

Föreläsning 6

IE1332 Utveckling av elektronikprodukter

Kapitel 11 Layout and grounding

- Layout och jordning
- Partitionering
- PCB layout
- Principer för jordning

Kontroll över interferens

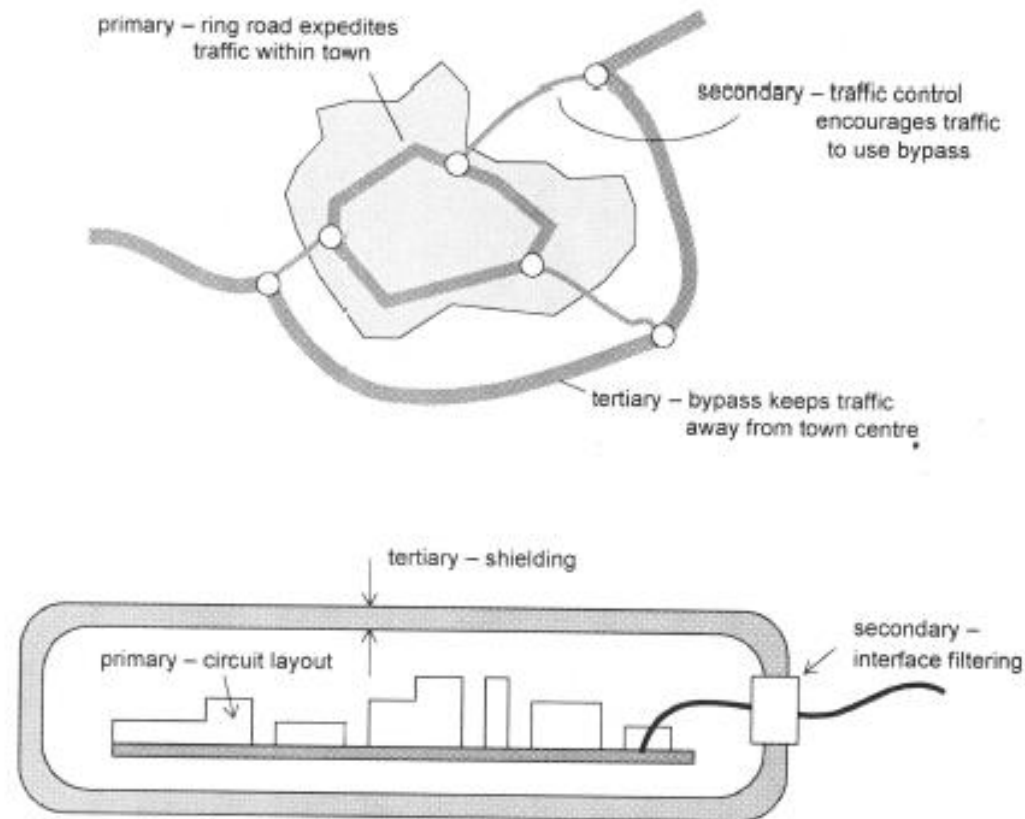


Figure 11.1 EMC control measures

Partitionering av system

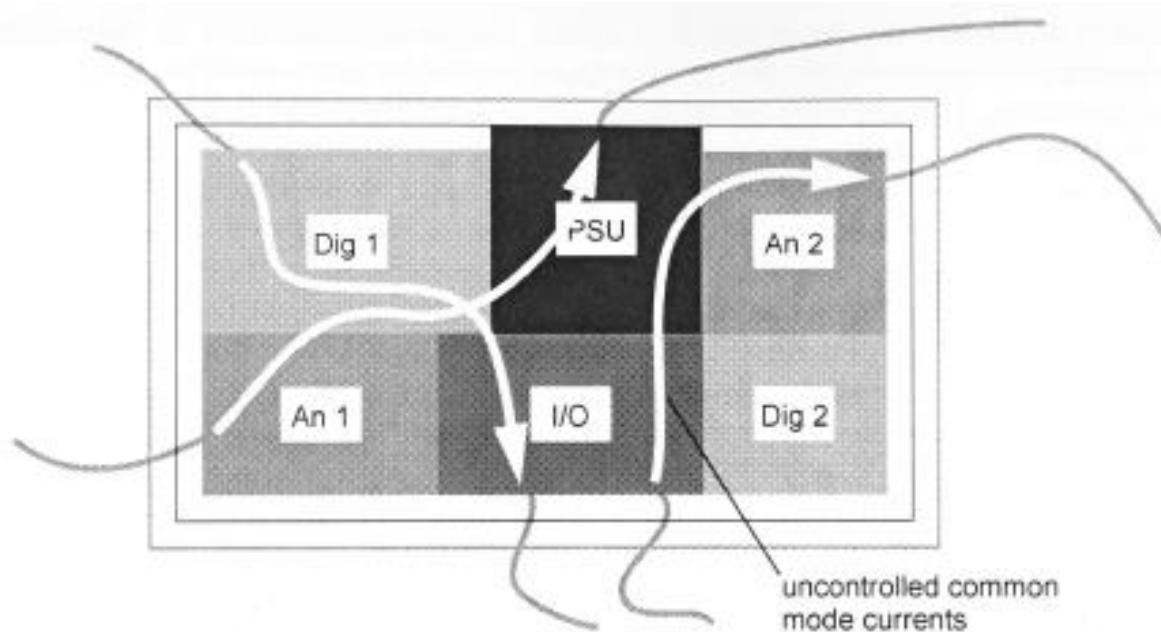


Figure 11.2 The haphazard system

Dåligt partionerat: Dåligt definierade interface mellan delar,
externa portar utspridda
Kan vara svårt att ha kontroll över emission även om man
skärmar och filtrerar

