12

Conclusions

The design of low impedance power distribution networks is a key element in achieving high performance integrated circuits. The inductance of the power grid is a primary obstacle to achieving this goal. Proper allocation of the decoupling capacitors can significantly reduce the network impedance. The effective series resistance and inductance of a decoupling capacitor are key factors in reducing the effectiveness of the decoupling capacitor. The resonant circuit formed within the power network increases the impedance of the network near the resonant frequency.

The network impedance can be reduced by implementing a variety of network structures, based on area, resistance, and inductance tradeoffs. The package impedance also needs to be considered when designing a power distribution network for use within high performance integrated circuits. A number of synthesis and analysis algorithms are available to enhance the power network design process. Accuracy and computational efficiency is the primary tradeoff within all of these design algorithms and tools. A methodology is described based on a two-port infinite mesh model, providing both high accuracy and computational efficiency when analyzing large scale integrated circuits.

The design of power distribution networks is typically performed at several design stages, increasing the accuracy of the current flow estimate while reducing the granularity of the power distribution network. Furthermore, the power distribution network is allocated over a large area with the entire network interacting, requiring near full-scale simulation. Efficient and accurate analysis is therefore a key factor in the design of high performance power distribution networks.

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