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Digital AXPpci 233XL Module Set

OEM Design Guide

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Preface

The purpose of this OEM (Original Equipment Manufacturer) Design Guide is to provide system integration customers with the necessary design details of the module so they can integrate this component into standard or custom applications. This guide includes details on the physical and environmental characteristics of this module set.

Digital has attempted to provide every detail required for this integration in one complete and concise guide. The reader is encouraged to inform Digital of any omissions or errors that may be found so that the quality and completeness of this guide can be enhanced.

Document Summary

Chapter 1 - System Summary - Lists the overall system characteristics in table form.

Chapter 2 - Physical Description - Describes the dimensions, connectors, mounting, and setable features of the various system modules and any cables.

Chapter 3 - Environmental Data - Describes any required environmental constraints or inputs.

Appendix A - Reference Documents - Lists other associated documents.

Appendix B - Module Kit Ordering - Lists hardware part numbers.

Appendix C - Connector Summary - Summarizes connectors and vendor part numbers.

Conventions

The following conventions are used in this guide.

- **Main Logic Board (MLB)** refers to the module containing the ISA and PCI option slots.
- **CPU** refers to the module containing the DECchip 21064A Alpha AXP^{TM} processor chip.
- **PCB** refers to the printed circuit board (also known as a printed wire board).
- **Side 1** refers to the primary component side of a printed circuit board.
- **Side 2** refers to the side opposite the component side of a printed circuit board.
- Except as noted, all dimensions shown in the figures are in inches.

1 System Summary

The following table describes the physical, performance, and operating characteristics of the DEC system. This module set is the same as that used in Digital's AlphaStation 400 Model 4/233 system.

Table 1 AXPpci 233XL Module Set Summary

OPERATING SYSTEMS	DEC OSF/1 AXP™ , OpenVMS AXP™
SYSTEM CHARACTERISTICS	
CPU	DECchip™ 21064A (EV45) RISC microprocessor
Clock speed	4.3nS (233 MHz)
Instruction issue	Up to 2 instructions issued per clock cycle
Word size	64 Bits
Address size	34 bits physical address/43 bits virtual address
Floating-point format	VAX (F and G) and IEEE
SPECfp92/SPECint92	146/179
Memory (minimum RAM) (maximum RAM)	16 MB, parity-protected longword (two 2Mx36bit) 192MB Supports 1Mx36, 2Mx36, 4Mx36, 8Mx36, 70ns SIMMs
Memory (ROM)	2MB Flash ROM 64KB diagnostic ROM (DROM) 8KB serial ROM (SROM) 8KB NVM (nonvolatile memory)
On-chip I-Cache	16 KB, direct-mapped
On-chip D-Cache	16 KB, write-through, direct-mapped
External Bcache 12ns, 128 bit wide, write-back, direct-mapped, parity protected	512 KB
Memory bus width	64 data bits plus 2 parity bits
...continued on next page	

Table 1.1 AXPpci 233XL Module Set Summary (continued)

LOAD/STORAGE MEDIA	
Internal storage interface	Floppy Disk Controller (FDC) Fast SCSI-2
External storage interface	Fast SCSI-2 interface; (Maximum of 7 peripheral devices including internal SCSI-2 devices)
GRAPHICS	
Integral graphics	(None included)
Graphics option interfaces	PCI and ISA
INPUT/OUTPUT	
Input devices	PS/2® compatible keyboard and mouse
Communications	Two serial communications Ports (9-pin 'D' style connectors) One parallel (Centronics compatible) communications port
Audio	(via PCI or ISA option module)
Buses: PCI	Supports two 32-bit/5V PCI option slots. (Maximum of six options for PCI and ISA)
PCI/ISA combination	Supports one 32-bit/5V PCI option or an ISA option
ISA	Supports three ISA option slots (Maximum of six options for PCI and ISA)
SCSI-2	Implements one NCR 53C810 Fast SCSI-2 controller, single-ended bus. One internal and one external SCSI-2 connector; 7 peripheral devices maximum. Asynchronous or synchronous (@ 10MHz) operation.
Networks	via PCI or ISA bus
PHYSICAL CHARACTERISTICS	
Width/Depth/Height (includes option modules)	English: 9.335"/13.865"/5.573" Metric: 237mm/352mm/142mm
Power supply voltages (refer to section 3.2 for current consumption)	+5V/8.0A +12V/0.5 A -12V/0.09A -5V/0.03A +3.3V/4.0A
ENVIRONMENTAL CHARACTERISTICS (operational)	
Temperature	(Refer to Chapter 3 for ambient temperatures as they relate to air flow)
Temperature change rate (max)	11°C/hr (20°F/hr)
Relative humidity	10-90% noncondensing
Maximum wet bulb	25°C (77°F)
Minimum dew point	2°C (36°F)
Electromagnetic emissions	Compliance certification is the responsibility of the system integrator. The AXPpci 233XL module set was tested in a Digital commercial enclosure and passed EMC testing.
Shock and vibration	Passing of shock and vibration tests depends on the method used to mount the module, the design of the enclosure, and how the enclosure is supported. It is the responsibility of the system integrator.

