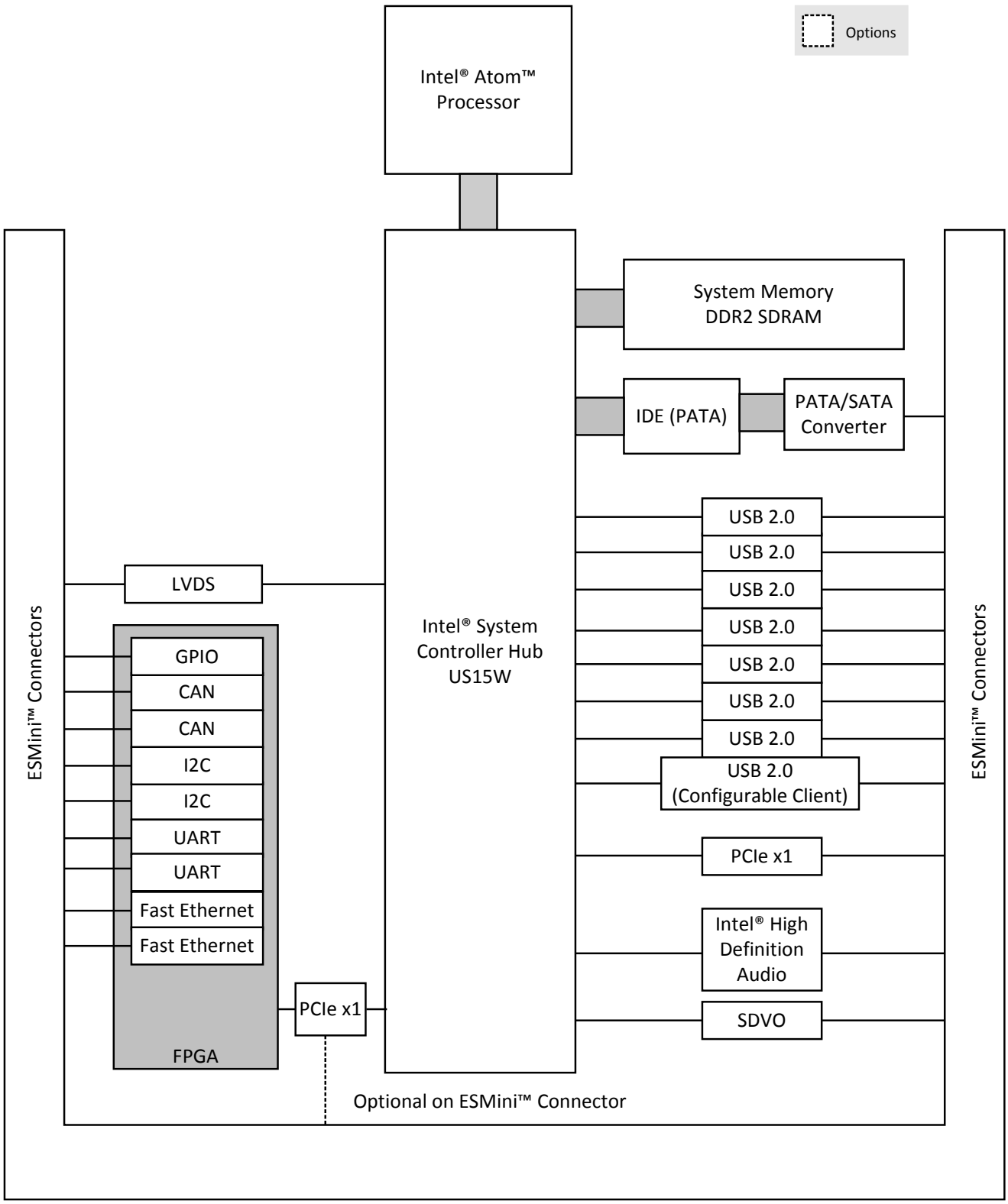
MM1 – ESMini™ COM with Intel® Atom™

- **Intel® Atom™ Z530 or Z510, up to 1.6 GHz**
- **Up to 1 GB DDR2 SDRAM**
- **1 PCI Express®**
- **Up to 2 Fast Ethernet interfaces**
- **8 USB 2.0 (1 client)**
- **2 UARTs**
- **Up to 2 CAN bus interfaces**
- **SDVO, LVDS**
- **Intel® HD Audio**
- **-40°C to +85°C Tcase screened (-25°C to +85°C Tcase with 1 GB DRAM)**
- **Conduction cooling**

