

TI Solutions for Sonar

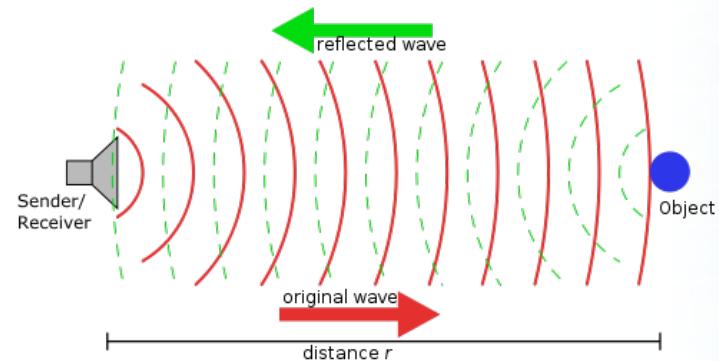


Introduction

- 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.



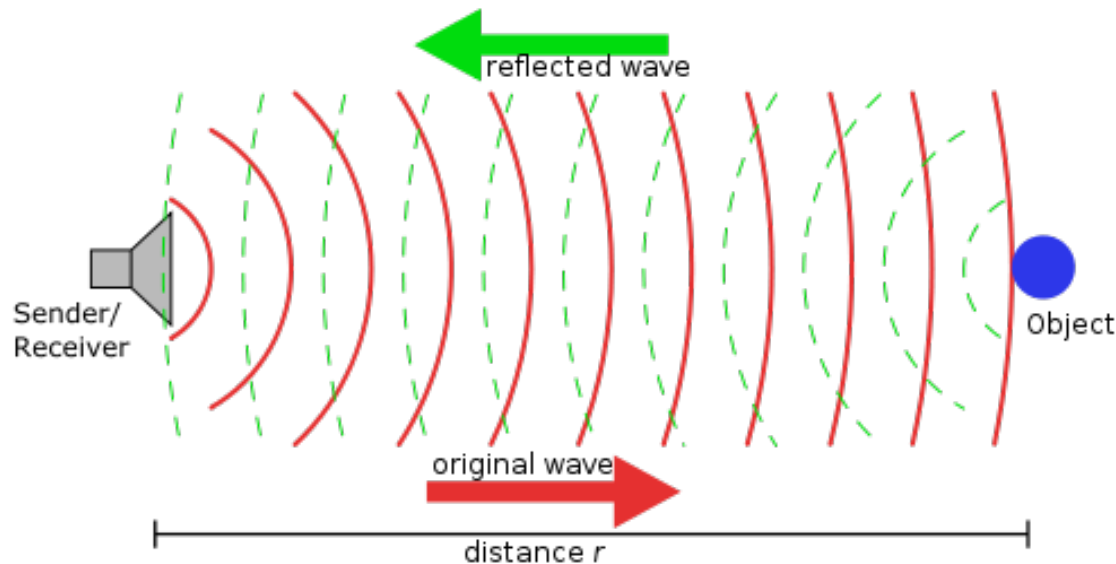
Sonar Applications

- 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

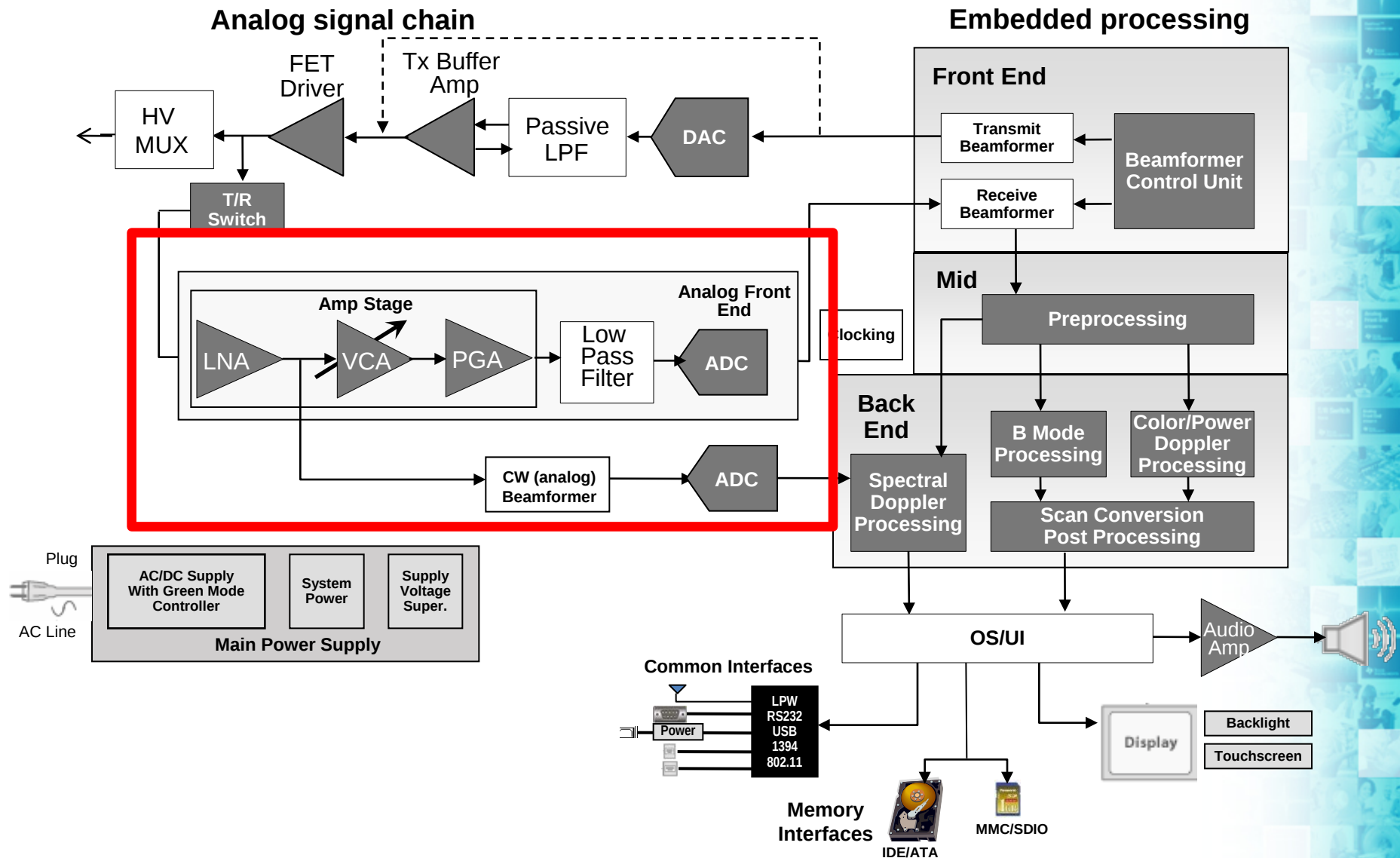
TI Solutions for Sonar:

Leveraging expertise in ultrasonic market

- Portfolio of VCA and AFE with low kHz frequency range for longer detection range
- Multi-channel feature for multi-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

