

XM51 - ESMexpress® COM with PowerPC® QorIQ™ P4080



- Freescale™ QorIQ™ P4080, P4040 or P3041
- 64-bit Power Architecture e500mc CPU
- Up to 8 cores, up to 1.5 GHz
- Up to 16 GB ECC DDR3 SDRAM, 1 or 2 controllers
- Up to 128 KB FRAM, up to 256 MB Flash
- 2 Gb Ethernet, 4 USB 2.0, 1 USB client
- 2 SATA (3 Gbit/s), 2 PCIe® x1 (5 Gbit/s)
- U-Boot Universal Boot Loader
- -40°C to +85°C Tcase with qualified components
- Conduction cooling
- ANSI/VITA 59 in process

The XM51 is a multi-core computer-on-module based on the Freescale™ PowerPC® QorIQ™ family. The card is an ESMexpress® CPU in accordance with the proposed ANSI/VITA 59 standard currently under development. Together with an application-specific carrier board it forms a semi-custom solution for industrial, harsh, mobile and mission-critical environments. The XM51 is built around a QorIQ™ P4080, P4040 or P3041 running at frequencies between 1.2 and 1.5 GHz. All types have multi-core performance and advanced processing functions (incl. encryption), but the XM51 is still scalable to individual needs. The eight-core P4080 is a high-end number cruncher, while the P3041 aims at power and cost efficiency. The entire board draws a maximum power of 32 W and supports extended operating temperatures in all configurations.

The COM has up to 16 GB of soldered ECC main memory driven by two independent controllers. The two RAM banks can be assigned to processor cores to avoid access conflicts and assure deterministic behavior. This facilitates building up certifiable solutions for safety-critical avionics or railway applications. Up to 512 KB industrial, non-volatile FRAM and 256 MB Flash round out the XM51's onboard memory. Further capacity can be added on the

carrier board as needed via high-speed serial buses, i.e. USB or SATA.

All interfaces routed from the QorIQ™ processor are available on any ESMexpress® carrier board. Those include four USB 2.0 host ports and one USB client realized using a UART-to-USB converter, two Gigabit Ethernet channels, dual 3-Gbit SATA, and two PCI Express® x1 links. The latter support PCIe® 2.x with data rates of 5 Gbit/s per lane.

The XM51 is qualified for operation in a -40°C to +85°C conduction or convection cooled environment. As all ESMexpress® modules it is embedded in a covered frame. This ensures EMC protection and allows efficient conductive cooling. Air cooling is also possible by applying a heat sink on top of the cover. ESMexpress® 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. All ESMexpress® modules support a single 95 x 125 mm form factor.

For evaluation and development purposes an ATX carrier board is available. The ESMexpress® module can be evaluated on a COM Express™ carrier board via an adapter from ESMexpress® to COM Express™.

Technical Data

CPU

- Freescale™ QorIQ™ P4080 or P4040 or P3041
 - 1.2 GHz up to 1.5 GHz
 - Eight/four high-performance Power Architecture e500mc cores

Memory

- 32 KB instruction and data L1 cache and private 128 KB L2 cache per processor core
- Up to 16 GB SDRAM system memory
 - Soldered
 - DDR3 with ECC support
 - Up to 667 MHz memory bus frequency, depending on processor configuration
 - P4080/P4040 with two independent memory controllers, P3041 with one controller
- Up to 256 MB boot/program Flash
- 128 KB non-volatile FRAM
- Serial EEPROM 8 kbits for factory settings

Serial ATA (SATA)

- Two ports via ESMexpress® connector
- SATA Revision 2.x support
- Transfer rates up to 300 MB/s (3 Gbit/s)
- Via PCIe®-to-SATA bridge

USB

- Four USB 2.0 host ports via ESMexpress® connector
 - OHCI and EHCI implementation
 - Data rates up to 480 Mbit/s
- One USB client port via ESMexpress® connector
 - Via UART-to-USB converter
 - Data rates up to 230.4 kbit/s
 - 16-byte transmit/receive buffer
 - Handshake lines: none

Ethernet

- Two 10/100/1000Base-T Ethernet channels
- Two LED signals per channel for LAN link and activity status and connection speed
- Accessible via ESMexpress® connector

PCI Express®

- Two x1 links via ESMexpress® connector
- PCIe® 2.x support
- Data rate 500 MB/s in each direction (5 Gbit/s per lane)

GPIO

- 3 lines via ESMexpress® connector

I2C Bus

- 1 interface via ESMexpress® connector

Miscellaneous

- Real-time clock (with GoldCap or battery backup on the carrier board)
- Temperature sensor, power supervision and watchdog

ESMexpress® Specifications

- In accordance with proposed standard ANSI/VITA 59 RSE: Rugged System-On-Module Express

Electrical Specifications

- Supply voltage/power consumption:
 - +12V (9..16 V), 32 W max.

