MiniBlade™ SPECIFICATION

Revision 1.00

March 6, 2009

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Revision History

Draft Revision	Issue Date	Comments
1.00	3.06.09	Initial Release

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1.0 Introduction

The MiniBlade system consists of a MiniBlade module and its host socket. The MiniBlade module is a postage stamp-sized, rugged 40-pin card-edge solid-state storage solution intended for embedded system environments. It is complimented by a robust, latching 40-pin socket, available in both vertical and right-angle configurations. Together, the MiniBlade module and MiniBlade socket are known as the MiniBlade storage solution or just MiniBlade technology.

This MiniBlade specification contains information (physical and electrical) on the MiniBlade module (the storage device) and the latching MiniBlade socket. This specification affords a design engineer sufficient pertinent information to implement the MiniBlade module storage solution into an embedded system design.

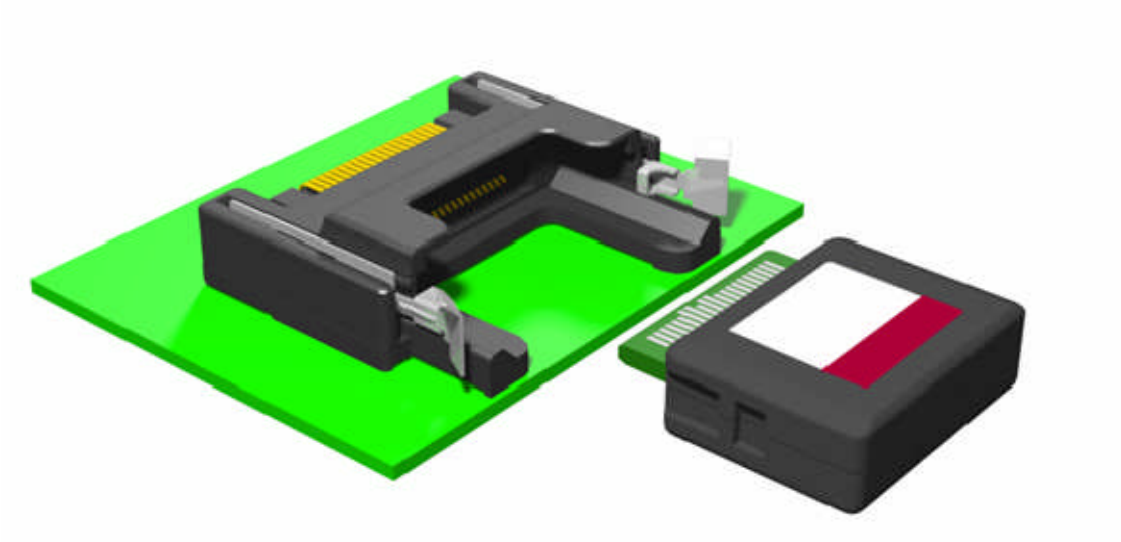


Figure 1 - MiniBlade Module & MiniBlade Socket (right-angle)

1.1 General Description

MiniBlade technology is intended to meet the storage requirements of high-reliability, high-performance and multi-year life-cycle embedded applications. These systems may be deployed in environments that must endure high-vibration, temperature extremes, G-forces and other difficult environments.

The criteria for developing MiniBlade module technology are small size, mechanically rugged, support an array of common protocols and achieve initial storage capacity of 8GB. As the storage technology matures MiniBlade module

capacity could become larger. The array of protocol support may also be expanded.

The MiniBlade module is encapsulated in a rugged plastic frame. This frame has chamfered corners that act as a polarization feature to ensure proper insertion into the MiniBlade socket. There is a pocket in either side of the frame to accommodate the latches from the MiniBlade socket to ensure a firm insertion.

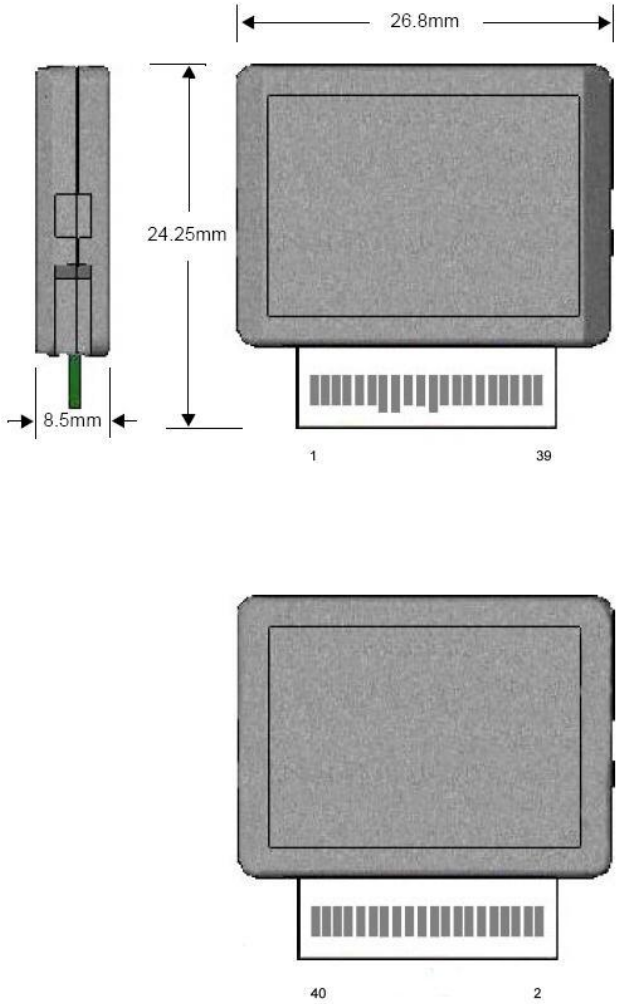


Figure 2 - MiniBlade Module

The 40-pin MiniBlade socket is available in a vertical or right-angle configuration. Like the MiniBlade module, the MiniBlade socket is designed to endure environments which require high-reliability, high-performance and long product life cycles. The MiniBlade socket has latching tabs on both sides which provide a secure fit when the MiniBlade module is properly inserted. These latches snap into the pockets on the MiniBlade module shell. The MiniBlade socket is a high-speed socket, able to handle all protocols called out in this specification.

