

LIGHT UP YOUR WAY!

Lighting is one of the most growing applications in the automotive segment. Approximately 30% of all accidents occur at night, that's why it is essential for both seeing and being seen. To improve driving safety, Tier 1 customers are developing innovative adaptive front lighting systems (AFS).

In the latest systems, for example, a total of 25 LEDs can be operated on full power in each headlight.

Currently, electronic designers are facing the problem of developing LED driver circuits with low power consumption and finding components working reliably at high frequency (some MHz).

Picture 1 shows the block diagram of such a design, which is mainly based on an input filter followed by boost and buck stages. The filter circuit is designed to absorb noise, allowing the ECU to work properly in its reserved frequency range.

In the boost stage input voltage is transformed to a higher output voltage, in most cases from 12V to 70V. Usually such boost converters are operating in the frequency range of 1-2MHz to improve the efficiency.

The buck converters are supplying the LEDs by providing an output voltage of 5V or lower.

To achieve stable boost and buck converter circuits, it's necessary to use power inductors with high current capability and low temperature drift. A drastic drop of the inductance value can lead to a malfunction, which results in instability of the output voltage. Due to its monolithic structure, Panasonic's ETQP series has soft saturation behavior. (Picture 2). By applying high ripple current the inductance will drop almost linear and there is nearly no deviation of the inductance value at temperatures of up to 160°C.

As mentioned before, high efficiency and low losses are the requirements for lighting designs.

On the inductor side there is two different kinds of losses occurring: DC and AC losses.

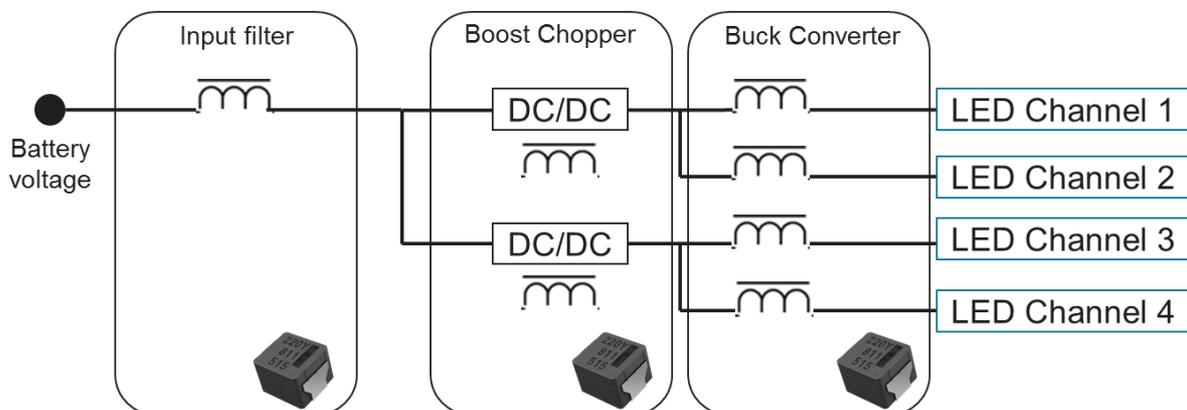
DC losses are mostly due to resistance of the copper wire which benefit of the low DCR of the ETQP series down to 1mΩ. AC losses, on the other hand, are mostly related to frequency dependent core losses.

As you can see in Picture 3, by increasing the frequency the core losses are increased as well.

