

# User Manual DA9213, DA9214, and DA9215 Performance Boards

## **UM-PM-029**

### Abstract

This document is a user guide for DA9213, DA9214, and DA9215 Performance Boards. It provides the basic information on how to configure the PCB, how to install and use the Power Commander (GUI) software.



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# DA9213, DA9214, and DA9215 Performance Boards

## **1** Terms and Definitions

Ball Grid Array
Central Processing Unit
Double Data Rate SDRAM (Synchronous Dynamic Random Access Memory)
Device Under Test
Graphic Processing Unit
Graphical User Interface
Printed Circuit Board
Point Of Load
Power Supply Unit
Universal Serial Bus

## 2 References

[1] DA9213, DA9214, and DA9215, Datasheet, Dialog Semiconductor.



## 3 Introduction

DA9213, DA9214, and DA9215 are multi-phase buck converters optimized for the supply of CPUs, GPUs, and DDR memory rails in smartphones, tablets, and other handheld applications.

DA9213 is configured as a single channel 4-phase buck converter capable of delivering up to 20 A output current. DA9214 is configured as 2-channel, 2-phase buck converter capable of delivering up to 10 A output current per channel. DA9215 is configured as 2-channel PMIC with a 3-phase buck converter capable of delivering up to 15 A output current and a single-phase buck converter capable of delivering up to 5 A output current.

The output voltage is configurable in the range 0.3 to 1.57 V. The input voltage range of 2.8 to 5.5 V makes it suited for a wide variety of low voltage systems, including all Li-Ion battery supplied applications.

DA9213, DA9214, and DA9215 Performance Boards have been designed to allow measurement, evaluation, and programming of the device.

The Power Commander software DA9215\_1v5 can be used for DA9213, DA9214, and/or DA9215 Performance Boards. It uses a simple graphical interface, allowing the device to be controlled via the USB port of a PC. The mini USB connection is visible on the board and as long as the cable is connected to the USB port of the PC the green LED D3 is on.

The software allows the configuration of the device by write and read operations to all control registers, and provides monitoring of device status. The software uses operating system Windows 2000/XP/Vista/Windows 7 with a USB1.1 or USB2.0 interface.

### **4** Software Installation

Plug the USB stick into a spare port on your computer and run the program **setup.exe** to start the automated script. This file can be found in the Software directory.

By default, the directory C:\Dialog Semiconductor\Power Management\DA9215\_1v5 is used.

₩ DA9215_1v5	
Destination Directory Select the primary installation directory.	
All software will be installed in the following locations. To install software into a different location, click the Browse button and select another directory.	
Directory for DA9215_1v5 C:¥Dialog Semiconductor¥Power Management¥DA9215_1v5¥	Browse
Directory for National Instruments products C:¥Program Files¥National Instruments¥	Browse
<pre>&lt; Back Next &gt;&gt;</pre>	Cancel

1. Click **Next** to accept the default software installation location.

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↓ DA9215_1v5	
License Agreement You must accept the licenses displayed below to	o proceed.
<u>Power Management Controlle</u> <u>Software Licens</u>	er and Power Commander e Agreement
BY CLICKING "AGREE" TO THIS (HEREINAFTER, "CUSTOMER") ACK READ, UNDERSTOOD AND AGREE TO THIS LICENSE AGREEMENT IN REI POWER MANAGEMENT CONTROLL SOFTWARE SUPPLIED BY DIA	S LICENSE AGREEMENT, YOU NOWLEDGE THAT YOU HAVE D BE BOUND BY THE TERMS OF LATION TO YOUR USE OF THE ER AND POWER COMMANDER LOG SEMICONDUCTOR Ltd.
	<ul> <li>I accept the License Agreement.</li> <li>I do not accept the License Agreement.</li> </ul>
	<< Back Next >> Cancel

2. Click the radio button to accept the software license agreements twice.

₩ DA9215_1v5	- • •
Start Installation Review the following summary before continuing.	
Adding or Changing • DA9215_1v5 Files	
Click the Next button to begin installation. Click the Back button to change the installation setting	gs.
Save File) << Back Next >>	Cancel

3. Click **Next** to begin the software installation.

₩ DA9215_1v5		
Installation Complete		
The installer has finished updating your system.		
	< < Back N	lext>> Finish

4. When the installer indicates it has finished updating, click **Finish** to complete the process.

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### NOTE

After the installation has been completed you need to restart your computer.

