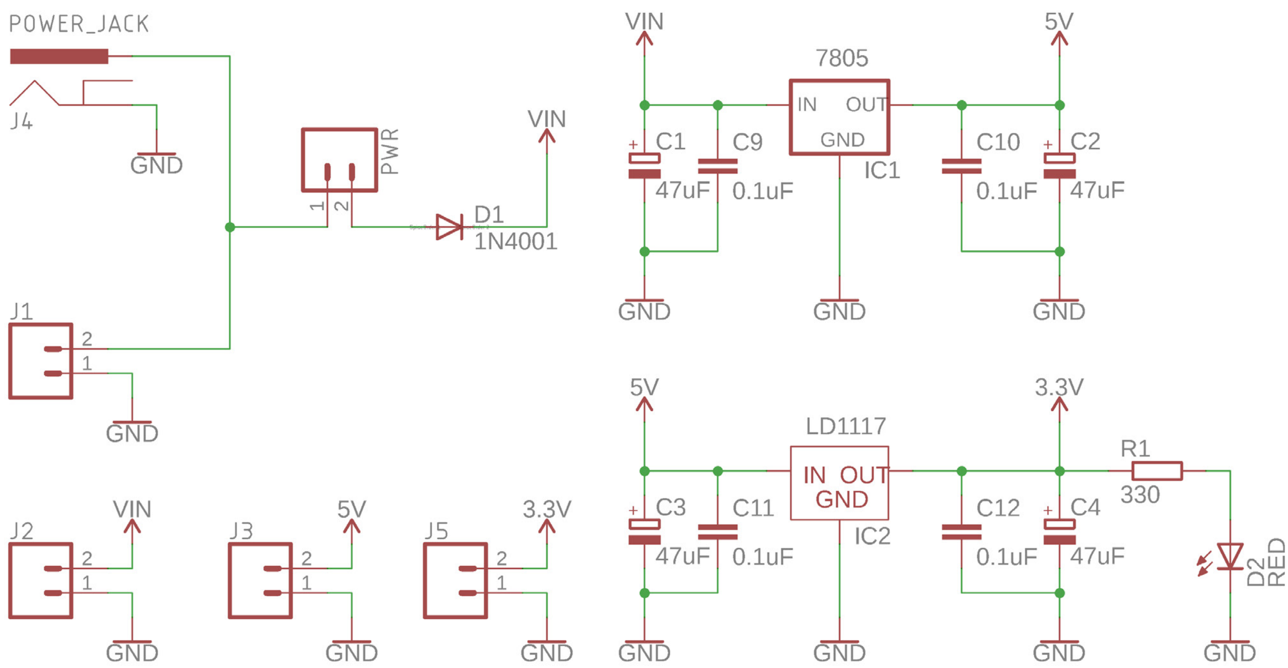
P1: Power Supply Kit Rev. C



Description: This kit uses linear voltage regulators to provide a 5V and 3.3V output that can be used to power different circuits.

An input voltage ranging from 7-24V can be applied to the input terminals - this could be from the screwterminals (J1) or the power jack (J4). A jumper acts as a switch and can be used to turn the circuit ON/OFF. The output from the jumper is then passed through a diode (D1) which is used to ensure that the input is connected with the correct polarity. The output from the diode is termed as VIN which is then used to generate the required voltages. VIN is also passed-through to the output terminal (J2) and can be used to power other circuits.

VIN is used as the input for the 7805 regulator (IC1) which generates a fixed output voltage of 5V. The 5V output is connected to the output terminal (J3). We use capacitors at the input and output pins of IC1 to filter out noise and to also act as an energy reservoir.

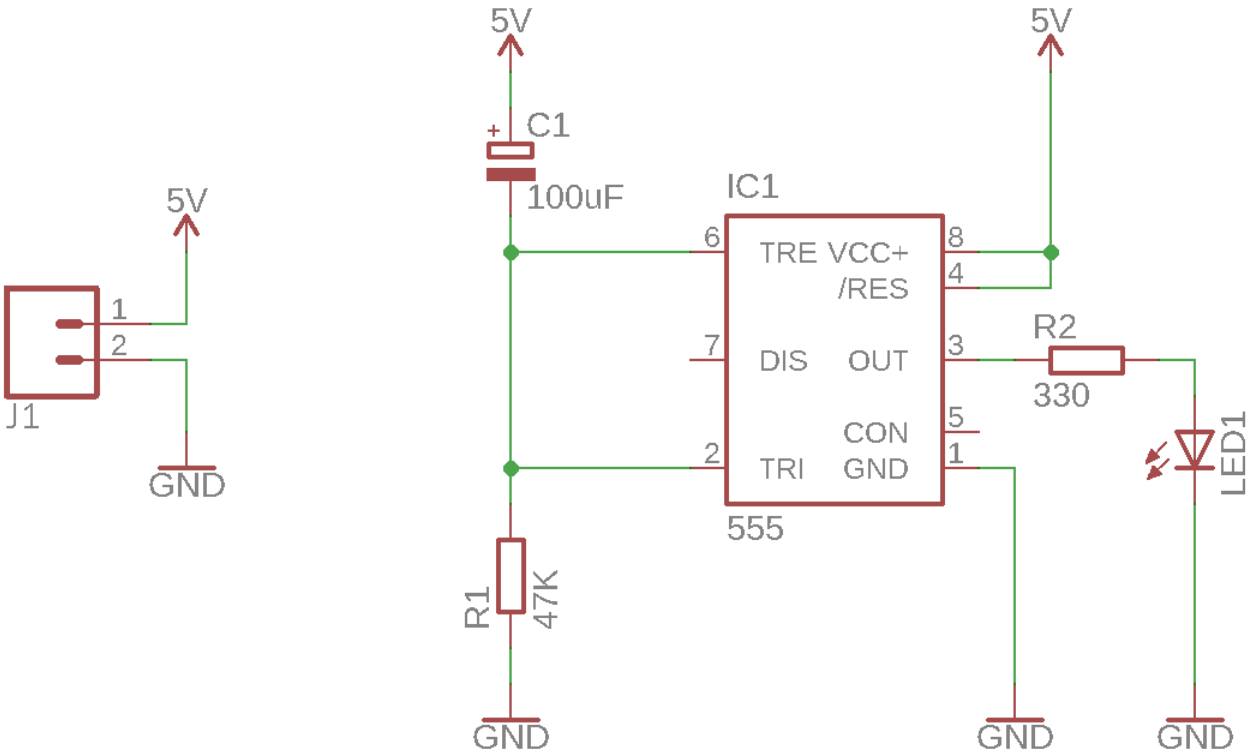
To generate 3.3V, we use the 5V output from IC1, this is fed to the input of the L1117 regulator (IC2). The 3.3V output is connected to the output terminal (J5) and just like before, we use capacitors to filter out noise and to act as an energy reservoir.

We have also connected an LED to the 3.3V output which will glow when the 3.3V output has switched ON. The 5V & 3.3V regulators can supply a maximum current of 1A, though adequate heatsinking would have to be provided to take care of the heat generated at higher currents.

Learn how the circuit works along with related information by visiting the following link:

www.BnBe.club/BBox2/p1

P2: 555 Delay Circuit Rev. A



Description: This circuit generates a delay using the 555 timer IC. The 555 timer can be powered from a supply voltage ranging from 5V to about 16V but we will simply use the 5V output from the power supply board we built in the last project.

Pins 8 and 1 are the power supply pins and we connect 5V to pin 8 and ground to pin 1. Pin 4 is the RESET pin and if this pin is LOW (at ground potential) then the 555 timer will be in the RESET state, which is why we connect 5V to this pin to keep it in the HIGH state. Pin 3 is the output pin and we connect an LED through a current limiting resistor so that we can view the output state.

Pins 2 and 6 control the operation of the circuit depending on the voltages at this pin. We've connected the two pins together and we also have a RC circuit in place which varies the voltage at pins 2 & 6. You can use the link below to get a deeper understaning of how the 555 operates but here's the important information that you need to know to understand the circuit:

1. If the voltage at the trigger pin (pin 2) is less than 1/3rd of the supply voltage, the output will be HIGH.

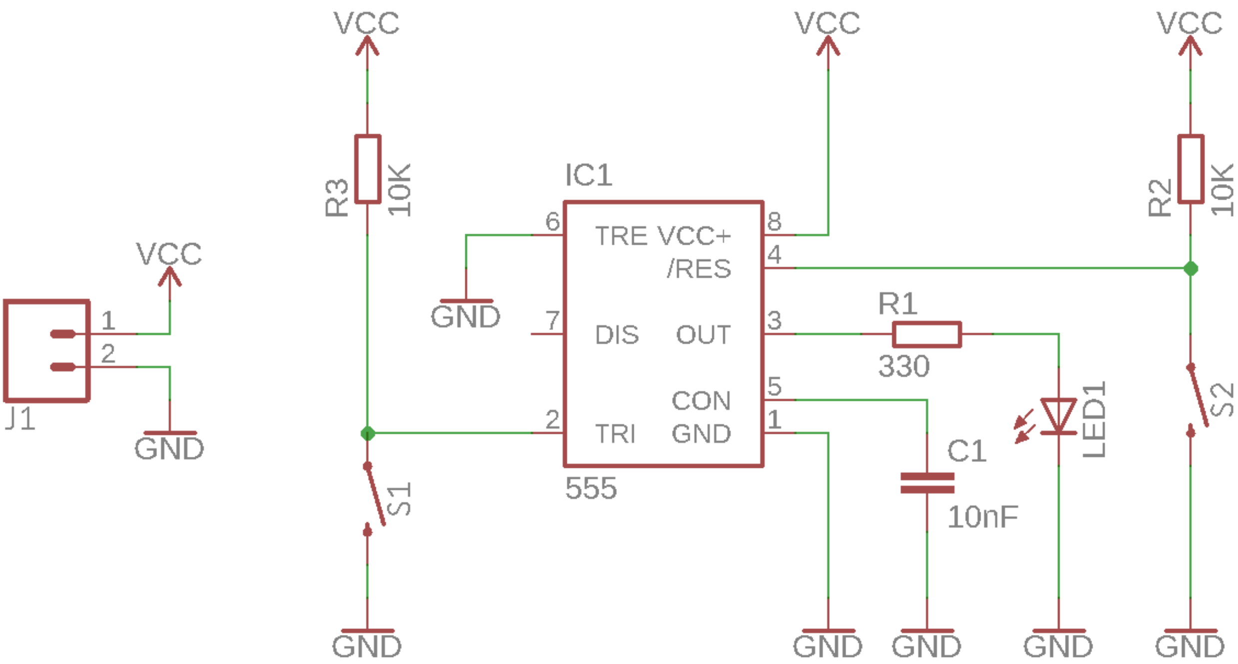
2. if the voltage at the threshold pin (pin 6) is above 2/3rd of the supply voltage, the output will be LOW.

When the circuit is powered ON, the capacitor does not have any charge, consequently the voltage across it is 0. This means that we have approximately 5V across R1. This voltage is also connected to pins 2 and 6, and this causes the output to stay LOW (LED OFF). As the capacitor charges, the voltage across it starts to rise. Consequently, the voltage across R1 starts to drop as the sum has to be equal to the supply voltage of 5V. As the voltage across R1 drops below 1/3rd of the supply voltage, it causes the output to go HIGH, switching ON the LED. The delay is approximately 7 seconds and can be adjusted by changing the values of R1 and C1.

Learn how the circuit works along with related information by visiting the following link:

www.BnBe.club/BBox2/p2

P3: 555 Set-Reset Rev. A



Description: We use two switches to control the output state of an LED using a 555 IC. The LED turns ON when switch S1 is pressed, and it turns OFF when switch S2 is pressed. This gives us a SET-RESET circuit which is the basis behind a digital electronics component called a flip-flop that is used in various electronic components including digital memory.

