9v Power Supply

COLIN MITCHELL

This project is a continuation of our 5v POWER SUPPLY article where we presented 3 circuits that delivered a 5v regulated output from 3v supply.

Two of the power supplies can be purchased on eBay as modules for less than the cost of the individual components and we take advantage of these bargains.

This article is continued on the webpage:

http://www.electronicsmaker.info, for now we show how to "Jack-up" the output by providing a voltage-divider on the output to produce 9v.

These 9v power supplies will take the place of a 9v battery and when using two AA cells, they will last 3 times longer and cost much less.

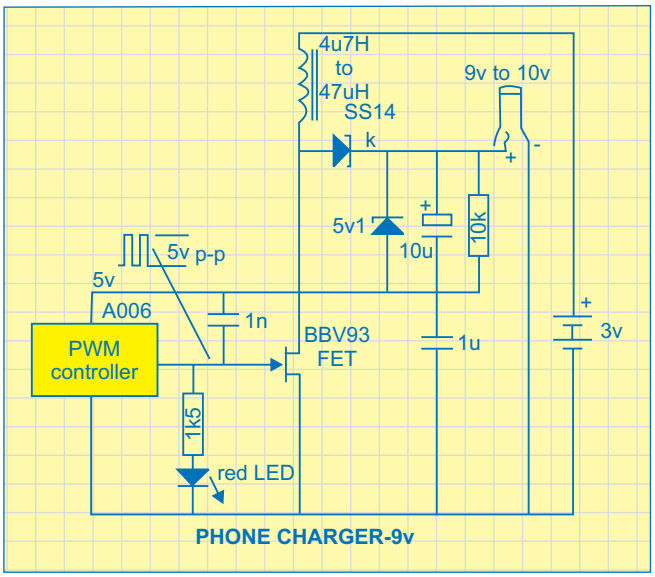
The results of our tests were better than expected. The voltage hardly dropped when up to 200% current was delivered and the only point to remember is the high current taken from the battery due to the step-up-voltage situation, when even 30mA is delivered.

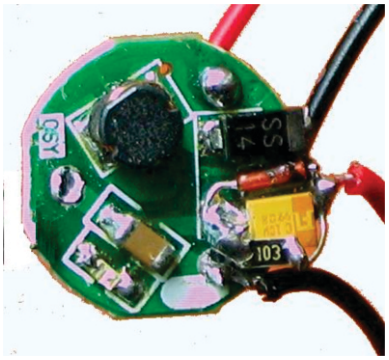
The only problem with this type of circuit is the noise it produces. It operates at about 200kHz and if the output is connected to an AM radio, it produces a lot of hash in the background. Only loud stations can be received. However this is not the case with FM reception and these supplies can be connected to FM receivers.

Jacking up the output is not an easy thing to do.

The aim is to create a divider that consumes no current when the load is removed. And we have achieved this with the PHONE CHARGER circuit.

These circuits are classified as LOW IMPEDANCE circuits and this means both the input and output need to have capacitors so the circuit can "push against the capacitor" via the positive rail and produce the required output. If a capacitor is not present, the circuit relies on the low-impedance of the battery.





This means you cannot put a milliammeter (this is the correct wording for a milli-amp meter) in the positive line and expect the circuit to work correctly. The high-resistance of the meter will cause the output to decrease considerably. To get around this, a 1 ohm resistor (brown-black-gold-gold) is placed on the positive rail and a multimeter (200mV or 2v range) is connected across the resistor. This means each mV reading will represent 1mA current.

For the PHONE CHARGER circuit, the idle current was less than 0.1mA and could not be read on the meter. The output voltage dropped to 5v (in idle mode) and kept the 1u ceramic capacitor charged.

To turn-on the PWM controller chip requires a reasonably –high current for a very short period of time. This is achieved by the 10u tantalum capacitor and when the chip draws current, a voltage of 5.1v is dropped across the zener. The 10k resistor is needed to quickly discharge the 10u if the power is removed and re-applied. If the 10k is removed, it takes more than 10 seconds to discharge the 10u so it can re-apply the spike of current.

We placed a 47R across the output to check the regulation. It got HOT (200mA) but the output voltage remained at 10v. This is classified as "100% regulation" and is an amazing achievement for microscopic components.

The photo shows the surface-mount components added to the top of the PC board. The SS14 Schottky diode is turned 90 degrees so the additional components can be fitted. This is shown in more detail on the web.

If you are connecting a 9v battery snap to the output, remember it is being used "in reverse" and the negative lead must be connected to positive so the snap can be connected to another snap on a radio or other device needing 9v.

