MM2 – ESMini™ COM with Intel® Atom™ E600 Series

- **Intel® Atom™ E600 series, up to 1.6 GHz**
- **Up to 2 GB DDR2 SDRAM**
- **2 PCI Express®**
- **2 Gb Ethernet interfaces**
- **6 USB 2.0 hosts and 1 USB 2.0 client**
- **4 UARTs**
- **1 CAN bus interface**
- **SDVO, LVDS**
- **Intel® HD audio**
- **2 SATA ports**
- **-40°C to +85°C Tcase (screened or with qualified components)**
- **Conduction cooling**

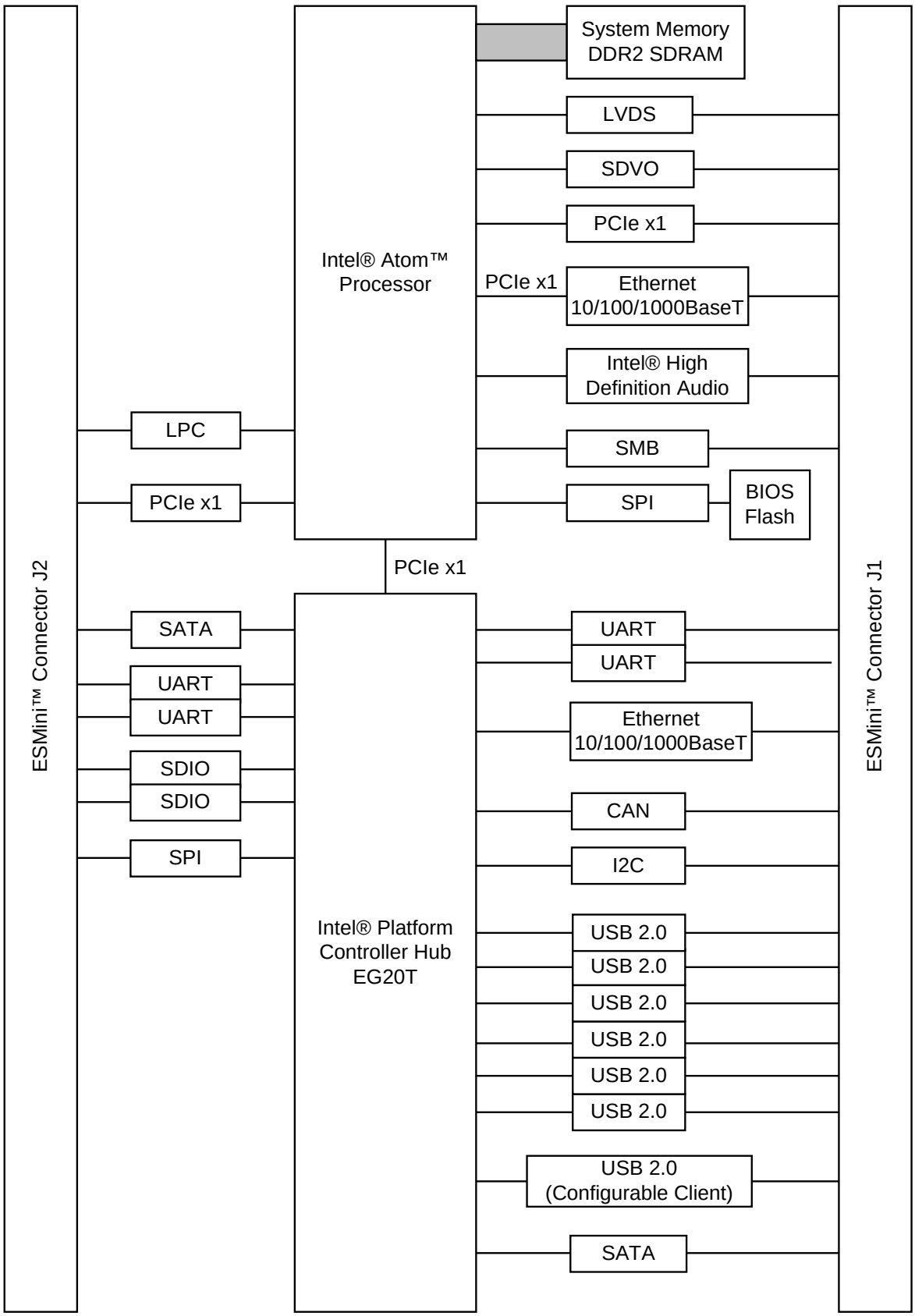
The MM2 is an ultra-small Computer-On-Module of the rugged ESMini™ family. Together with an application-specific carrier board it forms a semi-custom solution for industrial, harsh, mobile and mission-critical environments.
The small form factor board is controlled by an Intel® Atom™ processor from the E6xx series. This processor family offers high I/O flexibility as it uses the PCI Express® standard for the processor-to-chipset interface. The MM2 has a total power consumption of max. 5 to 7 W, while having a clock frequency of up to 1.6 GHz.
The MM2 accommodates up to 2 GB of directly soldered main memory. Different mass storage media are supported on the carrier board.
The MM2 offers a multitude of I/O: besides modern serial I/O like two PCI Express® x1 links, LVDS, SDVO, high-definition audio, SATA and USB, it also provides legacy I/O (1 CAN, 4 COM, 2 I2C).

