Draft Standard Physical and Environmental Layers for PCI Mezzanine Cards: PMC

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Bus Architecture Standards Committee
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Working Draft

Abstract: This draft standard, in conjunction with P1386 (CMC), defines the physical and environmental layers of a PCI Mezzanine Card (PMC) Family to be usable on (but not limited to) single slot VME64x boards, CompactPCI Boards, Multibus I boards, Multibus II boards, desktop computers, portable computers, severs and similar types of applications. The electrical and logical layers are based on the PCI Specification from the PCI Special Interest Group. The PCI Mezzanine Cards allow for a variety of optional function expansions for the host system. I/O functionality from the PMC may be either through the mezzanine front panel, or via the backplane by routing the I/O signals through the mezzanine connector to the host.

Keywords: Backplane I/O, Bezel, Board, Card, CompactPCI, Face Plate, Front Panel I/O, Metric, Host Computer, I/O, Local Bus, Mezzanine, Module, Modular I/O, PCI, Multibus I, Multibus II, VME, VME64, VME64x, VMEbus.

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Comments
If you have questions or comments regarding this draft, please contact the chair/draft editor of this proposed standard:

Wayne Fischer
PMC Chair & Draft Editor
Tahoe Embedded Computers
PO Box 8600
Incline Village, NV 89452-8600 USA
Ph: 775-832-0447
Em: wfischer@nvbell.net
Ws: www.TahoeWayne.com

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Introduction
(This introduction is not part of this Draft Standard Physical and Environmental Layers for a PCI Mezzanine Card: PMC)

This draft standard provides the specifications for implementing the PCI local bus between a host and mezzanine card based on the P1386 (CMC) Standard for usage on VME64x boards, CompactPCI boards, and Multibus I & II boards. PCI boards defined for the general personal computer market will not fit on these boards since they mount perpendicular on the host computer. This standard provides the necessary mechanical and environmental requirements for the use of PCI based mezzanine cards in a large variety of low profile applications. PCI Mezzanine Cards can provide front bezel I/O, backplane I/O via the host, additional local host functions or a combination of the three.

Special thanks are due to Dave Moore, original P1386.1 Working Group Draft Editor, for the generation of the many drafts, Rick Spratt, Cliff Lupien, Harry Parkinson, Chau Pham and Heinz Horstmeier for their contribution to development of this proposed standard.

At the time this standard was completed, the P1386.1 Working Group had the following membership:

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1. Overview

1.1 Scope

This draft standard defines a family of slim modular mezzanine cards for VME64x, CompactPCI, Multibus I & II, desktop computers, portable computers, servers and other computer systems with the logical and electrical layers based on the PCI (Peripheral Component Interface) Specification from the PCI Special Interest Group.

The complete physical (mechanical) and the environmental layers are specified within the Common Mezzanine Card (CMC) Standard P1386 [1][1].

1.2 Purpose

PCI is a high speed local bus being used by a variety of microprocessors. The PCI specification defines a 4.2 by 12.3 inch board that plugs into a mother board in a perpendicular fashion. These perpendicular boards are not usable for low profile computer applications. This draft standard defines the mechanics of a slim, modular, parallel mezzanine card family that uses the logical and electrical layers of the PCI specification for the local bus. I/O can be via the front bezel and/or through the connector to the host computer for backplane I/O. Additional local functionality can also be provided by these mezzanine cards.

1.3 General Arrangement

PCI Mezzanine Cards (PMC) are intended to be used where slim, parallel board mounting is required such as in single board computer host modules with the addition of expander cards or option cards, as illustrated in Figure 1-1. The PMC may be mounted with instruments and panels that comply with the requirements of IEEE Std 1386 [1].

For maximum utilization of component space, the mezzanine card is typically placed such that the major component side (side one) of the mezzanine card faces the major component side (side one) of the host board.

1.4 Dimensions

All mechanical dimensions are specified in P1386 [1]. All dimensions are in millimeters.

