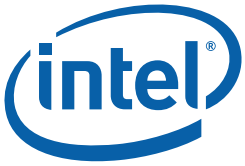

Intel® Atom™ Processor N270 and Mobile Intel® 945GSE Express Chipset

Development Kit User's Manual

September 2008

Revision 002

320436-002

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Revision History

Document Number	Revision Number	Description	Revision Date
320436	001	Initial release.	August 2008
320436	002	• Updated Chapter 5 EFI Firmware	September 2008

§

1 About This Manual

This manual describes the typical hardware set-up procedures, features, and use of the Intel® Atom™ Processor N270 and Mobile Intel® 945GSE Express Chipset Customer Reference Board (CRB) and other components included in the Development Kit. This manual is written for OEMs, system evaluators, and embedded system developers. This document defines all jumpers, headers, LED functions, and their locations on the development board along with subsystem features. This manual assumes basic familiarity in the fundamental concepts involved with installing and configuring hardware for a personal computer system.

Note: Read this document in its entirety prior to applying power to the motherboard. Chapter 6 provides quick start procedures.

Intel recommends having both the schematic and board present while reading this document.

The references in this document correlate to reference designators and board properties of Intel® Atom™ Processor N270 and Mobile Intel® 945GSE Express Chipset FAB B Customer Reference Board.

This manual is intended to be used with the Development Kit but can also be used to help bring up the Intel® Atom™ Processor N270 and Mobile Intel® 945GSE Express Chipset board, although not all associated peripherals will be included with the development board.

1.1 Content Overview

Chapter 1.0, "About This Manual" — This chapter contains a description of conventions used in this manual. The last few sections explain how to obtain literature and contact customer support.

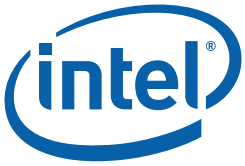
Chapter 2.0, "Getting Started"— This chapter identifies key components, features and specifications.

Chapter 3.0, "Theory of Operation" — This chapter provides information on the system design.

Chapter 4.0, "Hardware Reference"— This chapter provides a description of development kit primary features, connectors, and configuration settings.

Chapter 5.0, "Software" — This chapter provides information on system BIOS and OS support.

Chapter 6.0, "Quick Start"— This chapter provides a summary of hardware and power-on instructions for the development kit.

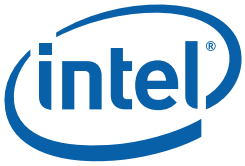


1.2 Text Conventions

The notations listed in Table 1 may be used throughout this manual.

Table 1. Text Conventions

Notation	Definition
#	The pound symbol (#) appended to a signal name indicates that the signal is active low. (e.g., PM_BMBUSY#)
Variables	Variables are shown in italics. Variables must be replaced with correct values.
Instructions	Instruction mnemonics are shown in uppercase. When you are programming, instructions are not case-sensitive. You may use either uppercase or lowercase.
Numbers	Hexadecimal numbers are represented by a string of hexadecimal digits followed by the character H. A zero prefix is added to numbers that begin with A through F. (For example, FF is shown as 0FFH.) Decimal and binary numbers are represented by their customary notations. (That is, 255 is a decimal number and 1111 is a binary number. In some cases, the letter B is added for clarity.)
Units of Measure A GB KB KΩ mA MB MHz ms mW ns pF W V µA µF µs µW	The following abbreviations are used to represent units of measure: amps, amperes gigabytes kilobytes kilo-ohms milliamps, milliamperes megabytes megahertz milliseconds milliwatts nanoseconds picofarads watts volts microamps, microamperes microfarads microseconds microwatts
Signal Names	Signal names are shown in uppercase. When several signals share a common name, an individual signal is represented by the signal name followed by a number, while the group is represented by the signal name followed by a variable (n). For example, the lower chip-select signals are named CS0#, CS1#, CS2#, and so on; they are collectively called CSn#. A pound symbol (#) appended to a signal name identifies an active-low signal. Port pins are represented by the port abbreviation, a period, and the pin number (e.g., P1.0).



1.3 Glossary of Acronyms

Table 2 defines the acronyms used throughout this document.

Table 2. Acronyms

Term	Definition
ACPI	Advanced Configuration and Power Interface
AGTL	Assisted Gunning Transceiver Logic
ATA	Advanced Technology Attachment (disk drive interface)
ATX	Advanced Technology Extended (motherboard form Factor)
BGA	Ball Grid Array
BIOS	Basic Input/Output System
CMOS	Complementary Metal-Oxide-Semiconductor
CRB	Customer Reference Board
DDR	Double Data Rate
DMA	Direct Memory Access
DVI-D	Digital Visual Interface Digital only
EFI	Extensible Firmware Interface
FAE	Field Application Engineer
FCBGA	Flip Chip Ball Grid Array
FSB	Front Side Bus
FWH	Firmware Hub
GMCH	Graphics Memory Controller Hub
GPIO	General Purpose Input Output
HDD	Hard disk drive
ICH	I/O Controller Hub
IDE	Integrated Device Electronics
Intel® HD Audio	Intel® High Definition Audio
ITP	In-Target Probe
LAN	Local Area Network
LED	Light Emitting Diode
LPC	Low Pin Count
OS	Operating System
PATA	Parallel AT Attachment
PCIe*	PCI Express*