- Plug in the USB cable so that Windows detects the USB device. A prompt for the drivers, which should be automatically located in the Driver\_PID-1011 directory of the media, appears. If this does not happen automatically, open the Device Manager:
  - Disk drives
     Display adapters 👂 🕼 Human Interface Devices IDE ATA/ATAPI controllers 👌 📲 IEEE 1394 Bus host controllers Keyboards Mice and other pointing devices Monitors Network adapters Other devices 🔚 📠 Dialog USB-Lab IO Ports (COM & LPT) Processors SD host adapters Devices Sensors Smart card readers Sound, video and game controllers ▷ I System devices
- 6. Double-click on the unknown Dialog device, and update the driver as shown:

Bevice Manager			
File Action View Help			
🗢 🔿 📧 🔯 Dialog USB-Lab IO Properties			
Amile MN-ENG-LT-MK     Batteries     General Driver Details	🕞 📱 Update Driver Software - Dialog USB-Lab IO		
p - €     Bluetooth Radios       p - €     Computer       p - №     Credential Vault Device       p - ∞     Credential Vault Device   Dialog USB-Lab IO	How do you want to search for driver software?		
Display adapters     Display adapters     Manufacturer: Unknown     Gamer Device Status     Coalion: Port_#0001.Hub_#0008     Ord_#0001.Hub_#0008     Ord_#0001.Hub_#0008     Ord_#0001.Hub_#0008	Search automatically for updated driver software Windows will search your computer and the Internet for the latest driver software for your device, unless you've disabled this feature in your device installation settings.		
→ Ů     Mice and other pointin.     The drivers for this device are not installed. (Code 28)       →     Monitors     There is no driver selected for the device information set or element.       →     Note Vertoric Adapters     element.       →     Dialog USB-Lab IO     To find a driver for this device, click Update Driver.	Browse my computer for driver software Locate and install driver software manually.		
Update Driver			
A System devices     OK Can	Cancel		
a - ⊕ Universal Serial Bus controllers	-		

 Browse to the Driver\_PID-1011 directory of the media. When installed correctly, Dialog USB Driver is listed on the Device Manager.



	Browse For Folder
	Select the folder that contains drivers for your hardware.
	Image: Computer         Image: Network         Image: DA9063_CD         Image: Docmentation         Image: Driver_PID-1011         Image: Driver_PID-1011         Image: Driver_PID-1011         Image: Driver_PID-1011
	OK Cancel
Dialog USB-Lab IO Properties	Update Driver Software - Dialog USB-Lab 10
Dialog USB-Lab IO	Windows has successfully updated your driver software
Device type: Other devices Manufacturer: Dialog Semiconductor	Windows has finished installing the driver software for this device:
Location: Port_#0001.Hub_#0008	Dialog USB-Lab IO
This device is working property.	
OK OK	Cancel

### Figure 1: Successful Installation Procedure

To uninstall the software please use the Windows Add/Remove Programs function, which is in the Start, Settings, Control Panel menu.



### 5 Hardware

Each device has its dedicated evaluation PCB. DA9213 Performance Board is based on PCB numbered 227-02-A, DA9214 Performance Board is based on PCB numbered 227-04-D, and DA9215 Performance Board is based on PCB numbered 227-07-B.

The Performance Board includes an USB-I<sup>2</sup>C bridge for communication with the device and a few external active components to reduce the requirement for external equipment. It also has some jumper links to provide access to different configurations and measurement test points (see Appendix A). Altering the jumper positions should only be done with a complete understanding of the links description and a supplemental configuration of some registers may be required.



Figure 2: DA9213 Performance Board (227-02-A)

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Figure 3: DA9214 Performance Board (227-04-D)





Figure 4: DA9215 Performance Board (227-07-B)

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## 6 Configuration Tab

The software is launched by clicking the shortcut in the **Start** menu.

The optimum setting for the PC display size is 1024x768 pixels or above. The font size on the PC display should be normal (95dpi). It is important to note that a display size other than the recommended setting may affect the way in which the tabs appear.

A pop-up for selecting a configuration file appears on start-up. If you do not have any to load, click **Cancel**.

Figure 5 appears, with the **USB OK?** LED lit if the USB cable is correctly connected and the USB interface is functioning.



### Figure 5: Initial Interface

Three tabs are available across the top:

- 1. Control, for the main settings of I/Os, the interface and the status/event registers.
- 2. **Configuration**, for advanced DA9213, DA9214, or DA9215 configuration.
- 3. Buck, which includes all the buck settings (output voltages, operating modes)

As the software has been developed to evaluate DA921X and DA9063 (main PMIC) separately or together on the same PCB, the specific DUT can be configured in the drop-down menu at the bottom left of the screen. By default this is **DA921X only** as shown in Figure 6.





Figure 6: DUT Selection

### 6.1 Interface Indicators

DA9215/13	3/14 IRQ
Start Device	Polling Enabled
	USB OK?
Interface	No Ack
SAM3U	12C 🗸
No	Stop
Communication	Program

### Start Device

When pressed it automatically configures the register R327 CONFIG\_E for standalone operation.

### Polling Enabled

If disabled, the main read-backs from the device are suppressed. This is used to force the communication over the bus to be silent.

If this is set to automatic, the program only polls the device while the application is the topmost window. If obscured by another program or window, polling is disabled.

### LED

If device is active this is green, otherwise it is red.

### Interface

Select between USB I<sup>2</sup>C control, offline mode, and SPI. Switching to offline, then back to USB reinitialises the USB interface.

### USB OK?

The light indicates that the USB is fine and communicating.

### Read Chip ID

These fields indicate the device version and trim status when the device is active. When inactive, the version and trim status are not correct.

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### Stop Program

This terminates the program but leaves it inactive on the screen.