The connections are very similar to the previous circuit, we add a switch along with a pull-up resistor to pin 4. This switch (S2) acts as the RESET switch.

We do not use the threshold pin and we connect it to ground. We add C1 to filter out any noise that may cause the 555 to trigger falsely.

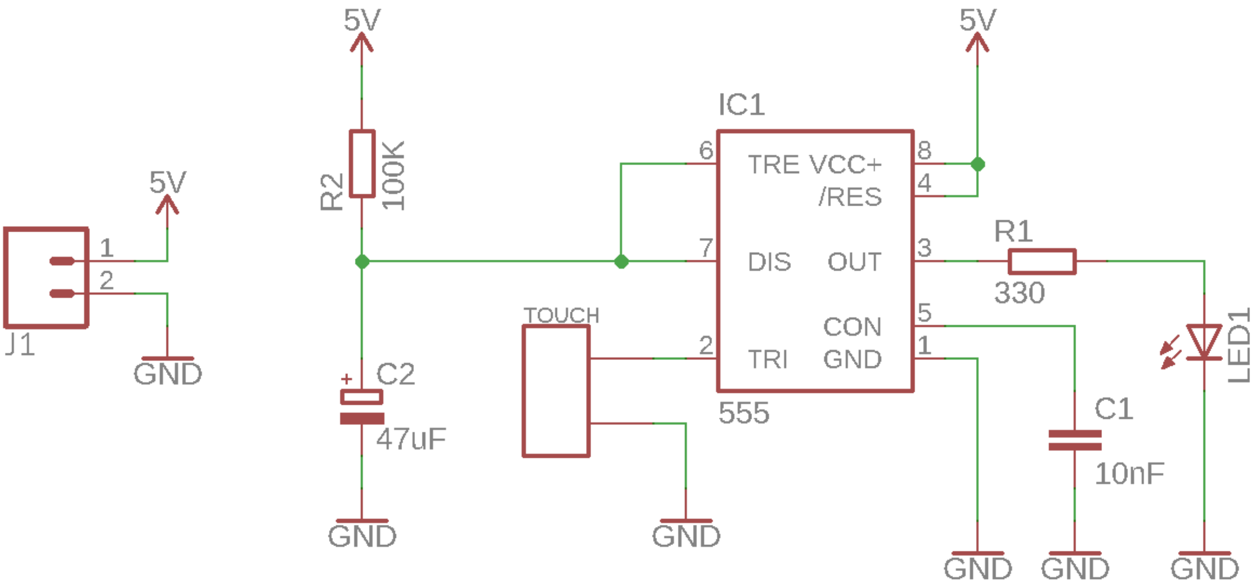
We connect a switch (S1) and pull-up resistor to pin 2 which is the trigger pin. Pressing S1 will cause the voltage at pin 2 to go LOW. Since this will be below $1/3^{rd}$ of the supply voltage, it will cause the output to go HIGH, switching ON the LED. This is a stable state and the LED will continue to glow.

Pressing S2 will RESET the 555 IC and cause the LED to switch OFF. This is also a stabe state for the circuit which means that the LED will stay OFF till S1 is pressed again.

Learn how the circuit works along with related information by visiting the following link:

www.BnBe.club/BBox2/p3

P4: 555 Touch Sensor Rev. A



Description: We design a simple touch switch with a delay, using the 555 timer. When the circuit is powered ON, the output is LOW (LED OFF) but when we touch the probe points, it causes the output to go HIGH for a brief period of time, before returning to the OFF state. This is an example of a monostable 555 circuit.

Before we look at the circuit operation, we need to keep in mind that the 555 timer contains a discharge transistor that can pull pin 7 to ground, which can be used to discharge any capacitor connected to it. When the circuit is powered ON, the output is in the LOW state. The discharge capacitor is switched ON and it shorts capacitor C2 to ground, which prevents it from charging.

When we touch the capacitor probes, it causes the voltage at pin 2 (trigger) to drop below 1/3rd of the supply voltage which will cause the output to change state and the output will now be HIGH which switches ON the LED. When this happens, the discharge transistor switches OFF and C2 can now start charging.

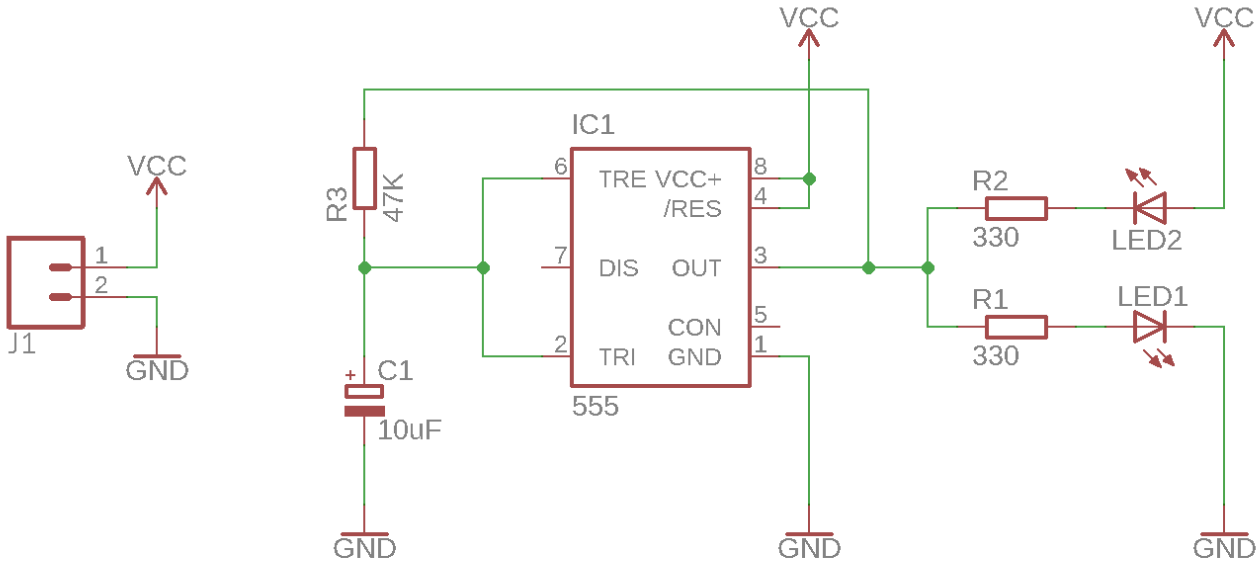
The rate at which C2 charges is controlled by resistor R2 and once the voltage across C2 reaches 2/3rd of the supply voltage, it will cause the output to change state to LOW again. This will switch ON the discharge transistor and it will cause C2 to discharge, bringing us back to the initial (or stable) state.

This cycle will repeat the next time the probe is touched.

Learn how the circuit works along with related information by visiting the following link:

www.BnBe.club/BBox2/p4

P5: 555 Flashing Lights Rev. A



Description: We build a circuit that can flash two LEDs alternatively. This is one way to build an astable multivibrator circuit using the 555 timer IC.

When the circuit is powered ON, the output is LOW. R3 and C1 form a RC charging circuit, but since R3 is connected to the output, the voltage across the RC network is 0. Pin 2 (trigger) and pin 6 (threshold) are both connected to the capacitor and this means that the voltage across the capacitor will control the output state of the 555 IC. Since the voltage across the RC network is 0, the voltage at pin 2 will also be 0 and this will cause the output to switch states, causing the output to go HIGH.

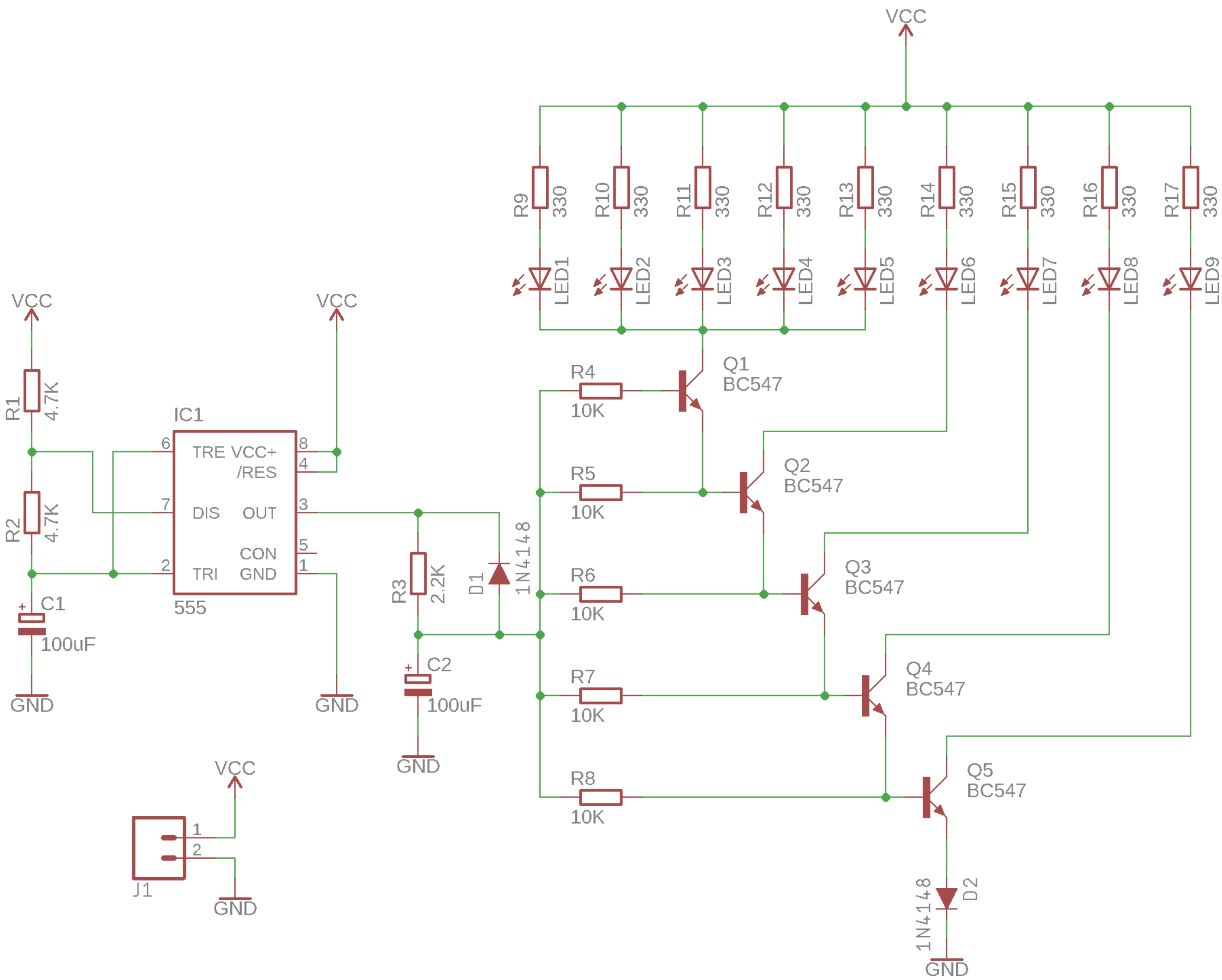
Again, the output is directly connected to the RC network and this means that there is now an output voltage across the RC network which can charge the capacitor. When the capacitor voltage reaches 2/3rd of the supply voltage, it will cause the output to switch states again - causing the output to go LOW. The capacitor will now start to discharge and once it's voltage drops below 1/3rd of the supply voltage, it will cause the output to toggle to the HIGH state. This cycle keeps repeating, giving rise to a square wave at the output. Since the circuit has no stable state, and keeps alternativing between the two states, it is called an astable multivibrator circuit.

