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THE IMPORTANCE OF ANALOG/ANALOG VLSI IN THE WORLD OF DIGITAL AND BIG-DATA

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ANALOG IC OVERVIEW

- The wider semiconductor industry is worth around US$350 Billion and is growing at around 3% annually
- The analog IC part is worth around US$70 Billion and growing at 7% annually
- Some market drivers for Analog ICs include Automotive, wireless and wireline communication devices, Handset /cellphone etc.
- In SKA analog is required in signal reception (cryo-LNA and conversion (A-to-D), SERDES (clock recovery) etc.

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Analog/Analog VLSI in next-gen IT/AI upheaval

* Analog computing for Deep machine learning Engines

* neuromorphic (like neural interaction in the brain through action potential) and cytomorphic (like molecular interaction in the cell/ DNA-Protein machinery) computing in Analog VLSI

*Mobile applications (sensing, data-conversion, actuation)

*Internet of things (battery-less RF)

*Next-gen wireless/wireline (low-power RF, optical)

* Autonomous entities (sensing and actuation)

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VALUE OF ANALOG IC IN DIGITAL DEVICES

- Without Analog IC

(a) Device will not turn-on (power supply and regulation)

(b) Display will not work (display driver, buffer)

(c) Camera won't work (CMOS pixel capture using photodiode)

(d) S –pen won't work (pressure sensor)

(e) many other sought after functions won't work (even if the above weren't big enough problems)

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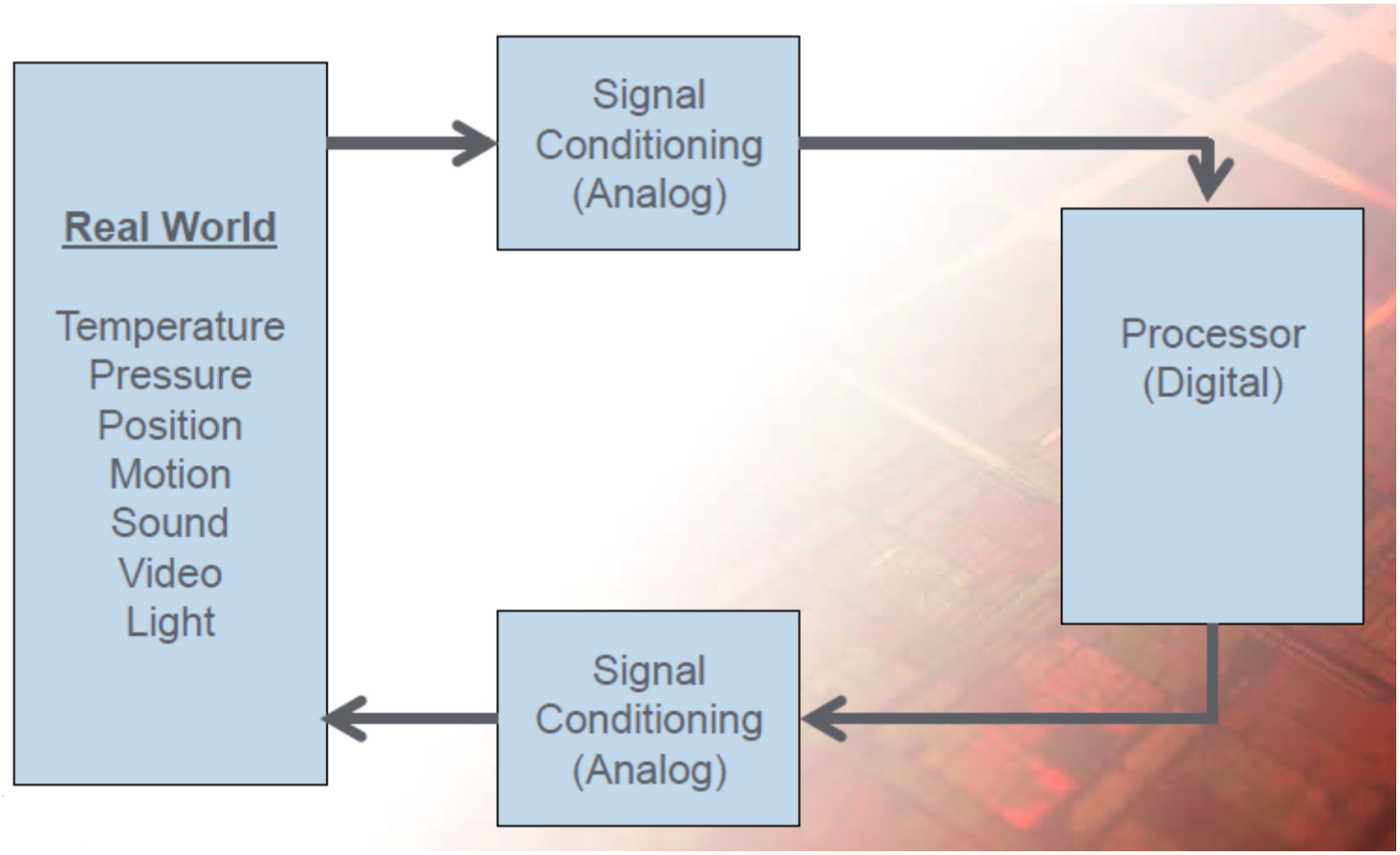
How does analog handshake with the Digital World ?