Partitionering

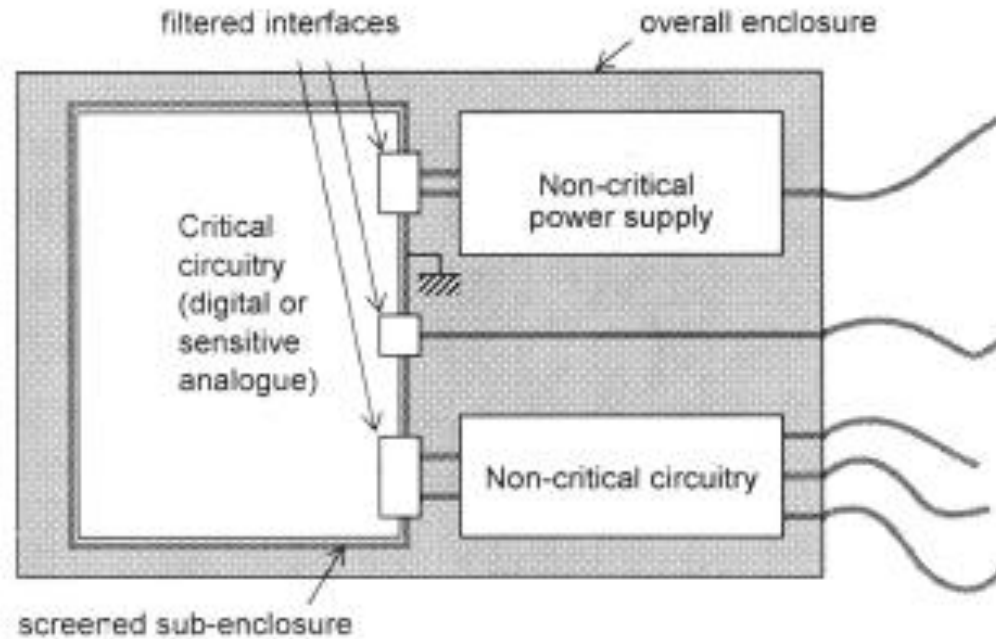


Figure 11.3 System partitioning

Separera systemet i kritiska och icke-kritiska delar ur EMC-synpunkt

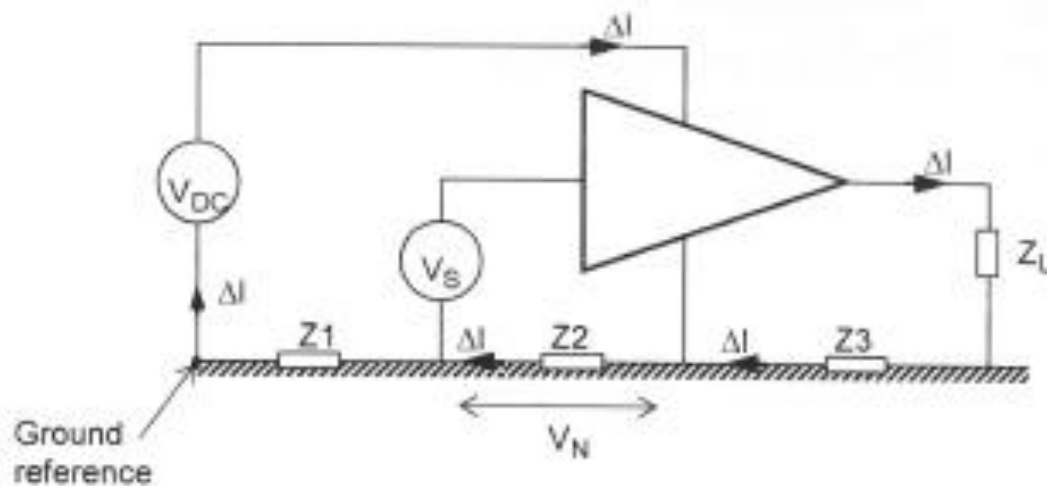
Jordning

Definition på jord: en punkt, ledning eller ledningsplan som har samma potential och är referens för ett system

Meningslös definition ur EMC-synpunkt när det går strömmar i jordledningen!

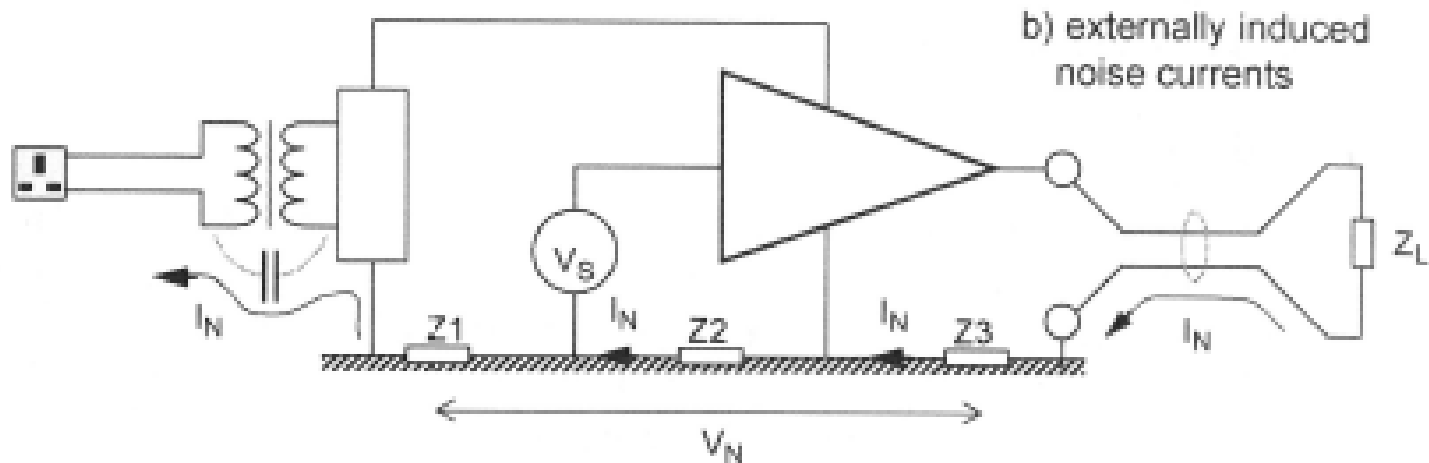
Alternativ definition: en lågimpediv väg där strömmen kan återvända till källan

