Battery Charging Regulator

- D_1 D_2 produce full wave rectifier signal across SCR_1
- 12 Volt battery will be charged
- At low battery voltage SCR_2 is at Off state (so SCR_2 is open)
- If SCR_2 is open, SCR_1 acts as series static switch control (discussed in early examples)
- If full wave rectified input is high enough to produce the required turn-on gate current (controlled by R_1) SCR_1 will turn on and it will charge the battery
- At the beginning as battery is starting being charged the voltage V_R will be low, due to voltage divider resistor ratios (R_4 and R_5)
- As V_R is low the Gate value of SCR_2 $G_{SCR_2} = V_{R2} + V_Z$ and V_Z will be very small (below 11 volt) for conduction and firing SCR_2, (Zener acts open in this case)
- C_1 regulates the voltage at G_{SCR_2} and prevents any transients to turn on G_{SCR_2} on. (It acts as a DC holder circuit)

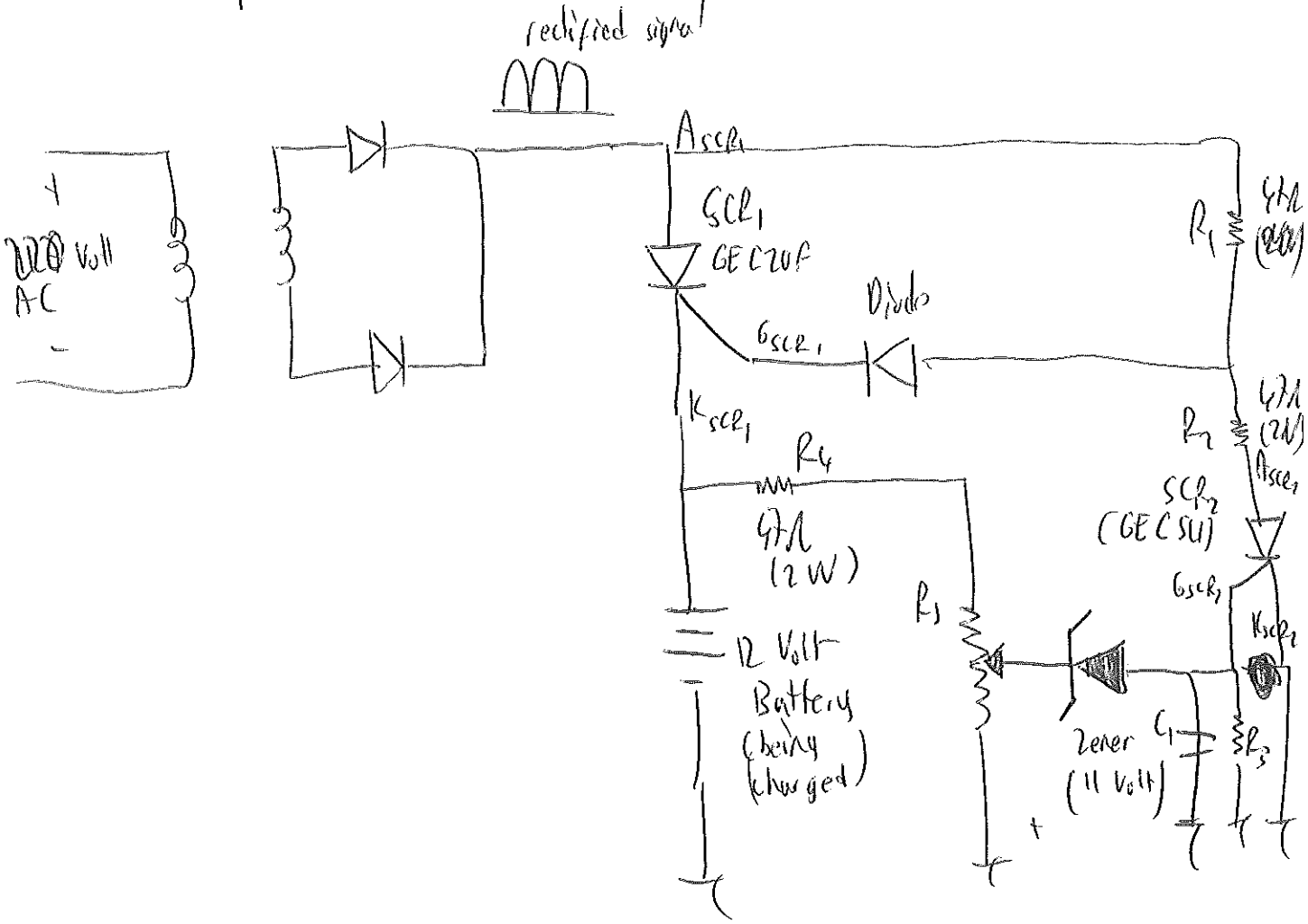
- As charge increase V_R will increase

$G_{SCR_2} = V_R + V_Z \rightarrow V_R$ (it will go to on mode)

at $V_Z \simeq 11$ volt it will fire G_{SCR_2}

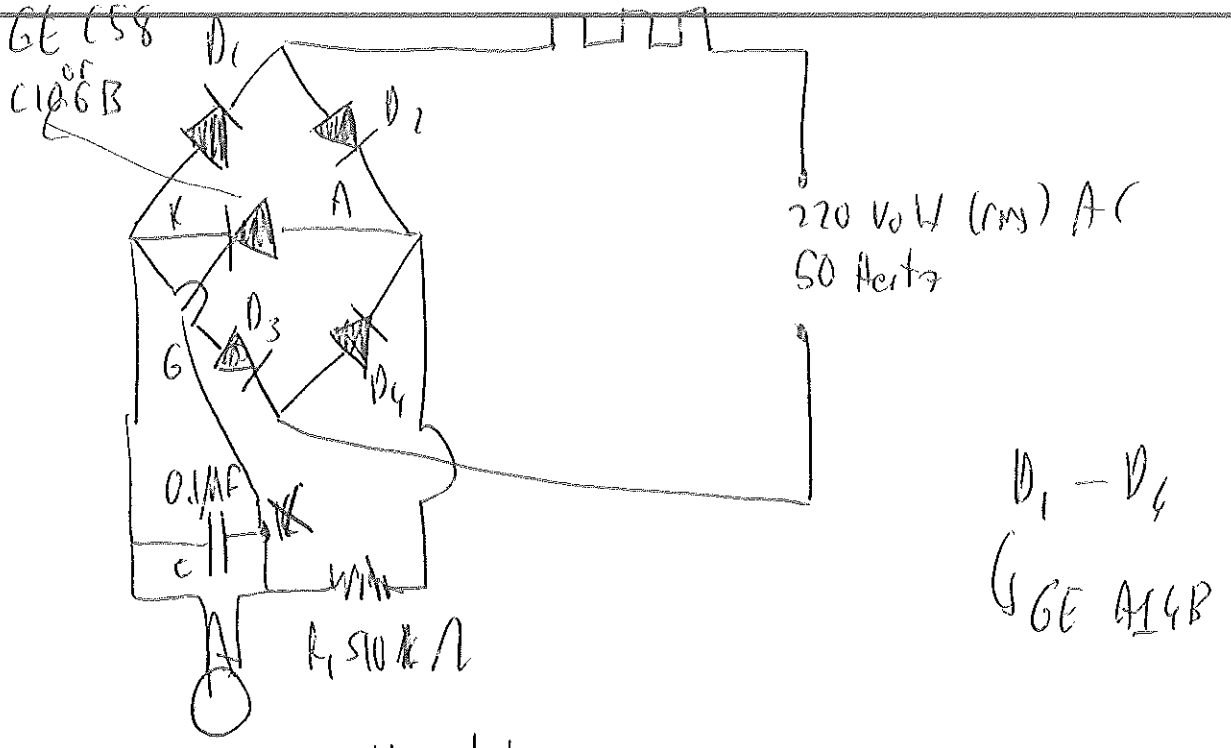
- As G_{SCR_2} fired SCR_2 Anode-Cathode will be short circuit V_2 will drop to a lower value and SCR_1 will be at off state (this means charging is finished)

