Tone generator application

Here's your next project called Tic Tac Tone Generator - and other things. It is called it, because it is primarily a different type of oscillator. It's not like the previous Test Box MVB circuit - it uses 2 transistors of conflicting polarities (NPN as opposed to PNP - Test Box used 2 x NPN transistors - same polarity.) This circuit has only one capacitor and a (fixed or variable) resistance, plus an output unit. However, you will find that this basic circuit configuration will perform many simple tasks, but we'll only look at three of them - a basic metronome (a tic - tic kind of sound, used for timing and punctuation during music practice,) an LED flasher - useful if you want to make the fake red lights in the model your police car comes to life (yes you can run 2 of them by a 9 volt battery). Then there's tone generator part of it - you can add a morse code key and practice learning your code, in case you want to become an amatuer radio station operator ... called a Ham. You can build 2 of them and use a 4-phone cable to place the speakers at opposite ends of your home/school room and send each other morse code, and see how many dots and dashes you can read. Or you can just enjoy tweaking the tone generator (use a variable resistance to vary the frequency) so that it makes all sorts of fun sounds ... The choice is your... This is a different type of oscillator, and we will take a brief look at how it works, in general, and then apply these basics to several different scenarios. This circuit looks a little bare bones at the moment, but it can be configured to do several different tasks. It is essentially an oscillator, which uses two transistors of opposite polarity. BC 557 Q2, is a PNP transistor, and needs a -ve potential on its base lead for it to turn on. What? I thought it was the other way around? Well - yes - it is - for BC547, which is an NPN transistor - the one you used in the Transistor Amp project #2.So now you have to deal with a mirror image compared to the 2 transistors involved in this particular circuit - somehow ... By the way, the current flows in the opposite direction in an NPN transistor, than it does in a PNP, which is why Q2 seems to be upside down while Q1 is right side up - right? Confused? Don't worry - we'll fix it eventually. Back in the early days of electronics, scientists and inventors believed that the current flow began on the positive (+ve) terminal of the battery or power supply, and traveled down through the circuit and into the -ve terminal. That is why all needles on the diode and transistor devices point towards the -ve polarity of the power supply in a given circuit. The rule of thumb still holds - needle points negative, which is still a good way to remember how to connect an active semiconductor device into one circuit, but the current (electron current) actually flows in the other direction (-woe to +ve) up circuit elements. OK - just to summarize everything - at startup when the power is first used, Q2 will be off (not conductive) and Q1 will turn on when the base wire is sufficiently biased on + 0.5 of a volt, by C1 charging up via R1 and output unit (speaker, LED or low value resistance to earth /ve rail.) When the Q1 is turned on, the collector cable will be pulled down near the ground/ve rail (a virtual short circuit) and this will give -ve bias that transistor Q2 (BC557) needs on the base line, to turn on. When Q2 is turned on, condenser C1 is discharged via the output unit, which is activated, and at the same time turns Q1 (BC547) off, and then the cycle begins again. Complete Parts SetI gives you the Jaycar catalog numbers for the entire parts list in all variants of the oscillator circuit, and this will allow you to build all three versions and tinker with the different component values on the list. You may need to invest in a set of plastic drawers and some sticky labels so you can store all your parts and know where they are. A set of 12 drawers would be a minimum - don't worry, they won't stay empty for long, if you're serious about hobby electronics!!! One word of warning - miswiring transistors and diodes up to a 9 volt battery can cook them, even if they appear to be wired correctly. A circuit needs a device (called a load) to develop the output voltage across. Failure to give a large enough load, can damage some components. If your diodes or transistors are hot (put your fingers short on each one,) then turn off the circuit immediately and check all wires - including battery polarity (red and black wires from the battery connected to the correct parts of the matrix card...) Parts List R1 - 220k Resistance - RR 0628 R2 - 39R (ohms) - RR 0538 VR1 - 500k (linen A pot)- RP 3622C1a - 5 100nF Greencap - RG 5125 C1b - 10uF Electrolytic - RE 6066 Q1 - BC 547 - ZT 2152 Q2 - BC 557 - ZT 2 2164 Led 1 - Red LED - ZD 0150 (5mm) LDR - Light-dependent resistance - RD 3485 (this is a very sensitive device - well worth the money!) 