More on this circuit plus the other two circuits are covered in the article on the web, at: http://www.electronicsmaker.info where we present more images and text on analysing and understanding how they work.

LED Dice

COLIN MITCHELL

This project uses a single 8-pin microcontroller to produce the effect of a rolling dice.

The circuit is very simple because all the effects are controlled by a program in the micro and only a few current-limiting resistors and a switch are needed.

The main aim of this project is to introduce the hobbyist into programming a microcontroller to produce projects that can be reduced from a mass of chips and circuitry to a single micro and a few surrounding components.

In a previous project we have presented a PIC programmer consisting of less than 15 components called PIC Programmer MkIV. It can be connected to the serial port of a tower computer to "burn" the program into one of the smallest and simplest micros on the market.

See the website: http://www.electronicsmaker.info for PIC Programmer MkIV and you will see how it can be connected to a computer to load your program into the "program space" in the chip. The article also contains software to allow you to write a program in NotePad2 and convert it to a .hex file via another program called MPASM for loading into the micro via WinPIC.

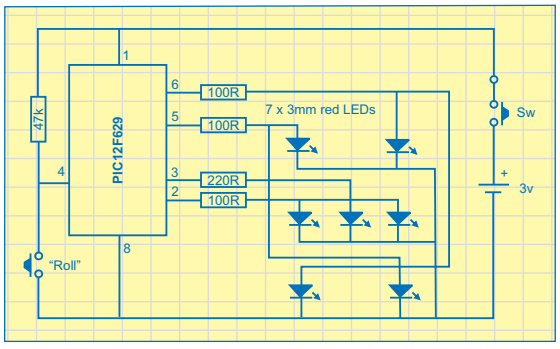
There is very little we can discuss with this project because it is so simple.

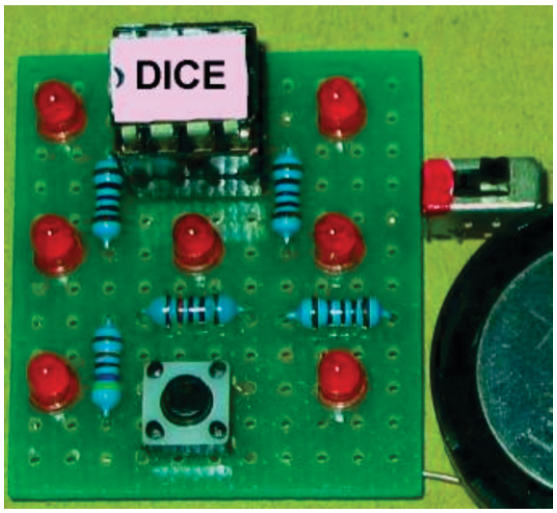
The only components that may have to be adjusted are the current-limiting resistors, to get the desired brightness. We have suggested values for super-bright red LEDs, but if you want to use other colours you may have to decease the values slightly. For white LEDs, the supply voltage will have to be increase to at least 4.5v. This modification is covered in the article on the web.

You can build this project as a soldering exercise or go further and investigate the program and change some of the instructions to produce different "rolling" effects.

This project is part of our series to get you into microcontroller programming as this is the way of the future.

Microcontroller circuits are the simplest, smallest and cheapest way to get a product onto the market. Even simple devices use a microcontroller, as the product can





LED DICE circuit using a PIC12F629 Microcontroller

be developed by adding a program to the chip and it's ready for production.

The only thing you have to be careful about with the micro is the supply voltage. It cannot go above 5.5v and if a 6v battery is used, a diode needs to be placed on the positive rail to drop 0.6v for the chip.

Many microcontrollers will work down to 2v and a 3v or 3.6v single cell can be used. Our circuit uses a 3v lithium cell.

When the circuit is switched on, the tactile switch is pressed and the LEDs flash to represent the rolling of the dice.

The LED Dice project constructed on Matrix Board.

The "rolling" gradually slows and a result appears on the LEDs. After 6 seconds the LEDs go out and the switch can be pressed again for another "roll."

The project is easy to build on Matrix Board and all the components are readily available. The .hex file can be downloaded from the website and PIC Programmer MkIV can be built in an evening using parts from your component box to "burn" the micro.

PARTS LIST

3 - 100R
1 - 220R
1 - 47k
7 - 3mm high-bright red LEDs
1 - 8 pin IC socket
1 - PIC12F629 microcontroller with DICE program
1 - tactile switch
1 - mini on-off slide switch
1 - coin cell holder
1 - 3v lithium coin cell CR2032
fine tinned copper wire - 30cm
Fine enamelled wire – 30cm
Fine solder – 30cm
1 - Matrix Board 11 x 12 hole

PIC Programmer MkIV

COLIN MITCHELL

This project will start you in the amazing world of designing projects with a microcontroller.

