

# *Data Acquisition System*

**(a PC-compatible, True-RMS DVM)**

Uday Arya and Jim George  
VIII semester, E&C

## Test & Measurement needs

---

- Ease of use
- Ability to store and visualize data
- High accuracy and large dynamic range
- Basic signal processing support
- Field measurement storage
- Low cost

# Features

---

- Easy-to-use Menu Driven Interface
- High resolution (six digits)
- PC Interface
  - Logged Mode
  - Slave Mode
- True-RMS measurement
- 128 Reading Non-volatile Memory

# Features

---

- Different Averaging modes supported
- Auto-ranging support
- Analog-like Bar graph mode
- Minimum-Maximum mode
- 16x2 backlit LCD display

# Design Issues

---

- Analog Front-end Design
  - Attenuator
    - Attenuate applied voltage to within the ADC's dynamic range (512 mV)
    - Provide protection against high voltage and ESD
  - True RMS-to-DC Converter
  - Coupling selector
    - Chooses between direct input voltage and RMS-to-DC converted voltage

# Design Issues

---

- ADC
  - Easy-to-use Serial Interface (SPI)
  - 50/60 Hz Line Noise Rejection
  - Conversion rate of 13 readings/sec.
  - Noise at Input
    - Use of a ground-plane on the PCB
    - Separation of Analog and Digital sections
    - Liberal power-supply decoupling at each chip

