# A 13.56MHz CMOS Active Diode Full-Wave Rectifier Achieving ZVS with Voltage-Time-Conversion Delay-Locked Loop for Wireless Power Transmission

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A highly efficient full-wave rectifier with active diodes (AD) for implanted-medical devices
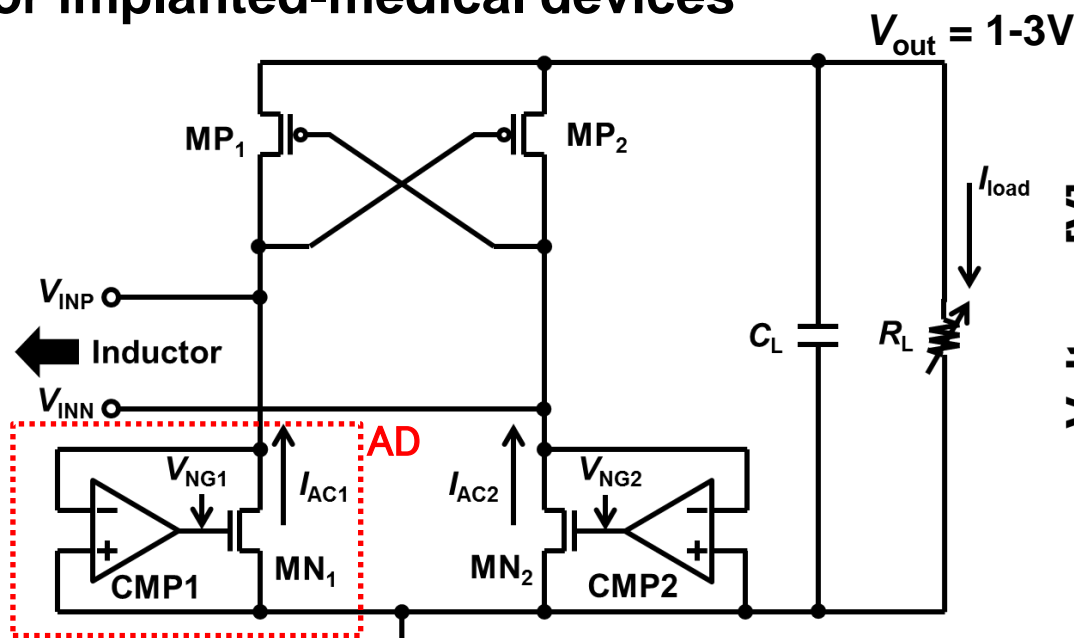
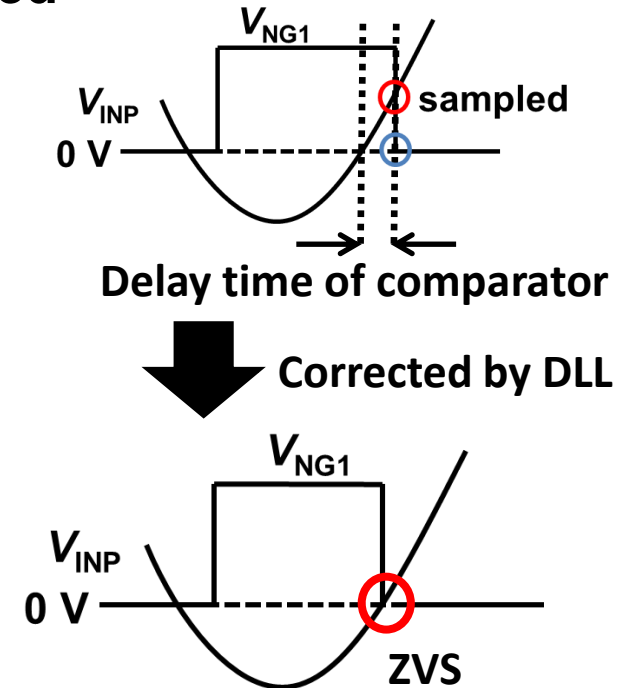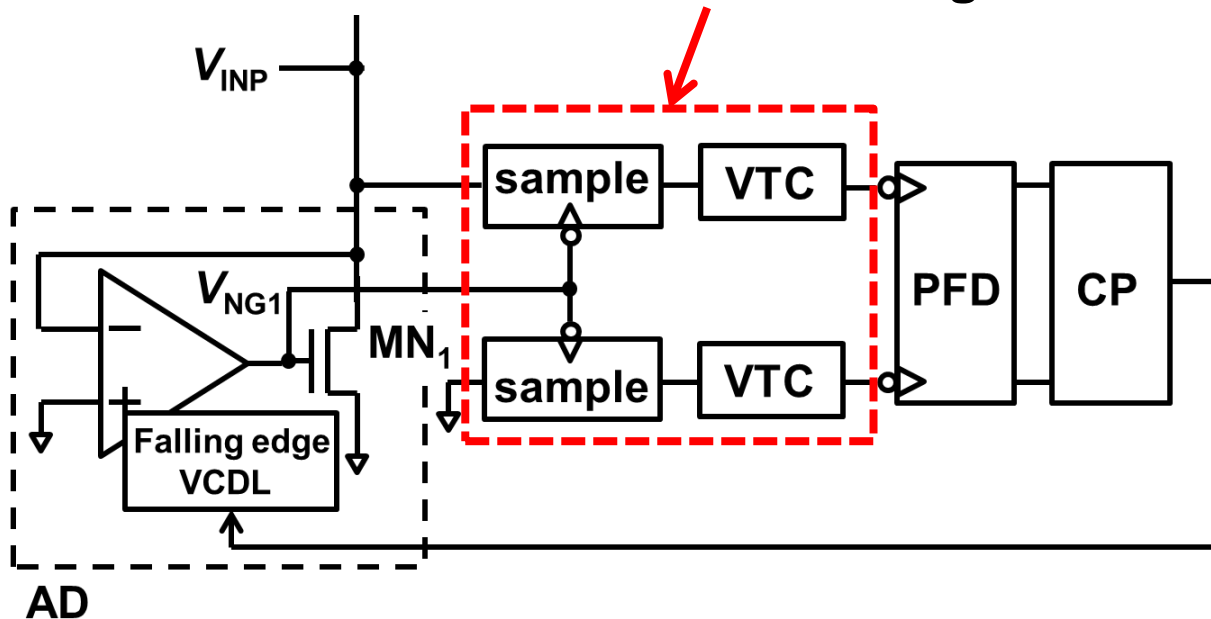**Forward voltage drop ⇒ P/N junction diode : 0.5V**
Active diode : 0.2V
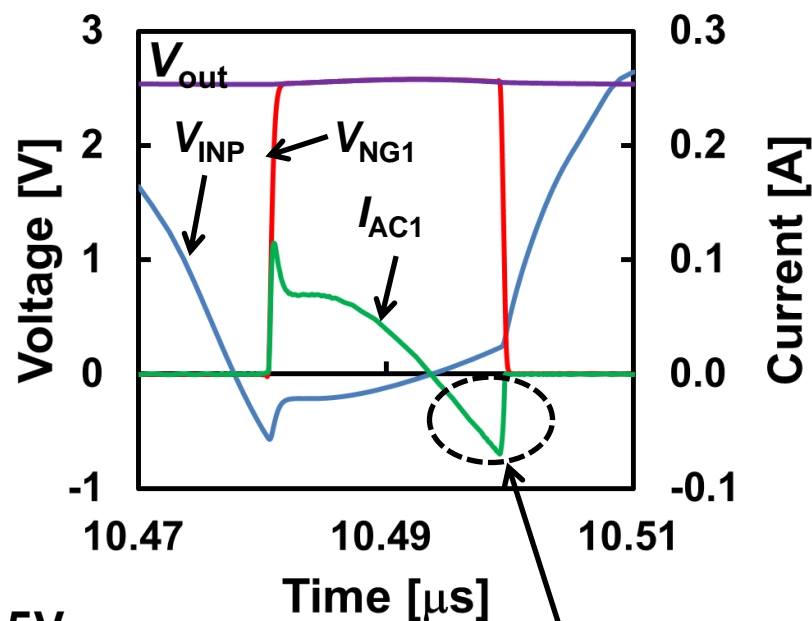
Reverse current flows

