Chapter 6

# Software Specifications

*Get to know more about the Z96Js series Notebook with a detailed look at the software specifications.*

The information contained in the chapter can be quite useful when you are troubleshooting the system's hardware. Each item has its individual usage for you to understand the software side of the notebook's architecture.

# 1. General Description

The specification is a guideline for bios development on Z96J platform. It is for internal use only. Anyone who needs the information of system bios can check it for reference.

The general device specification, hardware block diagram, SMBUS, PCI Devices IRQ Routing Table, GPIO Definition and so on are subjected to be depicted in this document. Hotkeys implementation and other bios features are also included.

Any question about this specification, please feedback to anven_chu@asus.com.tw.

## 2. CPU, Chipsets & Main Devices

***Table 2-1***

| Item | Vendor | Specification | Part's Name | Revision |
|---|---|---|---|---|
| **CPU** | Intel | SpeedStep (1.66G/2.13G) | Yohna | |
| **North Bridge** | Intel | Intel 945 PM | Intel 945 PM | |
| **South Bridge** | Intel | ICH7-M | ICH7-M | |
| **VGA** | ATI | M56 256MB | M56 256MB | |
| **Audio** | Intel | ICH7-M (Integrated) | ICH7-M | |
| **USB** | Intel | ICH7-M | ICH7-M | |
| **LAN** | Realtek | 10/100/1000 Mbps LAN | Realtek 8169 | |
| **Card Reader** | Ricoh | | R5C832 | |
| **IEEE1394** | Ricoh | | R5C832 | |
| **Azalia** | Realtek | | ALC882 | |
| ***External SATA** | J-Micron | | JMB 360 | |
| **Clock Gen.** | ICS | | ICS954310 | |
| **Thermal** | GMT | | G781 | |

## 3. PCI Devices & Interrupt Routing Table

*Table 3-1*

| Device | Vendor | Bus # | Device # | Function # | INTA | INTB | INTC | INTD |
|---|---|---|---|---|---|---|---|---|
| **Host bridge** | Intel | 0 | 0 | 0 | n/a | n/a | n/a | n/a |
| **P.E.G. Port** | Intel | 0 | 1 | 0 | n/a | n/a | n/a | n/a |
| **Azalia Contorller** | Intel | 0 | 27 | 0 | PIRQA | n/a | n/a | n/a |
| **PCI Express Port 1** | Intel | 0 | 28 | 0 | PIRQA | n/a | n/a | n/a |
| **PCI Express Port 2** | Intel | 0 | 28 | 1 | PIRQB | n/a | n/a | n/a |
| **PCI Express Port 3** | Intel | 0 | 28 | 2 | PIRQC | n/a | n/a | n/a |
| **USB0** | Intel | 0 | 29 | 0 | PIRQH | n/a | n/a | n/a |
| **USB1** | Intel | 0 | 29 | 1 | n/a | PIRQD | n/a | n/a |
| **USB2** | Intel | 0 | 29 | 2 | n/a | n/a | PIRQC | n/a |
| **USB3** | Intel | 0 | 29 | 3 | n/a | n/a | n/a | PIRQA |
| **EUSB** | Intel | 0 | 29 | 7 | PIRQH | n/a | n/a | n/a |
| **SMBUS Bridge** | Intel | 0 | 31 | 3 | n/a | PIRQD | n/a | n/a |
| **IDE** | Intel | 0 | 31 | 1 | n/a | PIRQD | n/a | n/a |
| **LPC/ISA Bridge** | Intel | 0 | 31 | 0 | n/a | n/a | n/a | n/a |
| **PCI2PCI Bridge** | Intel | 0 | 30 | 0 | n/a | n/a | n/a | n/a |
| **VGA** | ATI | 1 | 0 | 0 | PIRQA | n/a | n/a | n/a |
| **Card Reader 1** | Ricoh | 6 | 1 | 1 | n/a | PIRQB | n/a | n/a |
| **Card Reader 2** | Ricoh | 6 | 1 | 2 | n/a | PIRQB | n/a | n/a |
| **Card Reader 3** | Ricoh | 6 | 1 | 3 | n/a | PIRQB | n/a | n/a |
| **Firewire** | Ricoh | 6 | 1 | 0 | PIRQA | n/a | n/a | n/a |
| **Lan** | Realtek | 6 | 7 | 0 | PIRQC | n/a | n/a | n/a |
| **Mini Card( WLAN )** | Intel | 4 | 0 | 0 | PIRQB | n/a | n/a | n/a |
| ***External SATA** | J-Micron | 5 | 0 | 0 | PIRQA | n/a | n/a | n/a |

## 4. GPIO Definition Tables

The following tables are the definition of GPIO pins. Some of GPIO pins need to be initialized by system bios and some of them need the driver to support. Please check the Description column for reference.

