BSP for Microsoft* Windows* 7 (WIN*7, WES7* and POSReady 7) 32 and 64-bit for Intel® Atom™ processor E3800 Product Family

User Guide

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Revision History

Date	Revision	Description
May 2016	002	Updated for Windows* 7 Maintenance Release 4
November 2015	001	Updated for Windows*7 Maintenance Release 3

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1 Introduction

1.1 Scope of document

This document presents information that uses Intel developed General Purpose Input/output (GPIO), Inter-Integrated Circuit* (I^2C*), Serial Peripheral Interface (SPI), High Speed-Universal Asynchronous Receiver/Transmitter (HS-UART), SD, eMMC*, and USB3.0 XHCI drivers for Windows* 7 (Win7*), Windows Embedded Standard 7* (WES7*) and Windows Embedded POSReady 7* (POSReady 7*).

This User Guide presents procedures to build the Windows BSP, platform, and driver software best known methods.

The intended audience for this document is Original Design Manufacturers (OEMs) and Original Equipment Manufacturers (ODMs) that are enabling Win7* and WES7* drivers with Intel® Atom E3800 processor, Intel® Celeron® Processor N2XXX and Intel® Celeron® Processor J1XXX.

Note: To update the GPIO, I2C* and SPI drivers on structure definition in public driver header files from a beta driver to a gold driver, recompile your applications with the latest public driver header.

1.2 System Requirements

The following Operating Systems (OS) are supported:

- Windows* 7 Operating System (32-bit and 64-bit versions)
- Windows* Embedded Standard 7 Operating System (32-bit and 64-bit versions)
- Windows* Embedded POSReady 7 Operating System (32-bit and 64-bit versions)

1.3 Acronyms and Terminology

Table 1. Acronyms and Terminology

Term	Description
BSOD	Blue Screen of Death (Stop Error)
GPIO	General Purpose Input/output
I^2C	Inter-Integrated Circuit
HS-UART	High Speed Universal Asynchronous Receiver/Transmitter
ODMs	Original Design Manufacturers

Term	Description
OEMs	Original Equipment Manufacturers
OS	Operating System
SPI	Serial Peripheral Interface
SUT	System Under Test
HS-UART	High Speed-Universal Asynchronous Receiver/Transmitter
WES7*	Windows Embedded Standard 7*
Win7*	Windows* 7
POSReady 7*	Windows Embedded POSReady 7*

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2 User Guide

2.1 Building Windows BSP

The content of this section covers Windows* 7, WES7* and POSReady 7*.

1. Prepare the installation media as follows:
   a. Get a thumb drive with a capacity between 8 GB – 32 GB and format it with FAT32.

   b. Extract all files from the ISO image of WIN7*/WES7*/POSReady 7* and save to the thumb drive.
2. BIOS Setup for installation:
   a. To setup the BIOS by navigating to “Device Manager -> System Setup -> **Boot**, then enter the following settings:
      - OS Selection: **Win7 32/64 Legacy**
      - Legacy USB Booting: **Enable**
   b. Then press “**F4**” commit changes and Exit.

c. Enter into "**Boot Manager**" and select the option to boot from the drive or device which contains the OS image then select **ENTER**.

Note: DO NOT use EFI USB boot since Win 7 is using the legacy mode.

3. OS Installation:

   Install an OS with Windows OS default installation steps.

4. Intel IO drivers installation:

   a. For Win7* 64-bit or WES7* 64-bit, install the **Microsoft* Hotfix KB2732471** (http://support.microsoft.com/kb/2732471)

      Remark: This hotfix is only required for the SD driver. Does not need to be installed for Win7/WES7 (64-bit) if the SD driver is not used.

   b. Execute Intel Atom E3800 Win*7 IO Drivers **32Bit.msi** or Intel Atom E3800 Win*7 IO Drivers **64-bit.msi**.

   c. Select **Next** and accept the license agreement.

   d. Choose **Complete** and then select **Install**.

e. In the User Account Control Dialog box, select **Yes**.

f. Select "**install this driver software anyway**" until finished.

Note: If the system has imported the Intel Certification, check the checkbox "**Aways trust software from Intel Technology `Sdn.Bhd`**" and select **Install**.

g. Restart system.

