Project on spy ear

Business, Industries

CHAPTER 1 INTRODUCTION, CIRCIT DIAGRAM AND WORKING INTRODUCTION Spy ear is the devices which converts low power audio signal to high power signal and gain. It can be used in Theaters , Concert halls, Lecture rooms, Trains, Court houses, Conference rooms, Embassies, Gaming facilities, Recording studios, Aircraft , railways , bus station etc. With this sound amplifier, you can now hear things crystal clear that you could never hear before. Spy ear is very easy to use, just put the ear buds in your ears - aim the Spy Ear towards what you want to hear and things are heard crystal clear.

Spy Ear has adjustable volume control, which amplifies sound up to 50 decibels. Spy ear is also great for watching TV late at night, while your spouse sleeps you can keep the sound on the TV way down and still hear clearly. In spy ear circuit the most important part which is used to amplify the ckt is An IC named LM386N, which is a low sound amplifier, it amplifies the sound which is received by the condenser mic connected in the ckt. The LM386 is a power amplifier designed for use in low voltage consumer applications.

The gain is internally set to 20 to keep external part count low, but the addition of an external resistor and capacitor between pins 1 and 8 will increase the gain to any value from 20 to 200. The inputs are ground referenced while the output automatically biases to one-half the supply voltage. The quiescent power drain is only 24 mill watts when operating from a 6 volt supply, making the LM386 ideal for battery operation. Spy ear is widely using in the spy works. Many spy agencies, National Security

Agencies using both wired and wireless spy ears to hear the private conversation and to cought any illegal person doing any illegal work.

CIRCUIT DIAGRAM [pic] WORKING What binoculars do to improve your vision, this personal sound enhancer circuit does for listening. This lightweight gadget produces an adjustable gain on sounds picked up from the built-in high-sensitivity condenser microphone. So you can hear what you have been missing. With a 6V (4? 1. 5V) battery, it produces good results. a small signal amplifier is built around transistor BC547 (T1). Transistor T1 and the related. components amplify the sound signals picked up by the condenser microphone (MIC).

The amplified signal from the preamplifier stage is fed to input pin 3 of IC LM386N (IC1) through capacitor C2 (100nF) and volume control VR1 (10-kilo-ohm log). A decoupling network comprising resistor R5 and capacitor C3 provides the preamplifier block with a clean supply voltage. Audio amplifier IC LM386N (IC1) is designed for operation with power supplies in the 4-15V DC range. It is housed in a standard 8-pin DIL package, consumes very small quiescent current and is ideal for battery-powered portable applications. The processed output signal from capacitor C2 goes to one end of volume control VR1.

The wiper is taken to pin 3 of LM386N audio output amplifier. Note that the R6-C4 network is used to RF-decouple positive-supply pin 6 and R8-C7 is an optional Zobel network that ensures high frequency stability when feeding an inductive headphone load. Capacitor C6 (22? F, 16V) wired between pin 7 and ground gives additional ripple rejection. The output of LM386N power amplifier can safely drive a standard 32-ohm monophonic headphone/earphone. Assemble the circuit on a small general-purpose PCB and house in a suitable metallic enclosure with an integrated battery holder and headphone/ earphone socket as shown in .

Fit the on/off switch (S1), volume control (VR1) and power indicator (LED1) on the enclosure. Finally, fit the condenser microphone (MIC) on the front side of the enclosure and link it to the input of the preamplifier via a short length of the shielded wire. CHAPTER 2 COMPONENTS AND TOOLS USED COMPONENT USED COMPONENT NAMESPECIFICATION QUANTITY RESISTANCES R14. 7K? 1 R2330K? 1 R333? 1 R4680? 1 R5150? 1 R610? 1 R71K? 1 R810? , 0. 5W1 CAPACITANCES C110n(Non Polar)1 C2100n(Non Polar)1 C347µ(elec.) , 16V(Polar)1 C41000µ(elec.) , 16V(Polar)1 C54. 7µ(elec.) , 16V(Polar)1 C622µ(elec.) , 16V(Polar)1 C7100n(Non Polar)1

C8100µ(elec.) , 16V(Polar)1 C9100n(Non Polar)1 C10470µ(elec.) , 16V(Polar)1 VOLUME CONTROLLER VR110K? 1 TRANSISTOR T1BC5471 ICLM386N1 IC BASE8-PIN1 LED1 CONDENSER MIC1 EARPHONE32? 1 BATTERIES1. 5V4 BATTERIES HOLDER1 HOLDER CAP1 SWITCH1 PCBSINGLE SIDED1 TOOLS USED IN PCB DESIGNING COMPONENTQUANTITY SAW1 FeCl31 [pic] MULTIMETER1 [pic] HAND DRILLER1 [pic] SOLDERING IRON1 [pic] SOLDERING PASTE1 [pic] SOLDERING WIRE1 [pic] CHAPTER 3 PREPARATION AND PROCESS OF PCB DESIGNING Materials: ? Liquid solutions:- Ferric Chloride (Fecl3), Ferric chloride solution, about 1 liter/ 0, 26 gallons Lacquer thinner Safety solutions:- Safety goggles, Soft plastic brush, Clothes iron, Rubber gloves ? layout solutions:- Software for drawing layout. Like:- 1. P-Spice 2. ExpressPCB 3. PCB Wizard 3. 50 Pro 4. EDWinXP ? Good quality magazine pages (A4 Size) (Glossy paper), ? Laser printer ? Scrubbing pad ? Good ventilation ? Paper towel, ? Tin snips ? Drill or rotary tool ? PCB drill bits ? 5-gallon plastic pail full of water ? Single sided 1 ounce copper clad ? A plastic container the board will fit in PREPARATION Print the bottom side layer on a piece of paper from a high quality magazine or Glossy paper.