Exempel på returströmvägar



a) initial circuit

Exempel på returströmvägar



Exempel på returströmvägar

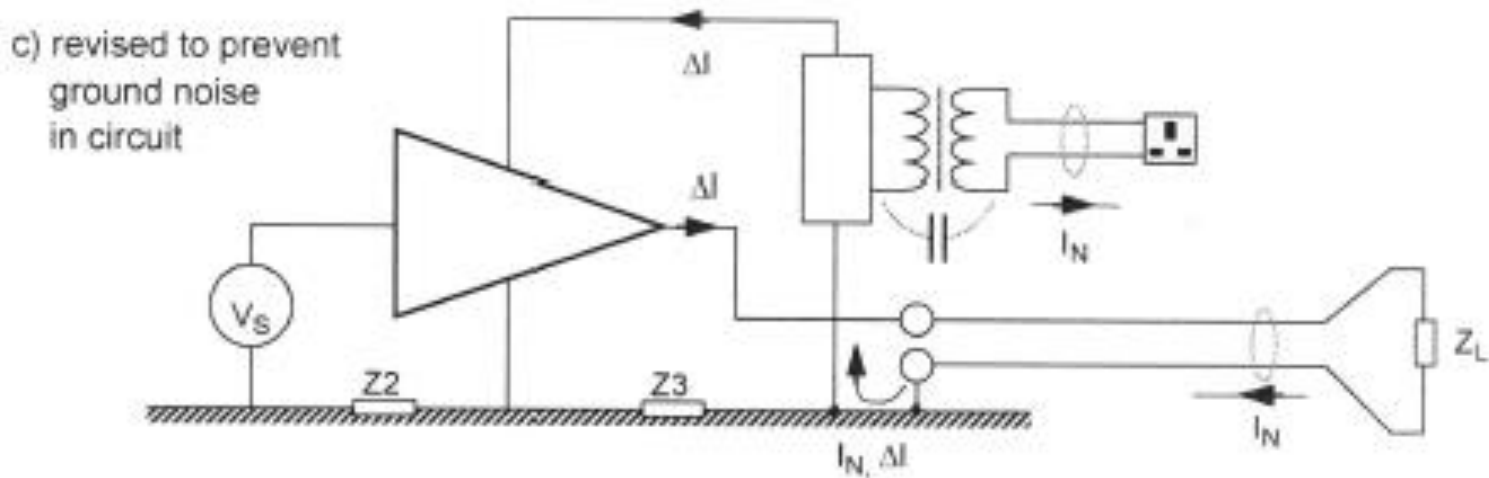
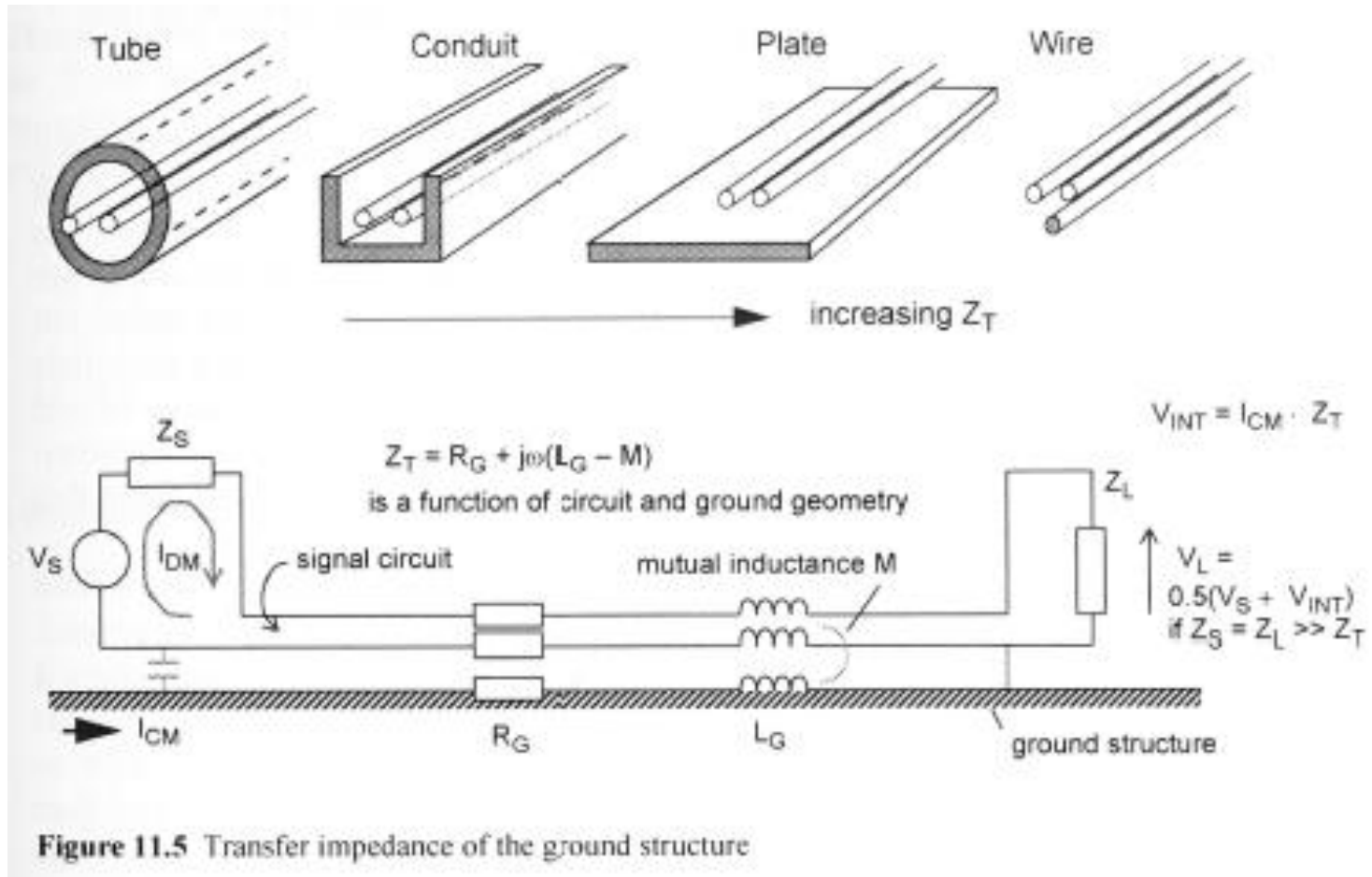
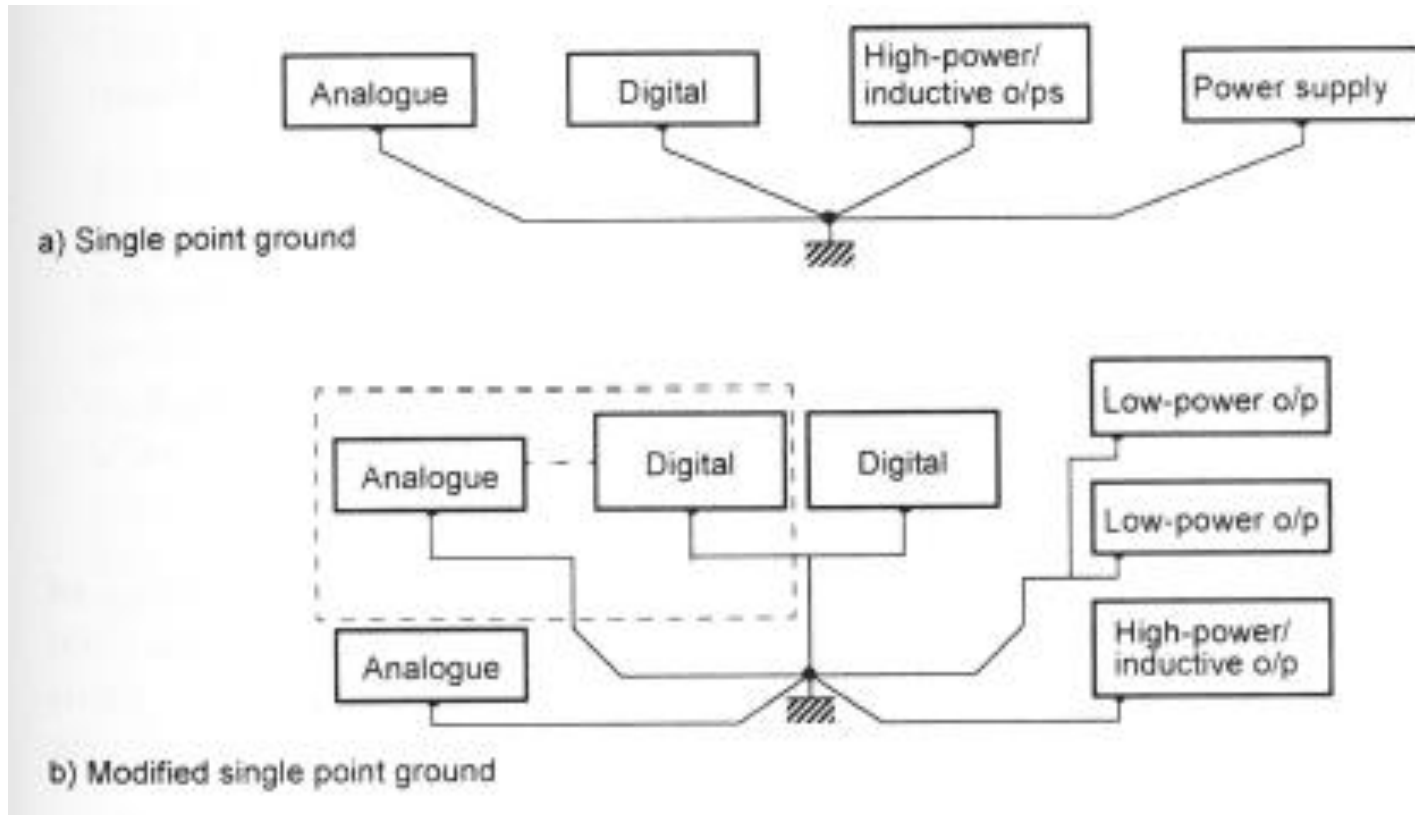