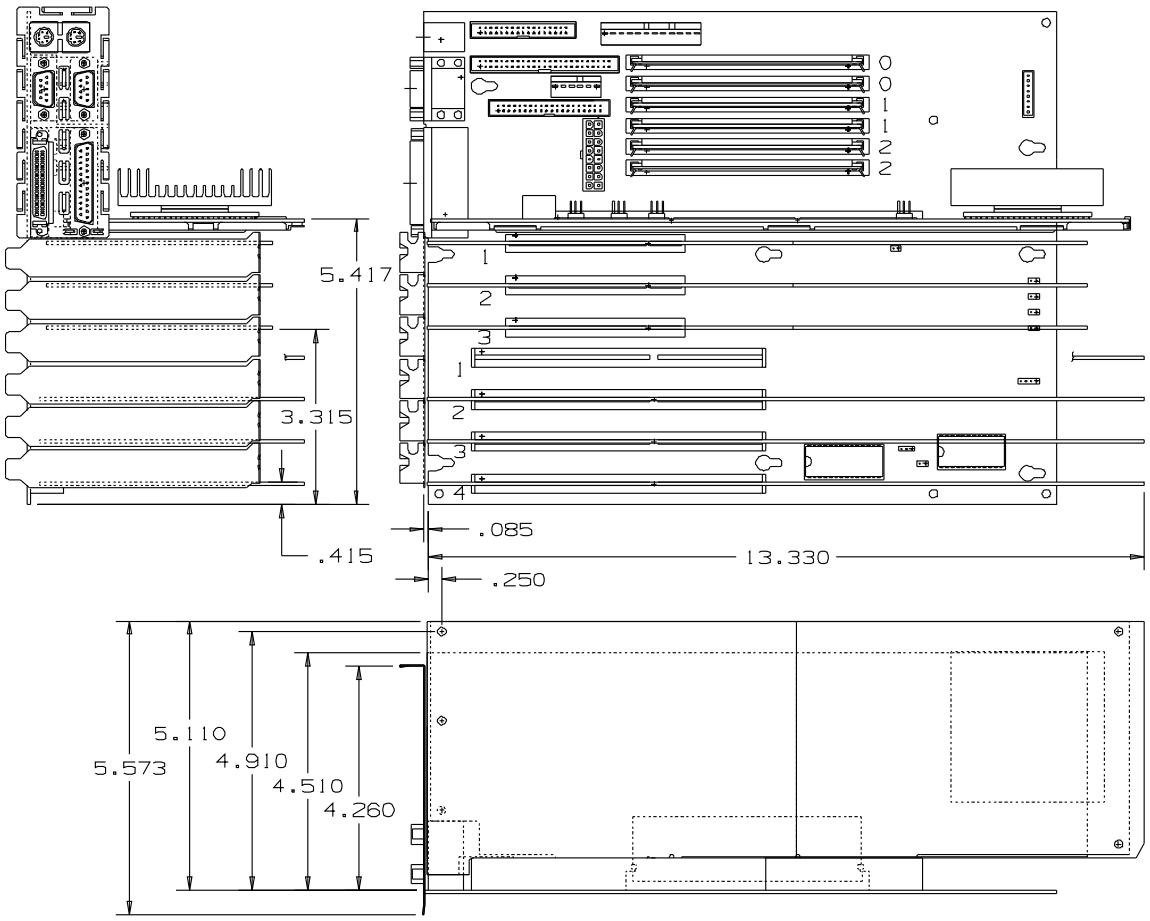
2 Physical Description

This chapter describes the core module assembly, the main logic board (MLB), the CPU module, the single in-line memory module (SIMM), the ISA option modules, and the PCI option modules.

2.1 Core Module Assembly

The following figure depicts the core module assembly consisting of the MLB, CPU module, 6 SIMMs (Single Inline Memory Modules), and I/O, power and inter-module connectors. All ISA and PCI option slots are shown with options installed, however PCI slot #3 and ISA slot #1 are mutually exclusive as they use the same bulkhead.

Figure 1 Core Module Assembly Outline



2.2 Main Logic Board (MLB)

The MLB contains a Floppy Disk Controller (FDC), IDE (Integrated Device Electronics) disk controller, SCSI-2 controller, two serial ports, parallel port, PS/2 compatible keyboard/mouse controller, memory subsystem which support 6 SIMMs, interconnect to the CPU module, interconnects to three PCI and four ISA option modules, interconnect to a control panel, and interconnect to a speaker.

2.2.1 Physical Mounting

The MLB has eight 0.157"/0.291" keyhole mounting openings, two 0.157" diameter mounting holes and three 0.157" diameter module tooling holes. The eight keyhole openings have grounding pads or etch that must have electrical contact with the chassis. Use of metal screws at these locations is required to reduce electromagnetic emissions and ESD sensitivity. These screws must provide electrical contact between the metal chassis and these grounding holes.

2.2.2 Connectors

The following connectors are described in detail for use by the system integrator. See MLB outline (Figure 4) for connector locations and pin orientation. Connectors are presented here in alphabetical order. Appendix C lists the connectors in numerical order. All connectors are on side 1 of the MLB.

2.2.2.1 CPU Connector (J15)

The CPU connector on the MLB supports a proprietary bus for connection of an Alpha AXP processor module explicitly designed for the AXPpci 233XL. The pinout for this connector is not provided as there is no means of changing this electrical interface without impacting system integrity.

2.2.2.2 DC Power Input Connectors (J14, J16, and J18)

The MLB has three power connectors.

J14 provides +5V and is a 6-position (1x6) vertical male keyed connector. The mating connector required by the power source is a Molex housing 90331 with a key at position 3 on the connector housing.

Table 2 DC Power Connector (+5V) Pin-out (J14)

Pin #	Function
1	+5V
2	+5V
3	+5V
4	GROUND
5	GROUND
6	GROUND

J16 is a two-part connector and provides +5V, +12V, -12V and -5V and is a 12-position (1x12) vertical male keyed connector. The mating connectors required by the power source are Molex housing 90331 for positions 1-6 with a key at position 4 on the housing and a Molex housing 90331 for positions 7-12 with a key at position 1 on the connector housing.

Table 3 DC Power Connector (+5/±12/-5V) Pin-out (J16)

Pin #	Function
1	POWER GOOD H
2	+5V
3	+12V
4	-12V
5	GROUND
6	GROUND
7	GROUND
8	GROUND
9	-5V
10	+5V
11	+5V
12	+5V

J18 provides +3.3V and is a 16-position (2x8) vertical male keyed connector. The mating connector required by the power source is a Molex housing 39-01-216X.

Table 4 DC Power Connector (+3.3V) Pin-out (J18)

Pin #	Function	Pin #	Function
1	GROUND	9	+3.3V
2	GROUND	10	+3.3V
3	GROUND	11	+3.3V
4	GROUND	12	+3.3V
5	GROUND	13	+3.3V
6	GROUND	14	+3.3V
7	GROUND	15	+3.3V
8	GROUND	16	+3.3V

2.2.2.3 Fan Power

A fan power connector is not provided by the MLB. Fan power must be supplied by some other means, typically a direct connection to the power supply.

2.2.2.4 Floppy Disk Connector (J4)

The AXPpci 233XL includes a floppy disk interface which can support up to two floppy or tape drives. This internal connector is a 34-position (2x17) male shrouded keyed connector.

Table 5 Floppy Disk Connector Pin-out (J4)

Pin #	Function	Pin #	Function
1	GROUND	2	DENSEL
3	GROUND	4	MTR3 L
5	GROUND	6	DRATE0
7	GROUND	8	INDEX L
9	GROUND	10	MTR0 L
11	GROUND	12	DR1 L
13	GROUND	14	DR0 L
15	GROUND	16	MTR1 L
17	no connection	18	DIR L
19	GROUND	20	STEP L
21	GROUND	22	WRDATA L
23	GROUND	24	WGATE L
25	GROUND	26	TRK0 L
27	no connection	28	WP L
29	GROUND	30	RDDATA L
31	GROUND	32	HDSEL L
33	GROUND	34	DISKCH L

2.2.2.5 IDE Disk Connector (J10)

The AXPpci 233XL has one IDE compatible disk interface. This internal connector is a 40-position (2x20) male shrouded keyed connector.

Table 6 IDE Disk Connector Pin-out (J10)

Pin #	Function	Pin #	Function
1	RESET	2	GROUND
3	DATA7	4	DATA8
5	DATA6	6	DATA9
7	DATA5	8	DATA10
9	DATA4	10	DATA11
11	DATA3	12	DATA12
13	DATA2	14	DATA13
15	DATA1	16	DATA14
17	DATA0	18	DATA15
19	GROUND	20	no connection
21	DMA REQ	22	GROUND
23	IOWC	24	GROUND
25	IORC	26	GROUND
27	IO CH RDY	28	STROBE
29	DMA GRANT	30	GROUND
31	INTERRUPT	32	no connection
33	A1	34	no connection
35	A0	36	A2
37	SEL 0	38	SEL 1
39	BUSY	40	GROUND

2.2.2.6 ISA Slot Connectors (J6-J9)

The AXPpci 233XL supports four full-length ISA option slots. The PCI option in PCI slot #3 (J13) uses the same bulkhead that the ISA option in ISA slot #1 (J6) uses, making the slots mutually exclusive. For definition of signal and power pin assignments, refer to the ISA specification referenced in Appendix A.

