Ingenuity Unlimited

ROLL-UP, ROLL-UP!

Ingenuity is our regular round-up of readers' own circuits. We pay between $16 and $80 for all material published, depending on length and technical merit. We're looking for novel applications and circuit tips, not simply mechanical or electrical ideas. Ideas must be the reader's own work **and must not have been submitted for publication elsewhere.** The circuits shown have NOT been proven by us. *Ingenuity Unlimited* is open to ALL abilities, but items for consideration in this column should preferably be typed or word-processed, with a brief circuit description (between 100 and 500 words maximum) and full circuit diagram showing all relevant component values. **Please draw all circuit schematics as clearly as possible.**

Send your circuit ideas to: Alan Winstanley, *Ingenuity Unlimited*, Wimborne Publishing Ltd., Allen House, East Borough, Wimborne, Dorset BH21 1PF. They could earn you some real cash and a prize!

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- **50MSPS Dual Channel Storage Oscilloscope**
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If you have a novel circuit idea which would be of use to other readers, then a Pico Technology PC based oscilloscope could be yours.

Every six months, Pico Technology will be awarding an ADC200-50 digital storage oscilloscope for the best IU submission. In addition, two single channel ADC-40s will be presented to the runners up.

One Volt LED – A Bright Light

Illuminating a LED from a very low supply voltage is difficult as most devices have a forward drop of at least 1·8V. This excludes their use in products operating from a single 1·2V or 1·5V battery. However, by applying techniques used in DC-to-DC converters, a very compact, economical and efficient solution can be produced. The circuit diagrams shown in Fig.1a to Fig.1c will brightly illuminate a LED from a supply as low as 750mV and as high as 1·5V, i.e., most single cell batteries available including nearly dead ones.

In the Micro-torch circuit Fig.1a, transistor TR1, transformer T1 and resistor R1 form a current-controlled switching oscillator. Each time TR1 turns off, the collapsing magnetic field in T1 generates a 30V (off-load) positive pulse at TR1's collector (c). This, in series with the supply, is fed directly to the LED.

Switching occurs at a very high frequency and with a low duty cycle, which results in an average LED current of about 18mA, sufficient to illuminate most LEDs. Current, and therefore brilliance, can be increased by reducing the value of resistor R1 and vice versa. A value of 2 kilohms produces 30mA, which is more than enough even for hyper-bright devices.

Conversion efficiency depends on transistor TR1. Although any transistor can be used, high performance devices with very low $V_{CE(SAT)}$ yield the best results; for the ZTX450, efficiency is 73 percent. A ZTX650 increases it to 79 percent whilst a BC550 reduces efficiency to 57 percent. Even at this value it still out-performs conventional circuits using higher voltage supplies where efficiency rarely exceeds 50 percent.

A micro-toroid center-tapped transformer, T1, is constructed using an anti-parasitic bead 6mm by 4mm in diameter with a 2mm hole. Fold 90cm of 38s.w.g. enameled copper wire in half, press the crease tightly together and then thread the folded wire repeatedly through the bead hole until 20 turns are wound. Trim protruding wires to 25mm.

The bead now contains two sets of 20 turns with two starts at one extremity and two ends at the other. Join an appropriate start and end together to form the tap (CT). If the circuit fails to oscillate, check the tap is correctly formed; otherwise, it's most likely a shorted turn.

The simplest application,

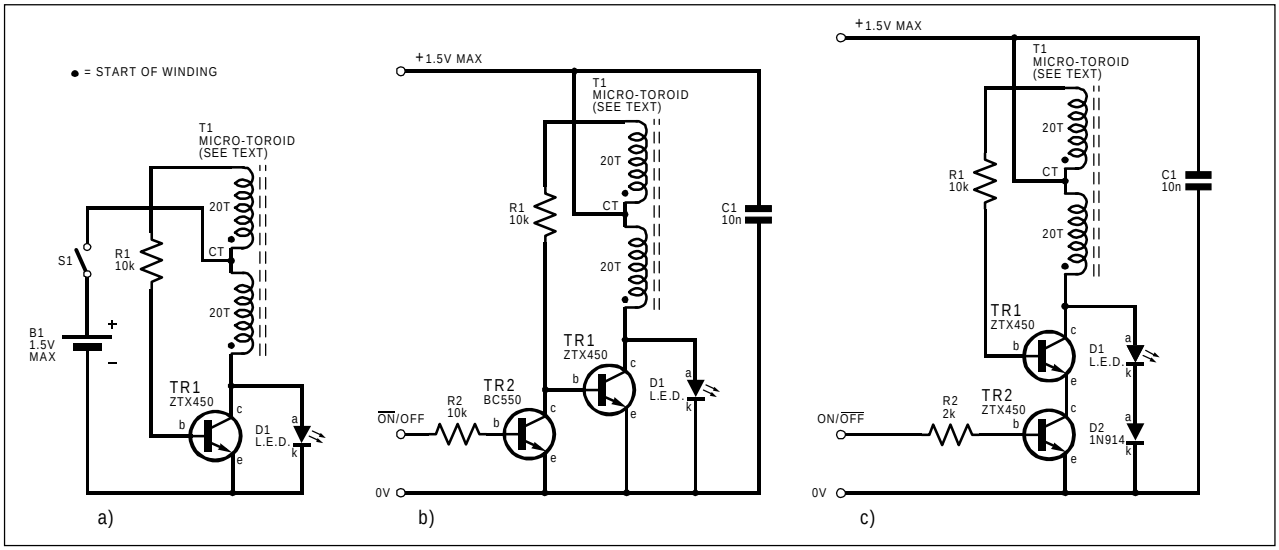

Fig.1. Three drive circuits for operating LEDs from supply voltages below 1.5V

Fig.1a is a Micro-torch, power-on indicator or simple infrared transmitter. Indicators for use with other circuits are shown in Fig.1b and Fig.1c, the latter consuming no power when off. Diode D2 in Fig.1c raises the forward drop as some LEDs leak when operated with a fresh alkaline battery; it is also necessary with infrared devices that have a forward drop of less than 1·5V.

When used with other circuits, decoupling with capacitor C1 in close proximity to the oscillator is recommended. Also keep lead lengths short, especially to the transformer, as the circuit operates at a high frequency; fortunately using a micro-toroid transformer significantly reduces radiation.

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