AdvancedMC™

PICMG® AMC.0 R2.0
Short Form Specification

December 28, 2006

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PICMG®
Open Modular
Computing Specifications

Introduction and objectives 1

1.1 Overview

¶ 1 The PICMG® Advanced Mezzanine Card™ (AdvancedMC or AMC) specification defines the base-level requirements for a wide-range of high-speed mezzanine cards optimized for, but not limited to, AdvancedTCA® Carriers and PICMG® Micro Telecommunications Computing Architecture (MicroTCA™) systems. This base specification defines the common elements for Modules and Carriers including mechanical, management, power, thermal, and the connector and signals that interconnect them. Subsidiary specifications will define the usage requirements for mapping specific interconnect protocols between AdvancedMC Modules and Carriers. Example interconnect protocols include PCI Express, Advanced Switching, Serial RapidIO, and Gigabit Ethernet.

1.2 Introduction

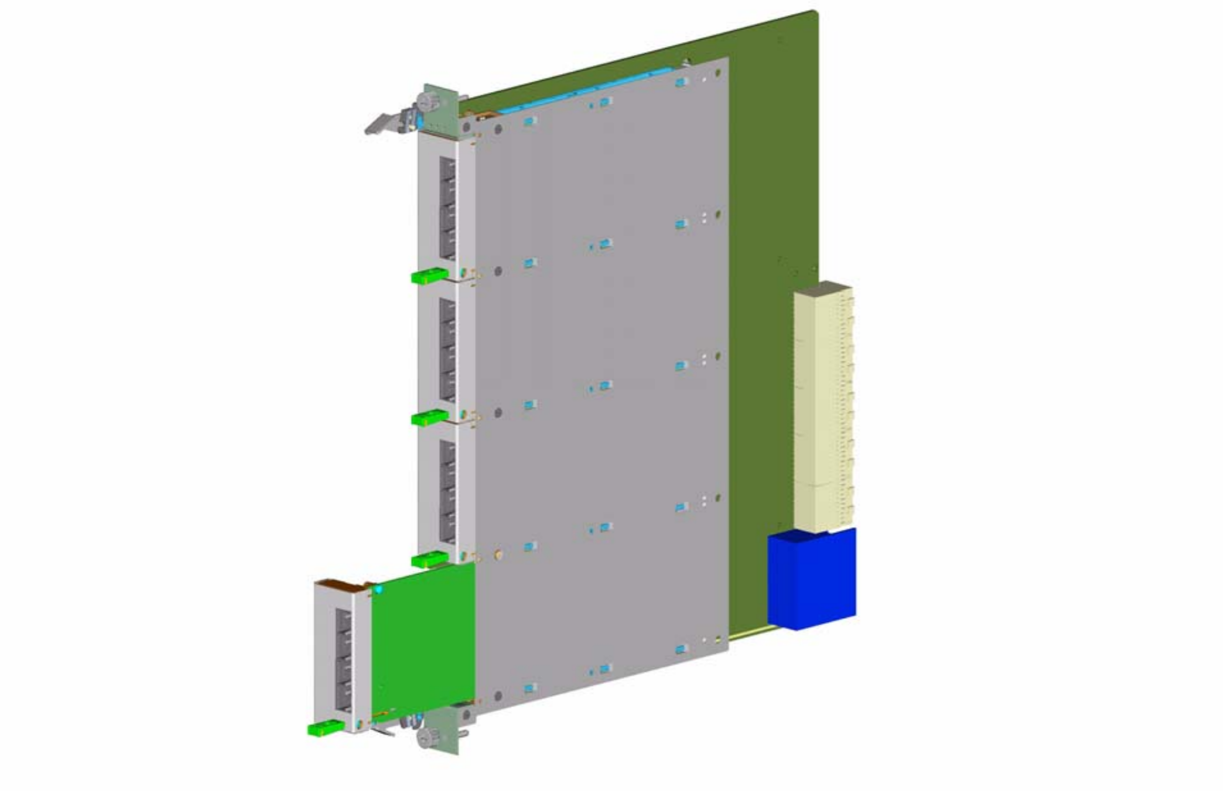
¶ 2 AdvancedMC defines a modular add-on or "child" card that extends the functionality of a Carrier Board (see Figure 1-1). Often referred to as mezzanines, these cards are called "AdvancedMC Modules" or "Modules" throughout this document. AdvancedMC Modules lie parallel to and are integrated onto the Carrier Board by plugging into an AdvancedMC Connector. Carrier Boards can range from passive boards with minimal "intelligence" to high performance single board computers. AdvancedMCs are also the core of PICMG's MicroTCA specification. Instead of employing a Carrier Board, MicroTCA configures AdvancedMCs directly on the backplane. Refer to the MicroTCA specification for more details.

¶ 3 AdvancedMC enables a modular building block design for industry standard and proprietary Carrier Boards and MicroTCA systems. This AMC.0 specification enables larger markets with more unique functions and creates economies of scale that lower prices.

¶ 4 Envisioned AdvancedMC Modules cover a wide range in terms of their functionality and include the following examples:

- Telecom connectivity (ATM/POS [OC-3/12/48], T1/E1, VoIP, GbE, etc.)
- Processors (CPUs, DSPs, and FPGAs)
- Network communication processors (NPUs)
- Network communications co-processors (Classification, Security or Intrusion Detection)
- Mass storage

Figure 1-1 Four AdvancedMC Modules on an AMC Carrier AdvancedTCA Board



1.2.1 Scope

¶ 5 This AMC.0 specification defines the framework or base requirements for a family of anticipated subsidiary specifications. The objective of this document is to define the requirements for mechanical, thermal, power, interconnect (including I/O), system management (including Hot Swap), and regulatory guidelines for AdvancedMC Modules and Carriers. It includes the definitions and requirements for Face Plates with ejectors, defined component spaces, complete mechanical dimensions, thermal definitions, mounting, guides, and a connector necessary to interface between the Module and the Carrier Board. Carrier Board examples in this specification focus on single Slot AdvancedTCA Board implementations but the features and requirements can be applied to other Carrier form factors.

¶ 6 Some of the changes incorporated into AMC.0 Release 2.0 include:

- New AMC Connector options for connecting to a Carrier Board. Press fit, surface mount, and through-hole style connectors are allowed along with the original compression fit style AMC Connector.
- New naming convention for Module sizes. Modules formally called “Half-height, Full-height and Extended Full-height” are now called “Compact, Mid-size and Full-size” Modules.
- Mid-size Module defined with new Face Plate dimensions optimized for ATCA conventional Carrier usage.

- Port 16 allocated for telecom clock usage. In total there are now four pairs dedicated for telecom clock usage and one dedicated for fabric clock usage.
- A new Electronic Keying capability used for managing /configuring clocks.
- Improved Module Face Plate LED placement guidelines in keeping with Central Office practices.
- Allowance for new varieties of AMC ejector handles.
- The amount of maximum Module power was increased from 60W to 80W for payload and increased from 100mA to 150mA for Management Power.

¶ 7 This AMC.0 specification does not define specific interconnect usage, although it is optimized for current and emerging LVDS interconnect standards, such as PCI Express, Advanced Switching, Serial RapidIO, and Gigabit Ethernet. The Port mapping definitions for these and other interconnect protocols will be provided through AMC.x subsidiary specifications.

Table 1-1 AMC.x subsidiary specifications

Specification	Title
AMC.1	PCI Express and Advanced Switching on AdvancedMC
AMC.2	AMC Gigabit Ethernet/ 10 Gigabit XAUI Ethernet
AMC.3	Advanced Mezzanine Card Specification for Storage
AMC.4	Serial RapidIO

1.2.2 Design goals

¶ 8 This AMC.0 specification was written with the following design goals in mind:

- **PICMG 3.0 optimized:** All elements must work within the bounds of the PICMG 3.0 base specification and build upon its strengths of Reliability, Availability, and Serviceability (RAS). The AdvancedMC Module is not limited by other chassis standards.
- **Building block for MicroTCA**: After the initial release of this specification, PICMG developed the MicroTCA specification, PICMG MicroTCA.0, which uses AMC Modules plugged directly into a backplane.
- **System management:** System management is an extension of the PICMG 3.0 Shelf management scheme.
- **Hot Swap support:** Hot Swap of AdvancedMC Modules is enabled in support of Availability and Serviceability objectives. The focus is on front loadable Hot Swap Modules with non Hot Swap being an optional implementation.
- **Low Voltage Differential Signaling (LVDS) interconn3ect:** AdvancedMC is optimized for LVDS interconnects.
- **Low pin count:** The interconnect is conservative in its total pin count, thereby reducing the amount of space required on both the Module and the Carrier Board, yet provide sufficient real estate for intended interconnects and usage models.
- **Support for a rich mix of processors:** This includes compute processors (CPUs), network processors (NPUs), and digital signal processors (DSPs).

- **Reduced development time and costs:** The reduced total cost of ownership is accomplished through component standardization and by driving economies of scale.
- **Communications and embedded industry focus:** Target usage includes support for edge, core, transport, data center, wireless, wireline, and optical network design elements.
- **Modularity, flexibility, and configurability:** AMC Modules have designed-in modularity features with the physical sizes that offer flexibility in use and configuration on an AMC Carrier AdvancedTCA Board including the ability to stack mezzanines.
- **Future advances in signal throughput:** AMC technology anticipates advances in interconnect technologies by supporting a minimum of 12.5 Gbps throughput per LVDS signal pair.

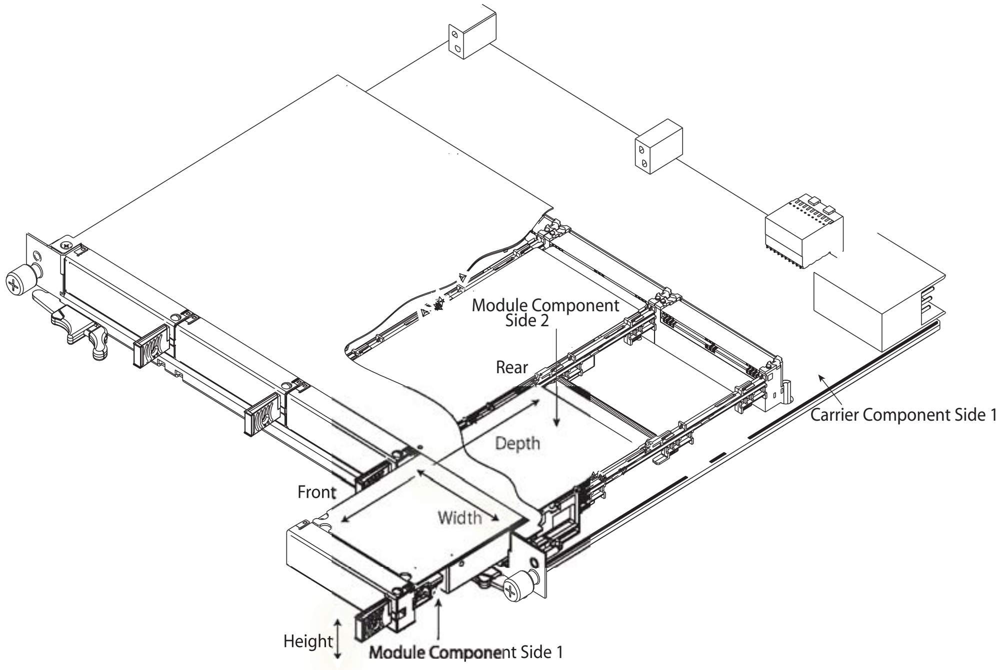
1.3 Theory and operation of usage

¶ 9 The AdvancedMC Module is designed to be Hot Swappable into an AdvancedMC Connector, seated parallel to the Carrier Board. The Carrier Face Plate provides one or more openings through which the Modules are inserted into AdvancedMC Bays. Struts and Module Card Guides located on the Carrier Board support the insertion of the Modules into the AdvancedMC Connectors (see Figure 1-2). The combination of Face Plate aperture, Struts, Card Guides and AdvancedMC Connector make up an AdvancedMC Bays which provides all the necessary mechanical support, power and signal connectivity and EMI shielding needed to accommodate AdvancedMC Modules.

¶ 10 Connectivity between the AdvancedMC Module and the Carrier is provided via an AdvancedMC Connector attached to the Carrier Board. Compression fit, compliant pin, SMT or other attachment techniques can be used to attach the AdvancedMC Connector to the Carrier Board. The AdvancedMC Connector has one or two Slots that can accept the Card-edge Interface located at the rear of each AdvancedMC Module.

¶ 11 An AdvancedMC Module can have I/O connections via the Face Plate and via the AdvancedMC Connector. I/O connections provided via the AdvancedMC Connector are routed on the Carrier to On-Carrier devices, to the backplane, to another AdvancedMC or to an RTM (Rear Transition Module), as is commonly done on AdvancedTCA systems.

Figure 1-2 General orientation and insertion of AdvancedMC Modules



1.3.1 AdvancedMC Bays and Slots

¶ 12 AdvancedMC Modules are installed into AdvancedMC Bays. AdvancedMC Carriers integrate the AdvancedMC Connector, Module Card Guides, Face Plate aperture, EMC Gaskets, Struts, and physical space that make up an AdvancedMC Bay. An AdvancedMC Bay comprises one or two AdvancedMC Slots, each providing support and connectivity for the installation of one AdvancedMC Module.

¶ 13 AdvancedMC Bays are classified as Conventional Bays and Cutaway Bays.

¶ 14 **Cutaway Bay:** The term "Cutaway" is derived from the fact that the PCB of Carrier Board below the AdvancedMC Slot is cut-away to make maximum use of the Face Plate and component area provided in a single Slot AMC Carrier AdvancedTCA Board to accommodate Full-size or stacked Compact Modules. Cutaway Bays are grouped as Single Slot and Dual Slot Cutaway Bays. Single Slot Cutaway Bays utilize a B or B+ style Connector to support one Full-size Module. Dual Slot Cutaway Bays utilize the AB or A+B+ style Connector to support two stacked Compact Modules or one Full-size Module per Cutaway Bay. Full-size Modules can be inserted into Slot B of an AB or A+B+ style Connector when Slot A is unoccupied. Cutaway Carrier AdvancedTCA Boards can support between one and four Cutaway Bays.

¶ 15 **Conventional Bay:** Conventional Bays can be built as Compact Conventional Bay or Mid-size Conventional Bay with different Face Plate apertures supporting the Conventional and Mid-size Modules accordingly. Both versions of the Conventional Bay are supported by B or B+ style AMC Connectors. A Mid-size Conventional Bay supports one Mid-size Module; a Compact Conventional Bay supports one Compact Module. Conventional Bays allow for the Carrier Board PCB and some limited-height components to reside in the area beneath the installed AdvancedMC Module. The Face Plate aperture of the Compact and Mid-size Conventional Bays are different to match the Face Plates of the corresponding Module types.

Full-size Modules cannot be installed into Conventional Bays. Compact Modules cannot be installed into a Mid-size Conventional Bay, but Compact Modules can be converted to Mid-size Modules by changing the Face Plate to a Mid-Size Face Plate. Similarly, Mid-size Modules can be converted into Full-size Modules to match the aperture of the Cutaway Bay. Conventional Carrier AdvancedTCA Boards can support between one and four Conventional Bays.

¶ 16 AdvancedMC Bays can be configured as Single Bays or Double Bays. Single and Double Bays are analogous to a one car and two car garage; that is, the two car garage is twice as wide as a one car garage. Similarly, Single Bays accommodate Single Modules and Double Bays support Double Modules. A Single Bay is physically too small to accommodate a Double Module. A Double Bay can be created by removing the Strut and Module Card Guide between two adjacent Single Bays. AMC Carrier AdvancedTCA Boards can have up to four Single Bays or two Double Bays. Generally, a Single Bay is simply referred to as a Bay whereas a Double Bay is always described as a Double Bay.

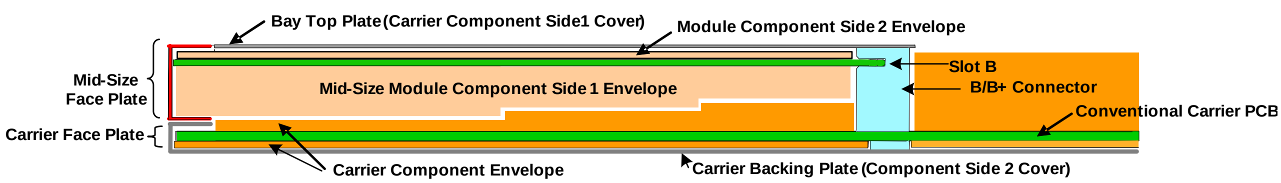
1.3.2 AdvancedMC Modules

¶ 17 AdvancedMC Modules come in several different sizes but all share some common attributes. When installed onto a Carrier Board, AdvancedMC Modules are oriented parallel to the Carrier Board PCB plane and are installed through the Face Plate of the Carrier Board. AdvancedMC Modules have a Face Plate that is compatible with AMC Carrier AdvancedTCA Board Face Plates such that it seats flush establishing an EMI seal. The Module Face Plate provides access to I/O connections, user LED indicators and the Module Handle. AdvancedMC Modules utilize a card-edge connection interface, consisting of conductive traces (gold fingers) along the edge of the Module PCB opposite the Face Plate, to provide Power and Management and I/O connectivity to/from the Carrier Board. The conductive traces at the card-edge of the AdvancedMC act as male pins, which mate to a female Slot in the AdvancedMC Connector mounted on the Carrier Board.

1.3.2.1 AdvancedMC Module in a Conventional Bay

¶ 18 AdvancedMC Modules in a Conventional Bay are placed such that Component Side 1 of the Module faces the Carrier Board. The mechanical envelope of the Mid-size Conventional Bay is defined for the support of a single Mid-size Module, while allowing for components to be placed on the Carrier PCB underneath the Bay.

Figure 1-3 Mid-size Module in a Conventional Bay (Section View)



1.3.2.2 AdvancedMC Module in a Cutaway Bay

¶ 19 Cutaway Bays support two stacked Compact Modules or one Full-size Module. The Compact Modules are stacked such that Component Side 1 of each Module faces in the direction towards the Carrier Board backing plate (Component Side 2 Cover). Single Slot Cutaway Bays support one Full-size Module using a B or B+ style Connector.