MiniBlade technology supports the PCIe, SATA, SDIO, MMC and USB interfaces that were originally developed for desktop and mobile environments while leveraging them for use in embedded, medical, instrumentation, communications and industrial applications. A single MiniBlade socket may support more than one protocol simultaneously. While initial MiniBlade modules may support only mass storage, it is the intention of this specification to lay the groundwork for MiniBlade modules that address other I/O capabilities such as wired or wireless networking and GPS.

Likely Uses

- Flash disk drive on single-board computers
- Operating system boot device
- Wireless transceivers

Likely Applications

- Industrial control systems
- Wireless data loggers
- Process monitoring probes
- Wearable computers
- Automotive
- Medical
- Military

This iteration of MiniBlade technology specifically supports the following I/O connectivity:

- One (x1) PCIe channel
- One USB 2.0 channel
- One SATA 3.0Gbps channel
- One 8-bit MMC or One 4-bit SDIO channel (Optional SPI is overlaid on this channel).

A given MiniBlade module may use one or more of the above interfaces. In the event that a host platform does not include all of the interfaces simultaneously, included interfaces must be clearly declared on all product documentation.

1.2 Audience

This document is written for design engineers that understand the basics of PC-style peripherals and chipsets. It specifies the electrical and mechanical parameters of the MiniBlade socket and MiniBlade modules in order to ensure multiple sourcing.

Since MiniBlade supports 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 below for their design and layout recommendations.

1.3 Related Documents and Organizations

The MiniBlade specification makes reference to, and is based on the current version of the following specifications and datasheets:

MiniBlade Socket
Samtec SiliconBlade™ Socket datasheet
Samtec, Inc.
520 Park East Boulevard
New Albany, IN 47151-1147 USA
Phone: +1-812-944-6733
Fax: +1-812-948-5047
http://www.samtec.com

MiniBlade Module
SiliconSystems SiliconDrive™ Blade Solid-State Drives datasheet
SiliconSystems, Inc.
26840 Aliso Viejo Parkway
Aliso Viejo, CA 92656 USA
Phone: +1-949-900-9400
Fax: +1-949-900-9500
Email: info@siliconsystems.com
http://www.siliconsystems.com

Interfaces

SD Card Association
2400 Camino Ramon, Suite 375
San Ramon, CA 94583 USA
Telephone: +1 (925) 275-6615
Fax: +1 (925) 886-4870
E-mail: office@sdcard.org
http://www.sdcard.org

SATA-IO Administration
3855 SW 153rd Drive
Beaverton, Oregon 97006 USA
Tel: +1 503-619-0572
Fax: +1 503-644-6708
E-mail: admin@sata-io.org
http://www.sata-io.org

PCI Express Specification
PCI-SIG
3855 SW 153rd Drive
Beaverton, OR 97006 USA
Phone: +1-503-619-0569
Fax: +1-503-644-6708
http://www.pcisig.com

USB
USB Implementers Forum, Inc.
3855 SW 153rd Drive
Beaverton, OR 97006
http://www.usb.org

MMC
JEDEC
3103 North 10th Street
Suite 240 South
Arlington, VA 22201-2107
Phone: +1.703.907.7540
Fax: +1.703.907.7583
http://www.jedec.org

SPI
The SPI bus is a *de facto* standard, rather than one agreed by any international committee. The reason for this is its essential simplicity. A good reference is http://www.freescale.com/files/microcontrollers/doc/ref_manual/S12SPIV3.pdf

2.0 Acronyms and Terms

ATX-style: Refers to the power supply configuration that allows the computer to be turned off via software. ATX power supplies have two separate five volt signals, one that powers up and down with the system (+5V) and one that remains powered unless the supply is unplugged from the AC source (+5VSB, standby) in order for the system to be capable of waking up from network traffic, keyboard, etc.

Lane: A PCI Express link is built around dedicated unidirectional couples of serial (1-bit), point-to-point connections known as "lanes". PCI Express lanes are full-duplex links, meaning that data can be transferred in both directions simultaneously (Tx transmit and Rx receive lines are separate).

Lane counts are written with an “x” prefix with “x1” designating a single-lane and ”x4” for a four-lane interface. A x1 (pronounced “by one”) lane is very space efficient compared to the parallel PCI bus that it replaces, with 2.5 times the bandwidth using only five signals.

Link: A connection between any two PCI Express devices is known as a "link", and is built up from a collection of one or more lanes. All devices must minimally support single-lane (x1) link.

MMC: A memory card form factor that uses SDIO signals.

PCIe: Abbreviation for PCI Express. It is a high-speed computer expansion bus designed to replace the general-purpose PCI expansion bus. It is software compatible with PCI in order to be transparent to system software. It is structured around point-to-point full-duplex serial links called lanes. In PCI Express version 1.1 (currently the most common version), each lane operates at a data rate of 250 MB/s in each direction.

MiniBlade™ supports two single lanes and one quad lane of data between the baseboard and expansion card. Lane counts are written with an “x” prefix with “x1” designating a single-lane and ”x4” for a four-lane interface. A x1 (pronounced “by one”) lane is very space efficient compared to the parallel PCI bus that it replaces, with 2.5 times the bandwidth using only five signals. Four lanes of 250 MB/s in a x4 link gives a maximum transfer rate of 1 GB/s (250 MB/s x4) in each direction for PCIe 1.1.

SBC: Abbreviation for Single Board Computer.

SBS: Samtec, Inc. SiliconBlade socket . 2X20 positions card edge connector with latches.