***Table 4-1. Intel ICH7-M GPIO Definition***

| GPIO | Type | Definition | Activated Level | Description |
|---|---|---|---|---|
| **GPIO7** | O | WLAN_BT_LED_ON# | High | Control LED of WLAN and BT |
| **GPIO8** | I | EXTSMI# | Low | Any system management interrupt will be issued through this pin. It will notify the system that some events happened. |
| **GPIO10** | O | WLAN_ON# | High | If WLAN is closed, the pin will be pulled High. |
| **GPIO12** | I | KBCSCI# | High | From KBC, runtime and wake up event will be sent to system through this pin.(GPI) |
| **GPIO30** | I | NEWCARD_OC# | High | High level indicates a new card is inserted. |
| **GPIO33** | O | BT_ON# | High | If BT is closed, the pin will be pulled High. |

*Table 4-2. KBC GPIO Definition*

| Port | Type | Definition | Activated Level | Description |
|---|---|---|---|---|
| **B.0** | O | CAP_LED# | LED | CAP Lock Indicator. |
| **B.1** | O | NUM_LED# | LED | Number Lock Indicator |
| **B.2** | O | SCROLL_LED# | LED | Scroll Lock Indicator |
| **C.3** | O | EMAIL_LED# | LED | Email received indicator |
| **C.6** | I | BAT_IN_OC# | Low | Low level indicates that battery is existed |
| **D.3** | O | EXT_SCI# | High | SCI pin to notify system of runtime or wake up events from KBC. |
| **E.0** | I | DISTP_SW# | Low | It indicates that Disable TouchPad button is pressed. |
| **E.1** | I | MARATHON# | *PU | It indicates that MARATHON button is pressed. |
| **E.2** | I | EMAIL_SW# | Low | It indicates that EMAIL button is pressed. |
| **E.3** | I | EXPLORER# | Low | It indicates that EXPLORER button is pressed. |
| **E.6** | I | LID_EC# | *PU | It indicates that LID status. |
| **G.7** | I | AC_APR_UC# | High | High level indicates that AC adapter is existed. |
| **I.5** | I | BAT_LL# | Low | When the pin is set as low, it represents that battery is in very low capacity. |
| **I.6** | O | BAT_LEARN | High | This pin is used for battery learning (refresh). To set it as low for battery charging. To set it as high for battery discharging. |

* : PU -> Pulled Up, PD -> Pulled Down, NC -> Not Connected.

# 5. Setup Menu

Z96J system BIOS allows users to change some system hardware/function settings during POST (power on self test) stage, users may hit F2 key to enter SETUP mode in POST, the setup feature is categorized into 6 menus described as below:

### *5.1 MAIN MENU:*

Main menu describes system overall information with some user changeable setting, it contains below items:

1. **System Time**: [hh/mm/ss]←current time
2. **System Date** : [mm/dd/yy]←current date
3. **Primary IDE Master** : [Drive Name/NotDetected ] ← drive name if device connected , enter to do more detail setting
4. **Primary IDE Slave**: [Drive Name/NotDetected ] ← same as above .
5. **System Information**: BIOS Version / Processor speed and Type / System Memory size .

### *5.2 ADVANCED MENU:*

In advanced menu the users may configure I/O device resource such as I/O base, interrupt vector or DMA (Direct Memory Access) channel, some auxiliary settings may be changed as well. Detailed I/O device setting are described below:

1. **CPU Configuration:**
   - **Max CPUID Value Limit [ select item ]:**
     Some Legacy OS need to set this item enabled.
     Available settings are:

| Disabled |
|---|
| Enabled |

2. **lOnboard Devices Configuration :**
   - **3.1 Onboard LAN Boot ROM [ select item ] :**
     Enable this item to support Boot from LAN.
   - **3.2 Wake-Up on Lan from S5 [ select item ] :**
     Enable this item to support wake-up event on Lan from S3.

### *5.3 POWER MENU:*

Reducing power consumption is a very important feature for notebook computer design, for legacy operating system such as MS-DOS, Window3.1, Windows95 many of such task is done via system BIOS, as for the most advanced operating system, power conservation control is done via ACPI, the legacy power control becomes obsolete since it may cause system failure if BIOS involves such control.

1. **Start Battery Calibration:**
   After long time incomplete charge/discharge cycles, the battery meter becomes less and less accurate (the total power capacity is not significantly affected, however). Battery gauge needs to "*learn*", this item helps users to recalibrate the battery gauge.

