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1 Introduction

The Intel® Atom™ Processor Z670/Z650 platform with Intel® SM35 Express Chipset requires two sets of BIOS firmware for a complete product implementation. The first is system firmware which enables the chipset to control boot functions for the entire system leading up to the handoff to the operating system. The second is for the Nuvoton NPCE791EA0DX* embedded controller, which is a third-party microcontroller that Intel has validated and strongly recommends for use with the Intel Atom processor Z670/Z650 platform. The firmware for this embedded controller will enable it to manage essential power management and lower-level functions during system operation. To give customers flexibility, Intel has partnered with multiple third-party BIOS software and silicon vendors to provide support for firmware development along with production licensed system and embedded controller BIOS.

Intel does not provide production licensed firmware/BIOS for either the overall system or the embedded controller due to legal constraints and the differing requirements of customer product implementations. This document identifies the third-party vendors Intel has partnered with for platforms based on the Intel Atom Processor Z670/Z650 with Intel SM35 Express Chipset. It also provides the appropriate third-party BIOS contacts that customers should communicate with to enlist development and validation support for their production-level firmware needs for this platform.

1.1 System BIOS Development Contacts

Intel has partnered with three different software developers to provide customers with technical support for system BIOS development: American Megatrends, Inc. (AMI), Phoenix Technologies, and Insyde Software. All three vendors can provide production-licensed system BIOS solutions as well. Contacts for each company are listed below.

**American Megatrends, Inc. (AMI)**
Srivatsan Ramachandran
Phone: +1-678-576-8978
Email: Srivatsanr@ami.com
Website: http://www.ami.com/

**Phoenix Technologies**
Bobby Sabhlok
Phone: +1-408-570-1637
Email: Bobby_sabhlok@phoenix.com
Website: http://www.phoenix.com/
1.2 Embedded Controller BIOS Development and Hardware Support Contacts

Platforms based on the Intel Atom Processor Z670/Z650 with Intel SM35 Express Chipset platform operate best when an embedded controller is included to manage several peripheral system functions. The Nuvoton NPCE791EA0DX is a 16mm x 16 mm highly integrated 16-bit embedded microcontroller with PECI 3.0 and an internal clock that has been validated by Intel on several of our reference platforms (Alpine Bay, Fox Lake, and Green Ridge) to control the following I/O functions:

- 16x8 scan matrix keyboard
- PS/2 keyboard and PS/2 mouse
- Port 80 and battery charger
- LVDS backlight control and ambient light sensor
- Serial port

*Figure 1* illustrates the NPCE791EA0DX embedded controller’s location and major functions within Intel’s Alpine Bay customer reference board (CRB).

*Figure 1. Roles of Nuvoton NPCE791 Embedded Controller on Alpine Bay CRB*
The NPCE791x embedded controller (EC) incorporates a high-performance 16-bit RISC processor, on-chip ROM and RAM memories, a Flash interface unit, and an extended set of system support functions. These system support functions include: watchdog, timers, interrupt control, PWM, General Purpose I/O with internal keyboard matrix scanning, PS/2* interface, SMBus interface, UART, HDMI-CEC, SPI, and high-accuracy analog-to-digital and digital-to-analog converters for battery charging. The NPCE791x also interfaces to the host Intel SM35 Chipset via an LPC interface and includes an integrated Super I/O with host controlled serial port.

For more information on the benefits of the NPCE791 series and other Embedded Controllers that Intel has designed into Intel Atom processor-based embedded reference designs, consult the white paper titled Embedded Controller Usage in Low Power Embedded Designs - An Overview, posted on Intel's Embedded Design Center. This white paper provides additional details of the form, fit and function of ECs and how best to include them in your design.

Please click on the following URL for further information on the NPCE791x EC, and to request datasheets from Nuvoton:


To reiterate, Intel only developed firmware source code and binaries for the Nuvoton NPCE791EA0DX for use on our Alpine Bay CRB. Intel’s source code is not suitable for production nor will it be licensed to any customer for that purpose.

However, because the Nuvoton NPCE791 series EC handles many useful low-level functions not available with the Intel Atom processor Z6xx and Intel SM35 Chipset (and recognizing that replacing the EC with an alternate IC and/or discrete components would be both time consuming and more costly), Intel strongly recommends the NPCE791 series EC for production designs. By doing this, the same functions, passives and circuitry around the EC that are included in the Alpine Bay CRB should operate similarly in a customer design because Intel has validated this platform with the EC. To further assist customers, Intel has provided engineering firmware source code for the Nuvoton NPCE791EA0DX on the Alpine Bay CRB to our partner Insyde, who has added to and refined this code and licenses it for production.

Customization of the NPCE791EA0DX firmware is required if the customer design deviates in any way from the functions implemented with the EC on Intel’s Alpine Bay reference platform (for the Intel Atom Processor Z670/Z650 with Intel SM35 Express Chipset). When this occurs (as it often does) customers should initiate contact with Insyde using the contact information that follows. Insyde will then provide an estimate of the work and the fee(s) required for firmware customization and production licensing. Insyde requests that customers provide a high-level list of functions controlled by the EC that are unique to their platform and not supported in Intel’s Alpine Bay CRB.

Examples of these functions include:

1. PWM backlight control
2. Hot Keys removal or addition
3. Scan matrix keyboard support
4. Customization of the keyboard scan matrix table
5. Battery support / different battery vendors
6. Low battery notifications
7. LCD backlight enablement/disablement based on power states
8. LID open/close detection. Example: SMC-LID (pin 91). '0' = lid closed. '1' = lid open.
9. PWM control of power LED using POWER-LED-PWM signal
10. Push-button power control
11. SMBus monitoring of CPU/DDR thermal sensor

Finally, firmware development support for the NPCE791EA0DX and hardware questions about the Nuvoton NPCE791EA0DX embedded controller should be requested from the following contacts:

Contact information for **Insyde Software Corp.** for NPCE791EA0DX firmware:

   Ed Brohm  
   Phone: +1-508-599-3999 x110  
   Email: ed.brohm@insydesw.com

   or

   [http://www.insydesw.com/contact](http://www.insydesw.com/contact)

Contact information for **Nuvoton Technology Corp.** (NPCE791EA0DX Hardware Questions):

   Chris Glowacki (Applications Engineer)  
   Phone: +1-503-724-1940  
   Email: GLOWACKI@nuvoton.com

   Website: [http://www.nuvoton.com](http://www.nuvoton.com)

   Tim Gilman (Sales Manager)  
   Phone: +1-425-908-7283  
   Email: TGilman@nuvoton.com

   Website: [http://www.nuvoton.com](http://www.nuvoton.com)