



AGP Pro Specification

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Original Date: April 1999



Revision History

Following is a brief history of this document. The date indicates when the text was last modified, causing the revision number to change.

Revision	Date	Description
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1.0 Introduction

This document defines an extension to the AGP interface specification that meets the needs of advanced workstation graphics. This new specification, AGP Pro, is primarily designed to deliver additional electrical power to the graphics add-in cards. The AGP Pro definition includes an extended connector, thermal envelope, and mechanical specifications for cards, I/O brackets, and motherboard layout requirements.

AGP Pro extends the existing AGP connectors on both ends to deliver additional power on the 12 V and 3.3 V rails. The extension is illustrated in Figure 1. AGP Pro is intended to supplement, but not replace, the existing AGP connector set.

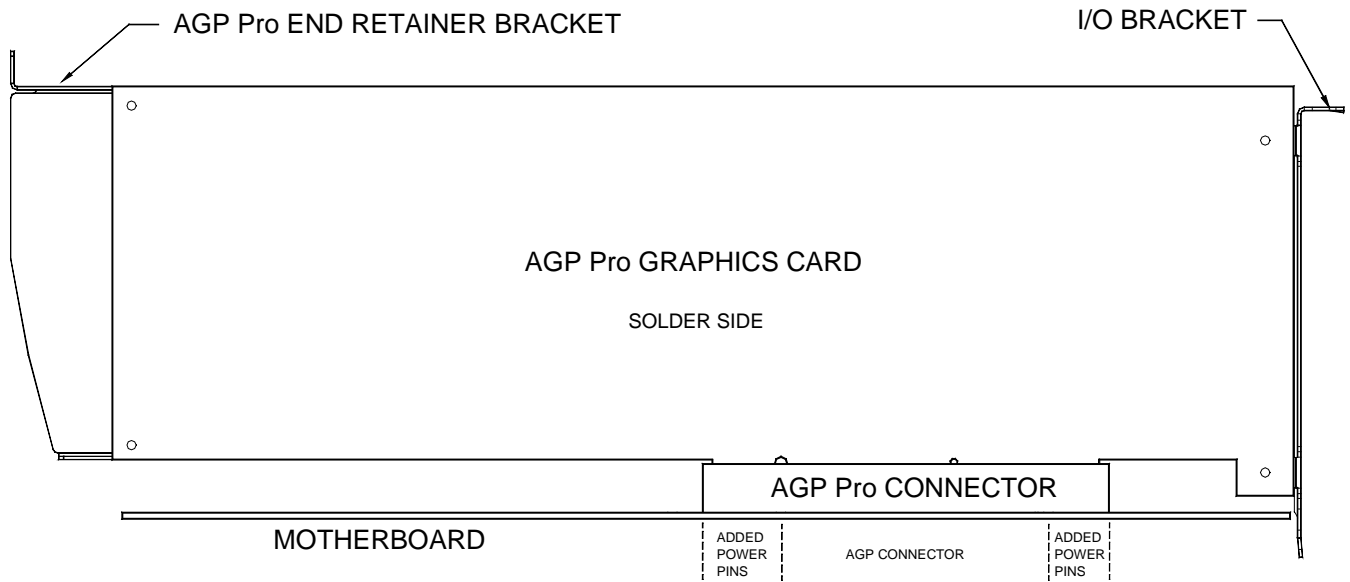


Figure 1: AGP Pro Connector Orientation.

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2.0 System Design Implementation

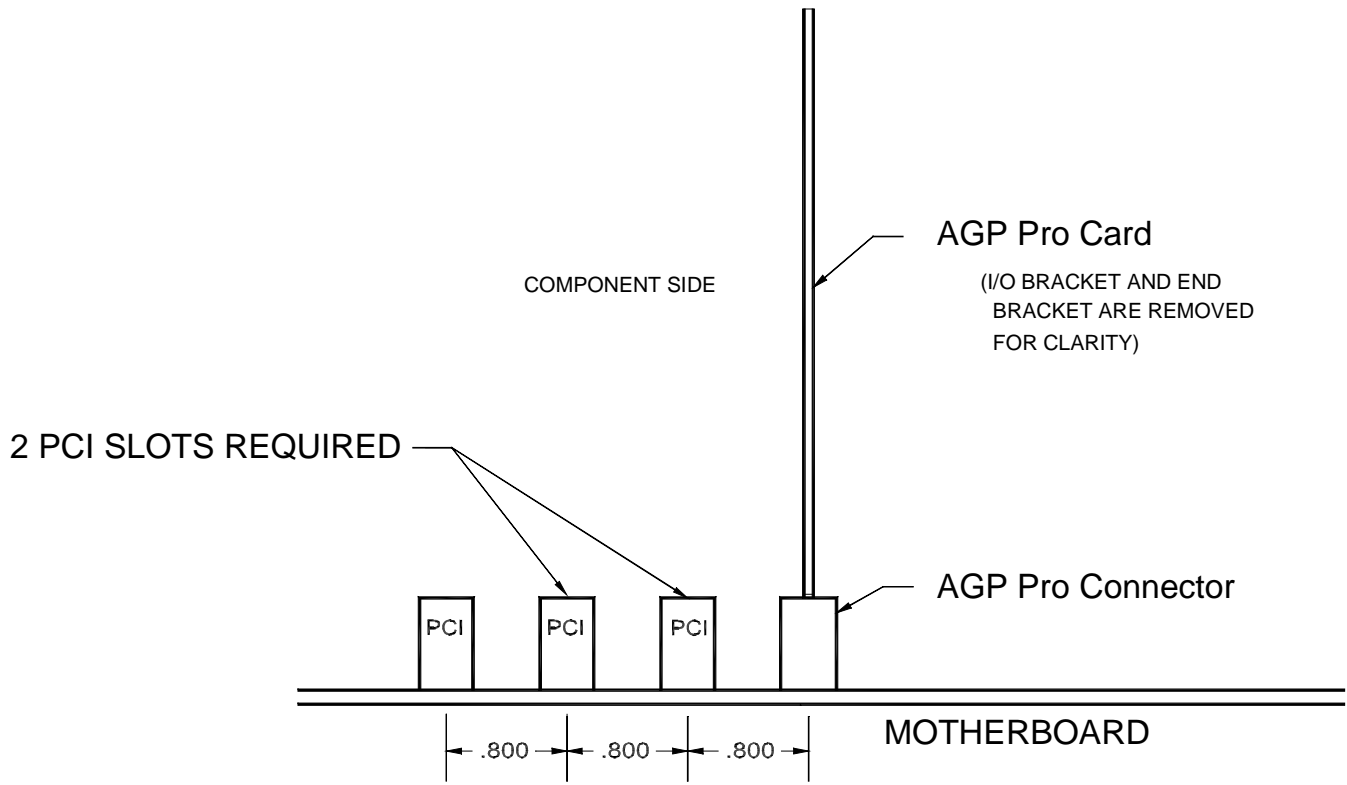
AGP cards come in three- (3) form factors:

- WTX
- ATX
- NLX

The WTX* and ATX* form factor cards have the same component area, I/O bulkhead panel, and brackets as PCI cards. The NLX* form factors are smaller and target Basic PC systems. The AGP Pro* specification targets the WTX and ATX form factor implementation of the AGP specification. NLX implementations for AGP cards are not defined.

2.1 System Design Requirements

An AGP Pro compliant system must have two- (2) PCI slots adjacent to the AGP Pro connector as illustrated in Figure 2 that follows. The PCI slots at minimum, guarantee 33 MHz / 32 bit operation. 66 MHz or 64 bit operations are not guaranteed to be provided on the two (2) adjacent PCI slots. Section 2.5 describes how PCI slots can be used as an option by the AGP Pro card, for electrical, mechanical, or PCI functional purposes.



NOTE: ALL DIMENSIONS ARE IN INCHES.

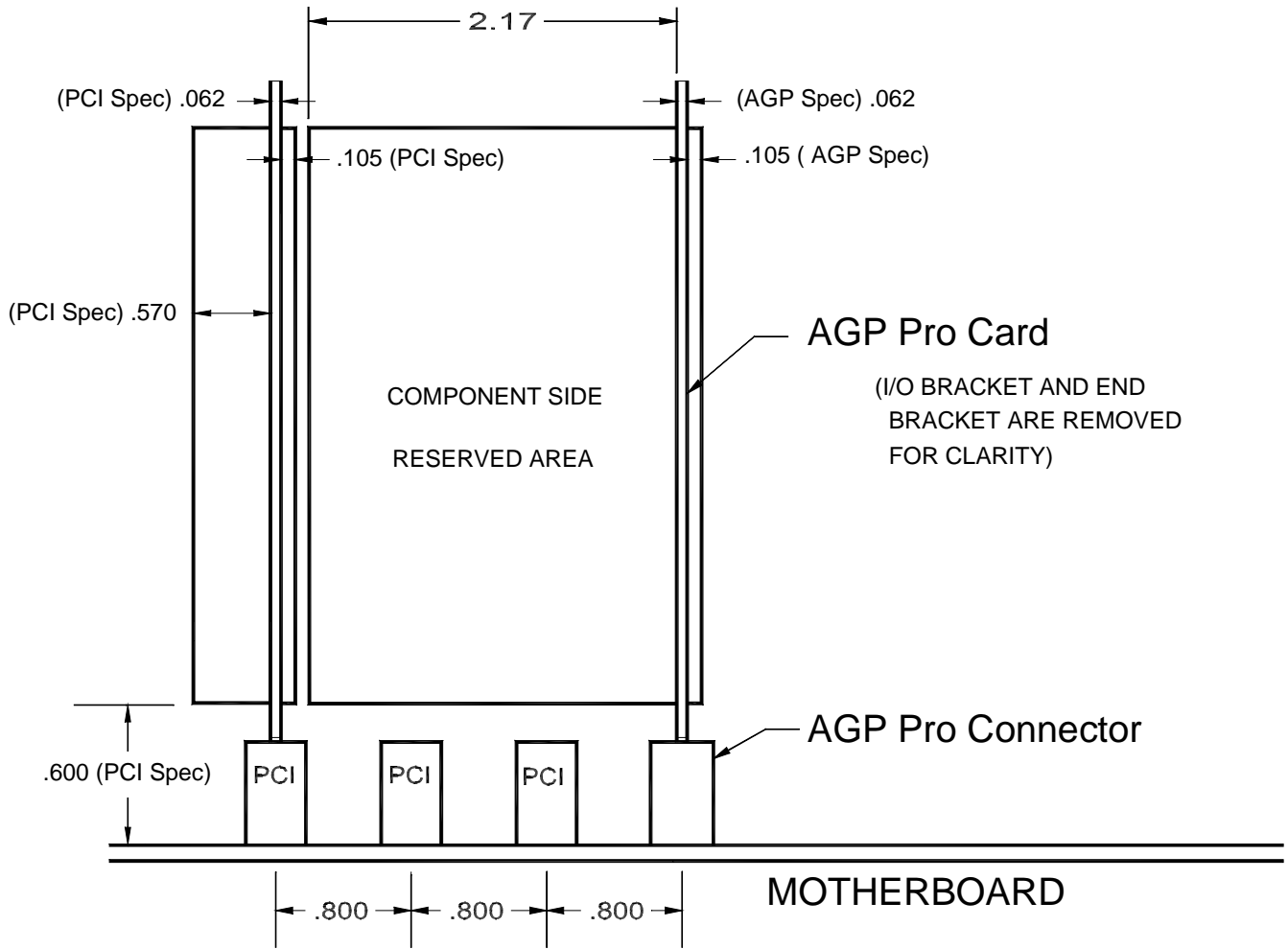
Figure 2: AGP Pro System Design Requirements.

