Integrated voltage regulator for next-generation microprocessors

Technology #cu12053

This technology is an integrated four-phase switched-inductor (buck) converter capable of regulating the high voltage bandwidths required for microprocessors.

Unmet Need: Integrated voltage regulator that delivers the tight voltage conversion requirements imposed by microprocessors

Integrated voltage regulators (IVRs) are critical to overcoming limits on microprocessor scaling because they transform the high input voltage from a power source into the lower voltage used by electronic devices. Switched-capacitor IVRs exhibit high efficiency at reasonable current densities but operate at a fixed conversion ratio and therefore do not address transient requirements. In comparison, switched-inductor (buck) IVRs show high current densities and efficiencies with a continuous range of conversion ratios, but can be challenging to integrate with high-quality inductors. As such, there is a need for an improved IVR that can effectively deliver the tight voltage conversion requirements of microprocessors.

The Technology: Integrated buck converter achieves stable, predictable, and near-instantaneous signal response

This technology is an integrated four-phase switched-inductor (buck) converter that provides small-signal dynamics and fast response to large-signal input and load-current transients. This technology is integrated directly into the microprocessor unit, which reduces both wasted power and the thermal limits on the downscaling of highly parallel processors. This technology can be used for integrated power conversion on a large scale, such as supplying power to microprocessors with high efficiency.

Prototypes of this technology have been demonstrated to achieve response times as fast as 700ps while driving a 64-tile network-on-chip load in 45-nm SOI.

Applications:

- Voltage conversion in integrated circuits with multiple voltage requirements
- Efficient power conversion in portable electronics like mobile devices
Advantages:

• Stable and predictable signal response
• Near-instantaneous current response to large loads
• Provides continuous voltage conversion ratios
• Removes power and thermal limits on microprocessor downscaling

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Patent Information:

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Related Publications:


Tech Ventures Reference:

• IR CU12053

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