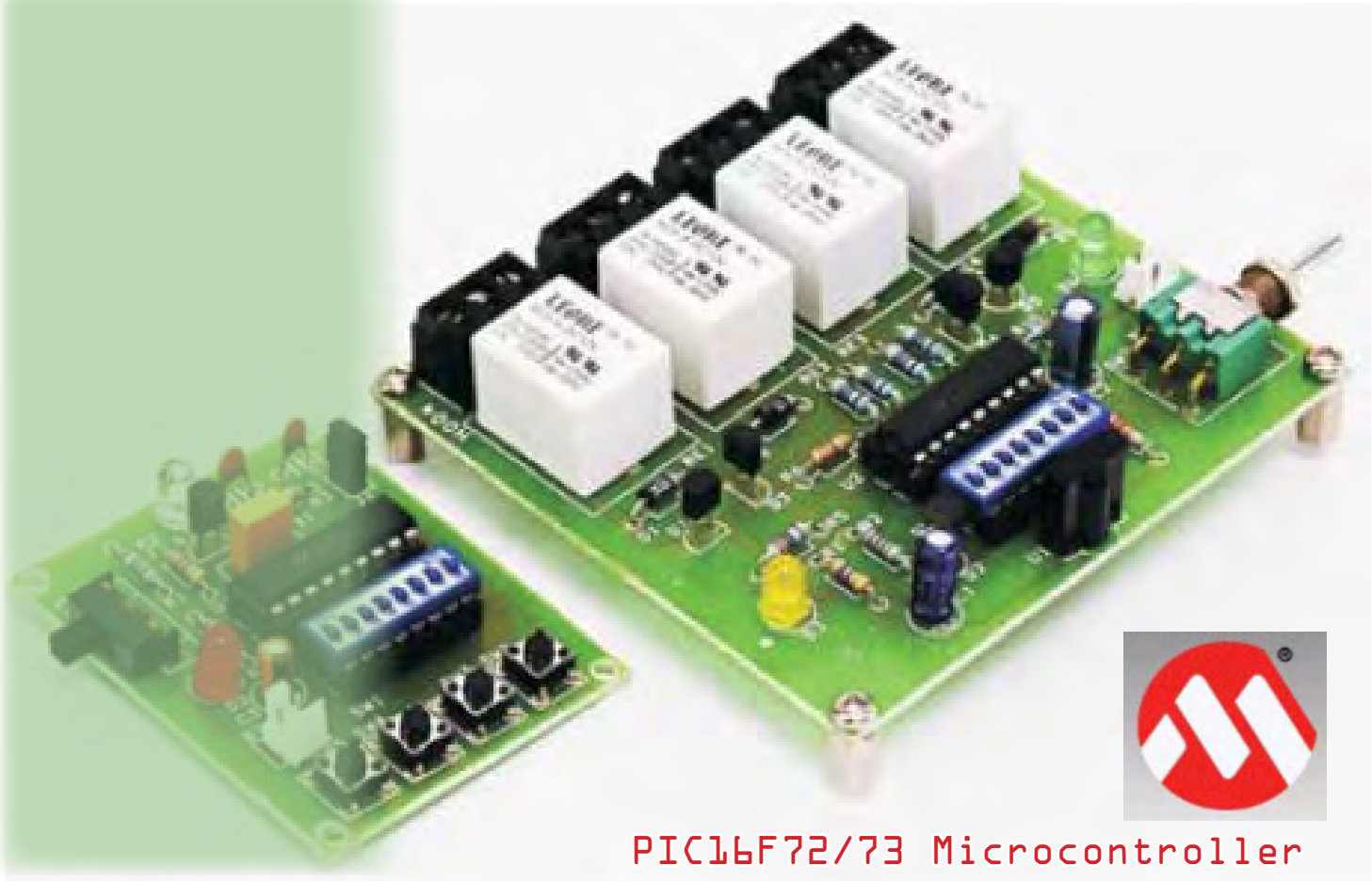
Wireless RF Module Using PIC Controller

Six Weeks Summer Training Report



PIC16F72/73 Microcontroller

An RF module is a small electronic circuit used to transmit, receive, or transceive radio waves on one of a number of carrier frequencies. RF modules are widely used in consumer applications such as garage door openers, wireless alarm systems, industrial remote controls, smart sensor applications, weather monitoring system, RFID, wireless mouse technology and wireless home automation systems. They are often used instead of infrared remote controls as they have the advantage of not requiring line-of-sight operation.

