



P-3395



**AN ADAPTIVE HANDSFREE TECHNIQUE FOR MOBILE
COMMUNICATION**

by

N.KARTHIKEYAN

Reg No: 0710107044

T.KIRTHIKUMAR

Reg No:0710107047

R.T.KIRUBANANTHAN

Reg No:0710107048

V.S.NALLAKUMAR

Reg No:0710107059

of

**KUMARAGURU COLLEGE OF TECHNOLOGY,
COIMBATORE - 641 049.**

(An Autonomous Institution affiliated to Anna University of Technology, Coimbatore)

A PROJECT REPORT

Submitted to the

**FACULTY OF ELECTRONICS AND COMMUNICATION
ENGINEERING**

In partial fulfillment of the requirements

for the award of the degree

of

BACHELOR OF ENGINEERING

in

ELECTRONICS AND COMMUNICATION ENGINEERING

APRIL 2011

BONAFIDE CERTIFICATE

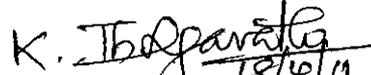
This is to be certified that this project report "AN ADAPTIVE HANDSFREE TECHNIQUE FOR MOBILE COMMUNICATION" is the bonafide work of "KARTHIKEYAN.N (0710107044), KIRTIKUMAR.T (0710107047), KIRUBANANTHAN.R.T (0710107048), NALLAKUMAR.V.S (0710107059)" who carried out the project work under my supervision.


SIGNATURE


Dr.(Mrs).Rajeswari Mariappan

Head of the Department

Department of Electronics and
Communication Engineering,
Kumaraguru College of Technology
Coimbatore.

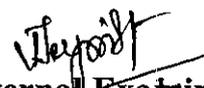

SIGNATURE

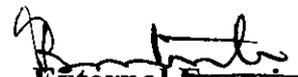
Mrs. K.Thilagavathi

Project Guide

Department of Electronics and
Communication Engineering,
Kumaraguru College of
Technology
Coimbatore.

The candidates with University Register Numbers 0710107044, 0710107047, 0710107048, 0710107059 are examined by us in the Project Viva Voce Examination held on 19-4-11


Internal Examiner
19/4/11


External Examiner
19/4/11

ABSTRACT

Mobile phone use while driving is common but controversial. Being distracted while operating a vehicle has been shown to increase the risk of accidents. The main aim of the project is to avoid the accidents, during driving.

The mobile phones are made available with a special mode called vehicle mode. Once the vehicle gets ignited the RF transceiver in the vehicle transmits the signal to the RF transceiver in the mobile phone. Once the mobile receives the signal, it automatically changes to the vehicle mode. The design of vehicle mode makes only the emergency calls to connect the users. The vehicle slowly decreases its speed and stops, if the call gets connected.

The mode of communication used in the project is serial communication. The signal is sent serially from the microcontroller to the GSM modem. The level converters are used for voltage conversion process between the microcontrollers and the GSM modem. MAX 232 is the level converter used here.

KEIL IDE and MPLAB IDE are the compilers used for two different microcontrollers. The language used for the practical implementation of the project is embedded C.

ACKNOWLEDGEMENT

We are extremely grateful to **Dr.J.Shanmugam, Ph.D., Director,** Kumaraguru College of Technology for having given us a golden opportunity to embark on this project.

We are extremely grateful to **Dr.Ramachandran, M.Tech., Principal,** Kumaraguru College of Technology for having given us a golden opportunity to embark on this project.

We are deeply obliged to **Dr.Rajeshwari Mariappan, M.E., Ph.D., B.Tech.Ed., F.I.E, MISTE, Head of the Department** of Electronics& Communication for her concern and implication during the project course.

We extend our heartfelt thanks to our project coordinator **Associate.Prof.V.Jeyasri Arokiamary,M.E.,** and our respectable Guide **Mrs.K.Thilagavathi, M.E.,** Department of Electronics and Communication for their helpful guidance and valuable support given to us throughout this project.

Our thanks to all **Teaching and non-teaching staffs** of our department for providing us the technical support for our project.

We also thank **our college Management, friends and family** who helped us to complete this project with flying colours.

CONTENT

CHAPTER	TITLE	PAGENO
	ABSTRACT	iii
	LIST OF TABLES	ix
	LIST OF FIGURES	x
	LIST OF ABBREVIATIONS	xii
1.	INTRODUCTION	01
	1.1 Embedded systems	
	1.2 Microcontroller	
	1.3 Encoder and decoder	02
	1.4 Serial communication	
2.	PROJECT OVERVIEW	03
	2.1 Block diagram	
	2.2 Block diagram description	04
	2.3 Existing system	05
	2.4 Proposed system	
	2.5 Circuit diagram	06
	2.6 Flowchart	08
3.	POWER SUPPLY	10
	3.1 Introduction	
	3.2 Circuit Diagram	11
	3.2.1 Working Principle	
	3.2.2 Transformer	12

	3.2.3 Bridge Rectifier	
	3.2.4 IC Voltage Regulators	14
4.	MICROCONTROLLER	15
	4.1 AT89S51 microcontroller	
	4.1.1 Introduction	
	4.1.2 Features	
	4.1.3 Pin Diagram	16
	4.1.4 Internal architecture	17
	4.1.5 Memory organization	18
	4.1.5.a Program memory	
	4.1.5.b Data memory	
	4.1.6 UART	19
	4.1.7 Interrupt	
	4.1.8 Oscillator characteristics	
	4.2 PIC18F452 microcontroller	20
	4.2.1 Introduction	
	4.2.2 Memory organization	22
	4.2.3 UART	23
	4.2.4 Internal architecture	24
	4.2.5 Interrupts	25
	4.2.6 Pin Diagram	

	4.2.7 Overall features and pin functions	27
5.	SERIAL COMMUNICATION	29
	5.1 Introduction	
	5.2 Null MODEM	31
	5.3 RS232	32
	5.4 Null MODEM without Handshaking	33
	5.5 Compatibility issues	34
6.	SOFTWARE TOOLS	35
	6.1 Software Requirements	
	6.2 MPLAB IDE	
	6.3 PIC KIT 2 Programmer	37
	6.4 ORCAD	
	6.4.1 Design flow of ORCAD	38
	6.5 KEIL IDE	39
7.	OTHER HARDWARE TOOLS	40
	7.1 GSM MODEM	
	7.1.1 Definition	
	7.1.2 The GSM Network	
	7.1.3 GSM MODEM	41
	7.1.4 GSM MODEM Applications	42

7.1.5	Facts and applications of GSM/GPRS	43
7.1.6	Applications	45
7.1.7	Application suitable for GSM communication	46
7.2	RS 232	47
7.3	MAX 232	48
7.4	RF Modules	52
7.4.1	RF Transmitter	
7.4.2	RF Receiver	53
7.5	HT 12E Encoder	54
7.5.1	Features	
7.6	HT 12D Decoder	55
7.6.1	Features	
8.	CONCLUSION	56
9.	APPENDIX	A-1
10.	REFERENCES	R-1

LIST OF TABLES

S.NO	TITLE	PAGE NO.
1.	NULL MODEM CONNECTOR FUNCTIONS	33
2.	FUNCTION TABLE FOR LEVEL CONVERSION	51

LIST OF FIGURES

S.NO	TITLE	PAGE NO.
	BLOCK DIAGRAM	
2.1	DASH BOARD SECTION	3
2.2	MOBILE SECTION	4
	CIRCUIT DIAGRAM	
2.3	VEHICLE SECTION	6
2.4	MOBILE SECTION	7
	FLOWCHART	
2.5	MOBILE SECTION	8
2.6	VEHICLE SECTION	9
3.1	POWER SUPPLY	11
3.2	CIRCUIT OF POWER SUPPLY	
4.1	PIN DIAGRAM OF AT89S51	16
4.2	INTERNAL ARCHITECTURE OF AT89S51	17
4.3	INTERNAL ARCHITECTURE OF PIC	24
4.4	PIN DIAGRAM OF PIC	25

5.1	NULL MODEM WITHOUT HANDSHAKING	33
6.1	DESIGN FLOW OF ORCAD	37
6.2	FLOWCHART -ORCAD FLOW	38
7.1	GSM NETWORK ELEMENTS	41
7.2	GSM MODEM APPLICATIONS	43
7.3	PIN DIAGRAM OF MAX 232	48
7.4	CIRCUIT DIAGRAM OF SERIAL COMMUNICATION	49
7.5	LOGIC DIAGRAM OF MAX 232	51
7.6	RF TRANSMITTER	52
7.7	RF RECEIVER	53
7.8	HT 12E ENCODER PIN DIAGRAM	54
7.9	HT 12 D DECODER PIN DIAGRAM	55

LIST OF ABBREVIATIONS

RFID	RADIO FREQUENCY IDENTIFICATION
PIC	PERIPHERAL INTERFACE CONTROLLER
RS 232	RECOMMENDED STANDARD 232
EIA	ELECTRONIC INDUSTRY ALLIANCE
UART	UNIVERSAL ASYNCHRONOUS RECEIVER/ TRANSMITTER
DTE	DATA TERMINAL EQUIPMENT
DCE	DATA COMMUNICATION EQUIPMENT
GSM	GLOBAL SYSTEM FOR MOBILE
EEPROM	ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY
EPROM	ERASABLE PROGRAMMABLE READ ONLY MEMORY
ROM	READ ONLY MEMORY
TTL	TRANSISTOR TRANSISTOR LOGIC
CMOS	COMPLEMENTARY METAL OXIDE SEMICONDUCTOR
RAM	RANDOM ACCESS MEMORY
LCD	LIQUID CRYSTAL DISPLAY
RTS	REQUEST TO SEND
CTS	CLEAR TO SEND

CHAPTER 1

INTRODUCTION

1.1 EMBEDDED SYSTEM:

An embedded system is an electronic system that includes a microcontroller that is configured to perform a specific dedicated operation. A microcontroller is an embedded (hidden) inside the device which also has memory. In embedded system software is programmed on ROM, EPROM or EEPROM. Embedded systems are used for real time applications. The main characteristics are

- Systems are highly flexible and reliable.
- The throughput is very high.
- The operation of the system does not vary with temperature. It has fast response.

1.2 MICRO CONTROLLER:

A micro controller consists of a powerful CPU tightly coupled with memory RAM, ROM or EPROM, various I/O features such as serial ports, parallel ports, Timer/Counter, data acquisition interfaces Analog to Digital Convertor (ADC), Digital to Analog Convertor (DAC), everything integrated onto a single silicon chip. It does not mean that any micro controller should have all the above said features on chip, Depending need and area of application for it is designed. The on chip features present in it may or may not include all the individual section said above.

In this project, ATMEL 89C51 is used. This is based on 89C51 architecture, 128 byte RAM, 4K flash ROM etc., the coding is done in KEIL-C compiler and the resulting HEX code is dumped in the program memory. This code has several

routines to control the external devices such as LCD, keyboard, stepper motor driver, relays and serial transmission to PC.

1.3 ENCODER AND DECODER:

The HT12E encoders are series of LSIs for remote control system applications. They are capable of encoding 12 bit of information, which consist of N address bits and 12 N data bits. Each address and data input is externally ternary programmable if bonded.

The HT 12D decoders are the series of LSIs for remote control systems applications. These ICs are paired with each other. For proper operation, a pair of encoder and decoder with same number of address and data formats should be selected. The decoder receives the serial address and data from the corresponding decoder, transmitted by a carrier using an RF transmission medium and gives output to the output pins after processing the data.

1.4 SERIAL COMMUNICATION:

In serial communication one bit follows another, so there is need for only one communicating channel rather than N to transmit between two devices. The signal from the controller to PC is sent serially using EIA-232, DB-9 interface. A level convertor MAX232 is used to convert TTL-CMOS levels. These level converted signals activate the timer control in the visual basic environment and do the dedicated work.

CHAPTER-2

PROJECT OVERVIEW

The use of mobile phone while driving motor vehicles which leads to so many accidents. In this project RF transceiver, GSM modem is used to overcome the risk of accidents while driving motor vehicles. Two microcontrollers of different families are used here. AT 89S51 and PIC 18F452 are used. The RF transceiver of 433.92 MHz (unlicensed) is used here at both the mobile and vehicle sections. The MAX232 IC which is a level converter is used here. It is used for voltage conversion process. The encoders and decoders which have pin compatibility with RF transceivers are used.

2.1 BLOCK DIAGRAM: DASH BOARD SECTION

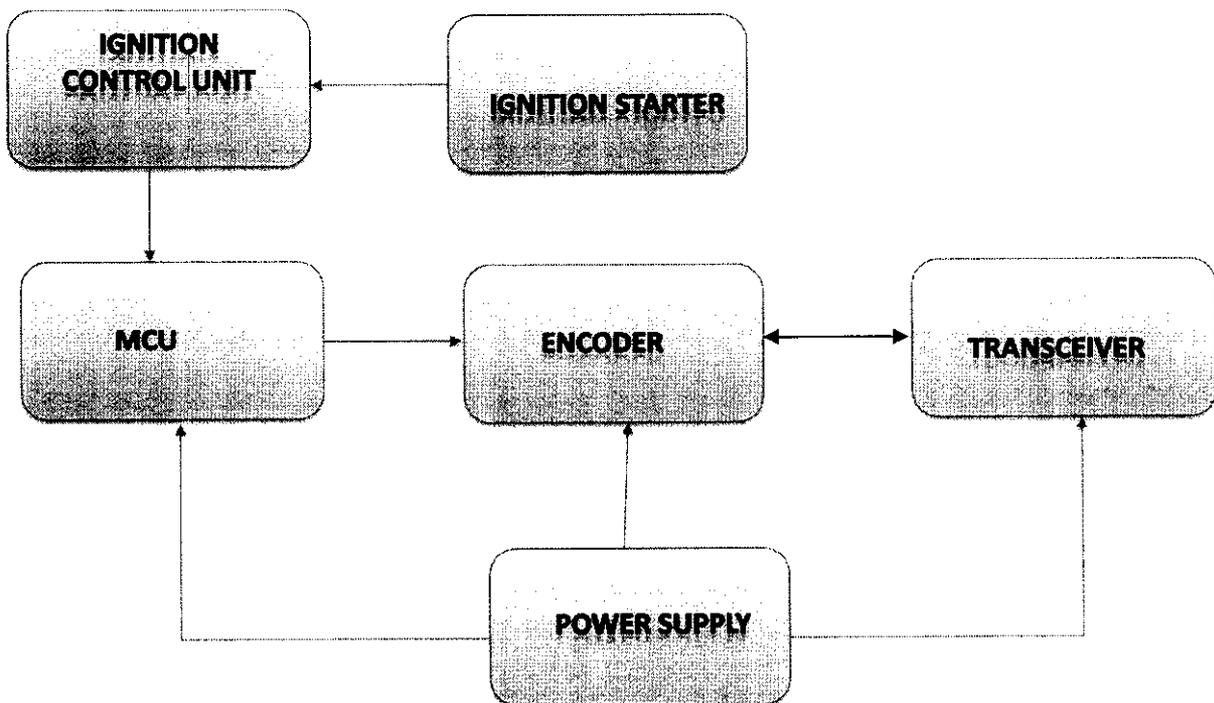


Fig 2.1 Dash Board Section

MOBILE SECTION

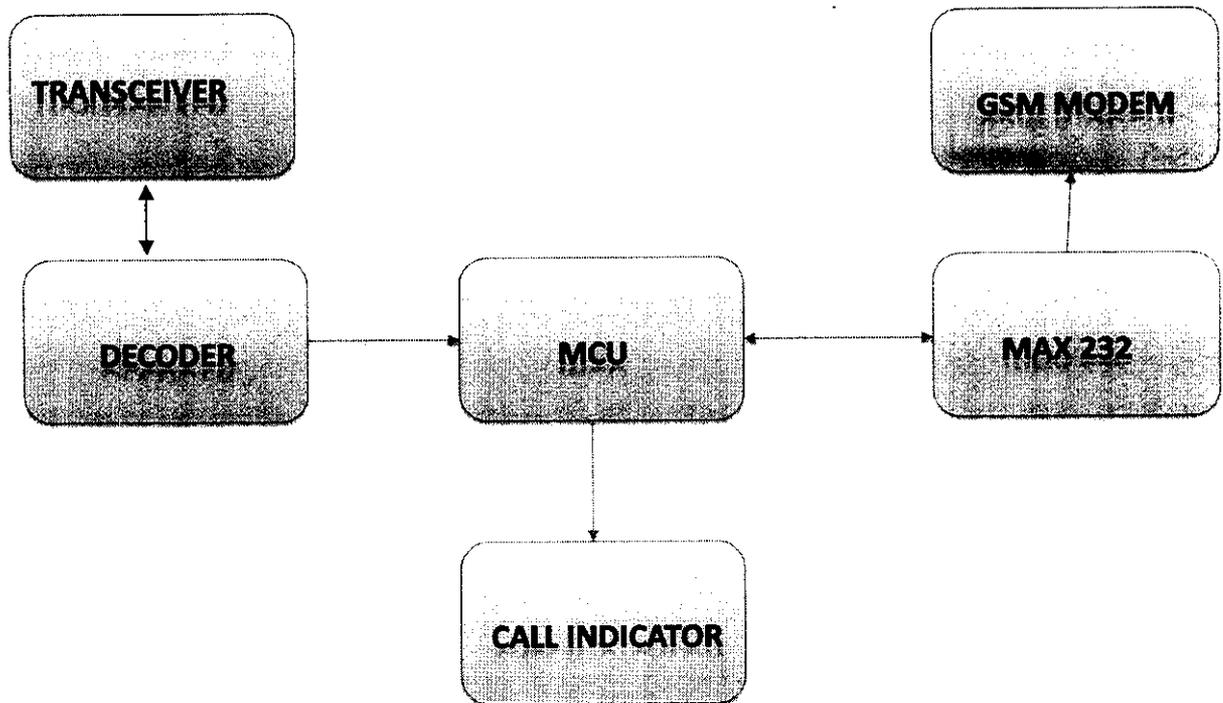


Fig 2.2 Mobile Section

2.2 BLOCK DIAGRAM DESCRIPTION:

- The former section Consists of Ignition Starter. Once the vehicle gets ignited, the microcontroller gives the signal to the mobile.
- When the signal is received by the mobile it immediately changes in to Driving Mode.
- In driving mode, if someone is calling it automatically informs that the person is driving the vehicle.
- If the call is from same number, the alert module gets activated.