### 6.2 File Load/Save

File Operations	
Load	-
Save	▼

### Load

Load previously saved text files.

#### Save

Save current panel state to a text file. Selecting the **Register Dump** option saves the current register values to the text file, see Appendix A.

Note 1 There is a difference between Save and Register Dump. Save dumps the contents of all panel controls to the file (a save state operation), while Register Dump reads the device contents (including status registers) into the file.

### 6.3 Register Access

This is probably the most important section of the Configuration Panel.



#### **CoPMIC** slave

Set the slave address of the device. This affects all I<sup>2</sup>C communications. See also the register INTERFACE in the DA9213/4/5 Datasheet [1].

### Find

Finds a control matching a full or partial register name, a control bit name, a register number (for example, R208 or D0h). Pressing **Find** repetitively steps through all matching items.

#### Send

Sends single byte data to I<sup>2</sup>C device using Slave Address, Register Address, and Data to Send.

#### Read

Reads single byte data from I<sup>2</sup>C device using Slave Address and Register Address.

User	<sup>.</sup> Manual	
0301	manuai	



<mark>a)</mark>	<mark>b)</mark> ⇒ []
c) t	
d) all back ind.	e) ad all

### a) Synchronize Panel from Device

Reads all the register contents of the device and updates the panel to match.

#### b) Synchronize Device from Panel

Writes all the device registers to match the panel (refresh operation).

#### c) Reset Configuration

Resets the registers to values specified in configuration file.

#### d) Clear all read-back indication

Sets all read-back indicators to 0.

#### e) Read all read-back

Reads all registers, comparing with the panel controls.

### 6.4 Control Tabs

The tabs DA921X Control, DA921X Configuration, and DA921X Buck all have the same format.

Each register cluster comprises a control with a mixture of:

- 1. Boolean toggle buttons.
- 2. Multi-value ring controls or slide controls.
- 3. A hex indicator showing the total equivalent value.
- 4. A read-back indicator showing the current contents of the register. The read-back indicator is labeled with the register number in both decimal and hex.

Read-back indicators can be switched individually by clicking on the **x** to decimal, octal, hex, or binary, or they may all be changed at once between hex and binary by using the **Settings**, **Binary Indicators** menu item.



BUCKA_CONT		×D
Bit 7		Disabled
VBUCK_GPI	0	00 : NONE
BUCK_SEL	1)	VBUCK_A
PD_DIS		Disabled
BUCK_GPI	0	00 : NONE
BUCK_EN		Disabled
R9	3=05D	h 00
BUCKA_CONF_A		×92
DOWN_CTRL	100 :	20mV/us 🤜
UP_CTRL	100:	20mV/us
MODE	10 :	SYNC .
R20	9=0D1	h ×00
_VBUCKA_MAX_		(7⊨ 3)
MAX () 1111	111 : 1	.57v <b>2)</b>
R213=0D5h	×00	4)
_VBUCKA_CTRL_A	×4	6
SL A	SYNC	
VB_A	0:1.0	OV
R215=0D7h	00	
iters op in a		
VBUCKA_CTRL_B	× 46	5

Changing a register control immediately sends the value to the selected register, and reads the value back again, comparing the result with the hex indicator. Note that all bits of the registers are sent at once. Therefore, this does not allow changing multiple bits simultaneously.

If the read-back indicator is red, it indicates that the current value does not match the panel.



## 7 Quick Start Tutorial Guide

This section provides instructions for starting up the evaluation board and the software to get the device up and running. It also tackles the first steps of making modifications on the device.

DA9214 Performance Board (227-04-D) is used for this example; however, the same method applies for both DA9213 and DA9215 Performance Boards.



Figure 7: Measurement Set-Up

Supply DA9214 from the VSYS and GND connectors as shown in Figure 7. A voltage of 3.7 V (typical Li-Ion battery voltage) is applied and the input current is measured via a multi-meter. The output voltage can be directly measured via a second multi-meter.

Start the GUI software installed on your computer. The **USB OK?** LED on the right-hand side of the screen should be off if the USB cable is not plugged. Once the USB cable is connected the LED displays a steady green. The Interface selector should show **SAM3U I2C**. If not, change it to **off** and then to **SAM3U I2C**.

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At the top right of the configuration tab the interface indicator should display the same details as shown in Figure 8.



Figure 8: Top Right Interface Indicator

Select the **Start Device** button to configure the software for standalone operation correctly. This enables control of the DA9214 in standalone mode. In this mode, DA9214 acknowledges all I<sup>2</sup>C commands, which does not always happen if it is in companion mode.

For details please refer to the STAND\_ALONE bit in the Datasheet [1].

Synchronize the panel from the device, by pressing the icon (indicated by the red arrow in Figure 9), the target voltages and all DA9214 parameters are updated to the content of the IC registers.

I2C i/f <mark>∮×D0</mark> CoPMIC slave
Find     ↓×0     Reg. address       Send     ↓×0     Data to Send       Read     ×40     Data read
₽↔□₽↔□
Reset Configuration

Figure 9: Bottom Right Interface Indicator

Enable the BUCKA converter by pressing on the BUCK\_EN button in BUCKA Control, which is equivalent to writing 0x01 into the related bit, see Figure 10. An increase in the current drawn from the external supply will occur.