2.2.2.7 Keyboard/Mouse Connector (J1-A, J1-B)

The PS/2 compatible 6-pin mini-DIN keyboard and mouse connectors are physically stacked. The J1 designation is differentiated for presentation purposes by an ’-A’ and ’-B’ suffix. Although keyboard and mouse connector pin-outs are the same, the keyboard and mouse interfaces are not interchangeable in software.

Table 7 Keyboard and Mouse Connector Pin-out (J1-A and J1-B)

Pin #	Function
1	DATA
2	no connect
3	GROUND
4	+5V
5	CLOCK
6	no connect

2.2.2.8 LEDs/Switch Connector (J31)

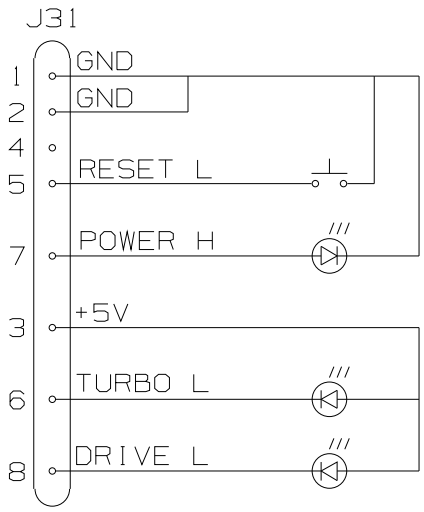
The LEDs/Switch connector provides an interface point for two LEDs and one reset switch. The following table shows the required connections to J31 of the MLB.

NOTE: The J6 jumper on the CPU module must be installed in position 1-2 to enable this RESET function.

Table 8 LEDs/Switch Connector Pin-out (J31)

Pin #	Function	Description
1	GROUND	-
2	GROUND	-
3	+5V	-
4	(no connection)	-
5	RESET L	RESET SWITCH INPUT (normally open)
6	TURBO L	TURBO LED (cathode)
7	POWER H	POWER LED (anode)
8	DRIVE ACTIVE L	DRIVE ACTIVE LED (cathode)

Figure 2 LEDs/Switch Circuit



2.2.2.9 Parallel Port Connector (J3-B)

This parallel port connector is a 25-position D-style connector and provides a Centronics compatible interface. This parallel port connector and the external SCSI-2 port connector are physically stacked. The J3 designation is differentiated for presentation purposes by an '-A' and '-B' suffix.

Table 9 Parallel Port Connector Pin-out (J3-B)

Pin #	Function	Pin #	Function
1	STRB L	14	AUTOFD L
2	DATA O	15	ERROR L
3	DATA 1	16	INIT L
4	DATA 2	17	SLCTIN L
5	DATA 3	18	GROUND
6	DATA 4	19	GROUND
7	DATA 5	20	GROUND
8	DATA 6	21	GROUND
9	DATA 7	22	GROUND
10	ACK	23	GROUND
11	BUSY	24	GROUND
12	PE	25	GROUND
13	SLCT		

2.2.2.10 PCI Slot Connectors (J11, J12, J13)

The AXPpci 233XL supports three PCI option slots (5V/32-bit). The ISA option in ISA slot #1 (J6) uses the same bulkhead slot that the PCI option in PCI slot #3 (J13) uses, making the slots mutually exclusive. For definition of signal and power pin assignments, refer to the PCI specification referenced in Appendix A.

2.2.2.11 SCSI-2 Connectors (J5, J3-A)

The AXPpci 233XL supports one SCSI-2 bus using the NCR 53C810 Fast SCSI-2 controller chip with an internal connector (J5) and an external connector (J3-A). The internal SCSI-2 connector is a 50-position (2x25) male shrouded keyed connector. The external SCSI-2 connector is a 50-position (2x25) high-density shielded connector. The external SCSI-2 connector and the parallel connector are physically stacked. The J3 designation is differentiated for presentation purposes by an ’-A’ and ’-B’ suffix .

Table 10 Internal SCSI-2 Connector Pin-out (J5)

Pin #	Function	Pin #	Function
1	GROUND	2	DB0 L
3	GROUND	4	DB1 L
5	GROUND	6	DB2 L
7	GROUND	8	DB3 L
9	GROUND	10	DB4 L
11	GROUND	12	DB5 L
13	GROUND	14	DB6 L
15	GROUND	16	DB7 L
17	GROUND	18	PB L
19	GROUND	20	GROUND
21	GROUND	22	GROUND
23	no connection	24	no connection
25	no connection	26	TERM POWER
27	no connection	28	no connection
29	GROUND	30	GROUND
31	GROUND	32	ATN L
33	GROUND	34	GROUND
35	GROUND	36	BSY L
37	GROUND	38	ACK L
39	GROUND	40	RST L
41	GROUND	42	MSG L
43	GROUND	44	SEL L
45	GROUND	46	C/D L
47	GROUND	48	REQ L
49	GROUND	50	I/O L

The external SCSI-2 connector is physically stacked with the parallel port connector. The J3 designation is differentiated for presentation purposes by an ’-A’ and ’-B’ suffix.

Table 11 External SCSI-2 Connector Pin-out (J3-A)

Pin #	Function	Pin #	Function
1	GROUND	26	DB0 L
2	GROUND	27	DB1 L
3	GROUND	28	DB2 L
4	GROUND	29	DB3 L
5	GROUND	30	DB4 L
6	GROUND	31	DB5 L
7	GROUND	32	DB6 L
8	GROUND	33	DB7 L
9	GROUND	34	PB L
10	GROUND	35	GROUND
11	GROUND	36	GROUND
12	GROUND	37	GROUND
13	no connection	38	TERM POWER
14	GROUND	39	GROUND
15	GROUND	40	GROUND
16	GROUND	41	ATN L
17	GROUND	42	GROUND
18	GROUND	43	BSY L
19	GROUND	44	ACK L
20	GROUND	45	RST L
21	GROUND	46	MSG L
22	GROUND	47	SEL L
23	GROUND	48	C/D L
24	GROUND	49	REQ L
25	GROUND	50	I/O L

2.2.2.12 Serial Ports (J2-A and J2-B)

These 9-position ’D’ style serial port connectors are physically stacked. The J2 designation is differentiated by an ’-A’ and ’-B’ suffix for presentation purposes, but the pin-out and functions are identical.

Table 12 Serial Port Pin-outs *(J2-A and J2-B)*

Pin #	Function	Pin #	Function
1	DCD	6	DSR
2	SERIAL IN	7	RTS
3	SERIAL OUT	8	CTS
4	DTR	9	RI
5	GROUND		

2.2.2.13 SIMM Interconnects (J22-J27)

Each AXPpci 233XL SIMM has a 36-bit wide data path. Each pair member has 32 data bits and 1 parity bit; the other 3 bits are not used. SIMMs must be installed in pairs with both members of the pair being the same size and type. The pairs are:

Table 13 SIMM Banks 1-3

Bank 0	Bank 1	Bank 2
J22-J23	J24-J25	J26-J27

Table 14 SIMM Connector Pin-out (J22-J27)

Pin #	Function	Pin #	Function
1	GROUND	37	PARITY (not used)
2	DATA	38	PARITY (not used)
3	DATA	39	GROUND
4	DATA	40	CAS
5	DATA	41	CAS
6	DATA	42	CAS
7	DATA	43	CAS
8	DATA	44	RAS
9	DATA	45	RAS
10	+5V	46	no connection
11	no connection	47	WRITE
12	A0	48	no connection
13	A1	49	DATA
14	A2	50	DATA
15	A3	51	DATA
16	A4	52	DATA
17	A5	53	DATA
18	A6	54	DATA
19	A10	55	DATA
20	DATA	56	DATA
21	DATA	57	DATA
22	DATA	58	DATA
23	DATA	59	+5V
24	DATA	60	DATA
25	DATA	61	DATA
26	DATA	62	DATA
27	DATA	63	DATA
28	A7	64	DATA
29	A0	65	DATA
30	+5V	66	no connection
31	A8	67	no connection
32	A9	68	no connection
33	RAS	69	no connection
34	RAS	70	no connection
35	PARITY (Bank 1 only)	71	no connection
36	PARITY (Bank 0 only)	72	GROUND

2.2.2.14 Speaker Connector (J37)

The speaker connector is a 4-position (1x4) connector. The drive circuit is designed for a 4-16 ohm dynamic-load speaker.

