

Envelope Tracking Power Chips Boost Efficiency In Smart Phones

To significantly boost the efficiency of 3G and 4G/LTE multi-mode, multi-band RF power amplifiers (PAs) used in smartphones and tablets, [Texas Instruments](#) has released an efficient envelope tracking (ET) power supply chipset. The ET chipset comprises a new step-down converter with integrated dc-dc boost, the LM3290, and the companion LM3291 linear amplifier (Fig.1). In fact, the LM3290 is an RF envelope supply modulator with integrated boost converter.

Because the ET replaces the fixed dc supply voltage to the RF power amplifier (PA) with a dynamic supply voltage to track the amplitude or envelope of the transmitted RF signal, it provides higher output power levels and high efficiency at high peak-to-average power ratio (PAPR). Plus, it meets stringent receive band noise requirements in all LTE bands. As a result, it offers significant improvement in the energy efficiency of RF PAs.

According to TI, this new ET power supply solution cuts overall power consumption by about 25%. This lower loss translates into lower generated heat. As a result, the transmitting PA's temperature can be lowered by about 20°C, according to the vendor.

Because average power tracking (APT) offers best results for low output power and ET improves efficiency at high output power and high PAPR, which is a typical operating condition for LTE, the LM3290 combines the best results of APT and ET operation (Fig.2.) Hence, the LM3290 operates in two modes. For low amplifier output power, the LM3290 operates in APT mode, providing a static, but programmable, output voltage to supply the PA. At light load and in APT mode, the LM3290 enters into pulse frequency mode (PFM) operation automatically and operates with reduced switching frequency and quiescent current to extend the battery life.

In ET mode, the LM3290 together with the LM3291 efficiently provide a dynamic, high-bandwidth supply voltage for the PA to maximize total envelope modulator (EM) + PA efficiency. The EM follows the envelope reference input signal delivered by the RFIC to the LM3291 via a differential analog input. The output is a single-ended power supply signal to the PA as shown in Fig.1.

Supporting 3G and 4G LTE bandwidths up to 20 MHz, the ET chipset handles battery voltages from 2.5 V to 5.0 V. The LM3290 buck-boost converter comes in a 30-bump, lead-free DSBGA package, and is priced at \$0.80 in 1,000-unit quantities. Similarly, the LM3291 linear amplifier comes in a 12-bump lead-free DSBGA package, and is priced at \$0.75 in 1,000-unit quantities.

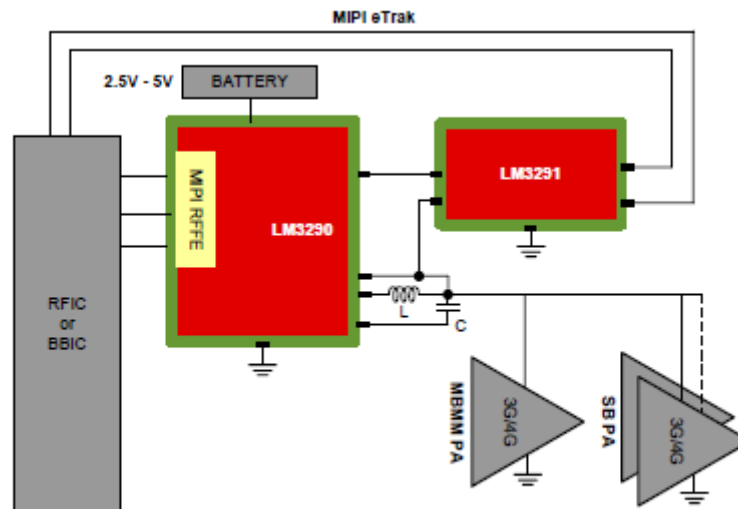


Fig.1. The envelope tracking (ET) chipset comprises a step-down converter with integrated dc-dc boost, the LM3290, and a companion linear amplifier, the LM3291. In ET mode, these two chips efficiently provide a dynamic, high-bandwidth supply voltage to the PA to maximize total envelope modulator + PA efficiency.

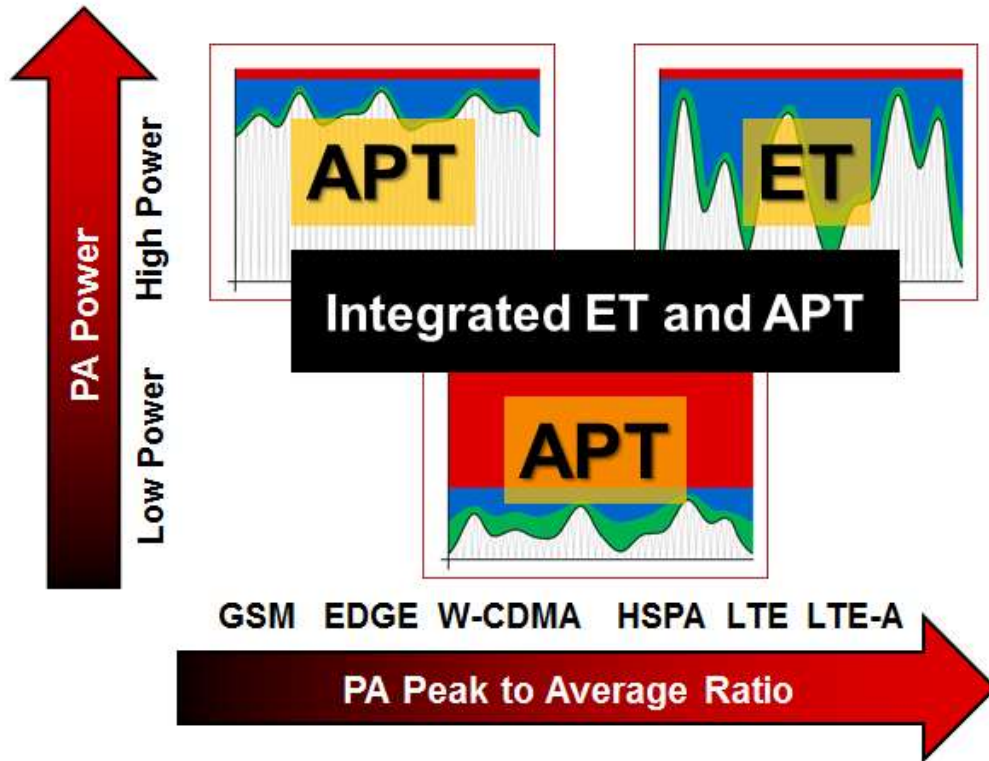


Fig.2. The LM3290 combines the best attributes of average power tracking (APT) and envelope tracking (ET) operation.

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