TI Solutions for Sonar

Introduction

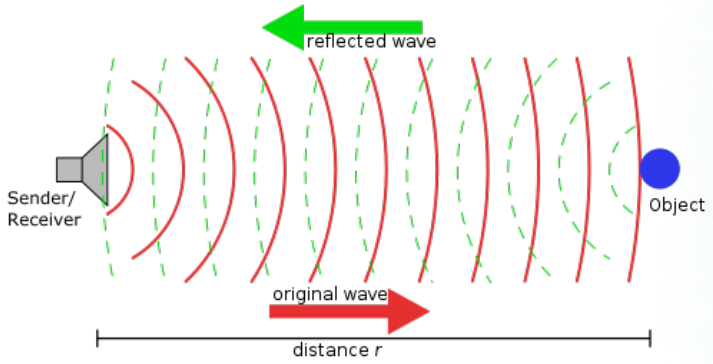
- Purpose
  - To introduce TI's AFE, VCA, and ADC solutions for Sonar
- Content
  - Ultrasound vs Ultrasonic
  - Sonar applications
  - TI Solutions for Sonar
    - AFE5809
    - AFE5808A
    - VCA2615
    - VCA5807
    - ADS5295
    - ADS5294

Ultrasonic vs Ultrasound

- Ultrasonic refers to more than just Medical Ultrasound.

- It refers to any application that uses high frequency sound pulses or electromagnetic waves to measure distance, velocity, or material characteristics.

- Basic operation and electronic components are similar, but frequencies, distances, measurement environments, and total number of channels can vary greatly.

