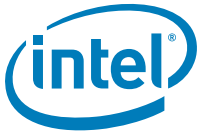

Intel® RAID Smart Battery AXXRSBBU3

Technical Product Specification

Intel order number D84273-003

Revision 1.3

July 2008

Enterprise Platforms and Services Marketing

Revision History

Date	Revision Number	Modifications
November 2006	1.0	initial Release
July 2007	1.1	Add Intel® RAID Controller SRCSASJV support
February 2008	1.2	Add Intel® RAID Controller SRCSASPH16I support
July 2008	1.3	Update Battery pack information

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1. Overview

This document describes the key hardware components, firmware, and software utilities for the Intel® RAID Smart Battery AXXRSBBU3. The Smart Battery AXXRSBBU3 provides data integrity for the RAID (Redundant Array of Inexpensive Disks) solution by ensuring that the data passing through the cache is written to the hard drives.

The Smart Battery supports RAID controllers that use a standard 256 MB or 512 MB DDR2 DIMM (Dual In-Line Memory Module). It is available as an accessory for selected RAID controllers and to support the RAID-on-Motherboard (ROMB) solutions used on the following Intel® server boards and systems.

- Intel® Server System SR4850HW4
- Intel® Server System SR6850HW4
- Intel® Server System SR4850HW4/M
- Intel® Server System SR6850HW4/M
- Intel® Server Board S5000PSL
- Intel® Server Board S5000PAL (and Intel® Server Systems with this server board installed)

Intel® RAID Smart Battery AXXRSBBU3 contains the following components:

- Plastic clamshell holder: Works with Intel® Server Chassis that have clamshell attach points. The battery pack is installed in the clamshell, which mounts inside the server chassis.
- Connecting cables: Three different 20-pin connector cables are provided to work with each specific RAID product.
- Smart Refresh Circuit: Ensures that the battery is maintained at optimal performance and charge levels. This circuit is based on the Texas Instruments bq2060A SBS v1.1-Compliant Gas Gauge IC*.
- 5-pin connector cable: The connector is used for communicating between the Smart Refresh Circuit board and Battery pack.
- Battery pack: Includes a circuit logic board and attached LiON (Lithium Ion) batteries. The logic board provides sensing and management logic to support the battery charge, discharge, and monitoring functions.
- Software: Monitors and informs the user of any issues or actions for the Intel® Smart Battery AXXRSBBU3. Monitoring is accomplished through the Intel® RAID BIOS Console 2, Intel® RAID Web Console 2, or Intel® RAID Command Line Tool 2 utilities.

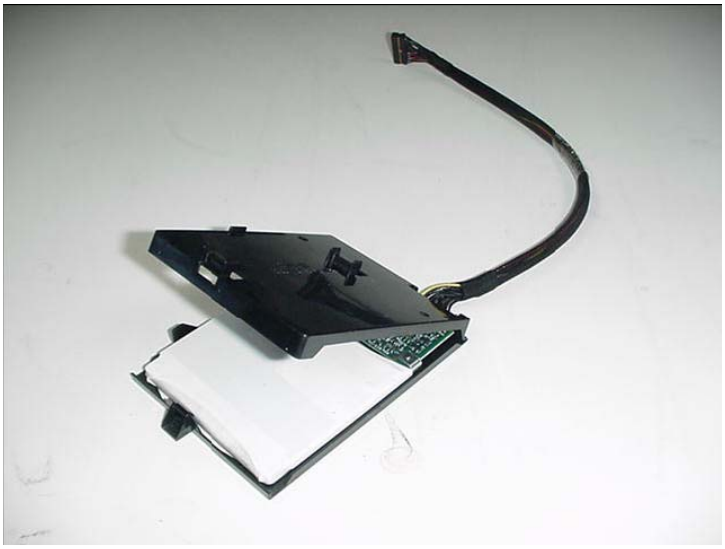

Figure 1. Intel® RAID Smart Battery AXXRSBBU3

The battery pack charges automatically and communicates battery status information, such as voltage, temperature, and current to the host computer system.

Because it is faster to write data to the RAID adapter's cache memory than it is to write it directly to a storage device, data is first written to the cache memory. These write operations are completed quickly at the software application level. The RAID controller then writes the cached data to the storage device when system activity is low or when the cache is full.

