BISON VI

The material in this manual is for information only and is subject to change without notice.

REVISION: 1.1

RADIO FREQUENCY INTERFERENCE STATEMENT

This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference with radio and television reception.

If this equipment does cause interference to radio or TV reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

* Reorient the receiving antenna.
* Relocate the computer away from the receiver.
* Move the computer away from the receiver.
* Plug the computer into a different outlet so that computer and receiver are on different branch circuits.
* Ensure that card slot covers are in place when no card is installed.
* Ensure that card mounting screws, attachment connector screws, and ground wires are tightly secured.
* If peripherals are used with this system, it is suggested to use shielded, grounded cables, with in-line filters if necessary.

If necessary, the user should consult the dealer service representative for additional suggestions.

The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. It is the responsibility of the user to correct such interference.

Note

1. Electronic components are sensitive to dust and dirt. Do inspect and clean the computer system regularly.

2. Turn off the power whenever you install or remove any connector, memory module and add-on card. Before turning on the power, make sure that all the connectors, memory modules and add-on cards are secured.

3. After power is on, wait for a minute. The system BIOS are going through a self-test during this period and nothing is shown on the screen. After the self-test, the system BIOS will initialize the display adaptor and show messages.

4. The SIMM sockets are fragile device. Do not force the SIMM modules into the sockets. It may break the locking latches.

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Chapter One
Introduction

OCTEK BISON VI is a workstation class platform that can meet the demand of most time critical applications nowadays. With the Intel Pentium processor and 64 bit interleaved memory system, it delivers higher performance among the PC/AT class machines that ever been.

ISA bus are incorporated to adapt the most popular add-on card standard. Latest local bus technology - Peripheral Component Interconnect (PCI) is also implemented, that makes BISON VI tremendous adaptability.

Next-generation design remains 100% binary and PC/AT compatible that boosts up the existing applications without re-compile.

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Chapter Two
General Features

Specifications

Processor : Pentium 75MHz, 90MHz or 100MHz CPU

I/O Slot : Four 16 bit ISA slots
Four PCI local bus slot (supporting four bus masters)

Cache* :
Internal cache inside Pentium: 8K instruction cache
8K data cache
External cache: 256K external cache expandable to 2M

DRAM : Supports 3 banks of 32 bit wide SIMM modules with 1MB, 2MB, 4MB, 8MB, 16MB, 32MB and 64MB DRAMs
Supports DRAM size from 2MB to 128MB
Two non-cacheable regions
DRAM post write buffer and Read buffer

Others : Fast Gate A20 and reset emulations.

* Both caches are in write back.

The Central Processing Unit

The Pentium processor is the next-generation member of 80486 family of microprocessors. It contains all of the features of the 80486 and provides significant enhancements and additions. It is 100% binary compatible with the X86 CPU.

The superscalar architecture of the Pentium processor contains two instruction pipelines and floating-point unit on the Pentium processor are capable of independent operation. Each pipeline issues hit instructions in a single clock. The dual pipes can issue two integer instructions in one clock, or one floating-point instruction in one clock.

The branch prediction unit includes two prefech buffers, one to prefetch code in a linear fashion, and one to prefetch code according to the Branch Target Buffer so that the needed code is almost always prefetched before it is needed for execution.

The floating point unit is redesigned and runs at least three times faster than 80486.

The Pentium processor includes separate 8K code cache and 8K write-back data cache. Each cache is 32 byte line size and is 2-way set associative. The data cache is configurable to be write-back or write-through on a line-by-line basis and follows the MESI protocol. The code cache is a write-protected cache.

The Pentium processor has widen the data bus to 64 bits to improve the data transfer rate. Burst read and burst writeback cycles are supported by the Pentium processor.

In summary, the Pentium processor provides an ultimate performance levels and retains compatibility with the existing applications.

Cache Subsystem

The external cache of BISON VI is write-back, direct-mapped with sizes of 256K, 512K, 1M or 2M. It is organized by single or dual bank mode. Dual bank mode is accessed in interleaved manner and it can support 3-2-2-2 burst read cycle.

DRAM Subsystem

The memory controller is 64 bit wide and has the following features:

Posted-Write to the DRAM improves the write-cycle timing. One quad-word deep data buffer is used to hold the data from the CPU without waiting for the external DRAM cycle.