There have been lots of projects, designed around a micro, presented in the pages of Electronics Maker. A micro simplifies a project enormously and can quite often make it smaller, cheaper and perform better than using individual components.

But the problem is starting in this field. Before you can start designing a micro project you need to have a programmer (burner) to put (load) a program into the micro.

The programmer described in this project is one of the simplest as it uses about 15 components to perform the task of programming a PIC micro.

It connects to the serial port of a desk-top computer (also called a "tower" computer) and has an 18 pin socket for "burning" a chip.

This socket will also accept 8 pin micros by inserting the chip with the notch to the left, to align with pin 1.

We have chosen PIC microcontrollers for our projects due to their low cost and enormous back-up on the web.

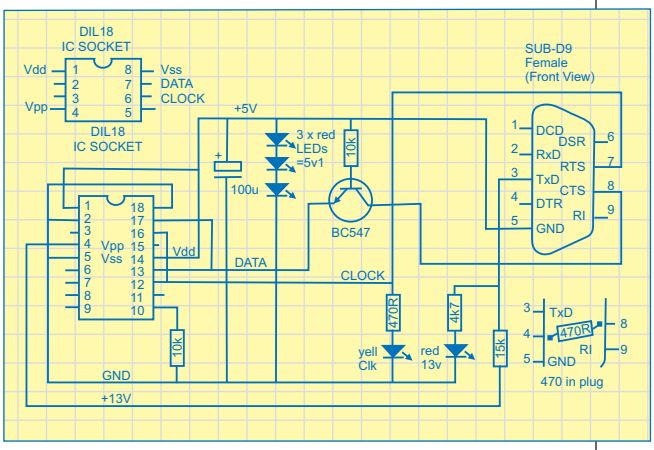
We have also chosen two of the smallest in the range so you don't get worried about complexities.

We will be taking you as a beginner, to designing your own projects, at the lowest possible cost.

The PIC Programmer MkIV is built on matrix board and the full article is on the web at:

http://www.electronicsmaker.info

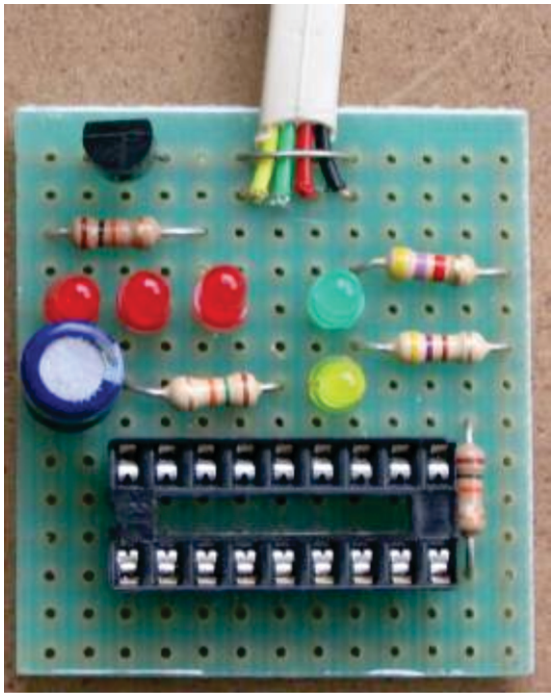
The article also contains the software needed so your program (written in NotePad) can be assembled by an assembler (MPASM) then loaded into ICPROG or WinPIC. We have provided two different software



programs and recommend WinPIC. It will communicate with PIC Programmer MkIV and put your program into the program area of the chip.

PIC Programmer MkIV on Matrix Board

The web article also contains a complete library of



routines that you cut-and-paste to produce your own programs.

We have done everything to make the process simple.

Microcontroller projects are the way of the future. Projects that originally required 5 to 10 IC's can now be designed around a single micro.

But the greatest advantage of a micro is security.

You can create a program and burn it (load it, or program it) into a micro so that no-one can get to the code. This makes your idea (or invention) safe from prying eyes and you have a marketable design.

There are so many areas where a micro can be used. Health, toys, education, invalid assistance, automotive and games are just a few.

Once you get started in micro-controller-design, you will be hooked.

Instead of needing an assortment of different IC's you just need one.

In the forthcoming issues of Electronics Maker we will be presenting projects using the simplest PIC chip on the market, the PIC12F629.

Even though it has only 8 pins, it has 5 in/out lines and one input line.

The other chip to get you started is the PIC16F628.

It has 15 in/out lines and one input line. With these two micros we have produced a range of projects that will amaze you.