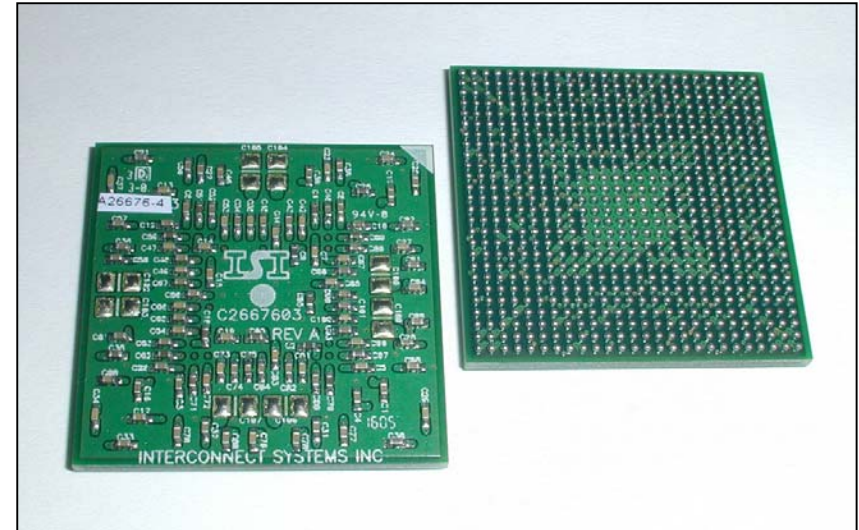
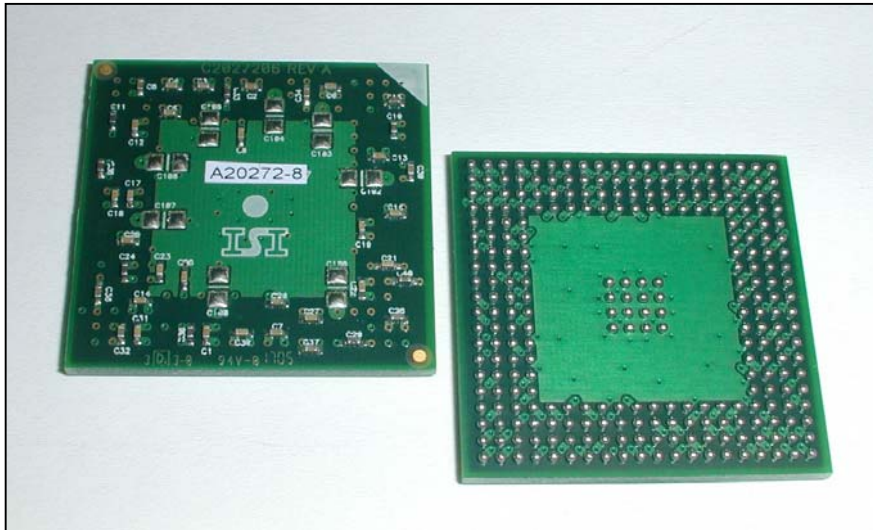
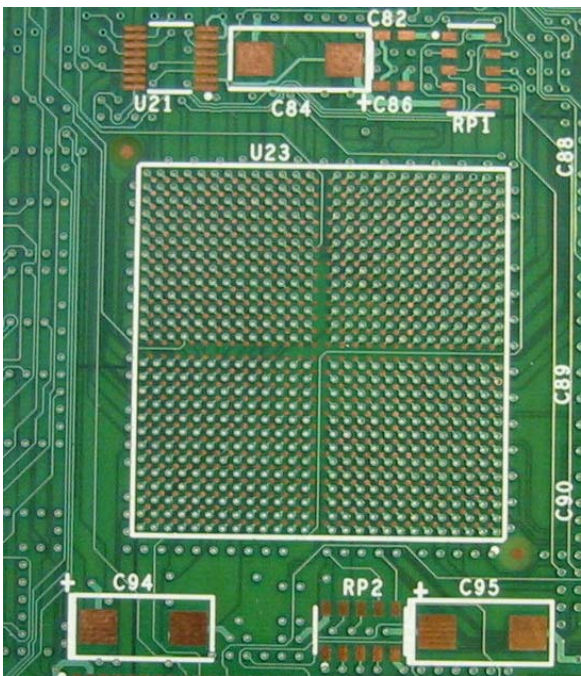


What is QStack?