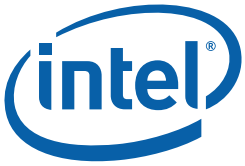
Term	Definition
POST	Power-on self-test
PXE	Pre-boot Execution Environment
RTC	Real Time Clock
SATA	Serial Advanced Technology Attachment
SIO	Super Input Output
SMB	System Management Bus
SMC	System Management Controller
SO-DIMM	Small Outline Dual In-line Memory Module
SPI	Serial Peripheral Interface Bus
SSD	Solid-state Drive
TDP	Thermal Design Power
TPM	Trusted Platform Module
USB	Universal Serial Bus
VGA	Video Graphics Array
VID	Voltage Identification
VRM	Voltage Regulator Module
WoL	Wake on LAN
XDP	Extended Debug Port

1.4 Technical Support

Support Services for your hardware and software are provided through the secure Intel® Premier Support Web site at https://premier.intel.com. After you log on, you can obtain technical support, review "What's New," and download any items required to maintain the platform. Support is provided through the following product: Dev Kit (Embedded/N270/945GSE/ICH7M).

1.4.1 Additional Technical Support

If you require additional technical support, please contact your field sales representative or local distributor.



1.5 Product Literature

To order hard copies of product literature, the following instructions should be followed:

1. Determine the SKU Number

   If you do not know the SKU # of the document you are ordering, please refer to www.intel.com or contact your FAE. The SKU # is the first 6 digits of the number on the PDF file, such as: 12345612.pdf or at the bottom of the download page for that document.

2. Call, Mail or Email a request

   Call: To place an order for a publication or text in hardcopy or CD form, please contact our Intel® Literature Fulfillment Centers listed in Table 3.

Table 3. Intel Literature Centers

Location	Telephone Number
U.S. and Canada	1-800-548-4725
International	1-303-675-2148
Fax	1-303-675-2120

Mail a request to:

Intel Literature Fulfilment Center
P.O. Box 5937
Denver, Colorado 80217-9808
USA

Email a request to: intelsupport@hibbertgroup.com

Please make sure to include in your mailed/emailed request:

SKU #
Company Name
Your Name (first, last)
Full mailing address
Daytime Phone Number in case of questions

Note: Please be aware not all documents are available in all media types. Some may only be available as a download.

1.6 Related Documents

Table 4 is a partial list of the available collateral. For the full lists, contact your local Intel representative.

Table 4. Related Documents

Document	Document Numbers/ Location
Processor and GMCH-Related Documents	
Basic Mobile Platform '08 – Design Guide	Contact your FAE for the latest revision
Intel® Atom™ Processor N270 with Intel® 945GSE Express Chipset – Platform Design Guide Addendum	
Intel® Atom™ N270 Processor with Mobile Intel® 945GSE Express Chipset Schematic	
Mobile Intel® Atom™ Processor N270 Single Core Datasheet	http://download.intel.com/design/processor/datashts/320032.pdf
Intel® Atom™ Processor N270 Series Specification Update	http://www.intel.com/design/chipsets/embedded/specupdt/320047.pdf
Mobile Intel® 945 Express Chipset Family Datasheet	www.intel.com/design/mobile/datashts/309219.htm
Mobile Intel® 945 Express Chipset Family Specification Update	www.intel.com/design/mobile/specupdt/309220.htm
Intel® I/O Controller Hub 7 (ICH7) Family Datasheet	www.intel.com/design/chipsets/datashts/307013.htm
Intel® I/O Controller Hub 7 (ICH7) Family Specification Update	www.intel.com/Assets/PDF/specupdate/307014.pdf

Note: Mobile Intel® 945GSE Express Chipset is same as Mobile Intel® 945GMS Express Chipset with the exception of no support for MacroVision*.

2 Getting Started

This chapter identifies the development kit's key components, features and specifications. It also details basic development board setup and operation.

