

Building Your Prototype

Prototype Construction Techniques

Part Numbers

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Schematic Diagrams

Practical Advice

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Prototype Construction Techniques

1) Protoboard

Use DIP components

Keep your wires neat and color coded

Prone to bad connections

Maximum operating speed: ~ few MHz

2) Wire Wrap

Often done using wire wrap sockets on a vector board

Use DIP components

Wire used is good for digital signals

Be careful with high current lines because the
wire is small.

Typical wire:

30 gauge 0.34 Ω /m

28 gauge 0.21 Ω /m

3) Soldered Board

Single solder points board

Tied solder points board (Your mini project #1)

PCB: printed circuit board

PCB can be made for ECE 480 projects in the

ECE Shop: See the shop's web page.

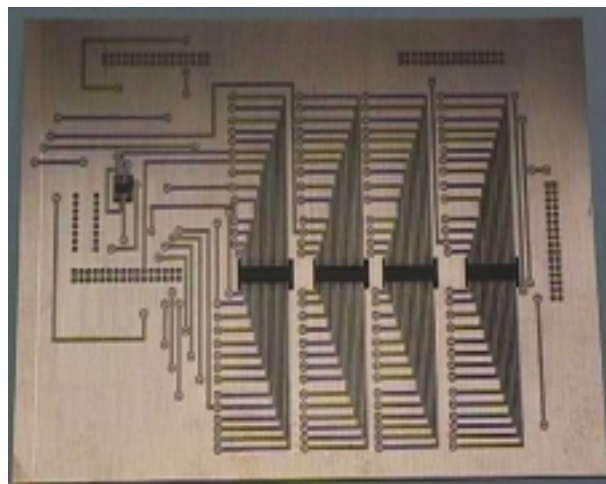
(Also see the next page)

Printed Circuit Board System General Information

QUICK CIRCUIT



T-Tech Prototyping Machine



ECE 482 Student Project Design

Part Numbers

Typical Part Number: DM8095N

Prefix: Indicates the manufacture of the part. See two pages in Attachment 1.

Suffixes: Indicates temperature range: “military”, “industrial”, “commercial”

Also the suffixes are used to indicate package types.

The ECE shop deals most often with the following electronic part suppliers.

Allied Electronics (www.alliedelec.com)

Digi Key (www.digikey.com)

Newark Electronics (www.newark.com)

For other (non-electronic) supplies, suppliers often used are

Grainger (www.grainger.com)

McMaster Carr (www.mcmaster.com)

Package Types

DIP: Dual Inline Package

Easiest to use.

Works in protoboards, solder boards, wire wrapping,
easiest to solder components to PCB

This is your choice for ECE 480.

PLCC: Plastic Leaded Chip Carrier

PQFP: Plastic Quad Flat Pack

LQFP: Low Profile Quad Flat Package

TSOP: Thin Small Outline Package

SSOP: Small Shrink Outline Package

SOIC: Small Outline Integrated Circuit

Generally to use PLCC, PQFP, LQFP, TSOP, SSOP, or SOIC you need to have a printed circuit board (PCB) made. Then it is very difficult to solder the component to the PCB.

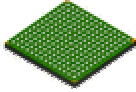



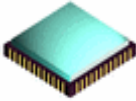
Sometimes an adapter from SOIC, SSOP or PLCC to DIP can be purchased. They are expensive and often not in stock at supply companies. See page from DigiKey catalog in Attachment 2.

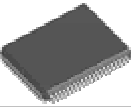

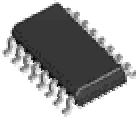
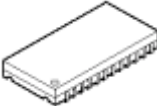

Electronic Package Types & Acronyms


Compiled by CADKraft Engineering

Home Page: <http://www.cadkraft.com/>


Integrated Circuit - Package Types

	Ball Grid Array
BGA	
BQFP	Bumped Quad Flat Pack
CBGA	Ceramic Ball Grid Array
CDIP	Ceramic Dual Inline Package 
CFP	Ceramic Flat Package
CQFP	Ceramic Quad Flat Pack 
CSP	Chip Scale Package
CZIP	Ceramic Zig Zag Package
DIP	Dual Inline Package 
DIMM	Dual Inline Memory Module
LCC	Leadless Chip Carrier 

