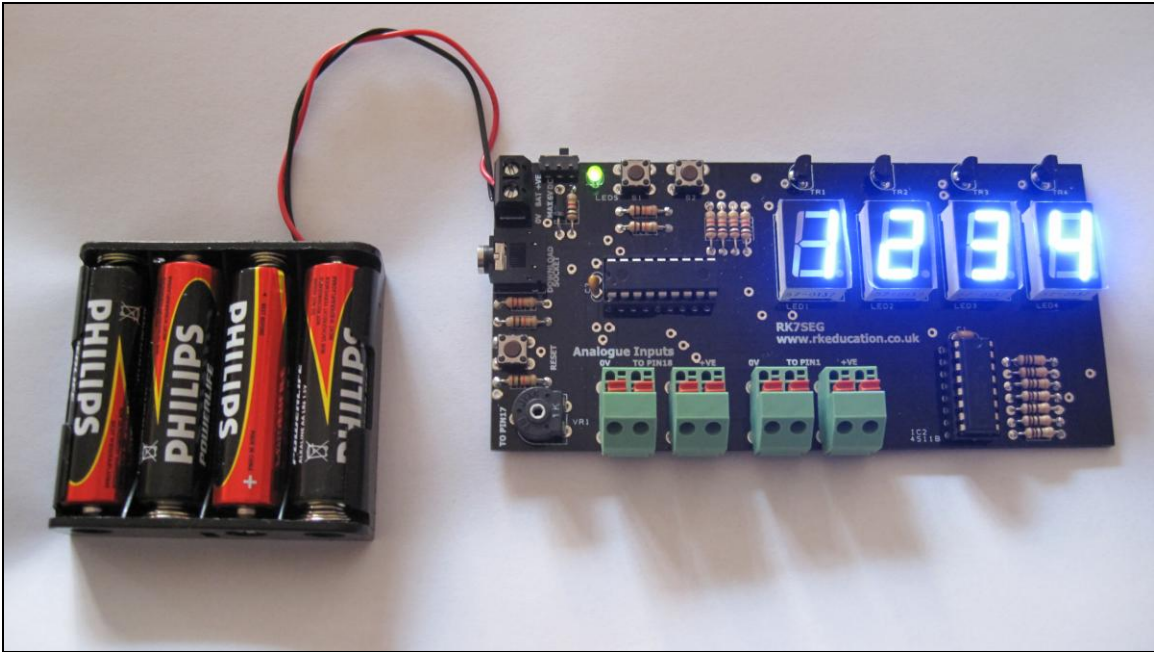
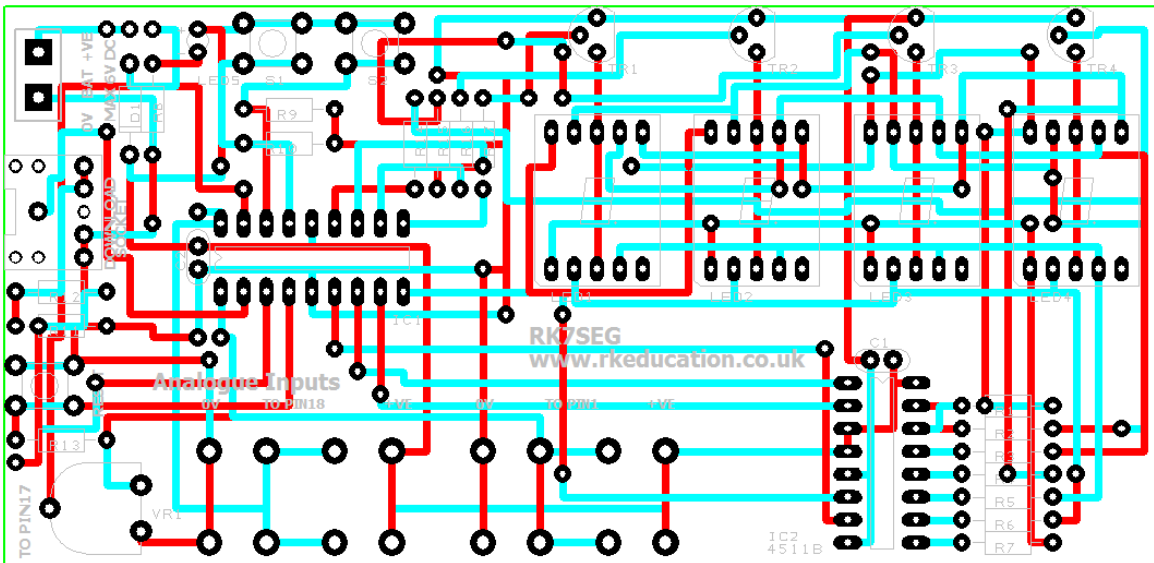