1 x AAA battery holder with flying wires - 3 1 x 9 volt battery snap - 1 x mini 8 ohm speaker - AS 3004 - mylar cone 1 x ceramic earphone / transducer PKM44EW by Murata (or your standard crystal earphone will do firstly.) Final notes: feel free to try different colored LEDs and also buy some smaller and larger caps - eg: 47uf, 22uF and 4.7uF electrolytics, as well as some fixed resistors - eg: 47k, (but no less) 150k, 270k - the list of parts is the minimum minimum. Most importantly - just use 39R (39 ohm) resistance as an output device where specified - use it anywhere else, and something can go pop - OK? Have a play with LDR in scenario 3 (the actual noise production Tone Generator) instead of a fixed resistance (R1) or variable pot (VR1) – you can plug the small speaker in as the output load, and play it like a mini Theremin! (Note: the above layout is a generic only - it's meant to be a guide - NOT an actual practical circuit - OK? :)) Lay all the parts out on a clean surface. Take the matrix handlebar and look at the part setup and start with the resistance and condenser, start building the generator accordingly. Start with the R1 resistance and then the C1 capacitor. Mount the two transistors last and then the wire in the desired output unit (depending on the role the oscillator will play) a mini-raiser, or an LED or another low impedence device wired between Q2 emitter and -ve end of C1 join and down to the ground/ve lead. Now you should be experts in parts insertion, connections and even circuit 'troubleshooting' (finding and fixing wiring errors,) so I'm not going to go into too much detail with the build itself, as such. More detailed attention will be given to the different incarnations of this circuit in later stages. For this project, I have chosen a fixed on/off switch that can be mounted in the flap of the white lid of the Tic Tac box. The previous project incorporated only a temporary on/off switch, due to intermittent use of the test box. It is thought that tone generator can be switched on for extended periods, and thus the need for a different type of power switch. Note that some versions of the TT tone Generator can operate on a +1.5 volt supply, but others (speakers and LEDs) may need a 9 volt battery for them to operate more efficiently (lighter or higher) so you have to be satisfied with an external 9 vo lt battery connected outside the box - OK? Good - you can attach it to the bottom of the box using one of the thick red-colored rubber bands, or use 2 pieces of double-sided tape squares. Here are 2 scenarios and the results from each circuit variation:Scenario #1: Metronome: the speaker will click on and off regularly, according to the value of resistance R1 (or the setting of VR1 - a variable resistance - known as a pot.) So in this version, VR1 would actually be the 500k variable pot. C1 would be 10uF electrolytic capacitor (see the polarity of it!) Make sure that the positive wire (+) of the C1/10uF goes to the bottom of Q1 - BC547, and the negative (-) wire goes to the emitter of Q2 - BC557 Scenario #2: the LED lamp flashes on and off periodically, as warning light, a marker of danger in the dark etc. So you can only use the red LED, 10uF cap and 220k fixed resistance, or another fixed value for a faster or slower but steady flash speed. Using a bright LED (larger lighter LED) you can use it to indicate hazards in the dark (dug up walkways or fallen tree branches etc). If you use the larger Tic Tac box for this version, the circuit board AND 9 volt battery both fit into the box - see the image above. A variety of yellow-coloured LEDs can be connected in series/parallel (you need to experiment with the numbers)) and mounted on a Lego roadside layout to act as warning lamps, along with traffic (those with zebra stripes on them,) to give some realism to a crash scene, or to a roadworks layout - trucks, sensors, bulldozer Lego etc... Inserted update: The new image shows the Tone Generator (a new build on another table,) with the speaker option employed, and an adjustable pot on board, and make sure the tray can fit into the box. The pot is actually a 20 tour precision device, scavenged from an old analog TV set tuner. pot used to control the voltage of a varicap diode (varactor). there were 7 of them, preset on a PC board, and I got a lot! Buying them today doesn't cost much, but I still saved $15 to $20 in scavenging them. Scenario #3: the resistance R2, will complete the circuit to the ground, allowing another device to perform a result. For example, the condenser can be replaced by the ceramic transducer (watching it operate on principles similar to a capacitor,) and so low value resistance - a 39 ohm one, becomes the actual output load, while the transducer does clicking or tone generation. Both variants will work, according to the parts you have on hand - and that's what I mean by versatile design and use. I'm going to put in modified circuits over the next few days to make everything clear. No matter what configuration you have set up the circuit for, and regardless of the values of R1 and C1 you have decided, or which output device you have selected, (providing the design of the circuit and components are compatible with how the oscillator works,) the circuit will perform a result and then reset itself. The power will flow through R1, charge C1 and turn Q1 on first - then Q1 will turn Q2 on, thereby activating the output unit. - every time. It's the basics of how it works, and you can see that there is some diversity built into this simple but effective oscillator circuit (because that's what it is - an oscillator...) Well, all the best for now and I'll be back soon with some circuit modes and updates ASAP - enjoy ... mk484 mk484

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