### *5.4 BOOT MENU*

1. **BOOT DEVICE PRIORITY :**
   In this menu users can decide the boot sequence, as long as the device with highest boot priority exists, system BIOS will boot from it, device boot priority is adjusted by pressing "+","-"or space key on the selected (highlighted) item.
2. **BOOT SETTING CONFIGURATION :**
   1. **Quick Boot :**
      Allow BIOS to skip certain test while booting.
   2. **Full Screen Logo :**
      Options to display LOGO or normal post message .
3. **SECURITY :**
   Z96J BIOS supports two levels of password for security protection:
   1. **Supervisor password:**

Users may set, change or erase system password, the password data is saved in non-volatile device (CMOS), system password check is done during POST (Power On Self Test). The BIOS will prompt a dialog message to ask user for password check when:
The system has password stored, and “Password on boot” setting in BIOS SETUP is enabled.
If password verification fails for 3 times, the system BIOS will halt the machine to inhibit users from operating.

2. **User Password**
   If your settings of BIOS have been modified by other, you can set the function [Enable], And Key-in your password and confirm, Don’t modify BIOS setting if no password.
3. **Hard disk password:**
   Users may set, change or erase hard disk password, the password data is stored in the drive itself, the BIOS prompts a dialog message for hard disk password verification whenever it finds the hard disk locked in POST.
   If hard disk password verification fails for 3 times, the system BIOS will halt the machine to inhibit users from operating.
4. **TPM Control:**
   If users want to use this function in OS, they have to enable it.
5. **TPM Owner:**
   If users want to clear the current owner of TPM, they have to select “Clear” item and save to restart the system.

### *5.5 EXIT MENU:*

Exit BIOS setup, users may make final decision if they want to save the change just made, or load BIOS default setting, lists are:

- **Exit Saving Changes**
- **Exit Discarding Changes**
- **Discard Changes**
- **Load Setup Defaults**

# 6. Power Management

## *6.1 – ACPI 2.0*

C0, C1, C2, C3, S0, S1, S3, S4, S4BIOS, and S5 power management modes, control method battery, proprietary on-screen display utility support.

**6.1.1 System sleep states**: The system supports:

1. **S0 state**: The CPU and all devices are working.
2. **S1 state**: The CPU enters stop clock mode, PCI clocks stopped, all devices enter low power state.
3. **S3 state**: PCI devices are put into deep power saving mode, PCI clocks stopped, CPU and super I/O are powered off, keyboard controller enters stop clock mode, memory enters self refresh mode.
4. **S4 state**: The system is powered off, with all setting saved into hard disk.
5. **S5 state**: Mechanical off.

Below table illustrates signal vs. wake up event:

| Resume Event | S1 | S3 | S4 | S5 |
|---|---|---|---|---|
| RTC Alarm (IRQ 8) | Y | Y | Y | Y |
| Power Button | Y | Y | Y | Y |
| LID# | | | | |
| RI# | Y | Y | | |
| PME# | Y | Y | | |
| EXTSMI# (For any key resume) | Y | Y | | |

**6.1.2 Embedded Controller (EC) events**:

With ASUSTek specific ACPI compliant driver Z96J system BIOS can support event driven GUI (Graphics User Interface), all events are generated via embedded controller, ACPI BIOS gets the event code then notifies to the OS and the driver, briefly those events are:

- Hot keys.
- Instant keys.

## *6.2 – INTEL SPEED STEP*

Z96J system BIOS support Intel® SpeedStep® (GEYSERVILLE) transition technology, regarding to Intel specification, speed step CPUs support 2 power modes, battery optimized mode and performance optimized mode, the former runs at slower internal clock and the later runs at faster internal clock, if speed step driver applet is not installed, the BIOS will set CPU to battery optimized mode when running with battery power or performance optimized mode when AC adapter is in use. The BIOS supports dynamically switch between battery optimized and performance optimized mode if adapter is inserted or removed during run time.

