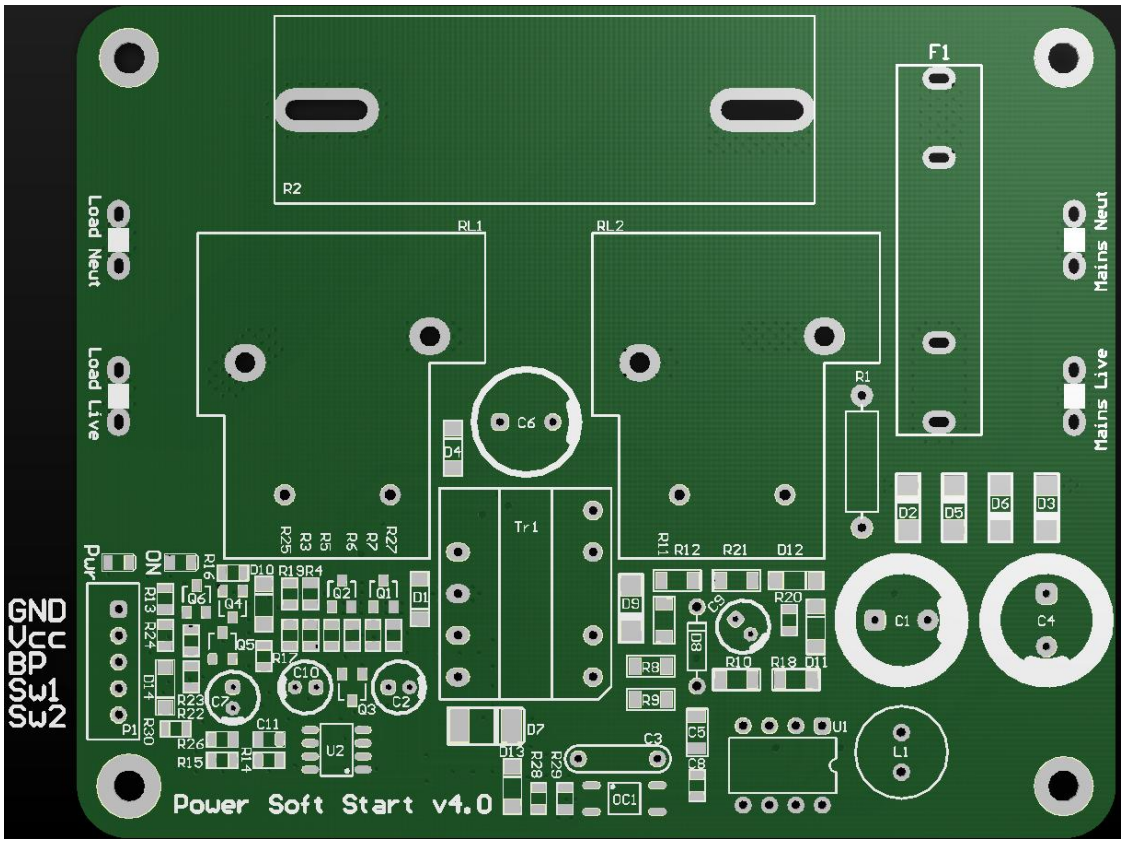
Power Soft Start

The **Power Soft Start Circuit** has the function to limit the inrush current which is drawn from the mains by the transformer of the amplifier during power ON sequence. When the power amplifier is switched on, the initial current drawn from the mains is few times higher than the maximum current which is drawn at the full power because the transformers will draw huge current at switch on, until the magnetic flux has stabilized and because the secondary side electrolytic capacitors are completely discharged at the first power on and act as a short circuit for a brief but possibly destructive if measures are not taken to limit the time interval. The current is higher as the capacitors capacity and voltage is higher, and is proportional with the capacitor stored energy ($CU^2/2$). The effect is worst when power is applied as the AC voltage passes through zero, and is minimized if power is applied at the peak of the AC waveform. This is exactly the opposite of what you might expect.

