Embedded Solutions

EM02 - ESM with Tualatin Pentium III

- ◆ **Embedded System Module with:**

- ◆ **Tualatin ULP Pentium III / 933 MHz**
- ◆ **Tualatin ULV Celeron / 400 MHz**
- ◆ **Up to 512 MB DRAM, CompactFlash**
- ◆ **Graphics, USB 1.1 (front)**
- ◆ **Gigabit Ethernet (front)**
- ◆ **DVI/TFT/video (rear)**
- ◆ **1 COM, keyboard/mouse, (E)IDE, floppy (rear)**
- ◆ **Stackable with PCI-104**

The EM02 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 EM02, the EM02 with an application-specific carrier card and/or with additionally plugged PCI-104 modules.

The EM02 is controlled by an Ultra-Low Power Tualatin Pentium III with 933MHz or an Ultra-Low Voltage Tualatin Celeron Processor with 400MHz. It provides 16KB L1 cache controlled by processor programmable registers and 512KB/256KB L2 cache for ECC protected cache data array.

The EM02 uses the Intel 815G chip set, including graphics. It provides one VGA connector, one USB connector Type A and one Gigabit or one Fast Ethernet interface at the front panel. It also has an SO-DIMM socket and a CompactFlash interface on board. As an alternative to onboard USB, legacy I/O is routed to the carrier board via the J2 system connector of the EM02. It includes a serial interface, (E)IDE, a hub interface for DVI/TFT/video, a floppy interface, as

well as two PS/2 interfaces for keyboard and mouse. The EM02 is an ideal computing platform for embedded industrial PCs, offering the whole world of Windows and Linux based software, e.g. for infotainment applications.

For a first evaluation of the functions of the EM02 it is strongly recommended to use the EK01 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

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CPU
- Celeron or Pentium III
- 400MHz or 933MHz processor core frequency
- 256KB or 512KB L2 cache
- 100MHz or 133MHz system bus frequency
- 33MHz APIC bus frequency

Graphics
- Integrated VGA graphics controller
  - Connection at front panel via VGA connector

Memory
- 512MB SDRAM
  - One 144-pin SO-DIMM socket for synchronous DRAM modules
  - 133/100MHz memory bus frequency
- CompactFlash interface
  - Type I
  - True IDE

Interfaces
- 10/100/1000Base-T PCI Ethernet controller
  - 82540(EM) controller
  - RJ45 interface at front panel
  - Three onboard LEDs to signal LAN Link, Activity status and connection speed (10/100/1000Base-T)
  - Supports network boot
- USB 1.1 interface
  - Type A
  - UHCI implementation
  - At front panel
  - Data throughput up to 12Mbits/s
  - Supplies High-Power (500mA) without external power supply

Mass Storage
- Fast IDE ports
  - One IDE hard-disk/CD-ROM port via I/O connector to carrier board
  - One IDE port for local CompactFlash

I/O Extension
- Super I/O
- Accessible via J2
  - Keyboard
  - Mouse
  - COM1
  - Floppy
  - TFT panel
  - AC'97 audio (on request)

PCI Interface
- 32-bit PCI interface at PCI-104 connector J1

- Support of 4 external masters

Miscellaneous
- Battery-backed real-time clock
- Integrated hardware monitor

Electrical Specifications
- Supply voltage/power consumption:
  - +5V (4.85V..5.25V), 796mA (Celeron version)
  - +3.3V (3.2V..3.4V), 794mA (Celeron version)
- MTBF: 165,000h @ 50°C

Mechanical Specifications
- Dimensions: conforming to ESM specification (PCB: 149mm x 71mm)
- Weight: 215g (incl. heat sink)