Circuit for battery charging



Temperature Controller

100 - Watt heater load

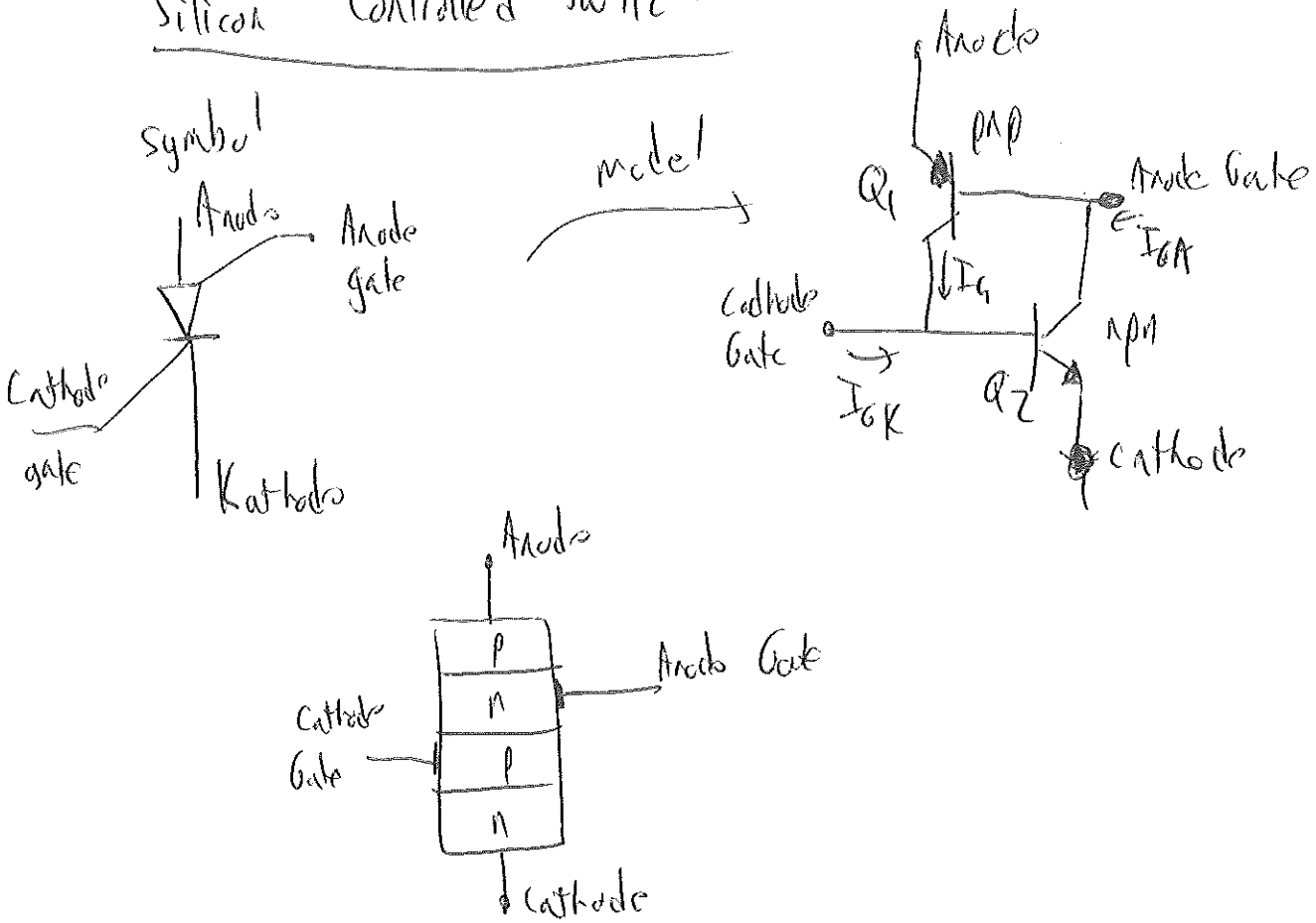


Mercury ← Hg in glass thermostat
(such as vap-air div. 206-44 series
prime #T141 or equivalent)

