Low-Power Programmable Logic: A Vendor’s Perspective

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Actel Fellow
Performance vs. Differentiators

As product performance exceeds requirements, differentiators are rewarded in the market place.
Twist to the Dilemma?

If Batteries Followed Moore’s Law

Mobile Customer Requirements?

Source: Avicenne
FPGAs Taking Market Share from ASICs

Source: iSuppli
An Unwelcome Challenger: 32Bit MCU

Source: iSuppli
Where’s the Money?

Semiconductor Elasticity

\[ y = 49.253x^{0.2947} \]

\[ y = 49253x^{-0.7053} \]

Source: iSuppli

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Still Champion: ASSPs

Source: iSuppli
Actel’s Investment in Low Power

TECHNOLOGY

SILICON

TOOLS
Benefits of Flash Technology for FPGAs

- Non-volatile (no boot PROM)
- Reprogrammable
- Low static power:
  - <50\(\mu\)W at 1M Gates ... several orders of magnitude less than SRAM competition
  - <5\(\mu\)W for smallest device
- Retains configuration with zero power
- Design security
- Saves time and energy to load configuration at power up
- Immune to firm errors
  - Good for high-reliability and space applications
- Fusion mixed-signal FPGA with on-chip embedded flash memory
  - Ideal soft processor solution (8051, ARM CortexM1)
- Smallest packages in the Industry (3mm\(^2\))
Where Actel’s Low Power Solutions Fit Today

Power Comparison @ 1M Gates - 100% Active

- AGL-V2
- AGL-V5
- Cyc3
- SRAM

Static is the Y Intercept
Dynamic is the slope
Portable Market

Volume

Features

Consumer

Industrial, Medical

Military, Automotive
Example: Cellphone/MP3 Player Audio Buffer

Customer Requirement:
“Play as much music on the phone as an iPod can between charges.

FPGA solution increased time from 13 hours to 50 hours
Application Example: Telematics

Customer Requirement: “The car needs to be able to be parked at an airport for 1 month and not drain the battery”
Customer Requirement:
“The field device must get all its power from the 4mA HART modem current loop.”
Application Example: Smartphone Display

Input Data

H: 800
V: 480

LCD I/F: Rotate

FPGA

Output Data

V: 800
H: 480

Image 90°
Clockwise Rotate
800x480 -> 480x800

< LCD >
Interfaces: MIPI

MIPI D-PHY

www.mipi.org
## Displays

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Phone of the Future:

Modem → Application Processor → Programmable Device
Points of Influence

Choice of solution can lead to >10X inefficiencies.

Implementation Tools can save ~40%

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Speers’ Law 2.0

% of Hardware Designers (EDA Revenue)

% of FPGA Sales Generated

Hardware Design IQ
What Kind of Tools & Hardware Does this Person Need?

[Diagram showing the relationship between Software IQ and Hardware Design IQ with a dotted line intersecting at Peak Low Power FPGA Sales?]
Some Thoughts

Tools:
- Anything that helps the system architect know the ideal result.
- Easy to use library functions
  - Require zero knowledge about hardware
  - Pre-wrapped in an API

Hardware:
- Convert excess performance to ease of use
  - FPGA architected so that a hardware library element will work in any context
- From Actel’s perspective, work on lowering dynamic power.
Summary

- Market forces pointing towards a significant role for programmable logic in low power applications.
- Attributes of Actel’s flash based FPGA make it attractive for low power applications.
- We are winning in applications where FPGAs have not played before.
- A lesson from our first salvo into this market is that the target customer is not necessarily a typical FPGA customer and therefore may require different tools and capabilities in order to be successful.