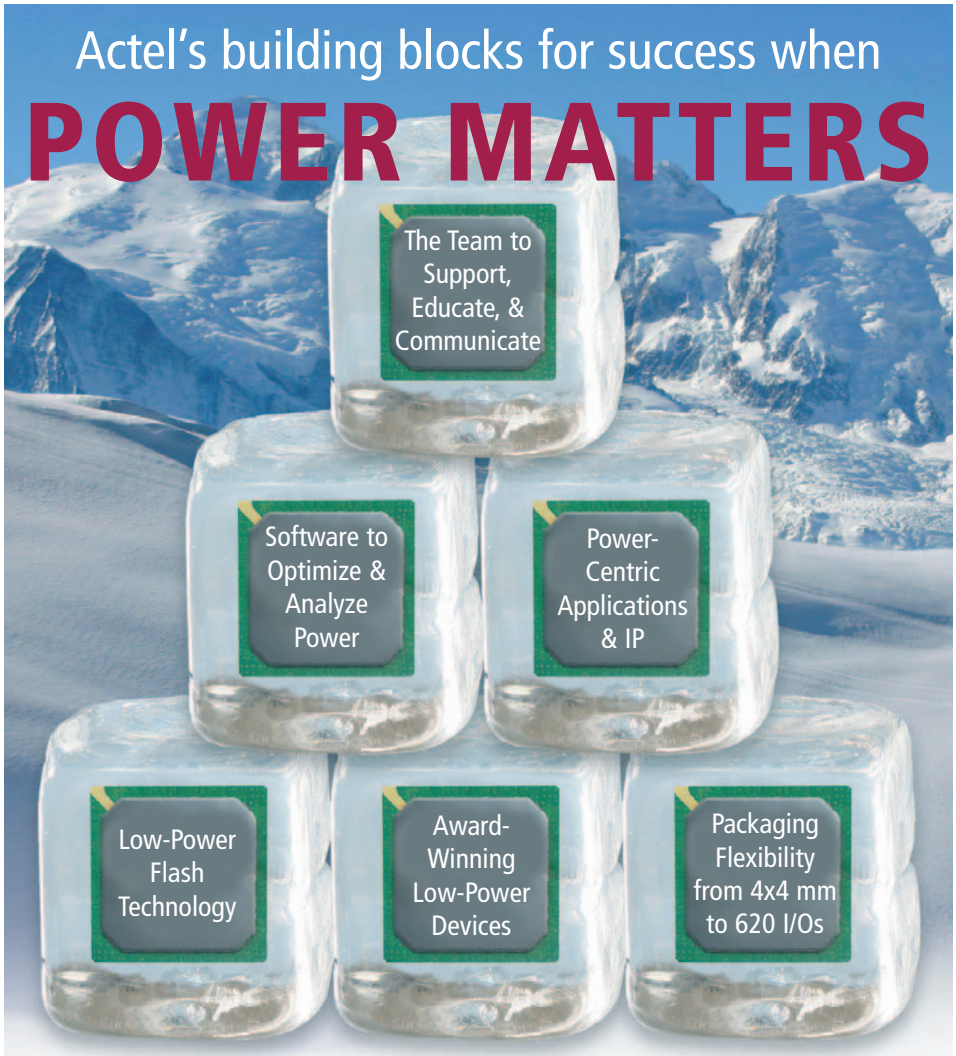
Actel POWER MATTERS

eZone ultra-low power FPGA news

Q1.2008



Actel understands that low power is a design requirement, not a marketing spin—a few milliwatts can make a big difference to designers.

Actel is attacking power at every level from base technology through award-winning devices, including offering the right packages for these applications and having IP and support focused on low power. If you are looking for a company that is all about low power, then look no further. Actel is now, and will continue to be, the team that goes one step further for low power.

