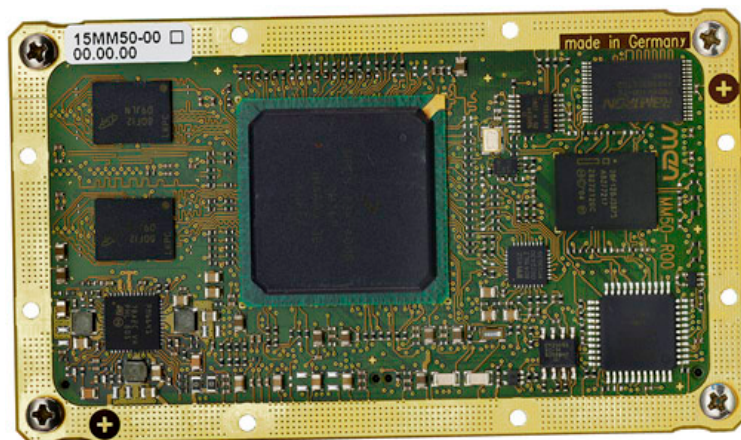# MM50 – ESMini™ COM with MPC5121e/ MPC5123

- **MPC5121e or MPC5123, up to 400 MHz**
- **Up to 512 MB DDR2 SDRAM**
- **Flash, FRAM**
- **1 Fast Ethernet interface**
- **6 USB 2.0 (1 client)**
- **2 UARTs**
- **Up to 4 CAN bus interfaces**
- **6 programmable serial controllers, or display interface**
- **AC'97 audio**
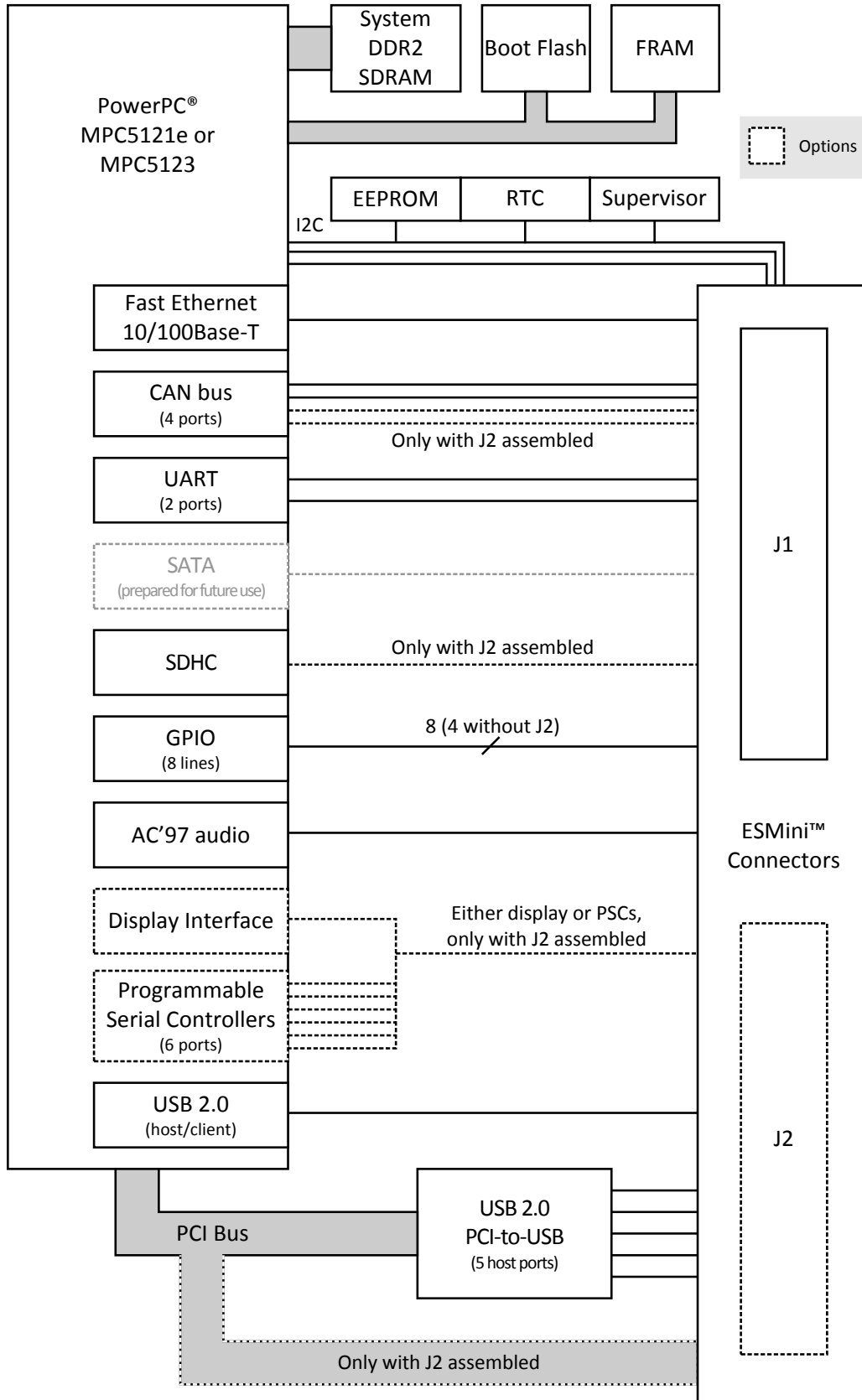- **U-Boot Universal Boot Loader**
- **-40°C to +85°C screened**