Project By Abhi Sharma

ABSTRACT

The Radio Frequency Module is basically a PIC Microcontroller Based Wireless Communication System. Wireless RF Module Technology enables a vast edge to any electronics project & provide many consistent advantages, which leads it to today's up-to-date technology. An RF module is a small electronic circuit used to transmit, receive, or transceive a radio waves on one of a number of carrier frequencies. RF modules are widely used in consumer applications such as garage door openers, wireless alarm systems, industrial remote controls, smart sensor applications and wireless home automation systems. They are often used instead of infrared remote controls as they have the advantage of not requiring line-of-sight operation.

Radio Frequency involves two sub units Named, Transmitter & Receiver. As their name implies transmitter is used to transmit or to send the data from input & it convert into serial port data by using HT12E encoder. This encoded data get received by receiver placing far away from it. The first job that a receiver do after receiving it, Is to convert or decode the data into parallel ports by using HT12D decoder. After converting the data into parallel form we simply connect the receiver side circuit with relay so that we can operate AC devices (e.g. Bulb, Tube, Fan etc.) with RF Module.

And, About The Matter Technology that I have used is PIC16F73. The Technology of Any Project is Considered as The Heart as well as The Mind To It. The Biggest Concern To Any Student Or Trainee Remains That The Technology He's Going Learn Must Be Up-to-Date and Must to be In Industry's Interest. So, That's Why I've Chosen PIC Series Of Microcontrollers. They are Cost Effective, Provide Wide Availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability.

The very first thing that concern to any electronics engineering student before choosing the project is it's Applications. That means How much innovative the project is ? And How We can make it more innovative & also make it up-to-date so that it can extend to the bigger Applications of this age of Smart & Vast life.? And, Also It's Applications must be cost effective so that everyone can use it without any economical hesitation. There are numerous applications of wireless RF module. As, Today's one of the vast & leading technology Named RFID is based on this principle of RF module. The wireless mouse also work on the same principle. And, beyond them Industrial Automation, Custom Wireless Remote Controls like wireless x-ray systems & Long-Range Wireless Switch System (Hand-Held), Machine To Machine (M2M) RF Wireless Networking, Robot Control , Weather Monitoring System & Identifying Objects Using RF Transmitters And Receivers and Retrieving Data Using GSM etc. could be considered as It's Future prospects to work on. This is Indeed a great Project to work on.!

Acknowledgement

It would be inappropriate to call this report complete and successful, If I don't thank the people who guided as in the preparation of this project. The submission of this project report gives me an opportunity to convey my gratitude to all those who have helped me to reach stage from where I have immense confidence to launch my career in the competitive world of electronics engineering.

First and foremost, I would like to acknowledge my hearty thanks to the respected **Mr. |----------|,** HOD (ECE) for being a source of perpetual inspiration and for providing me such a nice environment for training with timely help.

I would also like to express my most sincere gratitude and indebtedness to my guide **Mr. |----------|** for their valuable help during the development of this project. Without his priceless suggestion and timely help I would not be able to complete this project. He has been a source of perpetual inspiration to me, towards a bright career. Not to forget the pain staking efforts of my college training and placement cell. Last but not the least I would express my utmost regards for the electronics and communication department of my Institute.

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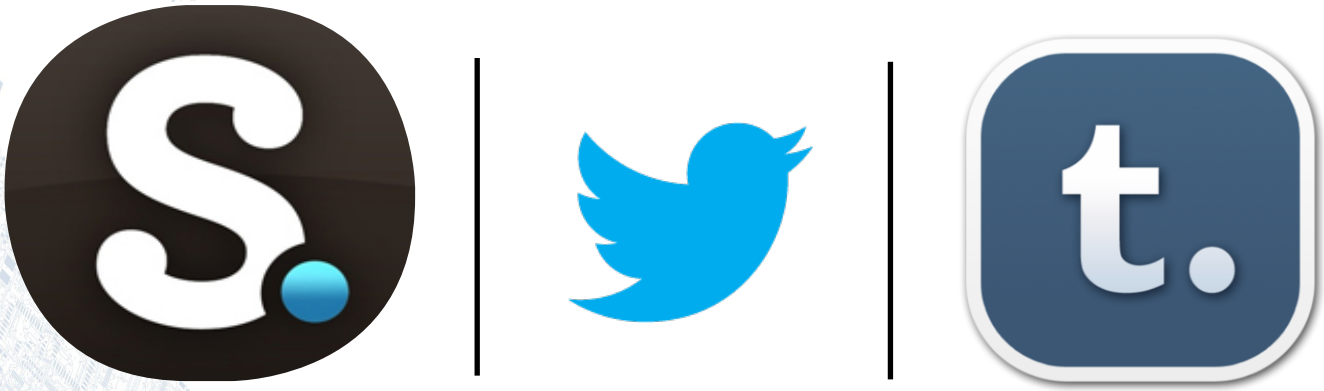

