

## Credit card-sized XT mother board introduces DOS to embedded systems

Tom Williams, Western Managing Editor

**N**umerous factory-floor control systems, medical instruments and clusters of electronic instrumentation are controlled and monitored by an IBM PC or compatible. Even real-time control systems that use dedicated microcontrollers to monitor critical processes need a user interface, which is often provided by a PC attached to the system. Such systems also require an increasing amount of flexibility for programming at the functional level to retrieve and analyze data that's been acquired by a real-time system or to set parameters for process monitoring. But PCs are bulky, aren't protected against harsh environments and represent a cost factor the system designer would like to reduce.

The Wildcard 88, recently introduced by Intel (Santa Clara, CA), lets OEM system designers embed DOS functionality into all kinds of equipment, from consumer products to medical and industrial instrumentation. The Wildcard incorporates all of the core logic found on a 48-in.<sup>2</sup> IBM PC XT mother board onto a circuit board measuring 8 in.<sup>2</sup> All connections for I/O, memory, power and control interface are brought out to a 68-pin card edge connector that plugs into a standard high-density single in-line module (SIM) connector.

The board space was reduced through a chip-on-board technique in which the IC die was wire-bonded directly onto the circuit board and then covered with a layer of epoxy. This technique was accomplished by using an 80C88 CMOS microprocessor and an application-specific IC designed to incorporate memory refresh, interrupt, timer/counter and clock functions. Clock speed is 7.15 MHz, but is software-switchable to the XT standard 4.77-MHz frequency.

### ■ Various approaches use DOS

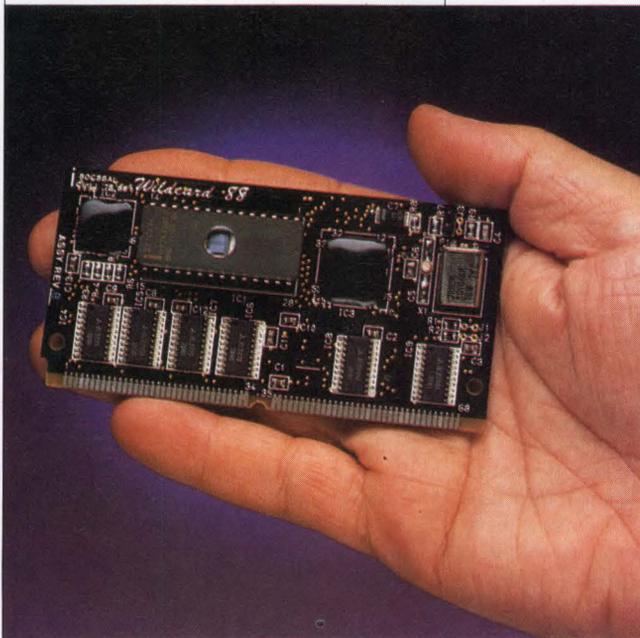
Although there's plenty of space on the back of the board, Intel hasn't incorporated any system memory on the card. There simply was no in-

centive for the company to include memory, according to product manager Dirk Smits, since Intel no longer makes memories. Memory can be added via SIM memory modules to the system being designed.

The Wildcard carries a socket for a ROM BIOS that's supplied by Phoenix Software (Norwood, MA) and Award Software (Los Gatos, CA). Since the card is 100 percent XT-compatible, designers will take different

ware. These memory cards also have the added advantage of being about the same form factor as the Wildcard. In addition, there's a ROM version of DOS, DR-DOS, available from Digital Research (Monterey, CA)

Smits is careful to point out that the embedded PC functionality isn't intended for real-time control, but is more of a monitor. It lets users interact with the system in terms of familiar DOS functions or some specialized user interface, such as graphics instrument symbols. It also allows programming of system functions, which may include real-time control. In addition, DOS compatibility allows incorporation of off-the-shelf applications, such as spreadsheets, for data analysis in specialized equipment. A



*At only 2 x 4 in., the Wildcard 88 holds all the core logic of an IBM PC XT mother board, letting OEMs incorporate DOS functionality into a wide range of intelligent systems. A CMOS 80C88 processor and an integrated peripheral controller chip are mounted directly on the board and encased in epoxy.*

approaches to incorporating DOS in their systems. The easiest way, of course, is to include a floppy drive and boot DOS, just like in a desktop PC. That solution, however, is undesirable in portable equipment.

Instead, ROM or battery-backed RAM cartridges can be used, as well as credit card-sized memory cards such as the Star Card from ITT Cannon (Santa Ana, CA) and the Melcard from Mitsubishi (Tokyo, Japan). The latter two options are available in EPROM, ROM and RAM configurations, letting designers mix and match memory and embedded soft-

lot of software development can also be done off-line on a normal desktop XT or compatible and moved directly to the target equipment.

Intel supplies a prototyping board with connections for a power supply, a keyboard, several SIM connectors and three XT card slots. Presumably, a system designer could prototype his system, develop software and then make the decision whether to use off-the-shelf cards, such as I/O boards or display controllers, or to fold the desired functionality into a more compact special circuit board for the final design. □