Electronics Design and Manufacturing

EE20194: Group Design and Professional Engineering Practice II

Lecture 6/6

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Outline

- Ingress protection
- Enclosures
- Connectors

- Electrostatic discharge (ESD)
  - Is it that important?
  - Handling and protection of components

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Ingress Protection (IP) Rating

- Can be used to classify connectors and enclosures (boxes)
- Protection against solid objects and liquids
  - Covered by standard BS EN 60529:1992 Degrees of Protection provided by enclosures
  - Indicated by a alpha-numeric code: IPxx (*e.g.,* IP54)
    - First digit refers to protection against solid objects (0-6)
    - Second digit refers to protection against liquids (0-8)

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IP Ratings

First digit (Solid objects)		Second digit (Liquids)	
0	No protection	0	No protection
1	Protected against objects > 50mm (*e.g.,* touching with hands)	1	Protection against vertically falling water drops
2	Protected against objects > 12mm (*e.g.,* touching with fingers)	2	Protected against direct sprays of water up to 15° from the vertical
3	Protected against objects > 2.5mm (*e.g.,* large tools)	3	Protected against sprays up to 60° from the vertical
4	Protected against objects > 1mm (*e.g.,* screwdriver)	4	Protected against water sprayed from all directions – limited ingress permitted
5	Protected against dust – limited ingress allowed	5	Protected against low pressure jets of water
6	Totally protected against dust – no ingress	6	Protected against strong jets of water
		7	Protected against the effects of temporary immersion between 15cm and 1m. Duration of test 30 minutes
		8	Protected against long periods of immersion under pressure

Enclosures

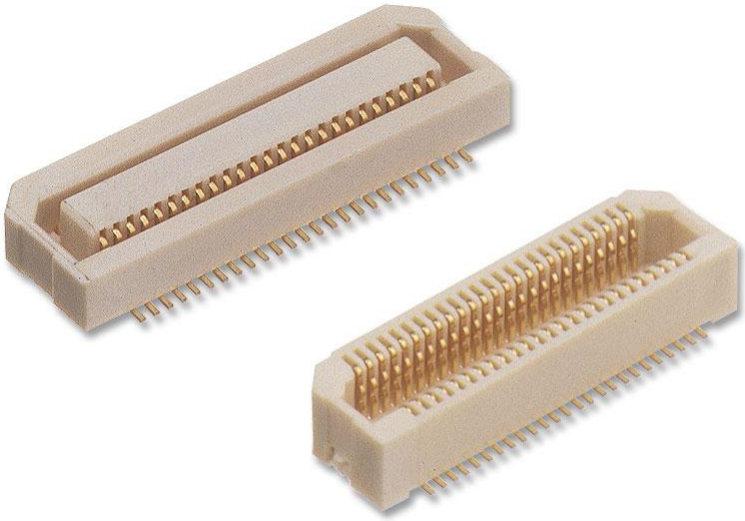
- Enclosure? A fancy name for a box!
  - Materials: ABS, polycarbonate, aluminium, stainless steel
  - Various IP ratings
- Zillions of manufacturers:
  - Hammond http://www.hammondmfg.com/
  - http://www.hammondmfg.com/pdf/1551N.pdf
  - Deltron http://www.dem-uk.com/deltron-enclosures/default.asp

