Pico-I/O™ SPECIFICATION

Revision 1.0

August 25, 2009

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Please send comments via electronic mail to *info@sff-sig.org*.

Revision History

Revision	Issue Date	Comments
1.0	8/25/09	Initial Release

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1.0 Overview

This document is written for design engineers that understand the basics of SUMIT™ and the serial buses that are collectively supported by this Specification. It specifies the form factor, mounting hole locations, connector locations and stacking conventions for Pico-I/O modules to be used for I/O expansion on single board computers that support a SUMIT interface. By definition, this document also defines the relationship between mounting holes supporting the I/O expansion stack and SUMIT connector locations on any single board computer that supports Pico-I/O expansion. However, this document DOES NOT specify the location of the I/O stack itself on any single board computer. The stack may be placed in any location as long as the relationship between the mounting holes supporting the I/O modules and the SUMIT connector placement remains fixed.

Since Pico-I/O 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 Documentation

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
www.samtec.com/search/sumit.aspx

SUMIT Interconnect Specification

SFF-SIG (for the SUMIT Specification)
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3.0 Pico-I/O Module

3.1 Overview

A Pico-I/O module is an I/O expansion module designed to stack on a Single Board Computer (SBC) supporting the SUMIT (Stackable Unified Module Interconnect Technology) Interface. A Pico-I/O module is a 60mm x 72mm size circuit board supporting one or two 52-pin, high-speed connectors capable of supporting PCI Express (PCIe) and USB data rates as well as other moderate-speed I/O bus interfaces separately defined by the independent SUMIT Interconnect Specification (See Section 2 above). This Pico-I/O Specification defines a 4320 sq. mm board footprint with four dedicated corner mounting holes for stand-off mounting. (See Figure 1.) A Pico-I/O module is one half the size of the traditional Industrial Standard Module (ISM™) of 96 x 90mm (8640 sq. mm). This new smaller I/O board standard was made possible by the removal of the legacy ISA and PCI parallel buses and the introduction of the modern lower pin-count serial computer I/O interfaces. A Pico-I/O module can plug into virtually any standard form factor or custom SBC, with SUMIT expansion and mounting holes for a Pico-I/O size module stack. Pico-I/O is unique in that it combines very small size, modularity, flexibility, and interface versatility into a single stack of I/O modules.

Through the SUMIT Interface, Pico-I/O modules incorporate both PCI Express and USB serial buses developed for desktop and mobile environments, leveraging them for use in embedded, military, medical, and industrial applications. It offers a compact, stackable, I/O-centric, multi-board solution for small form factor embedded systems. Unlike slot-based cards, COM modules or mezzanine cards, Pico-I/O provides the I/O portion of a stackable multi-board solution that is neither processor architecture nor chipset dependent. Pico-I/O is a significant milestone in embedded I/O by defining universal I/O in a smaller form factor to take advantage of denser electronics available for the ever-shrinking size of processor modules in the embedded computer marketplace.

Pico-I/O is well suited for:

- Small form factor embedded systems
- Custom I/O
- 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