This method of writing data carries a risk. Cached data on the RAID controller can be lost if the AC power fails before it is written to the storage device. The Smart Battery mitigates this risk by providing battery power to the RAID controller if AC power is lost.

The Smart Battery monitors the voltage level of the DRAM (Dynamic Random Access Memory) modules on the RAID controller. If the voltage drops below a predefined level, the Smart Battery switches the memory power source from the RAID controller to the battery pack. The battery pack provides power for the memory until the voltage returns to an acceptable level, at which time the Smart Battery circuit board switches the power source back to the RAID controller. Cached data is then written to the storage devices with no loss of data. The Smart Battery provides additional fault tolerance when used with a UPS.

The battery pack cache-memory hold time depends on the size and configuration of the RAID controller memory. Retention time depends on memory capacity and the number of memory components on the DIMM to support the capacity. Estimated battery backup retention time is 72 hours (three days).

2. Hardware

2.1 Electrical and Mechanical Details

The battery pack is rated at a nominal voltage of 3.7 V with a typical capacity of 1050 mAH.

Table 1. Electrical and Mechanical Details

Feature	Description
RAID controller	Intel® RAID Controller SRCSAS144E Intel® RAID Controller SRCSASJV Intel® RAID Controller SRCSASPH16I
Data retention	Up to 72 hours (three days) for 128 MB memory
Chemistry	LiON
Dimensions	Maximum 2.749 inches by 2.63 inches
Weight	Cells / GG card / battery logic and charger (90 grams typical)
Operating temperature	10 to 45° C dry bulb temperature (the maximum dry bulb temperature shall be derated by 3.3° C per 1000 m above 500 m)
Operating humidity	20% - 80 %, non-condensing
Storage temperature	Greater than 90 days at 0 to 30 degrees Celsius 30 to 90 days at 30 to 40 degrees Celsius Less than 30 days at 40 to 50 degrees Celsius
Storage humidity	20% - 80 %, non-condensing
Capacity	1050 mAH
Voltages	Nominal OCV: 3.7 V
Fast charge current	512 mAH
Battery voltage conditioning	Less than 3.0 V
Battery charge time	Typical: 6 hours to charge from 3.6 V OCV to 4.2 V OCV Worst case: 10 hours if pack is completely depleted of charge
MTBF (Electrical Components)	4,403,153 hours at 40 degrees Celsius
Battery shelf life	1 year
Battery operational life	500 recharges cycles Note: Intel recommends replacing the battery yearly