[1] The numbers in brackets correspond to those of the references in Section 2.

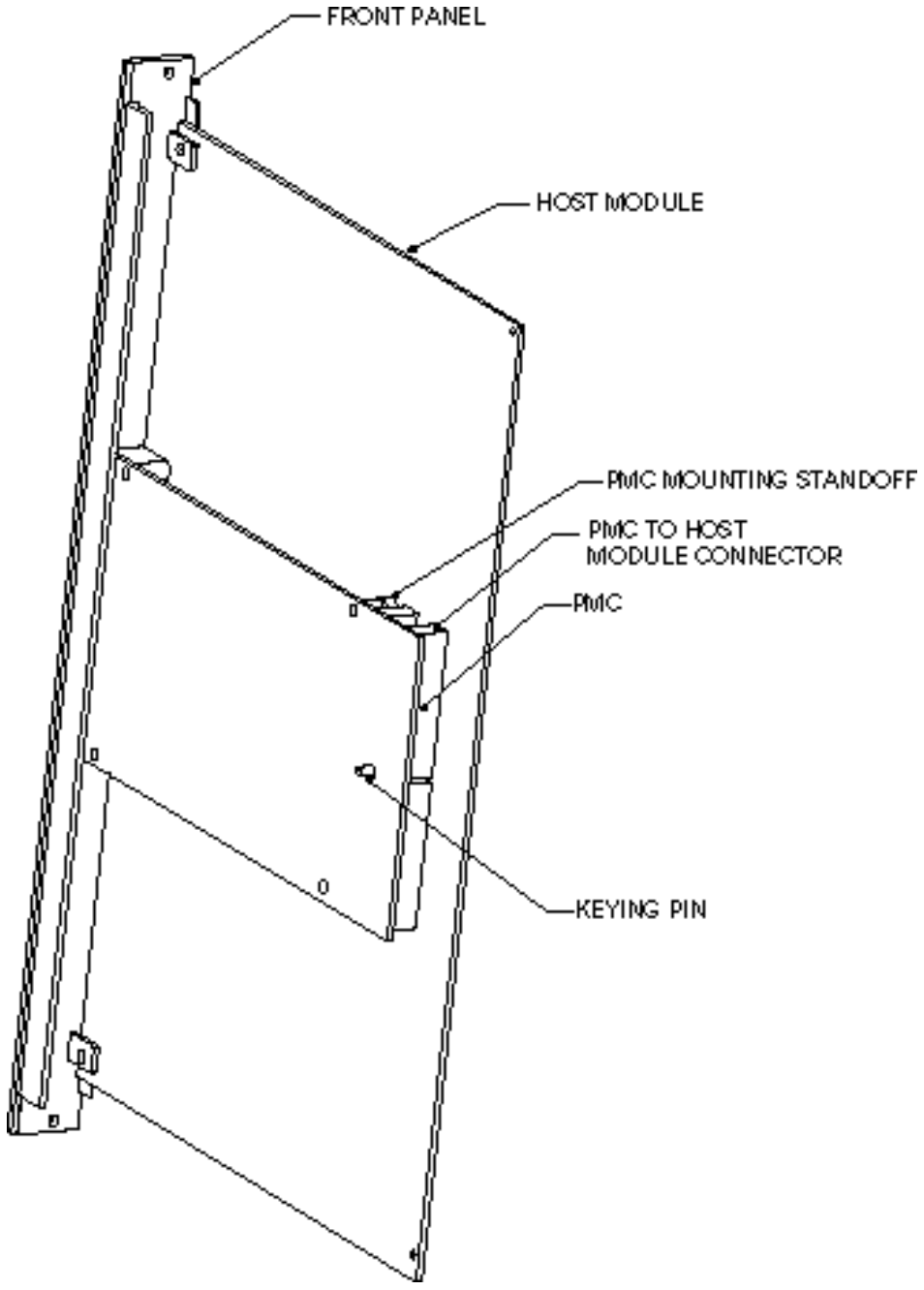

Figure 1-1
Typical PMC Mounted to a Host Module

2. References

The following publications are used in conjunction with this standard:

[1] IEEE P1386 Standard Mechanics for a Common Mezzanine Card Family: CMC [2]

[2] PCI Local Bus Specification, Revision 2.2 1998 [3]

3. Definitions, Abbreviations and Terminology

3.1 Special Word Usage

shall, A key word indicating a mandatory requirement. Designers shall implement such mandatory requirements to ensure interchangeably and to claim conformance with the specification. The phrase is *required* is used interchangeably with the key word *shall.*

should, A key word indicating flexibility of choice with a strongly preferred implementation. The phrase is *recommended* and the word *preferred* are used interchangeably with the key word *should*.

may, A key word indicating flexibility of choice with no implied preference. The phrase is *optional* is used interchangeably with the key word *may*.

4. Mechanics and Compliance

4.1 Conformance

A vendor of host modules or mezzanine cards may claim compliance to the P1386.1 (PMC) standard if there are no areas of conflict between the host design and the P1386 [1] or P1386.1 standards. In addition, the vendor claiming compliance shall specify in the product specifications those areas of compliance where optional features are allowed.

4.2 PMC Voltage Keying

The PCI bus uses either 3.3V or 5V for signaling bus levels. A voltage keying is required to prevent association of host slots and mezzanine card with incompatible signaling voltages. The host shall indicate in its product specification which signaling voltage it uses and has been keyed for. Note that the mezzanine card may be designed to accept either or both signaling voltages.

For keying mechanics see P1386 [1].

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2 IEEE publications are available from the institute of Electrical and Electronics Engineers, Service Center, 445 Hoes Lane. PO Box 1331, Piscataway, NJ 08855-1331, USA. www.ieee.org

3 PCI Specifications are available from PCI Special Interest Group 2575 NE Kathryn Street, #17, Hillsboro, Oregon 97124, USA, www.pcisig.com

4.3 Connector Configurations

The 32 bit PCI bus requires two 64 pin connectors, Pn1/Jn1 and Pn2/Jn2. The 64 bit PCI bus requires three 64 pin connectors, Pn1/Jn1, Pn2/Jn2 and Pn3/Jn3. When I/O is routed through the host's backplane, the Pn4/Jn4 connector is used for routing of the I/O signals. Any combination of connectors may be used on the mezzanine card as well as on the host.

4.4 Power Consumption, Heat Dissipation and Air Flow

Each PMC vendor shall document in the product's information the current drawn on the 5V and 3.3V power pins. The average heat dissipated on both sides shall be given as well as the average percent of area, side view, occupied by the components. A user can then calculate the amount of air flow that can be expected to flow across each mezzanine card as well as the amount of air needed to properly cool the mezzanine card.

4.5 Electromagnetic Compatibility

Each PMC vendor shall document in the product's literature to which Electromagnetic Compatibility (EMC) standards and to what level(s) the product was designed and tested to (if tests were performed).

4.6 Shock and Vibration

Each PMC vendor shall document in the product's literature to which shock and vibration standards and to what level(s) the product was designed and tested to (if tests were performed).

4.7 Environmental

Each PMC vendor shall document in the product's literature to which environmental standards and to what level(s) the product was designed and tested (if tests were performed).

4.8 MTBF

Each PMC vendor shall state in the product's literature the calculated MTBF (mean-time-between-failure) for which environmental level and state what method was used to calculate the MTBF number(s).

5. Electrical and Logical Layer

5.1 Connector Utilization

The PMC and associated host connector pin assignments are based on specific signal integrity rules as well as power distribution. The 5V pins are assigned to Pn1 connector, the 3.3V pins are assigned to Pn2/Jn2 connector and the V(I/O) to Pn1/Jn1 and Pn3/Jn3 connectors. All signal pins are adjacent to a voltage or ground pin with the CLK (clock) pin surrounded by three ground pins.