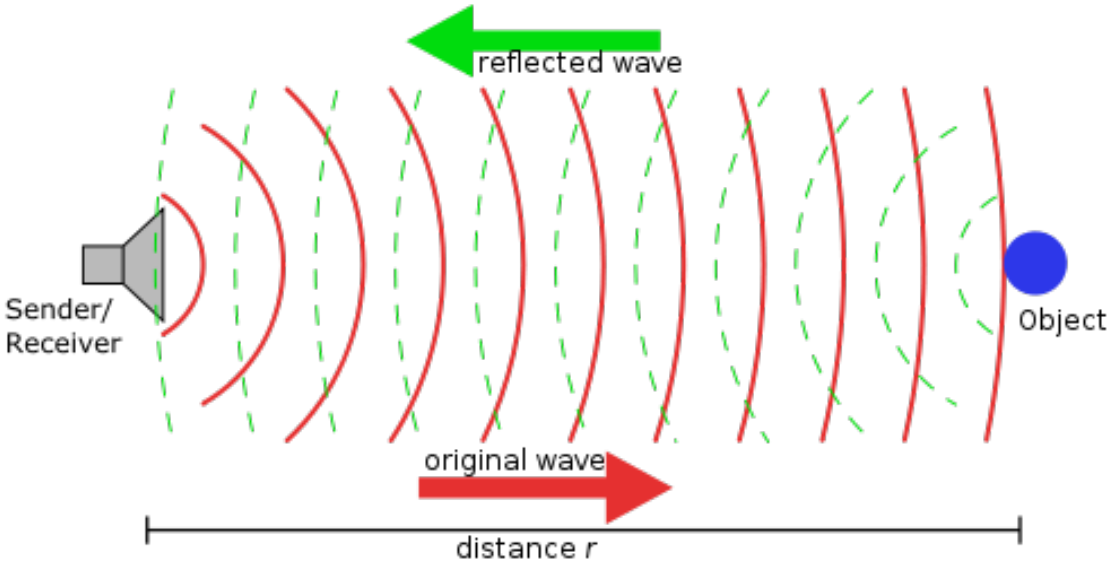


Sonar Applications

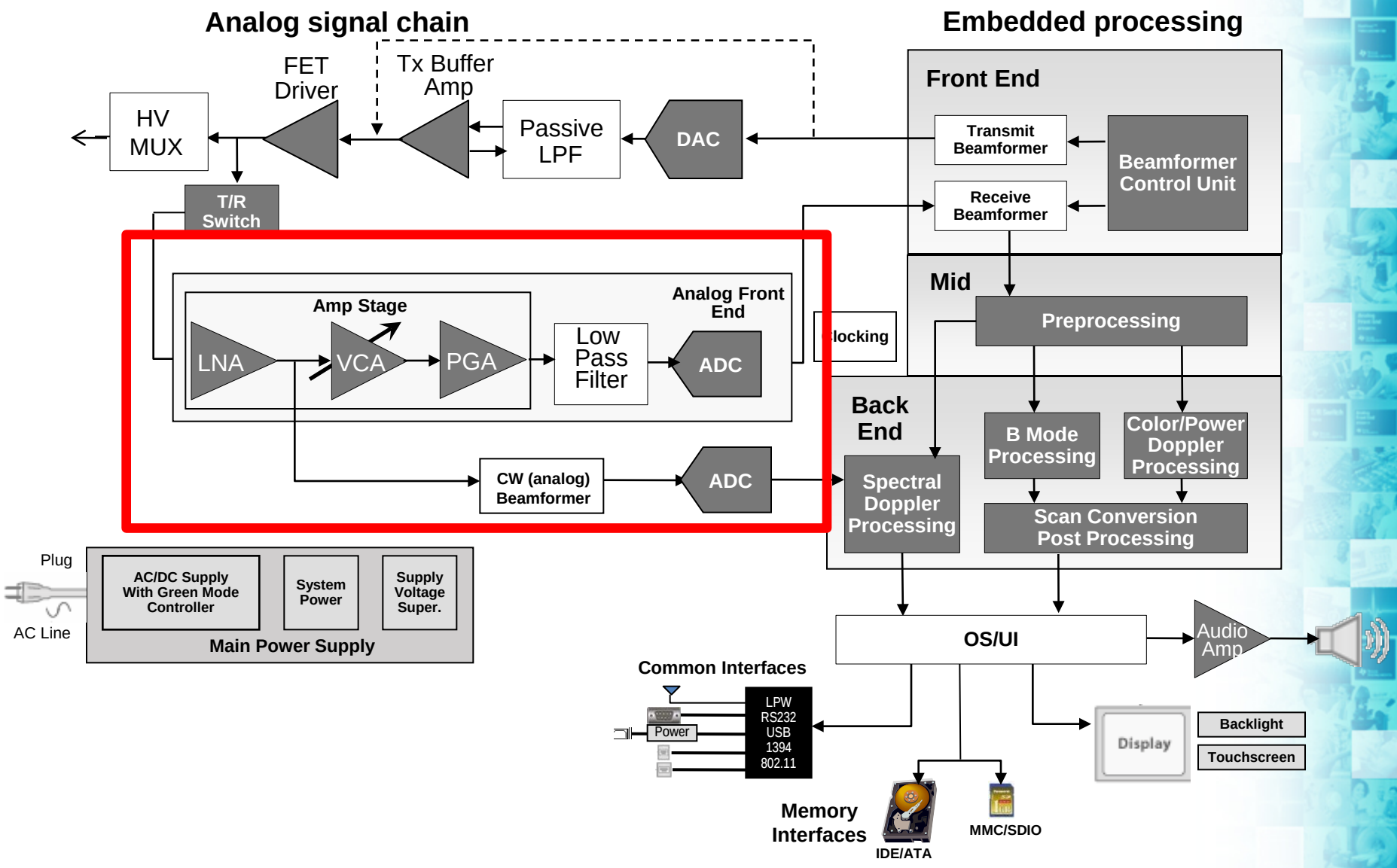
- Sonar:
  - Uses sound waves to measure or detect objects on or under the surface of the water.
  - Similar to medical ultrasound, beamforming is used and an array of receivers produces spatial differentiation.
  - Unlike medical ultrasound, lower frequency's and higher gain ranges are sometimes needed to measure very far distances.
  - Typical Sonar applications include:
    - Fish finders – lower channel count, smaller size
    - Deep water survey – longest distances
    - Military and Stealth applications

TI Solutions for Sonar: Leveraging expertise in ultrasonic market

- Portfolio of VCA and AFE with low kHz frequency range for longer detection range
- Multi-channel feature for mulit-beam echo sounder and side scan sonar
- Integration for ease-of-design



Ultrasonics: Sonar



Sonar Products

Analog Front Ends

Complete integrated solutions
Including LNA +VCA + PGA +AAF+ADC

Production now!