2.2 Functional Block Diagram

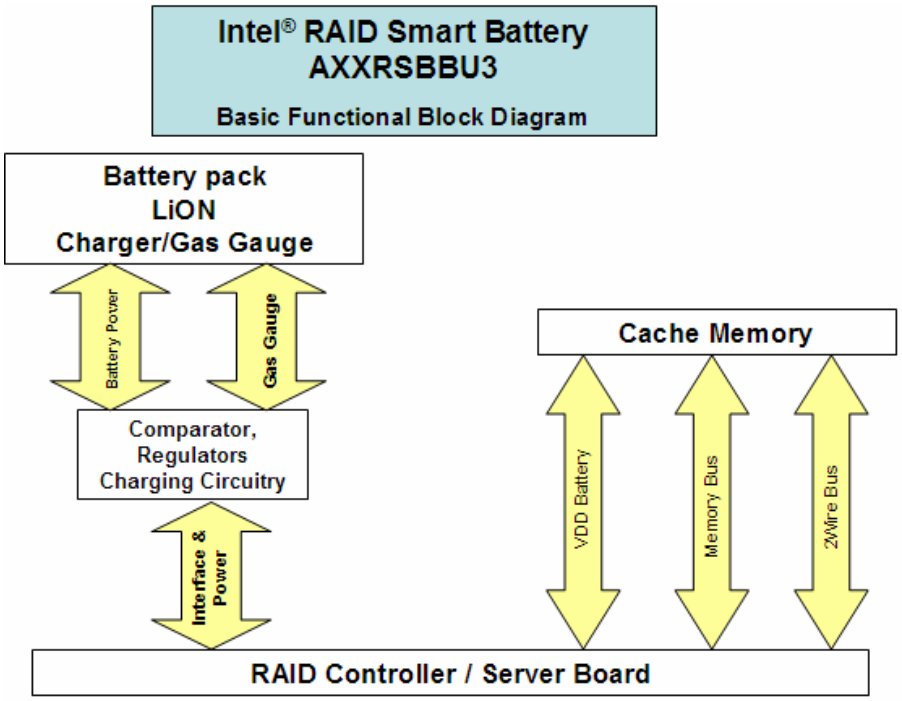

Figure 2. Block Diagram

2.3 Clamshell Holder

The clamshell holder eases installation and retention of the battery pack in the server chassis. The battery pack is shipped pre-installed in the plastic clamshell holder.

Figure 3. Clamshell Holder

2.4 Connecting Cables

Three cables are shipped with the battery package. The following table shows cable compatibility with both RAID controllers and integrated RAID solutions. The 11-inch cable is pre-installed in the battery pack. If a different cable must be used, open the clamshell, carefully remove the 11-inch cable from the circuit board connector and attach the correct cable.

Table 2. Cable Compatibility

Intel® RAID Controller or Server System	11-inch Cable	20-inch Cable	27-inch Cable
Intel® RAID Controller SRCSAS144E		X	
Intel® RAID Controller SRCSASJV		X	
Intel® RAID Controller SRCSASPH16I		X	
Intel® Server System S5000PSL (product code S5000PSLROMB)			X
Intel® Server System SR1550AL with Integrated RAID	X		
Intel® Server System SR2500AL with Integrated RAID	X		
Intel® Server System SR4850HW4 with SCSI Integrated RAID	X		
Intel® Server System SR6850HW4 with SCSI Integrated RAID	X		
Intel® Server System SR4850HW4/M with SAS Integrated RAID			X
Intel® Server System SR6850HW4/M with SAS Integrated RAID			X

Table 3. Interface Connector Pin-out

Pin	Signal Name	Signal Type
1	+12 V	Input
2	GND	GND
3	+5 V	Input
4	GND	GND
5	VREG_DDR (1.8 V / 2.5 V)	Input
6	GND	GND
7	+3.3 V	Input
8	GND	GND
9	DDR – Rail (2.5 V – 1.8 V)	In Pwr / out pwr, depending on mode
10	GND	GND
11	RESET#	Input
12	GND	GND
13	SCL	Input / output
14	GND	GND
15	SDA	Input / output
16	PFAIL#	Output
17	DDR_SEL	Input, tied high on battery backup
18	XD0-BBE	Input
19	BBSTROBE	Output
20	BBSTATUS	Output

2.5 Smart Refresh Circuit Board

The Intel® RAID Smart Battery AXXRSBBU3 is based on the Texas Instruments bq2060A SBS v1.1-compliant Gas Gauge IC. The key features of the SBS v1.1 IC are listed:

- Provides accurate measurement of available charge
- Supports SBS Smart Battery Data Specification v1.1
- Reports voltages
- Provides voltage, temperature, and current measurements
- Measures charge flow using a V-to-F converter with an offset of less than 16µV after calibration

The bq2060A SBS-compliant Gas Gauge IC for the battery pack maintains an accurate record of the available charge. It determines battery capacity by monitoring the amount of charge available to or removed from a rechargeable battery.

The bq2060A measures battery voltage, temperature, and current estimates battery self-discharge; and monitors the battery for low-voltage thresholds. It measures charge and discharge activity by monitoring the voltage across a small-value series sense resistor between the battery's negative terminal and the negative terminal of the battery pack. The available battery charge is determined by monitoring this voltage and correcting the measurement for environmental and operating conditions.

For more information about the Texas Instruments bq2060A SBS v1.1-compliant Gas Gauge IC, refer to the manufacturer website.

