass screw and nuts	
NEON21K		Plasma driver kit	#NEON21K
NEON2100		Plasma driver assembly	#NEON2100

Figure 12-2 Circuit Schematic



NEON21 Power Module

The ideal peak power of this circuit can be approximated by evaluating the product of the charge voltage across C1 x the peak current as determined by Ipk = Epk x the square root of the capacitance of C1/the total inductance of the discharge circuit. This expression implies no resistance (R) in the discharge circuit that now is only in an ideal situation. In all actuality the resistance in the real world will now be a factor in where e to the -(pi/square root of L/C) / R must be a factor in the above ideal condition. This now implies a damped waveform.

Diodes D1,2 are 10 kv 10 ma fast recovery
Resistor R1 is three 47k 1 watt resistors in series and isolate the diodes from the dv/dt of the discharge.
L2 inductor tunes out the capacitive reactance of the antenna at the desired resonant frequency

Capacitor C1 is a “slapper” capacitor. These are used to produce a very fast rise time necessary to detonate initiators necessary for initiating high explosive. Its claim to fame is the high peak current discharge current. The capacitor is constructed as strip lines with the connection leads exiting a common end.

Fig 12-3 Generator Board Bottom Gap View

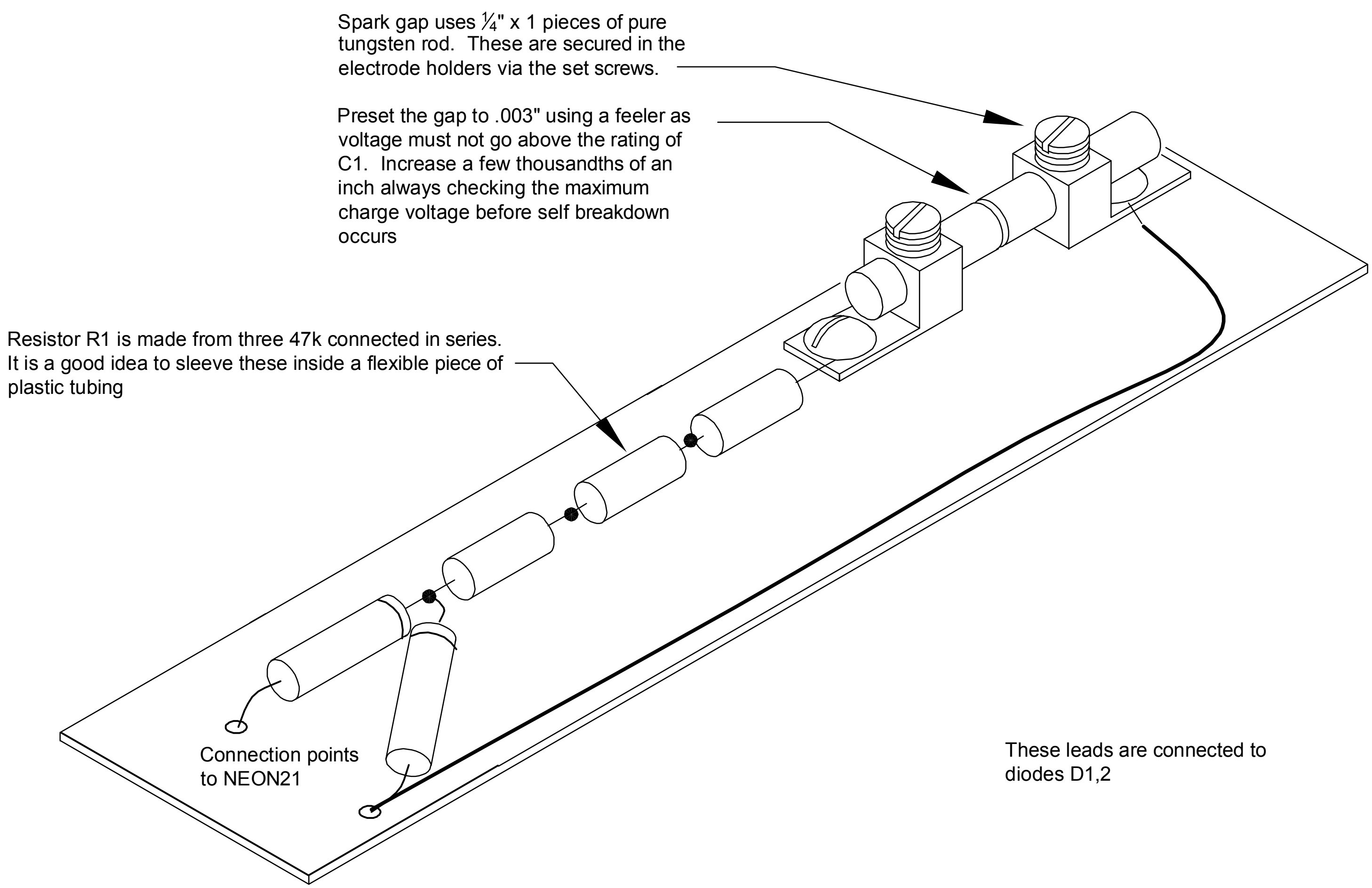
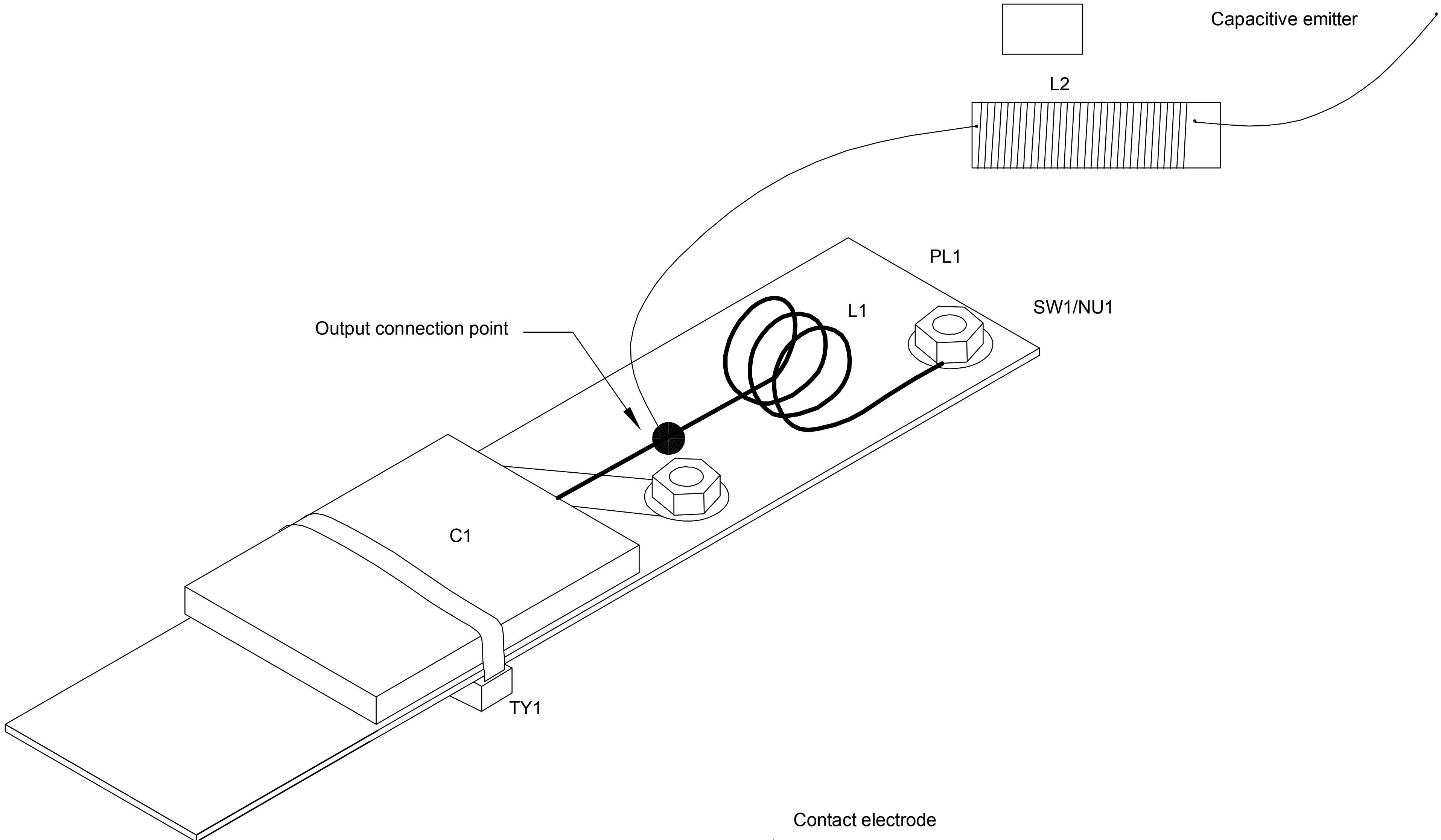
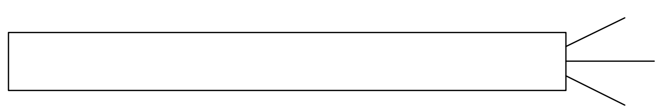