Shadow RAM is available as an option. System BIOS and video BIOS residing in slow EPROM can be copied to local DRAM to speed up accesses to BIOS code. Video BIOS at C0000h - C7FFFh can be cached in the external cache after shadowing.

Two DRAM control regions can be selected to adapt the bus mastering add-on cards. For the memory region that bus master would write to, set it to non-cacheable or write-through would improve bus bandwidth owing to the elimination of the time-consuming cache invalidation cycle. For the card with its own memory mapped overlay to the system memory, memory holes can be set to allow accessing to the memory.

PCI Bus

The Peripheral Component Interconnect (PCI) local bus was specified to establish a high performance local bus standard for several generations of product. It is a 32 bit wide, burst transfer mode bus that is designed to allow glue-less interconnect of component. The following is the features of the PCI :

High performance -

Synchronous bus with operation up to 33MHz 132Mbytes/sec substantial transfer rate.

Ease of use -

Enables full auto configuration support of PCI local bus add-in boards and components. PCI devices contain registers with the device information required for configuration.

Features of the PCI bus in OCTEK BISON VI

* The PCI local bus is fully compliant to PCI V2.0 specification.
* Up to four PCI masters.
* Burst mode PCI accesses to local memory support.
* Combine host CPU sequential writes into PCI burst write cycles.

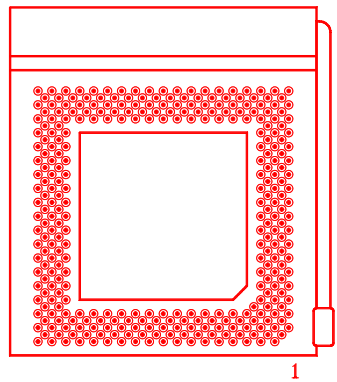
Chapter Three
Configuring The System

Important Note: Turn off the power before installing or replacing any component.

Installing The Processor

Pentium (75/90/100) is a 296 pin SPGA device. Make sure the pin 1 of Pentium (with a notch at the corner) is line up with the pin 1 of the socket.

Before installing the processor, make sure that all the pins are straight. The pins are very fragile. Once these pins are bent, the processor may be damaged.



PENTIUM 75/90/100 OVERDRIVE SOCKET

Installing RAM Modules

BISON VI has three banks on board for 72-pin SIMM modules. Bank 0 must be installed first. Make sure pin 1 of the SIMM module inserted near the power connector. Lock it firmly with the latches on the socket.

Extra SIMM module should be inserted at bank 2 and bank 3.

Configuring The Cache Memory

Note: If you have any question about the configuration of the cache memory, consult your local dealer. Improper configuration will cause the system malfunction.

The external cache is organized by single bank or dual banks with sizes of 256KB to 2MB. Follow the tables below to configure the system.

Cache size	JP1	JP2	JP3	JP4	JP5	JP6	Type (Data RAM)	Bank
256K	1-2	1-2	1-2	1-2	1-2, 3-4	2-3	32Kx8	0
512K	2-3	1-2	1-2	2-3	2-3, 4-5	2-3	32Kx8	0, 1
512K	2-3	1-2	1-2	1-2	1-2, 3-4	1-2	64Kx8	0
1M	2-3	2-3	1-2	2-3	2-3, 4-5	2-3	64Kx8	0, 1
1M	2-3	2-3	1-2	1-2	1-2, 3-4	2-3	128Kx8	0
2M	2-3	2-3	2-3	2-3	2-3, 4-5	2-3	128Kx8	0, 1

