Limitations in Today's Passive Electrical Components

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Compared to active (semiconductor) devices, passive components have been largely left behind in terms of device scaling. Despite attempts, fundamental physics and lack of robust materials have prevented successful shrinking of passives. Frequency scaling is particularly problematic, given the degree of energy loss mechanisms that only worsen at MHz frequencies and beyond. Moreover, the increased power density that accompanies circuit scaling elevates localized temperatures, reducing the reliability of the materials comprising magnetic and capacitive components. This self-heating puts a severe strain on passive components and limits their utility and potential for scaling.

This talk will address some of the shortcomings and limitations in today's passive electrical components covering topics from magnetic devices to capacitive devices to substrates. A careful examination of both the underlying physics hurdles and the need for new advanced material systems will be presented as technical challenges in need of solutions. As a systems integrator and microelectronics component manufacturer, BAE Systems has a vested interest in adaptive and rugged, small form factor (SFF) passive electronic devices that augment system capabilities in support of the warfighter.