We have two LEDs conencted to the output pin. LED 1 is connected between the output pin and ground such that it will switch ON when the output is HIGH. LED 2 is connected between the output pin and the supply voltage such that it will switch ON when the output is LOW.

Learn how the circuit works along with related information by visiting the following link:

www.BnBe.club/BBox2/p5

P6: 555 Arrow Circuit Rev. B



Description: We now build an interesting arrow (turn signal) circuit using what we have learnt so far.

The circuit is an extension of the astable circuit we built in the last project. The RC network is connected to the supply voltage. The capacitor charges through R1 & R2, while it discharges through R2 and the discharge pin (pin 7). The values of R1, R2, C1 set the charge and discharge rates.

Instead of connecting the output pin directly to the LEDs, we connect it to an RC circuit that causes a capacitor to charge. We use transistors to control the LEDs and the transistors are connected such that the voltage required to switch them ON increases as we move further up the diagram. Q5 will switch ON at approximately 1.4V (0.7V for Q5 + 0.7V for D2). Q4 will switch ON at approximately 2.1V (0.7V for Q4 + 0.7V for Q5 + 0.7V for D2) and so on. This gives us the “sequential“ effect as the capacitor voltage rises.

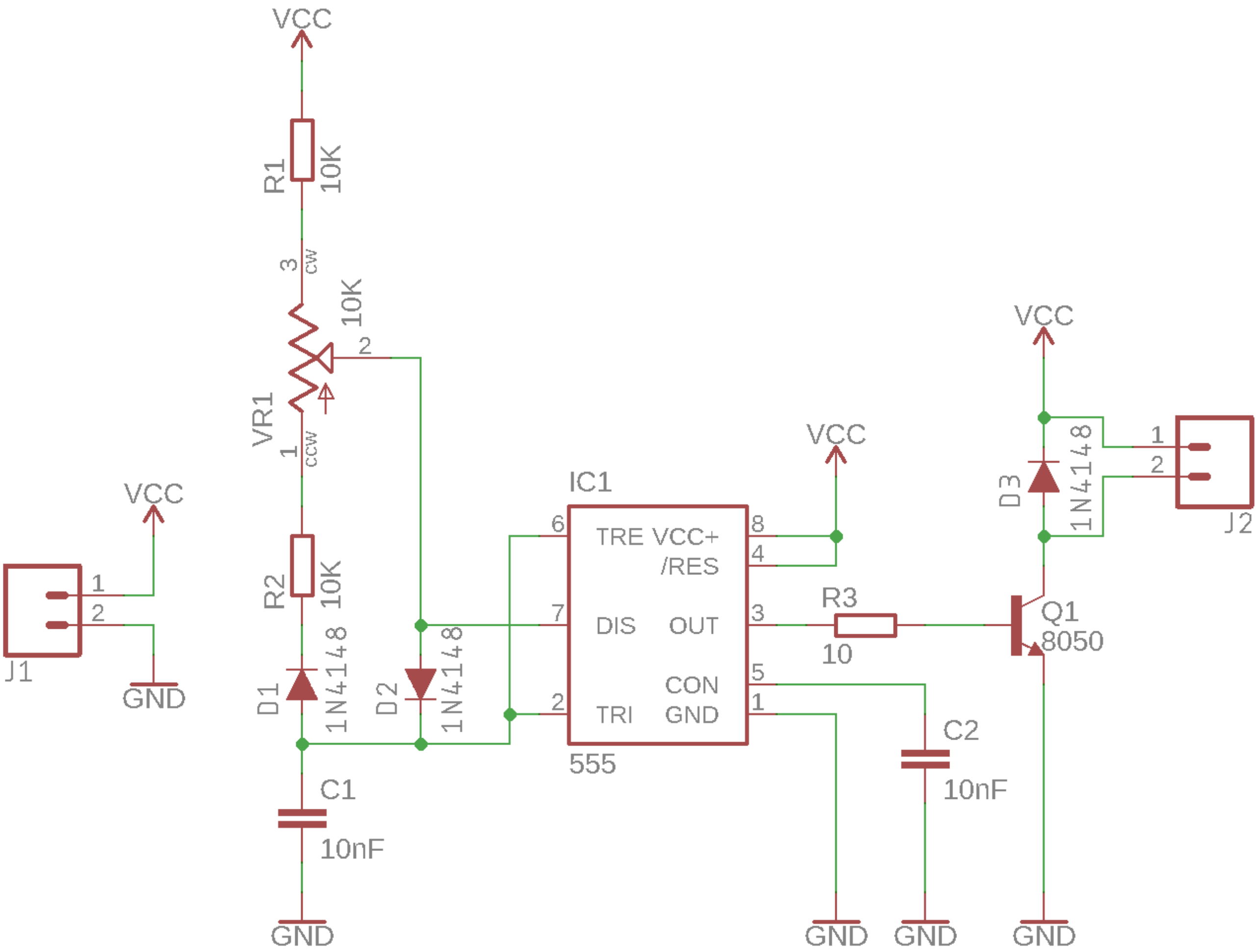
When the output is LOW, the capacitor will discharge through the output pin. We add D1 in parallel to R3 as this provides a low resistance discharge path allowing us to quickly start the next charging cycle to give us a nice turn signal like effect.

The circuit can work at 12V. You can bypass D2 and remove some transistor stages to get it to work at lower voltages.

Learn how the circuit works along with related information by visiting the following link:

www.BnBe.club/BBox2/p6

P7: 555 PWM Circuit Rev. B



Description: We build a basic PWM circuit that can be used to control speed or brightness. We use the 555 in the astable mode.

The operation of this circuit is very similar to the previous one. We use a RC network to charge a capacitor and the voltage across the capacitor will determine the circuit state. The capacitor charges through R1, the top half of VR1 and through the bypass diode D2. It discharges through diode D1, R2, the bottom half of VR1 and into the discharge pin. By varying VR1, we can vary the charge-discharge time.

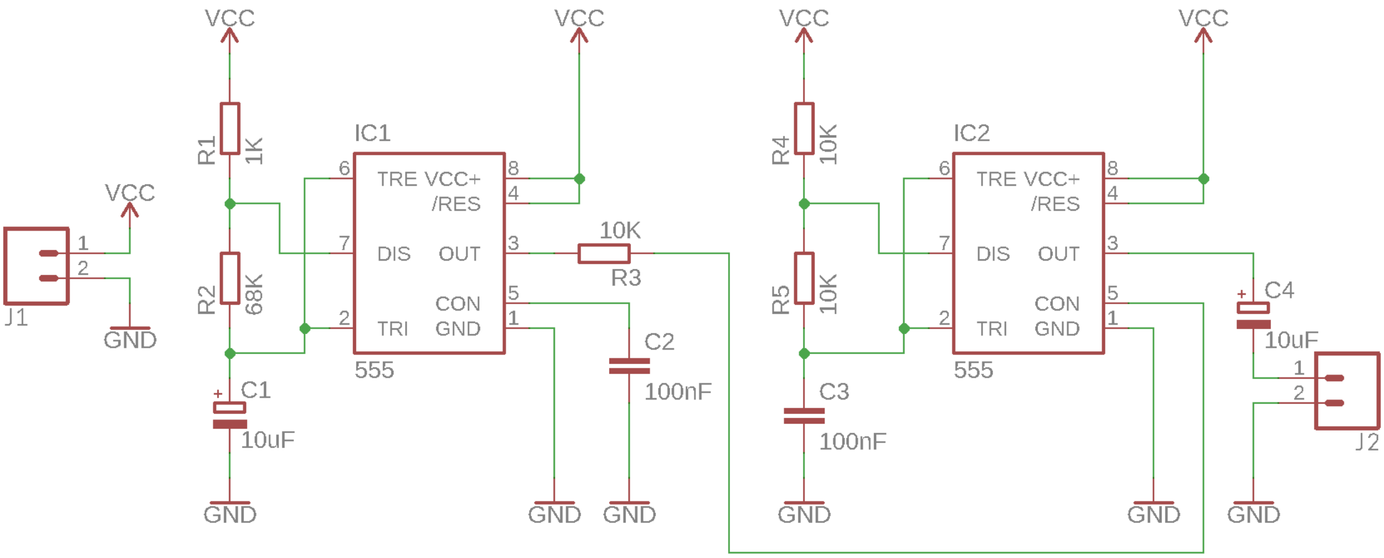
When the voltage across the capacitor falls below 1/3rd the supply voltage, it causes the output to go HIGH and the capacitor starts to charge. When the capacitor voltage reaches 2/3rd of the supply voltage, it causes the output to go LOW and the capacitor starts to discharge. This gives us a sqaure wave and we can control the ON/OFF time by varying VR1.

When the output is HIGH, the transistor Q1 is switched ON and this causes the load connected to J2, to switch ON. When the output is LOW, the load is switched OFF. If the pulse width is 100% (i.e. always ON), the voltage at the load will be approx. the supply voltage. If the pulse width is 50%, then the output load voltage will be approx. 50% of the supply voltage. By varying the output voltage, we can control parameters like motor speed or LED brightness.

Learn how the circuit works along with related information by visiting the following link:

www.BnBe.club/BBox2/p7

P8: 555 Siren Rev. A



Description: We now build a police siren using two 555 timer ICs. Both the ICs operate in the astable mode and we make use of pin 5 to alter the output frequency of IC2.

IC1 is configured in the standard astable mode, with the timing set by R1, R2, C1. The frequency is approx. 1 Hz and this controls the high and low phases of the siren. The output of IC1 is connected to pin 5 of IC2.

The 555 IC has two internal comparators which are responsible for determining the output state. By default, the threshold voltages are 1/3rd and 2/3rd the supply voltage. We can apply an external voltage to the control pin to alter these thresholds which will alter the output frequency.

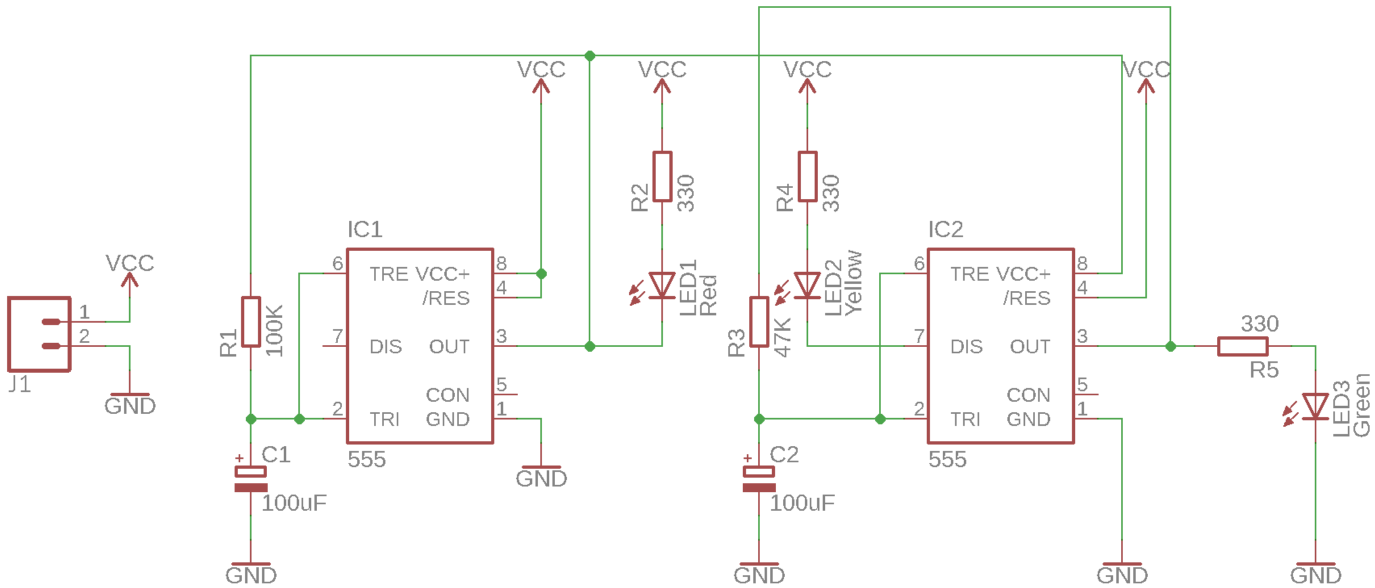
IC2 is configured as an astable multivibrator with a much higher base frequency of 480Hz. Remember that the output of IC1 is connected to the control voltage pin (pin 5) and this alters the output frequency. When IC1 is HIGH, it increases the threshold voltages and this decreases the output frequency, giving us the low phase of the siren. When IC1 is LOW, it reduces the threshold voltages and this increases the output frequency, giving us the high phase of the siren.

