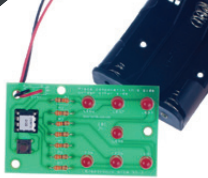
Kitronik



PLAY GAMES ON THE MOVE BY BUILDING THIS

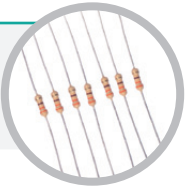
# ELECTRONIC DICE KIT

# BUILD INSTRUCTIONS

Before you start take a look at the Printed Circuit Board (PCB). The components go in the side with the writing on and the solder goes on the side with the tracks and silver pads.

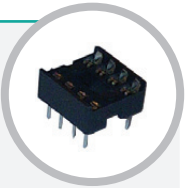
## 1 PLACE RESISTORS

Start with the seven resistors R1–R7 are 330Ω (orange, orange, brown coloured bands). The text on the PCB shows where R1, R2, etc go.



## 2 SOLDER THE IC HOLDER

Solder the Integrated Circuit (IC) holder into IC1. When putting this into the board, be sure to get it the right way around. The notch on the IC holder should line up with the notch on the lines marked on the PCB.



## 3 PLACE THE SWITCH

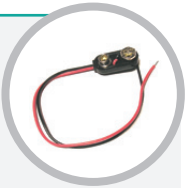
Insert the switch into the board where it is labelled SW1. Once you have got the pins lined up with the holes they can be pushed firmly into place and soldered.

## 4 SOLDER THE LEDs

Solder the seven Light Emitting Diodes (LEDs) into LED1 – LED7. The LEDs won't work if they don't go in the right way around. If you look carefully one side of the LED has a flat edge, which must line up with the flat edge on the lines on the PCB

## 5 FIT THE BATTERY CONNECTOR

The battery connector should be soldered into the 'Power' terminal. First feed the power clip through the strain relief hole next to the power connection. You should feed the wire from the solder side of the board. The red wire must go to the '+' terminal (also marked 'red') and the black wire must go to the '–' (also marked 'black') terminal.



## 6 INSERT INTEGRATED CIRCUIT (IC)

The IC can be put into the holder ensuring the notch on the chip lines up with the notch on the holder.

## 7 CONNECT THE BATTERIES

Connect the PP3 snap on to the 3xAA battery box. **Do not use a 9V battery with this circuit as it will destroy the IC.**

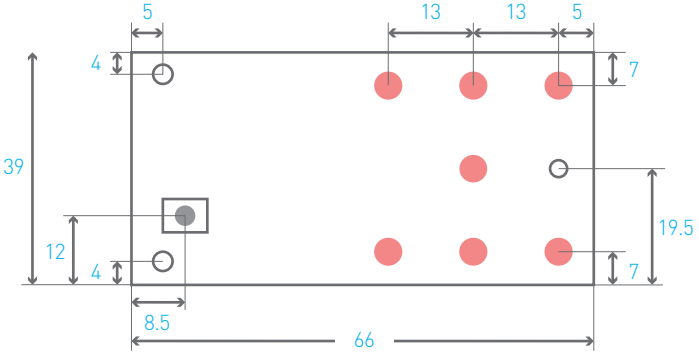
## CHECKING YOUR PCB

Check the following before you connect power to the board:

- Check the bottom of the board to ensure that:
  - All these leads are soldered.
  - Pins next to each other are not soldered together.

- Check the top of the board to ensure that:
  - The notch on the IC holder / IC is next to the power connection.
  - The flat edge of each of the LEDs match the outline on the board.
  - The red and black power leads are connected to the correct pads (see the PCB markings).

## MECHANICAL DETAILS




Dimensions in mm

# TESTING THE PCB

Before testing the board it's worth checking to make sure everything is in the correct place, as described in 'checking your PCB'.

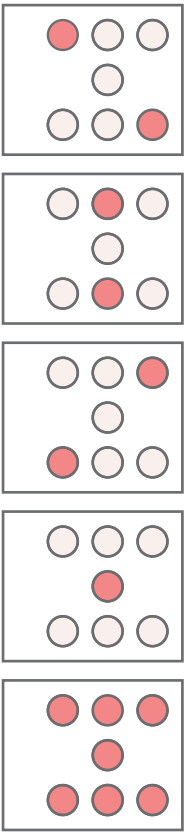
The software on the microcontroller has been specially designed to allow easy testing of the PCB. Each time the board is powered up the LEDs will flash the pattern shown right before it then works as a dice.