### NOTE

The quiescent current shown on the multi-meter may still be higher than expected. This is due to the missing configuration and connection of floating I/O ports and will be reduced as soon as they are correctly set.

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File Settings Help DA921X Control DA921X Configuration DA921X Buck BUCKA Control BUCKB Control	BUCK Configuration	• DA9215/13/14 IRQ
BUCKA_CONT         *1         BUCKE_CONT         *0           BR7         Disabled         BR7         Disabled           VBUCK_GPI         00: NONE         BR7         VBUCK_GPI         00: NONE           BUCK_SEL         VBUCK_A         PD_DIS         Disabled         BUCK_SEL         VBUCK_A           BUCK_GPI         00: NONE         BUCK_SEL         VBUCK_GPI         Disabled         BUCK_SEL         VBUCK_A           BUCK_SPI         00: NONE         BUCK_SFL         Disabled         BUCK_GPI         Disabled           BUCK_SPI         00: NONE         BUCK_SFL         Disabled         BUCK_SFL         Disabled           BUCK_SPI         00: NONE         BUCK_SPI         Disabled         BUCK_SFL         Disabled           BUCK_SUP_CTRL         100: 20mV/us         BUCK_SPI         Disabled         BUCK_SPI         Disabled           DOWN_CTRL         100: 20mV/us         DOWN_CTRL         100: 20mV/us         BUCK_SPI         SPICKB_CONF_A         SPIC           R20=00Dh         92         VBUCK_AMA_CTR_FF         R210=002h         SPICHAMA_CTR_FF         SPIC	BUCK_DIM FF	Start Device Polling Enabled C USB OK? No Ack SAM3U I2C Device SAM3U I2C Rev: A IDs: 24 10 0 0 Read Chip IID File Operations Load Save
R213-005h     7F       _VBUCKA_CTRLA     46       VB_A     1000110:1.00V       R215=007h     46       VBUCKA_CTRLB     46	SLEW_RATEL DEBOUNCING R86=056h	Read +0 Data read Find Reset Configuration Clear all readback ind. Reset Configuration Clear all readback ind. Reset Configuration Clear all readback ind. Power Commander Software Status Idle

Figure 10: Enabling BUCKA

The same operation can also be done via the I<sup>2</sup>C interface panel by selecting the register address, the data to send and pressing the **Send** button. A read-back can be performed by clicking the **Read** button, see Figure 11.

I2C i/f	★D0 CoPMIC slave
Find	×5D Reg. address
Send	×1 Data to Send
Read	×1 Data read
🔍 Find	

Figure 11: Middle Right Interface Indicator

After enabling the BUCKA converter it is possible to monitor the output voltage on the PCB via an external multi-meter connected to the VOUT\_A pin, as shown in Figure 7. The read-back should provide a value close to 1.0 V. If the part is not trimmed the value can slightly differ from the target.

It is also possible to directly monitor some relevant signals on the PCB, for example, the inductor current of each phase.



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Figure 12: Monitoring the Inductor Current of BUCKA

When BUCKA is enabled, only phase-1 (LX\_A1) is switching, whilst phase-2 (LX\_A2) does not. This is happens when PH\_SH\_EN1 is asserted. Since no load is applied to the output of the buck converter, DA9214 automatically optimizes the number of active phases and turns off phase-2 to save power.





Figure 13: Inductor Current of Phase-1, Phase-Shedding Enabled

To disable the phase shedding set the PH\_SH\_EN1 bit to zero, thereby forcing both phases to be enabled.

The inductor current of phase-1 and phase-2 when BUCKA operates with two active phases is shown in Figure 14.





Figure 14: Inductor Current of Phase-1 and Phase-2, Phase-Shedding Disabled



There is an easy way to modify the output voltage of BUCKA. This is by using the VBUCKA\_CTRL\_A and VBUCKA\_CTRL\_B registers, see the red box in Figure 15.

In the **BUCK\_SEL** field choose **VBUCK\_A** (see the red arrow in Figure 15), now changing the value in **VBUCKA\_CTRL\_A** changes the output voltage. This initiates a DVC transition towards the new selected voltage.