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2.1.1 High Power AGP Pro110* Card

A High Power AGP Pro card consumes 50 to 110 Watts of power, and is called an AGP Pro110 card. This card requires sufficient space on the component side to facilitate cooling as shown in Figure 3. Two (2) adjacent PCI slots must be left unoccupied to provide this space. The unused PCI connections provide 2.17 inches of clearance space for the card. A special, three-slot wide I/O bracket installed on the AGP Pro110 High Power card reserves the use of this space. This bracket is defined in the Mechanical Specification section of this document.

Note: All retail channel High Power AGP Pro cards must use the 3-slot wide I/O bracket. AGP Pro card vendors may have OEM specific solutions that do not require this bracket. Also, a chassis that supports an AGP Pro connector on the motherboard must be able to accept a High Power AGP Pro card equipped with up to a three wide I/O bracket.



NOTE: ALL DIMENSIONS ARE IN INCHES.

Figure 3: Orientation for High Power AGP Pro110 Cards.

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2.2 AGP Pro Motherboard Implementation

An AGP Pro connector on a motherboard is illustrated in Figure 5.

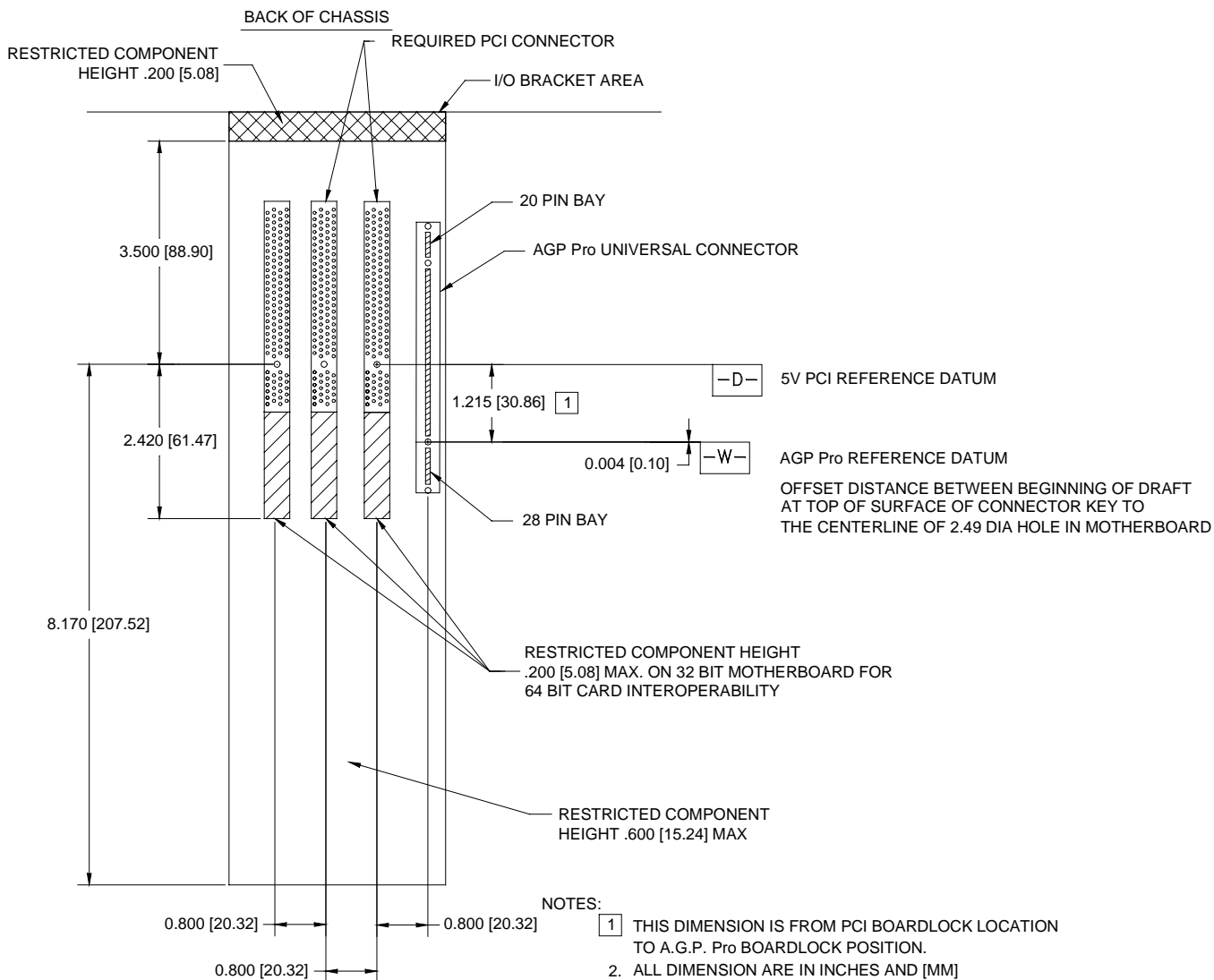


Figure 5: AGP Pro Motherboard Implementation.

2.3 AGP Card in an AGP Pro Connector

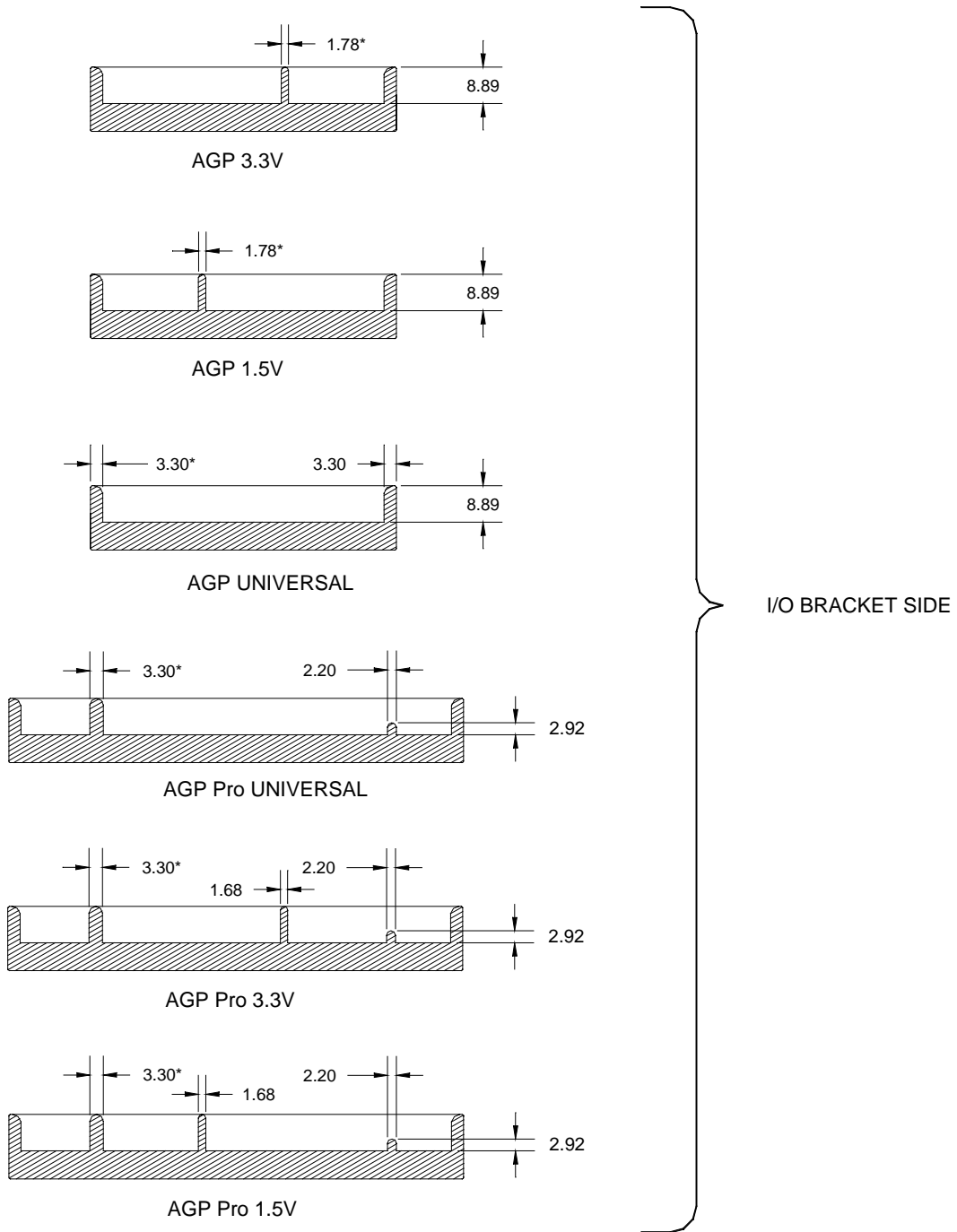
AGP 3.3 V and 1.5 V connectors use the 1.78-mm wide voltage key to register the AGP add-in card. The AGP Universal connector makes use of the 3.30-mm 'end-housing' in conjunction with the registration tab on the AGP add-in card to register.