Mechanical Specifications

- Dimensions: 95 mm x 125 mm (conforming to ESMexpress® specification)
- ESMexpress® PCB mounted between a frame and a cover
- Weight: 230 g (incl. cover and frame)

Environmental Specifications

- Temperature range (operation): -40..+85°C Tcase (ESMexpress® cover/frame) (qualified components)
- 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

- 475,088 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 ESMexpress® module. MEN has performed general, successful EMC tests for ESMexpress® using the XC1 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)

Technical Data

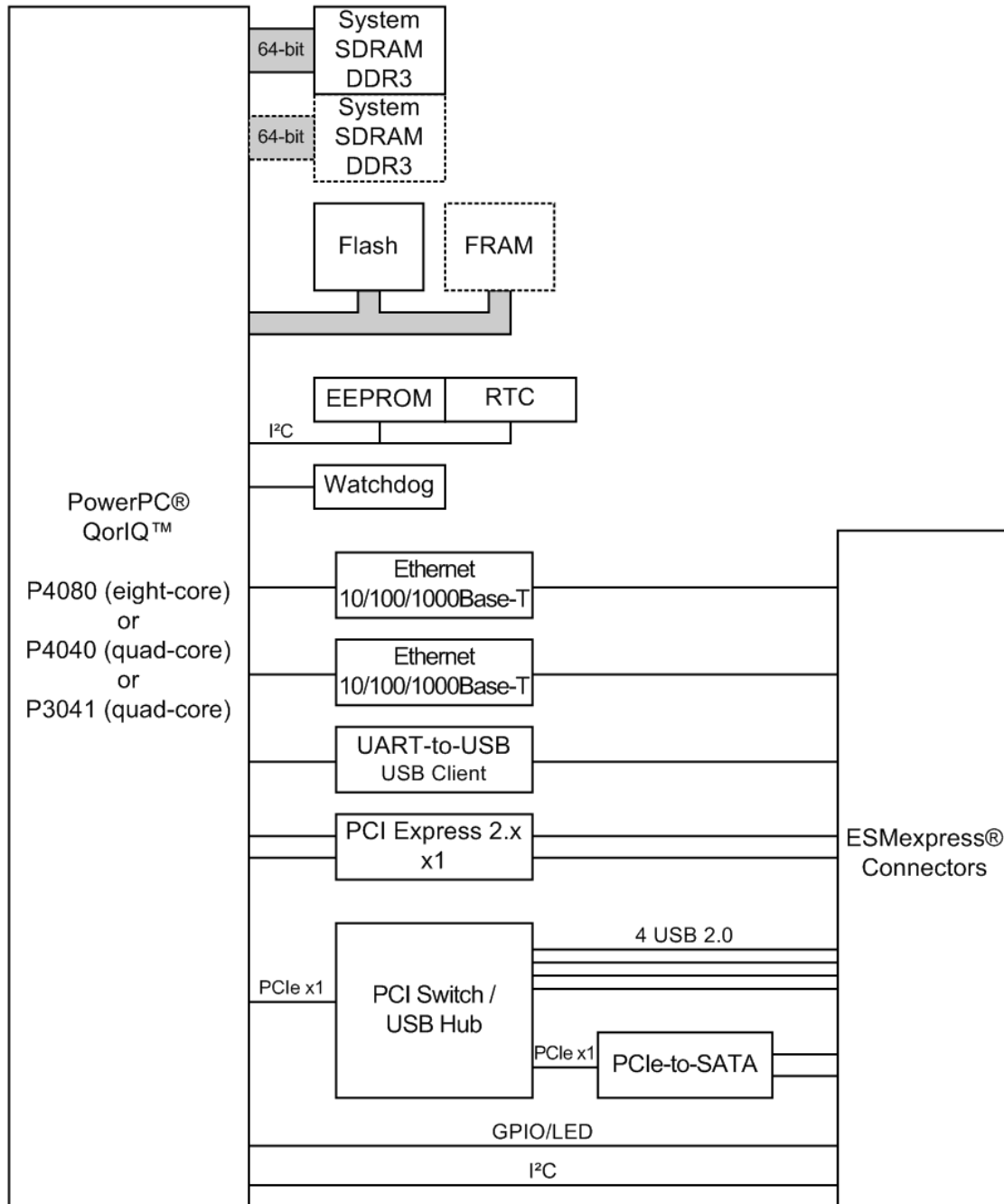
BIOS

- U-Boot Universal Boot Loader

Software Support

- VxWorks®
- Linux (on request)
- For more information on supported operating system versions and drivers see Software.

Diagram



Configuration & Options

Standard Configurations

| Article No. | CPU Type | Clock | System RAM | Flash | FRAM | Temperature | Cover |
|-------------|------------------|---------|-------------------|-------|--------|------------------|-------|
| 15XM51-00 | Eight-core P4080 | 1.2 GHz | 2 x 1 GB, 600 MHz | 64 MB | 128 KB | -40..+85°C Tcase | yes |

Options

CPU

- QoriQ™ P4080 or P4040 or P3041
 - P4080: eight cores, up to 16 GB DDR3 RAM (two controllers), 2 MB L3 cache, 30 W max. (processor)
 - P4040: four cores, up to 16 GB DDR3 RAM (two controllers), 2 MB L3 cache, 24 W max. (processor)
 - P3041: four cores, up to 8 GB DDR3 RAM (one controller), 1 MB L3 cache, 18.2 W max. (processor)
- All processors available with 1.2 GHz, 1.33 GHz or 1.5 GHz

Memory

- System RAM
 - One or two memory banks, depending on processor type
 - 2 GB, 4 GB, 8 GB
 - 16 GB (only possible with two banks, P4080 or P4040)
 - Currently only 2 GB are supported by U-Boot and BSP
- Boot/program Flash
 - 64 MB, 128 MB or 256 MB
- FRAM
 - 0 KB or 128 KB

Software Support