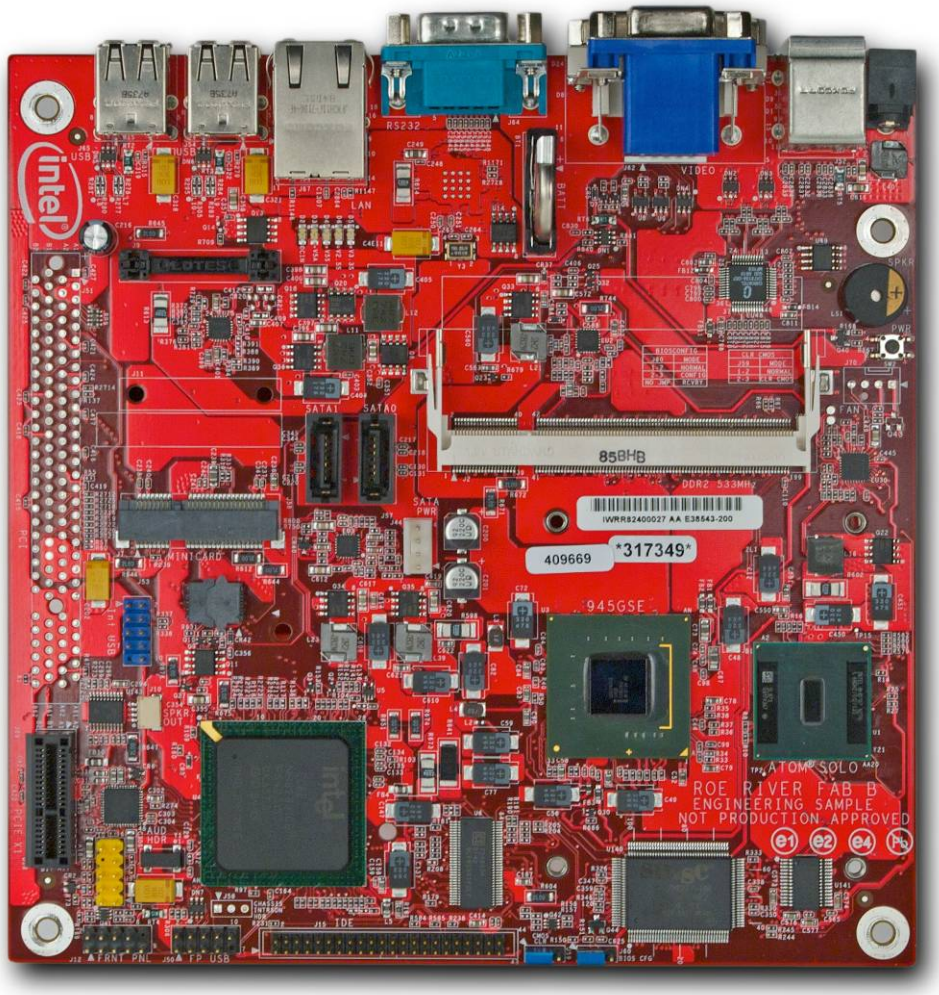
2.1 Overview

The development board consists of a motherboard populated with the Intel® Atom™ Processor N270 and Mobile Intel® 945GSE Express Chipset, other system board components and peripheral connectors.

Note: The evaluation board is shipped in a closed chassis. The user is required to observe extra precautions if the user opens the chassis for any reason.

Note: Review the document provided with the Development Kit titled "Important Safety and Regulatory Information". This document contains additional safety warnings and cautions.

Figure 1. Intel® Atom™ Processor N270 and Mobile Intel® 945GSE Express Chipset Board (Top View)



2.2 Development Board Features

Table 5 provides a list of the major features present on the Intel® Atom™ Processor N270 and Mobile Intel® 945GSE Express Chipset customer reference board.

Table 5. Intel® Atom™ Processor N270 and Mobile Intel® 945GSE Express Chipset CRB Feature Set Summary

	CRB Implementation	Comments
Processor	Intel® Atom™ N270 processor with 512KB L2 cache 1.6 GHz FSB 533 MT/s at 1.6 GHz	437-pin FCBGA8
Chipset	Mobile Intel® 82945GSE Express Chipset (GMCH)	998-pin Micro-FCBGA Package
	82801GBM I/O Controller Hub (ICH7M)	652-pin BGA Package
Memory	One DDR2 SODIMM slot	Supports DDR2 frequency of 533 MT/s or 400 MT/s, single channel, 1GB max
Video	Integrated graphics One DVI-D and one VGA Connector	
PCI Express* On-Board LAN	RealTek* RTL8111C-GR	The RTL8111C-GR is connected to the ICH via a PCI Express* lane, 10/100/1000, WOL capability
Wireless Communication	Wireless LAN support on Mini-card slot	Mini-PCIe* interface
82801GBM I/O CONTROLLER HUB (ICH7M) SPI	Socket solution	Support for multi-vendor SPI devices
Audio	RealTek* ALC268	Supporting Intel High Definition Audio Headphone, microphone, and internal 8-ohm speaker connector
Board Speaker	1 Piezo on-board speaker	Option for error codes
TPM	TPM 1.2 on motherboard	
ATA/Storage	1 PATA port	44-pin mobile header
	2 SATA ports	150 MB/s per port
Peripheral power	1 SATA power port	Connector to power hard disk drive
USB	4 rear panel ports 2 front panel ports 1 to PCIe* mini-card	

	CRB Implementation	Comments
	1 internal port (supports USB flash)	
SPI BIOS flash	Socketed, 8 Mb	8-pin socket
PCI Express*	1 PCIe* 1.1 X1 slot	Non-standard location
PCI expansion	1 PCI 2.3 slot	Un-populated (rework required)
Clocks	IDT* ICS9LPRS501 system clock generator	CK-505 compatible
RTC	Battery-backed real time clock	
Thermal Monitoring	Processor temperature sensor	
Processor Voltage Regulator	Intel® Mobile Voltage Positioning (Intel® MVP)-6 for processor core	
Power Supply	12VDC +/-5% 2mm connector	12VDC, 5.0A, 60W
Debug Interfaces	Extended Debug Port (XDP)	XDP connector
Power Management	ACPI Compliant	S0 – Power On S3 – Suspend to RAM S4 – Suspend to Disk S5 – Soft Off
Form Factor	Mini-ITX	6.75” X 6.75” (17 cm X 17 cm)

Note: Review the document provided with the Development Kit titled “Important Safety and Regulatory Information”. This document contains safety warnings and cautions that must be observed when using this development kit.

2.3 Included Hardware and Documentation

This following hardware and documentation is included in the development kit:

- Intel® Atom™ Processor N270 and Mobile Intel® 945GSE Express Chipset Development Board (Installed)
- Firmware Hub (FWH) (Installed)
- Combination CPU/GMCH heatsink (Installed)
- Jumpers (Installed)
- 1 GB DDR2 SODIMM (Installed)
- Type 2032, socketed 3V lithium coin cell battery (Installed)
- Mini-ITX Chassis
- 12V AC-DC adapter with universal AC plugs
- SATA DVD-ROM Drive (Installed)
- 80 GB 2.5” SATA Mobile Hard Drive (Installed)
- Associated cables (Installed)
- Documentation and Software CD

Note: Not all peripherals listed will be included with an Intel® Atom™ Processor N270 and Mobile Intel® 945GSE Express Chipset board if it is not obtained as a development kit.

