VIA Em-ITX Form Factor

The Art of Ultra-Slim Design

Introducing VIA's Em-ITX form factor

Mainboard Specification
White Paper

VIA Technologies, Inc.
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1. Introduction

This document defines the Em-ITX form factor developed by VIA Technologies, Inc. Building on VIA's reputation as a global leader and pioneer of ultra compact x86 system design in embedded single board computer markets, Em-ITX is the first standard form factor specification to specify two I/O coastlines, making it ideally suited to the development of versatile, scalable, ultra-slim embedded devices.

2. The Art of Designing Ultra-Slim Systems

Ultra-slim system design brings several dedicated challenges; most are directly tied to the board selected, in terms of I/O availability and I/O accessibility. For I/O availability, the length of the I/O coastline can dictate how to configure the system, and whether a larger board or extending or stackable expansion boards are required, all of which has a direct impact on the size of the system. For I/O accessibility, the common use of pin-headers requires greater use of cabling inside the chassis, which in turn restricts airflow and requires more active system cooling and thus electricity to operate the system.

Until now, ultra-slim embedded computer design meant massive investment of both resources and time in custom-designing boards capable of producing an ultra-slim computer. What was needed was a board form factor that met these challenges in an innovative way.

2.1 Introducing the Em-ITX Form Factor

VIA designed the Em-ITX board form factor from the ground up to address the need for a more rational approach to developing ultra-slim embedded devices. Measuring 170mm x 120mm, the rectangular Em-ITX features I/O ports on its two longest sides, enabling considerably more I/O availability than standard embedded boards; this allows developers to design systems that can be less than 2cm high.

2.11 Dual Coastlines

The Em-ITX form factor takes a new approach to ultra-slim design by modifying the dimensions and layout of the board to offer extended I/O coastlines on the two longest sides of the board, increasing I/O real estate and greatly reducing the need for cabling.

2.12 Em-ITX Expandability

The Em-ITX form factor also uses a specially developed Em-IO Expansion Bus for data flow between Em-ITX board and expansion boards. These expansion boards offer even further accessible I/O real estate for developers to exploit. The Em-IO Bus gives developers access to both modern and legacy buses through simple board to board connectors.

2.13 Fully Scalable Architecture

Forthcoming boards based on the Em-ITX form factor will be able to take advantage of VIA's extensive, fully scalable range of processor platforms. From the fanless VIA Eden processor to the latest 64-bit superscalar VIA Nano processor, the Em-ITX form factor is geared to deliver a versatile base for a variety of applications and usage scenarios including high end, high performance systems and applications.

Table 1: Em-ITX Mainboard Feature & Benefit Summary

Features	Benefits
Ultra-compact 17cm x 12cm Board Size	Enables longer I/O coastlines compared to a square board with identical surface area
Dual I/O Coastline	Expands the I/O real estate without impacting device size
Supports all VIA Processor Platforms	Offers truly scalable and interchangeable processor platform options
Unique Em-IO bus	Supports modern and legacy bus technologies
Faster time-to-market cycles	Brings the benefits of custom boards in a faster time-to-market, off-the-shelf solution

3. Em-ITX Form Factor Overview

3.1 Em-ITX Form Factor Dimensions

The Em-ITX form factor is 30% smaller than VIA's Mini-ITX form factor, and 30% larger than the Nano-ITX form factor, both industry standard board form factors in the embedded industry. Yet because of its dual I/O coastline, the available I/O coastline is actually a remarkable 200% more than that of Mini-ITX.

VIA's decision to leverage the dimensions used in both Mini-ITX and Nano-ITX (17cm and 12cm respectively) means system designers can also take advantage of existing chassis and device designs.

