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LOW VOLTAGE WHITE LED DRIVER	MEK02-001-FA

IMAGE

INTRODUCTION

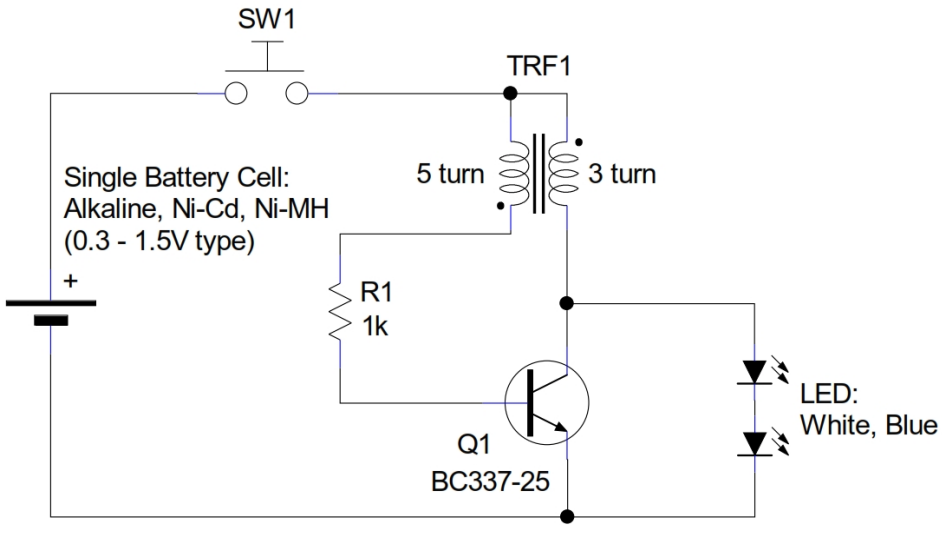
LED's are semiconductors that produce visible or infrared light when a current passes through them as a result of an applied DC voltage. Different colour LED's require different voltage to generate sufficient current before they will produce useful light output.

In the case of a white LED, this DC voltage is between 3 and 4 volts DC. This means that we cannot operate a white LED from a 1.5V battery, without additional circuitry. The second challenge is that DC voltages can't be transformed with the use of a simple conventional transformer.

This kit, using the circuit and technique shown below, overcomes these challenges in a simplified yet very effective way. The technique is based on the principle that when an electromagnetic circuit is turned off, it produces a voltage significantly higher than that which turned it on in the first place (back EMF). This happens as a result of the collapsing magnetic field initially produced.

This circuit is also commonly referred to as Joule-Thief because is able to "steal" energy from very low voltage sources, such as single cell batteries or discharged old batteries.

CIRCUIT DIAGRAM



LOW VOLTAGE WHITE LED DRIVER	MEK02-001-FA (page 2 of 2)
EXPLANATION	For the ease of understanding, the circuit above can be divided into various sections : the source of DC power (the 1.5V battery), the oscillator (the transistor and the transformer), the step up transformer (the same transformer) and the obvious 2 x LED requiring over 6V to operate. Imagine the instant when the battery is first connected. Current will first flow from the battery, through the primary of the transformer and the 1K ohm resistor into the base of the transistor, turning the transistor on and producing a current and magnetic field in the secondary of the transformer. At this stage the LEDs were, and are off because the 1.5V coming through the secondary of the transformer was insufficient to turn them on (Because they are in series, they requires 6V or more). However, when the current starts flowing in the secondary, it produces a voltage on the primary, of the opposite polarity to that which the battery initially delivered, hence turning the transistor off and subsequently turning off the secondary too. The collapse of the secondary current and magnetic field, produces a back EMF / voltage on the secondary, sufficiently high and of the correct polarity to drive the LEDs. Hence the LEDs will illuminate, consuming the stored magnetic energy ! And so the cycle will repeat itself... Please note the dots close to each winding of the transformer. This indicates the start point of the windings or the direction in which it is wound. The primary and secondary are wound in different directions, so as to generate the reverse voltage on the primary that will turn the transistor off as mentioned above. See image below for wiring details. This is the same electrical principle used to turn on fluorescent tubes and the spark plugs in your car. More explanations, images and circuits related to this matter can be found on the internet. We also keep other kits related to this one and many others.

A close-up view of the transformer's primary or feedback winding (red) and the secondary in grey.	In the image below, you can clearly see the two signals discussed above... The yellow trace is the output driving the LED, while the blue trace is the feedback from the 5 turn winding. In this particular example, the circuit is oscillating at about 2.6KHz.