Figure 1-4 Stacked Compact Modules in a Cutaway Bay (Section View)

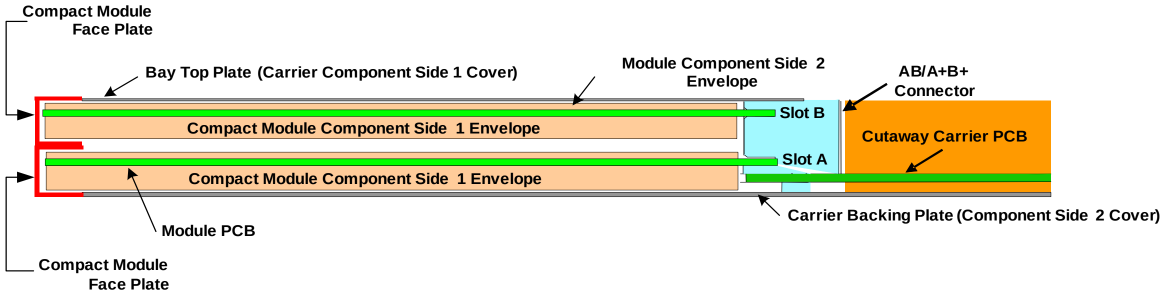
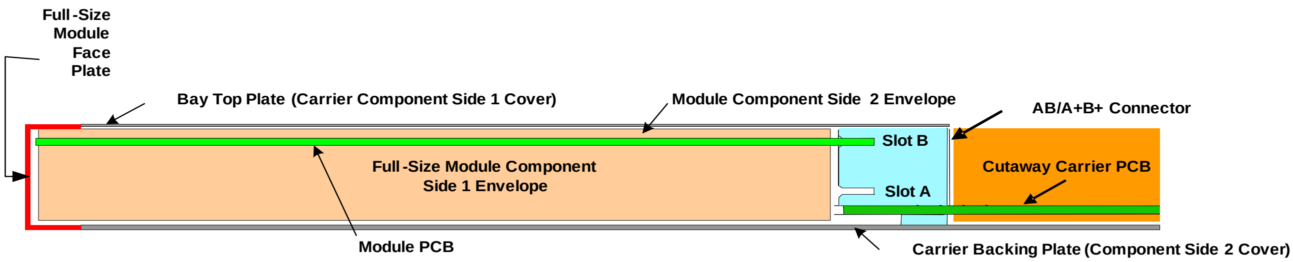


Figure 1-5 Full-size Module in a Cutaway Bay (Section View)



1.3.2.3 Module Width

¶ 20 AdvancedMC Modules can be Single or Double Modules. The PCB size and Face Plate size of Double Modules are twice as wide as Single Modules. The increased PCB size and power dissipation of the Double Module enables designs that would not fit on a Single Module implementation. Like Single Modules, Double Modules have a single Card-edge Interface that plugs into an AdvancedMC Connector. Stated differently, all Modules, whether Single or Double, have the same amount of connectivity to/from the Carrier. Generally, a Single Module is simply referred to as a Module whereas a Double Module is always described as a Double Module.

¶ 21 A Single Module is approximately 74 mm wide. A Double Module is approximately 149 mm wide. Modules are approximately 180 mm deep.

1.3.2.4 Module Sizes

¶ 22 AdvancedMC Modules come in three height variations: Full-size, Mid-size and Compact. The size of the Face Plate and the Component Side 1 height allocation varies for each size.

¶ 23 **Full-size Modules**: Full-size Modules make maximum use of the Face Plate and component height allowance afforded in a Cutaway Bay. The Full-size Module Face Plate size is capable of supporting dual-row SFPs and RJ-45 connectors for high density I/O implementations. The Full-size Module is installed into Slot B of the AB, A+B+, or B style AMC Connector in the Cutaway Bay. Full Size Modules cannot be installed into Conventional Bays.

¶ 24 **Mid-size Modules:** Mid-size Modules are built to be installed into Mid-size Conventional Bays. The Face Plate and component height allowance match the aperture and keepout areas for Mid-size Conventional Bays. A Mid-size Module cannot be installed into a Cutaway Bay, but it can be converted into a Full-size Module by exchanging its Face Plate to match the aperture of the Cutaway Bay.

¶ 25 **Compact Modules:** The Face Plate and the envelope of the Compact Module are specified such that two stacked Compact Modules occupy the same space as a Full-size Module. Two Compact Modules can be installed into a Dual Slot Cutaway Bay in a stacked fashion, one per Slot A and Slot B, allowing for highly dense deployments of AdvancedMC Modules. A Compact Module can be also installed into a Compact Conventional Bay. A Compact Module cannot be installed into a Mid-size Conventional Bay, but it can be converted into a Mid-size Module by exchanging its Face Plate for an installation into a Mid-size Conventional Bay.

¶ 26 A Compact Module is approximately 13mm high. A Mid-size Module is approximately 18mm high. A Full-size Module is approximately 28mm high.

¶ 27 Table 1-2, "Face Plate Connectors that fit on the different Module sizes," provides information on the number of a given connector type that can be supported on various size Modules. This information is for guidance only.

Table 1-2 Face Plate Connectors that fit on the different Module sizes

Connector types	Full-size Module		Mid-size Module		Compact Module	
	Single Wide	Double Wide	Single Wide	Double Wide	Single Wide	Double Wide
XPAK (low profile)	1	3	1	3	1	3
XPAK2 (X2 MSA) (*low profile*)	1	3	1	3	1[2]	3[2]
XENPAK	1	2	NA[1]		NA[1]	
SFP (MiniGBIC)	8	16	4	8	4	8
XFP	4	10	2	5	2	5
RJ-45	9	18	4	8	4	8

[1] Indicates that the specified connector type will not fit on the Module
[2] With restricted pin length

¶ 28 Table 1-3 presents a general assessment of a variety of AdvancedMC Modules that would typically be expected to fit on the configurations identified.

Table 1-3 Sample Module configurations and functionality

AMC Module configurations	Example functionality
Single Compact Module	Laptop Disk Drive, DSP Array, FPGA Array, Encryption Engine, T1/E1/J1 Line Cards, T3/E3 Line Cards, OC-3/12/48 Line Cards, GbE WAN Cards, 10 GbE Optical WAN Card, InfiniBand WAN Card, Memory Arrays
Single Mid and Full-size Modules	All of the above for the corresponding Single Modules plus: CPU Boards, DOCSIS Cable Modem, Baseband Modem, Radio Cards, Enterprise class disk drive
Double Compact, Mid and Full-size Modules	All of the above for the corresponding Single Modules plus: NPU Boards, DSP farms, Bulk RAMs, Optical disk drives

1.3.3 Carrier Types

¶ 29 AdvancedMC Carriers can support Cutaway Bays, Conventional Bays or both. This specification describes AdvancedMC Carrier features and requirements with a focus on Carrier AdvancedTCA Board implementations but AdvancedMC Carriers can take different forms.

¶ 30 **Conventional Carriers:** The term Conventional Carrier refers to a Carrier Board with one or more Conventional Bays. A Compact Conventional Carrier provides up to four Compact Conventional Bays, while a Mid-size Conventional Carrier provides up to four Mid-size Conventional Bays.

¶ 31 **Cutaway Carriers:** The term Cutaway Carrier refers to a Carrier Board with one or more Cutaway Bays. The term "Cutaway" is derived from the fact that the Carrier Board PCB is cut-away to provide maximum space for installation of Full-size Modules or stacked Compact Modules. Cutaway Carriers can support up to eight Compact Modules across an AMC Carrier AdvancedTCA Board if Dual Slot Cutaway Bays are supported.

¶ 32 **Hybrid Carriers**: Hybrid Carriers combine both Conventional and Cutaway Bays on a single Carrier Board.

1.3.4 AdvancedMC Connector

¶ 33 The AdvancedMC Connector provides the electrical interface between the Module and the Carrier. The AdvancedMC Connector is fixed to the Carrier Board and Modules plug into AdvancedMC Connector Slots. There are different styles of connectors for the different types of AdvancedMC Bays and for different levels of connectivity. AdvancedMC Connectors can be attached to the Carrier Board via compliant pin, SMT, through hole solder or compression mount techniques. The various connector mount types are available for all AMC Connector styles, B, B+, AB, and A+B+.

1.3.5 Module Management

¶ 34 Module management is optimized for an AdvancedTCA environment. Other platforms can require extensions to accommodate the AdvancedMC Modules. A management controller is located on every Module and it supports at least a defined minimal subset of IPMI commands. The intent of this subset of commands is to minimize both the size and the cost of the Module Management Controller. This specification also provides unique geographical address lines for each Module's IPMI address. The Module's management controller communicates with the Carrier Board using IPMB.

1.3.6 Module Power

¶ 35 AdvancedMC Carriers provide +12V DC Payload Power and +3.3V DC Management Power to AdvancedMC Modules via the AdvancedMC Connector.

1.3.7 Module Interconnect

¶ 36 The card-edge connection on AdvancedMC Modules provides a great deal of connectivity between the Modules and their Carrier. In addition to power and IPMI management signals, the AdvancedMC Module can access connections to JTAG, clocking and high speed serial I/O through the AdvancedMC Connector.

1.4 Name and logo usage

¶ 37 The PCI Industrial Computer Manufacturers Group policies regarding the use of its logos and trademarks are as follows:

¶ 38 Permission to use the PICMG organization logo is automatically granted to designated members only as stipulated on the most recent Membership Privileges document (available at www.picmg.org) during the period of time for which their membership dues are paid. Non-members must not use the PICMG organization logo.

¶ 39 The PICMG organization logo must be printed in black or color as shown in the files available for download from the member's side of the Web site. Logos with or without the "Open Modular Computing Specifications" banner can be used. Nothing may be added or deleted from the PICMG logo.

¶ 40 Manufacturers' distributors and sales representatives may use the AdvancedTCA and AdvancedMC logos (but not the PICMG organization logo) in promoting products sold under the name of the manufacturer. The use of AdvancedMC and MicroTCA logos is a privilege granted by the PICMG organization to companies who have purchased the relevant specifications (or acquired them as a member benefit), and who believe their products comply with these specifications. Use of the logos by either members or non-members implies such compliance. PICMG may revoke permission to use logos if they are misused. The AdvancedMC logo can be found on the PICMG web site www.picmg.org.

¶ 41 The term "AMC" is an abbreviation and may not be used as a logo or in logo form due to the possible infringement of an existing trademark outside of PICMG for the term "AMC.

¶ 42 The PICMG name and logo are registered trademarks of PICMG. Registered trademarks must be followed by the ® symbol, and the following statement must appear in all published literature and advertising material in which the logo appears:

The PICMG name and logo are registered trademarks of the PCI Industrial Computer Manufacturers Group.

1.5 Glossary

¶ 43 AMC is the abbreviation of Advanced Mezzanine Card as is AdvancedMC and is used throughout the document as such. AdvancedMC is the preferred name and AMC is used throughout the document as well.

Table 1-4 AdvancedMC terms

Term or acronym	Description
A	Amps
A+B+ Connector	The AMC Connector style A+B+ is a Connector used in Cutaway Bays. A+B+ Connectors have two Slots to accommodate up to two Compact Modules. The “+” indicates this connector is an Extended Connector meaning each Slot has 170 connections to the AMC Module.
AB Connector	The AMC Connector style AB is used in Cutaway Bays. AB Connectors have two Slots to accommodate up to two Compact Modules. AB is a Basic Connector meaning each Slot has 85 connections to the AMC Module.
AdvancedMC Slot, AMC Slot, or Slot	The environment providing connectivity for an AMC Module to a Carrier or Backplane.
AdvancedTCA® or AdvancedTCA	A registered trademark of the PCI Industrial Computer Manufacturers Group® referring to the PICMG 3.0 architecture.
Aggressor	A signal inductively and/or capacitively coupled to a Victim signal and considered to be source of noise that distorts the Victim signal being transferred between transmitter and receiver.
AMC	When the term “AMC” is used on its own, it can refer to the AMC.0 specification or it can generically refer to the family of AMC specifications, depending on the context.
AMC Bay or Bay	Mounting location on an AMC Carrier for AMC Modules. An AMC Bay provides the mechanical housing and structural support necessary to properly align, install and secure an AMC Module onto an AMC Carrier. There are two kinds of AMC Bays, Cutaway Bays and Conventional Bays.
AMC Carrier or Carrier or Carrier Board	An AMC Carrier supports all the design elements necessary to house and activate one or more AMC Modules; including AMC Bays, IPMC support, power distribution and signal routing to/from the AMC.
AMC Carrier AdvancedTCA Board	An AdvancedTCA Board, which provides AMC Bays. This is the primary target environment for AMC Modules.
AMC Connector or Connector	Used to refer to any of the connector styles B, B+, AB, A+B+ as defined in this specification, mounted on a Carrier for the insertion of AMC Modules.
AMC Connector Slot	The B and B+ Connectors support one Slot (Slot B) to accept an AMC Module. The AB and the A+B+ Connectors support two Slots (lower Slot A and upper Slot B).
AMC Module or Module	An AMC Module is a mezzanine or modular add-on card that extends the functionality of a Carrier Board. The term is also used to generically refer to the different varieties of Multi-Width and Multi-Height Modules.
AMC Slot ID	An AMC Slot ID identifies the physical location of each Slot in all AMC Bays on a Carrier into which AMC Modules can be installed.
ANSI	American National Standards Institute
ASIC	Application Specific Integrated Circuit
B Connector	The AMC Connector style B is a Basic Connector which supports one AMC Module. The style B connector is used in Conventional Bays or Single Slot Cutaway Bays.
B+ Connector	The AMC Connector style B+ is an Extended Connector which supports one AMC Module. The style B+ Connector is used in Conventional Bays or Single Slot Cutaway Bays.

Table 1-4 AdvancedMC terms (Continued)

Term or acronym	Description
Backend Power	Backend Power includes all the power supplies on the Module derived from Payload Power.
Basic Connector	Provides conductive contacts on only one side of each Connector Slot and supports all the indispensable connectivity including power and management, and yields 8 Ports. Basic Connector contains 85 contacts per Slot. Conventional and Cutaway Connectors can be Basic Connectors.
Basic Side	Refers to the side of the AMC Connector that supports the defined connections via Pins 1 to 85.
BGA	Ball Grid Array
BITS	Building Integrated Timing Supply
Card-edge Interface	The conductive fingers used on AMC Modules that interface to the AMC Connector.
Card Guide	See *Module Card Guide or Card Guide*
Carrier Face Plate	Face Plate of the Carrier Board.
Carrier Handle	The Handle of the AMC Carrier AdvancedTCA Board.
Carrier IPMC	IPM Controller on the Carrier. This is the required intelligent controller on the Carrier that interfaces with the Module's MMC over the IPMB-L.
Carrier SDRR	Sensor Data Record Repository that resides on the Carrier Board.
CFM	Cubic Feet per Minute. One CFM is equivalent to 472 cubic centimeters per second, or 0.000,471,947 cubic meter/second.
Channel	An arbitrary set of up to four Ports which are logically grouped together via E-Keying to define the physical traces of a Link between Link partners. Multiple Channels can be aggregated for a wider Link.
Clearance	The shortest distance between two conductive parts, measured through air.
Clock Link	A connection between two clocks, together with the associated protocol.
Common Options Region	A region on the Basic Connector (Ports 0-3) used to define essential interfaces that are common across diverse assignments in the Fat Pipes Region. Ideal candidates for this region include storage (e.g., SAS, SATA and FC) and Control Path interfaces.
Compact Module	Compact Modules are the smallest size Module. The Face Plate and component height on Component Side 1 are defined to allow for two Compact Modules to be installed into a Dual Slot Cutaway Bay. Compact Modules can also be installed into Compact Conventional Bays. (Previously termed Half-height AMCs in AMC.0 R1.0)
Component Side 1 Cover and Component Side 2 Cover	Board Covers provide mechanical rigidity for the Carrier Boards as well as a place to mount the Module Card Guides and the AMC Connector body. Board covers are required on both sides of all AMC Carrier Board configurations.
Component Envelope Depth	Maximum length for placing components between the Face Plate and rear connector.
Component Envelope Height	Maximum height allowed for components.

Table 1-4 AdvancedMC terms (Continued)

Term or acronym	Description
Component Side 1	The side of the AMC which supports the greater Component Envelope Height and faces the Carrier Board when the Module is installed into a Bay. Component Side 1 height definition varies between Compact, Mid-size and Full-size Modules.
Component Side 2	The side of the AMC which supports the lesser Component Envelope Height and does not face the Carrier Board when the Module is installed into a Bay. Component Side 2 height definition is the same for Compact, Mid-size and Full-size Modules.
Connector Brace	A counter-pressure plate needed in conjunction with compression mount connectors that is mounted on Component Side 2 of the Carrier Board, opposite the AMC Connector and required to guarantee uniform contact conditions between Connector and Carrier by preventing the Carrier Board from bending.
Contact List	Defines the use of each contact. Directed signals appear in the lists differently, as applies to the respective viewpoint of the Module and the Carrier.
Conventional Bay	A Conventional Bay utilizes the B or B+ style AMC Connector and is characterized by the presence of the Carrier PCB and components under the AMC Bay. A Compact Conventional Bay supports a Compact Module, while a Mid-size Conventional Bay supports a Mid-size Module.
Conventional Carrier	A Conventional Carrier exclusively supports one or more Conventional Bays. Conventional Carrier AdvancedTCA Boards can support up to four Conventional Bays.
CPU	Central Processing Unit or Computer
Creepage	The shortest path between two conductive parts, measured along the surface of the insulation.
Cutaway Bay	A Cutaway Bay is characterized by cutaway of the Carrier PCB between the AMC Connector and the Face Plate. A Cutaway Bay can be a Dual Slot Cutaway Bay or a Single Slot Cutaway Bay. The Dual Slot Cutaway Bay is equipped with the AB or the A+B+ style connector and supports two Compact Modules or one Full-size Module. The Single Slot Cutaway Bay is equipped with a B or B+ style Connector and supports one Full-Size Module.
Cutaway Carrier	A Cutaway Carrier exclusively supports one or more Cutaway Bays. Cutaway Carrier AdvancedTCA Boards can support up to four Cutaway Bays.
Depth	Edge-to-edge length from the leading edge of the Face Plate to the trailing edge of the connector.
Double Bay	Mounting location on an AMC Carrier for Double Modules. Double Bays can be Conventional or Cutaway Bays.
Double Module	A Module that is roughly twice the width of a Single Module and requires a Double Bay. Compact, Mid-size and Full-size Modules can be Double Module configurations. (Previously termed Double-width AMCs in AMC.0 R1.0)
DSP	Digital Signal Processor
EIA	Electronic Industry Association
E-Keying	Abbreviation for Electronic Keying. Electronic Keying defines the process in which a Carrier determines a matching configuration of the Channel and clock connections to an AMC Module.
EMI	Electromagnetic interference. Electromagnetic radiation created by rapid switching in electronic circuits that causes unwanted signals to be induced in other circuits.

