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Innovative power inductors for power management in ADAS and AD systems

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ADAS[1] and AD[2] systems place very high demands on the reliability of the components that are used. That's why TDK has developed the CLT32 product series for inductors used in power management units. This series is setting new standards with regard to reliability, miniaturization and electrical parameters.

In ADAS and AD systems, high-performance processors are used that evaluate the data from the different sensors at very high speed and with high processing power, and that control actuators and show information on displays. These processors are supplied with voltages in the range of 1 V but require currents in the double-digit ampere range. PMICs (Power Management ICs) are used as power supplies, which work with multi-phase outputs to provide the necessary high currents. Key components for the stabilization of these currents are power inductors at the outputs. Figure 1 shows a typical topology of an 8-phase PMIC unit for supplying power to a processor.

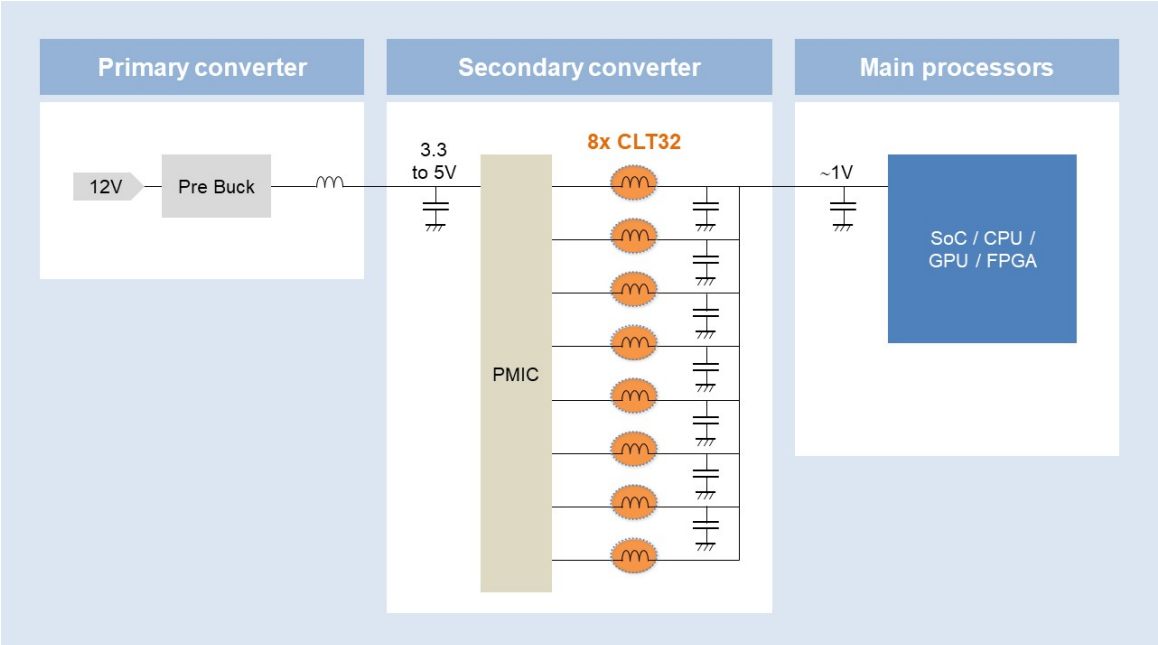

Figure 1: *Principle of an 8-phase PMIC unit with 8 CLT32 power inductors for supplying power to a processor.*

[1] Advanced Driver Assistance Systems
[2] Autonomous Driving

New TDK inductors meet the most demanding requirements

Inductors for PMICs in the automotive sector are subject to very high electrical and mechanical requirements. These include:

- Compact dimensions
- High reliability
- High saturation current
- Extremely low R_{DC}
- Low losses
- Suitable for high frequencies
- Use at high ambient temperatures

To meet all of these requirements, TDK has opted for an innovative design principle for the new CLT32 series of power inductors. This involves a solid copper coil being over-molded with a special ferromagnetic plastic compound. This technology is hugely beneficial thanks to the fact that the coil core and the housing are created simultaneously.

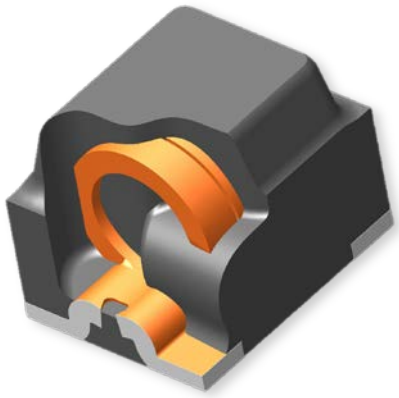

Figure 2: *This cross-section explains the new design: The ferromagnetic plastic compound forms the coil core and the housing simultaneously.*

Another benefit of the new design is that there is none of the usual internal connections as the ends of the coil are already designed as terminals, as shown in Figure 2. This design principle offers two significant benefits for automotive applications in particular: It significantly increases the reliability and, it helps to achieve extremely low R_{DC} values.

A pioneer in miniaturization and electrical performance

Thanks to the innovative design concept, the inductors of the CLT32 series require a footprint of just 3.2 x 2.5 mm^2 with aheight of 2.5 mm. This means that their space requirements are up to nearly 4 times less than that of competitor products with comparable electrical performance. The crucial factor here is that several of these power inductors can be used in PMIC topologies, which ultimately leads to significant reductions in terms of the size of the PCB.

As well as the size, the new series also boasts much better electrical performance compared to rival technologies. For example, the alternating current losses at high frequencies are significantly and remarkably lower compared to thin-film or metal-composite technologies, as shown in Figure 3.