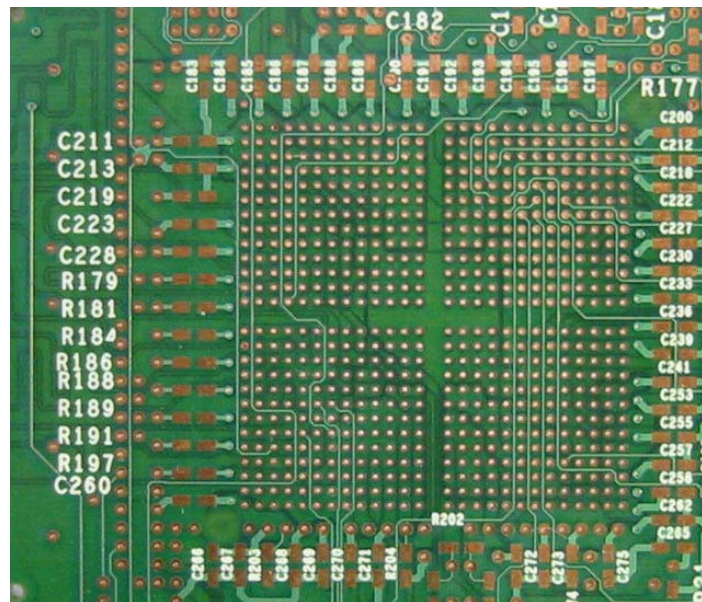
A decoupling method that reduces board space and improves power delivery.



Typical BGA Layout Photos

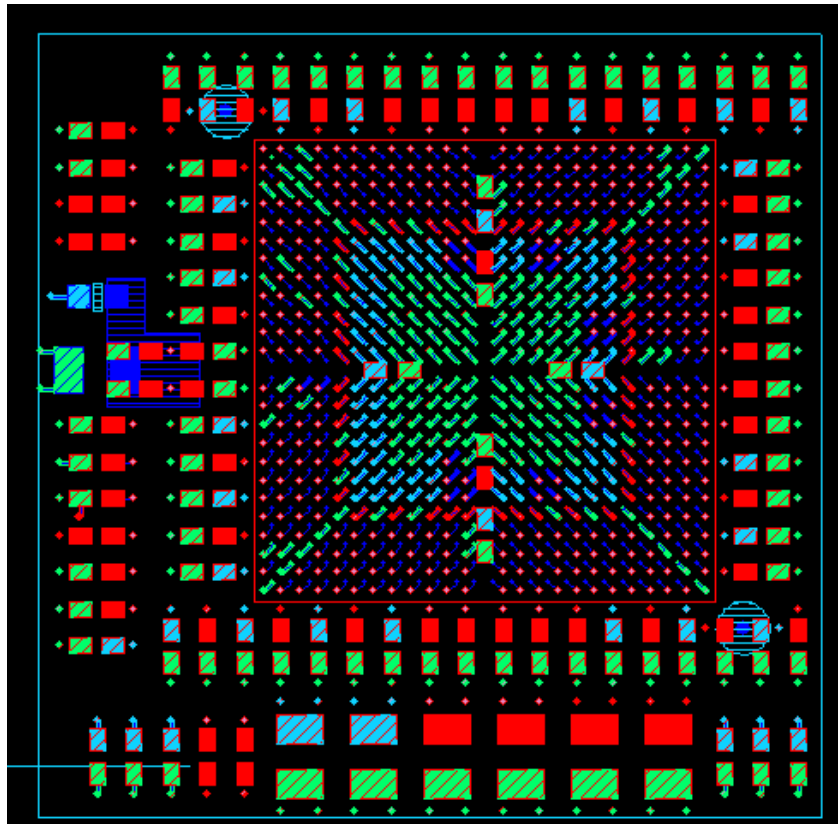


Top Side



Bottom Side

decoupling capacitors placed around perimeter of BGA site. Capacitors can not be placed directly under the BGA because of through-hole vias