SDIO: Secure Digital I/O. Secure Digital (SD) is a flash (non-volatile) memory card format developed by Matsushita, SanDisk, and Toshiba for use in portable devices such as digital cameras, handheld computers, PDAs, mobile phones, GPS receivers, and video game consoles. Although SD cards are typically for consumer applications, the interface signals and software are useful for embedded applications when placed on a suitably rugged connector.

SMBus: System Management Bus — A simple two-wire bus, derived from I^2C and used in the x86 architecture for communication with low-bandwidth devices such as memory sticks, clock generators, and temperature sensors.

USB: Universal Serial Bus — It is a serial bus designed to allow peripherals to be connected using a single standardized interface which replaces certain legacy varieties of serial and parallel ports.

3.0 Connector

3.1 Connector and Placement

MiniBlade uses a 40-pin card edge connector. Both vertical and right-angle (low profile) sockets are part of the standard. The assignments for the connector pins are shown in Appendix B. MiniBlade can support Generation 1 PCI Express data rates of 2.5Gb/s. Actual test results to demonstrate that it will support data rates of 5Gb/s which is required for PCI Express Generation 2 are not available at the time this specification version was created. In addition, the USB 2.0 data rate of 480Mbps is supported.

The Samtec SBS-120-01-S-DV-A-ML socket with a 0.8 mm (0.031-inch) pin pitch is the vertical connector designed specifically for MiniBlade. The right-angle connector part number is SBS-120-01-S-DH-WT-ML . Gold plated pins are mounted in a double row configuration. A total of 40 pins (2X20) are available in the MiniBlade socket. The connector is rugged enough to support many industrial environments. For more information about these connectors, contact Samtec as listed in section 1.3 above.

Specifications, drawings, and suggested PCB land patterns for the socket and the mating gold-plated PCB traces (card edge fingers) are in Appendix A.

Certain chipsets do not support all the interfaces defined on a MiniBlade socket. If an SBC vendor's board does not or cannot support one or more of the interfaces, it should be clearly marked in the data sheet and technical manuals.

4.0 Power

The MiniBlade specification provides for power to be supplied on designated pins. Ground return is supplied through individual pins in each bank populated.

The power available to a MiniBlade module is shown below, although the processor board chosen may also limit the total power available to modules somewhat less than the MiniBlade specification. Power requirements in excess of the SBC's available power specification, or greater than those listed below for the system level definition, must be supplied by a secondary connector on the MiniBlade module itself.

In any case, it is up to the system integrator to ensure that the power the processor supplies to the MiniBlade connector(s), the number of modules, and total power consumption for all modules are reconciled and conform to the system available resources.

The following tables describe the typical power a host systems should make available for each MiniBlade module in the system. MiniBlade modules that require power in excess of these ratings should document such requirements in the module's datasheet or user manual.

4.1 MiniBlade System Power Specifications

MiniBlade module type	Interface	Host-supplied minimum current	Voltage tolerance
Solid-state storage	USB 2.0	200mA	+5V ± 10%
Solid-state storage	SATA	400mA	5V ± 10%
Solid-state storage	SD	120mA	3.3V ± 10%
Solid-state storage	MMC	120mA	3.3V ± 10%
Solid-state storage	PCIe	500mA	3.3V ± 10%
Solid-state storage	SPI	120mA	3.3V ± 10%
Solid-state storage	USB 3.0	At the time of publication, this interface has not been built and tested. Please contact SFF-SIG for status of verification	

Connector Ratings @ +85°C:	
+3.3V	3A continuous
+3VSB	3A continuous
+5V	3A continuous

Appendix A

MiniBlade™ Connector Physical Specifications

Samtec Part Number SBS-120-01-S-DV-A-ML

Materials	Spec
Housing:	LCP (Liquid Crystal Polymer) Thermoplastic, UL 94-V0
Contact:	BeCu
RoHS Compliant:	Yes

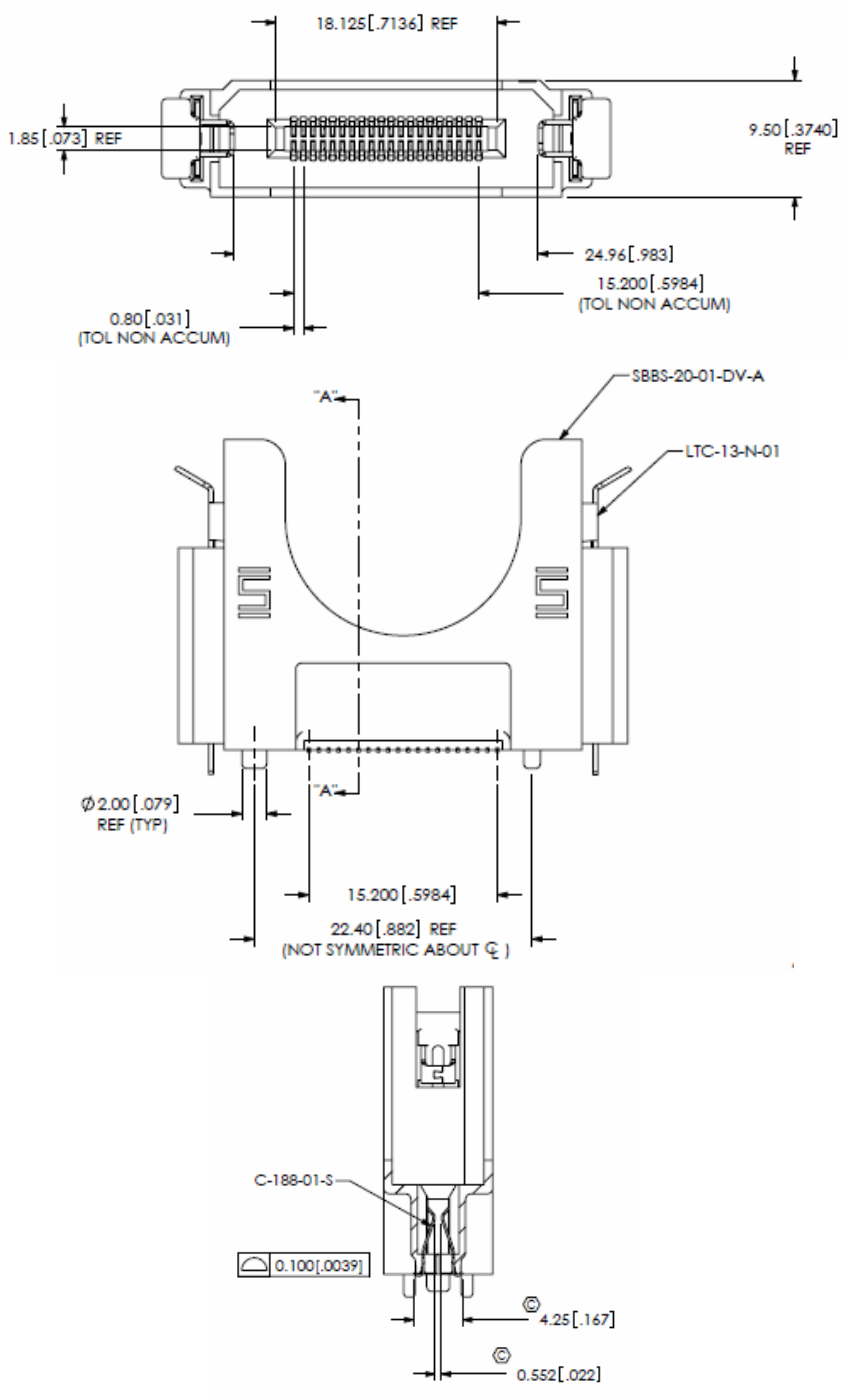
Contact Finish	Spec
Socket Interface:	30 micro-inches Gold On Contact Area
Underplate:	50 micro-inches Minimum of Nickel