- In case of emergency it automatically attends the call and gives response only for the emergency call.
- Once the call is attended, the vehicle slowly reduces its speed and finally stops.

2.3 EXISTING SYSTEM:

- ⊙ Muting Mobile.
- ⊙ Voice Mail Converter.
- ⊙ Advertisements
- ⊙ Call diverting

2.4 PROPOSED SYSTEM:

- ⊙ Automatic attend of the call.
- ⊙ Gives information about the Driver.
- ⊙ Only Emergency Call will connect to the User.

2.5 CIRCUIT DIAGRAM: VEHICLE SECTION

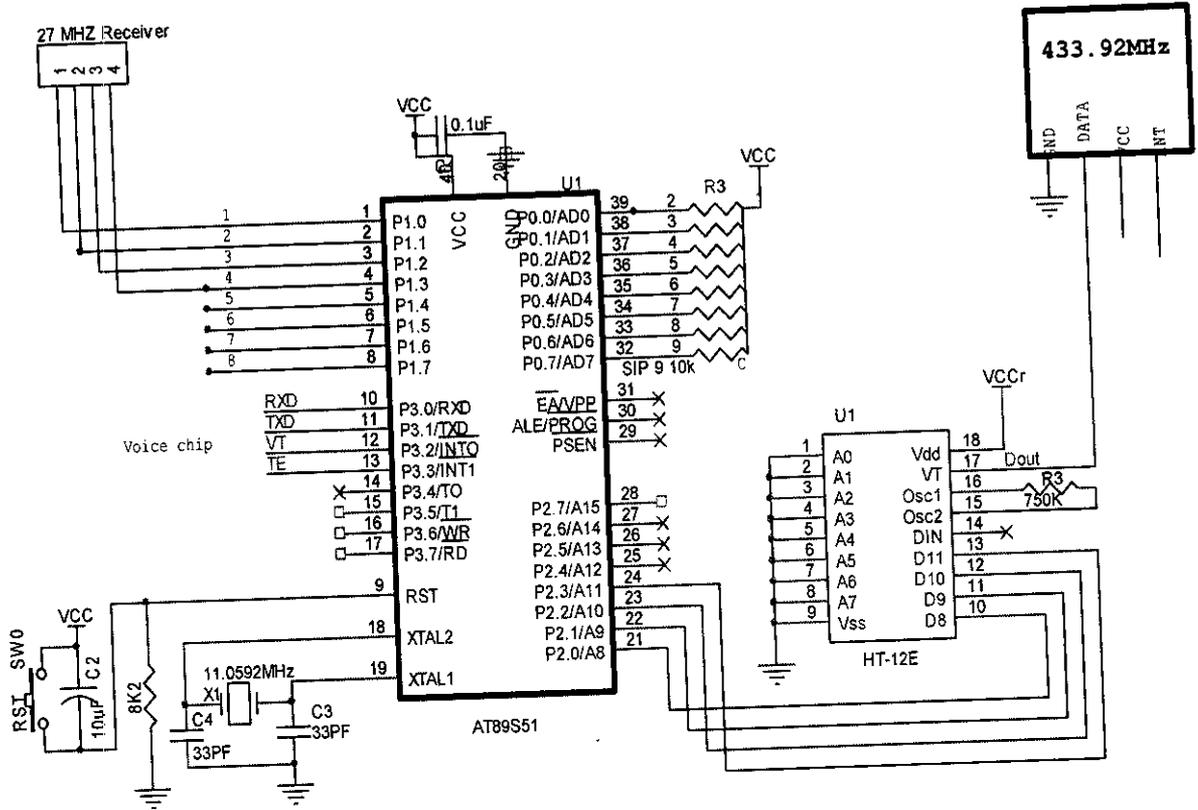


Fig 2.3 Vehicle Section

MOBILE SECTION

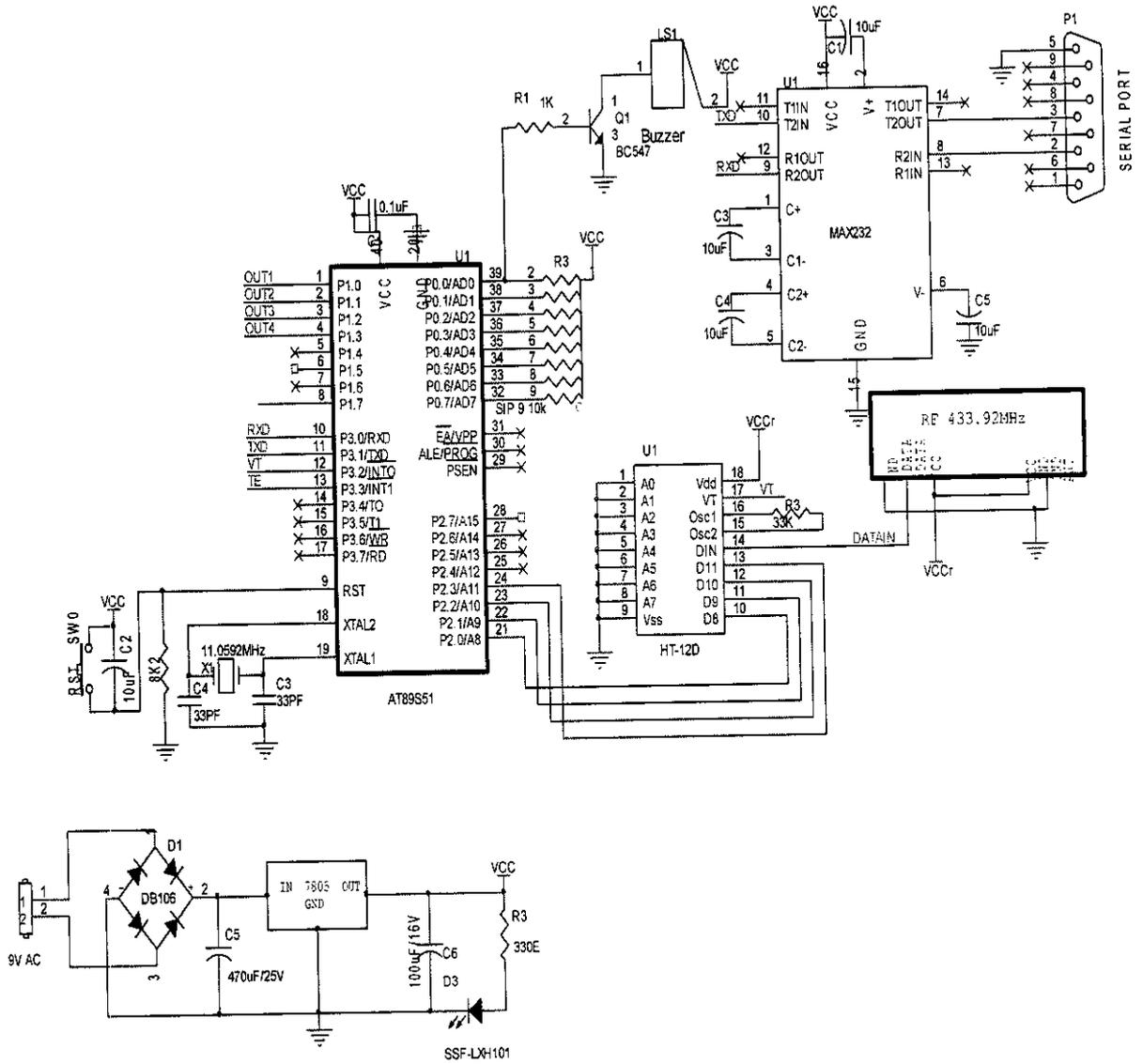


Fig 2.4 Mobile Section

2.6 FLOWCHART:

VEHICLE SECTION

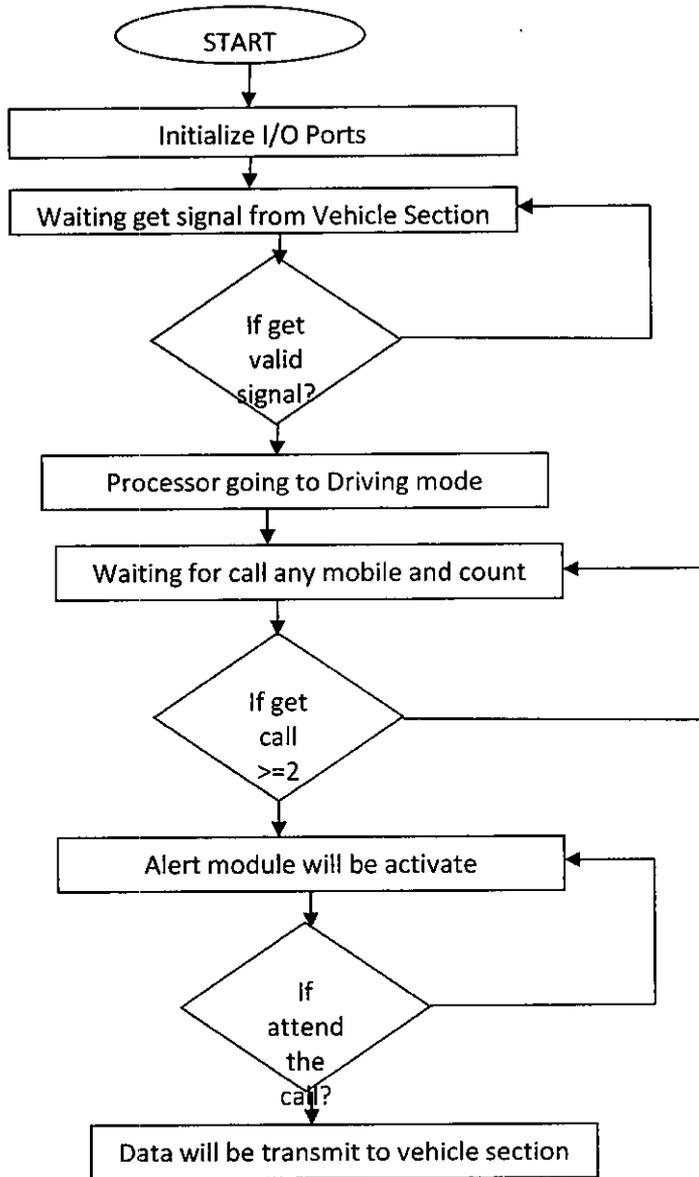


Fig 2.5 Vehicle Section Flowchart

MOBILE SECTION:

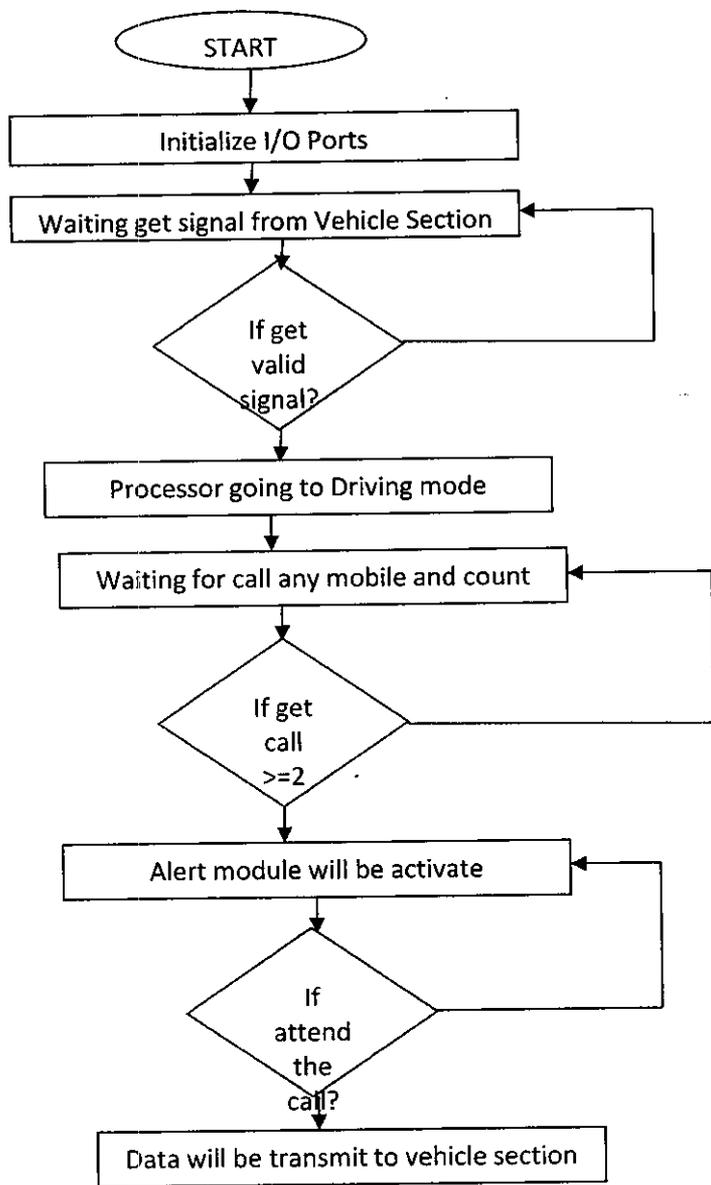


Fig 2.6 Mobile Section Flowchart

CHAPTER 3

POWER SUPPLY

3.1 INTRODUCTION:

The present includes the operation of power supply circuits built using filters, rectifiers, and then voltage regulators. Starting with an A.C voltage a steady D.C voltage is obtained by rectifying the A.C voltage, then filtering to the D.C level, and finally, regulating to obtain a desired fixed D.C voltage. The regulation is usually obtained from an IC voltage regulator unit, which takes D.C voltage and provides a somewhat lower D.C voltage, which remains the same even if the input D.C voltage varies, or the output load connected to the D.C voltage changes.

The block diagram contains the part of a typical power supply and the voltage at various points in the unit is shown. The A.C voltage, typically 120 Vrms, is connected to a transformer, which steps down the A.C voltage the level for the decided D.C output. A diode rectifier then provides a full wave rectified voltage that is initially filtered by a simple capacitor filtered by a simple capacitor filter to produce a D.C voltage. This resulting D.C voltage usually has some ripple or A.C voltage variation. A regulator circuit can use this D.C input to provide a D.C voltage that not only has much less ripple voltage but also remains the same D.C value even if the input D.C voltage varies somewhat, or the load connector to the output D.C voltage changes.