DRAM Configuration

Bank 0		Bank 1		Bank 3		Total
Simm 5	Simm 6	Simm 3	Simm 4	Simm 2	Simm 1	
1MB-S	1MB-S					2MB
1MB-S	1MB-S	1MB-S	1MB-S			4MB
1MB-S	1MB-S	1MB-S	1MB-S	4MB-S	4MB-S	12MB
1MB-S	1MB-S	1MB-S	1MB-S	16MB-S	16MB-S	36MB
2MB-D	2MB-D					4MB
2MB-D	2MB-D			2MB-D	2MB-D	8MB
2MB-D	2MB-D			4MB-S	4MB-S	12MB
2MB-D	2MB-D			8MB-D	8MB-D	20MB
2MB-D	2MB-D			16MB-S	16MB-S	36MB
4MB-S	4MB-S					8MB
4MB-S	4MB-S	4MB-S	4MB-S			16MB
4MB-S	4MB-S	4MB-S	4MB-S	4MB-S	4MB-S	24MB
4MB-S	4MB-S	4MB-S	4MB-S	8MB-D	8MB-D	32MB
4MB-S	4MB-S	4MB-S	4MB-S	16MB-S	16MB-S	48MB
4MB-S	4MB-S	4MB-S	4MB-S	32MB-D	32MB-D	80MB
4MB-S	4MB-S	16MB-S	16MB-S			40MB
4MB-S	4MB-S	16MB-S	16MB-S	16MB-S	16MB-S	72MB
8MB-D	8MB-D					16MB
8MB-D	8MB-D			4MB-S	4MB-S	24MB
8MB-D	8MB-D			8MB-D	8MB-D	32MB
8MB-D	8MB-D			16MB-S	16MB-S	48MB
8MB-D	8MB-D			32MB-D	32MB-D	80MB
16MB-S	16MB-S					32MB
16MB-S	16MB-S	16MB-S	16MB-S			64MB
16MB-S	16MB-S	16MB-S	16MB-S	8MB-D	8MB-D	80MB
16MB-S	16MB-S	16MB-S	16MB-S	16MB-S	16MB-S	96MB
32MB-D	32MB-D					64MB
32MB-D	32MB-D			4MB-S	4MB-S	72MB
32MB-D	32MB-D			16MB-S	16MB-S	96MB
32MB-D	32MB-D			32MB-D	32MB-D	128MB
64MB-S	64MB-S					128MB

Type S stands for single density DRAM module, type D stands for double density. 70nS 72-pin 32-bit wide SIMM modules can be used.

Reset CMOS Setup Information

Sometimes, the improper setting of system setup may make the system malfunction. In this case, shorted JP16. The internal CMOS status register is reset. The BIOS finds the CMOS status register is reset and regards the setup information is invalid. So it will prompt you to correct the information.

Before shorting JP16, please take note of the following.

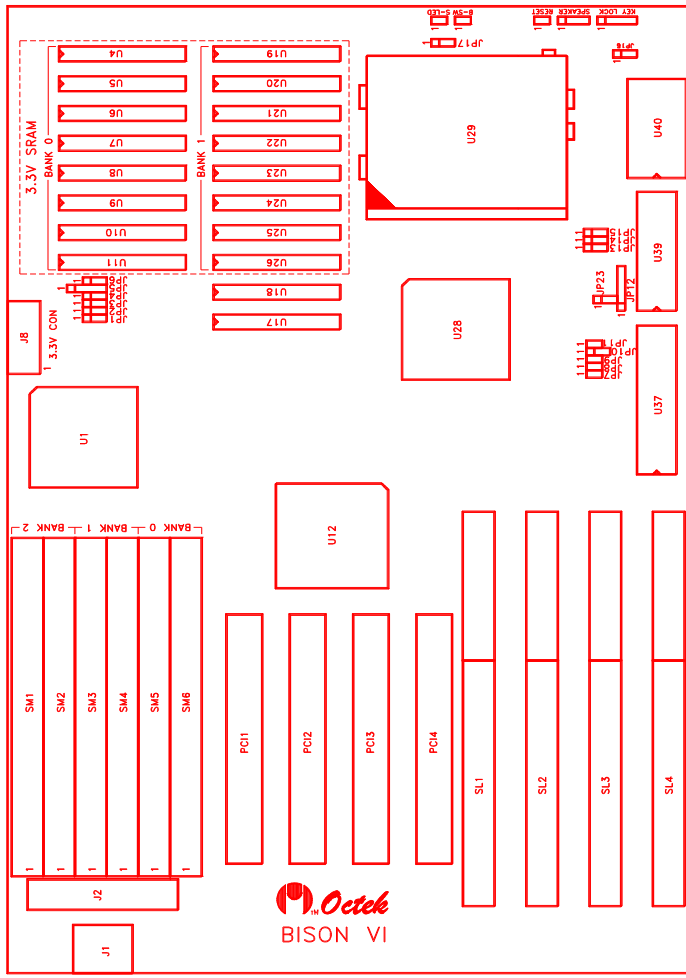
- If the U40 (Real time clock) is Benchmarq bq3287AMT, the JP16 jumper must be shorted while the computer is powered ON.
- If the U40 (Real time clock) is Dallas DS12887A, the JP16 jumper must be shorted while the computer is powered OFF.