Figure 3 Speaker Connector Pin-out (J37)

Pin #	Function
1	+5V
2	(no connection)
3	(no connection)
4	SPEAKER OUTPUT

2.2.3 Configuration Jumpers

The MLB has several sets of jumpers as described in the following sections. These jumpers are installed onto *headers* which consist of 0.025" posts on 0.100" spacing. All jumpers are for use by service personnel only. When jumper plugs are not used for shorting two pins, they may be stored by pushing them onto a single post.

2.2.3.1 Clear NVM Jumper (J29)

This 2-position jumper allows clearing of nonvolatile memory of the Real Time Clock by temporarily installing this jumper. The jumper is attached to only one post in the OUT position.

Table 15 Clear NVM Jumper (J29)

Clear	**Normal** (factory setting)
IN	OUT

2.2.3.2 Real-Time Clock Interrupt Selection Jumper (J39)

This 2-position jumper must be installed.

Table 16 *Real-Time Clock Interrupt* Selection Jumper (J39)

Processor Module	
Alpha AXP (factory setting)	**Intel**
IN	OUT

2.2.3.3 Reprogram Boot Block Jumper (J40)

Table 17 Reprogram Boot Block Jumper (J40)

Reprogram Boot Block Disabled (factory setting)	**Reprogram Boot Block Enabled**
IN	OUT

2.2.3.4 Unused Jumper

The MLB for this Alpha system also serves as an MLB for an Intel processor module. As a result, some jumpers' functions are not used with an Alpha CPU module. The following jumpers are unused and should not be installed.

- **Password Clear (J32)**
- **Color/Mono (J33)**
- **Recovery Mode (J34)**
- **BIOS ROM Upgrade (J35)**

2.2.4 MLB Drawings

The following figure identifies connector and jumper locations as well as pin orientations. Dimensions of the MLB and location of its major components and mounting holes are shown in the following two figures.

Figure 4 MLB Component Outline

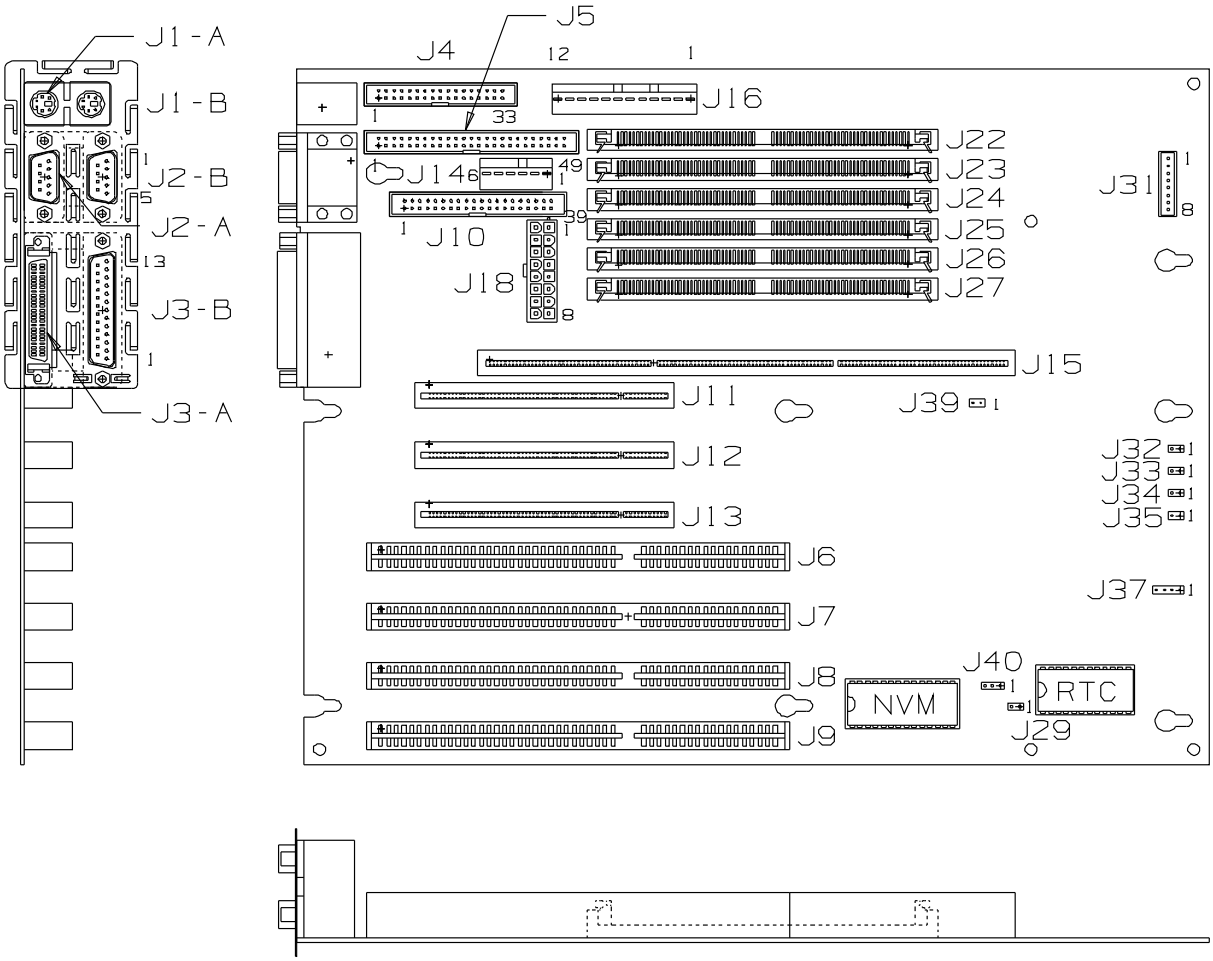
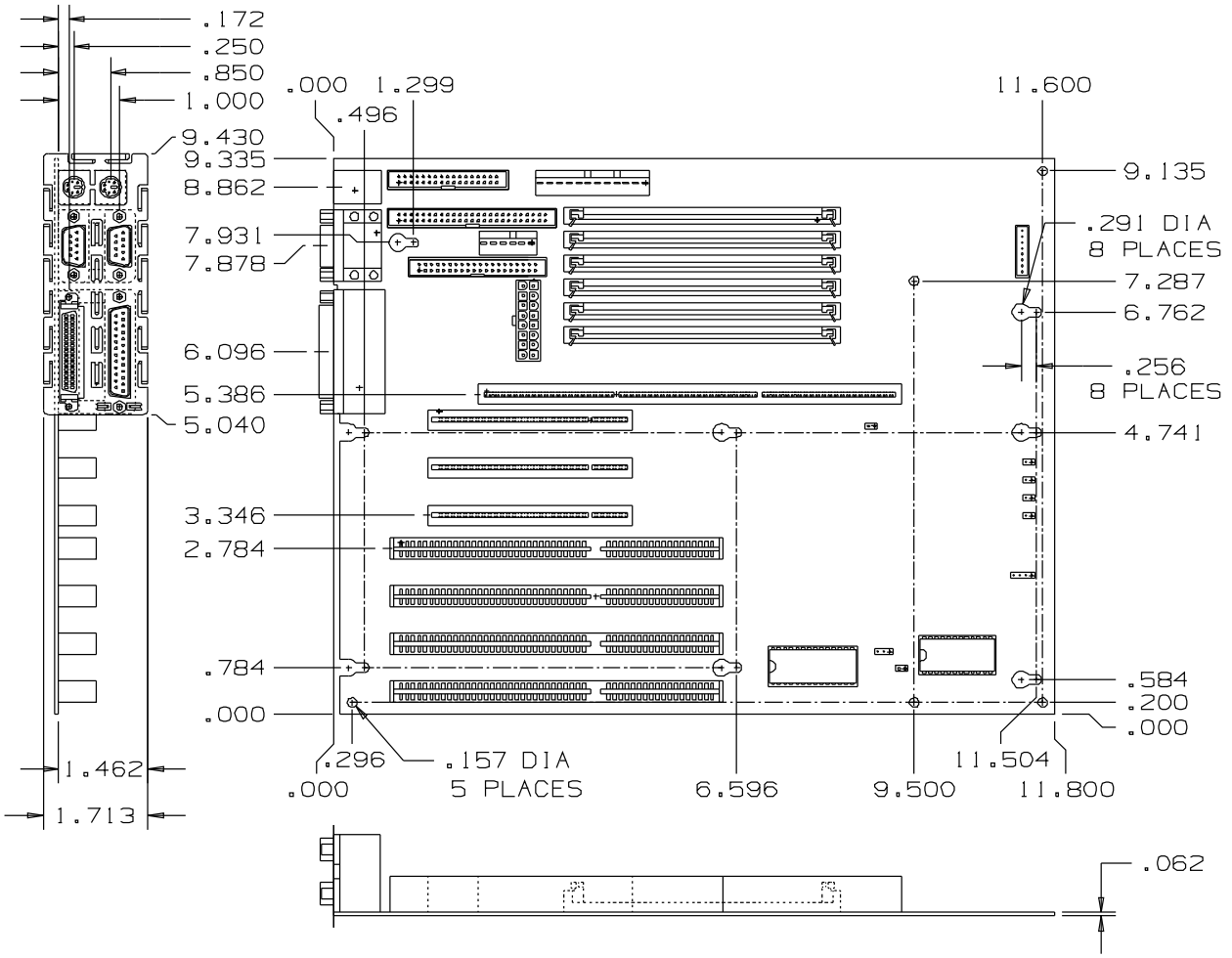