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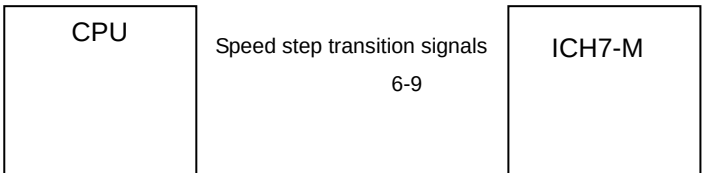
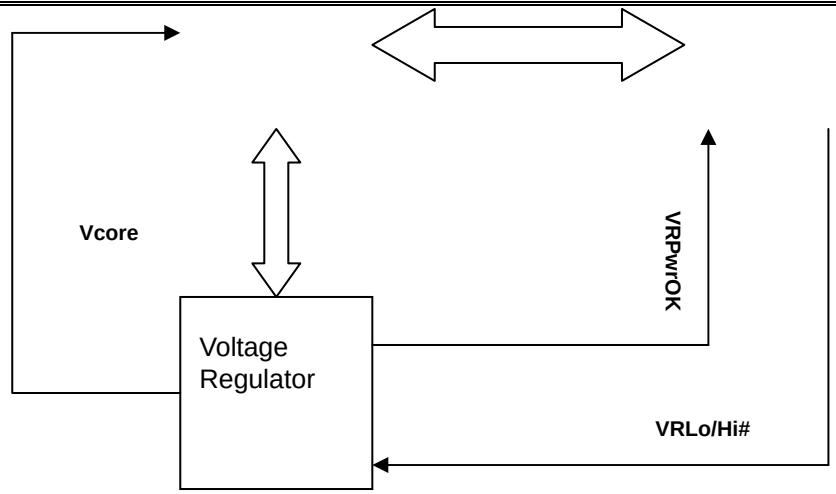
If the operating system has speed step driver installed, the BIOS supports speed step software function interface per Intel specifies, and the driver takes over the mode transition depends on driver applet setting the users selects.






Speed step transition block diagram

# 7. Embeded Controller (EC)

With ASUSTek specific ACPI compliant driver Z96J system BIOS can support event driven GUI (Graphics User Interface), all events are

## *7.1 – HOTKEY*

For easily adjusting some system hardware setting for users such as flat panel backlight control, audio volume control, display control or quickly bringing up some predefined applications an easy way for the users is through key combination or some switches on the machine, V6V defines below hotkeys and instance keys.

Fn hotkey tables

| Hotkey | Function | Description |
|---|---|---|
| Fn+F1 | Suspend key | Functions as sleep button |
| Fn+F2 | Wireless key | Control Bluetooth and wi-fi card |
| Fn+F3 | Display switch | LCD/CRT/Both |
| Fn+F4 | Brightness up | |
| Fn+F5 | Brightness down | |
| Fn+F6 | Volume on/off | Toggle function |
| Fn+F7 | Volume down | |
| Fn+F8 | Volume up | |
| Fn+F9 | Play key | Play/Pause in Media Player |
| Fn+F10 | Stop | Stop in Media Player |
| Fn+F11 | Backward | Backward in Media Player |
| Fn+F12 | Forward | Forward in Media Play |

## *7.2 – INSTANT KEY*

4 instant keys are installed on the function cap of the machine, as user press any one of them, an event is generated, and the ACPI BIOS and ASUSTeK specific utility will service it and bring up predefined applications.

In Z96J system design, the default applications of the 4 instant keys are defined as below (from left to right).

**i.** Power4Gear switching.
**ii.** Internet application.
**iii.** Email application.
**iv.** Touch Pad Switch.

## *7.3 – BATTERY INTERFACE*

Z96J supports Li-Ion Battery Pack.

### 1.1 7.3.1 Battery Sub-system

The charger will stop charge the battery when the following condition is detected.

The temperature of the system is too high. The battery voltage is too high.

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Note that the battery life depends on different configuration running. (E.g. the battery life is shorter with CDROM running, the battery life is longer with document keyin only; battery life is short while PMU disabled, battery life is longer while PMU enabled.)

### 1.2 7.3.2 Battery Low

When the battery capacity remains 10%*, the IT8510 will generate a battery warning SMI. The system will do the following actions.

The system will issue continuous warning beeps and enable CPU throttling.

Note: *Under Win 98: It will depend on the setting of O/S. (Default is 10%)

### 1.3 7.3.3 Battery Low Low

When the battery capacity reaching 13.5V*, the system will generate a battery low SMI. The system will do the following actions.

During operation mode:

The system will enter Suspend To Disk mode even the power management is disabled.

Note: *Under Win 98: It will depend on the setting of O/S. (Default is 3%)

### 1.4 7.3.4 AC Adapter

When plug in the AC adapter, the system will do the following action:

The charger will charge the Battery.

The Battery Charging Indicator will turn on if the battery is in changing mode.

The “Battery Warning” and “Battery Low” condition will be removed.

Z96J ACPI BIOS supports control method battery. With one single wire connection between keyboard controller and the battery gauge, with ACPI embedded controller interface the ACPI BIOS read gauge registers and reports battery related information to system.