PCI-Bus Adapter Installation

PCI-Bus adapters can be installed either at PCI1, PCI2, PCI3 or PCI4. The corresponding PCI slot number of each physical slot is listed in the following table :

	PCI1	PCI2	PCI3	PCI4
PCI Slot #	1	2	3	4

Board Layout



System Board Jumper and Connector Summary

	Description
J1	Keyboard Connector
J2	Power Supply Connector (5V)
J8	Power Supply Connector (3.3V)
JP1~JP6	Cache Size Selection
JP7~JP9	CPU Clock Speed Selection
JP12	Flash ROM Selector
JP13, JP15	CPU Internal Cache Write Back, Write Through Selector
JP14	CPU Pipeline Selector
JP16	Reset CMOS
Key Lock	Power LED & Ext-Lock Connector
Speaker	Speaker Connector
Reset	Hardware Reset Connector
B-SW	Suspend Switch
S-LED	Suspend LED

System Board Jumper Setting

There are several options which allows user to select by hardware switches.

JP7~JP9 - CPU Clock Speed Selection

	JP7	JP8	JP9
75MHz-CPU / 50MHz Bus	Open	Open	Short
90MHz-CPU / 60MHz Bus	Short	Open	Short
100MHz-CPU / 66MHz Bus	Short	Short	Short

JP12 - Flash ROM Selection

Pin	
1-2	12-Volt Flash ROM
2-3	5-Volt Flash ROM

Pin	
3-4	Flash ROM Programming Disable **(Default)**
4-5	Flash ROM Programming Enabled

JP13 - CPU Internal Cache Write Back Selection

Pin	
1-2	CPU Internal Cache Write Back **(Default)**
2-3	CPU Internal Cache Write Through

JP14 - CPU Pipeline Selection

Pin	
1-2	CPU Pipeline Disabled
2-3	CPU Pipeline Enabled **(Default)**

JP15 - CPU Internal Cache Write Through Selection

Pin	
1-2	For CPU Write Through
2-3	For CPU Write Back **(Default)**

System Board Connectors

Under typical conditions, these connectors should be connected to the indicators and switches of the system unit. The functions and the pin assignment of the connectors on the motherboard are listed below.

J1 - Keyboard Connector

Pin	Assignment
1	Keyboard Clock
2	Keyboard Data
3	Spare
4	Ground
5	+5 Vdc

J8 - Power Supply Connector (3.3V)

Pin	Assignment
1	Ground
2	Ground
3	Ground
4	3.3 Vdc
5	3.3 Vdc
6	3.3 Vdc

J2 - Power Supply Connector (5V)

Pin	Assignment
1	POWERGOOD
2	+5 Vdc
3	+12 Vdc
4	-12 Vdc
5	Ground
6	Ground

Pin	Assignment
1	Ground
2	Ground
3	-5 Vdc
4	+5 Vdc
5	+5 Vdc
6	+5 Vdc

Key Lock - Power LED & Ex-Lock Connector

Pin	Assignment
1	+5 Vdc
2	Key
3	Ground
4	Keyboard Inhibit
5	Ground

Speaker - Speaker Connector

Pin	Assignment
1	Data Out
2	+5 Vdc
3	Ground
4	+5 Vdc

Reset - Hardware Reset Connector

Pin	Assignment
1	Selection Pin
2	Ground

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Chapter Four
Technical Information

This section provides technical information about BISON VI and is intended for advanced users interested in the basic design and operation of BISON VI.

Memory Mapping

Address	Range	Function
000000-7FFFFF	000K-512K	System Board Memory (512K)
080000-09FFFF	512K-640K	System Board Memory (128K)
0A0000-0BFFFF	640K-768K	Display Buffer (128K)
0C0000-0DFFFF	768K-896K	Adaptor ROM / Shadow RAM (128K)
0E0000-0EFFFF	896K-960K	System ROM / Shadow RAM (64K)
0F0000-0FFFFF	960K-1024K	System BIOS ROM / Shadow RAM (64K)
100000-7FFFFF	1024K-8192K	System Memory
800000-FFFFFF	8192K-16318K	System Memory

I/O Address Map

I/O Address Map on System Board

I/O address hex 000 to 0FF are reserved for the system board I/O.