2.4 Software Key Features

The driver CD included in the kit contains all of the software drivers necessary for basic system functionality under the following operating systems: Microsoft Windows XP*, Microsoft Windows XP Embedded*, WinCE 6.0*, and Linux.

Note: While every care was taken to ensure the latest versions of drivers were provided on the enclosed CD at time of publication, newer revisions may be available. Updated drivers for Intel components can be found at: http://developer.intel.com/design/intarch/software/index.htm

For all third-party components, please contact the appropriate vendor for updated drivers.

Note: Software in the kit is provided free by the vendor and is only licensed for evaluation purposes. Refer to the documentation in your evaluation kit for further details on any terms and conditions that may be applicable to the granted licenses. Customers using the tools that work with Microsoft* products must license those products. Any targets created by those tools should also have appropriate licenses. Software included in the kit is subject to change.

Refer to http://developer.intel.com/design/intarch/devkits for details on additional software from other third-party vendors.

2.4.1 EFI firmware

This development kit ships with a pre-boot EFI firmware pre-installed. This industry-standard EFI firmware runs most standard operating systems, including Microsoft Windows XP*, Microsoft Windows XP Embedded*, Linux, and others.

The following features of the EFI firmware are enabled in the development board:

- DDR2 SDRAM detection, configuration, and initialization
- Mobile Intel® 945GSE Express Chipset configuration
- PCI/PCI Express* device enumeration and configuration
- Integrated video configuration and initialization
- Super I/O configuration
- CPU microcode update

2.5 Before You Begin

The following additional hardware may be necessary to successfully set up and operate the development board.

VGA Monitor: Any standard VGA or DVI-D monitor may be used. The setup instructions in this chapter assume the use of a standard VGA monitor, TV, or flat panel monitor.

Keyboard: The development board can support either a PS/2 or USB style keyboard.

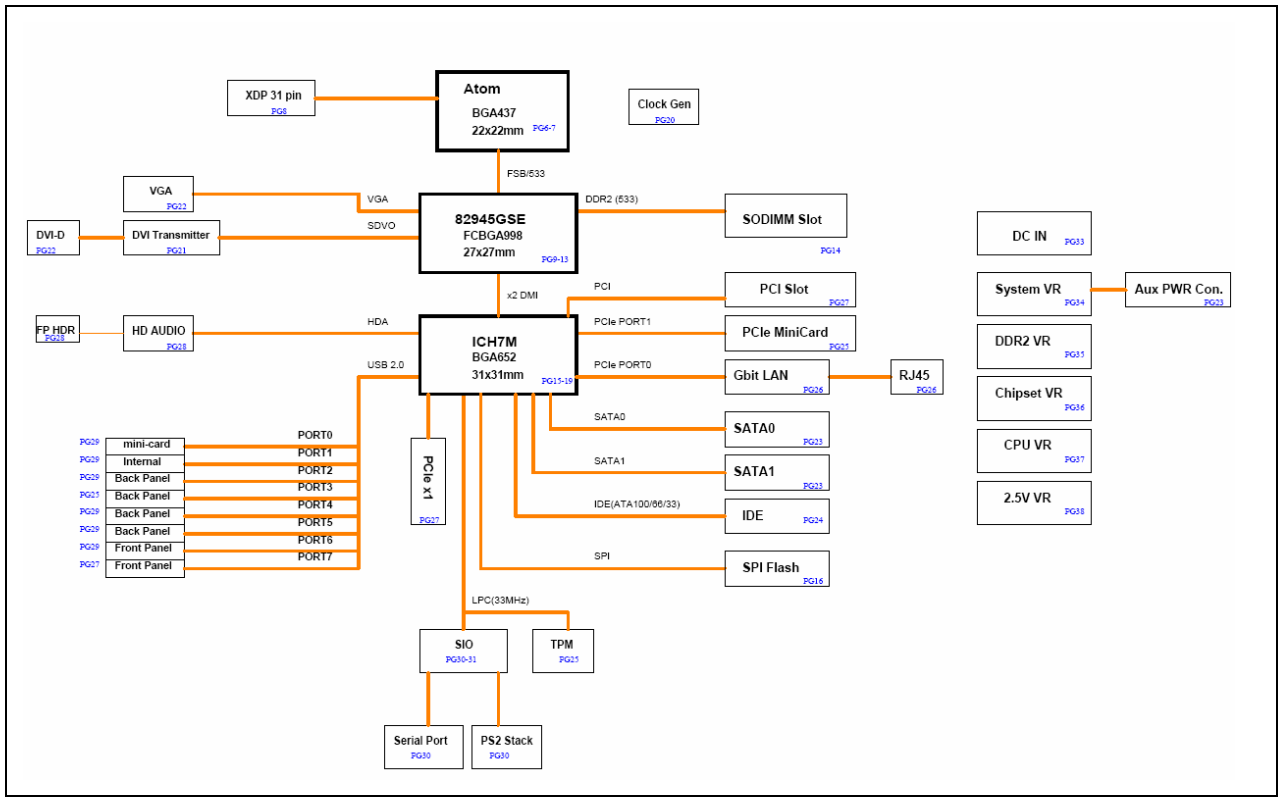
Mouse: The development board can support either a PS/2 or USB style mouse.

Note: The enclosed driver CD includes drivers necessary for LAN, Integrated graphics, Audio, and system INF utilities.

3 Theory of Operation

3.1 Block Diagram

Figure 2. Intel® Atom™ Processor N270 and Mobile Intel® 945GSE Express Chipset CRB Block Diagram



NOTE: Schematic pages are shown for reference in the block diagram.

