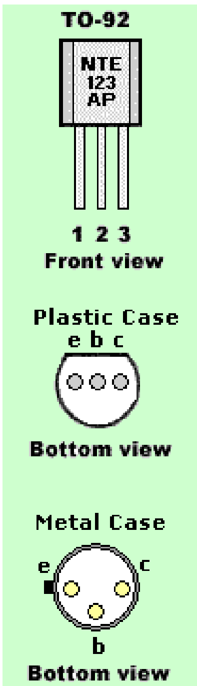
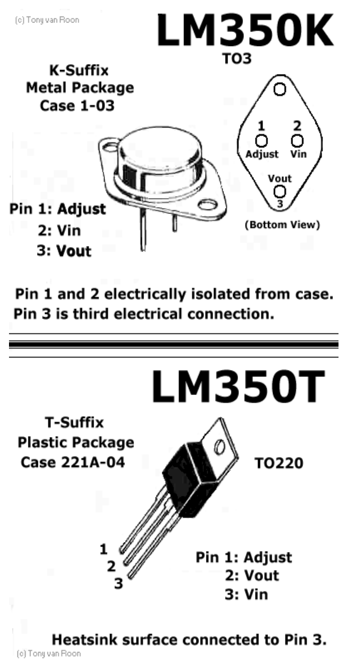
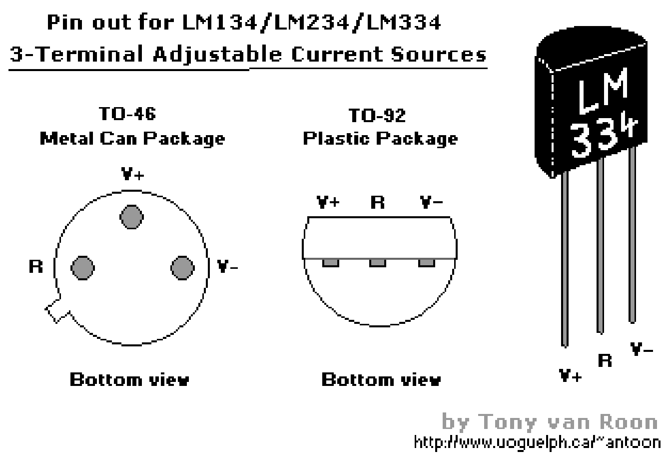
Data Sheet for Various Semiconductors

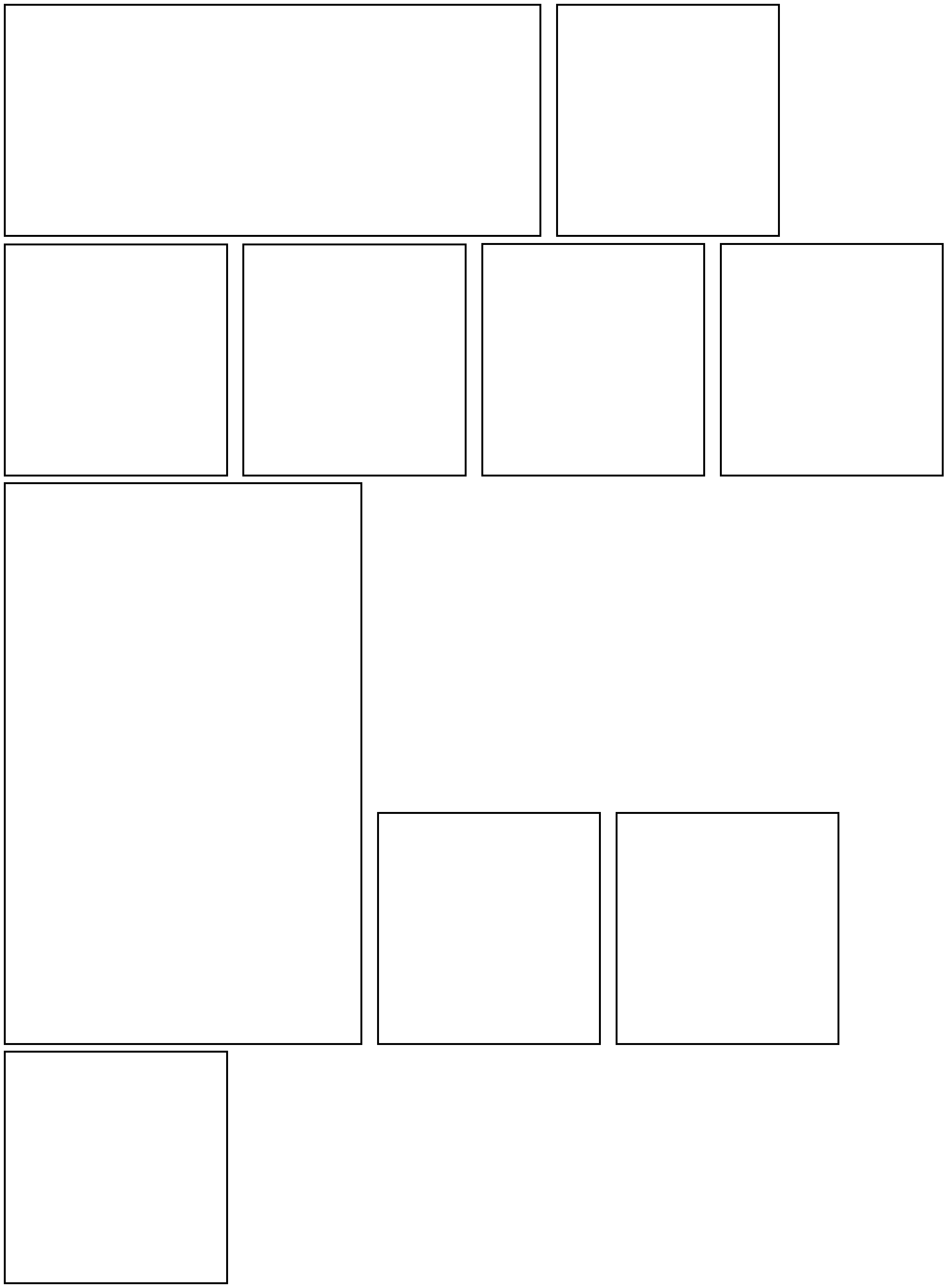
by Tony van Roon

To enlarge any of the diagrams, just click on it...





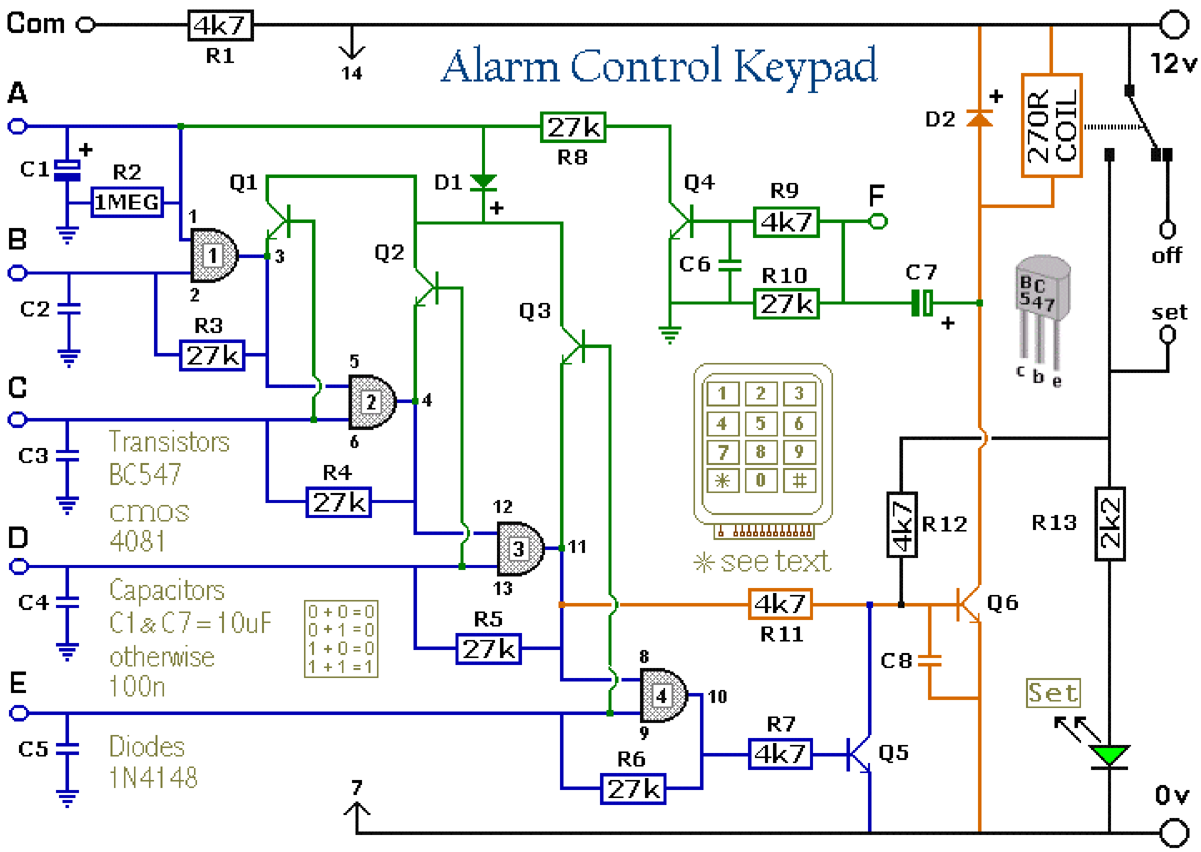




Enhanced 5 Digit Alarm Keypad

Circuit : Ron J
Email:ronj@gofree.indigo.ie

Description:
This is an enhanced 5 digit keypad which may be used with the Modular Alarm System.

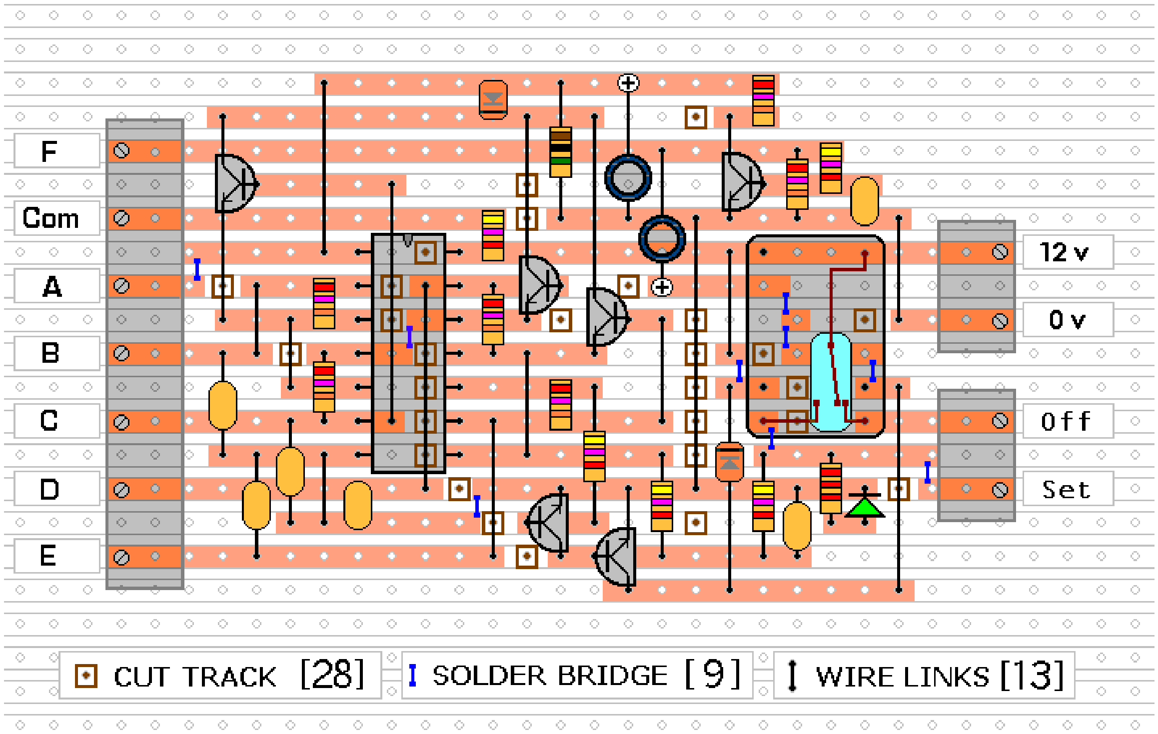


Notes:
This switch will suit the Modular Burglar Alarm circuit. However, it also has other applications. The Keypad must be the kind with a common terminal and a separate connection for each key. On a 12-key pad, look for 13 terminals. The matrix type with 7 terminals will NOT do. Choose the five keys you want as your code, and connect them to 'A, B, C, D & E'. Wire the common to R1 and all the remaining keys to 'F'. Because your choice can include the non-numeric symbols, almost 100 000 different codes are available. The Alarm is set using the first four of your five chosen keys. When 'A, B,

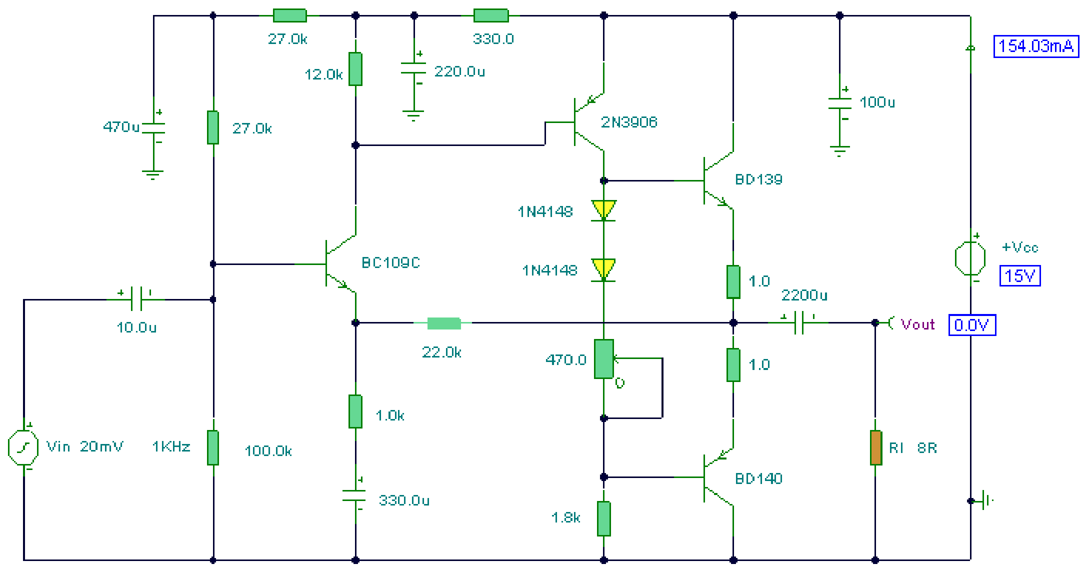
C & D' are pressed in the right order and within the time set by C1 and R2 (about 10 seconds), current through R11 switches Q6 on. The relay energizes, and then holds itself on by providing base current for Q6 through R12. The 12-volt output switches from the "off " to the "set " terminal, and the LED lights. To switch the Alarm off again it is necessary to press A, B, C, D & E in the right order. The IC is a quad 2-input AND gate, a Cmos 4081. These gates only produce a high output when both inputs are high. Pressing 'A' takes pin 1 high for a period of time set by C1 and R2. This 'enables' gate 1, so that when 'B' is pressed, the output at pin 3 will go high. This output does two jobs. It locks itself high using R3 and it enables gate 2 by taking pin 5 high. The remaining gates operate in the same way, each locking itself on through a resistor and enabling its successor. If the correct code is entered within the time allowed, pin 10 will switch Q5 on and so connect the base of Q6 to ground. This causes Q6 to switch off and the relay to drop out. Any keys not wired to 'A, B, C, D or E ' are connected to the base of Q4 by R9. Whenever one of these 'wrong' keys is pressed, Q4 takes pin 1 low. This removes the 'enable' from gate 1, and the code entry process fails. If C, D or E is pressed out of sequence, Q1, Q2 or Q3 will also take pin 1 low, with the same result. You can change the code by altering the keypad connections. If you make a mistake entering the code, just start again. If you need a more secure code you can use a bigger keypad with more 'wrong' keys wired to 'F'. A 16-key pad gives over half a million different codes. All components are shown lying flat on the board; but some are actually mounted upright. The links are bare copper wires on the component side. Two of the links must be fitted before the IC.