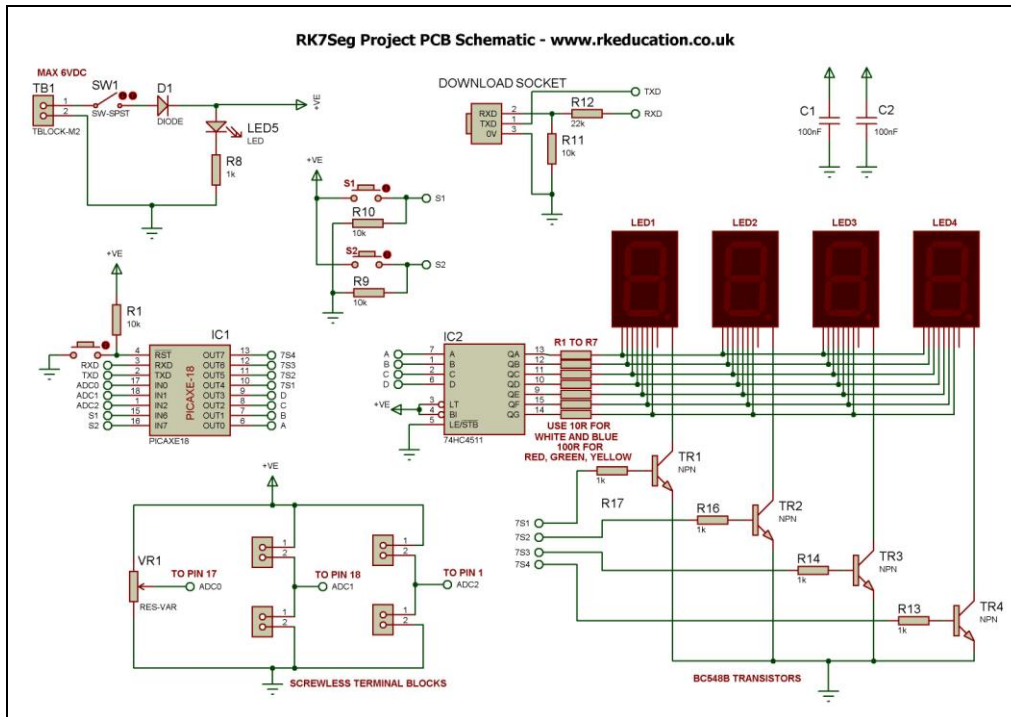
RK7Segment Component List and Instructions



Constructed PCB



PCB layout



Schematic Diagram

Description

The RK7Segment software development PCB has been designed to use 18 pin PIC microcontrollers such as the PICAXE-18M2

- Simple, low cost and compact
- Designed to allow the user to develop software that utilises 7 segment displays
- Perfect for testing PIC software
- Ideal for use in schools for teaching and learning
- Great for electronic hobbyists
- Designed for PIC projects that use 7 segment LED displays
- Uses a BCD to 7 segment decoder
- Software is downloaded from a PC into the microcontroller via a 3.5mm stereo socket
- Designed to be fully compatible with PIC microcontrollers such as PICAXE
- Compatible with your existing flowchart software
- The 8 outputs are used to control the LED displays and output to the BCD decoder
- All of the inputs are utilised
- 2 inputs are connected to tactile switches
- 3 inputs are analogue, 1 is connected to a PCB mounted potentiometer and 2 are connected to screwless terminal block potential dividers
- The clock reference is from an internal resonator
- Powered from 4AA batteries
- High quality, professional double sided PCB
- Power switch and LED power indicator

Component List

C1, C2 – Smoothing caps, 100nF ceramic capacitor

Power Switch – Ultra miniature slide switch

Download Socket – 3.5mm stereo socket

D1 – 1N400x

R1 to R7– Current limit resistors for the 7 segment displays, for blue and white displays use 10R (brown, black, black) and for red, green and yellow use 100R (brown, black, brown)

R8 – 1k (brown, black, red)

R9 to R11 – 10k (brown, black, orange)

R12 - 22k (red, red, orange)

R13 - 10k (brown, black, orange)

R14 to R17 - 1k (brown, black, red)

RESET, S1, S2 – 6mm tactile switch

LED1 to LED4 - 14.2mm common cathode 7 segment LED display

LED5 – 3 or 5mm LED (Not blue or white)

IC1 – 18 pin DIP socket with PICAXE, e.g. PICAXE-18M2

IC2 - BCD to 7 segment decoder, e.g. 4511b, 74HCT4511

Terminal block for the power supply

When constructing it is advisable to start with the components that have the lowest profile and work high, for example start with the resistors and end on terminal block.