Figure 11.4 Ground current paths in an example circuit

Transfer impedance



Jordning, single point



Jordning, multi point

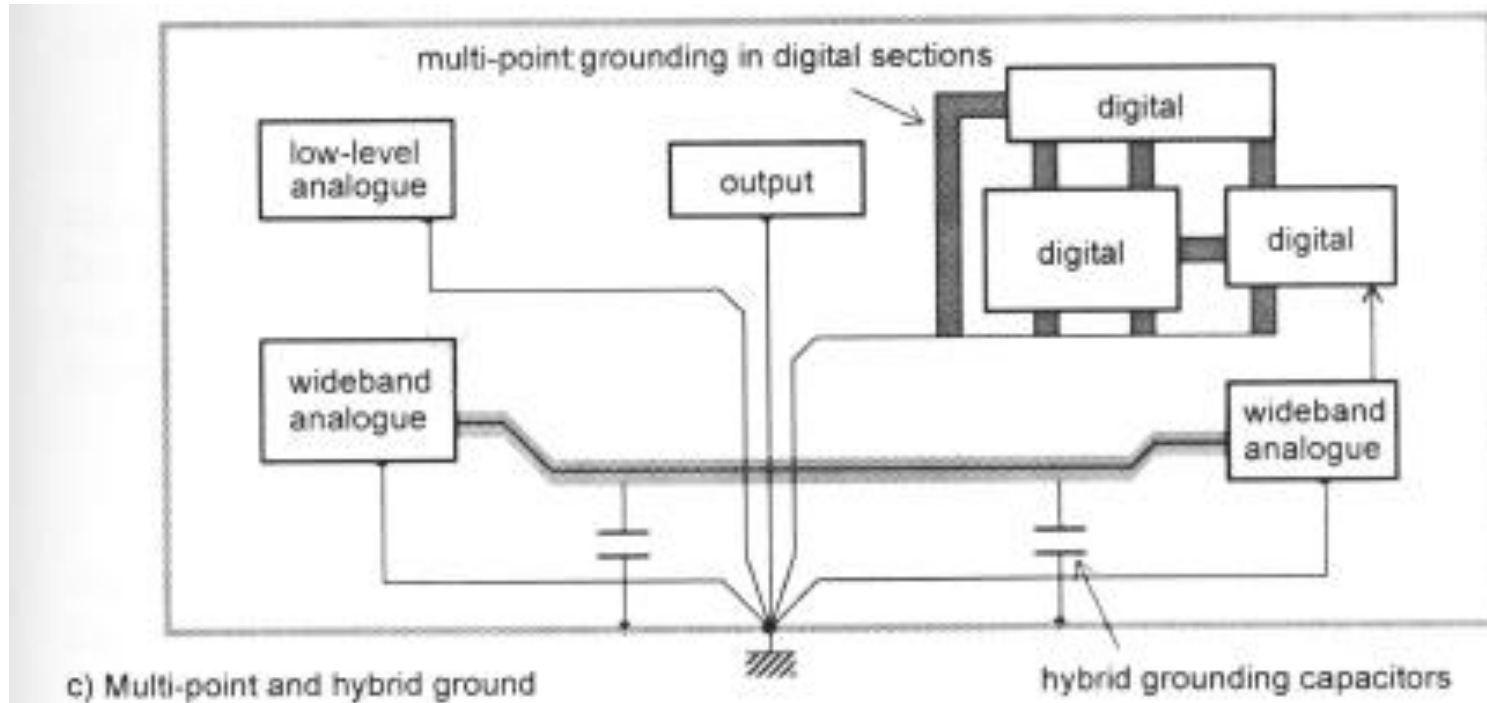


Figure 11.6 Grounding systems

Jordledningens impedans

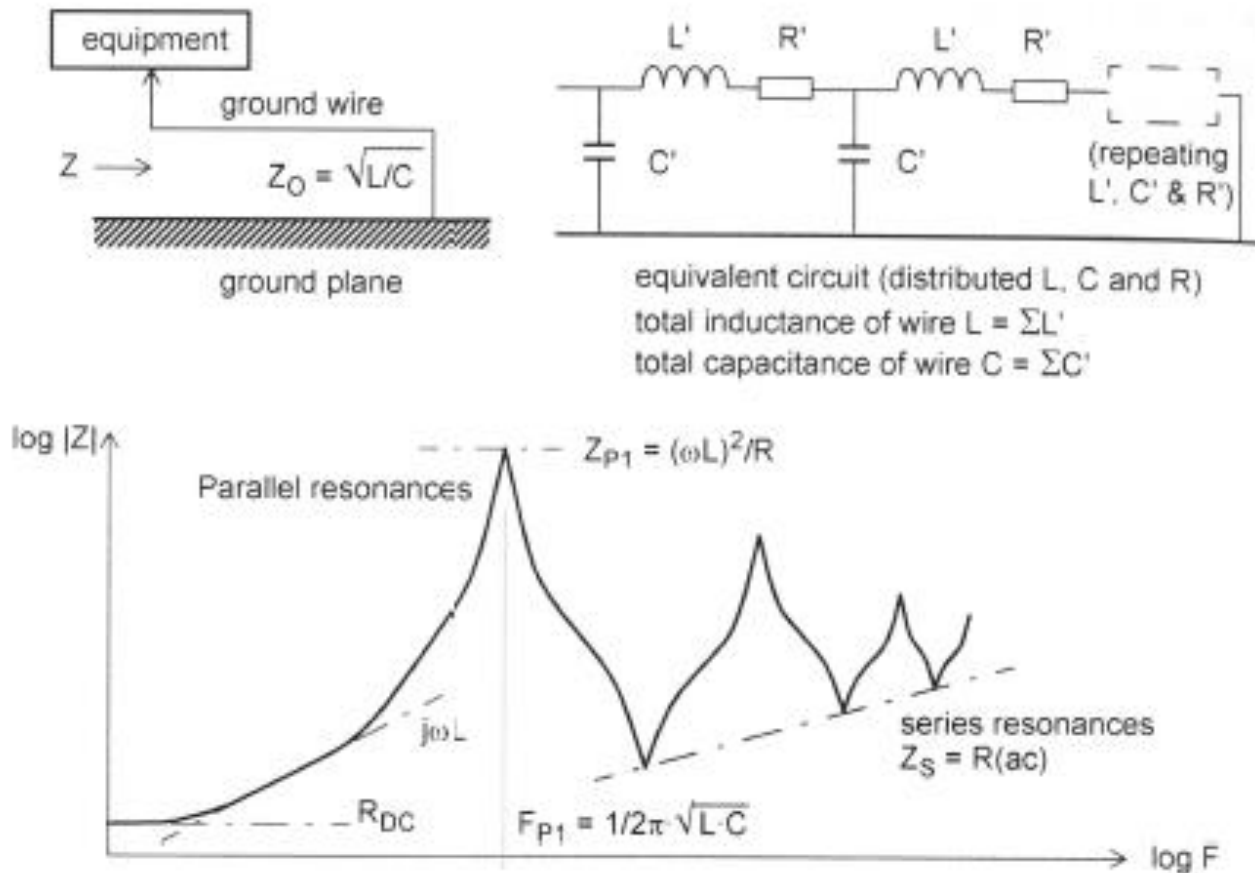


Figure 11.7 The impedance of long ground wires

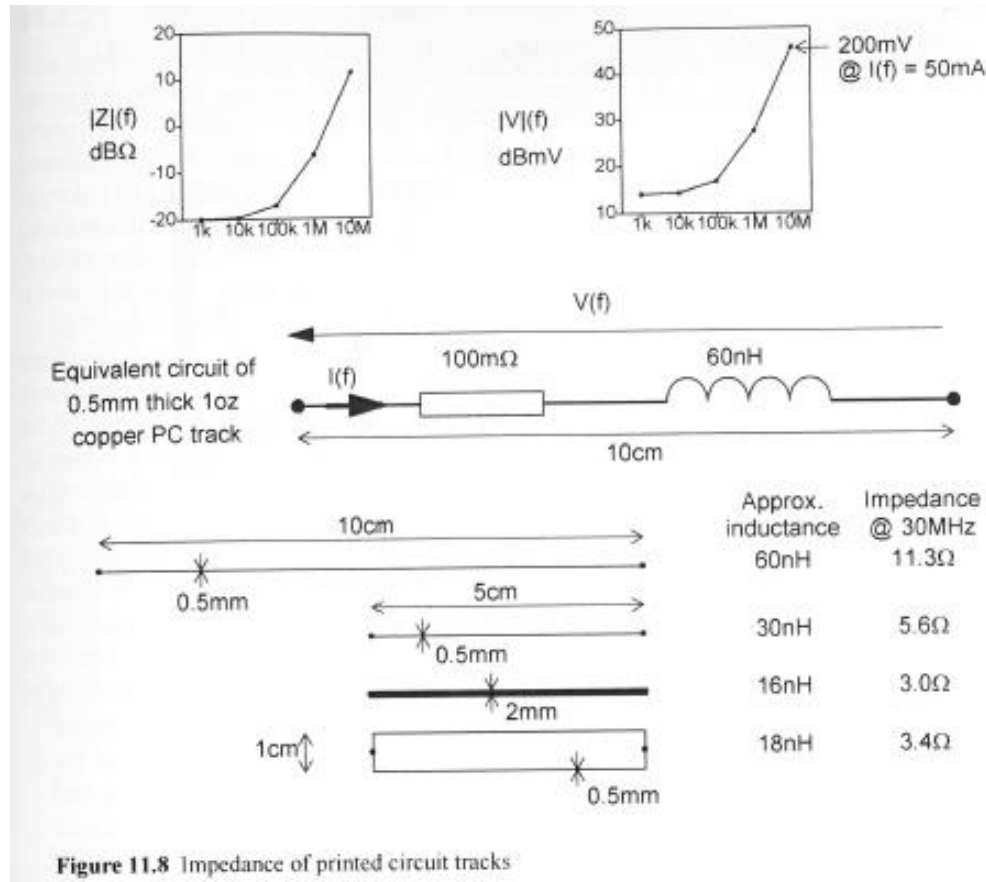
Principer för jordning

Grounding principles

- All conductors have a finite impedance which increases with frequency
- Two physically separate ground points are not at the same potential unless no current flows between them
- At high frequencies there is no such thing as a single point ground

- Alla ledningar har en ändlig impedans som ökar med frekvensen
- Två fysiskt separata jordningpunkter har samma potential endast om det inte flyter någon ström däremellan
- Vid höga frekvenser existerar inte något som heter jordningspunkt

PCB-layout utan jordningsplan



- Minimera ledningslängd, öka om möjligt bredden
- Lägg returvägen parallellt eller nära