Fig 12-4 Generator Board Top View





Side view of C1 showing copper strip electrodes seperated by a dielectric insulating piece. Very carefully solder to the foil electrodes of C1 being careful not to burn the insulating foil

NEON21 Universal Low Power Plasma Supply

Useful modular circuit can be used for a low power source of high frequency for energizing gas discharge displays by contact or proximity. High frequency arc can be used for etching, precision burning, chemical excitation, wart removal, Kirlian photography, wireless energy transmission and more. Power supply is easily retrofitted to our multiplier modules for DC voltages up to 100 kv. The unit is open and short circuit protected and can be operated fro 12 vdc or 115 vac via a wall adapter.

This is an intermediate level project requiring basic electronic skills. Expect to spend $25 to $35. All parts are readily available with specialized parts through Information Unlimited (**www.amazing1.com**) and are listed on the parts list at the end of these plans.

Driver Circuit Description Reference Figure 10-2

The circuit is a frequency, high voltage oscillator that consists of transistor (Q1) connected as a simple oscillator where its collector drives the primary winding (PR1) of resonant transformer (T1). Feedback is obtained via a second winding (FB) and fed to the base of Q1 thru current limiting resistor (R1). Resistor (R2) biases Q1 into conduction and initiates oscillation.

Capacitor (C3) speeds up the “turn off” time of Q1 while resistor (R3) capacitor and (C4) provide a filter to prevent oscillation at the self resonant frequency of T1. Resonating capacitor (C5) resonate the transformer to around 35 kHz. Current limiting inductor (L1) limits the short circuit current to a non catastrophic value. Capacitor (C1) and (C2) bypass any signal to ground

Figure 10-3 Board Assembly

1. Layout and identify all parts and pieces. Verify with parts list, separate resistors as they have a color code to determine their value. Colors are noted on parts list.

2. Obtain the available printed circuit board as shown figure 10-3 or fabricate a piece of perforated circuit board to the PC as laid out. Note size of the printed circuit board is 3 1/2" X 1-3/8" and contains the silk screening that shows the positioning of the mounted parts**.**

3. If you are building from a perforated circuit board it is suggested to Insert the components starting in the lower left hand corner. Pay attention to polarity of capacitors with polarity signs, and all semiconductors. Route leads of components as shown and solder as you go cutting away unused

wires. Attempt to use certain leads as the wire runs. Follow foil traces on drawing as these indicate connection runs on underside of assembly board.

4. Insert the components as indicated by the silk screened identification numbers. Compare with the bill of materials to identify. Attach three 6” #22 -20 leads as shown for input power (P1,2) and external high voltage return. Attach a high voltage lead to the output as shown. Note this lead must be selected for required length. Use silicon 20 kv dc wire or equivalent. Note the ground lead that connects to the metal frame under the screw head. as shown.

5. Double check accuracy of wiring and quality of solder joints. Avoid wire bridges, shorts and close proximity to other circuit components. If a wire bridge is necessary, sleeve some insulation onto the lead to avoid any potential shorts.