AFE5809

AFE w/ B-Mode and CW-mode imaging paths for Spectral Doppler equipment

Digital I/Q Demodulator to reduce FPGA load and processing needs

Integrated, small-package solutions

Production now!

AFE5808A

AFE w/ B-Mode and CW-mode imaging paths for Spectral Doppler equipment

Best-in-class noise performance of 0.75 nV/rtHz for superior image quality

Integrated, small-package solutions

Voltage Controlled Attenuators

Low Noise Pre-Amp + VGA

Production now!

VCA2615

Dual, Variable Gain Amplifier (VGA) with Low Noise Pre-Amp (LNP)

LNP with 3-22dB variable Gain and programmable input impedance

VGA with hi/lo mode (0/+6dB) for interfacing w/ ADCs and 52 dB Gain Control Range

Production now!

VCA5807

Voltage Controlled Attenuator with Spectral Doppler feature

Noise optimization of 0.75nV/rtHz @ 99 mW/CH

Low frequency of 200kHz for sonar multi-team and total max gain of 54 db for NDT.

Sonar Products

Discrete ADC's

High Speed, multi-channel ADC's

Production now!

ADS5295

12-bit/100M
Serial LVDS
71 dBFS SNR @ 10 MHz
80mW/ch @ 100 MSPS

Production now!

ADS5294

14b/80M
Serial LVDS
71.5 dBFS SNR @ 10 MHz
77mW/ch @ 80 MSPS

AFE5809:

AFE with Passive CW Mixer & Digital I/Q Demod

Features

- 8 CH AFE with LNA, VCAT, PGA, LPF, ADC, CW Mixer and integrated:
  - **Digital I/Q demodulator**
  - Continuous wave Doppler (CWD)
- 14 bit ADC w/ **77 dBFS SNR**.
- Selectable power/noise combo's to optimize system
  - 158mW/ch at **0.75nV/rtHz**, 65MSPS
  - 99mW/ch at 1.1nV/rtHz, 40MSPS
  - 80mW/ch at CW Mode
- Package: 15 mm x 9 mm, 135-BGA

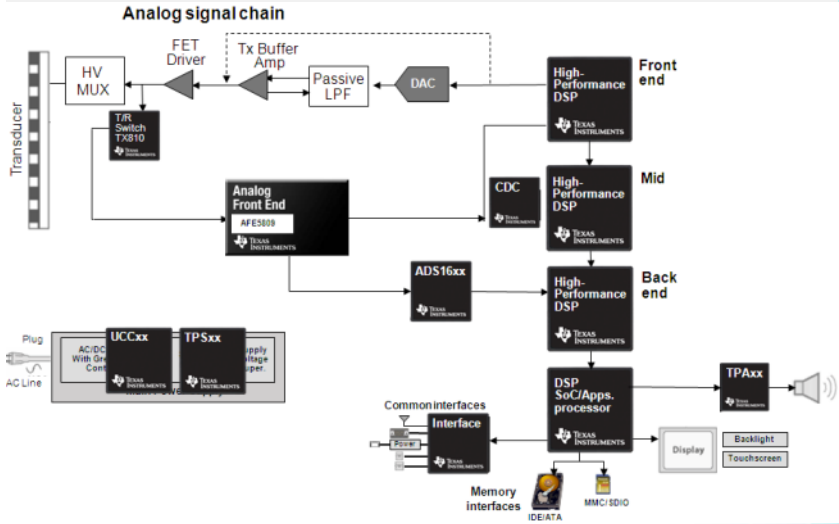
Benefits

- Complete AFE for Ultrasound and Ultrasonic systems
- Lowers interface rate, cost of FPGA
- Measures blood flow velocity in Spectral Doppler systems
- Best in-class noise levels for crisp image qualities.
- Ability to fine-tune power consumption for portable systems

Applications

- Ultrasound Imaging
- Non-destructive Testing
- Sonar
- Military Radar

Samples: Now
EVM: Now
Production: Released!