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

Safety
- PCB manufactured with a flammability rating of 94V-0 by UL recognized manufacturers
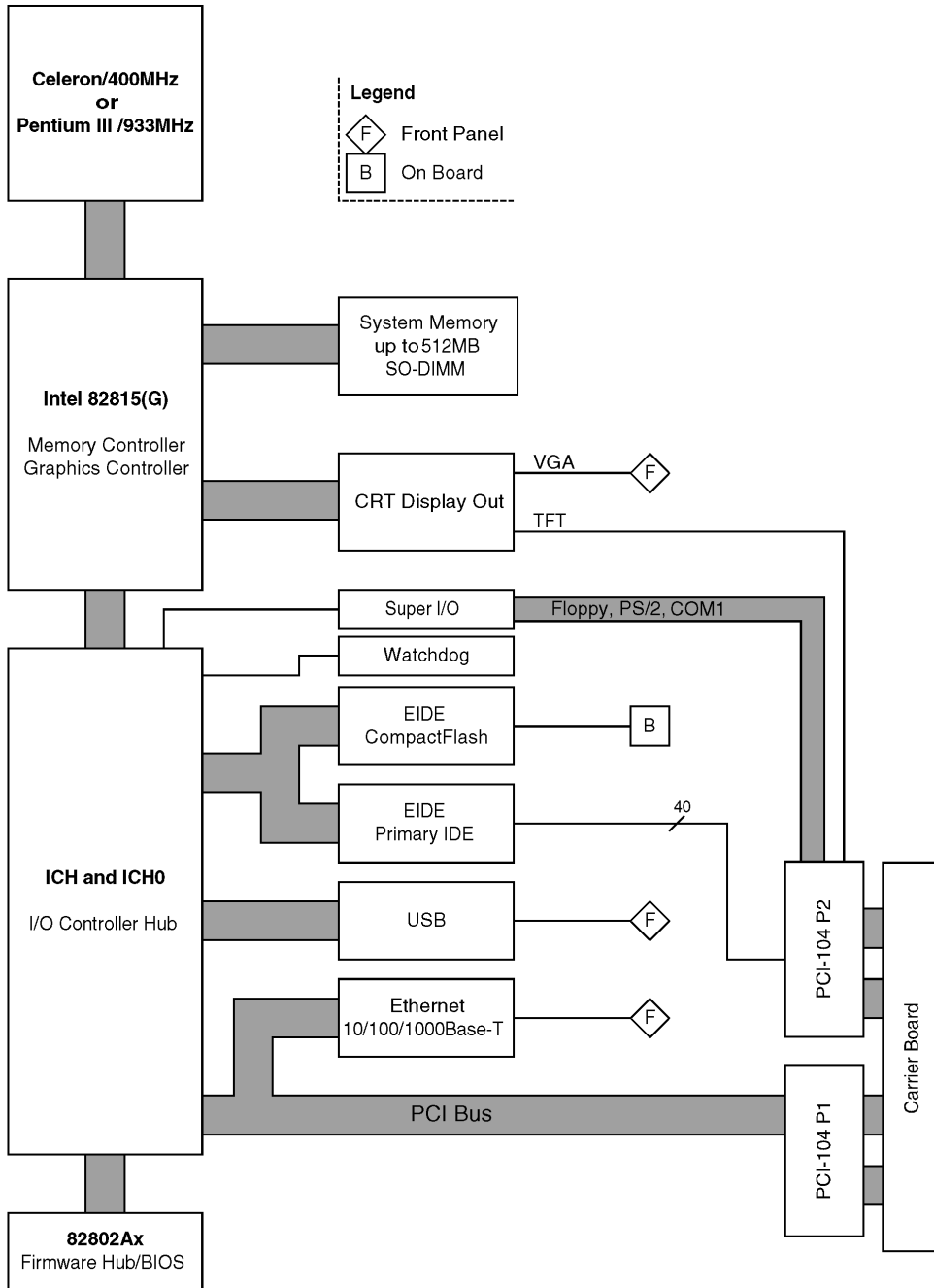
EMC
- Tested according to EN 55022 / 1999-05 (radio disturbance) and EN 55024 / 1999-05 (immunity) with regard to CE conformity

Software Support
- Phoenix BIOS
- Windows
- Linux (on request)
- VxWorks (on request)
- QNX (on request)
- RTX (on request)

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Diagram

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┌──────────────────────┐
│   Celeron/400MHz      │
│        or            │
│  Pentium III /933MHz  │
└──────────────────────┘
```

Legend

◇ F Front Panel

☐ B On Board

```
┌──────────────────────┐       ┌──────────────────────┐
│                      │       │   System Memory       │
│                      │───────│   up to 512MB         │
│   Intel 82815(G)     │       │   SO-DIMM             │
│                      │       └──────────────────────┘
│  Memory Controller   │
│  Graphics Controller │       ┌──────────────────────┐       VGA    ◇ F
│                      │───────│   CRT Display Out     │──────
│                      │       │                      │       TFT
└──────────────────────┘       └──────────────────────┘
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                              ┌──────────────────────┐
                              │     Super I/O         │   Floppy, PS/2, COM1
                              └──────────────────────┘
                              ┌──────────────────────┐
                              │     Watchdog          │
                              └──────────────────────┘
                              ┌──────────────────────┐
                              │       EIDE            │        ☐ B
┌──────────────────────┐      │   CompactFlash        │
│                      │      └──────────────────────┘
│   ICH and ICH0       │      ┌──────────────────────┐          40
│                      │      │       EIDE            │
│  I/O Controller Hub  │      │   Primary IDE         │──────
│                      │      └──────────────────────┘
│                      │      ┌──────────────────────┐
│                      │      │       USB             │        ◇ F
│                      │      └──────────────────────┘
│                      │      ┌──────────────────────┐
│                      │      │     Ethernet          │        ◇ F
│                      │      │  10/100/1000Base-T    │
└──────────────────────┘      └──────────────────────┘

