



Mobile-ITX

The Science of Small

A Computer-on-Module Form Factor for
Next Generation Ultra Compact Embedded PCs

**Mobile-ITX Specification
White Paper**

**VIA Technologies, Inc.
December 2009**

1. Introduction

This document defines the new Mobile-ITX form factor, the embedded industry's smallest Computer-on-module form factor specification, developed by VIA Technologies, Inc. Mobile-ITX continues VIA's efforts to shrink the x86 platform to inspire innovative system design and to make x86 computing accessible for next generation of ultra-compact devices.

In addition to describing the main features and applications of the Mobile-ITX form factor, this document also includes information about the VIA Mobile-ITX CPU module reference design, a working version of the board with suggested components and layout.

2. Mobile-ITX Form Factor Overview

2.1 Mobile-ITX Form Factor Features and Benefits

Measuring a mere 6cm x 6cm, the Mobile-ITX form factor is currently the smallest x86 Computer-on-module specification in the industry, and the latest advance in modular device design.

Vertical market segments have evolved to demand greater miniaturization from today's x86 platforms. Mobile-ITX addresses the need for a simple, modular approach to IPC design, making it easier than ever to bring to market ultra-compact and lightweight devices that offer comprehensive connectivity options and a rich, flexible feature set.

The new Mobile-ITX form factor provides system developers and OEMs with a standardized, ultra compact yet highly integrated Computer-on-module specification that can be utilized across multiple embedded PC, system and appliance designs. Mobile-ITX offers system designers a more compact, flexible and feature rich solution for a range of device designs and is especially suited for next-generation, ultra-compact applications in military, medical, robotics and transportation segments.

Table 1 below provides a summary of the main features and benefits of the Mobile-ITX Computer-on-Module form factor.



Table 1: Mobile-ITX Features & Benefit Summary

Features	Benefits
Ultra-compact 6cm x 6cm Board Size	Enables small footprint system designs Reduces overall system costs
Rich I/O Expansion	Support for complete range of I/O standards: <ul style="list-style-type: none"> ▪ USB, CRT, TTL LCD, PCIe, SPI, LPC, Video capture (or COM), SDIO, IDE, PS/2, SMB, GPIO, Audio..etc ▪ Optional HDMI, DVI, LVDS (by Transmitter).
VIA Processor Platform	Ultra low power consumption Passive (fanless) cooling Enables more compact system designs
Slimline 12W Power Supply	Saves system space Enables fanless silent PC designs due to its low heat characteristics Reduces overall system costs Enhances reliability

2.2 Mobile-ITX Board Dimensions

Table 2 below compares the dimensions of the Mobile-ITX with those of other common Computer-on-Module form factors used in the embedded industry. As you can see, the Mobile-ITX specification is currently the smallest available form factor on the market.

Table 2: Computer-on-Module Dimensions Chart

	Maximum Width (mm)	Maximum Depth (mm)	Maximum Area (mm ²)	% Larger than Mobile-ITX
Mobile-ITX	60	60	3,600	-
CoreExpress	58	65	3,770	4.7%
Qseven	70	70	4,900	36%
PC/104	95.9	90.2	8,650	140%
COM express	125	95	11,875	230%



2.3 Mobile-ITX Power Supply Budget

All processors in the VIA processor product family are based on the advanced VIA CoolStream™ Architecture to deliver a power consumption as low as one watt when running in optimized low voltage mode.

Based on different applications and operating modes, the power consumption is described as Table 3.

