hi friends sometimes you may have noticed that whenever we connect any appliance to the mains outlet you see the huge spark comes out during plug-in you see the blub also starts with peak initial brightness and then it stabilize and also the tools that we use in our daily life holds huge amount of initial current than the nominal and this initial current is actually called the inrush current like you can see the drill starts with jerk and pulls huge current to move from the resting state same also happens in the most power supplies and other appliances the large filter capacitors needed to be charged which also pulls the huge initial current which is bad for the rest of the circuit but nowadays some manufacturers add thermistors for circuit protection but during long operation the resistance increases due to increasing temperature of thermistor and there the power loss occurs for protection by limiting the in rush current to any circuit or appliances i designed the perfect soft starter circuit with simple working principle when we switch on ac at input the appliance connected on output gets limited initial current through this resistor or diode can be also used at the same time the circuit of transformer less power supply gets to work and this 12 volts and a diode stabilized the voltage at 12 volts this 220 uf capacitor gets charged slowly through this 51 kilo ohms resistor so adding delay of a second when capacitor gets full the base of transistor gets sufficient current and turns on the negative voltage to relay coil now relay turns on and load at output gets full current directly from input by bypassing the current limiting resistor. nice now let's place all the components according to the circuit diagram would like to make pcb at home now let's solder all the components on the circuit board now our soldering is complete and it's time to trim excess leads of components you can use isopropyl alcohol to clean flux residue now our pcb is nice and clean and ready to test i will use this blob to show you actual and visible working of this circuit you can see blub initially turns on at low brightness then with little delay it switches to full brightness same like this other appliances will turn on softly and protect them from inrush current.