Zero-voltage switching (ZVS) is needed to suppress reverse current.
➡ ZVS in wide conditions is difficult due to AC input, process variations, etc.
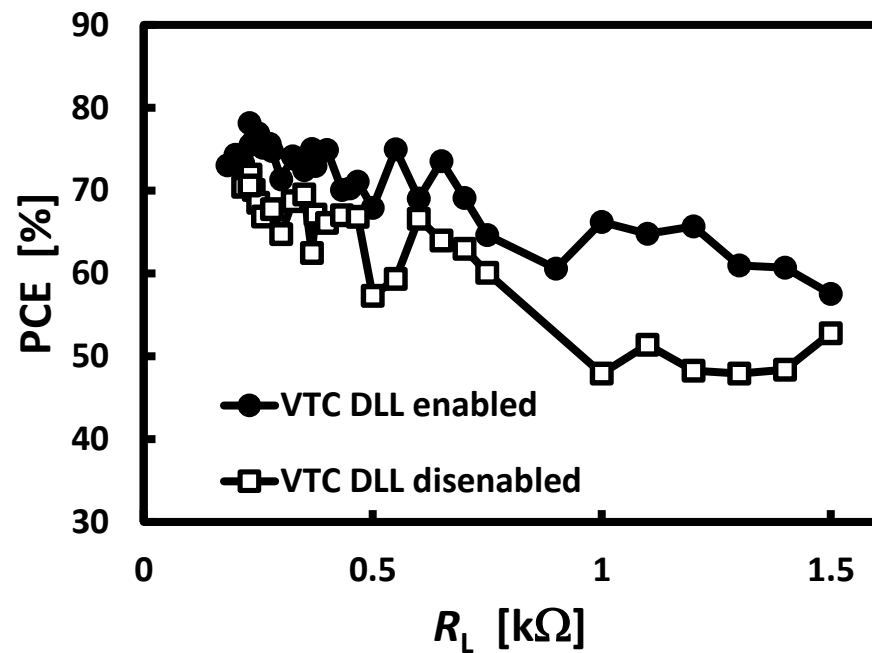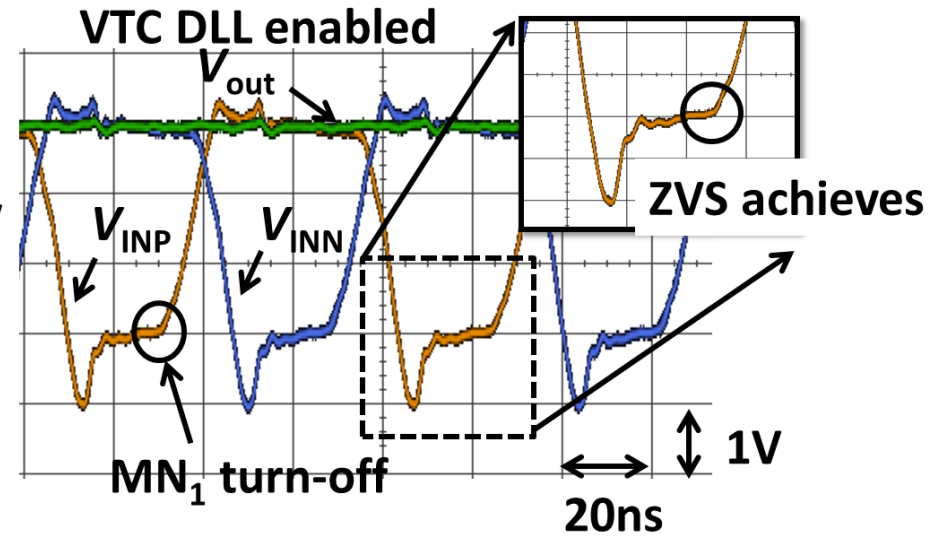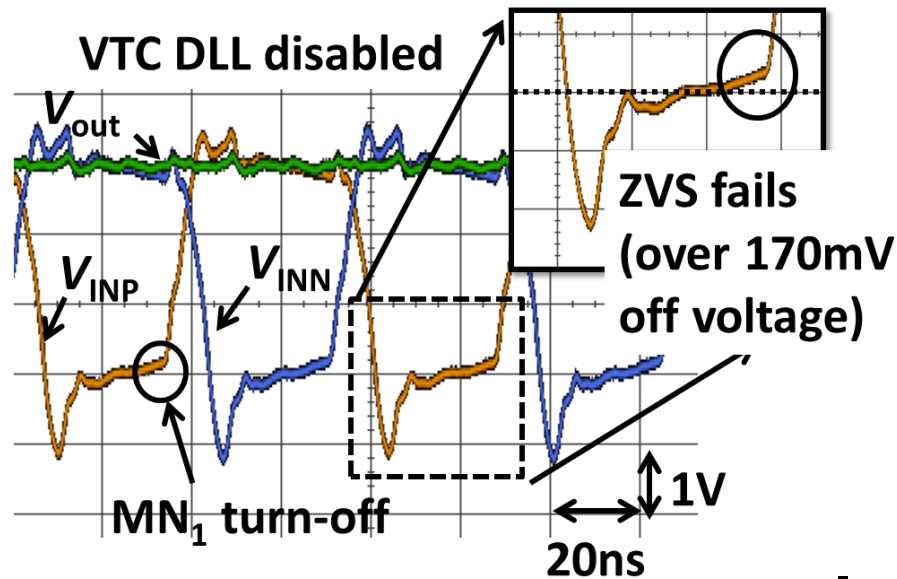
Proposed VTC-DLL Technique

Sampled voltage errors are converted to time domain error signals.

VTC-DLL samples AC input voltage at falling edges of V_{NG1} and corrects sampled voltage errors with feedback operation.
➡ ZVS is achieved in wide operation conditions.

Measurement Results

Implementation:
Standard 0.18um CMOS process using I/O MOSFETs (0.0726mm^2)

Maximum PCE 78% is obtained at R_L=231ohm (P_{OUT}=39mW).

PCE is enhanced by 8.2% in average with proposed VTC-DLL.