Electrical Performance	Spec
Contact Current Capacity:	3.1 A @ 30°C Temp Rise

Solderability	Spec
Lead-Free Solderable?	Yes
Processing Temperature:	260°C Produces No Blistering, Distortion, or Discoloration (20 seconds, 3x) 230°C for 60 seconds
SMT Lead Coplanarity	0.004” (0.1mm) max

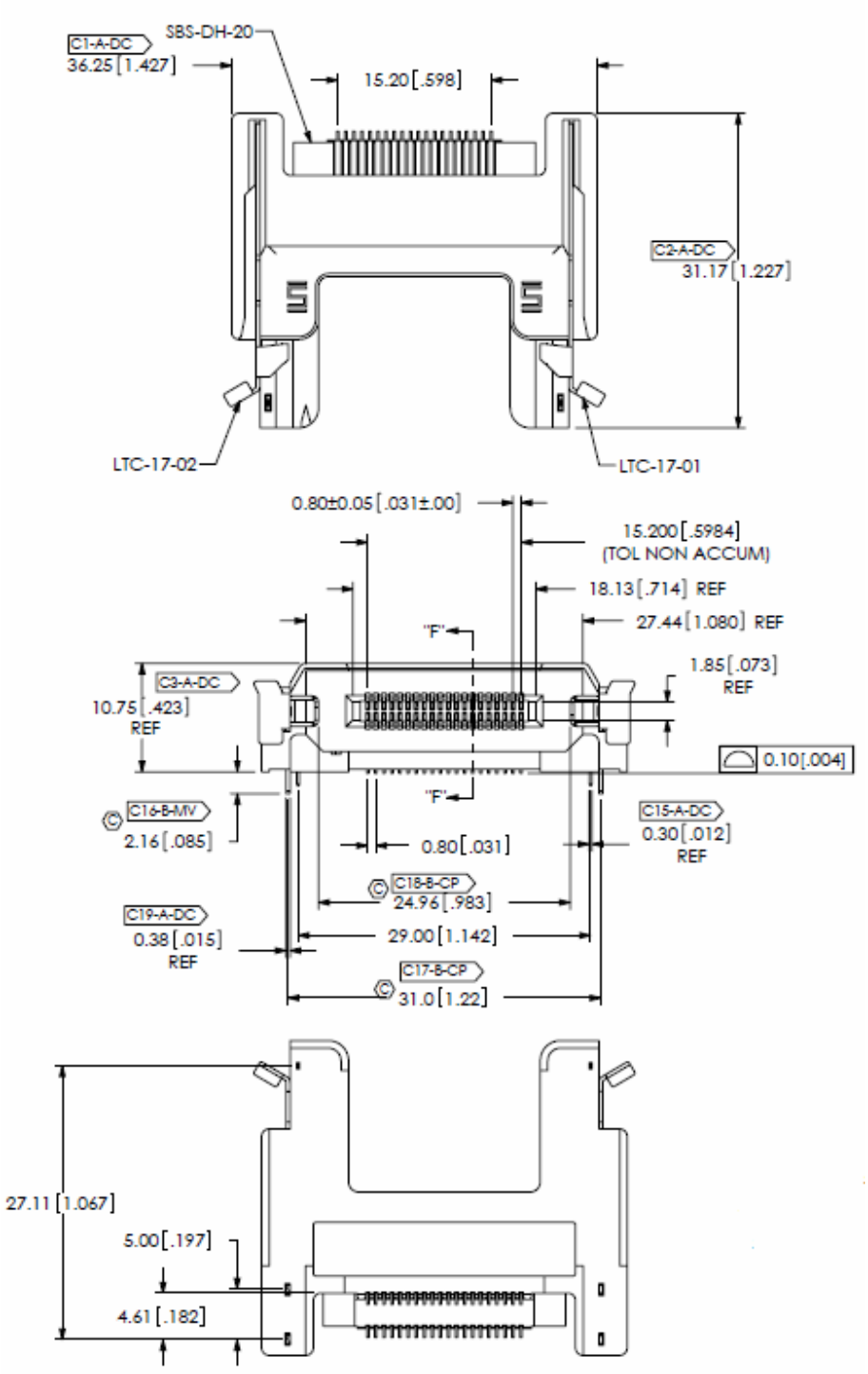
MiniBlade Vertical Connector Drawings

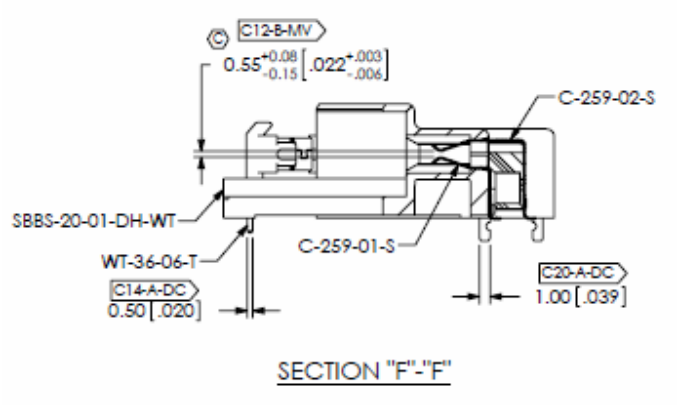
Dimensions in mm [in.]



MiniBlade Right Angle Connector Drawings

Dimensions in mm [in.]

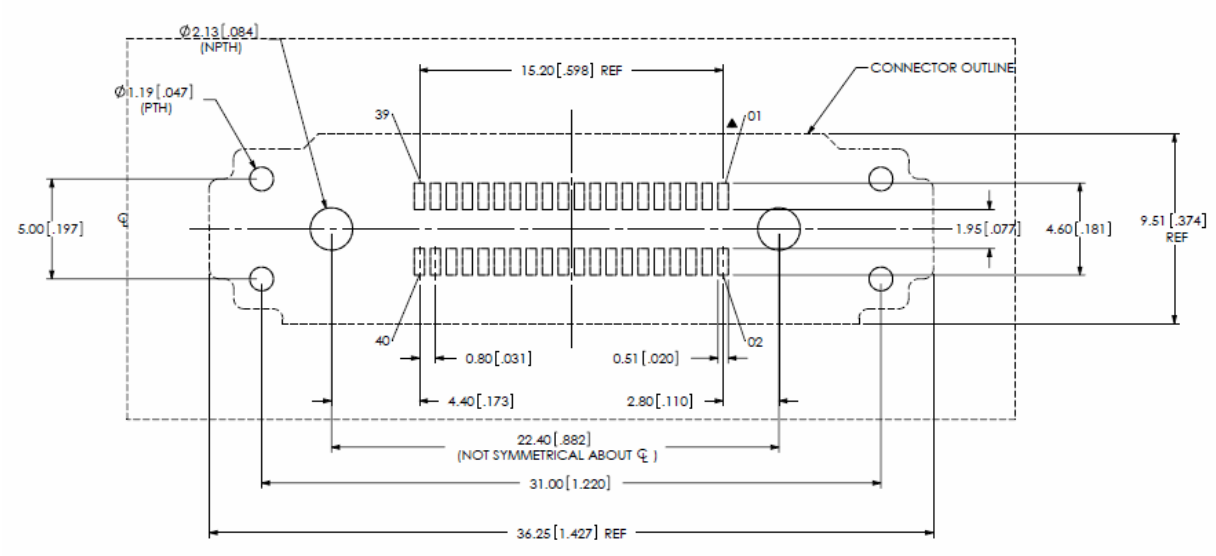