The AGP Pro connector is an extension of the existing AGP connector and it accepts existing AGP cards. All versions of the AGP Pro connector make use of the 3.30-mm wide key to register existing AGP cards. Therefore, the AGP cards must have a registration tab as defined in the AGP specification to work in the AGP Pro connector. Note that the width of the 3.3 V and 1.5 V voltage key on the AGP Pro connector has been reduced to 1.68-mm from 1.78-mm, since these keys are not used to register the AGP card. Also, to ensure correct operation with the AGP Pro connector, no vias or components should be placed on the registration tab.

2.4 AGP Pro Card in an AGP Connector

AGP Pro add-in cards will not fit into systems designed with existing AGP connectors. This is intentional, and is ensured by selecting a shorter height key for AGP Pro connectors as compared to the height of the end-housings on AGP connectors as illustrated in Figure 6. The height of the key on the side closest to the I/O bracket is 2.92-mm for AGP Pro connectors. The corresponding height of the 'end-housing' for the existing AGP connectors is 8.89-mm. This ensures that AGP Pro add-in cards designed to the 2.92-mm height of the key will not fit into the existing AGP connectors.

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* = REGISTRATION KEYING FEATURE

NOTES:
 1. DIMENSIONS ARE IN MM
 2. DRAWING NOT TO SCALE

Figure 6: AGP Pro Key Dimensions.

Figure 6 shows an AGP Pro connector based on extending the Universal AGP connector. If an AGP Pro connector is built by extending the 3.3 V or 1.5 V AGP connectors, the width of the keys must remain the same as on the AGP Pro connector. The width of the keys is fixed at 2.20-mm on one end and 3.30-mm on the other end.

2.5 Usage Rules of PCI Slots for Multi-Slot AGP Pro Cards

An AGP Pro compliant system must provide two- (2) PCI slots adjacent to the AGP Pro slot. The AGP Pro card may use these PCI slots for mechanical support, electrical power, or PCI bus functional purposes. Multi-slot AGP Pro cards must follow the rules below in order to use the PCI slots.

If the PCI slots are used for additional power, then:

- Design a Universal PCI card edge so that it can plug into a 3 or 5 V PCI connector.
- Do not use V I/O pins on the PCI connector for power.
- Use the 3.3 or 5 V rail for power. Note that 3.3 V pins are provided on a 5 V connector also.
- Do not tie **M66EN** (pin 49-side B) to GND on the card because this slows a 66 MHz bus to 33 MHz operation.

If the multi-slot AGP Pro card is using the PCI slots for PCI Bus functionality, then:

- Design the card to work with 33 MHz/32 bit PCI bus as only this is guaranteed to be available. 66 MHz or 64 bit PCI operation is not guaranteed to be provided on the adjacent PCI slots.
- Design the I/O buffers on the PCI component to operate at 3.3 V with 5 V tolerance.

While it is recommended that the system be designed to deliver 3.3 V to both the PCI and AGP Pro slots from a common 3.3V V_{cc} plane, it is not always possible given the limitations of existing power supplies. Some systems may need to deliver current from both the main power supply and a local 3.3 V DC-DC converter. In this case, the multi-slot AGP Pro solution needs to make provisions so the two sources of 3.3 V power are not interconnected. Therefore, when designing multi-slot 3.3 V cards, any connector or cable tying the AGP Pro and multiple PCI cards together, cannot bridge the 3.3 V AGP Pro to the 3.3 V PCI slot 1 and PCI slot 2.

3.0 Electrical Specification

3.1 AGP Pro Connector Pinout

The AGP Pro connector is designed as an extension to the existing AGP connectors. The AGP connectors are extended on both ends to build the AGP Pro connector. It is a monolithic connector. Any of the specified AGP connectors can be extended to build the AGP Pro connector. This section illustrates the use of the Universal AGP connector to build the AGP Pro connector. The Universal connector can be replaced with 3.3 V or 1.5 V AGP connectors to build the AGP Pro connector.

Figure 7 shows the AGP Pro connector layout based on extending the Universal AGP connector. Table 1 lists the pinout for the extended part of the AGP Pro connector.

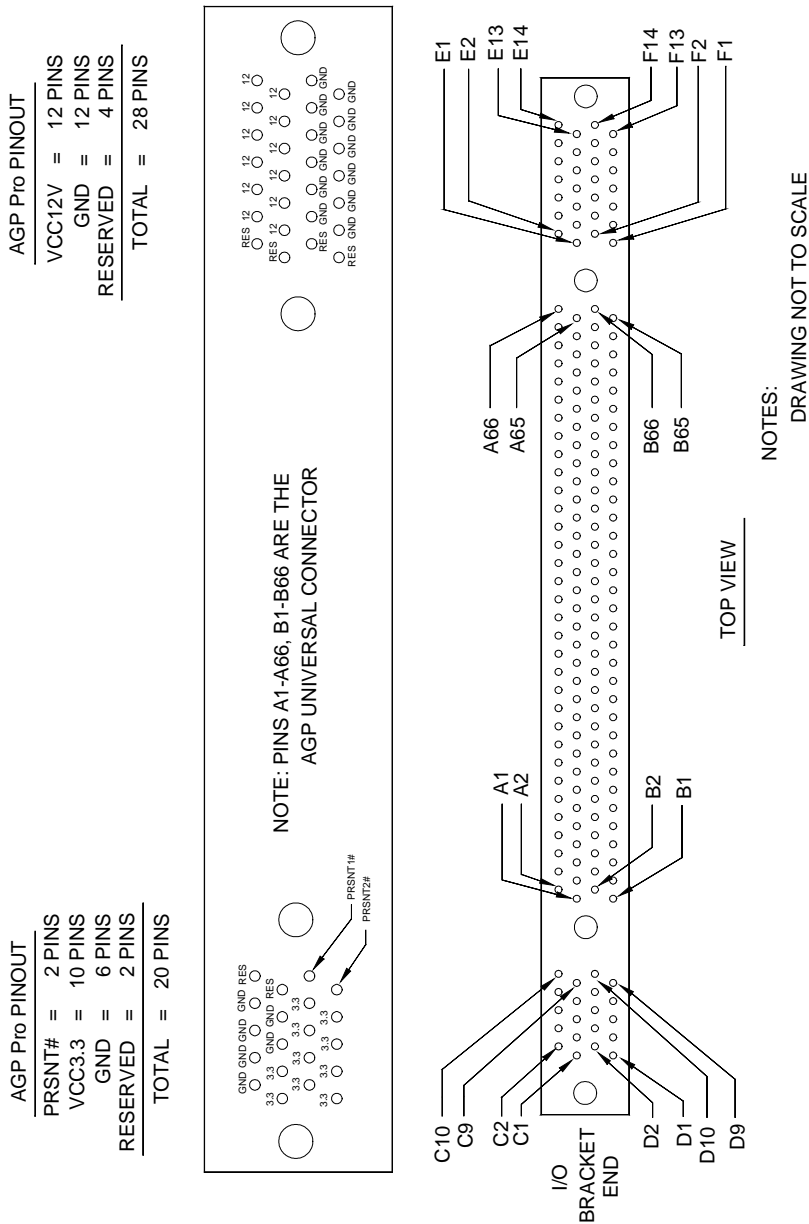


Figure 7: AGP Pro Connector Pinout Assignments.

Table 1: AGP Pro Connector Pinout

AGP Pro Extended Connector		
Pin #	D	C
1	VCC3.3	VCC3.3
2	VCC3.3	Ground
3	VCC3.3	VCC3.3
4	VCC3.3	Ground
5	VCC3.3	Ground
6	VCC3.3	Ground
7	VCC3.3	Ground
8	VCC3.3	Ground
9	PRSNT2#	Reserved
10	PRSNT1#	Reserved
	F	E
1	Reserved	Reserved
2	Reserved	Reserved
3	Ground	VCC12
4	Ground	VCC12
5	Ground	VCC12
6	Ground	VCC12
7	Ground	VCC12
8	Ground	VCC12
9	Ground	VCC12
10	Ground	VCC12
11	Ground	VCC12
12	Ground	VCC12
13	Ground	VCC12
14	Ground	VCC12

Note: Since Pins A1–A66 and B1–B66 are the same as for the AGP connector they are not listed in this table.

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3.2 AGP Pro Power

3.2.1 AGP Pro Power Delivery

Table 2 lists the voltage ranges for the 3.3 V and 12 V power supplies and the maximum current that can be supplied via the extended part of the AGP Pro connector. This information is provided for the designer of the DC/DC converters on the AGP Pro card.

Table 2: AGP Pro Add-in Card Power Supply Limits

Symbol	Parameter	Condition	Min	Max	Units
VCC3.3	3.3 V power supply	$I_{max} = 7.6 \text{ A}$	3.15	3.45	Volts
VCC12	12 V power supply	$I_{max} = 9.2 \text{ A}$	10.2	12.6	Volts

The motherboard must connect all power supply pins on the connector to guarantee proper current delivery and to provide proper AC signal return paths. The AGP Pro add-in card must attach all connector power pins to appropriate power planes on the card for good power delivery and signal returns. AGP Pro cards must use all ground pins. Appropriate capacitive decoupling (high frequency and bulk) must be provided on all voltage rails used on the add-in card and on the motherboard.