Use one actual page from the magazine or Glossy paper, the thicker and shinier the magazine paper the better, but do not use the cover. You must use a laser printer, not an inkjet. If your printer uses ink cartridges and not toner cartridges, it will not work. If you do not have a laser printer, you can work around this by printing to white paper and using a photocopier set to the darkest setting to copy the layout to the magazine paper. If the paper jams in the printer, you are not using a thick-enough magazine pages. Again, do not use the magazine covers, as they do not work.

Magazine pages are used because they work well, and they are cheap! The reason they work is because the paper is very glossy and the toner does not adhere well to the glossy pages. The printing used on the magazine page is ink and it does not come off, but toner does. Toner is actually a plastic polymer, and different toners may yield varied results. In our experience, a genuine HP toner cartridge was used with great success. The sole purpose of the toner is the protect the copper below it from etching away; you only want the uncovered areas to etch. Next, wash your hands to remove any oils.

Keep handling to a minimum once the pages are printed and do not touch the laser printing with your fingers; this could get oils on the printing. Keep pages as flat as possible. [pic][pic] Very carefully, remove the copper clad from the packaging. Do not touch the copper surface for the same reason as above. You can cut the copper clad to size using a tin snip if needed. Use the scrubbing pad to gently buff the surface. Do not use steel wool because it will embed steel into the copper. Clean off the residual dust with a slightly damp paper towel. [pic] Find a hard, very flat, sturdy, heat resistant surface.

Empty the water out of the clothes iron and set the iron on the hottest setting. Allow the iron to get hot. [pic] This is both side of a piece of copper clad. Place the blank side facing down and copper side facing up. Align printing/paper onto copper clad board with the printing facing the copper. Do not allow it to move. [pic] [pic] Firmly press the iron onto the back of the magazine paper, sandwiching it between the copper clad and the iron. Pressing hard without moving the iron, hold the iron perfectly still for one full minute. Do not move the iron at all during this minute, and push hard, really hard!

Then, for four more minutes, slowly move the iron around making sure to put a lot of pressure on the paper, but not allowing the paper to slide on the copper. When done, let the board fully cool before you move it at all. This will allow the toner to adhere to the copper and prevent you from being burned. Put the board in cold water and let soak for five minutes. After five minutes, try to peel the wet paper from the board leaving only the toner/print from your laser printer. Only the toner should be left adhering to the copper. If the paper does not come off easily, let it soak in the water for a while longer.

If necessary, rub with your finger to remove any paper, leaving only the toner. It’s ok if there are a few excess paper fibers stuck to the toner. [pic] [pic] [pic] If you find not every trace adhered to the copper clad or it is misaligned, use lacquer thinner and paper towel to clean the toner from the copper board and start over. If the traces look good then move on. Inspect the traces carefully, however, because what you see now will be your finished product. [pic] In a well-ventilated area with a fan, add hot water to a plastic container. Gently pour in 1-cup Fecl3, to create the etching solution.

Always wear goggles, gloves, and do not inhale the fumes. Do not use any metal containers, measuring cups, stainless steel sinks, or tools with this mixture as this mixture will aggressively etch metal. Acid safety, think " triple A", for Always Add the Acid, it's whatever is in the container that will end up splashing. This etching solution, while made with common chemicals, should commandrespect. It is dangerous to you and surroundings treat it with respect. Put the board copper side up in the plastic container filled with etching solution. Use a soft plastic brush to gently wipe the board.

You will notice the copper begin to dissolve. It takes about 3-4 minutes to get all the exposed copper dissolved. You just have to watch to make sure it is gone in all areas between the traces. Do not leave the board in the etching mix for too long as the traces will dissolve under the toner that is protecting them. [pic] [pic] Use lacquer thinner (paint thinner and acetone do not work well) and a paper towel to remove any toner left on top of the copper traces. Tinning prevents the copper from oxidizing, which can make it hard to solder to in the future.

If you choose, you can tin all the traces with solder and a soldering iron now. This actually makes drilling much easier because it helps to center the drill bit [pic] Print out the top side silkscreen layer on magazine paper and iron this onto the top side, using the same processes as above. Again, run under water and peel off the paper. Now you have the component ID's on the top side. For layout design we use software: 1. P-Spice 2. ExpressPCBSetup 3. PCB Wizard 3. 50 Pro 4. EDWinXP Drill all the holes for the through-hole parts using the correct size PCB drill bit and rotary tool.

Drill large mounting holes with a normal drill. PCB drill bits are carbide and made to drill through fiber glass that would quickly dull standard bits. There are a few very common sizes of bits and these are often sold in packs. We use . 0260? for IC holes and . 0310? for resistors and caps. [pic] CHAPTER 4 RESISTANCES [pic] INTRODUCTION A resistor is a two-terminal passive electronic component which implements electrical resistance as a circuit element. When a voltage V is applied across the terminals of a resistor, a current I will flow through the resistor in direct proportion to that voltage. The reciprocal of the onstant of proportionality is known as the resistance R, since, with a given voltage V, a larger value of R further " resists" the flow of current I as given by Ohm's law: [pic] UNITS The ohm (symbol: ?) is the SI unit of electrical resistance. An ohm is equivalent to a volt per ampere. Since resistors are specified and manufactured over a very large range of values, the derived units of Milliohm (1 m? = 10? 3 ?), Kilohm (1 k? = 103 ?), Megohm (1 M? = 106 ?) are also in common usage. Resistance is Determined partially by Composition, and is inversely proportional to Cross Sectional Area. [pic]

SERIES AND PARALLEL RESISTORS In a series configuration, the current through all of the resistors is the same, but the voltage across each resistor will be in proportion to its resistance. The potential difference (voltage) seen across the network is the sum of those voltages, thus the total resistance can be found as the sum of those resistances: [pic] [pic] As a special case, the resistance of N resistors connected in series, each of the same resistance R is given by NR. Resistors in a parallel configuration are each subject to the same potential difference (voltage), however the currents through them add.