AFE5808A:

8-CH, 65MSPS, 77dBFS SNR AFE with CW Mixer

Features

- 8 CH AFE with LNA, VCAT, PGA, LPF, ADC, CW Mixer
- 14 bit ADC with LVDS outputs up to 65 MSPS and **77 dBFS SNR**.
- Selectable power/noise combo's to optimize system
  - 158mW/ch at **0.75nV/rtHz**, 65MSPS
  - 99mW/ch at 1.1nV/rtHz, 40MSPS
  - 80mW/ch at CW Mode
- Low close-in phase noise -155dBc/Hz at 1KHz off a 2.5 MHz carrier
- Total Max Gain: 54 db
- 0.25/0.5/1 Vpp Linear Input Range
- 3rd order LPF with selectable bandwidth of 10, 15, 20, and 30 MHz
- 50, 100, 200 or 400Ω active termination
- Package: 15 mm x 9 mm, 135-BGA

Benefits

- Complete AFE for Ultrasound and Ultrasonic systems
- Measures blood flow velocity in Spectral Doppler systems
- Best in-class noise levels for crisp image qualities.
- Ability to fine-tune power consumption for portable systems

Applications

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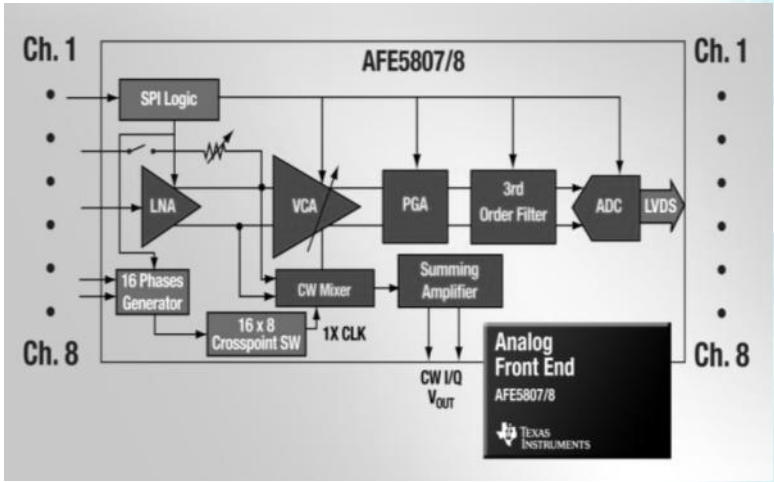

VCA2615:

Dual, Low-Noise VCA w/ Pre-amp

Features

- 2 CH VGA with LNP
- LNP
  - variable gains: 3, 12, 18, 22dB
  - Programmable input impedance
- VGA
  - High/Low-Mode: (0/+6dB) for interfacing with ADCs
  - 52dB Gain control range
- Bandwidth: 42MHz
- Harmonic distortion: -55dB

Benefits

- Flexible LNP gain settings while maintaining excellent noise and signal handling characteristics.
- Able to closely match source impedance resulting in optimized overall system noise performance.
- Differential LNP outputs can either be buffered for further CW processing or fed directly into VGA
- VGA High/Low-Mode allows user to optimize the output swing for a variety of ADCs.