Why not use the same FPGA you have always used? ***Because Power Matters!***

THIS ISSUE

King of Low Power	p2
Why Switch FPGAs? Because Power Matters!	p2
Zero-Power Devices?	p3
Judge the Chip by Its Cover	p4
Trusting Power Numbers	p5
MicroTCA Reference Designs	p6
Low-Power Portable IP	p6
Power-Smart Decisions	p7

Actel News

Feb 19, 2008 Actel Offers New Low-Power IGLOO® and ProASIC3 FPGAs for 99 Cents

Jan 07, 2008 Actel's ProASIC®3L Family Balances Low Power, Speed, and Low Cost

Dec 17, 2007 Actel Delivers Battery-Powered Icicle Kit Based on Industry's Lowest Power FPGA

Dec 10, 2007 Actel Drives Industry's Lowest Power FPGAs into Portable Displays

Nov 19, 2007 Actel Libero® Integrated Design Environment (IDE) v8.1 Maximizes Power Efficiency with New Power-Driven Layout and Advanced Power Analysis

Nov 13, 2007 Actel Delivers Industry's First 4x4 mm Package For Programmable Logic Devices

John East's Viewpoint

The Reigning King of Low Power

As a customer using programmable logic, the unrelenting claims of low-power leadership could be tiresome and confusing. How can all vendors claim low-power leadership? Clearly, not everyone can be the king. How can you determine who is the true sovereign?

Ignore the claims and check the datasheets. Examine the basic power components: static, dynamic, inrush, configuration power, and low-power mode.

Comparing one-million gate devices, for example, SRAM-based FPGAs, marketed as the "lowest power FPGAs," claim static power consumption between 40 mW and 150 mW, which is 800–3000 times higher than Actel's 0.05 mW, flash-based IGLOO device. Similarly, when comparing "zero-power" CPLD solutions against IGLOO devices, the "zero-power" devices consume 10 times higher static power.

All told, these competitive claims are nothing more than creativity and arm waving.

Next, examine additional power optimization options. Is there a development environment capable of reducing dynamic power by as much as 30 percent? Are FPGA-optimized, 32-bit ARM® processors and power-smart IP cores available?

Today, no other vendors have grounds upon which to challenge our throne.

It's good to be the king.

John East

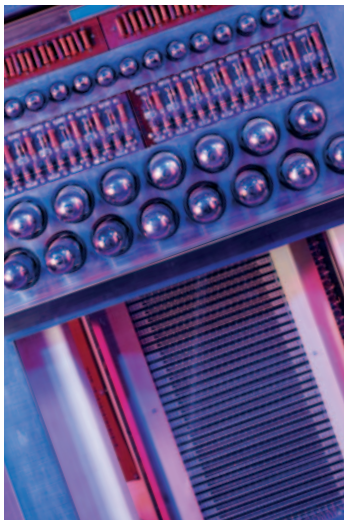
President and CEO, Actel Corporation

What Can Engineers Do About Global Warming?

Read Article

actel.com/ezone/Q108

Still Using the Same Old FPGA Supplier?



For many companies, the decision about which FPGA supplier to use was made some time ago. In some instances, the argument for changing suppliers is like asking someone to challenge their own religious beliefs. However, the decision should not be about changing suppliers, but instead about leveraging the right technology to get the job done.

Are technology differences significant enough to make it worth going out on a limb?

In this edition of eZone, we provide you with the arguments, data, and support you need to make the right choice. At Actel, we understand the difficulties and risks you take when recommending a new technology to your boss or team. With your existing supplier, you know the design tools, you know your rep, and you know your FAE and his home number when you need him. You don't want to learn new tools, find new IP, or risk design flow issues in this critical time-to-market, have-everything-done-yesterday environment.

You need to have a very good reason to leave the comfort of your existing design world and examine the alternatives. In this fast-paced world of more features with faster time-to-market and lower costs, that reason includes the ever-increasing demand for low power, extended battery life, and providing more features at the same battery life. Even if you are not designing for battery-powered applications, the UN has stated that it is the responsibility of design engineers to use less power in all applications. Just because it has a plug doesn't mean it should be power hungry. Think of all the fans in a server room trying to keep equipment cool—that's a lot of power!

Why not use the same FPGA you've always used?

Because Power Matters!