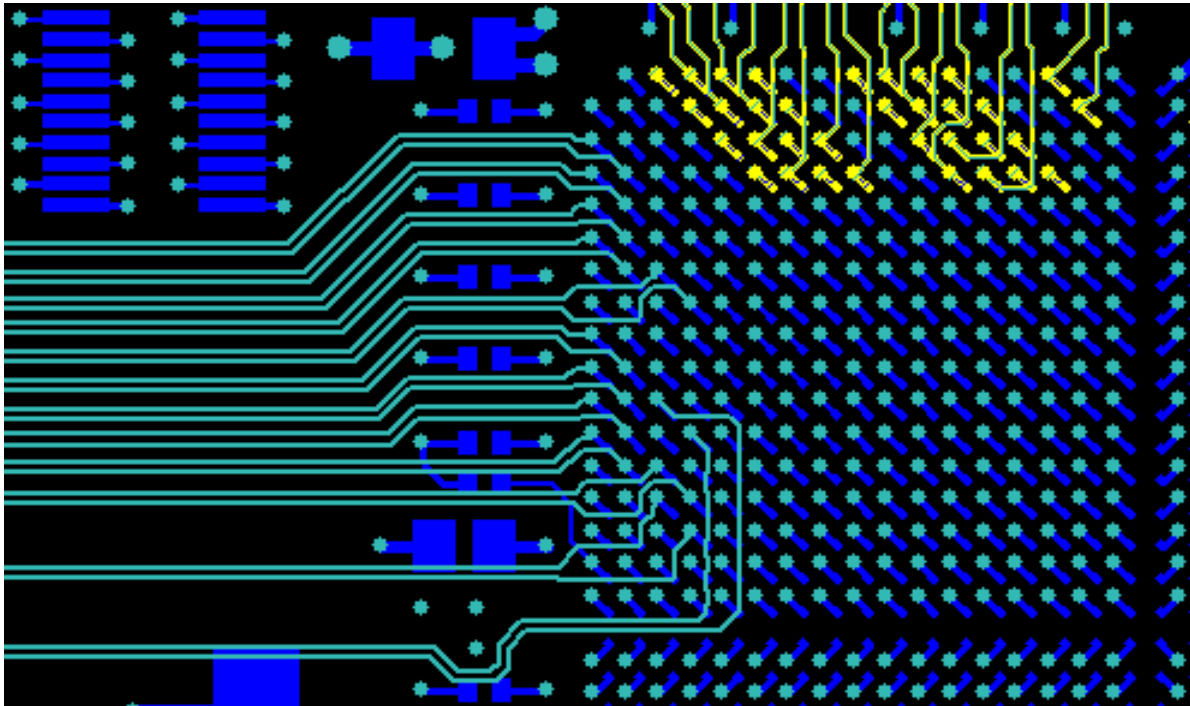
Typical Layout in CAD system

Green = GND
Lt Blue = 1.5
Dk Blue = 1.2
Red = 3.0

This shows an example of a BGA layout, with de-coupling sites on the top side of the PCB. In this case decoupling increases the effective foot print by more than 30% +