Power up your board and check this sequence is displayed.

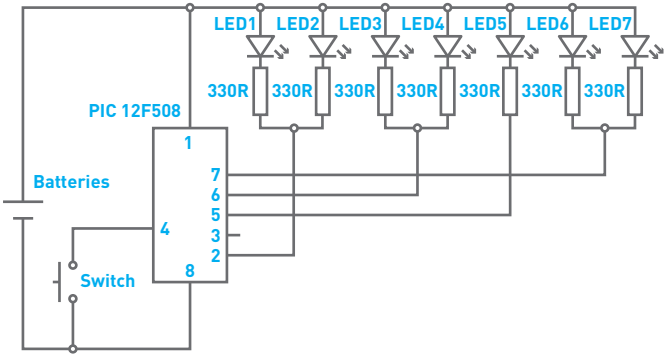
Push the switch and check the lights flash and that when the switch is released a number is shown.

If your dice doesn't work as described use the checking your PCB information on the left.

**POWER UP SEQUENCE**



## HOW THE CIRCUIT WORKS



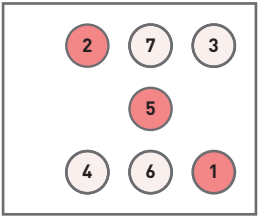

At the heart of the electronic circuit is a PIC microcontroller. A microcontroller is in effect a small computer. The circuit uses a push switch to detect when it should start generating the next number to be displayed. When the button is pressed the PIC very rapidly cycles through number 1 to 6, upon release of the button the number is displayed. The PIC then determines which of the LED's should be lit up and sets pins 2, 5, 6 and 7 as required.

The relationship between the number that is to be displayed on the dice, the LED's that need to be lit up and the PIC pins that controls them are shown in the table below.

| No. on Dice | LEDs that are on | PIC Pins |
|---|---|---|
| 1 | 5 | 5 |
| 2 | 1+2 | 2 |
| 3 | 1+2+5 | 2+5 |
| 4 | 1+2+3+4 | 2+6 |
| 5 | 1+2+3+4+5 | 2+5+6 |
| 6 | 1+2+3+4+6+7 | 2+6+7 |

## HOW THE CIRCUIT WORKS

So for example, if the number 3 (shown right) was to be displayed on the dice this would require LED's 1, 2 and 5 to be lit. These are controlled by PIC pins 2 and 5 (pin 2 controls LED's 1 and 2). As the cathode of the LED's are permanently connected to V+ the LED's are turned on by taking their associated PIC pin low. This creates a voltage across the LED(s) and which turns it/them on.




The value of resistors R1-R7 is 330Ω. These resistors limit the current that can flow through the LED's. This protects the LEDs and controls their brightness.

## USING YOUR DICE

- When the button is pressed a number is shown on the dice.
- Pressing the button again will display a new number.
- After a number has been displayed for 30 seconds the LEDs go out and the microcontroller goes to sleep. In this state is takes virtually no power so the batteries can be left connected when the dice is not in use. Next time the button is pressed the dice wakes up and functions as normal.

This dice kit is a fun way to practice your soldering skills. Once built the kit has seven LEDs that are used to display a random dice number every time the 'start' button is pressed. The dice is controlled by a (pre-programmed) PIC micro-controller. The example shown to the right shows the built dice kit being used as part of a travel game.

Example Use

**TOOLS REQUIRED:**

- Soldering Iron
- Solder
- Wire Cutters

**INSTRUCTIONS:**

This booklet contains build instructions and a circuit explanation. For more detailed resources please visit our website at www.kitronik.co.uk/2109

**KIT REQUIRES**

3 x AA batteries

**STOCK CODE**

2109 or 1009 (Retail Version)

**WARNING**: Contents may inspire creativity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Designed & manufactured in the UK by Kitronik

RoHS CE

For more information on RoHS and CE please visit kitronik.co.uk/rohs-ce. Children assembling this product should be supervised by a competent adult. The product contains small parts so should be kept out of reach of children under 3 years old.