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1. INTRODUCTION

1.1 What is wireless ?

Wireless is a term used to describe telecommunications in which electromagnetic waves (rather than some form of wire) carry the signal over part or all of the communication path. Some monitoring devices, such as intrusion alarms, employ acoustic waves at frequencies above the range of human hearing; these are also sometimes classified as wireless.

Wireless technology is rapidly evolving, and is playing an increasing role in the lives of people throughout the world. In addition, ever-larger numbers of people are relying on the technology directly or indirectly. (It has been suggested that wireless is overused in some situations, creating a social nuisance.)

1.2 Examples Of Wireless Devices

- ***Cellular phones and pagers*** -- provide connectivity for portable and mobile applications, both personal and business
- ***Global Positioning System (GPS)*** -- allows drivers of cars and trucks, captains of boats and ships, and pilots of aircraft to as certain their location anywhere on earth
- ***Cordless computer peripherals*** -- the cordless mouse is a common example; keyboards and printers can also be linked to a computer via wireless
- ***Cordless telephone sets*** -- these are limited-range devices, not to be confused with cell phones
- ***Home-entertainment-system control boxes*** -- the VCR control and the TV channel control are the most common examples; some hi-fi sound systems and FM broadcast Receivers also use this technology
- ***Remote garage-door openers*** -- one of the oldest wireless Devices in common use by consumers; usually operates at Radio frequencies
- ***Two-way radios*** -- this includes Amateur and Citizens Radio Service, as well as business, marine, and military Communications
- ***Baby monitors*** -- these devices are simplified radio transmitter/receiver units with limited range
- ***Satellite television*** -- allows viewers in almost any location to select from hundreds of channels.

1.3 Radio Frequency

Radio Frequency (RF) is a rate of oscillation in the range of about 3 kHz to 300 GHz, which corresponds to the frequency of radio waves, and the alternating currents which carry radio signals. It is the use of radio signals to communicate real-time data from the warehouse floor to the WMS database and back to the floor.

This expedites processing in the warehouse. Scanners collect the data and transmit it via radio frequency to antennas located throughout the warehouse.

From the antennas, the signal proceeds to an access point that communicates with the warehouse management system. This process reduces paper, data entry time delays, cycle count processing, out of stock quantities, typing errors, and misshipments.

1.4 What is RF Module?

An RF Module is a (usually) small electronic circuit used to transmit, receive, or transceive radio waves on one of a number of carrier frequencies. RF Modules are widely used in consumer application such as garage door openers, wireless alarm systems, industrial remote controls, smart sensor applications, and wireless home automation systems. They are often used instead of infrared remote controls as they have the advantage of not requiring line-of-sight operation.

1.5 Main Factor Affecting RF Module's Performance

As with any other radio-frequency device, the performance of an RF Module will depend on a number of factors. For example, by increasing the transmitter power, a larger communication distance will be achieved. However, this will also result in a higher electrical power drain on the transmitter device, which will cause shorter operating life for battery powered devices.

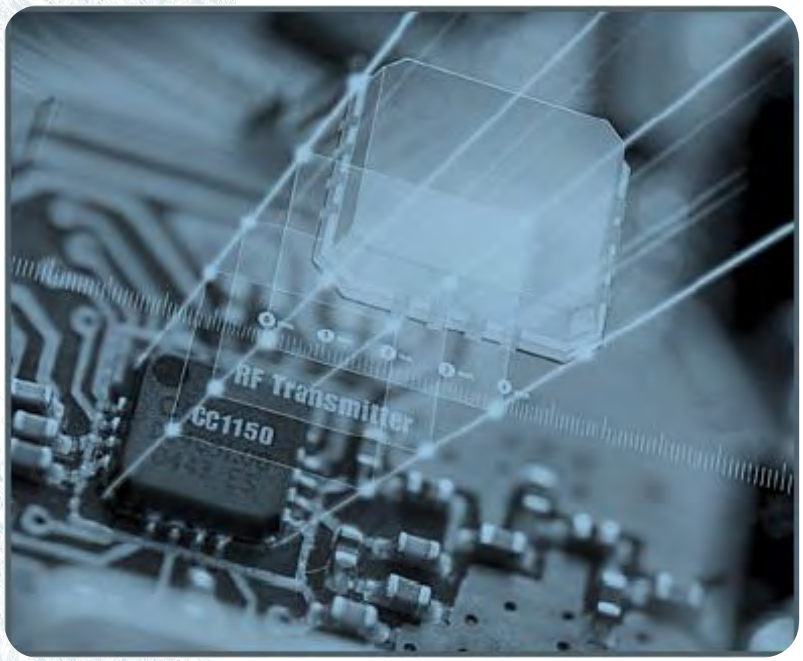
Also, using a higher transmit power will make the system more prone to interference with other RF devices, and may in fact possibly cause the device to become illegal depending on the jurisdiction.