ALARM CONTROL KEYPAD

Component Side



2 Watt Audio Amplifier

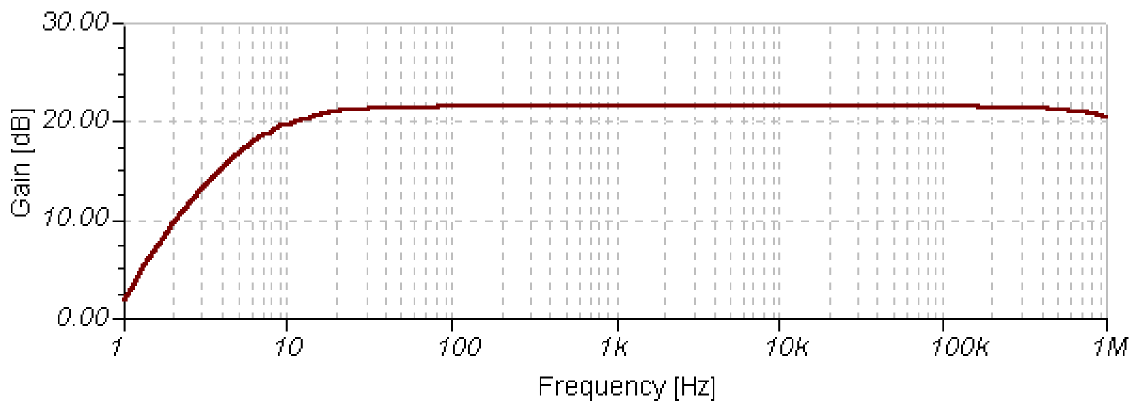


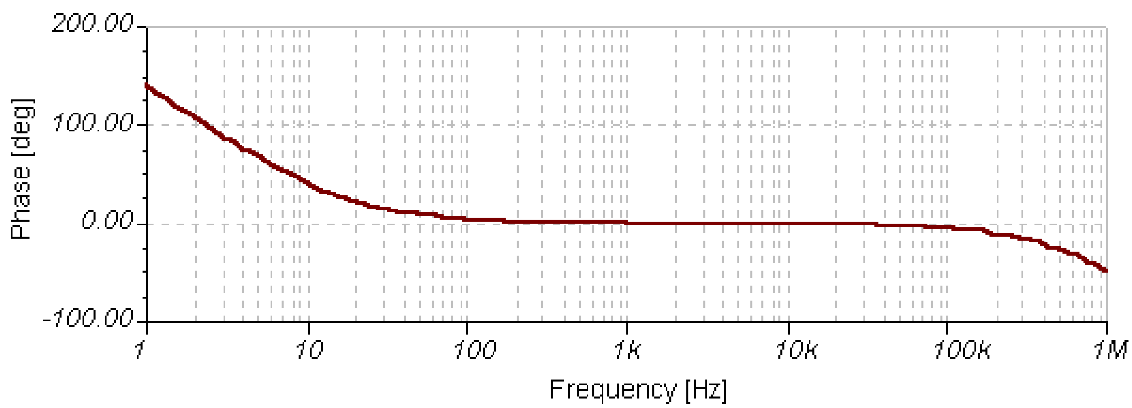
Notes:

This was one of the earliest circuits that I ever designed and built, in Spring 1982. At that time I had only an analogue meter and a calculator to work with. Although far from perfect, this amplifier does have a wide frequency response, low distortion, and is capable of driving an 8 ohm speaker to output levels of around 5 watts with slightly higher distortion. Any power supply in the range 12 to 18 Volts DC may be used.

Circuit Description

The amplifier operates in Class AB mode; the single 470R preset resistor controls the quiescent current flowing through the BD139/140 complimentary output transistors. Adjustment here, is a trade-off between low distortion and low quiescent current. Typically, under quiescent conditions, standby current may be 15 mA rising to 150 mA with a 50 mV input signal. A simulated frequency response is shown below:



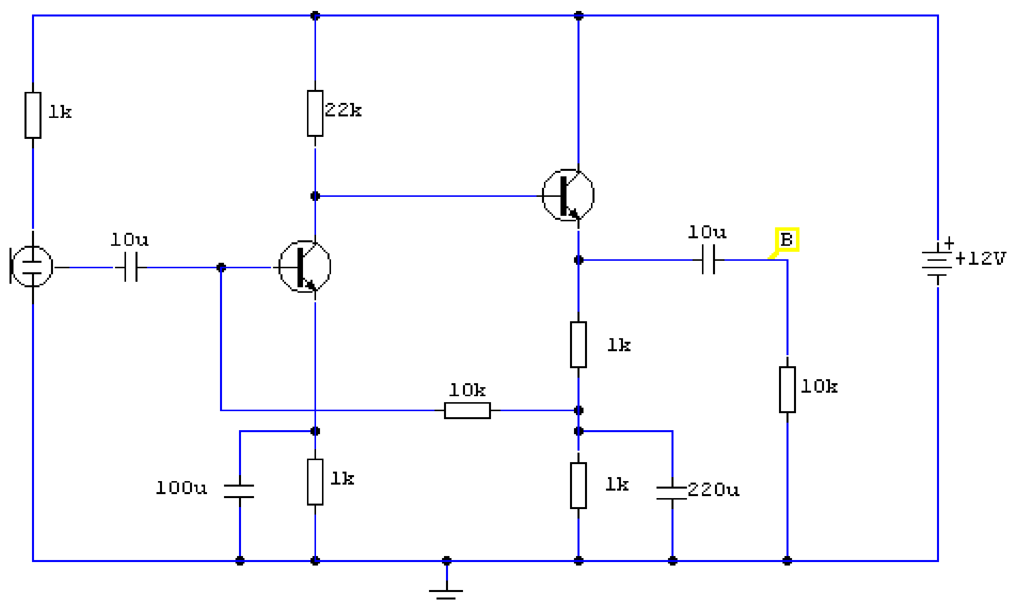


The circuit is DC biased so that the emitters of the BD139 and BD140 are at approximately half supply voltage, to allow for a maximum output voltage swing. All four transistors are direct coupled which ensures:-

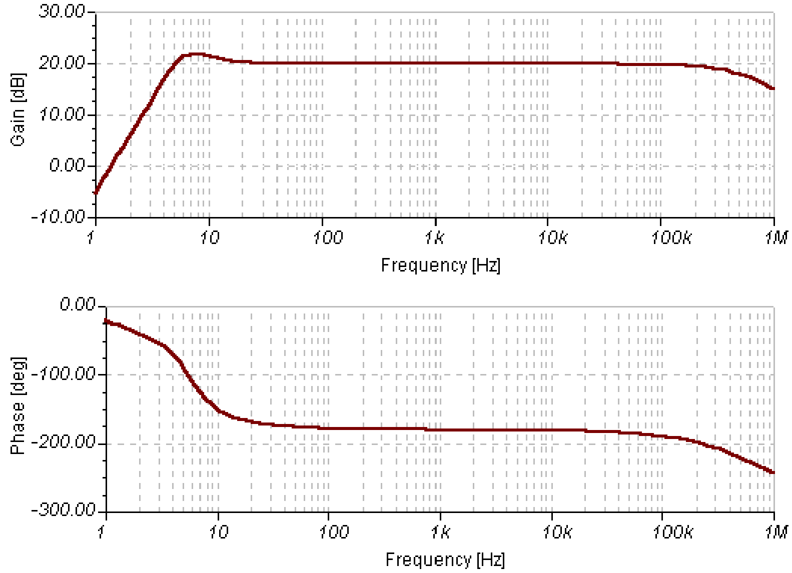
(i) A good low frequency response
(ii) Temperature and bias change stability.

The BC109C and 2N3906 operate in common emitter. This alone will provide a very high open loop gain. The output BD139/140 pair operate in emitter follower, meeting the requirements to drive low impedance speakers. Overall gain is provided by the ratio of the 22k and 1k resistor. A heat sink on the BD139/140 pair is recommended but not essential, though the transistors will run "hot" to the touch.

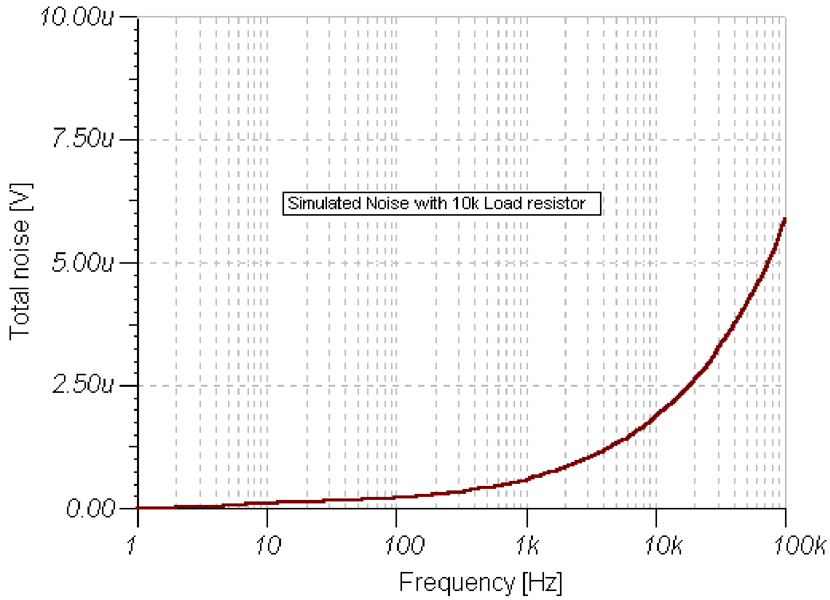
ECM Mic Preamplifier



Notes:
Both transistors are low noise types. In the original circuit, I used BC650C which is an ultra low noise device. These transistors are now hard to find but BC109C are a good replacement. The circuit is very device tolerant and will set its quiescent point at roughly half the supply voltage at the emitter of the last transistor.
The electret condenser microphone (ECM) contains a very sensitive microphone element and an internal FET preamp, a power supply in the range 2 to 10 volts DC is therefore necessary. Suitable ECM's may be obtained from Maplin Electronics. The 1k resistor limits the current to the mic. The output impedance is very low and well suited to driving cables over distances up to 50 meters. Screened cable therefore is not necessary.
The frequency response measured across a 10k load resistor is plotted below:

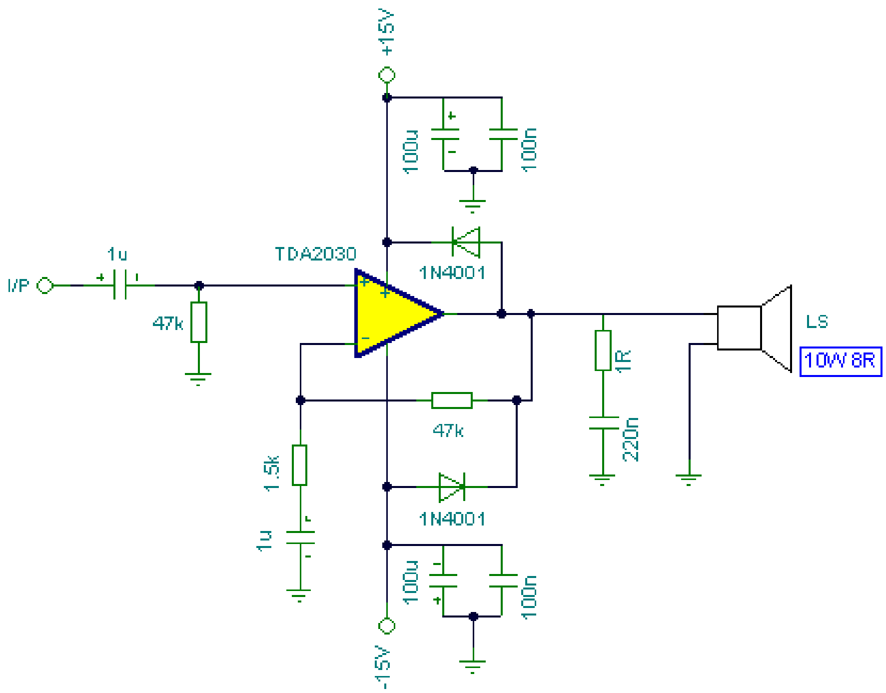


The noise response of the amplifier measured across the 10k load is shown below. Please note that this plot was made with the mic insert replaced by a signal generator.



This preamplifier has excellent dynamic range and can cope with anything from a whisper to a loud shout, however care should be taken to make sure that the auxiliary equipment i.e. amplifier or tape deck does not overload.

8 Watt Amplifier



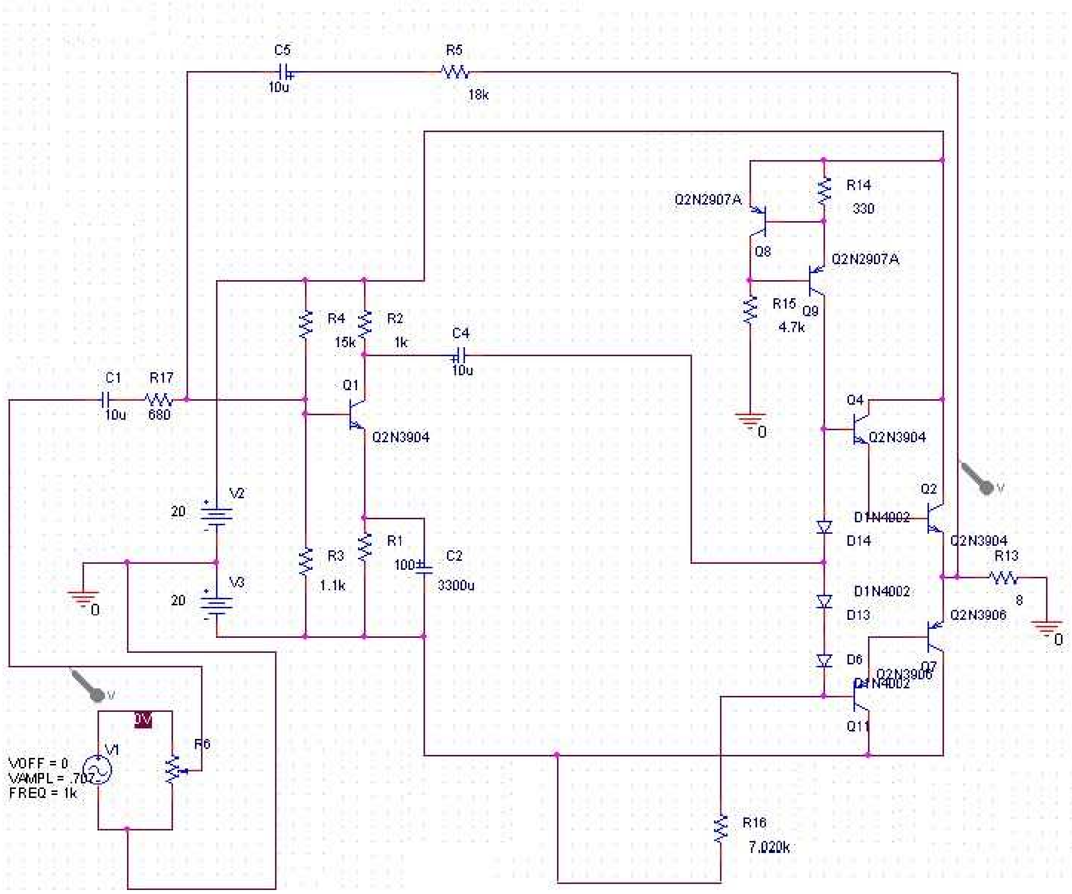
Notes:

Although the TDA2030 can deliver 20 watts of output power, I deliberately reduced the output power to about 8 watts to supply 10 watt speakers. Input sensitivity is 200mV. Higher input levels naturally will give greater output, but no distortion should be heard. The gain is set by the 47k and 1.5k resistors. The TDA2030 IC is affordable and makes a good replacement amplifier for low to medium audio power systems. Incidentally, it is speaker efficiency that determines how "loud" your music is. Speaker efficiency or sound pressure level (SPL) is usually quoted in dB/meter. A speaker with an SPL of 97dB/m will sound louder than a speaker with an SPL of 95dB/m.