Figure 5 MLB Mechanical Drawing



2.3 Alpha AXP CPU Module

The CPU module contains the DECchip 21064A AXP^{TM} processor chip, Bcache, data and control ASICs, PCI bus interface chip, serial ROM and interface, configuration jumpers, and eight diagnostic LEDs. The modularity of the CPU module makes upgrade to a faster processor in the future easier.

2.3.1 Physical Mounting

The CPU module is installed into an edge connector (J15) on the MLB.

2.3.2 Connectors

The following connectors are described in detail for use by the system integrator. See CPU module drawing (Figure 6) for size, connector locations, and pin orientation. These connectors are presented here in alphabetical order. Appendix C lists the connectors in numerical order. All connectors are on side 1 of the CPU.

2.3.2.1 Engineering/Manufacturing Test Connector (J2)

A 10-position (2x5) connector is for Digital engineering/manufacturing use only. Do not connect.

2.3.2.2 MLB Connector (J1)

The pinout for this edge connector is not provided as there is no means of changing this electrical interface without impacting the integrity of the system or using it for other purposes. This connector provides all signals and power to the Alpha AXP CPU module.

2.3.3 Configuration Jumpers

The MLB has four sets of jumpers as described in the following sections. These jumpers are 0.025" posts on 0.100" spacing. When jumper plugs are not used for shorting two pins, they may be stored by pushing them onto a single post.

2.3.3.1 Configuration Jumpers 0 and 1 (J3, J5)

The Configuration jumpers (0 and 1) are software readable jumpers for use by service personnel.

Configuration jumper 0 (3-position) is used to either cause the processor to stop booting at the Serial ROM console prompt, or to continue booting from the image code in the Flash ROM. See Table 18.

Configuration jumper 1 (3-position) is used to either cause the system to execute the image code from a floppy disk, or to execute the image code in Flash ROM. See Table 19.

Table 18 Configuration Jumper 0 (J3)

Enable Serial ROM Output to Serial Port	Disable Serial ROM Output to Serial Port
PIN 1-2	PIN 2-3

Table 19 Configuration Jumper 1 (J5)

Enable Diagnostic ROM Output to Serial Port	Disable Diagnostic ROM Output to Serial Port
PIN 1-2	PIN 2-3

2.3.3.2 Flash Memory Jumper (J4)

This jumper allows the contents of the firmware Flash ROM on the CPU module to be changed through the use of a stand-alone software utility.

Table 20 Flash ROM Jumper (J4)

Flash ROM Writeable	Flash ROM Write-Protected
PIN 1-2	PIN 2-3

2.3.3.3 RESET Enable Jumper (J6)

The RESET enable jumper determines if the system will reset when the RESET connector switch is closed, if installed (see J31 on MLB).

This jumper may be left off if this RESET function is not required. Leaving the jumper off disables resetting the system through the RESET switch.

Table 21 RESET Enable Jumper (J6)

RESET Enable	do not use
PIN 1-2	PIN 2-3

2.3.4 LED Display

Eight LEDs on the CPU module indicate system status during power-up self-test diagnostics. The following table lists the LED patterns and their meanings.