1.6 Typical Applications/Scope of Wireless RF Module

- Vehicle Monitoring
- Remote Control
- Telemetry
- Small-Range wireless network
- Wireless meter reading
- Access control systems
- Wireless home security systems
- Area paging
- Industrial data acquisition system
- Radio tags reading
- RF contact less smart cards
- Wireless data terminals
- Wireless fire protection systems
- Biological signal acquisition
- Hydrological and meteorological monitoring
- Robot remote control
- Wireless data transmissions
- Digital video/audio transmission
- Digital home automation, such as remote light
- Industrial remote control and remote sensing
- Remote control for household appliances and Electronics projects
- Mobile web server for elderly people monitoring

2. Features Of RF Module

There are several features of wireless RF Module:



- Interference Immunity
- Low Power Required
- Receiver Sensitivity
- RF Basics
- Wireless Data Communication
- Wireless Transceiver Modules
- Reliable
- Power Efficient
- Long Range Communication
- 3KHz - 300GHz of Range
- Cost Effective
- Small size (QLP 4x4 mm package)
- True single chip UHF RF transmitter
- Frequency bands: 300-348 MHz, 400-464MHz and 800-928 MHz
- Programmable data rate up to 500kBaud
- Low current consumption
- Programmable output power up to +10dBm for all supported frequencies
- Programmable baseband modulator
- Ideal for multi-channel operation
- Very few external components:
- Completely on-chip frequency Synthesizer,
- no external filters needed
- Configurable packet handling hardware
- Suitable for frequency hopping systems due to a fast settling frequency synthesizer
- Optional Forward Error Correction with interleaving
- Many powerful digital features allow a high-performance RF system to be made using an inexpensive microcontroller
- Efficient SPI interface: All registers can be programmed with one “burst” transfer
- Integrated analog temperature sensor
- Support for asynchronous transparent transmit mode for backwards compatibility with existing radio communication protocols

The RF Transmitter and Receiver modules provide a simple to use RF data link at up to 300GHz from any standard CMOS/TTL source. The modules are very simple to operate and offers low current consumption. Data can be supplied directly from a microprocessor or encoding device, thus keeping the component count down and ensuring a low hardware cost. These modules exhibit extremely stable electronic characteristics due to the use of Etched The PCB In OrCAD Technology, which uses no adjustable components and ensures very reliable operation.

3. HARDWARE & SOFTWARE REQUIREMENTS

3.1 Input Requirements

The Wireless RF Module has following Input Requirements:

- The CPU Must Has 8-Pin Port So that The Serial Port Can Be Inserted for Burning Purposes.
- If We have a Laptop Then Universal USB To Serial Port Converter Could be Used For Burning.
- PIC IC is Most Important For Input The Source Code in It.
- Mikro C is Also used as Input Required Software.
- Any kind of sensors are also usable as input requirement.

3.2 Output Requirements

For Getting the output we can use any hardware devices as follows. It all depends upon our programming requirements. As:

- LCD Can be used To Receive The Output of the PIC.
- LED or 7-Segments offers the Same properties as of LCD.
- DC Motor or Stepper Motors or Relays are also used as output Requirement devices.
- We can also use PS/2 keyboards & ADC Ports etc.