At each stage of the design process, you have certain choices. Let's assume your design includes an FPGA or an FPGA is contending for the spot of logic processing or general muscle in your system. When you think FPGA, you most likely consider popular SRAM-based solutions from Altera® and Xilinx®. We suggest that these may not be the right choices for your application.

Nonvolatile flash technology offers significant benefits worth considering. For power alone, flash-based FPGAs consume more than 200 times less static power than SRAM-based offerings and deliver more than 10 times the battery life of the current leading PLDs in portable applications. These advantages are worth looking into, are they not? Other benefits include single chip, no boot PROM, live at power-up, security, firm-error immunity, and the list goes on…

Similarly, consider the move toward on-board flash-based microcontrollers instead of having to run code from external SRAM. The fact that your SRAM-based FPGA supplier has to recommend a flash device for configuration or build a hybrid part to store their configuration might suggest that starting with a flash-based FPGA would just be easier.

In order to convince you to change suppliers, we have recognized that we need to have more than just the right technology. For this reason, Actel is attacking power in every aspect of FPGA design—from process to power-optimized design tools, IP, packaging, and education. So, to help you see the possibilities in a change to Actel, this edition of eZone will walk you through your key decision points.

A Chinese proverb suggests: "You can't do today's job with yesterday's methods and be in business tomorrow."

In a world where power matters, can you afford not to take a look?

To learn more about Power Matters, visit: actel.com/ezone/Q108

Zero-Power or NOT Zero-Power: That Is the Question

Having a great base technology is only the first block in building the ultimate low-power application. We need to take that technology and build it into the perfect device just for your design, which might require a certain number of I/Os, logic gates, clock resources, SRAM, and FIFOs. So Actel has created a range of devices to fit every need, or at least a good cross-section.

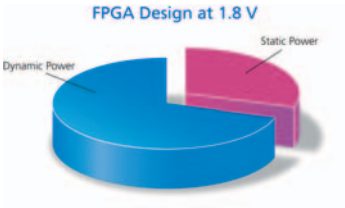
Since power matters, we can start there. The IGLOO devices start at 30 k gates, with static current of just 4 µA, and operate at 1.2 V. For faster performance, with low-power features still built in, the ProASIC3L family offers the balance of power and performance. The ProASIC3 family is the speed family for extra processing power, and still benefits from the inherently low-power flash technology. This doesn't mean much until you look at a specific area or application. We have been talking about replacing your old FPGA,, so let's go head-to-head.

Low-Density Devices – Actel vs. "Zero-Power" MAX® IIZ

If you are currently using a MAX II, let's assume your next step would be an upgrade to the new MAX IIZ device. Our equivalent part would be an IGLOO device with 30 k gates.

	LEs	Max. User I/Os	Voltage Supply	Standby Current	Power
AGL030	341	81	1.2 V	4 µA	5 µW
EPM240Z	240	80	1.8 V	29 µA	52 µW

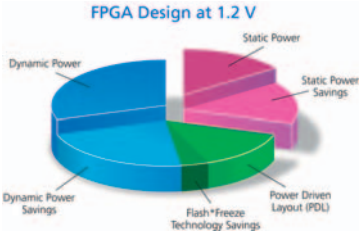
So, using the datasheet numbers above, IGLOO has about 40% more logic, with 10 times lower power than the "Zero-Power" MAX IIZ device. In addition, since IGLOO FPGAs operate from a 1.2 V core voltage, the dynamic power consumption is also significantly lower.



Mid-Density Devices – Actel vs. Spartan™-3 or Cyclone® III

In this case, all the devices can operate from 1.2 V, so compare basic power consumption at, say, 10,000 logic elements.

The standby current is hundreds of times higher in Cyclone III and Spartan-3AN than in the IGLOO device, and the active current is 2 or 3 times higher. Not what you would look for in a power-sensitive application. In a battery-powered application, this can lead to 10 or even 20 times longer battery life with IGLOO FPGAs.