3.2 Mechanical Form Factor

The development board conforms to the mini-ITX form factor, 6.75” X 6.75” (17 cm X 17 cm). Internal and rear panel system I/O connectors are described in Chapter 4.3.

3.3 Thermal Management

The objective of thermal management is to ensure that the temperature of each component is maintained within specified functional limits. The functional temperature

limit is the range within which the electrical circuits can be expected to meet their specified performance requirements. Operation outside the functional limit can degrade system performance and cause reliability problems potentially including failure of the part and damage to the system.

The development kit is shipped with a heatsink thermal solution installed on the processor and chipset. This thermal solution has been tested and is sufficient for development purposes. The designer must ensure that adequate thermal management is provided for if the system is used in other environments or enclosures.

3.3.1 Thermal Solution

The Thermal Design Power (TDP) for the processor and chipset is less than 10W. The system can be passively cooled with a maximum 40 W dissipation.

3.4 Power Management

3.4.1 Power Management States

Table 6 lists the power management states defined for the platform.

Table 6. Platform Power Management States

State	Description
G0/S0/C0	Full on
G0/S0/C1	Auto Halt
G0/S0/C2	STPCLK# signal active
G0/S0/C3	Deep Sleep: Clock to CPU stopped
G0/S0/C4	Deeper Sleep: DPRSLP# signal active
G1/S3	Suspend To RAM (all switched rails are turned off)
G1/S4	Suspend To Disk
G2/S5	Soft Off
G3	Mechanical Off

3.4.2 Power Measurement Support

Power measurement resistors are provided on the platform to measure the power of most subsystems. All power measurement resistors have a tolerance of 1%. The value of these power measurement resistors are 2-mOhm by default. Power on a particular subsystem is calculated using the following formula:

$$P = \frac{V^2}{R}$$

R = value of the sense resistor (typically 0.002 Ω)

V = the voltage difference measured across the sense resistor.

It is recommended to use a high precision digital multi-meter tool such as the Agilent 34401A* digital multi-meter.

3.5 Intel® Atom™ Processor N270

The CRB design supports the Intel® Atom ™ N270 at 1.6 GHz with 512 KB L2 cache in a 437-pin FCBGA8 package.

3.5.1 Processor Voltage Regulators

The CRB implements an on-board Intel® MVP-6 regulator for the processor core supply in a single phase.

3.5.2 FSB

The front side bus (FSB) on the CRB supports 533 MT/s (133 MHz quad-pumped). The FSB is AGTL+ and runs at 1.05 V.

3.5.3 Power Management

The Intel® Atom ™ Processor N270 supports C0-C4 power states along with C1E, C2E, and C4E. DPWR# protocol is also supported on the CRB.

3.5.4 Debug Interfaces

An XDP (Extended Debug Port) connector is provided at J1 for processor run control debug support. This connector is compatible with both XDP and ITP-700. An external adapter is used to interface ITPFlex700 cable to the platform.

Note: The XDP interface is backward-compatible with the ITP interface. However, an XDP to ITP converter cable is necessary to use the older ITP tools. Also, in some cases a resistor change rework is necessary to get the older ITP tools to function properly. Please contact local Intel field representative for additional details.

3.5.5 Testability

The CRB provides an Extended Debug Port (XDP) for testing at J1 and direct processor probing. The XDP interface is backwards-compatible with the older ITP interface as

well. The user must use an XDP or ITP interface that is compatible with the Intel® Atom™ Processor N270 processor with 512 kB L2 cache. XDP and ITP are backwards-compatible, but a cable adapter is necessary since the connectors for XDP and ITP are different.

3.6 Mobile Intel® 945GSE Express Chipset GMCH

The CRB design supports the Mobile Intel® 94GSE Express Chipset GMCH with an Intel ICH-7M ICH.

3.6.1 Memory

Type : DDR2, 533 MHz (PC2-4200)

Channel : 1

Connector : 1 SO-DIMM

Max Memory : 1GB max supported

3.6.2 Graphics

The Intel 945GSE GMCH integrated graphics (Intel® Graphics Media Accelerator 950) with VGA and DVI-D (through external SDVO-to-DVI device) outputs with maximum resolution support up to 1900x1200@60 Hz.

3.7 ICH7M

3.7.1 PCI Expansion Slot

Support for one PCI 2.3 expansion card with a maximum motherboard power delivery of 15W.

Note: The PCI slot is un-populated. Rework is required to populate this slot. This slot is aligned with the PCIe* X1 Expansion Slot, and while it is possible to populate both connectors simultaneously, it is not possible to add cards for both slots simultaneously without riser cards.

3.7.2 PCIe* x1 Expansion Slot

A PCI express* x1 connector is located in-line with the (empty) PCI slot. The slot has a non-standard mini-ITX location. Board may need to be removed from Chassis to populate this slot, depending on the size of the PCIe* card.

3.7.3 PCIe* Mini-Card

One PCIe* mini-card connector with support for PCIe* x1 and USB based mini-cards. WLAN activity signal from PCIe* mini-card to front panel header is provided.

Note: The evaluation board is shipped in a closed chassis. The user is required to observe extra precautions if the user opens the chassis to add a PCI or PCIe* card.

3.7.4 LAN

LAN support for 10/100/1000 connections using the RealTek* RTL8111C-GR Ethernet controller. Wake on LAN (WoL) functionality support for ACPI S3, S4, and S5.

3.7.5 USB 2.0

3.7.5.1 USB Port Assignment

Four USB 2.0 ports are provided on the back panel with two USB 2.0 ports on the front panel. One internal header with one USB port is provided on the motherboard to support an internal USB flash drive. An additional USB port is routed to the mini-card connector.