The output of IC2 is connected to a small speaker that generates the siren. We use a capacitor (C4) to block the DC component of the signal so as to prevent damage to the speaker.

Learn how the circuit works along with related information by visiting the following link:

www.BnBe.club/BBox2/p8

P9: 555 Traffic Lights Rev. A



Description: This circuit uses two 555 timer ICs connected in the astable configuration to control 3 LEDs, giving us a traffic light like configuration. The circuit has a twist to it, as we will soon see.

The first timer IC (IC1) uses the standard astable configuration, with R1-C1 providing the required timing. The red LED is switched ON when the output of IC1 is LOW, while it is switched OFF when the output is HIGH.

If you look at the circuit carefully, you will notice that IC2 is powered by the output of IC1. This means that IC2 is switched ON only when the output of IC1 is HIGH and we know that the red LED is OFF during this time. IC2 is responsible for controlling the yellow and green LEDs.

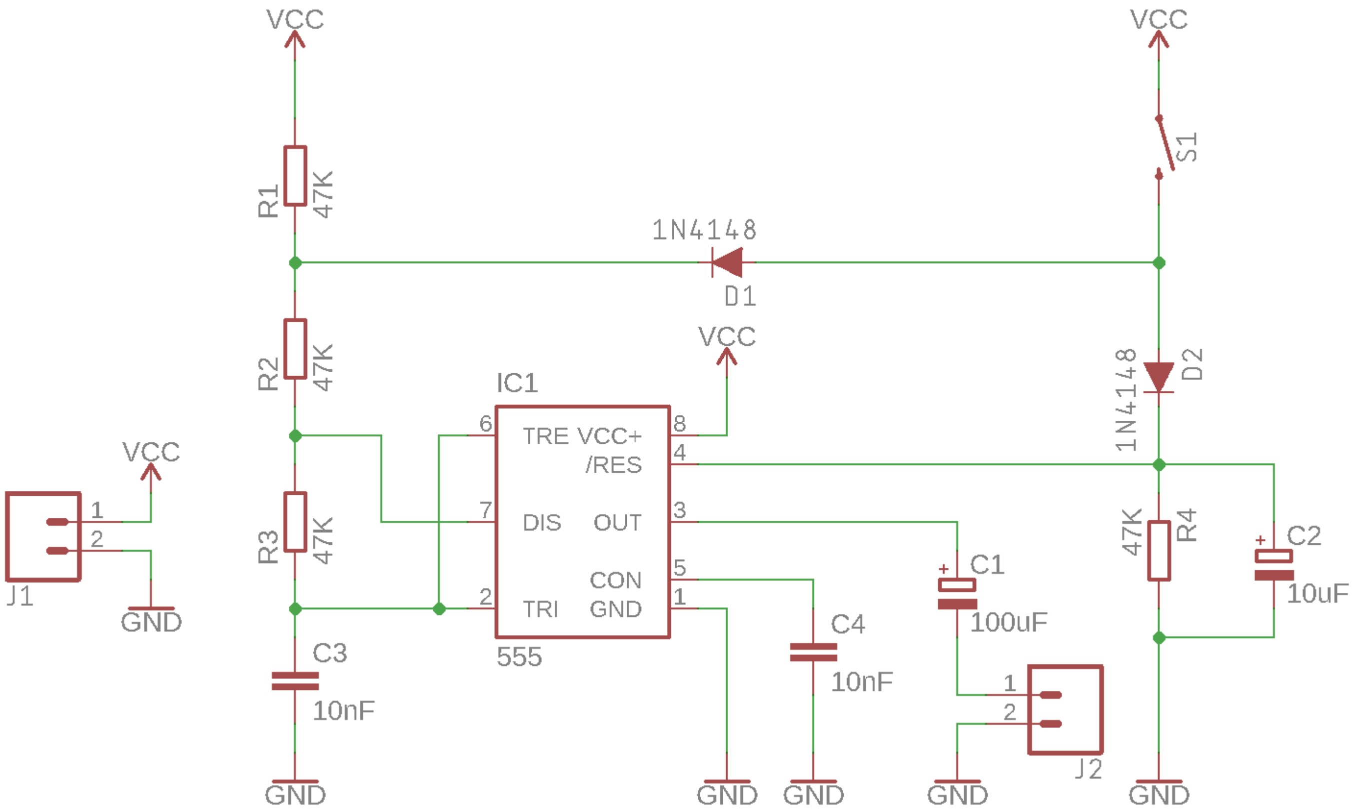
IC2 also operates in the astable mode but has a shorter timer period due to the lower value of R3 compared to R1. The timing for IC2 is provided by the R3-C2 combination. When the voltage across C2 is lower than 1/3rd of the supply voltage, the output of IC2 will be HIGH, switching ON the green LED. As the capacitor charges, the voltage across it will rise and as this reaches 2/3rd of the suplly voltage it will cause the output to change to the LOW state and the capacitor will discharge as it is connected to the output pin. The internal discharged transistor is also switched ON and this causes the yellow LED to switch ON.

All this while, IC1 is getting ready to change it's state again. When this happens, IC2 is switched OFF and the red LED is switched ON. The cycle repeats itself continuously. The trick is to ensure that the IC2 completes it's two states before IC1 has the chance to switch it's state. Because ICs like these require very low currents for operation, we can power them using outputs of other ICs to create interesting circuits like these.

Learn how the circuit works along with related information by visiting the following link:

www.BnBe.club/BBox2/p9

P10: 555 Doorbell Rev. A



Description: This circuit uses a single 555 IC to create a doorbell sound.

IC1 is configured in the astable mode with the charge-discharge times controlled by the RC network. The reset pin (pin 4) of IC1 is normally pulled-down to ground by R4, which means that the 555 timer IC is held in reset mode until the switch (S1) is pressed. When S1 is pressed, the voltage across R4 rises to VCC, which allows the timer IC to operate in the astable mode. C2 is added in parallel with R4 to keep the IC out of reset for a little while after S1 is released. This is necessary as we need enough time to complete the bell sound.

When S1 is pressed, the charging path for capacitor C3 is through D1, R2, R3 while the discharge path is through R3 and the internal discharge transistor. When S1 is released, the charging path changes to R1, R2, R3 but keep in mind that C2 is currently keeping the IC ON and once it discharges, the IC will switch OFF and so will the sound. The circuit remains in this OFF state until the switch is pressed again.

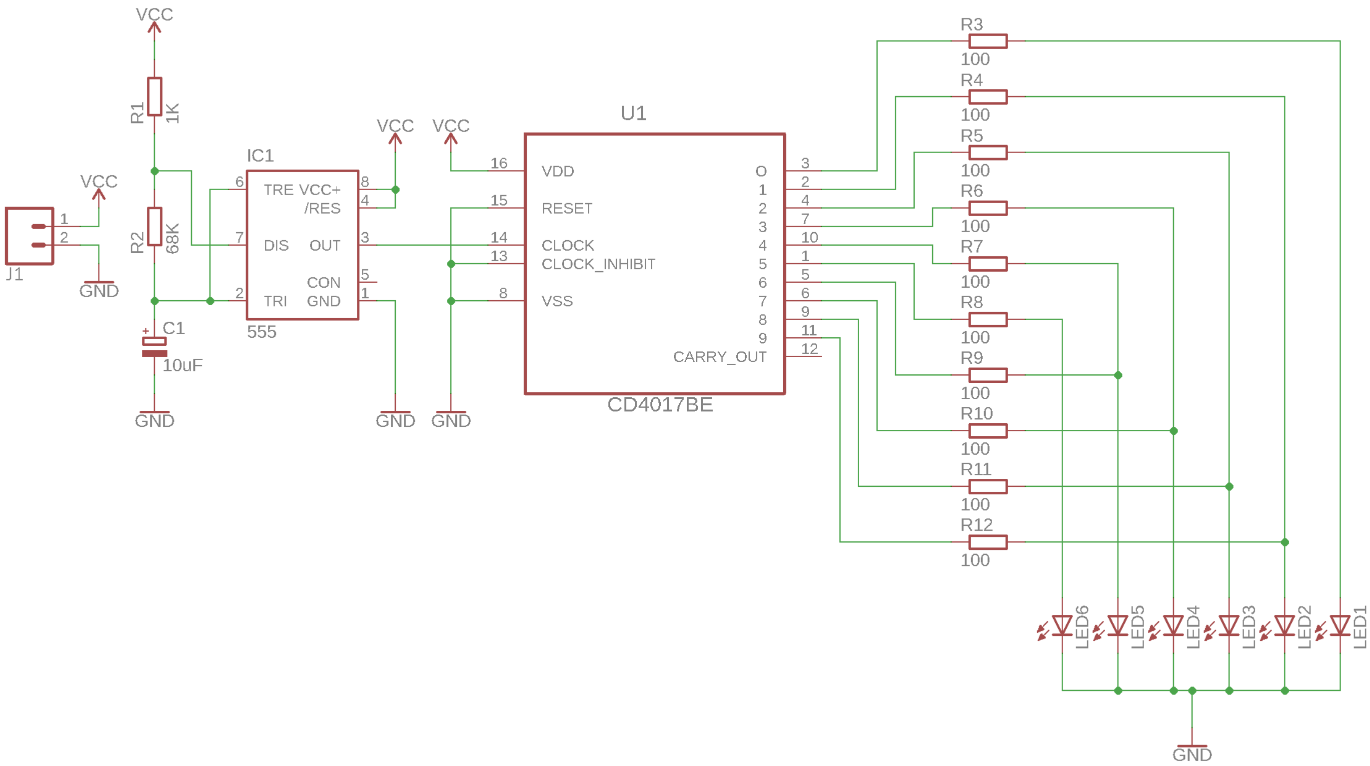
Diode D2 ensures that C2 will discharge through R4 only. Without D2, this voltage could make it's way to the RC charging network through D1, which would affect the charging rate. Similarly, D1 ensures that C2 is only charged when the switch is pressed, and not through R1.

We also add C1 in series with the speaker to eliminate the DC voltage.

Learn how the circuit works along with related information by visiting the following link:

www.BnBe.club/BBox2/p10

P11: LED Runner Rev. A



Description: We use a new IC in this circuit to build an LED runner circuit. We use a 555 timer IC to create the required clock pulse.