	Standby Current	Active Current at 100 MHz
AGL1000	0.05 mW	94 mW
EP3C16	42 mW	161 mW
XC3S700AN	96 mW	254 mW

Low-Power Modes That Go One Step Further

Many FPGA vendors have talked about low-power modes of operation. Few truly deliver what has been claimed. Actel looked at ProASIC3 technology and thought about what an engineer truly wants to do when the device is in a static mode. From this development effort, the Flash*Freeze™ technology and IGLOO family were created. With a single pin, the device can enter Flash*Freeze mode and instantly drop power. Internal clocks automatically switch off, inputs continue to toggle, and the low power is controlled. Other vendors claim x number of microamps if you prevent toggling on the I/O, with single-pin control. Well, it's not really single-pin control if you have to find a way to disable every input. Enter Flash*Freeze mode in 1 µs and the competitors' mode in 250 µs. At Actel we have chosen to take power seriously and do not try to fake low-power modes to market our products. Actel delivers truly power-smart devices. The device family members range from 30 k gates to 3 million gates. Device choices include 1 to 6 PLLs, SRAM and FIFO, on-board user flash memory, flexible clock networks, 4x4 mm packaging, and 620 user I/Os.

To learn more about Actel Devices, visit: actel.com/ezone/Q108

Measure Power with IGLOO Power Calculator

Download Now actel.com/ezone/Q108

Compare Power Against ProASIC3L Calculator

Download Now actel.com/ezone/Q108

Lower the Cost of Intelligent Power Control with FPGAs

View Article from Embedded.com actel.com/ezone/Q108

Actel Fusion™

The Ultimate Power Management Solution

In addition to lowering power during active and standby modes of a device, another method is to manage and control power within the system. Fusion contains a fully functional FPGA array with FIFO, SRAM, and PLLs, in addition to an analog frontend and voltage regulator circuitry.

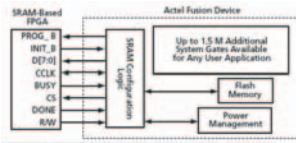
Fusion can be used for controlling power and monitoring voltage, current, and temperature. If you need a device that can do all the logic and functions of ProASIC3 and IGLOO, and also manage the power for the rest of the system, then upgrade to a Fusion device.

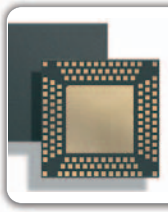
There is a lot more to Fusion than we have room for here, but the Fusion Webcast can provide a good overview of the devices and their capabilities.

Configuring SRAM FPGAs Using Actel Fusion

If you must use an SRAM FPGA in your system, a Fusion device can not only store the configuration for the device, but can also manage power to the device. Turn off the high-power SRAM FPGA when not needed. Use a Fusion FPGA array for additional processing when the SRAM is turned off.

Download App Note and Design Files





The Right Package For Your Design

Select It Now

actel.com/ezone/Q108

Need the Facts?

IGLOO Product Brief

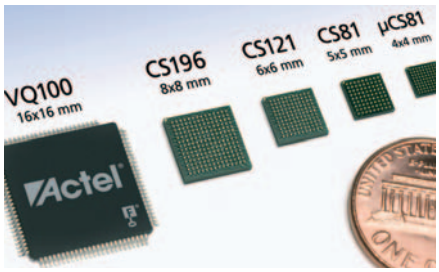
Download Now

actel.com/ezone/Q108

Judge the Chip by Its Cover

Go Ahead

Packaging is one of those areas where everyone really wants the same thing, which is a package with just enough I/Os to fit their design in the smallest footprint possible at the lowest cost. So basically everyone wants or needs a custom package.



Actel has delivered all the standard packaging you would expect to see for FPGAs, with plenty of variations of I/O count, power consumption, and performance. Then on all sides of the standard packages, Actel has gone to extremes to meet the needs of an engineer who is designing beyond the standard FPGA limits. As you read this, be aware that this is only part of the story. We're not done yet.

Minimizing Footprint for Real Designs

Actel offers a µCS81 package for IGLOO devices. This package is 4x4 mm with 0.4 mm pitch. There are no other CPLDs or FPGAs that offer this packaging technology. Now, in a 4x4 footprint, you would assume that you don't have many user I/Os, but since the pitch is 0.4 mm, there is room for plenty of I/Os as well. Compare this at low density with MAX IIZ CPLDs of comparable size.