15 Watt Amplifier

Description:

A 15 watt amplifier made using discrete components. Sergio designed this circuit for his Electronics Level II course.



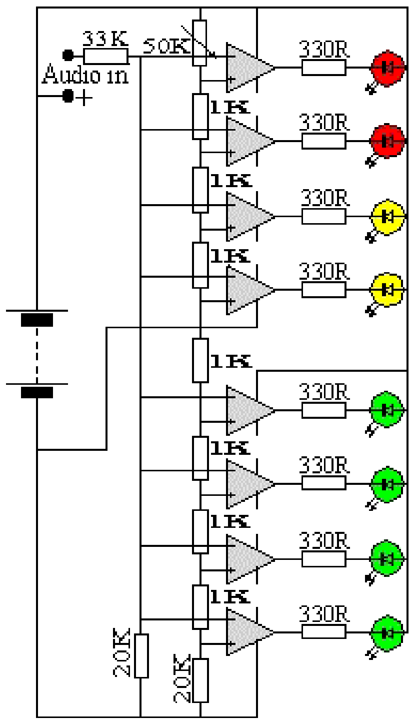
Notes:

This amplifier uses a dual 20 Volt power supply and delivers 15 watts RMS into an 8 ohm load. Q1 operates in common emitter, the input signal being passed to the bias chain consisting of Q8, Q9, D6, D13 and D14. Q8 and Q9 provide a constant current through the bias chain to minimize distortion, the output stage formed by a discrete darlington pair (Q2,Q4) and (Q7,Q11). The last two transistors are power Transitors, specifically the 2N3055 and MJ2955. The 7.02K resistor, R16 was made using a series combination of a 4.7K, 680 Ohms, and two 820 Ohms. The 1.1K resistor, R3 was made using a 100 Ohms and a 1K resistor. You can use this circuit with any walkman or CD player since it is designed to take a standard 500mv RMS signal.

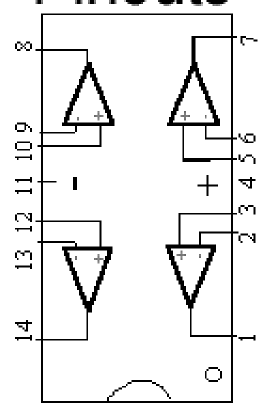
Audio VU Meter

Description:

This circuit uses two quad op-amps to form an eight LED audio level meter. The op-amp used in this particular circuit is the LM324. It is a popular IC and should be available from many parts stores.



LM324 Pinouts



Notes:

The 1K resistors in the circuit are essential so that the LED's turn on at different audio levels. There is no reason why you can't change these resistors, although anything above 5K may cause some of the LED's to never switch on. This circuit is easily expandable with more op-amps, and is not limited to use with the LM324. Pretty much any op-amp will work as long as you look up the pinouts and make sure everything is properly connected.

The 33K resistor on the schematic is to keep the signal input to the circuit at a low level. It is unlikely you will find a 33K resistor, so the closest you can get should do. The value of this resistor may need to be changed, so it is best you breadboard this circuit before actually constructing it on PCB. The circuit in it's current form will accept line level inputs from sources such as the aux out on a Hi-Fi, all though could be easily modified to accept speaker inputs.

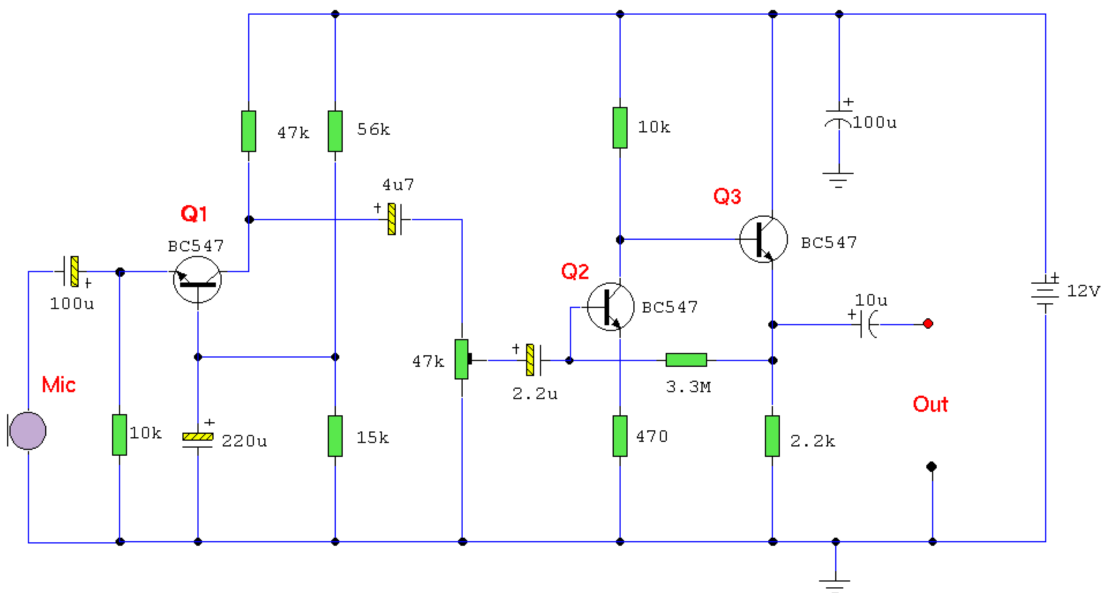
The audio + is connected to the main positive rail, while the audio - is used for signal input. The 50k pot can be used to vary the sensitivity of the circuit.

Dynamic Microphone Preamp

Circuit : Andy Collinson
Email: anc@mitedu.freeserve.co.uk

Description:

A low noise pre-amplifier suitable for amplifying dynamic microphones with 200 to 600 ohm output impedance.

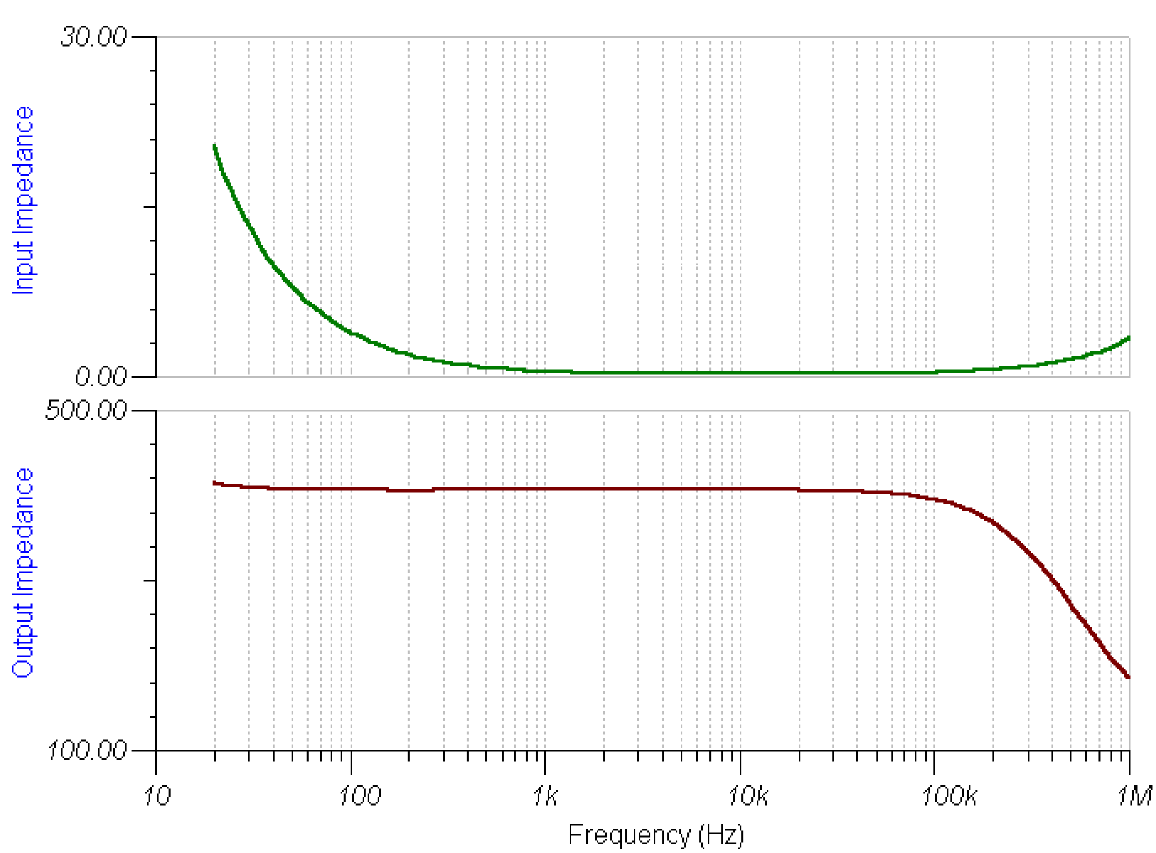


Notes:

This is a 3 stage discrete amplifier with gain control. Alternative transistors such as BC109C, BC548, BC549, BC549C may be used with little change in performance. The first stage built around Q1 operates in common base configuration. This is unusuable in audio stages, but in this case, it allows Q1 to operate at low noise levels and improves overall signal to noise ratio. Q2 and Q3 form a direct coupled amplifier, similar to my earlier mic preamp.

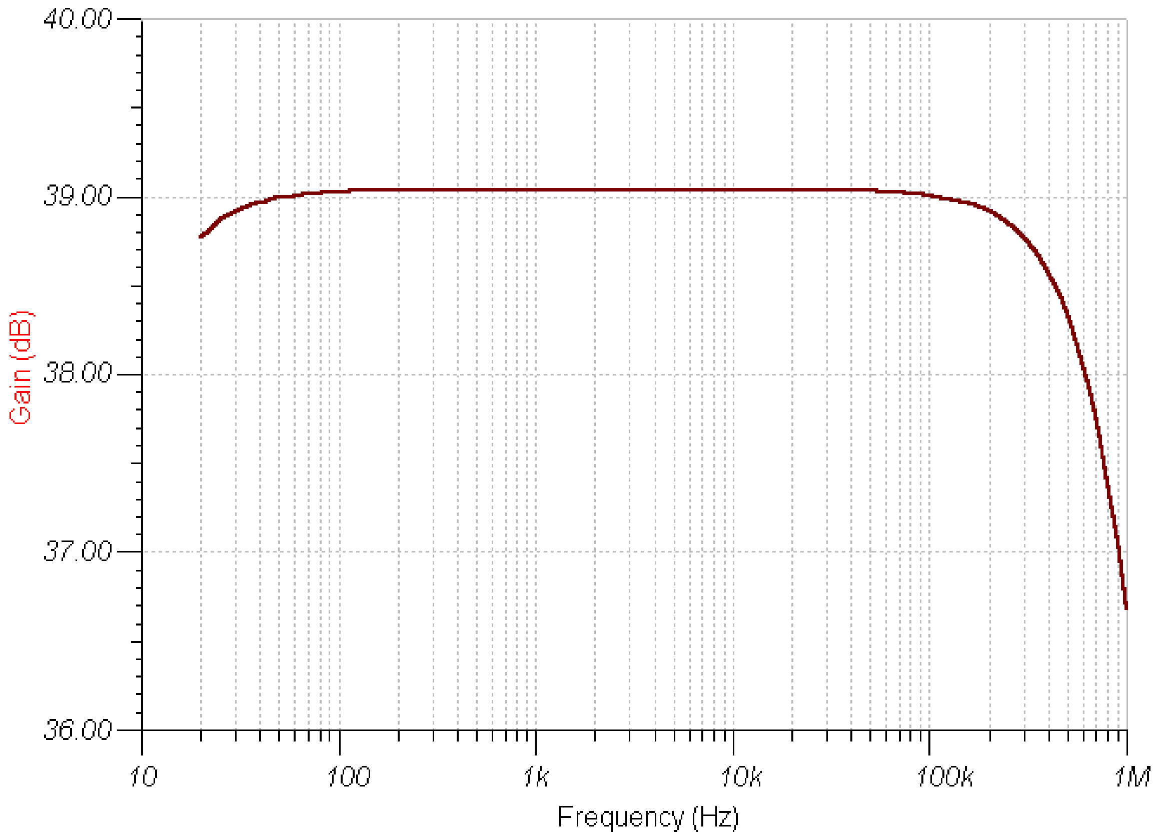
Input and Output Impedance:

As the signal from a dynamic microphone is low typically much less than 10mV, then there is little to be gained by setting the collector voltage voltage of Q1 to half the supply voltage. In power amplifiers, biasing to half the supply voltage allows for maximum voltage swing, and highest overload margin, but where input levels are low, any value in the linear part of the operating characteristics will suffice. Here Q1 operates with a collector voltage of 2.4V and a low collector current of around 200uA. This low collector current ensures low noise performance and also raises the input impedance of the stage to around 400 ohms. This is a good match for any dynamic microphone having an impedances between 200 and 600 ohms. The output impedance at Q3 is low, the graph of input and output impedance versus frequency is shown below:



