RAQ's

Rarely Asked Questions

Strange stories from the call logs of Analog Devices

What's the (Converter) Frequency Kenneth?

Q. How Do I Design a Converter Front-end without Compromising the Performance?

A. Designers that employ a converter for high-frequency sampling have to face many challenges. Designing a front-end isn't simple, but the following comments can guide the designer to a solution.

Designers can choose amongst three types of front-ends: baseband, narrowband, or wideband; the application determines which should be applied.

Baseband applications require bandwidth from dc or the low MHz to the Nyquist frequency of the converter. In terms of relative bandwidth, this implies about 100 MHz or less. These designs can employ either an amplifier or a transformer (balun).

Narrowband applications (narrow being relative to the ADC's full Nyquist bandwidth) usually operate at high intermediate frequencies (IF). They typically use only 5 to 20 MHz of bandwidth in the 2nd or 3rd Nyquist zone, with a center frequency ≥190 MHz. The design only needs a portion of the Nyquist bandwidth, but the unused bandwidth is often needed to implement an anti aliasing filter. A transformer or balun is typically used for these applications, but an amplifier can be used if its performance is adequate at these frequencies.

Wideband designs need it all, with the user taking as much as the converter will supply. These designs have the widest bandwidth, making the frontend design the most challenging of the three types. These applications require bandwidth from dc or low MHz to several GHz. Currently, these designs



typically employ a wideband balun, but amplifiers are catching up in bandwidth and performance.

After choosing the converter, choose the front-end amplifier (active) or transformer (passive). The tradeoffs between the two are many and depend on the application, but can be distilled to a few points. Amplifiers add noise, require a power supply, and burn power, but they are not gain bandwidth dependent like a transformer. Also, they have better gain flatness within the pass band region. Transformers are passive, so they don't add noise or burn power, but their asymmetrical behavior can cause spurious issues. Transformers are not ideal devices: if not used properly their parasitics can undermine any design, particularly at higher frequencies (>100 MHz).

Hopefully, this advice will keep the design on track. For additional information, please refer to the references or send me an email.

To Learn More About Front-end Design

http://designnews.hotims.com/23118-100



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Have a question involving a perplexing or unusual analog problem? Submit your question to: raq@reedbusiness.com

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