The conductance of the resistors then adds to determine the conductance of the network. Thus the equivalent resistance (Req) of the network can be computed: [pic] [pic] The parallel equivalent resistance can be represented in equations by two vertical lines "||" (as in geometry) as a simplified notation. For the case of two resistors in parallel, this can be calculated using: [pic] As a special case, the resistance of N resistors connected in parallel, each of the same resistance R, is given by R/N.

A resistor network that is a combination of parallel and series connections can be broken up into smaller parts that are either one or the other. For instance, [pic] [pic] POWER DISSIPATION The power P dissipated by a resistor (or the equivalent resistance of a resistor network) is calculated as: [pic] The first form is a restatement of Joule's first law. Using Ohm's law, the two other forms can be derived. The total amount of heat energy released over a period of time can be determined from the integral of the power over that period of time: [pic] Practical resistors are rated according to their maximum power dissipation.

The vast majority of resistors used in electronic circuits absorbs much less than a watt of electrical power and require no attention to their power rating. Such resistors in their discrete form, including most of the packages detailed below, are typically rated as 1/10, 1/8, or 1/4 watt. Resistors required to dissipate substantial amounts of power, particularly used in power supplies, power conversion circuits, and power amplifiers, are generally referred to as power resistors; this designation is loosely applied to resistors with power ratings of 1 watt or greater.

Power resistors are physically larger and tend not to use the preferred values, color codes, and external packages described below. If the average power dissipated by a resistor is more than its power rating, damage to the resistor may occur, permanently altering its resistance; this is distinct from the reversible change in resistance due to its temperature coefficient when it warms. Excessive power dissipation may raise the temperature of the resistor to a point where it can burn the circuit board or adjacent components, or even cause a fire. There are flameproof resistors that fail (open circuit) before they overheat dangerously.

Note that the nominal power rating of a resistor is not the same as the power that it can safely dissipate in practical use. Air circulation and proximity to a circuit board, ambient temperature, and other factors can reduce acceptable dissipation significantly. Rated power dissipation may be given for an ambient temperature of 25 °C in free air. Inside an equipment case at 60 °C, rated dissipation will be significantly less; a resistor dissipating a bit less than the maximum figure given by the manufacturer may still be outside the safe operating area and may prematurely fail.

TYPES OF RESISTER Fixed resistors Variable resistors FIXED RESISTORS The diagram shows the construction of a carbon film resistor. During manufacture, a thin film of carbon is deposited onto a small ceramic rod. The resistive coating is spiraled away in an automatic machine until the resistance between the two ends of the rod is as close as possible to the correct value. Metal leads and end caps are added; the resistor is covered with an insulating coating and finally painted with colored bands to indicate the resistor value.

Carbon film resistors are cheap and easily available, with values within ±10% or ±5% of their marked or 'nominal' value. Metal film and metal oxide resistors are made in a similar way, but can be made more accurately to within ±2% or ±1% of their nominal value. There are some differences in performance between these resistor types, but none which affect their use in simple circuits. COLOUR CODING OF THE RESISTERS [pic] [pic] [pic] VARIABLE RESISTORS Variable resistors consist of a resistance track with connections at both ends and a wiper which moves along th track as you turn the spindle.

The track may be made from carbon, cermets (ceramic and metal mixture) or a coil of wire (for low resistances). The track is usually rotary but straight track versions, usually called sliders, are also available. TYPE OF VARIABLE RESISTORS Linear (LIN) and Logarithmic (LOG) tracks Rheostat Potentiometer Presets LINEAR (LIN) AND LOGARITHMIC (LOG) TRACKS Linear (LIN) track means that the resistance changes at a constant rate as you move the wiper. Logarithmic (LOG) track means that the resistance changes slowly at one end of the track and rapidly at the other end, so halfway along the track is not half the total resistance!

This arrangement is used for volume (loudness) controls because the human ear has a logarithmic response to loudness so fine control (slow change) is required at low volumes and coarser control (rapid change) at high volumes. It is important to connect the ends of the track the correct way round, if you find that turning the spindle increases the volume rapidly followed by little further change you should swap the connections to the ends of the track. RHEOSTAT This is the simplest way of using a variable resistor.

Two terminals are used: one connected to an end of the track, the other to the moveable wiper. Turning the spindle changes the resistance between the two terminals from zero up to the maximum resistance. [pic] If the rheostat is mounted on a printed circuit board you may find that all three terminals are connected! However, one of them will be linked to the wiper terminal. This improves the mechanical strength of the mounting but it serves no function electrically. POTENTIOMETER Variable resistors used as potentiometers have all three terminals connected.

These are miniature versions of the standard variable resistor. They are designed to be mounted directly onto the circuit board and adjusted only when the circuit is built. Presets are much cheaper than standard variable resistors so they are sometimes used in projects where a standard variable resistor would normally be used. [pic] PRESETS Multitier presets are used where very precise adjustments must be made. The screw must be turned many times (10+) to move the slider from one end of the track to the other, giving very fine control. [pic] |[pic] |[pic] | | Preset | Presets | Multitier preset | |(open style) |(closed style) | | | | | | | | | |

CHAPTER 5 CAPACITANCES [pic] INTRODUCTION | A capacitor is a passive electronic component that stores energy in the form of an electrostatic field. In its simplest form, a capacitor consists of two | | conducting plates separated by an insulating material called the dielectric. Capacitance is directly proportional to the surface areas of the plates, and is | | inversely proportional to the plates' separation. | | Capacitance also depends on the dielectric constant of the dielectric material separating the plates. | | | Capacitance calculated as XY x 10Z for the numbers XYZ and the letter indicates the tolerance J, K or M for ±5%, ±10% and ±20% respectively and unit is in pF. | | The standard units of Capacitance, | | farad: F | | microfarad: μF (1 μF = 10-6 F) | nanofarad: nF (1 nF = 10-9 F) | | microfarad: pF (1 pF = 10-12 F) | | | | | | | | FOR CAPACITORS IN PARALLEL | | Capacitors in a parallel configuration each have the same applied voltage. Their capacitances add up.