- Linux; processors are supported, U-Boot support already implemented

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 XM51 Models

15XM51-00 P4080 (8 cores), 1.2 GHz, 2 GB DDR3 SDRAM, 64 MB Flash, 128 KB FRAM, 2 Gb Ethernet, 2 PCIe@ x1, 4 USB 2.0 host ports, 1 USB client port, with frame and cover, -40..+85°C (qualified components)

Related Hardware

08AE12-00 ESMexpress® module to COM Express™ carrier adapter, 0..+60°C

08XC01-00 Evaluation and development board for all ESMexpress® modules (coming with top cover and frame), 0..+60°C, incl. faceplate, 4 GB USB Flash Disk and USB cable type A to A

Miscellaneous Accessories

0712-0019 Standard ATX PSU, 350 W, 0..+40°C

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.

10XM51-60 VxWorks® BSP (MEN) for XM51

Software: Firmware/BIOS

This product uses the U-Boot bootloader available from DENX together with board-specific additions from MEN.

14XM51-00 U-Boot Bootloader (DENX/MEN) for XM51

Software: Miscellaneous

A Windows® USB2UART driver from FTDI is available for XM50, XM51 and F50P/F50C Windows® hosts. More info & downloads

For operating systems not mentioned here contact MEN sales.

Documentation

Compare Chart ESMexpress® Embedded System 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.

20XM51-ER XM51 Errata

20XM51-00 XM51 User Manual

Contact Information

Germany

MEN Mikro Elektronik GmbH
 Neuwieder Straße 3-7
 90411 Nuremberg
 Phone +49-911-99 33 5-0
 Fax +49-911-99 33 5-901
 E-mail info@men.de
www.men.de

France

MEN Mikro Elektronik SA
 18, rue René Cassin
 ZA de la Châtelaïne
 74240 Gaillard
 Phone +33 (0) 450-955-312
 Fax +33 (0) 450-955-211
 E-mail info@men-france.fr
www.men-france.fr

USA

MEN Micro, Inc.
 24 North Main Street
 Ambler, PA 19002
 Phone (215) 542-9575
 Fax (215) 542-9577
 E-mail sales@menmicro.com
www.menmicro.com

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