The Intel® RAID Smart Battery AXXRSBBU3 features are reviewed:

- Integrates into the battery pack
- Reduces host CPU (Central Processing Unit) intervention
- Shares I^2C bus with the onboard EEPROM (Electrically Erasable Programmable Read-Only Memory) for memory
- Provides real-time battery status information
- Displays a low charge warning
- Provides instantaneous voltage, current, and temperature information
- Supplies battery charge percentage remaining and at-rate information
- Broadcasts event alarms to the host:
  - Out-of-temperature
  - Terminate charge
  - Terminate discharge
  - Low capacity
- Displays manufacturing information

- Provides Smart Charger Protocol for improved battery maintenance, calibration, and charging performance

2.6 Connector Cable

A 5-pin connector cable connects the battery pack to the Intel® RAID Smart Battery AXXRSBBU3 circuit board.

Table 4. Connector Pin-outs

Pin	Signal Name	I/O	Description
1	VBATP	Input	Battery positive terminal
2	THERMISTOR SENSE	Output	Sense contact of the thermistor
3	GND	Input	Battery negative terminal
4	SCL	Output	I^2C Clock for pack monitoring
5	SDA	Input	I^2C Data for pack monitoring

2.7 Battery Pack

The cache-memory hold time depends on the size and configuration of the RAID controller memory. Retention time varies depending on memory capacity and the number of memory components used on the DIMM to support that capacity. Estimates for battery backup retention time with different configurations of DDR2 memory are listed:

- 256 MB (256 Mb devices) = 46 hours
- 512 MB (256 Mb devices) = 23 hours
- 512 MB (512 Mb devices) = 46 hours

2.7.1 Battery States

The battery pack includes battery sensing logic that senses the battery voltage levels and recognizes the battery state.

2.7.1.1 Initialized State

The battery is in the initialized state during a normal power-up sequence. In RAID firmware, there are two times when initialization occurs:

- During boot loader execution
- During RAID firmware boot

2.7.1.2 Discharging State

The battery voltage is drained as part of a relearn cycle.

2.7.1.3 Fully Charged State

A battery that is not fully charged has a low-voltage level that indicates the level of charge. Charging begins when the battery logic detects low voltage and power is supplied.

Once a new battery is fully charged, a relearn cycle is initiated. Relearn is the process of taking a fully charged battery through the discharge-charge cycle to update the gas gauge capacity parameters. The relearn cycle takes up to 24 hours to fully discharge and recharge the battery pack. After the relearn cycle is complete, information from the battery accurately provides the state of charge, capacity, and other parameters. These parameters determine the health of the battery.

- The relearn cycle can be set at a user-definable interval. The default is a one-month (30 days) interval.
- A relearn cycle initiates on a newly-inserted battery, even if the battery was previously fully charged.
- Some applications can start a relearn, or a relearn can be manually started.

2.7.1.4 Fully-discharged State

The fully-discharged state is detected as a low voltage parameter. The charger detects a fully-discharged battery state and starts charging the cells when sufficient power is available; and when the firmware has finished initializing the battery pack.

3. RAID Firmware Interaction

RAID firmware detects the battery status and logs the following events:

- Battery is present
- Battery is not present
- New battery is detected
- Battery has been replaced
- Battery temperature is high
- Battery voltage is low
- Battery is charging
- Battery is discharging
- Battery voltage is normal
- Battery needs replacement: SOH is bad
- Battery needs replacement: Battery is three years old
- Battery needs replacement: Charger is not working
- Relearn has started
- Relearn is in progress
- Relearn completed
- Relearn timed out
- Relearn pending: Battery is charging
- Relearn postponed
- Relearn will start in four days
- Relearn will start in two days
- Relearn will start in one day
- Relearn will start in five hours

4. Software

4.1 Intel® RAID BIOS Console 2

The system BIOS loads the RAID option ROM that resides on the Intel® RAID Controller flash. Run this utility by pressing <Ctrl> + <G> when prompted during POST (Power On Self Test). The option ROM checks for the presence of the battery and informs the user if the battery is missing or not fully charged. The Intel® RAID BIOS Console 2 Utility can be used to monitor charge cycle count and voltage levels.

4.2 Intel® RAID Web Console 2

This operating system based utility for the Microsoft Windows* and Linux* operating systems is supported by the active RAID solution. It can be used to monitor battery status, charge level, and the number of recharge cycles.

4.3 Intel® RAID Command Line Tool 2 Utility

This text-based command-line utility (CLU) is available for Microsoft Windows* and Linux* operating systems. It can be use to view battery status and to initiate a relearn.