LCCC	Leadless Ceramic Chip Carrier
LGA	Land Grid Array
LQFP	Low-profile Quad Flat Pack
MCM	Multi-Chip Module
PGA	Pin Grid Array
PLCC	Plastic Leaded Chip Carrier 
PQFP	Plastic Quad Flat Pack 
PSSOP	Plastic Small Outline Package
QFP	Quad Flat Pack
QSOP	Quarter Size Outline
QVSOP	Quality Very Small Outline Package
SIMM	Single Inline Memory Module
SOIC	Small Outline Integrated Circuit 
SOJ	Small Outline J-Lead 
SOP	Small Outline Package
SQFP	Shrink Quad Flat Pack
SSO	Shrink Small Outline
SSOP	Shrink Small Outline Package 
TQFP	Thin Quad Flat Pack

TSOP	Thin Small Outline Package 
TVSOP -	Thin Very Small Outline Package
VFBGA	Very Fine-Pitch Ball Grid Array
VSO	Very Small Outline

Discrete Component - Package Types

Axial	Leads Through Center Axis
CC	Chip Capacitors
CR	Chip Resistors
CRN	Chip Resistor Networks
DIP	Dual Inline Package
DPAK	SMT Version of "TO-220"
MELF	Metal Electrode Face
Radial	Leads on the Radius
SIP	Single Inline Package
SORP	Small Outline Resistor Package
SOT	Small Outline Transistors 

Specification Sheets

Typical Information

General Description

Detailed Specification

Absolute Maximums

Package/Pin Connections (Details of part numbers)

Plots of Typical Characteristics

Theory of Operation

Application Hints

Dimensions

Discuss examples of LM74 and LT1083

ADVICE: Don't order the part until you look at its spec sheet to make sure you are ordering the correct part.

How to Draw Schematic Diagrams

1. Drawings should be unambiguous.
Label all pins, parts, polarities, etc.
2. A good schematic diagram makes circuit function clear.
Keep functional areas of the circuit distinct.

Specific Rules:

1. Wires connecting are indicated by a heavy black dot.
2. Wires not connecting just cross each other without a black dot.
3. Four wires must not cross and be connected.
4. Always use the same symbol for the same device.
5. Wires and components are aligned horizontally or vertically.
6. Label pins on the outside of a symbol, label signal names on the inside.
7. All parts should have values or types indicated.

See the two examples in attachment 3.

For more information on drawing schematic diagrams see Appendix E of The Art of Electronics by Horowitz and Hill, 2nd Edition.

Safety and Practical Advice

Mandatory Safety Requirements

1. Portions of any circuit that can be operated above 50 volts must be protected by a box enclosure or a plexiglass cover.
2. The same requirement applies to circuits connected to high current sources (such as lead-acid car batteries) that can output more than 1 amp of current. (Use a box enclosure or a plexiglass cover.)
3. Any circuit that plugs into a wall (110 volt) outlet or any circuit that connects to a high current source (such as a lead-acid car battery) needs to have a fuse installed in the power supply circuit.
4. Do not wear loose metal jewelry around your wrist or neck when working with electronic circuits. The metal jewelry can touch the circuit creating shorts that destroy the circuit and possibly hurt you.

Practical Advice

Put a capacitor (~0.1 microfarad) between $+V_{DD}$ and ground near some or all of the IC chips on a board. This provides a more stable power supply voltage to individual IC chips.

Electrostatic Discharge (ESD)

Handling of ESD sensitive parts. – you can generally assume all chips and circuits in this class are ESD sensitive

- 1) Always keep chips in antistatic carrier. (Especially CMOS)
- 2) Do not pass chips or boards from person to person.
- 3) When you feel a shock from static electricity- it is several thousand volts. (Less than 10 volts can damage many circuits!)
- 4) Always touch a good ground before touching your circuit. For example, touch the metal chassis of the computer.
- 5) For some particularly sensitive chips you may need to use a static pad and/or a wrist strap.