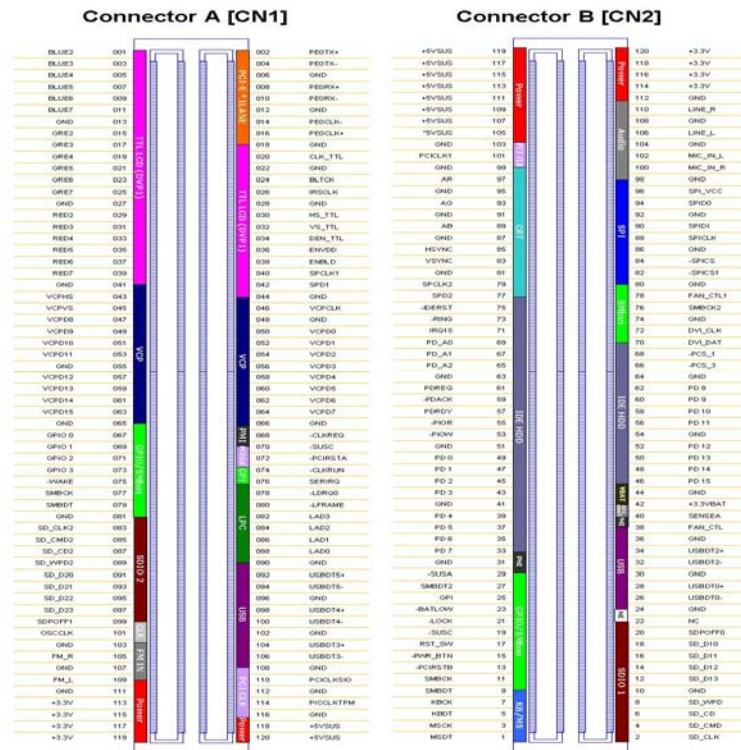
Table 3: Mobile-ITX Power Supply Budget

Item	Power Consumption		
	Voltage	Current (Max)	Watt (Max)
3DMark 2003	5.0V	2.4A	12.0W
Idle at Win XP	5.0V	1.6A	8.0W
Suspend S1	5.0V	0.9A	4.5W

2.4 Mobile-ITX Connectors

The Mobile-ITX specification uses two 120-pin connectors for all I/O signals and 5V single power supply as shown in Figure 1.