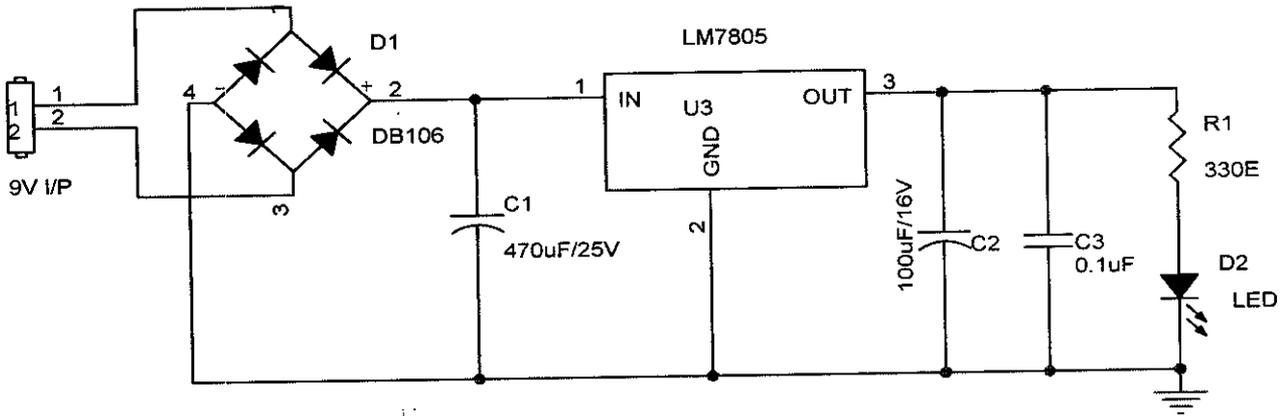


Fig 3.1 Power Supply

3.2 CIRCUIT DIAGRAM FOR POWER SUPPLY:



P. 3395

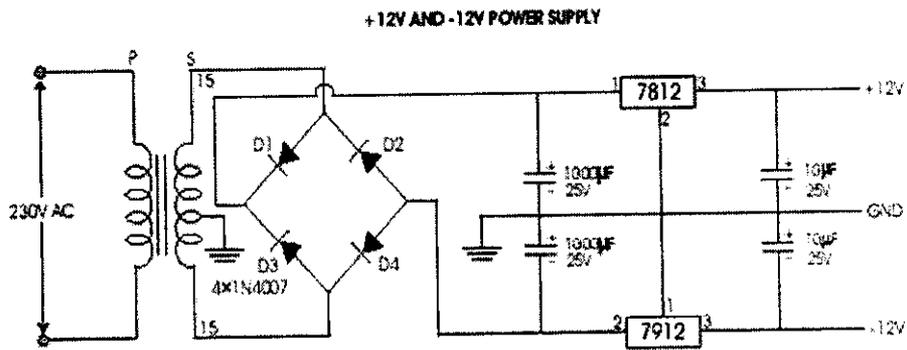
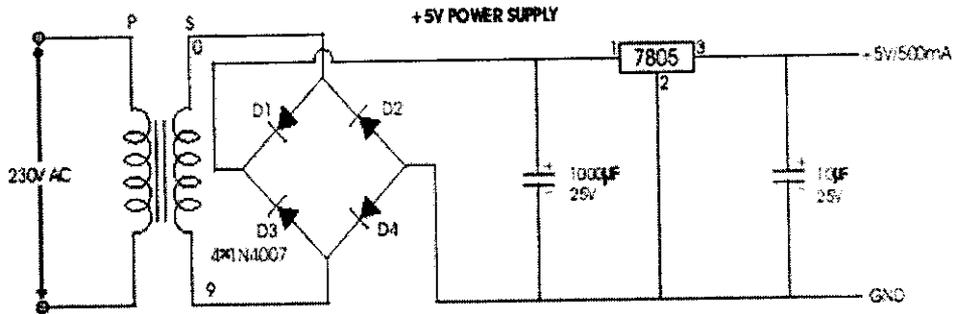


Fig 3.2 Circuit Diagram For Power Supply

3.2.1 WORKING PRINCIPLE:

The AC voltage, typically 220V rms, is connected to a transformer, which steps that AC voltage down to the level of the desired DC output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a DC voltage. This resulting DC voltage usually has some ripple or AC voltage variation. A regulator circuit removes the ripples and also remains the same DC value even if the input DC voltage varies, or the load connected to the output DC voltage changes.

3.2.2 TRANSFORMER:

The potential transformer will step down the power supply voltage (0-230V) to (0-6V) level. Then the secondary of the potential transformer will be connected to the precision rectifier, which is constructed with the help of op-amp. The advantages of using precision rectifier are it will give peak voltage output as DC, rest of the circuits will give only RMS output.

3.2.3 BRIDGE RECTIFIER:

When four diodes are connected as shown in figure, the circuit is called as bridge rectifier. The input to the circuit is applied to the diagonally opposite corners of the network, and the output is taken from the remaining two corners.

The transformer is working properly and there is a positive potential, at point A and a negative potential at point B. the positive potential at point A will forward bias D3 and reverse bias D4.

The negative potential at point B will forward bias D1 and reverse D2. At this time D3 and D1 are forward biased and will allow current flow to pass through them; D4 and D2 are reverse biased and will block current flow.

The path for current flow is from point B through D1, up through RL, through D3, through the secondary of the transformer back to point B. This path is indicated by the solid arrows. Waveforms (1) and (2) can be observed across D1 and D3.

One-half cycle later, the polarity across the secondary of the transformer reverse, by forward biasing D2 and D4 and reverse biasing D1 and D3. Current flow will now be from point A through D4, up through RL, through D2, through the secondary of T1, and back to point A. This path is indicated by the broken arrows. Waveforms (3) and (4) can be observed across D2 and D4. The current flow through RL is always in the same direction.

In flowing through RL this current develops a voltage corresponding to that shown waveform (5). Since current flows through the load (RL) during both half cycles of the applied voltage, this bridge rectifier is a full-wave rectifier.

One advantage of a bridge rectifier over a conventional full-wave rectifier is that with a given transformer the bridge rectifier produces a voltage output that is nearly twice that of the conventional full-wave circuit.

This may be shown by assigning values to some of the components shown in views A and B. Assume that the same transformer is used in both circuits. The peak voltage developed between points X and Y is 1000 volts in both circuits. In the conventional full-wave circuit shown—in view A, the peak voltage from the center tap to either X or Y is 500 volts. Since only one diode can conduct at any instant, the maximum voltage that can be rectified at any instant is 500 volts.

The maximum voltage that appears across the load resistor is nearly-but never exceeds-500 volts, as result of the small voltage drop across the diode. In the bridge rectifier shown in view B, the maximum voltage that can be rectified is the full secondary voltage, which is 1000 volts. Therefore, the peak output voltage

across the load resistor is nearly 1000 volts. With both circuits using the same transformer, the bridge rectifier circuit produces a higher output voltage than the conventional full-wave rectifier circuit.

3.2.4 IC VOLTAGE REGULATORS:

Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection all in a single IC. IC units provide regulation of either a fixed positive voltage, a fixed negative voltage, or an adjustably set voltage.

CHAPTER-4

MICROCONTROLLER

4.1 AT89S51 MICROCONTROLLER:

4.1.1 INTRODUCTION:

The AT89S51 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density non-volatile memory technology and is compatible with the industry-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S51 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications.

The AT89S51 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S51 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The idle mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

4.1.2 FEATURES:

- Compatible with MCS®-51 Products
- 8K Bytes of In-System Programmable (ISP) Flash Memory
 - Endurance: 10,000 Write/Erase Cycles
- 4.0V to 5.5V Operating Range

- Fully Static Operation: 0 Hz to 33 MHz
- Three-level Program Memory Lock
- 256 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Three 16-bit Timer/Counters
- Eight Interrupt Sources
- Full Duplex UART Serial Channel
- Low-power Idle and Power-down Modes
- Watchdog Timer
- Dual Data Pointer
- Power-off Flag
- Fast Programming Time
- Flexible ISP Programming (Byte and Page Mode)

4.1.3 PIN DIAGRAM:

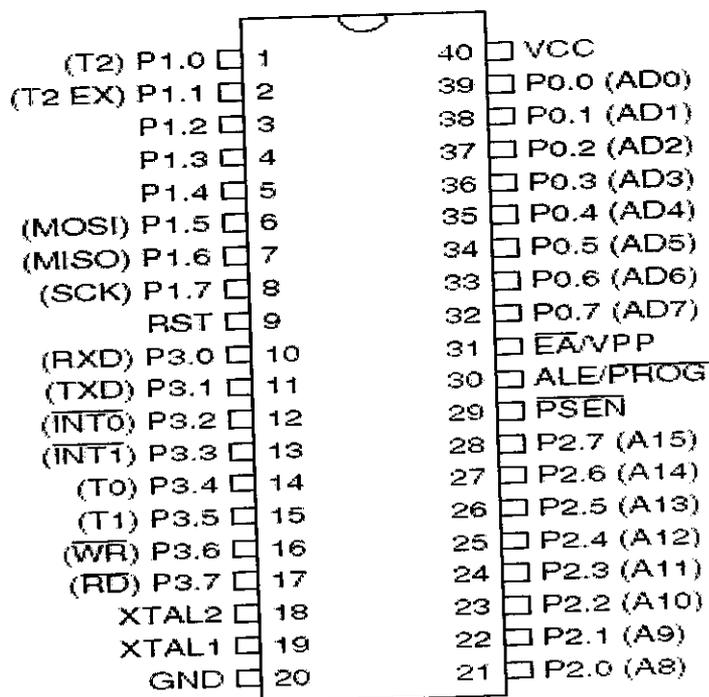


Fig 4.1 Pin Diagram Of AT89s51

4.1.4 INTERNAL ARCHITECTURE

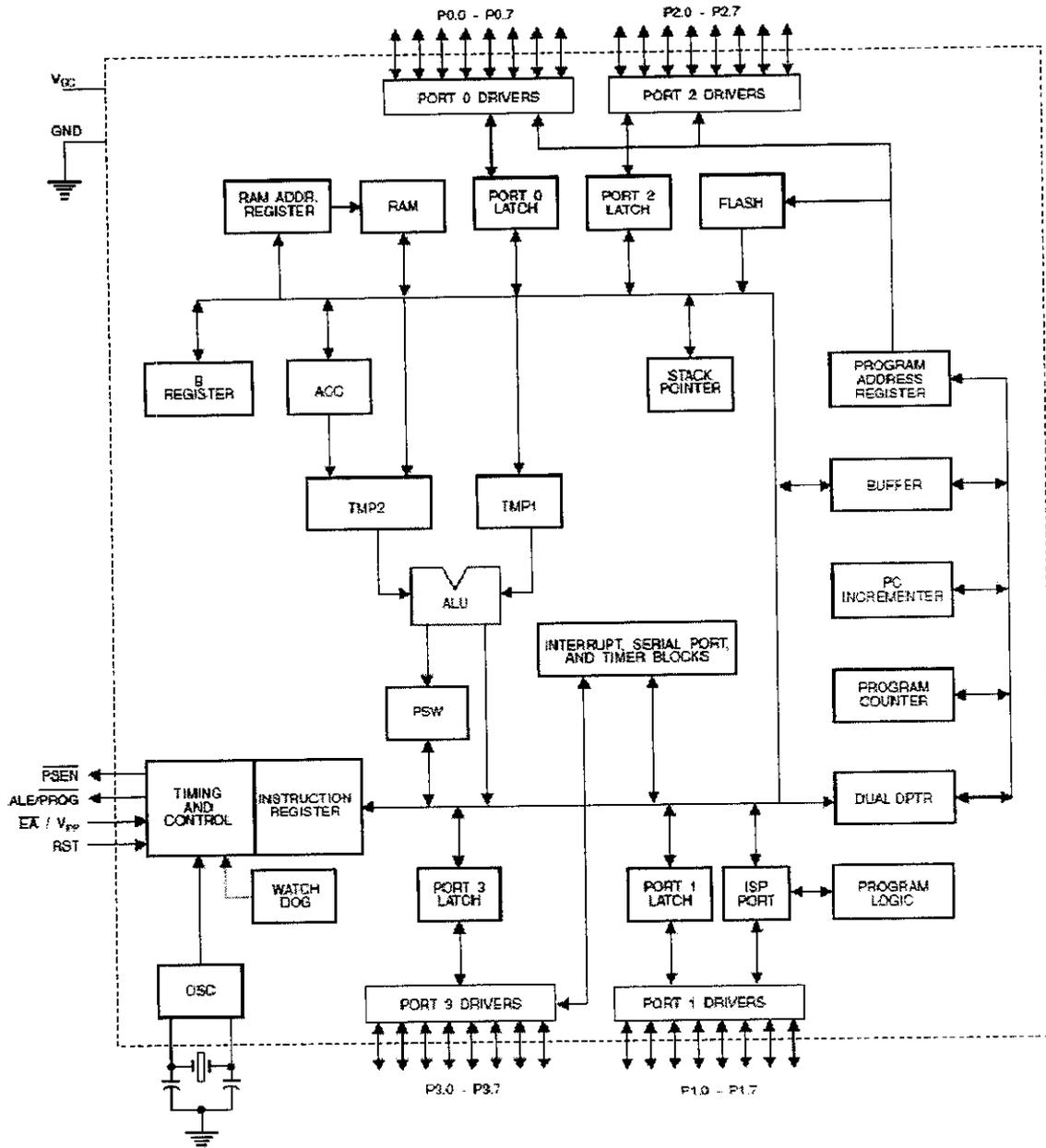


Fig 4.2 Internal Architecture Of AT89S51

4.1.5 Memory Organization

MCS-51 devices have a separate address space for Program and Data Memory. Up to 64K bytes each of external Program and Data Memory can be addressed.

4.1.5. a. Program Memory

If the EA pin is connected to GND, all program fetches are directed to external memory. On the AT89S52, if EA is connected to VCC, program fetches to addresses 0000H through 1FFFH are directed to internal memory and fetches to addresses 2000H through FFFFH are to external memory.

4.1.5. b. Data Memory

The AT89S52 implements 256 bytes of on-chip RAM. The upper 128 bytes occupy a parallel address space to the Special Function Registers. This means that the upper 128 bytes have the same addresses as the SFR space but are physically separate from SFR space. When an instruction accesses an internal location above address 7FH, the address mode used in the instruction specifies whether the CPU accesses the upper 128 bytes of RAM or the SFR space. Instructions which use direct addressing access the SFR space.

For example, the following direct addressing instruction accesses the SFR at location 0A0H (which is P2). `MOV 0A0H, #data` Instructions that use indirect addressing access the upper 128 bytes of RAM. For example, the following indirect addressing instruction, where R0 contains 0A0H, accesses the data byte at address 0A0H, rather than P2 (whose address is 0A0H). `MOV @R0, #data` Note that stack operations are examples of indirect addressing, so the upper 128 bytes of data RAM are available as stack space.

4.1.6 UART

A universal asynchronous receiver/transmitter, abbreviated UART, is a type of "asynchronous receiver/transmitter", a piece of computer hardware that translates data between parallel and serial forms. UARTs are commonly used in conjunction with communication standards such as EIA RS-232, RS-422 or RS-485. The universal designation indicates that the data format and transmission speeds are configurable and that the actual electric signaling levels and methods typically are handled by a special driver circuit external to the UART.

It is also receive-buffered, meaning it can commence reception of a second byte before a previously received byte has been read from the receive register. (However, if the first byte still hasn't been read by the time reception of the second byte is complete, one of the bytes will be lost). The serial port receive and transmit registers are both accessed at Special Function Register SBUF. Writing to SBUF loads the transmit register, and reading SBUF accesses a physically second receive register.

4.1.7 INTERRUPTS

The AT89S51 has a total of six interrupt vectors: two external interrupts (INT0 and INT1), three timer interrupts (Timers 0, 1, and 2), and the serial port interrupt. Each of these interrupt sources can be individually enabled or disabled by setting or clearing a bit in Special Function Register IE. IE also contains a global disable bit, EA, which disables all interrupts at once. User software should not write a 1 to this bit position, since it may be used in future AT89 products. Timer 2 interrupt is generated by the logical OR of bits TF2 and EXF2 in register T2CON. Neither of these flags is cleared by hardware when the service routine is vectored to. In fact, the service routine may have to determine whether it was TF2 or EXF2 that generated the interrupt, and that bit will have to be cleared in software.

The Timer 0 and Timer 1 flags, TF0 and TF1, are set at S5P2 of the cycle in which the timers overflow. The values are then polled by the circuitry in the next cycle. However, the Timer 2 flag, TF2, is set at S2P2 and is polled in the same cycle in which the timer overflows.

4.1.8 OSCILLATOR CHARACTERISTICS

XTAL1 and XTAL2 are the input and output, respectively, of an inverting amplifier that can be configured for use as an on-chip oscillator, as shown in Figure 16-1. Either a quartz crystal or ceramic resonator may be used. To drive the device from an external clock source, XTAL2 should be left unconnected while XTAL1 is driven. There are no requirements on the duty cycle of the external clock signal, since the input to the internal clock-ing circuitry is through a divide-by-two flip-flop, but minimum and maximum voltage high and low time specifications must be observed.