Instructions

The PCB has been designed to use microcontrollers based on the PIC e.g. Genie, please see the appropriate website

There are 5 areas to familiarize yourself with.

1. Power
2. Software download socket
3. PIC I.C.
4. BCD to 7 segment decoder
5. Tactile switch inputs
6. Analogue inputs
7. Transistors
8. LED display outputs

1. Connecting power

The first step is to power the PCB, there is a terminal block and this is where power is supplied to the circuit. To power the PCB supply it with 6VDC, this could be from a battery box with 4AA batteries for example, the power supply should not exceed 6VDC. The maximum voltage for a PIC is 5.5VDC, there is a diode that reduces the voltage from 6V by approximately 0.7VDC.

The system can now be turned on using the ultra-miniature slide switch at the top of the PCB. The green power LED should light up, it is next to the power switch. If it does not light up it may indicate faulty batteries or power supply, check them carefully or a short circuit.

2. Downloading software into the RK7Segment

Once the software has been written using a suitable Programming Editor it can be downloaded into the PICAXE (or equivalent). This is downloaded using a download cable that connects either to your PC's serial port or USB port. Insert the download plug into the download socket and activate the program function in your Programming Editor, if all goes well it will tell you the program download was successful.

If the software has been written correctly and the inputs and outputs (i/o) have been set correctly in your software the PCB will work in the way you planned, if you are a beginner it is always best to start simple and work up, this makes it easier to iron out any bugs in your software.

3. PIC I.C.

This section of the PCB contains the PIC microcontroller and it is the 'brains' and it controls the circuit, this is dependent on how the software has been written. This PCB has been designed to use PICAXE microcontrollers, for example the PICAXE-18M2. Please refer to manufacturers information for more information on how to use your chosen MCU.

4. BCD to 7 segment decoder

The purpose of the BCD (binary coded decimal) to 7-segment decoder is to convert the logic states at the outputs of the PICAXE MCU into a form which will drive a 7-segment display. The display then shows the decimal numbers 0-9 and is easily understood. The reason a BCD to 7-segment decoder is used is to reduce the number of PICAXE outputs used, by using the BCD to 7-segment decoder 4 outputs are used rather than the 7 if it were not used. BCD to 7-segment decodes are very common and are widely used, there is a huge amount of information about them online.

BCD inputs				segment outputs							display
D	C	B	A	a	b	c	d	e	f	g	
0	0	0	0	1	1	1	1	1	1	0	0
0	0	0	1	0	1	1	0	0	0	0	1
0	0	1	0	1	1	0	1	1	0	1	1
0	0	1	1	1	1	1	1	0	0	1	1
0	1	0	0	0	1	1	0	0	1	1	1
0	1	0	1	1	0	1	1	0	1	1	1
0	1	1	0	0	0	1	1	1	1	1	1
0	1	1	1	1	1	1	0	0	0	0	0
1	0	0	0	1	1	1	1	1	1	1	1
1	0	0	1	1	1	1	0	0	1	1	1

Truth table

5. Tactile switch inputs

When pressed the tactile switches connect the +VE supply to the appropriate pin of the PIC. The standard state is 0V, 0V represents a logic 0 and +VE represents logic 1. The inputs on the PCB are intended to be used for counting operations, for example up/down counting and other tasks such as starting and stopping a software function. How exactly these switches are used depends on what the intended purpose of the software is.

Please note there is a RESET switch on the PCB and this used for resetting the PIC.

6. Analogue inputs

This circuit has 3 analogue inputs, 1 PCB mounted potentiometer and 2 sets of pairs of screwless terminal blocks that are arranged as potential dividers.

The purpose of these is to allow the user to read in analogue voltages, convert them to a digital value and display the value. For example the PCB mounted pot could be read into the MCU and the digital value displayed. A temperature reading could be taken or a light level reading could be taken.

7. Transistors

The purpose of the 4 transistors are to control the 4 LED displays, when a logic one is sent to the base of a transistor the LED display it is connected to will be enabled and it will display according to what signals are being sent to the BCD to 7-segment decoder at that moment in the software sequence.

There are 4 transistors and 4 displays and in order to control the LED displays in a meaningful way they will need to be multiplexed, the displays are not all operated simultaneously. This involves turning each LED display on in turn at high speed and sending the appropriate data to each display. It is possible that the displays will visibly flicker and this is quite normal.

7. LED display outputs

The LED displays are made up of 7 separate LEDs and these make up a digit, there is also a decimal point but these are not used in this circuit. When appropriate data is sent to the BCD to 7-segment decoder and when a display is enabled it will display a number.

Please visit our website

www.rkeducation.co.uk

If you have any comments or queries please email us at

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