Ideas for On-Chip Measurement of EM Interference

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Noninvasive Ckts

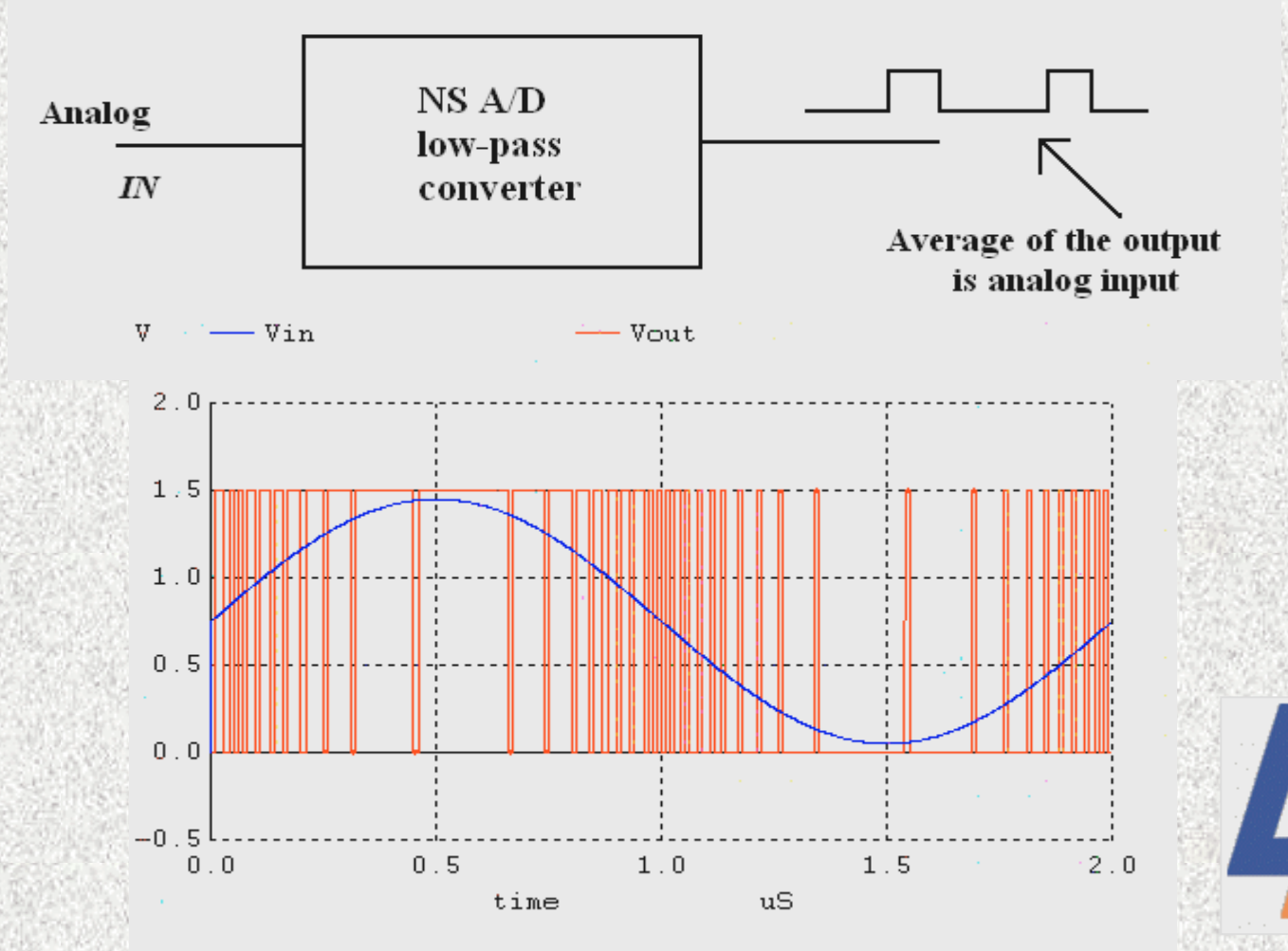
- Must not interfere with circuit operation
- Connect to on-chip circuitry
- Robust operation (tolerant to EM interference)
- Example: Connect measuring circuit to clock distribution tree. What happens?

