Packaging

Purposes

1) Electrical connection
   - Signals
   - Power / Ground

2) Heat dissipation
   - Convection: heat sink into air
   - Conduction: heat flow into PCB

3) Physical protection

4) Environmental protection
   - Against corrosion and moisture
   - "Hermetic seal"

Rout's Rule:

- Empirical - data based

\[ P = K G^B \]

\[ P = \# \text{ I/O connections} \]

\[ K = \text{ Ave. \# I/Os per "gate"} \]

\[ \beta = \text{ empirical parameter } \text{Typ. } 0.1 - 0.7 \]

\[ G = \# \text{ of gates} \]
### Metrics

1) **Electrical**
   - Low R
   - Low L
   - Low C

2) **Mechanical**
   - Stable across temp

3) **Thermal**
   - Low thermal resistance

4) **Cost**
a) Package itself
b) Assembly
   - chip - pkg
   - pkg - board
c) System
   Ex. heat removal

**Materials**

1) Plastic
   - low cost
   - typically requires a custom package

2) Ceramic
   - better for heat flow
   - reliable

**Interconnection Levels**

- System
- PCB - Printed Circuit Board
- Package
- Chip
Eutectic

Universal glue

- Tin / Lead Alloy
  50/50%
  63/37% Sn/Pb eutectic mixture

- Low melting temp
  183°C or 361°F for eutectic
- Good electrical conductivity

Large efforts to eliminate Pb

RUTS - Rest of U.S. Sub. Div.