Table 1-4 AdvancedMC terms (Continued)

Term or acronym	Description
EMC	Electromagnetic Compatibility is the condition that prevails when telecommunications (communication-electronic) equipment is collectively performing its individual designed functions in a common electromagnetic environment without causing or suffering unacceptable degradation due to electromagnetic interference to or from other equipment/systems in the same environment.
EMC Gasket	An electrically conductive elastic strip mounted to defined edges of the Face Plate, of the Carrier, and of the Shelf, providing EMC closure around the AMC Modules.
Envelope 1, Envelope 2, Envelope 3	Envelope 1, 2 and 3 define the amount of space available on a Mid-size Module or Conventional Carrier in the defined step segments. Envelope 1 is closest to the Face Plate with Envelopes 2 and 3 going successively towards the rear of the Module or Carrier.
ESD Contact	Conductive element in the Carrier's Strut that provides a low-impedance path to Shelf Ground in the Carrier. The ESD Contact touches the Module ESD Strip during Module insertion/removal and provides a path for controlled discharge of electrostatic energy from the Module PCB to Shelf Ground.
ESD Segment	ESD Segment 1, ESD Segment 2, and ESD Segment 3 constitute the Module ESD Strip. The ESD Segments are the contact areas on the Module which the ESD Contact wipes along during the Module insertion providing discharge phases for the Shelf Ground and Logic Ground domains and granting a low impedance connection of the Module Face Plate to Shelf Ground for the installed Module.
ETSI	European Telecommunications Standards Institute
ETTE	Environmental Testing for Telecommunication Equipment
Extended Connector	Provides conductive traces on both sides of the Connector and is an extension of the Basic Connector definition. Extended Connectors contain 170 contacts per Slot and are identified with the “+” designation (i.e., B+ and A+B+).
Extended Options Region	The Extended Options Region is loosely defined but recommend for use for RTM (Rear Transition Module) support. It is also recommended for use as an extension of both the Common Options and Fat Pipes Regions, when additional Ports are needed.
Extended Side	Refers to the side of the AMC Connector associated with the additional connectivity provided by an Extended Connector.
Face Plate	The front-most element of a Module, attached perpendicular to the PCB, and serves to mount connectors, indicators, controls, and also seals the front of the Subrack for airflow and EMC.
Fat Pipes Region	Ports 4 though 11 of the AMC Connector constitute the Fat Pipes Region. This Region of Ports is intended for the assignment of multiple Lane interfaces, also called “fat pipes”.
FIC	Fabric Interface Component
Filler Module	A unit with no or very limited functionality used for filling up the empty Bays and Slots that often has air baffle included.
FRU	Field Replaceable Unit. Any entity that can be replaced by a user in the field. FRU Information is data that describes a FRU, with an emphasis on data that characterizes the FRU. Format for this data is described in IPMI Platform Management FRU Information Storage Definition and extended herein.

Table 1-4 AdvancedMC terms (Continued)

Term or acronym	Description
Full-size Module	Full-size Modules utilize the maximum size Module Face Plate and component area on Component Side 1. Full-size Modules can be installed into Cutaway Bays only. (Similar to what were termed Full-height AMCs in AMC.0 R1.0)
g	Grams
GbE	Gigabit Ethernet
Gbps	Gigabits per second
Geographic Address	The term Geographic Address identifies the physical location of the AMC Slots in the AMC Bays on a Carrier via three, three-state signals. Each valid GA combination of the three signals maps to a specific AMC Slot ID in which the A and B layers of the AMC Bays that are implemented on a Carrier are numbered sequentially in their order of occurrence starting with 1 and from the top of the Carrier.
GPS	A satellite-based global navigation system that consists of (a) a constellation of 24 satellites in orbit 11,000 nmi above the Earth, (b) several on-station (i.e., in-orbit) spares, and (c) a ground-based control segment. The satellites transmit signals that are used for extremely accurate three-dimensional (latitude, longitude, and elevation) global navigation (position determination), and for the dissemination of precise time. GPS-derived position determination is based on the arrival times, at an appropriate receiver, of precisely timed signals from the satellites that are above the user's radio horizon
GUID	A Globally Unique Identifier (GUID) is 128 bits long and if generated in a compliant manner, is either guaranteed to be different from all other GUIDs generated until 3400 A.D. or extremely likely to be different (depending on the mechanism chosen). An *OEM GUID* is constructed and processed as specified in Chapter 17.8 of the IPMI specification.
HA	High Availability
Hot Swap	To remove a component (e.g., an AMC Module) from a system (e.g., an AMC Carrier AdvancedTCA Board) and plug in a new one while the power is still on and the system is still operating.
Hot Swap Switch	A switch that is integrated with the Module Latch Mechanism so that its state reflects the state of the Module Handle. The Hot Swap Switch is activated when the Module Handle is fully inserted.
HP	Horizontal Pitch (5.08 mm or 0.2 inches)
Hybrid Carrier	An AMC Carrier that has both Conventional and Cutaway Bays.
I/F	Interface
I/O	Input/Output
I^2C	Inter-integrated Circuit bus. A multi-master, two-wire serial bus used as the basis for IPMBs.
IEC	International Electro-technical Commission
IEEE	Institute of Electrical and Electronics Engineers
IPMB	Intelligent Platform Management Bus. The lowest level hardware management bus as described in the Intelligent Platform Management Bus Communications Protocol Specification.

Table 1-4 AdvancedMC terms (Continued)

Term or acronym	Description
IPMB-0	Intelligent Platform Management Bus Channel 0 as defined in the IPMI v1.5 specification. This is the logical aggregation of ATCA IPMB-A and IPMB-B, as defined in the PICMG 3.0 specification.
IPMB-L or Local IPMB	The IPMB located on the Carrier interconnecting the Module's MMC with the Carrier IPMC. This bus is electrically separate and occupies a separate address space from the Carrier's IPMB (IPMB-0).
IPMI	Intelligent Platform Management Interface. A specification and mechanism for providing inventory management, monitoring, logging, and control for elements of a computer system as defined in Intelligent Platform Management Interface Specification.
ITU	International Telecommunication Union (ITU): A civil international organization established to promote standardized telecommunications on a worldwide basis. Note: The ITU-R and ITU-T are committees under the ITU. The ITU headquarters is located in Geneva, Switzerland. While older than the United Nations, it is recognized by the U.N. as the specialized agency for telecommunications
JTAG	Joint Test Action Group (test bus, IEEE 1149.1)
kHz	kilohertz
Lane	1. A set of differential signal pairs, one pair for transmission and one pair for reception. One or more Lanes operate together to form a Link. Same as Port. 2. E-Keying definition of a differential pair associated with a specific Link (e.g.,a Link generally consists of Lanes[x:0])
LED	Light Emitting Diode
LFM	Linear Feet per Minute. A measure of air velocity. One LFM is equivalent to 0.508 centimeters per second, or 0.005,08 meter/second.
Link	1. One or more Ports aggregated under a common protocol. Links are groups of Ports that are enabled and disabled by Electronic Keying operations. A xN Link (pronounced "by-N Link") is composed of N Ports. 2. A group of Lanes which operate together to connect two devices; the number of Lanes used is negotiated.
Logic Ground, Ground, or GND	The reference potential for logic signaling and local power distribution on the Carrier and on the Module.
LUN	Logical Unit Number as defined by IPMI.
LVDS	Refers to Low Voltage Differential Signaling and defined in ANSI/EIA-644-A.
m	meters
MAC	Media Access Control
Management Power or MP	The 3.3V power for a Module's Management function, individually provided to each Slot by the Carrier.
MHz	Megahertz
MicroTCA	A PICMG specification in which AMC Modules plug directly into a backplane.

Table 1-4 AdvancedMC terms (Continued)

Term or acronym	Description
Mid-size Module	Mid-size Modules are optimized for installation into Conventional Bays. Each Conventional Bay can accept one Mid-size Module. Mid-size Modules can also be installed into Cutaway Bays if converted to a Full-size Module with a different Face Plate.
M-LVDS	A later development of LVDS defined in ANSI/TIA/EIA-644. It is specifically designed for multi-drop and multi-sourced signaling.
mm	millimeters
MMC	Module Management Controller. The MMC is the required intelligent controller that manages the Module and is interfaced to the Carrier via IPMB-L.
Module Card Guide or Card Guide	Card Guide utilized by AMC Modules to facilitate insertion into the AMC Bay and to help facilitate Hot Swap of Modules.
Module Handle	Hand grip that is connected to the Module Latch Mechanism, provides user interface that initiates Hot Swap sequence and Module removal.
Module Latch Mechanism	Mechanism to hold the Module locked in the AMC Bay with the Module in contact with the bottom of the AMC Connector Slot. The Module Latch Mechanism also provides coupling to the Hot Swap Switch.
Module ESD Strip	Plated region on the Module PCB that provides a path for controlled discharge of electrostatic energy. The Module ESD Strip includes all three ESD Segments found on an AdvancedMC Module.
Module LEDs	The collective name for the following LEDs available at the Module Face Plate: BLUE LED, LED 1, and LED 2.
NEBS	Network Equipment Building Systems
non-AMC Carrier AdvancedTCA Board	An AMC Carrier which is not an AdvancedTCA Board.
Octet	A normally contiguous group of eight bits not necessarily byte aligned.
Payload	The primary function that a FRU provides. This includes all the hardware on the FRU except that associated with management. It can also include the firmware, operating system and application software running on the Payload hardware.
Payload Power or PWR	The nominal 12V supply power, individually provided to each Slot by the Carrier for the payload function of the Module.
PDH	PDH refers to the DS1/DS2/DS3 family of signals which were developed as an asynchronously multiplexed hierarchy for transmission systems which are now more frequently encountered as payload in a SONET system.
PHY	Physical Layer Device
PICMG	PCI Industrial Computer Manufacturers Group
Pin	The elementary connectivity provided by the Connector.
Port	A set of differential signal pairs, one pair for transmission and one pair for reception. Same as a Lane.

Table 1-4 AdvancedMC terms (Continued)

Term or acronym	Description
PRS	Primary reference source. Equipment that provides a timing signal whose long-term accuracy is maintained at 1 x 10-11 or better with verification to Coordinated Universal Time (UTC), and whose timing signal may be used as the basis of reference for the control of other clocks within a network. The primary reference source may generate a timing signal completely autonomous of other references, in which case cesium beam technology is suitable. Alternatively, the primary reference source may not be a completely autonomous implementation, in which case it may employ direct control from normal UTC-derived frequency and time services.
RAS	Reliability Availability Serviceability
RJ-45	Short for Registered Jack-45, an eight-wire connector used commonly to connect computers onto a local-area network (LAN), especially Ethernets.
RoHS	Restriction of the Use of Certain Hazardous Substances
s	second
SBC	Single Board Computer
SDH	Synchronous Digital Hierarchy
SerDes	Serializer-Deserializer
SELV	Safety Extra-Low Voltage. A designation defined in IEC 60950-1 and related documents for circuits with a voltage that remains below 60 V.
SFP	Small Form-factor Pluggable. An industry standard definition for a pluggable Module and cage typically used for fiber optic connections.
Shelf Ground	The electrical potential of the metal frame of the system, the Face Plate of the Carrier, and the Face Plate of the Module.
Shelf Manager	The entity responsible for managing the power, cooling, and interconnects (with Electronic Keying) in an AdvancedTCA Shelf. The Shelf Manager also: routes messages between the System Manager Interface and IPMB-0, provides interfaces to System repositories, and responds to event messages. The Shelf Manager can be partially or wholly deployed on the ShMC and/or System Manager Hardware.
ShMC	Shelf Management Controller. An ShMC is a mandatory component part of an AdvancedTCA Shelf.
Single Bay	Mounting location on an AMC Carrier for Single Modules. Single Bays can be Conventional or Cutaway Bays.
Single Module	AMC Module with a width around 74mm which fits into a Single Bay. (Previously termed Single-width AMCs in AMC.0 R1.0)
Site Number	Architecture-independent abstraction of the AMC Slot identification for the purposes of System Management.
Slot	See AdvancedMC Slot, AMC Slot, or Slot
Slot A	The lower Slot of an AB or an A+B+ Connector. It is located in the cutout section of a Cutaway Bay and is utilized by Compact-Modules only.
Slot B	The upper Slot of and AB or A+B+ Connector or the Slot position of a B or B+ Connector.
SMC	SONET minimum clock

Table 1-4 AdvancedMC terms (Continued)

Term or acronym	Description
SMT	Surface Mount Technology
SONET	An interface standard for synchronous optical-fiber transmission, applicable to the Physical Layer of the OSI Reference Model
Stacked Modules	Used to describe two Compact Modules installed into a Cutaway Bay.
STM	Synchronous transport mode
Strut	Used to align the Module Card-edge within the AMC Bay
System Manager	A level of management functionality above the Shelf Manager charged with the management of an entire System, whatever that may mean in a specific implementation. The System Manager can, nevertheless, be partially or wholly deployed on the ShMC and/or System Manager Hardware.
V	Volts
Victim	A signal inductively and/or capacitively coupled to an Aggressor signal and considered to be a receptor of noise that distorts the signal being transferred between transmitter and receiver.
XENPAK	A fiber-optic transceiver Module which conforms to the 10 Gigabit Ethernet (10 GbE) standard as laid down by the IEEE 802.3ae.
XFP	10 Gigabit Small Form-factor Pluggable. An industry standard definition for a 10 Gigabit pluggable Module and cage typically used for fiber optic connections.
XPAK	A specification authored by a number of companies to build a small form factor 10 Gigabit Module that is Face Plate pluggable, and is mounted on the top of a customer printed circuit (rather than requiring a cutout in the board).

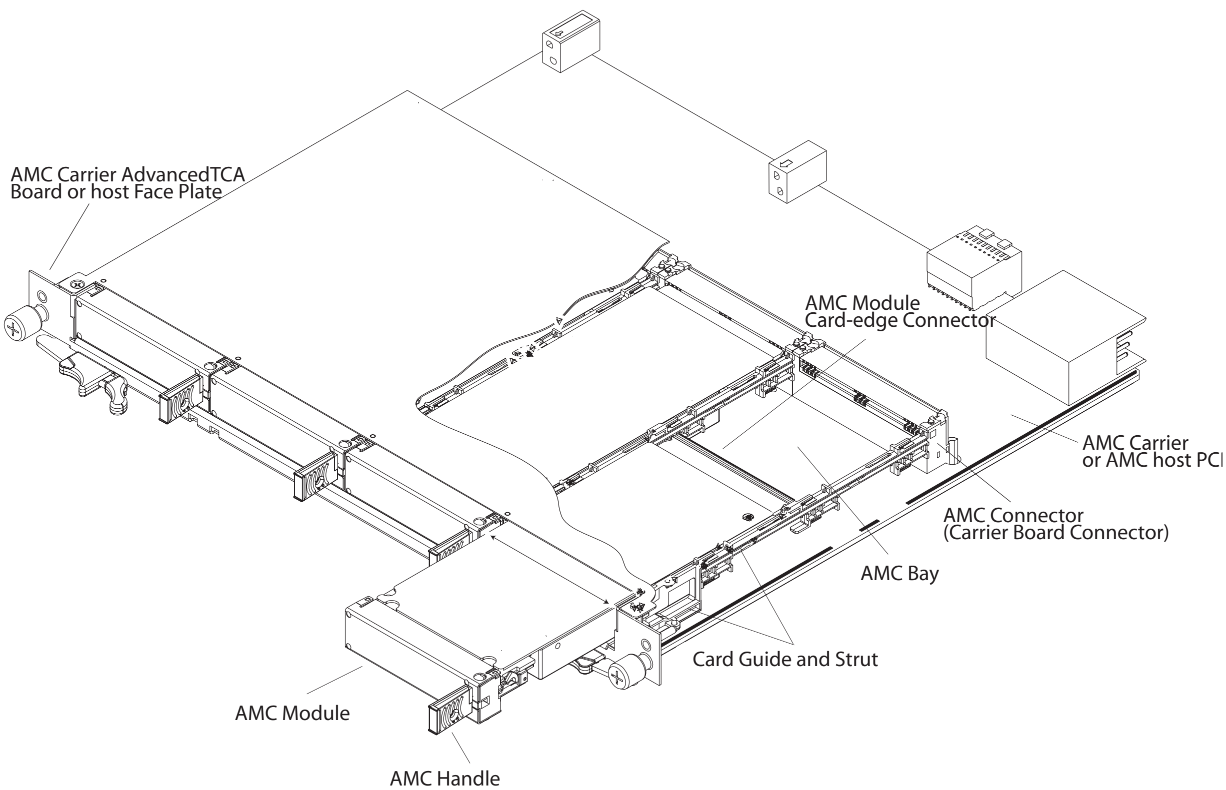
Mechanical 2

¶ 44 AMC Modules are intended to be installed into a Carrier to be operational. Carriers can come in many different sizes and shapes, but the mechanical interfaces necessary to house an AMC Module are referred to as the AMC Bay. Figure 2-1, "Typical AMC Carrier AdvancedTCA Boards with AMC Modules" shows the general relationship of an AMC Module with a Carrier Board and some key features and interfaces of the Module and the Bay.

¶ 45 This section defines the essential mechanical features and requirements for AMC Modules and AMC Bays. The AMC Bay requirements can be applied to any type or size of Carrier. In addition to the AMC Module and AMC Bay definitions, this section also describes mechanical requirements and considerations specific to AdvancedTCA Carriers. For the purposes of this specification, an AdvancedTCA Carrier is defined to be any ATCA Board or blade equipped with 1 or more AMC Bays.

¶ 46 A Carrier Board can be a self-contained functional unit or a sub Module of a larger system. The mechanical interface between a Carrier Board and its associated backplane is outside the scope of this specification; for Carrier AdvancedTCA Boards refer to PICMG 3.0.

Figure 2-1 Typical AMC Carrier AdvancedTCA Boards with AMC Modules



2.1 Mechanical overview

¶ 47 AMC Modules are installed onto Carrier Boards in an orientation that is parallel to the Carrier Board PCB. The Modules slide into an aperture, called a Bay, in the Carrier Face Plate and the Card-edge Interface on the Module plugs into a Slot in the AMC Connector. Struts and Card Guides align the Module Card-edge with the AMC Connector Slot. A Module Handle and Latch allow the Module to be secured into the Slot and extracted when required. The Module's Face Plate seats flush to the Carrier Face Plate, ensuring an EMC seal.

