

### Key Features

- Complete F/W solution for PICMG® AMC Module Management Controller (MMC), a mandatory AMC component
- Dramatically shortens time to market for newly designed AMC
- Brings up MMC firmware to a new level for re-designed AMC
- Meets IPMI 1.5, IPMB CPS v1.0, PICMG® 3.0 Rev.3.0 and AMC.0 R2.0 specifications
- Requires minimal to no knowledge of specifications
- Royalty free
- Robust, well structured, documented 'C' source code with detailed references to applicable specifications
- Runs on low-cost, space saving Atmel 8-bit AVR XMEGA microcontrollers with only a few external components required
- Extremely simple porting to user AMC hardware to meet different requirements of PICMG® 3.0 compatibility
- Ready to go out of the box for minimal MMC functionality
- Easily integrates into MMC microcontroller top-level complex management application with powerful system monitoring and management tasks, communication, etc
- Based on robust, compact, truly royalty free, source code FreeRTOS® from Real Time Engineers Ltd ([www.freertos.org](http://www.freertos.org))
- Comes with a TAMMC® EVM for immediate learning and testing

### Details

- Organized as a set of non-blocking RTOS tasks
- Easily customized SDRs and FRU records
- Expandable set of AMC MMC compliant IPMI commands
- AMC event generation, BLUE LED and E-keying support
- Supports minimum AMC Hot Swap sensor and two temperature sensors with user added extra temperature sensors
- User added optional sensors (voltage, current, knobs, etc)
- Unified hardware mapped macros for porting to user hardware
- Debug messages (DM) and run-time notification messages (RTM) support to dump incoming/outgoing IPMI packets, display received IPMI commands and events, activity tracking, etc
- DM/RTM output either via TAMMC® Default Debug Console (DDC) or user provided calls to top-level remote console API
- Completely user configurable to include desired TAMMC® options via project specific configuration definitions

### Development Tools

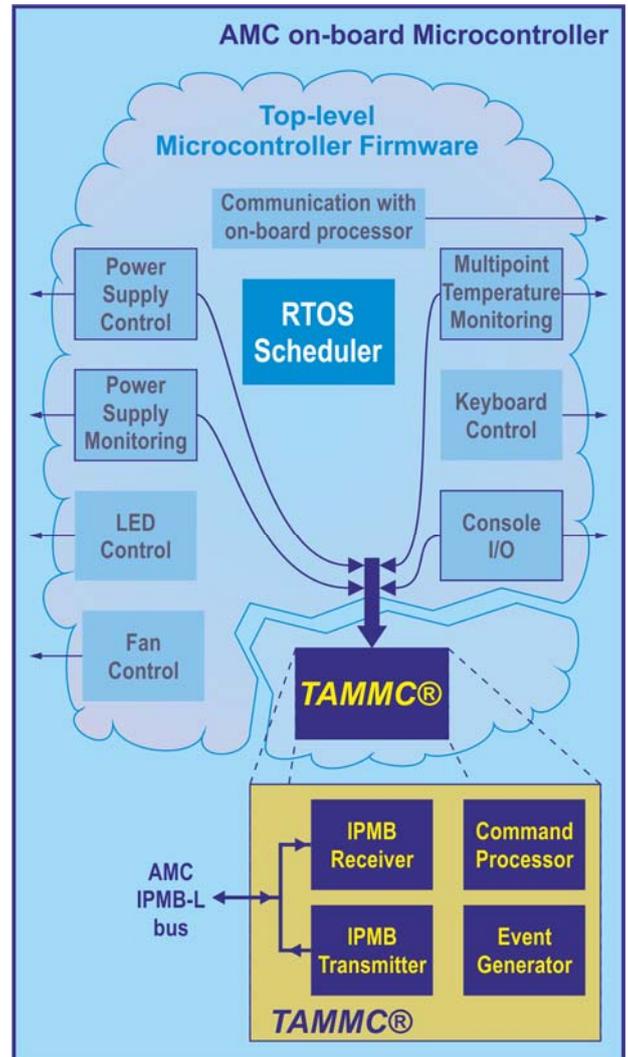
- Atmel AVR Studio tools (v4 or later)
- MicroLAB Systems TAMMC® EVM

### Applications

- AMC module MMC design

### Technical Support and Services

- Lifetime warranty, technical support and updates
- Optional Custom Design service to design complete AMC on-board microcontroller hardware and firmware on Customer specifications



## TAMMC® AMC Module Management Controller (MMC) Software Development Kit (SDK)

Every PICMG® AMC.0 compliant Advanced Mezzanine Card (AMC) must implement an on-board Module Management Controller (MMC). The MMC communicates detailed information about the AMC to the host (manufacturer, p/n, specifications compliance, backplane I/O ports details, power consumption, sensors details, etc). The MMC is also responsible for the AMC activation and system health monitoring.

Although the MMC hardware design is rather simple, the MMC firmware design is not as simple as it may seem at a first glance because it requires detailed knowledge of several tightly coupled industry standard specifications and clear understanding of system data flow and synchronization. This becomes even more complicated in the event the hardware design engineer designs an all in one and has requirements to add other important board management tasks to the AMC on-board microcontroller going beyond AMC MMC compliance. These add-on tasks may include backend power management, extended board temperature and health monitoring, communication with on-board processors and many more in order to increase system reliability and safety and to extend microcontroller functionality beyond MMC compliance by taking advantage of all the highly integrated resources of the microcontroller chip used to implement the AMC MMC.

