

Intel[®] Serial IO Driver

User Guide and Release Note

Braswell SoC, Windows 10 64bit

June 2015

Revision 1.3

Intel Confidential



INFORMATION IN THIS DOCUMENT IS PROVIDED IN CONNECTION WITH INTEL PRODUCTS. NO LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT. EXCEPT AS PROVIDED IN INTEL'S TERMS AND CONDITIONS OF SALE FOR SUCH PRODUCTS, INTEL ASSUMES NO LIABILITY WHATSOEVER AND INTEL DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY, RELATING TO SALE AND/OR USE OF INTEL PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

A "Mission Critical Application" is any application in which failure of the Intel Product could result, directly or indirectly, in personal injury or death. SHOULD YOU PURCHASE OR USE INTEL'S PRODUCTS FOR ANY SUCH MISSION CRITICAL APPLICATION, YOU SHALL INDEMNIFY AND HOLD INTEL AND ITS SUBSIDIARIES, SUBCONTRACTORS AND AFFILIATES, AND THE DIRECTORS, OFFICERS, AND EMPLOYEES OF EACH, HARMLESS AGAINST ALL CLAIMS COSTS, DAMAGES, AND EXPENSES AND REASONABLE ATTORNEYS' FEES ARISING OUT OF, DIRECTLY OR INDIRECTLY, ANY CLAIM OF PRODUCT LIABILITY, PERSONAL INJURY, OR DEATH ARISING IN ANY WAY OUT OF SUCH MISSION CRITICAL APPLICATION, WHETHER OR NOT INTEL OR ITS SUBCONTRACTOR WAS NEGLIGENT IN THE DESIGN, MANUFACTURE, OR WARNING OF THE INTEL PRODUCT OR ANY OF ITS PARTS.

Intel may make changes to specifications and product descriptions at any time, without notice. Designers must not rely on the absence or characteristics of any features or instructions marked "reserved" or "undefined". Intel reserves these for future definition and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to them. The information here is subject to change without notice. Do not finalize a design with this information.

The products described in this document may contain design defects or errors known as errata which may cause the product to deviate from published specifications. Current characterized errata are available on request.

Contact your local Intel sales office or your distributor to obtain the latest specifications and before placing your product order.

Copies of documents which have an order number and are referenced in this document, or other Intel literature, may be obtained by calling 1-800-548-4725, or go to: <http://www.intel.com/design/literature.htm%20>

All products, computer systems, dates, and figures specified are preliminary based on current expectations, and are subject to change without notice.

This document contains information on products in the design phase of development. Do not finalize a design with this information. Revised information will be published when the product is available. Verify with your local sales office that you have the latest datasheet before finalizing a design.

Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. See www.intel.com/products/processor_number for details.

Code names featured are used internally within Intel to identify products that are in development and not yet publicly announced for release. Customers, licensees and other third parties are not authorized by Intel to use code names in advertising, promotion or marketing of any product or services and any such use of Intel's internal code names is at the sole risk of the user.

Intel, Celeron, Pentium, and the Intel logo are trademarks of Intel Corporation in the U.S. and/or other countries.

*Other names and brands may be claimed as the property of others.

Copyright © 2014, Intel Corporation. All rights reserved.



Contents

1	Introduction	5
	1.1 Purpose and Scope of Document	5
	1.2 Acronyms and Terminology	5
2	Release Kit Summary	7
	2.1 Release Kit Details	7
3	Driver Installation	8
	3.1 Manual Driver Installation via INF File	8
	3.2 Driver Installation via Installer	9
	3.3 Silent Driver Installation via Installer	11
4	Driver Uninstall	14
	4.1 Uninstalling the Driver via Control Panel	14
5	Supported Languages	16
	5.1 Introduction	16
6	Changing SDA Hold Time	17
	6.1 Purpose	17
	6.2 BIOS ACPI DSDT Table	17
	6.3 Windows Registry Key	17
7	Closed Issues	19
8	Known Issues	20
9	Limitations	21