	Footprint	User I/Os	Package Pins	Technology	Pitch
AGL030	4x4 mm	66	81	Micro Chip Scale	0.4 mm
EPM240Z	5x5 mm	54	64	Micro FineLine BGA	0.5 mm

The only small footprint package CoolRunner-II has is 5x5 mm with only 21 I/Os, supported only in their smallest density—about one-eighth the logic of AGL030—so it isn't really competitive in the same field as these two. The device that is comparable in logic to the two above comes in an 8x8 mm package, which has a footprint 4 times larger.

Maximizing Number of I/Os per Board Area

In the mid-range density devices, the CS196 package offers an 8x8 mm footprint with up to 143 user I/Os, and the CS281 offers up to 215 I/Os in a 10x10 mm footprint. For Spartan-3 (all family variations), the maximum number of I/Os in an 8x8 mm area is 92. The next smallest package size is 16x16 mm, which has 64 user I/Os. Altera does slightly better with a 14x14 mm package with 182 user I/Os. Neither vendor has chosen to address the needs of designers looking for smaller-footprint, higher-I/O packages, which are required to meet the needs of the aggressively competitive market that designers face.

Migration and Flexibility

Just in case you decide to start with a ProASIC3 device, and then decide maybe you should have used an IGLOO device for lower power, Actel also offers many packages that allow migration—not only within each family but also across multiple families, including ProASIC3, IGLOO, and the new ProASIC3L family. Refer to device handbooks on the Actel website for migration tables.

Actel has firmly established itself as the leader in innovative packaging for programmable logic to meet the demands of small-form-factor, battery-powered devices that are exploding across rapidly changing applications.

Max Headroom

If your application is lacking headroom, Actel may have what you need.

From an application point of view, certain locations in smart cards, PCMCIA cards, and other such parts require a thinner device. You may decide for the thinner device that you have to design on one side of the board only. But with thinner technology you may be able to go to two sides and maximize your functionality against the competition.

Don't let your FPGA be the limiting factor for headroom. IGLOO devices offer 4 packages less than 1 mm in height.

IGLOO Family Packages	Length x Width (mm)	Max. User I/O	Height (mm)
UC81	4x4	66	0.80
CS81	5x5	66	0.80
CS121	6x6	96	0.99
QN132	8x8	87	0.75
CS196	8x8	143	1.20
CS281	10x10	215	1.05
FG144	13x13	97	1.45
VQ100	14x14	77	1.00
FG256	17x17	177	1.60
FG484	23x23	341	2.23
FG896	31x31	620	2.23

The Xilinx Spartan family has a minimum headroom of 1.1 mm. The CoolRunner™-II family has two devices at 0.9 mm, with 21 and 37 user I/Os, respectively. Their "Advanced Packaging" brochure was last updated in 2004.

Similarly, Altera does not seem to have pushed the limits on packaging, with the Cyclone III minimum height at 1.55 mm and MAX II in the Micro FineLine BGA at 1.2 mm. Altera has no packages less than 1 mm in either family.

Detailed Packaging Information

- **Package Mechanical Drawings**
- **Thermal Characteristics and Weights**
- **Packaging Material Information**

Download Now

To learn more about Packaging Options, visit: actel.com/ezone/Q108

Trusting the Power Numbers

With claims in cyberspace about "zero-power" CPLDs and FPGAs, and "optimized for low power" with standby current as low as 35 mW, how can you trust anything you hear about power in programmable logic?