5. Import Intel Certificate

   a. Go to path C:\Program Files\Intel\Intel Processor Win7 IO Drivers XXBit\iaiospi and double click on iaiospi.cat file

Note: Make sure your target machine have Network Connection.

   b. Go to path `C:\Program Files\Intel\Intel Processor Win7 IO Drivers XX Bit\iaiospi` and double click on `iaiospi.cat` file

   c. Click on `View Signature -> View Certificate -> Install Certificate -> Browse -> point import path to "Trusted Root Certification Authorities"`

   d. Click "**OK**" to proceed import.

   e. Restart

   f. Verify certification has successful import:

   g. Go to `Device Manager -> right click on any IO component -> go to Driver tab`

   h. Digital Signer is show "**Intel(R) Windows LPSS IO Drivers**"

Figure 1. Driver Properties Overview

2.2 Platform BKMs

The following are recommended platform rework procedures to enable the supported Win*7 IO drivers on Intel CRBs, which is not an exhaustive list of platform rework.

2.2.1 How to Rework Bakersport Fab B USB3.0 Port

By default, Bakersport Fab B has an issue with the USB3.0 port. This port fails to read several types of USB3.0 thumb drives and will not achieve USB3.0 performance.

Remark: Patriot Memory* 64 GB and EDGE DiskGo* 32 GB thumb drives are not recommended for use in the EHCI mode.

Affected Platform	Bakersport boards (PBA# **G72250-200 Rev 02) (Fab B)**
Rework Steps	1. Un-stuff choke on L8A2 2. Stuff R8A4 and R8A3 (0 ohms)

2.2.2 How to Rework Bakersport Fab B I^{2}C* Port 6

By default, Bakersport Fab B has an issue with the I^{2}C* port 6. This port fails to read and write due to incorrect resistor connections.

Affected Platform	Bakersport boards (PBA# **G72250-200 Rev 02) (Fab B)**
Rework Steps	1. UnStuff R5H9, R5H12, R5H8, R5H10 2. Stuff R5H4 (22 ohms) 3. Stuff R5H3 (22 ohms)

2.2.3 How to Rework UART in Bakersport and Bayley Bay

By default, Bakersport Fab B has an issue with I^{2}C port 6. This port fails to read and write due to incorrect resistor connection.

Rework Steps	1. Place a 10K resistor followed by a 28 AWG wire from R6J4 to R6H9 See below rework layout, yellow box is the 10K PU resistor which is attached by an orange wire to R6H9
Affected Platform	Bakersport boards (PBA# **G72250-200 Rev 02) (Fab B)** Bayley Bay boards Fab 3 (IOTG configured) platforms only

R6J5
R6J4
R6J3
R6H9
C6H2
C6H1
R6H8
R6H5
R6H4
R6H7
R6H3
R6H2
R6H6
R6J2
R6J1
TP6J3
TP6J2
TP6J1
R6H13
R6H12
R6H11
R6H10
J6J1

2.2.4 How to Rework Bayley Bay Fab 3 PCI-E* INLI Slot-Port 3

By default, Bayley Bay Fab 03 has an issue with PCI-E* Slot 3. This PCIe* slot fails to detect the network card after shutdown followed by power up (without switching off the main power).

Affected Platform	Bayley Bay boards Fab 3 (IOTG configured) platforms only
Rework Steps	1. Remove R6C4 2. Add jumper wire from C6C7 to R6C4 as shown below.
Reasons for the rework:	NIC cards don't get recognized in Windows while the jumper block (J7C2) is configured to Desktop mode, pins [1–2]. Failure mode occurs in PCIe* Slot3.

2.2.5 How to Use Serial Port in Bayley Bay

The common serial port on the Bayley Bay board does not work. The actual serial port is the Micro USB port near the COM port on the CRB board. Use a USB cable to connect the Micro USB port on the CRB board to the USB port on the host machine (laptop or desktop).

Install a driver on the host machine from the following link: http://www.ftdichip.com/FTDrivers.htm

Once the driver is installed, a virtual COM port is created in the host machine to communicate with the Bayley Bay board.

2.3 Software Driver BKMs

2.3.1 How to Enable Hibernation in WES7

By default, hibernation is disabled in WES7*. To enable it, start at the Windows* Command Prompt and type "**powercfg /h on**" to enable the hibernation.

2.3.2 How to Create OS Boot from USB Device for WES 7*

The following procedures outline the generic steps for enabling the OS boot on Windows* machines. Refer to the Microsoft* website for further instructions.