A921X Control DA921X Configuration UUCKA Control UUCKA CONT BIT 7 VBUCK (SPI BUCK SPI BUCK SP	BUCKB_Control BUCKB_CONT BUCKB_CONT BUCKB_CONT BUCK_GPI D0:NONE BUCK_GPI D0:NONE BUCK_GPI D0:NONE BUCK_GPI D0:NONE BUCK_GPI D0:NONE BUCK_GPI D0:NONE BUCKB_CONF_A BUCKB_CONF_	BUCK_CONF.gs vIF PH_SH_EN2 Enabled PH_SH_EN1 Enabled PHASE_SE12 2 phases PHASE_SE1 11:4 phases R211=003h IF BUCK_B_ILM III:6000mA BUCKA_ILM FF CONTROL_A r53 VLOCK Disabled SLEW_RATE2 10:1uz	● DA9215/13/14 IRQ Start Polling Polling Device Polling No Ack ■ No Ack ■ No Ack ■ Device: Rev: A DD: 24 100 0 Read Chip ID File Operations Load ■ Save ■ Program Pile Operations Load ■ Save ■ Pile Operations Load ■ Save ■ Pile Operations Load ■ Save ■ Pile Operations Load ■ Do CoPMIC slave Pile 0 Pile Reg. address Send Pile Data to Send Pile Data read
_VBUCKA_CTRLA #6 SL_A SYNC VB_A 1000110:1.00V R215=007h 46 _VBUCKA_CTRLB 46 SL_B SYNC VB_B 1000110:1.00V R216=008h 46	VBUCKB_CTRLA 46 SLA SYNC VB_A 1000110 : 1.00V R217=009h 46 VBUCKB_CTRLB 46 SLB SYNC VB_B 1000110 : 1.00V R218=00Ah 46	DEBOUNCING 011:10ms V R86=056h 53	Reset Configuration Clear all readback ind. Read all registers Power Commander Software

Figure 15: Output Voltage Control

By toggling the value on **BUCK\_SEL** it is also possible to change the output voltage between the value contained in **VBUCKA\_CTRL\_A** and the value contained in **VBUCKA\_CTRL\_B**.



This example configures 1.2 V in **VBUCKA\_CTRL\_A** and 0.8 V in **VBUCKA\_CTRL\_B**. After asserting the **BUCK\_SEL** bit the DVC transition in the output voltage is as shown in Figure 16.

<u>k Stop</u>					–				, ÎÎ		÷														<del></del>
		· · ·		· · ·		Ũ													-	16.0 -24. \\\	)µs 0µs 0µs	8 0	1 8ι Δ4	.20 )0m 1001	V IV mV
.8		•				1			- - - -	 							-						•		
		· · · ·		• • • •					 		÷	 •				÷							· · ·		
- - - -				· · ·			++		· · ·	 -II		 								······································			· · · · · · · · · · · · · · · · · · ·	i	
- - - 																									
	·																								
VOUT ·	·															÷									
									 		÷						· · ·								
			: :	1.		3	200	mV	BW		-	 )   	00j	us 191	. <u></u>	iµs	<u>.</u>	100 100	iMSz IK pe	's oint	s) (	3	· ·	1.	05 \
																						(	13 A 16:5	pr 9:4	201 1

### Figure 16: DVC Transition

The voltage is decreased by 400 mV in approximately 40  $\mu$ s, therefore, the slope of the DVC transition can be seen as 10 mV/ $\mu$ s.

The value can be set on the **SLEW\_RATE1** field of **CONTROL\_A** register. This field is located on the **Buck** tab of the GUI, as shown by the red arrow in Figure 17.

Do not confuse the slew rate setting of DVC voltage changes with the UP\_CTRL, DOWN\_CTRL of each buck, as they do only refer to the power up and power down slope.

VLOCK	Disab	led
SLEW_RATE2	10:1us	•
SLEW_RATE1	10:1us	•
DEBOUNCING	011 : 10ms	-

Figure 17: Buck Tab CONTROL\_A Register Field



There is another means of controlling the output voltage of the buck converter by using one of the GPIO ports available on the device.

This example uses GPI4 in the **VBUCK\_GPI** field of **BUCKA\_CONT** register. GPIO4 is already selected as the input port active high in the related registers as shown in Figure 18.



Figure 18: GPIO Port Voltage Control

Simply change the connection of red jumper (highlighted by the red circle in Figure 19) which is reflected into a change of the output voltage of BUCKA between VBUCKA\_CTRL\_A and VBUCKA\_CTRL\_B. So the BUCK SEL bit functionality has been replaced by the GPI4 input port.

The same procedure can be applied to the **BUCK\_GPI** field, which selects a GPIO to implement the buck enable/disable functionality. By changing the connection of the selected GPIO the buck converter can be seen to enable and disable.



Figure 19: Port Control of the Buck Output Voltage

To turn off the whole IC and not only the buck converter use the IC\_EN port (see also jumper link J28). By toggling the position of the jumper to the alternative position, the whole IC goes off and the current measured from the supply is close to zero.

DA9214 is a very powerful and flexible device, so it is possible that issues will arise through continued and personalized usage. For questions and clarification please refer to your local Dialog support team.

## 8 Troubleshooting

This section is an aid to resolving some of the more common issues.

### 8.1 Software Issues

The USB device should automatically install without difficulty. Make sure that the installation finds and uses the driver contained on the supplied media.

If the program is started before the USB Interface board is plugged in, the program will default to the offline mode. This can be useful to explore the software in a desk environment without the hardware attached. If the board is subsequently attached, move the Interface control to **SAM3U I2C** or **SAM3U SPI**.

The software can have unpredictable effects when used in conjunction with a USB hub. It is recommended that a direct connection is made to the USB interface board.

The software is optimized for a display screen size of 1024 by 768 pixels or greater, with fonts set to Normal (96dpi).