The MM50 is an ultra-small Computer-On-Module of the rugged ESMini™ family. Together with an application-specific carrier board it forms a semi-custom solution for industrial, harsh, mobile and mission-critical environments.

The MM50 is controlled by the PowerPC® MPC5121e or MPC5123, an e300 core processor with a performance of up to 400 MHz and optimized for mobile applications. With its integrated I/O features and powerful graphics engine, the MPC5121e pairs advanced video features with low power and excellent price/performance. Due to its architecture, the CPU has a power consumption of less than 3 W. The MPC5123 also integrates graphics but has no 3D acceleration. The MM50 accommodates up to 512 MB of directly soldered main memory and supports memory extensions via SDHC on the carrier board, e.g., using MMC, SD, or SDIO cards.

The COM module also comes with a multitude of I/O: besides modern serial I/O like USB (SATA prepared), it also provides legacy I/O (up to 4 CAN, 2 COM, 1 Fast Ethernet, 3 I2C, GPIO lines). Its display interface and AC'97 audio gear the MM50 for multimedia applications, while its six programmable serial controllers give additional flexibility to implement more serial I/O.

The MM50 is screened for operation in a -40°C to +85°C temperature range with suitable airflow. As all ESMini™ modules it can also be embedded in a covered frame. This ensures EMC protection and allows efficient conduction cooling, if needed, e.g., in harsh environments. ESMini™ modules are firmly screwed to a carrier board and come with rugged industry-proven connectors supporting high frequency and differential signals. Only soldered components are used to withstand shock and vibration, and the design is optimized for conformal coating. The MM50 supports a 95 x 55 mm form factor.

For evaluation and development purposes a microATX carrier board is available.

Diagram

PowerPC®
MPC5121e or
MPC5123

System DDR2 SDRAM

Boot Flash

FRAM

Options

I2C

EEPROM | RTC | Supervisor

Fast Ethernet
10/100Base-T

CAN bus
(4 ports)

Only with J2 assembled

UART
(2 ports)

SATA
(prepared for future use)

Only with J2 assembled

SDHC

GPIO
(8 lines)

8 (4 without J2)

AC'97 audio

J1

ESMini™
Connectors

Display Interface

Either display or PSCs,
only with J2 assembled

Programmable
Serial Controllers
(6 ports)

USB 2.0
(host/client)

J2

PCI Bus

USB 2.0
PCI-to-USB
(5 host ports)

Only with J2 assembled

Technical Data

CPU	■ PowerPC® MPC5121e or MPC5123
	  □ e300 PowerPC® processor core with MMU and double-precision, floating-point unit
	  □ Up to 400 MHz clock frequency
	  □ Please see Standard Configurations for available standard versions.