4.2 PIC18F452 MICROCONTROLLER:

4.2.1 INTRODUCTION

Microchip, the second largest 8-bit microcontroller supplier in the world, is the manufacturer of the PIC microcontroller and a number of other embedded control solutions. Check out the following links for an overview of the history of Microchip and PIC microcontrollers.

Microchip offers four families of PIC microcontrollers, each designed to address the needs of different designers.

- Base-Line: 12-bit Instruction Word length
- Mid-Range: 14-bit Instruction Word length
- High-End: 16-bit Instruction Word length
- Enhanced: 16-bit Instruction Word length

The PIC18F452 microcontroller has 16K of code space, 10-bit A/D converters, 34 I/O pins and many other features in a 40-pin DIP package. Compilers include PicBasic which has a Parallax BASIC Stamp 1 compatible instruction set, PicBasic Pro which features an enhanced instruction set compatible with the BASIC Stamp 2 and the CCS C Compiler which gives developers the capability to quickly produce very efficient code from an easily maintainable high level language.

Harvard architecture has the program memory and data memory as separate memories which are accessed from separate buses. This improves bandwidth over traditional Von Neumann architecture in which program and data are fetched from the same memory using the same bus.

PIC microcontrollers have a data memory bus of 8-bit and a program memory bus of 12, 14 or 16 bit length depending on the family. All PIC microcontrollers have a mix of different on-chip peripherals like A/D converters, Comparators, weak pull-ups, PWM modules, UARTs, Timers, SPI, I2C, USB, LCD, and CAN etc.

PIC microcontrollers come in various sizes, from the 6-pin smallest microcontroller in the world to the high pin count, high memory devices. But from a student's/hobbyist's perspective the 16F series of PICs are the most ideal to start with and out of them the PIC16F84 seems to be the most popular microcontroller. Although the PIC16F84 and the PIC16F84A (later silicon revision of the PIC16F84) have been replaced by the higher specifications, lower priced PIC16F628 and the PIC16F628A,

The most popular, fastest and the easiest to build programmer is the Parallel David Tait PIC programmer which is commonly known as the father of all PIC programmers. Although David Tait no longer provides support for his design there are a number of variants of his design available on the internet.

The use of another very popular programmer known as the JDM programmer because it works on the serial port and requires no external power supply whereas all variants of the David Tait programmer work connect to the parallel port of a PC and require an external power supply. But one thing I would want to say here is that the simplicity of the JDM programmer comes at a cost of unreliability.

The JDM programmer draws power from the serial port and most serial ports are not designed for such a task (especially laptop serial ports). There are some versions of the JDM programmer which use an external supply. So, if someone wants to build a JDM programmer he should look for versions with an external power supply. But even then I wouldn't recommend a serial port programmer like the JDM.

The assembler for PICs is known as MPASM and it comes with MPLAB. The MPLAB integrated development environment (IDE) is a free, integrated toolset for the development of embedded applications employing Microchip's PICmicro and dsPIC microcontrollers. MPLAB also has a simulator for PIC microcontrollers known as MPSIM. Check Microchip's website for the latest version of MPLAB. MPLAB will assemble your code into a ".HEX" file.

4.2.2MEMORY ORGANISATION:

- Program Memory - A memory that contains the program (which we had written), after we've burned it. As a reminder, Program Counter executes commands stored in the program memory, one after the other.

- Data Memory – This is RAM memory type, which contains a special registers like SFR (Special Function Register) and GPR (General Purpose Register). The variables that we store in the Data Memory during the program are deleted after we turn off the micro. These two memories have separated data buses, which makes the access to each one of them very easy.
- Data EEPROM (Electrically Erasable Programmable Read-Only Memory) - A memory that allows storing the variables as a result of burning the written program.

Each one of them has a different role. Program Memory and Data Memory are two memories that are needed to build a program, and Data EEPROM is used to save data after the microcontroller is turned off. Program Memory and Data EEPROM are non-volatile memories, which store the information even after the power is turned off. These memories are called FLASH or EEPROM. In contrast, Data Memory does not save the information because it needs power in order to maintain the information stored in the chip.

4.2.3 UART:

A universal asynchronous receiver/transmitter, abbreviated UART, is a type of "asynchronous receiver/transmitter", a piece of computer hardware that translates data between parallel and serial forms. UARTs are commonly used in conjunction with communication standards such as EIA RS-232, RS-422 or RS-485. The universal designation indicates that the data format and transmission speeds are configurable and that the actual electric signaling levels and methods typically are handled by a special driver circuit external to the UART.

It is also receive-buffered, meaning it can commence reception of a second byte before a previously received byte has been read from the receive register.

(However, if the first byte still hasn't been read by the time reception of the second byte is complete, one of the bytes will be lost). The serial port receive and transmit registers are both accessed at Special Function Register SBUF.

4.2.4 INTERNAL ARCHITECTURE:

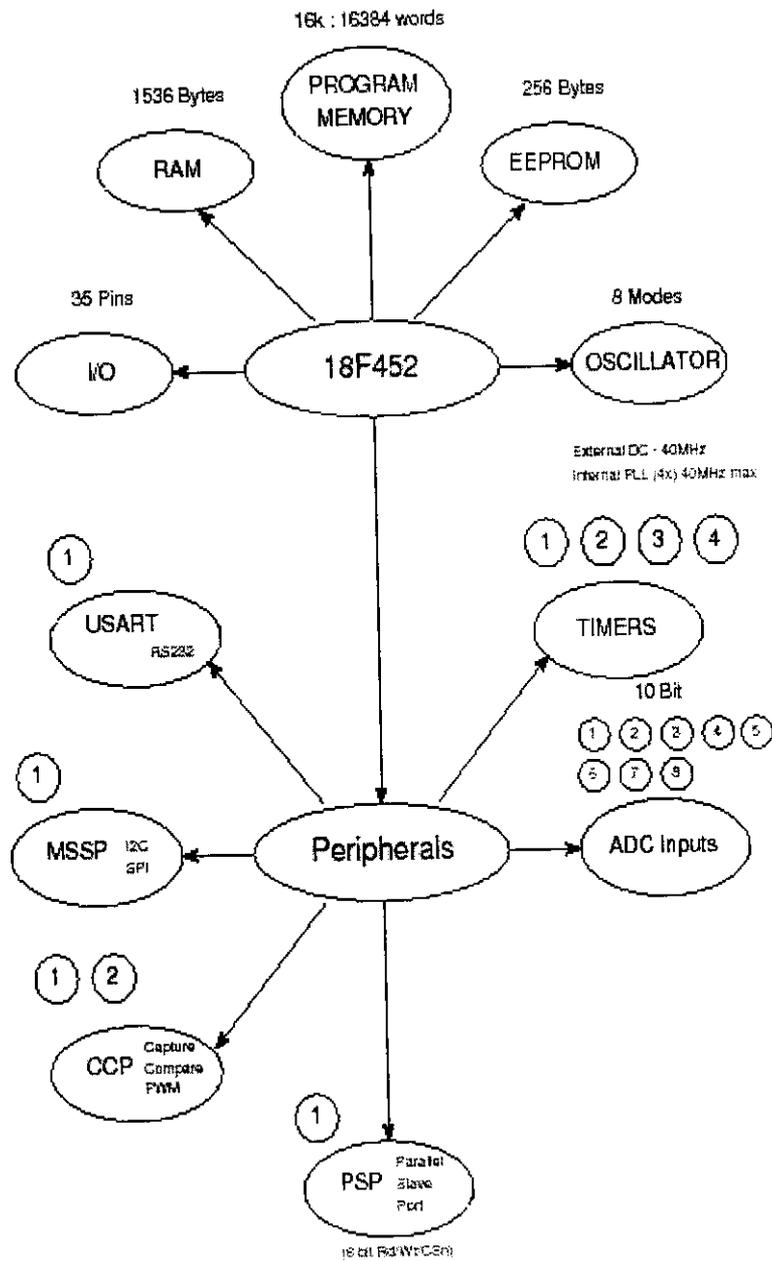


Fig 4.3 Internal Architecture Of PIC18F452

4.2.5 INTERRUPTS:

The PIC has 4 sources of interrupt. They can be split into two groups. Two are sources of interrupts that can be applied externally to the PIC, while the other two are internal processes. RB0 is obviously Port B bit 0. The INT symbolizes that it can also be configured as an external interrupt pin. Also, Port B bits 4 to 7 (pins 10 to 13) can also be used for interrupts. Inside the PIC there is a register called INTCON, and is at address 0Bh. Within this register there are 8 bits that can be enabled or disabled. Bit 7 of INTCON is called GIE. This is the Global Interrupts Enable. Setting this to 1 tells the PIC that we are going to use an interrupt. Bit 4 of INTCON is called INTE, which means Interrupt Enable. Setting this bit to 1 tells the PIC that RB0 will be an interrupt pin. Setting bit 3, called RBIE, tells the Pic that we will be using Port B bits 4 to 7.

4.2.6 PIN CONFIGURATION:

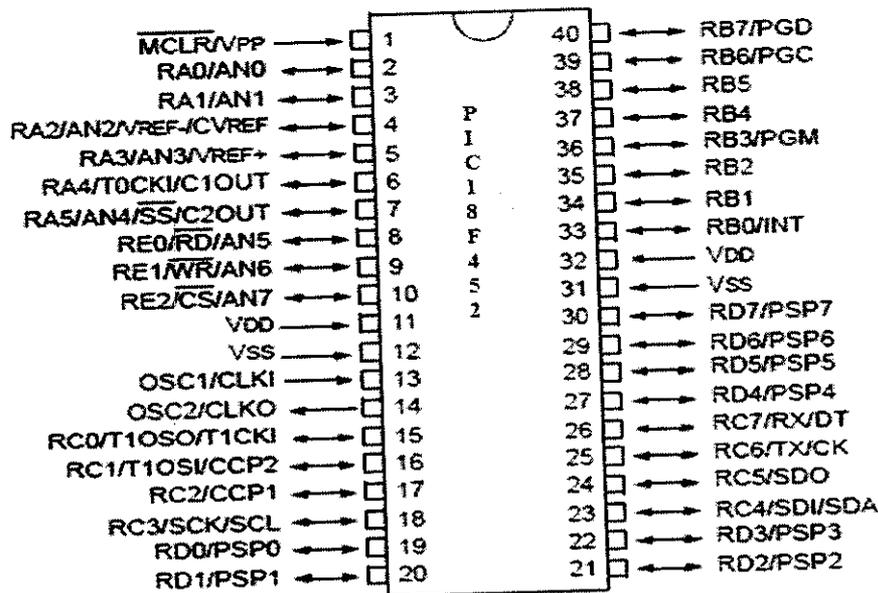


Fig 4.4 Pin Configuration

4.2.7 OVERALL FEATURES AND PIN FUNCTIONS:

- It is 8-bit Microcontroller
- System is RISC Architecture
- It has Small set of Instruction set
- It has 35-Instructions only
- Compatibility: avail 28/40 Pin ICs
- Operating Speed Max 20 MHz, Voltage-(2-5.5)v
- Memory:

Flash Program	8Kx14 Words,
RAM	368 Bytes,
EEPROM Data Memory	256 Bytes.

- It has 5 Ports for Internal and External usage
- It has on chip Timers. 3 Timers are avail
- It has in built Analog to Digital Converter
- In built Multiplexer availability for signal Selection
- It has serial as well as Parallel Communication facilities
- In built Capture, Compare and Pulse width modulation

PORT A

- PIN – RA0 to RA6
 - BIDIRECTIONAL I/O PINS
 - ANALOG AND DIGITAL INPUT
 - DIGITAL OUTPUT

PORT B

- PIN – RB0 to RB7
 - BIDIRECTIONAL I/O PINS
 - DIGITAL INPUT AND OUTPUT

PORT C

- PIN – RC0 to RC7
 - BIDIRECTIONAL I/O PINS
 - DIGITAL INPUT
 - CCP – CAPTURE COMPARE PULSE WIDTH MODULATION
 - TIMER – T0, T1, T2.
 - SERIAL – USART

PORT D

- PIN – RD0 to RD7
 - BIDIRECTIONAL I/O PINS
 - DIGITAL INPUT
 - EXTERNAL INTERRUPT

PORT E

- PIN – RE0 to RE2
 - BIDIRECTIONAL I/O PINS
 - ANALOG AND DIGITAL INPUT
 - DIGITAL OUTPUT

CHAPTER-5

SERIAL COMMUNICATION

5.1 INTRODUCTION:

Serial communication is basically the transmission or reception of data one bit at a time. Today's computers generally address data in bytes or some multiple thereof. A byte contains 8 bits. A bit is basically either a logical 1 or 0. Every character on this page is actually expressed internally as one byte. The serial port is used to convert each byte to a stream of ones and zeroes as well as to convert a stream of ones and zeroes to bytes. The serial port contains an electronic chip called a Universal Asynchronous Receiver/Transmitter (UART) that actually does the conversion.

The serial port has many pins. Whenever the serial port sends a logical zero (0) a positive voltage is affected. When no data is being sent, the serial port's transmit pin's voltage is negative (1) and is said to be in a MARK state. Note that the serial port can also be forced to keep the transmit pin at a positive voltage (0) and is said to be the SPACE or BREAK state. (The terms MARK and SPACE are also used to simply denote a negative voltage (1) or a positive voltage (0) at the transmit pin respectively).

The baud rate is the number of times the signal can switch states in one second. These characteristics define the entire interpretation of the data stream. The first characteristic is the length of the byte that will be transmitted. This length in general can be anywhere from 5 to 8 bits.

The second characteristic is parity. The parity characteristic can be even, odd, mark, space, or none. If even parity, then the last data bit transmitted will be a logical 1 if the data transmitted had an even amount of 0 bits. If odd parity, then

the last data bit transmitted will be a logical 1 if the data transmitted had an odd amount of 0 bits. If MARK parity, then the last transmitted data bit will always be a logical 1. If SPACE parity, then the last transmitted data bit will always be a logical 0. If no parity then there is no parity bit transmitted.

The third characteristic is the amount of stop bits. This value in general is 1 or 2. Assume we want to send the letter 'A' over the serial port. The binary representation of the letter 'A' is 01000001. Remembering that bits are transmitted from least significant bit (LSB) to most significant bit (MSB), the bit stream transmitted would be as follows for the line characteristics 8 bits, no parity, 1 stop bit and 9600 baud.

Consider the example LSB (0 1 0 0 0 0 0 1 0 1) MSB. This sequence represents (Start Bit) (Data Bits) (Stop Bit). To calculate the actual byte transfer rate simply divide the baud rate by the number of bits that must be transferred for each byte of data. In the case of the above example, each character requires 10 bits to be transmitted for each character. As such, at 9600 baud, up to 960 bytes can be transferred in one second.

Full duplex communication means that a device can receive and transmit data at the same time. Half duplex means that the device cannot send and receive at the same time. Half duplex serial communication needs at a minimum two wires, signal ground and the data line. Full duplex serial communication needs at a minimum three wires, signal ground, transmit data line, and receiver data line. The RS232 specification governs the physical and electrical characteristics of serial communications. This specification defines several additional signals that are asserted (set to logical 1) for information and control beyond the data signal.

These signals are the Carrier Detect Signal (CD), asserted by modems to signal a successful connection to another modem, Ring Indicator (RI), asserted by modems to signal the phone ringing, Data Set Ready (DSR), asserted by modems

to show their presence, Clear To Send (CTS), asserted by modems if they can receive data, Data Terminal Ready (DTR), asserted by terminals to show their presence, Request To Send (RTS), asserted by terminals if they can receive data.

Hardware flow control is a method that two connected devices use to tell each other electronically when to send or when not to send data. A modem in general drops (logical 0) its CTS line when it can no longer receive characters. It re-asserts when it can receive again. A terminal does the same thing instead with the RTS signal.

5.2 NULL MODEM:

Serial communication with RS232. One of the oldest and most widely spread communication methods in computer world. The way this type of communication can be performed is pretty well defined in standards. I.e. with one exception. The standards show the use of DTE/DCE communication, the way a computer should communicate with a peripheral device like a modem.

One of the main uses of serial communication today where no modem is involved—a *serial null modem* configuration with DTE/DTE communication—is not so well defined, especially when it comes to flow control.

In most situations, the original modem signal lines are reused to perform some sort of handshaking. Handshaking can increase the maximum allowed communication speed because it gives the computers the ability to control the flow of information. A high amount of incoming data is allowed if the computer is capable to handle it, but not if it is busy performing other tasks. If no flow control is implemented in the null modem connection, communication is only possible at speeds at which it is sure the receiving side can handle the amount information even under worst case conditions.