C1-A-DC
36.25 [1.427]
SBS-DH-20
15.20 [.598]
C2-A-DC
31.17 [1.227]
LTC-17-02
LTC-17-01
0.80±0.05 [.031±.00]
15.200 [.5984]
(TOL NON ACCUM)
18.13 [.714] REF
27.44 [1.080] REF
'F'
1.85 [.073]
REF
C3-A-DC
10.75 [.423]
REF
0.10 [.004]
C16-B-MV
2.16 [.085]
C15-A-DC
0.30 [.012]
REF
0.80 [.031]
C18-B-CP
24.96 [.983]
C19-A-DC
0.38 [.015]
REF
29.00 [1.142]
C17-B-CP
31.0 [1.22]
27.11 [1.067]
5.00 [.197]
4.61 [.182]



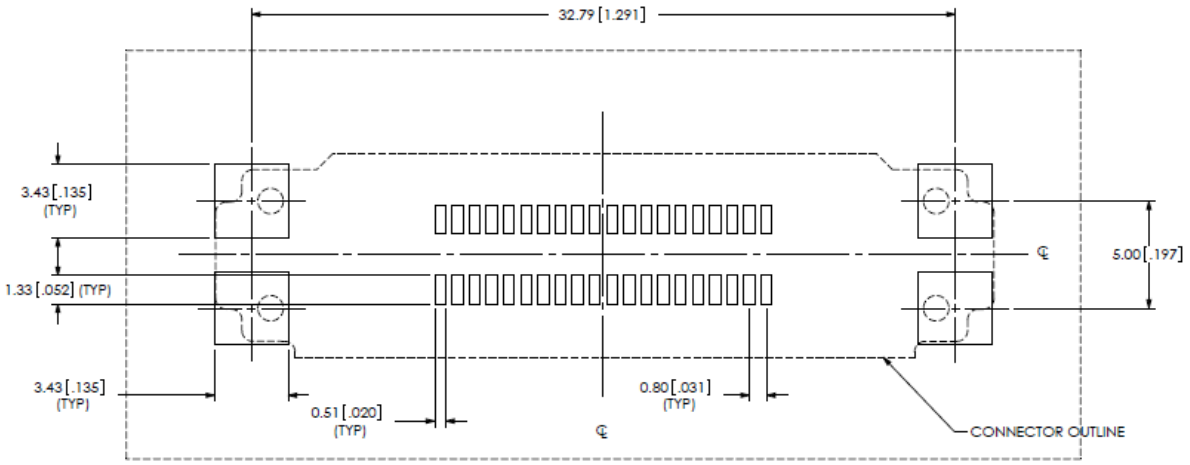
Recommended PCB and Stencil Layouts

Dimensions in mm [in.]