Charge is apportioned among them by size. Using the | | schematic diagram to visualize parallel plates, it is apparent that each capacitor contributes to the total surface area. | |[pic] | | | | FOR CAPACITORS IN SERIES | | Connected in series, the schematic diagram reveals that the separation distance, not the plate area, adds up.

The capacitors each store instantaneous charge | | build-up equal to that of every other capacitor in the series. The total voltage difference from end to end is apportioned to each capacitor according to the | | inverse of its capacitance. The entire series acts as a capacitor smaller than any of its components. | |[pic] | | Capacitors are combined in series to achieve a higher working voltage, for example for smoothing a high voltage power supply. The voltage ratings, which are | | based on plate separation, add up.

In such an application, several series connections may in turn be connected in parallel, forming a matrix. The goal is to | | maximize the energy storage utility of each capacitor without overloading it. | | Series connection is also used to adapt electrolytic capacitors for AC use. | | | | CAPACITOR MAY BE: | | Polarized | | Unpolrized | | POLARIZED CAPACITOR(VALUE MAX THAN 1 μF) |

pic] Circuit symbol: [pic] ELECTROLYTIC CAPACITORS Electrolytic capacitors are polarized and they must be connected the correct way round, at least one of their leads will be marked + or -. They are not damaged by heat when soldering. There are two designs of electrolytic capacitors; axial where the leads are attached to each end (220µF in picture) and radial where both leads are at the same end (10µF in picture). Radial capacitors tend to be a little smaller and they stand upright on the circuit board. It is easy to find the value of electrolytic capacitors because they are clearly printed with their capacitance and voltage rating.

The voltage rating can be quite low (6V for example) and it should always be checked when selecting an electrolytic capacitor. If the project parts list does not specify a voltage, choose a capacitor with a rating which is greater than the project's power supply voltage. 25V is a sensible minimum for most battery circuits. TANTALUM BEAD CAPACITORS Tantalum bead capacitors are polarized and have low voltage ratings like electrolytic capacitors. They are expensive but very small, so they are used where a large capacitance is needed in a small size. Modern tantalum bead capacitors are printed with their capacitance, voltage and polarity in full.

However older ones use a color-code system which has two stripes (for the two digits) and a spot of color for the number of zeros to give the value in µF. The standard colour code is used, but for the spot, grey is used to mean ? 0. 01 and white means ? 0. 1 so that values of less than 10µF can be shown. A third color stripe near the leads shows the voltage (yellow 6. 3V, black 10V, green 16V, blue 20V, grey 25V, white 30V, pink 35V). The positive (+) lead is to the right when the spot is facing you: 'when the spot is in sight, the positive is to the right'.

For example: blue, grey, black spot means 68μF for example: blue, grey, white spot means 6. 8μF For example: blue, grey, grey spot means 0. 68μF UNPOLARIZED CAPACITOR(MAX. VALUE UPTO 1 μF) [pic] Circuit symbol: [pic] Small value capacitors are Unpolrized and may be connected either way round. They are not damaged by heat when soldering, except for one unusual type (polystyrene). They have high voltage ratings of at least 50V, usually 250V or so. It can be difficult to find the values of these small capacitors because there are many types of them and several different labeling systems!

Many small value capacitors have their value printed but without a multiplier, so you need to use experience to work out what the multiplier should be! For example 0. 1 means 0. 1μF = 100nF. Sometimes the multiplier is used in place of the decimal point: For example: 4n7 means 4. 7nF. POLYSTYRENE CAPACITORS This type is rarely used now. Their value (in pF) is normally printed without units. Polystyrene capacitors can be damaged by heat when soldering (it melts the polystyrene!) so you should use a heat sink (such as a crocodile clip). Clip the heat sink to the lead between the capacitor and the joint. | | | | | | | VARIABLE CAPACITORS Variable capacitors are mostly used in radio tuning circuits and they are sometimes called 'tuning capacitors'. They have very small capacitance values, typically between 100pF and 500pF (100pF = 0. 0001μF). The type illustrated usually has trimmers built in (for making small adjustments - see below) as well as the main variable capacitor. Many variable capacitors have very short spindles which are not suitable for the standard knobs used for variable resistors and rotary switches. It would be wise to check that a suitable knob is available before ordering a variable capacitor.

Variable capacitors are not normally used in timing circuits because their capacitance is too small to be practical and the range of values available is very limited. Instead timing circuits use a fixed capacitor and a variable resistor if it is necessary to vary the time period. [pic][pic] Variable Capacitor Symbol Variable Capacitor | | | | | | | | TRIMMER CAPACITORS Trimmer capacitors (trimmers) are miniature variable capacitors.

They are designed to be mounted directly onto the circuit board and adjusted only when the circuit is built. A small screwdriver or similar tool is required to adjust trimmers. The process of adjusting them requires patience because the presence of your hand and the tool will slightly change the capacitance of the circuit in the region of the trimmer! Trimmer capacitors are only available with very small capacitances, normally less than 100pF. It is impossible to reduce their capacitance to zero, so they are usually specified by their minimum and maximum values, for example 2-10pF.

Trimmers are the capacitor equivalent of presets which are miniature variable resistors. [pic] [pic] Trimmer Capacitor Symbol Trimmer Capacitor CAPACITOR NUMBER CODE A number code is often used on small capacitors where printing is difficult: • the 1st number is the 1st digit, • the 2nd number is the 2nd digit, • The 3rd number is the number of zeros to give the capacitance in pF. • Ignore any letters - they just indicate tolerance and voltage rating.

For example: 102 means 1000pF = 1nF (not 102pF!) For example: 472J means 4700pF = 4. 7nF (J means 5% tolerance). | Color Code | | Color | Number | | Black | 0 | | Brown | 1 | | Red | 2 | | Orange | 3 | | Yellow | 4 | | Green | 5 | | Blue | 6 | | Violet | 7 | | Grey | 8 | | White | 9 | CAPACITOR COLOR CODE A color code was used on polyester capacitors for many years. It is now obsolete, but of course there are many still around.