                                    PCI Bus
```

PCI-104 P2

PCI-104 P1

Carrier Board

```
┌──────────────────────┐
│      82802Ax          │
│   Firmware Hub/BIOS   │
└──────────────────────┘
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Related Products

Standard Hardware

08EK01-01	ESM evaluation kit: Mini ATX carrier board EC01 with 1 ESM slot, 3 PCI slots, floppy interface; ESM EM02 with ULP Pentium III / 933MHz, graphics, Gigabit Ethernet, USB; temperature range: 0..+60°C; incl. external PSU and adapter for mounting of one PCI-104 module - 512MB DRAM installed, CompactFlash not installed (08EK01-01 = EC01-03 + EM02-04)
08EK01-02	ESM evaluation kit: Mini ATX carrier board EC01 with 1 ESM slot, 3 PCI slots, floppy interface; ESM EM02 with ULV Pentium III Celeron/ 400MHz, graphics, Gigabit Ethernet, USB; temperature range: 0..+60°C; incl. external PSU and adapter for mounting of one PCI-104 module - 512MB DRAM installed, CompactFlash not installed (08EK01-02 = EC01-03 + EM02-07)
08EK01-03	ESM evaluation kit: Mini ATX carrier board EC01 with 1 ESM slot, 3 PCI slots, floppy interface; ESM EM02 with ULV Celeron 650MHz, graphics, Gigabit Ethernet, USB; temperature range: 0..+60°C; incl. external PSU and adapter for mounting of one PCI-104 module - 512MB DRAM installed, CompactFlash not installed (08EK01-03 = EC01-03 + EM02-09)
15EM02-04	EM02, ESM - Embedded System Module, ULP Pentium III / 933MHz, CompactFlash slot, 512MB DRAM installed, graphics, Gigabit Ethernet, USB; PCI-104 stackable; temperature range: 0..+60°C
15EM02-07	EM02 for ESM Kit EK01-02, ESM - Embedded System Module, ULV Celeron / 400MHz, CompactFlash slot, 512MB DRAM installed, graphics, Gigabit Ethernet, USB;temperature range: 0..+60°C
15EM02-09	EM02 for ESM Kit EK01-03, ESM - Embedded System Module, ULV Celeron / 650MHz, CompactFlash slot, 512MB DRAM installed, graphics, Gigabit Ethernet, USB; temperature range: 0..+60°C

Please refer to our ESM - Embedded System Modules compare chart for a selection of further single-board computers with different processors and on-board functionality.

Accessories

0751-0006	CompactFlash card, 512MB, Type I, 0..+60°C
0751-0008	CompactFlash card, 64MB, Type I, 0..+60°C
0751-0009	CompactFlash card, 128MB, Type I, 0..+60°C
0751-0012	CompactFlash card, 256MB, Type I, 0..+60°C
0751-0018	CompactFlash card, 256MB, Type I, -40..+85°C
0752-0096	512MB DRAM 0..+60°C for 15EM02-04 (08EK01-01)
0752-0156	512MB DRAM 0..+60°C for 15EM02-07 (08EK01-02)

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Related Products

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0752-0166	512MB DRAM 0..+60°Cfor 15EM02-09 (08EK01-03)

Software

This MEN board is designed to work in a Microsoft Windows environment. For additional Windows driver packages provided or recommended by MEN please refer to the ordering numbers below.

QNX software for this MEN board is available from QNX (www.qnx.com). For QNX BSP and driver support provided by MEN please refer to the ordering numbers below.

VxWorks software for this MEN board is available from WindRiver Systems. For VxWorks BSP and driver support provided by MEN please refer to the ordering numbers below.

This board is an MEN product running Linux. For Linux BSP and driver support provided by MEN please refer to the ordering numbers below.

13EM02-70	Windows 2000/XP graphics driver (Intel graphics driver for 815 chipset) for A13, EM02 (ESM kit EK01)
13EM02-71	Windows 2000/XP network driver (Intel) for A13 and EM02 (ESM kit EK01) - only for 933MHz versions!
13Z011-06	MDIS4/2004 low-level driver sources for F7/F7N/D4/EM02 watchdog
13Z011-70	MDIS4/2004 Windows NT4/W2K driver for F7/F7N/D4/EM02 watchdog

Documentation

20ABMX-00	Phoenix BIOS user manual
20EK01-00	EK01 user manual, includes EM02 user manual (20EM02-00)
20EM02-00	EM02 user manual

For the most up-to-date ordering information and direct links to other data sheets and downloads, see the EM02 online data sheet under www.men.de. --> Click here!

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