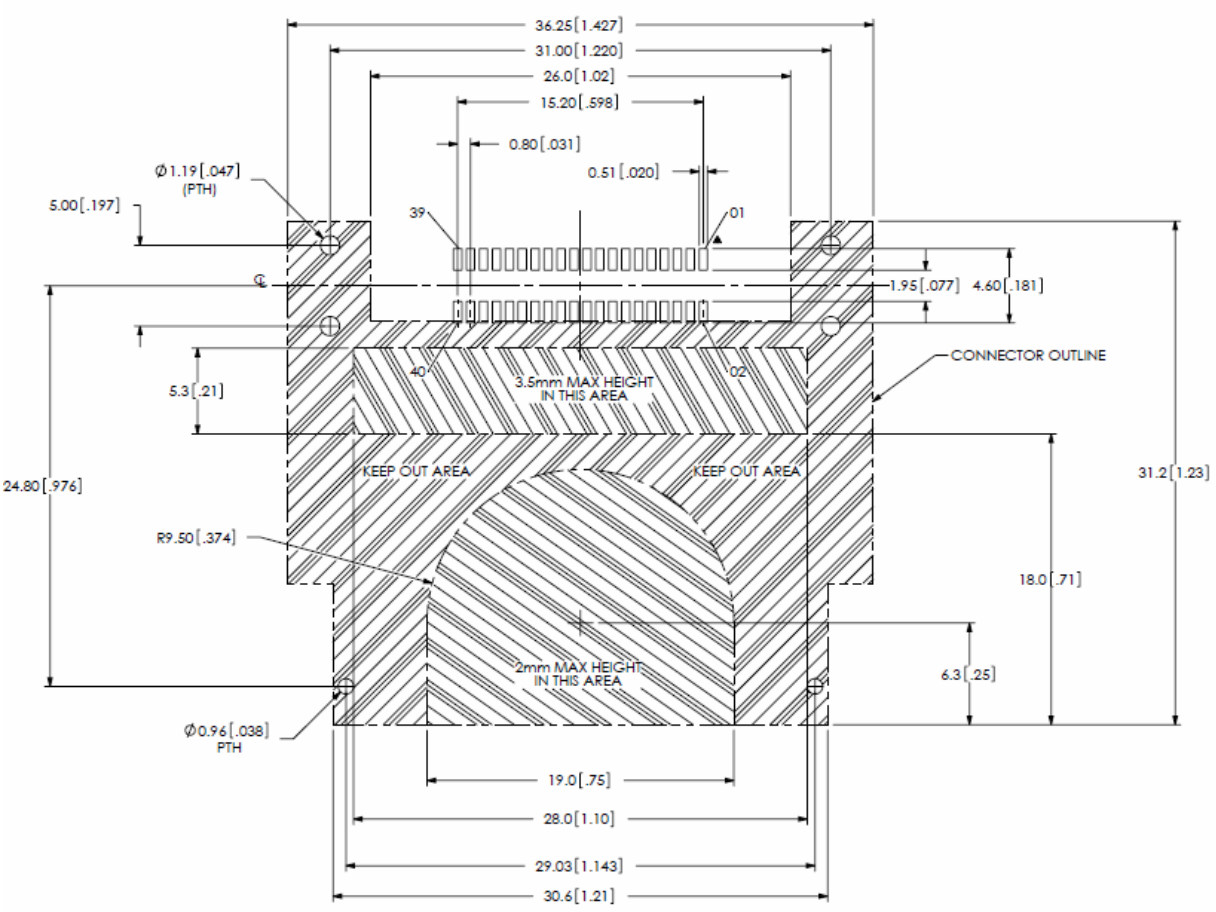
All dimensions are symmetric about the centerline.



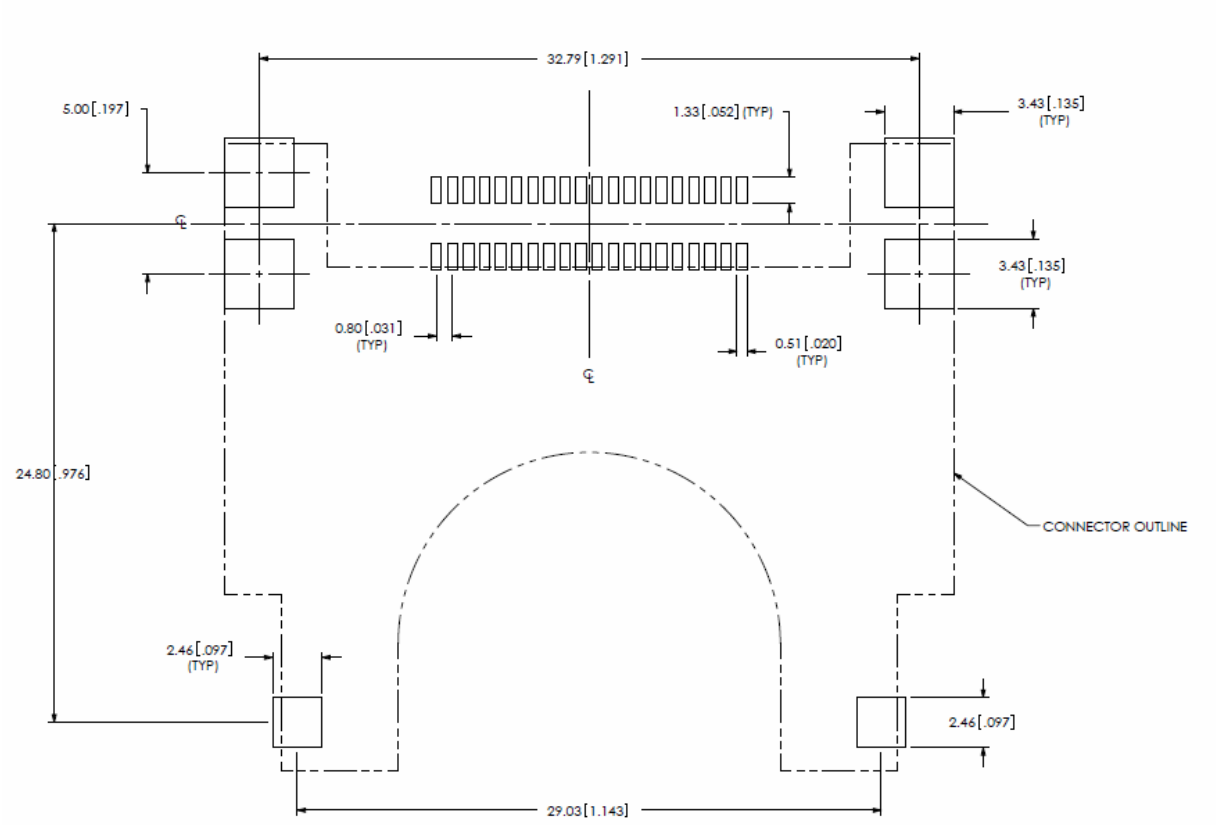
PCB layout for vertical MiniBlade socket



