THE CURIOUS ELECTRIC CO.

Solar Dice Instructions

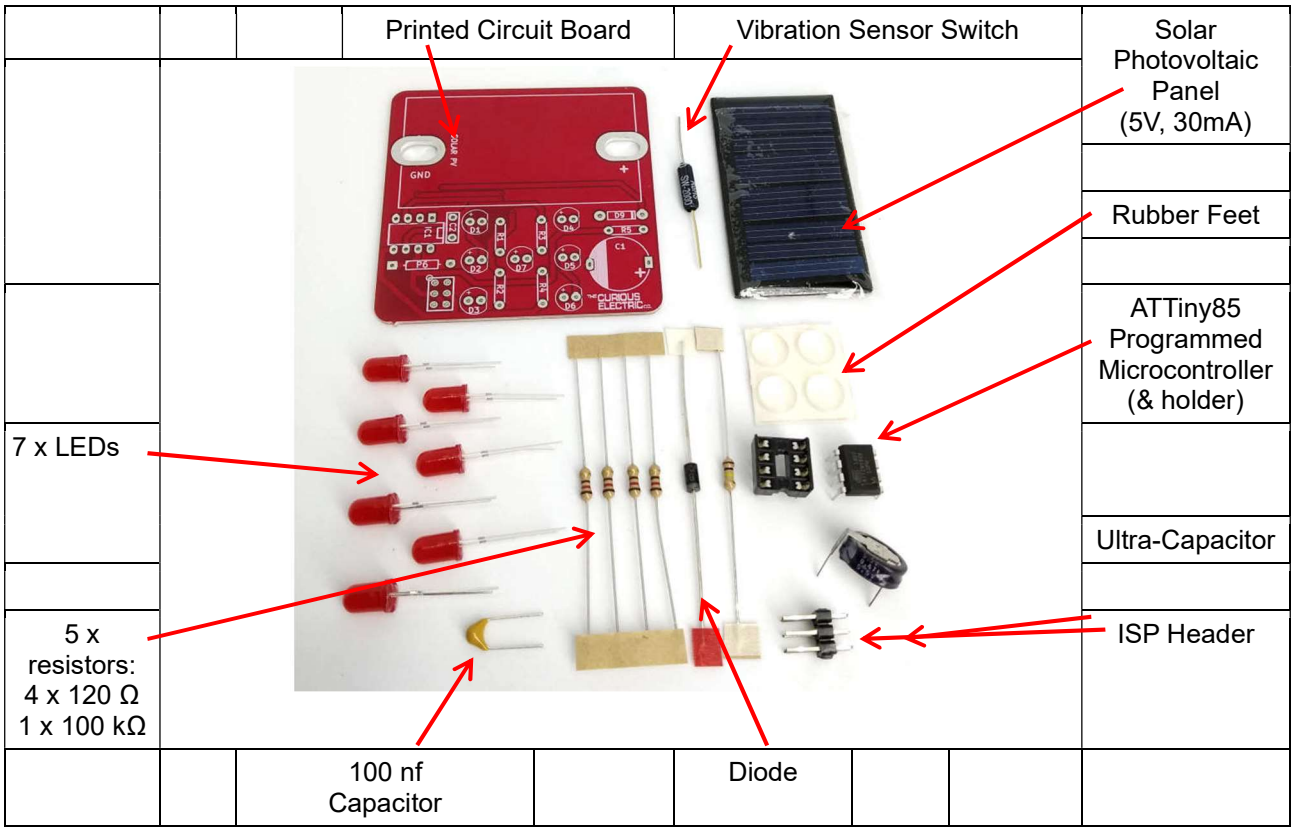
Date:	15/05/2020	Version:	1.0	By:	Matt Little

Shake the solar dice to roll!

When you shake and wake the unit, the seven LEDs around in classic dice formation on the PCB will glow in sequence and slowly stop on a value.

It's solar powered, so will never need batteries! It uses an ultra-capacitor to store the solar energy, so will work even if left uncharged for a long time. But it will need to be left in sun to recharge and then you get in the region of 10-20 'rolls' of the 8 ball.
Once made, it should look great on a bright bit of desk or a windowsill and will be ready for your next board game…
It's designed as a fun and interactive way introduce solar power and improve soldering skills.

