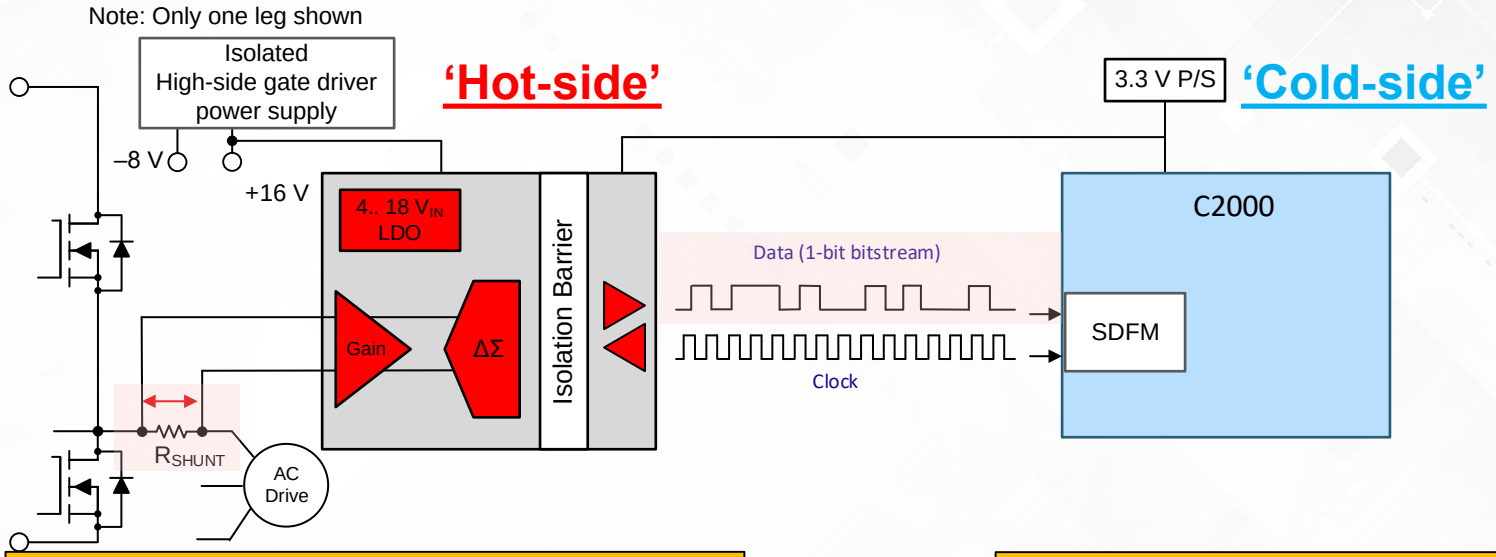
Sigma Delta Modulator Overview

C2000 Sigma Delta Filter Module (SDFM) Series

Sigma Delta ADC



Isolated ΔΣ Modulator

Converts analog input signal and outputs 1-bit stream using:-

- Oversampling
- Noise shaping

Sigma Delta Filter Module (SDFM)

Configurable Digital / Decimation Low pass filter

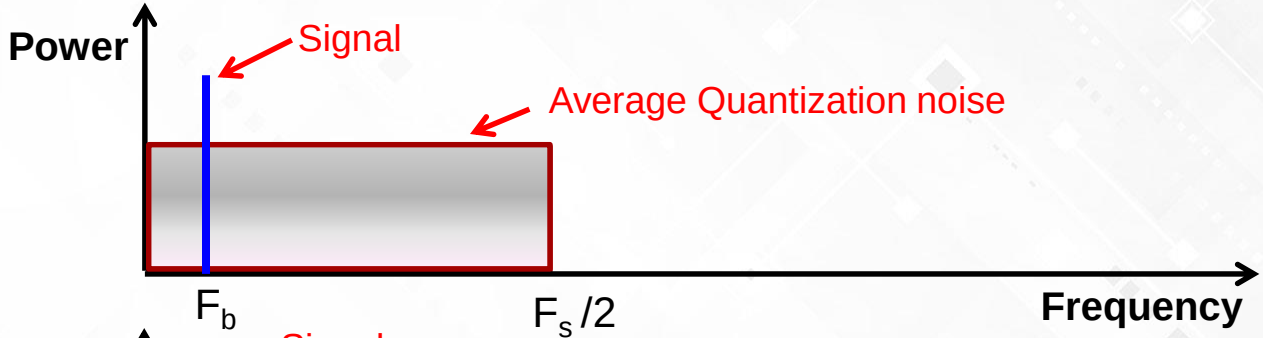
- Sinc1 / Sinc2 / Sinc3 / SincFast
- Configurable Decimation rate