The MM2 is completed by a board management controller for temperature and power supervision. It comes with a UEFI BIOS. The MM2 is screened for operation in a -40°C to +85°C temperature range (Tcase at the cover and frame). 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 operating 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 MM2 supports a 95x55mm form factor.

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

Diagram


ESMini™ Connector J2
Intel® Atom™ Processor
System Memory DDR2 SDRAM
LVDS
SDVO
PCIe x1
PCIe x1
Ethernet 10/100/1000BaseT
Intel® High Definition Audio
SMB
SPI
BIOS Flash
LPC
PCIe x1
PCIe x1
Intel® Platform Controller Hub EG20T
SATA
UART
UART
SDIO
SDIO
SPI
UART
UART
Ethernet 10/100/1000BaseT
CAN
I2C
USB 2.0
USB 2.0
USB 2.0
USB 2.0
USB 2.0
USB 2.0
USB 2.0 (Configurable Client)
SATA
ESMini™ Connector J1

Technical Data

CPU	■ Intel® Atom™ E600 series □ Up to 1.6 GHz processor core frequency □ 320 or 400 MHz graphics frequency ■ Chipset □ Intel® platform controller hub EG20T
Memory	■ 512 KB L2 cache integrated in Atom processor ■ Up to 2 GB DDR2 SDRAM system memory □ Soldered □ 800 MHz memory bus frequency
Serial ATA (SATA)	■ Two ports via ESMini™ connectors J1 and J2 ■ SATA Revision 2.x support ■ Transfer rates up to 300 MB/s (3 Gbit/s)
Graphics	■ Integrated in Intel® Atom™ processor ■ One SDVO port □ 160 MHz maximum pixel clock □ Maximum resolution up to 1920x1080 @ 50Hz □ 1920x1080 @ 60Hz or 1600x1200 @ 60Hz with reduced blanking ■ One LVDS port □ 80 MHz maximum pixel clock □ Maximum resolution up to 1280x768 @ 60Hz ■ Available via ESMini™ connector J1
USB	■ Six USB 2.0 host ports □ The host ports also support USB 1.1 (OHCI implementation) ■ One USB client port ■ Data rates up to 480 Mbit/s ■ Available via ESMini™ connector J1
Ethernet	■ Two 10/100/1000Base-T Ethernet channels ■ Two status LEDs per channel ■ Available via ESMini™ connectors J1 and J2
UART	■ For implementation of four RS232/RS485 interfaces on carrier board ■ External line drivers/receivers implemented on carrier board (e.g. via SA-Adapter™) ■ Full or half-duplex ■ One interface with full handshake supports □ Receive and transmit lines, RTS, CTS, DCD, DTR, DSR and RI □ Data rates between 300 bit/s and 4 Mbit/s ■ Three interfaces without handshake support □ Receive and transmit lines □ Data rates between 300 bit/s and 1 Mbit/s ■ Available via ESMini™ connectors J1 and J2
CAN bus	■ One CAN bus channel ■ Line driver implemented on carrier board (e.g. via SA-Adapter™) ■ 2.0 B CAN protocol ■ Data rates up to 1 Mbit/s ■ Available via ESMini™ connector J1
I²C Bus	■ One interface ■ Available via ESMini™ connector J1
SMBus	■ One interface ■ Available via ESMini™ connector J1
SPI	■ One interface ■ Available via ESMini™ connector J2

