



# **Pico-ITXe™ SPECIFICATION**

**Revision 1.0**

**August 25, 2009**

## IMPORTANT INFORMATION AND DISCLAIMERS

The Small Form Factor Special Interest Group, Inc. (SFF-SIG) does not make any warranties with regard to the Pico-ITXe™ specification (“Specification”) and in particular, neither warrants nor represents that this Specification nor any products made in conformance with it will work in the intended manner. Nor does the SFF-SIG assume responsibility for any errors that the Specification may contain or have any liabilities or obligations for damages including, but not limited to, special, incidental, indirect, punitive, or consequential damages whether arising from or in connection with the use of this specification in any way.

No representation or warranties are made that any product based in whole or part on this Specification will be free from defects or safe for use for its intended purposes. Any person making, using, or selling such product does so at his or her own risk.

**THE USER OF THIS SPECIFICATION HEREBY EXPRESSLY ACKNOWLEDGES THAT THE SPECIFICATION IS PROVIDED “AS IS”, AND THAT THE SFF-SIG MAKES NO REPRESENTATIONS, EXTENDS ANY WARRANTIES OF ANY KIND, EITHER EXPRESS OR IMPLIED, ORAL, OR WRITTEN, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE, OR WARRANTY OR REPRESENTATION THAT THE SPECIFICATION OR ANY PRODUCT OR TECHNOLOGY UTILIZING THE SPECIFICATION OR ANY SUBSET OF THE SPECIFICATION WILL BE FREE FROM ANY CLAIMS OF INFRINGEMENT OF ANY INTELLECTUAL PROPERTY, INCLUDING PATENTS, COPYRIGHT AND TRADE SECRETS NOR DOES THE SFF-SIG ASSUME ANY RESPONSIBILITIES WHATSOEVER WITH RESPECT TO THE SPECIFICATION OR SUCH PRODUCTS. THE SFF-SIG DISCLAIMS ALL LIABILITY, INCLUDING LIABILITY FOR INFRINGEMENT OF ANY PROPRIETARY RIGHTS RELATING TO USE OF INFORMATION IN THIS SPECIFICATION. NO LICENSE, EXPRESS OR IMPLIED BY ESTOPPEL, OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED HEREIN.**

Designers must not rely upon the absence or characteristics of any features marked “reserved”. The SFF-SIG reserves these for future definition and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to them.

Pico-ITXe, Pico-I/O and SUMIT are trademarks and Intellectual Property of the SFF-SIG. All other product names and trademarks, registered trademarks, or service marks are property of their respective owners.

Please send comments via electronic mail to [info@sff-sig.org](mailto:info@sff-sig.org).

Copyright 2008/2009 © Small Form Factor Special Interest Group, Inc.

## Revision History

<b>Revision</b>	<b>Issue Date</b>	<b>Comments</b>
1.0	8/25/09	Initial Release

## **Table of Contents**

1.0	Introduction	5
1.1	SUMIT Expansion on Pico-ITX makes Pico-ITXe	5
1.2	Pico-ITXe Applications	5
1.3	Audience	6
2.0	Related Organizations and Documentation	6
3.0	Pico-ITXe Single Board Computer	7
4.0	SUMIT Implementation on Pico-ITXe	7
4.1	Board-to-Board Spacing	9
4.2	Connector Placement	9
4.3	Stack Direction	11
5.0	Power	11
6.0	Logo and Name Use	11

## **Figures**

Figure 1	Pico-ITXe Outline	7
Figure 2	Sample SUMIT connector placement on a Pico-ITXe SBC	10
Figure 3	Sample SUMIT connector placement on a Pico-ITXe SBC	10

## 1.0 Introduction

### 1.1 SUMIT™ expansion on Pico-ITX makes Pico-ITXe™

The Stackable Unified Module Interconnect Technology (SUMIT) Specification defines the electrical and connector characteristics of a stackable expansion bus for single-board computers and expansion modules. SUMIT defines two identical 52-pin connectors ("A" and "B"), which together carry up to 6 lanes of PCI Express, four USB 2.0 ports, ExpressCard™ support, a LPC (low pin count) parallel bus, SPI/uWire and SMBUS/I<sup>2</sup>C serial buses plus various power and ground supplies. SUMIT specifies only connectors and signals. It is independent of a board's form factor.