Prepare the setup environment as follows:

1. Connect a USB Flash Device which will be used to deploy the WES 7* image to the USB port and connect the storage device that contains WES 7 image.
2. Power up the system and boot to the **WES 7** image.
3. Select **Build an Image**. Accept the license terms and conditions, followed by Select **do not use a template**, choose a **language**, and then click **Next**.
4. In the select the packages window to include in your image page, click "**Feature Packages**" to expand the branch, then click "**Embedded Enabling Features**", and then select "**Bootable Windows USB Stack**".
5. Add any other additional drivers/packages that you may need.

   To install the chipset **INF**. and **NET** is required when installing the **WES**, or there would be an error as shown below:

6. Click on **Resolve Dependencies** and try to resolve all the dependency issues.

   Note: If you are asked to choose between the Standard Windows* USB Stack and a Bootable Windows USB Stack, make sure only the Bootable Windows USB Stack is checked.

7. On the drive-selection screen, select the install partition.
8. Click **next** and wait for the installation to complete.

2.3.3 How to Disable the DMA Feature for I²C*

There are seven I²C* controllers in the Intel® Atom™ E3800 processor and these controllers use the windows registry to control the DMA feature.

[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\iaioi2c\Parameters]

"ForceDma"="0,0,0,0,0,0,0"

ForceDma is a string type and there are seven values mapped to the seven I²C controllers which are device IDs from 0F41 to 0F47h.

Value 0, will force the DMA to be disabled, and I²C data will read/write in PIO mode.

Value other than 0, if data length is more than the specified value, I²C data will be read/write in DMA mode; if data length is less than the specified value, I²C data will read/write in PIO mode.

By default, without any registry settings, I²C will use PIO mode.

2.3.4 How to Set the Baud Rates of HS-UART

1. The baud rate is calculated based on the following method:

   Baud rate = (SourceClockFrequency) / (16 * divisor)

   Source Clock Frequency = 50000000* PrescalerMValue /PrescalerNValue*2

   For example, to set baud rate to 1M:

   Set PrescalerMValue = 64

   Set PrescalerNValue = 100

   SourceClockFrequency = 64,000,000

   Users can customize the value of **SourceClockFrequency, PrescalerMValue** and **PrescalerNValue** from the windows registry. Reboot the system after setting these values.

2. To support baud rates between 230,400 and 3,686,400, create and change the following registry settings:

   [HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\iaiouart\Parameters]

   ;High speed source clock, M and N prescalers

   "HSUartSourceClockFrequency"=dword:01c1f8f8

   "HSUartPrescalerMValue"=dword:00003fff

   "HSUartPrescalerNValue"=dword:00006c80

3. To support a baud rates between 300 and 115200, change the following registry settings for Low speed source clock, M and N prescalers:

   "UartSourceClockFrequency"=dword:001c2000

   "UartPrescalerMValue"=dword:0000025a

   "UartPrescalerNValue"=dword:00007fff

   See Section 27.2.3 Baud Rate Generator in the "*Bay Trail-I SoC External Design Specification*" document for details.

2.3.5 How to Install I/O Driver Unattended in Windows* 7

All operations mentioned below require **administrator privileges** in Windows 7 and WES7. You will need to write a windows batch file to complete these steps.

Suppressing the Windows Security prompt

1 This prompt will pop up every time during driver installation until the user clicks the "**Always trust software from**..." click box.

Note: To suppress this prompt, you need to first add the "**Intel Windows LPSS IO Drivers**." as a trusted publisher.

a. Manually install the Intel IO driver on Windows 7 and select the "**Always trust software from Intel Technology Sdn. Bhd**." click box.

b. After installation, run the Windows tool **certmgr.msc** and navigate to Trusted Publishers ->**Certificates**.

c. Export the certificate with the name "**Intel Windows LPSS IO Drivers**." to your local disk with DER encoded binary X.509 (.CER) format. For example, "**Intel.cer**".

d. On your other Windows platform where you intend to install the driver unattended, add the exported certificate to the Windows Trusted Publisher. Run the following command with administrator privileges:

- **certmgr.exe** -add **intel.cer -c -s -r localMachine TrustedPublisher**
- User can obtain ***certmgr.exe*** from Windows SDK. Refer to MSDN* Certificate Manager Tool

Suppress the Windows Installer prompt:

Intel IO driver package is in Windows Installer (MSI) format which can use the **msiexec.exe** to install it in **unattended mode**. For example, run this command in administrator privileges:

```
msiexec /i "Intel Atom E3800 Win7 IO Drivers 32Bit.msi" /passive
```

To uninstall it:

```
msiexec /x "Intel Atom E3800 Win7 IO Drivers 32Bit.msi" /passive
```

Unattended uninstallation when .msi file is not present.

