Miniaturization of LED Drivers

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Miniatrization of LED Drivers

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Introduction

- Great demand for miniaturization in lighting industry
- Power supplies are bottle neck, due to their bulky energy storage components
- This poster: several design considerations towards miniaturized LED drivers.

Design Considerations

- Topologies: Soft-switching resonant converters
- Control: Combination of control schemes (e.g. frequency control + burst mode control)
- Devices: Wide band-gap (WBG) devices and Integrated Passive Devices (IPDs) technologies
- Energy Storage: Active ripple port circuits allowing for employment of smaller and more robust capacitor technologies
- Frequency: HF and VHF operation.

Experimental Results

Measurement results of a class-DE series-resonant converter that can be incorporated for the AC-DC and the DC-DC stages in an LED driver:

- Up to 400V input with soft-switching
- 1 MHz operation
- High voltage GaN switches and SiC diodes
- Potential for operation in HF and VHF ranges
- Frequency modulation can be used for line/load regulation.

Fig. 1 Miniaturization Strategy.

Fig. 2 Class-DE Series-Resonant Converter.

Conclusion

- Operation at high frequencies is key for miniaturization
- Good candidate: soft-switching resonant converters
- WBG devices show great potential for high efficiencies
- Combined control can allow for enhanced line/load regulation.

References


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