There have been reported issues of unpredictable display effects when large fonts (120dpi) are used. This can be changed from the Window **Properties**, **Settings** tab; choose **Advanced**, then select **Normal size** from the drop-down menu.

If communications are apparently lost, first click the **Start Device** button. This attempts to make the device go active. Also switching the **Interface mode** to **Offline**, then back to **USB** can reinitialize the USB interface. Alternatively, unplug the USB then reconnect so that the software detects it and reinitializes.

### 8.2 Hardware Issues

Most hardware problems can be traced to incorrect jumper positions.

Check carefully all jumper positions. Use the jumper table details and the board schematic as a guide to the jumper functions and locations, see Appendix A.

Take particular care to ensure the power supply configuration is correct.

It is usually preferable that the USB is deactivated if the device supply is missing. This will mimic the target system operation in which the host processor has no power if the PMIC has no supply. It also avoids unintended current flow between a USB port output and an unpowered GPIO input.



## **Appendix A - Links Description**

### Table 1: DA9213 Performance Board (227-02-A) Links Description

Link	Position 1 (Pin 1-2)	Position 2 (Pin 2-3)	Function
J1	To VSYS		Enables diode D1 when VSYS supply is connected
J3	BUCKA local GND		BUCKA VSS local headers
J5	To GND		Short VSYS to GND
J9	To VOUT		Connects L1 to the output of the BUCKA converter
J10	To VOUT		Connects L2 to the output of the BUCKA converter
J11	To clock input		Connects GPIO1 to plug for external clock input signal
J12	Signal headers		I/Os and main signals
J13	to VSYS		Connects VSYS pin to the VSYS rail
J15	To VOUT		Connects L3 to the output of the BUCKA converter
J16	to VOUT		Connects L4 to the output of the BUCKA converter
J18	to VDDIO		Connections for GPIOs pull up resistors
J19	BUCKA local VOUT		BUCKA VOUT local headers
J20			Connects GPIOs to 100 k $\Omega$ pull up resistors
J21	to VDDIO		connections for nIRQ (via 100 k $\Omega$ pull up resistors)
J22			Connection for GPIOs
J23			Connects GPIOs to GND (via 100 k $\Omega$ pull down resistors)
J24	to VDDIO		Connection for I <sup>2</sup> C interface pull up (via 2.2 k $\Omega$ resistors)
J25			Connects GPIOs to ATSAM3U
J26	to VDDIO (via 100kΩ resistor)	to GND (via 1 kΩ resistor)	Connection for IC_EN
J27	to ATSAM3U port	to J29	Connection for IC_EN
J28	to SPI_SCLK	to SCL_0	Selection of SPI or I <sup>2</sup> C clock
J29	to SPI_MOSI	to SDA_0	Selection of SPI or I <sup>2</sup> C data
J32	to VDDIO_OUT		Connects VDDIO to the VDDIO_OUT rail generated by external LDO
J33	to VDDIO_OUT		Connection of VDDIO_USB used by ATSAM3U
J34	low voltage VDDIO		Selection of VDDIO_OUT voltage: open => 3.3 V short => 1.8 V



# DA9213, DA9214, and DA9215 Performance Boards

### Table 2: DA9214 Performance Board (227-04-D) Links Description

Link	Position 1 (Pin 1-2)	Position 2 (Pin 2-3)	Function
J2	BUCKA local GND		BUCKA VSS local headers
J3	To VSYS		Enables diode D1 when VSYS supply is connected
J6	To GND		Short VSYS to GND
J10	To VOUT		Connects LA2 to the output of the BUCKA converter
J11	To VOUT		Connects LA1 to the output of the BUCKA converter
J13	To clock input		Connects GPIO1 to plug for external clock input signal
J14	BUCKA local VOUT		BUCKA VOUT local headers
J15	Signal headers		I/Os and main signals
J16	to VSYS		Connects VSYS pin to the VSYS rail
J18	BUCKB local VOUT		BUCKB VOUT local headers
J19	To VOUT		Connects LB2 to the output of the BUCKB converter
J20	to VOUT		Connects LB1 to the output of the BUCKB converter
J21	to VDDIO		Connections for GPIOs pull up resistors
J22			Connects GPIOs to 100 k $\Omega$ pull up resistors
J23	to VDDIO		connections for nIRQ (via 100 k $\Omega$ pull up resistors)
J24			Connection for GPIOs
J25			Connects GPIOs to GND (via 100 k $\Omega$ pull down resistors)
J26	to VDDIO		Connection for I <sup>2</sup> C interface pull up (via 2.2 k $\Omega$ resistors)
J27			Connects GPIOs to ATSAM3U
J28	to VDDIO (via 100 kΩ resistor)	to GND (via 1 kΩ resistor)	Connection for IC_EN
J30	to ATSAM3U port	to J29	Connection for IC_EN
J31	to SPI_SCLK	to SCL_0	Selection of SPI or I <sup>2</sup> C clock
J32	to SPI_MOSI	to SDA_0	Selection of SPI or I <sup>2</sup> C data
J36	BUCKB local GND		BUCKB VSS local headers
J37	to VDDIO_OUT		Connects VDDIO to the VDDIO_OUT rail generated by external LDO
J38	to VDDIO_OUT		Connection of VDDIO_USB used by ATSAM3U
J39	low voltage VDDIO		Selection of VDDIO_OUT voltage: open => 3.3 V short => 1.8 V