The MM1 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 MM1 is controlled by the Intel® Atom™ processor, a first generation IA-32 core based on 45nm process technology. Due to the new power architecture of the Intel® Atom™ CPU, the MM1 has a total power consumption of max. 5 to 10 W, while having a clock frequency of up to 1.6 GHz.
The MM1 accommodates up to 1 GB of directly soldered main memory and supports other memory like USB Flash on the carrier board.
The MM1 offers a multitude of I/O: besides modern serial I/O like one PCI Express® x1 link, LVDS, SDVO, high-definition audio, SATA and USB, it also provides legacy I/O (2 CAN, 2 COM, 2 Fast Ethernet, 2 I2C) and up to 120 FPGA signals.
The MM1 is completed by a board management controller for temperature and power supervision. It comes with a Phoenix® Award BIOS configurable for the final application.
The MM1 is screened for operation in a -40°C to +85°C temperature range (Tcase, -25°C to +85°C for board versions with 1 GB DRAM). As all ESMini™ 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. Where operation temperatures are moderate, the module may even do without the frame and cover, with a suitable low-power processor and airflow.
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 MM1 supports a 95x55mm form factor.
For evaluation and development purposes a microATX carrier board is available.

Diagram


Options
Intel® Atom™ Processor
System Memory DDR2 SDRAM
IDE (PATA)
PATA/SATA Converter
USB 2.0
USB 2.0
USB 2.0
USB 2.0
USB 2.0
USB 2.0
USB 2.0
USB 2.0 (Configurable Client)
PCIe x1
Intel® High Definition Audio
SDVO
LVDS
GPIO
CAN
CAN
I2C
I2C
UART
UART
Fast Ethernet
Fast Ethernet
FPGA
PCIe x1
Intel® System Controller Hub US15W
ESMini™ Connectors
ESMini™ Connectors
Optional on ESMini™ Connector

Technical Data

CPU	■ Intel® Atom™ Z530 or Z510 □ Up to 1.6 GHz processor core frequency □ 400 MHz or 533 MHz system bus frequency ■ Chipset □ Intel® system controller hub US15W
Memory	■ 512 KB L2 cache integrated in Atom processor ■ Up to 1 GB DDR2 SDRAM system memory □ Soldered □ 400/533 MHz memory bus frequency locked to the FSB frequency
Serial ATA (SATA)	■ One port via ESMini™ connector ■ Transfer rates up to 100 MB/s ■ Via PATA-to-SATA converter
Graphics	■ Integrated in Intel® System Controller Hub US15W ■ Maximum resolution: 1366x768 pixels ■ 1 SDVO port ■ 1 LVDS port □ 112 MHz maximum pixel clock □ 18 or 24 bits pixel color depths ■ Available via ESMini™ connector
USB	■ Eight USB 2.0 host ports (or 7 host ports and 1 client port, adjustable by software) □ Via ESMini™ connector □ Six of these ports also support USB 1.1 (UHCI implementation) ■ EHCI implementation ■ Data rates up to 480 Mbit/s
Ethernet	■ Up to two 10/100Base-T Ethernet channels ■ Two status LEDs per channel ■ Available via ESMini™ connector
UART	■ Two interfaces ■ RS232 or RS422/RS485 ■ Full or half-duplex ■ Data rates up to 115,200 bit/s ■ 60-byte transmit/receive buffer ■ Handshake lines: RTS, CTS ■ Available via ESMini™ connector
CAN bus	■ Two CAN bus channels ■ 2.0 A/B CAN protocol ■ Data rates up to 1 Mbit/s ■ Available via ESMini™ connector
I²C Bus	■ Two interfaces ■ Available via ESMini™ connector
PCI Express®	■ One x1 link to connect legacy I/O (FPGA) ■ One x1 link via ESMini™ connector ■ Data rate 250 MB/s in each direction (2.5 Gbit/s per lane)
GPIO	■ One line from board controller on ESMini™ connector J1 ■ Three lines from FPGA on ESMini™ connector J1 ■ Up to 19 differential pairs of receive and transmit lines on ESMini™ connector J2 ■ Up to 116 single I/O lines on ESMini™ connector J2
HD Audio	■ Via ESMini™ connector