- In this circuit SCR acts as current amplifier
- It is not an amplifier in the sense that it magnifies the current level of the thermostat. Rather, it is a device whose higher current level is controlled by the behavior of thermostat
- We observe full-wave rectified voltage over SCR
- When thermostat is open the capacitor voltage will be charged over R_1 and C, and time constant will be $\tau = CR_1$ as the charging happens K voltage will reach to a value to fire G-K.
- This will trigger the SCR during each half-cycle of the input signal, permitting a flow of charge (current) through heater

- As the temperature rises, the conductive thermistor will be short circuit (as a result capacitor will be shorted) and they will eliminate the possibility of the capacitor charging to the firing potential and triggering the SCR.
- In this case R_1 will have very low current value

Silicon Controlled Switch



Turn on techniques

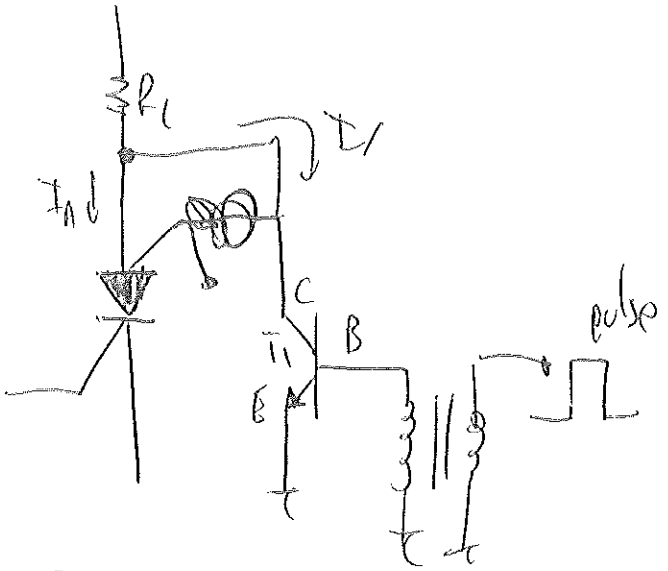
- Anode gate connection can be used to turn the device ON or OFF
- To turn OFF a negative pulse is necessary and to turn off a positive pulse is necessary.

- A negative pulse at the anode gate will forward bias base-to-emitter junction $V_{EB_{Q_1}} > 0$ so Q_1 will be on and I_{C_1} will be produced and I_{C_1} will turn on Q_2 resulting in a regenerative action and the ON state for SCS (Silicon Controlled Switch) will be observed

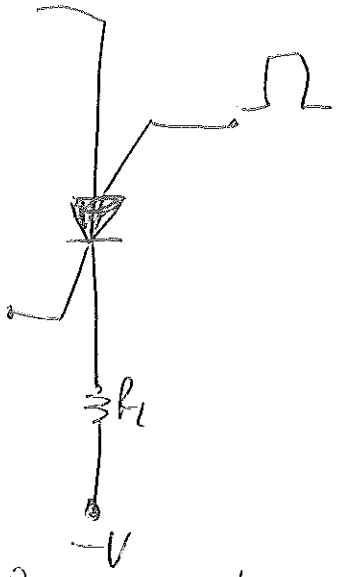
- Reverse A positive pulse will turn base-to-emitter junction to reverse bias $V_{EB_{Q_1}} < 0$ so Q_1 will be Off an SCS will be off state,

Generally turn-on anode gate current I_{GA} is 1.5mA whereas the required cathode gate current I_{GK} is 1mA.