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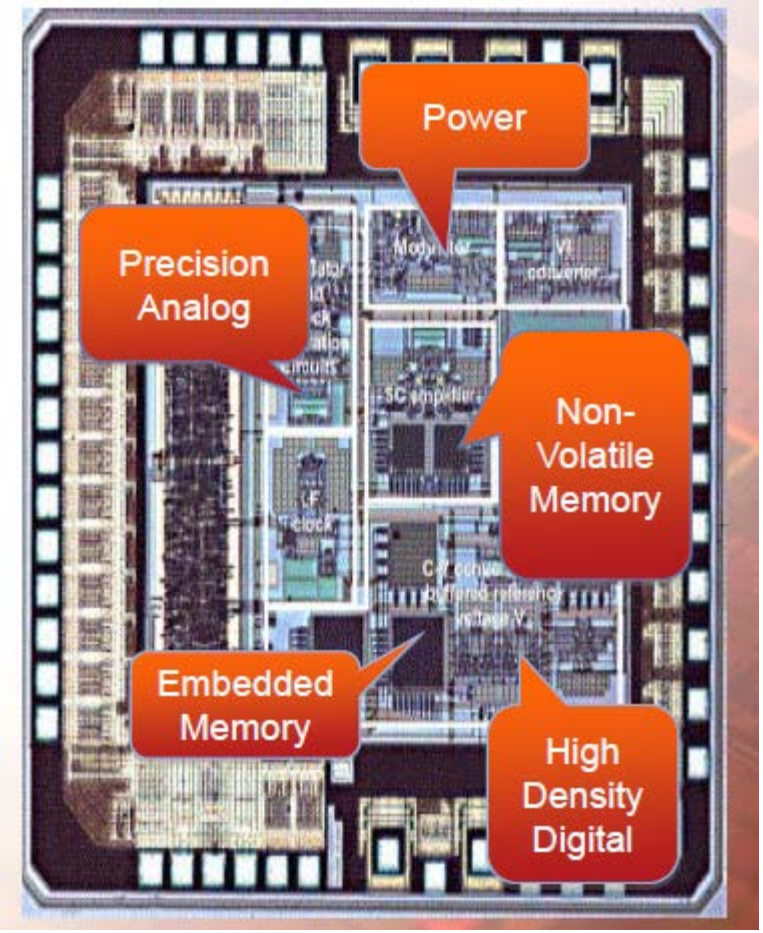
A MIXED SIGNAL SOC WITH ANALOG SECTIONS