The Pn1/Jn1 and Pn2/Jn2 connectors are always present and contain the signals for the 32 bit PCI Bus. When the PCI Bus is expanded to 64 bits, the Pn3/Jn3 connector is used for these signals. User defined I/O signals are assigned to the Pn4/Jn4 connector. The Pn3/Jn3 and Pn4/Jn4 connectors do not need to be present on either the PCI Mezzanine Card or the host when those signals are not used. Use of PCI Bus reserve (PCI-RSVD) and PMC (PMC-RSVD) reserved pins are not allowed as their use may be defined by future versions of the PCI specifications or by this standard, respectively. All Pn1/Jn1 and Pn2/Jn2 connector pins are fixed and shall not be reassigned to other functions.

Pn4/Jn4 connectors are for user defined I/O functions. The mapping of these I/O signals to the backplane is defined in the P1386 (CMC) Standard [1] for VME and Multibus applications. Mapping of I/O signals off the rear of CompactPCI boards through CompactPCI backplanes is defined and controlled by PICMG, www.PICMG.com.

5.2 PMC Connector Pin Assignment

PCI Mezzanine Cards and associated hosts that support PMC slots shall assign the local bus signal pins per the pin assignment given in Table 5-1.

See Figures 5-1 and 5-2 for connector orientation on the PMC and on the associated host, respectively.

Table 5-1
PMC Connectors Pin Assignments

Pn1/Jn1 32 Bit PCI				Pn2/Jn2 32 Bit PCI			
Pin	**Signal**	**Signal**	**Pin**	**Pin**	**Signal**	**Signal**	**Pin**
1	TCK	-12V	2	1	+12V	TRST#	2
3	Ground	INTA#	4	3	TMS	TDO	4
5	INTB#	INTC#	6	5	TDI	Ground	6
7	BUSMODE1#	+5V	8	7	Ground	PCI-RSVD*	8
9	INTD#	PCI-RSVD*	10	9	PCI-RSVD*	PCI-RSVD*	10
11	Ground	PCI-RSVD*	12	11	BUSMODE2#	+3.3V	12
13	CLK	Ground	14	13	RST#	BUSMODE3#	14
15	Ground	GNT#	16	15	3.3V	BUSMODE4#	16
17	REQ#	+5V	18	17	PCI-RSVD*	Ground	18
19	V (I/O)	AD[31]	20	19	AD[30]	AD[29]	20
21	AD[28]	AD[27]	22	21	Ground	AD[26]	22
23	AD[25]	Ground	24	23	AD[24]	+3.3V	24
25	Ground	C/BE[3]#	26	25	IDSEL	AD[23]	26
27	AD[22]	AD[21]	28	27	+3.3V	AD[20]	28
29	AD[19]	+5V	30	29	AD[18]	Ground	30
31	V (I/O)	AD[17]	32	31	AD[16]	C/BE[2]#	32
33	FRAME#	Ground	34	33	Ground	PMC-RSVD	34
35	Ground	IRDY#	36	35	TRDY#	+3.3V	36
37	DEVSEL#	+5V	38	37	Ground	STOP#	38
39	Ground	LOCK#	40	39	PERR#	Ground	40
41	SDONE#	SBO#	42	41	+3.3V	SERR#	42
43	PAR	Ground	44	43	C/BE[1]#	Ground	44
45	V (I/O)	AD[15]	46	45	AD[14]	AD[13]	46
47	AD[12]	AD[11]	48	47	Ground	AD[10]	48
49	AD[09]	+5V	50	49	AD[08]	+3.3V	50
51	Ground	C/BE[0]#	52	51	AD[07]	PMC-RSVD	52
53	AD[06]	AD[05]	54	53	+3.3V	PMC-RSVD	54
55	AD[04]	Ground	56	55	PMC-RSVD	Ground	56
57	V (I/O)	AD[03]	58	57	PMC-RSVD	PMC-RSVD	58
59	AD[02]	AD[01]	60	59	Ground	PMC-RSVD	60
61	AD[00]	+5V	62	61	ACK64#	+3.3V	62
63	Ground	REQ64#	64	63	Ground	PMC-RSVD	64