The colors should be read like the resistor code, the top three color bands giving the value in pF. Ignore the 4th band (tolerance) and 5th band (voltage rating). For example: Brown, black, orange means 10000pF = 10nF = 0. 01µF. Note that there are no gaps between the colors bands, so 2 identical bands actually appear as a wide band. For example: Wide red, yellow means 220nF = 0. 22µF. CHAPTER 6 TRANSISTORS INTRODUCTION Transistors amplify current, A transistor may be used as a switch (either fully on with maximum current, or fully off with no current) and as an amplifier (always partly on).

The amount of current amplification is called the current gain, symbol hFE. [pic] [pic] Transistor circuit symbols Types of transistor | | | | There are two types of standard transistors, NPN and PNP, with different circuit symbols. The letters refer to the layers of semiconductor material used to make the transistor. Most transistors used today are NPN because this is the easiest type to make from silicon. If you are new to electronics it is best to start by learning how to use NPN transistors. The leads are labeled base (B), collector (C) and emitter (E). These terms efer to the internal operation of a transistor but they are not much help in understanding how a transistor is used, so just treat them as labels. CONNECTING Transistors have three leads which must be connected the correct way round. Please take care with this because a wrongly connected transistor may be damaged instantly when you switch on. If you are lucky the orientation of the transistor will be clear from the PCB or strip board layout diagram, otherwise you will need to refer to a supplier's catalogue to identify the leads. The drawings on the right show the leads for some of the most common case styles.

Please note that transistor lead diagrams show the view from below with the leads towards you. This is the opposite of IC (chip) pin diagrams which show the view from above. [pic] TRANSISTOR CODES There are three main series of transistor codes used in the UK: ? Codes beginning with B (or A), for example BC108, BC478 the first letter B is for silicon, A is for germanium (rarely used now). The second letter indicates the type; for example C means low power audio frequency; D means high power audio frequency; F means low power high frequency. The rest of the code identifies the particular transistor.

There is no obvious logic to the numbering system. Sometimes a letter is added to the end (e. g. BC108C) to identify a special version of the main type, for example a higher current gain or a different case style. If a project specifies a higher gain version (BC108C) it must be used, but if the general code is given (BC108) any transistor with that code is suitable. ? Codes beginning with TIP, for example TIP31A TIP refers to the manufacturer: Texas Instruments Power transistor. The letter at the end identifies versions with different voltage ratings. ? Codes beginning with 2N, for example 2N3053

The initial '2N' identifies the part as a transistor and the rest of the code identifies the particular transistor. There is no obvious logic to the numbering system. CHOOSING A TRANSISTOR Most projects will specify a particular transistor, but if necessary you can usually substitute an equivalent transistor from the wide range available. The most important properties to look for are the maximum collector current IC and the current gain hFE. To make selection easier most suppliers group their transistors in categories determined either by their typical use or maximum power rating. NPN transistors | | Code | | PNP transistors | | Code | Structure | | Case style | There is a diagram showing the leads for some of the most common case styles in the Connecting section above.

This information | | | is also available in suppliers' catalogues. | | IC max. | Maximum collector current. | | VCE max. | Maximum voltage across the collector-emitter junction. | | | You can ignore this rating in low voltage circuits. | | hFE | This is the current gain (strictly the DC current gain). The guaranteed minimum value is given because the actual value varies | | | from transistor to transistor - even for those of the same type! Note that current gain is just a number so it has no units. | | The gain is often quoted at a particular collector current IC which is usually in the middle of the transistor's range, for | | | example '' means the gain is at least 100 at 20mA. Sometimes minimum and maximum values are given. Since the gain is | | | roughly constant for various currents but it varies from transistor to transistor this detail is only really of interest to | | | experts. | | | | | | Why hFE? | | It is one of a whole series of parameters for transistors, each with their own symbol. There are too many to explain here. | | Ptot max. | Maximum total power which can be developed in the transistor, note that a heat sink will be required to achieve the maximum | | | rating. This rating is important for transistors operating as amplifiers; the power is roughly IC ? VCE. For transistors | | | operating as switches the maximum collector current (IC max. is more important. | | Category | This shows the typical use for the transistor, it is a good starting point when looking for a substitute. Catalogues may have | | | separate tables for different categories. | | Possible substitutes | These are transistors with similar electrical properties which will be suitable substitutes in most circuits. However, they may | | | have a different case style so you will need to take care when placing them on the circuit board. | THE NPN TRANSISTOR

In the previous tutorial we saw that the standard Bipolar Transistor or BJT comes in two basic forms. An NPN (Negative-Positive-Negative) type and a PNP (Positive-Negative-Positive) type, with the most commonly used transistor type being the NPN Transistor. We also learnt that the transistor junctions can be biased in one of three different ways - Common Base, Common Emitter and Common Collector. In this tutorial we will look more closely at the " Common Emitter" configuration using NPN Transistors with an example of the construction of a NPN transistor along with the transistors current flow characteristics is given below. pic] THE COMMON EMITTER CONFIGURATION As well as being used as a semiconductor switch to turn load currents " ON" or " OFF" by controlling the Base signal to the transistor in ether its saturation or cut-off regions, NPN Transistors can also be used in its active region to produce a circuit which will amplify any small AC signal applied to its Base terminal with the Emitter grounded. If a suitable DC " biasing" voltage is firstly applied to the transistors Base terminal thus allowing it to always operate within its linear active region, an inverting amplifier circuit called a single stage common emitter amplifier is produced.

