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Complete CAN Capability

Siemens

Siemens are one of the largest forces within the European semiconductor market arena, with more than ten years experience in designing and manufacturing microcontrollers. Siemens' technology strategy for the embedded market is to develop tailored microcontroller architectures rather than modifying general purpose processors for embedded control applications. This includes optimizing the right cores for a variety of application segments, as well as developing various memory technologies and application-oriented peripherals such as CAN 2.0B. On these bases, Siemens has evolved into a world wide player particularly in the automotive, data-processing and telecom markets including localized support and decision making. In addition, specific derivative controllers have a strong stand in wireless terminals and smartcards.

How Siemens are making it happen

During the 1980s, Siemens products were based around the 8051 core kernel licensed from Intel. Approximately 6 years ago, Siemens adopted a more autonomous approach and introduced the 8051-compatible 8-bit C500 controller family with the aim of overcoming certain performance and design limitations. Today a wide variety of C500 products with a competitive price/ performance ratio are available. The compatibility to the 8051 industry standard also ensures that a wide range of low-cost and proven development tools are available. Based on their 8-bit experience, Siemens then developed their 16-bit C166 architecture. The main aim was to generate a kernel which was optimized for embedded control applications. Today, the resulting C166 family has been well established as the industry standard within the 16-bit MCU arena with its excellent real-time and computing performance capabilities. These 16-bit derivatives extend from processor-oriented variants in the 8-bit price range to systems-on-silicon for automotive and telecom applications. Following the embedded control path, Siemens are continuing to develop 16-bit derivatives in addition to providing future cores upgrades.
The integration of a wide range of on-chip memory variations is made possible through a modular technology concept. Besides different RAM, ROM and OTP sizes, derivatives with on-chip Flash, EEPROM or DRAM are also now available. One of the key focal points lies in supporting the various bus systems such as CAN and USB. Indeed, Siemens already offer the largest number of CAN 2.0B embedded derivatives on the market from standalone through to 8 and 16-bit.

Siemens' microcontrollers have their strongest position in the automotive market where they are found in about 50 % of all European engine management systems. The company is now attempting to expand its presence into additional markets in the US and Asia-Pacific, by extending strengths like real-time performance, application specific peripherals, as well as adding new higher performance architectures.

Siemens excellent on-chip computing capacity has also given the company a good entry into

position in hard disc drives which will be extended with an enriched offer of new high-performance variants, plus logic integration into systems-on-silicon. Other major areas of strength are telecommunication and consumer applications. Here Siemens combines its wide experience on dedicated telecom and consumer products with microcontroller cores to generate versatile application-specific products and systems-on-silicon. Industrial applications profit from the various development activities.

Siemens complement its product offering with a market strategy that recognizes the increasing importance of applications support and development tools. Consequently, Siemens have set up a support and distribution network which spans the world. A major aim is to take responsibility and power closer to the markets. A current step is to delegate business responsibility to the regions worldwide and, by so doing, achieving a leading market support in all the major trade regions. For example, the management for computer peripherals has been moved to the USA, in addition to the existing Business Operations in the USA, Asia-Pacific, Japan and Europe, in order to assure swift and competent advice and support for the customers. Furthermore, Siemens have successfully implemented a strategy of collaboration with a wide range of third-party tool developers. The ability to offer the right tools is crucial at a time when success in product development increasingly depends on shorter development cycles and minimum code size. More than 120 partners world-wide enrich Siemens' offering with high-convenience and powerful development tools and environments. The availability of starter kits makes it easy and inexpensive to adopt and get started in designing Siemens microcontrollers.

Siemens' challenging target is to double its market share by the millennium, thus becoming one of the major players in the embedded control market. The Siemens Microcontroller group is confident that with the commitment of management and the strength of its activities in technology, products and support infrastructure this goal is achievable. In this challenge, the microcontroller technology will benefit from its relation with other Siemens' business units who will utilize cores for dedicated products and contribute valuable application specific know-how to improve the cost/system performance of microcontrollers.

C167CR with CAN 2.0B - the 16-Bit standard with FullCAN

Siemens Microcontrollers is today the Number 2 world wide and Number 1 supplier in Europe for engine management systems. The C166, the highest performance 16-bit microcontroller architecture on the market today, is already established as a industry standard for all kinds of applications requiring high real-time performance not only in the automotive market segment. The continuously increasing demands for highly reliable communications within engine management systems was one of the driving forces to setup the CAN protocol in the 1980´s. The C167CR, featuring besides others a CAN 2.0B module with 15 message on-chip buffers, covers perfectly all these requirements and has already become a high runner in the automotive industry. Various C166 derivatives are sold today in high volume worldwide across US, Europe and Japan.