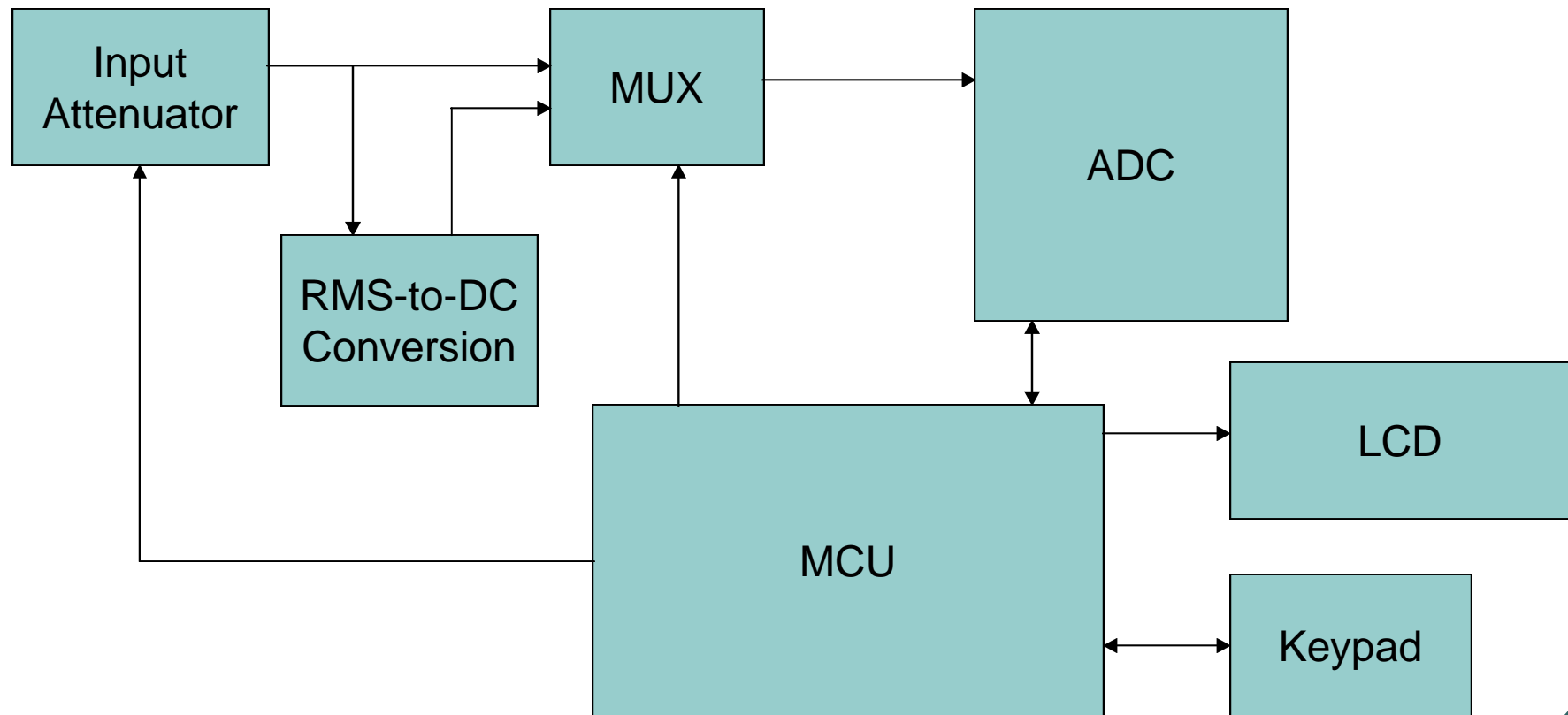
# Design Issues

---

- **Microprocessor**
  - Ease of Programming
  - Large onboard memory
    - 8k Flash program memory
    - 512 bytes EEPROM
    - 512 bytes SRAM
  - 32 bidirectional I/O ports
  - SPI and RS-232 support

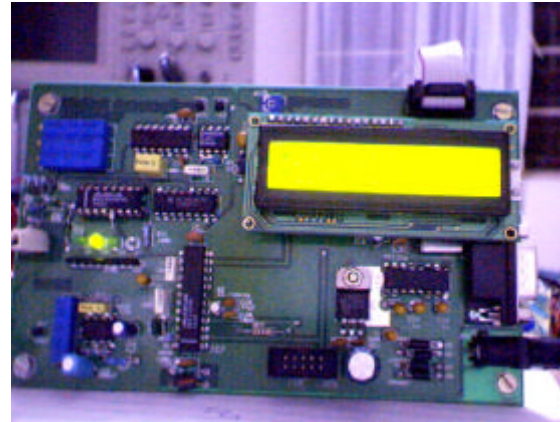
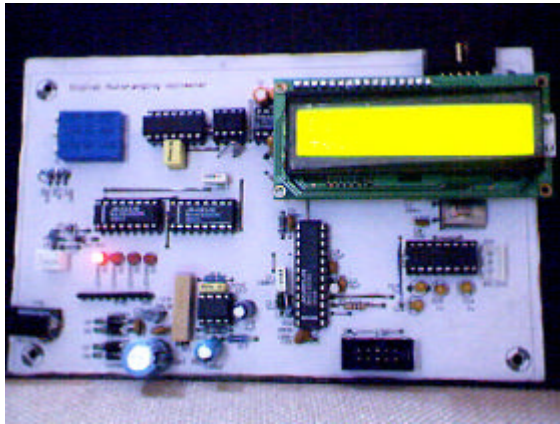
# Block Diagram