Stencil layout for vertical MiniBlade socket



PCB layout for right angle MiniBlade socket



Stencil layout for right angle MiniBlade socket

Appendix B

MiniBlade Connector Pin Assignments

Pin	Notes	Pin	Notes
1	+3VSB: Optional. Connecting the always-on standby voltage +3VSB to the target electronics allows the module to remain powered during low-power ACPI suspend/standby/sleep states for those SBCs that support ACPI. The module would then be capable of waking up (resuming) the system. Support for optional features must be declared in data sheets and manuals of host boards and MiniBlade modules***. If not used, +3VSB must be tied to +3V on the host system. The +3VSB and +3.3V pins must NOT be connected together on a MiniBlade module.*** Doing so would short-circuit the power supply on an ACPI-enabled SBC.	2	GND: All ground and power pins implemented on MiniBlade modules must be on long gold fingers as defined in the table below.
3	USB3TX+: At the time of publication, this interface has not been built and tested. Please contact SFF-SIG for status of verification.	4	SATA+:
5	USB3TX-: At the time of publication, this interface has not been built and tested. Please contact SFF-SIG for status of verification.	6	SATA-:
7	+3.3V: All ground and power pins implemented on MiniBlade modules must be on long gold fingers as defined in the table below.	8	+5V: All ground and power pins implemented on MiniBlade modules must be on long gold fingers as defined in the table below.
9	USB3RX-: At the time of publication, this interface has not been built and tested. Please contact SFF-SIG for status of verification.	10	PERST# or SDIO_WP: Reserved for future use as a general purpose interrupt
11	USB3RX+: At the time of publication, this interface has not been built and tested. Please contact SFF-SIG for status of verification.	12	BLADE_REQ#: General-purpose interrupt request signal from the MiniBlade module to the host SBC/chipset
13	+3.3V: All ground and power pins implemented on MiniBlade modules must be on long gold fingers as defined in the table below.	14	MMC_SDIO_D0 or SPI_DO: The SPI pin-out is an alternate to SD/MMC and is overlaid in the pin-out. Refer to the table below.
15	GND: All ground and power pins implemented on MiniBlade modules must be on long gold fingers as defined in the table below.	16	MMC_SDIO_D1 or SPI_IRQ: The SPI pin-out is an alternate to SD/MMC and is overlaid in the pin-out. Refer to the table below.
17	USB+:	18	MMC_SDIO_D2
19	USB-:	20	MMC_SDIO_D3 or SPI_CS#: The SPI pin-out is an alternate to SD/MMC and is overlaid in the pin-out. Refer to the table below.
21	GND: All ground and power pins implemented on MiniBlade modules must be on long gold fingers as defined in the table below.	22	MMC_SDIO_D4
23	A_PETp0	24	MMC_SDIO_D5

Pin	Notes	Pin	Notes
25	A_PETn0	26	MMC_SDIO_D6
27	BLADE_PRSNT#: Always grounded by the MiniBlade module. This signal must be on module short pins for PnP (plug-and-play / hot-swap) module applications.	28	MMC_SDIO_D7
29	A_PERp0	30	MMC_SDIO_CMD or SPI_DI: The SPI pin-out is an alternate to SD/MMC and is overlaid in the pin-out. Refer to the table below.
31	A_PERn0	32	MMC_SDIO_CLK or SPI_SCLK: The SPI pin-out is an alternate to SD/MMC and is overlaid in the pin-out. Refer to the table below.
33	GND: All ground and power pins implemented on MiniBlade modules must be on long gold fingers as defined in the table below.	34	+5V: All ground and power pins implemented on MiniBlade modules must be on long gold fingers as defined in the table below.
35	A_CLKp	36	SATB-
37	A_CLKn	38	SATB+
39	PCIe-PRSNT#: Grounded by the MiniBlade module only if PCIe is used to save power and reduce EMI from A_CLK toggling, This signal must be on short pins for PnP (plug-and-play / hot-swap) module applications.	40	GND: All ground and power pins implemented on MiniBlade modules must be on long gold fingers as defined in the table below.

Note: Signals are implemented as gold plated card edge signals. An inner layer ground plane must extend to the end of the module underneath the gold fingers.

MiniBlade Module Recommended Pin Lengths

Signal Type	Pin Length
Power and ground	2.6 mm
BLADE_PRSNT#	1.6mm
All other signals	2.1 mm

Interfacing to USB Protocol

The USB standard defines three modes of operation. Detailed descriptions and technical documentation for the USB 1.1, 2.0 and 3.0 specifications can be found at http://www.usb.org.