To prevent interactions with other items powered by the VCC rails, the DC-DC converters on the AGP Pro card cannot induce transients on either the VCC3.3 or VCC12 input lines greater than $0.1 \mu\text{s}$ under any loading conditions. These restrictions include going from low power mode (i.e., sleep mode), to full power mode.

3.2.2 Power for Single-Slot AGP Pro Add-in Cards

An AGP Pro card may draw power either from the existing part of the AGP Pro connector, the extended part, or a combination of the two. In all cases, the maximum power that may be drawn by an AGP Pro card is limited to 110 W. Power on the existing part of the connector is delivered on 5.0 V and 3.3 V rails. Power on the extensions is delivered on the 12 V and 3.3 V rails.

Table 3 lists some of the possible combinations allowed for an AGP Pro add-in card designed for the AGP Pro connector. This add-in card draws no power from the two- (2) adjacent PCI slots. Other combinations are possible within the guidelines.

Table 3: Single-Slot AGP Pro Add-in Card Power

AGP Pro		Total Power	Comments
Supported Combinations			
AGP connector (Max Power)	Additional power from extensions (Max Power)		
0 W	110 W–12 V	110 W	
25 W	85 W–12V	110 W	
25 W	25 W–3.3 V 60 W–12 V	110 W	
Unsupported Combinations			
25 W	110 W–12 V	135 W	Exceeds total power limit of 110 W
25 W	25 W–3.3 V 110 W–12 V	160 W	Exceeds total power limit of 110 W

3.2.3 Power For Multi-Slot AGP Pro Add-in Cards

Multi-Slot AGP Pro cards draw power from the adjacent PCI slots in addition to the AGP Pro slot. The maximum power budget for AGP Pro, plus two- (2) adjacent PCI slots is limited to 110 W. Table 4 that follows, lists some possible combinations allowed for an AGP Pro add-in card designed for the multiple slots. Other combinations are possible but must be kept below the 110 W maximum range.

Table 4: Multi-Slot AGP Pro Add-in Card Power

AGP PRO CONNECTOR		PCI Slot 1 (Max power)	PCI Slot 2 (Max Power)	Total Power	Comments
Supported Combinations					
AGP connector (Max Power)	Additional power from extensions (Max Power)				
0 W	110 W–12 V	0 W	0 W	110 W	
25 W	85 W–12 V	0 W	0 W	110 W	
25 W	25 W–3.3V 10 W–12 V	25 W	25 W	110 W	
25 W	25 W–3.3 V 35 W–12 V	25 W	0 W	110 W	
Unsupported Combinations					
25 W	25 W–3.3 V 20 W–12 V	25 W	25 W	120 W	Exceeds total power limit of 110 W
25 W	25 W–3.3 V 110 W–12V	25 W	25 W	210 W	Exceeds total power limit of 110 W

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3.3 Power for AGP Pro50 Add-in Cards

AGP Pro50 Cards can draw up to 50W of power from either 3.3 V or 12 V or some combination of the two voltage rails. Multi-slot solutions are allowed to draw a total of 50W from the AGP Pro slot and the adjacent PCI slot.

AGP Pro50 systems use the existing AGP Pro connector. The only difference is that 50W of power are provided on the 12 V (4.17A) extension instead of 110W. The power requirement for the 3.3 V extension is still 25W (7.6A) and the power requirements for the main part of the AGP connector is also 25W. The systems power supply should allocate 50W (4.17A) at +12V and 50W (15.2A) at 3.3V for a fully configured system.

3.3 Power ID Pins AGP Pro Card

Two- (2) pins are defined specifically on the AGP Pro connector, **PRSNT1#** and **PRSNT2#**. They are used for two- (2) purposes:

- Indicating that an AGP Pro cardboard is physically present in the slot.
- Providing information on the maximum power requirements of the card plugged into the AGP Pro connector. Table 5 defines the required settings for the **PRSNT#** pins for the AGP Pro add-in card.

AGP Pro50 systems can also use the Power ID pins (PRSNT1# and PRSNT2#) to detect APG Pro cards that consume more than 50W of power. Based on this, the system can take appropriate action to prevent damage and report problems.

Note: No mechanical means has been provided to prevent the insertion of an AGP Pro card into a system that supports only AGP Pro50 cards.

Table 5: Add-in Card Present Settings

PRSNT1#	PRSNT2#	AGP Pro Slot Configuration
Open	Open	No expansion board present
Ground	Open	Expansion board present, 50 W Max. power
Ground	Ground	Expansion board present, 110 W Max. power
Open	Ground	Reserved

In providing the power level indication, the pin strapping must indicate the total maximum power consumption of a fully configured AGP Pro card. The maximum power consumption may be more than that consumed in the card's shipping configuration. (E.g., sockets for memory expansion, etc.)

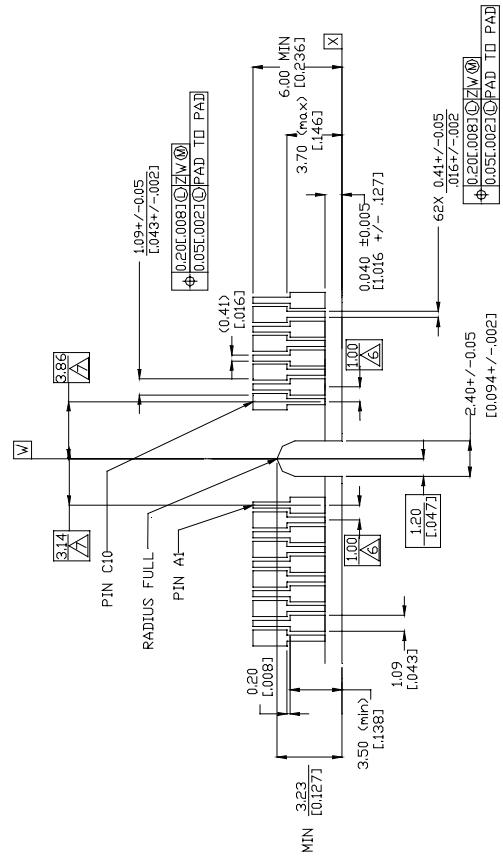
The system developer may use these signals for system configuration, diagnostics, or power allocation. If the signals are used by the motherboard, the system developer must provide pull-up resistors for both these signals. The systems developer determines the value of the resistor and the pull-up voltage based on the associated circuitry.

Note: On the AGP Pro add-in cards, these signals are either tied-to-ground, or left unconnected based on the information in Table 5.

4.0 Mechanical Specification

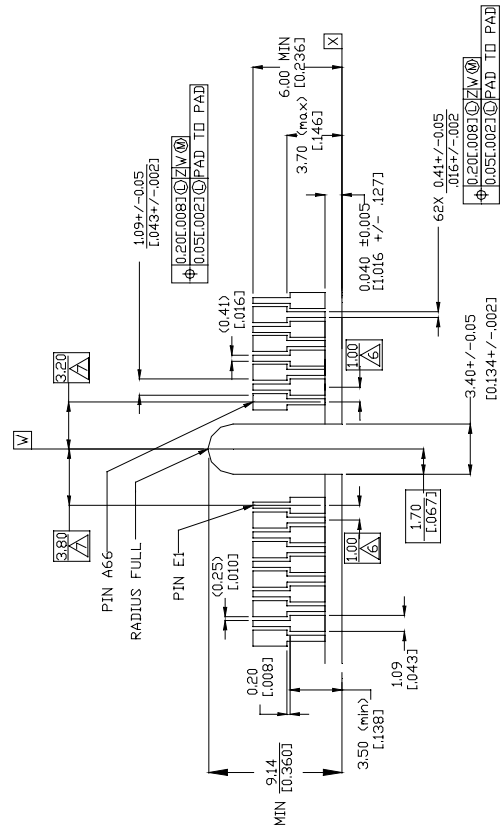
4.1 *Expansion Card Dimensions and Tolerances*

Figure 8 shows an AGP Pro form factor add-in card based on 3.3 V card edge. AGP Pro add-in cards designed for a 1.5 V card-edge must change the location of the 3.3 V key to the 1.5 V key location, as shown in Figure 9. Refer to the AGP specification for the location and dimension of the 1.5 V key.



Detail B

< AS VIEWED FROM SOLDER SIDE >



Detail A

< AS VIEWED FROM SOLDER SIDE >

Figure 10: Detail A and B: AGP Pro Card Edge Finger Layout

4.2 AGP Pro Add-in Card Connector Physical Description

Any of the specified AGP connectors can be extended to build the AGP Pro connector. This section illustrates the use of the Universal AGP connector to build the Universal version of the AGP Pro connector. This section also illustrates the use of 1.5 V AGP connectors used to build the 1.5 V version of the AGP Pro connector. The 3.3 V version of the AGP Pro connector is not illustrated. The 3.3 V AGP Pro connector can easily be designed based on the data provided.

Contact specifications for the AGP connector family, are listed in the AGP Specification. Only the specifications of the AGP Pro connector are listed in this section.

4.2.1 AGP Pro Add-in Card Connectors

a) Universal AGP Pro Connector

Refer to the following Figure 11 for the Universal AGP Pro connector dimensions. Refer to Figure 12 for the Universal AGP Pro connector layout dimensions.

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b) 1.5 V AGP Pro Connector

Refer to Figure 13 for the 1.5 V A.G.P. Pro connector dimensions. See Figure 14 for the 1.5V AGP Pro connector layout dimensions.

