

# Toshiba Does Windows CE at 166 MHz

## New R3922 Ties for Fastest Microprocessor for Windows CE Applications

by Jim Turley

Quiet MIPS vendor Toshiba is making a bigger noise in the embedded space with a fast new processor that runs Windows CE. The TMPR3922 joins a rapidly growing crowd of WinCE chips, but it stands out as one of the fastest available. Toshiba is aiming its newest weapon at consumer items and at its primary competitor, NEC's VR4300 family.

The R3922 is basically a speed upgrade—albeit a big one—from the existing TMPR3912. Top clock speed is now a respectable 166 MHz, more than double the R3912's peak frequency of 74 MHz. To support the faster clock rate, the R3922 also has vastly enlarged caches: 16K for instructions and 8K for data, or almost five times as much cache as its predecessor. In fact, the new chip is now 75% cache by area. The new data cache offers write-back as well as write-through update policies, at the programmer's option.

Just as significant as the speed change is the alteration to the device's memory management. Working with Microsoft, Toshiba subtly altered the R3922's MMU to support Windows CE. As ARM has found (see MPR 4/20/98, p. 10), the changes required are very minor but should make a big difference in market acceptance. Unlike ARM, Toshiba sees no point in offering a separate version without Windows compatibility.

### First Use of Toshiba's 0.25-Micron Process

The R3922 is the first standard part that Toshiba has fabricated in a 0.25-micron process. Before this one, the company made some customer-specific parts—including ASICs based on the TX39 CPU core—but no chips for general availability. Toshiba now joins NEC, Motorola, and IBM in offering embedded microprocessors in this leading-edge process.

The advanced process, of course, is what allows the R3922 to achieve its high clock rate. It should also keep power consumption low, although Toshiba hasn't character-

ized the part's power. Unfortunately, the 0.25-micron process also forces Toshiba to use a split power supply for the part: 2.5 V for the core and 3.3 V for the pad ring.

Starting with the SA-110, split power supplies have become more common but no less burdensome to designers. With no standard for the low-voltage portion, each designer must engineer a custom power source. A basic linear regulator can do the job but wastes all the power savings in heat. More elegant solutions require more board space.

### R3922 Holds Speed Lead With VR4310

Toshiba's new chip is now the second Windows CE-compatible processor to reach 166 MHz, after NEC's VR4310 (see MPR 10/27/97, p. 11). Or more precisely, it will be when the R3922 begins sampling in 3Q98. The NEC part is less expensive than Toshiba's, and it's shipping now. On the other hand, the R3922 includes considerably more on-chip I/O than the more spartan VR4310.

As Table 1 shows, the two chips have identical caches and instruction sets (including a MAC); neither implements the MIPS-16 compression hardware. Even though both are built in similar processes, NEC's VR4310 runs from a single supply voltage instead of using a split supply as the R3922 does. Toshiba's part, however, comes with a PCMCIA controller, IrDA support (including fast 4-Mbit/s IrDA 1.1), and a dozen programmable I/O pins.

Although neither chip is really suitable for handheld applications, both are well suited to small tethered systems in consumer electronics. Hoping to copy the success of the VR43xx in video games and printers, Toshiba might push its chip into set-top boxes and similar systems. Without an FPU, however, the R3922 won't be as powerful for graphics or rendering tasks. NEC's two-year head start also means Toshiba's market territory is well picked-over.

Like the R3901, the R3922 is a good processor in its own right and also as a development tool for those interested in a TX39-based ASIC. This chip may ultimately be more successful as a calling card than as a standalone processor. □

	R3922	R3912	VR4310	VR4300
Vendor	Toshiba	Toshiba	NEC	NEC
Architecture	MIPS	MIPS	MIPS	MIPS
Max freq	166 MHz	74 MHz	167 MHz	133 MHz
Inst cache	16K	4K	16K	16K
Data cache	8K	1K	8K	8K
Window CE?	Yes	No	Yes	Yes
PCMCIA?	Yes	No	No	No
Voltage	2.5/3.3	3.3 V	3.3 V	3.3 V
Power	n/a	300 mW	1.8 W	1.5 W
Price (10k)	\$35	\$25	\$25	\$20

Table 1. Toshiba's TMPR3922 is as fast as NEC's VR4310 but includes some integrated I/O in its \$35 list price.

### Price & Availability

Toshiba's TMPR3922U will begin sampling in 3Q98; production is scheduled for 4Q98. In 1,000-unit quantities, Toshiba has priced the chip at \$40.

For more information, contact Toshiba America Electronic Components (San Jose, Calif.) at 800.879.1177 or set your browser to [www.toshiba.com/taec](http://www.toshiba.com/taec).