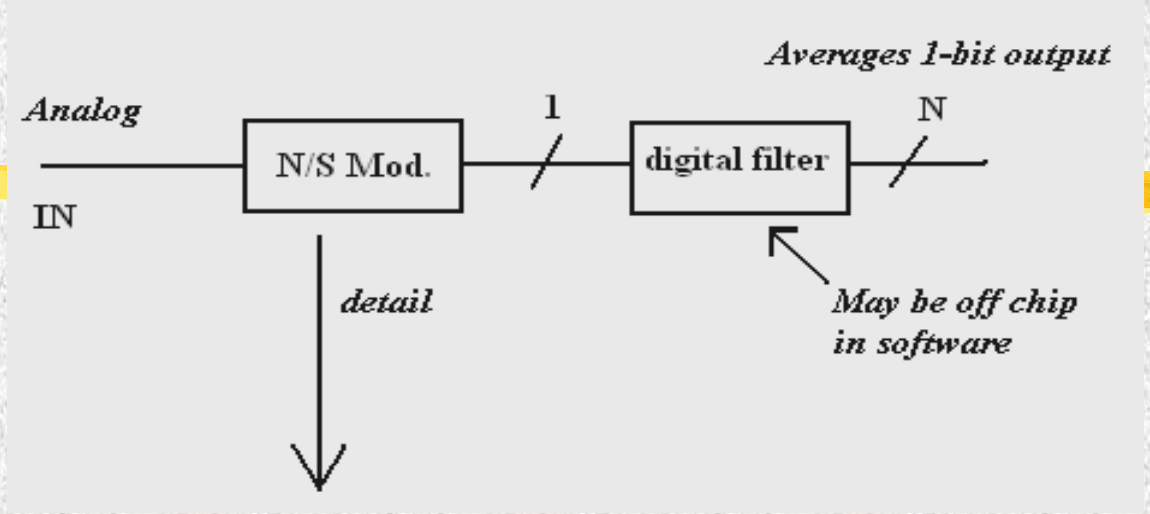
Basic idea: use a bandpass Analog-to-Digital converter employing noise-shaping

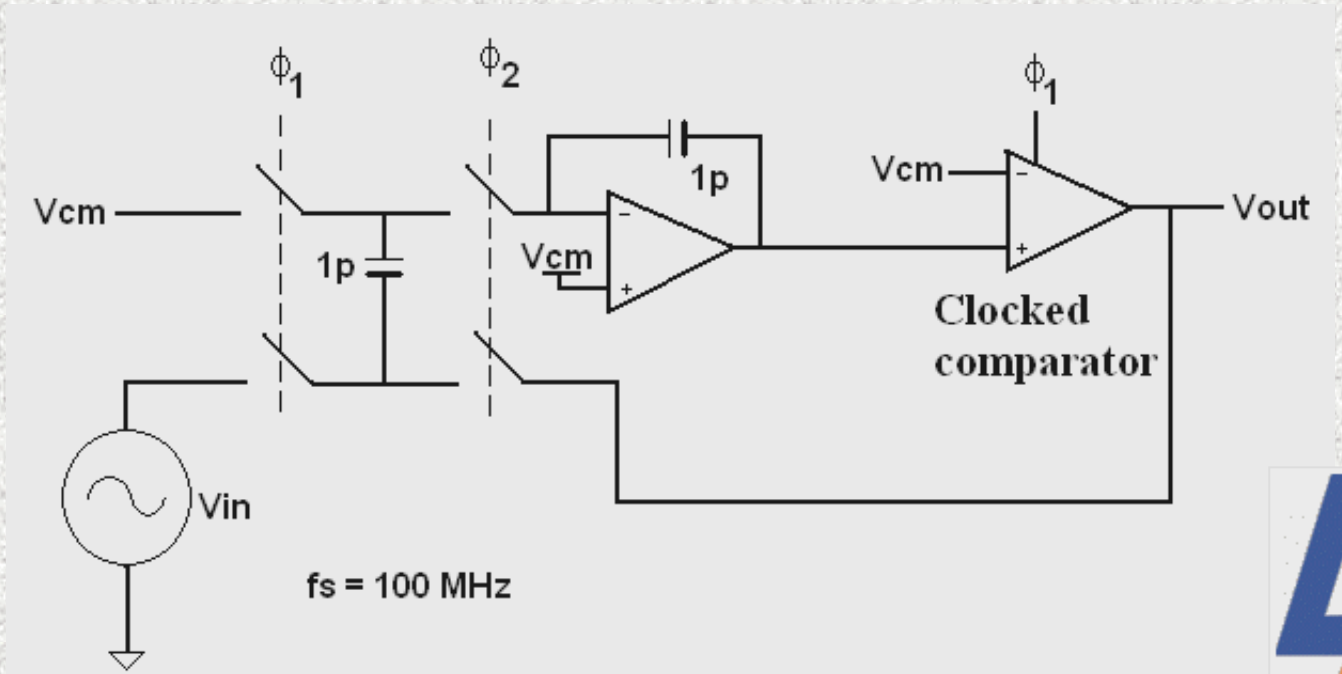
- Output is a 1-bit word
- can be averaged to reduce (eliminate) random interference
- dynamic range can be very large
- precise analog circuitry not required