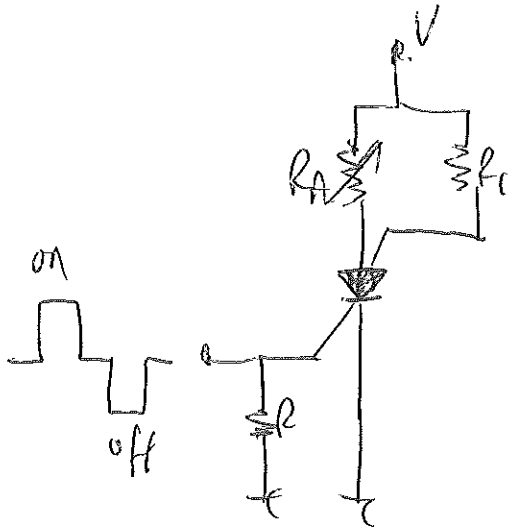
Turn-off circuits



(a) Apply pulse, the transistor will conduct heavily, resulting in low impedance (short-circuit) over C and E of T_1, so I_f will be pulled by T_1 and I_x will increas I_A will decrease



(b) Positive pulse at the anode gate will open circuit SCS



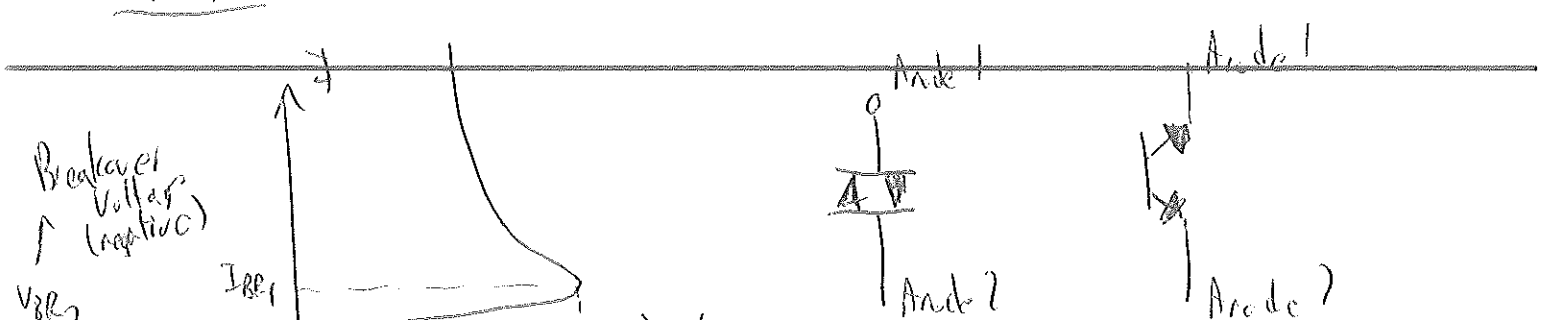
(c) apply a suitable pulse ~~(on)~~ (on or off) at the cathode gate with proper magnitude

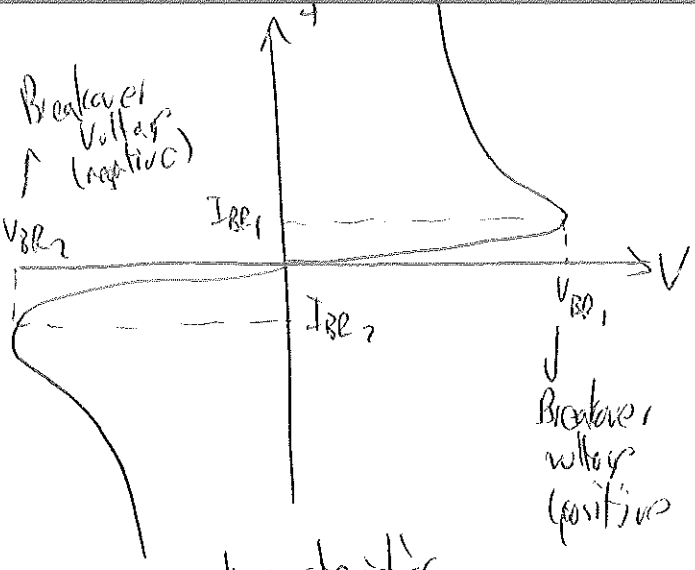
- R_A should be selected suitably

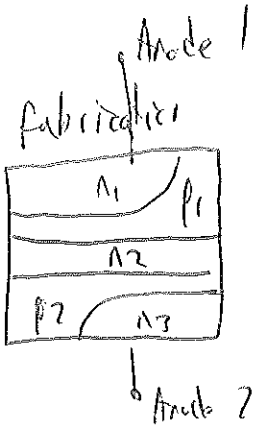
- SCS has reduced turn-on time w.r.t. SCR
- SCS has increased triggering and control sensitivity
- Applications of SCS (Voltage sensor, alarm circuit)