Technical Data

LPC Bus	■ One interface ■ Available via ESMini™ connector J2
PCI Express®	■ One x1 link between processor and platform controller hub ■ One x1 link for Gigabit Ethernet on J1 connector ■ Two x1 links via ESMini™ connectors J1 and J2 ■ Data rate 250 MB/s in each direction (2.5 Gbit/s per lane)
GPIO	■ Three lines on ESMini™ connector J1 ■ Twelve lines on ESMini™ connector J2
HD Audio	■ One interface ■ Available via ESMini™ connector J1
SDIO/MMC	■ Two interfaces ■ Compliant to SDIO Revision 1.1 and MMC Revision 4.1 ■ Available via ESMini™ connector J2
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) ■ Available via SMBus interface on ESMini™ connector J1
Electrical Specifications	■ Supply voltage/power consumption: □ +5V (-3%/+5%), power consumption 7 W
Mechanical Specifications	■ Dimensions: 95mm x 55mm ■ 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) (qualified or screened) ■ 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: 50 m/s², 30 ms (EN61373) ■ Vibration (function): 1 m/s², 5 Hz - 150 Hz (EN61373) ■ Vibration (lifetime): 7.9 m/s², 5 Hz - 150 Hz (EN61373) ■ Conformal coating on request
MTBF	■ 1,159,906h @ 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.
BIOS	■ InsydeH2O™ UEFI Framework
Software Support	■ Windows® ■ Linux ■ 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	ESMini Connectors	Operating Temperature
15MM02-00	E680T	1.6 GHz	1 GB	J1, J2	-40..+85°C Tcase qualified

Options

CPU	■ Intel® Atom™ E620, 0.6 GHz, 320 MHz graphics frequency, 3.3 W ■ Intel® Atom™ E620T, 0.6 GHz, 320 MHz graphics frequency, 3.3 W ■ Intel® Atom™ E640, 1.0 GHz, 320 MHz graphics frequency, 3.6 W ■ Intel® Atom™ E640T, 1.0 GHz, 320 MHz graphics frequency, 3.6 W ■ Intel® Atom™ E660, 1.3 GHz, 400 MHz graphics frequency, 3.6 W ■ Intel® Atom™ E660T, 1.3 GHz, 400 MHz graphics frequency, 3.6 W ■ Intel® Atom™ E680, 1.6 GHz, 400 MHz graphics frequency, 4.5 W ■ Intel® Atom™ E680T, 1.6 GHz, 400 MHz graphics frequency, 4.5 W
Memory	■ System RAM □ 512 MB, 1 GB or 2 GB
I/O	■ Third PCI Express® interface instead of one Gigabit Ethernet interface ■ ESMini™ connector J2 not assembled □ Fast Ethernet interfaces instead of Gigabit Ethernet □ Only one SATA interface, one or two PCI Express®, two UARTs, three GPIO lines □ No SDIO, LPC 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 MM2 Models	**15MM02-03**	Intel® Atom™ E680T, 1.6 GHz, 1GB DDR2 DRAM, 2 Gigabit Ethernet, 1 CAN, 4 COM, with J1 and J2, -40..+85°C with qualified components
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
Software: Linux	This product is designed to work under Linux. See below for potentially available separate software packages from MEN.	
	13MM02-03	Linux Graphics Driver (Intel®) for MM2 and SC27
	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
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
	13MM02-00	Windows® Chipset Driver for MM2 and SC27
	13MM02-01	Windows® XP Graphics Driver (Intel®) for MM2
	13MM02-02	Windows® 7 Graphics Driver (Intel®) for MM2
	13MM02-77	Windows® Installset (MEN) for MM2 and SC27 (Includes all free drivers developed by MEN for the supported hardware.)
	13T009-70	Windows® HD audio driver (Realtek) for XM1, XM1L, MM1, MM2
	13T010-70	Windows® 32-bit network driver (Intel®) for XM1, XM1L, XM2, MM2, F11S, F18, F18E, F19P, F21P, F22P, G20, G22, GM1, GM2, G211, G211F, SC24, BC50I, BC50M and BL50W
	13Y021-70	Windows® ERTC/SMB support package

For operating systems not mentioned here contact MEN sales.

Documentation	Compare Chart ESMini™ Computer-On-Modules » Download	
	20MM02-ER	MM2 Errata
	20MM02-00	MM2 User Manual
	21APPN015	Application Note: Using Real-Time Operating Systems on MEN CPUs with InsydeH2O™ UEFI BIOS
	21APPN016	Application Note: Accessing SMBus under Linux Kernel 3.2 on MEN Intel® Boards

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