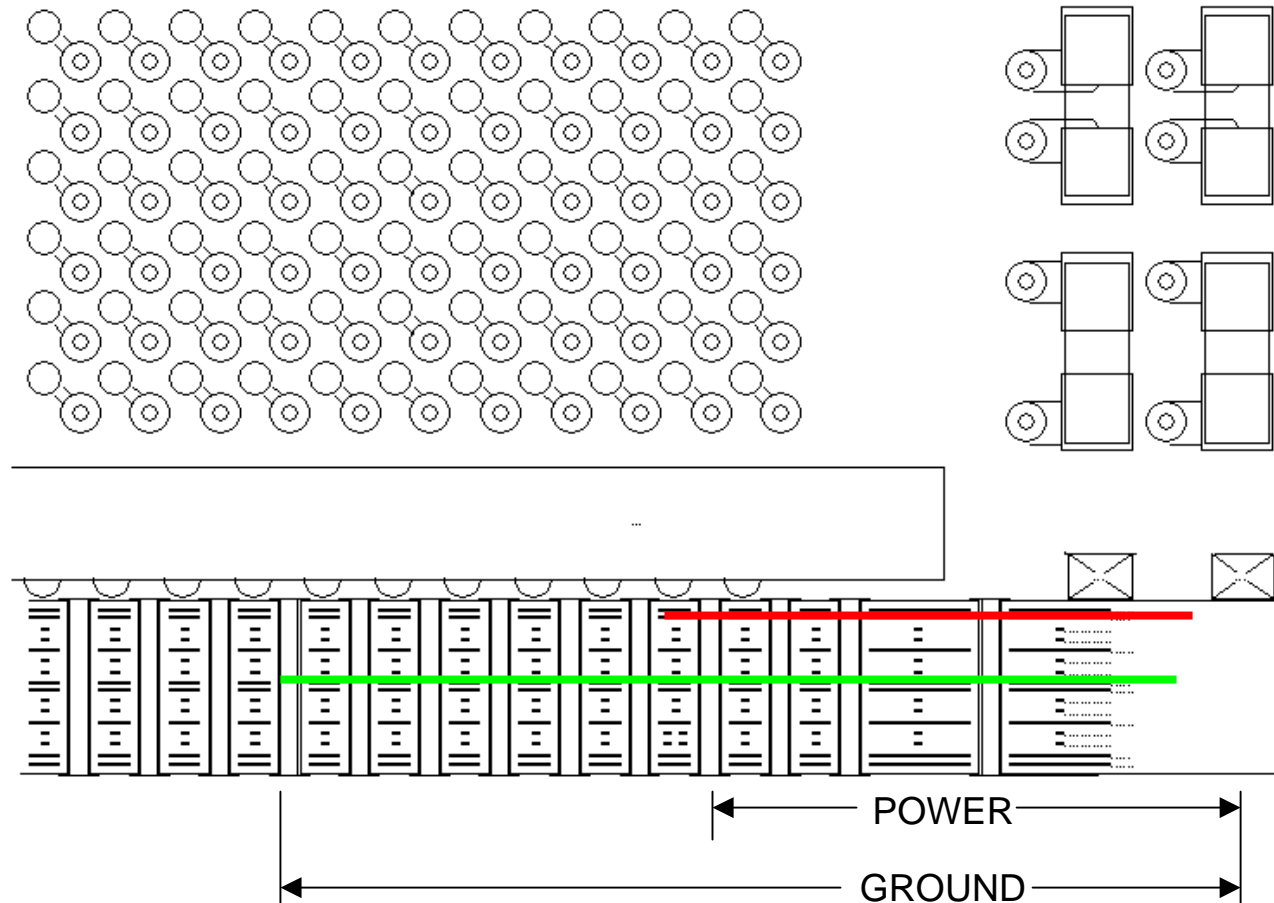
- **For dense boards, decoupling capacitors consume valuable real estate**
- Routing paths are blocked due to the vias required for decoupling

Typical Routing Around Caps



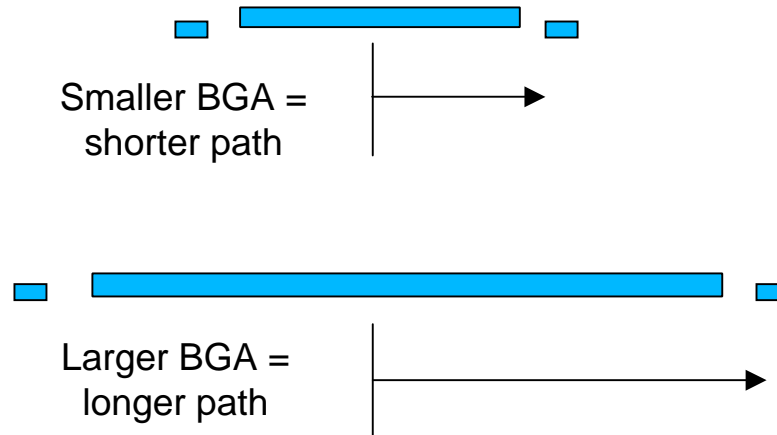
Notice how the caps force the routing to widen out as it enters the BGA.