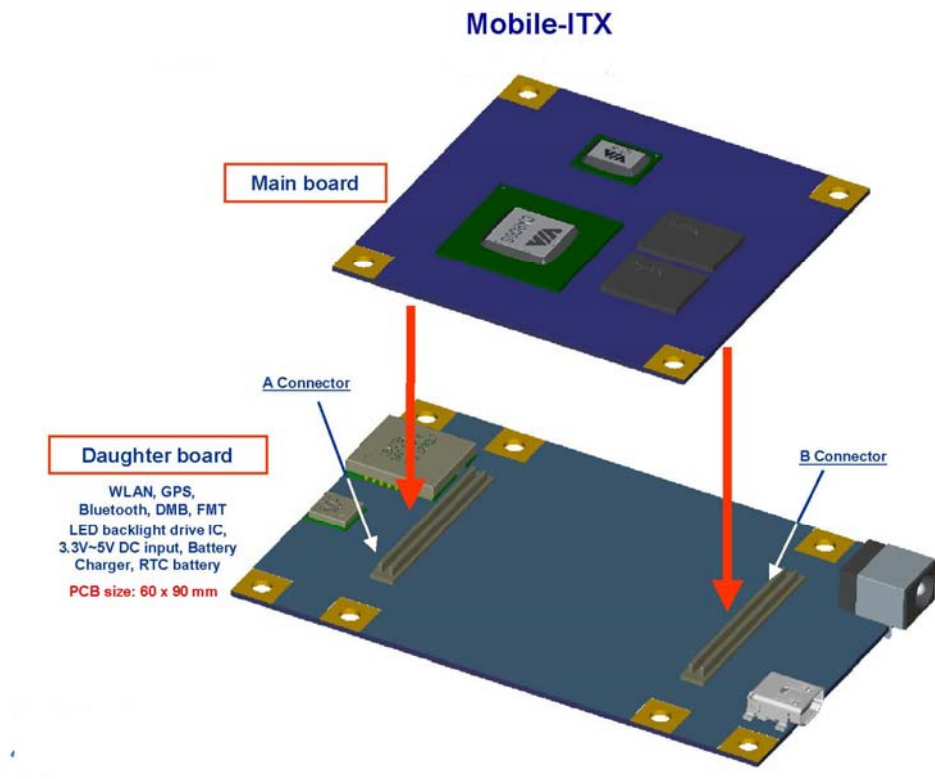
Figure 1: Mobile-ITX 120-pin connectors

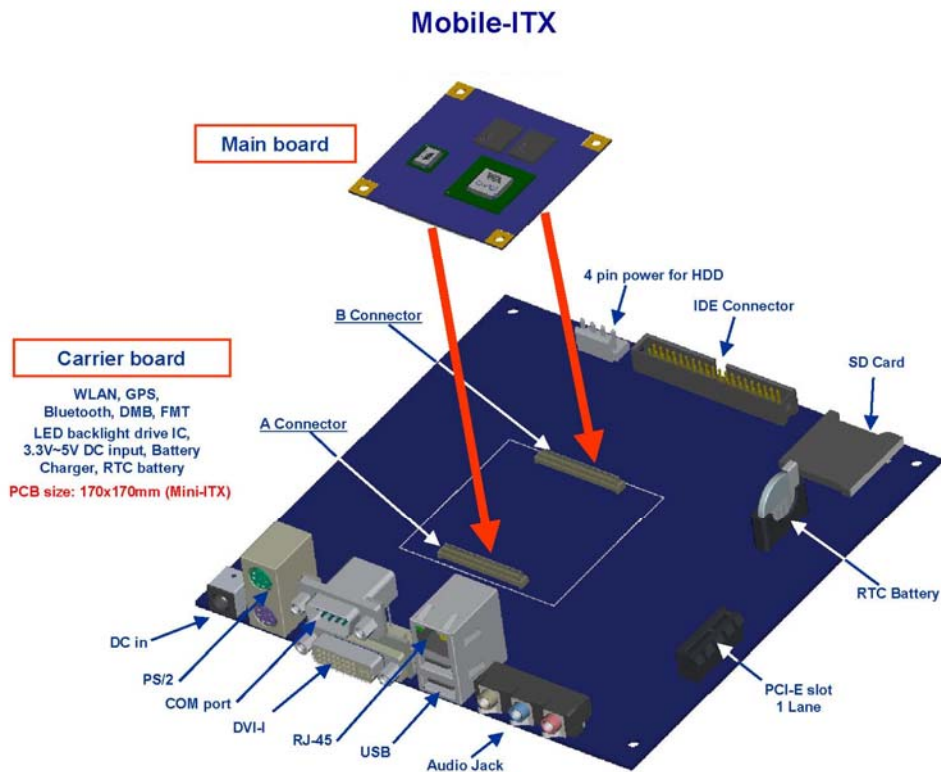


Item	Description	Location
1	BOARD TO BOARD CONN 2001S-120G-220-020-F7 2*60PIN/0.5mm SMD WHITE,LCP FEMALE STRAIGHT,H=2.2mm Neltron	CN1
2	BOARD TO BOARD CONN 2000P-120G-240-020-F7 2*60PIN/0.5mm SMD WHITE,LCP MALE STRAIGHT,H=2.4mm Neltron	CN2

2.5 Mobile-ITX IO Carrier Board Design

There are a range of several I/O carrier board designs to meet different target machine requirements. Typical implementations are shown below:





3. VIA Mobile-ITX Form Factor Reference Design

3.1 VIA Mobile-ITX Form Factor Reference Design Overview

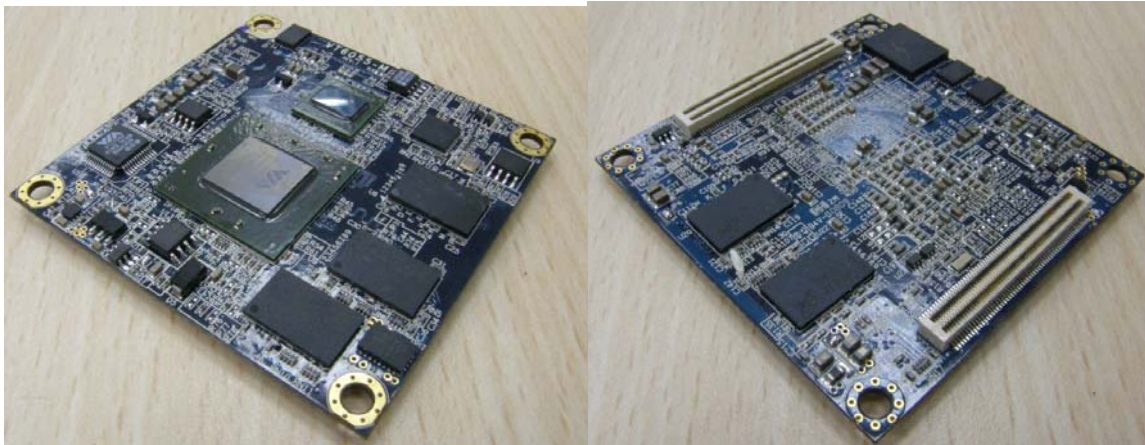
The VIA Mobile-ITX reference design provides developers with a standard platform for designing and building truly cost effective, ultra compact, scalable mainboards incorporating a range of features not previously possible using such a small form factor. With an onboard processor and all-in-chipset, the VIA Mobile-ITX reference design is a complete computer-on-module.