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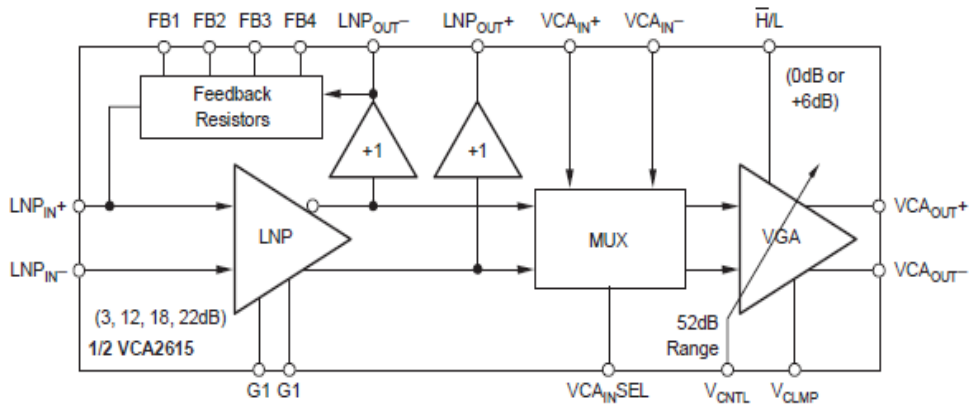

VCA5807:

8-CH, VCA w/ Passive CW Mixer

Features

- 8 CH VCA with LNA, VCAT, PGA, LPF, CW Mixer
- Noise/Power Optimization
  - 0.75nV/rtHz, 99mW/ch
  - 1.1nV/rtHz, 56mW/ch
  - 80mW/ch CW Mode
- Total Max Gain: 54dB
- Low close-in phase noise
  - -155dBc/Hz @ 1kHz off a 2.5MHz carrier
- 3rd order linear phase LPF w/ selectable BW of 10, 15, 20, or 30 MHz

Benefits

- Integrates complete TCG imaging path + CWD path
- Selectable power/noise combos for optimization for portable systems and applications
- The VCA5807 brings premium image quality to ultra–portable, handheld systems all the way up to high-end ultrasound systems.
- Marry with one of TI's ADC solutions for a complete Ultrasound front end system.

Applications

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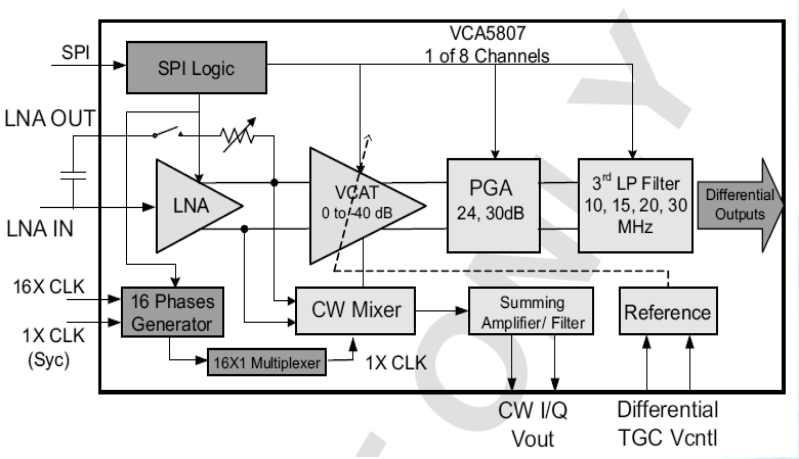
Samples: Now
EVM: Now
Production: Released!



ADS5295:

8-CH, 12 Bit, 100MSPS ADC

Features

- Low Noise/Power Performance
  - **71 dBFS SNR**, 85 dBc SFDR at 10 MHz/100MSPS
  - 80 mW/ch @ 100MSPS
- Digital Processing Block
  - Integrated Decimation Filters by 2,4,8
  - Programmable IIR High Pass Filter
  - Low frequency noise suppression mode
  - Programmable Digital Gain: 0 dB to 12 dB
- Selectable Serial LVDS ADC output:
  - One-Wire Interface: Up to 80 MSPS Sample Rate
  - Two-Wire Interface: Up to 100 MSPS Sample Rate
- 1.8V Supply