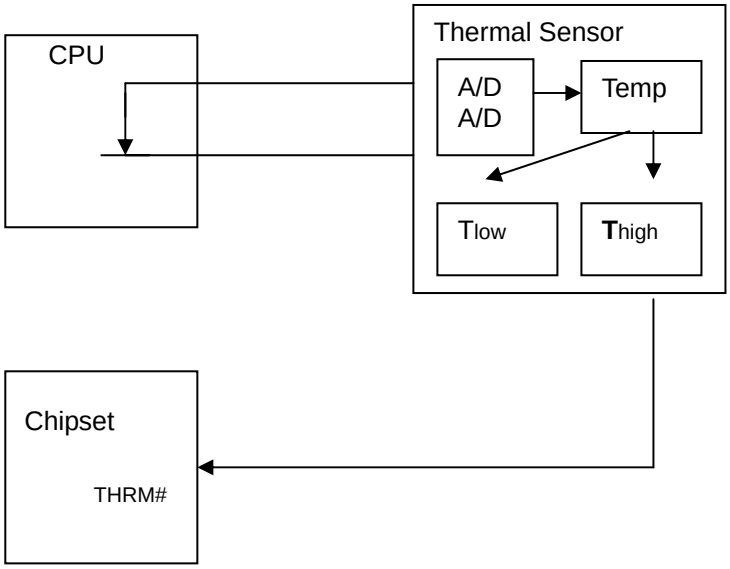
## *7.4 – THERMAL MANAGEMENT*

As CPU running with full speed, the temperature keeps raising, there must be some cooling devices to prevent the CPU from being overheated. According to ACPI specification there are two cooling policies – active cooling and passive cooling. For Z96J system, the thermal management has the following strategies:

1. If the system is idle for a long time, the CPU temperature is no more higher than 50℃ Celsius degree, no cooling mechanism is taken effect.
2. If the system becomes busy, the CPU temperature start to raise, when the Operating System finds the CPU temperature goes higher than 55℃ Celsius degree, the active cooling starts, the fan is turned on. And then, if the system becomes not busy, the CPU temperature start to down, when the Operating System finds the CPU temperature goes lower than 110℃ Celsius degree, the fan is turned off.
3. If however the system keeps busy and the temperature keeps increasing, and goes beyond 100℃, the Operating System will start passive cooling mechanism – “Down slow CPU speed”.

For overall ACPI BIOS thermal control activity, the thermal management can be categorized into two strategies:

1. A thermal device triggers an event to ACPI BIOS, the BIOS notifies to the Operating System to process such event. The event trigger temperature setting of the device has an upper and lower limit, when the CPU temperature goes above the upper limit or below the lower limit, the thermal event become active.
2. Operating System reads current temperature (through ACPI BIOS) periodically and process the thermal handler depends on its thermal policy.




Thermal device function block diagram

## 8. SMBIOS 2.3/2.2/2.1

There are some SMBUS components on the machine for system clock chip and system management:

1. Clock Generator: SMBUS address locates at 0D2h, some unconnected clock output pins need to be shut off.
2. Thermal control device: Two thermal monitor devices are installed on the machine (G781/G781-1, SMBUS address 99h/98h read/write, 9Bh/9Ah read/write), the device supports A/D converting rate setting, temperature reading and thermal event trigger control, the system BIOS properly sets its internal register (via SMBUS) and control cooling devices to keep the system from being overheated.
3. Extended memory socket interface: According to SODIMM specification, the characteristics of the installed memory are stored into a “Serial Presence Detect” (SPD) device, the BIOS use SMBUS interface, gets all related information about the memory and control the GMCH memory timing. More information please refer to SPD specification and GMCH EDS.

## 9. Other Features

### *9.1 – BIOS FLASH UTILITY & BIOS CRISIS RECOVERY.*

Steps for flashing BIOS:

1. Make a DOS boot diskette without autoexec.bat and config.sys files. Copy the AFLASH.EXE and unzipped BIOS image (ex.0404.ROM) files to this diskette.
2. Turn the system off, then boot the system using the boot diskette that you just created. Then type AFLASH auto 0404.ROM and press [ENTER].
3. It will now update the flash BIOS. If flash memory has been successfully programmed, it will back to dos prompt.

4. Assuming that you have successfully flashed the BIOS. After the system reboots, hit [F2] to enter the CMOS Setup. At this point, go to "Load Setup Defaults" field at "Exit" sub-menu. Then save and exit Setup. If screen resolution has shrunk after you restart,

### *9.2 – BIOS FEARTURES*

The BIOS haven’t support to wake up the system by external device, include external COM/PS2 mouse, you can wake up the system by instant key or internal keyboard.