VIA Mobile-ITX is built around VIA's highly integrated system media processors and features a combination of IDE interface and on-board CRT and LCD interfaces to provide a highly flexible and cost effective platform that can be scaled to meet a range of product requirements and feature sets.

The VIA C7-M ULV processor that powers the VIA Mobile-ITX reference design has also been specially adapted for the Mobile-ITX form factor, fabricated with a specially reduced package size of only 11mm x 11mm. Ultra compact versions of VIA's current processor families will also be available for customized Mobile-ITX designs.



Figure 2: VIA Mobile-ITX CPU Module Reference Design



The VIA Mobile-ITX CPU module reference design is ideal for embedded systems, since the embedded market demands much higher levels of energy efficiency and miniaturization than the PC industry, as well as greater product reliability and compatibility. The VIA Mobile-ITX reference design provides a standardized, off-the shelf platform with full hardware compatibility to minimize development and testing time and to speed time to market.

3.2 VIA Mobile-ITX CPU Module Reference Design Specification

The VIA Mobile-ITX CPU module reference design configuration specifies the combination of features as shown in Table 4 below.

Table 4: Mobile-ITX CPU Module Reference Design Specification

Item	Description
PCB	- Mobile-ITX Platform Size HDI 12 Layers - 60mm*60mm
CPU	- VIA C7-M ULV Processor - 400MHz Front Side Bus. - 11mm x 11mm x 1.79mm mobileBGA Package with 400 balls and 0.50mm ball pitch.
Chipset	- VIA All-in-one System Media Processor. - 400MHz Front Side Bus. - 21mm*21mm 1.81mm Flip Chip BGA (Ball Grid Array) Package with 1086 balls and 0.60mm ball pitch.
Graphics	- Enhanced features of VIA VX820 - VIA Chrome9 HC3 integrated Graphics Processor with 2D/3D/Video Controllers. - Support 64/128/256 Frame Buffers Size. - Graphics Engine Clocks up to 250MHz.
On-Board Memory Sub-System	- Supports 512MB DDRII 667/533MHz SDRAM. - Channel A (Shared System and Graphics Memory) - Four onboard DDR2 Memory Chips.
CRT Display Interface	- Supports CRT resolution up to 1920*1440 - Built-in CRT signal to Board-to-Board Connector.
Digital Video Port 1 Interface	- Support 18-bit TTL LCD panel interface. - Support 12-bit /16-bit / 20-bit interface to external TV encoder for NTSC or PAL TV or HDVT display. - Support 12-bit DVI Transmitter Interface. - Built-in DVP1 signal to Board-To-Board Connector.
Video Capture Interface	- Supports parallel and serial Transport Stream input. - Support 8-bit or 16-bit CCIR656/601 input. - Video capture and playback tear free auto flipping. - External Hsync/Vsync support. - Built-in Video Capture signal to Board-To-Board Connector.
USB Interface	- Support five USB 2.0 Ports. - USB 2.0 and Enhanced Host Controller interface (EHCI) V1.0 Compliant. - USB 1.1 and Universal Host Controller interface (UHCI) V1.1 compliant. - Legacy keyboard and PS/2 mouse support.
PCI Express Interface	- PCI Express 1.0a support. - Supports one 1-Lane port for peripheral devices. - Built-in PCI-E signal to Board-To-Board connector.
IDE Interface	- Single Channel EIDE controller supporting 2 Enhanced IDE devices. - Built-in IDE signal to Board-To-Board Connector.
SDIO Host Controller Interface	- Compliant with SD Host Controller Standard Specification ver. 1.00 with both DMA and PIO mode. - Compliant with SD Memory Card Specification ver. 2.0. - Built-in SDIO signal to Board-To-Board Connector.