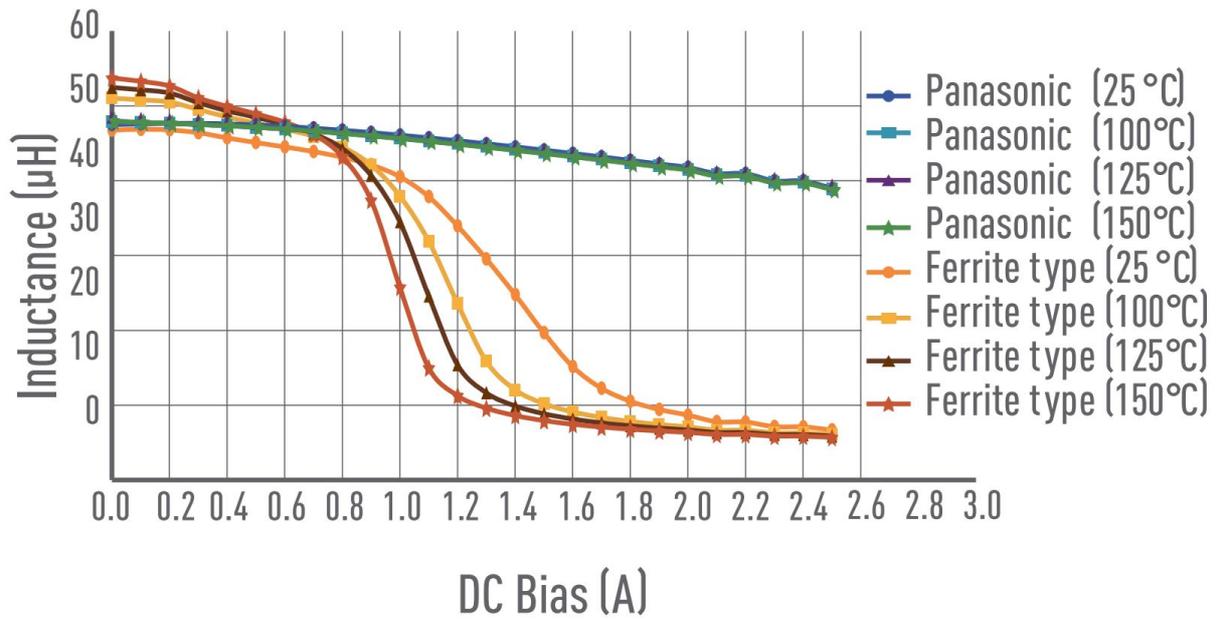
By Panasonic's metal composite technology, the core losses can be reduced by almost half compared to the ferrite technology. That way the efficiency and the thermal behavior of the circuit can be improved by reducing the losses. In addition, due to the monolithic structure, eddy current losses can be better controlled or reduced, which improves the power efficiency of the coil itself.

Besides all electrical advantages, with Panasonics ETQP series miniaturization of the inductor is possible as well. Panasonic can achieve better electrical behavior in smaller case size compared to competitor ferrite solutions in bigger case size.

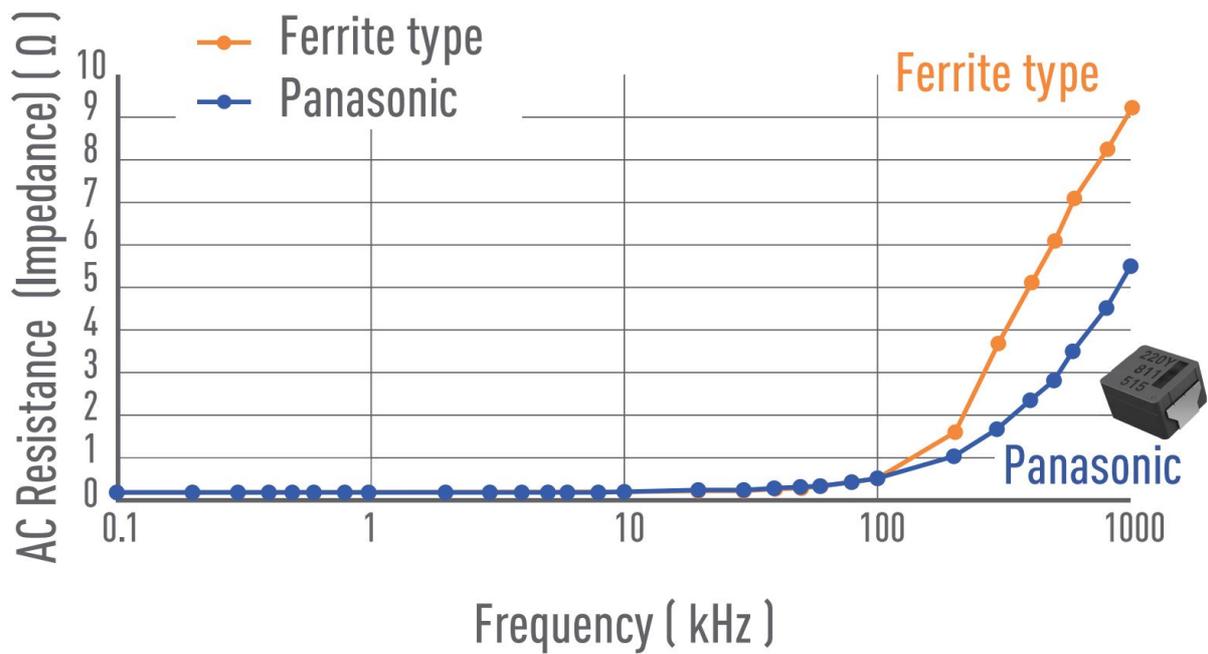
All these attributes of the Panasonic metal composite technology are making the component so successful for lighting applications. This allows electronic designers to achieve better thermal behavior, miniaturization and high efficiency in their circuit design.



Picture 1: Block diagram of lighting system



Picture 2: comparison Panasonic PCC vs Ferrite



Picture 3: comparison Panasonic PCC vs Ferrite by AC resistance vs frequency.