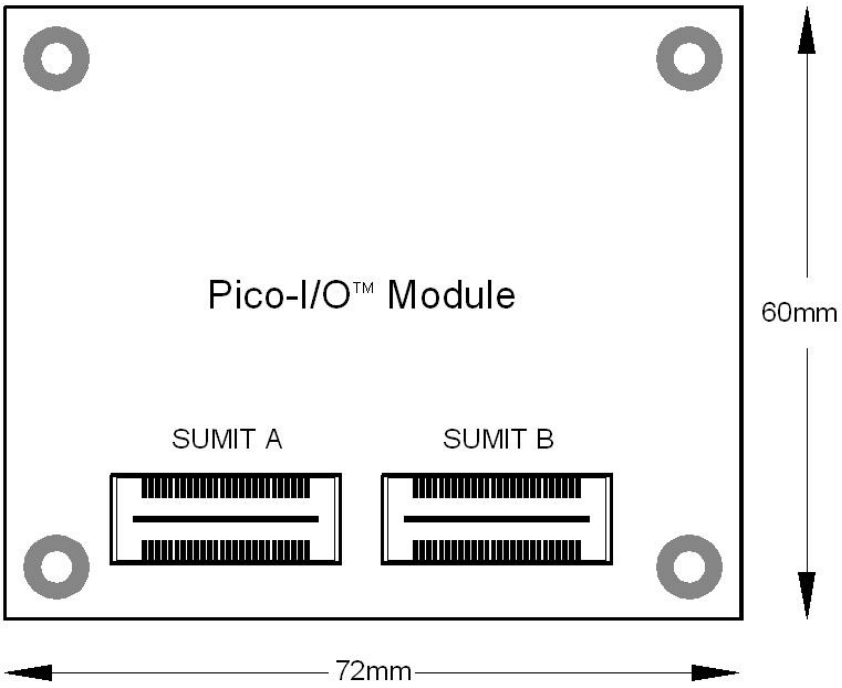

Figure 1: Pico-I/O Module Outline

Pico-I/O supports the following I/O connectivity technologies through the two SUMIT connectors (please reference current SUMIT specification for details):

- PCI Express channels
- USB 2.0 channels
- ExpressCard channel
- SPI/uWire channels
- SMbus/I²C bus
- LPC (Low Pin Count) bus

Pico-I/O add-on modules each use one or more of the above buses and pass unused resources further up the I/O stack. For lower cost and low-to-moderate I/O speed applications, the SUMIT A connector can be used alone. For higher speed I/O requirements both the SUMIT A and B connectors are recommended. This will allow the higher speed interfaces to be closer to the SBC while passing I/O interfaces through to the lower to moderate speed I/O boards further from the CPU. With all these features, Pico-I/O modules 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. This smaller I/O form factor will enable a host of new space conscious mobile OEM equipment for future new and growing computer monitoring and control markets.

3.2 SUMIT Interface

The Pico-I/O Specification provides for the use of one or two, 52-pin connectors in the SUMIT A, SUMIT B or SUMIT AB configurations. The controlling document is the SUMIT specification published and maintained by the SFF-SIG (www.sff-sig.org).

The following chart summarizes the compatibility of Pico-I/O modules with Pico-I/O compatible CPU modules from a connector configuration standpoint.

		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

3.2.1 Board-to-Board Spacing

The board-to-board spacing between Pico-I/O boards is 15.24mm (0.600-in) and is measured from the top of one board to the bottom of the next board in the stack. This is the mated height of the QMS/QFS connector pair, as well as that of the appropriate stand-off (spacer) length for mounting boards together. A total of four 3.18mm (0.125-inch) inside diameter holes are defined for threaded spacers that are used to provide accurate board separation and rigidity.

15.24mm (0.600-in) spacers are required in all four mounting holes to insure rigidity of the stack. This also helps to make sure that the SUMIT connectors are properly mated. It is important to ensure that they are neither over nor under inserted into their mating connectors.

Component height on the top side of a board should not exceed 11.05mm (0.435-in). The component height on the bottom of a board should not exceed 2.54mm (0.100 in) to prevent board-to-board interference while in a stack.

3.2.2 Connector Placement

The QMS is the top-side connector and the QFS is the bottom-side connector for Pico-I/O boards. “Top side” generally refers to the upward facing side of the circuit board for SBC and expansion boards. This is commonly the major component side of the board. “Bottom side” refers to the opposite I/O board side.

“Bottom side” connectors are not used on processor boards. The placement of the QMS/QFS connectors on a Pico-I/O module is shown in Figure 2.

3.2.3 Stack Direction

The stack is assembled in one direction only. It is “up” from the processor board (SBC), which is defined as the bottom board in the stack. A processor board 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 by the Pico-I/O Specification. 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 boards with this feature .

