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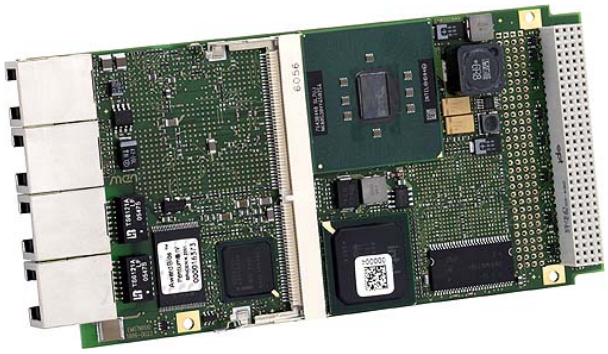
EM7N - Embedded System Module with Pentium® III



- **Embedded System Module with:**

- **ULP Pentium® III / 933 MHz**
- **ULV Celeron® / up to 650 MHz**
- **FPGA 18,752 LEs**
- **Up to 512 MB DRAM, 128 MB NAND Flash**
- **Dual Fast Ethernet (front)**
- **Dual UART (front)**
- **Graphics, 2 USB 1.1, (E)IDE, 2 CAN bus**
- **Individual programmable I/O functions in FPGA**
- **Stackable with PCI-104**

The EM7N is a complete embedded single-board computer for use on any carrier board in different industrial environments. The final application consists either of a stand-alone EM7N, the EM7N with an application-specific carrier card and/or with additional plugged PCI-104 modules.
The EM7N is an ideal computing platform for embedded industrial PCs, offering the whole world of Windows® and Linux based software, e.g. for infotainment applications.

It is controlled by an Ultra-Low Power Pentium® III at 933 MHz or an Ultra-Low Voltage Celeron® processor up to 650 MHz. It provides 512 KB / 256 KB L2 cache. Using the Intel® 815E chip set, the EM7N provides graphics, which is routed to the J2 rear I/O connector. It provides two Fast Ethernet and two RS232 interfaces via RJ45 connectors or 9-pin D-Sub connectors at the front. It also has an SO-DIMM socket, and a soldered NAND flash memory on board. Further I/O can be routed to the I/O connector of the ESM™ by means of an FPGA - with the corresponding connectors available on a carrier board. The standard I/O routed to the carrier board via the J2 system connector includes two CAN-bus interfaces, (E)IDE, four on-board USB 1.1 interfaces, and a Codec connection for AC'97 audio. In the same flexible way, additional functionality such as serial interfaces, CAN bus controllers, protocol converters, touch controller etc. can also be realized in the FPGA to the needs of the individual application. Before system boot-up, the FPGA is loaded from boot Flash. Updates of the FPGA contents can be made inside the boot Flash during operation and are available after a re-boot of the system.

For a first evaluation of the functions of the EM7N it is strongly recommended to use the EK5N ESM™ starter kit. The kit consists of the standard CPU module, the carrier card with I/O connectors, an external PSU, and an adapter for mounting a PCI-104 module.
ESM™ modules are complete computers on a plug-on module. They consist of the hardware (CPU, chip set, memory, I/O) which is not fixed to any application-specific function, and an FPGA programmed in VHDL code, which provides I/O that is also still independent of a specific application. ESM™ modules are based on PCI. They have two system connectors: J1 has a fixed signal assignment, while J2 is variable depending on the final application-specific configuration of the ESM™ and the carrier board. J2 also feeds the I/O signals of the functions programmed in the FPGA to the carrier card.

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Technical Data

CPU
- Celeron® or Pentium® III
  - 400MHz/650MHz or 933MHz processor core frequency
  - 100MHz or 133MHz system bus frequency
  - 33MHz APIC bus frequency

Memory
- 256KB or 512KB L2 cache integrated in CPU
- 512MB SDRAM system memory
  - One 144-pin SO-DIMM slot for SDRAM modules
  - 133/100MHz memory bus frequency
- Up to 1GB soldered NAND Flash (and more), FPGA-controlled
- Up to 16MB additional SDRAM, FPGA-controlled, e.g. for video data and NAND Flash firmware
- 2MB boot Flash