6. Fabricate the metal bracket (BRKT1) from a piece of .062 sheet aluminum and final assemble as shown figure 10-4. Note that the metal tab of Q1 must be insulated from the bracket as shown on the mounting scheme. This piece is also the heat sink for Q1.

Driver Board Testing

7. Obtain a 12 volt DC source preferably with a volt and ammeter. Leave out put leads open circuit and apply power. Note a current draw of less than than 250 milliamps. If you have a scope, observe the wave shape at the collector of Q1 as shown figure 10-2.

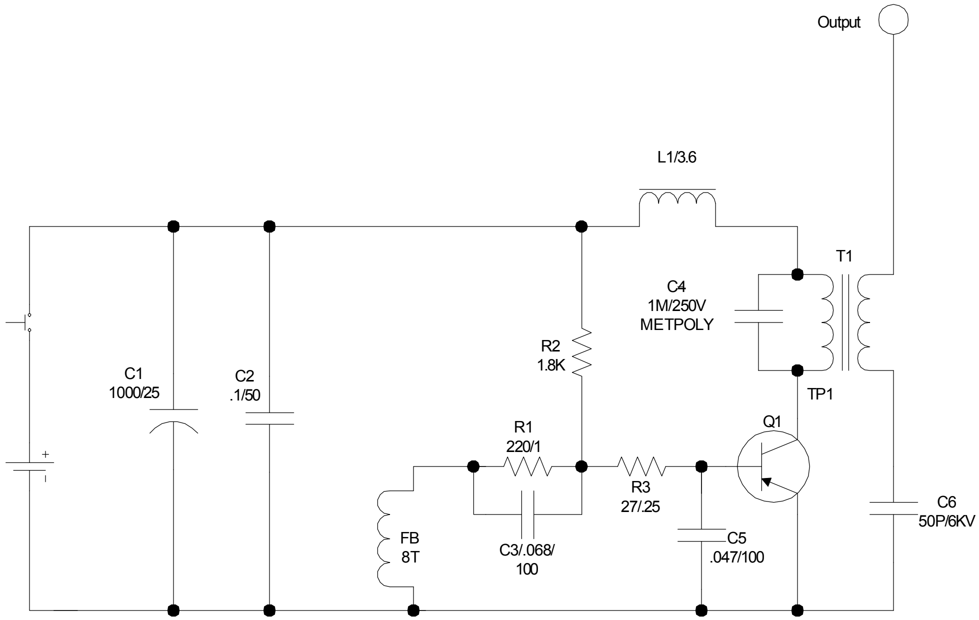
8. Contact the high voltage output lead to the bracket and note that you can draw a ½ inch arc with the input current going to 1 amp.

This completes this module.

Table 10-1 Parts List

Ref#	Qty	Description	DB#
R1		220 OHMS 1W (red-red-br)	
R2		1.8K 1/4 W (br-gray-red)	
R3		27 OHMS 1/4 W (red-pur-blk)	
C1		1000 mfd/ 25 volts vertical electrolytic capacitor	
C2		.1mfd/50 volts plastic (small blue capacitor)	
C3		.068mfd/ 50 volts plastic capacitor (683)	
C4		1mfd/ 250 volts (mf) larger blue plastic capacitor	
C5		.047mfd/ 100 volts plastic capacitor (473)	
C6,7	2	25 pfd at 6Kv ceramic capacitor or single 50 pfd 6 Kv.	
Q1		MJE3055T to220 power tab NPN transistor	
T1		Special high frequency transformer	#28K089
WR20	24"	#22-20 Vinyl stranded hook up wire	
PCMTC		MTC3 printed circuit board	#PCMTC
		Or use a piece of 3 1/2 x 1 1/2" .1 grid perf board	
BRKT1		Fabricate as shown figure 10-4	
WR20	4”	20 KV silicon high voltage wire	
		Assembled high voltage module figure 10-4	#MINIMAX7
14V/1G		14 volt 1 amp grounded adapter	#14V/1G