3.2.4 Stacking Order of Expansion Boards

The stacking order for the Pico-I/O modules is significant. Modules with SUMIT AB must be the first boards in the stack. Modules with only SUMIT A or SUMIT B are stacked above the modules with SUMIT AB. Note that both SUMIT A only and SUMIT B only modules cannot be used in the same system. Hence, a Pico-I/O expansion module with a PCIe x4 lane must be closest to the root SBC. Next would be a Pico-I/O expansion module(s) with a PCIe x1 lane. Stacked above that would be any USB, SPI/uWire, SMBus/I²C, and/or LPC modules.

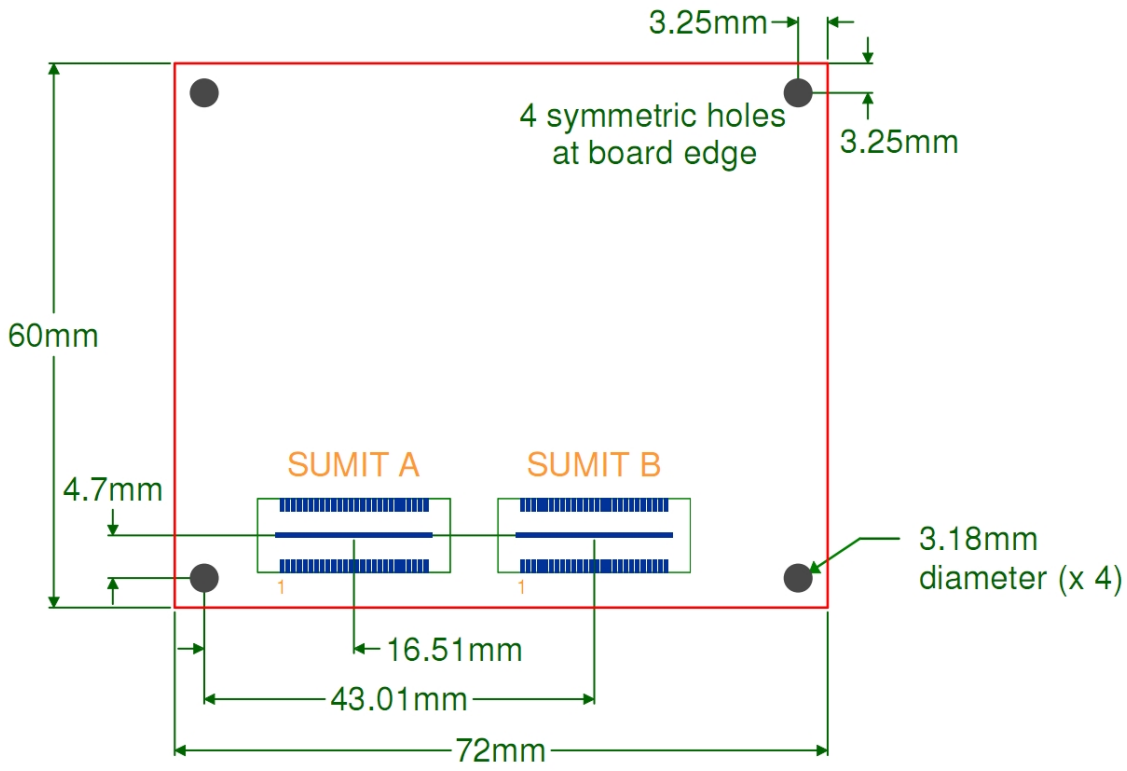

Figure 2: Physical Dimensions and SUMIT Connector Placement on a Pico-I/O Module

4.0 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 supported, and the total power consumption for all modules are reconciled and conform to the system resources available from the CPU. It is assumed that the processor board itself is powered from a connector separate from either SUMIT connector.

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		C	M	Y	K
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	Light Blue	37,	7,	3,	0
	Orange	0,	74,	100,	0
	Dark Blue	81,	61,	0,	0
	Black	0,	0,	0,	100

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