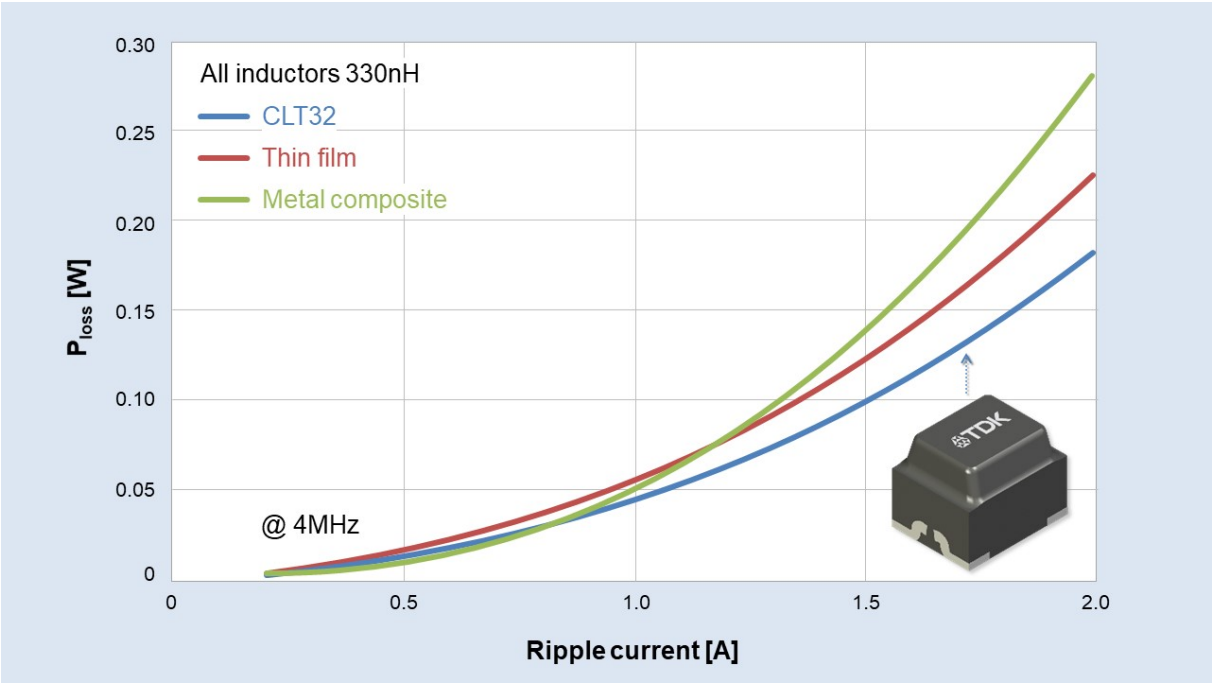

Figure 3: *Whereas metal-composite inductors have a power dissipation of 0.28 W at a ripple current of 2 A, this value is just 0.18 W with the new TDK inductor.*

The series CLT32 inductors are also far superior to other technologies with regard to the efficiency and the drift of the saturation current at different temperatures. Concerning inductance values, the new series includes values ranging from 17 nH to 440 nH. The new power inductors are designed for rated currents of 10 A to 45 A, with high saturation currents of up to 60 A also of particular importance. Another key benefit of the CLT32 series is its highly reliable operating temperature of 165 °C, making it extremely well-suited for automotive applications. Thanks to their wide frequency range of up to 10 MHz, the robust inductors are also suitable for GaN semiconductor applications.

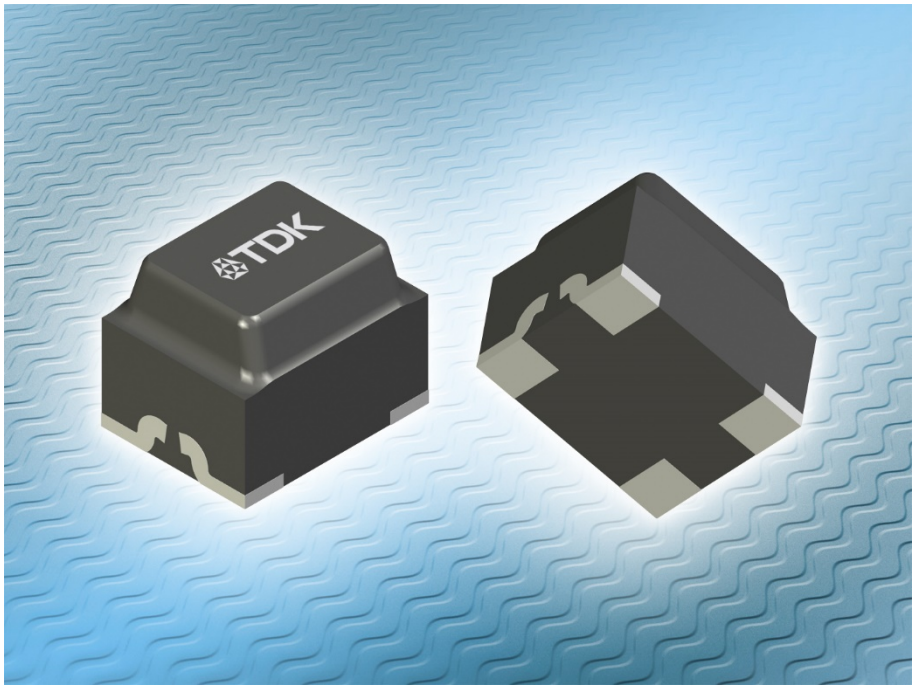

Figure 4: *Measuring just 3.2 x 2.5 mm² with a height of 2.5 mm and excellent electrical characteristics, the power inductors of the CLT32 series are setting new standards in miniaturization.*

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