Perhaps, most importantly, external clock sets center A/D conversion allowing coherent sampling (more on this when we discuss UWB measurements)

Low Pass noise-shaping (NS) A/D conversion (a review)

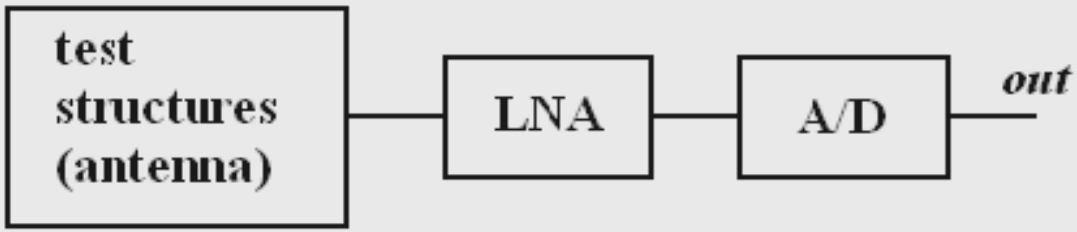



Averages 1-bit output
Analog
IN
N/S Mod.
1
digital filter
N
detail
May be off chip
in software

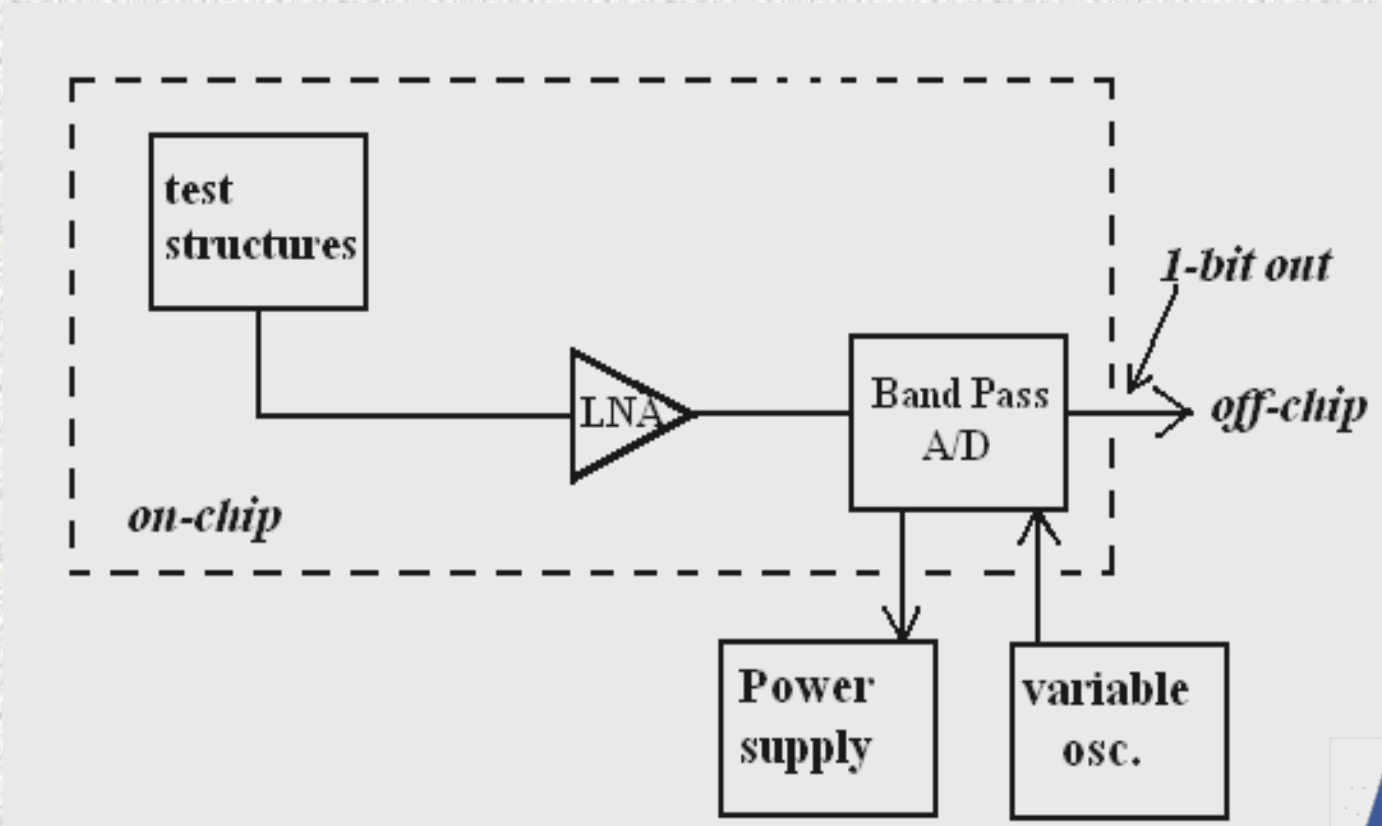

ϕ_1
ϕ_2
ϕ_1
Vcm
1p
Vcm
1p
Vcm
Vout
Clocked
comparator
Vin
fs = 100 MHz

Sensitivity can be adjusted by:

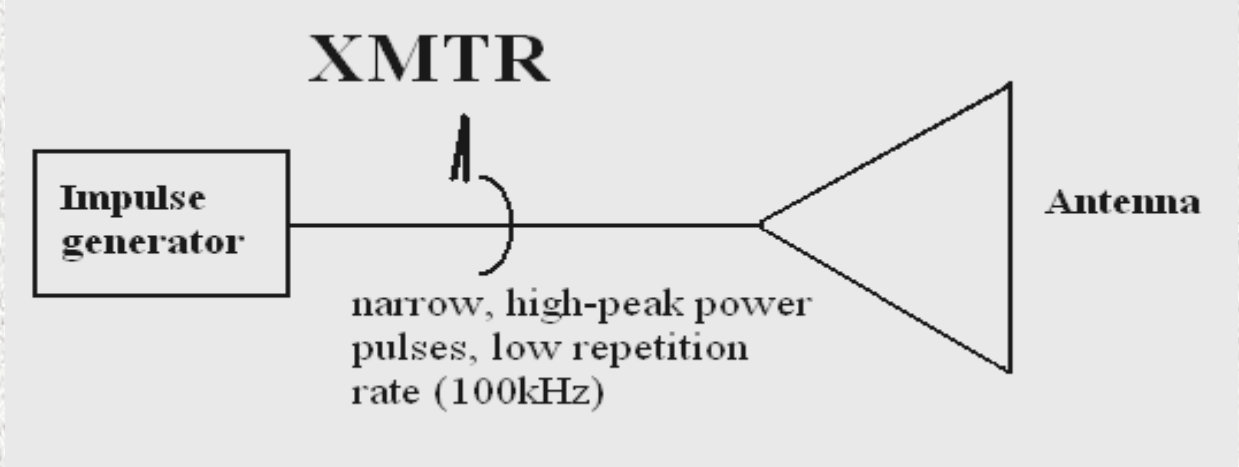
- Limiting output fed back voltage
- Inserting a LNA before A/D