Cross section showing paths



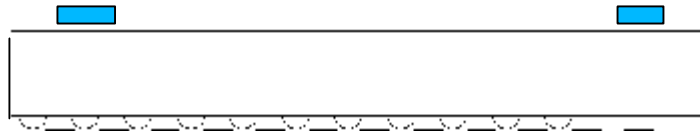
This scale cross section, based on a 1mm package shows the relationship of package, board and capacitors. Current traces from the de-coupling caps along the red and green lines to the device. The longer the line the more inductance in the path.

As BGA packages grow, the inductive path lengthens



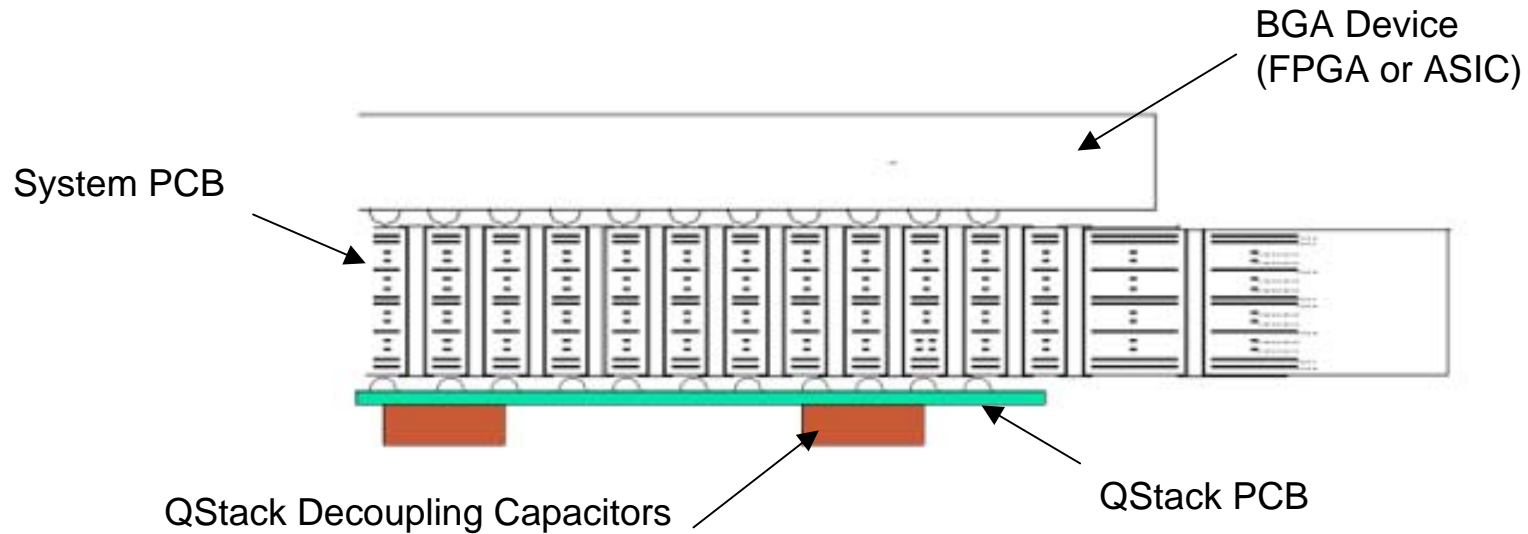
- Packages continue to grow larger.
- As the package grows so does the inductive path length.
- As packages grow the paths become longer, this lower the effectiveness of the de-coupling caps.

Power Delivery improvements From package point of view



One technique used to improve power delivery is to include some decoupling on the package. The amount of decoupling is limited, and increases the cost of the parts.

QStack solution



The QStack solution is to move the de-coupling caps to the bottom of the device. This requires an interface board, or a 'QStack Module'.

A QStack Module is a small PCB with decoupling capacitors on one side, and solder balls on the bottom

The bottom layout pattern need to mirror the surface pattern to allow the QStack module to be mounted as a BGA.