# DA9213, DA9214, and DA9215 Performance Boards

### Table 3: DA9215 Performance Board (227-07-B) Links Description

Link	Position 1 (Pin 1-2)	Position 2 (Pin 2-3)	Function	
J1	To VSYS		Enables diode D1 when VSYS supply is connected	
J5	BUCKB local VOUT	BUCKB VOUT local headers		
J7	BUCKB local GND		BUCKB VSS local headers	
J8	BUCKA local GND		BUCKA VSS local headers	
J9	To GND		Short VSYS to GND	
J13	To clock input		Connects GPIO1 to plug for external clock input signal	
J14	to VOUT		Connects LB1 to the output of the BUCKB converter	
J15	To VOUT		Connects LA3 to the output of the BUCKA converter	
J17	Signal headers		I/Os and main signals	
J18	to VSYS		Connects VSYS pin to the VSYS rail	
J20	To VOUT		Connects LA1 to the output of the BUCKA converter	
J21	To VOUT		Connects LA2 to the output of the BUCKA converter	
J22	to VDDIO	Connections for GPIOs pull up resistors		
J23	BUCKA local VOUT		BUCKA VOUT local headers	
J25	to VDDIO	connections for nIRQ (via 100 kΩ pull up resistors)		
J26			Connects GPIOs to 100 k $\Omega$ pull up resistors	
J27			Connection for GPIOs	
J28	to VDDIO		Connection for I <sup>2</sup> C interface pull up (via 2.2 k $\Omega$ resistors)	
J29			Connects GPIOs to GND (via 100 k $\Omega$ pull down resistors)	
J30	to VDDIO (via 100 kΩ resistor)	to GND (via 1 kΩ resistor)	Connection for IC_EN	
J31			Connects GPIOs to ATSAM3U	
J32	to ATSAM3U port	to J29	Connection for IC_EN	
J33	to SPI_SCLK	to SCL_0	Selection of SPI or I <sup>2</sup> C clock	
J34	to SPI_MOSI	to SDA_0	Selection of SPI or I <sup>2</sup> C data	
J39	to VDDIO_OUT		Connects VDDIO to the VDDIO_OUT rail generated by external LDO	
J40	to VDDIO_OUT		Connection of VDDIO_USB used by ATSAM3U	
J38	low voltage VDDIO		Selection of VDDIO_OUT voltage: open => 3.3 V short => 1.8 V	

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## **Appendix B - Performance Board Features**

DA9214 Performance Board (227-04-D) is used in this section as an example. DA9213 and DA9215 Performance Boards (227-02-A and 227-07-B) have the same features.

### B.1 USB-I<sup>2</sup>C Bridge

The USB-I<sup>2</sup>C bridge is mainly used for two purposes:

- 1. As a source of I<sup>2</sup>C and SPI control signals.
- 2. To provide the discrete signals for the GPIOs.

The USB-I<sup>2</sup>C bridge is powered via the USB cable via a fixed 3.3 V regulator.

Jumpers J31 and J32 on 227-04-D are used to select between I<sup>2</sup>C and SPI communication to DA9214. This has to be configured with the IF\_TYPE field of INTERFACE2 register.



Figure 20: ATSAM3U µ-Controller for USB-I<sup>2</sup>C bridge

### B.2 I/O and Supply Regulators

The external LDO regulators on the DA9214 Performance Board are used to generate power supply for the ATSAM3U and the I/O voltage needed by the device.

A voltage of 3.3 V or 1.8 V can be selected as supply for the I/O 9 (see jumper link J39).

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USCI	manuai	





Figure 21: Mini USB Input and Internal Rails Generation

### **B.3** Control and I/O Signals

All of the control and I/O signals from DA9214 appear on the headers pins shown above. These are the most useful monitor points for debug purposes.





If required, a suitable connector can bring these signals to the system board for integrated development. If used in this way, the other links which also control these pins should be removed to avoid logic or voltage clashes.

The arrangement of the jumper links to the GPIO pins is shown in Figure 23. The jumpers may be inserted on J27 for USB control and monitor. The jumpers can also be placed on the headers J22, J24, J25 as follows:

- Between J22 and J24, connecting GPIOs to VDD\_IO via 100 k $\Omega$  pull up resistor
- Between J24 and J25, connecting GPIOs to ground via 100 kΩ pull down resistor
- Left open for external connections

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Figure 24: GPIOs Control Schematic

## Appendix C - Scripting

The software includes the ability to save and load a text file containing hex codes representing the register addresses and data. This allows a basic scripting functionality on DA9213, DA9214, and DA9215 for advanced users.

If you wish to use register names directly (easier to read), instead of register addresses, from the **Settings** menu select **Reg names in file**. When selected the slave address is replaced by the word **WRITE2**. This is generally preferable and more readable. The register names are stored in an external file. Hex codes for slave address and register address are still accepted on reading in the file.