For the future, on-chip Flash memories for program as well as data storage will become more important. Siemens have faced up to this future challenge and have developed their own Flash process based on the Fowler Nordheim principle. The aim was to cover the needs of high

kB module has already been proven on the C163 derivative for the computer peripheral market. A first automotive product will be available early 1998.

C164CI - single chip CAN 2.0B solution for DC brush-less motor drive

Targeted towards the industrial control market and especially to motor drive applications a new member of the C166 family with on-chip CAN 2.0B recently joined the portfolio. Known as the C164CI, it is seen as the coming standard 16-bit microcontroller for industrial control. Powered by the well known C166 core it covers the requirements for increasing CPU performance for real-time critical applications. A powerful new peripheral for DC brush less motor control enables the user to steer electric drives using small software routines with the minimum of CPU overhead. One time programmable (OTP) memory for the C164CI improves flexibility and the ability to realize a single chip based solution.

Attracted by the fact, that the 16-bit C164 comes into the 8-bit arena with a relatively small price adder, applications traditionally using mid to high-end 8-bit microcontrollers today are beginning to see future systems benefits in favor of the C164 family. Indeed, several automotive applications based around 8-bit technology have already made the switch up to 16 bits; namely, intelligent switching units, central gateways, central body control modules and airbags. Driven by the well selected set of on-chip peripherals and the highly competitive price/performance-ratio the decision for a C164 derivative also provides the customer a systems upgrade path in various, software compatible steps towards future upgrades of the C166 family.

For low end and price sensitive applications such as intelligent sensors or actuators Siemens have enhanced their portfolio of 8-bit C500 microcontrollers with on-chip CAN 2.0B. The C505C is the first member of the portfolio featuring on-chip CAN 2.0B, an highly accurate A/D converter, PWM generation controlled by an 8-bit core at the price level of todays CAN 2.0B standalone derivatives.

User programmable versions of the C500 and C166 are available for all new derivatives, guaranteeing single chip solutions with a high degree of flexibility. Siemens on-chip OTP and Flash technologies have made it possible to offer the customer user programmable versions for all temperature ranges up to the full automotive temperature range, thus enabling OTP and Flash to be used not only for small series pre-production, but also for high volume mass production.

Besides the low cost C505C, the C164CI for mid-range applications and the C167CR for high-end 16-bit applications, a new 32-bit architecture is currently in preparation within Siemens. This new core approach will combine microcontroller, microprocessor and DSP functionality to address the future requirements of high-end real-time embedded systems and will be complemented with an enhanced application specific set of on-chip peripherals.

A New 32-Bit Architecture will cause a paradigm shift in most real-time embedded control system

The Trillium core architecture is a major paradigm shift for the traditional 32 bit embedded control arena. Based on an innovative multi-tasking engine, the Trillium core is capable of supporting both embedded control and DSP tasks using a single processing core and unified instruction set. System designers developing next-generation computer peripherals, communication products and automotive control systems are all expected to be amongst the initial adopters of the Trillium core architecture

The Trillium Core dramatically expands design flexibility and performance potential of real-time oriented embedded systems by enabling "virtual multiprocessor", single-chip designs. The superscalar Harvard type load/store architecture of the Trillium core is capable of issuing up to three instructions per cycle and can sustain a high DSP throughput using two 16x16 multiply accumulates per cycle, with a MAC unit that also provides zero overhead loop operation. Compact code size is easily achieved by freely intermixing 32-bit instructions with a 16-bit subset instruction format.

A fast, hardware supported task switching mechanism (via a wide bus to memory) enables the Trillium core to switch from any control or DSP task in just two instruction cycles. For an effective multi-tasking environment this combination of fast interrupt handling, fast context switching and fast response time is of primary importance and gives the Trillium core significant advantages over conventional microprocessor and embedded microcontrollers.

Digital signal processing is fast becoming standard practice in many real-time critical embedded control systems. The Trillium Core is the first 32-bit architecture to provide competitive DSP capabilities supporting fractional data formats, DSP oriented addressing modes, load/store instructions for packed arithmetic, data saturation, support for min. and max. data searches as well as advanced overflow flags.

Development tools, including compilers, source level debuggers, and an instruction set simulator are all provided embedded system designers the ideal platform in which to evaluate the future capabilities of the Trillium core within their future real-time embedded systems. Siemens plans to introduce an evaluation chip based on a 100 MHz Trillium Core, and supported by system design evaluation boards, in the second quarter of 1998.

* * * The Trillium Core architecture is the basis for a future family of customer-specific and application-specific derivatives for telecom, data communication, automotive and industrial control systems as well as for consumer electronics goods and EDP peripherals. The unique combination of microcontroller and DSP characteristics within the Trillium core will inevitably lead to the best price/system performance ratio for future 32-bit embedded applications.