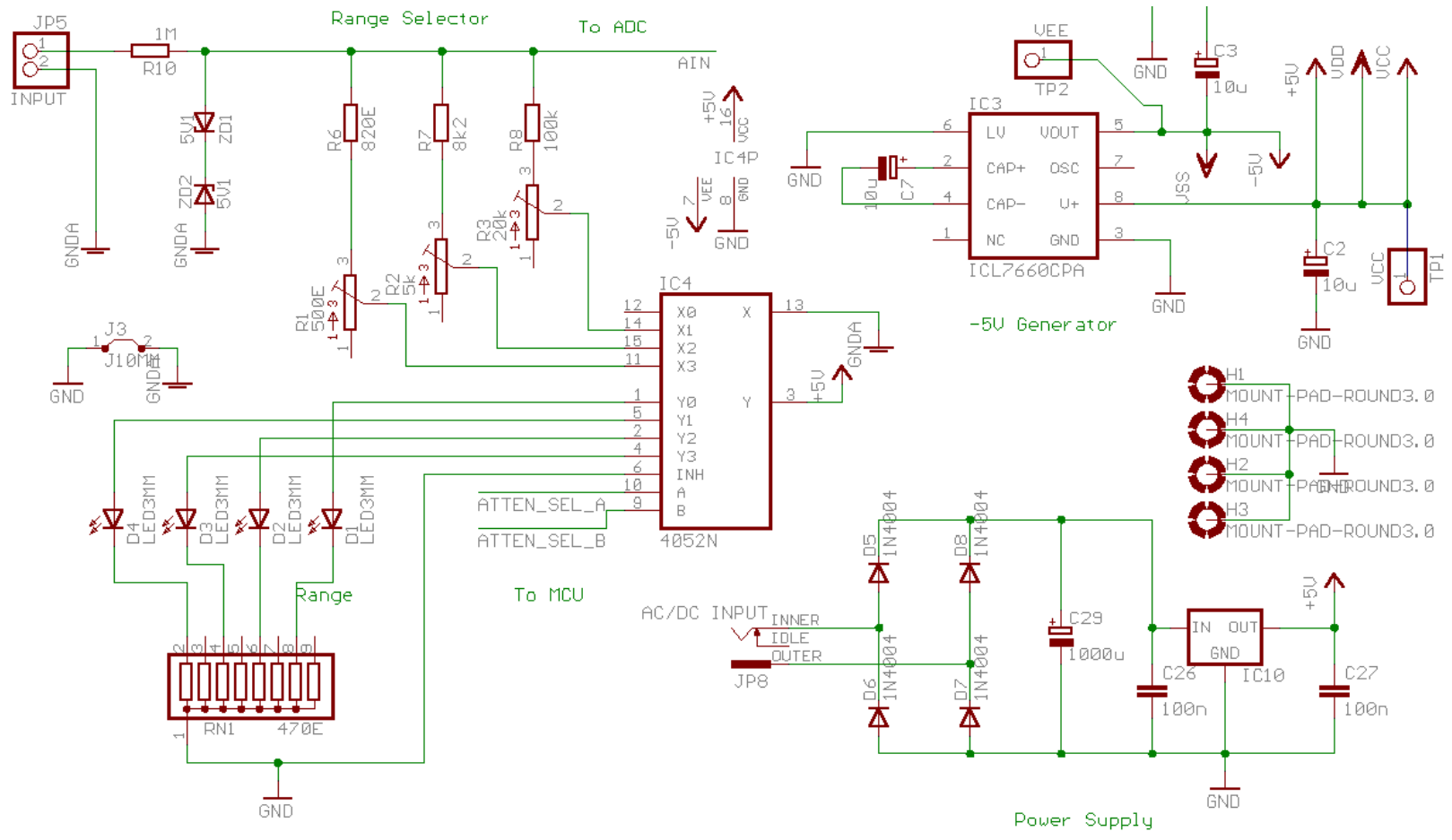
---