¶ 48 Orientation of the AMC Module and Bay is referenced relative to the Carrier Board as shown in Figure 1-2, “General orientation and insertion of AdvancedMC Modules” where the Carrier Face Plate represents the “front” of the Carrier Board and thus the “front” of the AMC Module and Bay. The opposite end of the Carrier Board is called the “rear”, thus the axis that runs from “front” to “rear” is described in terms of “depth.” The axis that runs parallel to the Carrier Board Face Plate is described in terms of “width.” The side of the Carrier Board PCB that contains the AMC Bay is called the “top” side of the Carrier, the other side of the Carrier Board PCB is called the “bottom.” The axis that runs from “top” to “bottom” is described in terms of “height.” This orientation is consistent with IEEE 1386.

¶ 49 In order to support a wide variety of application requirements, AMC Modules come in 3 different sizes (Compact, Mid-size, and Full-size) and there are different AMC Bay configurations to accommodate certain sized Modules. Basically, Modules and Bays can vary in “height” and “width”, but all have a fixed “depth.” Three sizes of Modules are defined with different “height” allowances for the Module Face Plate and the components placed on the Module. Two types of AMC Bays (Conventional Bay and Cutaway Bay) are defined to support Compact, Mid-size and Full-size Modules as described in Table 2-1, “Module and AMC Bay compatibility matrix.” Both Modules and Bays can come in Single or Double “widths”. Double Bays/Modules are twice as “wide” as Single Bays/Modules. Single Bays accommodate Single Modules and Double Bays accommodate Double Modules. Two adjacent Single Bays can be converted into a Double Bay (by removing the center Strut and Card Guide) to accommodate a Double Module, if the implementation supports convertible Bays.

¶ 50 Conventional Bays and Cutaway Bays serve different application requirements and are mechanically different based on the style of AMC Connector employed. Bays using the B/B+ AMC Connector have one Slot to accommodate one AMC Module, whereas Bays using the AB/A+B+ AMC Connector have two Slots to accommodate two Compact AMC Modules. Table 2-1, “Module and AMC Bay compatibility matrix,” illustrates the possible combinations of Modules supported by the different AMC Bay configurations.

¶ 51 Carriers can support Conventional Bays or Cutaway Bays or both. Carriers that support Conventional Bays are known as Conventional Carriers. Carriers that support Cutaway Bays are known as Cutaway Carriers. Carriers that support both Conventional and Cutaway Bays are known as Hybrid Carriers. AMC Carrier AdvancedTCA Boards are capable of supporting up to four Single Bays or up to two Double Bays.

Table 2-1 Module and AMC Bay compatibility matrix

Bay	Bay aperture	Connector style	Compact Module	Mid-size Module	Full-size Module
			supported via Slot		
Compact Conventional Bay	3 HP	B, B+	B	-	-
Mid-size Conventional Bay	4 HP	B, B+	Convert Face Plate to Mid-size	B	-
Single Slot Cutaway Bay	6 HP	B, B+	Convert Face Plate to Full-size	Convert Face Plate to Full-size	B
Dual Slot Cutaway Bay	6 HP	AB, A+B+	A and B	Convert Face Plate to Full-size	B

2.2 Module PCB dimensions

¶ 52 AMC Modules can be Single or Double Modules. The PCB area of a Double Module is approximately twice the area of a Single Module. The Card-edge Interface is the same for Single and Double Modules. The PCB details related to these two configurations are shown in Figure 2-2 and Figure 2-3.

Figure 2-2 Single Module PCB dimensions

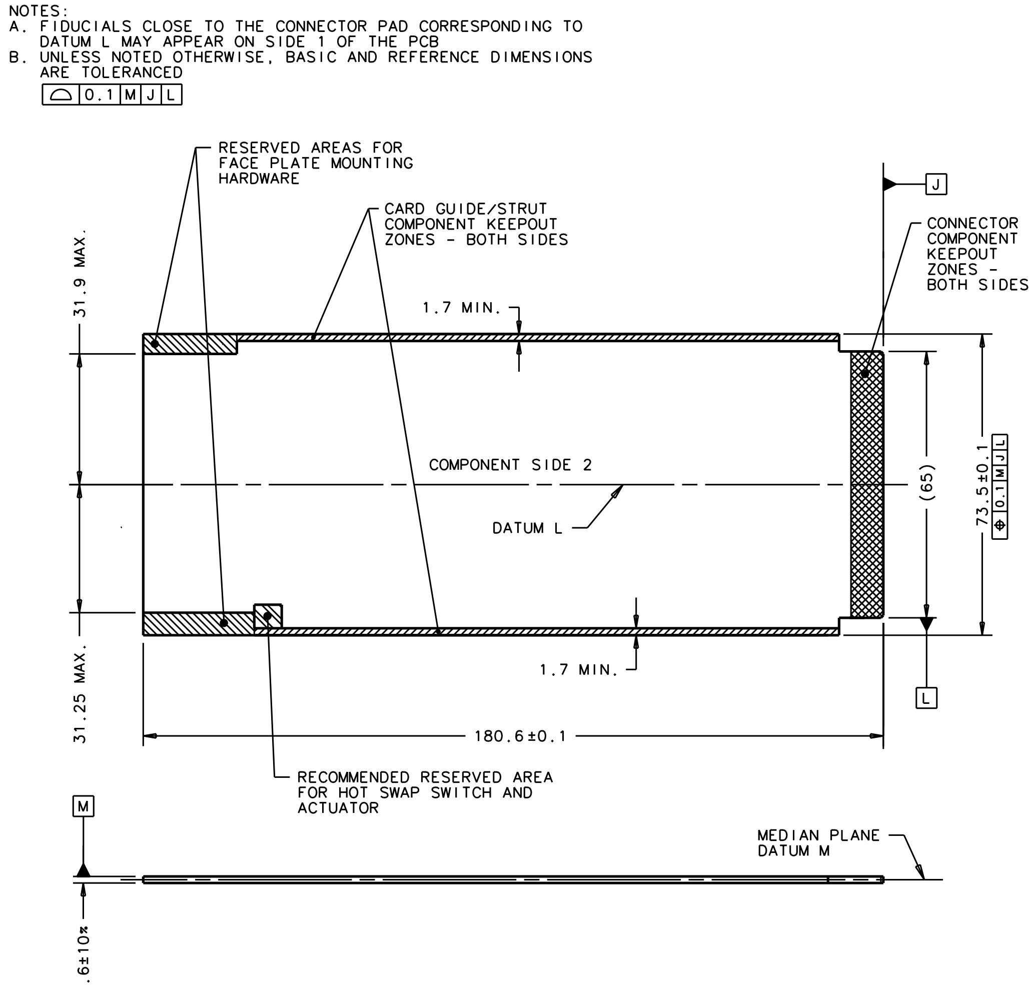
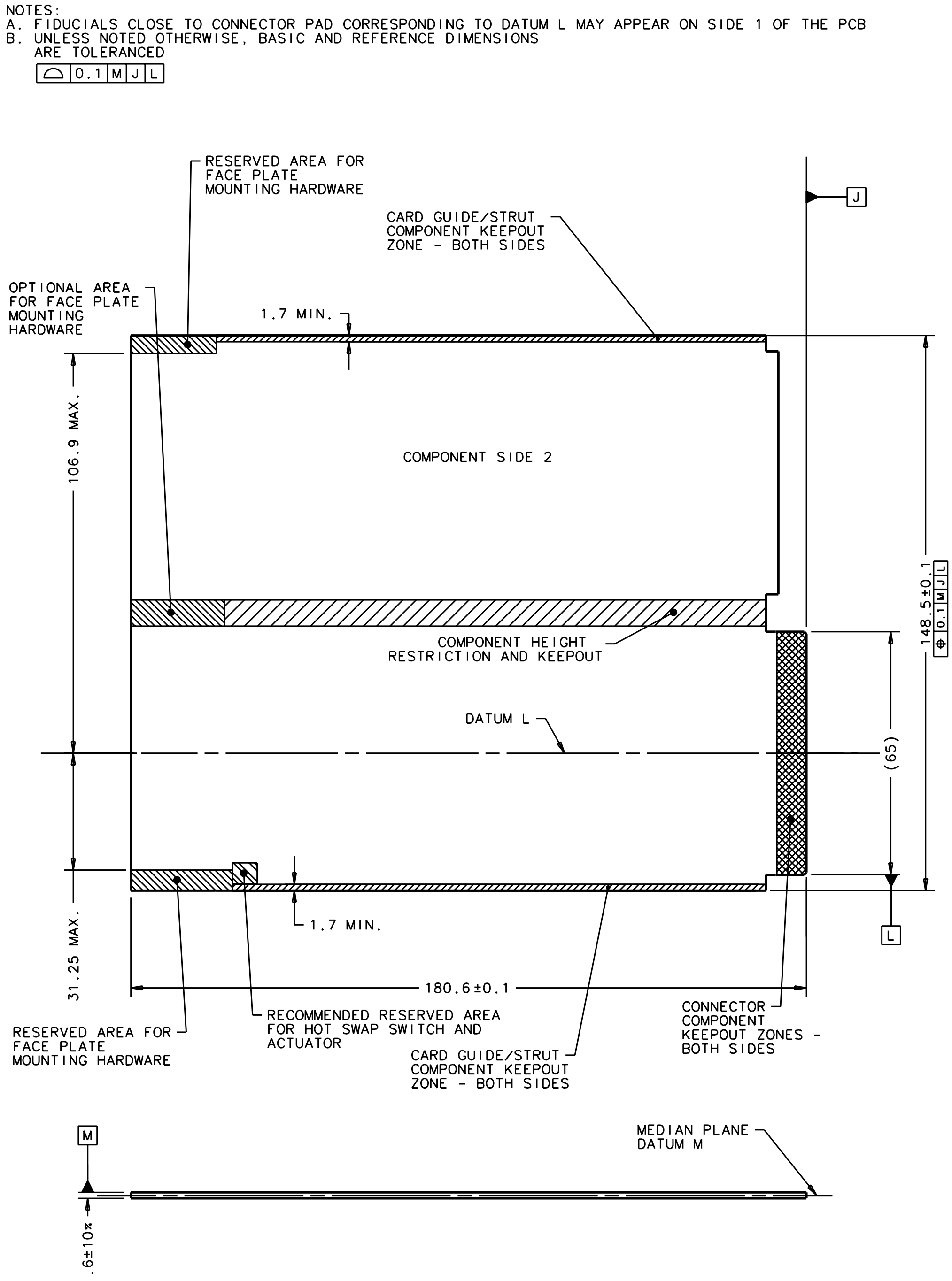


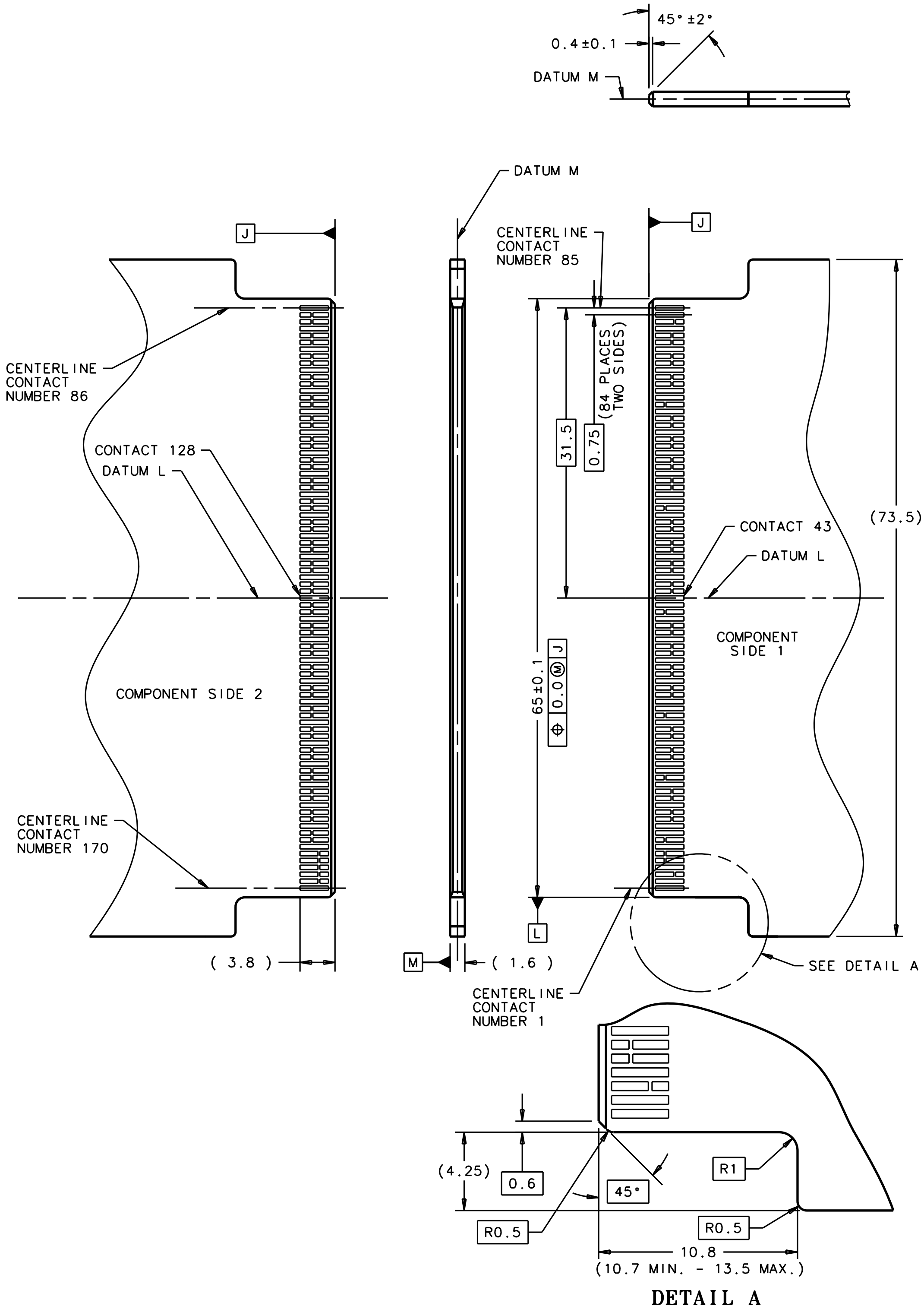
Figure 2-3 Double Module PCB dimensions



2.2.1 Module Card Edge Interface

¶ 53 The Module interface to the AMC Connector uses card-edge conductive fingers and is referred to as the Card-edge Interface.

Figure 2-4 Module Card-edge Interface dimensions



¶ 54 Pin staging on the Card-edge Interface is achieved by varying the length of the gold plated contact pads on the Module's Card-edge Interface. Four contact stages are supported by the Card-edge Interface. The First Mate contacts are the longest, they are defined as continuous contact pads. The Second Mate, Third Mate, and Last Mate contacts are defined with an unconnected pre-pad followed by the staged contact pad. The pre-pad has the same gold plating as the contact pads and its purpose is to prevent the deterioration of the AMC Connector contacts during Module insertion and extraction. First Mate contacts are used for the power and ground connections, Second Mate contacts are used for system management related signals, Third Mate contacts are used for the high speed differential pairs, and Last Mate contacts are used for the Module Present signals.

2.3 Module Face Plate

¶ 55 Module Face Plates fulfill a series of tasks:

- Support for the Module Handle
- Mounting surface for I/O connectors and LED indicators
- Mounting and mating of EMC Gasket surfaces
- Mechanical interface to the AMC Module PCB
- ESD shield and EMC containment
- Mounting and display of product information

Figure 2-5 Module Face Plate LEDs

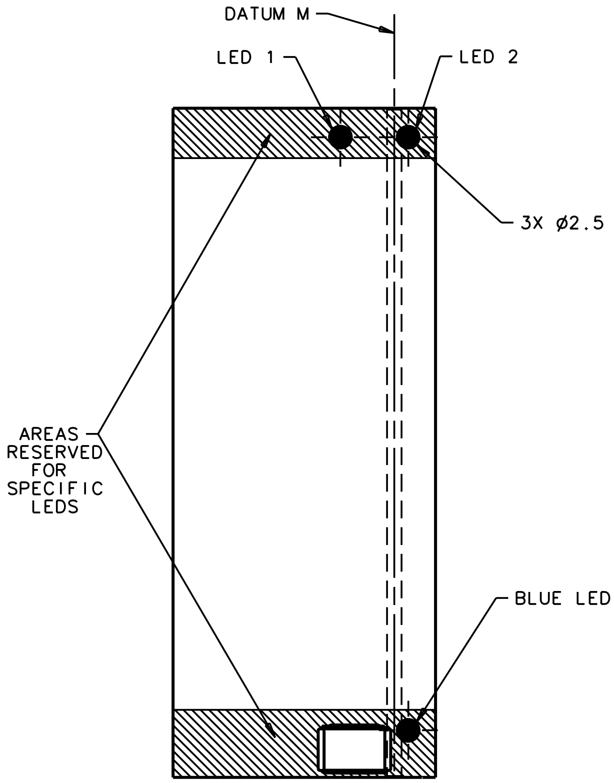


Table 2-2 Module Face Plate dimensions

Module Type	Height	Width
Single, Compact Module	13.88	73.8
Single, Mid-size Module	18.96	73.8
Single, Full-size Module	28.95	73.8
Double, Compact Module	13.88	148.8
Double, Mid-size Module	18.96	148.8
Double, Full-size Module	28.95	148.8

Note: Compact Modules can be converted to Mid-size or Full-size Modules by exchanging the Face Plate accordingly. Mid-size Modules can be converted to Full-size Modules by exchanging the Face Plate accordingly.

2.4 AMC Bay

¶ 56 A Carrier has one or more AMC Bays to receive AMC Modules. An AMC Bay comprises several separate elements that must be mechanically aligned for proper AMC operation. AMC Bays comprise Struts, Module Card Guides, the AMC Connector, and the physical space allocated to house AMC Modules, including a Face Plate opening for the AMC Module to slide into. Struts and Card Guides align the Module properly for insertion into the AMC Connector attached to the Carrier Board. Features and requirements for Cutaway and Conventional Bays described in this section can be applied to any suitable Carrier form factor.