IC1 is configured in the astable mode with the RC network given by R1-R2-C2. The values used give us a square wave with a frequency of 1Hz. The output of IC1 is fed into another digital IC - the CD4017. Digital circuits require a clock pulse to operate as this is used to synchronize all the internal elements - think of it as a heartbeat. A clock is simply a square wave with a steady frequency and pulse width.

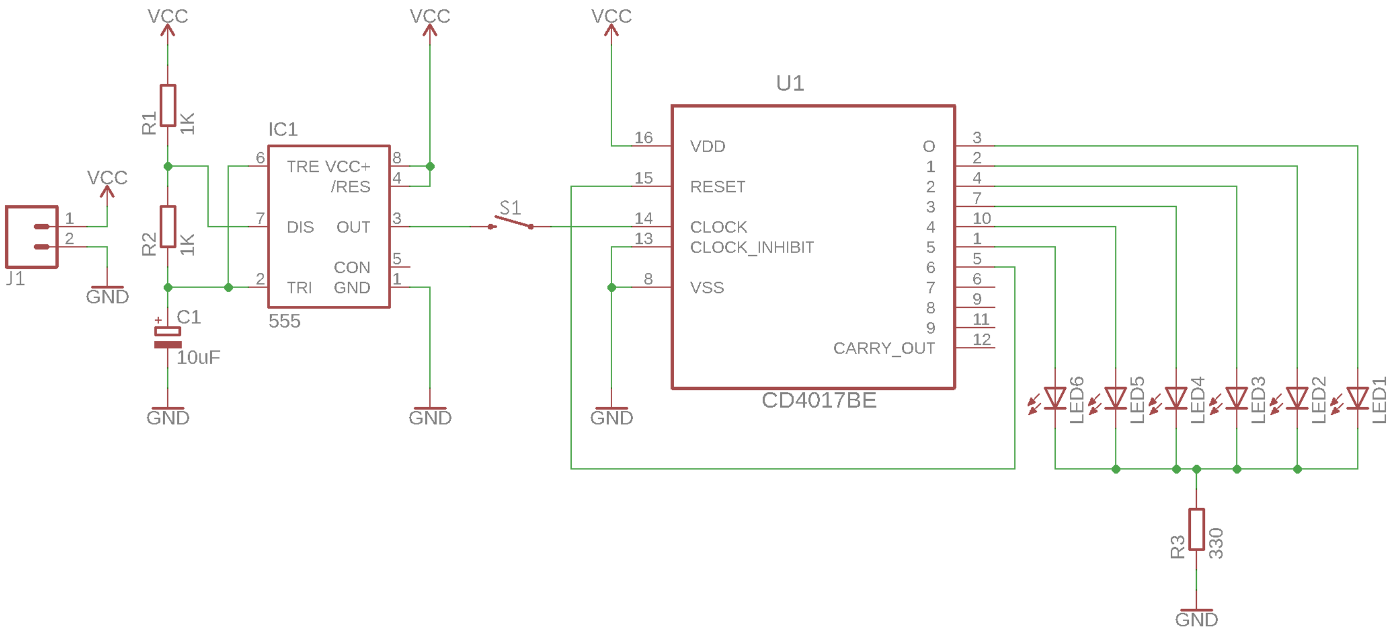
The CD4017 is an IC that acts as a counter. It has 10 outputs that can be used to control LEDs. At any given point of time, only one LED will be switched ON and when the next clock pulse is received, it will switch OFF the current LED and switch ON the next one in sequence. This cycle continues as long as the CD4017 receives clock pulses on pin 14.

IC1 provides the required clock pulses at 1Hz and this means that the CD4017 will cycle through all the LEDs every second. The CD4017 is a useful IC that can be used to count events and create interesting circuits as we will see in the next projects.

Learn how the circuit works along with related information by visiting the following link:

www.BnBe.club/BBox2/p11

P12: 555 Dice Rev. A



Description: We now use a similar circuit to create an electronic dice.

IC1 is configured in the astable mode with the RC network given by R1-R2-C2. The values used give us a square wave with a frequency of 48Hz. The output of IC1 is fed into another digital IC (CD4017) through a switch. We've increased the clock frequency here as we do not want the user to see the current LED while "rolling" the dice as he can then "cheat".

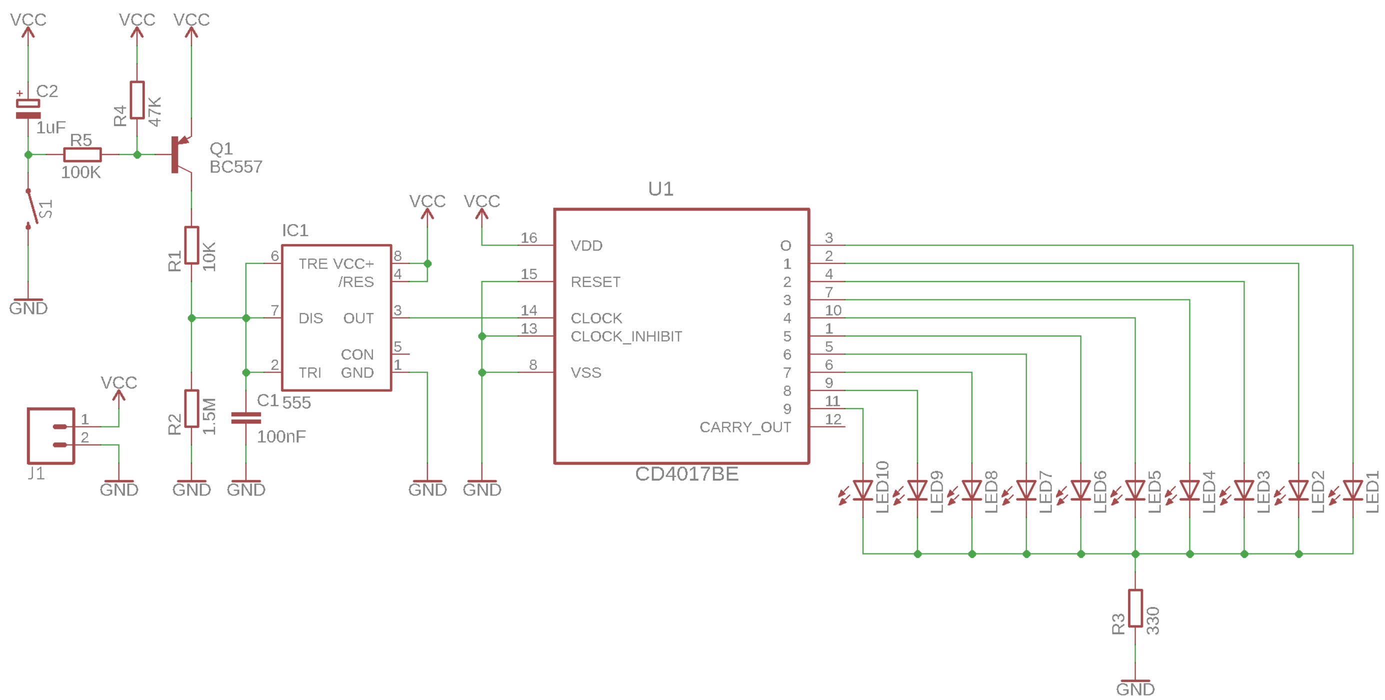
Since a dice only has 6 outcomes, we need to somehow eliminate the other 4 states from being shown as these have no meaning for a dice. We do this by simply connecting the 6th output (this is the 7th state as we start counting from output 0) to the reset pin. This way, the CD4017 only cycles between outputs 0-5 givin us a total of 6 states for the dice.

Also, instead of connecting a current limiting resistor for each LED, like the previous project, we simply connect one common resistor to all their cathodes as we know that only one LED will be switched ON at any given moment.

Learn how the circuit works along with related information by visiting the following link:

www.BnBe.club/BBox2/p12

P13: 555 Roulette Rev. A



Description: We use the 555 timer IC and the 4017 counter IC to build a roulette circuit, complete with the "roulette" effect.

This circuit works very similar to the previous one. We generate a clock signal using the 555 timer and we feed this into the counter which simply switches ON the LEDs sequentially. The 555 timer is configured in the astable mode with some external circuitry.

When the switch (S1) is pressed, the capacitor (C2) starts charging and also the PNP transistor (Q1) is switched ON. The supply voltage can make it's way to R1, R2 which form a voltage divider that charges capacitor (C1). The 555 timer operates in the astable mode, as usual, to provide the clock pulses.

When the switch is released, the capacitor provides the negative voltage required to keep Q1 ON for a little while and this allows the 555 to continue producing the clock pulses. As C2 discharges, the voltage across the voltage divider network reduces and this reduces the threshold voltages for the 555 timer which results in a slowing down of the clock pulses.

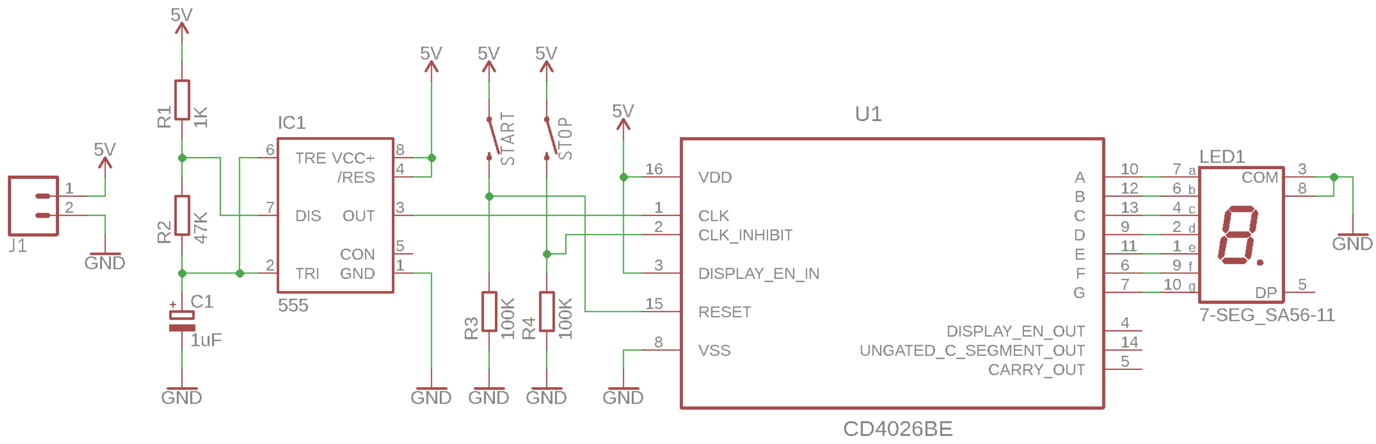
The 555 timer IC stops generating the clock pulses when C2 is discharged and the 4017 IC latches on to the last LED that was switched ON.

Play around with the component values in the RC network to slow down the clock pulses as needed.

Learn how the circuit works along with related information by visiting the following link:

www.BnBe.club/BBox2/p13

P14: 555 Reaction Timer Rev. B



Description: We build a reaction timer and use the 4026 IC to drive a 7 segment display.

The 4026 is a decade counter like the 4017 but it has the necessary circuitry to drive a 7 segment display directly. This means that we can view the output as a number, instead of an LED.

The 555 timer IC (IC1) is used in the astable mode to generate clock pulses, just like the previous circuits. R1, R2, C1 form the RC timing network and their values can be adjusted to change the clock frequency, which will change the speed at which the 4026 counts.

When we press the START switch, the 4026 is reset and starts counting from 0. When the STOP switch is pressed, it activates the internal clock inhibit ciruitry which stops the 4026 from counting and it latches on to the last count value. This allows us to view the result.