PCB-layout med gridded ground

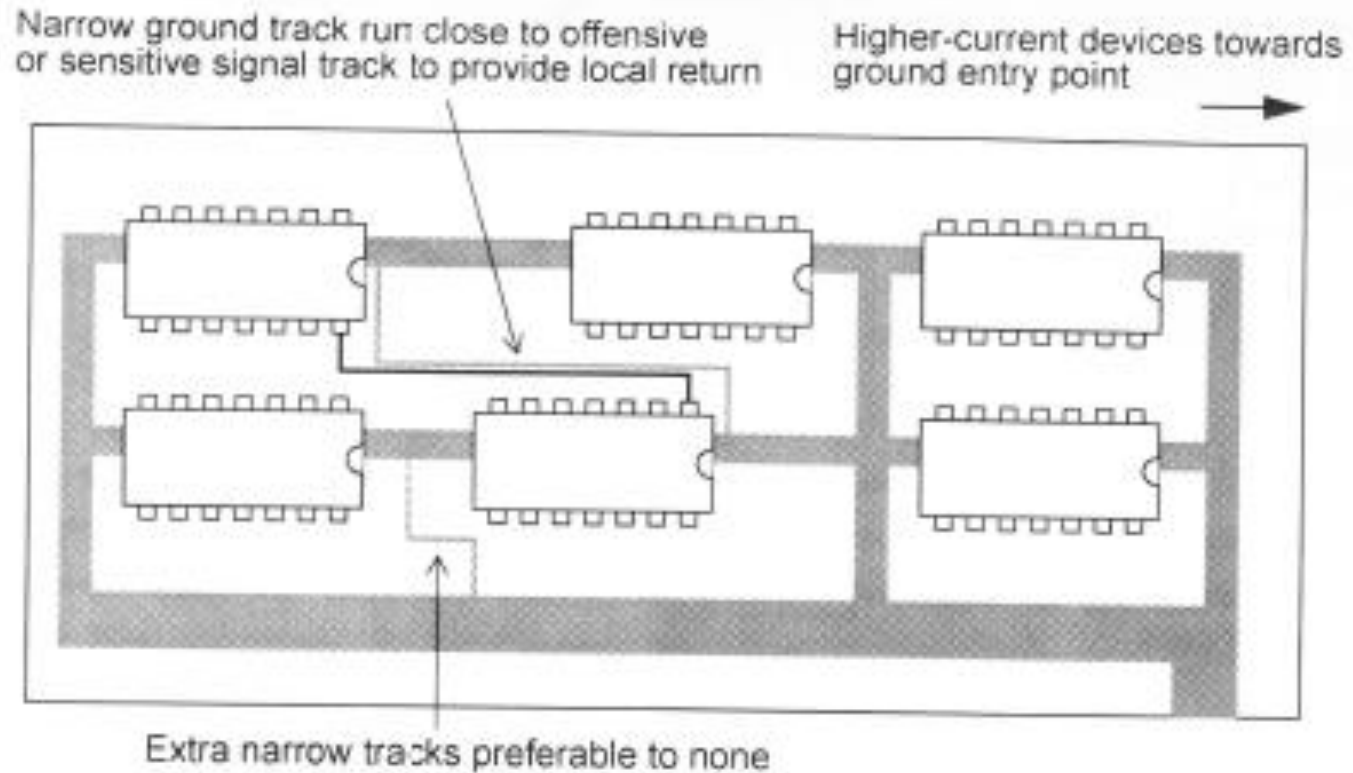


Figure 11.9 The gridded ground structure

PCB-layout, dålig jordning

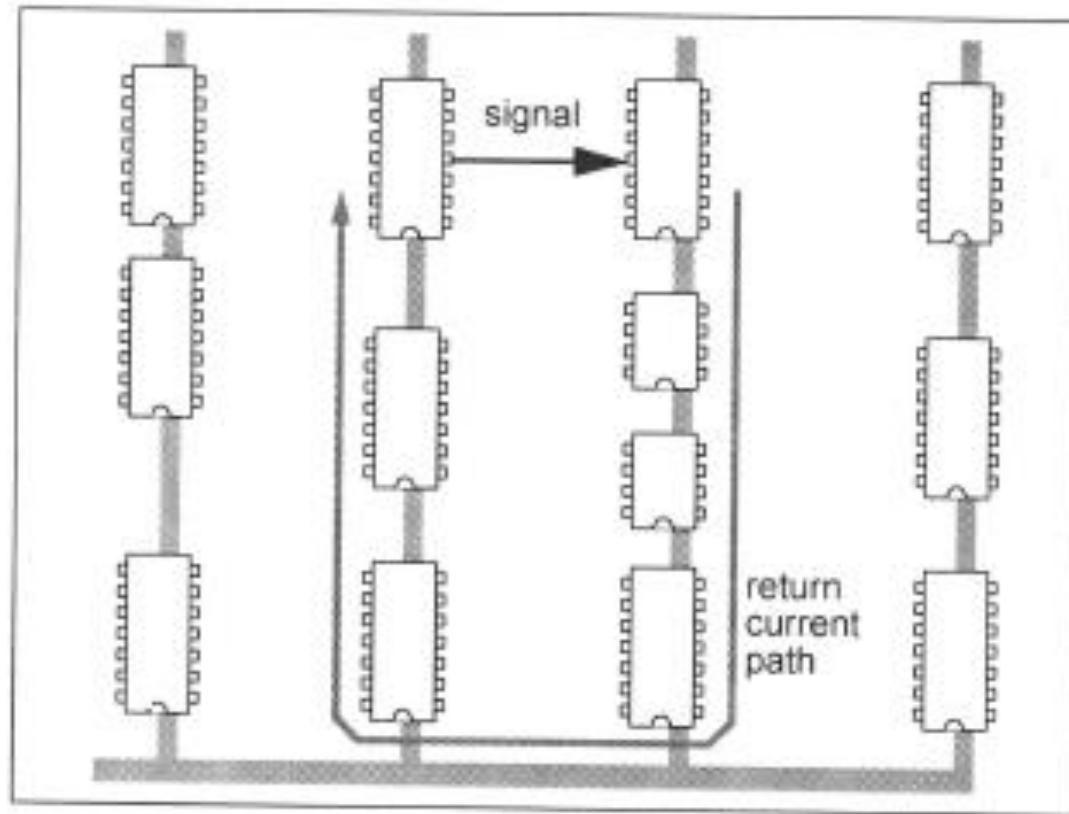


Figure 11.10 Undesirable: the comb ground structure

PCB-layout, jordplan

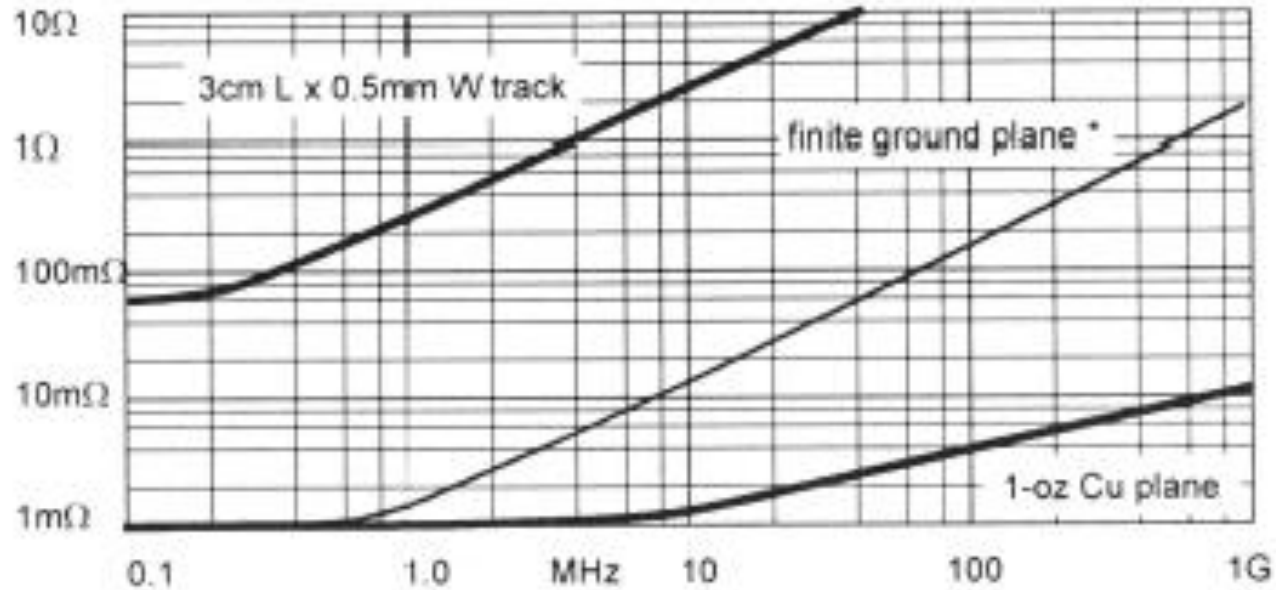
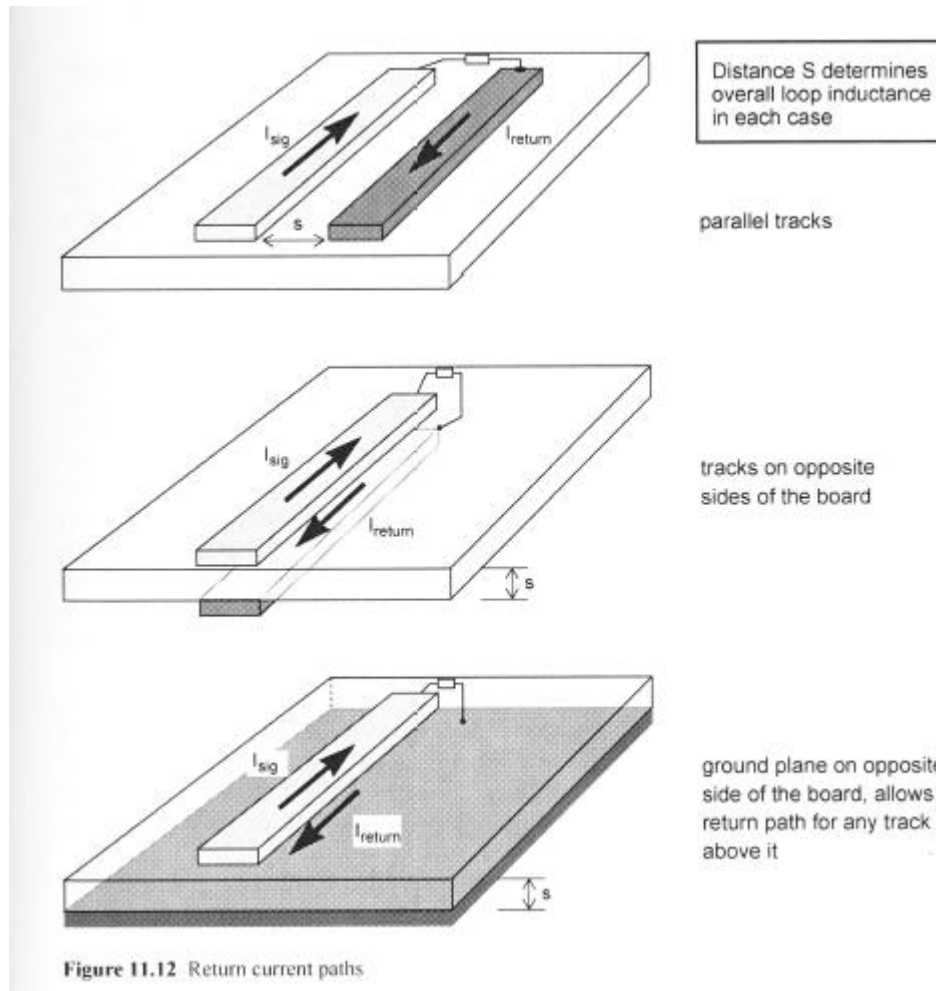


Figure 11.11 Impedance of ground plane versus track

* 5cm wide ground plane at 0.8mm under 3cm length of track, according to equation 11.3