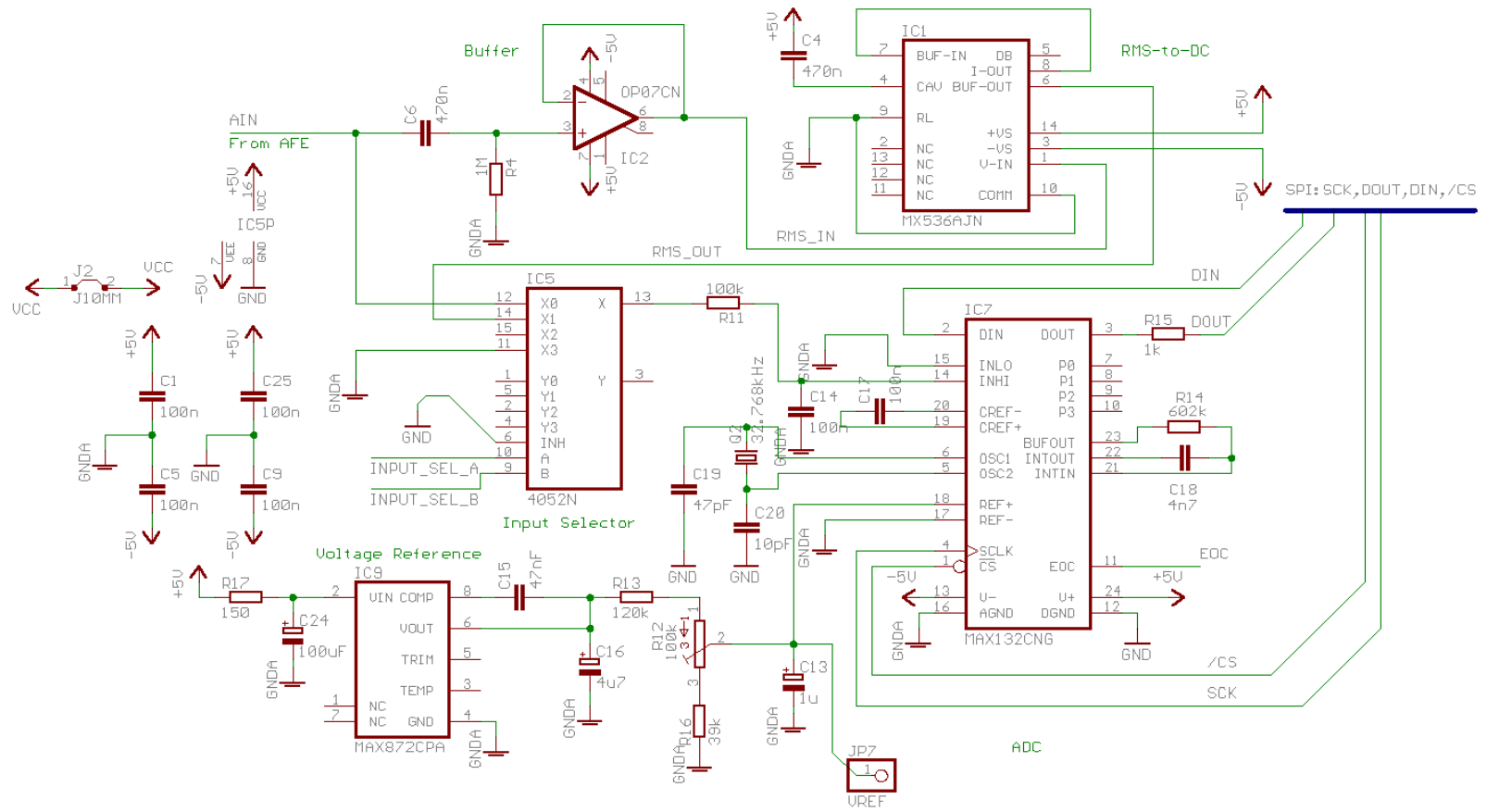


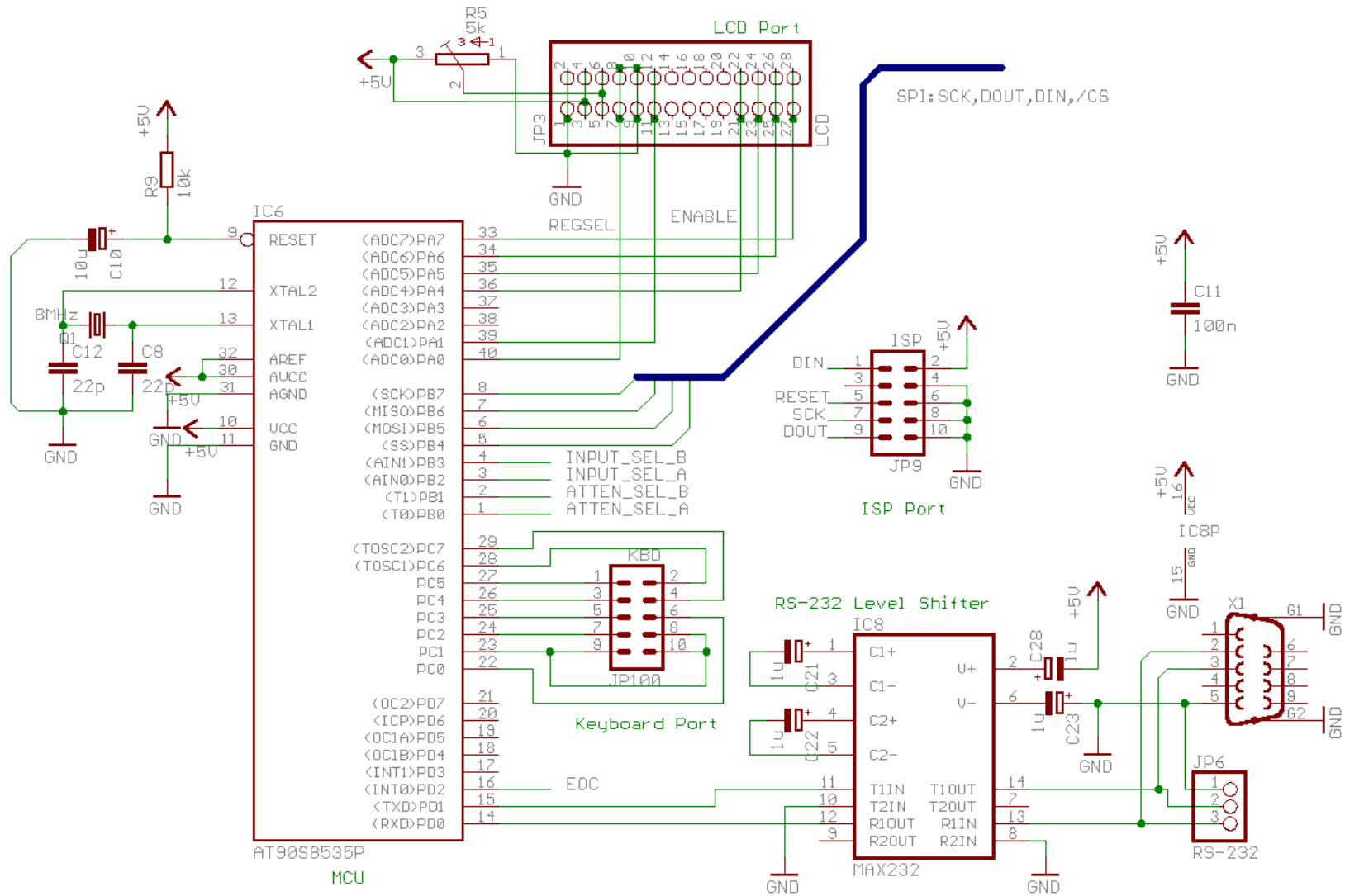