5.3 RS232:

When we look at the connector pin out of the RS232 port, we see two pins which are certainly used for flow control. These two pins are RTS, request to send and CTS, clear to send. With DTE/DCE communication (i.e. a computer communicating with a modem device) RTS is an output on the DTE and input on the DCE. CTS are the answering signal coming from the DCE.

Before sending a character, the DTE asks permission by setting its RTS output. No information will be sent until the DCE grants permission by using the CTS line.

If the DCE cannot handle new requests, the CTS signal will go low. A simple but useful mechanism allowing flow control in one direction. The assumption is that the DTE can always handle incoming information faster than the DCE can send it. In the past, this was true. Modem speeds of 300 baud were common and 1200 baud was seen as a high speed connection.

For this purpose, the DTR data terminal ready and DSR data set ready signals are present. The DTE uses the DTR signal to signal that it is ready to accept information, whereas the DCE uses the DSR signal for the same purpose. Using these signals involves not a small protocol of requesting and answering as with the RTS/CTS handshaking. These signals are in one direction only.

The last flow control signal present in DTE/DCE communication is the CD carrier detect. It is not used directly for flow control, but mainly an indication of the ability of the modem device to communicate with its counter part. This signal indicates the existence of a communication link between two modem devices.

5.4 NULL MODEM WITHOUT HANDSHAKING:

The simplest way to use the handshaking lines in a null modem configuration is to don't use them at all. In that situation, only the data lines and

signal ground are cross connected in the null modem communication cable. All other pins have no connection. An example of such a null modem cable without handshaking can be seen in the figure below.

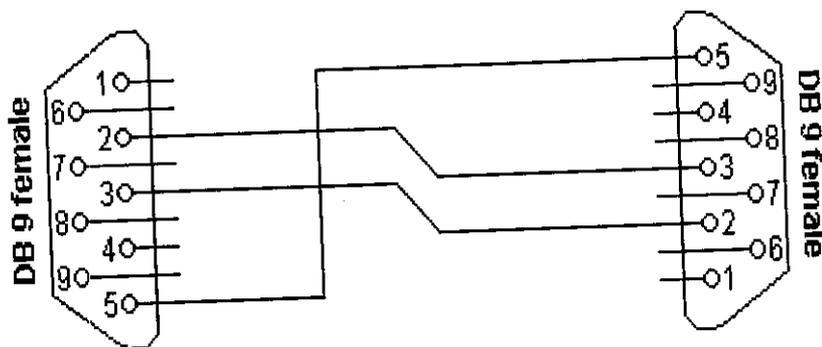


Fig 5.1 Null Modem Without Handshaking

Connector 1	Connector 2	Function
2	3	Rx ← TX
3	2	TX → Rx
5	5	Signal ground

Table 1. Connector Function

5.5 COMPATIBILITY ISSUES:

There is a problem, if either of the two devices checks the DSR or CD inputs. These signals normally define the ability of the other side to communicate. As they are not connected, their signal level will never go high. This might cause a problem.

CHAPTER-6

SOFTWARE TOOLS

6.1 SOFTWARE REQUIREMENTS

- KEIL IDE
- MPLAB IDE
 - Compiler
 - Linker
 - Simulator
 - Debugger
- WINPIC800 Programmer
- Orcad Design
 - Schematic
 - Layout
- Embedded C

6.2 MPLAB IDE

IDE – INTEGRATED DEVELOPMENT ENVIRONMENT

IDE is a software application that provides comprehensive facilities to computer programmers for software development. An IDE normally consists of

- Source Code Editor
- Compiler
- Debugger

A source code editor is a text editor program designed specifically for editing source code of computer programs by programmers. A compiler is a computer program that transforms source code written in a programming language into another computer language. The most common reason for wanting to transform source code is to create an executable program. A special program used to find errors (bugs) in other programs. A debugger allows a programmer to stop a program at any point and examine and change the values of variables. MPLAB IDE is a free, integrated toolset for the development of embedded applications employing Microchip's PIC® and dsPIC® microcontrollers.

MPLAB IDE runs as a 32-bit application on MS Windows. MPLAB is easy to use and includes a host of free software components for fast application development and super-charged debugging. MPLAB IDE also serves as a single, unified graphical user interface for additional Microchip and third party software and hardware development tools. MPLAB IDE is an integrated toolset for the development of embedded applications employing Microchip's PIC microcontrollers. The MPLAB IDE runs as a 32-bit application on Microsoft Windows. Both Assembly and C programming languages can be used with MPLAB IDE.

6.3 PIC KIT 2 PROGRAMMERS

Pic Kit 2 Programmer is software that is used to dump the hex file into the pic controller.

6.4 ORCAD

ORCAD really consists of tools. Capture is used for design entry in schematic form. Layout is a tool for designing the physical layout of components and circuits on a PCB. During the design process, you will move back and forth between these two tools. The design flow diagram is given below:

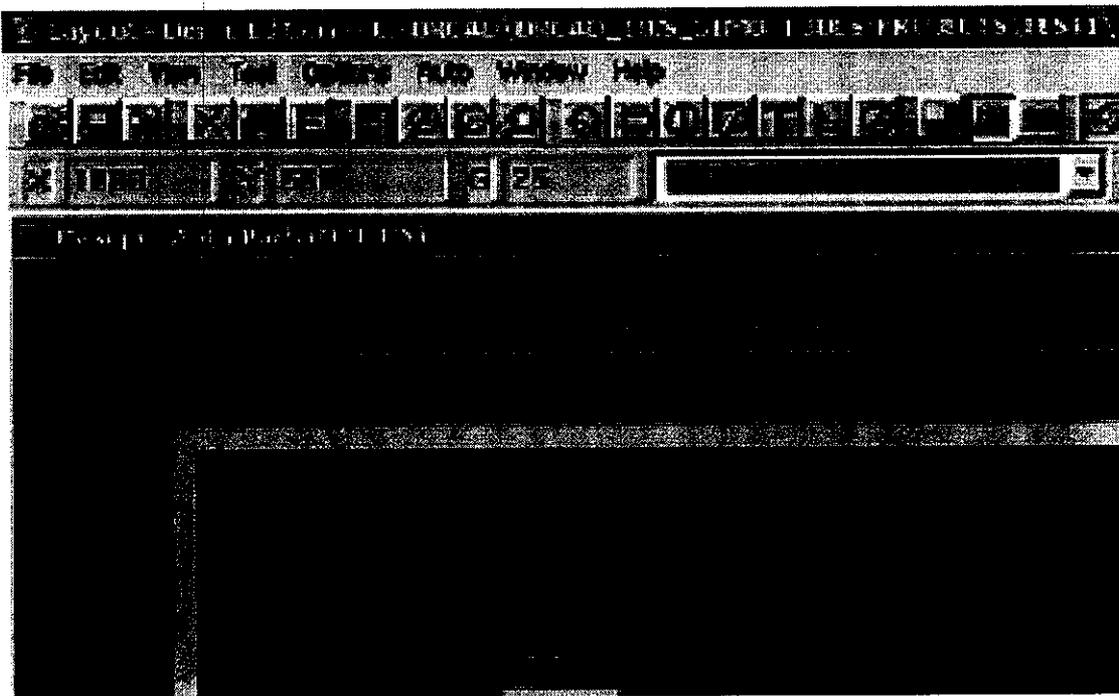


Fig.6.1. Design Window Of Orcad

The same holds for the RTS/CTS handshaking sequence. If the software on both sides is well structured, the RTS output is set high and then a waiting cycle is started until a ready signal is received on the CTS line. This causes the software to hang because no physical connection is present to either CTS line to make this possible. The only type of communication which is allowed on such a null modem line is data-only traffic on the cross connected Rx/TX lines.

It does however not mean that this null modem cable is useless. Communication links like present in the Norton Commander program can use this null modem cable. This null modem cable can also be used when communicating with devices which do not have modem control signals like electronic measuring equipment etc.

6.4.1 DESIGN FLOW OF ORCAD:

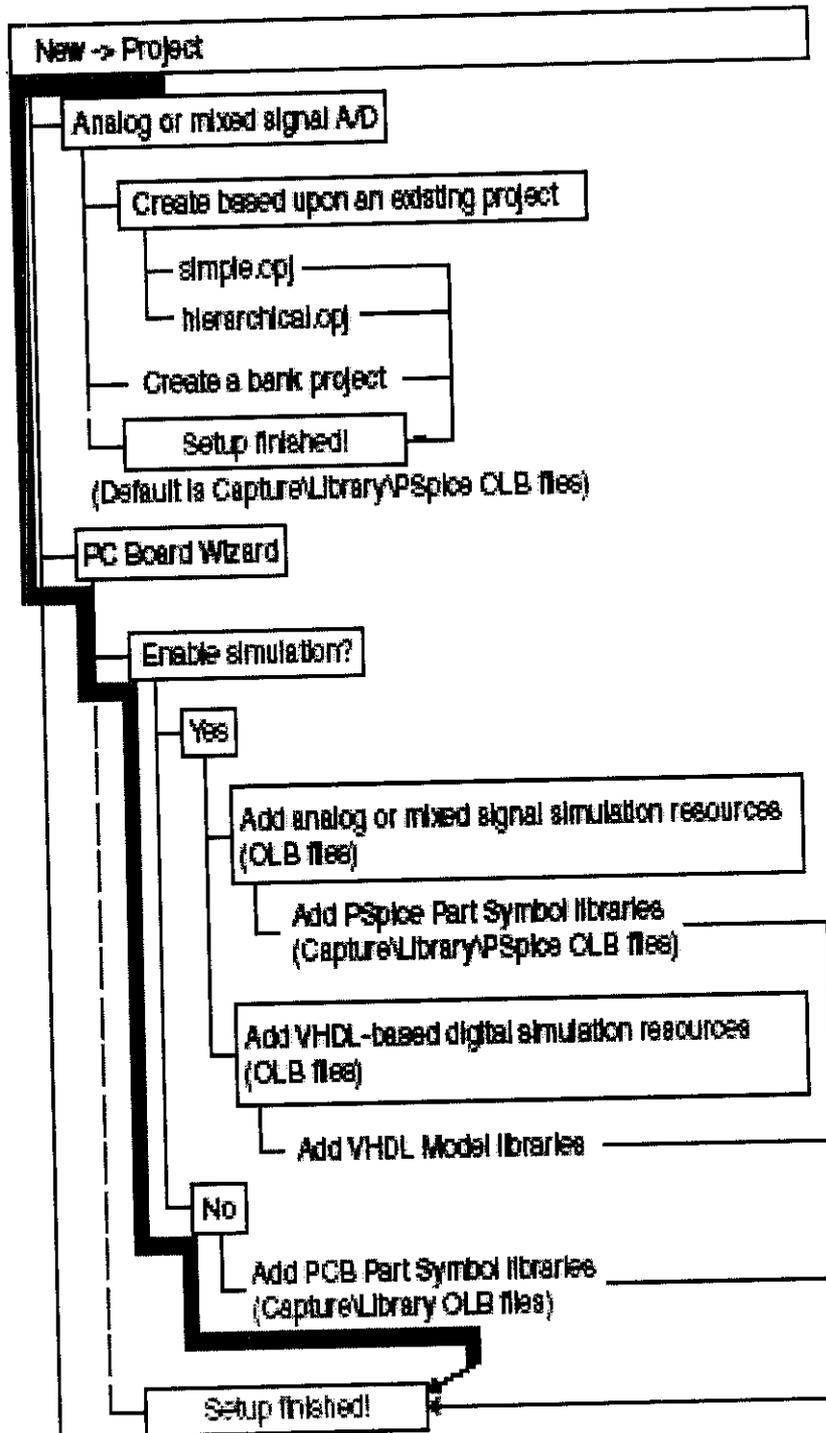


Fig 6.2 OrCAD Design Flow

6.5 KEIL C COMPILER

(AN INTEGRATED DEVELOPMENT ENVIRONMENT)

The C programming language is a general purpose programming language that provides code efficiency, elements of structured programming and a rich set of operators. C is not a big language and is not designed for any particular area of application. Its generality combined with its absence of restrictions, makes C a convenient and effective programming solution for wide variety of software tasks. Many applications can be solved more easily and efficiently with C than with other more specialized languages.

The Cx51 optimizing C compiler is a complete implementation of the American National Standard Institution (ANSI) standard for the C language. Cx51 is not a universal C compiler adapted for the 8051 target. It is a ground-up implementation dedicated to generating extremely fast and compact code for the 8051 microcontroller. Cx51 provides you with the flexibility of programming in C and the code efficiency and the speed of assembly language. The C language on its own is not capable of performing operations (such as input and output) that would normally require intervention from the operating system. Instead, these capabilities are provided as part of standard library. Because these functions are separate from the language itself, C is specially suited for producing code that is portable across a wide number of platforms. Since Cx51 is a cross compiler, some aspects of C programming language and standard libraries are altered or enhanced to address the peculiarities of an embedded target processor.

CHAPTER-7

OTHER HARDWARE TOOLS

Other than microcontroller, the hardware devices include,

- RF transceiver(transmitter and receiver)
- GSM modem
- Encoder
- Decoder
- RS 232
- MAX 232

7.1 GSM MODEM:

7.1.1 DEFINITION:

Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz.

7.1.2 THE GSM NETWORK

GSM provides recommendations, not requirements. The GSM specifications define the functions and interface requirements in detail but do not address the hardware. The reason for this is to limit the designers as little as possible but still to

make it possible for the operators to buy equipment from different suppliers. The GSM network is divided into three major systems: the switching system (SS), the base station system (BSS), and the operation and support system (OSS). The basic GSM network elements are shown in below *figure*

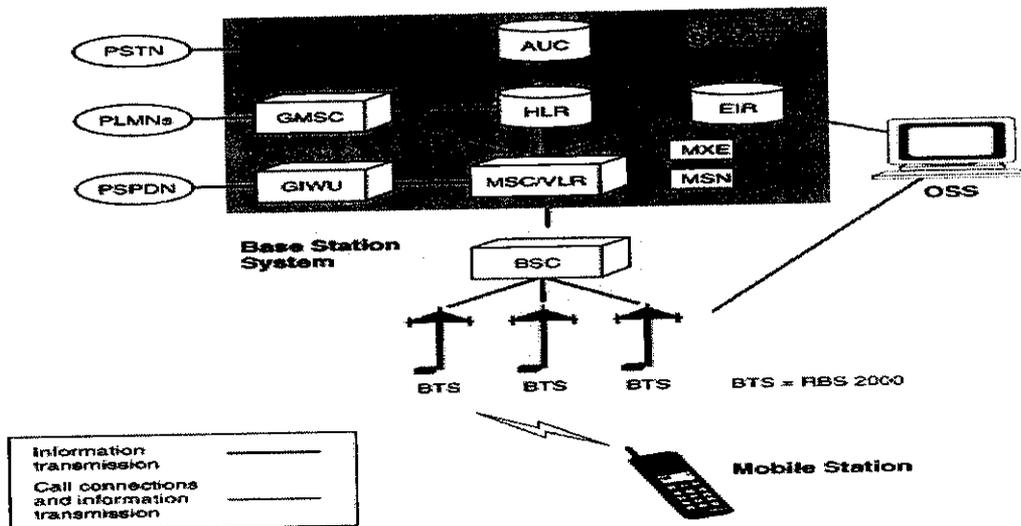


Fig 7.1 Gsm Network Elements

7.1.3 GSM MODEM:

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves.

A GSM modem can be an external device or a PC Card / PCMCIA Card. Typically, an external GSM modem is connected to a computer through a serial cable or a USB cable. A GSM modem in the form of a PC Card / PCMCIA Card is designed for use with a laptop computer. It should be inserted into one of the PC Card / PCMCIA Card slots of a laptop computer. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate.

Both GSM modems and dial-up modems support a common set of standard AT commands. You can use a GSM modem just like a dial-up modem.

In addition to the standard AT commands, GSM modems support an extended set of AT commands. These extended AT commands are defined in the GSM standards. With the extended AT commands, you can do things like:

- Reading, writing and deleting SMS messages.
- Sending SMS messages.
- Monitoring the signal strength.
- Monitoring the charging status and charge level of the battery.