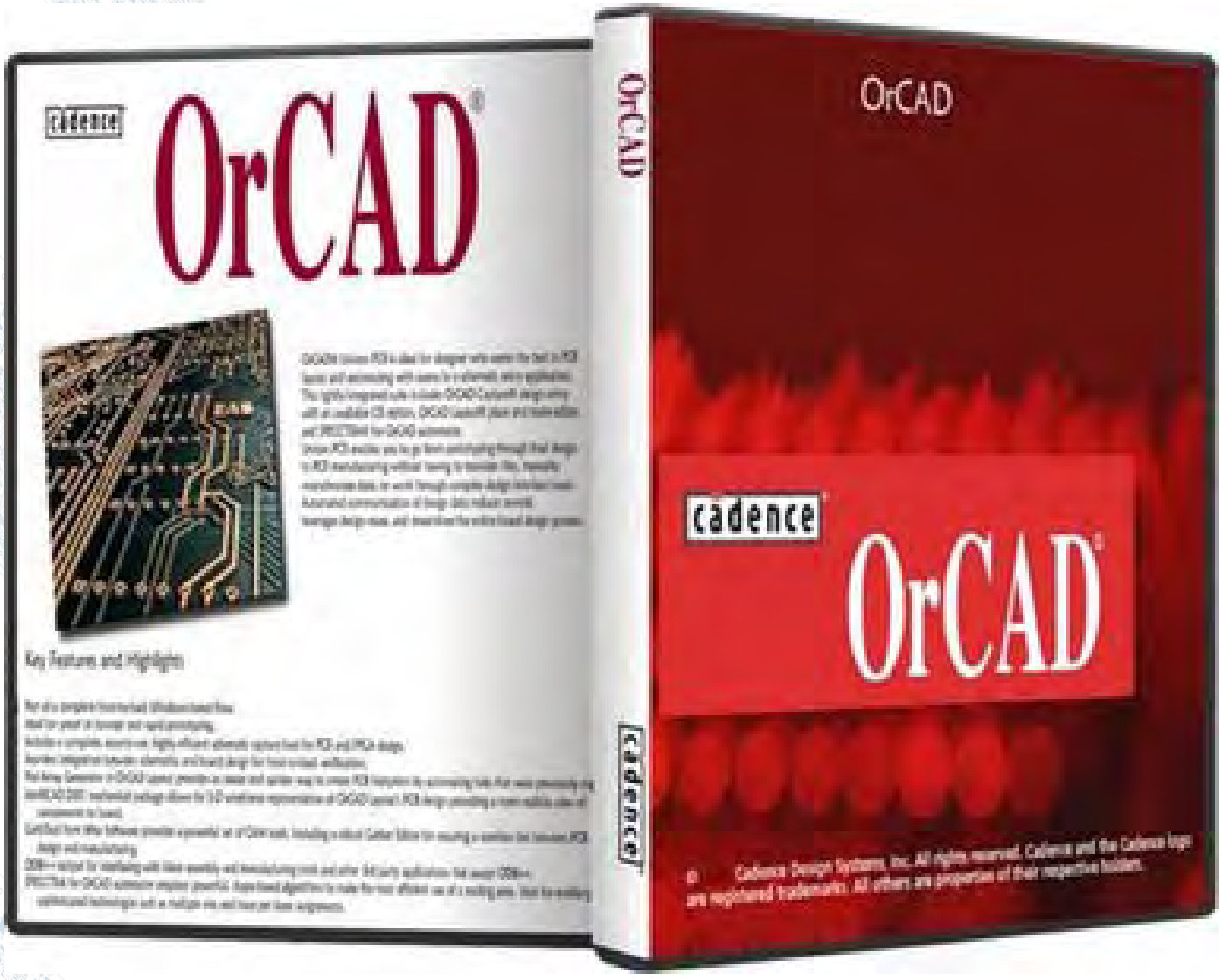
3.3 Software Requirements

- Windows , LINUX as an operating system.
- OrCAD as work space for PCB designing.
- TINA PRO for Simulation Purposes.
- Mikro C as a Compiler for Embedded C.
- PIC Burner.
- Boot Loader.

3.4 Hardware Requirements

- Pentium 4 Computer(Atleast).
- 256 MB RAM.
- Software Interfacing with PIC 16F73 Kit.
- Universal USB to Serial Port Convertor Using Laptop.
- 8-Pin serial port for burning the IC using CPU.
- Keyboard.
- Hard disk (20 GB).
- Mouse.

4. Tools Used For Development



OrCAD is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and electronic technicians to create electronic schematics and electronic prints for manufacturing printed circuit boards. The name OrCAD is a portmanteau, reflecting the company and its software's origins:

Oregon + CAD

4.1 OrCAD

The Cadence OrCAD product line provides affordable, high-performance PCB design tools that boost productivity for smaller design teams and individual PCB designers.