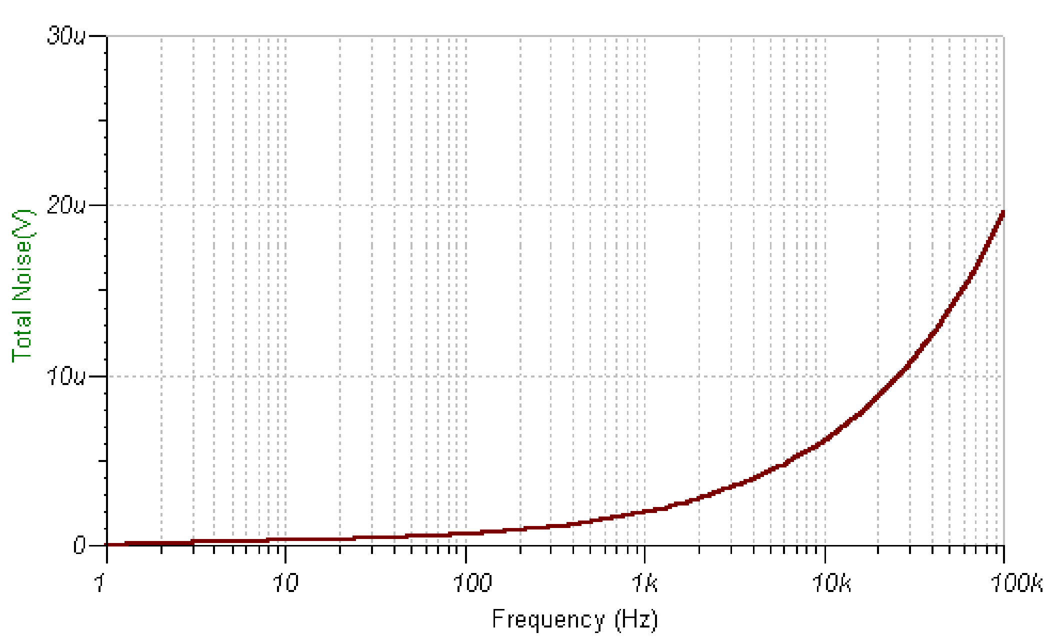
Gain and Frequency Response:

The overall gain of this pre-amplifier is around +39dB or about 90 times. The first stage Q1 has a gain of roughly Rc / Re or 4.7. This is however reduced by feeding into the input impedance of Q2 and Q3, and the shunt formed by the 47k preset. The amplifier formed with Q2 and Q3 has a gain of roughly Rc / Re as Q3 is an emitter follower and has unity gain. The gain of Q2 and Q3 is roughly 10 / 0.47 = 21 and overall gain therefore 4.7 x 21 = 98. The gain ofthe circuit may be reduced to 0 by the 47k preset. The response is flat to 100kHz, low frequency rolloff at 30Hz, a simulated plot is shown below:

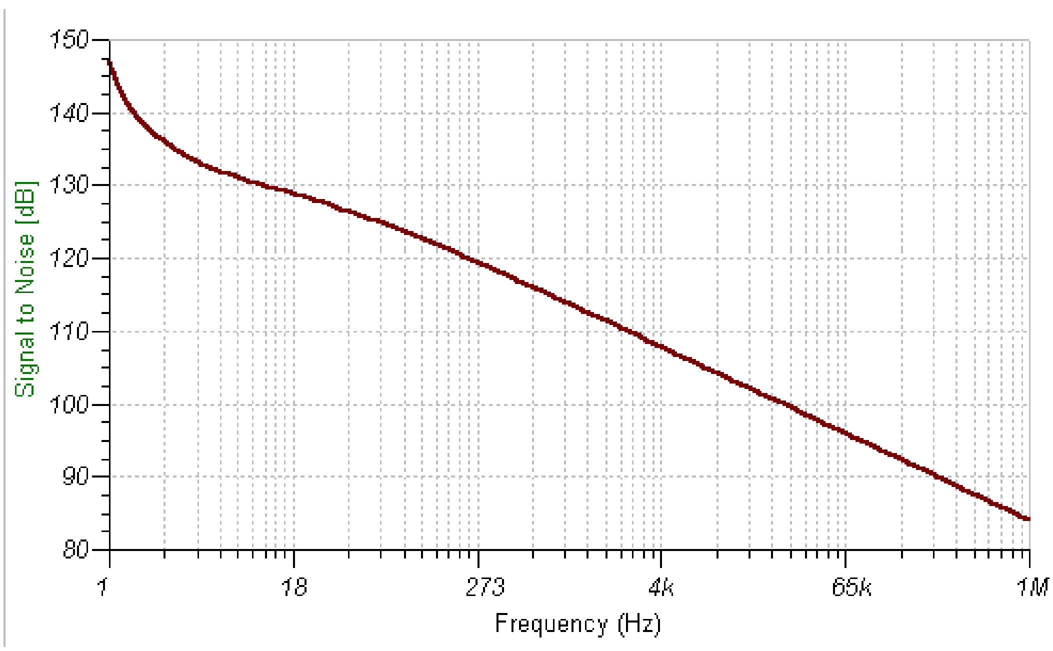


Output Noise and Overall S/N Ratio:

Any amplifier will add its own noise to the signal, degrading the overall performance. The noise of this preamp measured with a 10k load resistor is shown below.



The Signal to Noise ratio is shown below. Note that the input was simulated as a 200 ohm source at 1 mV amplitude.



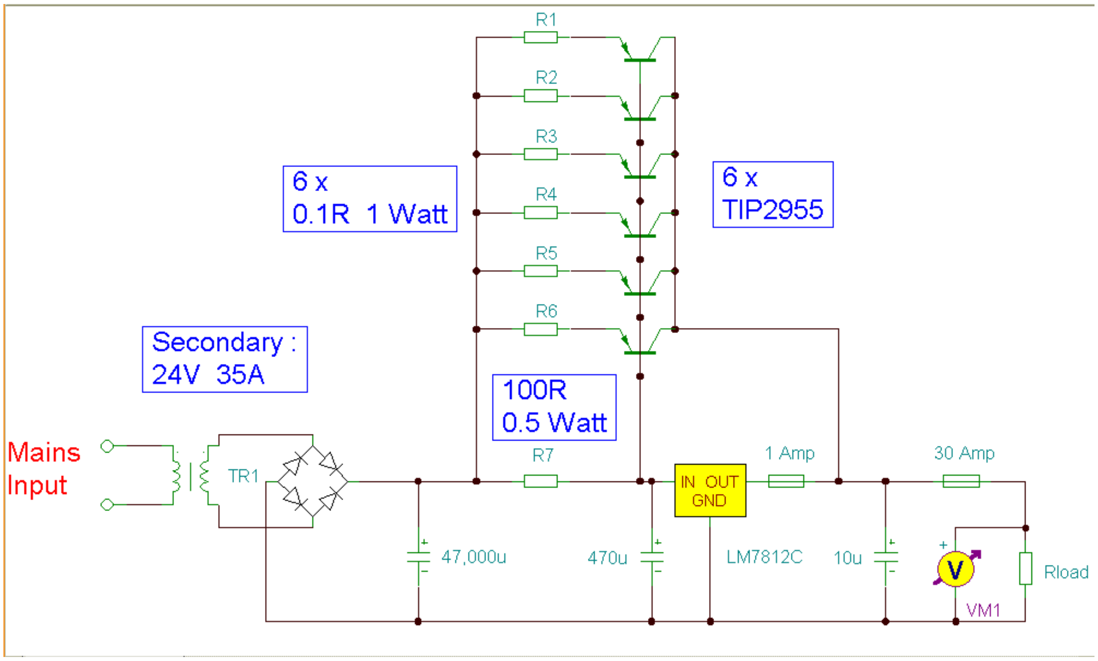
[Bias Conditions and Operating Point:]()

The first stage, Q1 was designed to operate with a collector current of 200 uA. With 15k and 47k bias resistors and a 12 V supply voltage the base voltage will be 12 x (15 / (15+47)) = 2.9 Volts. The emitter voltage will be the base voltage -0.7 V or 2.2 V. For a 200 uA

collector current the emitter resistor will be 2.2 / 0.2 mA =11k. A 10k resistor was used. As Ic and Ie are approximately equal then the collector voltage is 12 - (0.2 * 47) = 2.6 V.
The last stage is a composite amplifier similar to my ECM preamp. Q2 operates in common emitter and provides the voltage gain while Q3 operates in emitter follower, buffering the output and has a low impedance output, suitable for driving long cables, if required. The last stage, Q3 was designed for maximum voltage swing, hence Q3 emitter voltage should be around 6 V. Variation in transistor parameters however, means that measured voltages will be different to calculated voltages. Q2 collector voltage is a base-emitter voltage drop higher or 6.7 V and collector current is set at (12 - 6.7) / 10k = 530 uA. This is also the emitter current for Q2 abd hence emitter voltage will be (0.53 * 0.47) = 0.24 V. The base voltage will be higher by 0.7 V. As the base of Q2 is connected to the emitter of Q3, then the biasing is stabilised to a certain degree against changes in tmperature and current gain variation. However if a meter is available for testing transistor beta, then the transistor with the highest current gain should be used for Q2.

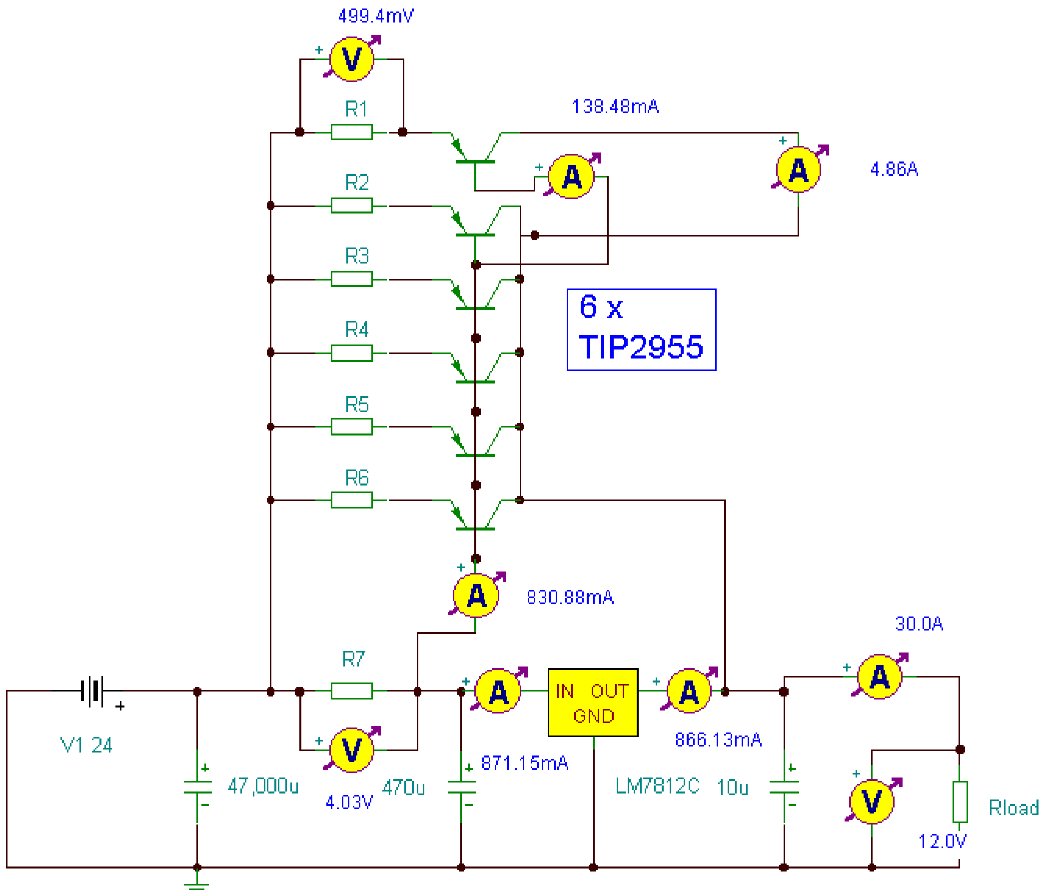
12 Volt 30 Amp PSU

Using a single 7812 IC voltage regulator and multiple outboard pass transistors, this power supply can deliver output load currents of up to 30 amps. The design is shown below:



Notes:

The input transformer is likely to be the most expensive part of the entire project. As an alternative, a couple of 12 Volt car batteries could be used. The input voltage to the regulator must be at least several volts higher than the output voltage (12V) so that the regulator can maintain its output. If a transformer is used, then the rectifier diodes must be capable of passing a very high peak forward current, typically 100amps or more. The 7812 IC will only pass 1 amp or less of the output current, the remainder being supplied by the outboard pass transistors. As the circuit is designed to handle loads of up to 30 amps, then six TIP2955 are wired in parallel to meet this demand. The dissipation in each power transistor is one sixth of the total load, but adequate heat sinking is still required. Maximum load current will generate maximum dissipation, so a very large heat sink is required. In considering a heat sink, it may be a good idea to look for either a fan or water cooled heat sink. In the event that the power transistors should fail, then the regulator would have to supply full load current and would fail with catastrophic results. A 1 amp fuse in the regulators output prevents a safeguard. The 400mohm load is for test purposes only and should not be included in the final circuit. A simulated performance is shown below:



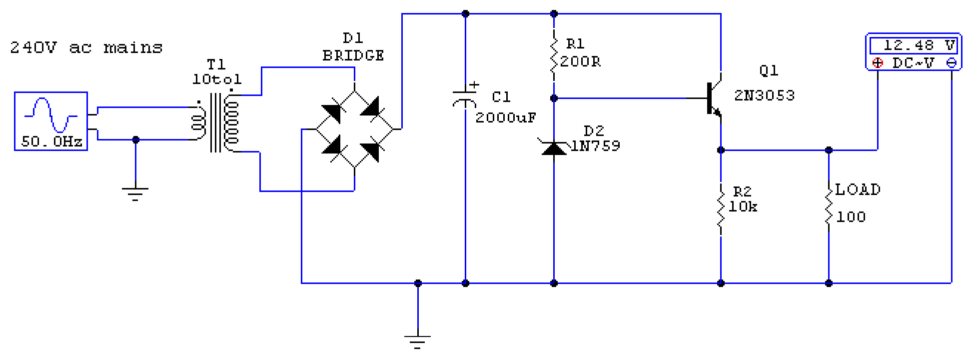
Calculations:

This circuit is a fine example of Kirchoff's current and voltage laws. To summarise, the sum of the currents entering a junction, must equal the current leaving the junction, and the voltages around a loop must equal zero. For example, in the diagram above, the input voltage is 24 volts. 4 volts is dropped across R7 and 20 volts across the regulator input, 24 -4 -20 =0. At the output :- the total load current is 30 amps, the regulator supplies 0.866 A and the 6 transistors 4.855 Amp each , 30 = 6 * 4.855 + 0.866. Each power transistor contributes around 4.86 A to the load. The base current is about 138 mA per transistor. A DC current gain of 35 at a collector current of 6 amp is required. This is well within the limits of the TIP2955. Resistors R1 to R6 are included for stability and prevent current swamping as the manufacturing tolerances of dc current gain will be different for each transistor. Resistor R7 is 100 ohms and develops 4 Volts with maximun load. Power dissipation is hence (4^2)/200 or about 160 mW. I recommend using a 0.5 Watt resistor for R7. The input current to the regulator is fed via the emitter resistor and base emitter junctions of the power transistors. Once again using Kirchoff's current laws, the 871 mA regulator input current is derived from the base chain and the 40.3 mA flowing through the 100 Ohm resistor. 871.18 = 40.3 + 830. 88. The current from the regulator itself cannot be greater than the input current. As can be seen the regulator only draws about 5 mA and should run cold.