One such Common Emitter Amplifier configuration of an NPN transistor is called a Class A Amplifier. A " Class an Amplifier" operation is one where the transistors Base terminal is biased in such a way as to forward bias the Base-emitter junction. The result is that the transistor is always operating halfway between its cut-off and saturation regions, thereby allowing the transistor amplifier to accurately reproduce the positive and negative halves of any AC input signal superimposed upon this DC biasing voltage. Without this " Bias Voltage" only one half of the input waveform would be amplified.

This common emitter amplifier configuration using an NPN transistor has many applications but is commonly used in audio circuits such as pre-amplifier and power amplifier stages. With reference to the common emitter configuration shown below, afamilyof curves known as the Output Characteristics Curves relates the output collector current, (Ic) to the collector voltage, (Vce) when different values of Base current, (Ib) are applied to the transistor for transistors with the same ? value. A DC " Load Line" can also be drawn onto the output characteristics curves to show all the possible operating points when ifferent values of base current are applied. It is necessary to set the initial value of Vce correctly to allow the output voltage to vary both up and down when amplifying AC input signals and this is called setting the operating point or Quiescent Point, Q-point for short and this is shown below. SINGLE STAGE COMMON EMITTER AMPLIFIER CIRCUIT |[pic] | CHAPTER 7 CONDENSER MIC [pic] INTRODUCTION

Microphones are a type of transducer - a device which converts energy from one form to another.

Microphones convert acoustical energy (sound waves) into electrical energy (the audio signal). Different types of microphone have different ways of converting energy but they all share one thing in common: The diaphragm. This is a thin piece of material (such as paper, plastic or aluminum) which vibrates when it is struck by sound waves. In a typical hand-held mic like the one below, the diaphragm is located in the head of the microphone. LOCATION OF MICROPHONE DIAPHRAGM [pic] When the diaphragm vibrates, it causes other components in the microphone to vibrate.

These vibrations are converted into an electrical current which becomes the audio signal. Note: At the other end of the audio chain, the loudspeaker is also a transducer - it converts the electrical energy back into acoustical energy. TYPES OF MICROPHONE There are a number of different types of microphone in common use. The differences can be divided into two areas: (a) THE TYPE OF CONVERSIONTECHNOLOGYTHEY USE this refers to the technical method the mic uses to convert sound into electricity. The most common technologies are dynamic, condenser, ribbon and crystal.

Each has advantages and disadvantages, and each is generally more suited to certain types of application. The following pages will provide details. (b) THE TYPE OF APPLICATION THEY ARE DESIGNED FOR some mics are designed for general use and can be used effectively in many different situations. Others are very specialized and are only really useful for their intended purpose. Characteristics to look for include directional properties, frequency response and impedance (more on these later). MIC LEVEL & LINE LEVEL The electrical current generated by a microphone is very small.

Referred to as mic level, this signal is typically measured in mill volts. Before it can be used for anything serious the signal needs to be amplified, usually to line level (typically 0. 5 -2V). Being a stronger and more robust signal, line level is the standard signal strength used by audio processing equipment and common domestic equipment such as CD players, tape machines, VCRs, etc. This amplification is achieved in one or more of the following ways: • Some microphones have tiny built-in amplifiers which boost the signal to a high mic level or line level. The mic can be fed through a small boosting amplifier, often called a line amp. • Sound mixers have small amplifiers in each channel. Attenuators can accommodate mics of varying levels and adjust them all to an even line level. • The audio signal is fed to a power amplifier - a specialized amp which boosts the signal enough to be fed to loudspeakers. Audio signal is fed to a power amplifier - a specialized amp which boosts the signal enough to be fed to loudspeakers. CONDENSER MICROPHONES Condenser means capacitor, an electronic component which stores energy in the form of an electrostatic field.

The term condenser is actually obsolete but has stuck as the name for this type of microphone, which uses a capacitor to convert acoustical energy into electrical energy. Condenser microphones require power from a battery or external source. The resulting audio signal is stronger signal than that from a dynamic. Condensers also tend to be more sensitive and responsive than dynamics, making them well-suited to capturing subtle nuances in a sound. They are not ideal for high-volume work, as their sensitivity makes them prone to distort. HOW CONDENSER MICROPHONES WORK A capacitor has two plates with a voltage between them.

In the condenser mic, one of these plates is made of very light material and acts as the diaphragm. The diaphragm vibrates when struck by sound waves, changing the distance between the two plates and therefore changing the capacitance. Specifically, when the plates are closer together, capacitance increases and a charge current occurs. When the plates are further apart, capacitance decreases and a discharge current occurs. A voltage is required across the capacitor for this to work. This voltage is supplied either by a battery in the mic or by external phantom power.

Phantom power is a means of distributing a DC current through audio cables to provide power for microphones and other equipment. The supplied voltage is usually between 12 and 48 Volts, with 48V being the most common. Individual microphones draw as much current from this voltage as they need. [pic] THE ELECTRET CONDENSER MICROPHONE The Electret condenser mic uses a special type of capacitor which has a permanent voltage built in during manufacture. This is somewhat like a permanent magnet, in that it doesn't require any external power for operation.

However good Electret condensers mics usually include a pre-amplifier which does still require power. Other than this difference, you can think of an Electret condenser microphone as being the same as a normal condenser. Technical Notes: • Condenser microphones have a flatter frequency response than dynamics. A condenser mic works in much the same way as an electrostatic tweeter (although obviously in reverse) DIRECTIONAL

PROPERTIES Every microphone has a property known as directionality. This describes the microphone's sensitivity to sound from various directions.

Some microphones pick up sound equally from all directions; others pick up sound only from one direction or a particular combination of directions. The types of directionality are divided into three main categories: 1. OMNI DIRECTIONAL Picks up sound evenly from all directions (Omni means " all" or " every"). 2. UNIDIRECTIONAL Picks up sound predominantly from one direction. 3. BIDIRECTIONAL picks up sound from two opposite directions. CHAPTER 8 IC LM386N [pic] INTRODUCTION The LM386 is a power amplifier designed for use in low voltage consumer applications.