3.7.5.2 USB Flash Drive Support

The internal USB header can support an internal USB flash drive conforming to the mechanical and electrical requirements of the Intel® Z-U130 module (2x5 header, standard profile). The flash drive's activity LED# signal is included in the front panel HDD activity LED output. The flash drive is not included in development kit.

3.7.6 Audio

Two channel Intel® High Definition Audio (HD Audio) using the RealTek* ALC268. Front panel audio standard header for connection to the system front panel stereo headphone and microphone.

3.7.6.1 Internal Speaker

Supports an 8-ohm speaker.

3.7.6.2 Board Mounted Speaker

Internal speaker for beep codes.

3.7.7 SATA

Two internal SATA 150 MB/s ports.

3.7.7.1 Peripheral Power Connector

There is support for a hard disk drive or optical disk drive. Both 12 VDC and 5 VDC are supplied in either ACPI S0 or S1. Due to total power available, there may be limitations on the simultaneous powering of a hard disk drive (using MB peripheral power connector), or support of a full 15W for the PCI expansion slot.

3.7.8 IDE

One 44-pin mobile type IDE connector.

3.7.9 TPM

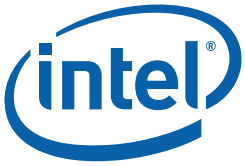
Stuffing option for a TPM 1.2 device.

3.7.10 GPIO

Table 7. ICH GPIOs

GPIOx	CRB Signal	Notes
GPIO0	PM_BMBUSY#	Bus master busy signal
GPIO1	PCI_REQ#5	
GPIO2	INT_PIRQE#	
GPIO3	INT_PIRQF#	
GPIO4	INT_PIRQG#	
GPIO5	INT_PIRQH#	
GPIO6	No connect	
GPIO7	FP_AUD_DETECT	
GPIO8	No connect	
GPIO9	IDE_PDIAG1	
GPIO10	No connect	
GPIO11	SMB_ALERT#	
GPIO12	LAN_ISOLATE#	
GPIO13	PCI_PME#	
GPIO14	No connect	
GPIO15		BIOS Config
GPIO16	PM_DPRSLPVR R	Mobile only signal – used to lower the voltage of VRM during C4 state.
GPIO17	PCI_GNT#5	Pull down site STUFFED - SPI boot mode
GPIO18	PM_STPPCI_ICH#	PCI clock stop used to support PCICLKRUN# protocol – Mobile only
GPIO19	SATA1_R1	
GPIO20	PM_STPCPU_ICH#	Mobile only – output to stop CPU clock during c3 state.
GPIO21	SATA0_R0	Pulled up
GPIO22	PCI_REQ#4	

GPIO23	LDRQ1#	LPC DMA master request signal goes to SIO
GPIO24	No connect	
GPIO25	No connect	
GPIO26	RF_KILL#	Active low to kill the WLAN card.
GPIO27	YELLOW_LED_CNTRL	
GPIO28	GREEN_LED_CNTRL	
GPIO29	USB_OC5#	
GPIO30	USB_OC6#	
GPIO31	USB_OC7#	
GPIO32	PM_CLKRUN#	Connects to peripherals that need to prevent clock stop or request clock start. Mobile only
GPIO33	No connect	
GPIO34	No connect	
GPIO35	No connect	
GPIO36	SATA2_R2	Pulled up
GPIO37	SATA3_R3	Pulled up
GPIO38	No connect	
GPIO39	No connect	
GPIO48	PCI_GNT#4	Pull-down site keep empty to boot to SPI memory range
GPIO49	H_PWRGD	



3.7.11 PCI Configuration Space

Table 8. PCI Configuration Space

Vendor	Device ID	Class	Bus	Dev (hex)	Dev (dec)	Func	Comment
Intel	27ACh	Host Bridge	00	00	0	0	Intel® 945GSE
Intel	27AEh	Graphics Controller	00	02	2	0	Intel® 945GSE Integrated Graphics
Intel	27A6h	Graphics Controller	00	02	2	1	Intel® 945GSE Integrated Graphics
Intel	27D8h		00	1B	27	0	Intel® HD Audio controller
Intel	27D0h	PCI to PCI Bridge	00	1C	28	0	ICH7M PCIe* Port 1 (used for Realtek LAN)
Intel	27D2h	PCI to PCI Bridge	00	1C	28	1	ICH7M PCIe* Port 2 (used PCIe* Mini-card)
Intel	27D4h	PCI to PCI Bridge	00	1C	28	2	ICH7M PCIe* Port 3 (used for PCIe* slot)
[Not implemented on board]	-	-	00	1C	28	3	ICH7M PCIe* Port 4
Intel	27C8h	USB Controller	00	1D	29	0	ICH7M USB UHCI Controller #1
Intel	27C9h	USB Controller	00	1D	29	1	ICH7M USB UHCI Controller #2
Intel	27CAh	USB Controller	00	1D	29	2	ICH7M USB UHCI Controller #3
Intel	27CBh	USB Controller	00	1D	29	3	ICH7M USB UHCI Controller #4
Intel	27CCh	USB Controller	00	1D	29	7	ICH7M USB 2.0 EHCI Controller
Intel	2448h	PCI to PCI Bridge	00	1E	30	0	ICH7M PCI to PCI Bridge for PCI bus
Intel	27B9h	ISA Bridge	00	1F	31	0	ICH7M LPC Controller
Intel	27DFh	IDE Controller	00	1F	31	1	ICH7M IDE Controller