Table 22 LED Display Codes

LED Code		Function	State (Notes)
Binary (1=on; 0=off) (D17-10)	Hex		
1111 1111	FF	Alpha AXP initialized	(see note 2)
1111 1110	FE	Memory sizing code	(see note 2)
1111 1101	FD	Memory sizing complete. Executing memory configuration routine.	No usable memory detected.
1111 1100	FC	Memory configuration routine complete. Bcache initialization started. Main memory initialized to zeros.	(see note 2)
1111 1011	FB	Bcache initialization successfully completed Bcache OFF/ Dcache OFF. Executing memory test 1.	(see note 2)
1111 1010	FA	Bcache ON/ Dcache OFF; memory test 2. Executing memory test 2.	Fatal error; mini-SROM console active (see note 2)
1111 1001	F9	Bcache OFF/ Dcache ON; memory test 3. Executing memory test 3.	Fatal error; mini-SROM console active (see note 2)
1111 1000	F8	Bcache ON/ Dcache ON; memory test 4. Executing memory test 4.	Fatal error; mini-SROM console active (see note 2)
1111 0111	F7	Completed 4 of 4 memory tests.	Fatal error; mini-SROM console active (see note 2)
1111 0110	F6	Initializing PCI interface registers.	(see note 2)
1111 0101	F5	Register initialization complete.	(see note 2)
1111 0100	F4	Attempting to load diagnostic ROM.	(see note 2)
1111 0011	F3	Diagnostic ROM load failed.	(see note 2)
1111 0010	F2	Console load determination complete. Load console into memory.	Diagnostic and console ROM corrupt.
1111 0001	F1	Completed console load.	(see note 2)
1111 0000	F0	SROM code execution completed. Transfer to diagnostics or console code.	Cannot execute console code or J3 jumper forced SROM mini-console execution.
....continued on next page			

Notes:

1. All unused codes are reserved.
2. System will not halt with this code.

Table 22.1 LED Display Codes (continued)

LED Code		Function	State (Notes)
Binary (1=on; 0=off) (D17-10)	Hex		
1101 1110	DE	Memory test failed.	
1101 1101	DD	Flash ROM ID test failed.	
1101 1100	DC	NVRAM test failed.	
1101 1011	DB	SCSI-2 controller test failed.	
1101 1010	DA	PCI/ISA bridge chip test failed.	
1101 1001	D9	Realtime clock test failed.	
1101 1000	D8	Keyboard controller test failed.	
1101 0111	D7	Floppy controller, parallel port or serial port test failed.	
1101 0110	D6	Interrupts test failed.	
1101 0000	D0	Power-on self-test passed; DROM console running.	
1110 0010	E2	Floppy load failed.	
1110 0001	E1	Flash ROM load failed.	
0010 0000	20	Machine check occurred; dump sent to serial port.	

Notes**:**

1. All unused codes are reserved.
2. System will not halt with this code.

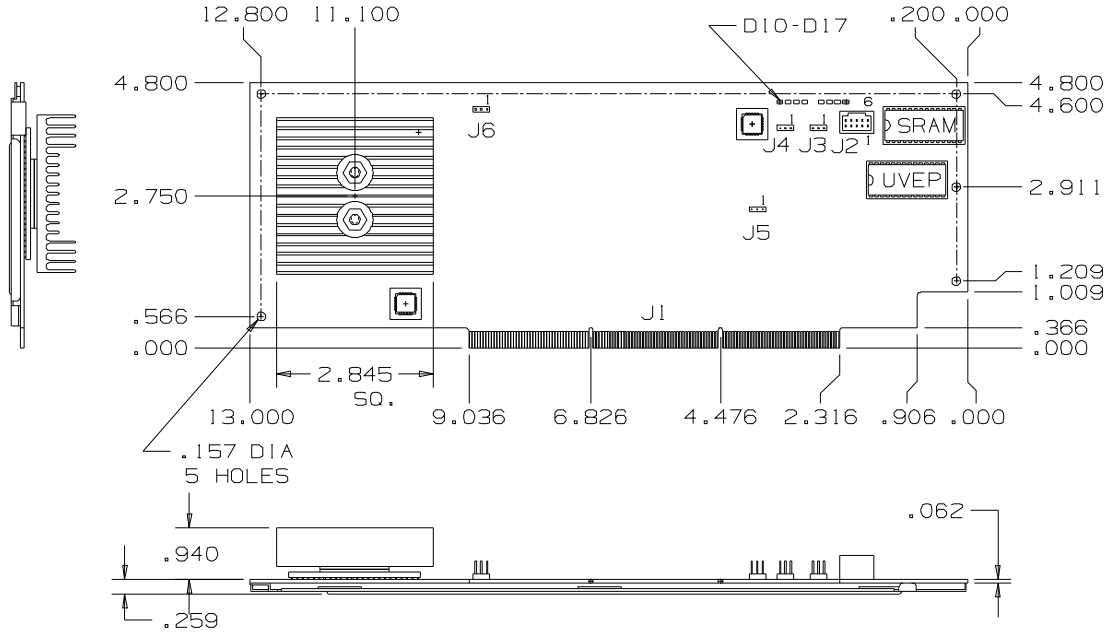
2.3.5 Beep Codes

The following sequences of audible beeps are emitted from the speaker (if connected) to indicate a particular condition as defined by the following table. These codes are a function of the SROM microcode resident on the CPU module. The speaker connector is on the MLB.

Table 23 Beep Codes

Beep Code	Meaning
1-1-4	Could not read header or checksum failed. This could be a DROM failure or Flash ROM failure.
1-2-4	Hard failure within the SROM like Bcache failure.
1-2-1	The BQ3287 failed or the real-time clock interrupt did not occur.
1-3-3	Could not find good 2MB or no memory present.
3-2-4	Keyboard/mouse controller failure.
3-2-1	2 possible problems with floppy. Problem caused by inability to read header on Flash ROM or checksum incorrect on Flash ROM.
3-2-3	J5 is enabled, no floppy in drive.
3-3-1	Hard failure within DROM testing. LEDs give exact indication of failure.

Figure 6 Alpha AXP CPU Module Drawing



2.4 SIMMs

Each SIMM provides a 36-bit wide data path and is compatible with commercially available SIMMs. Although the SIMMs used in a pair are identical, the socket they are installed in is specific to either the high-order or low-order bits.

SIMMs are not required to be installed in any order, but like SIMMs must be installed in pairs. AXPpci 233XL SIMMs are industry standard.

2.4.1 Connector

Each SIMM has 72 finger-type contacts. One end of the SIMM PCB is keyed to ensure proper installation in the socket.

2.4.2 Physical Mounting

SIM modules are inserted into edge connectors on the MLB and held in place with metal locking clips.

2.4.3 SIMM Installation/Removal Instructions

1. **Observe antistatic precautions.**
2. There are four types of SIMMs supported on the AXPpci 233XL. SIMMs must be installed in pairs consisting of identical devices. It is recommended that the SIMMs used are from the same vendor. Use of SIMMs from different vendors on the same MLB may result in unpredictable memory errors. SIMM sizes supported are listed in this section. SIMM pairs in any of the three banks may be of different sizes.
3. Always handle SIMMs by their edges to prevent damage.
4. **To install:**
   a. Hold the SIM module at an angle with the notch facing the key in the socket.
   b. Firmly push the SIM module into the connector and stand the module upright.
   c. Make sure the SIM module snaps into the metal locking clips on both ends.
5. **To remove:**
   a. Release the spring clips at both ends of the SIMM by gently pushing the clips outward.
   b. Hold the module by its edges, and tilt the module forward and remove.
   c. Temporarily place the SIM modules on antistatic material or store them in an antistatic bag.

2.4.4 Supported SIMMs

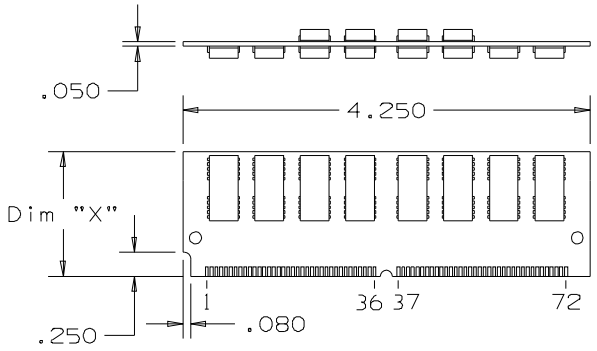
The AXPpci 233XL uses industry standard 36-bit, 70ns SIMMs. Table 24 lists the Digital SIMMs that are supported on this product. The table also includes the height dimension for the SIMMs. Each memory bank requires a pair of SIMMs.