7.1.4 GSM MODEM APPLICATIONS:

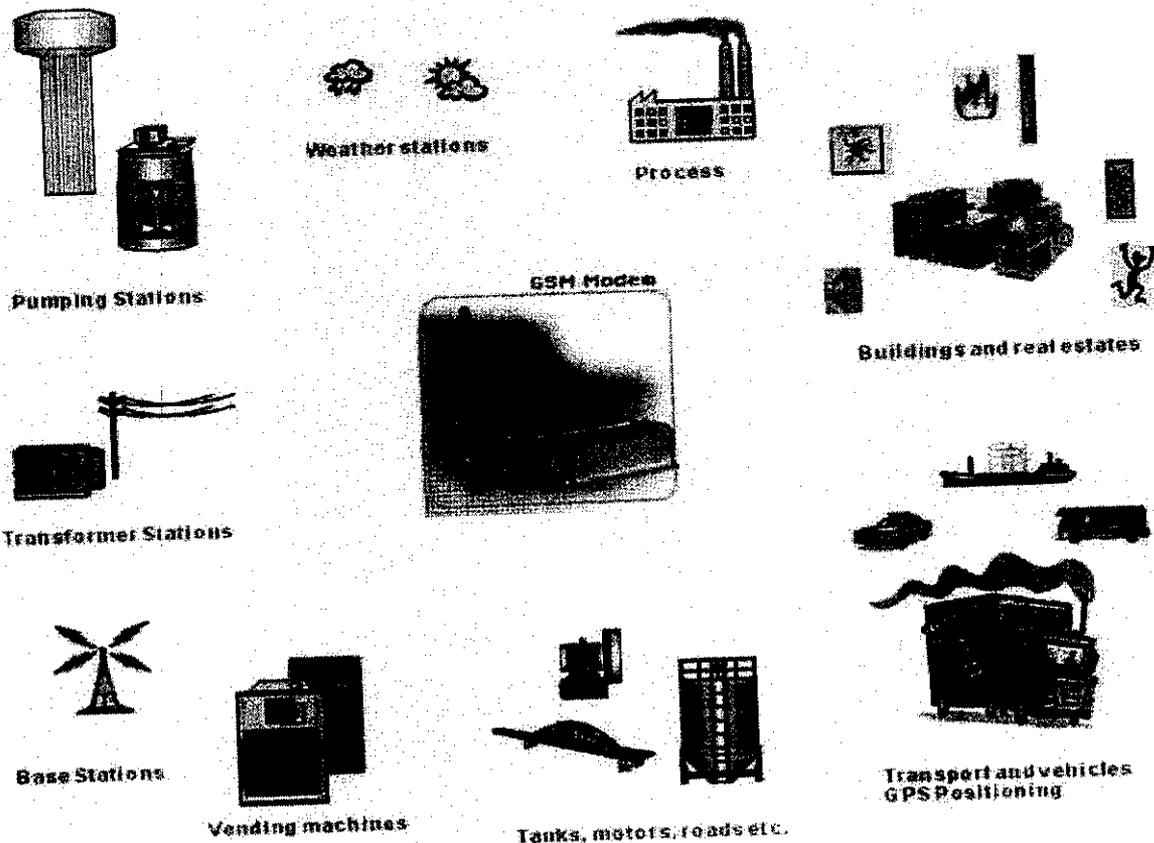


Fig 7.2 Gsm Modem Applications

7.1.5 FACTS AND APPLICATIONS OF GSM/GPRS MODEM:

The GSM/GPRS Modem comes with a serial interface through which the modem can be controlled using AT command interface. An antenna and a power adapter are provided. The basic segregation of working of the modem is as under

- Voice calls
- SMS
- GSM Data calls
- GPRS

7.1.5. a. Voice calls:

Voice calls are not an application area to be targeted. In future if interfaces like a microphone and speaker are provided for some applications then this can be considered.

7.1.5. b. SMS:

SMS is an area where the modem can be used to provide features like:

- Pre-stored SMS transmission
- SMS can be transmitted on certain trigger events in automation system.

SMS can also be used in areas where small text information has to be sent. The transmitter can be an automation system or machines like vending machines, collection machines or applications like positioning systems where the navigator keeps on sending SMS at particular time intervals.

7.1.6 APPLICATIONS:

7.1.6. a. Access control devices:

Now access control devices can communicate with servers and security staff through SMS messaging. Complete log of transaction is available at the head-office Server instantly without any wiring involved and device can instantly alert security personnel on their mobile phone in case of any problem. RaviRaj Technologies is introducing this technology in all Fingerprint Access control and time attendance products.

7.1.6. b. Transaction terminals:

EDC machines, POS terminals can use SMS messaging to confirm transactions from central servers. The main benefit is that central server can be anywhere in the world. Today you need local servers in every city with multiple telephone lines. You save huge infrastructure costs as well as per transaction cost.

7.1.6. c. Supply Chain Management:

Today SCM require huge IT infrastructure with leased lines, networking devices, data centre, workstations and still you have large downtimes and high costs.

7.1.7 APPLICATIONS SUITABLE FOR GSM COMMUNICATION:

If there are application needs one or more of the following features, GSM will be more cost-effective than other communication systems.

7.1.7. a. Short Data Size:

These small but important transaction data can be sent through SMS messaging which cost even less than a local telephone call or sometimes free of cost worldwide. Hence with negligible cost you are able to send critical information to your head office located anywhere in the world from multiple points.

7.1.7. b. Multiple remote data collection points:

If there are multiple data collections points situated all over the city, state, country or worldwide you will benefit the most. The data can be sent from multiple points like your branch offices, business associates, warehouses, and agents with devices like GSM modems connected to PCs, GSM electronic terminals and Mobile phones. Many a times some places like warehouses may be situated at remote location may not have landline or internet but you will have GSM network still available easily.

7.1.7. c. High uptime:

If the business require high uptime and availability GSM is best suitable for you as GSM mobile networks have high uptime compared to landline, internet and other communication mediums. Also in situations where you expect that someone may sabotage your communication systems by cutting wires or taping landlines, you can depend on GSM wireless communication.

7.1.7. d. Large transaction volumes:

GSM SMS messaging can handle large number of transaction in a very short time. You can receive large number SMS messages on your server like e-mails without internet connectivity. E-mails normally get delayed a lot but SMS messages are almost instantaneous for instant transactions. Consider situation like shop owners doing credit card transaction with GSM technology instead of conventional landlines. time you find local transaction servers busy as these servers use multiple telephone lines to take care of multiple transactions, whereas one GSM connection is enough to handle hundreds of transaction.

7.1.7. e. Mobility, Quick installation:

GSM technology allows mobility, GSM terminals, modems can be just picked and installed at other location unlike telephone lines. Also you can be mobile with GSM terminals and can also communicate with server using your mobile phone. The GSM hardware like modems, terminals and mobile handsets, insert SIM cards, configure software and are ready for GSM communication.

7.2 RS 232

The connector pin out of the RS232 port has two pins which are certainly used for flow control. These two pins are RTS, request to send and CTS, clear to send. With DTE/DCE communication (i.e. a computer communicating with a modem device) RTS is an output on the DTE and input on the DCE. CTS are the answering signal coming from the DCE.

Before sending a character, the DTE asks permission by setting its RTS output. No information will be sent until the DCE grants permission by using the CTS line.

If the DCE cannot handle new requests, the CTS signal will go low. A simple but useful mechanism allowing flow control in one direction. The assumption is that the DTE can always handle incoming information faster than the DCE can send it. In the past, this was true. Modem speeds of 300 baud were common and 1200 baud was seen as a high speed connection.

For further control of the information flow, both devices have the ability to signal their status to the other side. For this purpose, the DTR data terminal ready and DSR data set ready signals are present. The DTE uses the DTR signal to signal that it is ready to accept information, whereas the DCE uses the DSR signal for the same purpose. Using these signals involves not a small protocol of requesting and answering as with the RTS/CTS handshaking. These signals are in one direction only.

The last flow control signal present in DTE/DCE communication is the CD carrier detect. It is not used directly for flow control, but mainly an indication of the ability of the modem device to communicate with its counter part. This signal indicates the existence of a communication link between two modem devices.

7.3 MAX 232

MAX-232 is primary used for people building electronics with an RS-232 interface. Serial RS-232 communication works with voltages (-15V ... -3V for high) and +3V ... +15V for low) which are not compatible with normal computer logic voltages. To receive serial data from an RS-232 interface the voltage has to be reduced, and the low and high voltage level inverted. In the other direction (sending data from some logic over RS-232) the low logic voltage has to be "bumped up", and a negative voltage has to be generated, too.

RS-232	TTL	Logic
-15V ... -3V	<-> +2V ... +5V	<-> high
+3V ... +15V	<-> 0V ... +0.8V	<-> low

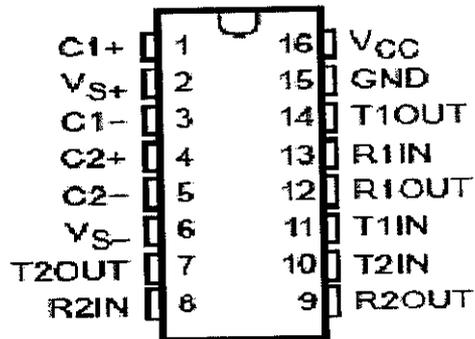


Fig 7.3 Pin Configuration Of Max 232

RS232 COMMUNICATION

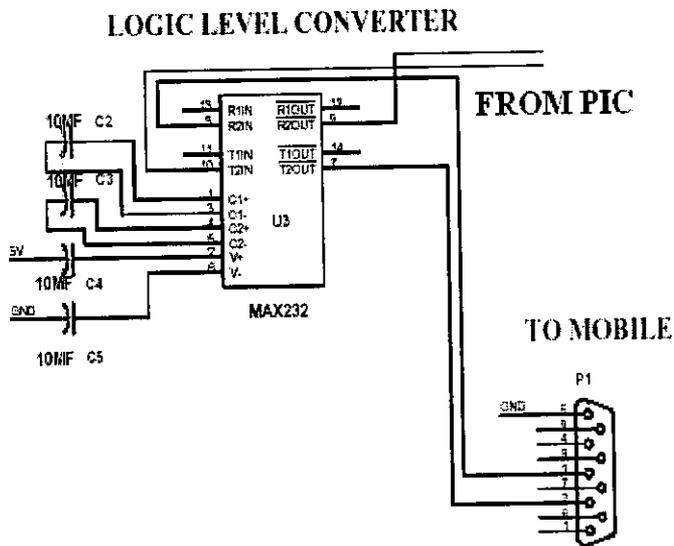


Fig 7.4 Circuit Diagram Of Serial Communication

In telecommunications, RS-232 is a standard for serial binary data interconnection between a DTE (Data terminal equipment) and a DCE (Data Circuit-terminating Equipment). It is commonly used in computer serial ports.

Scope of the Standard:

The Electronic Industries Alliance (EIA) standard RS-232-C [3] as of 1969 defines:

- Electrical signal characteristics such as voltage levels, signaling rate, timing and slew-rate of signals, voltage withstand level, short-circuit behavior, maximum stray capacitance and cable length
- Interface mechanical characteristics, pluggable connectors and pin identification
- Functions of each circuit in the interface connector
- Standard subsets of interface circuits for selected telecom applications

The standard does not define such elements as character encoding (for example, ASCII, Baudot or EBCDIC), or the framing of characters in the data stream (bits per character, start/stop bits, parity). The standard does not define protocols for error detection or algorithms for data compression.

The standard does not define bit rates for transmission, although the standard says it is intended for bit rates lower than 20,000 bits per second. Many modern devices can exceed this speed (38,400 and 57,600 bit/s being common, and 115,200 and 230,400 bit/s making occasional appearances) while still using RS-232 compatible signal levels.

Details of character format and transmission bit rate are controlled by the serial port hardware, often a single integrated circuit called a UART that converts data from parallel to serial form. A typical serial port includes specialized driver and

receiver integrated circuits to convert between internal logic levels and RS-232 compatible signal levels.

Circuit Working Description

In this circuit the MAX 232 IC used as level logic converter. The MAX232 is a dual driver/receiver that includes a capacitive voltage generator to supply EIA 232 voltage levels from a single 5v supply. Each receiver converts EIA-232 to 5v TTL/CMOS levels. Each driver converts TLL/CMOS input levels into EIA-232 levels.

Function Tables

EACH DRIVER

INPUT TIN	OUTPUT TOUT
L	H
H	L

H = high level, L = low level

EACH RECEIVER

INPUT RIN	OUTPUT ROUT
L	H
H	L

H = high level, L = low level

Table 2. Function Table

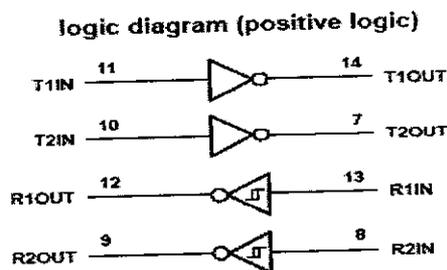


Fig 7.5 Logic Diagram

In this circuit the microcontroller transmitter pin is connected in the MAX232 T2IN pin which converts input 5v TTL/CMOS level to RS232 level. Then T2OUT pin is connected to reviver pin of 9 pin D type serial connector which is directly connected to PC. In PC the transmitting data is given to R2IN of MAX232 through transmitting pin of 9 pin D type connector which converts the RS232 level to 5v TTL/CMOS level. The R2OUT pin is connected to receiver pin of the microcontroller. Likewise the data is transmitted and received between the microcontroller and PC or other device vice versa.

7.4 RF MODULES

Radio-frequency identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders. The technology requires some extent of cooperation of an RFID reader and an RFID tag. An RFID tag is an object that can be applied to or incorporated into a product, animal, or person for the purpose of identification and tracking using radio waves. Some tags can be read from several meters away and beyond the line of sight of the reader

7.4.1 RF TRANSMITTER

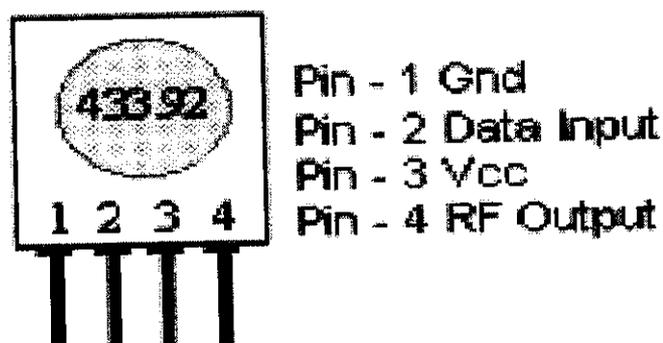
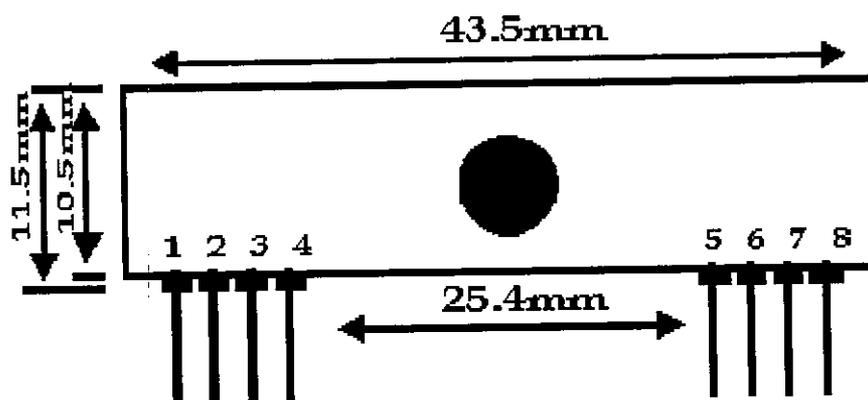


Fig 7.6 Rf Transmitter

- The transmitter output is up to 8mW at 433.92MHz with a range of approximately few meters
- It accepts both linear and digital inputs
- It can operate from 1.5 to 12 Volts-DC
- It is approximately the size of a standard postage stamp.

7.4.2 RF RECEIVER



- pin 1 : Gnd
- pin 2 : Digital Output
- pin 3 : Linear Output
- pin 4 : Vcc
- pin 5 : Vcc
- pin 6 : Gnd
- pin 7 : Gnd
- pin 8 :Ant (About 30 - 35 cm)

Fig 7.7 Rf Receiver

- It also operates at 433.92MHz, and has a sensitivity of 3uV.
- It operates from 4.5 to 5.5 volts-DC,
- It has both linear and digital outputs.