Mass Storage
- Parallel IDE (PATA)
  - One port for onboard NAND Flash
  - One port for hard-disk/CD-ROM via I/O connector to carrier board
- Up to 1GB soldered ATA NAND Flash (and more), FPGA-controlled

Graphics
- Integrated VGA graphics controller
- Available via I/O connector J2

I/O
- USB
  - Four USB 1.1 ports
  - Available via I/O connector J2
  - UHCI implementation
  - Data rates up to 12Mbits/s
  - Supplies High-Power (500mA) without external power supply
- Ethernet
  - Two 10/100Base-T Ethernet interfaces
  - Two RJ45 connectors (or one 9-pin D-Sub connector) at front panel
  - Four onboard LEDs to signal LAN Link and Activity status
- Two RS232 UARTs (COM1/COM2)
  - Two RJ45 connectors (or one 9-pin D-Sub connector) at front panel
  - Data rates up to 115.2kbits/s
  - 60-byte transmit/receive buffers
  - Handshake lines: CTS, RTS; DCD, DSR, DTR
- Further I/O depending on FPGA configuration

Front Connections
- Two Ethernet (Two RJ45 or one D-Sub)
- Two RS232 UARTs COM1/COM2 (Two RJ45 or one D-Sub)

FPGA
- Standard factory FPGA configuration:
  - Main bus interface
  - 16Z125_UART - UART controller (controls COM1..COM3)
  - 16Z029_CAN - CAN bus (2 IP cores)
  - 16Z043_SDRAM - Additional SDRAM controller
  - 16Z070_IDEDISK - NAND Flash controller
- The FPGA offers the possibility to add customized I/O functionality. See FPGA.

PCI Interface
- 32-bit/33-MHz PCI interface at PCI-104 connector J1
- Compliant with PCI Specification 2.2
- Support of 3 external masters

Miscellaneous
- Real-time clock, backed up by the carrier board
- Integrated hardware monitor

Electrical Specifications
- Supply voltage/power consumption:
  - +5V (-2%/+5%), 900mA typ. (Celeron® 400MHz), 1200mA typ. (Celeron® 650MHz), 1900mA typ. (Pentium® III 933MHz)
  - +3.3V (-2%/+5%), 700mA typ. (Celeron® 400MHz), 700mA typ. (Celeron® 650MHz), 700mA typ. (Pentium® III 933MHz)
- MTBF: 167,700h @ 40°C (derived from MIL-HDBK-217F)

Mechanical Specifications
- Dimensions: conforming to ESM™ specification (PCB: 149mm x 71mm), Type I-S
- Weight: 106g (w/o heat sink, w/o CompactFlash® card); standard heat sink: 155g

Environmental Specifications
- Temperature range (operation):
  - 0..+60°C
  - Industrial temperature range on request
  - Airflow: min. 10m³/h
- Temperature range (storage): -40..+85°C
- Relative humidity (operation): max. 95% non-condensing
- Relative humidity (storage): max. 95% non-condensing
- Altitude: -300m to + 3,000m
- Shock: 15g/11ms
- Bump: 10g/16ms
- Vibration (sinusoidal): 2g/10..150Hz
- Conformal coating on request