Create a bat file with following command. Run the **bat file** as administrator.

```
wmic product where name="xxxxxx" call uninstall
```

Note: "xxxxxx" refers to the application name. For example: Intel Atom E3800 Win7 IO Drivers 32bit

2.3.6 How to Install I/O Driver Using INF or SYS File

By default, you can run the Intel driver **.msi** installer package to install the I/O drivers. Alternatively, you can also install I/O drivers by retrieving the raw driver package (the **inf** and **sys** file) in following folders:

For 64 bit driver: [Program Files]\Intel\Intel Atom E3800 Win7 IO Drivers 64bit.

For 32 bit driver: [Program Files]\Intel\Intel Atom E3800 Win7 IO Drivers 32bit.

After driver installation,install the driver using PnPUtil or Windows DP Installer.

Once installed the user also can customize their own installation directly based on the driver package files they can download in the examples below:

- Use PnPUtil tool to install driver by **inf** file http://msdn.microsoft.com/en-us/library/windows/hardware/ff550423(v=vs.85).aspx
- Use Driver Package Installer (DPInst) http://msdn.microsoft.com/en-us/library/windows/hardware/ff544842(v=vs.85).aspx

2.3.7 How to Install USB3.0 Driver into System

Note: For more details on USB 3.0 refer to the USB 3.0 "*Bring up Guide*.pdf" which is available for download through the VIP website.

1. Connect PS2/USB keyboard and mouse onto your system
2. Boot into Windows 7 with the below BIOS configuration:

   Go to "Device Manager" -> System Setup -> Boot -> set OS selection to "Win7 32/64 Legacy" -> commit changes and exit

   Go to "Device Manager" -> System Setup -> South Cluster Configuration -> USB Configuration -> Change XHCI mode to <smart Auto>
3. Boot system into windows and install the USB3.0 driver.
4. After installation has completed, go to the Device Manager to ensure that the below USB3.0 devices are shown under the Universal Serial Bus Controllers. Observe that the device should not have a yellow bang.
   - Intel® USB 3.0 eXtensible Host Controller
   - Intel® USB 3.0 Root Hub

2.3.8 How to Install Windows 7 32-bit into SD and eMMC* Storage Devices

Manual driver file extraction:

1. Download the Intel IO driver's setup.
2. Extract drivers from .exe using tools such as 7zip*.

Note: eMMC* and SD cards have same the driver files.

3. Open the iaiosd.inf file in notepad and change the last value in line with “EMMCBoot” from 0x00 to 0x01, example:
   a. From this: [iaioeMMCBoot_Services_AddReg]
   b. HKLM,"System\CurrentControlSet\Services\iaiosd\Parameters\Device", "**EMMCBoot**", %REG_DWORD%, 0x00
   c. To this: [iaioeMMCBoot_Services_AddReg]
   d. HKLM,"System\CurrentControlSet\Services\iaiosd\Parameters\Device", "**EMMCBoot**", %REG_DWORD%, 0x01
4. Copy **eMMC/SD** driver files (e.g **iaiosd**.*) to any removable media (e.g Windows installation USB).

Installation:

1 Prepare a bootable Windows installation USB.

2 Copy the **eMMC/SD** driver to a folder on Windows installation USB.

3 Boot the host System from USB

4 Continue until you reach the screen shown below:

5. Select “Load Driver” and Browse to the folder where you have copied eMMC/SD card driver files.

6. Select eMMC Host Controller driver (first option) & Press/Click Next

7. eMMC card will be shown as Unallocated Space. Delete/create new partitions or let Windows decide.
8. Click Next
9. Windows 7 setup will start copying files to eMMC and continue with rest of installation.