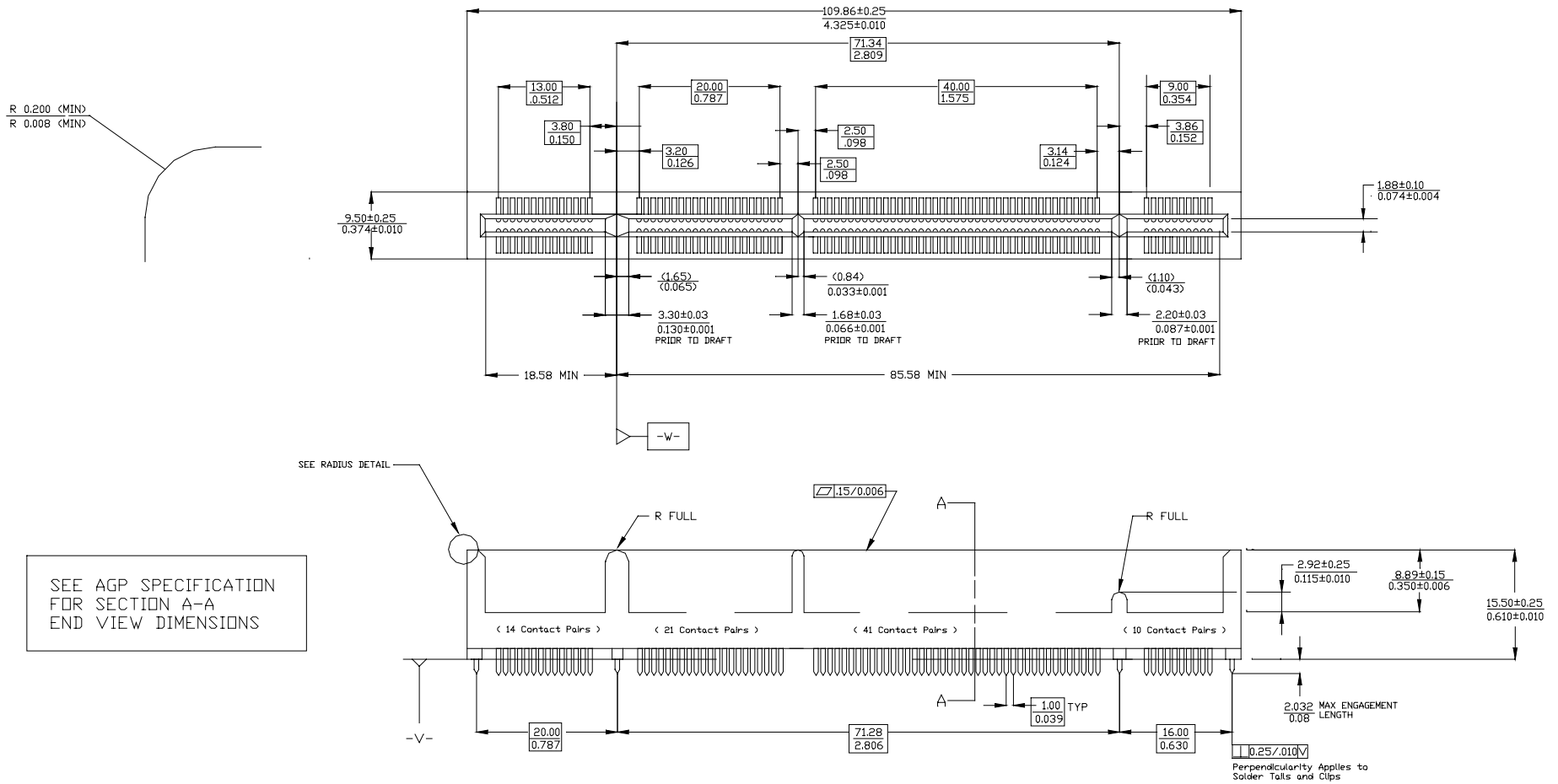


Figure 13: AGP Pro Connector Footprint (Based On APG 1.5 V Connector)

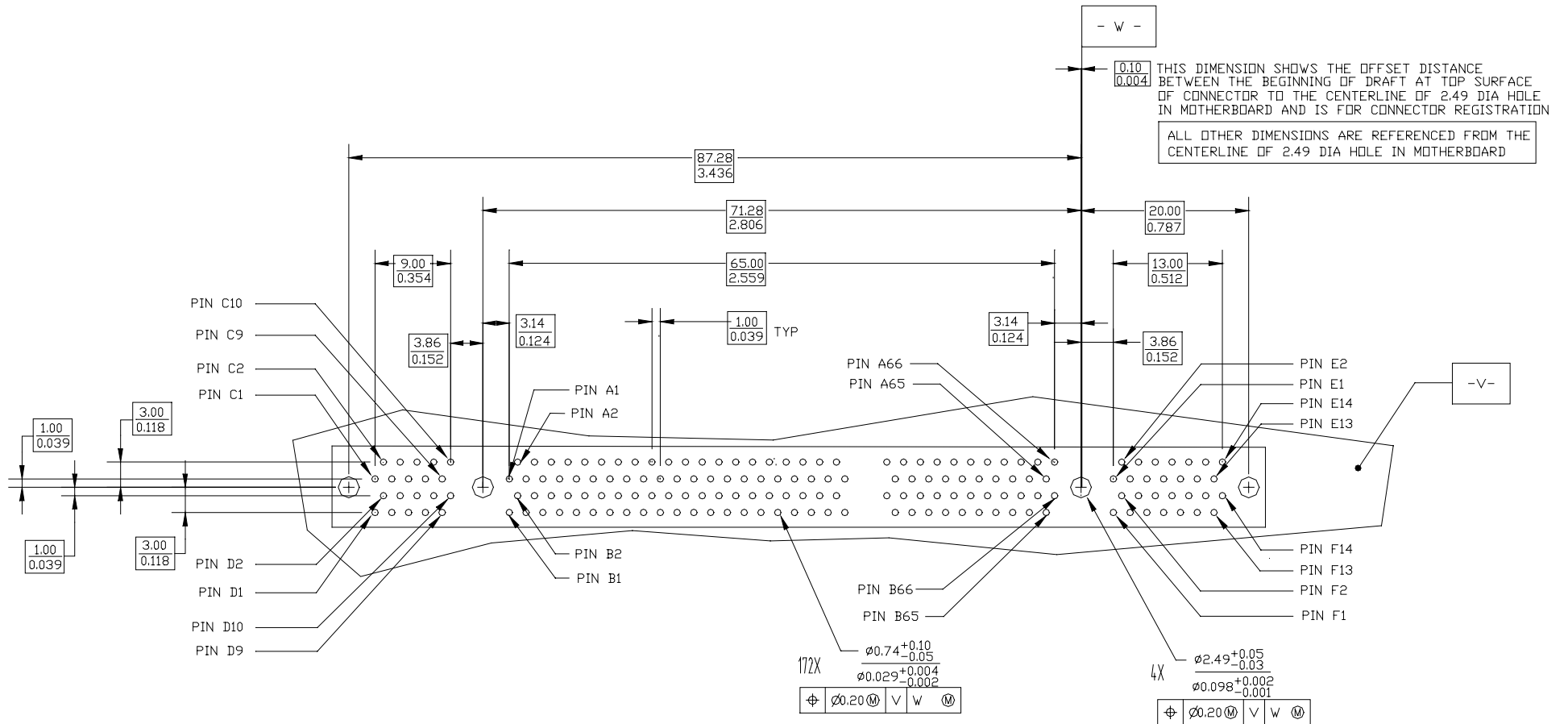


Figure 14: AGP Pro Connector Layout Dimensions (Based On AGP 1.5 V Connector).

4.2.2 Insertion/Extraction Force

- Insertion force of PCB into AGP Pro connector: 18.6 lbf (max)
- Extraction force of PCB from AGP connector: 11.2 lbf (max)
- AGP Pro connector shall withstand a minimum of 50 insertion/extraction cycles with an AGP Pro add-in card.

4.3 AGP Pro Connector Electrical Requirements

All AGP Pro connector electrical requirements are the same as the AGP connector specification except for the changes listed in Sections 4.3.1, 4.3.2, and 4.3.3.

4.3.1 Determination of Average Contact Resistance

- Measure Total Contact Resistance R_{AB} for each of the 180 AGP Pro contacts.
- Measure Bulk Contact Resistance R_{AC} for each of the 90 AGP Pro lower contacts.
- Determine Contact Resistance for each of the 180 AGP Pro contacts using either $R_{CB} = R_{AB}$ for upper contacts or $R_{CB} = R_{AB} - R_{AC}$ for lower contacts.

4.3.2 Mating Force

The total mating force for the AGP Pro Connector is <18.7 lb. Refer to the AGP specification for specific testing requirements.

4.3.3 Unmating Force

The total extraction force for the AGP Pro connector is <11.3 lb. See the AGP specification for specific testing requirements.

4.4 AGP Pro Brackets

Specially designed I/O brackets are necessary for proper implementation of the AGP Pro. Figure 15 shows a High Power AGP Pro add-in card with three- slot wide I/O bracket and an end retainer bracket.