High Definition Audio Codec	<ul style="list-style-type: none"> - High performance audio controller with 192KHz sample rate, 32-bit per sample and up to 8 channels. - VIA Vinyl VT1708B High Definition Audio Specification Rev.1.0 Compliant. - Support LINE OUT, MIC IN, LINE IN. - Built-in Audio signal to Board-To-Board Connector.
Thermal Monitor	<ul style="list-style-type: none"> - ANALOG DEVICES ADM1032 System Temperature Monitor. - Supports VIA C7/Eden CPU Thermal Diode. - Support SMBus Alert.
Clock Generator	<ul style="list-style-type: none"> - Support SMBus. - ICS Clock Generator - ICS9UM702 Clock Synthesizer.
BIOS	<ul style="list-style-type: none"> - Award System BIOS. - SPI Interface. - One SPI ST M25P40 4Mbit Flash Memory.
Real Time Clock	<ul style="list-style-type: none"> - Integrated DS 12885-style Real Time Clock with extended 256byte CMOS RAM, Day/Month Alarm and Century field. - Built-I RTC signal to Board-To-Board Connector.
Other Interfaces	<ul style="list-style-type: none"> - Low Pin Count interface. - System Management Bus (SMBus) interface - Keyboard / Mouse interface. - General Purpose input/output (GPIO) interface. - Power Management interface. - Built-in all signal to Board-to-Board connector.
Power Supply	<ul style="list-style-type: none"> - Support single 5V DC Power Input. - Built-in Power supply to Board-To-Board Connector.



3.3 VIA Mobile-ITX Form Factor Reference Design Layout

Figures 3 and 3 outline the basic placement of components on the VIA Mobile-ITX mainboard reference design layout, while Figure 6 specifies the board dimensions.

Figure 3: VIA Mobile-ITX CPU Module Reference Design PCB Layout - Top side

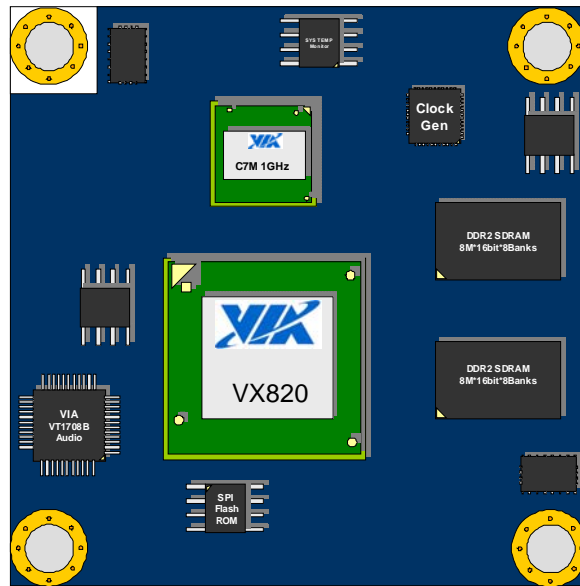


Figure 4: Mobile-ITX CPU Module Reference Design PCB Reference Design Layout - Bottom side

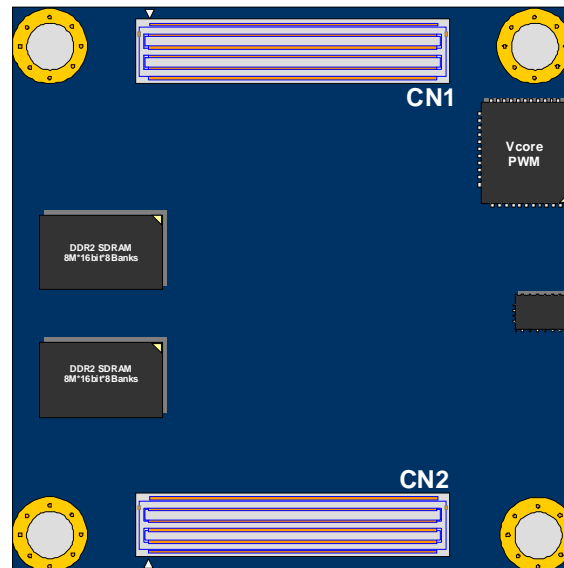
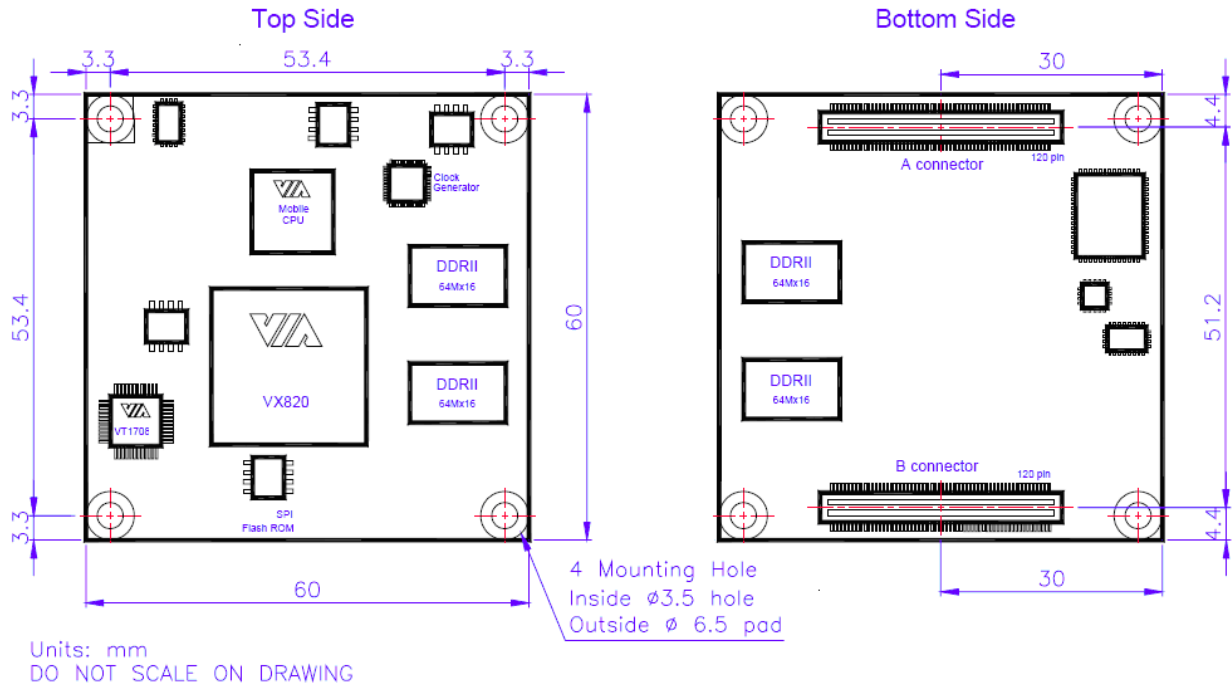