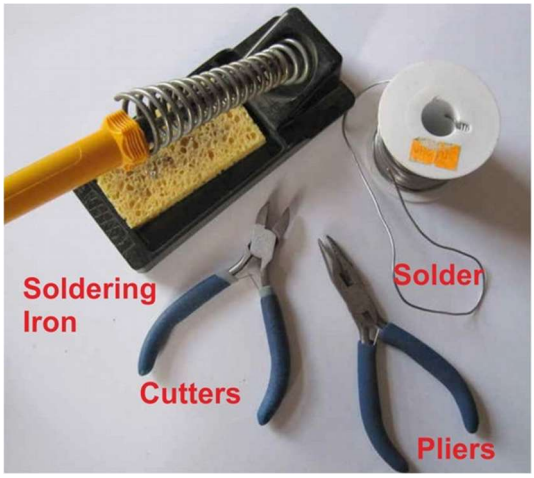
Parts included:



Parts list:

Item	Ref	Item	Ref
0.47F Ultra Capacitor	C1	2x3 ISP Header	P2
100nF Decoupling Capacitor	C2	Vibration Switch	P6
5mm Red LEDs	D1 – D7	Printed Circuit Board	PCB
1N5819 Shottky Diode	D9	120 Ω Resistor	R1 – R4
ATTiny85 Microcontroller (programmed) Plus IC Holder	IC1	100 kΩ Resistor	R5
Solar Photovoltaic Panel (5V, 30mA)	SC1	Rubber Feet	

Tools required:



PCB Instructions:

Step: 1	Solder Solar Photovoltaic Panel

The solar panel must be soldered with the correct orientation.
The solar panel has a + and a – marked side, which must align + to + and – to GND on the PCB.

The solar panel is placed flat onto the top of the PCB with the solder pads showing through the large holes.

It can help to use some tape or blue-tac to hold it in place here.

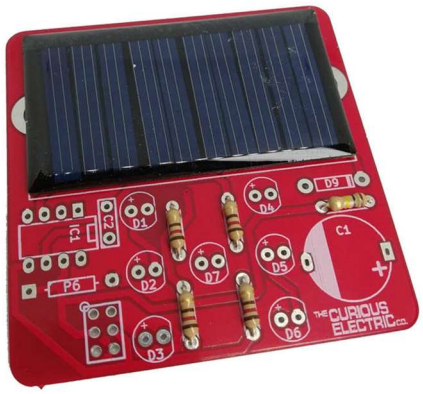
Solder the pads and onto the large holes of the PCB. You might need quite a bit of solder here.

Step: 2	Solder resistors

Value	Ref	Colour
120 Ω	R1 – R4	Brown – Red – Brown – Gold
100 kΩ	R5	Brown – Black – Yellow - Gold

Insert and solder the resistors to the locations marked on the PCB.
Polarity does not matter for resistors.
Ensure they are soldered flat & close to the PCB.

You can use a multi-meter or colour code chart to ensure correct resistor values.



Step: 3	Solder diodes

Ensure correct orientation for D9, the 1N5819 diode. This has tiny markings saying “1N5819” and also a white band around one end to indicate polarity. Ensure the white band on the diode aligns with the white band marked on the PCB.

There are 7 LEDs to solder around the edge of the PCB, marked D1 – D7 on the underside of the PCB. Ensure correct orientation!
The longer lead on the LED is positive, so place that into the hole marked +. The negative side has a slightly flat edge on the body of the LED.

Note: The LEDs are ‘charlieplexed’ which is an interesting way of running lots of LEDs from a small number of micro-controller pins.

Step: 4	Solder capacitors

First solder the non-polarised capacitor, C2. Orientation of these does not matter:

Value	Ref	Marking
100nf	C2	104

Next, solder the polarised ultra-capacitor. Ensure correct orientation of this component.
The negative lead is marked with a white bars. Align the positive lead with the + sign and the negative lead with the white PCB marking.

Value	Ref	Marking
0.47F	C1	0.47F 5.5V

Step: 5	Solder IC holders & ISP Port

Solder the 8 pin IC holder. These fit into the area marked IC1.

Ensure correct orientation!
Ensure the notch on the holder aligns with the notch shown on the PCB.

If you want to be able to reprogram the unit then solder in the 2x3 ISP header pins into the location marked ISP P2 on the back of the board. *(This is not needed if you are not going to re-program it!)*

Step: 6	Solder Vibration Switch

The vibration switch (P6) contains a small metal ball which connects some contacts to trigger the circuit.

One lead of the switch is gold coloured, the other is silver coloured.

To ensure correct operation of the switch, you need to solder the vibration switch into P6 so that it is at a slight angle (as shown) with the gold wire end slightly higher than the silver wire end.

Step: 7	Insert the IC & Test

Carefully push the microcontroller into the 8 pin IC holder.

Ensure that the dot on the microcontroller aligns with the notch on the IC holder.

Step: 8	Add Rubber Feet

Stick the four rubber feet onto the base of the PCB in the locations marked with a white circle.