Figure 1: Comparison of VIA-defined form factors

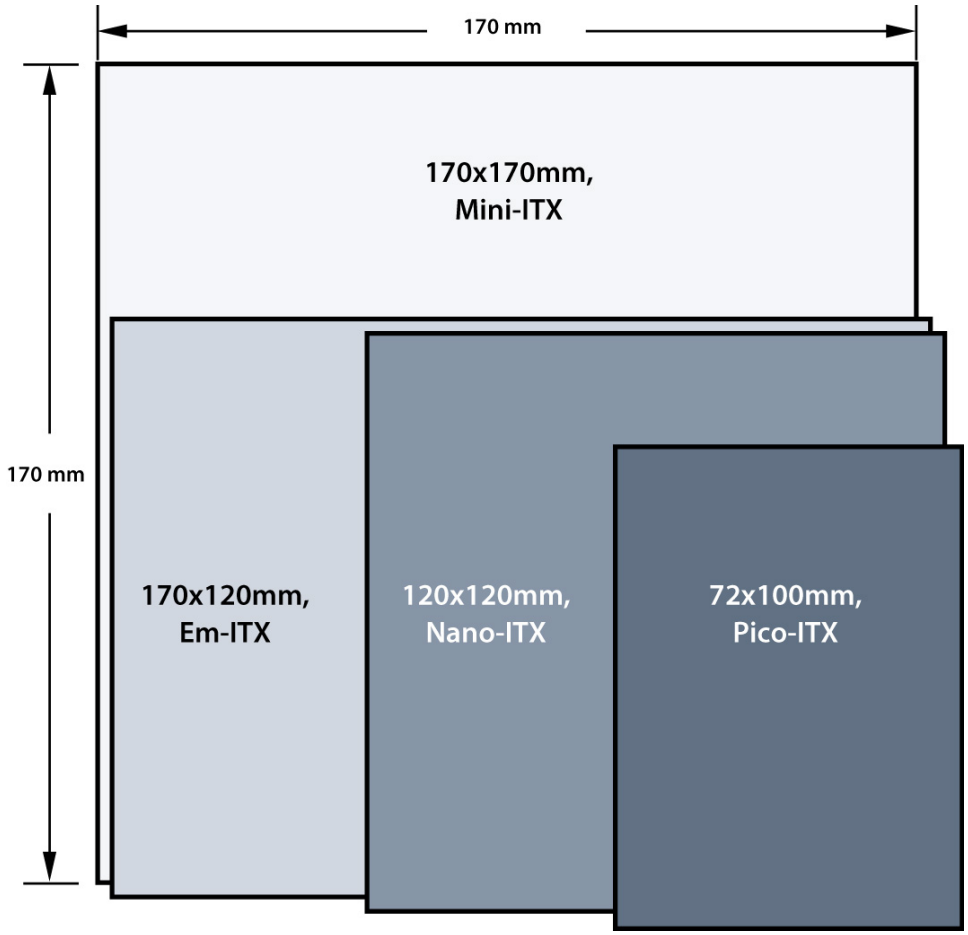
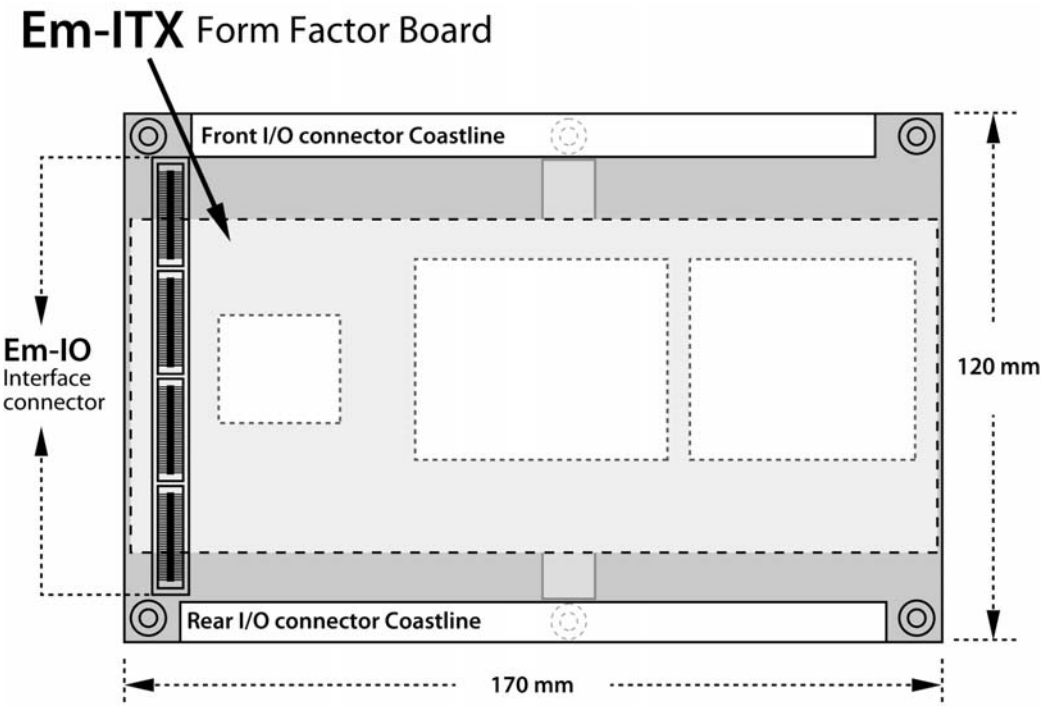


Figure 2: Em-ITX layout



VIA has carefully chosen the dimensions of the Em-ITX form factor to maximize the effectiveness of the dual I/O coastlines.