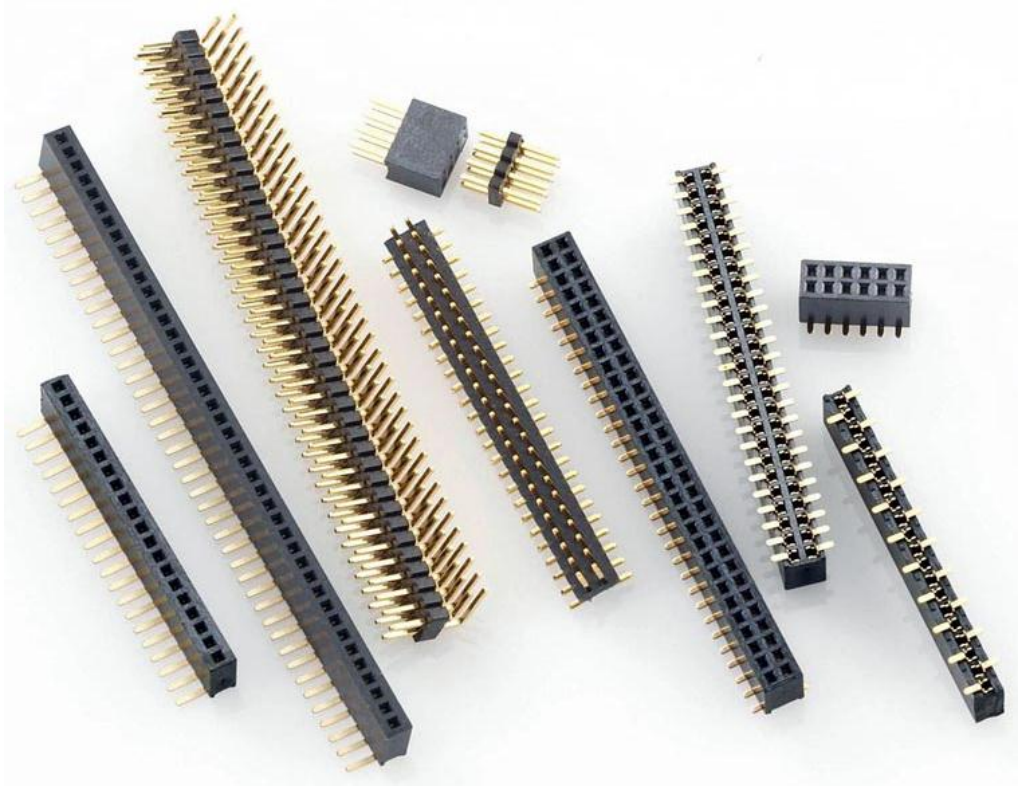
Connectors: rugged wired

- Round multi-way connectors
  - Amphenol, ITT Canon, TT AB
  - Fischer, Lemo

Connectors: board to board

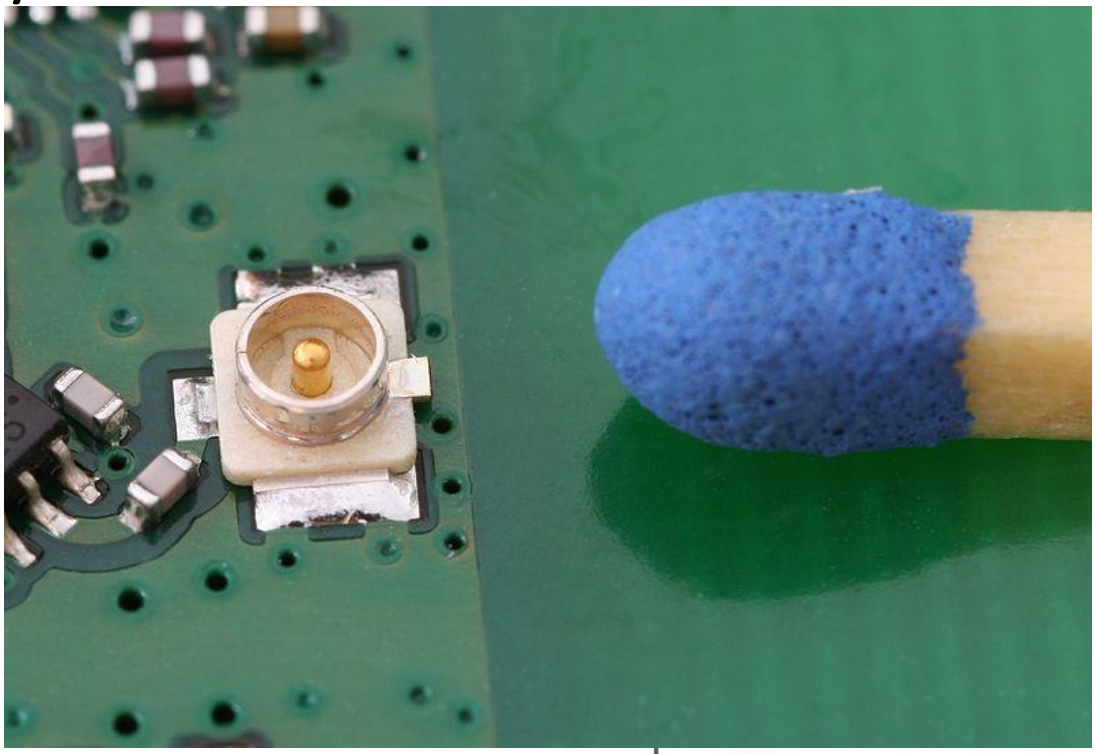
- Connecting PCBs together – daughter boards
  - Samtec & Hirose are the biggest manufacturers