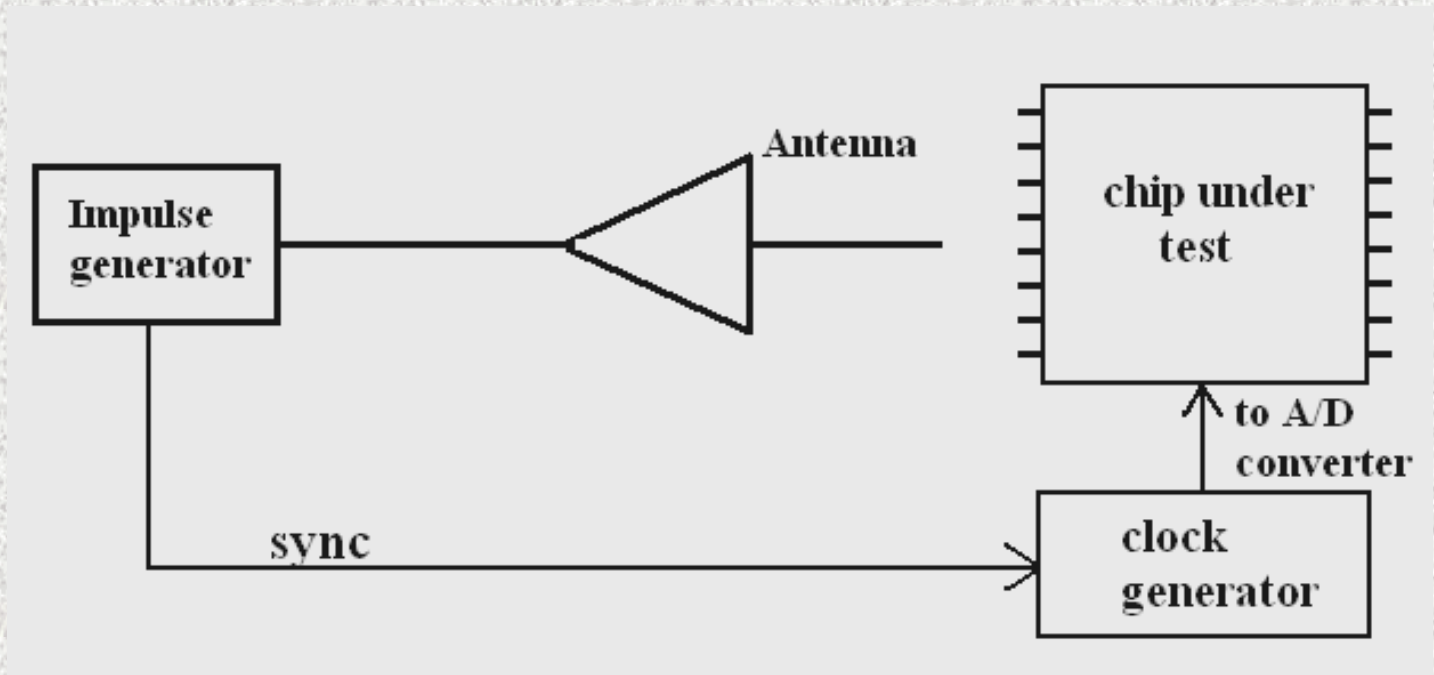
Basic circuit topology



Ultra-Wide band pulse interactions



- Non-invasive measurements
- Low-average power
- very difficult to detect



Allows coherent sampling to determine UWB pulse effects

Summary

- Develop bandpass A/D
- Use A/D with various test structures (and LNA)
- Design oscillators (not too useful with UWB pulses)