Step: 9	PCB is finished! Let's test...

Please note: *This unit is NOT waterproof. Do NOT leave outside if it will get wet.*

Place the finished unit in bright sunlight.

It should charge up enough to work quite quickly (1-5 mins).

Give it a shake and you should see the LEDs light up and slowly settle on a number 1 -6.

Keep the unit level or it will be activated all the time!

To get a full charge it will need to be left in the sun for a while. It can be left on a windowsill and will work very well there.

Step: 10	Re-programming Notes

Note: No programming is needed – the microcontrollers are already programmed! Here are some notes for people wanting to take things a step further…

The circuit board has a standard ISP (In-System Programming) port for the ATTiny85 microcontroller and full access to the code which can be programmed via the Arduino IDE, if that's your thing.
You will need an Arduino Uno with wiring set up for programming an ATTiny85 (please search internet).
You will need to include the ATTiny85 programming board manager into your version of the Arduino IDE (please search internet).
You upload code by using the "Arduino as an ISP" option.

Contact details:

We would like you to be happy with this kit. If you are not happy for any reason, then please contact us and we will help to sort it out.
Please email **hello@curiouselectric.co.uk** with any questions or comments.
Please tweet us at **@curiouselectric**
If any parts are missing from your kit then please email **hello@curiouselectric.co.uk** with details and, if possible, where the kit was purchased.
More technical information can be found via **www.curiouselectric.co.uk**