Memory	■ 2x 32 KB data and instruction cache integrated in MPC5121e/MPC5123
	■ Up to 512 MB SDRAM system memory
	  □ Soldered
	  □ DDR2
	  □ 200 MHz memory bus frequency
	■ Up to 64 MB boot Flash
	■ 128 KB non-volatile FRAM
	■ Serial EEPROM 2 kbits for factory settings
	■ Please see Standard Configurations for options and available standard versions.

Serial ATA (SATA)	■ Prepared for future use, not implemented yet! ■ One port via ESMini™ connector J1 ■ Transfer rates up to 150 MB/s (1.5 Gbit/s)
SDHC	■ Secure digital host controller for MMC/SD/SDIO cards ■ One port via ESMini™ connector J2

Graphics	■ MBX Lite 2D/3D graphics engine
	  □ Dedicated coprocessor
	  □ High-performance graphics controller
	  □ Integrated into MPC5121e; MPC5123: no 3D acceleration
	■ Display interface for TFT LCD displays
	  □ Integrated into MPC5121e/MPC5123
	  □ Maximum resolution: 1280 x 720 pixels
	  □ 60 Hz maximum refresh rate
	  □ 24 bits pixel color depth
	  □ Available via ESMini™ connector J2
	  □ 24-bit RGB interface
	  □ Signals shared with programmable serial controller (PSC), configurable by software
	  □ Either display interface or PSCs can be used

Audio	■ AC'97 audio ■ Via ESMini™ connector J1 ■ External Codec
USB	■ Six USB 2.0 host ports □ One port also usable as a client port, configurable by software ■ EHCI implementation ■ Data rates up to 480 Mbit/s ■ Via ESMini™ connector J1
Ethernet	■ One 10/100Base-T Ethernet channel ■ Two LED signals for LAN link and activity status ■ Available via ESMini™ connector J1 ■ External PHY
UART	■ Two interfaces ■ RS232 or RS422/RS485 ■ Data rates up to 115,200 bit/s ■ Handshake lines: RTS, CTS ■ Available via ESMini™ connector J1 ■ External transceivers

Technical Data

CAN Bus	- Four CAN bus channels 2.0 A/B CAN protocol - Data rates up to 1 Mbit/s - Available via ESMini™ connectors: 2 ports on J1, 2 ports on J2
Programmable Serial Controller (PSC)	- Six flexible serial interfaces - For individual configuration as SPI or UART (RS232, RS422 and RS485) - Available via ESMini™ connector J2 - Signals shared with display interface, configurable by software - Either PSCs or display interface can be used
GPIO	- Four lines on ESMini™ connector J1 - Four lines on ESMini™ connector J2
I2C Bus	- Three interfaces - Available via ESMini™ connector J1
Miscellaneous	- Real-time clock (with GoldCap or battery backup on the carrier board) - Temperature sensor, power supervision and watchdog
Electrical Specifications	- Supply voltage/power consumption: +5 V (-3%/+5%), approx. 550 mA
Mechanical Specifications	- Dimensions: 95 mm x 55 mm - ESMini™ PCB can be mounted between a frame and a cover for conduction cooling - Weight: 32 g (w/o cover and frame)
Environmental Specifications	- Temperature range (operation): -40..+85°C (screened) - Temperature range (storage): -40..+85°C - Relative humidity (operation): max. 95% non-condensing - Relative humidity (storage): max. 95% non-condensing - Altitude: -300 m to +3,000 m - Shock: 15 g, 11 ms (EN 60068-2-27) - Bump: 10 g, 16 ms (EN 60068-2-29) - Vibration (sinusoidal): 1 g, 10 Hz - 150 Hz (EN 60068-2-6) - Conformal coating on request
MTBF	1,439,384 h @ 40°C according to IEC/TR 62380 (RDF 2000)
Safety	PCB manufactured with a flammability rating of 94V-0 by UL recognized manufacturers
EMC	EMC behavior depends on the system and housing surrounding the ESMini™ module. MEN has performed general, successful EMC tests for ESMini™ using the XC4 evaluation carrier according to EN 55022 (radio disturbance), IEC 61000-4-2 (ESD), IEC 61000-4-3 (electromagnetic field immunity), IEC 61000-4-4 (burst), IEC 61000-4-5 (surge) and IEC 61000-4-6 (conducted disturbances)
BIOS	U-Boot Universal Boot Loader
Software Support	- Linux - VxWorks® - For more information on supported operating system versions and drivers see Downloads.

