Resources

Triquint White Paper: Gallium Nitride Applications

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Thu. May 15, 2008

I. Introduction

Since the late 1990s, Gallium Nitride technology has been developed from small pieces studied in universities and advanced research labs into a viable technology for commercial and military applications. Both private and government funding has propelled research and development in this wide bandgap material to bring it to market at a faster rate than Gallium Arsenide in the 70's and 80's.

The benefits of Gallium Nitride are by this time well documented. It has much higher power capability compared to Gallium Arsenide due to its high breakdown voltage and high current. In addition, Gallium Nitride has been demonstrated to have good noise and linearity characteristics making it suitable for a wide range of applications.

Most of the RF transistor work to date has been done on HEMTs, or High Electron Mobility Transistors. There continues to be work done on Heterojunction Bipolar Transistors (HBTs), but these devices lag HEMT development by several years and face some formidable challenges before they become commercially viable.

TriQuint Semiconductor has been a leader in Gallium Nitride HEMT development. TriQuint began investigating GaN along with university and commercial partners in 1999. By 2001, TriQuint had established a baseline process using 2" material on its R&D line in Richardson, Texas. The process showed promising results with over 7W/mm and efficiency as high as 50% at X-band, but the material and process were still immature. In 2003, TriQuint was the first to apply an integrated field plate gate and achieved stable, high efficiency devices operating at 30V. TriQuint established a baseline field plate process on its Richardson manufacturing line and in late 2004, 3" material started to become widely available. Then, in 2006, TriQuint employed a dual field plate technology which together with improved material enabled stable, reliable 40V operation with efficiency over 55%, power density over 6W/mm and gain over 12dB at X-band. Further refinements demonstrated world class results at 30GHz and 35GHz as well.

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