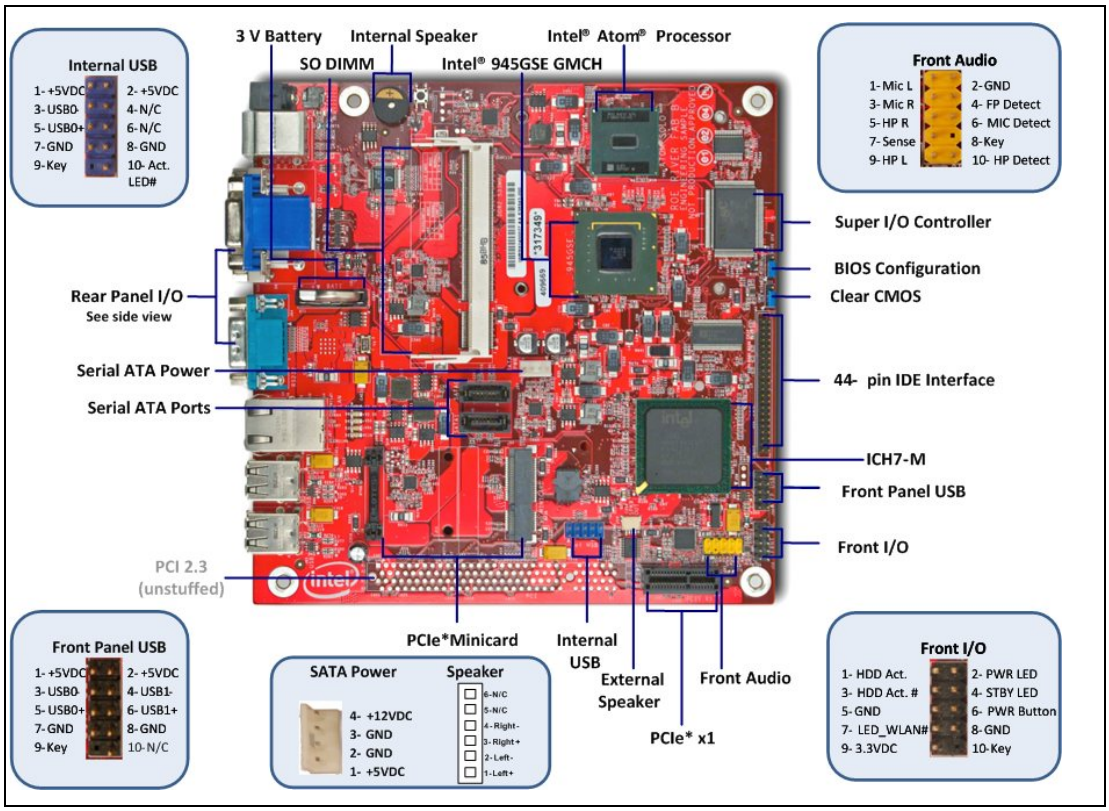
Intel	27C4h	IDE Controller	00	1F	31	2	ICH7M SATA Controller
Intel	27DAh		00	1F	31	3	ICH7M SMBus Controller
Realtk Semiconductor*	8168h	Ethernet Controller	01	00	0	0	RTL8111C Gbe LAN on ICH7M PCIe* Port 1
[PCIe* mini-card]	-	-	02	00	0	0	PCIe* Mini-card on ICH7M PCIe* Port 2
[PCIe* x1 slot]	-	-	03	00	0	0	PCIe* x1 slot on ICH7M PCIe Port 3
[PCI slot]			04	00	0	0	PCI slot

4 Hardware Reference

4.1 Primary Features

Figure 3 shows the major components of the CRB.

Figure 3. CRB Components



4.2 Power

12 VDC (+/-5%) input power will be supplied via a rear panel 2 mm [0.08”] connector.

4.2.1 Power Supply

Type : External

Input : 120/240 VAC, 50-60Hz

Output : 12 VDC

4.3 I/O Headers and Connectors

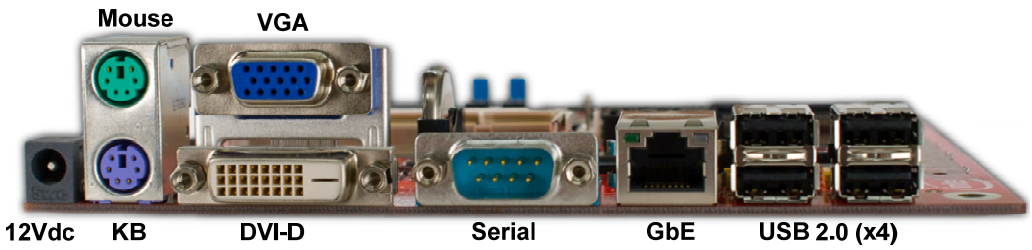
4.3.1 Front Panel I/O Headers

- Standard front panel header (with additional pins for wireless activity LED)
- Intel® High Definition Audio front panel audio header (supporting jack sensing). One headphone, 3.5mm Tip/Ring/Sleeve (TRS) w/Lime Green housing and one microphone, 3.5mm TRS w/ Pink housing.
- Standard front panel USB 2x5 supporting two ports, USB 2.0 type A receptacle.