Connectors: RF

- Lots of standards: BNC, TNC, SMA, SMB, SMC, F-type, N-type, APC 7mm, 3.5mm, K-type, V-type, MCX, MMCX, UFL, 7/16" ….



ESD: Electrostatic Discharge

- Why is it a problem?
  - electronic devices are small and can suffer permanent damage if subjected to electrostatic discharge
  - can impair/destroy and/or shorten lifetime of devices

- ESD safe work areas need to dissipate static electricity
  - dissipative mats, shoes, clothing, benches etc
  - human body model: 100pF capacitor and 1.5k resistor
  - big problem in dry (low humidity) environments

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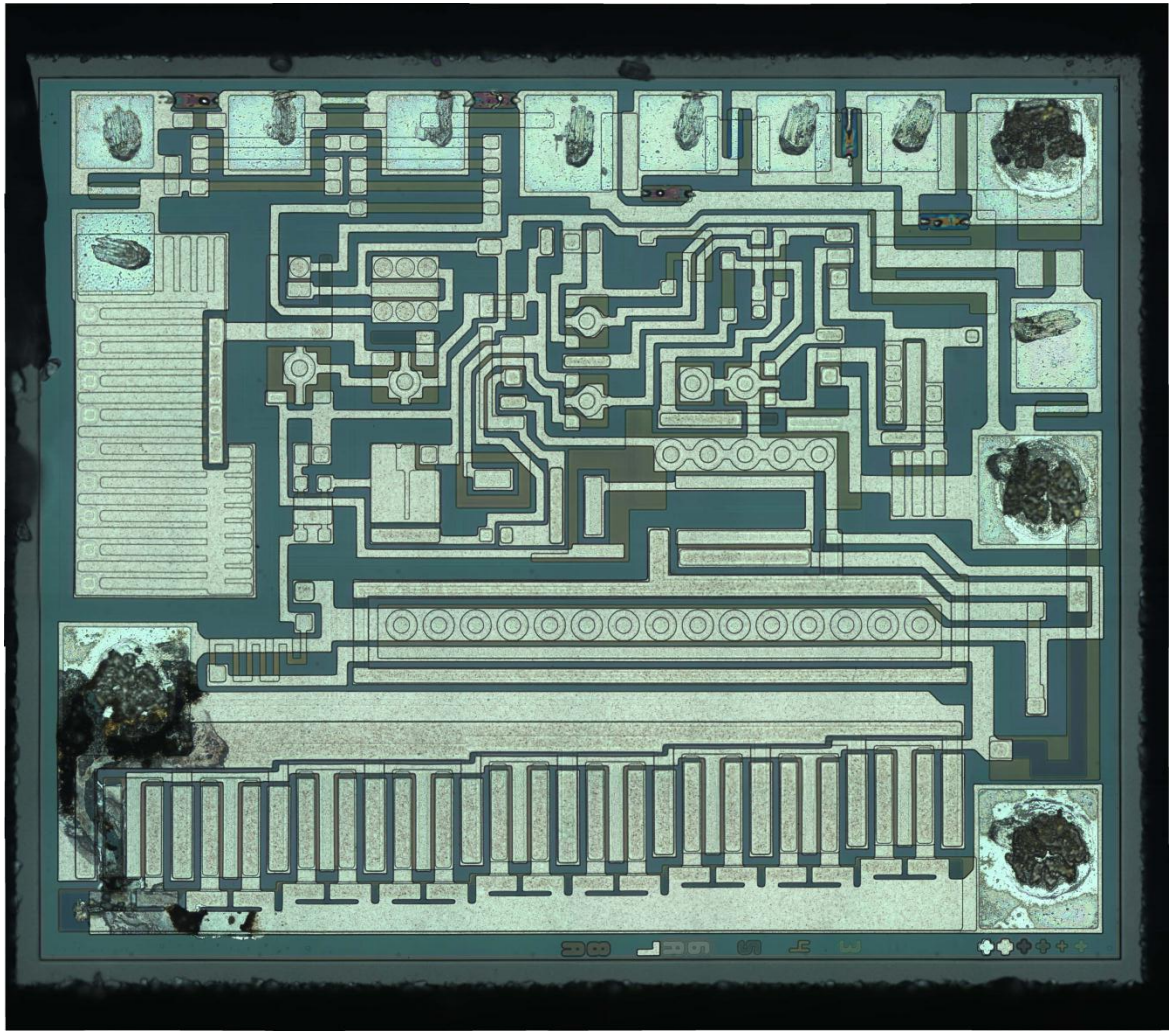
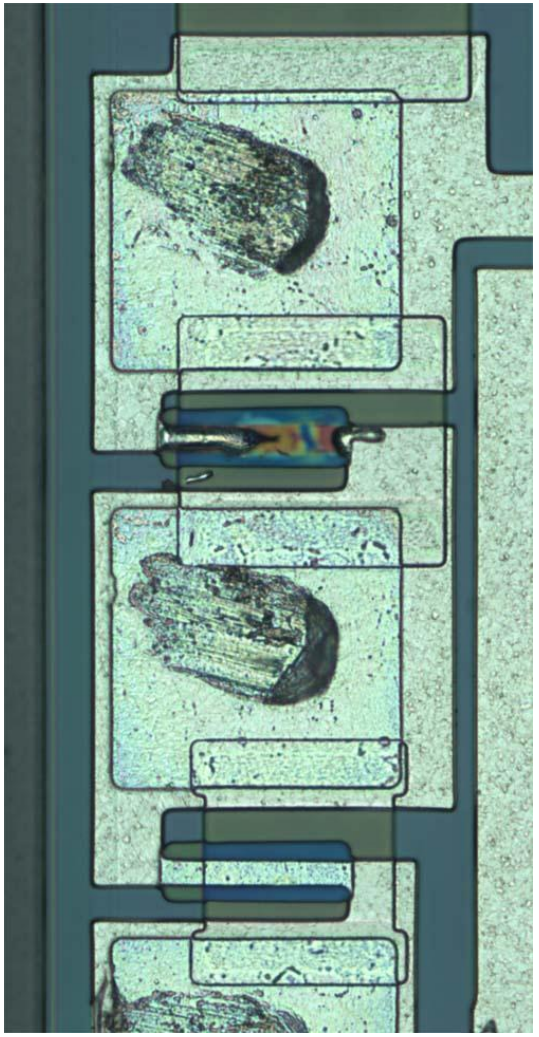
ESD damage





ESD warning signs

- Shielding and susceptibility

- Companies like Vermason http://www.vermason.com specialise in static handling and component protection

Summary of Lectures

- Components
- PCB manufacturing processes
  - Board types and manufacturing methods
  - Assembly, pick-and-place (component population)
  - Soldering, IR reflow
- Thermal design
  - Heat removal and heatsink calculations
- Enclosures and connectors
- Electrostatic discharge

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