Address (Hex)	Device
000-01F	DMA Controller 1, 8237
020-03F	Interrupt Controller 1, 8259, Master
040-05F	Timer, 8254
060-06F	Keyboard Controller
070-07F	Real Time Clock, NMI (non-maskable interrupt) mask
080-09F	DMA Page Register, 74LS612
0A0-0BF	Interrupt Controller 2, 8259
0C0-0DF	DMA Controller 2, 8237
0F0	Clear Math Coprocessor Busy
0F1	Reset Math Coprocessor
0F8-0FF	Math Coprocessor Port

I/O address hex 100 to 3FF are available on the I/O channel.

Address (Hex)	Device
1F0-1F8	Fixed Disk
200-207	Game I/O
278-27F	Parallel Printer Port 2
2F8-2FF	Serial Port 2
300-31F	Prototype Card
360-36F	Reserved
378-37F	Parallel Printer Port 1
380-38F	SDLC, bisynchronous 2
3A0-3AF	Bisynchronous 1
3B0-3BF	Monochrome Display and Printer Adapter
3C0-3CF	Reserved
3D0-3DF	Color Graphics Monitor Adapter
3F0-3F7	Diskette Controller
3F8-3FF	Serial Port 1
CF8	PCI Config-address Register +
CFC	PCI Config-data Register +

+ Double word I/O locations

System Interrupts

Sixteen levels of system interrupts are provided on BISON VI. The following shows the interrupt-level assignments in decreasing priority.

Level		Function
Microprocessor NMI		Parity or I/O Channel Check
Interrupt Controllers		
CTLR 1	CTLR 2	
IRQ0		Timer Output 0
IRQ1		Keyboard (Output Buffer Full)
IRQ2		Interrupt from CTLR 2
	IRQ8	Real-time Clock Interrupt
	IRQ9	Software Redirected to INT 0AH (IRQ2)
	IRQ10	Reserved
	IRQ11	Reserved
	IRQ12	Reserved
	IRQ13	Coprocessor
	IRQ14	Fixed Disk Controller
	IRQ15	Reserved
IRQ3		Serial Port 2
IRQ4		Serial Port 1
IRQ5		Parallel Port 2
IRQ6		Diskette Controller
IRQ7		Parallel Port 1

Direct Memory Access (DMA)

BISON VI supports seven DMA channels.

Channel	Function
0	Spare (8 bit transfer)
1	SDLC (8 bit transfer)
2	Floppy Disk (8 bit transfer)
3	Spare (8 bit transfer)
4	Cascade for DMA Controller 1
5	Spare (16 bit transfer)
6	Spare (16 bit transfer)
7	Spare (16 bit transfer)

The following shows the addresses for the page register.

Page Register	I/O Address (HEX)
DMA Channel 0	0087
DMA Channel 1	0083
DMA Channel 2	0081
DMA Channel 3	0082
DMA Channel 5	008B
DMA Channel 6	0089
DMA Channel 7	008A
Refresh	008F

Real Time Clock and CMOS RAM

Real time clock and CMOS RAM are contained on board. Real time clock provides the system date and time. CMOS RAM stores system information. Both are backed up by battery and will not lose information after power off

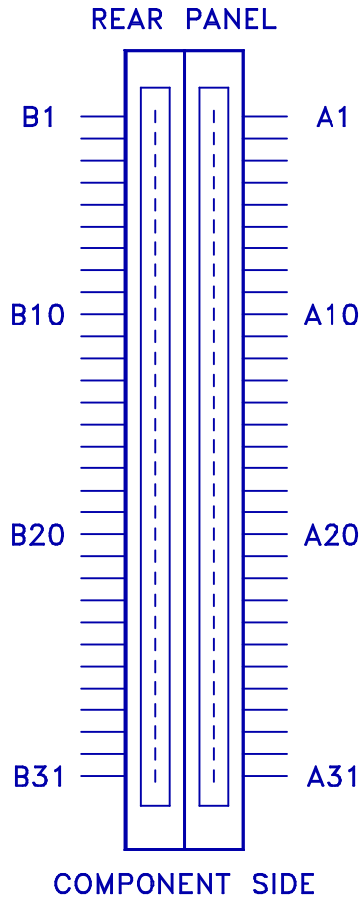
System Expansion Bus

BISON VI provides four 16-bit ISA slots.