Regulated 12 Volt Supply

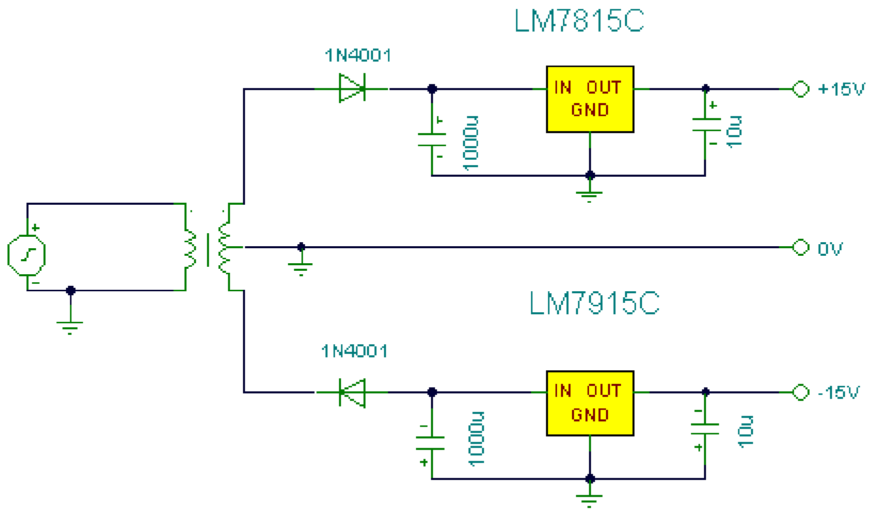
Circuit : Mick Devine
Email: mick_devine@yahoo.com

Description
A basic regulated 12 Volt power supply



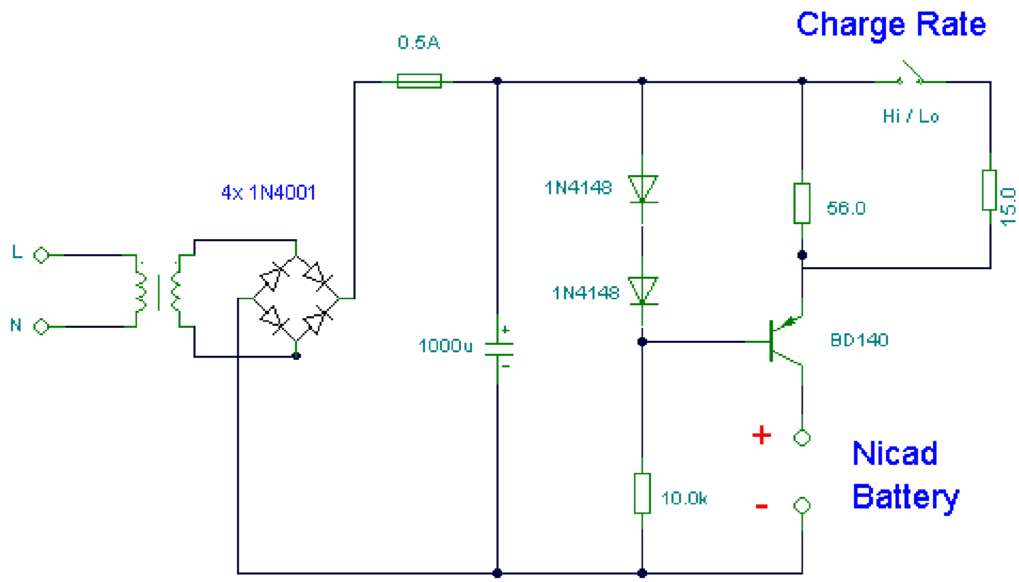
Notes:
This circuit above uses a 13 volt zener diode, D2 which provides the voltage regulation. Aprroximately 0.7 Volts are dropped across the transistors b-e junction, leaving a higher current 12.3 Volt output supply. This circuit can supply loads of up to 500 mA. This circuit is also known as an amplified zener circuit.

Dual Regulated Power Supply



Notes:
In this circuit, the 7815 regulatates the positive supply, and the 7915 regulates the negative supply. The transformer should have a primary rating of 240/220 volts for europe, or 120 volts for North America. The centre tapped secondary coil should be rated about 18 volts at 1 amp or higher, allowing for losses in the regulator. An application for this type of circuit would be for a small regulated bench power supply.

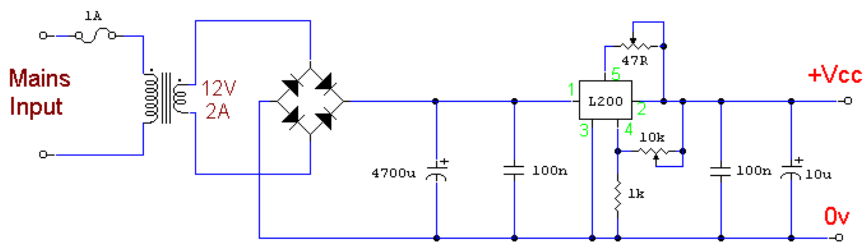
Nicad Battery Charger



Notes:
This simple charger uses a single transistor as a constant current source. The voltage across
the pair of 1N4148 diodes biases the base of the BD140 medium power transistor. The base-
emitter voltage of the transistor and the forward voltage drop across the diodes are relatively stable. The charging current is approximately 15mA or 45mA with the switch closed. This suits most 1.5V and 9V rechargeable batteries.
The transformer should have a secondary rating of 12V ac at 0.5amp, the primary should be
220/240volts for Europe or 120volts ac for North America.

WARNING: Take care with this circuit. Use a voltmeter to observe correct polarity. Nicads
can explode if short circuited or connected with the wrong polarity.

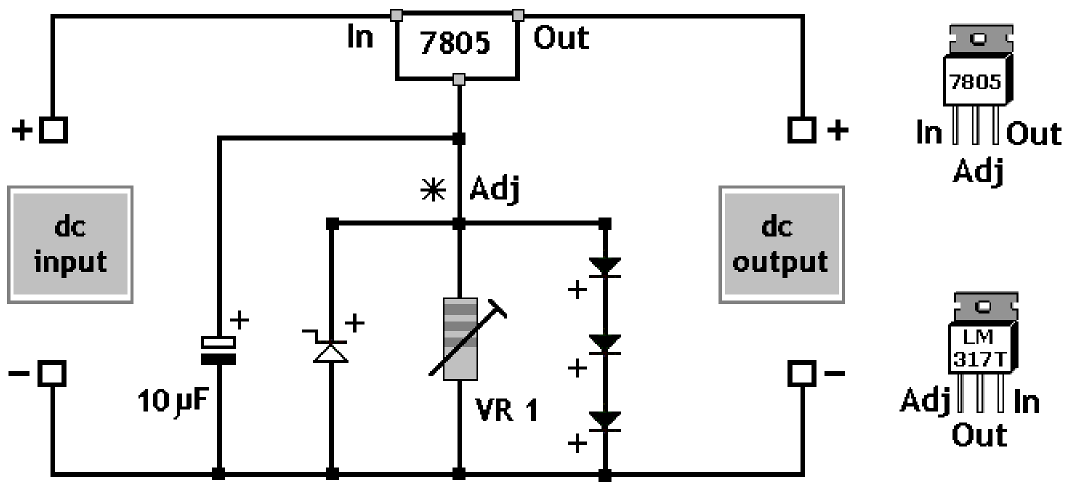
Variable Power Supply



Notes:
Using the versatile L200 voltage regulator, this power supply has independent voltage and current limits. The mains transformer has a 12volt, 2 amp rated secondary, the primary winding should equal the electricity supply in your country, which is 240V here in the UK. The 10k control is adjusts voltage output from about 3 to 15 volts, and the 47 ohm control is the current limit. This is 10mA minimum and 2 amp maximum. Reaching the current limit will reduce the output voltage to zero. Voltage and current regulation equations can be found at this page.

Variable Voltage Regulation

Variable Voltage from a 7805 Regulator



* Three different ways to change the output voltage of a 78 series regulator

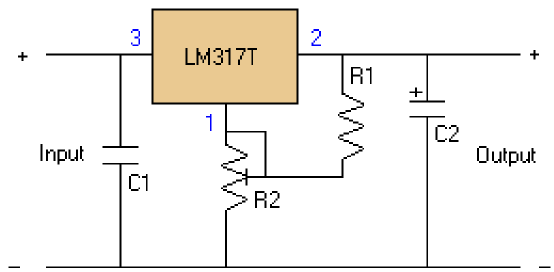
Circuit by Ron J
Text by ANC

Notes:
As Ron suggests, controlling the output voltage from a regulator can be made variable in three ways:-
1. Using a fixed reference zener diode to increase the output by the value of the zener
2. A variable resistor for variable output, note that a voltage less than the nominal regulator is not possible
3. A chain of diode such as 1N4001, this increases the output by +0.7 V for every diode used.

LM317 Regulator Circuit

Circuit :Matthew Hewson
Email: matthew.hewson@ntlworld.com

I constructed this voltage regulator to power my two way mobile radio from the car cigarette lighter circuit. It has many other uses and the voltage can easily be adjusted by the use of a potentiometer. The voltage regulator is an LM317T, and should accept up to about 14 volts without problems. It can handle up to 1 amp, but you WILL need a heatsink on the voltage regulator.

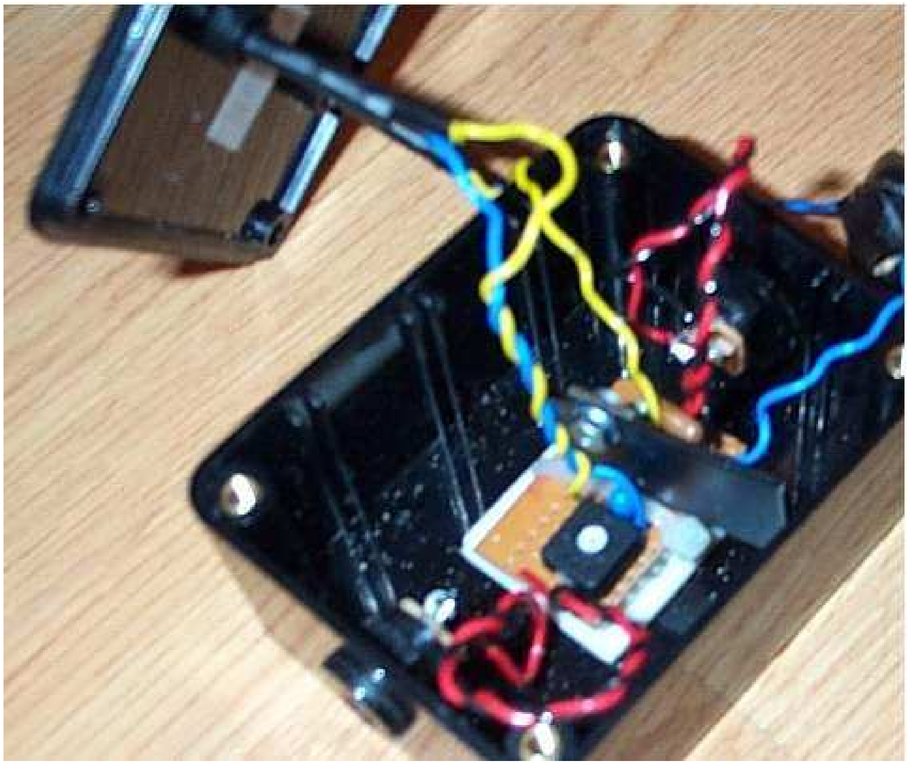


The components are:

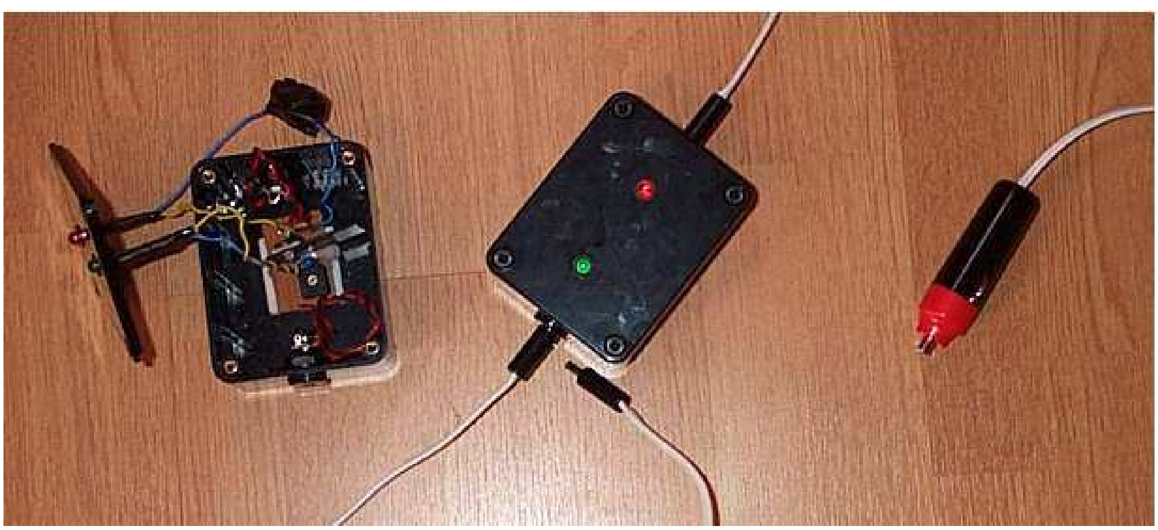
R1: 270R
R2: 2K Cermet or carbon preset potentiometer
C1: 100nF
C2: 1uF tantalum
LM317T Voltage regulator
Heatsink
PCB board

I also added DC power jacks for input and output on my voltage regulator, a green power LED, and a red over-voltage LED. The over voltage LED uses a zener diode to switch on the LED at a certain preset voltage, this can be varied depending on the voltage of the zener diode, I used a 6.2v zener diode. If you plan to vary the voltage for the different items you power, don't bother adding this feature. If you only plan to use items that run on one voltage, this is a very useful feature and will save plugging in and damaging your valuable (or not so valuable) equipment. You can even add a relay to switch off the power if the over voltage LED turns on, but bear in mind it will have to work from the voltage of the zener diode right up to the input voltage. I couldn't add a relay because I couldn't find any that operated from 6.2-13.8 volts. Anyway, the schematic is shown above, the over voltage and power LED are not included in them because it is assumed that anybody who makes this will understand how to use a zener diode:

This is what the final product should look like inside:



This is an outside view of the finished voltage regulator:



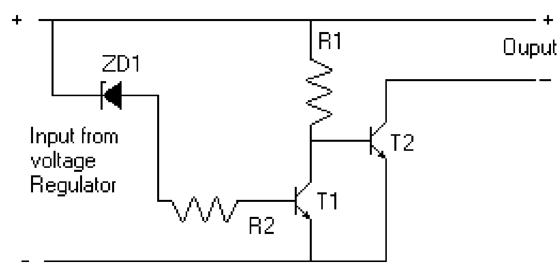
Here is what my voltage regulator is intended to power:

Overvoltage Protection for the LM317

Circuit : Adam
Email: electronicplanetuk@hotmail.com

Description:

This is an add-on Over Voltage Circuit for the LM317 Regulator Circuit submitted by Matthew Hewson. The original circuit may be viewed here.