Applications

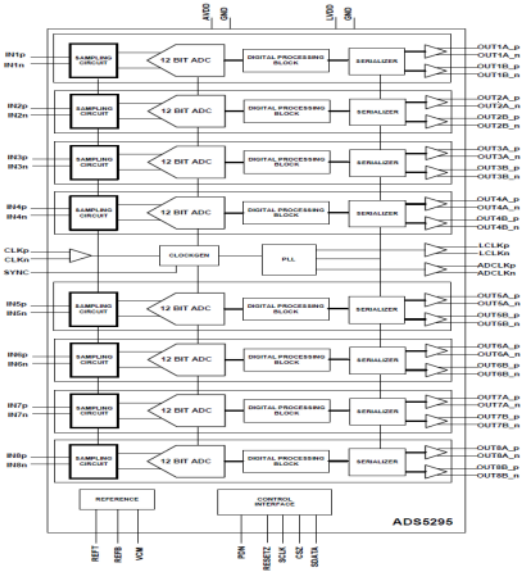
- Ultrasound Imaging
- High channel count data acquisition
- Sonar
- High speed communication applications

Samples: Now
EVM: Now
Production: Released!

Package: 12x12 mm TQFP-80

Benefits

- Optimized for high performance and high channel count data acquisition systems
- Minimizes harmonic interference errors
- Minimizes DC offset errors
- Enables the suppression of noise at low frequencies and improves SNR in the 1MHz band near DC by about 3dB



ADS5292/4:

8-CH, 12/14 Bit, 80MSPS ADC

Features

- ADS5294 - 14bit - Designed for High SNR
  - 75.5 dBFS SNR at 10 MHz/80MSPS
  - 77.4 dBFS SNR at 10 MHz & Decimation Filter
  - 85 dBc SFDR @10MHz/80MSPS
  - 65 mW/ch@65MSPS
  - 85 mW/ch@80MSPS (2 LVDS Wires/CH)
- ADS5292 - 12bit - Designed for Low Power
  - 72.5 dBFS SNR at 10 MHz/80MSPS
  - 84 dBc SFDR @10MHz/80MSPS
  - 55 mW/ch@65MSPS
  - 73 mW/ch@80MSPS (2 LVDS Wires/CH)
- Digital Processing Block
  - Integrated Decimation Filters by 2,4,8
  - Programmable Digital Gain: 0 dB to 12 dB
  - Channel averaging
  - Low frequency noise suppression mode
- 1.8V supply

Applications

- Ultrasound Imaging
- High channel count data acquisition
- Sonar
- High speed communication applications

Samples: Now
EVM: Now
Production: Released!

Benefits

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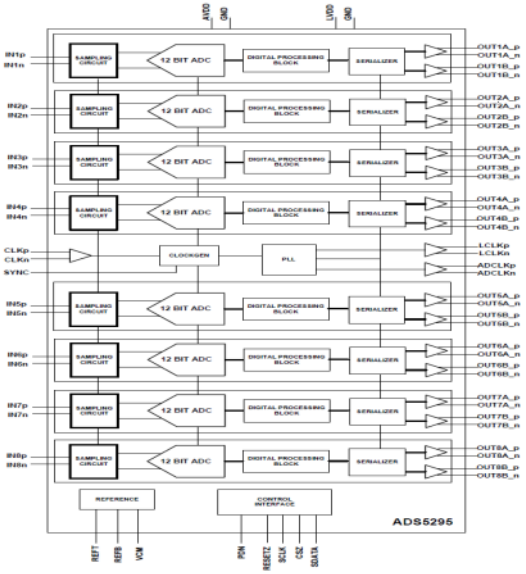

Summary

- TI Leverages Ultrasound Technology in the Ultrasonic market for Sonar
- TI offers Sonar solutions for AFE's, VCA's, and ADC's
- To learn more or order samples or evaluation module please visit www.ti.com/solution/military_radar_sonar