



LTEC Corporation

Newsletter

Air-core Inductors for High Frequency Power Conversion

(Enhanced reports available for purchase)

By

Louis Burgyan, Technical Advisor to Ltec Corporation

June 10, 2015. Embedded high-frequency air-core inductors, deployed in the Haswell and Broadwell processor families, have demonstrated good power efficiency, low ripple, high power density, and low manufacturing cost. The use of air-core inductors makes good economic sense in space-constrained high frequency power delivery systems where granularity and deployment of software-based supervision of power delivery are required. Aside from processors, field-programmable gate arrays (FPGAs), 5G wireless base stations, servers, and server farms are all fertile ground for the use of air-core inductors. For example, FPGAs can perform specific, repetitive functions such as call processing in cellular base stations, or encryption, networking, and many other functions in data centers, faster than processors.

In data centers FPGAs can also play an important role in the energy management side. The use of FPGAs is expected to increase in software-defined server farms where device performance and auxiliary functions such as cooling, air conditioning, and load-dependent power delivery are placed under software control. Energy consumption is a primary concern in server farms, cloud computing, communication, and data storage systems; and major efforts are under way in order to optimize energy delivery in accordance to the actual time/function-dependent load demand.

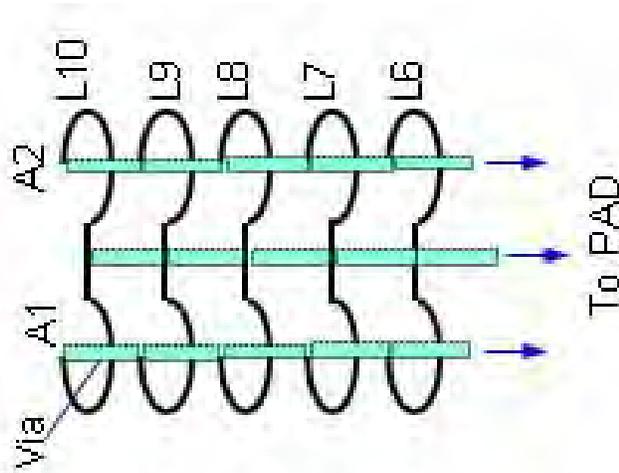
As worldwide data generation is predicted to grow ten-fold relative to its 2011 level, the demand for electrical power will inevitably grow. This rapidly escalating load on the power grid must be mitigated from the point of grid connection all the way down to transistor level. Power delivery and power-grid-related data center downtime will increase along with the cost of operation unless preventive measures are taken proactively at all levels within the cloud computing infrastructure. Today's software-defined data centers (SDDCs) allow virtualization and automatic deployment of storage, network, and security; however, power usage efficiency (PUE) optimization is done primarily within the data center through the deployment of data center infrastructure management (DCIM) software.

Current DCIM solutions do not optimize server capacity as a function of workload; this is the domain of software defined power delivery, which is a board, package, or chip-level implementation that requires specialized software defined power architectures (SDPAs).

Intel's fully integrated voltage regulators (FIVRs) used in the Haswell and Broadwell processors are the first successful commercial SPDA implementations of granular power distribution and delivery at chip/package level. Although there is some unconfirmed "evidence" pointing to a possible change or re-arrangement of the FIVR in the soon to be released Skylake power architecture, LTEC analysts anticipate that SPDA and granular power delivery will remain. The real question is whether or not the dozen or so substrate-embedded air-core inductors deployed in the Haswell and Broadwell processors will be replaced by package or chip-level integrated inductors containing magnetic materials. This is why we are anxiously waiting for the opportunity to analyze the Skylake power delivery system.

The pioneering work of Intel on granular power architectures is expected to influence the power management of advanced processors, smartphones, as well as FPGAs, 5G wireless base stations, and high frequency power conversion in general in the emerging era of integrated power management for years to come. Use LTEC's technical analysis reports to learn about high frequency air-core inductor designs.