Voltage Controlled Attenuators

Low Noise Pre-Amp + VGA

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

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!



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

Production now!



**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

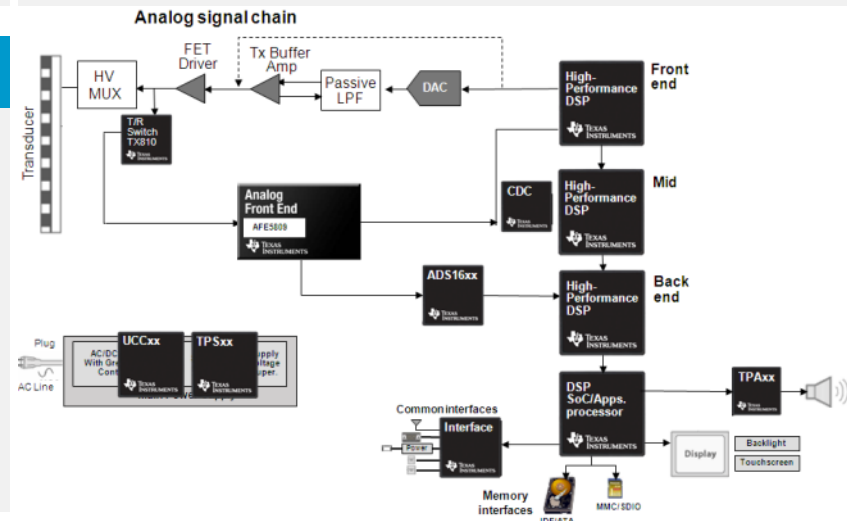
Applications

- 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

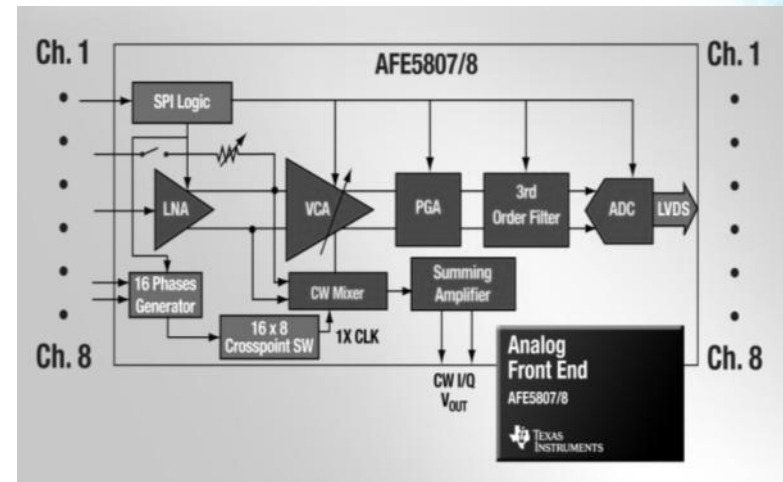
Applications

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

Samples: Now

EVM: Now

Production: Released!