Estimation of an AMC MMC project release time indicates about 6.8 months of employment for an experienced programmer starting from scratch with learning the specifications and ultimately delivering functional, debugged MMC code. However, this does not guarantee that all bugs are fixed and assumes no full featured documentation is released for further project management and support. Isn't it worth it to look at 3<sup>rd</sup> party well debugged and documented AMC MMC code instead?

Fortunately, MicroLAB Systems has recognized this problem and introduces the *TORNADO AMC MMC (TAMMC®)* SDK, which is an extremely easy to use and proven off-the-shelf building block to quickly add AMC MMC functionality to the on-board microcontroller of your newly designed and redesigned AMC modules.

Not only is the *TAMMC®* SDK a must have, second to none tool for companies that are designing their first AMC modules, but, it is also a useful tool for those companies who already have AMC module design experience and want to bring their AMC on-board MMCs to a higher firmware level with complex real-time system management and control going beyond basic AMC MMC compliance.

The *TAMMC®* SDK is royalty free, well structured, documented C-code, which is bundled with a *TAMMC®* Evaluation Module (EVM) board for immediate learning and testing of ported AMC MMC code.

The *TAMMC®* SDK uses an open, time proven, robust, extremely compact, truly royalty free FreeRTOS® operating system from Real Time Engineers Ltd ([www.freertos.org](http://www.freertos.org)). FreeRTOS® takes care of scheduling *TAMMC®* tasks, which are designed to be unblocking tasks each consuming only a minimum of the microcontroller's valuable time. This allows releasing the maximum amount of microcontroller time for top-level system management tasks.

Currently, the *TAMMC®* runs on highly integrated, low-cost, space saving Atmel 8-bit AVR XMEGA microcontroller chips. Other platforms are planned for future release.

The *TAMMC®* project typically fits into the Atmel AVR XMEGA 4KB RAM and 46KB of program memory in event nothing else other than minimal AMC MMC functionality is required. The

ATxmega128A4-MH 44-pin chip is sufficient to accommodate this design with only 7x7mm of valuable board space occupied.

However, the most attractive option with the *TAMMC®* is the opportunity to be easily integrated as only one of many building blocks into top-level complex AMC on-board microcontroller firmware, which provides AMC MMC functionality as only one of its many tasks. The MicroLAB Systems *TORNADO-A6678* DSP/FPGA AMC module is a good example. It populates the Atmel 64-pin ATxmega256A3-MH chip (16KB RAM, 256KB FLASH) with only 9x9mm footprint as a full featured board management controller providing AMC MMC compliance, accurate on-board power management and monitoring, extended temperature monitoring, power and temperature health status indication via on-board LEDs with AMC LED1/LED2 and notification to the on-board DSP, communication with DSP, remote management COM-port console, and many more useful features. All this significantly increases AMC module reliability and safety.

Porting the *TAMMC®* to user AMC hardware is as easy as editing several lines inside two OEM port specific files including localization of manufacturer name, board name and p/n, board revision, number of temperature sensors and their names, sensors parameters, hardware mapping of macros, i.e. actually as much as it is required by user AMC module design. However, minimal porting to just check functionality requires no editing at all.

The *TAMMC®* SDK supports run-time debug messages (DM) and run-time notification messages (RTM), which are grouped individually for every *TAMMC®* task and can be globally or individually enabled/disabled. DMs are useful during hardware debugging to dump incoming/outgoing IPMI packets, display received IPMI commands and events, activity tracking, etc, whereas RTMs are useful in the final firmware release to indicate ongoing MMC events and exceptional conditions. Both DMs and RTMs are output either via *TAMMC®* built-in Default Debug UART Console (DDC) or via calls to user provided top-level application remote console API.

The *TAMMC®* SDK is configurable via project configuration definitions and allows optional tasks timing tracking, global and individual masking of DMs/RTMs, DDC configuring, specific processing options, and more to fine tune AMC MMC functionality.

The *TAMMC®* SDK comes with a *TAMMC®* EVM mid-size AMC module, which includes on-board Atmel top-level ATxmega256A3-MH microcontroller chip, AMC Blue LED, bi-color AMC LED1 and AMC LED2, COM-port for remote console, 3-channel temperature monitor chip, backend power connector, power and temperature status LEDs, general purpose LEDs, local I2C bus extension connector, and a general purpose I/O header. The temperature monitor chip connects to the local microcontroller I<sup>2</sup>C bus, provides built-in PCB temperature sensor and supports two external temperature sensors via on-board connectors to simulate AMC module components heating/freezing. Two external temperature sensors are provided with a 30cm (12") long cable. Backend power is available via on-board connector and is enabled/disabled by the microcontroller on AMC MMC IPMI commands with continuous voltage and load current monitoring. The *TAMMC®* EVM allows an immediate check of ported AMC MMC functionality, to observe and fine tune MMC temperature event generation, to simulate functionality of backend power supplies, i.e. as much as designer imagination can advise to do. Full schematic, BOM and manual are included.

### Ordering information

<i>TAMMC-SDK</i>	<i>TAMMC®</i> AMC-module Management Controller (MMC) Software Development Kit (SDK) with <i>TAMMC®</i> EVM board.
<i>TAMMC-CDS</i>	Custom design service to design complete AMC-module on-board microcontroller hardware environment and firmware on Customer specifications in order to minimize Customer time-to-market. This service includes <i>TAMMC-SDK</i> item.