Revision History

Revision Number	Description	Revision Date
1.3	Fixed MUP file.	June 2015
1.2	Production Version for Win10 64 bits	June 2015
1.1	Released to support Win10 64 bits. Documentation changed only. Binaries are the same with Win8.1 64 bits version.	April 2015
1.0	Production Version - Added instruction to tune SDA hold time. - Driver .cat/.inf/.sys file name changed.	March 2015
0.95	Production Candidate - Fixed MUP file.	March 2015
0.91	Beta release - Fixed mup.xml file - Update silent install instructions in bring up guide	February 2015
0.9	Pre-Beta release - I2C controller driver filename changed to iaioi2c.inf/sys - Added Installer support - Added mup.xml support	December 2014
0.82	Update documentation	October 2014
0.81	Alpha	October 2014
0.8	Initial release	July 2014



1 Introduction

1.1 Purpose and Scope of Document

This document provides installation instructions and general usage of the driver as well as release information, such as release kit summary, important notes, resolved issues and known issues. This document is intended to help OEM and ODM customers setup their platform as they prepare for validation and debug.

This Intel® Serial IO Drivers support the following operating system and platform:

Operating System:

- Windows* 10 Operating System (64-bit version)

Hardware Requirements:

- Braswell

1.2 Acronyms and Terminology

Term	Description
ACPI	Advanced Configuration and Power Interface
BIOS	Basic Input/Output System
BKC	Best Known Configuration
DMA	Direct Memory Addressing
GPIO	General Purpose IO
I2C	Inter-Integrated Circuit, generically referred to as "two-wire interface"
LTR	Latency Tolerance Reporting
MMIO	Memory Mapped I/O
PIO	Programmed I/O



Introduction

§



2 Release Kit Summary

2.1 Release Kit Details

Kit Name:

Intel® Serial IO I2C, UART and GPIO Controller Drivers

Driver Version:

Intel® Serial IO I2C Controller Driver	604.10120.2652.361
Intel® Serial IO UART Controller Driver	604.10120.2654.367
Intel® Serial IO GPIO Controller Driver	604.10120.2653.391
Installer ¹	152702

Note¹:

Please use the LPSS_X64_Threshold_install_NNNNNN.EXE installer for driver installation. The Setup.exe installer included in this driver package is to be used in conjunction with the mup.xml file. If you do not need the mup.xml, please do not use Setup.exe.



3 *Driver Installation*

3.1 Manual Driver Installation via INF File

Follow the steps below.

1. Copy and unzip the Intel® Serial IO Driver Kit to the platform under test
2. Locate the INF file.

Intel® Serial IO I2C:	iai2ce.inf
Intel® Serial IO UART:	iauarte.inf
Intel® Serial IO GPIO:	iagpioe.inf

3. Right click on the INF file and select 'Install' option from the menu
4. Click the 'Yes' button in the pop-up window to start installation.



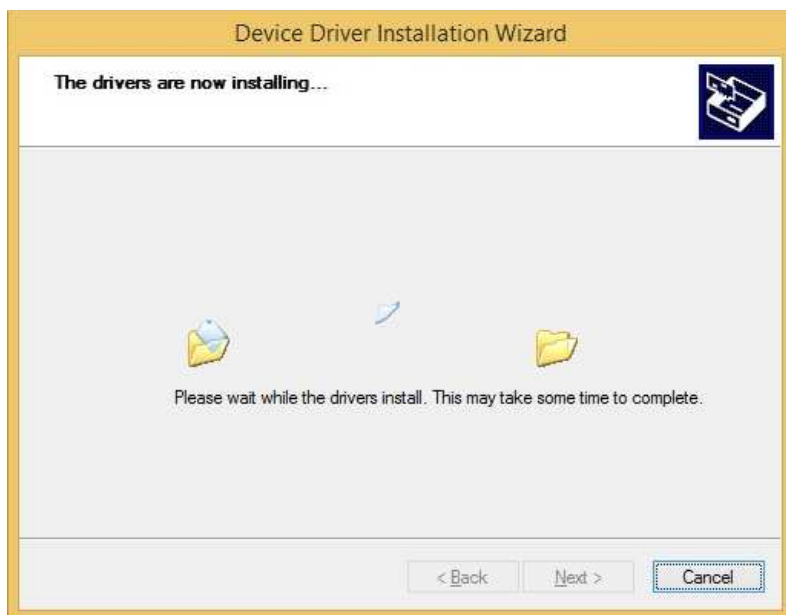
3.2 Driver Installation via Installer

Follow the steps below:

1. Copy and unzip the Intel® Serial IO Driver Kit to the platform under test
2. Locate the installer .EXE file.
3. Right click on the .EXE file and select "Run as administrator" option menu. Click "Yes" button in User Account Control pop-up window.
4. You should see the welcome screen as shown below.



5. Click "Next". The installation will takes a few minutes. You will see the screen as below.



6. For successful install, you will see screen as shown below.



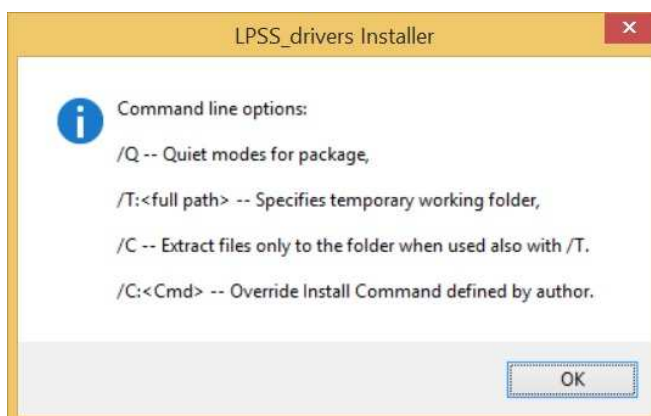


3.3 Silent Driver Installation via Installer

Follow the steps listed below:

1. Copy and unzip the Intel® Serial IO Driver package onto the Platform under test.
2. Open a Command Prompt (cmd.exe) with administrator rights (ie. Run as Administrator). Click on 'Yes' button in User Account Control pop-up window.
3. Change the directory to where you unzipped the driver package in Step 1 above and then change to the "Driver Installer" directory.
4. Locate the installer executable file (ie: LPSS_X64_Threshold_install_NNNNNN.EXE where the NNNNNN is the installer version number)
5. To see all available options for the Installer, run command:

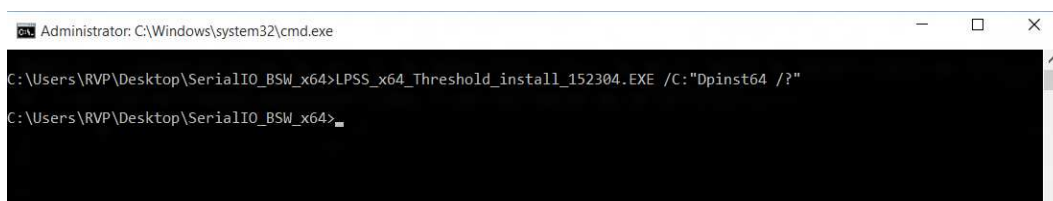
"LPSS_X64_Threshold_install_NNNNNN.EXE /?"



Note that only the /C:<Cmd> option will be supported. The installer executable contains Microsoft's Driver Package Installer (DPInst) version 2.1 (DPInst.exe). All the silent install commands are supported from DPInst.