With the dimensions of a perfect square covering the area of 204cm^2, the maximum amount of I/O coastline that can be obtained through doubling is less than 28.6cm. However, if the dimensions of the same 204cm^2 area are implemented in a rectangular fashion, as in the Em-ITX the longer edges would provide a total of up to 34 cm of I/O coastline. By merely changing the dimensions of the form factor to a rectangular shape, a 19% increase in available space for the I/O coastline was created (see Figure 3).

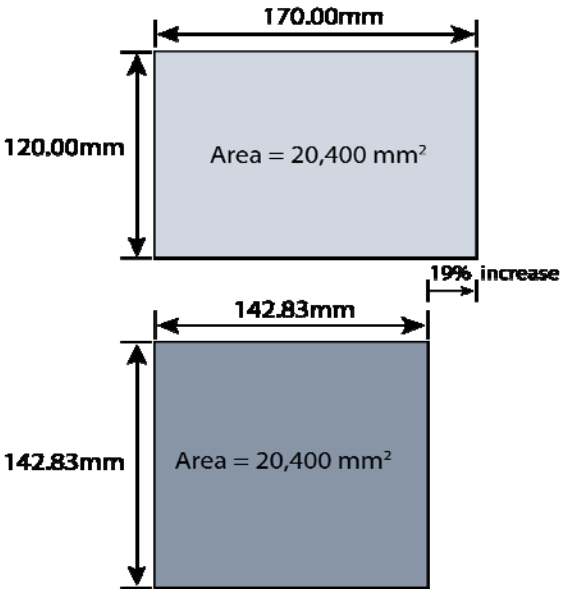


Figure 3: Comparison of square vs rectangular board shape

3.2 Dual Coastlines

The inclusion of dual I/O coastlines is central to the design rational of the Em-ITX form factor, and a world first for any standard board form factor. A key concern when developing low profile, ultra slim embedded devices is the need to accommodate I/O ports in an efficient and rational way that negates cluttered, cumbersome cabling associated with pin headers.

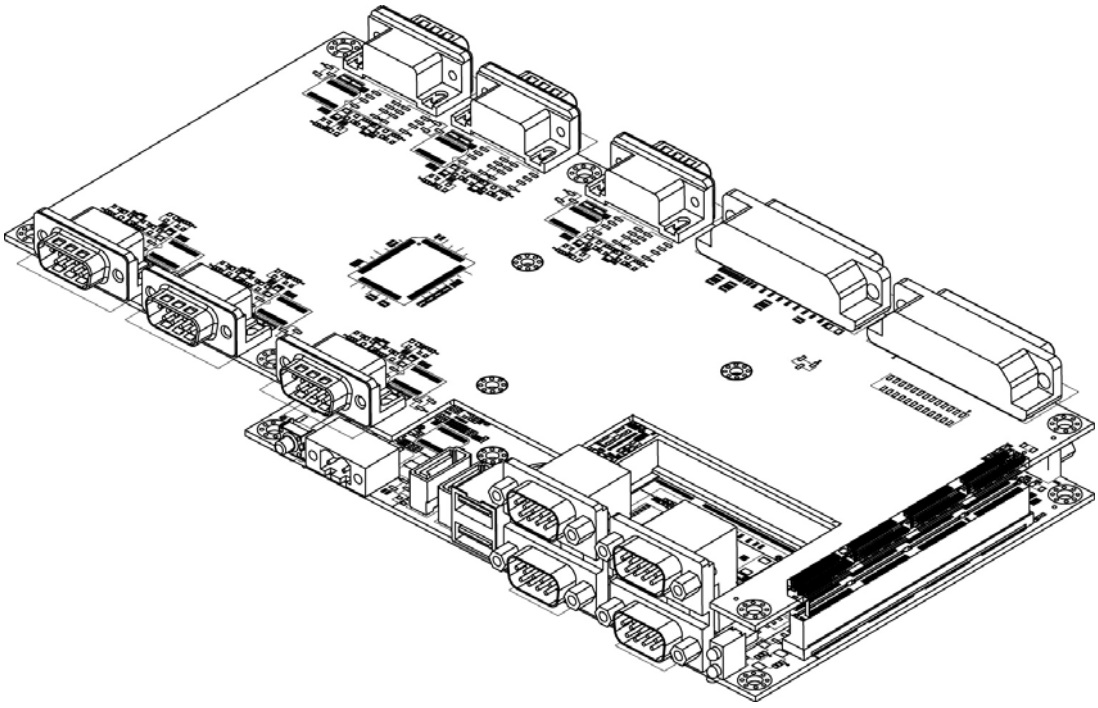
The inclusion of dual I/O coastlines in the Em-ITX form factor is a direct response to these needs, meaning I/O ports are simply hard-wired on to the board not attached via pin headers which need to be cable-connected to the board.

Essentially having more than double the I/O real estate on the board means fewer cable connected ports, less cabling generally which promotes better air-flow, which in turn means more effective heat dissipation and thus greater system stability and greater scope for miniaturization and slimmer designs. In short, the Em-ITX is engineered from the ground up to facilitate ultra-slim device design.