Technical Data

Board Management Controller	■ Input voltage supervision ■ Power sequencing ■ Board monitoring ■ Watchdog ■ Accessible via SMBus
Miscellaneous	■ Real-time clock (with Goldcap or battery backup on the carrier board) ■ SMBus interface
Electrical Specifications	■ Supply voltage: +5V (-3%/+5%) ■ Power consumption: □ 1.1 GHz Z510 model: 6.75 W typ., 7.7 W max. □ 1.6 GHz Z530 model: 7.5 W typ., 9.3 W max.
Mechanical Specifications	■ Dimensions: 95 mm x 55 mm ■ ESMini™ PCB mounted between a frame and a cover ■ Weight: 130 g (with cover and frame)
Environmental Specifications	■ Temperature range (operation): □ -40..+85°C Tcase (ESMini™ cover/frame) (screened) (board versions with 512 MB DDR2 SDRAM) □ -25..+85°C Tcase (ESMini™ cover/frame) (screened) (board versions with 1 GB DDR2 SDRAM) ■ 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..150 Hz (EN 60068-2-6) ■ Conformal coating on request
MTBF	■ 221,026 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	■ Award BIOS
Software Support	■ Windows® □ Windows® XP □ Windows® Vista™ □ Windows® 7 □ Windows® XP Embedded □ Windows® Embedded Standard 7 ■ Linux (in preparation) ■ VxWorks® (on request) ■ QNX® (on request) ■ For more information on supported operating system versions and drivers see Downloads.

Configuration & Options

Standard Configurations

Article No.	CPU Type	Clock	System RAM	Ethernet	CAN	ESMini Connectors	Operating Temperature
15MM01-00	Z510	1.1 GHz	512 MB	1	1	J1	-40..+85°C Tcase screened
15MM01-01	Z530	1.6 GHz	1 GB	2	2	J1, J2	-25..+85°C Tcase screened

Options

CPU	■ Intel® Atom™ Z530, 1.6 GHz ■ Intel® Atom™ Z510, 1.1 GHz
Memory	■ System RAM □ 512 MB or 1 GB
I/O	■ Second Fast Ethernet port ■ Second CAN port
PCI Express®	■ Second PCI Express® lane on ESMini™ connector □ Instead of FPGA (GPIO, CAN, UART, Fast Ethernet, I²C)
Operating Temperature	■ -40..+85°C Tcase (ESMini™ cover/frame) (screened) (board versions with 512 MB DDR2 SDRAM) ■ -25..+85°C Tcase (ESMini™ cover/frame) (screened) (board versions with 1 GB DDR2 SDRAM)
Cooling	■ With cover and frame ■ With cooling plate ■ With small heat sinks only on processor and chipset
BIOS	■ Accessible via UART using VT100 terminal
Software Support	■ VxWorks® (on request) ■ QNX® (on request)

