

TRG Palm Computing PDAs... Using CoolRunner CPLDs



Packing the equivalent of a desktop computer into a palm-sized device, TRG needed the low power and high performance of CoolRunner technology.

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If there is a more demanding design challenge than cell phones, it's palm computing: Personal Digital Assistants, or PDAs. In developing these devices, you often face quick, repeated design changes. In addition, you need high-speed, small size, light weight, and very low power consumption – all applied to a product that has the power of a desktop computer in a tiny fraction of the volume and at a much lower price. In facing

all these demands, one company, TRG Inc. of Des Moines, Iowa, found programmable logic devices from Xilinx to be a much better design solution than ASICs.

Think of TRG's TRGpro palm computer as a combination of drag racer and minivan. It's got speed and horsepower to spare, and plenty of storage space too. While retaining full compatibility with the PalmOS, the TRGpro adds quantities of memory almost unheard of in handheld computing: 8 MB of RAM and up to

16 MB of flash memory, on special order. The flash memory can be either onboard, or in removable modules (which present their own design challenges).

Choosing the CoolRunner Family

Engineers usually expect maximum performance and minimum power consumption with custom ASICs. However, Xilinx CPLDs proved superior in TRG's designs, according to Douglas DeVries, vice president for hardware engineering. TRG has been

using the Xilinx Cool Runner family of CPLDs since 1997 and continues to do so today. They use a variety of models and sizes ranging from the XCR3032 to the XCR3256, all of which have excellent quiescent current drain – a key specification.

Although low current drain was a major consideration, DeVries says other factors weighed into TRG's choice of Xilinx CPLDs, including "their low and predictable pin-to-pin delay characteristics, low operating (as opposed to quiescent) power consumption, nonvolatility, in-system programmability, availability of both chip scale and TSOP packaging, and relatively low cost."

Very Low Power Consumption

The TRGpro's battery life in typical situations is twelve weeks, which means the device has minimal current drain. "The systems that we design typically have overall quiescent currents in the 100µA to 500µA range. Of that total, the CPLD might get budgeted 20µA to 50µA," said DeVries. "CoolRunner CPLDs are the only low-cost devices out there that allow us to realize these goals without using special shut-down modes, which complicate designs and increase system complexity."

Lower Cost

Reducing system material costs for a consumer product like a PDA can mean hundreds of dollars at retail, where hitting the right price point can mean the difference between dominating a market niche and not even being a competitor. In using Xilinx programmable logic, TRG not only met its desired price point, but also enjoyed additional advantages only available with programmable logic – advantages like speed, ease of use, and reprogrammability. Flexibility in low-cost packaging is also a must for units like PDAs, so

the Xilinx chip scale packaged devices were a definite plus.

Having used Cool Runner CPLDs since 1997 in a variety of products, from micro-stepping motors to complex image-capture systems, TRG realized that when it needed a memory controller for 8-MB memory boards for Palm Pilot computers, it could use CPLDs to great advantage. DeVries says that, "By using a CoolRunner device to generate the necessary DRAM address and control signals, we interfaced the Motorola 68328 DragonBall processor (used in the Palm computer) to inexpensive DRAM instead of more expensive SRAM – providing substantial savings in system memory cost."

Reprogrammability

Reprogrammability was also an important factor in selecting Xilinx CPLDs, and in the development of TRG's products. According to DeVries, "Reprogrammability meant that we were able to move forward confidently with PCB layout once pin assignments and general functionality had been determined. This alone saved weeks in the schedule." And it wasn't just the design cycle that profited; Xilinx CPLDs helped TRG engineers speed through the beta testing and pre-production phases. "Once beta testing and pre-production began, we could quickly perform system updates to correct any problems that were reported. Even after production started, we made several small tweaks to the CPLD to improve performance or fix obscure problems."

Multiple Uses

Due to the many advantages of CoolRunner technology, TRG not only uses Xilinx CPLDs in its Palm-compatible TRGpro PDA, but also in a variety of accessory and aftermarket devices: SuperPilot memory board family, XtraXtra and XXPro memory board lines, IDEO's PEG digital imager

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product for HandSpring, boards for the Visor PDA, and subsystems for certain models of 3Com's PalmPilot.

Advantages over ASICs

Did TRG even consider ASICs? Yes, but the price-performance ratio was not attractive, and by their very nature, ASICs are not reprogrammable. According to DeVries, "We continue to consider ASICs for some designs. Once a product is really mature, all of the kinks have been worked out of the system, and things are ready to be cast in stone, ASICs can make sense and save money. However, in most of our applications, the difference in pricing between ASICs and CPLDs in high volume hasn't been compelling enough to make us switch to an ASIC. And since we tend to use the same CPLD device in multiple designs, we can aggregate CPLD volumes across product lines. This lowers CPLD unit price and decreases inventory risk because parts used in one product line that might be phasing out can be reprogrammed and used in a new product line – not so with an ASIC."

Conclusion

"We highly recommend the CoolRunner family of devices from Xilinx. They have served us well in numerous designs," concluded DeVries. "They continue to play an important role in removing the risk and shortening our development cycle."