Jordplan för billiga kort



Införa jordplan i enkla kort

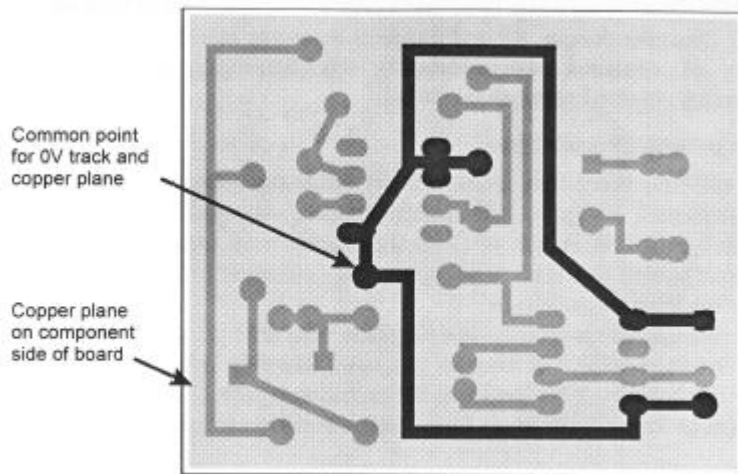


Figure 11.13 Simple copper layer added to a single-sided PCB

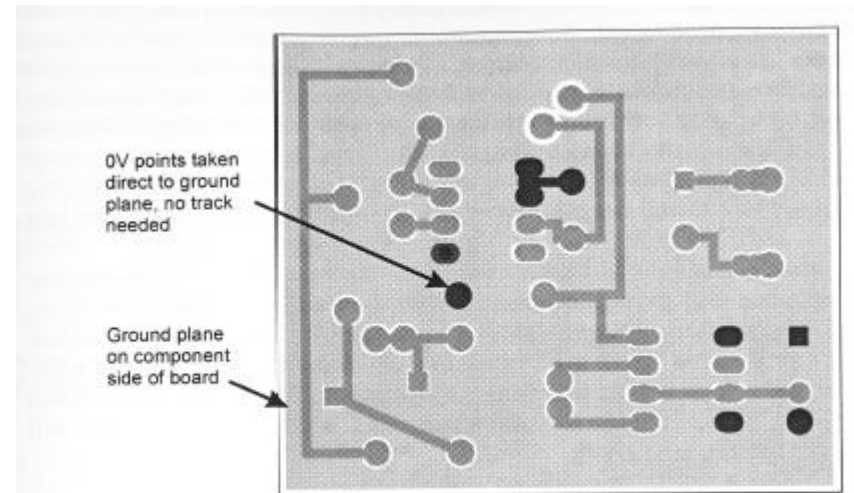
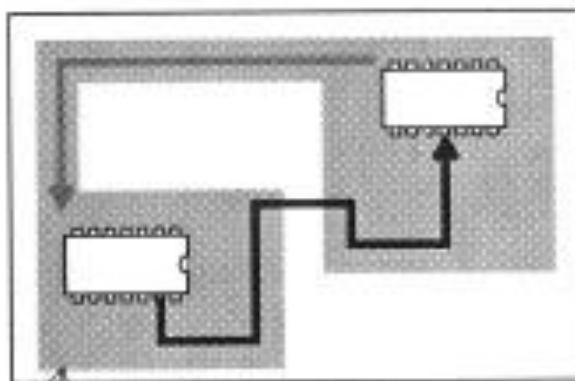


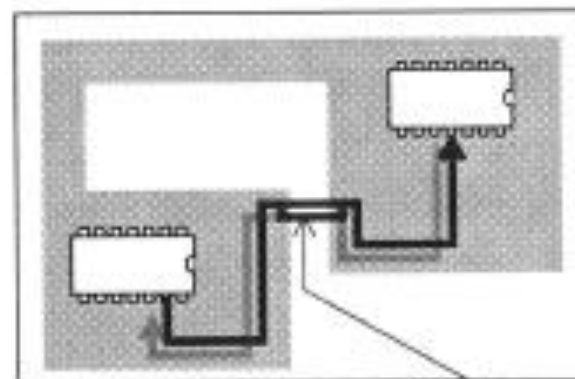
Figure 11.14 Taking all 0V connections to the ground plane

Avbrott i jordplan



No matter how much copper, this is not a ground plane!