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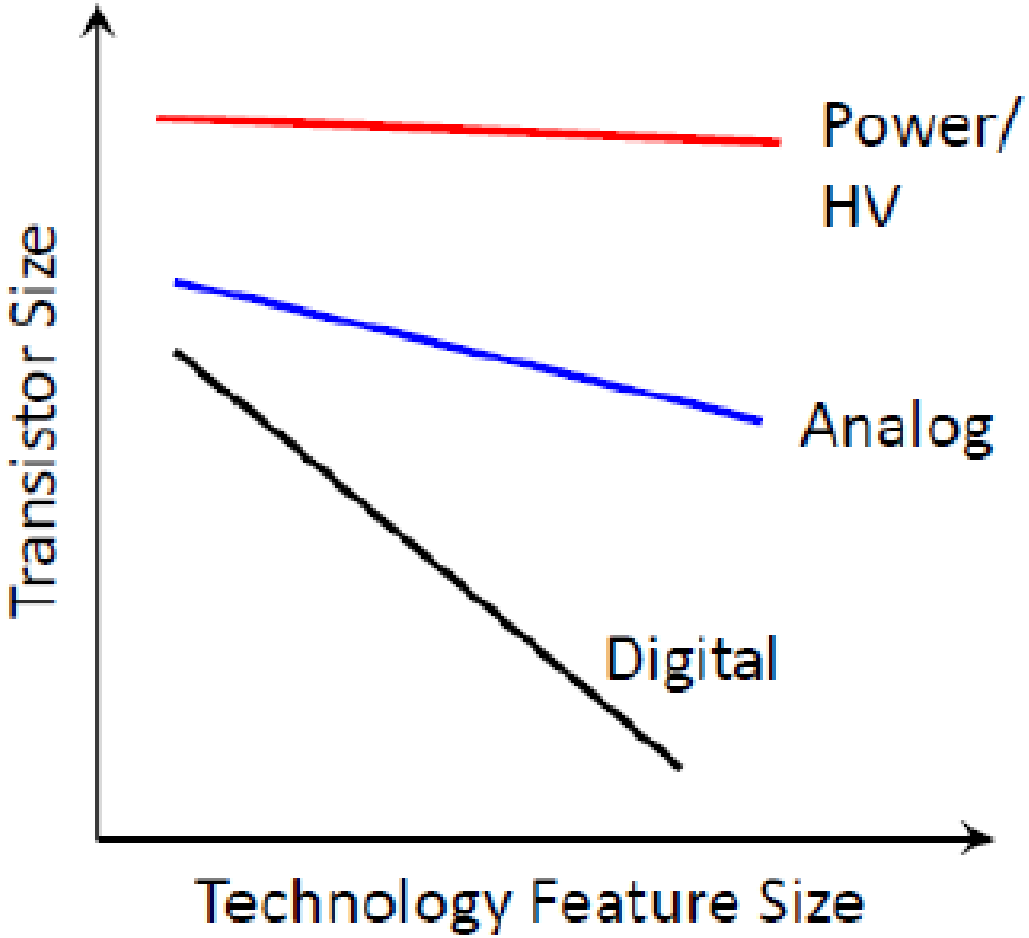
ANALOG CIRCUITS SCALING



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ANALOG/RF COMPONENTS IN A DIGITAL CMOS PROCESS

(1) THICK-OXIDE TRANSISTORS

(2) THICK METAL LAYERS FOR INDUCTORS

(3) COPPER METAL LAYERS

(4) ISOLATION LAYERS BETWEEN ANALOG AND DIGITAL FOR NOISE IMMUNITY (TRENCH ISOLATION)

(5) SEPARATE I/O AND VDD/GND PADS FOR ANALOG AND DIGITAL

(6) SECOND POLY LAYER FOR NON-VOLATILE MEMORY

(7) SPECIAL P-CELLS FOR CAPACITORS AND INDUTORS

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ANALOG IN OUR SKA DESIGN

ASIC for TDBF

- Analog design using 28nm GF HPP
- 15 G/s SERDES
- Power: 20W/chip (@ 1.2 GHz)
- size: 11mm x 11mm
- cost: $230 @ 10K quantity
- Package: Flip-chip BGA

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ANALOG IS EVERY WHERE

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CONCLUSION

- Analog IC is a Growth Market
- Analog is Everywhere !
- Analog - SoC's are here....

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Thank You!