* For PCI-RESVD/PMC Pin Relationship see Table 5-3

Table 5-1 (Concluded)
PMC Connectors Pin Assignments

Pn3/Jn3 64 Bit PCI				Pn4/Jn4 User Defined I/O			
Pin	**Signal**	**Signal**	**Pin**	**Pin**	**Signal**	**Signal**	**Pin**
1	PCI-RSVD	Ground	2	1	I/O	I/O	2
3	Ground	C/BE[7]#	4	3	I/O	I/O	4
5	C/BE[6]#	C/BE[5]#	6	5	I/O	I/O	6
7	C/BE[4]#	Ground	8	7	I/O	I/O	8
9	V (I/O	PAR64	10	9	I/O	I/O	10
11	AD[63]	AD[62]	12	11	I/O	I/O	12
13	AD[61]	Ground	14	13	I/O	I/O	14
15	Ground	AD[60]	16	15	I/O	I/O	16
17	AD[59]	AD[58]	18	17	I/O	I/O	18
19	AD[57]	Ground	20	19	I/O	I/O	20
21	V (I/O)	AD[56]	22	21	I/O	I/O	22
23	AD[55]	AD[54]	24	23	I/O	I/O	24
25	AD[53]	Ground	26	25	I/O	I/O	26
27	Ground	AD[52]	28	27	I/O	I/O	28
29	AD[51]	AD[50]	30	29	I/O	I/O	30
31	AD[49]	Ground	32	31	I/O	I/O	32
33	Ground	AD[48]	34	33	I/O	I/O	34
35	AD[47]	AD[46]	36	35	I/O	I/O	36
37	AD[45]	Ground	38	37	I/O	I/O	38
39	V (I/O)	AD[44]	40	39	I/O	I/O	40
41	AD[43]	AD[42]	42	41	I/O	I/O	42
43	AD[41]	Ground	44	43	I/O	I/O	44
45	Ground	AD[40]	46	45	I/O	I/O	46
47	AD[39]	AD[38]	48	47	I/O	I/O	48
49	AD[37]	Ground	50	49	I/O	I/O	50
51	Ground	AD[36]	52	51	I/O	I/O	52
53	AD[35]	AD[34]	54	53	I/O	I/O	54
55	AD[33]	Ground	56	55	I/O	I/O	56
57	V (I/O)	AD[32]	58	58	I/O	I/O	58
59	PCI-RSVD	PCI-RSVD	60	59	I/O	I/O	60
61	PCI-RSVD	Ground	62	61	I/O	I/O	62
63	Ground	PCI-RSVD	64	63	I/O	I/O	64