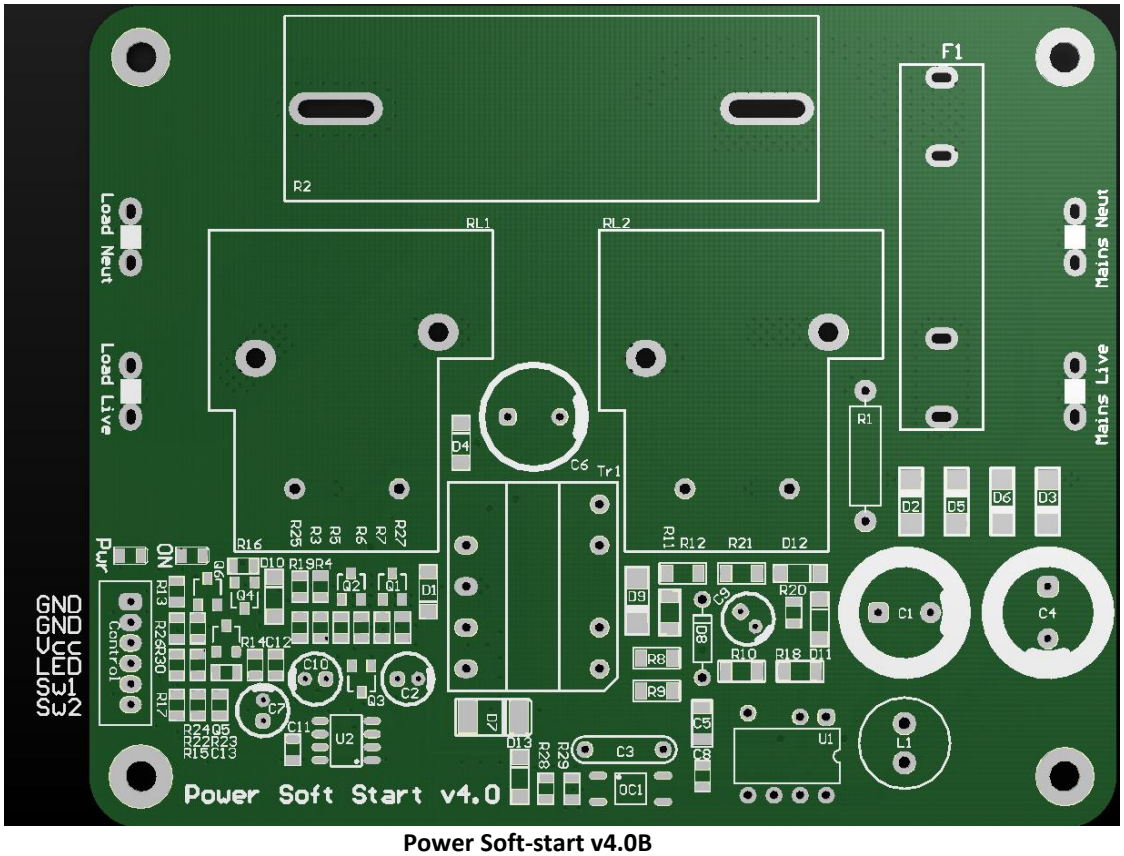
Most of the high power amplifiers used in PA and other industrial applications equipments use various types of Power Soft Start, although they are not commonly used in consumer equipment. Anyone who has a large power amp - especially one that uses a toroidal transformer had noticed a momentary dimming of the lights each time the amplifier is powered up. The current drawn is so high that in some cases other equipment can affected, like computers, TV's or other equipment which are sensitive enough or have the hold-up time of the capacitors from the power supply too small to compensate the voltage fall during this transients. In addition to the unpleasant effects, the high inrush current (as it is known) is stressful on many components in your amp, especially the fuses which may blow if they are fast acting type or underrated, the transformer can be affected, the massive current stresses the windings mechanically and electrically. It is not uncommon to hear a diminishing mechanical buzz as the chassis and transformer react to the magnetic stress. The rectifier bridge must handle an initial current way beyond the normal, because it is forced to charge empty filter capacitors which look like a short circuit until a respectable voltage has been reached. The capacitors can be also damaged, as the inrush current is many times higher than the ripple current rating of the capacitors, and stresses the internal electrical connections, which may lead to premature failure. Due to this reason, some of amplifier failures occur at power on. This is exactly the same problem that causes your lights at home to 'blow' as you turn on the light switch. You rarely see a light bulb fail while you are quietly sitting there reading, it almost always happens at the moment that power is applied.