# *Schematics and Board Layout*

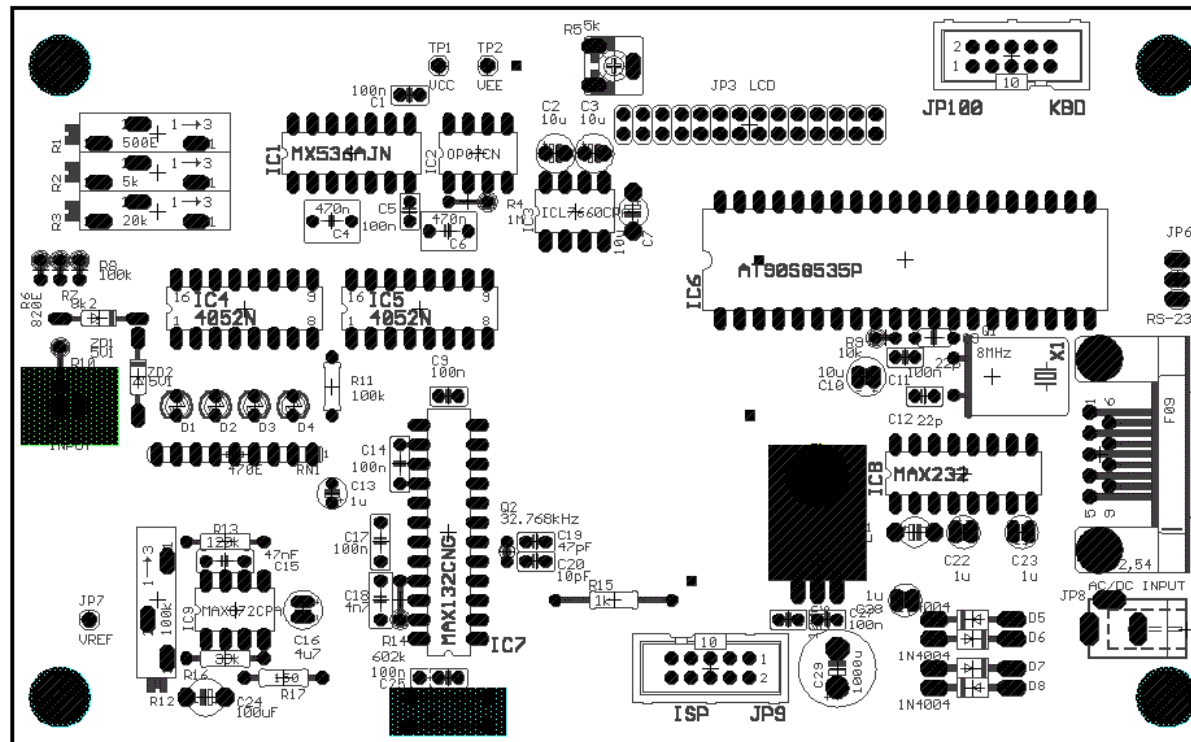