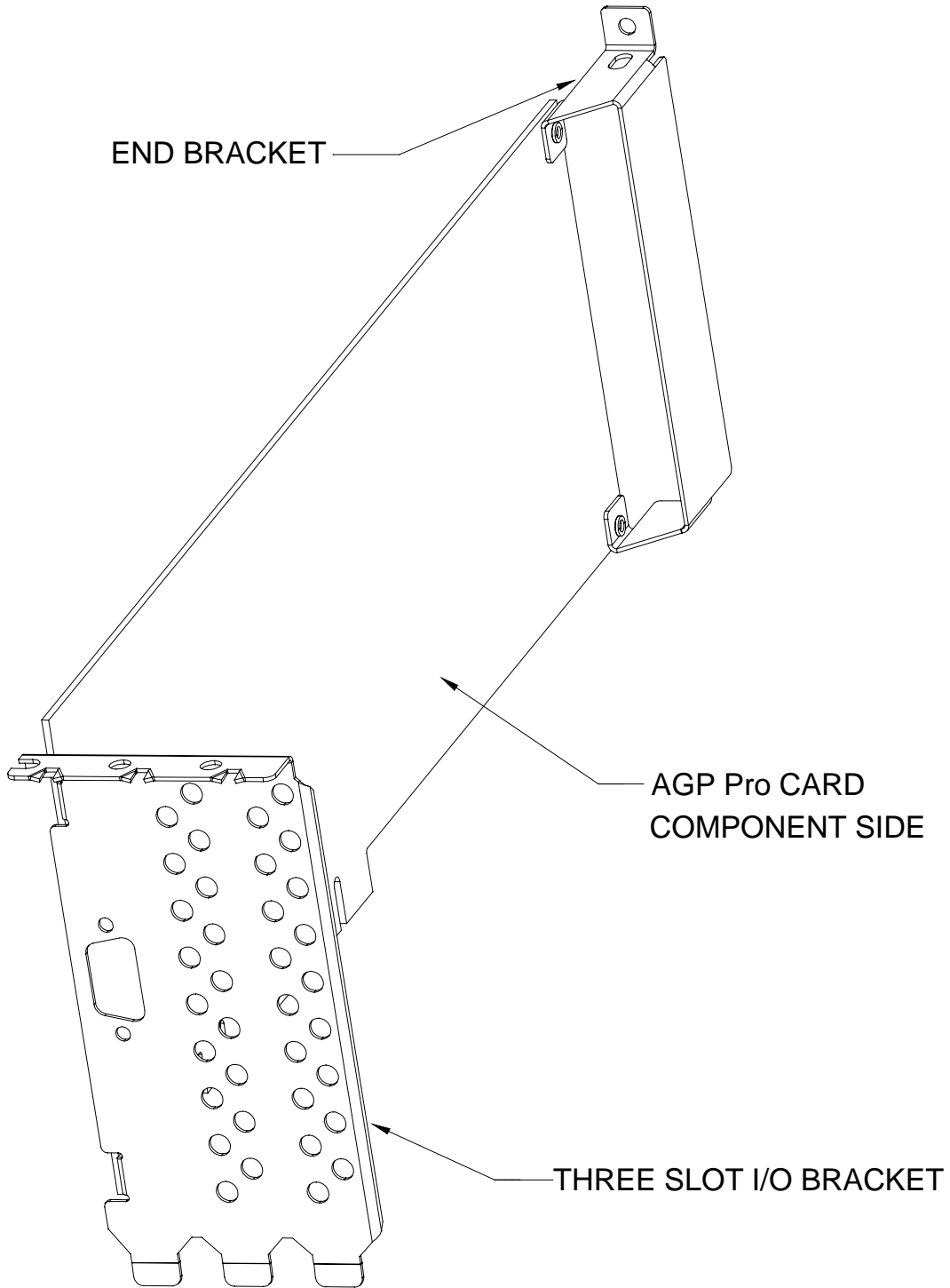


Figure 15: Isometric View of AGP Pro Brackets.

4.4.1 Three- Slot I/O Bracket Design

Figure 16 shows a detailed drawing of a three- slot I/O Bracket design. Figure 17 shows an isometric view of the three- slot I/O bracket with holes in the I/O connector, venting window. The size and number of holes must follow proper EMI and thermal design guidelines.

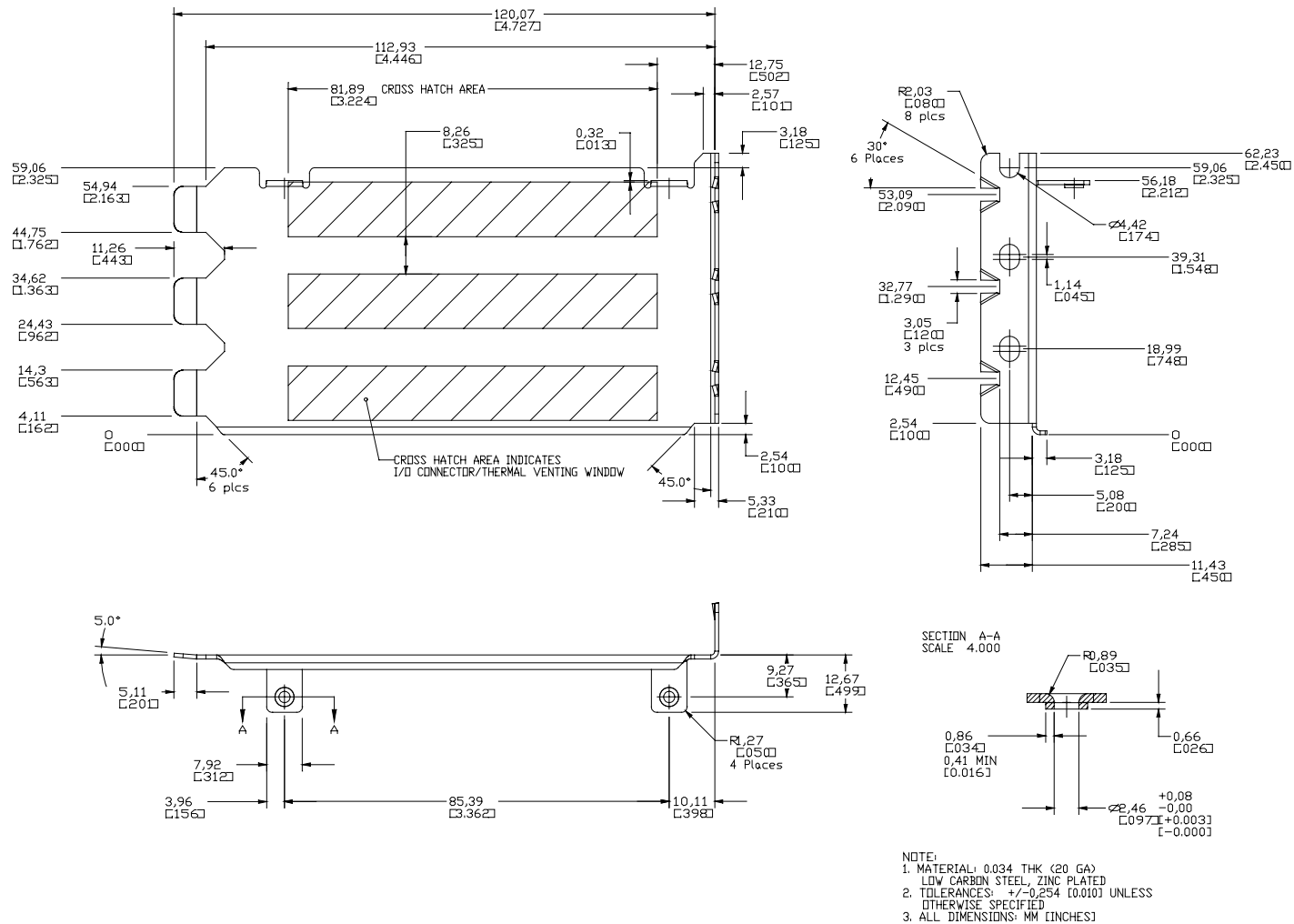


Figure 16: Detailed Three- Slot I/O Bracket Design.

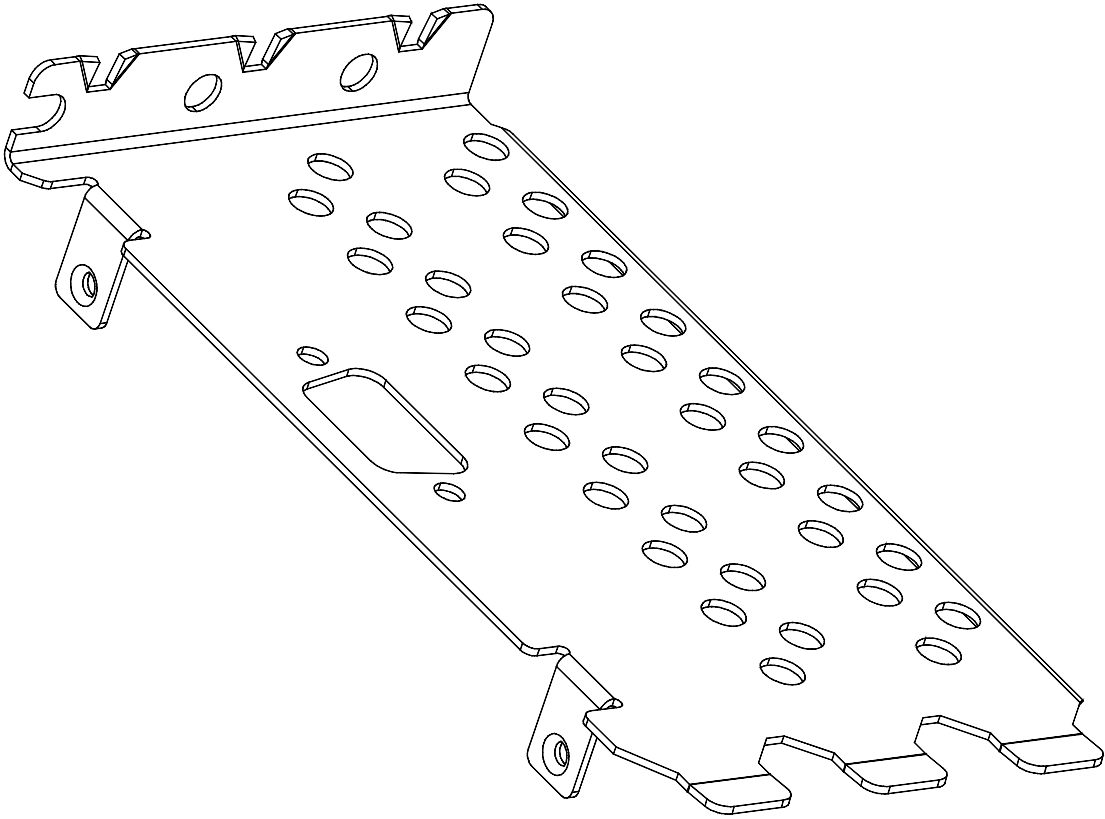


Figure 17: Three- Slot I/O Bracket Example (Isometric View).

