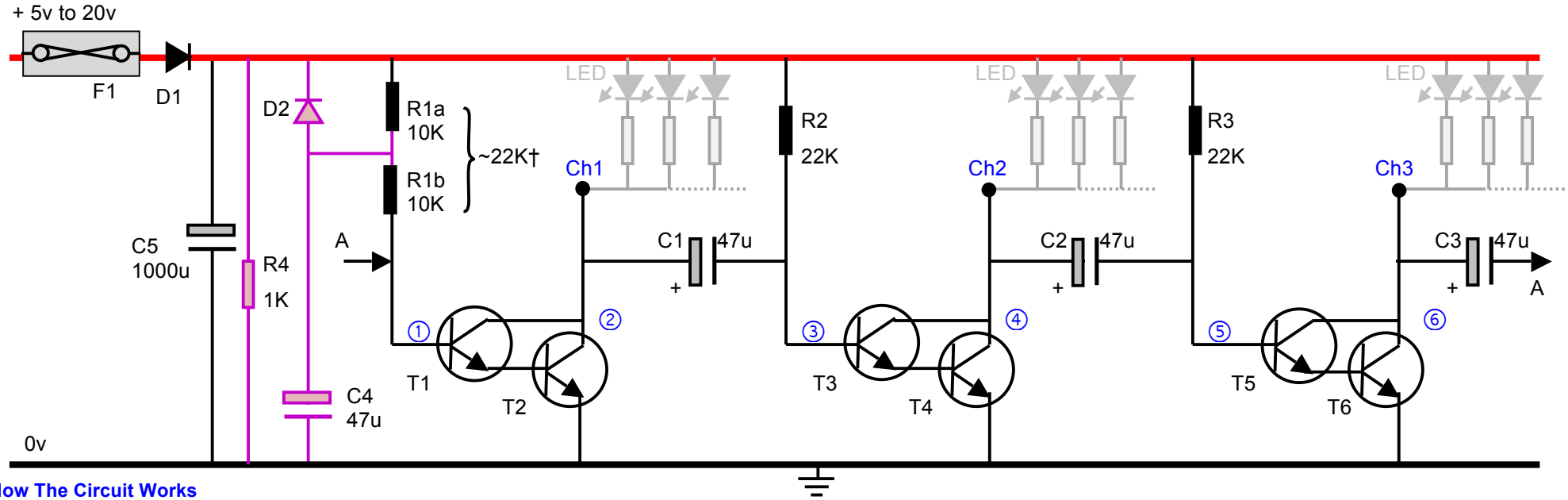
MGE115 Simple Ring Sequencer For LEDs

What Is Desired To Be Achieved

1. All LEDs to be illuminated. They are divided into three groups and each will be extinguished in sequence so as to appear moving.

Benefits Of This Circuit

1. A very small number of components are required ie no shift register is used.
2. Power transistors can be used in place of T2, T4 and T6.



How The Circuit Works

1. **Three independent amplifiers** Without the three capacitors (C1, C2, C3) each circuit channel acts as a high gain Darlington amplifier. The transistors are current operated devices and their behavior is such that the points ①, ③ & ⑤ never go above 2 x 0.6 = 1.2v*.
2. **Start Up: Off-On-On** When the circuit is first powered a very small current, provided by R2 & R3, sets the second and third channels on. However you will notice that R1† is actually split to make the start up circuit (shown purple). At switch on there's no voltage across C4 thus no current flows through R1b and the first amplifier can't switch on giving the Off-On-On state. This isn't permanent because R1a starts to charge C4. Its rising voltage starts to coax some current through R1b. When this current gets large enough, because of the high gain of the amplifier, suddenly it will switch on and the voltage at point ②, presently pulled high by the LEDs crashes to about 0.3v. Thus, momentarily, all amplifiers are switched on.
3. **Next in line** However C1 capacitively couples point ② to point ③ and thus this latter also drops to 0.3v. This turns the second amplifier off giving a On-Off-On state.
4. **Nothing is forever** C1 starts to charge through R2 (their time constant is roughly 0.6 sec). As C1 charges the voltage at point ③ rises. Eventually when that voltage reaches 1.2v it is enough to switch the second amplifier on.
5. **Next in line** If this second amplifier (T3/T4) suddenly turns on point ④ will drop to 0.3v and C2 will rob the third amplifier (T5/T6) of its base current through R3 and therefore turn the third amplifier off. The state is now On-On-Off. Of course, just as before, C2 now starts to charge. The voltage at point ⑤ rises until suddenly the third amplifier turns on.
6. **Ring Oscillator** Can you see because point A is connected back to the start each amplifier will turn off then on in sequence around the ring. The process continues indefinitely and if you have laid the groups of LEDs in contiguous sequence then a dead spot will appear to move onwards in sequence.

Components

Transistors Any small signal NPN transistor can be used for T1, T3 & T5 and likewise the others. However it is likely that you will have many LED's connected to each channel. With suitable LED series resistors you should aim for equal brightness at about 10mA/LED for all colours -except yellow and white LEDs that often need 15-20mA to give similar brightness. As I only had 8 LEDs per channel, that's 8 x 10mA = 80mA. Thus I was able to use BC107s for these latter as they can switch a healthy 200mA.

Capacitors Each time a channel turns off these will be charged to the supply voltage less 1.2v*. Therefore they should be 16v or 25v types. Incorrect polarity causes tantalum ones to explode.

D1 & R4 Optional D1 protects everything from accidental polarity reversal if you have hidden wiring. D2 discharges C4 at switch off –it can be any small signal diode. Resistor R4 is there to complete the discharge path via D1. It is optional -another load in your installation may perform the same task. If your installation is battery powered then don't include it.

C5 & Fuse This can be any reservoir capacitor to stop flickering. By default you always include a fuse in your circuits don't you ?