To avoid all the unpleasant effects which were showed above, the **Power Soft Start Circuit** must be used. The main role of the **Power Soft Start Circuit** is to limit inrush current to a safe value. The maximum current which the **Power Soft Start Circuit** can admit in normal operation is 20A RMS for 230V AC circuits and 24A RMS for 110V circuits. The maximum current thru the relays is limited at 30A, but because the power factor of the circuits is ≠ 1 this current have smaller value. An important feature is that the **Power Soft Start Circuit v4** can be used both with AC or DC voltage circuits, on the mains side or on the secondary DC circuits if the AC supply voltage is at least 90V AC or 120V DC. Older versions which use a mains transformer would only allow AC voltage to be supplied and each particular supply voltage required dedicated transformer.

Another important role of the **Power Soft Start Circuit** is that has the "remote" turn ON/OFF function, which means that the power circuit can be turned ON/OFF remote, by using a logic level control signal applied to the isolated control part of the **Power Soft Start Circuit**. This is particularly important when the **Power Soft Start Circuit** is used to control an Audio Power Amplifier which has remote turn ON/OFF function implemented or Stand-by for power saving. The idle current consumption is very small, and the power consumed is less than 0.8W at 230V AC and less than 0.65W at 110V AC. Although the soft start circuit can be added to any sized transformer, the winding resistance of 200VA and smaller transformers is generally sufficient to prevent a massive surge current. Use of a soft start circuit is definitely recommended for 300VA and larger transformers.



Power Soft-start v4.0A



Power Soft-start v4.0B

The new PSS use a high efficiency universal mains voltage SMPS instead of a mains transformer and can be powered either with AC (100-250V AC) or DC (120-300V DC). Momentary push-button with LED same like the one from the picture above is used for single push turn ON and OFF. The minimum pulse time must be 200ms and the time interval between pulses 2s to prevent erroneous trigger.

Mains input must be connected on the upper right side: **Mains Live** and **Mains Neut.**

Transformer or any other load connected on the upper left side: **Load Neut.** and **Load Live**

Control connector, version A on the bottom left has 5 pins:

1. **GND**
2. **Vcc** the board generates 12V (11.5 to 13V) and up to 1A which can be used to supply other devices within the amplifier enclosure. Use a 4k7 resistor from this pin to supply the LED within the Push-button if has LED.
3. **BP** Bypass, active high will turn ON the relays and bypass the switch action.
4. **Sw1** contact switch of the push-button.
5. **Sw2** contact switch of the push-button.

Control connector, version B on the bottom left has 6 pins:

1. **GND**
2. **GND**
3. **Vcc** the board generates 12V (11.5 to 13V) and up to 1A which can be used to supply other devices within the amplifier enclosure.
4. **LED** supply the LED from the push-button with 1mA. LED current limit resistor already included on the board. The LED will be ON only when the circuit is active.
5. **Sw1** contact switch of the push-button.
6. **Sw2** contact switch of the push-button.

Version A available since dec. 2013, version B available since april 2014.

The PSSv4.0 is equipped with a 20W 5R power resistor capable to withstand up to 15A short-time peak current while the transformer inrush current drops to a steady value and the second relay close bypassing the resistor. Its peak power rating is much higher than the power rating of the thermistor used in PSSv3 , making PSSv4.0 board suitable for large transformer and electrolytic capacitor bank such as those used in class A amplifiers.

Max current allowed at 230V mains voltage: 16A
Max current allowed at 120V mains voltage: 20A
No-load, OFF mode power consumption: 60mW at 120V mains voltage and 90mW at 230V mains voltage.
Regulated 12V DC (11.5 to 13V) output, up to 1A available.
On-board Power and ON LED for status indication.