This specification defines the form factor (board footprint and mounting hole locations) for Pico-ITXe single board computers and specifies the use of the SUMIT interface to create a stackable architecture embedded computer system. The I/O modules to be stacked on a Pico-ITXe SBC are declared to be Pico-I/O™ modules as defined in the Pico-I/O Specification available from the Small Form Factor Special Interest Group (SFF-SIG) at [www.sff-sig.org](http://www.sff-sig.org).

A Pico-ITXe SBC is defined as a 72 x 100mm single board computer along with one or two SUMIT QMS connectors on the top of the board to support a stack of one or more Pico-I/O modules.

### 1.2 Pico-ITXe Applications

Pico-ITXe single board computers are well suited for:

- Small form factor embedded systems
- High-performance computing
- Low power operational states using "green" computing initiatives
- Very low power and ultra mobile processors
- Processor architectures that include x86, DSP, RISC, MIPS, ARM, others

Pico-ITXe incorporates the PCI Express and USB serial expansion buses that were developed for desktop and mobile environments while leveraging them for use in embedded, medical, and industrial applications. It is a stackable, I/O-centric, multi-board solution for compact embedded systems. Unlike slot-based cards, COM modules or mezzanine cards, Pico-ITXe provides a stackable multi-board solution that is neither processor architecture nor chipset dependent.

Pico-ITXe supports the following I/O connectivity technologies through the two SUMIT connectors (please reference the current SUMIT specification from the SFF-SIG for details available at [www.sff-sig.org](http://www.sff-sig.org)):

- PCI Express channels
- USB 2.0 channels

- ExpressCard channel
- SPI/uWire channels
- SMBus/I<sup>2</sup>C bus
- LPC (Low Pin Count) bus

Pico-I/O™ expansion modules each use one or more of the above busses and pass unused resources further up the I/O stack. Pico-I/O expansion modules measure 60x72mm and are governed by the Pico-I/O specification (please reference current Pico-I/O specification, also from the SFF-SIG for details). With all these features, Pico-ITXe SBCs enable small, rugged, and reliable computer systems that are powerful, easy-to-use, cost-effective, and scalable. Low cost, high performance computer systems can be built for a variety of different embedded applications.

### 1.3 Audience

This document is written for design engineers that understand the basics of SUMIT and the serial busses that are collectively supported by this Specification. It specifies the form factor for Pico-ITXe-compliant SBC.

Since Pico-ITXe and SUMIT support high-speed serial bus signals, care must be exercised with respect to best layout practice for high-speed signals. Please reference industry standard organizations' and special interest groups' websites listed in the SUMIT specification for their design and layout recommendations. Also visit the SFF-SIG website for the current SUMIT specification, application notes, and any design guides that may be available.

## 2.0 Related Organizations and Documentation

### For SUMIT connector information

#### **Samtec, Inc.**

520 Park East Boulevard  
New Albany, IN 47151-1147 USA

Phone: +1-812-944-6733

Fax: +1-812-948-5047

Email: [standards@samtec.com](mailto:standards@samtec.com)

[www.samtec.com/search/sumit.aspx](http://www.samtec.com/search/sumit.aspx)

### For the SUMIT and Pico-I/O Specifications

#### **SFF-SIG**

Small Form Factor Special Interest Group  
2784 Homestead Road #269  
Santa Clara, CA 95051 USA

Phone: +1-650-961-2473

Email: [info@sff-sig.org](mailto:info@sff-sig.org)

[www.sff-sig.org](http://www.sff-sig.org)

### 3.0 Pico-ITXe Single Board Computer

Pico-ITXe is a single board computer (SBC) industry standard that provides for I/O expansion with Pico-I/O modules using the SUMIT Interface. Pico-ITXe systems (including an embedded processor plus one or more stackable I/O modules) occupy a very small space. Pico-ITXe is defined as a 72mm x 100mm board with one or two 52-pin, high-speed SUMIT connectors capable of supporting PCI Express and USB data rates while preserving signal integrity. Through SUMIT, a Pico-ITXe SBC can also support a wide variety of other I/O interfaces with more moderate bus speed requirements.