Note 2 The suffix 2 is used to identify coPMIC devices (such as DA9213, DA9214, or DA9215) and distinguish them from the main PMIC devices (such as DA9063). Although they can share the I<sup>2</sup>C address if STAND\_ALONE is set to zero (see Datasheet for details on STAND\_ALONE bit operation), the GUI offers the possibility to assign different I<sup>2</sup>C addresses to main and coPMIC devices. Thus WRITE automatically uses the main PMIC I<sup>2</sup>C address and WRITE2 uses the coPMIC I<sup>2</sup>C address assigned, see Section 6.3.

### C.1 Text File Format

- Numbers apart from time delays are expressed in Hex, separated by tabs. The use of 0x in front of the hex value is optional.
- The first parameter is the device slave address in 8 bit format.
- Alternatively the first parameter can be a token:
  - WRITE2 writes to the device at the currently selected slave address (I<sup>2</sup>C mode only)
  - READ2 reads from the device a the values of a number of registers
  - **PORT** sets the selected digital control line to the specified value (1 or 0)
  - **PORTREAD** reads the value of the specified digital control line
  - **PORTDIR** sets the direction of the digital control line to an input if the value is 0, or an output if set to 1.
  - **DELAY** or **WAIT** implements a time delay specified up to 65535 milliseconds. The delay time is specified in decimal, or hex if preceded by 0x.
  - **ITERATE** causes the whole script to be repeat the specified number of times.
- If you wish to use the GPIO-related commands, you need to jumper the respective jumpers of J27, to allow the ATSAM3U µC device to really operate on the specific port. The levels are not forced by DA92112 but instead this is done externally by the ATSAM3U.
- The second parameter is the register address as a name or hex value.
- The third parameter is the data.
- Comments (lines beginning with //) are permitted in the file.
- Inline comments (//comment) are permitted.
- The data will be processed in the order written, and written directly to the specified device. The screen controls will be updated once command in the file have finished.
- The use of the slave address in the file allows any device attached to the I<sup>2</sup>C bus to be controlled.
- The token PORT2 allows control over the GPIOs which are configured as inputs. The second parameter is the port name. The third parameter is 0 or 1.
- For read operations, the result of the read is passed to the history log window



DA9213, DA9214, and DA9215 Performance Boards

### C.2 Examples

//Test DA9214 //17.03.2017

//Read registers in 2 ways
//See the equivalent results
//Read from register 0xD1 n\_BUCK1\_CONF\_A
//for the next 10 registers
READ2 n\_BUCK1\_CONF\_A 10
READ2 0xD1 10

//Change value of register n\_BUCK1\_CONF\_A
WRITE2 n\_BUCK1\_CONF\_A FF
//Read back the new configured value
READ2 n\_BUCK1\_CONF\_A 1

//Configure the GPIO2 as output port //Note the "\_N" identifying the slave PORTDIR GPIO2\_N 1 //Set the level of GPIO2 low PORT GPIO2\_N 0 //Read back the voltage at GPIO2 PORTREAD GPIO2\_N //Set the level of GPIO2 high PORT GPIO2\_N 1 //Read back the voltage at GPIO2 PORTREAD GPIO2\_N

The results are displayed in the history log, which can be viewed by selecting Setting, History Log.

Use	er N	lan	ual
030		I CI I	uai



Histor	y Log				e X
Log	Clear	SAVE	Timestamp OFF/ON	Bold	Font size
//TEST D/ //13.04.2	A9214 017				•
//READ R //SEE THI //READ FF //FOR THI READ2 N READ2 0X	EGISTERS IN 2 WAY E EQUIVALENT RES ROM REGISTER 0XD E NEXT 10 REGISTEI _BUCK1_CONF_A 1( IDI 10 [ 92 92 1F 00	S ULTS 1 N_BUCK1_CONF_A RS 0 [40 00 00 00 00 00 00 17F 7F 46 46 46 46]	00 00 00]		
//CHANG WRITE2 N //READ B READ2 N	E VALUE OF REGIST LBUCK1_CONF_A F ACK THE NEW CON BUCK1_CONF_A 1	FER N_BUCK1_CONF_A F IFIGURED VALUE [FF]			
//CONFIG //NOTE T PORTDIR //SET THE PORT GPI //READ B PORTREA //SET THE PORT C	SURE THE GPIO2 AS "HE "_N" IDENTIFYIP GPIO2_N 1 E LEVEL OF GPIO2 L 02_N 0 ACK THE VOLTAGE D GPIO2_N [00] E LEVEL OF GPIO2 H 03_N 1 02_N 0	OUTPUT PORT NG THE SLAVE OW AT GPIO2 EGH			
PORT GPI //READ B PORTREA	OZ_N 1 ACK THE VOLTAGE D GPIO2_N [ 01]	AT GPIO2			
•					F.

Figure 25: History Log

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## **Revision History**

Revision	Date	Description
1.0	26-May-2017	Initial version.
2.0	25-Feb-2022	File was rebranded with new logo, copyright and disclaimer



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