SIMPLE MOSFET-BASED CFL

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This CFL circuit uses only two semiconductor devices and few passive components, which keeps the cost low and simplfies the circuit. Low power consumption is its another advantage.

The circuit works off a 12V, 7AH battery and is built around CMOS hex-inverter IC CD4069 (IC1). Using CMOS IC, the power consumption of the main stage (oscillator) is limited to a few microwatts. The IC is configured as an R-C oscillator with four of its gates connected in parallel to enhance its output drive capability. Its high output can drive TTL loads.

Gates N1 and N2 form an R-C oscillator and the remaining four gates (N3 through N6) are connected in parallel to provide a high output current to the MOSFET switch. The R-C oscillator has only two external components and its output frequency (f) can be roughly calculated using the following equation:

$$f = \frac{0.5}{R1 \times C1}$$

The recommended frequency for a ferrite transformer-based CFL is 18 to 35 kHz. To vary the frequency, you can change the value of resistor R1 in the R-C oscillator (see the table).

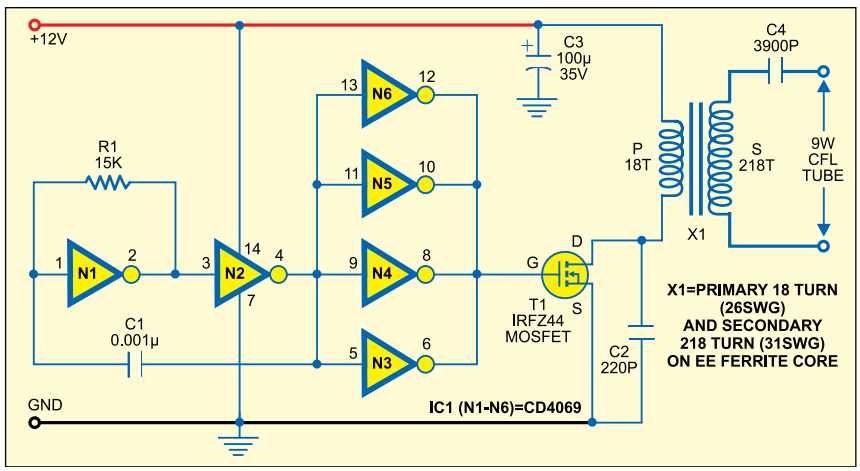

Fig. 1: Circuit of MOSFET-based CFL

Frequencies for Different R-C Combinations

R1	C1	F
20kΩ	1 kpF	25 kHz
15kΩ	1 kpF	35 kHz

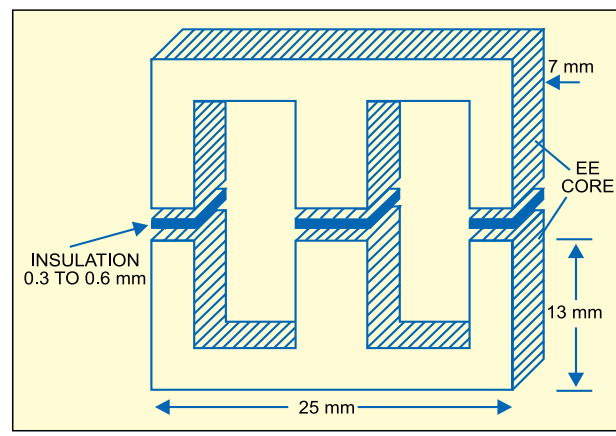

Fig. 2: EE ferrite dimensions

For R1 (15 kilo-ohms) and C1 (0.001 µF) used in this circuit, the selected frequency is 35 kHz.

Resistor R1 connected between pins 1 and 2 of gate N1 provides a negative DC feedback and biases the inverter to a linear region where it works as an amplifier. Capacitor C1 connected between pins 1 and 4 of IC1 provides a positive feedback to enable oscillations.

The n-channel enhancement-mode MOSFET IRFZ44 (T1) is readily available in the market. Transformer X1 is built around an EE-type, 25×13×7mm ferrite core. Use good insulation between the primary and secondary windings. After winding the transformer coils, put some insulating sheet or paper at the edges (tips) of the EE-cores as shown in Fig. 2. This insulation gap between the two cores helps to achieve maximum brightness with minimum current drain.

High-tension (HT) coupling capacitor C4 limits the current to the lamp. Capacitor C2 between drain and ground clips any ripple voltage to give a linear waveform.

The performance of this CFL depends on the type of the CFL, EE core, oscillation frequency, ferrite core gap, etc. Never use a Schmitt inverter (40106) for this circuit. Use a base for the IC and handle the MOSFET carefully. Before soldering the MOSFET, make sure that the R-C oscillator is oscillating properly. Connect the MOSFET only if the oscillations are proper. In case you don't use an IC base, make sure the soldering iron is earthed properly while soldering the IC.

Lab Note. A Philips 9W CFL was used for testing the circuit. ●