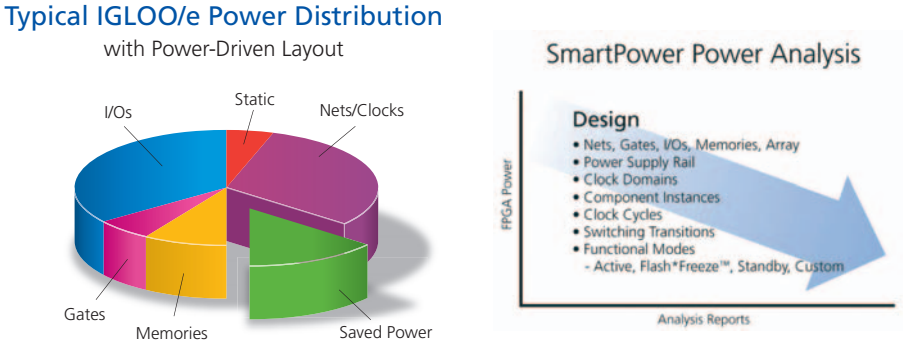
Actel doesn't expect you to just trust us. We want you to prove it to yourself and then tell all your friends. If you read through the other pages in eZone, you may get the point that Actel is serious about delivering honest, good technology to meet your needs. When it comes to power, there is no point in our convincing you we have low power, only to let you find out later that we didn't really have it. So we have made every effort to provide tools to help you predict power. We give you multiple boards that don't calculate the power for you, but instead let you attach a multimeter and measure it for yourself. Measure not just core power, but isolated I/O bank power. Let us explain what options are available.

The Power Calculator – Excel Spreadsheet

Enter the parameters of your design and then review power consumption, in Flash*Freeze mode, at different operating frequencies, and at different I/O voltages. And notice, when you change drive strengths, the power number changes correctly. If you've ever looked closely at, say, a competitor's power calculator, you might not find it quite so responsive. Using Excel allows you to see the calculations being made and save your analysis, unlike web-based calculators.

Power-Driven Layout

In the area of low-power design, much discussion takes place about such things as optimizing clock networks to reduce switching and power. Actel's new power-driven layout will move blocks together onto single clock trees to minimize switching current throughout the device, in addition to using other optimization techniques to reduce power consumption by as much as 30% in a suite of designs tested.



Power Profiling

Power profiling may not be a standardized technique, but it is a requirement of low power and especially battery-operated designs. When you design a low-power application, knowing that active power is 20 mW is not enough. You need to know standby power, low-frequency power options, and how much time you might spend in each mode. What does this do to your power budget and power supply design? In the Actel SmartPower analysis tool, you can define different modes of operation and enter the percent of time spent in each mode to get a clear picture of your power consumption and battery life through all modes of the product.

Cycle-Accurate Power Reports for Hazard Analysis

With an accurate testbench, Model*Sim*® can export switching data for your design. This information, loaded to SmartPower, can produce an average power consumption value. Other power analysis tools may do this, but the latest version of SmartPower now uses the cycle-accurate data created by the testbench. The new Activity and Hazards Power Reports enable you to quickly identify gates and nets of the design that consume power because of spurious transitions, allowing you to identify areas of your design with the potential to reduce power consumption.

Test Your Design with SmartPower

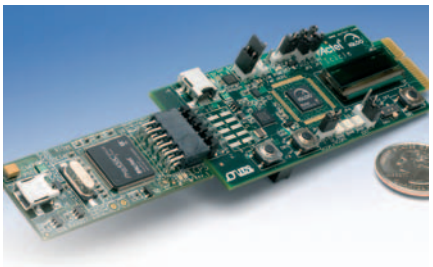
Download FREE actel.com/ezone/Q108

Test SmartPower Against Silicon

Before you go to the extent of creating your prototype board, you can test the accuracy of the Actel power numbers for yourself. Create a design and run analysis in SmartPower. Program the design to the new Icicle board and measure the power for yourself. This is a cheap and very simple way to build confidence in the Actel power numbers. We do, of course, provide a sample design you can use to do this if you do not wish to create a new design.

Measure on Icicle

Actel's **IGLOO Icicle Kit**, based on the 5 µW IGLOO device, is a low-cost, portable, low-power demonstration platform powered by built-in rechargeable lithium-ion battery, USB cable, or external power.



The Icicle evaluation board enables you to measure power consumption (dynamic, static, and Flash*Freeze mode) with the core operating at either 1.2 V or 1.5 V. When using it in conjunction with Actel's power analysis tools, you will have a clear picture of application power consumption at each stage in your design.