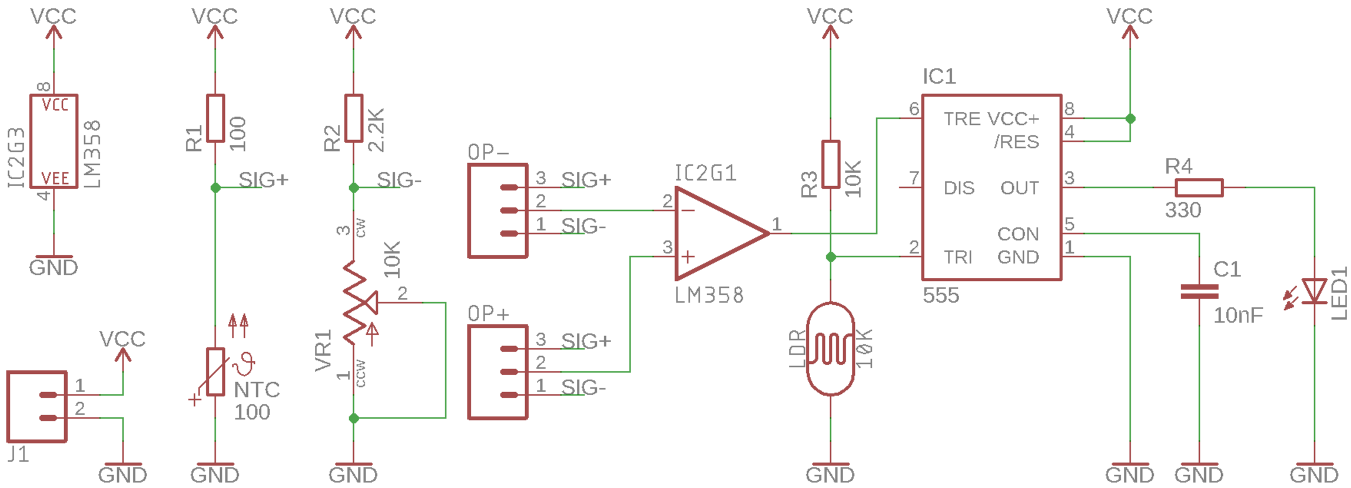
Keep in mind that the 4026 will loop back to 0 after 9, so you would need to adjust the RC timing network to change how quickly the 4026 counts the clock pulses. You can also add a variable resistor to adjust this as needed.

The 7 segment display we use is a common-cathode (CC) display, which means that the cathodes of the internal LED segments are connected together to the ground terminal. A positive voltage would need to be applied to the corresponding segment pin for it to switch ON.

Learn how the circuit works along with related information by visiting the following link:

www.BnBe.club/BBox2/p14

P15: Electronic Candle Rev. B



Description: This circuit uses the 555 timer in the bi-stable mode and we use some basic components along with an op-amp to control the timer IC.

In the bi-stable mode, the 555 timer has two stable states - set and reset. We connect a flicker LED to the output to give us a candle-like flicker effect. When the timer output is HIGH, the LED will switch ON and it will switch OFF when the output is LOW.

We use an LDR to detect the flame (or an increase in light intensity) and we connect this to the trigger input (pin 2). Recollect that the timer output goes HIGH when the voltage at the trigger pin falls below 1/3rd of the supply voltage. When light shines on the LDR, it causes it's resistance to drop which pulls pin 2 towards ground and this causes the LED to switch ON.

The circuit also uses a thermistor to monitor the surrounding temperature and this can be used to "blow-out" the candle. A comparator is a device that provides an output depending on the values of it's two input terminals. When it's positive terminal is at a higher potential compared to it's negative terminal, the output of the op-amp will be HIGH. In other cases, it's ouput will be LOW.

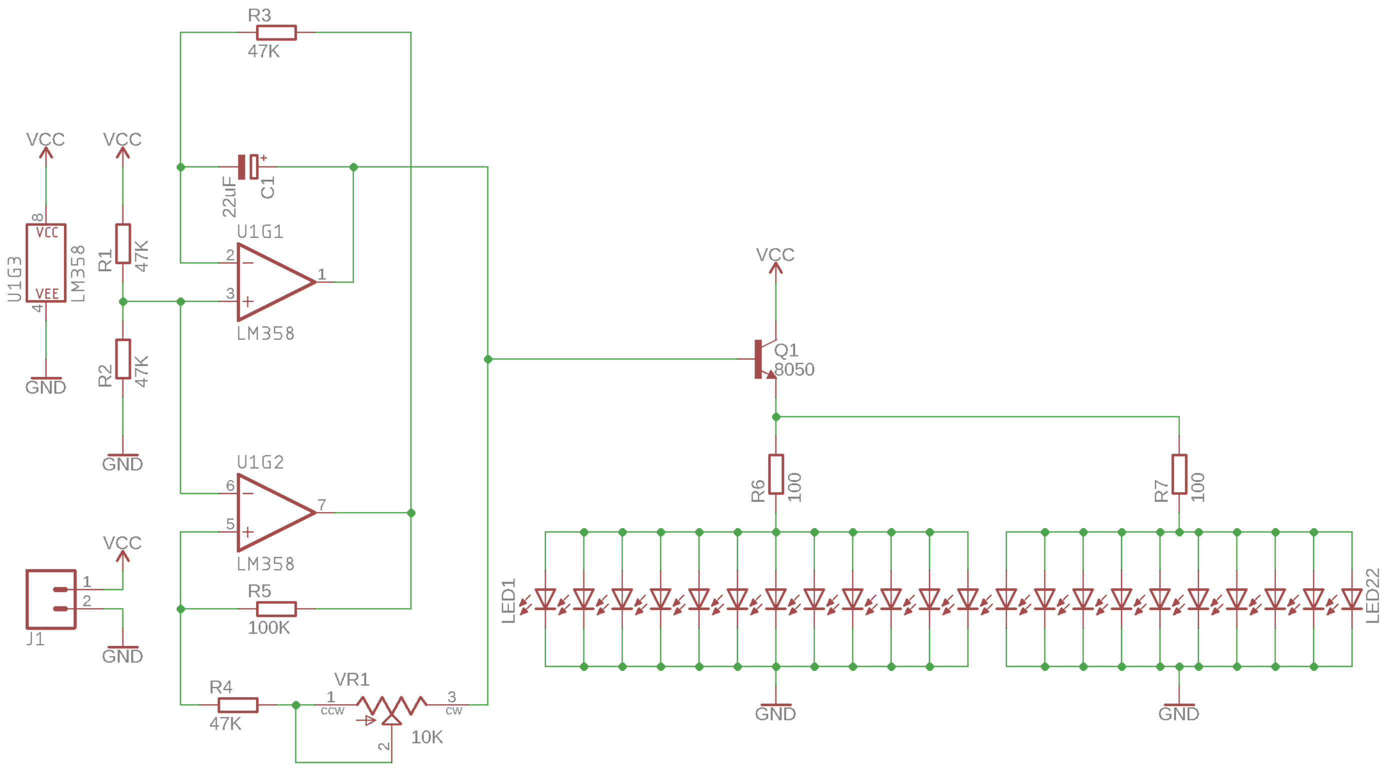
In normal cases, the output voltage (SIG+) of the thermistor section will depend on the ambient temperature, and when we blow air over the thermistor it's output voltage (SIG+) will increase or decrease depending on the temperature of the air blowing over it. In order for this scheme to work, we need to create some reference potential which acts as a threshold voltage. R2 and VR1 create this threshold voltage and we call this SIG-.

By using the jumpers (OP+ and OP-), we can attach either SIG+ or SIG- to either of the comparator outputs. The exact combination would really depend on the ambient temperature and the temperature of air blowing over the thermistor. When the op-amp is triggerd, it will cause a voltage greater than 2/3rd of the supply voltage to appear at pin 6 which will reset the 555 timer IC and switch OFF the LED.

Learn how the circuit works along with related information by visiting the following link:

www.BnBe.club/BBox2/p15

P16: Heartbeat Rev. B



Description: This circuit uses two operational amplifier to create a hearbeat or breathing LED effect.

An operational amplifier (op-amp) is a device that provides an ouptut depending on the input voltages. The circuit uses two LM358 op-amps and the output of the LM358 op-amp is the difference between the input voltages i.e. the difference between the voltage applied to the positive and negative op-amp terminals. Unlike a comparator whose ouptut is digital, the output of an op-amp is analog in nature.

We use a transistor (Q1) in the linear mode to control the LEDs. The transistor will switch ON depending on the voltage applied to it's base terminal. The op-amp section of this circuit generates a sawtooth waveform (voltage) which is dependent on the charging-discharging of the capacitor C1. This sawtooth voltage causes the transistor output to rise and fall which gives us the breathing effect.

If we look at U1G1, then we can see that the positive terminal is connected to a voltage divider that is made up of R1 and R2. The values of R1 and R2 keep the positive terminal at a fixed voltage that is half the supply voltage. The negative terminal is connected to the capacitor (C1). When first switched ON, the output of U1G1 is HIGH and this causes the capacitor to start charging with the polarity as given in the schematic. The output sawtooth voltage is in the rising phase, which causes the LEDs to glow brighter.

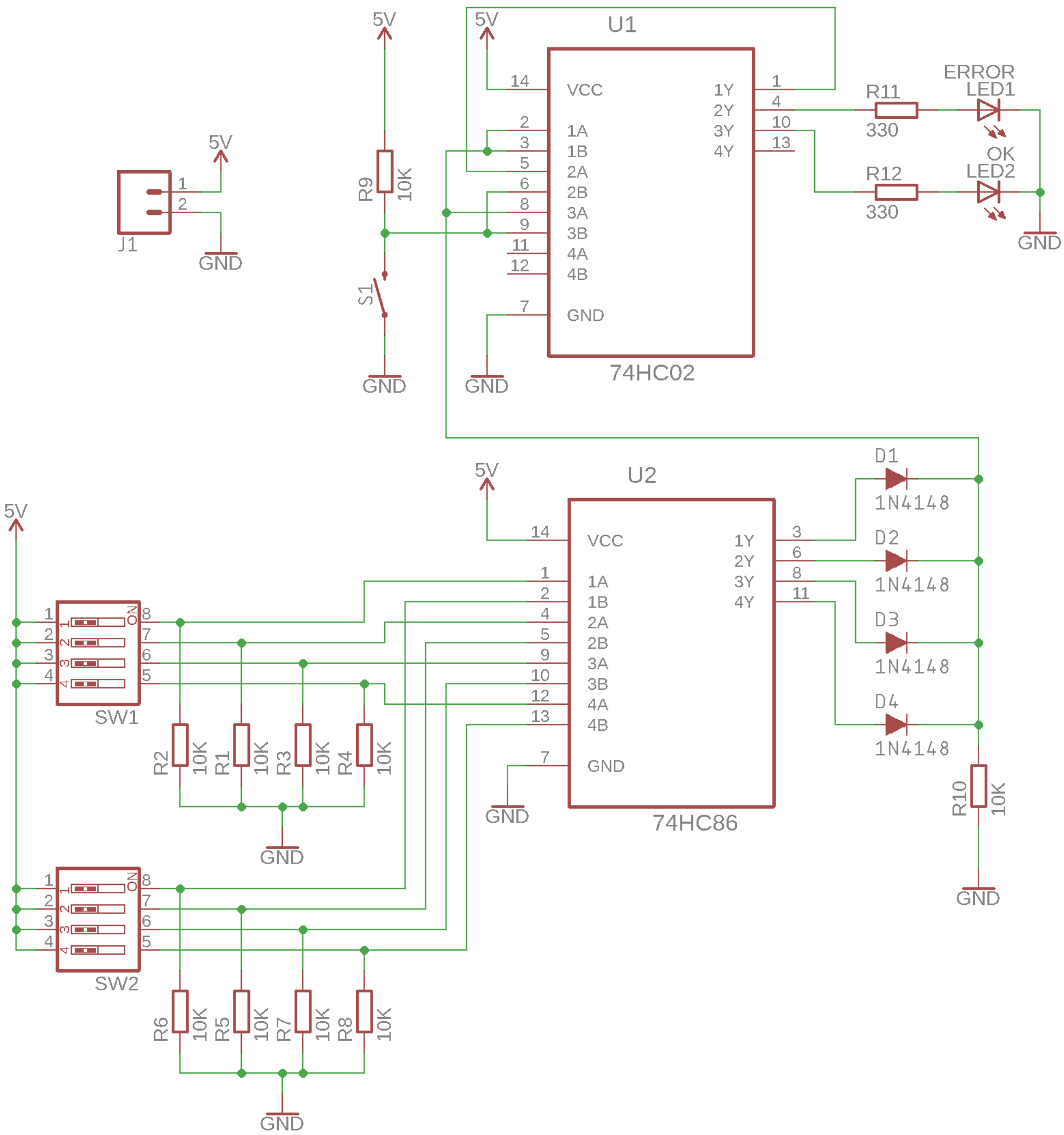
This sawtooth voltage is also fed back to the positive terminal of U1G2, while the negative terminal of U1G2 is held at the same reference voltage from the R1-R2 divider network. The output of U1G2 will increase as the difference between it's input terminals increases. This output is connected to the left terminal of C1 and eventually it will be at a higher potential compared to the right terminal. At this point, the output of U1G1 will start decreasing and the capacitor will start to discharge and charge with the opposite polarity. The output sawtooth voltage enters the falling phase, which causes the LEDs to dim.