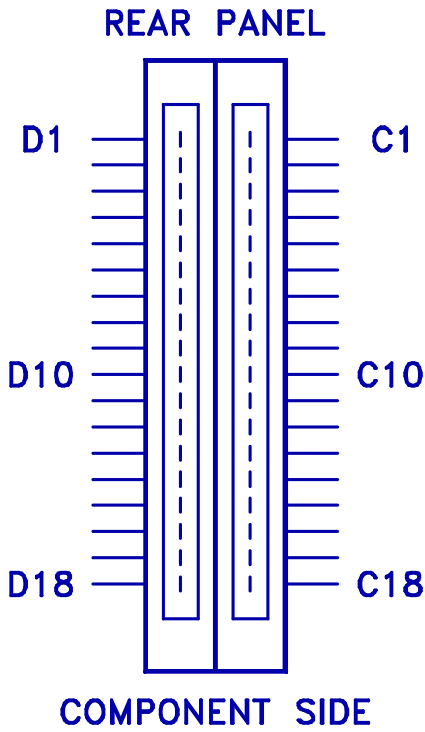
The I/O channel supports:

* I/O address space from hex 100 to hex 3FF
* Selection of data access (either 8 or 16 bit)
* 24 bit memory addresses (16MB)
* Interrupts
* DMA channels
* Memory refresh signal

The following figure shows the pin numbering for I/O channel connectors (A-side and B-side).



The following figure shows the pin numbering for I/O channel connectors (C-side and D-side).



The following tables summarize pin assignments for the I/O channel connectors.

I/O Channel (A-Side)

I/O Pin	Signal Name	I/O
A1	-I/O CH CK	I
A2	SD7	I/O
A3	SD6	I/O
A4	SD5	I/O
A5	SD4	I/O
A6	SD3	I/O
A7	SD2	I/O
A8	SD1	I/O
A9	SD0	I/O
A10	-I/O CH RDY	I
A11	AEN	O
A12	SA19	I/O
A13	SA18	I/O
A14	SA17	I/O
A15	SA16	I/O
A16	SA15	I/O
A17	SA14	I/O
A18	SA13	I/O
A19	SA12	I/O
A20	SA11	I/O
A21	SA10	I/O
A22	SA9	I/O
A23	SA8	I/O
A24	SA7	I/O
A25	SA6	I/O
A26	SA5	I/O
A27	SA4	I/O
A28	SA3	I/O
A29	SA2	I/O
A30	SA1	I/O
A31	SA0	I/O

I/O Channel (B-Side)

I/O Pin	Signal Name	I/O
B1	GND	Ground
B2	RESET DRV	I
B3	+5 Vdc	Power
B4	IRQ9	I
B5	-5 Vdc	Power
B6	DRQ2	I
B7	-12 Vdc	Power
B8	0WS	I
B9	+12 Vdc	Power
B10	GND	Ground
B11	-SMEMW	O
B12	-SMEMR	O
B13	-IOW	I/O
B14	-IOR	I/O
B15	-DACK3	I
B16	DRQ3	O
B17	-DACK1	I
B18	DRQ1	O
B19	-Refresh	I/O
B20	CLK	O
B21	IRQ7	I
B22	IRQ6	I
B23	IRQ5	I
B24	IRQ4	I
B25	IRQ3	I
B26	-DACK2	O
B27	T/C	O
B28	BALE	O
B29	+5 Vdc	Power
B30	OSC	O
B31	GND	Ground

I/O Channel (C-Side)

I/O Pin	Signal Name	I/O
C1	SBHE	I/O
C2	LA23	I/O
C3	LA22	I/O
C4	LA21	I/O
C5	LA20	I/O
C6	LA19	I/O
C7	LA18	I/O
C8	LA17	I/O
C9	-MEMR	I/O
C10	-MEMW	I/O
C11	SD8	I/O
C12	SD9	I/O
C13	SD10	I/O
C14	SD11	I/O
C15	SD12	I/O
C16	SD13	I/O
C17	SD14	I/O
C18	SD15	I/O

I/O Channel (D-Side)

I/O Pin	Signal Name	I/O
D1	-MEM CS16	I
D2	-I/O CS16	I
D3	IRQ10	I
D4	IRQ11	I
D5	IRQ12	I
D6	IRQ15	I
D7	IRQ14	I
D8	-DACK0	O
D9	DRQ0	I
D10	-DACK5	O
D11	DRQ5	I
D12	-DACK6	O
D13	DRQ6	I
D14	-DACK7	O
D15	DRQ7	I
D16	+5 Vdc	Power
D17	-MASTER	I
D18	GND	Ground

The following table summarizes pin assignments for PCI local bus connector.