DIAC

symbols





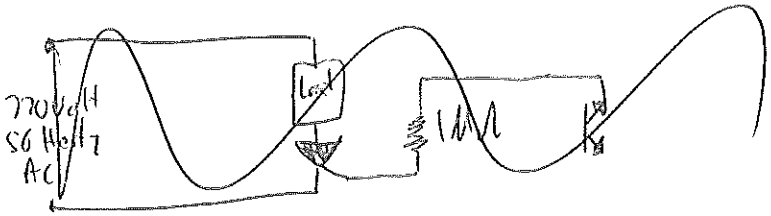


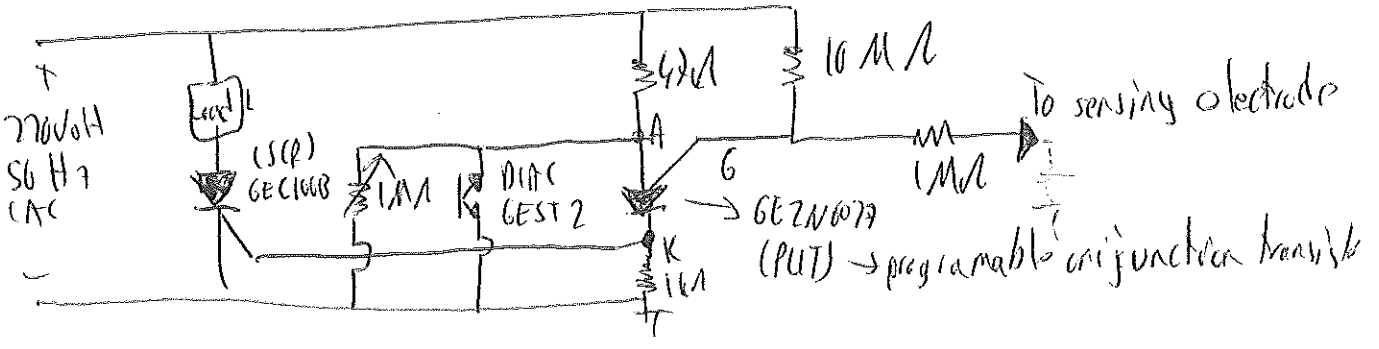
I_{BR_1}, I_{BR_2} → breakover currents

- Permit triggering in both directions
- ON operation is possible in both directions
- Generally $V_{BR_1} = V_{BR_2} \pm 0.1 V_{BR_2}$

$28 < V_{BR_1}, V_{BR_2} < 42$ @ $I_{BR_1}, I_{BR_2} \approx 0.2$ mA

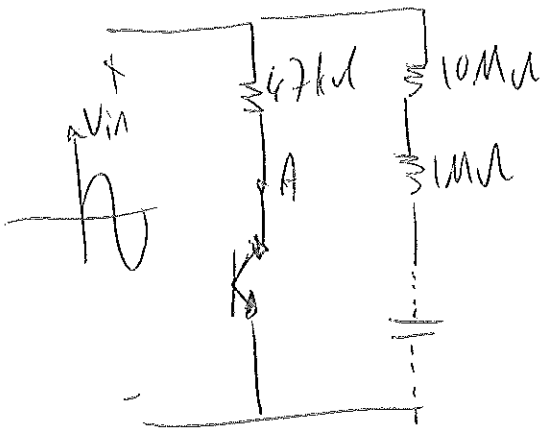
Proximity Detector



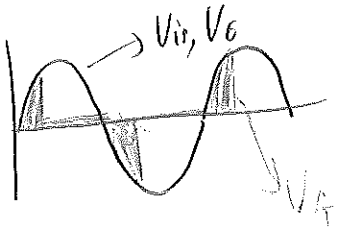


- As human body approaches to the sensing electrode the capacitance btw ~~electrod~~ and ground increases. The UJT (PUT programable unijuction transistor) is a device that will fire (enter short-circuit) when $A \geq 6 + 0.7$ (for silicon)