Figure 1 defines the base Pico-ITXe board outline and corner mounting hole locations.

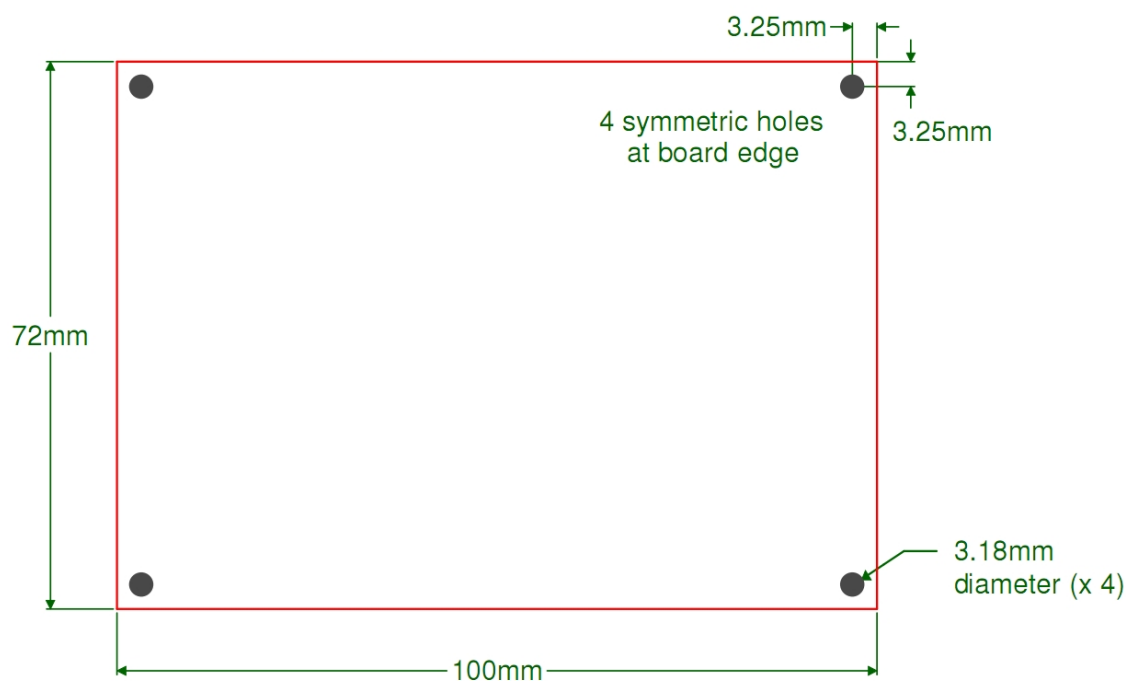


Figure 1: Pico-ITXe outline

### 4.0 SUMIT Interface Implementation on Pico-ITXe

The SUMIT specification defines three configuration alternatives based on having the SUMIT A connector alone, the SUMIT B connector alone, or both SUMIT A and B connectors present on a board. The controlling document is the SUMIT specification published and maintained by the SFF-SIG ([www.sff-sig.org](http://www.sff-sig.org)).