2.4.1 Card Guides and Struts

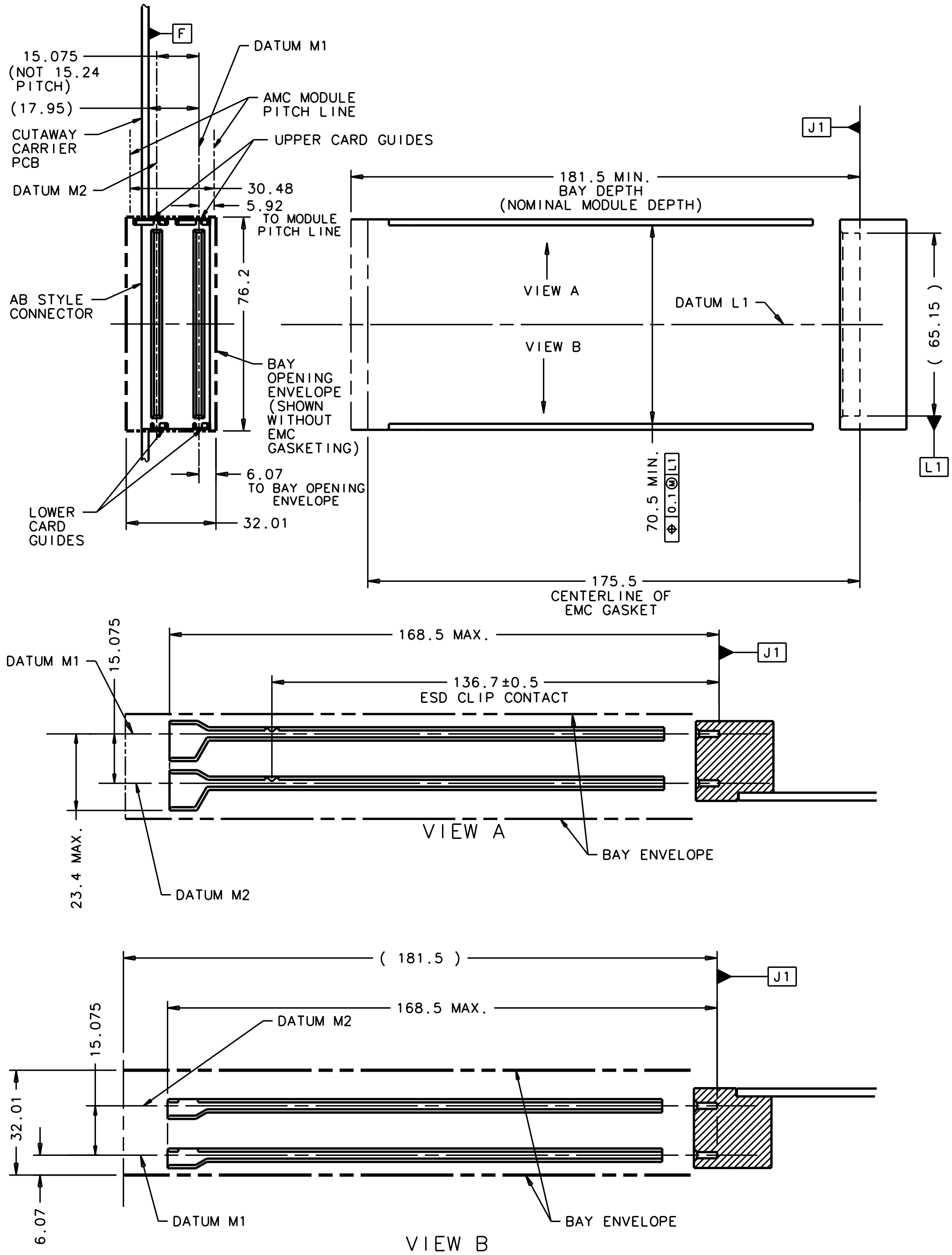
¶ 57 Card Guides provide the channels where the Module PCB edges ride in and out of the AMC Bay. The Card Guides are typically attached to the Carrier Component Side 1 Cover and can be removable or non-removable. Struts support the Card Guide and they also include the interface geometry for the Module Latch Mechanism. The Struts tie the Carrier Component Side 1 Cover to the Carrier Component Side 2 Cover or to the Carrier PCB. Strut and Card Guide design interfaces.

2.4.2 Cutaway Bay

¶ 58 A Cutaway Bay is created by removing the Carrier's PCB between the Face Plate and the AMC Connector. The AB or the A+B+ Connector style support a Dual Slot Cutaway Bay while the B or B+ Connector supports a Single Slot Cutaway Bay. The Single Slot Cutaway Bays that utilize the B or B+ style AMC Connector are optimized to support one Full-size Module.

¶ 59 The Carrier Face Plate aperture, or opening, in a Cutaway Bay is intended to support two Compact Modules or one Full-size Module including the EMC Gasket material for each Module. The Cutaway Bay Opening envelope is the same size as the Carrier AdvancedTCA Board's Face Plate. Cutaway Carrier AdvancedTCA Boards have no Face Plate in the area of any Cutaway Bays. Figure 2-6, "Cutaway Bay dimensions" shows the Cutaway Bay Opening envelope for a Single Bay.

Figure 2-6 Cutaway Bay dimensions



2.4.3 Conventional Bay

¶ 60 Conventional Bays utilize B/B+ style AMC Connectors to support either one Mid-size Module or one Compact Module per Bay. The Conventional Bay Opening defines whether a Conventional Bay is a Compact Conventional Bay or a Mid-size Conventional Bay. Compact Conventional Bays can only accommodate Compact Modules. Mid-size Conventional Bays can only accommodate Mid-size Modules. Full-size Modules are not supported by Conventional Bays.

¶ 61 The Conventional Bay allows Carriers to support AMC Modules while still making use of the Carrier PCB area underneath the Bay. A Conventional Carrier can utilize the Carrier PCB area to place components, connectors or other items within the described component area. Coincident with the Bay opening envelope the height of components that can be placed on the Carrier differs. Figure 2-7, "Single AMC Conventional Bay dimensions" and Table 2-3, "Conventional Bay opening tabulated dimensions for Figure 2-7" show the Conventional Bay opening envelope for Mid-size Modules.

Figure 2-7 Single AMC Conventional Bay dimensions

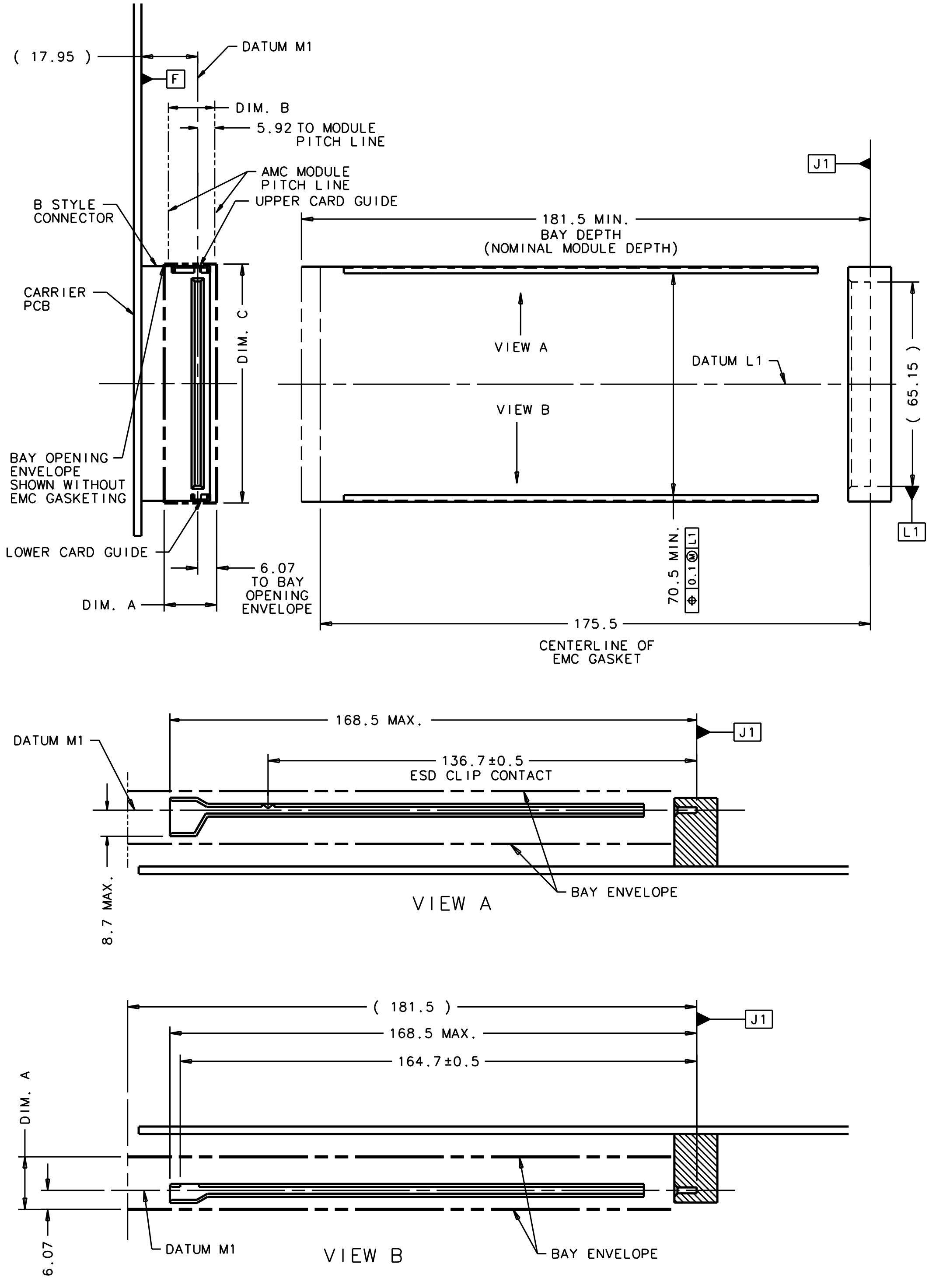


Table 2-3 Conventional Bay opening tabulated dimensions for Figure 2-7

Bay Opening envelope size	Dimension A (mm) without EMI gasket	Dimension B (mm)	Dimension C (mm) without EMI gasket
Compact Module	16.77	15.24	76.2
Mid-size Module	21.89	20.32	76.2
Double, Compact Module	16.77	15.24	151.2
Double, Mid-size Module	21.89	20.32	151.2

2.5 Carrier Boards

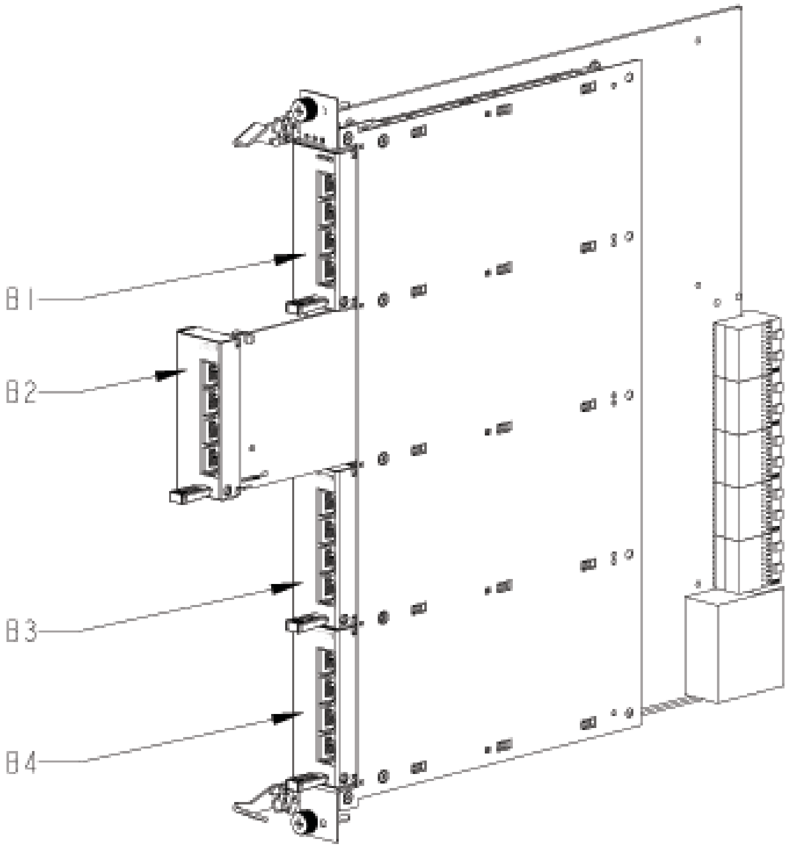
¶ 62 A Carrier Board has one or more AMC Bays to receive AMC Modules. An AMC Bay comprises several separate elements that must be mechanically aligned for proper AMC operation. AMC Bays comprise Struts, Module Card Guides, the AMC Connector, and the physical space allocated to house AMC Modules. Struts and Card Guides align the Module properly for insertion into the AMC Connector attached to the Carrier Board.

¶ 63 Carrier Boards can support Conventional Bays, Cutaway Bays or both. Carriers that support one or more Cutaway Bays are called Cutaway Carriers. Carriers that support one or more Conventional Bays are called Conventional Carriers. Carriers that support both Cutaway and Conventional Bays are called Hybrid Carriers. AMC Carrier AdvancedTCA Boards can support up to four Single Bays or two Double Bays.

¶ 64 Cutaway Carrier AdvancedTCA Boards have no Face Plate area where Cutaway Bays reside. The Cutaway Bay opening is sized to accommodate one Full-size Module or two Compact Modules. Cutaway Carrier AdvancedTCA Boards that support Bays near the edge of the board, such as with four Bay configurations, have specific Face Plate design requirements for LED and Carrier Handle support.

¶ 65 Conventional Carrier AdvancedTCA Boards have some Face Plate area that can be used to support LEDs or labels. The Bays can support either a Mid-size or a Compact Module individually, providing the corresponding aperture.

Figure 2-8 Full-size Modules installed on an Cutaway Carrier AdvancedTCA Board

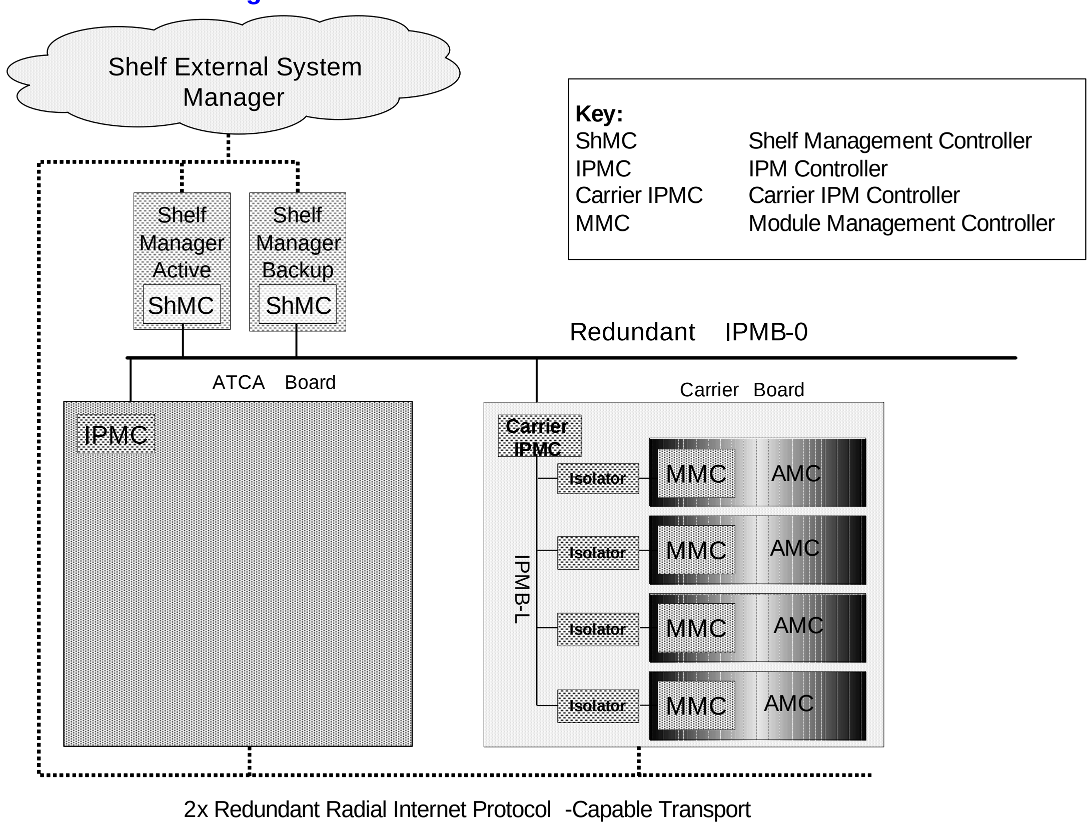


Hardware Platform Management 3

3.1 IPMI and IPMB architecture overview

¶ 66 The Carrier and Module communicate through a limited set of IPMI commands. The intent is to allow the use of inexpensive single chip microcontrollers on the Module. This specification requires that the Carrier provide ways to isolate the IPMB-L connection to each Module. This is done to prevent a single malfunctioning Module from disrupting the entire IPMB-L. The specification also allows IPMB-L to be implemented radially rather than on a bused basis. For clarity, the term IPMB-0 refers to the AdvancedTCA shelf-level IPMB and the term IPMB-L refers to the local, on-Carrier IPMB that links the Carrier IPMC with the MMCs of installed Modules. IPMB-0 and IPMB-L are physically separate buses. In general, the Carrier IPMC is responsible for forwarding messages between the ShMC and Modules as necessary.