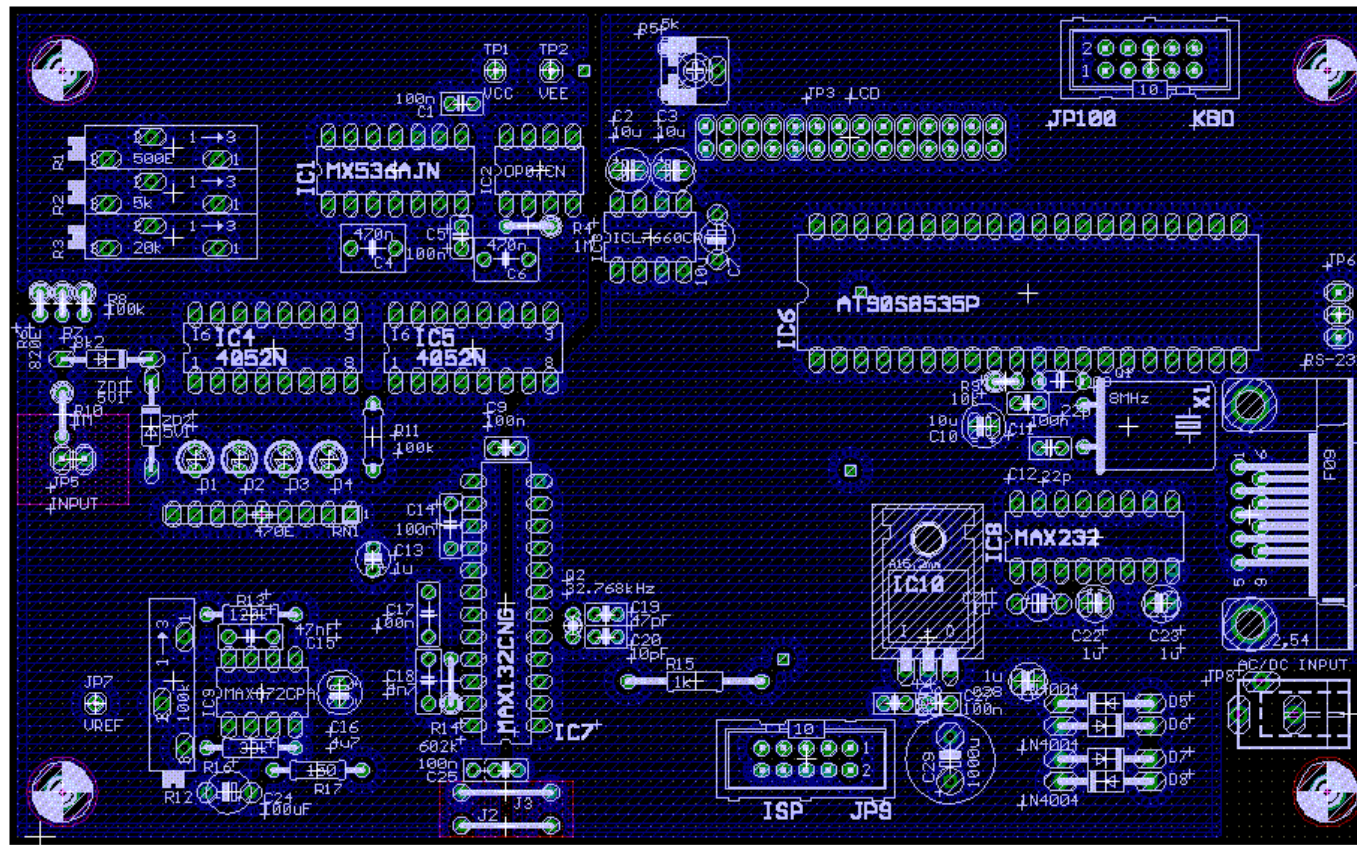