6. To see the commands supported by DPInst, run:

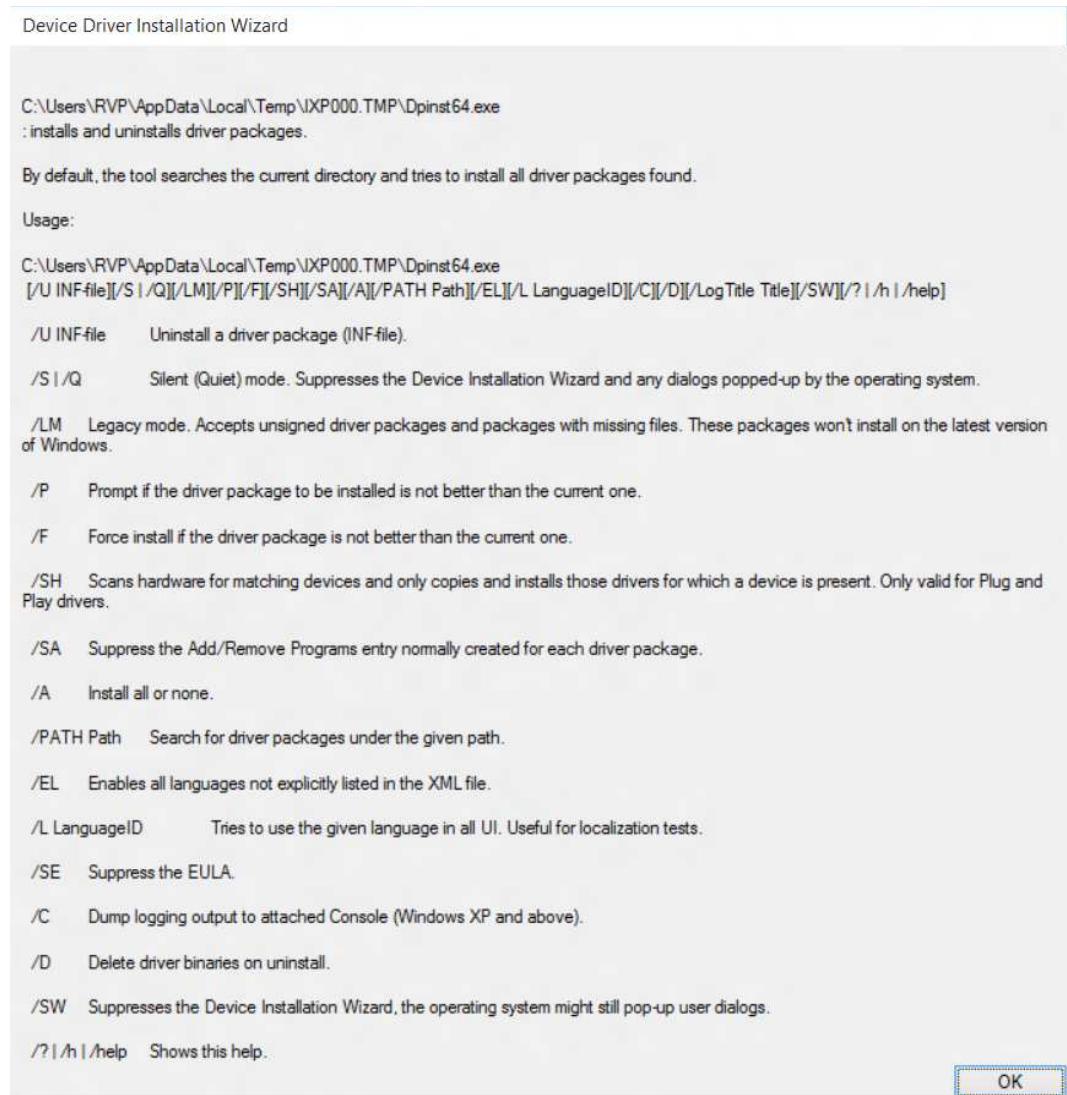
"LPSS_X64_Threshold_install_NNNNNN.EXE /C:"DPInst64 /?" Example as below:



A pop-up menu will show the supported command by DPInst. Example as below:



Driver Installation



Note that not all command listed above are validated by Intel. Customer are advice to do their own validation.

7. Silent Installation Command example:

Tasks	Command
To install all Serial IO drivers ¹	LPSS_X64_Threshold_install_NNNNNN.EXE /C:"DPInst64 /Q"
To see DPInst help	LPSS_X64_Threshold_install_NNNNNN.EXE /C:"DPInst64 /?"