Figure 3-1 Module management infrastructure



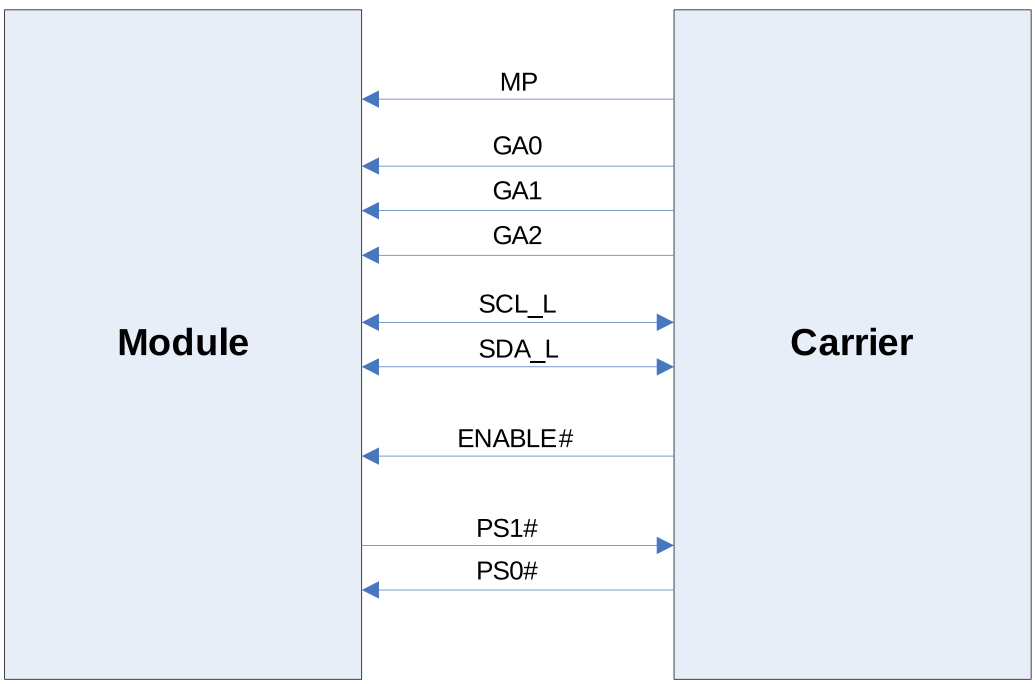
3.2 Module and Carrier Power architecture overview

¶ 67 The Carrier provides Management Power (MP) and Payload Power (PWR) to a Module. Management Power (MP) is used for the management circuitry in the Module. The management circuitry includes the MMC, and pullup resistors for IPMB-L and ENABLE#. Management Power is current-limited by the Carrier. An MMC reset function is provided on the Carrier via the ENABLE# signal. The Carrier holds the MMC in reset until the Module is fully inserted. The MMC reset can also be controlled by the Carrier in the event that it becomes necessary to reset the MMC. Payload Power (PWR) is the power provided to the Module from the Carrier for the main function of the Module. Module FRU Information contains a record that defines the power requirements for the Payload. A Carrier enables PWR if it (together with the Shelf Manager) determines that enough power and cooling exist to support the Module.

3.3 Module management interconnects

¶ 68 Figure 3-2 shows the management interconnects between a Module and its Carrier. Note that active low signals are denoted with a trailing #. All logic levels are assumed to be 3.3 V compatible unless otherwise noted.

Figure 3-2 Management interconnects between Carrier and Module



3.3.1 PS0# and PS1#

¶ 69 PS0# and PS1# pins are used to detect the presence of a Module in a Carrier. The PS0# and PS1# pins are last mate connections located on opposite ends of the connector. These pins are used to compensate for any skew on the Module during insertion and provide confirmation that all pins of the AdvancedMC Connector have mated (with a complementary role on extraction). The Carrier connects PS0# to Logic Ground and pulls up PS1# to the Carrier's 3.3V Management Power. The Module connects PS1# to PS0# through a diode, providing a low voltage drop path from PS1# to PS0#. The Carrier can detect the presence of a Module by an active PS1# signal.The Module can determine insertion into a Carrier by the Carrier's feedback of PS1# on ENABLE# as well as current flowing through the PS0# - PS1# connection.

3.3.2 ENABLE#

¶ 70 The ENABLE# pin is an active low input to the Module pulled up on the Module to Management Power (MP). This signal is inverted on the Module to create a RESET# signal toward the MMC. The negated state of this RESET# indicates to the MMC that the Module is fully inserted and valid states exist on all inputs to the Module. The MMC is not allowed to read the GA inputs or use the IPMB-L while ENABLE# is inactive.

3.3.3 IPMB-L

¶ 71 IPMB-L is made up of clock (SCL_L) and data (SDA_L) signals. These signals are to be considered valid by the Module only when ENABLE# is active. Each Module receives an individually controlled connection to IPMB-L. This individually controlled connection to IPMB-L can be provided using FET type switches or I^2C buffers, for example. Note that although each Module receives an individually controlled connection to IPMB-L, there can only be one logical IPMB-L on the Carrier. The designer of the Carrier is free to provide totally independent IPMBs to each AdvancedMC. Designers are encouraged to take appropriate action to ensure that the MMC provides a high impedance state to the IPMB-L when Management Power is ramping up to its specified range. The ESD protection diodes in most I^2C drivers provide a potential path for leakage. The designer has flexibility in how the Carrier's IPMB-L pullups are implemented. The specification mandates a maximum rise time and on-board capacitance. The designer can chose how to meet the rise time. If each AdvancedMC Slot has individual buffers, a separate resistor is required for each AdvancedMC Slot. If FET isolators are used, then it is possible to use a single pullup. In this case, care must be taken to ensure the pullup is still provided in the event that the Carrier disables an IPMB-L to a malfunctioning Module.

3.3.4 Management Power (MP)

¶ 72 Module management subsystem is powered by Module Management Power (MP). The Module is ensured via requirements to the Carrier that Payload Power is only available if Management Power is available.

¶ 73 Current limiting on the Carrier is required to prevent defective Modules from bringing down the other Modules on the Carrier. Since the current and resistances are quite low, it is possible to implement a Carrier design which will not require separate regulators for each AMC Slot. However, isolation of each AMC power management interface is required. So each Module source must be individually current limited on the Carrier. The Carrier power is determined indirectly by the fraction of total power that is consumed by the Modules. As an example, eight Modules would directly consume 4 W, which would be subtracted from the total power budgeted for the Carrier.

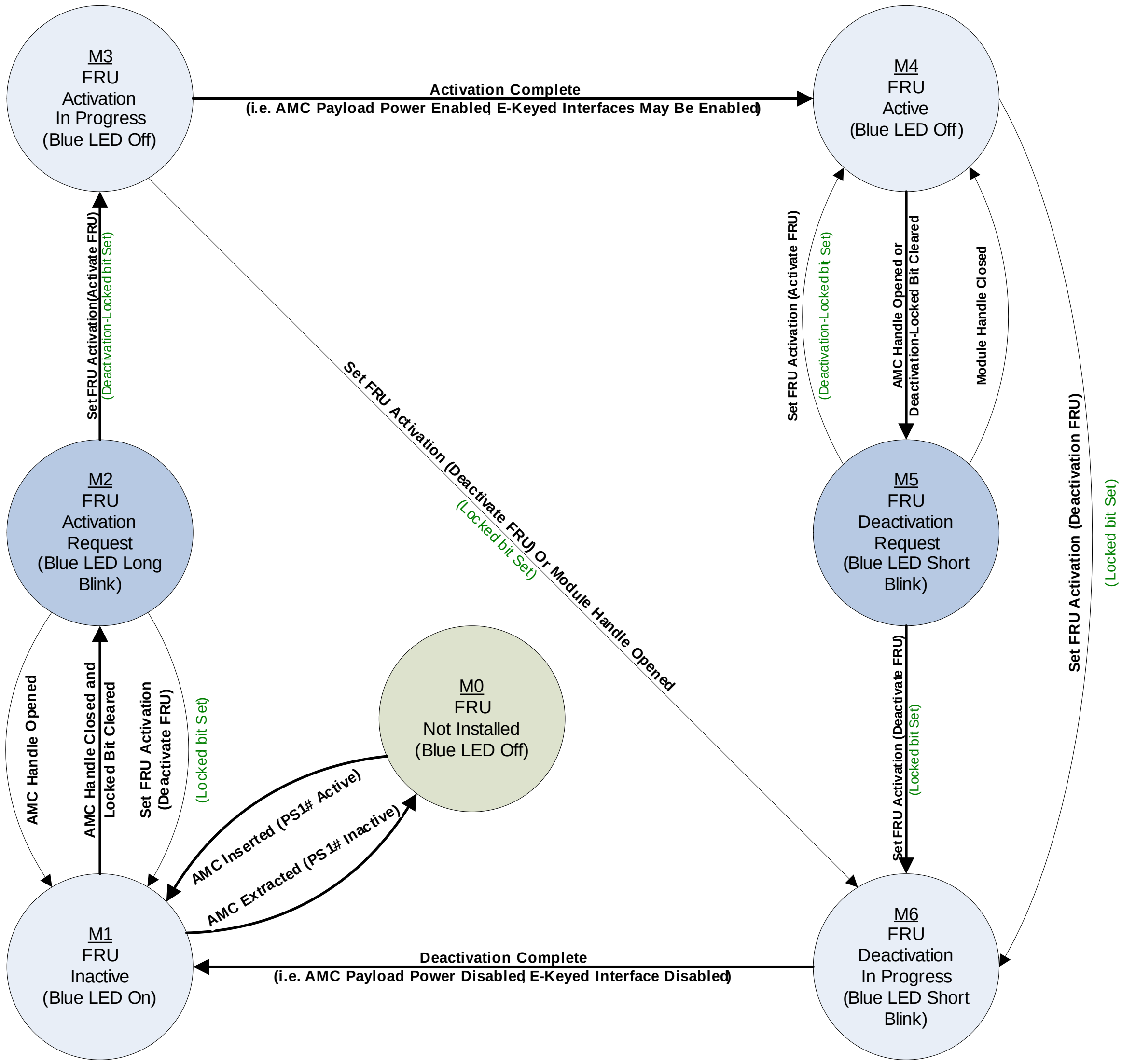
3.4 Module operational state management

¶ 74 The operator interface elements associated with operational state management of Modules include 1) the Module Handle, which is used to insert and extract the Module into and out of a Carrier, 2) the Module Handle state, which is open or closed, and 3) the BLUE LED that gives a visual indication to the operator of the operational state of the Module.

¶ 75 When a Module is inserted into a Carrier it goes through a series of states to become active. It also goes through a series of states as it deactivates in preparation for extraction.

¶ 76 These FRU states for the Module are tracked and reported by the Carrier IPMC for all its Modules. AMCs do not track their own FRU states and FRU state transitions.

Figure 3-3 FRU state transition diagram for AMC

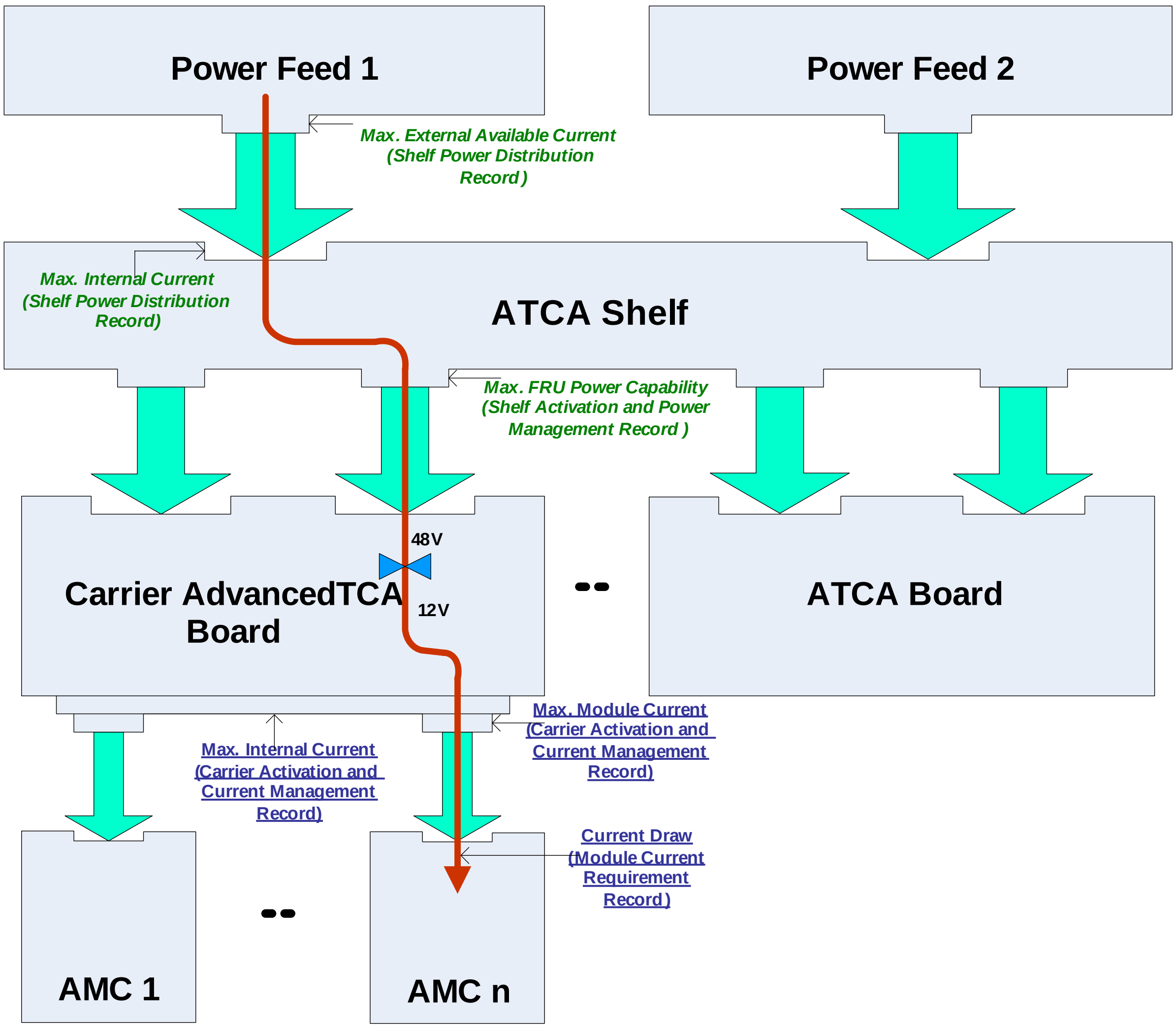


3.5 Power management

¶ 77 The power management of Modules is a shared responsibility between the Carrier and Shelf Manager. The Carrier is responsible for determining if the Carrier can supply the necessary power to a Module. If the Carrier can supply the power, the Carrier will request the necessary power budget from the Shelf Manager. Once the Carrier has been allocated power from the Shelf Manager, it is then able to enable PWR to the Module.

¶ 78 As explained in the PICMG 3.0 Specification, in order to make intelligent decisions about when FRUs (in this case, AdvancedMCs) are powered up or down and what power levels to assign for each FRU (in this case, AdvancedMC), the Shelf Manager must collect several items of data. Figure 3-4 shows the specific decision points and data items used by the Shelf Manager (italicized in dark green) and the Carrier IPMC (underlined in dark blue) to act on Power allocation for a Module.

Figure 3-4 Power distribution management architecture



3.6 Cooling management

¶ 79 To support higher level management in appropriately managing the cooling resources, the Module must provide reports of abnormal temperature in its environment. Every Module must have temperature sensors; when an MMC detects that a monitored temperature sensor crosses one or more thresholds in either direction, the MMC sends an IPMI temperature event message to the Carrier IPMC. The Carrier IPMC, or higher level management, uses this information to manage the cooling.

3.7 E-Keying

¶ 80 The AMC.0 specification supports two types of topologies for point-to-point fabric connections. One type is a direct Module to Module connection. The Carrier provides a connection between two Modules. No other device is allowed to be connected to the Module Port in this scenario. In the second type, the Carrier contains an on-Carrier device. The Module Port is terminated at the on-Carrier device. This device might contain connections to other AdvancedMC Slots or to the AdvancedTCA Zone 2 connector. The Carrier IPMC is responsible for E-Keying between the Modules and their connections to Carrier resources. E-Keying for an on-Carrier device to backplane interface is out of scope of the AMC.0 specification and is covered by PICMG 3.0.

¶ 81 Point-to-point fabric E-Keying is done on a Port by Port basis. Ports are enabled if both ends of the Port have matching protocols. The term enable when used in this section might not refer to the actual enabling of the LVDS driver for a Port. In this specification, Ports that are LVDS are not required to support the physical enabling/disabling of the driver. Note that non-LVDS Ports must power up in a disabled state.

¶ 82 The basis for the E-Keying process is the E-Keying entries present as FRU Information in the Carrier and all Modules. References in this section to AdvancedMCs refer to information that is relevant to Carriers as well as Modules. When necessary, Carrier and Module will be used to denote device specific information. There are two records that contain the E-Keying information. The Carrier Point-to-Point Connectivity record contains information about the Carrier's Port physical connections. The AdvancedMC point-to-point connectivity record describes the protocols supported by the port. The AdvancedMC point-to-point connectivity can be found in the Carrier and Module's FRU Information. The Carrier Point-to-Point Connectivity record is located in the Carrier's FRU Information. Those E-Keying entries describe the Fabric Interface implemented. It is the IPMC's responsibility to perform the Module Port E-Keying function. The AdvancedTCA Shelf Manager does not participate in the Module E-Keying.

¶ 83 For AdvancedMCs, the primary unit of point-to-point connectivity is a Port. A Port is two differential pairs (one transmit and one receive). One to four Ports can be grouped into a logical AdvancedMC Channel that is similar to an AdvancedTCA Channel. An AdvancedMC Channel is composed of an arbitrary (not necessarily numerically or physically contiguous) set of up to four Ports.

¶ 84 AdvancedMC Channels are identified by AdvancedMC Channel IDs. In the data structures and commands defined in this section, AdvancedMC Channel IDs play essentially the same role as Channel numbers in AdvancedTCA E-Keying. AdvancedMC Channel IDs start at 0 and are numbered sequentially on a Carrier or separately on a Module. A Channel ID is simply an index into the list of AdvancedMC Channels that are defined on a Carrier or on a Module.

3.7.1 Clock E-Keying

¶ 85 The AMC Clock Interface is comprised of four Telecom clocks (TCLKA, TCLKB, TCLKC and TCLKD) plus one fabric clock (FCLKA). These AMC clocks are typically connected to corresponding on-Carrier clock resources or, in the case of an AMC Carrier AdvancedTCA Board, the AdvancedTCA Backplane clocks. A connection between two clocks of these types, together with the associated protocol, is called a Clock Link. Clock Links can be dynamically configured based on the requirements of the application. By default, all AMC clocks and on-Carrier clock resources are in the disabled state when the AMC Module or Carrier is initially activated.

¶ 86 Just like fabric E-Keying which is discussed in the previous section, clock E-Keying provides a mechanism to manage the clock resources, including the on-Carrier devices and AMC clocks, and to prevent hardware damage due to a mismatch between the clock source and clock receiver at the Clock Link endpoints. Only when a match is found between the clock source and clock receiver, including the protocol, are the clocks activated. Typically the Carrier IPMC performs the clock E-Keying operation, but if an implementation needs the application to conduct the E-Keying operation, the clock activation can be controlled by the application.