MiniBlade Module pin-outs vary by operating mode.

USB 1.1/2.0

Pin #	Signal
8,34	+5V
2,15,21,33,40	GND
17	USB+
19	USB-
27	BLADE_PRSNT#

USB 3.0

Pin #	Signal
3	USB3TX+
5	USB3TX-
8,34	+5V
9	USB3RX+
11	USB3RX-
2,15,21,33,40	GND
17	USB+
19	USB-
27	BLADE_PRSNT#

Note: At the time of publication, USB 3.0 designs have not been built and tested. Please contact SFF-SIG for status of verification. Host platforms must connect 3.3V and 5V signals in all cases. Host platforms that do not supply +3.3VSB must connect +3.3VSB to +3.3V in all cases. This specification does not allow for exceptions.

Interfacing to SATA Protocol

SATA has three modes of operation: SATA 1.5 Gb/s, SATA 3 Gb/s, and SATA 6 Gb/s. All three modes support the same pin-out configuration and require a +5V supply voltage. Further documentation and specifications for SATA can be found at http://www.serialata.org.

Pin #	Signal
2,15,21,33,40	GND
4	SATA+
6	SATA-
8,34	+5V
27	BLADE_PRSNT#
36	SATB-
38	SATB+

Note: Host platforms must connect 3.3V and 5V signals in all cases. Host platforms that do not supply +3.3VSB must connect +3.3VSB to +3.3V in all cases. This specification does not allow for exceptions.

Interfacing to MultiMedia Card (MMC) Protocol

MultiMedia Card protocol has two modes of operation: eight-bit (high speed) and four-bit. Further documentation and specifications for the MMC interface can be found at http://www.mmca.org or http://www.jedec.org.

8-bit High Speed MMC

Pin #	Signal
1	+3VSB
2,15,21,33,40	GND
7,13	+3.3V
10	PERST# or SDIO_WP
14	MMC_SDIO_D0 or SPI_DO
16	MMC_SDIO_D1 or SPI_IRQ
18	MMC_SDIO_D2
20	MMC_SDIO_D3 or SPI_CS#
22	MMC_SDIO_D4
24	MMC_SDIO_D5
26	MMC_SDIO_D6
27	BLADE_PRSNT#
28	MMC_SDIO_D7
30	MMC_SDIO_CMD or SPI_DI
32	MMC_SDIO_CLK or SPI_SCLK

4-bit MMC

Pin #	Signal
1	+3VSB
2,15,21,33,40	GND
7,13	+3.3V
10	PERST# or SDIO_WP
14	MMC_SDIO_D0 or SPI_DO
16	MMC_SDIO_D1 or SPI_IRQ
18	MMC_SDIO_D2
20	MMC_SDIO_D3 or SPI_CS#
27	BLADE_PRSNT#
30	MMC_SDIO_CMD or SPI_DI
32	MMC_SDIO_CLK or SPI_SCLK

Note: Host platforms must connect 3.3V and 5V signals in all cases. Host platforms that do not supply +3.3VSB must connect +3.3VSB to +3.3V in all cases. This specification does not allow for exceptions.

Interfacing to Secure Digital (SD) Protocol

Secure Digital protocol has two modes of operation: four-bit (high speed) and one-bit. Further documentation and specifications for the SD interface can be found at http://www.sdcard.org.

4-bit High Speed SD

Pin #	Signal
1	+3VSB
2,15,21,33,40	GND
7,13	+3.3V
10	PERST# or SDIO_WP
14	MMC_SDIO_D0 or SPI_DO
16	MMC_SDIO_D1 or SPI_IRQ
18	MMC_SDIO_D2
20	MMC_SDIO_D3 or SPI_CS#
27	BLADE_PRSNT#
30	MMC_SDIO_CMD or SPI_DI
32	MMC_SDIO_CLK or SPI_SCLK

1-bit SD

Pin #	Signal
1	+3VSB
2,15,21,33, 40	GND
7,13	+3.3V
10	PERST# or SDIO_WP
14	MMC_SDIO_D0 or SPI_DO
27	BLADE_PRSNT#
30	MMC_SDIO_CMD or SPI_DI
32	MMC_SDIO_CLK or SPI_SCLK

Note: Host platforms must connect 3.3V and 5V signals in all cases. Host platforms that do not supply +3.3VSB must connect +3.3VSB to +3.3V in all cases. This specification does not allow for exceptions.

Interfacing to Serial Peripheral Interface (SPI) Protocol

Serial Peripheral Interface protocol is a pseudo-standard synchronous serial data link. There is no international governing body for the SPI protocol.

Pin #	Signal
1	+3VSB
2,15,21,33,40	GND
7,13	+3.3V
14	MMC_SDIO_D0 or SPI_DO
16	MMC_SDIO_D1 or SPI_IRQ
20	MMC_SDIO_D3 or SPI_CS#
27	BLADE_PRSNT#
30	MMC_SDIO_CMD or SPI_DI
32	MMC_SDIO_CLK or SPI_SCLK

Note: Host platforms must connect 3.3V and 5V signals in all cases. Host platforms that do not supply +3.3VSB must connect +3.3VSB to +3.3V in all cases. This specification does not allow for exceptions.

Interfacing to PCIe Protocol

PCIe requires a 3.3V supply voltage. The following describes the signals used and the connections needed to support PCIe. Further documentation and specifications for PCIe can be found at http://www.pcisig.com.

Pin #	Signal
1	+3VSB
2,15,21,33,40	GND
7,13	+3.3V
8,34	+5V
10	PERST# or SDIO_WP
23	A_PETp0
25	A_PETn0
27	BLADE_PRSNT#
29	A_PERp0
31	A_PERn0
35	A_CLKp
37	A_CLKn
39	PCIe-PRSNT#

Note: Host platforms must connect 3.3V and 5V signals in all cases. Host platforms that do not supply +3.3VSB must connect +3.3VSB to +3.3V in all cases. This specification does not allow for exceptions.