2.3.9 How to Install Windows 7 64-bit on to SD and eMMC* storage devices

Tools Required:

- Windows 7 64bit SP1 ISO image file
- An USB pendrive with Windows 7 64bit SP1 installer inside. (suggest 4 GB and above)
- An external hard drive with free space more than 10 GB
- A modified **storport.sys** file.
- A workstation with different OS (prefer Linux* OS)
- A Baytrail test station with SD card, eMMC card and hard drive plug in.
- Latest LPSS driver with SD and eMMC boot support.
- Windows update file: **Windows 6.1-KB2732471-v2-x64.msu** located at: https://support.microsoft.com/en-us/kb/2732471

Stage 1: Preparing a modified storport.sys file (on SUT)

1 Install Windows 7 64-bit SP1 on a Bayley Bay or Bakersport hard drive.

2 Install the latest LPSS driver.

3 Install windows update: Windows6.1-KB2732471-v2-x64.msu

4 Reboot the system.

5 Once OS is load, navigate to C:\Windows\System32**drivers.**

6 Locate **storport.sys** and copy it out.

For convenience copy the files located in this folder: C:\Program Files (x86)\Intel\Intel Processor Win7 IO Drivers 64Bit\iaiosd\.

Stage 2: Inject storport.sys into Windows 7 64Bit SP1 installer (on workstation)

1 On external hard drive (E:\ or it may be other drive letter), create a folder call wim (E:\wim) and another folder call temp (E:\temp).

2 Open Windows 7 64bit SP1 ISO file, extract files: **boot.wim & install.wim** to directory: E:\wim.

3 Now, hit Start Menu, launched **Command Prompt** with administrator privileges.

4 Mount **boot.wim 1** image with write permissions.

```
C:\windows\system32>dism /mount-Wim /WimFile:E:\wim\boot.wim /Index:1
/MountDir:E:\temp
```

5 Open a Windows Explorer window and navigate to E:\wim\mount\Windows\System32\drivers.

6 Locate and replace the existing storport.sys file with the one grabbed in Stage 1.

7 Unmount and commit the boot.wim 1 image.

```
C:\windows\system32>dism /Unmount-Wim /MountDir:E:\temp /Commit
```

8 Again, mount boot.wim 2 image with write permissions.

```
C:\windows\system32>dism /mount-Wim /WimFile:E:\wim\boot.wim /Index:2
/MountDir:E:\temp
```

9 Open a Windows Explorer window and navigate to E:\wim\mount\Windows\System32\drivers.

10 Locate and replace the existing storport.sys file with the one grabbed in Stage 1.

11 Unmount and commit the boot.wim 2 image.

```
C:\windows\system32>dism /Unmount-Wim /MountDir:E:\temp /Commit
```

12 For install.wim, mount the WIM image with write permissions:

```
C:\windows\system32>dism /mount-Wim /WimFile:E:\wim\install.wim /Index:4
/MountDir:E:\temp
```

Index 4, is in the case for Windows 7 Ultimate Edition 64-Bit. In case you need other editions of Windows 7, run following command:

```
C:\Windows\System32>dism /Get-WimInfo /WimFile:E:\wim\install.wim
```

And select correspondent index number.

13 Once the mounting process done, unplug the external hard drive without closing the current command prompt.

14 Plug in the external hard drive to a Linux* system as a superuser and navigate to <external hard drive>:\wim\mount\Windows\System32\drivers.

15 Locate and replace the existing storport.sys file with the one grabbed in Stage 1.

16 Unplug the external hard disk and plug it back into the workstation.

17 Unmount and commit the install.wim image.

```
C:\windows\system32>dism /Unmount-Wim /MountDir:E:\temp /Commit
```

18 Done for injecting storport.sys into Windows 7 64Bit SP1 installer.

19 Replace the boot.wim and install.wim in the USB pendrive with Windows 7 64Bit installer in folder: <USB pendrive>:\sources\

20 The installer is ready to use.

Stage 3: Install Windows 7 64Bit SP1 on SD or eMMC card.

1. Copy the iaiosd folder obtained in Stage 1 on to the installer pendrive.
2. Plug in the SD or eMMC card into Bayley Bay or Bakersport.
3. Plug in the installer pendrive into Bayley Bay or Bakersport.
4. Power up the SUT and boot into installer pendrive.
5. Perform any necessary operation until hard drive selection page.
6. Notice no drive/partition is showing up in this page.
7. Click on Load drivers button and navigate to the iaiosd folder in the installer pendrive.
8. Select the correspondent driver for SD or eMMC card.
9. Notice the disk drive for SD or eMMC card is showing up.
10. Select the drive and perform OS installation as usual.

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