Haswell i5-4430 Processor, Level 1 Report



Broadwell Processor, Level 1 Report

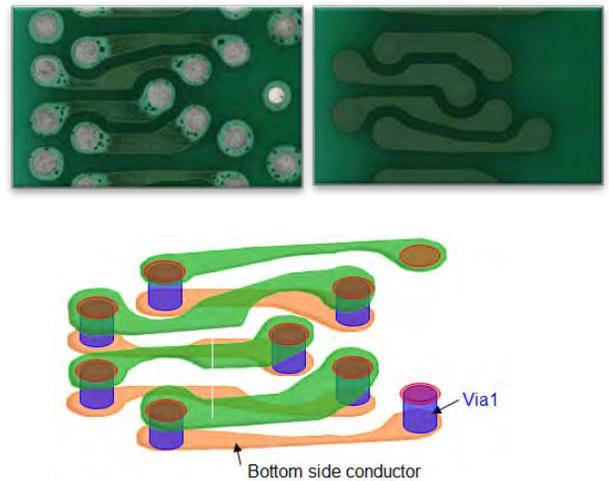
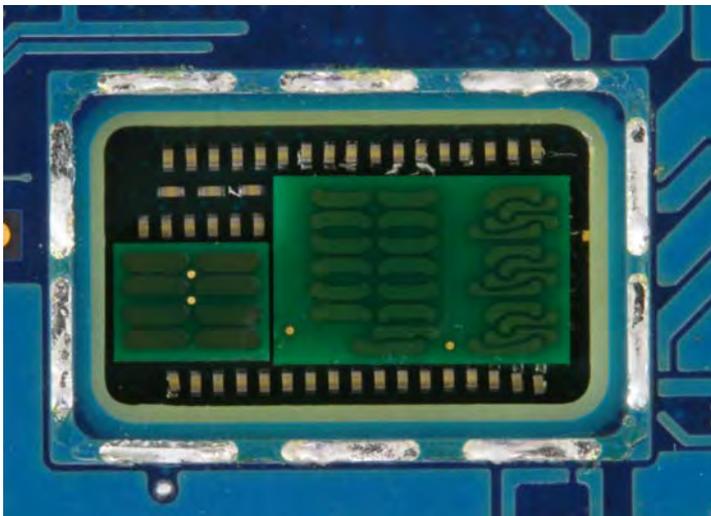


Fig. 2-2-19 Inductor structure rough illustration

These air-core inductor reports of the Haswell and Broadwell processors contain the mechanical design details of the high-frequency air-core inductors and more. Gerber, dxf, or mcm file representations are available upon request. Visit LTEC's website www.ltecusa.com and contact info@ltecusa.com to request our brochures.

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News from the World of IP Service

Viewed from a Practicing Engineer's Perspective

Contributed by Louis Burgyan,
Consultant, Technical Advisor to LTEC Corporation

I recently attended a lively gathering of patent attorneys and IP service providers at a Silicon Valley conference named IP Counsel Café. I am a practicing semiconductor design engineer, self-taught to read and understand patents and the filing process, yet I feel it was worth attending every minute of this event even though it was targeted for patent attorneys. Indeed, it was refreshing to observe the continuing progress of the historically rather static world of patent application and enforcement process. Yes, that's right; the IP world of today is far more dynamic than ever before, and this is not just the result of the continued high level of activity by patent trolls. Since most readers of this newsletter are practicing development engineers, I want to pass on a definition of "patent troll" I heard from Doug Luffman, VP & Chief IP Counsel of NetApp, who was one of the many great speakers at this conference: "A patent troll is a legal entity asserting patents of dubious quality for litigation nuisance value settlement purposes." Surely, not everyone will agree with this definition as patent trolls do provide useful service resulting not only in job security for many IP professionals, but they generate significant cash flow for assignees. The view on troll activity apparently depends on which side you are on.

Just as this lively "workshop-like" conference did, what I really want to focus on is the root causes behind the recent highly dynamic nature of the IP world, which is traceable all the way back to the America Invents Act (AIA) of the US Congress in 2011, a clear, but hopefully not singular, evidence of the US Congress actually accomplishing something very useful.

The AIA has fundamentally reformed the intellectual property laws of the United States by replacing the old "first to invent" system with a "first to file" process. While it is way beyond the scope of a brief newsletter, I can only barely scratch the surface of some of the main issues associated with the new system. The AIA changed the way inventors file, and the way examination of patent applications are performed by the USPTO. It introduced third party reforms, a slew of additional key reforms, and other provisions. Depending on the depth of their involvement, inventors, IP service providers, and (needless to say) patent attorneys, all need to be aware of the new rules and regulations. A good place for engineers to start honing in on the various topics, starting from a high level perspective, is by visiting the link: <http://www.aipla.org/advocacy/congress/aia/Pages/summary.aspx> and then drilling down from there to explore further details as needed.

The AIA had a huge impact on how practicing engineers and their attorneys interact with the USPTO, the often harshly criticized government organization that at this conference received well deserved kudos from some speakers and attendees of this event. Some reasons for the greatly improved image are reduced patent application inventory, the introduction of automated pre-examination search, and improved quality of customer service through the establishment of five regional USPTO offices (one right in the heart of Silicon Valley, San Jose, CA). I am hopeful this good news from the IP-world in some small way will encourage my fellow engineers to continue inventing and learning from inventions of others in order to help solve many challenges of our modern world of ever increasing complexity.

LTEC Corporation's intellectual property analysts take their own initiatives in keeping up with recent changes in the IP-world not only in the United States but within the European Union and Asia-Pacific regions. Contact us or call us to discuss you needs for prior art search, technical analysis, or any other IP-related service. Our experienced team of analysts will provide you with superior quality, timely delivery, and competitive pricing.

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LTEC, Japan's dominant intellectual property analysis company, provides in-depth competitive reverse engineering analysis services for the research and development engineering and industrial legal communities in Japan, USA, Korea, and Taiwan. LTEC helps its customers overcome intellectual property (patent) research, analysis, and protection challenges across all sectors of electronics. With Over 100 highly trained engineers and 33-years of an impeccable track record, LTEC stands ready to help retain or gain a competitive edge for its clients worldwide. www.ltecusa.com



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