3.3 Extensive Expandability

The Em-ITX form factor includes specifications for modular expansion, extending the I/O options further with VIA-designed expansion modules that take advantage of VIA's exclusive Em-IO bus. This is essential for designs which require communications-intensive capabilities, such as those that require several COM ports.

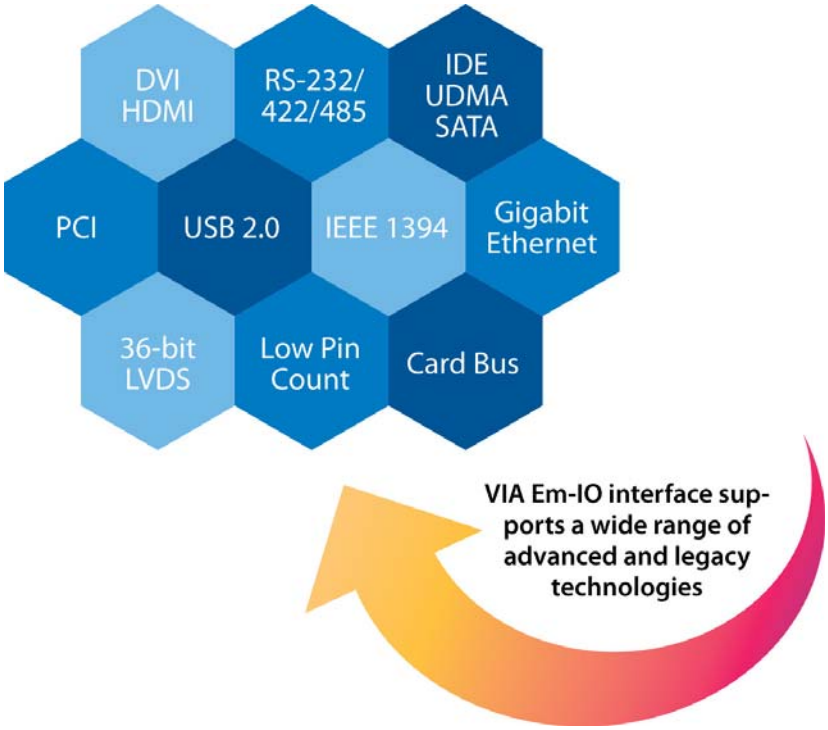
Figure 4 Example of Em-ITX board with expansion board



Developers of such devices can take advantage of VIA-developed series of modular interface expansion cards. These expansion modules are attached to the Em-ITX board via connectors and use the exclusive Em-IO data bus. These expansion modules offer extensive I/O options, again without resorting to cluttered cabling or hindering the capacity for ultra-slim design, as shown in Figure 4.

Based on a pair of 160-pin Samtec Q Strip® connectors, the Em-IO expansion bus integrates both legacy and modern data buses for a complete range of I/O devices, including USB 2.0, GPIO, LPC, PCI Express, DVI/HDMI, 36-bit LVDS, SMBus, CardBus, IEEE 1394, RS-232/422/485, ACPI 3.0, and DC power signals (3.3 V, 5 V, and 12 V), as illustrated in Figure 5.

Figure 5: Wide range of I/O interfaces supported



4. Diverse Embedded Applicability

The Em-ITX form factor facilitates a wide range of ultra-thin device types that increasingly rely upon their ability to combine compact form with extensive I/O.

These diverse application segments include discrete automation control devices such as environment and facility monitoring, medical instrument automation, as well as kiosk applications like toll booth, self-service ticketing and entrance control.

Comprehensive multi media I/O including DVI, LVDS and dual screen options combined with HD audio mean that Em-ITX-based devices are also ideal for digital signage applications, POI and modern gaming machines. Fleet management control and warehouse logistics applications are also suited to slim-line, handheld Em-ITX-based devices.

5. Conclusion

The open standard Em-ITX form factor offers embedded system developers clear advantages over competing form factors, allowing greater miniaturization and slimmer, more discrete devices without compromising on system I/O.

Embedded system developers can also reap the financial rewards of having an off-the-shelf solution for a wide range of ultra-slim applications. Where designers previously had to invest ample time and resources custom-designing boards that gave them necessary scope, Em-ITX is the ideal solution.

Boards based on the Em-ITX form factor will facilitate faster-time-to market, with developers reaping the rewards of a standardized ultra-slim form factor that leverages VIA's expertise in producing full-featured, fully integrated, low-power processor platforms.

With the Em-ITX form factor, VIA can fast-track your ideas, from concept to reality.

For more information on the Em-ITX form factor specification, please visit the VIA corporate website at www.viatech.com or contact embedded@via.com.tw

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