Slow Glow

Dirk Visser (The Netherlands)

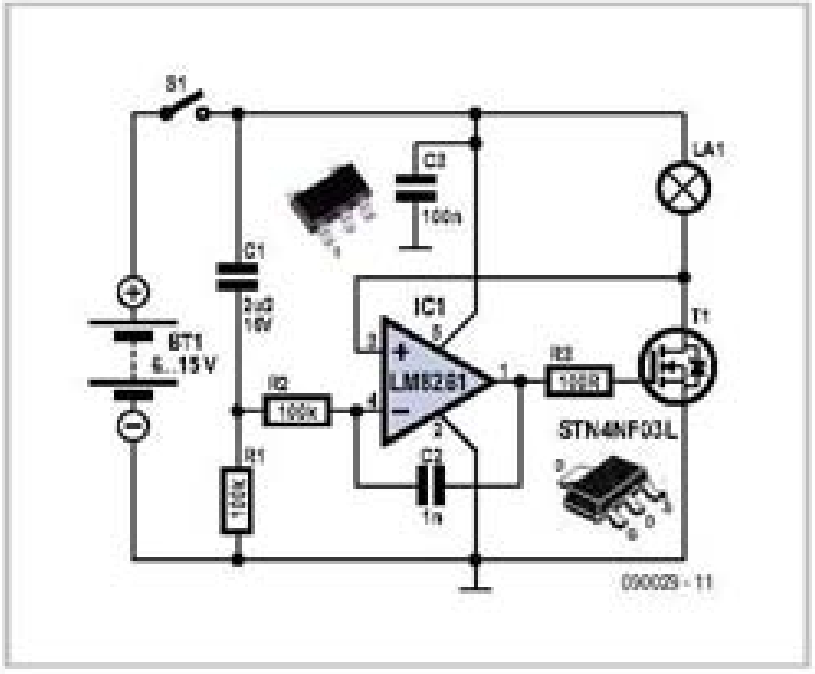
There are many different ways in which a lamp can be made to light up gradually. This circuit presents one of them. What is special about this circuit is that it can be turned into a power potentiometer with only a small modification.

Slow Glow operates as follows: the instant the circuit is turned on, the inverting input of the opamp is at the same voltage as the inverting input, which is equal to the supply voltage. However, C1 will slowly charge up, which causes the voltage on the inverting input to drop. This voltage therefore looks like an inverted RC charging curve. The reduction of this voltage causes the output voltage of IC1 to increase, and T1 is driven open harder. This in turn causes the voltage across the lamp to follow the shape of an RC charging curve, and the use of a transistor means that a large current can be supplied.

When it comes to the choice of op amp you have to keep in mind its common mode range. In this circuit it needs to be equal to the full supply voltage. As a voltage follower the need is therefore for a rail-to-rail opamp. An LM8261 was picked mainly because it

combines an exceptionally small package (SOT23-5, 2.92 x 2.84 mm) with an equally exceptional supply voltage range of 2.7 V to 30 V. There are very few rail-to-rail opamps offering such a large supply voltage range. The opamp has been decoupled with C3 because of its speed (GBWP: 21 MHz). The speed isn't critical in this case though. R3 is connected in series with the MOSFET to prevent spurious oscillations from occurring.

It stands to reason that this circuit is best built using SMD components. C1 can be obtained in an 0805 package (ceramic multilayer) and all other parts are also available in SMD packages. For the MOSFET we found an SOT-223 variant made by ST, the STN4NF03L. It can switch more than 6 A, which is impressive considering its dimensions (7 x 6.5 mm). If more power is needed than the maximum dissipation of 3.3 W (at 25 °C) permits, there is no problem if a bigger FET is used (for example, one in a larger D2PAK package). There is a large number of FETs available in this type of package that can cope with significantly higher currents and power.



The circuit can also be used with normal 12 V halogen lighting if a bit of cooling and a TO-220 package is used. With the values used for R1 and C1 the transistor needs to dissipate the maximum power for only just over a tenth of a second. This power is obviously dependent on the type of lamp connected up. The gate-source voltage of the MOSFET determines the permissible supply voltage range. The absolute maximum value here is 16 V, and there is also a minimum voltage required to obtain a low channel resistance (<0.05 Ω at U_{GS} = 5 V). Hence the supply voltage range for this circuit is 6 to 15 V and a 16 V rated type for C1 is sufficient.

When C1 and R1 are replaced with a potentiometer (with the slider connected to R2), the whole circuit behaves much like a potentiometer, but one with very large output power. The MOSFET is driven by IC1 such that a balance exists between the inputs of the op amp. The voltage at the drain therefore becomes equal to the voltage at the wiper of the potentiometer.

090029-I