Driver Installation



Note¹: The Serial IO controllers must be enabled in BIOS setup menu for I2C, HSUART and GPIO controller.

8. Restart system once installation is completed.

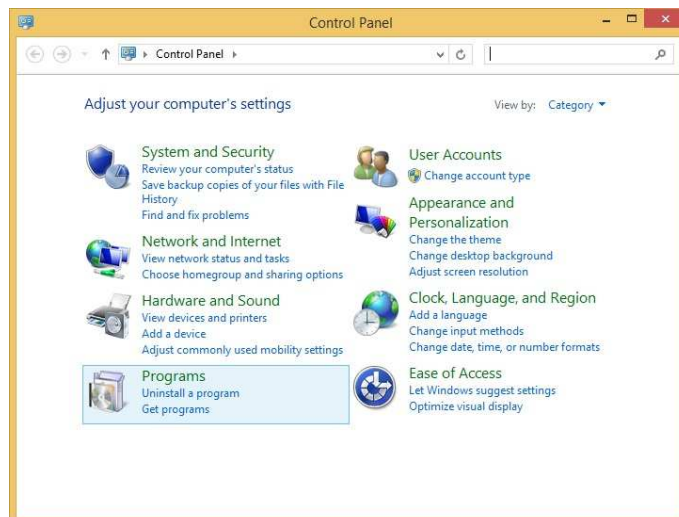


4 Driver Uninstall

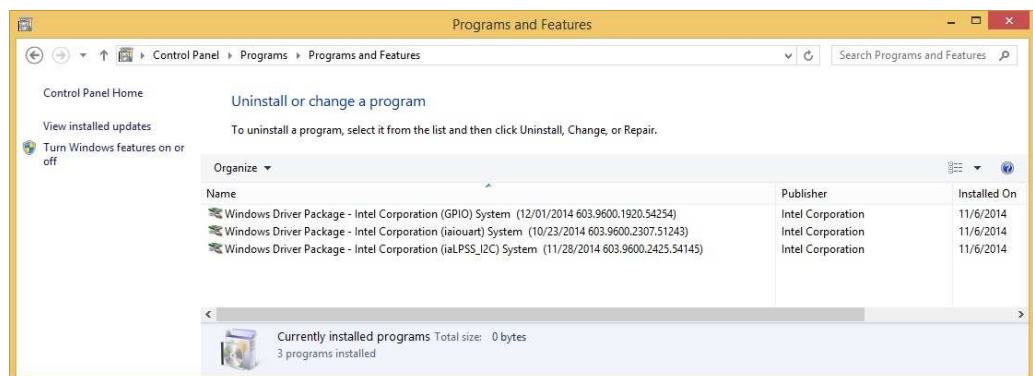
4.1 Uninstalling the Driver via Control Panel

Follow the steps below.

1. Open Control Panel.
2. If the Control Panel window is shown in 'Category' view, then select "Uninstall a program" as shown below. Otherwise if the Control Panel window is shown in 'icon' view, then select "Programs and Features".



3. On the next window, select the Serial IO driver that would like to uninstall. Then, click the "uninstall" button.



Driver Uninstall



4. Click "Yes" to continue.



5. Restart your system for the change to take effect.



5 Supported Languages

5.1 Introduction

The supported languages for the installer is as listed below.

LCID	Language	LCID	Language
0401	Arabic	0411	Japanese
0804	Chinese (Simplified)	0412	Korean
0404	Chinese (Traditional)	0413	Dutch
0405	Czech	0414	Norwegian
0406	Danish	0415	Polish
0407	German	0416	Portuguese (Brazil)
0408	Greek	0816	Portuguese (Standard)
0409	English (USA)	0419	Russian
040A	Spanish	041D	Swedish
040B	Finnish	041F	Turkish
040C	French		
040D	Hebrew		
040E	Hungarian		
0410	Italian		



6 Changing SDA Hold Time

6.1 Purpose

Based on Intel® Braswell External Design Specification (EDS), the SDA hold time, $t_{HD:DAT}$ is more than 0. This section is added based on special cases where the SDA hold time need to be tune such as for debug purposes. Most design do not need to tune the SDA hold time.

