E²Brain™

A revolutionary new approach to embedded computers

In the present world of pervasive computing, businesses and private users must rely on an ever increasing number of machines and appliances whose functionality is based solely on embedded computers. Manufacturers are faced with increasing pressure to supply more products in less time, system complexity explodes with the dawn of new technologies, and money is tight.

Embedded modules are an excellent way to alleviate this situation. By providing ready-to-run computer cores, they aid in the reduction of development efforts and shortening of product time to market.

A number of approaches for embedded computer modules in various form factors, with different interface technologies and CPU architectures, have been developed, but they all have one thing in common. More or less sophisticated and powerful, they serve as general purpose computer cores, but there's still a lot of effort required to deploy them in systems with particular needs from different application areas. That's exactly where the E²Brain™ concept comes into its own.

Computer-On-Module

E²Brain™ (Embedded Electronic Brain) is a highly application oriented new architecture for advanced computer modules. It fulfills the requirements of various markets such as industrial, medical, communications, transportation, and military by providing a comprehensive, perfectly tailored set of features and interfaces. The E²Brain™ specification defines a mechanical form factor and a set of functional interfaces providing a maximum of flexibility and scalability.

CPU Independent

E²Brain™ is open for all CPU architectures including PowerPC, ARM, SH and others. Thus a CPU technology which fits best to the application requirements can be chosen without making compromises.

Scalable Performance

Compatibility of all E²Brain™ modules is ensured on a basic level represented by the system interface (Pn1) and the basic communication and IO interface (Pn3).
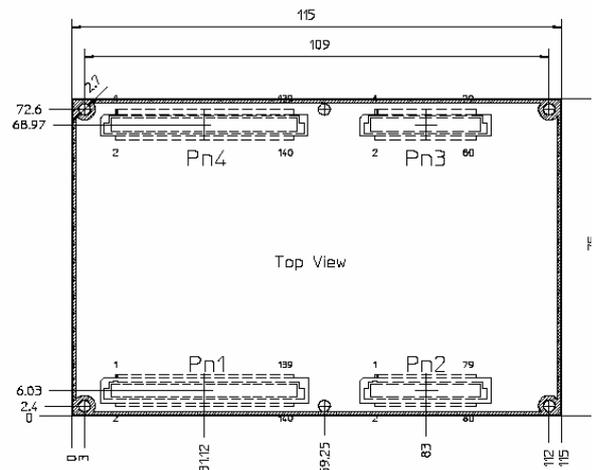
To accommodate a broad spectrum of applications, connectors Pn2 and Pn4 may also be populated to provide additional interfacing capabilities.

Furthermore it provides an upgrade path for integrating future interface technologies, e.g. switch fabrics like PCI-Express or Rapid IO.

Application Oriented

Different CPU architectures, scalable performance and connectivity let the user tailor the computing core exactly to the needs of the application.

E²Brain modules are available with a wide variety of characteristics:

eBrain™ Basic Architecture

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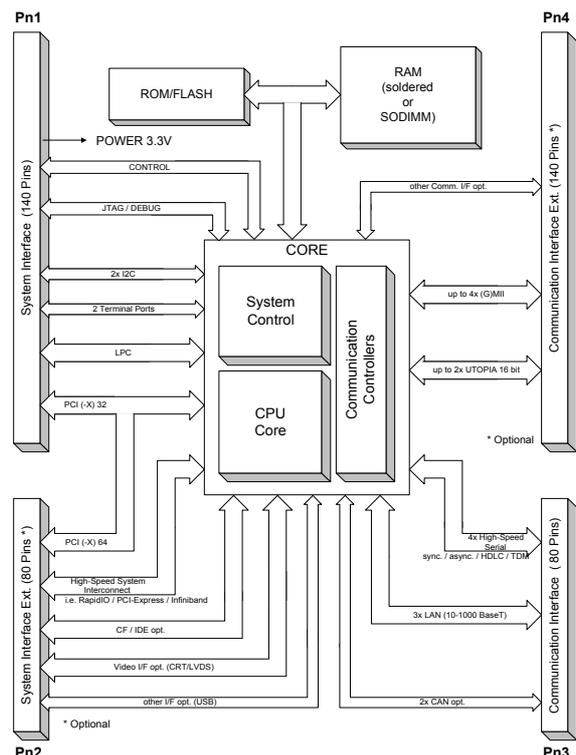
Advanced Computing Cores

- Deliver a combination of computing power and application specific IO
- Are designed for use in real time control units for industrial, medical, and mobile applications
- "The uncompromising Number Crunchers"

Communication Engines

- Provide a perfect core for subsystem controllers in the Telecom/Datacom infrastructure or industrial gateways and protocol converters.
- Are aimed for systems with enhanced requirements to communication interfaces
- "Interfaces, protocols, and more"