The gain is internally set to 20 to keep external part count low, but the addition of an external resistor and capacitor between pins 1 and 8 will increase the gain to any value from 20 to 200. The inputs are ground referenced while the output automatically biases to one-half the supply voltage. The quiescent power drain is only 24 mill watts when operating from a 6 volt supply, making the LM386 ideal for battery operation. FEATURES Battery operation Minimum external parts Wide supply voltage range: 4V–12V or 5V–18V Low quiescent current drain: 4mA Voltage gains from 20 to 200

Ground referenced input Self-centering output quiescent voltage Low distortion: 0. 2% (AV = 20, VS = 6V, RL = 8W, PO = 125mW, f = 1 kHz) Available in 8 pin MSOP package APPLICATION HINTS GAIN CONTROL To make the LM386 a more versatile amplifier, two pins (1 and 8) are provided for gain control. With pins 1 and 8 open the 1. 35 k? resistor sets the gain at 20 (26 dB). If a capacitor is put from pin 1 to 8, bypassing the 1. 35 k?

resistor, the gain will go up to 200 (46 dB). If a resistor is placed in series with the capacitor, the gain can be set to any value from 20 to 200.

Gain control can also be done by capacitive coupling a resistor (or FET) from pin 1 to ground. Additional external components can be placed in parallel with the internal feedback resistors to tailor the gain and frequency response for individual applications. For example, we can compensate poor speaker bass response by frequency shaping the feedback path. This is done with a series RC from pin 1 to 5 (paralleling the internal 15 k? resistor). For 6 dB effective bass boost: R. 15 k? , the lowest value for good stable operation is R = 10 k? if pin 8 is open. If pins 1 and 8 are bypassed then R as low as 2 k? an be used. This restriction is because the amplifier is only compensated for closed-loop gains greater than 9. INPUT BIASING The schematic shows that both inputs are biased to ground with a 50 kW resistor. The base current of the input transistors is about 250 nA, so the inputs are at about 12. 5 mV when left open. If the dc source resistance driving the LM386 is higher than 250 kW it will contribute very little additional offset (about 2. 5 mV at the input, 50 mV at the output). If the dc source resistance is less than 10 kW, then shorting the unused input to ground will keep the offset low (about 2. mV At the input, 50 mV at the output). For dc source resistances between these values we can eliminate excess offset by putting a resistor from the unused input to ground, equal in value to the dc source resistance. Of course all offset problems are eliminated if the input is capacitive coupled. When using the LM386 with higher gains (bypassing the 1. 35 kW resistors between pins 1 and 8) it is necessary to bypass the unused input, preventing degradation of gain and possible instabilities. This is done with a 0. 1 ? F capacitor or a short to ground depending on the dc source resistance on the driven input.

CHAPTER 9 EARPHONE [pic] INTRODUCTION Headphones are a pair of small loudspeakers, or less commonly a single speaker, held close to a user's ears and connected to a signal source such as an audio amplifier, radio, CD player or portable media player. They are also known as stereophones, headsets or, colloquially cans. The in-ear versions are known as earphones or earbuds. In the context of telecommunication, the term headset is used to describe a combination of headphone and microphone used for two-waycommunication, for example with a telephone.

The telephone earpiece such as the one pictured at the right was common at the beginning of the 20th century. Headphones originated from the earpiece, and were the only way to listen to audio signals before amplifiers were developed. The first truly successful set was developed by Nathaniel Baldwin, who made them by hand in his kitchen and sold them to the U. S. Navy. Very sensitive headphones such as those manufactured by Brandes around 1919 were commonly used for early radio work. These early headphones used moving iron drivers, either single ended or balanced armature.

The requirement for high sensitivity meant no damping was used, thus the sound quality was crude. They also had very poor comfort compared to modern types, usually having no padding and too often having excessive clamping force to the head. Their impedance varied; headphones used in telegraph and telephone work had an impedance of 75 ohms. Those used with early wireless radio had to be more sensitive and were made with more turns of finer wire; impedance of 1, 000 to 2, 000 ohms was common, which suited both crystal sets and triode receivers.

In early powered radios, the headphone was part of the vacuum tube's plate circuit and had dangerous voltages on it. It was normally connected directly to the positive high voltage battery terminal, and the other battery terminal was securely earthed. The use of bare electrical connections meant that users could be shocked if they touched the bare headphone connections while adjusting an uncomfortable headset. APPLICATIONS Headphones may be used both with fixed equipment such as CD or DVD players, home theater, personal computers and with portable devices (e. g. igital audio player/mp3 player, mobile phone, etc.). Cordless headphones are not connected via a wire, receiving a radio or infrared signal encoded using a radio or infrared transmission link, like FM, Bluetooth or Wi-Fi. These are actually made of powered receiver systems of which the headphone is only a component, these types of cordless headphones are being used more frequently with events such as a Silent disco or Silent Gig. In the professional audio sector headphones are used in live situations by disc jockeys with a DJ mixer and sound engineers for monitoring signal sources.

In radio studios, DJs use a pair of headphones when talking to the microphone while the speakers are turned off, to eliminate acoustic feedback and monitor their own voice. In studio recordings, musicians and singers use headphones to play along to a backing track. In the military, audio signals of many varieties are monitored using headphones. Wired headphones are attached to an audio source. The most common connection standards are 6. 35mm (??) and 3. 5mm TRS connectors and sockets. The larger 6. 35mm connector tending to be found on fixed location home or professional equipment.

Sony introduced the smaller, and now widely used, 3. 5mm " minijack" stereo connector in 1979, adapting the older monophonic 3. 5mm connector for use with its Walkman portable stereo tape player and the 3. 5mm connector remains the common connector for portable application today. Adapters are available for converting between 6. 35mm and 3. 5mm devices. BENEFITS AND LIMITATIONS [pic] Headphones may be used to prevent other people from hearing the sound either for privacy or to prevent disturbance, as in listening in a public library.