Get Your Own Icicle Kit

View Details

To learn more about Power Analysis, visit: actel.com/ezone/Q108

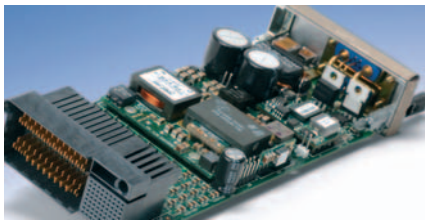
Actel μTCA™

The World's First Mixed-Signal FPGA for MicroTCA

Free Fusion-Based MicroTCA Power Module Reference Design

Actel has introduced a Fusion-based MicroTCA Power Module reference design that meets the MicroTCA specification version 1.0 and includes an enhanced module management interface (EMMC). Core8051 and two CoreI2C cores are the foundation for an IP and software platform that includes an IPMI protocol stack per IPMI specification 2.0, which supports the IPMB-0 connection and the power module EMMC interface to the MicroTCA carrier hub.

This is the first free and open reference design available for MicroTCA.

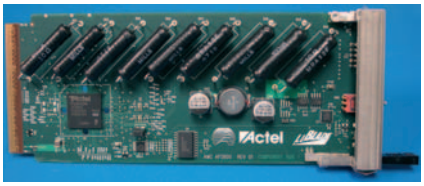


Request Reference Design, visit: actel.com/ezone/Q108

Free Fusion-Based Advanced Mezzanine Card Reference Design

As in the Power Module reference design, Actel has reduced the part count required for the Fusion-based MicroTCA mezzanine card in a unique reference design platform that includes hardware, software, and intellectual property.

The reference design is ready to plug in for evaluation and interoperability testing and conforms to the PICMG® AMC.0 ECR001 RC1.0 specification. It includes a module management controller (MMC) based on Core8051 and CoreI2C with 8051 application code.



Reducing Power in Handheld Products

Actel is systematically developing reference designs, IP, and demonstration platforms to address systems that are common to many handheld devices and other products.

1 Application Processing
LOW-POWER OPERATION AND CONTROL

2 Storage
INTERFACE WITH MULTIPLE STANDARDS

3 Motor/Servo Control
APPLICATION MOTOR CONTROL, LENS

4 Security
IP PROTECTION, DATA AND VOICE ENCRYPTION

5 Communication
WIRELESS AND WIRED INTERFACES

6 Human Interface
KEYPADS, SCROLL WHEELS, BUTTONS, SWITCHES

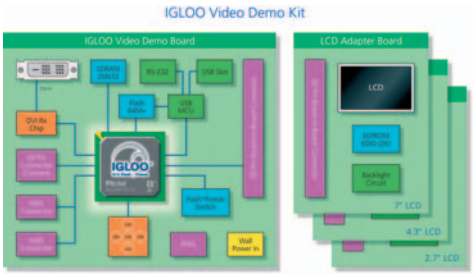
7 Display and Imaging
LCD, TOUCHSCREEN, LEDs

8 Power Management
SYSTEM POWER CONTROL, POWER SEQUENCING

Storage Actel and its partners offer multiple validated and proven IP cores for quick and easy integration of storage interfaces on flash FPGAs. The ability to support different storage interfaces on the same hardware platform can help target multiple markets by simply changing the FPGA configuration.

Display and Imaging Many LCD types and interfaces are used in portable electronics to meet preference and price, placing a challenge on the design, which needs to support all types of displays using a modular board. Many display and imaging interfaces can be implemented using low-power reprogrammable FPGAs, allowing interaction with multiple types of LCDs by changing only the FPGA configuration. Furthermore, timing control and image manipulations can be implemented on the same FPGA and modified as needed.

Human Interface and Control Different and ever-changing human interface support can be easily achieved using proven IP cores from Actel. Implementing the interface on IGLOO FPGAs reduces time-to-market while helping customize the end product and meeting customer preferences.



Video Demo Board

Actel, along with Attodyne, offers a demonstration platform that showcases IGLOO devices as controllers for various LCDs. You now have the opportunity to evaluate an IGLOO device as an ideal and flexible display controller for your designs.

