Technical Article

Take Your Ultrasound Design to the Next Level

Ultrasound designers face a constant challenge to improve system performance and incorporate the latest technological advances that will help physicians detect disease, monitor patients and save lives.

Based on an expansive portfolio of embedded and analog technologies, TI products can improve the way medical professionals interpret results from their ultrasound scanner equipment. By optimizing the complete signal chain and increasing power efficiency, TI is enhancing the future of medical ultrasound innovation. In this blog post, I'll discuss our latest reference designs through two key obstacles that ultrasound designers face: achieving a higher signal-to-noise ratio (SNR) and attaining high efficiency by optimizing power consumption.

Higher SNR

It is no secret that the fidelity of the signals in an ultrasound system directly impacts the quality of the generated image. Higher SNR enables higher-resolution images and allows for easier detection and diagnosis of issues by medical professionals.

TI reference designs for achieving higher SNR include:

- **High-Resolution, High-SNR True Raw Data Conversion Reference Design for Ultrasound CW Doppler**. Completing the continuous-wave (CW) Doppler signal chain with the analog front-end (AFE), this reference design features the ADS8900B 20-bit successive approximation register analog-to-digital converter (SAR ADC), achieving an among the industry's best SNR of 101.2dB for the entire signal chain. The higher sampling rate achieved by this design gives you more flexibility in implementing post-processing to improve SNR even further.
- **2.3 nV/, Differential, Time Gain Control (TGC) DAC Reference Design for Ultrasound**. This reference design delivers exceptionally low noise TGC signal for ultrasound applications, enabling TI's AFE58xx to resolve lower-amplitude signals and thus achieve deeper and higher-resolution images. The included full design simulation capability allows you to add constraints, change components and check the resulting impact on noise performance.

High-efficiency Power Solutions for Ultrasound Scanners

Improving power efficiency in ultrasound scanners is critical in order to enable portability, optimize overall power consumption and reduce power-supply design complexity.

TI reference designs for improving power efficiency include:

- **400-W Continuous, Scalable, ±2.5- to ±150-V, Programmable Ultrasound Power Supply Reference Design**. This 400W continuous design can generate scalable output voltages from ±2.5V to ±50V for low- and mid-voltage rails and up to ±150V for high-voltage rails, delivering up to 89% efficiency from a 24V input at full load.
- **Programmable ±100-V, High-Current, Floating Linear Regulator Reference Design for Ultrasound Systems**. This design replaces passive and active noise filters by using a linear regulator (LDO) approach, while supporting an output voltage between ±2.5V and ±100V. It can also enable shear wave or elastography modes by using power metal-oxide semiconductor field-effect transistors (MOSFETs) to scale the current.
- **Low-Noise Fixed Drop-Out ±2.5 to ±12-VOUT 3A Power Supply Reference Design for Ultrasound CW Pulser**. This reference design is the simplest way to provide an ultra-low-noise, low-ripple, programmable low-voltage power supply to support CW mode, adjustable by software.
- **Low-Voltage, Low-Noise Power-Supply Reference Design for Ultrasound Front End**. This reference design provides the complete power-supply solution for ultrasound analog front ends such as the AFE5818, able to drive up to 128 channels and up to 36W. It optimizes power efficiency and reduces component count, while providing overcurrent protection and maintaining ultra-low noise.

TI's extensive portfolio can provide complete, state-of-the-art solutions that maximize SNR, providing higher-quality images while simultaneously optimizing power efficiency and reducing design complexity.

Additional Resources

- Reduce the noise for the TGC circuit on your medical ultrasound design.
- Implement a floating linear regulator for your ultrasound transmitter power design.

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