• **7.5 HT 12E ENCODER:**

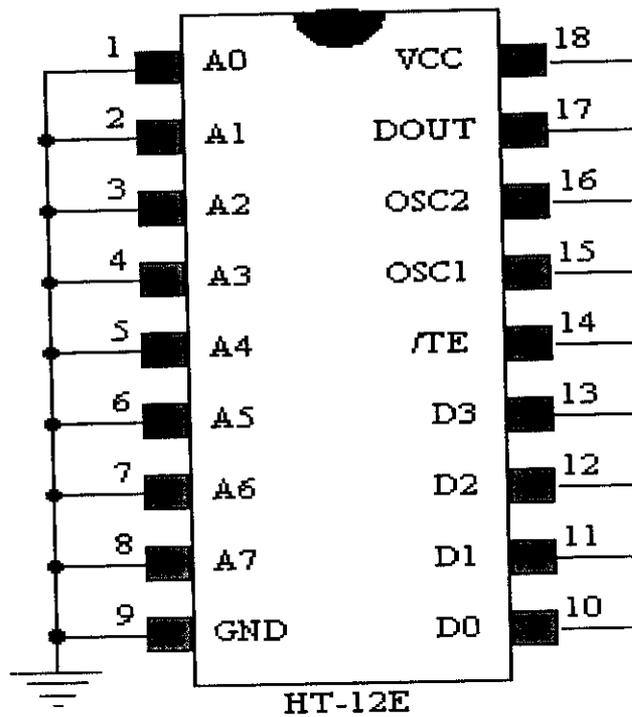


Fig 7.8 HT 12E Encoder

7.5.1 FEATURES:

- Operating voltage:2.4V~12V for the HT12E
- Low power and high noise immunity
- CMOS technology
- Minimum transmission word's of 4 words for the HT12E
- Built-in oscillator needs only 5% resistor
- Data code has positive polarity
- Minimal external components
- HT12E: 18-pin DIP/20-pin SOP package

7.6 HT 12D DECODER:

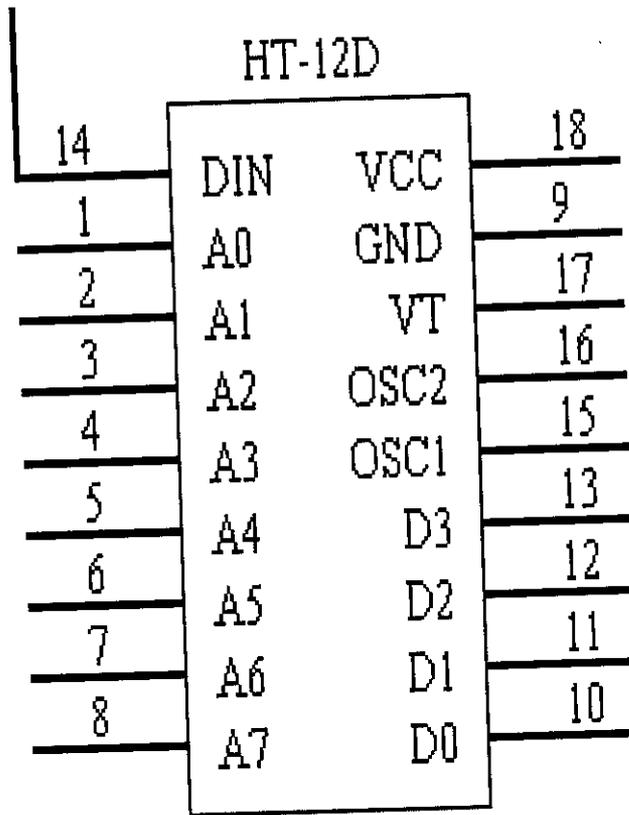


Fig 7.9 HT 12D Decoder

7.6.1 FEATURES:

- Operating voltage: 2.4V~12V
- Low power and high noise immunity
- CMOS technology
- Low standby current
- Capable of decoding 12 bits of information
- Binary address setting
- Received codes are checked 3 times
- Address/Data number combination

- - HT12D: 8 address bits and 4 data bits
- Built-in oscillator needs only 5% resistor
- Valid transmission indicator
- Easy interface with an RF transmission medium
- Minimal external components
- Pair with Holtek's 212 series of encoders
- 18-pin DIP, 20-pin SOP package

CHAPTER-8

CONCLUSION

The progress in science and technology is a nonstop process. New things and new technology are being invented. As the technology grows day by day, we can imagine about the future in which thing we may occupy every place.

The proposed system is found to be more compact, and less complex. The project “An Adaptive Hands free Technique For Mobile Communication” is both software and hardware controlled. Thus, this project decreases the risk of causing accidents.

Appendix-9

Appendix

28/40-pin High Performance, Enhanced FLASH Microcontrollers with 10-Bit A/D

High Performance RISC CPU:

- C compiler optimized architecture/instruction set
 - Source code compatible with the PIC16 and PIC17 instruction sets
- Linear program memory addressing to 32 Kbytes
- Linear data memory addressing to 1.5 Kbytes

Device	On-Chip Program Memory		On-Chip RAM (bytes)	Data EEPROM (bytes)
	FLASH (bytes)	# Single Word Instructions		
PIC18F242	16K	8192	768	256
PIC18F252	32K	16384	1536	256
PIC18F442	16K	8192	768	256
PIC18F452	32K	16384	1536	256

- Up to 10 MIPS operation:
 - DC - 40 MHz osc./clock input
 - 4 MHz - 10 MHz osc./clock input with PLL active
- 16-bit wide instructions, 8-bit wide data path
- Priority levels for interrupts
- 8 x 8 Single Cycle Hardware Multiplier

Peripheral Features:

- High current sink/source 25 mA/25 mA
- Three external interrupt pins
- Timer0 module: 8-bit/16-bit timer/counter with 8-bit programmable prescaler
- Timer1 module: 16-bit timer/counter
- Timer2 module: 8-bit timer/counter with 8-bit period register (time-base for PWM)
- Timer3 module: 16-bit timer/counter
- Secondary oscillator clock option - Timer1/Timer3
- Two Capture/Compare/PWM (CCP) modules. CCP pins that can be configured as:
 - Capture input: capture is 16-bit, max. resolution 6.25 ns ($T_{CY}/16$)
 - Compare is 16-bit, max. resolution 100 ns (T_{CY})
 - PWM output: PWM resolution is 1- to 10-bit, max. PWM freq. @: 8-bit resolution = 156 kHz
10-bit resolution = 39 kHz
- Master Synchronous Serial Port (MSSP) module, Two modes of operation:
 - 3-wire SPI™ (supports all 4 SPI modes)
 - I²C™ Master and Slave mode

Peripheral Features (Continued):

- Addressable USART module:
 - Supports RS-485 and RS-232
- Parallel Slave Port (PSP) module

Analog Features:

- Compatible 10-bit Analog-to-Digital Converter module (A/D) with:
 - Fast sampling rate
 - Conversion available during SLEEP
 - Linearity ≤ 1 LSB
- Programmable Low Voltage Detection (PLVD)
 - Supports interrupt on-Low Voltage Detection
- Programmable Brown-out Reset (BOR)

Special Microcontroller Features:

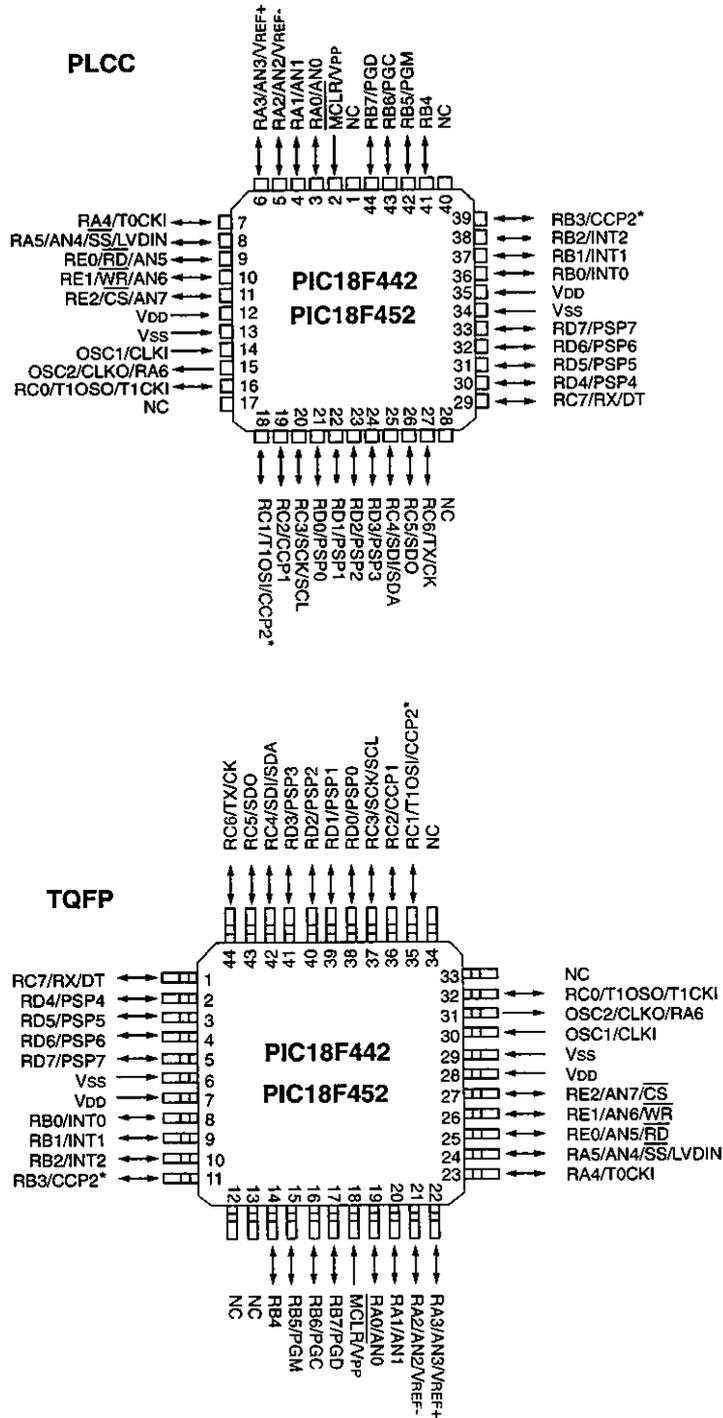
- 100,000 erase/write cycle Enhanced FLASH program memory typical
- 1,000,000 erase/write cycle Data EEPROM memory
- FLASH/Data EEPROM Retention: > 40 years
- Self-reprogrammable under software control
- Power-on Reset (POR), Power-up Timer (PWRT) and Oscillator Start-up Timer (OST)
- Watchdog Timer (WDT) with its own On-Chip RC Oscillator for reliable operation
- Programmable code protection
- Power saving SLEEP mode
- Selectable oscillator options including:
 - 4X Phase Lock Loop (of primary oscillator)
 - Secondary Oscillator (32 kHz) clock input
- Single supply 5V In-Circuit Serial Programming™ (ICSP™) via two pins
- In-Circuit Debug (ICD) via two pins

CMOS Technology:

- Low power, high speed FLASH/EEPROM technology
- Fully static design
- Wide operating voltage range (2.0V to 5.5V)
- Industrial and Extended temperature ranges
- Low power consumption:
 - < 1.6 mA typical @ 5V, 4 MHz
 - 25 μ A typical @ 3V, 32 kHz
 - < 0.2 μ A typical standby current

PIC18FXX2

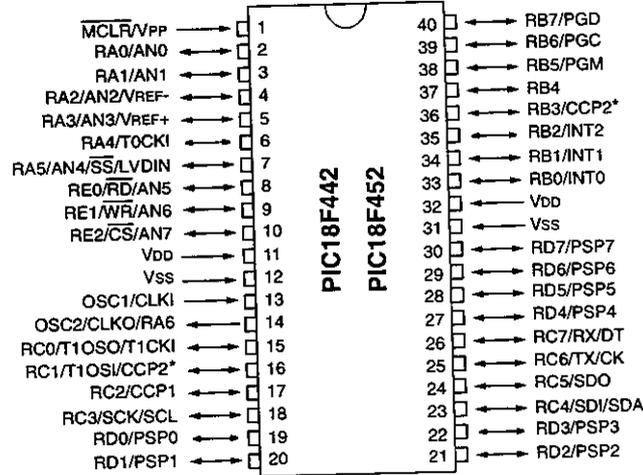
Pin Diagrams



* RB3 is the alternate pin for the CCP2 pin multiplexing.

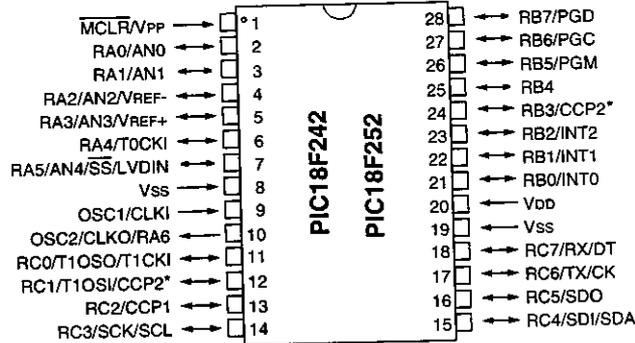
Pin Diagrams (Cont.'d)

DIP



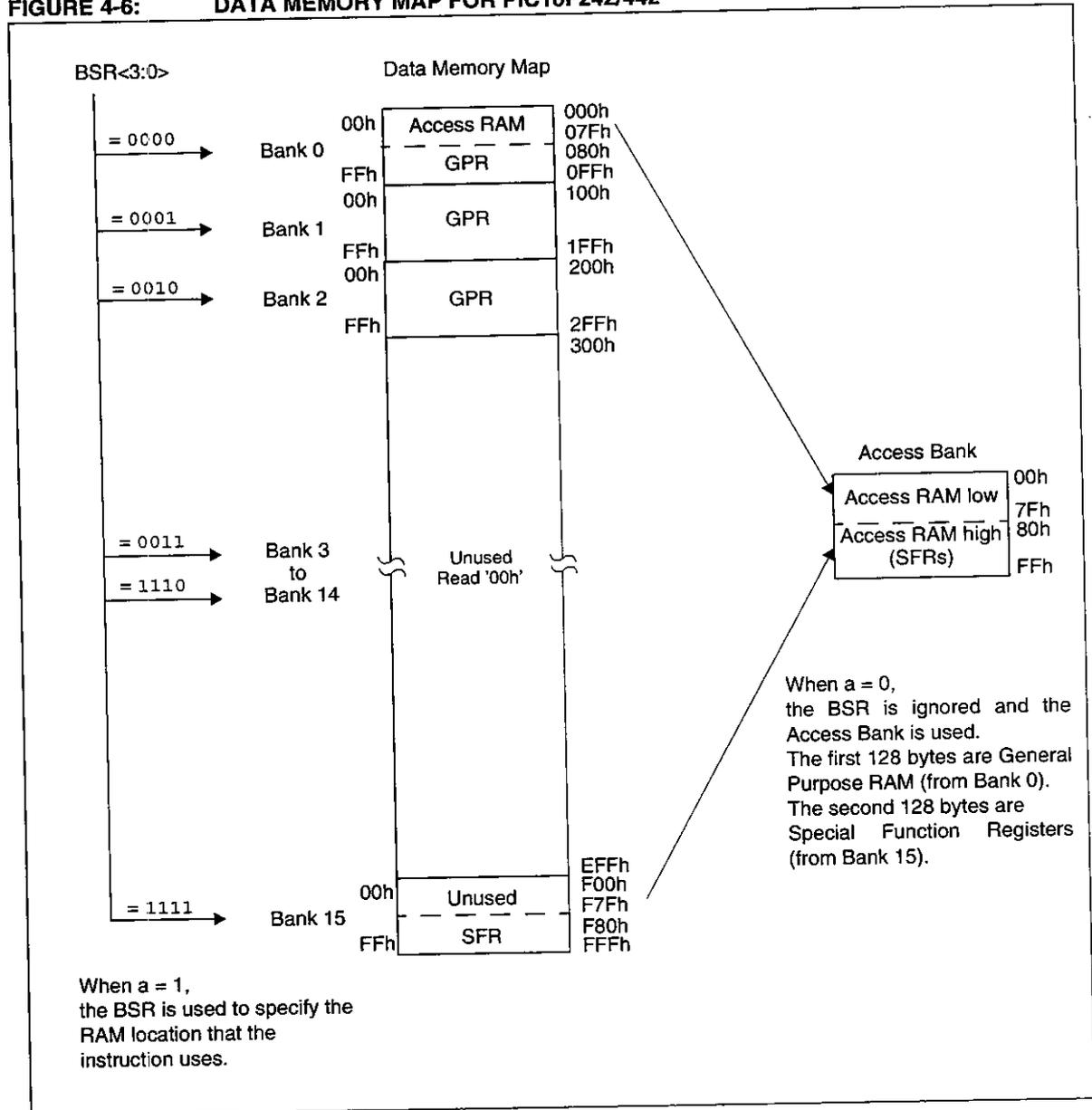
Note: Pin compatible with 40-pin PIC16C7X devices.