Chip placement in Figure 7 is for example only. Actual quantity and placement of chips varies by SIMM size and vendor.

Table 24 Supported SIMMs

SIMM Kits		SIM Modules			
Digital Order Number	**SIMMs per Kit**	**Module Number**	**SIMM Size**	**Bank Size**	**Dimension "X" (see Figure 7)**
PC77M-AA	2	54-21225-BA	1Mx36	8 MB	1.000"
PC77M-AB	2	54-21246-BA	2Mx36	16 MB	1.250"
PC77M-AC	2	54-21277-CA	4Mx36	32 MB	1.350"
PC77M-AD	2	54-21277-AA	8Mx36	64 MB	1.350"

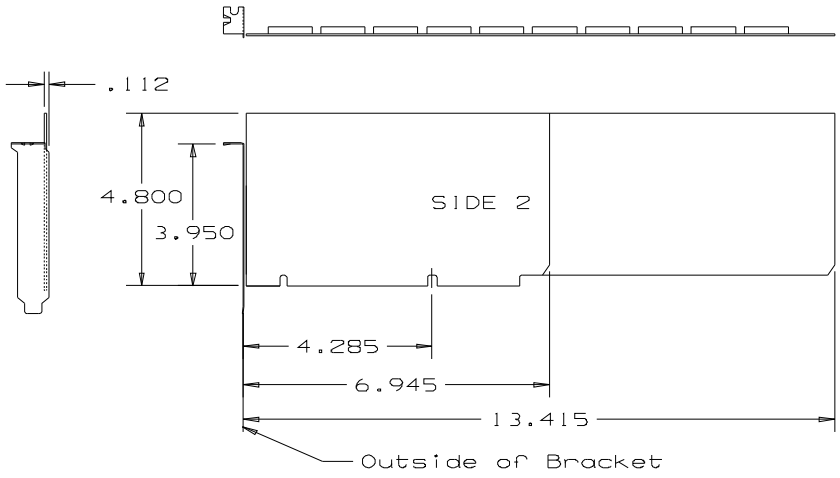
Figure 7 SIMM Outline



2.5 ISA Option Modules

The following figure is for reference only and describes a typical ISA option module. Note that the component side is on the back surface and is on the opposite side for a PCI option. Thus, the PCI option in PCI slot #3 (J13) uses the same bulkhead slot that the ISA option in ISA slot #1 (J6) uses, making the slots mutually exclusive.

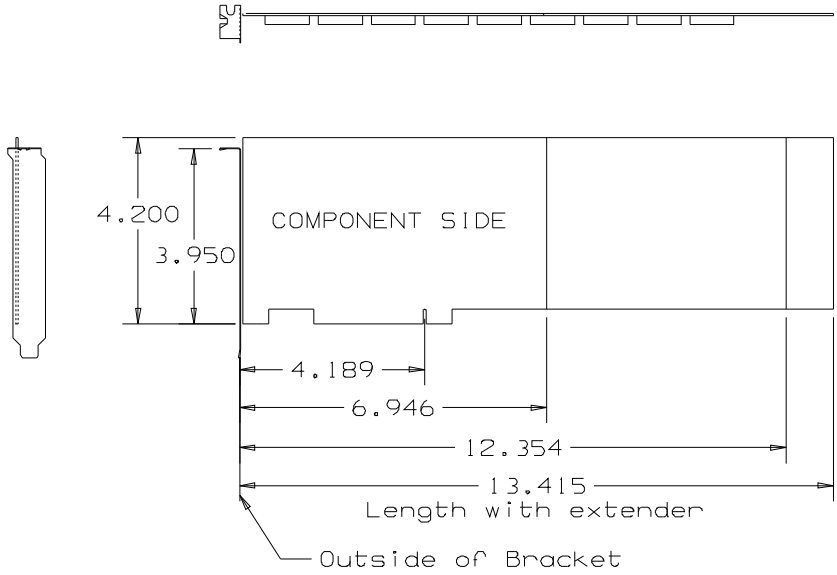
Figure 8 ISA Option Module



2.6 PCI Option Modules

The following figure is for reference only and describes a typical PCI option module. Note that the component side on the viewed surface is on the opposite side for an ISA option. Thus, the PCI option in PCI slot #3 (J13) uses the same bulkhead slot that the ISA option in ISA slot #1 (J6) uses, making the slots mutually exclusive.

Figure 9 PCI Option Module



2.7 Module Weights

The following table lists the weights of AXPpci 233XL components.

Table 25 Module Weights

Module Weights (English units rounded to nearest whole unit; overall variance ±5%)		
Module	**English**	**Metric**
Main logic board	23 oz	640 g
Alpha AXP CPU module	15 oz	414 g

3 Environmental Data

3.1 Cooling Requirements

Air flow direction relative to the core module set must be parallel to the heat sink fins on the DECchip 21064A.

A guideline for maximum case temperature is 75°C (167°F) for MOS devices, and 100°C (212°F) for bipolar devices. The DECchip 21064A is limited to 72°C (162°F) maximum case temperature at 28W. The DECchip 21064A case temperature should be measured on the center of the heat sink between its mounting studs.

The following table lists the maximum operating ambient temperatures for the DECchip 21064A at various air flows across its heat sink for the AXPpci 233XL.

Table 26 AXPpci 233XL and DECchip 21064A (233 MHz) Cooling Requirements

Air Velocity (linear feet per minute)	Power	Tc (max)	Theta jc	Theta ja	Theta ca	Maximum Ambient Temperature	Notes
100	28W	72°C	.65°C/W	3.90°C/W	3.25°C/W	-19°C	
200	28W	72°C	.65°C/W	2.90°C/W	2.25°C/W	9°C	
400	28W	72°C	.70°C/W	2.15°C/W	1.45°C/W	31°C	
600	28W	72°C	.70°C/W	1.85°C/W	1.15°C/W	40°C	
800	28W	72°C	.70°C/W	1.65°C/W	.95°C/W	45°C	1
1,000	28W	72°C	.70°C/W	1.50°C/W	.80°C/W	50°C	1

Notes:

1. Operation above 40°C ambient requires further thermal analysis by the system integrator to ensure maximum operating temperatures for any other device including storage devices, power supplies, PCI or ISA option modules, or other chips on the MLB are not exceeded.

3.2 DC Power Inputs

The MLB receives all DC power from the supply and distributes it to the CPU module, SIMMs, and PCI/ISA options.

The following table lists the power requirements for the MLB and Alpha AXP CPU module. These numbers do not include any SIMMs, disks, or ISA/PCI options.

Table 27 System DC Power Requirements (excludes PCI and ISA options)

Nominal Input	Typical Load Current	Maximum Load Current
+5V	8.0 A	9.5 A
+3.3V	4.0 A	8.5 A
+12V	0.5 A	0.6 A
-12V	0.09 A	0.16 A
-5V	0.03 A	0.04 A

3.2.1 Power Sequencing

At power-on, the +3.3V supply is required to reach its minimum voltage specified before the +5V output reaches +4.0V. At power-off, the +5V output must fall below +4.0V before the +3.3V starts to decay.