3.8 FRU Information

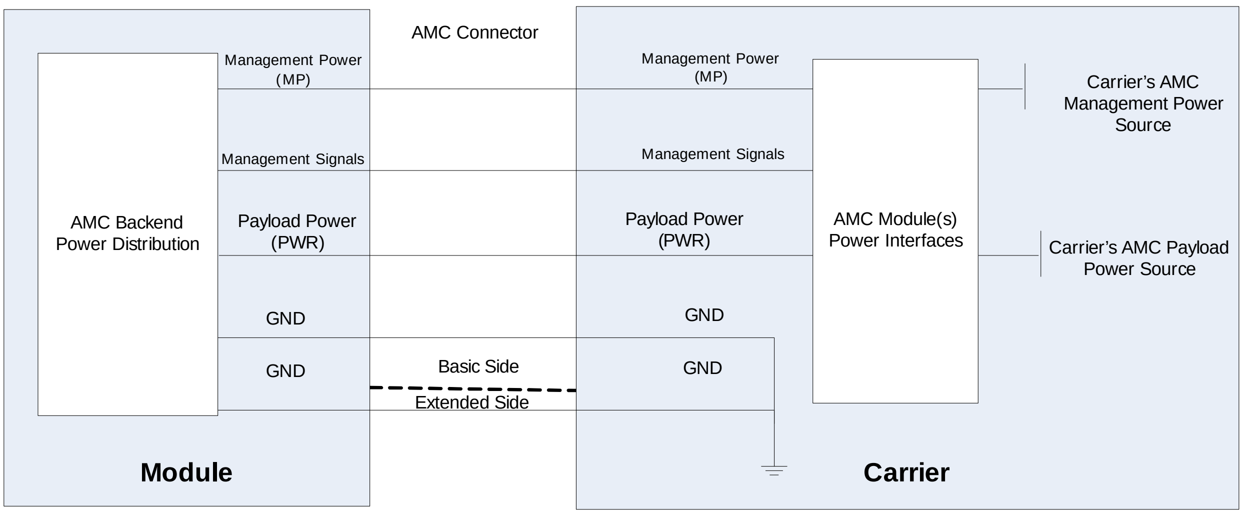
¶ 87 All Carriers and Modules must contain a FRU Information storage device (for instance, an SEEPROM) that contains information about capabilities (e.g. E-Keying) and inventory data. The format of the FRU Information follows the requirements set forth in Section 3.6.3, IPM Controller FRU Information, in the PICMG 3.0 Specification. In addition to this basic information, additional records are required to support functions unique to the Modules.

¶ 88 The term FRU Information refers to information stored within the Module or Carrier in some non-volatile storage location. For instance, it could be contained in a SEEPROM within the unit. In all cases, the FRU Information is accessed through a controller that communicates with the non-volatile storage within the FRU to read and write data.

Power Distribution 4

¶ 89 The power distribution required to support AMCs on the Carrier includes power sources for both Payload Power and Management Power. Figure 4-1, "Power distribution block diagram" shows the major components comprising the power distribution system.

Figure 4-1 Power distribution block diagram



¶ 90 AMC uses single 12V Payload Power, which can be converted on the Module to any voltage required. Single Payload Power voltage helps to minimize number of power pins. This also accounts for the supply voltages migrating to lower and lower voltages as chip geometries shrink. This approach has the additional advantage of lending itself to a point of load (POL) regulated power distribution strategy (to all payload circuits on the Module), which is recommended as a superior design technique. AMC Payload Power distribution is variable and determined by the Module design. Up to 80 W can be delivered to a Module via the AMC Connector.

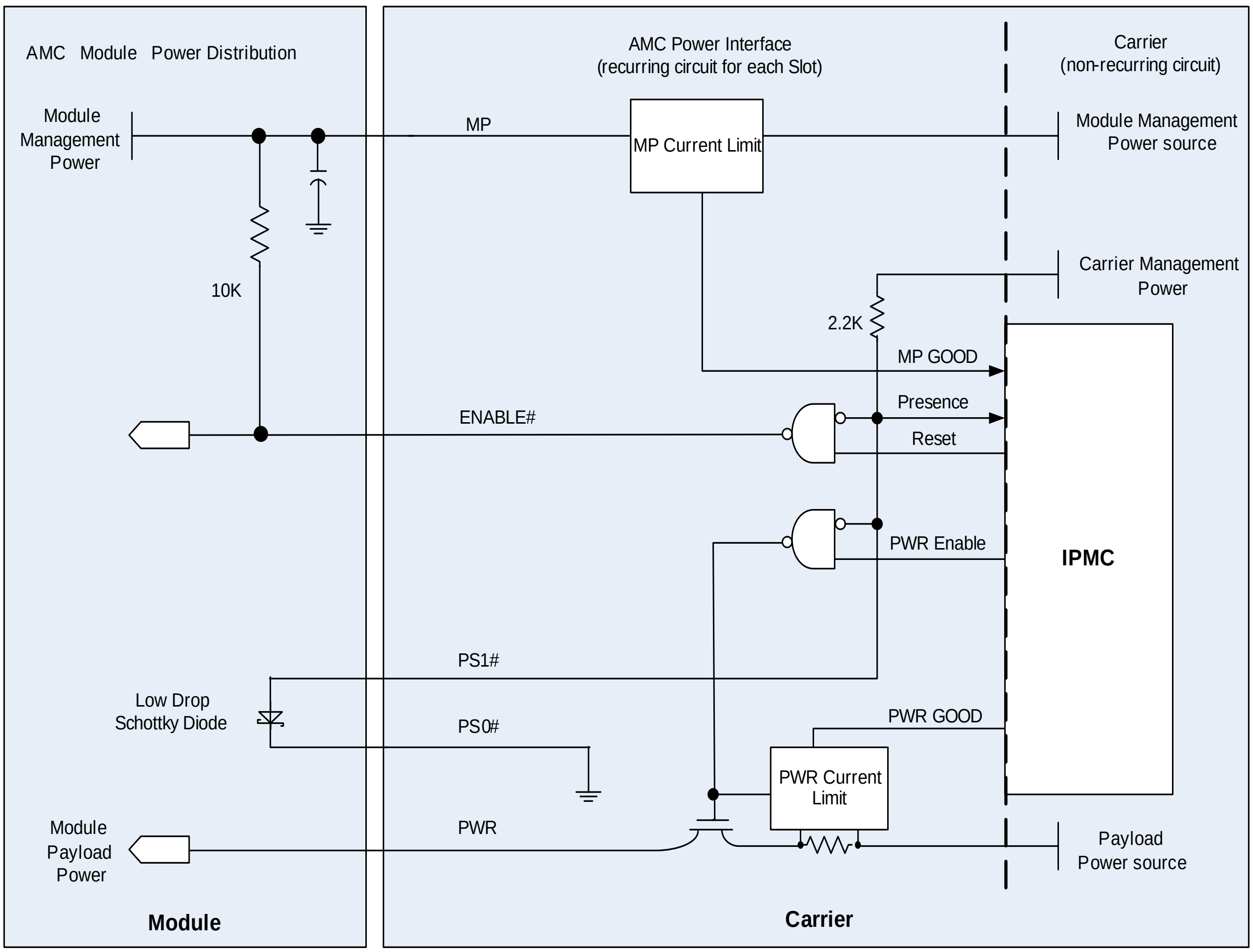
¶ 91 Management Power needs to be available at the AMCs even if the Carrier Payload Power is not activated. Therefore the Management Power for the Modules must be derived from the Carrier's Management Power.

¶ 92 Module power interface presented in Figure 4-2, "Module power interface" includes Management Power (MP) and Payload Power (PWR) current limiters; these two supply voltages need to have power-good indicators so that the system management can detect boot sequence events and nominal operating conditions.

¶ 93 PS0# and PS1# provide for AMC presence detection. Two signals are used to ensure that the Module is fully seated at both ends of the connector. Also, the interface circuitry presented in Figure 4-2, "Module power interface" recurs for every Module-Carrier combination. The power interface also provides an ENABLE# signal which is an open drain signal, driven by the Carrier and pulled up to MP on the Module. This signal is asserted when the Carrier detects that the Module is fully inserted. The Carrier can additionally cycle ENABLE# to restart the MMC if needed. The MMC is supposed to not execute a payload reset on the Module in this case.

¶ 94 The IPMC might be able to sense the actual amount of Payload Power current flow for any AMC Slot. This allows the IPMC to dynamically respond if an AMC Slot draws more current than the stored value on the FRU ROM. The response of the IPMC could be to inform the Shelf Manager of this or to immediately shut down the offending AMC Slot's Payload Power.

Figure 4-2 Module power interface



Thermal 5

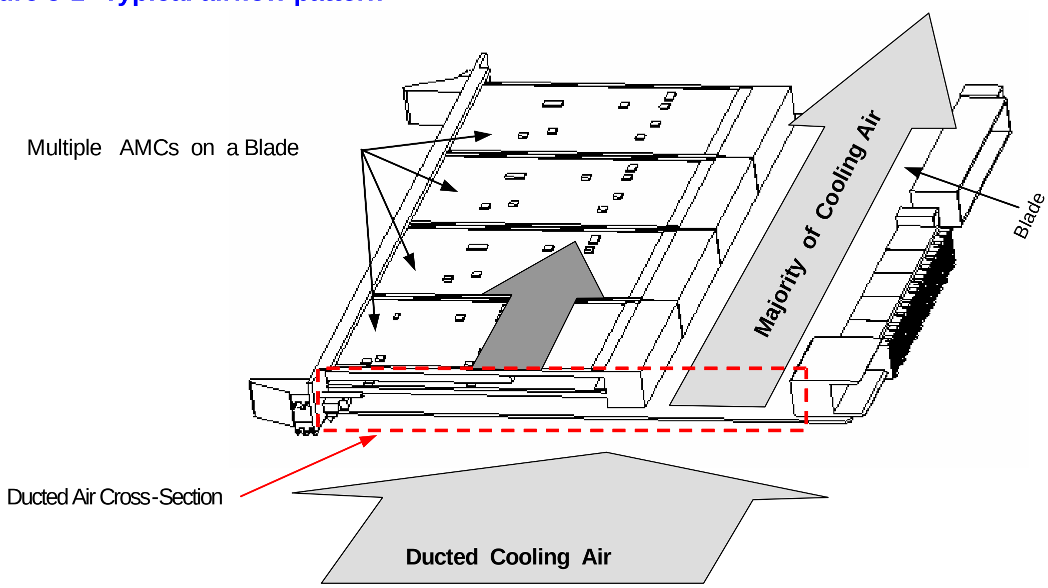
¶ 95 Carriers with mezzanine cards are in fact the most challenging thermal design applications and some issues that cause them to be so are:

- Multiple Carrier form factors
- Wide range of Module types
- Higher airflow impedance
- Varying power levels

¶ 96 There are at least two approaches to obtaining the thermal data required in this section: 1) Thermal analysis using Computational Fluid Dynamics modeling tools, such as ICEPAK from Fluent or Flotherm from Flomerics, and 2) Empirical measurement using a wind tunnel. The analysis approach requires specified pressure gradients across Modules or Carriers. Analysis can be carried out early in the design cycle. Empirical measurements also provide values for the pressure across a device for a set of airflows. One advantage of measurements is that the effect of every component on the board is included, provided that any errors introduced by the measurement process are accounted for. Knowing the design pressure will enable the ability to calculate volumetric airflow based on impedance curves of the individual components. Then having determined airflow, heat dissipation and temperature rise can be calculated.

¶ 97 Carrier airflow paths have significant influence on Module cooling. Depending on the configuration of the Carrier and the installed AMCs, the power dissipation can be extremely unbalanced. The ATCA enclosure provides an equally distributed airflow resource to each ATCA Slot. The Carrier with the installed AMCs ideally represents a homogenous airflow impedance to maintain a homogenous volumetric airflow along the cross-section of the ATCA Board. In some cases, baffles will be required to force the airflow to remain in a range despite high airflow impedance.

Figure 5-1 Typical airflow pattern



¶ 98 Though the AMC.0 specification allows any Module to draw and dissipate up to 80 W regardless of size, such a high dissipation level may not be viable for all Module sizes. In addition, Carriers can limit the amount of power allotted to Modules to a lesser value; this is handled through the IPMI subsystem as described in Section 3.5, "Power management." A first-order approximation of AMC Module thermal density compared with 200 W AdvancedTCA Boards gives a rough idea of what Module dissipation may be reasonable in AMC Carrier AdvancedTCA Boards.

Table 5-1 Representative Module power dissipation

	Single	Double
Compact	24	48
Mid-size	30	60
Full-size	48	80

Interconnect 6

¶ 99 The AMC.0 interconnect framework comprises the physical Connector used to mate the AMC with its Carrier Board, the mapping of signals to that Connector, and the routing of those signals among the AMCs across the Carrier, and also to the Carrier based switching elements. The performance headroom in the Connector will allow future interconnect technologies with higher signal rates to be accommodated within the framework. The generic signal mapping across the AMC Connector supports a variety of system fabric topologies for connecting AMCs. The Interconnect interfaces are divided into five functional groups:

- Fabric Interface
- System Management Interface
- AMC Clock Interface
- JTAG Test Interface
- Power/ Ground

¶ 100 The AMC.0 base specification provides a physical framework for the Fabric Interface. AMC.0 subsidiary specifications define how to overlay a specific switching interconnect technology onto the AMC.0 Fabric Interface physical framework.

¶ 101 Governance of AMC Module and Carrier Board compatibility for the Interconnect interfaces, including the Fabric Interface, is provided by an Electronic Keying mechanism that is an integral part of the AMC.0 Module Management architecture.

6.1 Connector contact allocation

¶ 102 The AMC Connector supports 170 or 85 contacts depending on the connector style. Pins numbered higher than 85 are available only on Extended style connectors.

¶ 103 The AMC Connector contacts are allocated to the five functional groups as follows:

- 40 signal pairs allocated to the Fabric Interface
- 5 signal pairs allocated to the AMC Clock Interface
- 5 contacts allocated to the JTAG Test Interface
- 9 contacts allocated to the System Management Interface
- 8 contacts allocated to Payload Power
- 56 contacts to allocated to Logic Ground
- 2 contacts reserved

¶ 104 Four levels of sequential mating (first mate, second mate, third mate, and last mate) are provided to ensure a correct electrical connection sequence is followed during insertion and extraction of the Module.

Table 6-1 AMC Module Card-edge Interface contact assignments

Basic Side (Component Side 1)					Extended Side (Component Side 2)				
Pin No.	Signal	Driven by	Mating	Pin Function on the AMC	Pin No.	Signal	Driven by	Mating	Pin Function on the AMC
84	PWR	Carrier	First	Payload Power	87	Rx8-	Carrier	Third	Port 8 Receiver -
83	PS0#	Carrier	Last	Presence 0	88	Rx8+		Third	Port 8 Receiver +
81	FCLKA-	FCLKA driver	Third	Fabric Clock A -	90	Tx8-	AMC	Third	Port 8 Transmitter -
80	FCLKA+		Third	Fabric Clock A +	91	Tx8+		Third	Port 8 Transmitter +
78	TCLKB-	TCLKB driver	Third	Telecom Clock B -	93	Rx9-		Third	Port 9 Receiver -
77	TCLKB+		Third	Telecom Clock B +	94	Rx9+	Carrier	Third	Port 9 Receiver +
75	TCLKA-	TCLKA driver	Third	Telecom Clock A -	96	Tx9-	AMC	Third	Port 9 Transmitter -
74	TCLKA+		Third	Telecom Clock A +	97	Tx9+		Third	Port 9 Transmitter +
72	PWR	Carrier	First	Payload Power	99	Rx10-	Carrier	Third	Port 10 Receiver -
71	SDA_L	IPMI Agent	Second	IPMB-L Data	100	Rx10+		Third	Port 10 Receiver +
69	Rx7-	Carrier	Third	Port 7 Receiver -	102	Tx10-	AMC	Third	Port 10 Transmitter -
68	Rx7+	Carrier	Third	Port 7 Receiver +	103	Tx10+		Third	Port 10 Transmitter +
66	Tx7-	AMC	Third	Port 7 Transmitter -	105	Rx11-	Carrier	Third	Port 11 Receiver -
65	Tx7+		Third	Port 7 Transmitter +	106	Rx11+		Third	Port 11 Receiver +
63	Rx6-	Carrier	Third	Port 6 Receiver -	108	Tx11-	AMC	Third	Port 11 Transmitter -
62	Rx6+		Third	Port 6 Receiver +	109	Tx11+		Third	Port 11 Transmitter +
60	Tx6-	AMC	Third	Port 6 Transmitter -	111	Rx12-	Carrier	Third	Port 12 Receiver -
59	Tx6+		Third	Port 6 Transmitter +	112	Rx12+		Third	Port 12 Receiver +
57	PWR	Carrier	First	Payload Power	114	Tx12-	AMC	Third	Port 12 Transmitter -
56	SCL_L	IPMI Agent	Second	IPMB-L Clock	115	Tx12+		Third	Port 12 Transmitter +
54	Rx5-	Carrier	Third	Port 5 Receiver -	117	Rx13-	Carrier	Third	Port 13 Receiver -
53	Rx5+		Third	Port 5 Receiver +	118	Rx13+		Third	Port 13 Receiver +
51	Tx5-	AMC	Third	Port 5 Transmitter -	120	Tx13-	AMC	Third	Port 13 Transmitter -
50	Tx5+		Third	Port 5 Transmitter +	121	Tx13+		Third	Port 13 Transmitter +
48	Rx4-	Carrier	Third	Port 4 Receiver -	123	Rx14-	Carrier	Third	Port 14 Receiver -
47	Rx4+		Third	Port 4 Receiver +	124	Rx14+		Third	Port 14 Receiver +
45	Tx4-	AMC	Third	Port 4 Transmitter -	126	Tx14-	AMC	Third	Port 14 Transmitter -
44	Tx4+		Third	Port 4 Transmitter +	127	Tx14+		Third	Port 14 Transmitter +
42	PWR	Carrier	First	Payload Power	129	Rx15-	Carrier	Third	Port 15 Receiver -
41	ENABLE#	Carrier	Second	AMC Enable	130	Rx15+		Third	Port 15 Receiver +
39	Rx3-	Carrier	Third	Port 3 Receiver -	132	Tx15-	AMC	Third	Port 15 Transmitter -
38	Rx3+		Third	Port 3 Receiver +	133	Tx15+		Third	Port 15 Transmitter +
36	Tx3-	AMC	Third	Port 3 Transmitter -	135	TCLKC-	TCLKC Driver	Third	Telecom Clock C -
35	Tx3+		Third	Port 3 Transmitter +	136	TCLKC+		Third	Telecom Clock C +
33	Rx2-	Carrier	Third	Port 2 Receiver -	138	TCLKD-	TCLKD Driver	Third	Telecom Clock D -
32	Rx2+		Third	Port 2 Receiver +	139	TCLKD+		Third	Telecom Clock D +
30	Tx2-	AMC	Third	Port 2 Transmitter -	141	Rx17-	Carrier	Third	Port 17 Receiver -
29	Tx2+		Third	Port 2 Transmitter +	142	Rx17+		Third	Port 17 Receiver +
27	PWR	Carrier	First	Payload Power	144	Tx17-	AMC	Third	Port 17 Transmitter -
26	GA2	Carrier	Second	Geographic Addr. 2	145	Tx17+		Third	Port 17 Transmitter +
24	Rx1-	Carrier	Third	Port 1 Receiver -	147	Rx18-	Carrier	Third	Port 18 Receiver -
23	Rx1+		Third	Port 1 Receiver +	148	Rx18+		Third	Port 18 Receiver +
21	Tx1-	AMC	Third	Port 1 Transmitter -	150	Tx18-	AMC	Third	Port 18 Transmitter -
20	Tx1+		Third	Port 1 Transmitter +	151	Tx18+		Third	Port 18 Transmitter +
18	PWR	Carrier	First	Payload Power	153	Rx19-	Carrier	Third	Port 19 Receiver -
17	GA1	Carrier	Second	Geographic Addr. 1	154	Rx19+		Third	Port 19 Receiver +
15	Rx0-	Carrier	Third	Port 0 Receiver -	156	Tx19-	AMC	Third	Port 19 Transmitter -
14	Rx0+		Third	Port 0 Receiver +	157	Tx19+		Third	Port 19 Transmitter +
12	Tx0-	AMC	Third	Port 0 Transmitter -	159	Rx20-	Carrier	Third	Port 20 Receiver -
11	Tx0+		Third	Port 0 Transmitter +	160	Rx20+		Third	Port 20 Receiver +
9	PWR	Carrier	First	Payload Power	162	Tx20-	AMC	Third	Port 20 Transmitter -
8	RSRVD8		Second	Reserved, not connected	163	Tx20+		Third	Port 20 Transmitter +
6	RSRVD6		Second	Reserved, not connected	165	TCK	Carrier	Second	JTAG Test Clock Input
5	GA0	Carrier	Second	Geographic Addr. 0	166	TMS	Carrier	Second	JTAG Test Mode Select In
4	MP	Carrier	First	Management Power	167	TRST#	Carrier	Second	JTAG Test Reset Input
3	PS1#	AMC	Last	Presence 1	168	TDO	AMC	Second	JTAG Test Data Output
2	PWR	Carrier	First	Payload Power	169	TDI	Carrier	Second	JTAG Test Data Input