DIP, SOIC



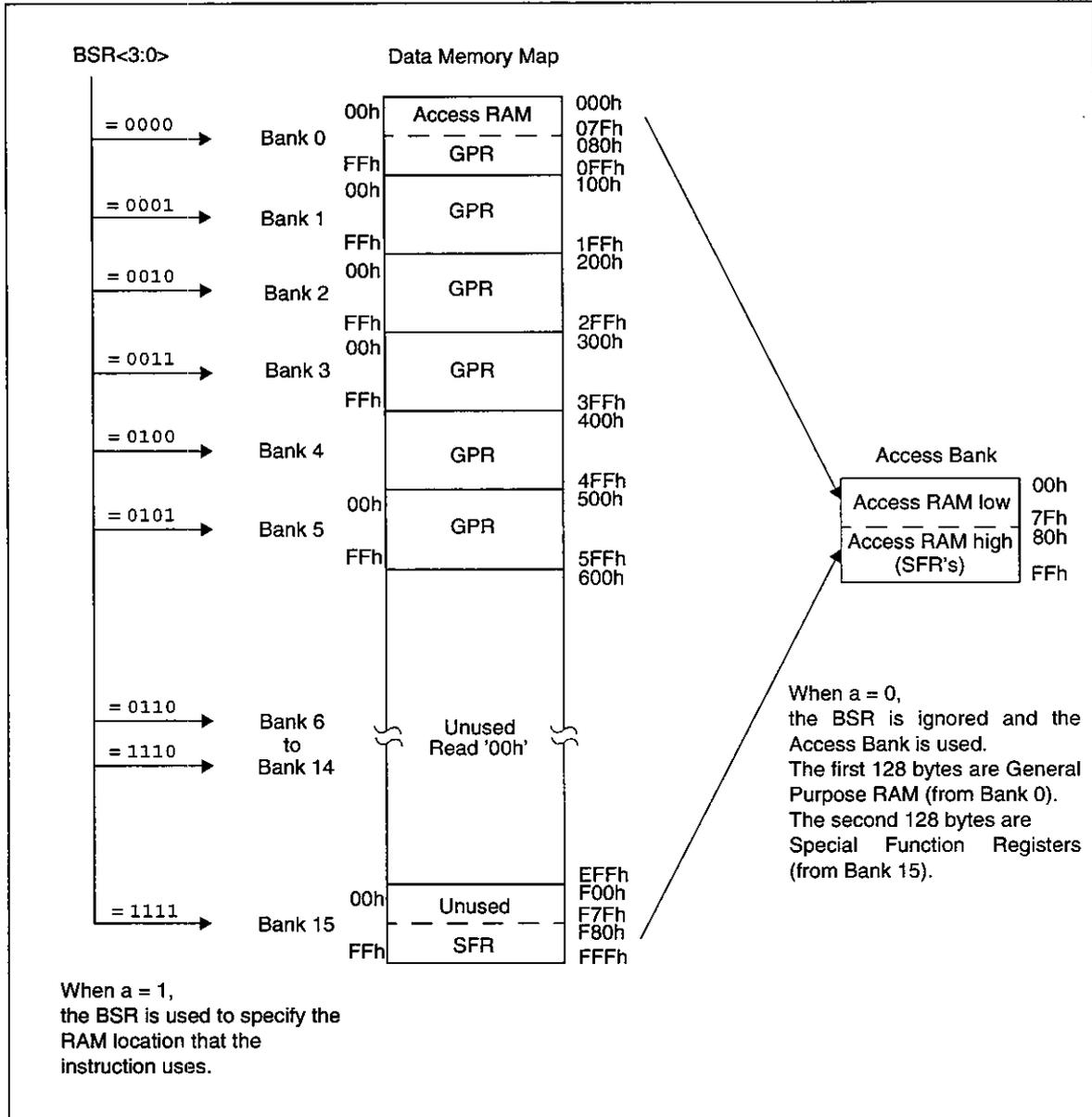
* RB3 is the alternate pin for the CCP2 pin multiplexing.

FIGURE 4-6: DATA MEMORY MAP FOR PIC18F242/442



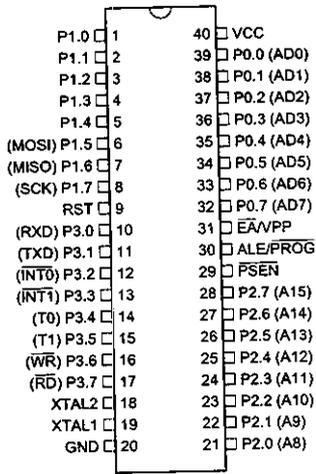
PIC18FXX2

FIGURE 4-7: DATA MEMORY MAP FOR PIC18F252/452

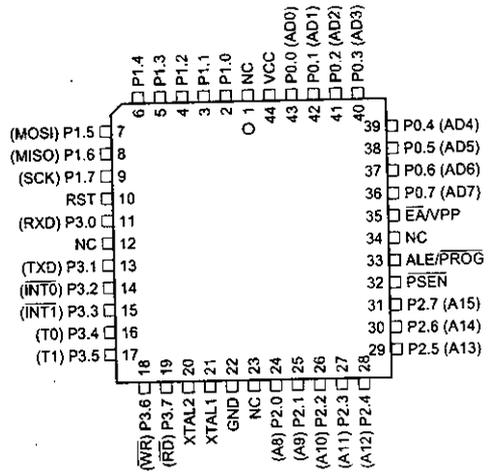


Pin Configurations

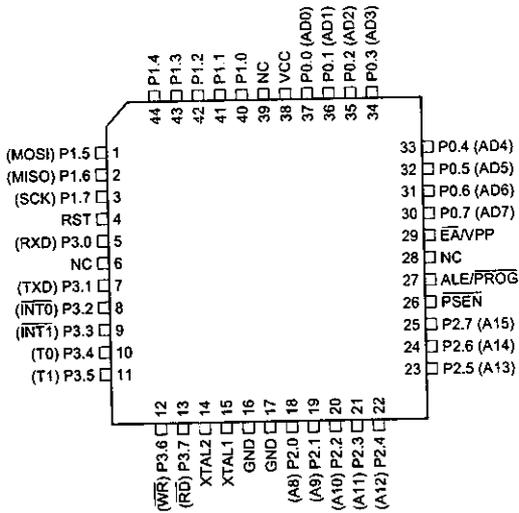
PDIP



PLCC



TQFP





Absolute Maximum Ratings*

Operating Temperature.....	-55°C to +125°C
Storage Temperature.....	-65°C to +150°C
Voltage on Any Pin with Respect to Ground.....	-1.0V to +7.0V
Maximum Operating Voltage.....	6.6V
DC Output Current.....	15.0 mA

*NOTICE: Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

DC Characteristics

The values shown in this table are valid for $T_A = -40^\circ\text{C}$ to 85°C and $V_{CC} = 4.0\text{V}$ to 5.5V , unless otherwise noted.

Symbol	Parameter	Condition	Min	Max	Units
V_{IL}	Input Low Voltage	(Except \overline{EA})	-0.5	$0.2 V_{CC} - 0.1$	V
V_{IL1}	Input Low Voltage (\overline{EA})		-0.5	$0.2 V_{CC} - 0.3$	V
V_{IH}	Input High Voltage	(Except XTAL1, RST)	$0.2 V_{CC} + 0.9$	$V_{CC} + 0.5$	V
V_{IH1}	Input High Voltage	(XTAL1, RST)	$0.7 V_{CC}$	$V_{CC} + 0.5$	V
V_{OL}	Output Low Voltage ⁽¹⁾ (Ports 1,2,3)	$I_{OL} = 1.6 \text{ mA}$		0.45	V
V_{OL1}	Output Low Voltage ⁽¹⁾ (Port 0, ALE, \overline{PSEN})	$I_{OL} = 3.2 \text{ mA}$		0.45	V
V_{OH}	Output High Voltage (Ports 1,2,3, ALE, \overline{PSEN})	$I_{OH} = -60 \mu\text{A}$, $V_{CC} = 5\text{V} \pm 10\%$	2.4		V
		$I_{OH} = -25 \mu\text{A}$	$0.75 V_{CC}$		V
		$I_{OH} = -10 \mu\text{A}$	$0.9 V_{CC}$		V
V_{OH1}	Output High Voltage (Port 0 in External Bus Mode)	$I_{OH} = -800 \mu\text{A}$, $V_{CC} = 5\text{V} \pm 10\%$	2.4		V
		$I_{OH} = -300 \mu\text{A}$	$0.75 V_{CC}$		V
		$I_{OH} = -80 \mu\text{A}$	$0.9 V_{CC}$		V
I_{IL}	Logical 0 Input Current (Ports 1,2,3)	$V_{IN} = 0.45\text{V}$		-50	μA
I_{TL}	Logical 1 to 0 Transition Current (Ports 1,2,3)	$V_{IN} = 2\text{V}$, $V_{CC} = 5\text{V} \pm 10\%$		-650	μA
I_{LI}	Input Leakage Current (Port 0, \overline{EA})	$0.45 < V_{IN} < V_{CC}$		± 10	μA
RRST	Reset Pulldown Resistor		50	300	$\text{K}\Omega$
C_{iO}	Pin Capacitance	Test Freq. = 1 MHz, $T_A = 25^\circ\text{C}$		10	pF
I_{CC}	Power Supply Current	Active Mode, 12 MHz		25	mA
		Idle Mode, 12 MHz		6.5	mA
		Power-down Mode ⁽²⁾	$V_{CC} = 5.5\text{V}$		50

- Notes: 1. Under steady state (non-transient) conditions, I_{OL} must be externally limited as follows:
 Maximum I_{OL} per port pin: 10 mA
 Maximum I_{OL} per 8-bit port:
 Port 0: 26 mA Ports 1, 2, 3: 15 mA
 Maximum total I_{OL} for all output pins: 71 mA
 If I_{OL} exceeds the test condition, V_{OL} may exceed the related specification. Pins are not guaranteed to sink current greater than the listed test conditions.
2. Minimum V_{CC} for Power-down is 2V.

AC Characteristics

Under operating conditions, load capacitance for Port 0, ALE/ $\overline{\text{PROG}}$, and $\overline{\text{PSEN}}$ = 100 pF; load capacitance for all other outputs = 80 pF.

External Program and Data Memory Characteristics

Symbol	Parameter	12 MHz Oscillator		Variable Oscillator		Units
		Min	Max	Min	Max	
$1/t_{\text{CLCL}}$	Oscillator Frequency			0	33	MHz
t_{LHL}	ALE Pulse Width	127		$2t_{\text{CLCL}}-40$		ns
t_{AVLL}	Address Valid to ALE Low	43		$t_{\text{CLCL}}-25$		ns
t_{LLAX}	Address Hold After ALE Low	48		$t_{\text{CLCL}}-25$		ns
t_{LLIV}	ALE Low to Valid Instruction In		233		$4t_{\text{CLCL}}-65$	ns
t_{LLPL}	ALE Low to $\overline{\text{PSEN}}$ Low	43		$t_{\text{CLCL}}-25$		ns
t_{PLPH}	$\overline{\text{PSEN}}$ Pulse Width	205		$3t_{\text{CLCL}}-45$		ns
t_{PLIV}	$\overline{\text{PSEN}}$ Low to Valid Instruction In		145		$3t_{\text{CLCL}}-60$	ns
t_{PXIX}	Input Instruction Hold After $\overline{\text{PSEN}}$	0		0		ns
t_{PXIZ}	Input Instruction Float After $\overline{\text{PSEN}}$		59		$t_{\text{CLCL}}-25$	ns
t_{PXAV}	$\overline{\text{PSEN}}$ to Address Valid	75		$t_{\text{CLCL}}-8$		ns
t_{AVIV}	Address to Valid Instruction In		312		$5t_{\text{CLCL}}-80$	ns
t_{PLAZ}	$\overline{\text{PSEN}}$ Low to Address Float		10		10	ns
t_{RLRH}	$\overline{\text{RD}}$ Pulse Width	400		$6t_{\text{CLCL}}-100$		ns
t_{WLWH}	$\overline{\text{WR}}$ Pulse Width	400		$6t_{\text{CLCL}}-100$		ns
t_{RLDV}	$\overline{\text{RD}}$ Low to Valid Data In		252		$5t_{\text{CLCL}}-90$	ns
t_{RHDX}	Data Hold After $\overline{\text{RD}}$	0		0		ns
t_{RHDX}	Data Float After $\overline{\text{RD}}$		97		$2t_{\text{CLCL}}-28$	ns
t_{LLDV}	ALE Low to Valid Data In		517		$8t_{\text{CLCL}}-150$	ns
t_{AVDV}	Address to Valid Data In		585		$9t_{\text{CLCL}}-165$	ns
t_{LLWL}	ALE Low to $\overline{\text{RD}}$ or $\overline{\text{WR}}$ Low	200	300	$3t_{\text{CLCL}}-50$	$3t_{\text{CLCL}}+50$	ns
t_{AVWL}	Address to $\overline{\text{RD}}$ or $\overline{\text{WR}}$ Low	203		$4t_{\text{CLCL}}-75$		ns
t_{QVWX}	Data Valid to $\overline{\text{WR}}$ Transition	23		$t_{\text{CLCL}}-30$		ns
t_{QVWH}	Data Valid to $\overline{\text{WR}}$ High	433		$7t_{\text{CLCL}}-130$		ns
t_{WHQX}	Data Hold After $\overline{\text{WR}}$	33		$t_{\text{CLCL}}-25$		ns
t_{RLAZ}	$\overline{\text{RD}}$ Low to Address Float		0		0	ns
t_{WHLH}	$\overline{\text{RD}}$ or $\overline{\text{WR}}$ High to ALE High	43	123	$t_{\text{CLCL}}-25$	$t_{\text{CLCL}}+25$	ns



1. Application

This specification applies to A4 size color contact image sensor unit HD12D-W01.

2. Outline

The contact-type image sensor unit, HD12D-W01, consists of a rod lens array, RGB LED, light-guide and a substrate on which a line Sensor is mounted.

3. Specifications

Item	HD12D-W01	Remarks
Effective scanning length	216mm	
Effective picture elements	10208	1200DPI
Sensor elements	10296	936×11
Scanning density	1200DPI/600DPI/300DPI	Mode selectable
CLK frequency	max 5.5MHz	
Storage time	1200DPI Color; 0.36ms×3 600DPI Color; 0.19ms×3 300DPI Color; 0.11ms×3	Red, Green, Blue
Bright output(Peak Value)	0.6V	R/G/B
Photoresponse nonuniformity	±40%	
Signal output	6 analog output (Vout)	
Optical Part	Lens Array	
Luminous source(LED)	λ_d (Red)=620nm λ_d (Green)=530nm λ_d (Blue)=467nm	Typical Value
Power supply	Vcc +3.3V $I_{LED}(R,G,B) 50mA \times 2$	RGB各2素子

4. Pin Condition

No.	IN/OUT	Pin Condition
1	OUT	Vout5
2	IN	GND (Analog)
3	OUT	Vout4
4	IN	GND (Analog)
5	OUT	Vout3
6	IN	GND (Analog)
7	OUT	Vout2
8	IN	GND (Analog)
9	OUT	Vout1
10	IN	GND (Analog)
11	OUT	Vout0
12	IN	GND (Analog)
13	IN	MODE (1200DPI=Hi/Hi, 600DPI=Lo/Lo)
14	IN	GND (Analog)
15	IN	Vcc
16	IN	Vcc
17	IN	VREF
18	IN	SP
19	IN	GND (Analog)
20	IN	CLK
21	IN	LED Anode (Common)1
22	IN	Blue LED Cathode1
23	IN	Green LED Cathode1
24	IN	Red LED Cathode1
25	IN	LED Anode (Common)2
26	IN	Blue LED Cathode2
27	IN	Green LED Cathode2
28	IN	Red LED Cathode2

Chapter-10

References

REFERENCES

IEEE PAPER REFERENCE:

Vince Stanford, “ Pervasive computing goes the last hundred feet with RFID systems”, IEEE pervasive computing published in 2003.

BOOK REFERENCE:

- Mobile Communication by technical publications, second revised edition by Theodore.S.Rappaport.
- Designing Embedded Systems with PIC microcontroller,developer reference, 4th edition by Douglas Boling.

WEBSITE REFERENCE:

- www.keil.com
- www.wavecom.com
- www.microcontroller.com
- www.rentron.com
- www.flashprogrammer.com