How does SD-modulator work? - Oversampling

Oversampling is the process of sampling an input-signal at a sampling frequency much higher than that of input signal's Nyquist frequency

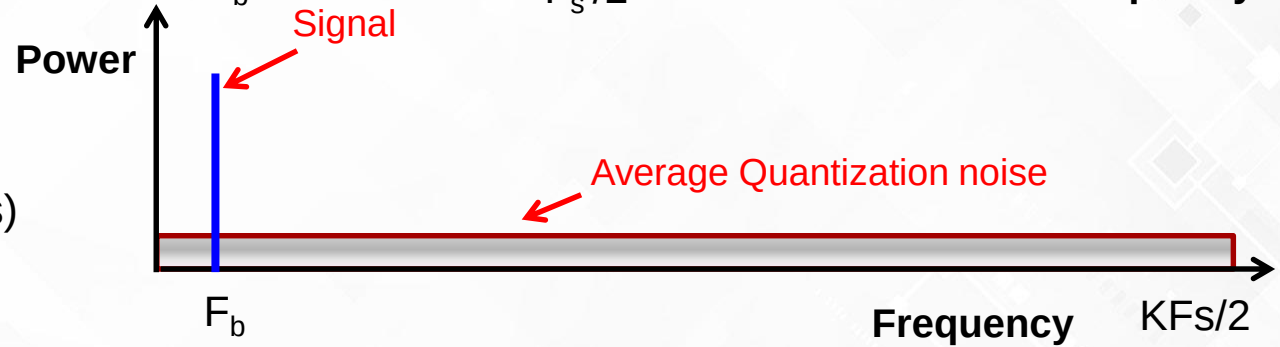
No oversampling

Fig (a) Sample rate (F_s)



With oversampling

Fig (b) Sample rate (KFs)



How does SD-modulator work? – Noise shaping

Noise shaping is a digital processing technique used to spectrally shape quantization noise to high frequency spectrum