This cycle repeats continuously, giving us a nice heartbeat like effect. VR1 can be adjusted to change the speed.

Learn how the circuit works along with related information by visiting the following link:

www.BnBe.club/BBox2/p16

P17: Combination Lock Rev. B



Description: This circuit uses two logic ICs to demonstrate the principle behind a basic combination lock.

The 74HC86 consists of 4 XOR gates which have 2 inputs each. The output of an XOR gate is LOW when both the inputs are the same (either HIGH or LOW). The 74HC02 consists of 4 NOR gates which have 2 inputs each. The output of a NOR gate is HIGH when both the inputs are LOW.

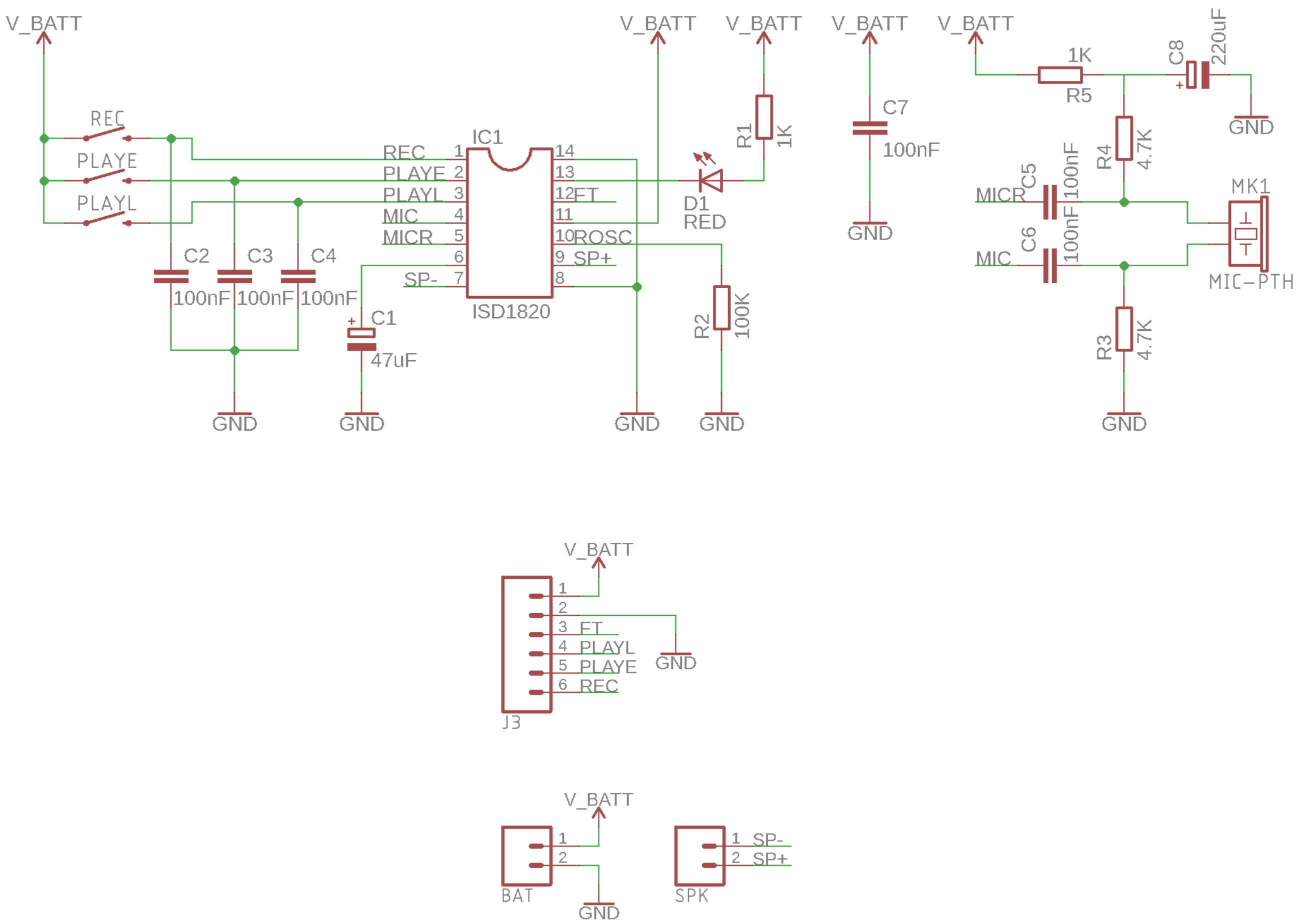
A combination lock has an input and a reference (also known as the key). Let's assume SW1 is the input, while SW2 is the reference. The first XOR gate is connected to the first switch of SW1 and the first switch of SW2. If both the states match, then the output will be LOW. We can extend this to the other XOR gates. The 4 outputs of the XOR gate are connected to diodes and a pull-down resistor and this is then used as the input for the NOR gate. If the output of any XOR gate is HIGH, then there will be a voltage drop across R10 and this will cause the input to the NOR gate to be HIGH, otherwise the NOR gate will receive a LOW input.

If both the switches are alike, then the XOR output will be LOW. When we press S1, the NOR gate 3 output will be HIGH and this will switch ON the OK LED. If the switches are not alike, then the XOR output will be HIGH. This is inverted by NOR gate 1 and is then fed to NOR gate 2. When S1 is pressed, the output of NOR gate 2 will be HIGH if the switches are not alilke, this switches ON the ERROR LED.

Learn how the circuit works along with related information by visiting the following link:

www.BnBe.club/BBox2/p17

P18: Voice Recorder Rev. A



Description: This circuit uses an ISD1820 IC to build a basic voice recorder. Please ensure that you power the circuit with **3.3V ONLY** as using a higher supply voltage will damage the ISD1820.

The ISD1820 is a dedicated voice recorder IC that needs a few external components for it to function. We use an electret microphone to caputure the voice and we add a biasing circuit for it's operation. The output from the MIC is fed to pins 4 and 5 of the ISD1820. A speaker is connected to pins 7 and 9 by using the screwterminals.

R2 sets the recording duration which also determines the sample rate. Here are the options as per the datasheet:

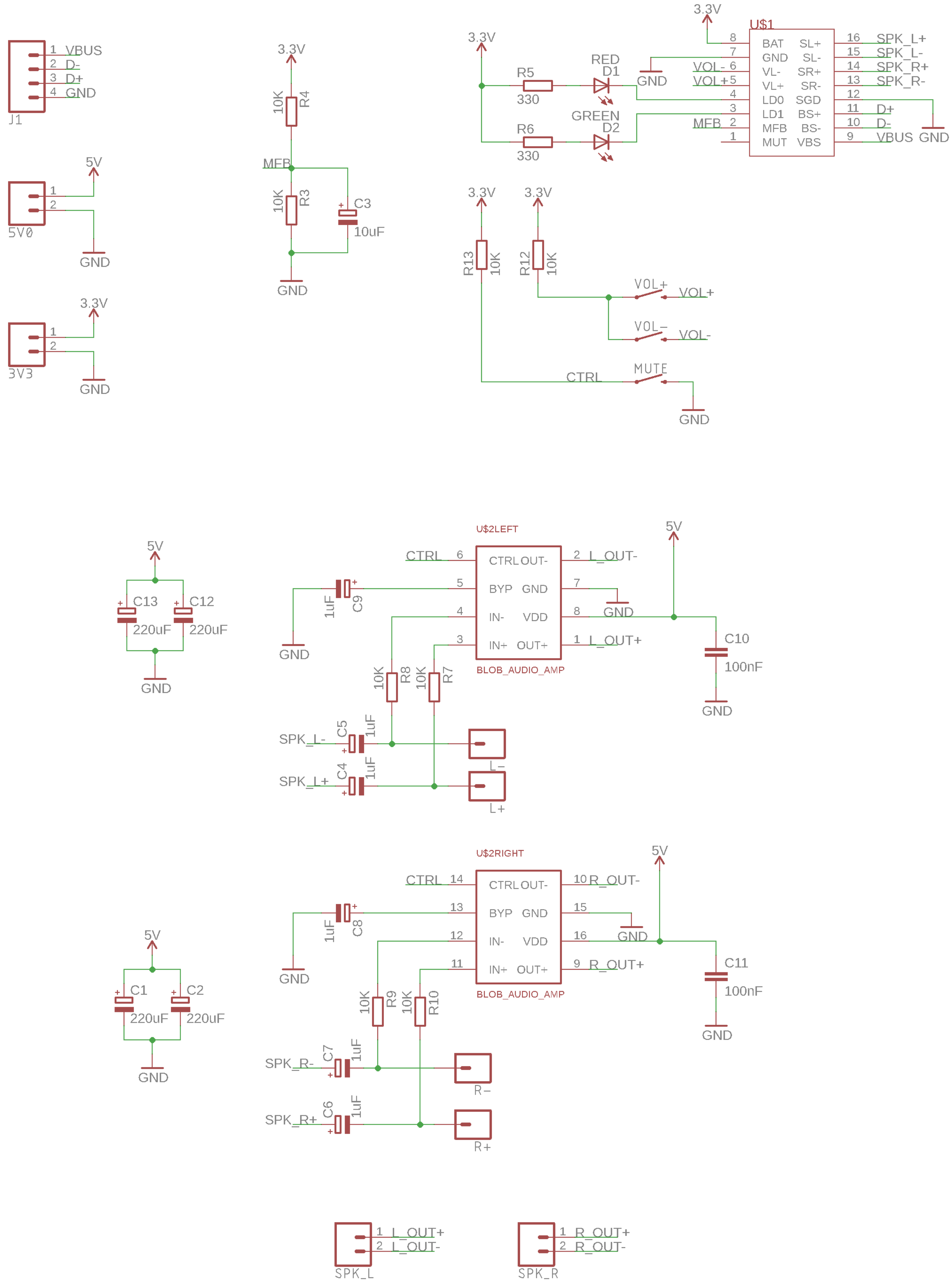
Resistor	Duration	Sample Rate
80K	8 seconds	8.0 KHz
100K	10 seconds	6.4 KHz
120K	12 seconds	5.3 KHz
160K	16 seconds	4.0 KHz
200K	20 seconds	3.2 KHz

You can press the REC button to start recording. Pressing the PLAYE button will cause the recording to be played back and playback will be stopped at the end of the message. Pressing the PLAYL button will cause the recording to played back in a loop, until the button is released. The circuit also has a header pin that can be used to interface it to a micro-controller for direct control.