They can also provide a level of sound fidelity greater than loudspeakers of similar cost. Part of their ability to do so comes from the lack of any need to perform room correction treatments with headphones. High quality headphones can have an extremely flat low-frequency response down to 20 Hz within 3dB. However, rated frequency response distortion figures do not provide information on what character the sound reproduced at that frequency will be. Marketed claims such as 'frequency response 4 Hz to 20 kHz' are usually overstatements; the product's response at frequencies lower than 20 Hz is typically very small.

Headphones are also useful for video games that use 3D positional audio processing algorithms, as they allow players to better judge the position of an off-screen sound source (such as the footsteps of an opponent). Although modern headphones have been particularly widely sold and used for listening to stereo recordings since the release of the Walkman, there is subjective debate regarding the nature of their reproduction of stereo sound.

Stereo recordings represent the position of horizontal depth cues (stereo separation) via volume differences of the sound in question between the two channels.

When the sounds from two speakers mix, they create the phase difference the brain uses to locate direction. Through most headphones, because the right and left channels do not combine in this manner, the illusion of the phantom center can be perceived as lost. Hard panned sounds will also only be heard only in one ear rather than from one side. This latter point is of particular importance for earlier stereo recordings which were less sophisticated, sometimes playing vocals through one channel andmusicthrough the other.

Binaural recordings use a different microphone technique to encode direction directly as phase, with very little amplitude difference (except above 2 kHz) often using a dummy head, and can produce a surprisingly life-like spatial impression through headphones. Commercial recordings almost always use stereo recording, because historically loudspeaker listening has been more popular than headphone listening. It is possible to change the spatial effects of stereo sound on headphones to better approximate the presentation of speaker reproduction by using frequency-dependent cross-feed between the channels, or—better still—a

Blumlein shuffler (a custom EQ employed to augment the low-frequency content of the difference information in a stereo signal). While cross-feed can reduce the unpleasantness that some listeners find with hard panned stereo in headphones, the use of a dummy head during recording, with artificial pinnae, can allow on playback through headphones, the experience of hearing the performance as though situated in the position of the dummy head. Optimal sound is achieved when the dummy head matches the listener's head, since pinnae vary greatly in size and shape.

Headsets can have ergonomic benefits over traditional telephone handsets. They allow call center agents to maintain better posture instead of tilting their head sideways to cradle a handset. Over time, headphone cables fail. The common scenario in which a replacement might need to be purchased is the physical breakdown of copper wiring at junction points on the cord (at the TRS jack, or at the point of connection to the headphone). These are the sites of greatest and most stressful motion on a cord and so they are typically fitted with some kind of strain relief.

CHAPTER 10 APPLICATIONS, FUTURE SCOPE AND CONCLUSION APPLICATIONS IN SPY AGENCIES [pic] 1. To hear private conversations of anyone. 2. To caught anyone doing any illegal work. SOUND AMPLIFIER 1. To amplify the low power audio signals. 2. In hearing aids. SOME OTHER APPLICATIONS As a spy can be use in 1. Concert halls 2. Court houses 3. Conference rooms 4. Embassies 5. Government facilities 6. Recording studios. 7. In army. 8. Secret agencies. FUTURE SCOPE [pic]

Spy ears are widely using in the spy agencies due to its amplifying capability of the low power audio signals into the high power audible audio signals due to this property of spy ears we can use it to hear the private conversations of anyone, In the present time spy ears are very popular to hear the private conversations and it can also be used as a hearing aid for the persons who do not have the ability to hear the voice correctly. Spy ears amplifies the sound so it amplify the sounds of low signal for the person and he can clearly hear the voice of the other person and other things.

If we consider the future prospectus than we can imagine that spy ears will become very popular in the future due to its hiding capability because we all know that at what rate corruption and illegal things are increasing so due to help of this equipment we can hear the conversation of any suspicious person and stop him. Spy ear can easily hide so they are very difficult to find and the other person can not see it and we can easily hear the conversation of the peritcular person and he van not imagine than someone hearing his conversation and his secret is now opened.

TYPES OF SPY EAR In the present condition spy ear are of two types: 1. Wired. 2. Wireless. 1. WIRED [pic] ? Wired spy ear for the short distance use only. ? We can only hear the sound of the person who is near the spy ear. ? Due to its short distance use they are now uses very less in compare to wireless spy ears. ? Wired spy ear can be used to hear the voice of the person at bus stop, school, colleges and many other places without getting his/her attention towards us. ? Wired spy ear can also be used as a hearing aid because of its audio amplifying capability.

But if we see in present condition the use of wired spy ears is very less because wireless spy ears can cover a wide range than the wired spy ears, many spy agencies and private security forces use wireless spy ear for the long distance communication. 2. WIRELESS [pic] ? Wire less spy ears are widely using for the long distance conversation due to its capability of receiving and sending signals from the long distance. ? Wire less spy ears are widely using in spy agencies and private security agencies to connect an long distance communication. ? Wire less spy ear consist of a receiving and a transmitting device. Both device are fabricated on the separate board so they have the property of long distance connectivity and the voice quality is also good. ? Wire less spy ears are also using with the mobile equipments. Transmitting device contain a sim and from our we call on it and after the connectivity we can hear and transmit our voice without getting the attention of the other person. CONCLUSION By the above all discussion at last we can say that the spy ear is very helpful at many levels such as PRIVATE LEVEL • We can hear the conversation of our neighbours without getting their attention. We can hear the conversation of people at bus stop, school, colleges without looking towards them • We can use it as h sound amplifier for low voice signals etc. COUNTRY LEVEL • We can use spy ear to hear the conversation of any suspected person and can know that what is going on. • We can use it against any corrupted person and send him in the jail. At last we can say that the spy ears are very helpful for private as well as national security purpose and in future they will become more popular due to there ability of hiding and catching low frequency voice signal. ----------------------- IASSCOM FORTUNE INSTITUTE OF TECHNOLOGY 1