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

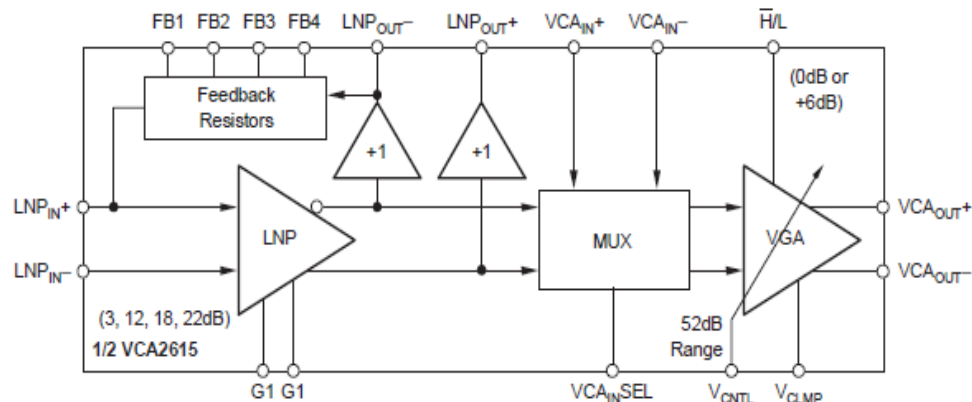
Benefits

- 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.

Applications

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

Samples: Now
EVM: Now
Production: Released!



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

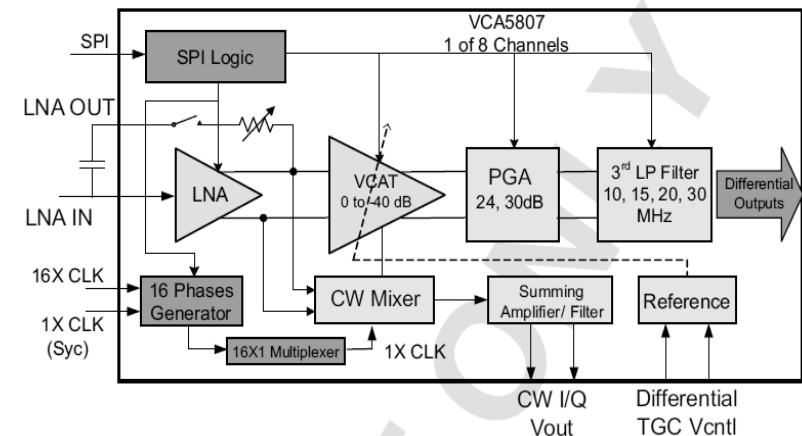
Benefits

- 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

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

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

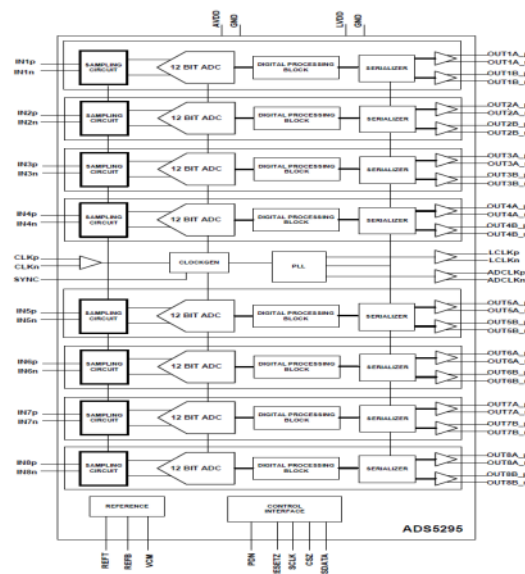
- Ultrasound Imaging
- High channel count data acquisition
- Sonar
- High speed communication applications

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

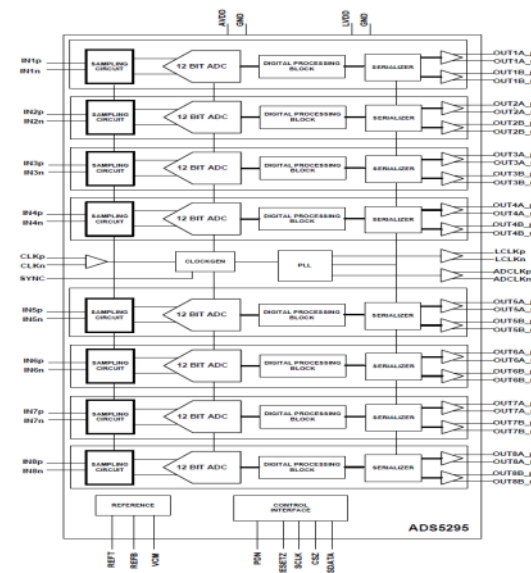
Benefits

- 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

Applications

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

Samples: Now
EVM: Now
Production: Released!



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