Learn how the circuit works along with related information by visiting the following link:

www.BnBe.club/BBox2/p18

P19: Bluetooth Speaker Rev. B (page 1)



Learn how the circuit works along with related information by visiting the following link:

www.BnBe.club/BBox2/p19

P19: Bluetooth Speaker Rev. B (page 2)

Description: We now build a very interesting bluetooth speaker system using the audio and bluetooth blobs. Please ensure you connect the power supply terminals with the right voltages and polarity as connecting them incorrectly will damage the components.

Please ensure that you connect the blobs in the right orientation as they can be damaged if connected incorrectly.

The bluetooth blob is resopnsible for connecting to a bluetooth audio source (mobile phone, computer etc). It operates at 3.3V and provides an audio output. The blob uses a CSR8645 IC which is the same one used in various commercial bluetooth headsets and speaker systems - giving you great quality audio output. The red and green LEDs show you the status of the module (rapid flash: pairing mode, steady flash: device paired). The VOL+, VOL- and MUTE buttons can be used to control the audio. C3, R3, R4 form a RC network that generates a small delay after the 3.3V power supply is switched ON. This is necessary for the CSR8645 to power ON correctly.

The audio output from the bluetooth blob is fed into the audio blob by passing it through an RC filter. The RC filter limits the low frequency singals that are sent to the audio blob. This eliminates any powerline noise and also sets the lower frequency limit for the output audio as the speakers we use are not designed to handle low frequencies at high power levels.

The audio blob simply consists of two class D amplifiers (HT6872) and acts as a breakout board. It uses a supply voltage of 5V. The CTRL pin is connected to the MUTE switch and is used to turn OFF the amplifier output. The ouptut from the audio blob is fed to the two speakers through screw terminals.

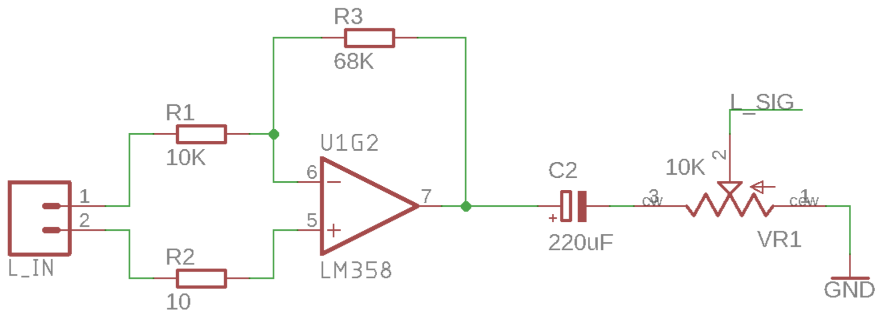
Capacitors C1, C2, C12, C13 are reservoir capacitors that store energy and supply it to the amplifiers when needed. This helps reduce voltage drops if the power supply cannot provide the necessary current during times when there is a surge in current (mostly due to low frequency beats).

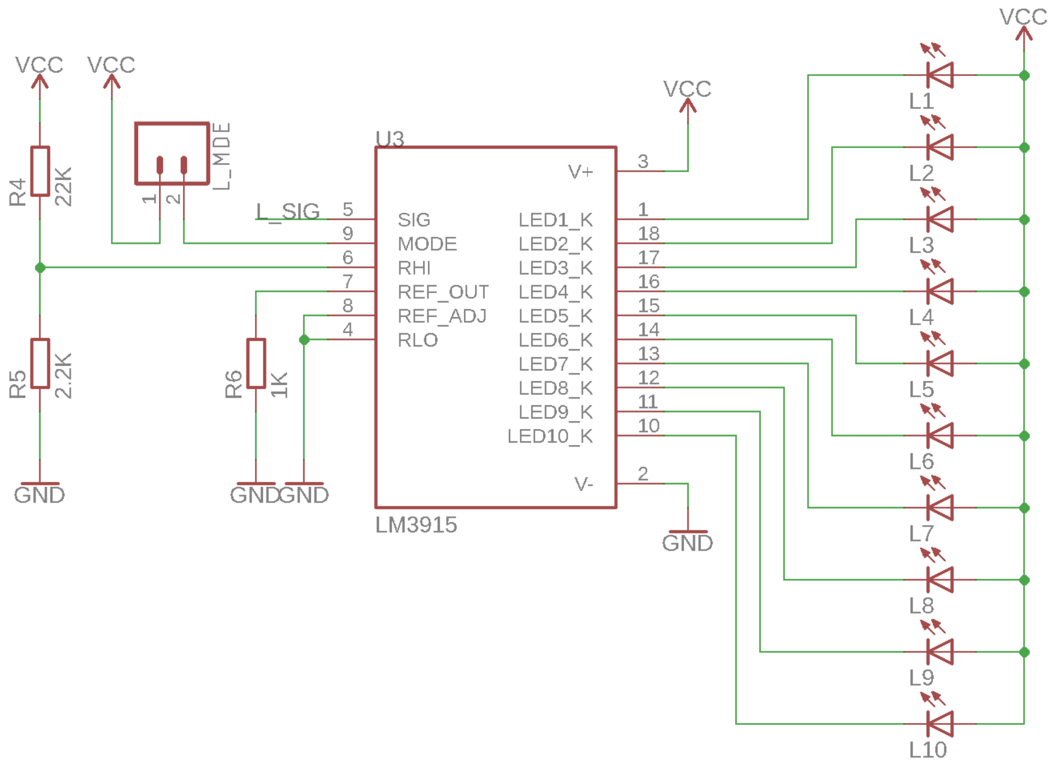
The PCB also contains a few test points (R+, R-, L+, L-)that can be used to extract the audio signal for use in other circuits. We will be using these in the next project.

Learn how the circuit works along with related information by visiting the following link:

www.BnBe.club/BBox2/p19

P20: VU Meter Rev. B (page 1)





Description: The VU meter circuit helps you visualize audio being played and we connect this to the bluetooth speaker system that we built in the previous video.

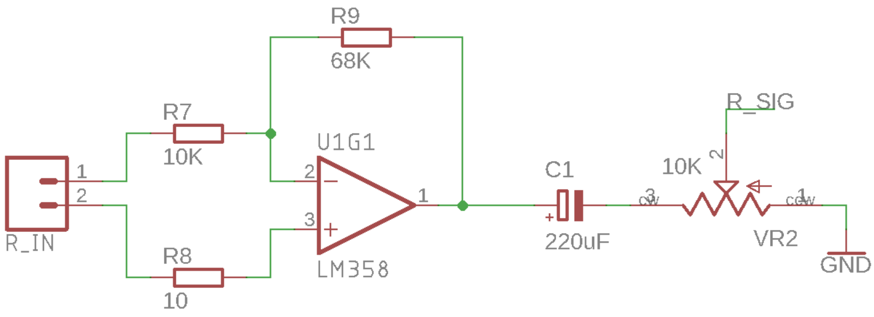
The circuit uses two LM3915 ICs to process the audio signals for each channel (right and left). The output of this IC is directly connected to the LEDs and it displays the audio level. We use rectangular LEDs for this project as it gives a nice effect compared to the regular 3MM round LEDs.

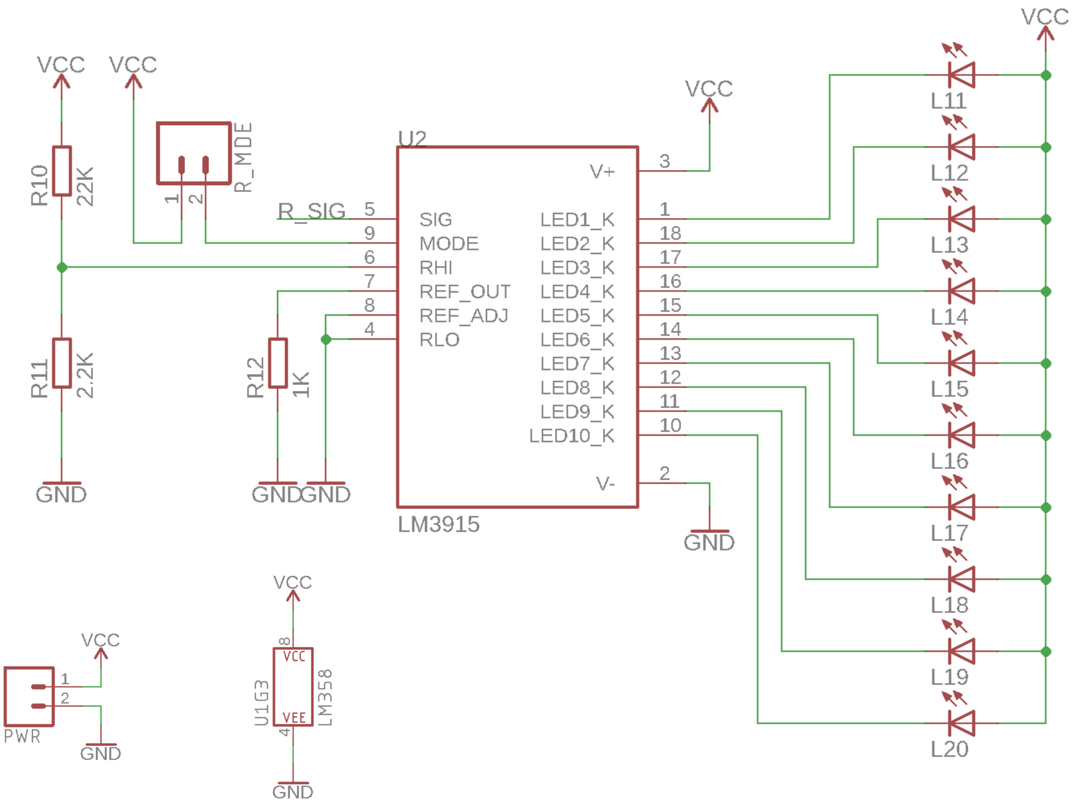
The LM3915 can switch between two modes - dot and bar. This can be set by adding a jumper to the L_MDE or R_MDE header pins. Resistors R6 & R12 set the LED brightness for the individual channels. Resistors R4, R5, R10, R11 are used to set the reference voltage (HIGH) which is approximately 0.8V when the circuit is powered with 9V. This reference voltage sets the maximum value that will be applied to the SIG pin (pin 5).

Learn how the circuit works along with related information by visiting the following link:

www.BnBe.club/BBox2/p20

P20: VU Meter Rev. B (page 2)





Description: Before we apply the audio signal to the LM3915, we pass it through an op-amp (LM358). This allows us to increase the signal strength and also gives us some control over the signal which is fed to the LM3915.

VR1 and VR2 can be adjusted to vary the audio level input depending on the source. You would only need to adjust this once when you are first setting up the audio source - the bluetooth speaker in our case.

Please ensure that you solder wires to the bluetooth speaker circuit and connect then to the correct screwterminals.

Learn how the circuit works along with related information by visiting the following link:

www.BnBe.club/BBox2/p20