Figure 10-2 Circuit Schematic



WAVESHAPE AT TP1

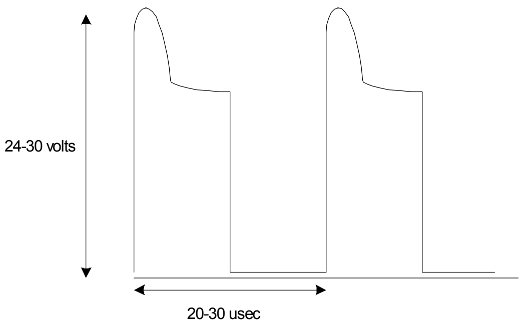
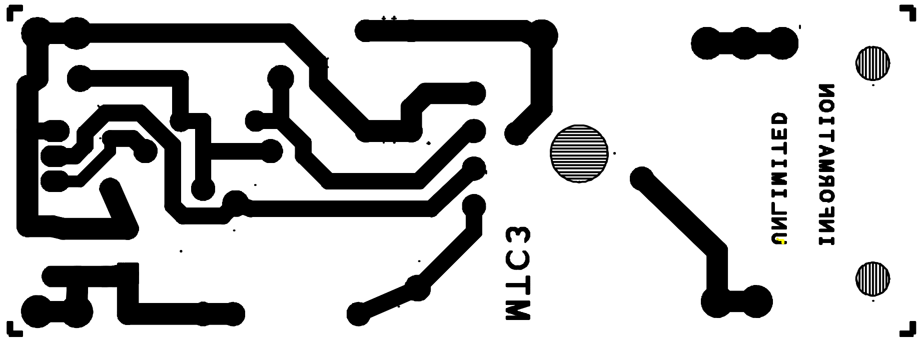