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Technical Data

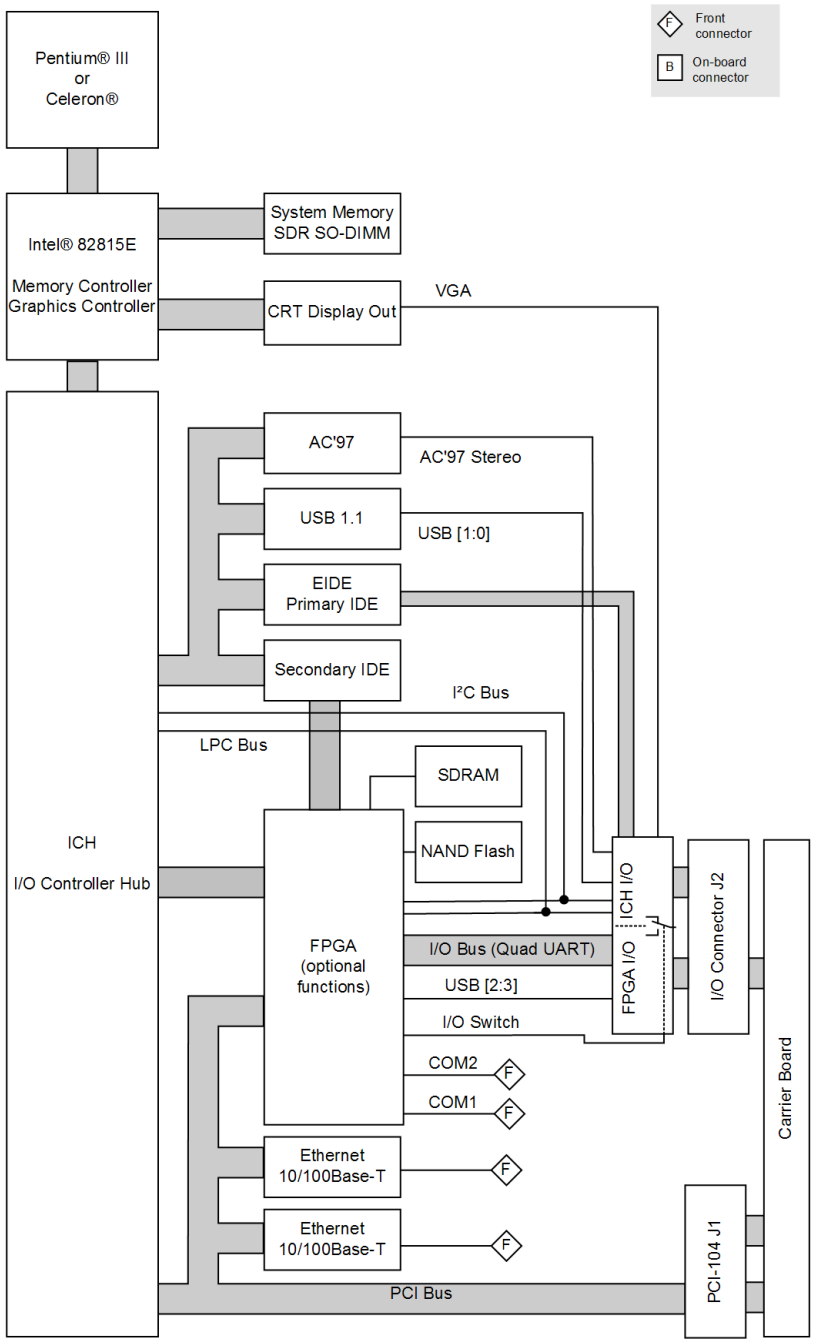
Safety
- PCB manufactured with a flammability rating of 94V-0 by UL recognized manufacturers

EMC
- Tested according to EN 55022 (radio disturbance), IEC1000-4-2 (ESD) and IEC1000-4-4 (burst)

BIOS
- Award BIOS

Software Support
- Windows®
- Linux
- VxWorks®
- QNX® (on request)
- RTX (on request)
- PikeOS (partitionable RTOS) certified platform
- For more information on supported operating system versions and drivers see Software.

Diagram



Configuration & Options

Standard Configurations

Article No.	CPU Type	Clock	System RAM	NAND Flash	Operation Temperature
15EM07N00	ULV Celeron®	650 MHz	512 MB	128 MB	0..+60°C
15EM07N01	ULP Pentium® III	933 MHz	512 MB	128 MB	0..+60°C

Options

CPU

- Type
  - ULV Celeron®
  - ULP Pentium® III
- Clock
  - 400 MHz
  - 650 MHz
  - 933 MHz

Memory

- System RAM
  - 256 MB or 512 MB
- NAND Flash
  - 0 MB up to maximum available

I/O

- AC'97 audio

Front Connections

- D-Sub connectors or RJ 45 connectors for Ethernet and COM
- COM1/COM2 options:
  - COM1 via one 9-pin D-Sub connector with handshake lines
  - COM1 and COM2 via one 9-pin D-Sub connector without handshake lines

Mechanical

- PCI and I/O connectors can also be placed for face-to-face assembly (ESM™ Type N)

Operation Temperature

- 0..+60°C
- -40..+85°C
- Depends on board configuration (CPU)

Please note that some of these options may only be available for large volumes. Please ask our sales staff for more information.