- Configuration A -- consisting of the SUMIT A connector, only
- Configuration AB -- consisting of both the SUMIT A & B connectors
- Configuration B -- consisting of the SUMIT B connector, only

A Pico-ITXe SBC typically uses one or two 52-pin connectors in the SUMIT A, SUMIT B or SUMIT AB configurations based on interface bus requirements and cost considerations. All Pico-ITXe compatible processor boards that wish to support SUMIT AB I/O expansion modules must either include both SUMIT A and SUMIT B connectors or must respect a keep-out area where the missing connector is located. This keep out area has a maximum height restriction of 5.08 mm (0.200-in). Failure to include the keep-out area may prohibit I/O modules with both SUMIT A and SUMIT B connectors from being used with SUMIT A or SUMIT B CPU boards. Note however, that SUMIT AB I/O modules that require signals on the SUMIT B connector can never be used with a SUMIT A CPU board. Similarly, SUMIT AB I/O modules that require signals on the SUMIT A connector can never be used with a SUMIT B CPU board. The chart below describes acceptable Pico-I/O module usage on Pico-ITXe SBCs

		Pico-I/O		
		SUMIT A	SUMIT B	SUMIT AB
Pico-ITXe	SUMIT A	OK	NO	OK
	SUMIT B	NO	OK	OK
	SUMIT AB	OK if SUMIT B signals not used	OK if SUMIT A signals not used	OK

The QFS/QMS Micro High Speed Series used for the SUMIT interface is a 0.635 mm (0.0250-inch) pin pitch connector chosen for Pico-ITXe and Pico-I/O. It is a 1-bank, terminal assembly that provides a ground blade in the center of the connector. Gold plated pins are mounted in a double row configuration. A total of 52 pins are available per connector. With two connectors in the SUMIT AB configuration, a total of 104 pins are available. The connector is rugged so as to support industrial application environments. For more information on these connectors, go to [www.samtec.com/search/sumit.aspx](http://www.samtec.com/search/sumit.aspx)

Only the top QMS connector is used on Pico-ITXe SBCs. The bottom QFS connector is not used. Both QMS and QFS connectors are used on Pico-I/O modules.

Certain chipsets do not support all the I/O interfaces defined on a SUMIT configuration AB. If a vendor's Pico-ITXe CPU board does not or cannot support one or more of the interfaces, it should be clearly marked in their data sheet and technical manuals as defined in the latest SUMIT specification.



## 4.1 Board-to-Board Spacing

The board-to-board spacing between a Pico-ITXe SBC and Pico-I/O module is 15.24 mm (0.600-in) and is measured from the top of the SBC to the bottom of the first I/O board in the stack. This is the mated height of the QMS/QFS pair, as well as the appropriate stand-off (spacer) length for mounting boards together.

The Pico-I/O stack support requires four 3.18 mm (0.125-inch) inside diameter mounting holes for threaded spacers. These are in addition to the four corner mounting holes defined in the Pico-ITXe drawing in Figure 1. Note that the Pico-I/O stack may share one or two mounting holes with the corner mounting holes (depending on orientation of the stack) of the Pico-ITXe SBC.

15.24mm (0.600-in) spacers are required in all four Pico-I/O stack mounting holes to insure rigidity of the stack. This also helps to make sure that the SUMIT connectors on the bottom of the bottom Pico-I/O board in the stack are properly mated to the QMS connectors on the top of the Pico-ITXe SBC. It is important to ensure that the connectors are neither over- nor under-inserted into their mating connectors.

