HIGH EFFICIENCY POWER AMPLIFICATION CONFIGURATION FOR PORTABLE WIRELESS DEVICES

Tech ID: 17893 / UC Case 2008-031-0

ABSTRACT

Transmit power consumption often governs the ultimate battery lifetime of portable wireless communications devices, and therefore transmit power amplifiers used in these devises are important to their commercial success. The efficiencies of these power amplifiers are set by the capabilities of the semiconductor transistor devices that drive them. The most efficient power amplifier configurations operate their semiconductor transistors as switches that, if ideal, would not dissipate any power, making these amplifiers theoretically capable of achieving 100% drain efficiency. However, semiconductor transistor switches are not sufficiently ideal to allow these power amplifiers to achieve their efficiency potential. Instead, their finite series resistance, large input capacitance, nonlinear drain capacitance, substrate losses, voltage limitations, and temperature dependencies all contribute to lower effective efficiency.

To achieve a more ideal efficiency for power amplification configurations, researchers at UC Berkeley have developed a switch design that reduces or eliminates many of the efficiencies of semiconductor transistor switches. In overcoming the long-standing impasse in power amplifier advancement, this innovative switch has the potential to open many new opportunities that include not only an increase in the talk-time of portable battery-powered wireless transceivers, but also a significant increase in the range of high power transmitters.

The higher efficiency enabled by this Berkeley switch reduces the power dissipated in the amplifier itself, thereby lowering its temperature and allowing a further increase in output power -- that is further accommodated by the large voltage handling capability and better temperature resilience of the switch. The net result is a high power transmitter in a smaller and lower weight package.

APPLICATIONS

Circuits that requires switching such as switching power amplifiers and power converters, and in particular the integration of power electronics in portable systems, where off-chip (i.e. non-CMOS) devices currently must be used for power regulation, power conversion, and power amplification. This technology makes possible the single-chip implementation of a complete portable electronic system (e.g. mobile phone hand set) that includes not only communications and computing circuits, but also the power conditioning and amplification circuits as well.

ADVANTAGES

Much faster switching (e.g. GHz switching speeds)

"On" resistance and "off" capacitance attributes that are superior to transistor-based alternatives

Higher reliability than conventional RF MEMS switches

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,077,060	07/07/2015	2008-031

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OTHER INFORMATION

KEYWORDS

mixed signal: transceivers, RF, MEMS, wireless, wireless: component

CATEGORIZED AS

- » **Communications**
  - » Wireless
- » **Semiconductors**
  - » Design and Fabrication
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