4.1.1 *PCB Designing*

PCB stands for “PRINTED CIRCUIT BOARD”. Printed circuit board (PCB) provides both the physical structure for mounting and holding the components as well as the electrical interconnection between the components. That means a PCB or PWB (printed wiring board) is the platform upon which electronic components such as integrated circuit chips and other components are mounted. A PCB consists of a nonconducting substrate (typically fibre glass with epoxy as resin) upon which the conductive pattern or circuitry is formed. Copper is the most prevalent conductor although nickel, silver and tin are also used in some cases.

Fig: 4.1.1 **Types Of OrCAD**

OrCad has a long history of providing individuals and teams with a complete set of technologies that offer unprecedented productivity, seamless tool integration, and exceptional value. New 10.5 release continues that tradition.
Today's lower cost and yet highly sophisticated electronic design automation systems have created a unique challenge to nearly every engineering department. Therefore the use of EDA tools has become increasingly important as product life cycles have become shorter and shorter.

Modern electronic design automation (EDA) tools are beginning to support a more efficient and integrated approach to electronic. OrCad Capture® design entry is the most widely used schematic entry system in electronic design today for one simple reason: fast and universal design entry. Whether you're designing a new analog circuit, revising schematic diagram for an existing PCB, or designing a digital block diagram with an HDL module, OrCad Capture provides simple schematic commands you need to enter, modify and verify the design for PCB. OrCad Layout ® offers PCB designers and PCB design teams the power and flexibility to create and share PCB data and constraints across the design flow. OrCad Layout delivers all the capabilities to designers need from netlist to place and route, to final output.

4.1.2 Layout Plus

Shrinking design cycles and a growing number of nets with constraints require customers to adopt PCB design methodologies that increase predictability and accelerate design turnaround. Cadence® layout and routing technology offers a scalable, easy-to-use, constraint-driven PCB design solution for simple to complex PCBs, including those with RF etch components.

Cadence® OrCAD® PCB Designer contains a fully integrated design flow that includes a constraint manager, design capture technology, component tools, a PCB editor, an auto/interactive router, and interfaces for manufacturing and mechanical CAD.

At the heart of OrCAD PCB Designer is OrCAD PCB Editor, an interactive environment for creating and editing simple to complex multi-layer PCBs. The extensive feature set addresses a wide range of design and manufacturability challenges. OrCAD PCB Designer and OrCAD PCB Designer with PSpice both include Cadence SPECCTRA® for OrCAD, the market-leading PCB solution for automatic and interactive interconnect routing.

Features

Offers a proven, scalable, easy-to-use PCB editing and routing solution that grows as needed
Tight, front-to-back application integration increases productivity and ensures data integrity
A comprehensive feature set and a seamless PCB design environment delivers a complete solution to take a design from concept to production

4.1.3 Capture CIS

OrCAD Capture provides fast and intuitive schematic design entry for PCB development or analog simulation using PSpice. The component information system (CIS) integrates with it to automatically synchronize and validate externally sourced part data.

Easy-to-use and powerful, Cadence® OrCAD® Capture is the most widely used schematic design solution, supporting both flat and hierarchal designs from the simplest to the most complex. Seamless bidirectional integration with OrCAD PCB Editor enables data synchronization and cross-probing/placing between the schematic and the board design. OrCAD Capture allows designers to back annotate layout changes, make gate/pin swaps, and change component names or values from board design to schematic using the feedback process. It also comes with a large library of schematic symbols and can export net lists in a wide variety of formats.

CIS allows designers to search, identify, and populate the design with preferred parts. With easy access to company component databases and part information, designers can reduce the amount of time spent researching needed parts.

Features

- Boosts schematic editing efficiency of complex designs through hierarchical and Variant design capabilities.
- Integrates with a robust CIS that promotes the use of preferred, current parts to Accelerate the design process and reduce project costs.
- Provides access to more than two million parts with Cadence Active Parts, Offering greater flexibility when choosing design components.

4.2 PIC Burner

This is the ultimate PIC/EEPROM programmer! The internet is full of PIC programmer software. The problem is that most of the programmers support only one type of hardware and only one operating system.

PIC Burner is very versatile software. We can use different kinds of hardware with it, because the pins used on parallel port can be set using a simple ini-file. We can also use different assemblers, because pburn can read all kinds of Intel hex file formats used (inhx32, inhx16 and inhx8m).

Features

- Linux and Windows XP/Vista/7 support
- Parallel port hardware support
- Program memory and configuration memory read/write/verify
- Data memory read/write/verify
- Reads and writes multiple hex file formats (inhx32, inhx16, inhx8m)
- Input file format auto detection
- Good documentation
- Support for serial port hardware