signal current
→
return current
←



If a break is unavoidable, it is best linked with a short bridging track

Figure 11.15 A broken ground plane

Slitsar i jordplan

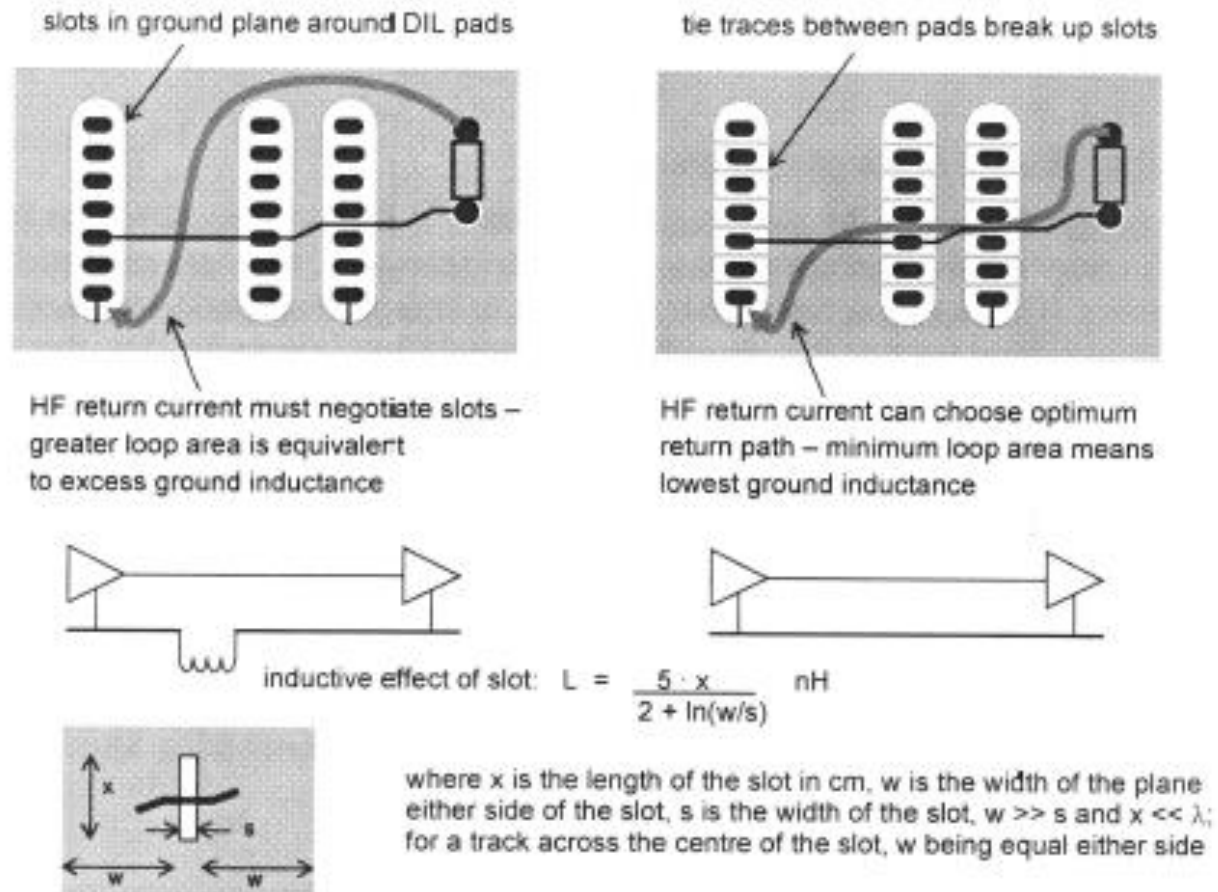


Figure 11.16 Dealing with slots at DIL pinouts

Multilayer

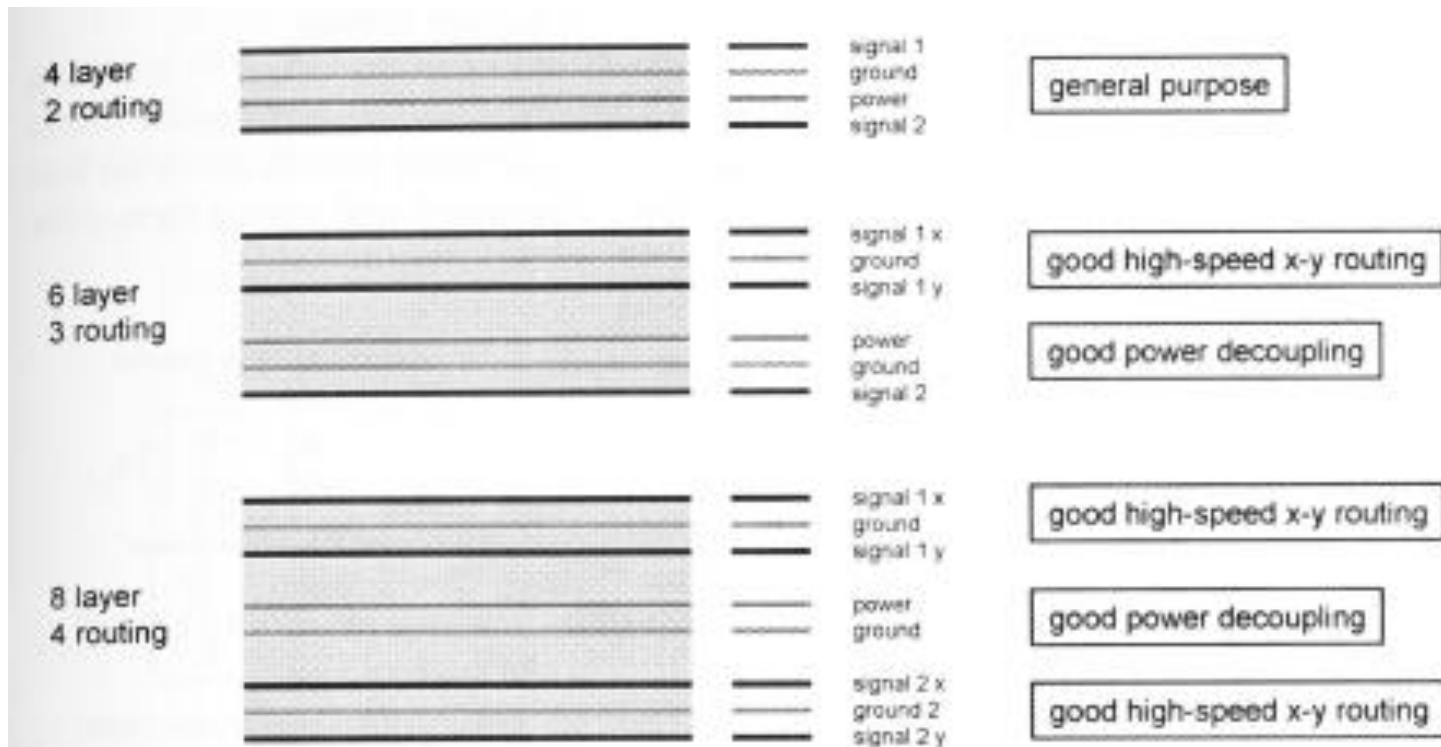
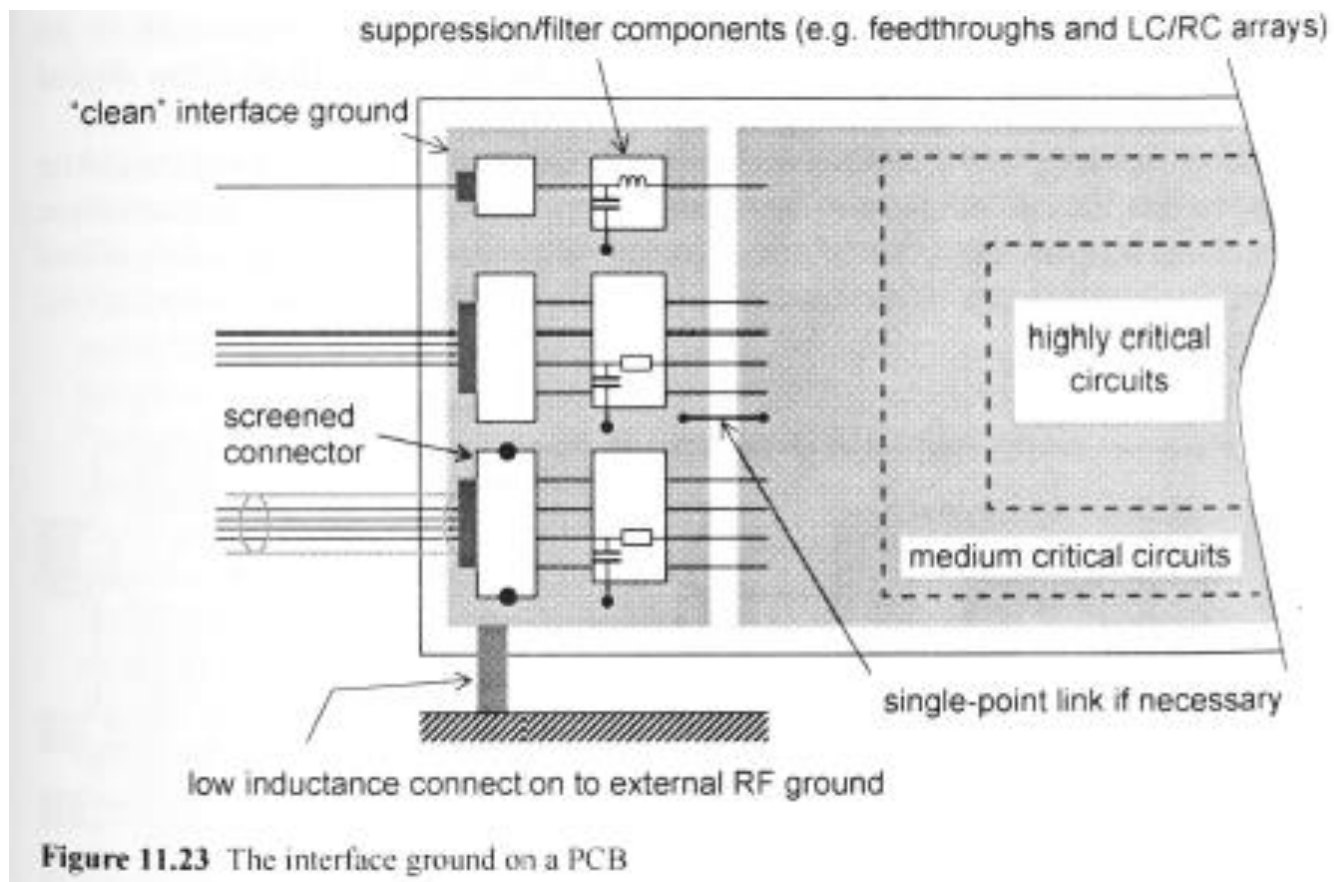