PCI Bus Pinout (side A)

I/O Pin	Signal Name
A1	TRST#
A2	+12V
A3	Reserved
A4	Reserved
A5	+5V
A6	INTA#
A7	INTC#
A8	+5V
A9	Reserved
A10	+5V
A11	Reserved
A12	Ground
A13	Ground
A14	Reserved
A15	RST#
A16	+5V
A17	GNT#
A18	Ground
A19	Reserved
A20	AD[30]
A21	Reserved
A22	AD[28]
A23	AD[26]
A24	Ground
A25	AD[24]
A26	IDSEL
A27	Reserved
A28	AD[22]
A29	AD[20]
A30	Ground

PCI Bus Pinout (side A)

I/O Pin	Signal Name
A31	AD[18]
A32	AD[16]
A33	Reserved
A34	FRAME#
A35	Ground
A36	TRDY#
A37	Ground
A38	STOP#
A39	Reserved
A40	SDONE
A41	SBO#
A42	Ground
A43	PAR
A44	AD[15]
A45	Reserved
A46	AD[13]
A47	AD[11]
A48	Ground
A49	AD[09]
A50	C/BE[0]#
A51	Reserved
A52	AD[06]
A53	AD[04]
A54	Ground
A55	AD[02]
A56	AD[00]
A57	+5V
A58	REQ64#
A59	+5V
A60	+5V

PCI Bus Pinout (side B)

I/O Pin	Signal Name
B1	-12V
B2	TCK
B3	Ground
B4	Reserved
B5	+5V
B6	+5V
B7	INTB#
B8	INTD#
B9	PRSNT1#
B10	Reserved
B11	PRSNT2#
B12	Ground
B13	Ground
B14	Reserved
B15	Ground
B16	CLK
B17	Ground
B18	REQ#
B19	+5V
B20	AD[31]
B21	AD[29]
B22	Ground
B23	AD[27]
B24	AD[25]
B25	Reserved
B26	C/BE[3]#
B27	AD[23]
B28	Ground
B29	AD[21]
B30	AD[19]

PCI Bus Pinout (side B)

I/O Pin	Signal Name
B31	Reserved
B32	AD[17]
B33	C/BE[2]#
B34	Ground
B35	IRDY#
B36	Reserved
B37	DEVSEL#
B38	Ground
B39	LOCK#
B40	PERR#
B41	Reserved
B42	SERR#
B43	Reserved
B44	C/BE[1]#
B45	AD[14]
B46	Ground
B47	AD[12]
B48	AD[10]
B49	Ground
B50	AD[08]
B51	AD[07]
B52	Reserved
B53	AD[05]
B54	AD[03]
B55	Ground
B56	AD[01]
B57	Reserved
B58	ACK64#
B59	+5V
B60	+5V

Appendix A
Operation and Maintenance

Static Electricity

When installing or removing any add-on card, DRAM module or processor, you should discharge the static electricity on your body. Static electricity is dangerous to electronic device and can build-up on your body. When you touch the add-on card or motherboard, it is likely to damage the device. To discharge the static electricity, touch the metal of your computer. When handling the add-on card, don't contact the components on the cards or their "golden finger". Hold the cards by their edges.

Keeping The System Cool

The motherboard contains many high-speed components and they will generate heat during operation. Other add-on cards and hard disk drive can also produce a lot of heat. The temperature inside the computer system may be very high. In order to keep the system running stably, the temperature must be kept at a low level. A easy way to do this is to keep the cool air circulating inside the case. The power supply contains a fan to blow air out of the case. If you find that the temperature is still very high, it would be better to install another fan inside the case. Using a larger case is recommended if there are a number of add-on cards and disk drives in the system.

Cleaning The "Golden Finger"

Whenever inserting an add-on card to the motherboard, make sure that there is no dirt on the "golden finger" of the add-on card. If not, the contact between the "golden finger" and the slot may be poor and thus the add-on card may not work properly. Use a pencil eraser to clean the "golden finger" if dirt is found.

Cleaning The Motherboard

The computer system should be kept clean. Dust and dirt is harmful to electronic devices. To prevent dust from accumulating on the mother-board, installing all mounting plates on the rear of the case. Regularly examine your system, and if necessary, vacuum the interior of the system with a miniature vacuum.