FPGA

Flexible Configuration

- This MEN board offers the possibility to add customized I/O functionality in FPGA.
- It depends on the board type, pin counts and number of logic elements which IP cores make sense and/or can be implemented. Please contact MEN for information on feasibility.
- You can find more information on our web page "User I/O in FPGA"

FPGA Capabilities

- FPGA Altera® Cyclone® EP2C20
  - 18,752 logic elements
  - 239,616 total RAM bits
- Connection
  - Available pin count: 12 pins
  - Functions available e.g. via I/O connector

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Ordering Information

Standard Hardware

15EM07N00	ULV Celeron 650MHz, front: 512MB SDRAM, 128MB NAND Flash, 2 Fast Ethernet (RJ45), 2 UARTs (RJ45), 0..+60°C (also for ESM evaluation kit)
15EM07N01	ULP Pentium III 933MHz, 512MB SDRAM, 128MB NAND flash, front: 2 Fast Ethernet (RJ45), 2 UARTs (RJ45), 0..+60°C (also for ESM evaluation kit EK5N)

Related Hardware

08EK05N00	ESM evaluation kit for EM7N: Mini ATX carrier board, EM7N with ULV Celeron 650MHz, 512MB DRAM, 128MB Nand Flash, 2 Fast Ethernet, 2 COMs, IDE, graphics, 2 USB 2.0, 2 USB 1.1, RJ45 to D-Sub cable, VGA cable, external PSU and adapter for mounting of one PCI-104 module, 0..+60°C
08EK05N01	ESM evaluation kit for EM7N: Mini ATX carrier board, EM7N with ULP Pentium III 933MHz, 512MB DRAM, 128MB Nand Flash, 2 Fast Ethernet, 2 2 COMs, IDE, graphics, 2 USB 2.0, 2 USB 1.1, RJ45 to D-Sub cable, VGA cable, external PSU and adapter for mounting of one PCI-104 module, 0..+60°C
15XM01-00	Intel Atom Z530, 1.6 GHz, 1 GB DDR2 RAM, 1 Gb Ethernet, 1x PCIe, with cover, -40..+85°C screened

Memory

0752-0238	512MB DRAM 0.. +60°C for 15EM07N00 (EK5N)
0752-0239	512MB DRAM 0.. +60°C for 15EM07N01(EK5N)

Miscellaneous

05F006-00	RS232 interface cable RJ45 to 9-pin D-Sub (1 COM to 1 COM), 2m

Software: OS independent

13Z015-06	MDIS4/2004 driver (MEN) for 16Z029_CAN (MSCAN/Layer2)
13Z016-06	MDIS4/2004 driver (MEN) for 16Z029_CAN (CANopen master)

Software: Linux

13EM07-90	Linux driver package (MEN) for EM7, EM7N, F11 and F11N
13Z025-90	Linux native driver (MEN) for 16Z025_UART, 16Z057_UART and 16Z125_UART

Software: Windows

13EM07-71	Windows network driver (Intel) for EM7, EM7N, F11 and F11N
13EM07-72	Windows 2000/XP graphics driver (Intel) for EM7, EM7N, F11 and F11N
13Z015-70	MDIS4/2004 Windows driver (MEN) for 16Z029_CAN (MSCAN/Layer2)
13Z016-70	MDIS4/2004 Windows driver (MEN) for 16Z029_CAN (CANopen master)

Software: VxWorks

10EM07-60	VxWorks BSP (MEN) for EM7, EM7N, F11 and F11N

Documentation

20APPN004	Application Note: How to make a USB stick bootable
20EM00-00	ESM Specification
20EM07N00	EM7N User Manual
21APPN009	Application Note: 16Z025_UART and 16Z125_UART under Linux
22Z125-ER	16Z125_UART Errata

For the most up-to-date ordering information and direct links to other data sheets and downloads, see the EM7N online data sheet under » www.men.de.

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