Figure 11.17 Layer stacking on a multilayer board

Interfacejord



Separata kretsjordar

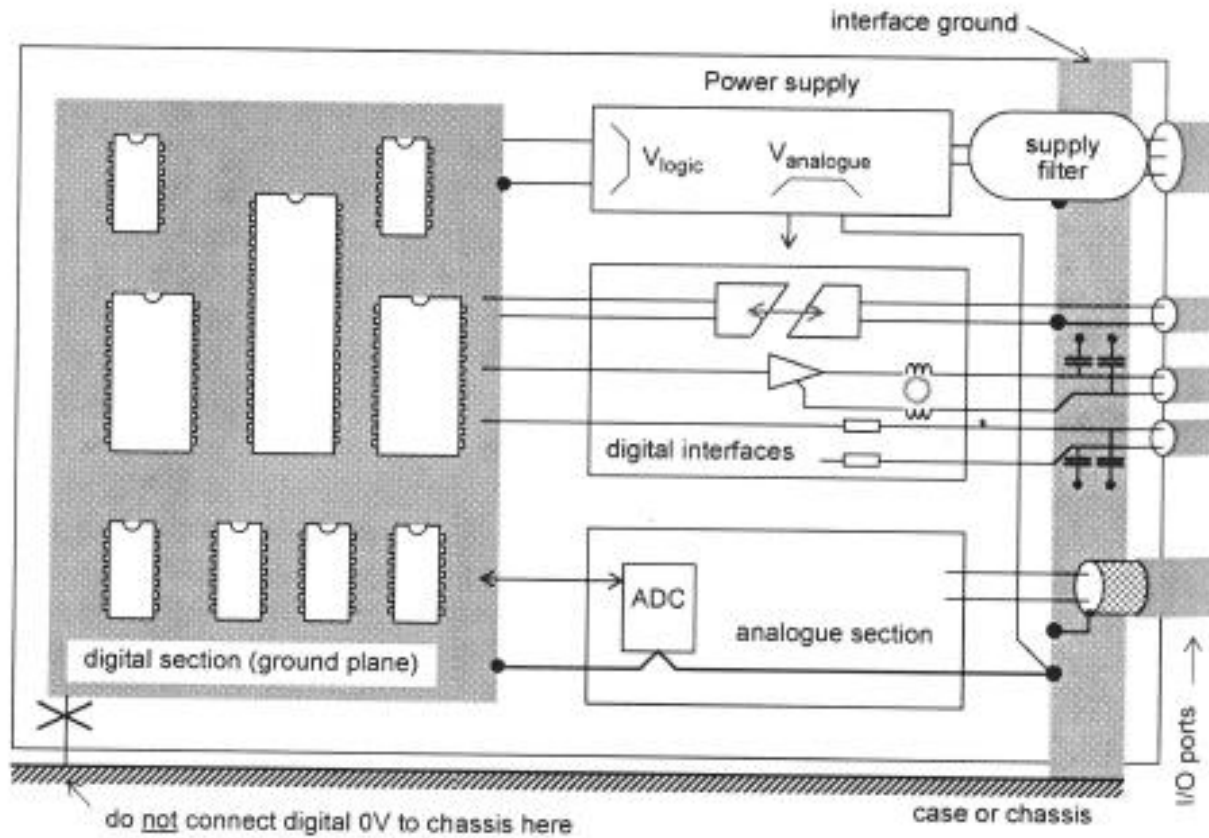


Figure 11.24 Multiple ground areas

Anslutning kabelskärmar

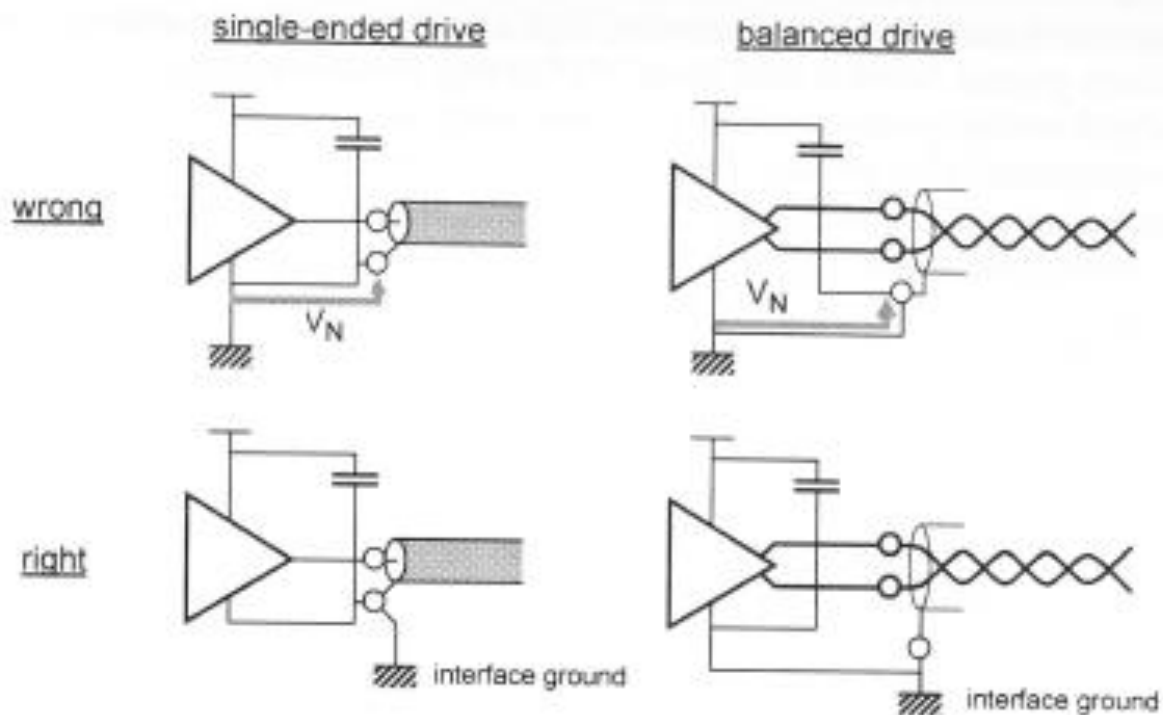


Figure 11.25 The point of connection of I/O cable screens