The Intel® Serial IO I2C driver implemented two methods for customer to modify the I2C SDA hold time. The `_SHT` method in system BIOS DSDT table and Windows registry key method. The Intel® I2C driver look for SDA override value in DSDT table first, follow by Windows registry. If both are not found, a default value is loaded.

In the event where the newly tuned SDA hold time value need to be permanently implemented in your system. The BIOS DSDT method is preferred.

6.2 BIOS ACPI DSDT Table

System BIOS add the `_SHT` method in DSDT table. Intel® I2C driver look for this value in DSDT table and write the value to "I2C SDA Hold Time Length Register (`IC_SDA_HOLD`)" in the Braswell SoC.

Example:

```
Device (I2C1) {
    Name (_ADR, Zero)          // _ADR: Address
    Name (_HID, "80860F41")    // _HID: Hardware ID
    Name (_CID, "80860F41")    // _CID: Compatible ID
    Name (_DDN, "Intel(R) I2C Controller #6 - 80860F46")
    Name (_UID, 0x06)          // _UID: Unique ID
    Name (_SHT, 0x32)          // Replace the SDA_HOLD value ...
}
```

The `_SHT` method override the SDA hold time for all I2C modes of operation, include Standard mode (100Kb/s), Fast mode (400Kb/s), Fast Mode Plus (1Mb/s) and High-Speed mode (1.7 Mb/s)

6.3 Windows Registry Key

Alternately, the SDA hold time can be change dynamically under Windows Operating System. This provide better flexibility for debug purposes.

Follow the steps below:

1. Install the latest Intel® Serial IO I2C Driver.



2. Restart system.
3. Add the SDA hold time override value to Windows registry. User can copy the sample code below. Write to a txt file and rename the text file to .reg extension. Double click the .reg file to add the registry key to Windows.
4. After that, open Windows Device Manager, select "System devices". Right click. Then, select "Scan for hardware changes". The new SDA key in the registry will be loaded after that.

Example code:

```
Windows Registry Editor Version 5.00
[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\iaioi2c]

; Timing override for I2C SDA hold time (All Fast Speed)
"BUS_FS_SDA_1"=dword:0000000F
"BUS_FS_SDA_2"=dword:0000000F
"BUS_FS_SDA_3"=dword:0000000F
"BUS_FS_SDA_4"=dword:0000000F
"BUS_FS_SDA_5"=dword:0000000F
"BUS_FS_SDA_6"=dword:0000000F
"BUS_FS_SDA_7"=dword:0000000F
```

For the example above, it changes SDA hold time for I2C controller number 1 to number 7 for fast speed mode (FS).

To change SDA hold time for other operation mode, use the table below:

SS	Standard Speed (100Kb/s)
FS	Fast Speed (400Kb/s)
FP	Fast Mode Plus (1Mb/s)
HP	High-Speed (1.7Mb/s)

Example:

Change I2C controller no 4, high-speed mode (1.7Mb/s) SDA hold time to 0x8

```
"BUS_HP_SDA_4"=dword:00000008
```



7 Closed Issues

Issue #	Description	Resolution
5505259/ 5584421	I2C touch pad not working probably caused by interaction with GPIO driver.	Fixed in pre-beta package.
N/A	Intel® Serial IO Controller driver name shown in Microsoft Windows Device Manager is not final and subject to change in future Serial IO kit releases.	Fixed in alpha package.
N/A	Braswell A3 UART feature not enabled/verified. This feature is not recommended for validation. Refer to CDI#550213.	Fixed in alpha package.



8 *Known Issues*

Issue #	Description
n/a	



9 Limitations

#	Description
1	Intel® Serial IO Controller Driver install, uninstall, upgrade and downgrade using Microsoft devcon.exe tool is not supported.