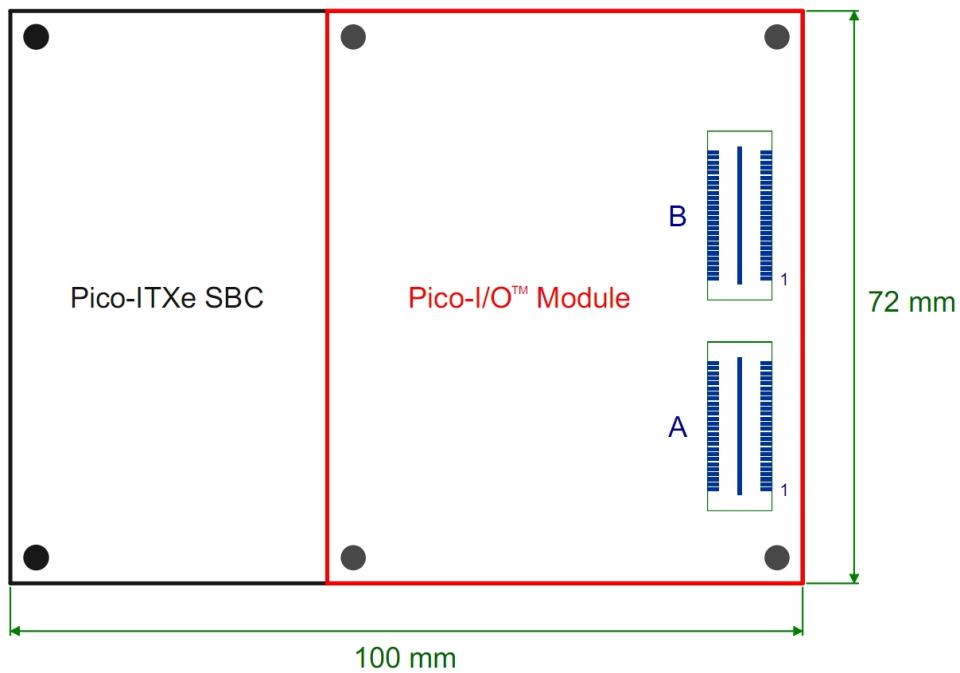
Component height on the top side of a Pico-ITXe SBC board should not exceed 11.05 mm (0.435-in) underneath the Pico-I/O stack. If this component height limit cannot be maintained, it is permissible to use a 22mm height QMS connector on a Pico-ITXe SBC. However, the number of cards which may be supported in the Pico-I/O stack may be reduced. Also the spacer height must be increased accordingly.

## 4.2 Connector Placement

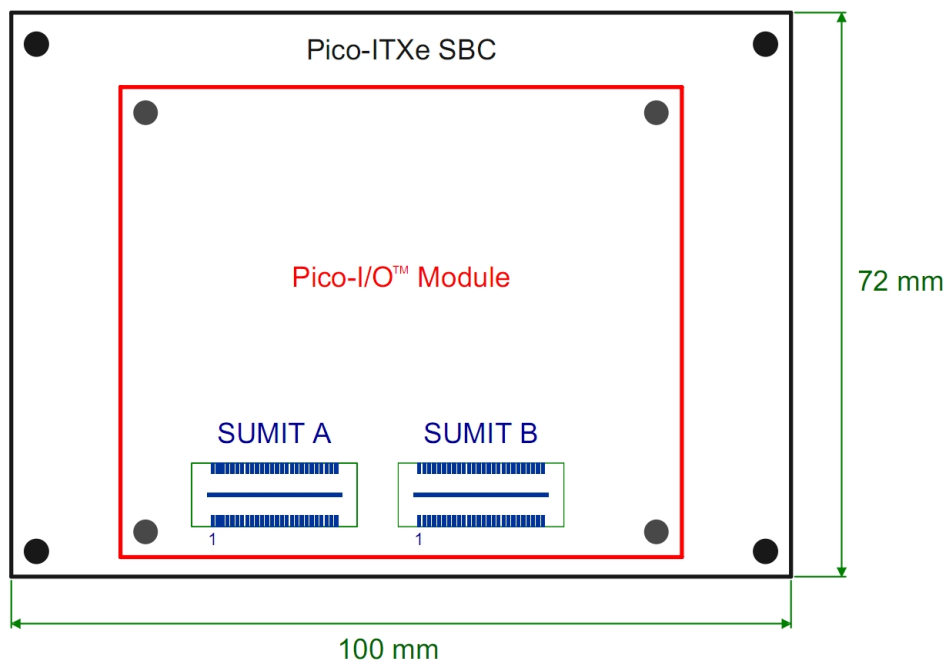
The QMS SUMIT connectors may be placed anywhere on the Pico-ITXe SBC; however, Pico I/O modules should not overhang the edge of the SBC. The four Pico-I/O stack mounting holes must maintain the relationship with the SUMIT connector(s) as specified in the Pico-I/O specification.