To learn more about Low-Power Apps, visit: actel.com/ezone/Q108

How to Make a Power-Smart Decision

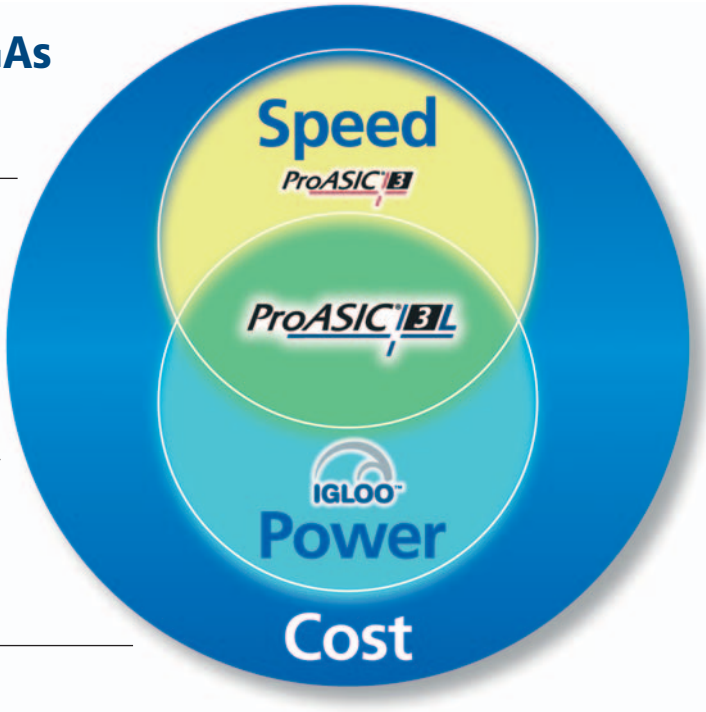
Actel has a long history of offering low-power devices. The company's nonvolatile flash technology is inherently low power.

Recently, Actel has worked hard to optimize power consumption and to maximize your ability to reduce power. We also recognize that each designer requires something different. Yes, you need low power, but do you also need speed, low densities, and low cost? To address the varying needs of designers around the globe, Actel has a broad portfolio of low-power, value-based flash FPGA families.

ProASIC3 FPGAs
Optimized for speed

ProASIC3L FPGAs
Optimized for low power and speed

IGLOO FPGAs
Optimized for low power



Actel recently announced the addition of new 15,000-gate FPGAs to the IGLOO and ProASIC3 families at a $0.99 price point, providing a lower cost, 10-times-lower-power alternative to low-density FPGAs and more expensive CPLDs in a variety of applications.

To learn more about being Power-Smart, visit: actel.com/ezone/Q108

Actel Low Power in the News - Highlights

ARTICLE	MEDIA
Energy Efficiency Moves Up the Industry's "To-Do" List	Electronic Design
Actel Powers Down—Again	FPGA and Structured ASIC Journal
Low-Power Technology—the Chicken or the Egg?	DSP-FPGA.com
The Green Monster Stirs	IC Design and Verification Journal

Low-Power FPGA Design Guide

Get Your Copy Now

actel.com/ezone/Q108

Designing for Low Power with IGLOO FPGAs

Introducing the Actel IGLOO FPGA family as a solution for low-power applications, including hands-on labs that demonstrate the use of Actel's power analysis tools and techniques to improve power consumption. Learn how to do the following:

- Examine different power components in a design
- Perform power analysis using Actel's SmartPower analysis tool
- Evaluate techniques to reduce power consumption in a design
- Understand the power-friendly features in Actel IGLOO FPGAs

Classes are held at Actel headquarters. However, students who cannot travel to Actel may attend any course remotely.

Register for a One-Day Class
or Review Class Details and Schedules
actel.com/ezone/Q108

2008 Power Forum

During 2008, Actel will be presenting a series of seminars in multiple locations. The seminars will cover information on power profiles, budgets, analysis, and optimization for programmable logic designs, including microprocessors, FPGAs, and Programmable System Chips.

Since we are still in the planning stages, vote to have a power forum hosted near you.

Register Your Vote Now
actel.com/ezone/Q108

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