Figure 10-3 Views of the printed circuit board



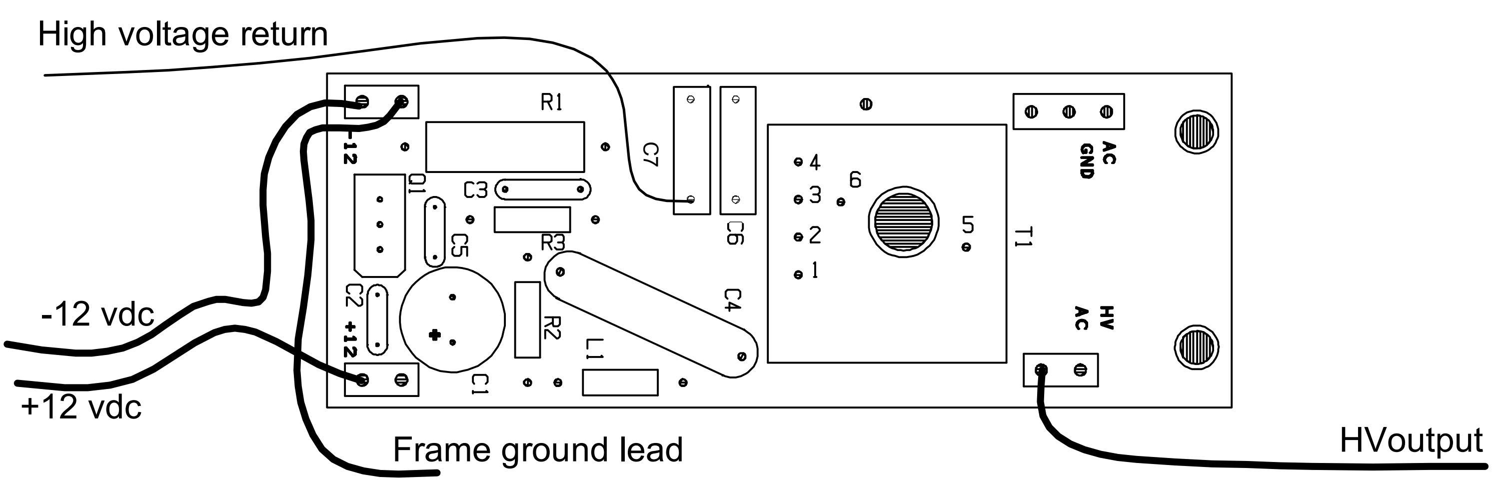
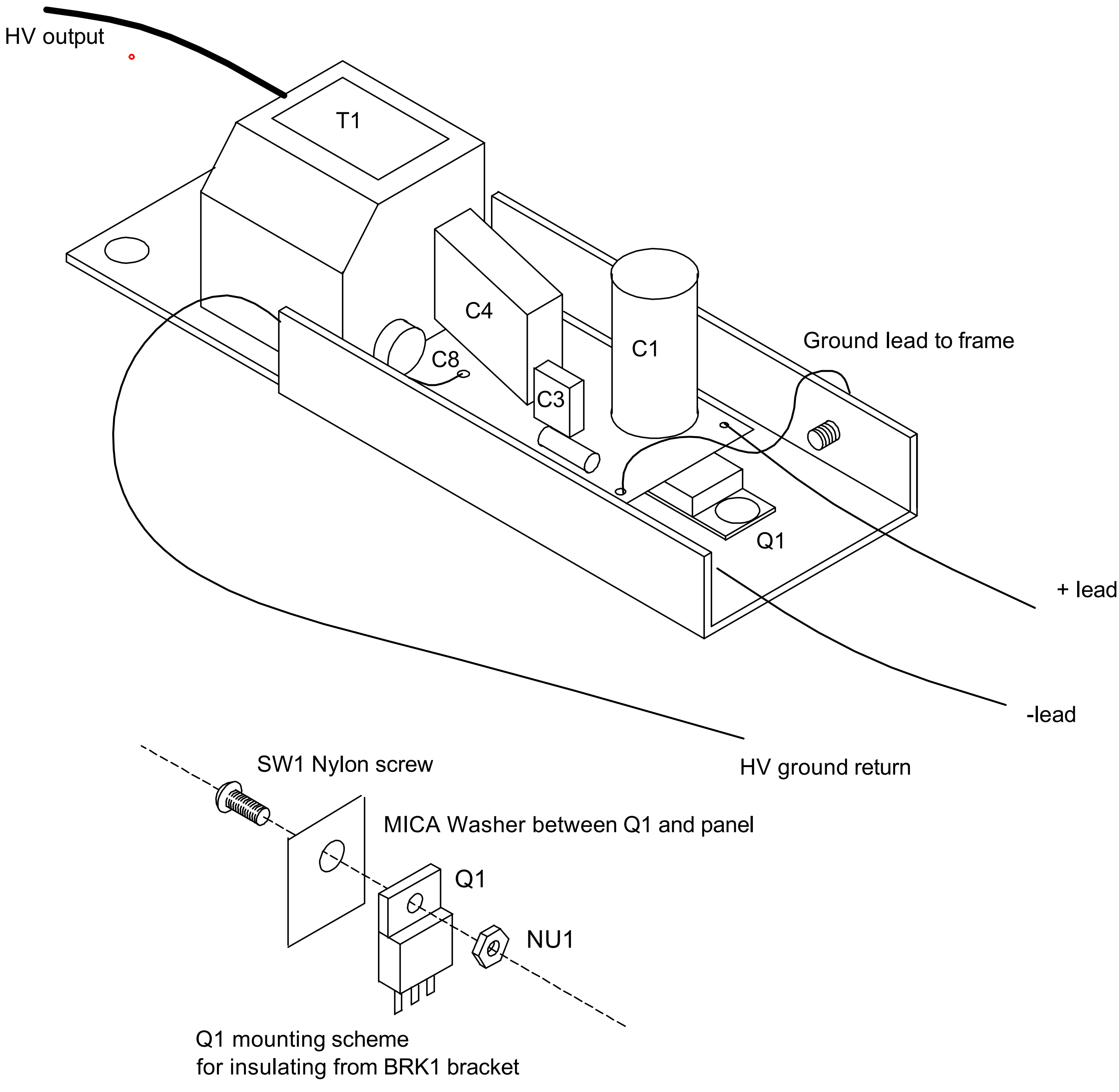


Figure 10-4 Iso view of driver module



Q1 mounting scheme
for insulating from BRK1 bracket