The two figures on the next page demonstrate different ways that SUMIT connectors can be placed on a Pico-ITXe board to allow a Pico-I/O module to stack above it. The first example has the SUMIT connectors oriented such that a Pico-I/O board is right justified over the base SBC. This configuration allows the Pico-I/O board to share two of the mounting holes of the Pico-ITXe base board. The second example shows SUMIT connector placement such that a Pico-I/O module is in the bottom center of the SBC.

There are more configurations that are possible and these two are examples that demonstrate the principles of flexibility for I/O expansion with a Pico-ITXe board. Placement and orientation of the SUMIT connectors is at the discretion of the Pico-ITXe designer as long as they adhere to the guidelines in the first paragraph.



**Figure 2:** A sample placement of the SUMIT A and SUMIT B Connectors on a Pico-ITXe SBC. The outline of the Pico-I/O module is shown to the right.



**Figure 3:** Another sample placement of the SUMIT A and SUMIT B Connectors on a Pico-ITXe SBC. Connector placement may vary as long as the relationship between the connectors and the four Pico-I/O mounting holes is maintained.

### 4.3 Stack Direction

The Pico-I/O stack is assembled in one direction only. It is “up” from the Pico-ITXe SBC, which is defined as the bottom board in the stack. A Pico-ITXe SBC may require the Pico-I/O module(s) to stack on the reverse side from the major components. But the stack may only proceed in one direction.

Simultaneous upward and downward stacking is not supported. This is to preserve the point-to-point routing nature of PCI Express and USB, while removing the significant additional cost and complexity necessary to implement processor and I/O expansion cards with this feature for the vast majority of applications.

### 5.0 Power

The SUMIT specification provides for expansion module power to be supplied through both connectors on designated pins. It is up to the system integrator to ensure that the power the processor supplies to the SUMIT connector(s), the number of modules, and total power consumption for all modules are reconciled and conform to the system available resources. It is assumed that the Pico-ITXe board itself is powered from a connector separate from either SUMIT connector.

Pico-ITXe boards must supply both +5 volts and +3.3 volts to the SUMIT connector(s) while +12 volts is optional. This applies only to SBC’s but does not require an I/O card to use all the voltages. It is a power supply source issue to accommodate a variety of possible I/O cards on a stack with their different interface requirements. This does not imply that certain SUMIT interface signals be +5 volt tolerant.

### 6.0 Logo and Name Use



	<u>C</u>	<u>M</u>	<u>Y</u>	<u>K</u>	
The CMYK colors are:	Green	55,	0,	100,	0
	Light Blue	37,	7,	3,	0
	Orange	0,	74,	100,	0
	Dark Blue	81,	61,	0,	0
	Black	0,	0,	0,	100

The use of the Pico-ITXe logo is intellectual property licensed by the SFF-SIG to member companies who believe their products comply with this Specification.

Use of the logo by member companies implies such compliance. Non-member companies are prohibited to use the logo without written permission of SFF-SIG. The SFF-SIG may revoke permission to use logos if they are misused. The Pico-ITXe logo is as follows:

The Pico-ITXe logo must be printed in black or color. The aspect ratio of the entire logo must be maintained, but the size may be varied. Nothing may be added or deleted from the Pico-ITXe logo. Permission is automatically granted to designated SFF-SIG members only as stipulated on the most recent membership agreement during the period of time for which their membership dues are paid.

The Pico-ITXe name and logo are trademarks of the Small Form Factor Special Interest Group and must be acknowledged in all published literature and advertising material in all media formats (i.e. print, electronic, web, etc.).