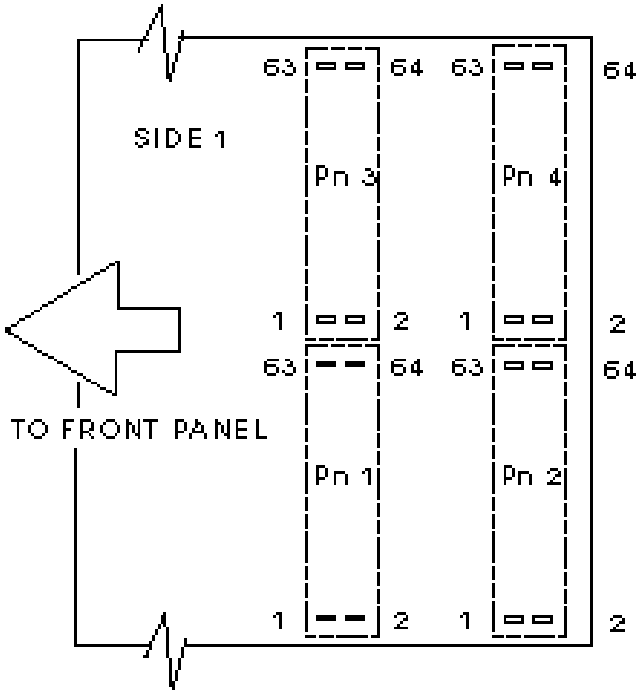

Figure 5-1
Connector Orientation on PMC, Side 1

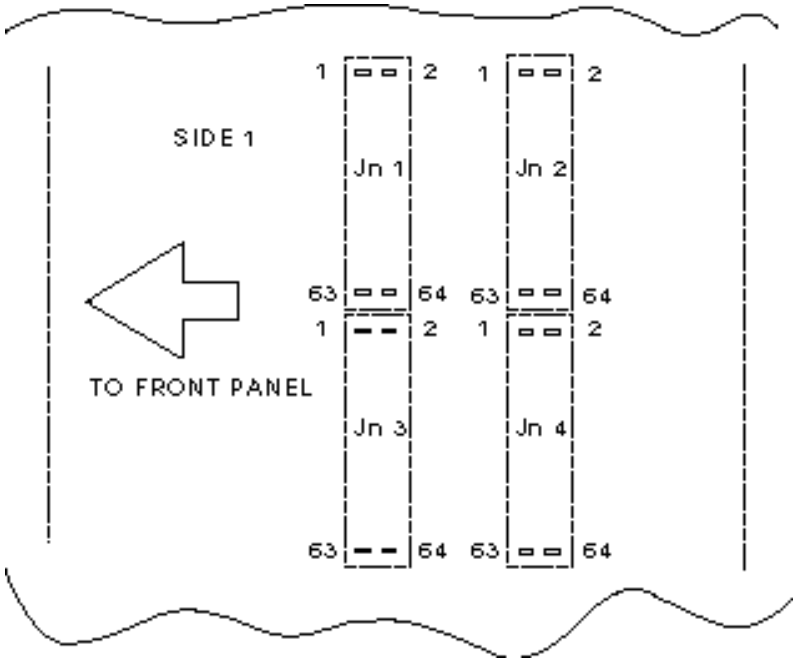

Figure 5-2
Connector Orientation on Host, Side 1

5.3 Comparison of Pin Usage, PCI to PMC

For reference purposes, a comparison of pin usage, PCI to PMC is provided in Table 5-2 below, where all the four 64-pin connectors are implemented.

Table 5-2
Pin Use Comparison PCI to PMC (Single Size)

Power Pins	Bus Pins	PCI	PMC
+ 5V		8	6
+ 12V		1	1
- 12V		1	1
+ 3.3V		12	9
V (I/O		11	8
Ground		42	44
Subtotal		75	69
	Signals	100	100
	BUSMODE	2	4
	I/O	0	64
	PCI	11	11
	PMC	0	8
	Subtotal	113	187
	Total Pins	188	256

5.4 Mapping of PCI Reserve Pins

In the future, should one or more of the PCI reserved pins become assigned to a new function, the assignment to the PMC connector shall be consistent. Table 5-3 lists the assignment of these reserved pins to the PMC connector. It will not be necessary to update this draft standard whenever this occurs.

Assignment of PMC reserved pins will require an update to this standard.

Table 5-3
PCI-Reserved/PMC Relationship

PCI-RSVD	PMC Signal	PCI-RSVD	PMC Signal
9A	Pn2-8	63B	Pn3-1
10B	Pn2-9	92A	Pn3-59
11A	Pn2-10	92B	Pn3-60
14A	Pn1-12	93B	Pn3-61
14B	Pn1-10	94A	Pn3-64
19A	Pn2-17		