Configuration & Options

Standard Configurations

Article No.	CPU Type	System RAM	Flash / FRAM	Interfaces	ESMini Connectors	Operating Temp.	Cover/Frame
15MM50-00	MPC5123, 400 MHz	256 MB	32 MB / 128 KB	1 ETH, 6 USB, 4 CAN, display/PSC, SDHC, AC'97	J1, J2	-40..+85°C	No
15MM50-01	MPC5123, 400 MHz	256 MB	32 MB / 128 KB	1 ETH, 6 USB, 4 CAN, display/PSC, SDHC, AC'97	J1, J2	-40..+85°C	Yes

Options

CPU	- PowerPC® MPC5121e, 400 MHz - PowerPC® MPC5123, 400 MHz - No 3D graphics acceleration - PowerPC® MPC5123, 300 MHz - No 3D graphics acceleration
Memory	- System RAM 256 MB or 512 MB - Boot Flash 16 MB, 32 MB or 64 MB - FRAM 0 KB or 128 KB
I/O	- Only J1 assembled, J2 not assembled - Only 2 CAN bus interfaces instead of 4 - No display interface - No programmable serial controller (PSC) ports - No SDHC interface - No PCI bus interface
Cooling	With or without cover and frame

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

Ordering Information

Standard MM50 Models	**15MM50-00**	MPC5123, 400 MHz, 256 MB DRAM, 32 MB Flash, 128 KB FRAM, 1 Fast Ethernet, 4 CAN bus, 2 COM, 6 USB, 1 SDHC, display interface, AC'97, 6 PSC, -40..+85°C screened
	15MM50-01	MPC5123, 400 MHz, 256 MB DRAM, 32 MB Flash, 128 KB FRAM, 1 Fast Ethernet, 4 CAN bus, 2 COM, 6 USB, 1 SDHC, display interface, AC'97, 6 PSC, -40..+85°C screened - with cover and frame
Related Hardware	**08XC04-00**	Evaluation and development board for all ESMini™ modules, 0..+60°C, incl. 2 GB USB Flash Disk and SA-Adapters™ for 1 RS232 and 1 CAN bus
Miscellaneous Accessories	**0712-0019**	Standard ATX PSU, 350 W, 0..+40°C
	08XC04-00	Evaluation and development board for all ESMini™ modules, 0..+60°C, incl. 2 GB USB Flash Disk and SA-Adapters™ for 1 RS232 and 1 CAN bus
Software: Linux		This product is designed to work under Linux. See below for potentially available separate software packages from MEN.
	10MM50-90	General Linux BSP for MM50
	13Z015-06	MDIS5™ low-level driver sources (MEN) for 16Z029_CAN (MSCAN/Layer2)
Software: VxWorks®		This product is designed to work under VxWorks®. For details regarding supported/unsupported board functions please refer to the corresponding software data sheets.
	10MM50-60	VxWorks® BSP (MEN) for MM50
	13Z015-06	MDIS5™ low-level driver sources (MEN) for 16Z029_CAN (MSCAN/Layer2)
Software: Firmware/BIOS		This product uses the U-Boot bootloader available from DENX together with board-specific additions from MEN.
	14MM50-00	U-Boot Bootloader (MEN) for MM50

For operating systems not mentioned here contact MEN sales.

Documentation	Compare Chart ESMini™ Computer-On-Modules » Download
	You can find general literature on MEN computer-on-modules, including presentations about ESMexpress®, ESMini™ and their cooling concept, in our Download Library.
20MM50-00	MM50 User Manual

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