Dedicated Controllers

- Are dedicated to specific tasks such as motor and axis control
- Fit perfectly to decentralised lean industrial and closed loop control systems
- "The cost-conscious problem solvers"

Thermal Design

E²Brain™ modules are consequently optimized for highest performance at lowest power consumption. Passive cooling and a comprehensive thermal design is a prerequisite for deeply embedded applications: This has been achieved with BrainCAP™. The acronym stands for "E²Brain Cooling Assembly, Protector". Because BrainCAP™ is more than just a heat sink, the milled aluminum element provides mechanical stability as well as EMI protection.
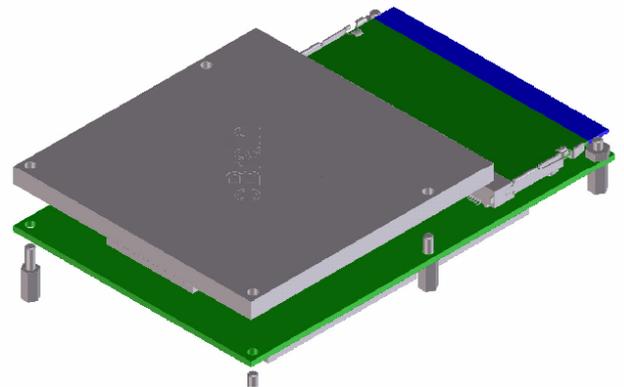
E²Brain™ Technical Features

E²Brain™ modules are complete Computer-On-Modules incorporating four basic function blocks:

1. CPU core
2. Volatile and non-volatile memory (SDRAM, Flash, SRAM, E²Prom)
3. Basic system and communication interfaces
4. Application specific interface extensions

The E²Brain specification defines a common set of interfaces for all modules assuring compatibility and interchangeability at that level:

- PCI (32-bit)
- LPC
- 2 terminal ports (Rx/Tx)
- 1 to 4 high speed serial interfaces
- I²C
- JTAG/BDM interface
- Utility port (reset, abort, and control signals)
- Power supply (3.3V)
- Ethernet

A number of optional interfaces tailor the modules for specific application areas:

- 2 CAN interfaces
- PCI(-X) 64-bit extension
- CompactFlash IDE interface
- Graphics interface CRT/LVDS
- USB
- PS/2
- High speed system interconnect (e.g. RapidIO™, PCI-Express)
- Up to 2 UTOPIA (16-bit) interfaces
- Up to 4 (G)MII (Media Independent Interface)
- Additional application specific IO ports

Carrier boards

E²Brain™ modules are complete computing cores with CPU, memory and a number of ports, however, the module power supply, physical interfaces and additional functional extensions are required to be implemented on a carrier board. For each module type, a corresponding evaluation carrier board is provided which enables the user to begin immediately with application software development using the ready-to-run VxWorks or Linux Board Support Packages. Because the E²Brain concept simplifies carrier board design, users themselves may easily implement application specific designs or if required carrier board designs may be provided as a service.
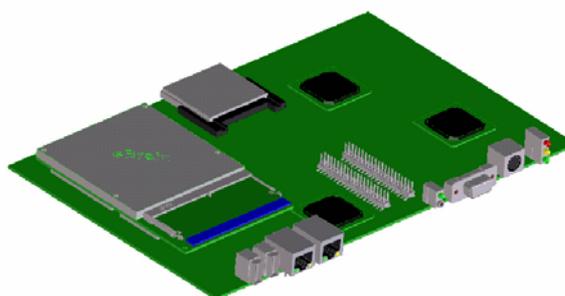
Customer benefits

The highly application oriented approach offers the customer essential system functionality off-the-shelf, saving time and money. Integration of E²Brain™ modules is made easy by keeping all interfaces standard: complex processor specific know how is not needed. Thus a customer can really focus on his core competencies and achieves shorter product time to market.

E²Brain™ is qualified for harsh environments by providing possibilities for mechanical fixing, optional conformal coating, and extended temperature range: -40°C to +85°C. Moreover long term availability is guaranteed by carefully selected components with life times significantly higher than known from the PC market. Even in case of component discontinuances a form-fit-function substitute is available due to the E²Brain™ family concept.

Roadmap

The feature-rich and highly integrated PowerPC processors like MPC8245, MPC860T or MPC8540/8541 or Intel XScale like the IXP425 are a perfect match for E²Brain™ due to their extremely low power consumption and long term availability. But due to the CPU architecture independent concept, any other type of processor may be implemented on E²Brain™ modules as well.

CPU Performance

Advanced Computing Cores
Communication Engines
Dedicated Controllers

EB860

EB8245

Vertical Market Orientation

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