Plug-and-play realization of the virtual infinite capacitor (Ramot)

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In high power applications, especially where AC/DC or DC/AC conversion are involved, the high voltage DC bus suffers from voltage ripples. Low frequency current smoothing is required to minimize ripple voltage on the DC bus, which may affect other circuitry connected to the bus. Voltage smoothing is required in multiple applications, including photovoltaic and wind energy inverters and electrical vehicles DC bus, electrical vehicles chargers and LED lighting drivers.

The ripple smoothing is achieved by connecting large electrolytic capacitors across the bus terminals. These capacitors have short life (5,000 – 10,000 hours) that reduce system reliability. Moreover, they are large and bulky and present constrains on system size. Film capacitors that have much better operating life span (~20 years), and are much smaller in size, have the disadvantage of low capacitance-voltage product.

Technology Overview

The PnP VIC is a two terminal, plug and play, high reliability alternative to large electrolytic capacitors for smoothing applications. The PnP VIC is a smart system, comprising of power circuitry incorporating low capacitance - long life film capacitors, and control circuitry. This scheme boosts the internal low capacitance to filter ripples like a very large capacitance. In addition, this two terminal device automatically tunes itself to the bus voltage, allowing simple integration into existing power electronics. The high reliability and the smaller size of the PnP VIC compared to its electrolytic capacitor equivalent, makes it a promising solution for demanding HV bus smoothing challenges.

Benefits

- Two terminal voltage smoothing device, plug and play architecture
- 300V-1000V DC voltage operation range
- Efficiency > 99.8% relative to the DC bus power
- 15:1 size reduction compared to equivalent performance electrolytic capacitor
- Lifetime (ΔC/C ≤ 5%): 100,000 hours at nominal voltage and at 70°C

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