4.4.2 Two-Slot I/O Bracket Design

Figure 18 shows a detailed drawing of a two-slot I/O Bracket design. Figure 19 shows an isometric view of the two-slot I/O bracket with holes in the I/O connectors, venting window. The size and number of holes must follow proper EMI and thermal design guidelines.

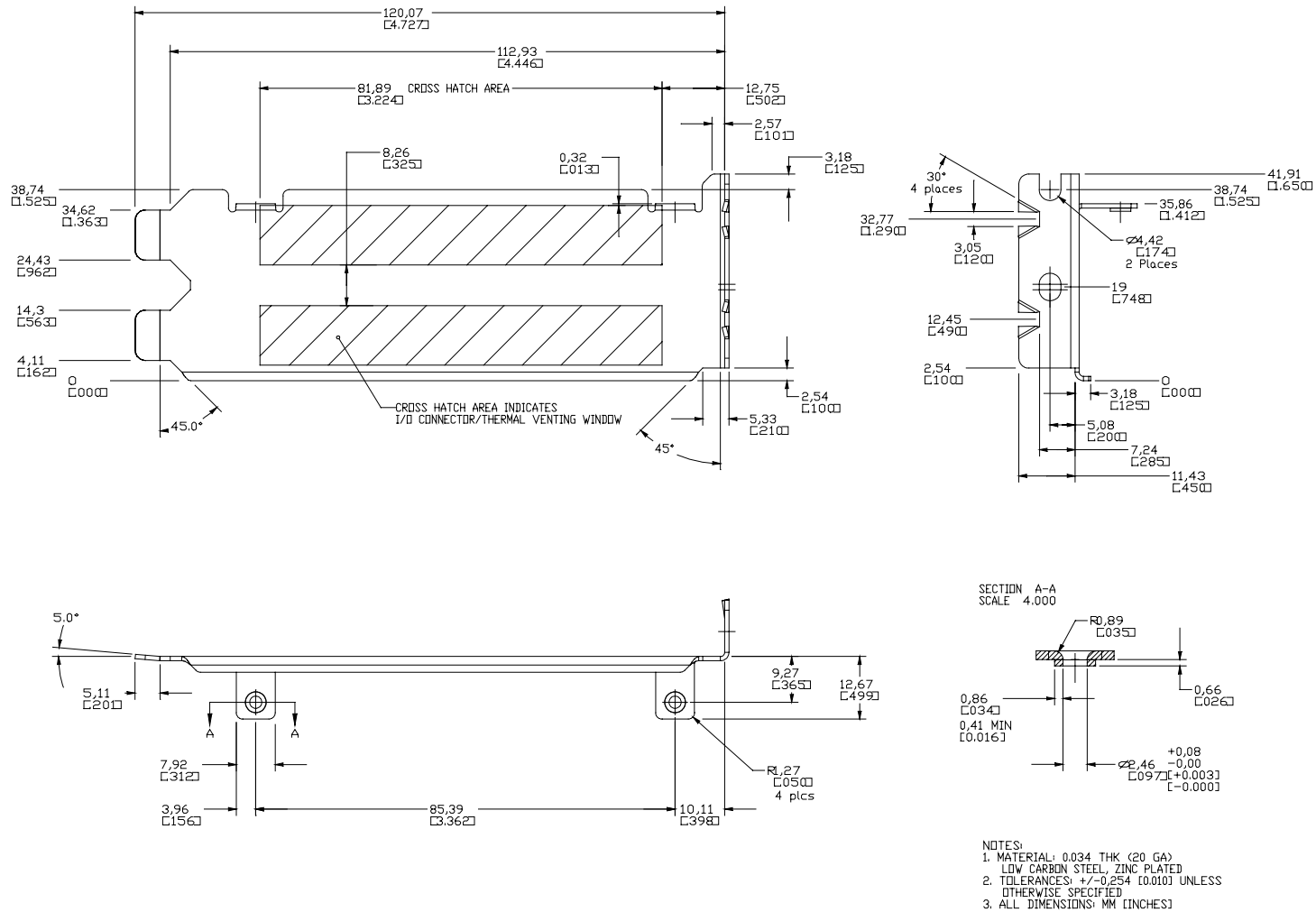


Figure 18: Detailed Two- Slot I/O Bracket Design.

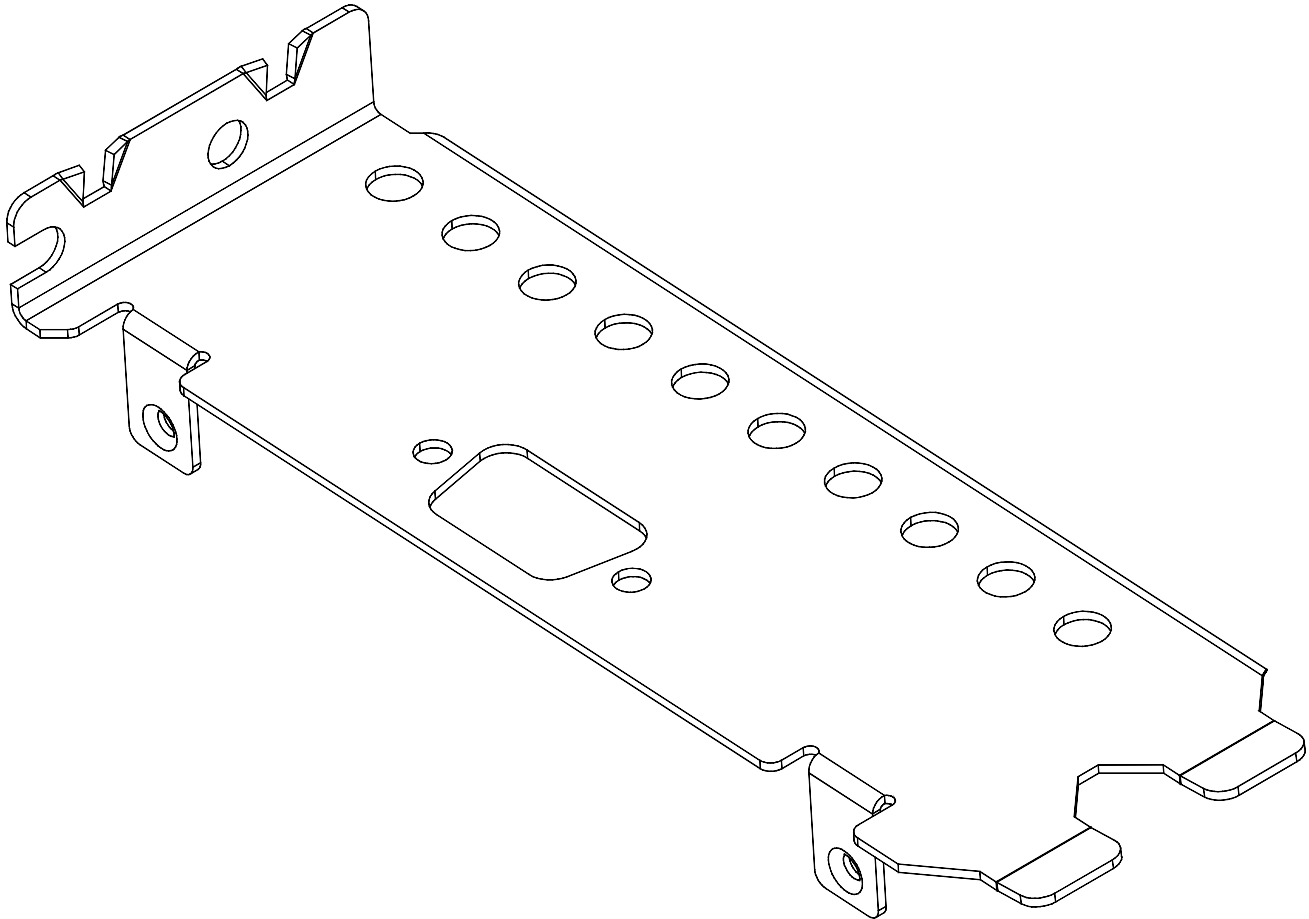


Figure 19: Two- Slot I/O Bracket Example (Isometric View).

4.4.3 AGP Pro End Retaining Bracket

A full length AGP Pro card must be equipped with an end retaining bracket as shown in Figure 20, and an isometric view of the AGP Pro End Retaining Bracket design. This end bracket provides holes for two- (2) additional hold down locations. OEM's may use this feature on the end brackets to hold down AGP Pro add-in cards.