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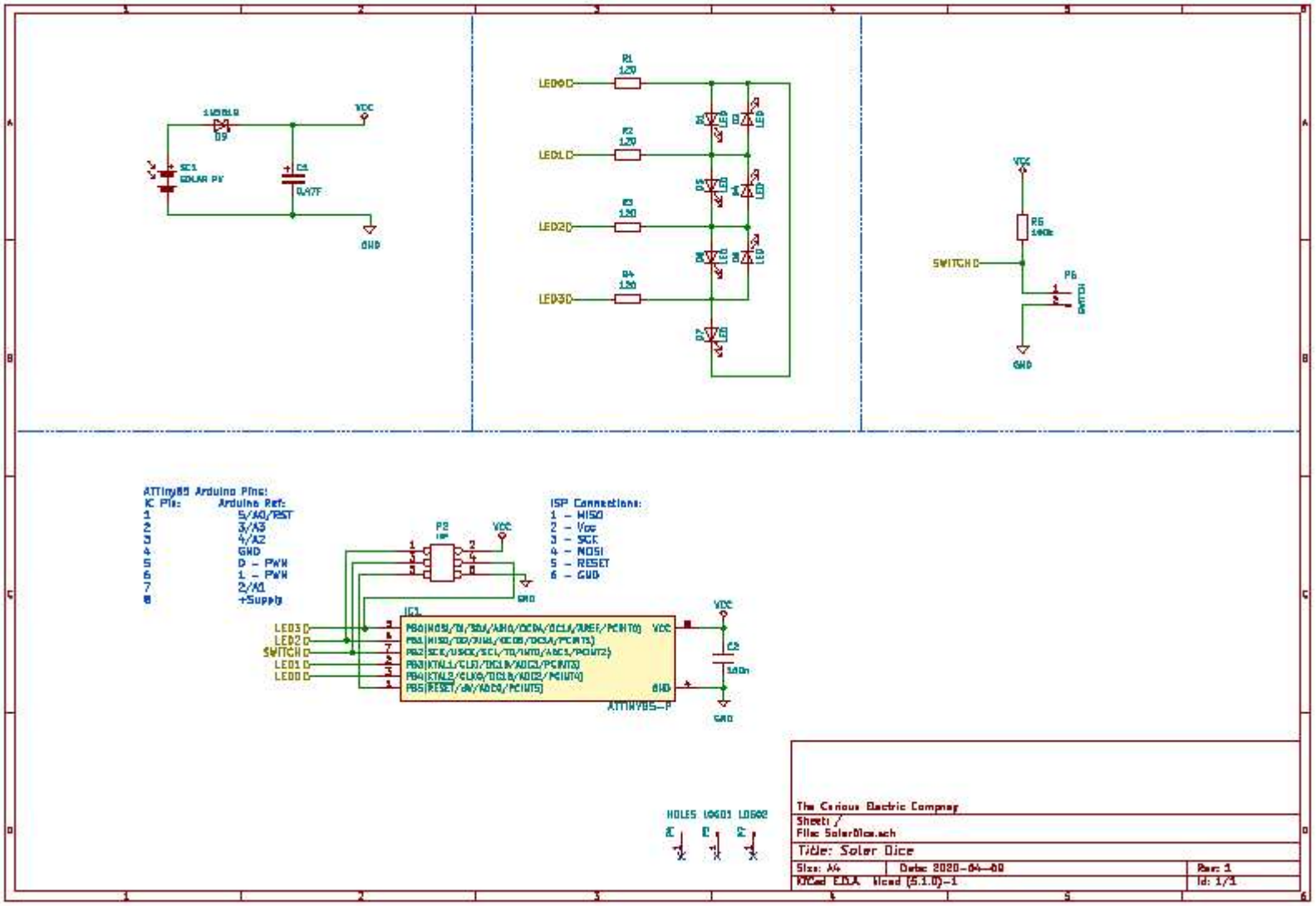
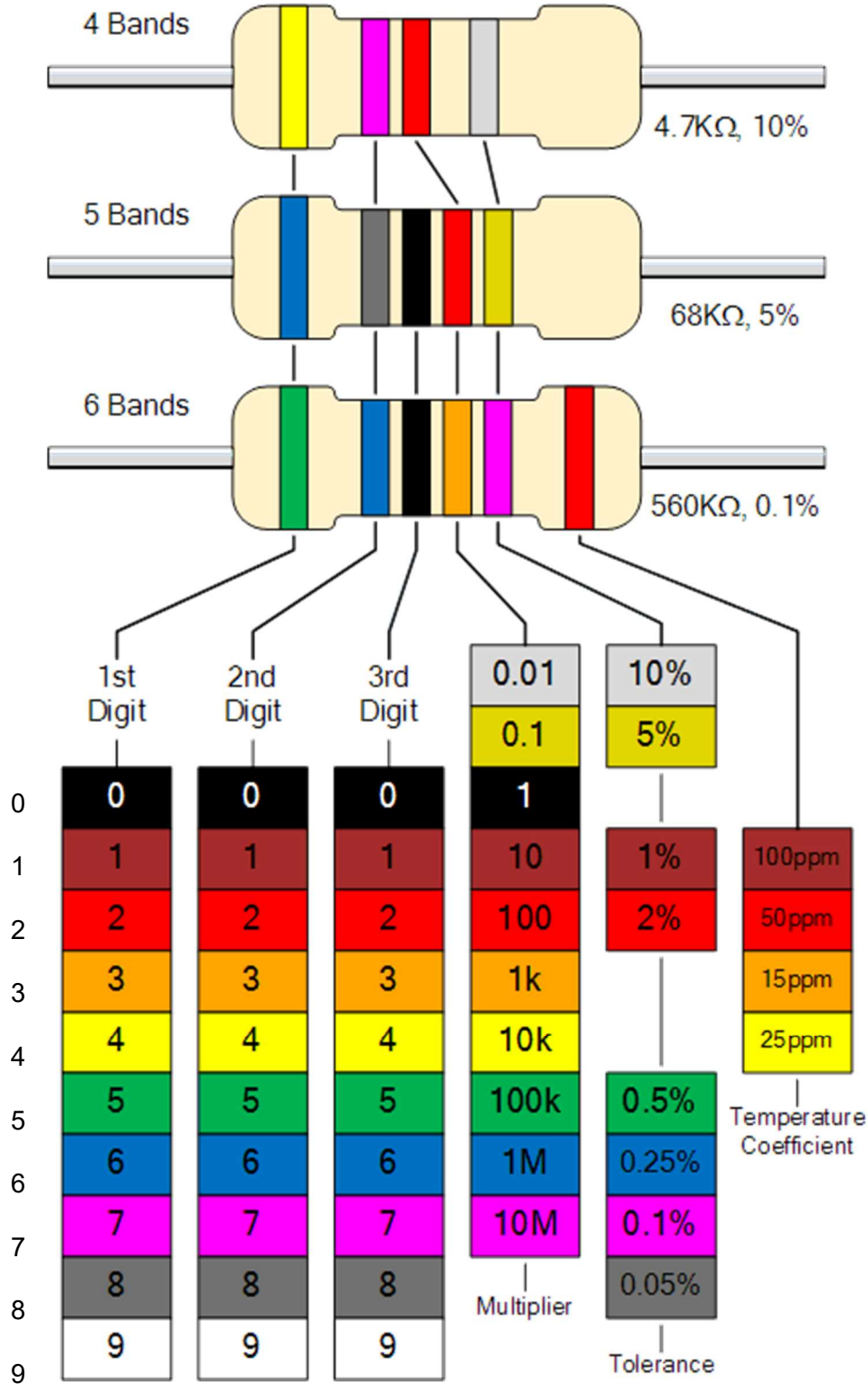
Circuit Schematic



Resistor Colour Codes