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 MM1 Models	**15MM01-00**	Intel® Atom™ Z510, 1.1 GHz, 512MB RAM, 1 Fast Ethernet, 1 CAN, -40..+85°C Tcase screened
	15MM01-01	Intel® Atom™ Z530, 1.6 GHz, 1GB RAM, 2 Fast Ethernet, 2 CAN, -25..+85°C Tcase screened
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
	08XC06-01	Carrier board for ESMini™: 1x TTY, 1x RS232, 1x DVI-I, 1x Audio I/O, 4x USB2.0, 2x Fast Ethernet, USB Flash slot, PCI Express® Mini Card socket, SIM card holder, microSD™ card socket, 8x GPIOs, -40°C..+85°C screened
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
	08XC06-01	Carrier board for ESMini™: 1x TTY, 1x RS232, 1x DVI-I, 1x Audio I/O, 4x USB2.0, 2x Fast Ethernet, USB Flash slot, PCI Express® Mini Card socket, SIM card holder, microSD™ card socket, 8x GPIOs, -40°C..+85°C screened
Software: Linux	This product is designed to work under Linux. See below for potentially available separate software packages from MEN.	
	13XM01-06	MDIS5™ low-level driver sources (MEN) for XM1, XM1L, MM1, MM2, XM2, F11S, F19P, F21P, F22P, G20, G22, SC21, SC27 and DC2 board controller
	13Z015-06	MDIS5™ low-level driver sources (MEN) for 16Z029_CAN (MSCAN/Layer2)
	13Z016-06	MDIS5™ driver (MEN) for 16Z029_CAN (CANopen master)
	13Z017-06	MDIS5™ low-level driver sources (MEN) for 16Z034_GPIO, 16Z037_GPIO and 16Z127_GPIO
	13Z025-90	Linux native driver (MEN) for 16Z025_UART, 16Z057_UART and 16Z125_UART
	13Z077-90	Linux native driver (MEN) for 16Z077_ETH and 16Z087_ETH

Ordering Information

Software: Windows®	This product is designed to work under Windows®. See below for potentially available separate software packages from MEN.	
	10F014-78	Windows® XP Embedded BSP (MEN) for F11S, F14, F15, F17, F18, F19P, F21P, G20, XM1, XM1L, XM2, MM1, MM2, SC21, SC24, DC1, DC2, RC1, BC50I, BC50M and BL50W
	10Y000-78	Windows® Embedded Standard 7 BSP for F11S, F19P, F21P, F22P, F75P, G20, G22, XM1L, XM2, MM1, MM2, SC21, SC24, SC27, BC50M, BC50I, BL50W, BL50S, DC13, F206, F210, F215, F216, G215, P506, P507 and P511
	13MM01-77	Windows® Installset (MEN) for MM1 and RC1 (Includes all free drivers developed by MEN for the supported hardware.)
	13T009-70	Windows® HD audio driver (Realtek) for XM1, XM1L, MM1, MM2
	13T011-70	Windows® graphics driver (Intel®) for XM1, XM1L, MM1 and F11S
	13T012-70	Windows® XP/Vista chipset driver (Intel®) for XM1, XM1L, MM1 and F11S
	13T013-70	Windows® USB client driver installation package (Intel®) for XM1, XM1L and MM1
	13T014-70	Windows® Vista™ HD audio driver (Realtek) for XM1, XM1L and MM1
	13T016-70	Windows® Vista™ chipset graphics driver (Intel®) for XM1, XM1L, MM1 and F11S
	13Z015-70	MDIS4™/2004 / MDIS5™ Windows® driver (MEN) for 16Z029_CAN (MSCAN/Layer2)
	13Z016-70	MDIS5™ Windows® driver (MEN) for 16Z029_CAN (CANopen master)
	13Z017-70	MDIS4™/2004 / MDIS5™ Windows® driver (MEN) for 16Z034_GPIO devices
	13Z087-70	Windows® native driver (MEN) for 16Z087_ETH (Ethernet controller)
Software: Firmware/BIOS	MEN's CANopen firmware consists of the Vector Informatik protocol stack. The corresponding driver software comes from MEN. It is based on MDIS™ (MEN Driver Interface System), which makes the hardware ready for use under Windows®, Linux, VxWorks®, QNX®, OS-9® and other software environments. You can find more information on the Vector CANopen tools at www.vector-informatik.de.	
Software: Miscellaneous	Intel® software development products such as analyzers, compilers, threading tools etc. can be downloaded under www.intel.com/cd/software/products/asmo-na/eng/index.htm. IA-32 Intel® Architecture Software Developer's Manuals are available under www.intel.com/products/processor/manuals/index.htm.	

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.	
	20APPN004	Application Note: How to make a USB stick bootable
	20MM01-ER	MM1 Errata
	20MM01-00	MM1 User Manual
	21APPN016	Application Note: Accessing SMBus under Linux Kernel 3.2 on MEN Intel® Boards
	21Z025-90	16Z025_UART and 16Z125_UART under Linux User Manual

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