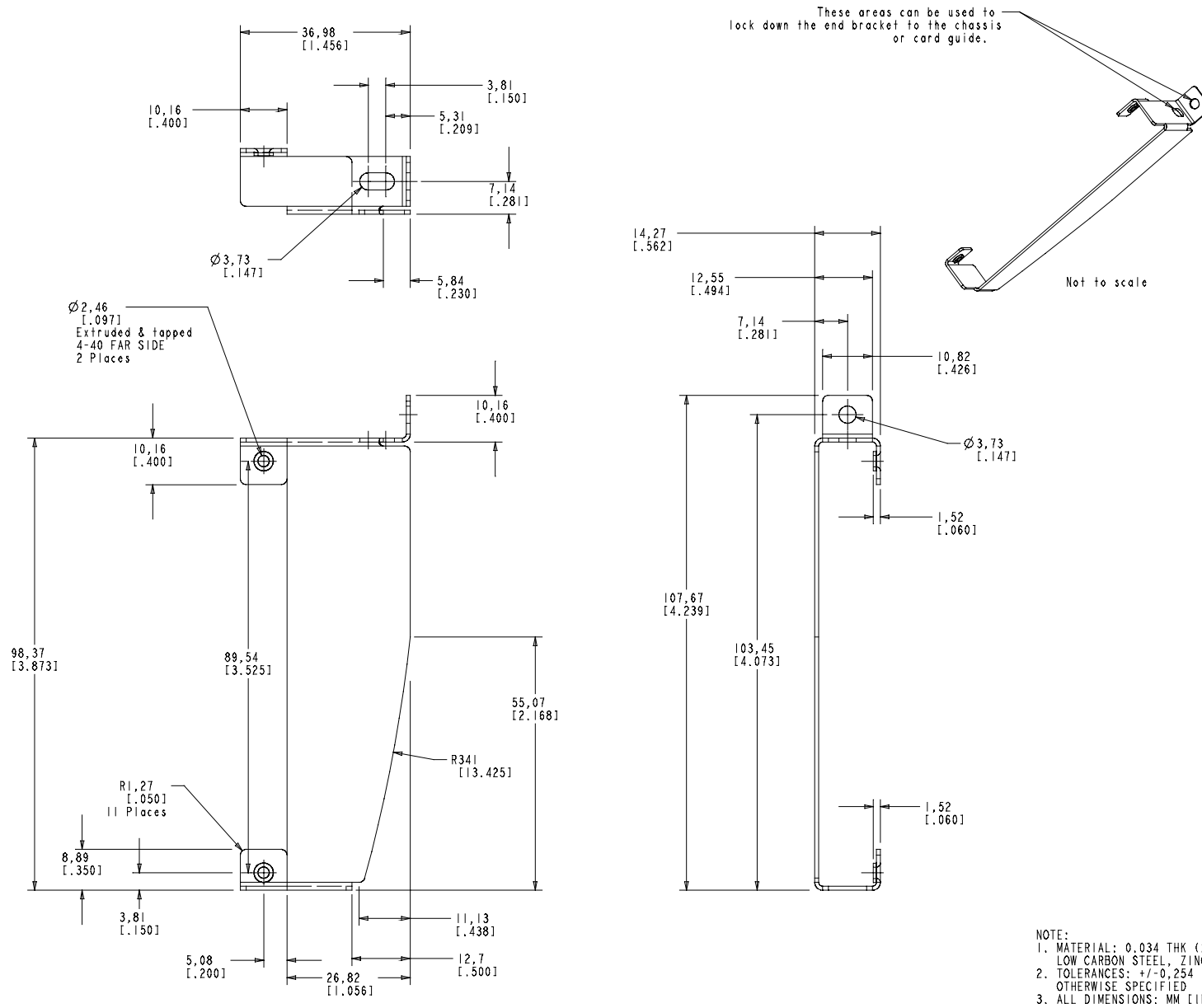


Figure 20: Detailed Drawing of the AGP Pro End Bracket.

For AGP Pro cards that are not full-length, it is strongly recommended that the card be extended to utilize the AGP Pro end, retaining bracket. This provides a retention mechanism for the card. The card can be extended using the concept shown in Figure 21. Other mechanical means can be used to extend the card.

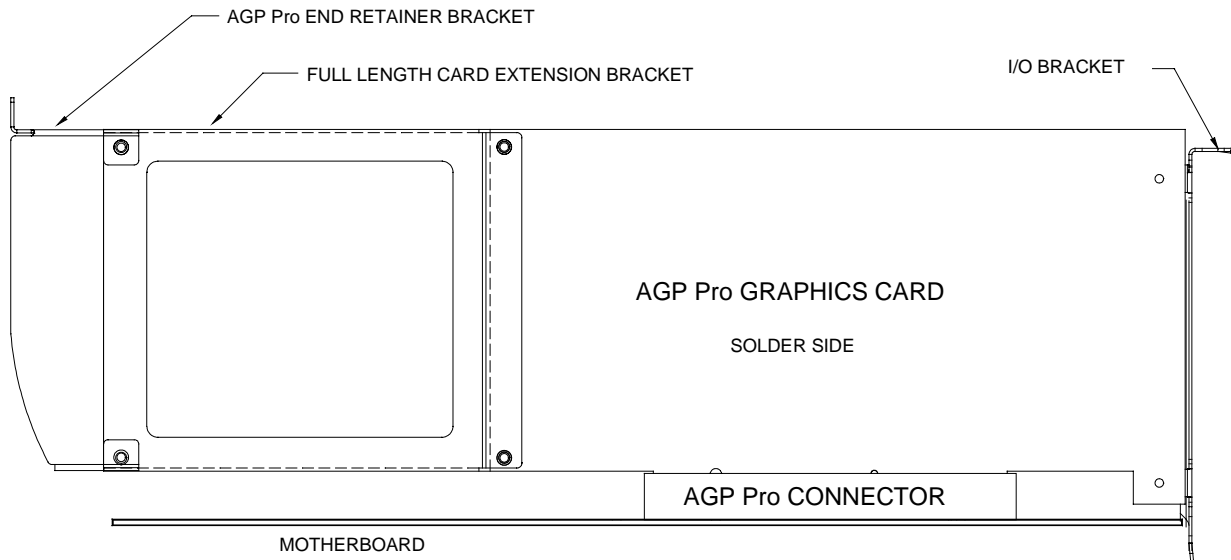


Figure 21: Full Length Card Extension Concept.

The retention mechanism for AGP cards using the notch in the registration tab will not work when AGP cards are used in an AGP Pro system. In order to use AGP cards in an AGP Pro system it is strongly recommended that the cards be extended to utilize AGP Pro end retaining bracket. This provides a retention mechanism for the AGP card. These cards can be extended using the concept shown in Figure 21.

In fact the full-length AGP cards can be equipped with the AGP Pro end, retaining bracket to operate in both the AGP and AGP Pro systems.

5.0 Thermal Specification

Figure 22 represents a thermal envelope for AGP Pro implementations. System vendors will need to provide a minimum of 200 LFM of non-obstructed airflow at the inlet of this envelope for AGP Pro110 cards. The maximum inlet temperature is 45 °C.

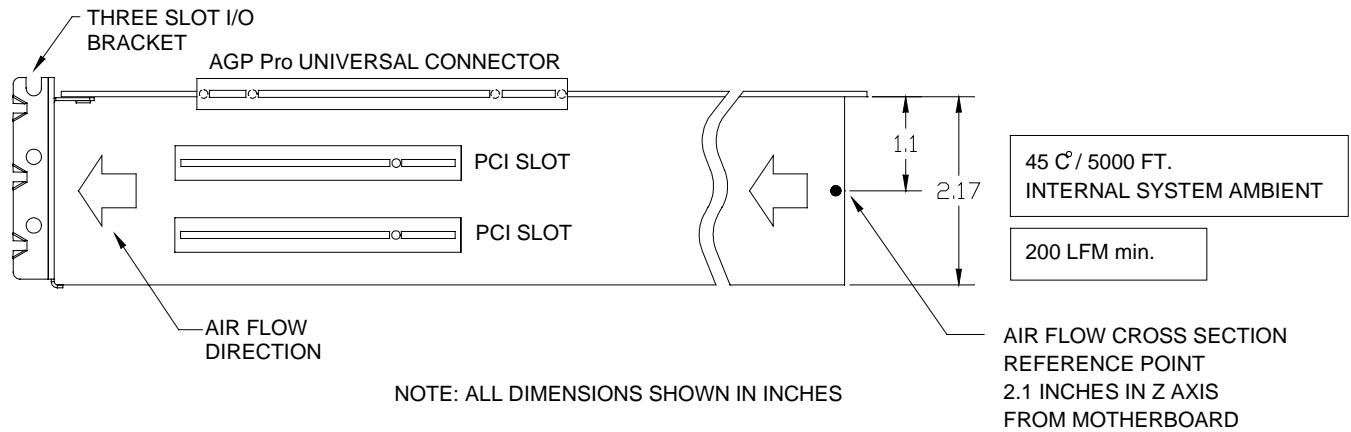


Figure 22: Thermal Envelope for AGP Pro Implementation.

The AGP Pro add-in card vendor should do thermal modeling based on the requirements listed in Table 6. If the AGP Pro card has additional cooling requirements, it must provide its own cooling solutions within the AGP Pro envelop. I/O brackets, (with holes), may be used by graphics vendors to provide venting. These brackets are specified in Section 4.

Table 6: Thermal Specification for AGP Pro System

Symbol	Parameter	Min	Max	Units	Notes
Ta	Ambient Temperature		45	C°	1
Af	Air flow	200		LFM	1, 2

Notes:

1. Measured at the reference point in the cross section of inlet.
2. LFM is linear feet per minute.

6.0 Revision History Chronology

Revision History:

Revision 1.0	August 1998	Released to www.agpforum.org web site
Revision 1.1	April 1999	<p>Section 2 Added form factor information</p> <p>Section 2.1.2 Clarification on AGP Pro50</p> <p>Section 2.2 Change Figure 2-4 AGP Pro Planar implementation, to reflect a change in dimension from board lock to center of key are not collinear. Added note for clarity.</p> <p>Section 2.5 Clarification on the 3.3V separation between AGP pro and PCI slots.</p> <p>Section 3.2.1 Change text to show 3.3V power is delivered through the extended part of the AGP Pro connector. Update Table 3.2 to reflect new 12V tolerances.</p> <p>Section 3.3 Added section for AGP Pro50 cards</p> <p>Section 3.4 Added AGP Pro50 Reference</p> <p>Section 4.1 Changed dimensions for 3.3V card edge. Added 1.5V card edge Figure 4-1B. Changed Figure 4-1B to 4-1C.</p> <p>Section 4.2.1.2 Change Figure 4-5 to reflect proper 1.5V orientation on AGP Pro 1.5V connector layout dimensions.</p> <p>Section 4.4.1 and 4.4.2 Change Three and Two Slot I/O Brackets to reflect changes in dimensions.</p> <p>Section 4.4.3 Added new text regarding retention of AGP card used in an AGP Pro system.</p>