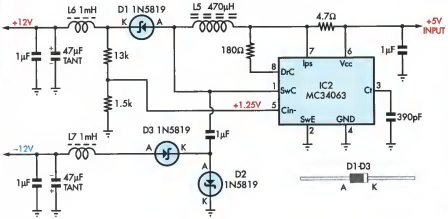
# CIRCUIT NOTEBOOK

Interesting circuit ideas which we have checked but not built and tested. Contributions will be paid for at standard rates. All submissions should include full name, address & phone number.




## Simple split supply generator

This circuit shows how a simple boost regulator can be used to generate a split supply by adding just a few components. This example is based around the MC34063 and is derived from the improved SiD-RADIO power supply published in Circuit Notebook, June 2014 (pages 80-81). However, virtually any boost circuit can be used in this way.

The +12V rail is generated from the +5V rail in the usual manner: IC2 briefly switches on an internal transistor between pins 1 and 2 (Switch Collector and Switch Emitter, respectively). This causes current to flow from the 5V supply through the 4.7Ω resistor, then inductor L5 and through IC2 to ground. This current flow charges L5's magnetic field.

When IC2's internal switch turns off, L5's magnetic field starts to collapse and as a result, the voltage at pin 1 of IC2 rises dramatically, forward-biasing Schottky diode D1 and charging the output capacitor filter bank via RF interference suppression inductor L6. The resulting voltage is well above the 5V input and depends on the duty cycle that IC2's internal switch operates at.

The voltage across the output capacitors is divided down by the 13kΩ and 1.5kΩ resistors to provide feedback to pin 5 of IC2, so it can regulate the output voltage to about 12V [1.25V x (13kΩ ÷ 1.5kΩ + 1)]. IC2 also senses the voltage across the 4.7Ω resistor and should this exceed 300mV, the internal switch is turned off, protecting the circuit against overload.

The extra components comprise a 1µF capacitor from pin 1 of IC2 to feed two more Schottky diodes. When the voltage at pin 1 shoots up, just after the internal switch is turned off, this capacitor charges up to 12V via D2. The next time IC2's internal switch turns on, pin 1 drops to 0V and so the bottom end of this added capacitor swings to -12V. This causes diode D3 to become forward-biased, charging the two output capacitors to a little less than -12V via L7.

There are a couple of provisos to this method of generating a split supply. First, the -12V output is likely to be a little lower than nominal, ie, around -11.7V.

Since IC2 must compensate for the forward voltage of D1 by driving pin 1 above +12V, this effectively cancels out the voltage loss for the negative rail generator in D2. However, D3 will also contribute a voltage drop of around 0.2-0.5V (depending on current draw) and so the negative output will be this much lower than the positive rail, assuming the load is connected across both rails. But note that most circuits requiring balanced rails do not require exactly the same voltage from each rail anyway.

If you need the rails to be better balanced, one simple solution is to replace D1 with a pair of series-connected Schottky diodes. This will reduce overall efficiency but IC2 will respond by increasing the voltage at pin 1 slightly and this will tend to cancel out the loss in voltage at the negative rail due to D3.

Regardless, the negative output as shown here is not regulated since IC2 has no feedback from this output. Also, note that op amps tend to be more sensitive to variations in the voltage at their negative rail than the positive rail, although this does vary from device to device (check the positive and negative CMRR curves in the respective data sheet).

A better solution is to change the feedback divider resistors to increase the output voltage by 0.5-2V and then fit a symmetrical pair of linear regulators, with worst-case drop-out voltages lower than the voltage increase you have provided, on both outputs. Using LDO regulators will let you minimise the extra voltage required, maximising efficiency.

**Nicholas Vinen,**
**SILICON CHIP.**

## Circuit Ideas Wanted

Got an interesting original circuit that you have cleverly devised? We need it and will pay good money to feature it in the Circuit Notebook pages. We can pay you by electronic funds transfer, cheque (what are they?) or direct to your PayPal account. Or you can use the funds to purchase anything from the SILICON CHIP on-line shop, including PCBs and components, back issues, subscriptions or whatever. Email your circuit and descriptive text to editor@siliconchip.com.au