

8-Channel Ultrasound Receiver with a Beamforming Embedded SAR ADC

Taehoon Kim(t.kim@tudelft.nl)

Delft University of Technology

Abstract

Three-dimensional ultrasound imaging systems call for an array of thousands of ultrasonic transducer elements, far exceeding the number of channels of conventional imaging systems. To avoid an unmanageable number of cables, signal-processing electronics, including a receiver and a transmitter, need to be integrated into the probe. Focusing on the design of the receive path, an 8-channel ultrasound receiver compatible with in-probe electronics for 3D ultrasound imaging is presented. It has eight analog front-ends for signal conditioning and beamforming embedded SAR ADC for performing both an 8-to-1 analog summation and its digitization in charge mode. By combining the 30-dB programmable gain of the analog front-ends with the 60 dB SNR of the ADC, the 8-channel receiver achieves the DR of 80.2 dB. The delay is set in increments of 4.17 ns, up to a maximum of 292 ns. Implemented in a 0.18 μ m CMOS process, a prototype occupies an active area of 0.525mm²/channel and draws 23.25 mW/channel at a sampling frequency of 20MHz.

Keywords: *Ultrasound receiver, analog front-end (AFE), in-probe beamforming, analog-to-digital converter (ADC)*

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Biography

Taehoon Kim received the B.S., M.S., and Ph.D. degrees in electrical and computer engineering from Seoul National University, Seoul, Korea, in 2009, 2012 and 2017, respectively. From 2017 to 2018, he was with ASIC & IP development team in Samsung Electronics, Hwasung, Korea. Currently, he is a postdoc researcher in Electronic Instrumentation Lab, TU Delft with LEaDing Fellowship (Marie-Curie COFUND) support. His research interests include front-end electronics for ultrasound medical imaging.