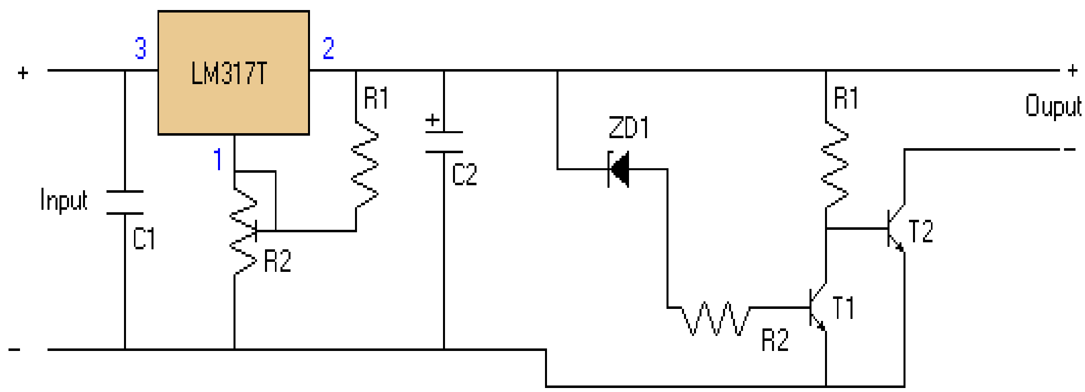
Notes:

It is a voltage regulator that allows a 6v portable supply to be derived from the 12v car battery. You can add a 6.2V zener diode and a LED to warn you when the input supply is overvoltage. If you could find a relay that would operate from 6.2v right up to 12v that you could connect in such a way that if over voltage occurred, then the relay would automatically switch off the output preventing damage to any connected equipment.
Such a relay would be quite difficult to find, so I designed this, it is a simple two transistor circuit which will switch off the output should the voltage raise above 6.2v (this can be changed by selecting a different value of zener diode).

Components are as follows:
ZD1 =3D 6.2v Zener diode (you can change this to any value, the circuit will switch off the output if the input voltage raises above the value of the zener diode)
R1 = 1K Resistor (this can be of any power rating, it carries very little power)
R2 = 1K Resistor (this can be of any power rating, it carries very little power)
T1 = Low power NPN Transistor (BC108 or BC547 will do fine)

T2 = NPN transistor transistor capable of switching the equipment you are running (BFY51 or BC140 can switch 1 Amp, which is the maximum the voltage regulator circuit can handle)

It is advisable to test this circuit with a voltmeter, slowly increasing the voltage on the regulator circuit and make sure that this circuit switches off the output when the value of the zener diode is reached, before plugging in your expensive equipment. This circuit is intended to be used with the voltage regulator posted by Matthew Hewson, my overvolatge add-on circuit is shown with the original below:-

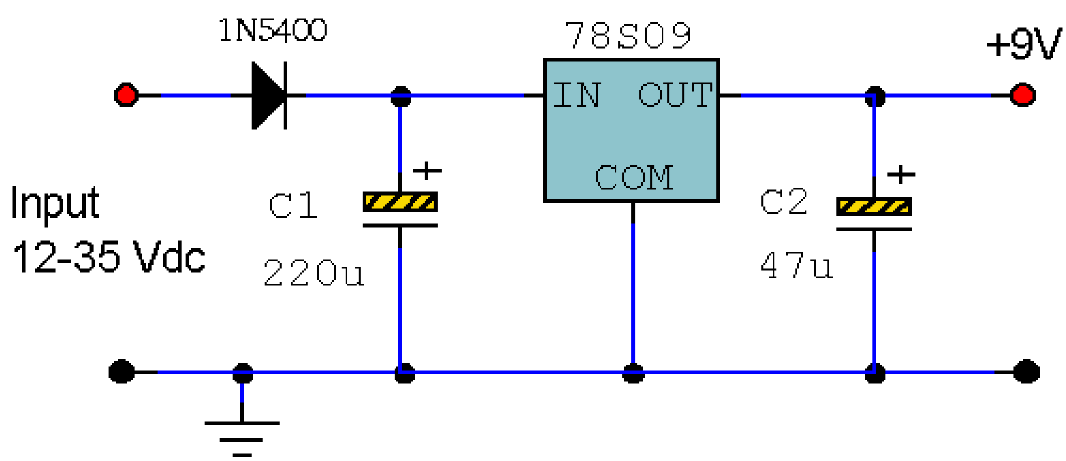


Double check the polarity, It is very easy to blow up components in the eqipment that you are powering if you reverse the polarity. Also, if you want to increase the power output of the voltage regulator circuit above 1 Amp then connect several LM317's in parallel, be sure to make sure that transistor T2 on this circuit is of a high enough rating if you do this.
If you have any problems with this circuit, you can email me at:
electronicplanetuk@hotmail.com
or have a look for updates on my http://www.electronics.vze.com/
Adam

9 Volt 2 Amp Power Supply

Circuit : Andy Collinson
Email: anc@mitedu.freeserve.co.uk

Description:
A simple 9 Volt 2 amp supply using a single IC regulator.



Notes:
There is little to be said about this circuit. All the work is done by the regulator. The 78S09 can deliver up to 2 amps continuous output whilst maintaining a low noise and very well regulated supply.

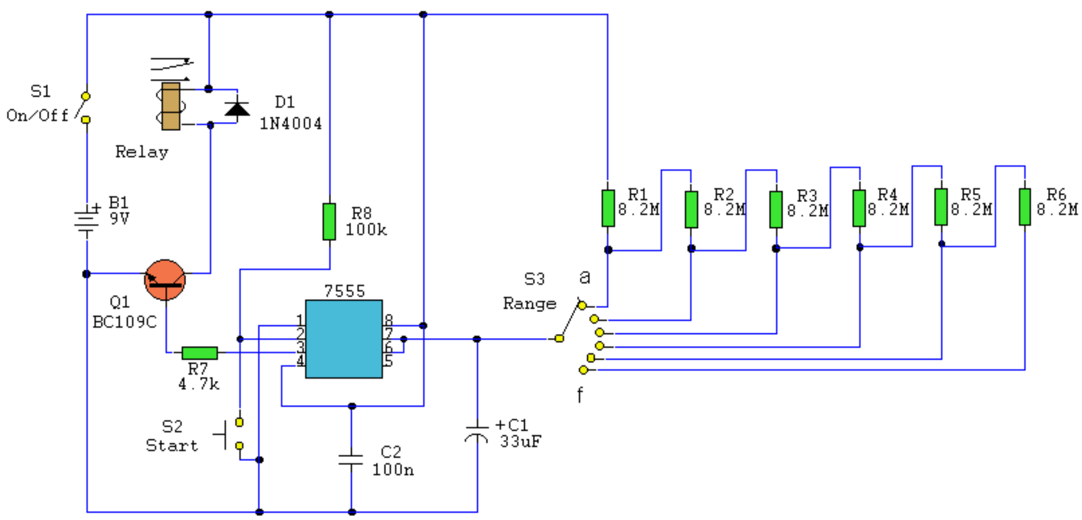
The circuit will work without the extra components, but for reverse polarity protection a 1N5400 diode is provided at the input, extra smoothing being provided by C1. The output stage includes C2 for extra filtering, if powering a logic circuit than a 100nF capacitor is also desirable to remove any high frequency switching noise.

5 to 30 Minute Timer

Circuit : Andy Collinson
Email: anc@mitedu.freeserve.co.uk

Descriptipn:

A switched timer for intervals of 5 to 30 minutes incremented in 5 minute steps.



Notes:

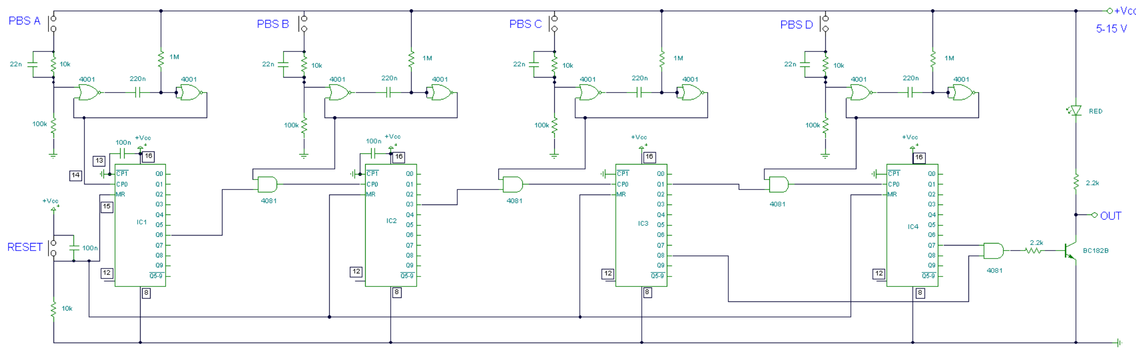
Simple to build, simple to make, nothing too complicated here. However you must use the CMOS type 555 timer designated the 7555, a normal 555 timer will not work here due to the resistor values. Also a low leakage type capacitor must be used for C1, and I would strongly suggest a Tantalum Bead type. Switch 3 adds an extra resistor in series to the timing chain with each rotation, the timing period us defined as :-

$$\text{Timing} = 1.1\ C_1 \times R_1$$

Note that R_1 has a value of 8.2M with S3 at position "a" and 49.2M at position "f". This equates to just short of 300 seconds for each position of S3. C_1 and R_1 through R_6 may be changed for different timing periods. The output current from Pin 3 of the timer, is amplified by Q1 and used to drive a relay.

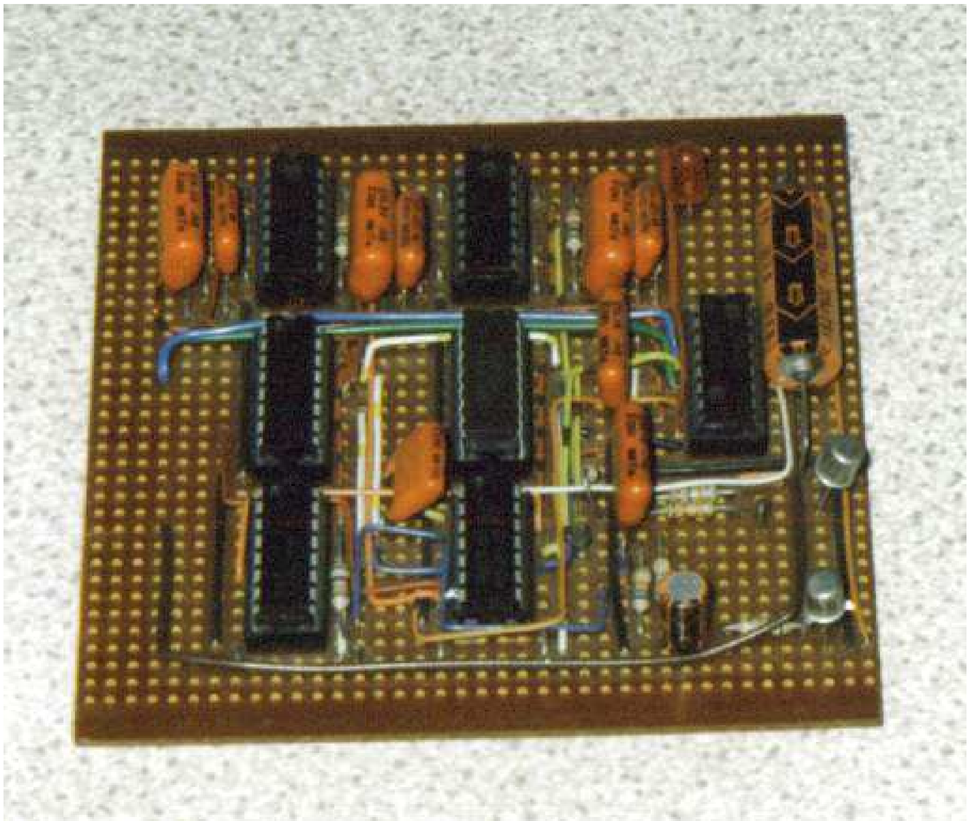
Parts List:
Relay 9 volt coil with c/o contact (1)
S1: On/Off (1)
S2: Start (1)
S3: Range (1)
IC1: 7555 (1)
B1: 9V (1)
C1: 33uF CAP (1)
Q1: BC109C NPN (1)
D1: 1N4004 DIODE (1)
C2: 100n CAP (1)
R6,R5,R4,R3,R2,R1: 8.2M RESISTOR (6)
R8: 100k RESISTOR (1)
R7: 4.7k RESISTOR (1)

Digital Combination Lock



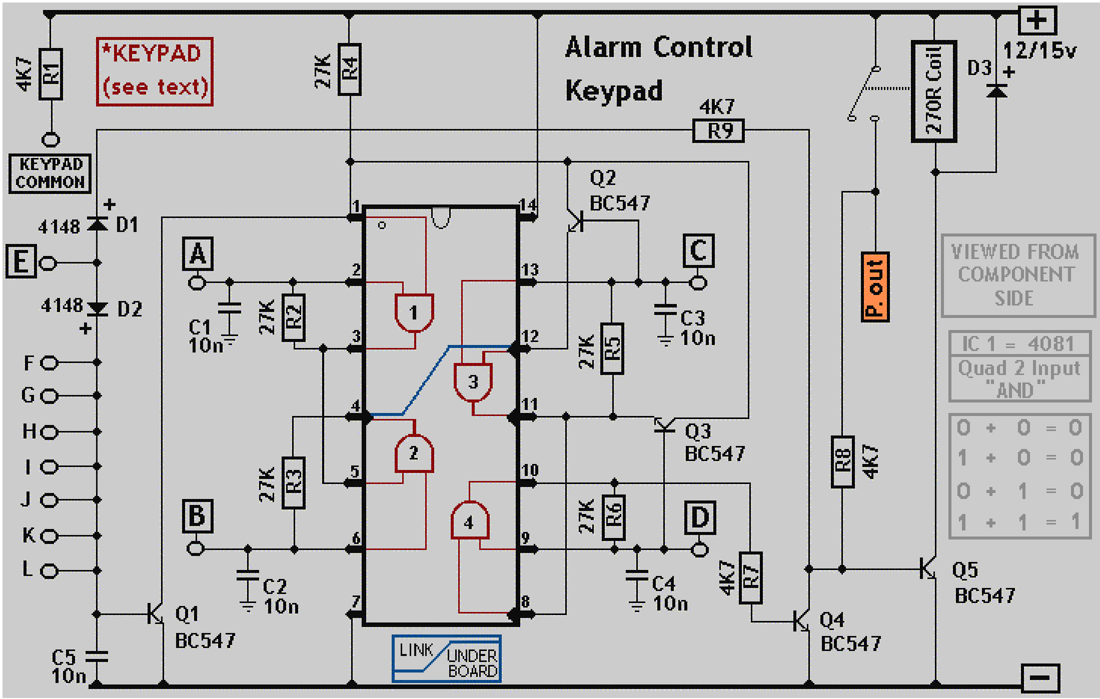
IC1-4 are CMOS4017

Notes:
The circuit above above makes use of the CMOS 4017 decade counter IC. Each depression of a switch steps the output through 0 - 9. By coupling the output via an AND gate to the next IC, a predefined code has to be input to create the output. Each PBS switch is debounced by two gates of a CMOS4001 quad 2-input NOR gate. This ensures a clean pulse to the input of each CMOS 4017 counter. Only when the correct number of presses at PBS A will allow PBS B to become active. This is similar for PBS C and PBS D. At IC4, PBS D must be pressed 7 times. Then PBS C is again pressed 7 times, stepping from output 1 to output 8. The AND gate formed around CMOS4081 then goes high, lighting the LED. The Reset switch can be pressed at any time. Power on reset is provided by the 100n capacitor near the reset switch. Below is a picture of one that I made about 15 years ago:



Unfortunately, this board was part of a much larger project containing multiple power supplies. One day whilst working on another circuit , I slipped with a wire and splashed 24volts DC onto this board. There was a small spark, and puff of smoke before all this chips were cooked! If anyone does consider building such a circuit, then my advice would be to stop and look in your local electronic parts catalogue. There are now dedicated combination lock IC's with combinations many times greater than this circuit. Incidentally the number of combinations offered here is 10 x 10 x 10 x 10 x 9 = 90,000. Check out Dean White's Electronic Gadgets, on the Electronic Sites Alliance web ring, he also has a combination lock circuit.