Figure 4. Front Panel

4.3.2 Back Panel I/O Connectors

Figure 5. Back Panel



- DC Power In : 12 VDC Power jack
- PS/2 Mouse : Green
- PS/2 Keyboard : Purple
- Graphics : 1 each VGA and DVI-D
- Serial Port : 1 each DB-9, (Teal or turquoise color coding)
- LAN : RJ45 with LED indicators for link status and activity
- USB (Gen. Purpose): 4 each, USB 2.0 type A

4.4 Configuration Settings

4.4.1 Configuration Jumpers/Switches

Caution: Do not move jumpers with the power on. Always turn off the power and unplug the power cord from the computer before changing jumper settings. Otherwise, it may damage the board.

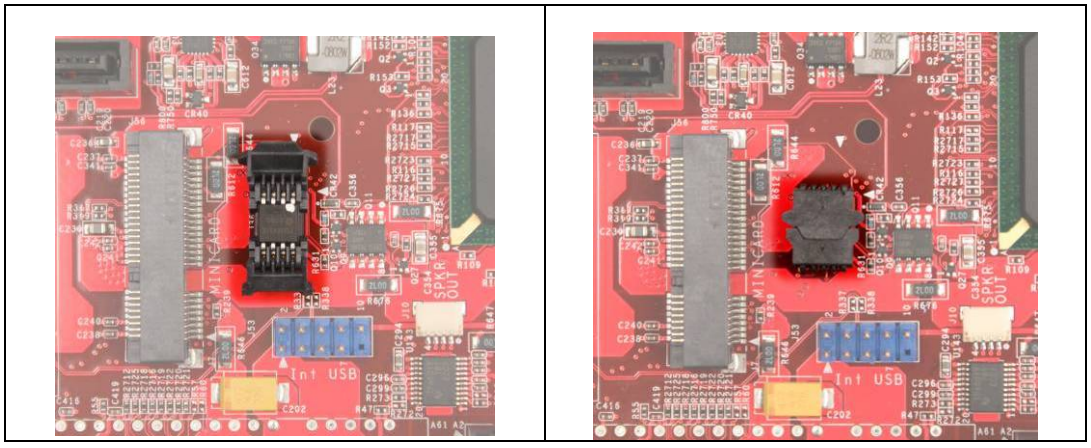
Note: A jumper consists of two or more pins mounted on the motherboard. When a jumper cap is placed over two pins, it is designated as IN. When no jumper cap is to be placed on the jumper, it is designated as OUT. When a switch is designated as 1-2 the switch slide is position such that pins 1 and 2 are shorted together.

4.4.2 System EFI Firmware Configuration

Follow the steps below to update the EFI firmware:

1. Put firmware SPI flash into J36 socket.
2. Clear CMOS by moving jumper J59 to 2-3 position and then back to 1-2 position.

Figure 6. Firmware Hub



4.5 LED

Table 9 lists the LEDs that provide status of various functions on the CRB.

Table 9. CRB LEDs

Function	Reference Designator
DCIN – RED	D2
+5VA – RED	D3
+5VS – YELLOW	D4
+2.5S – GREEN	D5
+3.3S – YELLOW	D6

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5 Software

5.1 EFI Firmware

5.1.1 Overview

The EFI firmware is stored on an 8Mb SPI part. The EFI setup utility for changing the date, enabling/disabling peripherals, and boot order is accessed during POST by pressing the <F2> key.

5.1.2 EFI Setup Security

EFI setup entry password protection options are available for both the Administrator and End-User.

5.1.3 PXE Boot Support

EFI support for network boot capability using Pre-boot Execution Environment (PXE) is supported. PXE boot is accessed by enabling the "PXE OpRom" option in BIOS setup.

5.1.4 ACPI

The EFI firmware supports S1 and S3 power states.

5.2 OS Support

Microsoft Windows XP Embedded*

Microsoft Windows XP Professional* with SP3

WinCE 6.0*

SUSE Linux Enterprise*

Fedora Linux FC8*

6 Quick Start

The following sections summarize the necessary hardware and power-on instructions for the Intel® Atom™ Processor N270 and Mobile Intel® 945GSE Express Chipset Development Kit.

6.1 Required Peripherals

- DDR2-533 SDRAM SO-DIMM (included in kit)
- AC-DC adapter with universal AC plugs (included in kit)
- Keyboard and Mouse (not included)
- External display (not included)

6.2 Power Up/Power Down

Steps to operate the Intel® Atom™ Processor N270 and Mobile Intel® 945GSE Express Chipset Development Kit

Note: These steps may already be completed in the Development Kit.

1. Place the DDR2 SO-DIMM in memory socket J2.
2. Attach the heat spreader for the processor and chipsets according to the assembly guide.

Steps to be completed by the user

1. Connect a USB keyboard in one of the USB connectors or a PS/2 keyboard in the bottom connector of J52.
2. Connect a USB mouse in one of the USB connectors or a PS/2 mouse in the top connector of J52.
3. Connect a monitor to the VGA port or DVI-D port J62.
4. Choose the right AC plug for your electrical outlets. Connect it to the 12V AC/DC adapter. Plug in the AC-DC adapter.

Steps to power-up the CRB

1. Press the power-button located at SW1 or the front panel of chassis.
2. As the system boots, press F2 to enter the EFI firmware setup screen.
3. Check time, date, and configuration settings and change if necessary.
4. Save and exit the EFI firmware setup.

Steps to Power-down the CRB

There are three options for powering-down the CRB:

1. Use OS-controlled shutdown through the menu (or equivalent).
2. Press the power-button on the motherboard at SW1 to begin power-down.
3. If the system is hung, it is possible to asynchronously shut the system down by pressing the power-button continuously for 4 seconds.

Caution: Intel does not recommend powering down the board by removing power to the DC power supply or disconnecting the DC input from the board.

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