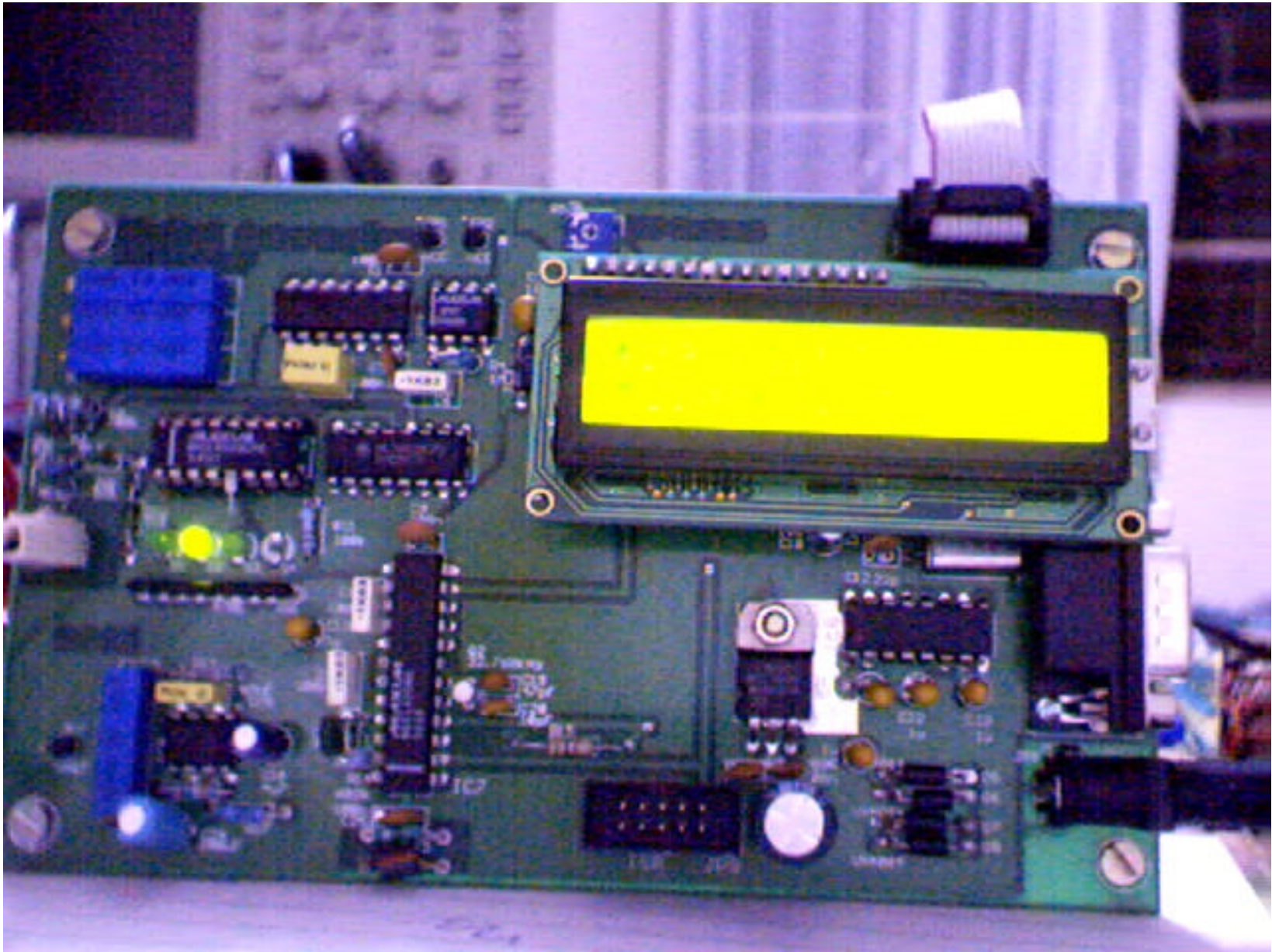
# Parts Layout (Silkscreen)