Electronic Keypad



The IC is a quad 2 input "AND" gate, a CMOS 4081. These gates only produce a HIGH output, when BOTH the inputs are HIGH. When the key wired to 'E' is pressed, current through R1 and D1 switchs Q5 on.The relay energises; and Q5 is 'latched on' by R8. Thus, the Alarm is set by pressing a single key,say one of the two non-numeric symbols.

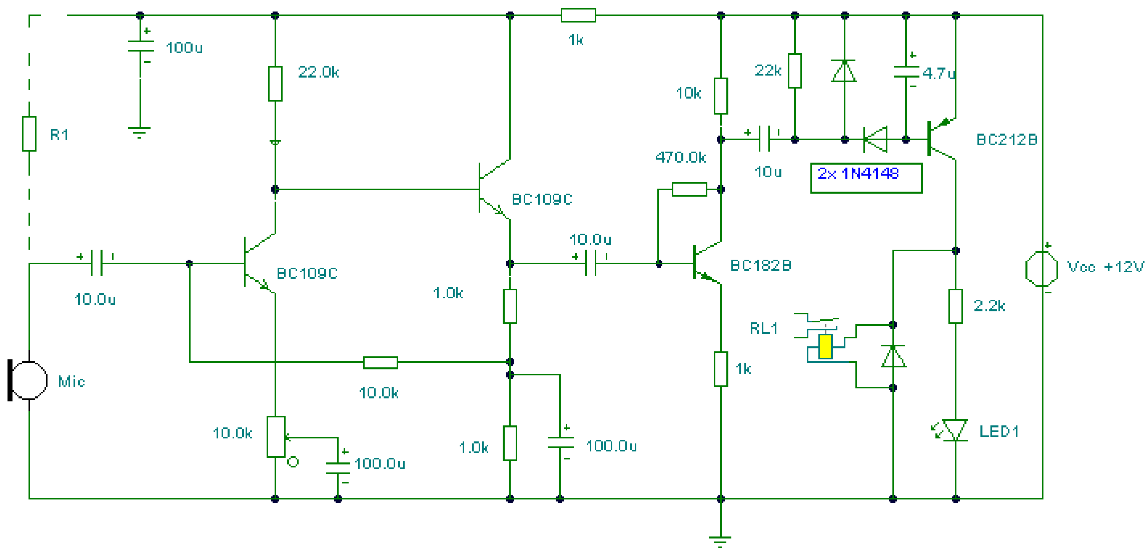
The alarm will switch off when the 4 keys connected to "A,B,C,D" are pushed in the right order.The circuit works because each gate 'Stands' upon its predecessor.If any key other than the correct key is pushed, then gate 1 is knocked out of the stack, and the code entry fails. Pin 1 is held high by R4. This 'Enables' gate 1; and when button 'A' is pressed, the output at pin 3 will go high. This output does two jobs.It locks itself 'ON' through R2 and it 'Enables' gate 2, by taking pin 5, high. Now, if 'B' is pressed, the output of gate 2, at pin 4 will go high. This output does two jobs. It locks itself 'ON' through R3 and it 'Enables' gate 3 by taking pin 12 high.

Now, if 'C' is pressed, the output of gate 3 will lock itself 'ON' through R5 and, by taking pin 8 high, 'Enable' gate 4. Pressing 'D' causes gate 4 to do the same thing; only this time its output, at pin 10, turns Q4 'ON'. This takes the base of Q5 to ground, switching it off and letting the relay drop out. This switches the alarm off.

Any keys not connected to 'A B C D E' are wired to the base of Q1. Whenever 'E' or one of these other keys is pressed, pin 1 is taken low and the circuit is reset. In addition, if 'C' or 'D' is pressed out of sequence, then Q2 or Q3 will take pin 1 low and the circuit will reset. Thus nothing happens until 'A' is pressed.Then if any key other than 'B' is pressed, the circuit will reset.
Similarly, after 'B', if any key other than 'C' is pressed,the circuit will reset. The same reasoning also applies to 'D'.
The Keypad needs to be the kind with a common terminal and a separate connection to each key. On a 12 key pad, look for 13 terminals. The matrix type with 7 terminals will NOT do. Wire the common to R1 and your chosen code to 'A B C D'. Wire 'E' to the key you want to use to switch the alarm on. All the rest go to the base of Q1.

The diagram should give you a rough guide to the layout of the components, if you are using a stripboard. The code you choose can include the non-numeric symbols.In fact, you do not have to use a numeric keypad at all,or you could make your own keypad.
I haven't calculated the number of combinations of codes available, but it should be in excess of 10 000 with a 12 key pad; and, after all, any potential intruder will be ignorant of the circuit's limitations. Of Course, if you must have a more secure code, I can think of no reason why you shouldn't add another 4081 and continue the process of enabling subsequent gates. Or you could simply use a bigger keypad with more "WRONG" keys.
Any small audio transistors should do. The 27k resistors could be replaced with values up to 100k. And the only requirements for the 4k7 resistors is that they protect the junctions while providing enough current to turn the transistors fully on.
Capacitors (C1 C2 C3 C4 C5) are there to slow response time and overcome any contact bounce. They are probably unnecessary.

Sound Operated Switch



Notes:
This sensitive sound operated switch can be used with a dynamic microphone insert as above,
or be used with an electret (ECM) microphone. If an ECM is used then R1 (shown dotted) will
need to be included. A suitable value would be between 2.2k and 10kohms.

The two BC109C transitors form an audio preamp, the gain of which is controlled by the 10k
preset. The output is further amplified by a BC182B transistor. To prevent instability the
preamp is decoupled with a 100u capacitor and 1k resistor. The audio voltage at the collector
of the BC182B is rectified by the two 1N4148 diodes and 4.7u capacitor. This dc voltage will
directly drive the BC212B transistor and operate the relay and LED.

It should be noted that this circuit does not "latch". The relay and LED operate momentarily
in response to audio peaks.

Neon Desklamp.

By Rev. Thomas Scarborough.

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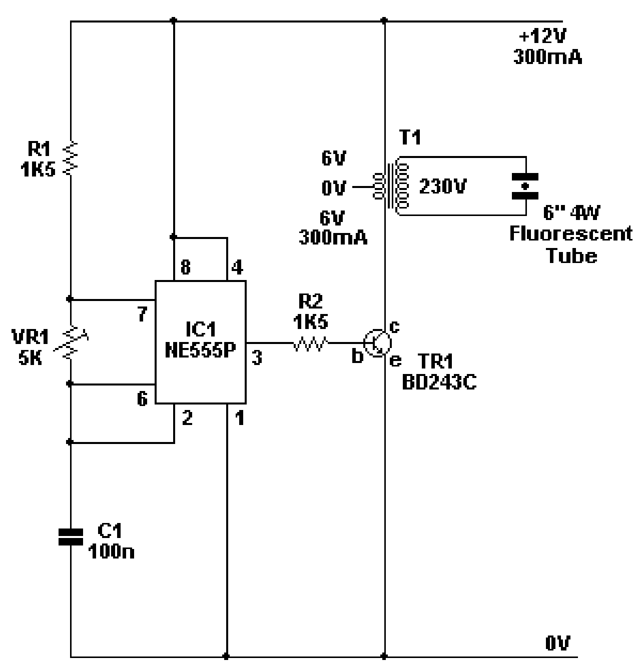
E-mail scarboro@iafrica.com

Figure 1.



This circuit will power a 6 inch 4 Watt fluorescent tube off a 12 volt supply, consuming 300 mA. It may also be powered by a suitably rated universal AC/DC adapter. Advantages of the design are: good light, low power consumption, and readily available stock parts.

The circuit is based on IC1, which is a 555 timer IC in astable mode. IC1's current output is amplified by TR1, and the voltage at the collector is stepped up by T1, a mains to 6-0-6 V transformer. Heat-sinks are advised for TR1 and T1.

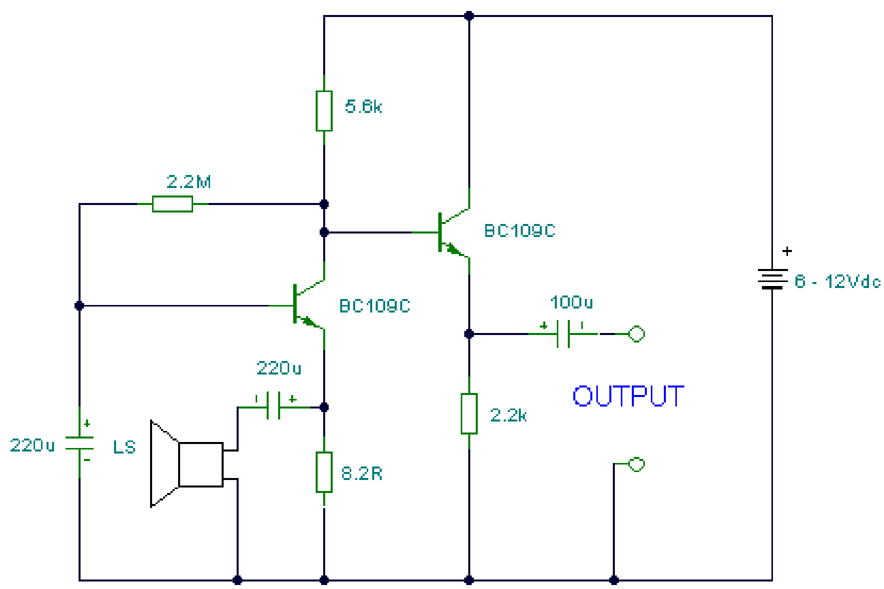
Before applying power, VR1 should be advanced to a full 5 K. While power consumption is monitored with a multimeter, VR1 should be turned back slowly until power consumption rises to 300 mA maximum. The fluorescent tube should now shine brightly. Power consumption should not exceed 300 mA, or the circuit may be destroyed.

Should a universal AC/DC adapter be used at a later stage, constructors are advised to repeat the setup procedure with VR1, since the voltage of such adapters is unstable and may destroy the circuit.

Constructors should be aware that a high voltage is present at the transformer primary, which could deliver a nasty shock.

Speaker Microphone Circuit

Description:
This circuit takes an ordinary loudspeaker and allows it to be used in reverse, as a microphone.



Notes:
This circuits allows you to use a cheap loudspeaker as a microphone.Sound waves reaching the speaker cone cause fluctuations in the voice coil. The voice coil moving in the speakers magnetic field will produce a small electrical signal . The circuit is designed to be used with an operating voltage between 6 and 12 volts dc. The first transistor operates in common base mode. This has the advantage of matching the low input impedance of the speaker to the common base stage, and secondly has a high voltage gain. The second stage is direct coupled and operates in emitter follower. Voltage gain is slightly less than unity, but output impedance is low, and will drive long cables.
Speech quality is not as good compared to an ordinary or ECM microphone, but quite acceptable results can be obtained. Speaker cones with diameters of 1 inch to 3 inches may be used. Speaker impedance may be 4 ohm to 64 ohm. The 8.2 ohm resistor value may be changed to match the actual speakers own impedance.

LED Torch.

Rev. Thomas Scarborough.

A common problem with small torches is the short life-span both of the batteries and the bulb. The average incandescent torch, for instance, consumes around 2 Watts. The LED Torch in Fig. 1 consumes just 24 mW, giving it more than 80 times longer service from 4 AA alkaline batteries (that is, up to one month's continuous service). Although the torch’s light output is modest, it is nonetheless quite sufficient to illuminate a pathway for walking.

The LED Torch is based on a 7555 timer running in astable mode (do not use an ordinary 555). A white LED (Maplin order code NR73) produces 400 mcd light output, which, when focussed, can illuminate objects at 30 metres. Try Conrad Electronic for what appears to be a stronger white LED (order code 15 37 45-11).

A convex lens with short focal length is placed in front of the LED to focus the beam. If banding occurs at the beam’s perimeter, use another very short focal length lens directly in front of the LED to smooth the beam.

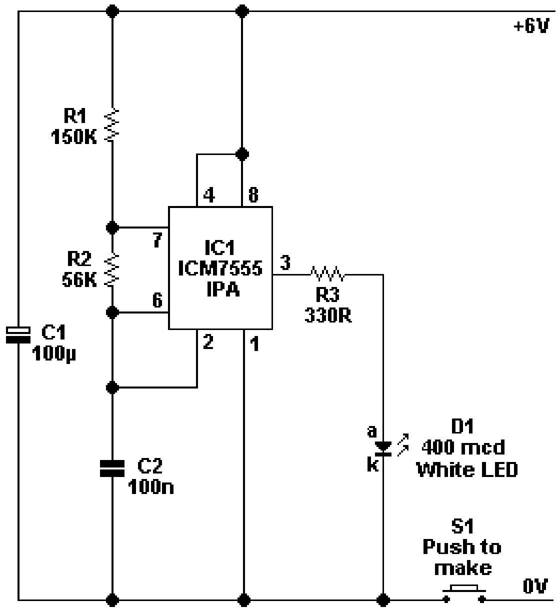
If a different supply voltage is preferred, the value of resistor R3 is modified as follows:

9V - 470 Ohm

12V - 560 Ohm

LED Torch.

Figure 1.



Rev. Thomas Scarborough.

See my "Wind-up Torch" feature article in the October 2000 edition of Everyday Practical Electronics for a completely battery-free go-everywhere torch.

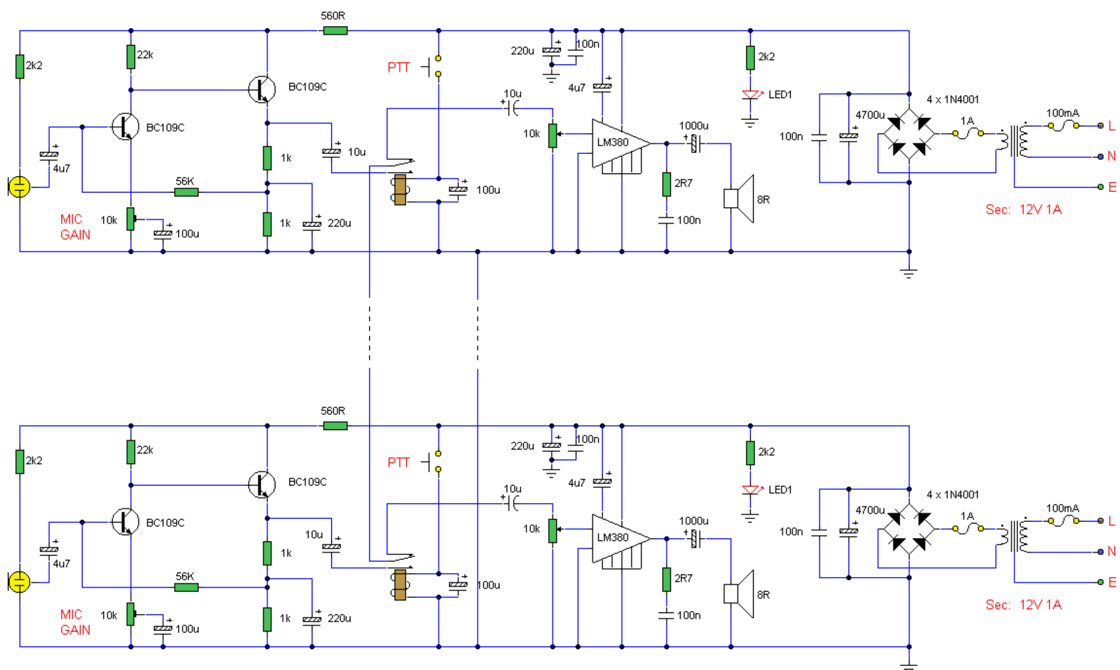
E-mail scarboro@iafrica.com

High Quality Intercom

Description:

A very high quality intercom, which may also be used for room monitoring.