Legend to the colors used in the signal mapping tables			
PWR	12V Payload Power		Fabric Interface differential signal
MP	3.3V Managemnent Power		Clock Interface differential signal

Note: Port 16 as defined in R1.0 of the AMC.0 specification (pins 135-136, 138-139) has been re-defined for use as TCLKC and TCLKD. As a result, there is no Port 16 defined for the Fabric Interface any longer. The R1.0 clock names have now changed: CLK1 is now TCLKA, CLK2 is now TCLKB, CLK3 is now FCLKA.

Note: The Logic Ground pin numbers are: 1, 7, 10, 13, 16, 19, 22, 25, 28, 31, 34, 37, 40, 43, 46, 49, 52, 55, 58, 61, 64, 67, 70, 73, 76, 79, 82, 85, 86, 89, 92, 95, 98, 101, 104, 107, 110, 113, 116, 119, 122, 125, 128, 131, 134, 137, 140, 143, 146, 149, 152, 155, 158, 161, 164, 170.

6.2 Fabric Interface

¶ 105 The Fabric Interface comprises up to 20 Ports providing point-to-point connectivity for Module-to-Carrier and Module-to-Module implementations. The Fabric Interface can be used in a variety of ways by AMCs and AMC Carrier Boards to meet the needs of many applications. There are two usage models:

- Transport types covered by the AMC subsidiary specifications, i.e., Ethernet, PCI-Express, etc.
- Vendor-specific mappings named within this specification as General Purpose Input/Output. GPIO still adheres to the Fabric Interface electrical specifications.

6.3 AMC Clock Interface

¶ 106 The AMC specification provides two types of clocks, Telecom Clocks and a Fabric Reference Clock. A total of five clocks are provided - four Telecom Clocks and one Fabric Reference Clock. The support for these clocks is optional and dependent on the application and Fabric used. Linkage between ATCA and AMC clock usage is provided as guidance. The AMC specification defines recommended usages of the clocks to maximize vendor interoperability. These are just recommendations and designers are provided flexibility in the implementation and usage of the clocks. At this time, the AMC specification provides guidance for Telecom Clock usage in SONET/SDH and PDH applications. It is envisioned that future versions of this specification or subsidiary specifications will provide guidance for other applications such as WiMax and synchronous ethernet. Fabric clocks are only required for some interfaces, such as PCI Express (AMC.1). They are not connected for other fabric types. Table 6-2, “AMC Telecom Clock usage” and Table 6-3, “AMC Fabric Clock usage” provide a list of the AMC clocks and preferred usage.

Table 6-2 AMC Telecom Clock usage

Clock Name	Contacts	Direction
TCLKA	74/75	In to Module
TCLKB	77/78	Out from Module
TCLKC	135/136	In to Module
TCLKD	138/139	Out from Module

Table 6-3 AMC Fabric Clock usage

Clock Name	Contacts	Direction
FCLKA	80/81	In to Module

6.3.1 AMC Clock architecture

¶ 107 Each AMC clock is implemented as a differential pair that connects to each AMC Module Slot through the AMC Connector pins. AMC Modules can implement a connection to any number of Telecom and Fabric Clock Interfaces.

¶ 108 The AMC Module specification provides support for a half-duplex (bi-directional) point-to-point M-LVDS clocking scheme. A 100 Ω line-termination is required on both ends of the transmission line.

¶ 109 Telecom Clock distribution is typically implemented on a Carrier using buffers or muxes to connect each AMC Site to an on-Carrier Clock bus. In this case, a Carrier based clock distribution device is responsible for receiving the incoming clock from either an AMC Module or an external source and then providing multiple versions of the received clock to the other subscribed entities. Alternatively, Telecom Clock distribution can be implemented using a radial clock buffer such as prescribed in MicroTCA.

6.4 JTAG Interface

¶ 110 JTAG IEEE 1149.1 Test Access Port (TAP) support is provided on the AMC Connector. This provides an industry standard method of performing manufacturing test and verification and is critical to the test of today's complex products that are often making extensive use of BGA device packages. The JTAG Interface enables a variety of cost-effective, structural test and programming solutions for devices, boards, and systems applicable across all phases of product development, manufacturing, installation, servicing and repair with minimal incremental Materials Only Cost (MOC). The optional JTAG support is provided via the Extended Side of the AMC Connector, which is available in the B+ or A+B+ Connectors.

¶ 111 The Module can support JTAG as required by the vendor. The Carrier can provide JTAG chain support for Modules and must allow the chain to be kept intact in the absence of an empty Module Bay. If it supports JTAG, the Module must function correctly on a non-JTAG supporting Carrier by providing applicable pullup/pulldown resistors.

¶ 112 Buffering of the JTAG signal distribution is prescribed both on the Carrier and on the Module for the support of high test clock rates and for reliable functionality of the JTAG test in non-AdvancedTCA environments.

6.5 Fundamental routing models

¶ 113 There are fundamentally two AMC Carrier routing models that can be adopted, these being the centralized AMC switch model and the Module to Module direct connectivity model. The connectivity of the Module to the AMC Carrier AdvancedTCA Board's Zone 2 Connector is typically implemented via the AMC Carrier provided switch element as this allows the coupling of the non-redundant local signals to the redundant network on the Backplane. Figure 6-1 and Figure 6-2 show how direct AMC Module connectivity to the AdvancedTCA Zone 3 for rear I/O support could be supported.

Figure 6-1 Centralized switch model

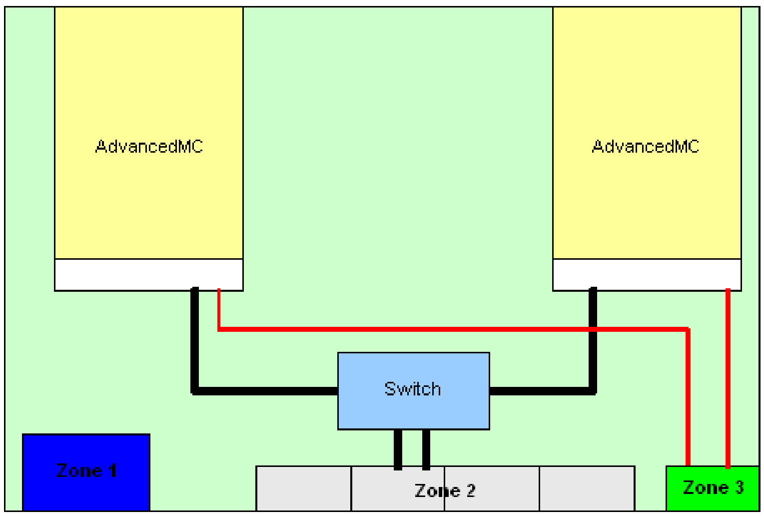
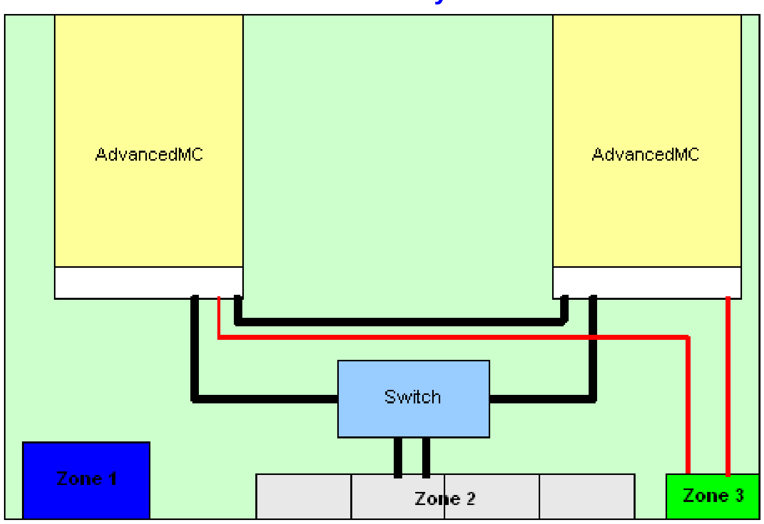


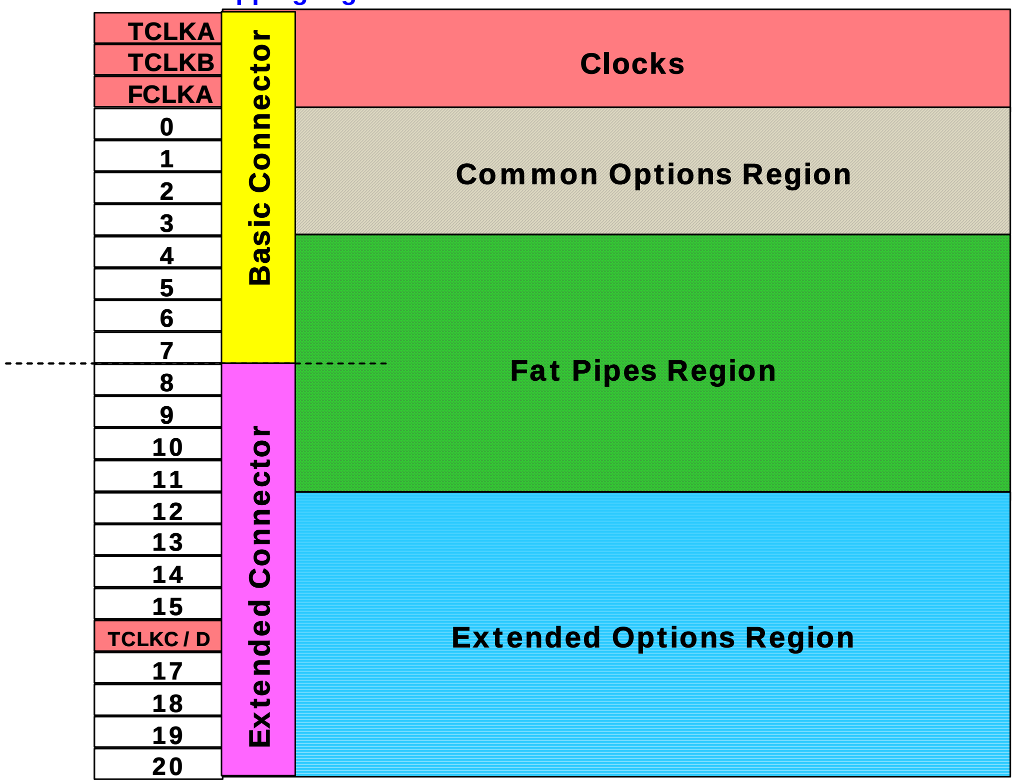
Figure 6-2 Module-to-Module direct connectivity



6.6 AMC Port mapping guidance

¶ 114 Three primary regions are defined for AMC Ports as illustrated in Figure 6-3: Common Options, Fat Pipes, and Extended Options. A fourth category "AMC Clocks" is also provided for completeness.

Figure 6-3 AMC Port mapping regions



6.6.1 Fat Pipes Region

¶ 115 The Fat Pipes Region is defined to support data path connections such as PCI Express, Advanced Switching, Ethernet and Serial RapidIO. A "Fat Pipe" is a data transmission circuit or network that is capable of carrying large amounts of data without significantly degrading the speed of transmission.

¶ 116 The Fat Pipes Region includes a total of 8 Ports using Ports 4-11, with 4 of those Ports defined on the Basic Side and the remaining 4 on the Extended Side of the Connector. The Extended Connector is needed only when more than 4 ports are needed for Fat Pipes.

6.6.2 Common options region

¶ 117 The Common Options region is defined to support essential interfaces that are common across multiple Fat Pipe implementations. The intent is to define each common interface once and allow it to be used in conjunction with other Fat Pipe interfaces or used independently. This helps to ensure a standardized approach of common options across multiple Fat Pipe subsidiary specifications. The Common Options Region is defined as Ports 0-3 to ensure their availability on a Basic Connector. Ideal candidates for this region include storage (e.g., SAS, SATA and FC) and Control Path interfaces.

6.6.3 Extended options region

¶ 118 The Extended Options Region is loosely defined but recommend for use for RTM (Rear Transition Module) support. It is also recommended for use as an extension of both the Common Options and Fat Pipes Regions, when additional Ports are needed.

AMC Connector 7

¶ 119 The AMC Connector is a single-part Z-Pluggable Connector. It contains groups of contacts for power, for general purpose connections, and for very high speed transmissions.

¶ 120 The general contact pitch is 0.75mm at the Module side and at the Carrier side.

¶ 121 The AMC Connector makes pluggable card edge connections to the contact fingers on the AMC Module PCB and by either solderless compression or other methods to either connections to the conductive pads or other conductive features on the Carrier Board. If required, it can be mounted on the Carrier by means of two screws through the Carrier Board onto a steel Connector Brace.

¶ 122 The AMC Connectors also support non-AdvancedTCA applications.

7.1 AMC Connector options

¶ 123 The Extended Connector connects to contact fingers on both sides of the AMC Module PCB. The contacts on Component Side 2 are called the Extended Side of the AMC Module Interface.

¶ 124 The Basic Connectors have been designated as B and AB, while the Extended Connectors have been designated as B+ and A+B+.

¶ 125 Each style of connector is available with options for mounting to the Carrier Board via compression mount, compliant pin, surface mount or through hole connection techniques.

Figure 7-1 Overview of AMC Connector housings

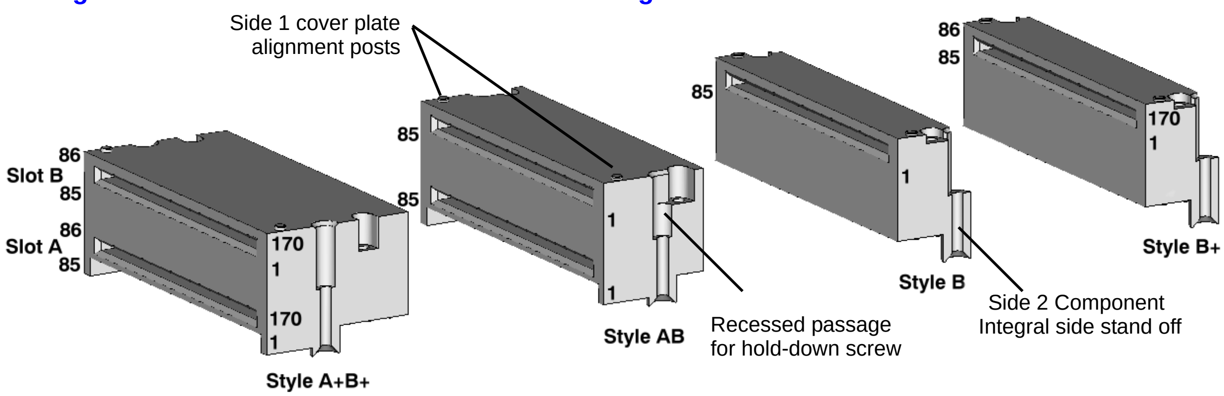


Table 7-1 Number of contacts in the fixed Connector

Connector Style	Interface to AMC Module	Number of Module Slots	Number of contact positions to Carrier	Number of contact rows on Carrier	Differential pairs	General purpose contacts	Power contacts	Ground contacts
B	Basic	1	85	1	19	11	8	28
B+	Extended	1	170	2	45	16	8	56
AB	Basic	2	170	2	38	22	16	56
A+B+	Extended	2	340	4	90	32	16	112

¶ 126 On a Dual Slot Cutaway Carrier Board two layers of Compact AMC Modules can be used. AMC Connectors AB and A+B+ provide the interconnections between both AMC Module layers and the Cutaway Carrier Board.

¶ 127 On a Conventional Carrier Board (no cut-out), only AMC Module Layer B can be used. AMC Connectors B and B+ provide the connections between Module Layer B and the Conventional Carrier Board.

¶ 128 The AMC Connector housing contains features to facilitate the assembly of the AMC Carrier Component Covers.

¶ 129 On Component Side 1 and Component Side 2 (top and bottom), the housings have posts to align the AMC Carrier Component Covers. At their extremities they contain recesses for the passage of the Component Cover mounting screws. Their overall height keeps the Component Covers at the right distance, independently of the Carrier Board thickness.

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