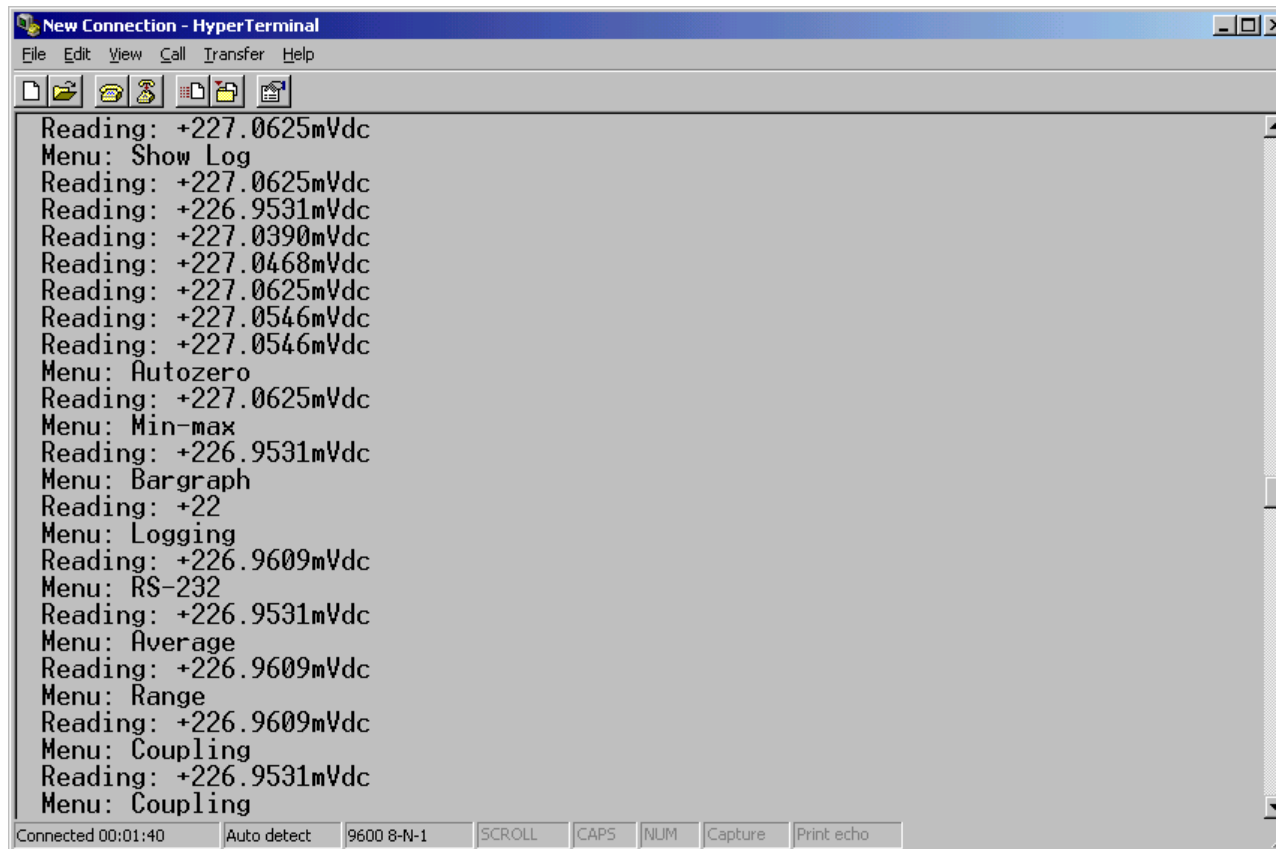
# Ground Plane Layer







# RS-232 Slave Mode Operation



```
New Connection - HyperTerminal
File Edit View Call Transfer Help
Reading: +227.0625mVdc
Menu: Show Log
Reading: +227.0625mVdc
Reading: +226.9531mVdc
Reading: +227.0390mVdc
Reading: +227.0468mVdc
Reading: +227.0625mVdc
Reading: +227.0546mVdc
Reading: +227.0546mVdc
Menu: Autozero
Reading: +227.0625mVdc
Menu: Min-max
Reading: +226.9531mVdc
Menu: Bargraph
Reading: +22
Menu: Logging
Reading: +226.9609mVdc
Menu: RS-232
Reading: +226.9531mVdc
Menu: Average
Reading: +226.9609mVdc
Menu: Range
Reading: +226.9609mVdc
Menu: Coupling
Reading: +226.9531mVdc
Menu: Coupling
Connected 00:01:40 Auto detect 9600 8-N-1 SCROLL CAPS NUM Capture Print echo
```



## Comparison with the Tektronix TX-1

---

- Tektronix TX-1

- 4½ - digit accuracy
- 10 field measurements may be stored
- Cost : US\$ 275

- Our DVM

- 6 – digit accuracy
- Up to 128 measurements
- Cost : < Rs.2,000

# Applications

---

- High-resolution bench top DVM
  - With Data logging facility
- Field (service) measurements
  - As a stand-alone, reliable instrument
- Battery-charge monitor
  - Measurement over time
- Input Device for Data Analysis software

*Questions?*

[jimgeorge@softhome.net](mailto:jimgeorge@softhome.net)  
[uday\\_9271@yahoo.com](mailto:uday_9271@yahoo.com)