3.2.2 DC POWER OK Signal

The POWER OK (asserted HIGH) signal to the MLB is required to ensure the logic to the system comes up and goes down in a defined state. On power-up, the AXPpci 233XL power supply asserts the POWER OK signal 100-500ms after DC power is within the operating range. On power-down, the AXPpci 233XL power supply provides regulated power levels for a period greater than 1ms after the POWER OK signal negates (see following figure). The POWER OK signal input is TTL compatible. The following two tables define the recommended electrical characteristics for the power supply and POWER OK signal which is fed into a 74F00 type gate. There is no required relationship between +5V valid levels and the turn-on or turn-off of the ±12V or -5V supplies.

Figure 10 POWER OK Timing Diagram

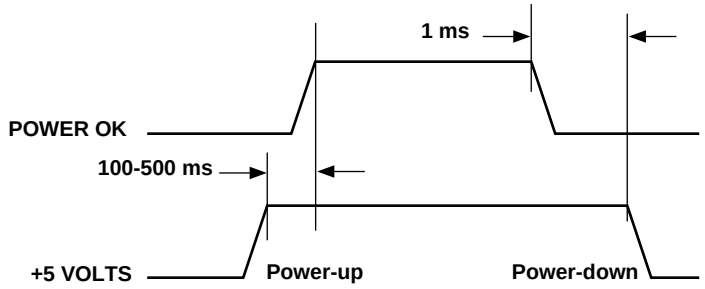


Table 28 DC POWER OK - Undervoltage Threshold

Supply Voltage	Minimum Output for POWER OK Assertion	Maximum Output for POWER OK Assertion
+3.3V	+2.81V	+3.14V
+5V	+4.25V	+4.75V

Table 29 DC POWER OK - Electrical Characteristics

Characteristic	Test Condition	Minimum	Maximum	Units
V_{ol}	I_{out} = 1.6mA	0	0.4	V
I_{oh}	V_{oh} = +7V	-	80	uA
t_{rise}, t_{fall}	C_{load} = 15pf, R_{pullup} = 4.7K	50	500	ns

3.3 ESD Considerations

Enclosure design is a key part of protection against ESD. Protection of circuitry against ESD is left up to the system integrator design. Adequate precautions were included in the module design at the point of interface to the enclosure and cable interconnects.

3.4 EMC Considerations

Enclosure design is also a key part to EMC. Electro-magnetic compliance is left up to the system integrator. Adequate precautions were included in the module design for electro-magnetic compliance and proven in a Digital enclosure.

3.5 Reliability Data

The calculated Mean Time Between Failure (MTBF) data for these system components are listed in Table 30 calculated for 25°C and 40°C environments ambient to the modules. Items not listed, such as the power supply and PCI or ISA options, are explicitly excluded from these calculations.

Table 30 MTBF for AXPpci 233XL

Module (Digital Part Number)	MTBF at 25°C (hours)	MTBF at 40°C (hours)
Main Logic Board (54-23572-02)	693,700	357,600
Alpha AXP CPU Module (54-23262-02)	499,100	237,400

Appendix A - Reference Documents

A.1 Related AXPpci 233XL Documents

1. AlphaStation 400 Model 4/233 Installation Information (EK-PCDSA-II)
2. AlphaStation 400 Model 4/233 User Information (EK-PCDSA-UI)
3. AlphaStation 400 Model 4/233 Service Information (EK-PCDSA-OI)
4. AlphaStation 400 Model 4/233 Technical Reference (EK-PCDSA-TI)

A.2 Other Related Documents

1. PCI Local Bus Specification(s). Contact the following organization for the latest revision:

   PCI Special Interest Group
   M/S HF3-15A
   5200 N.E. Elam Young Parkway
   Hillsboro, Oregon 97124-6497
   TEL: (503) 696-2000

2. ISA Bus Specification P996

   IEEE Service Center
   445 Hoes Lane
   PO Box 1331
   Piscataway, New Jersey 08855

A.3 DECchip 21064A Documents

1. Alpha Architecture Reference Manual (EY-L520E-DP)
2. Alpha Architecture Handbook (EC-H1689-10)
3. DECchip 21064A Microprocessor Data Sheet (EC-N0699-72)
4. DECchip 21064A Microprocessor Hardware Reference Manual (EC-Q9ZUA-TE)

Appendix B - Module Kit Ordering

Table 31 Module Set Contents

Qty	Description	Part Number
1	Main Logic Board	54-23572-02
1	Alpha AXP CPU module, 233 MHz	54-23262-02

Table 32 Orderable Kits

Description	Digital Part Number	Notes
AXPpci 233XL module set with console code (no operating system license)	EBS01-AA	
AXPpci 233XL module set with OSF/1, two-user license.	EBS01-BA	
AXPpci 233XL module set with OpenVMS license.	EBS01-VA	Not shipping at this time.
AXPpci 233XL module set with OSF/1 license and developer's kit.	EBS01-BB	
AXPpci 233XL module set with OpenVMS license and developer's kit.	EBS01-VB	Not shipping at this time.

Appendix C - Connector Summary

The following table lists and briefly describes all connectors and jumpers on the MLB.

Table 33 MLB Connectors and Jumpers

Designation	Description	Vendor Part Number or Equivalent
J1-A&B	KEYBOARD/MOUSE (connector)	
J2-A&B	SERIAL PORT 1&2 (connector)	Hon Hai Prec DM10153-73
J3-A&B	SCSI/PARALLEL (connector)	Hon Hai Prec DM11353-Q4
J4	FLOPPY DISK CONTROLLER (connector)	Dupont 66506-353
J5	SCSI-2 INTERNAL (connector)	Dupont 66506-032
J6-J9	ISA (connector)	AMP 645169-3
J10	IDE (connector)	Dupont 66506-354
J11-J13	PCI (connectors)	AMP 145035-1
J14	DC POWER (connector; see also J16 & J18)	Molex 87218-0602
J15	CPU (connector)	Burndy CEE2X130-SVC30-214
J16	DC POWER (connector; see also J14 & J18)	Molex 87218-1202
J17	(not installed)	-
J18	DC POWER (connector; see also J14 & J16)	Molex 5566-16A
J22-J27	SIMM (connectors)	AMP 822021-4
J29	CLEAR NVM (jumper)	AMP 531220-3
J31	LED/SWITCH (connector)	JST B 8B-XH-A
J32	PASSWORD CLEAR (jumper)	(NOT USED)
J33	COLOR/MONO (jumper)	(NOT USED)
J34	RECOVER MODE (jumper)	(NOT USED)
J35	BIOS ROM UPGRADE (jumper)	(NOT USED)
J36	(not installed)	-
J37	SPEAKER (connector)	AMP 103321-4
J38	(not installed)	-
J39	CPU Selection (jumper)	AMP 531220-3
J40	Reprogram Boot Block (jumper)	AMP 531220-3

Table 34 Alpha CPU Module Connectors and Jumpers

Designation	Description	Vendor Part Number or Equivalent
J1	MLB EDGE (connector)	-
J2	ENGINEERING/MANUFACTURING TEST (connector)	-
J3-J6	CONFIGURATION (jumpers)	AMP 531220-3

AXPpci 233XL Module Set OEM Design Guide
Revision: 1.0
Customer Response Card

Date:

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