Figure 5: VIA Mobile-ITX CPU Module Reference Design Mechanical Specifications



4. Conclusion

4.1 The Science of 'Small is Beautiful'

Mobile-ITX follows previous VIA specifications and is the fourth generation of platform miniaturization from VIA:

VIA Form Factor	Dimensions	Surface Area	Announced
Mini-ITX	17cm x 17cm	289cm ²	November 2001
Em-ITX	17cm x 12cm	204cm ²	March 2009
Nano-ITX	12cm x 12cm	144cm ²	March 2004
Pico-ITX	10cm x 7.2cm	72cm ²	April 2007
Mobile-ITX	6cm x 6cm	36cm ²	Dec 2009

Remarkably, with the exception of Em-ITX, a board area reduction of exactly 50% has been achieved at each stage of miniaturization, with an overall reduction in size between from Mini-ITX and the Mobile-ITX form factor of more than 87.5%.

Achieving these levels of miniaturization has been facilitated by VIA's principal product design strategy, which focuses on enhanced power efficiency, thermal management and feature integration across both silicon and the platform levels. Only by developing smaller, more energy-efficient components have these size reductions in board design become technologically feasible.



Principal among these advances has been VIA's processor platforms, which have seen an area reduction of 95% over a eight-year timeframe, from the Socket 370 package of 50mm x 50mm, to the nanoBGA2 package of the VIA C7 and VIA Nano processor families of just 21mm x 21mm, and current MobileBGA 11mm x 11mm. The VIA Mobile-ITX reference design has been specifically developed to be powered by the energy efficient VIA processor platforms, such as the VIA Nano, VIA C7 or fanless VIA Eden processors.

The introduction of the Mobile-ITX form factor builds on VIA's tradition of technology leadership at the platform level. The VIA-developed Mini-ITX form factor has been enthusiastically adopted by both developers and hobbyists alike and fostered a whole community dedicated to small form factor design, with multiple vendors offering this form factor in both the PC and embedded industries, and a broad and mature infrastructure in place for chassis and other accessories. Both Nano-ITX and Pico-ITX have also been well received by the embedded market, receiving widespread adoption as industry standard form factors. Mobile-ITX now takes over the mantle as the smallest x86 platform, paving the way for a new breed of innovative modular and compact designs.

5. Contacts

For more information on the Mobile-ITX form factor specification, please visit the VIA corporate website at www.viatech.com.

- 1) International Marketing Contact: Richard Brown, RIBrown@via.com.tw
- 2) Technical Contact: Robert Kuo, RobertKuo@via.com.tw
- 3) VIA Embedded Contact: viaembedded@via.com.tw