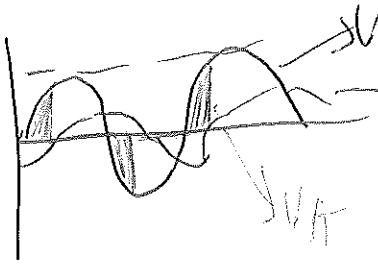
Before UJT turn on (at off mode)



if C = 0 farad



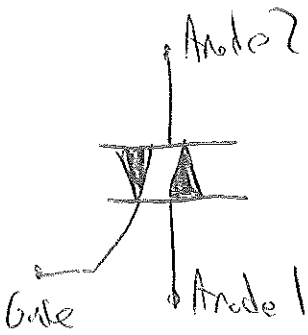
if C ≠ 0 farad

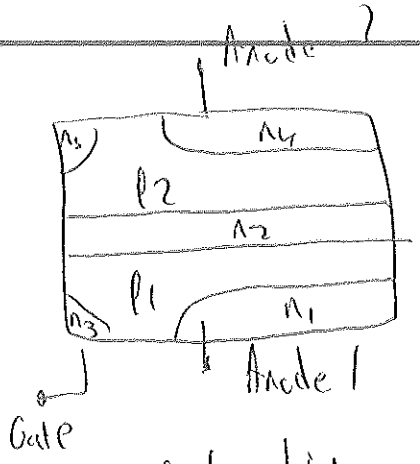


- As input voltage rises, the diac voltage V_G will follow until firing potential is reached
- It will then turn on and the diac voltage will drop substantially (diac is in essentially open-circuit state until it fires)
- ~~V_A~~ can never be greater than G by 0.7
- As capacitive element is introduce G can lag and A can be greater then G by 0.7 and the PUT will be fired
- PUT will establish heavy current in this cct and K voltage will rise an SCR will be turned on and heavy current will be obtained

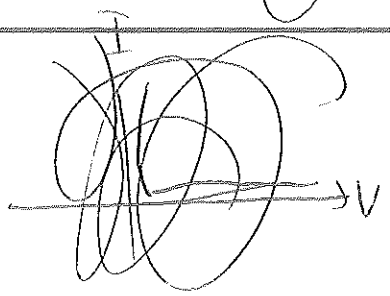
over load (meaning a person is approaching

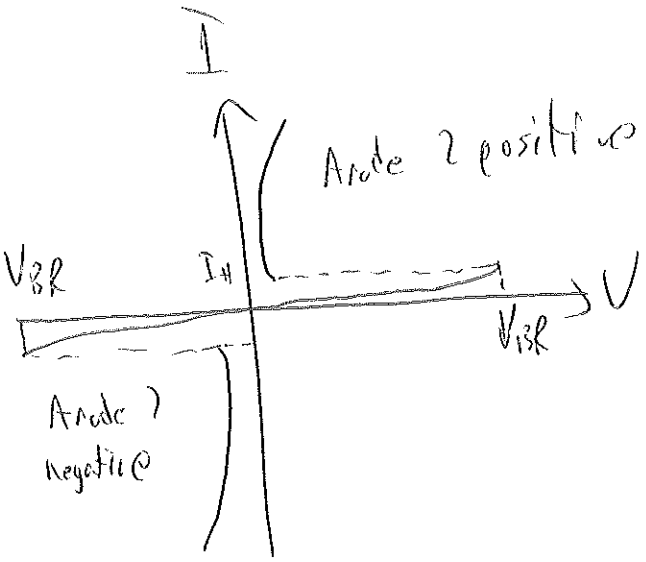
TRIAC





fabrication





Phase (Power) Control