Full image resolution at 1600x1200



Click here to download a smaller 1024 x768 resolution schematic

Notes:

This circuit consists of two identical intercom units. Each unit contains a power supply, microphone preamplifier, audio amplifier and a Push To Talk (PTT) relay circuit. Only 2 wires are required to connect the units together. Due to the low output impedance of the mic preamp, screened cable is not necessary and ordinary 2 core speaker cable, or bell wire may be used.

The schematic can be broken into 34 parts, power supply, mic preamp, audio amplifierand PTT circuit. The power supply is designed to be left on all the time, which is why no on / off switch is provided. A standard 12 V RMS secondary transformer of 12VA will power the unit. Fuses are provided at the primary input and also secondary, before the rectifier. The 1 A fuse needs to be a slow blow type as it has to handle the peak rectifier current as the power supply electrolytics charge from zero volts.

The microphone amplifier is a 2 transistor direct coupled amplifier. BC108B transistors will work equally well in place of the BC109C transistors. The microphone used is a 3 terminal electret condenser microphone insert. These are popular and require a small current to operate. The preamp is shown in my audio circuit section as well, but has a very high gain and low distortion. The last transistor is biased to around half the supply voltage; this provides the maximum overload margin for loud signals or loud voices. The gain may be adjusted with the 10k preset. Sensitivity is very high, and a ticking clock can easily be heard from the distant loudspeaker.

The amplifier is based on the popular National Semiconductor LM380. A 50 mV input is all thats required to deliver 2W RMS into an 8 ohm loudspeaker. The choice of loudspeaker determines overall sound quality. A small loudspeaker may not produce a lot of bass, I used an old 8 inch radio loudspeaker. The 4.7u capacitor at pin 1 of the LM380 helps filter out any mains hum on the power supply. This can be increased to a 10u capacitor for better power supply rejection ratio.

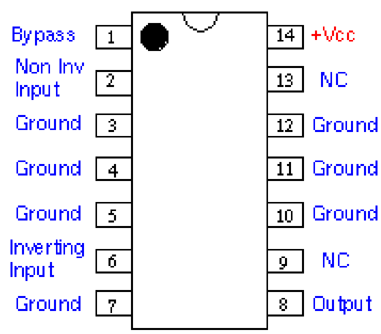
The push to talk (PTT) circuit is very simple. A SPDT relay is used to switch between mic preamplifier output or loudspeaker input. The normally closed contact is set so that each intercom unit is "listening". The non latching push button switch must be held to talk. The 100u capacitor across the relay has two functions. It prevents the relays back emf from destroying the semiconductors, and also delays the release of the relay. This delay is deliberate, and prevents any last word from being "chopped" off.

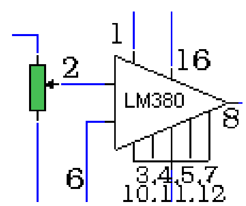
Setting Up and Testing:

This circuit does not include a "call" button. This is simply because it is designed to be left on all the time, someone speaking from one unit will be heard in the other, and vice versa. Setup is simple, set to volume to a comfortable level, and adjust the mic preset while speaking with "normal volume" from one meter away. You do not need to be in close contact with the microphone, it will pick up a conversation from anywhere in a room. If the units are a long way away, there is a tendency for the cable to pick up hum, or radio interference. There are various defenses against this. One way is to use a twisted pair cable, each successive turn cancels the interference from the turn before. Another method is to use a small capacitor of say 100n between the common terminal of each relay and ground. This shunts high frequency signals to earth. Another method is to use a low value resistor of about 1k. This will shunt interference and hum, but will shunt the speech signal as well. However as the output impedance of each mic preamp is low, and the speech signals are also low, this will have little effect on speech but reduce interference to an acceptable level.

IC Pinout:

The LM380 pinout viewed from above is shown below on the left. In the schematic, the LM380 has been represented as a triangle, the pins are shown on the right hand diagram. Pins marked "NC" have no connection and are not used.



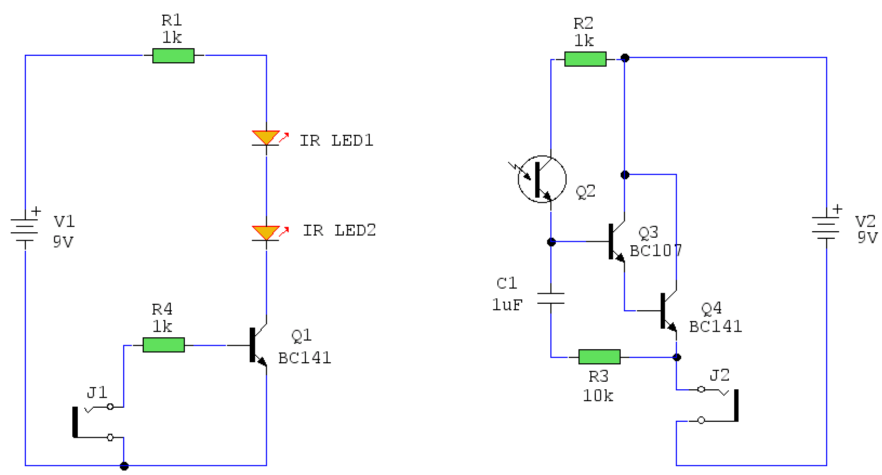


IR Link

Circuit :Milan Markovi?
Email : milan.markovic2@zg.hinet.hr
English Notes : Andy Collinson

Description:

A basic Imfra Red Link for audio communication for distances upto 3 metres.



Notes:

Ovo je shema jednostavne bez?i?ne komunikacije sa malo komponenata .Diode d1 i d2 su infracrvene le-diode ,a foto transistor je tako?er infracrveni radi ?to manjeg vanjskog utjecaja .Domet ure?aja je oko 3m no on se mo?e promijeniti brojem le-dioda i naponom koji se dovede na diode.Na izlaz se ?ak mogu i direktno spojiti slu?alice.Link mo?e poslu?iti i za prijenos drugih vrsta signala..Na popisu komponenata nema kriti?nih dijelova i izrada sklopa je jako jeftina. Uz malo pa?nje ne moe da ne radi.
P.S Transistors can be replaced with 2N3904 and 2N2222

Notes:

In his circuit Milan has created a basic Infra Red transmitter and receiver. The transmitter comprises a single amplifying stage driving two series connected IR LEDS. The input source is connected to J1. Please note that the device will pass a small DC current through it and also directly bias the transistor. A suitable device is therefore a high output crystal microphone. These can produce high output voltages up to 1 Volt but this will be reduced by the transistors low input impedance.

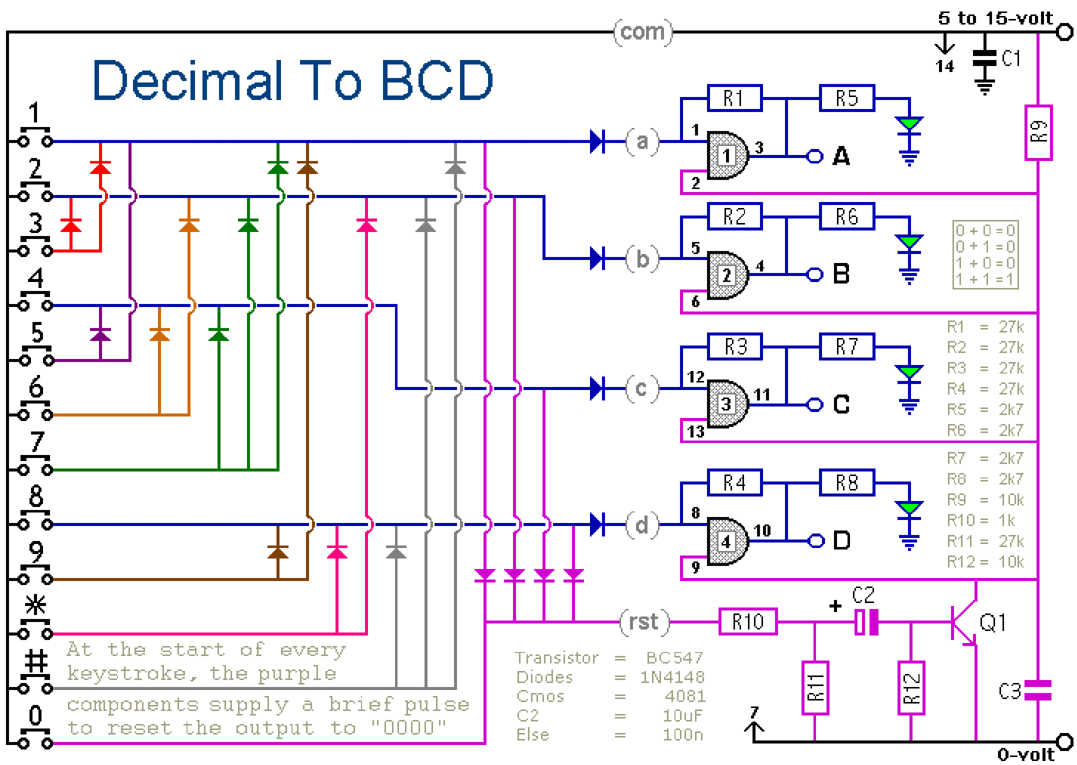
The receiver is three stages, the first stage being a phototransistor. Stages two and three form a high gain darlington emitter follower, the bias for the whole stage derived through R2 and the phototransistor itself. C1 and R3 form a filter to reduce interference from flourescent lighting and other hum sources. The output is via Jack J2. Note also that the output device will pass a small DC current so a medium impedance loudspeaker or headphones are a good choice here.

Notes:

When any particular key is pressed, its value will appear in BCD form at the outputs (A, B, C & D). It will remain there until another key is pressed. The 12 keys produce outputs up to "1011". Extended to 16 keys, the circuit will give the full HEX to BCD conversion.

Memory Module:

The above circuit produces an output ONLY while the input switch is depressed. To make a convertor with a latched output, the following modifications are made. Each CMOS 'AND' gate has its free input tied to Vcc, and by the action of R1 through R4 any 'hi input' will therefore cause the output to be latched.



When any particular key is pressed, its value will appear in BCD form at the outputs (A, B, C & D). It will remain there until another key is pressed. The 12 keys produce outputs up to "1011". Extended to 16 keys, the circuit will give the full HEX to BCD conversion.

The LEDs are a visual indication of the value. They are not necessary to the operation of the circuit. If you wish, you may leave them out; together with their associated resistors (R5, R6, R7 & R8).

The circuit works at voltages from 5 to 15 vdc. Please note that A, B, C & D are connected directly to the outputs of the Cmos IC. You will need to regulate the load your application places on these outputs.

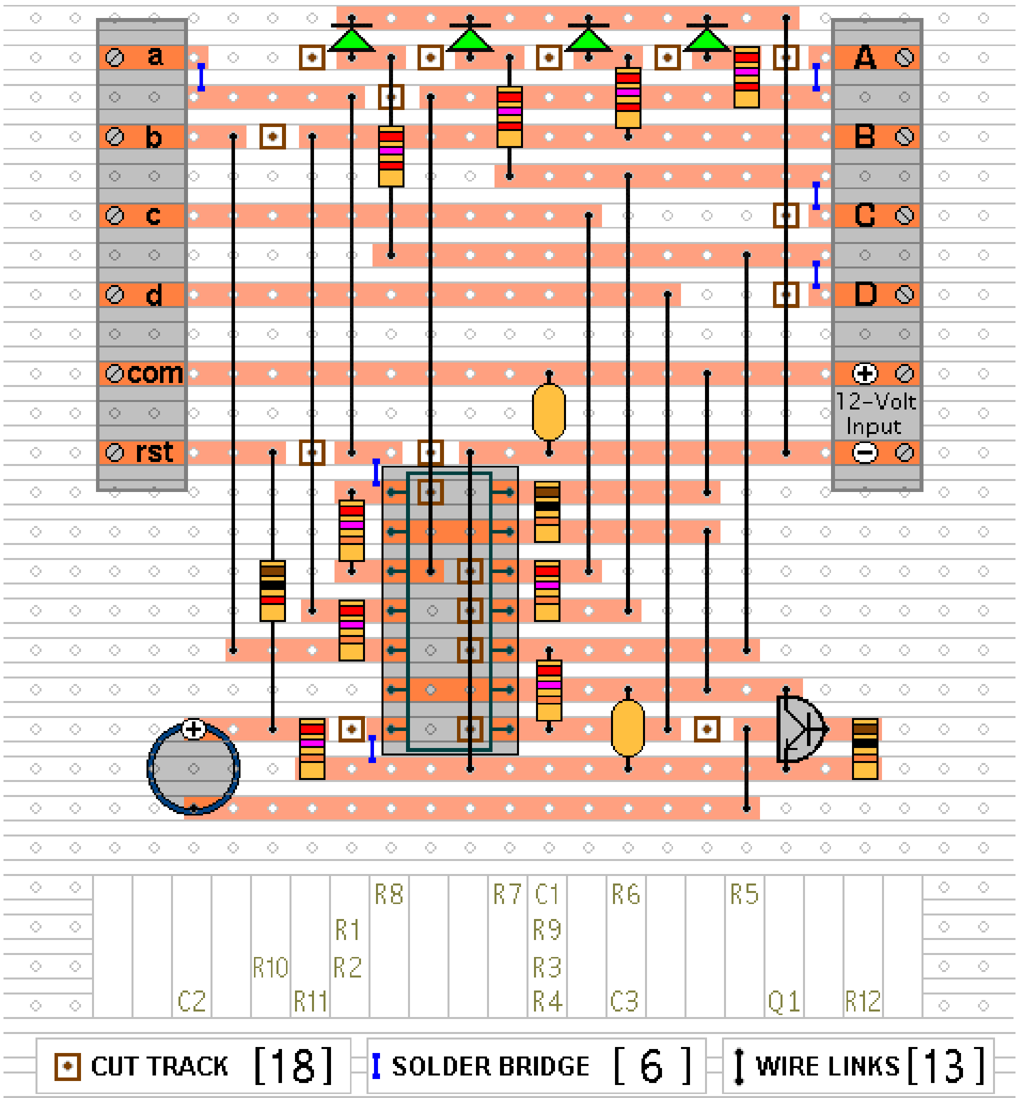
Construction:

Because the keypad may be used without the memory, the layouts are drawn separately. If you build them both on the same piece of stripboard, isolate them from one another. Cut all of the tracks except for the six that join the keypad terminals to the memory module. Always check carefully that the copper is cut all the way through. Sometimes a small strand of copper remains at the side of the cut and this will cause malfunction. If you don't have the proper track-cutting tool, then a 6 to 8mm drill-bit will do. Just use the drill-bit as a hand tool; there is no need for a drilling machine.

Board Layout:

BCD Memory Module

COMPONENT SIDE



For clarity, all the components are shown lying flat on the board. However, those connected between close or adjacent tracks are mounted standing upright. Using a socket reduces the chances of damaging the IC; and makes it easier to replace if necessary. The links are bare copper wire on the component side of the board. Two of them need to be fitted before the IC socket. You can make the links from telephone cable:- the single stranded variety used indoors to wire telephone sockets. Stretching the core slightly will straighten it; and also allow the insulation to slip off.