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ARM GRABS TRISCEND

Purchase of Microcontroller Company Makes ARM a Chip Vendor

By Tom R. Halfhill {2/17/04-02}

No more is ARM the “chipless chip company.” ARM’s surprise acquisition of Triscend, a microcontroller vendor in Silicon Valley, will make ARM a fabless semiconductor company for the first time—at least in a small way.

ARM’s traditional business model is licensing intellectual property (IP), primarily hard and soft 32-bit microprocessor cores for system-on-chip (SoC) and ASIC integration. Except for some chips sold with development systems, ARM prefers to let its customers design and sell their own chips based on ARM cores. ARM was a pioneer in licensing microprocessor IP and remains the most successful example. Although ARM will continue pursuing that business model, the U.K.-based company will now sell standard-part ICs in the merchant market as well.

However, ARM insists it does not intend to compete with its own customers that sell ARM-based chips. (And with 128 licensees, ARM seems to have almost everyone as a customer.) The slight departure from ARM’s traditional line of business is actually a strategic move intended to strengthen that business. ARM’s goal is to seed the market for ARM-based 32-bit microcontrollers as the industry makes a transition from less powerful 8- and 16-bit chips.

Main Attraction: Triscend’s Unique Technology

The reasoning behind ARM’s acquisition is that Triscend’s chips are a good way to introduce new customers to 32-bit microcontrollers containing ARM cores. Triscend, founded in 1997, is a fabless semiconductor company that designs and sells an unusual product line of microcontrollers based on 8051-compatible 8-bit cores and ARM7 32-bit cores.

Unlike conventional microcontrollers, Triscend’s chips contain small amounts of reconfigurable logic. Using

Triscend’s special design tools, customers can configure the chips for specific applications by adding function units and peripherals from a library of royalty-free IP. Essentially, Triscend brings some of the flexibility of an FPGA to a standard-part microcontroller. (See *MPR 9/15/03-02*, “Triscend Revs Up for Motors.”)

Because of their reconfigurable logic, Triscend’s chips are two or three times more expensive than other ARM7 microcontrollers, which typically cost \$5 or less. However, Triscend’s chips tend to be more capable—and not just because of their reconfigurable logic. The most recent Triscend microcontrollers are in the elite SoC class, thanks to such extras as USB 1.1, 10–100Mb/s Ethernet, support for control-area networks (CAN2.0B), DMA, and analog-to-digital converters. Table 1 compares the features of Triscend’s latest ARM7 microcontrollers to some other luxury-model ARM7 microcontrollers from Atmel, Hynix, Oki, and Philips.

The relatively high prices of Triscend’s well-appointed microcontrollers make them less suitable for low-cost or large-volume applications. Interestingly, the pricey features make Triscend’s chips more attractive for ARM’s purposes. Their flexibility allows customers to configure and field-test the chips in real-world applications before launching a project to design a custom microcontroller or an ASIC around an ARM core. At the same time, their higher prices reduce the likelihood that ARM will compete with its own licensees making ARM-based microcontrollers. The Triscend acquisition

Feature	Triscend A7VL05	Triscend A7VE05	Triscend A7VC05	Triscend A7VT05	Atmel AT91FR40xx	Hynix HMS39C70x	Oki ML67Q500x	Philips LPC2106
CPU Core	ARM7TDMI	ARM7TDMI	ARM7TDMI	ARM7TDMI	ARM7TDMI	ARM7TDMI	ARM7TDMI-S	ARM7TDMI
Core Freq	64MHz	64MHz	64MHz	64MHz	82MHz	50MHz	60MHz	60MHz
I/D Cache	8K, 4-way	8K, 4-way	8K, 4-way	8K, 4-way	—	—	—	—
Scratchpad	32K	32K	32K	32K	256K	4–12K	32K	64K
Config Logic	512 cells	512 cells	512 cells	512 cells	—	—	—	—
Flash	External Interface	External Interface	External Interface	External Interface	512–2,048K In package	192–512K On chip	256–512K In package	128K On chip
DMA Ctrl	Yes	Yes	Yes	Yes	—	—	Yes	—
Timers	4 x 32-bit 2 x 16-bit + watchdog	4 x 32-bit 2 x 16-bit + watchdog	4 x 32-bit 2 x 16-bit + watchdog	4 x 32-bit 2 x 16-bit + watchdog	3 x 16-bit + watchdog	6 x 16-bit + watchdog	7 x 16-bit + watchdog	2 x 32-bit + watchdog
UARTs	2	2	2	2	2 USART	2	2	2
I ² C Interface	—	2	2	2	—	—	1	1
CAN 2.0B	—	—	1	1	—	—	—	—
USB 1.1 Ctrl	—	1	—	1	—	—	—	—
ADC	—	Yes	Yes	Yes	—	Yes	—	—
Ethernet Ctrl	—	1	1	2	—	—	—	—
Core Voltage	1.8V	1.8V	1.8V	1.8V	1.65–1.95V	3.0–3.6V	3.6V	1.8V
Package	PQFP-208	BGA-324	BGA-324	BGA-324	BGA-121	TQFP-100	LQFP-144 LFBGA-144	LQFP-48 HVQFN-48
Availability	Now	Now	Now	Now	Now	Now	Now	Now
Price (10k)	~\$10.40	~\$12.20	~\$12.20	~\$13.70	n/a	n/a	\$6–7 (100k)	<\$8

Table 1. Triscend's ARM7-based microcontrollers cost more than other ARM7 microcontrollers but have features rarely found in these kinds of chips. Reconfigurable logic is their unique feature. Other high-end features—such as USB and Ethernet controllers—require larger packages with more pins, which also inflates the cost of the chips. n/a: not available.

thus gives ARM a back door into the chip business without significantly altering its traditional IP-licensing business.

Seeking a Slice of the Microcontroller Pie

ARM says the Triscend acquisition is only the first move in a long-term strategy to make the ARM architecture as pervasive in 32-bit microcontrollers as it is in cellphones. ARM considered starting a new division or subsidiary to develop its microcontroller business but decided to acquire Triscend instead. In addition to the reasons outlined above, other attractions were Triscend's mature design tools, its respected engineering staff, its existing customers, and what ARM describes as “a cultural match in company values.”

When the acquisition becomes final—probably within a month—ARM will pay \$13.2 million in cash for Triscend, plus another \$1.8 million if the company meets certain performance targets during the coming year. Triscend, based in Mountain View, California, is a private company funded with more than \$66 million in venture capital. Its 41 employees will join ARM, and the company's brand name will be phased out. Although ARM acquired Triscend for its

32-bit products, ARM says it will continue selling and supporting the 8051-compatible 8-bit chips to customers that want them.

In its new (albeit small) role as a fabless semiconductor company, ARM will pick up Triscend's foundry relationships with Sharp in Japan and UMC in Taiwan.

ARM's pursuit of the 32-bit microcontroller market is a wise strategy. The 8051 architecture alone accounts for sales of 3.3 billion chips per year, according to *World Semiconductor Trade Statistics*. If ARM can lure more 8- and 16-bit microcontroller customers toward 32-bit chips, it will greatly expand the market for ARM licensees—and generate lucrative royalties for ARM.

Although the higher prices of Triscend's microcontrollers will limit them to lower-volume applications that aren't especially cost sensitive, their configurability will eliminate the need for a custom design, in some cases, or make it easier to evaluate a configuration before embarking on a custom design. That uniqueness dovetails with ARM's objectives. The deal also comes at a propitious moment for Triscend, which was struggling through the tech recession. ♦

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