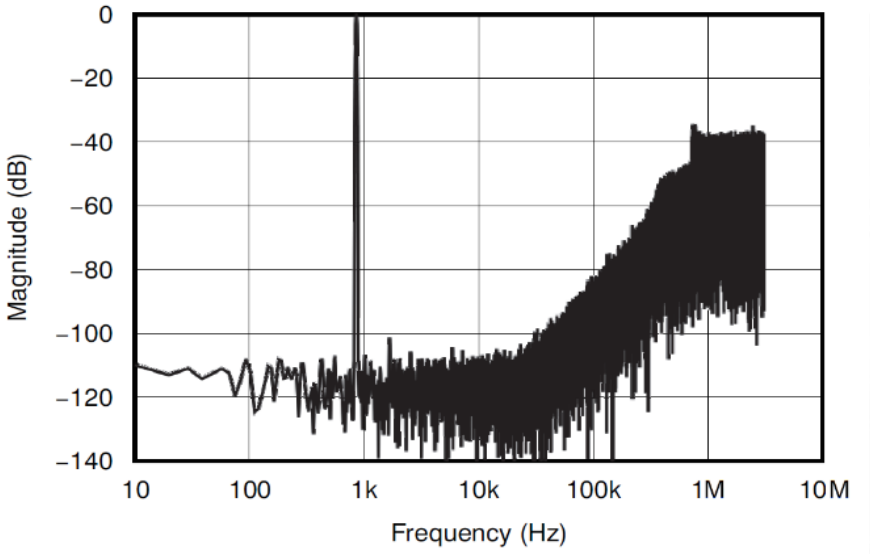


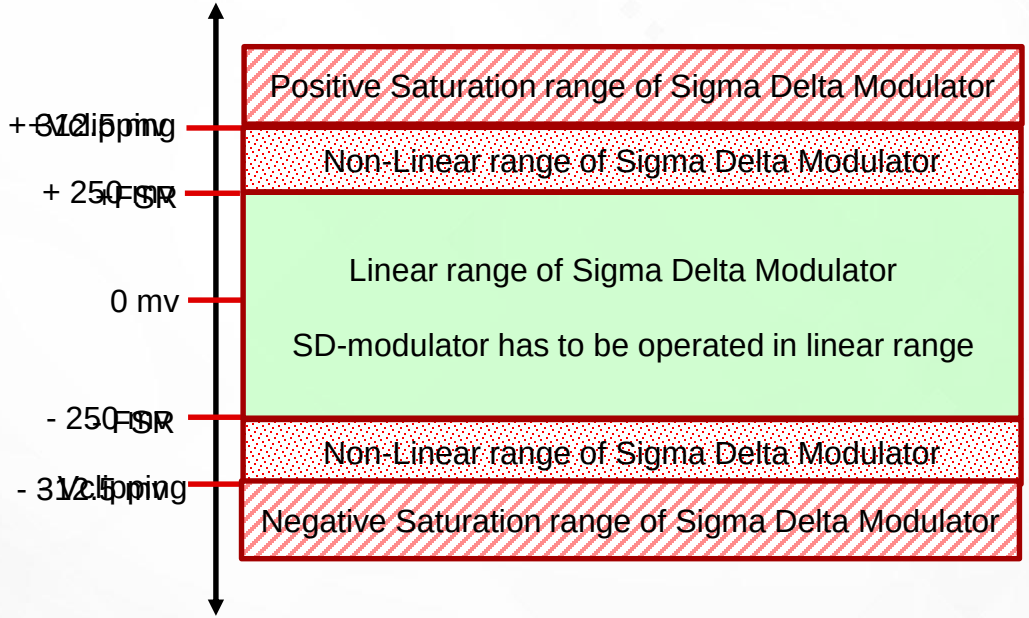
Fig (c) With oversampling + noise shaping

Understanding Sigma Delta bitstream

7.10 Electrical Characteristics: AMC1304x25

All minimum and maximum specifications are at T_A = –40°C to 125°C, LDOIN = 4.0 V to 18.0 V, DVDD = 3.0 V to 5.5 V, AINP = –250 mV to 250 mV, AINN = 0 V, and $sinc^3$ filter with OSR = 256, unless otherwise noted. Typical values are at T_A = 25°C, CLKIN = 20 MHz, LDOIN = 15.0 V, and DVDD = 3.3 V.

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
ANALOG INPUTS						
$V_{Clipping}$	Maximum differential voltage input range (AINP-AINN)			±312.5		mV
FSR	Specified linear full-scale range (AINP-AINN)		–250		250	mV



+250 mv	90% ones and 10% zeros
0 mv	50% ones and 50% zeros
-250 mv	10% ones and 90% zeros

Additional SDFM Resources

Foundational Materials

- How delta-sigma ADCs work, Part 1
- How delta-sigma ADCs work, Part 2
- Nuts and Bolts of the Delta-Sigma Converter (video)
- C2000 Academy with Hands-on Labs

Expert Materials

- Achieving Better Signal Integrity With Isolated Delta-Sigma Modulators in Motor Drives
- C2000 DesignDRIVE Development Kit for Industrial Motor Control
- Isolated Current Shunt and Voltage Measurement Kit
- Three Phase Power Factor Correction Reference Design Using C2000 MCU

Check Video Description for Additional Resources