Patent Search

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Abstract:

Abstract Compared to conventional silicon semiconductors, wide bandgap semiconductors have advantageous material features that could one day allow power dev function at elevated temperatures, voltages, and flipping speeds. Wide bandgap semiconductors that produce power can reach extraordinary levels of efficiency with density of power due to the relatively low on-resistance and rapid switching speeds of these devices. These intriguing power semiconductor components will enhance performance of current power converters and enable the creation of new ones, increasing the effectiveness of electric energy conversions and rationalizing their use. source voltage of the circuits significantly overshoots, and the current that drains rings in resonance via the parasitic capacitance present because of the fast-changin which generates a voltage across the parasitic inductance within the circuit. Consequently, reducing parasitic inductance is critical for reliably driving WBG semicondu supply power. This work suggests a lattice in three dimensions for PCBs that cancel magnetic flux in horizontal and vertical directions, thereby lowering parasitic indu designed structure's electromagnetic flux cancellation is detailed, and the connection between the cancellation effect and overall parasitic inductance is analyzed. A w circuit board design process is also offered that relies on the suggested architecture. The most recent 20-A 5-MHz 3-D incorporated POL converter shows power dens as high to be 1100 W/in3 that is an enhancement of a factor of 10 over conventional products at the comparable current level. The converters for energy based on W can benefit from the suggested method's increased efficiency and robustness.

Complete Specification

Description:Eliminating Parasitic Inductance in Semiconductor-Based Converters with A 3D Lattice Structure

Field and Background of the Invention

The Power converters are due for an upgrade to a new generation of devices utilizing WBG materials for semiconductors. The improved effectiveness of electrical e transformation made possible by employing WBG power semiconductors will eventually result in a more sensible use of electromagnetic electricity and a critical enhancement in the size and durability of power conversions. To reduce parasitic inductance, many strategies have been presented. It can be minimized by shorten duration of the current circuit or increasing the breadth of the conductor the current is flowing through. By attaching the decoupled capacitor immediately onto the bridge of a system-in-a-package, the power loop can be kept to a minimum. Although this strategy can lessen the power circuit inductance, connecting the capacito straight to a SiP can be difficult. By strategically situating conductors carrying opposite currents next to one another in the initial layer, the flux of magnetic cancellat inside the layer can be optimized. Segments in the subsequent layer are positioned so that their current flows in the opposite direction from the layer above and be them to maximize flux cancellation between the layers. Then, to maximize the magnetic flux cancellation, the initial and subsequent layers are paired up and layere several times to create a multilayer structure. As can be seen, the proposed magnetic flux cancels out between layers.

When two layers intersect, the magnetic flow cancels out, creating a horizontal magnetic field. Since the suggested 3-dimensional lattice structure may generate hor and vertical electromagnetic flux cancellations, the parasitic impedance of the PCB could be efficiently reduced when more segments or layers are added. By emplo ANSYS, we compared the conducting material's magnetic flux density before and following implementing the recommended structure. In both situations, the dimer

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