User Manual

DA9318 Evaluation Board

UM-PM-021

Abstract

This document describes the hardware and software used to evaluate the DA9318 evaluation board.

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Contents

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1   Terms and Definitions

BOM   Bill Of Materials
CRC   Cyclical Redundancy Check
DUT   Device Under Test
GUI   Graphical User Interface
GUID   Globally Unique IDentifier
HW   HardWare
INI   INItialization
LED   Light Emitting Diode
LS   Level Shifter
OTP   One Time Programmable
PC   Personal Computer
PCB   Printed Circuit Board
PCM   Power Commander Mode
PMIC   Power Management IC
PVC   Power Voltage Converter
SAM3U   USB I^{2}C Interface
TCP   Transmission Control Protocol
USB   Universal Serial Bus

2   References

[1]   DA9318 Datasheet, Dialog Semiconductor
[2]   329-01-B1_SCH.pdf, Dialog Semiconductor

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3   Introduction

The DA9318 evaluation board, see Figure 1, facilitates the measurement, evaluation, and programming of DA9318.

Dialog's control software package SmartCanvas™ uses a simple graphical user interface which enables DA9318 to be controlled via the USB port of a PC. The mini USB connection is visible on the left side of the board. When the cable is connected to the USB port of the PC the green LED (D1) is on.

The board contains jumper links, see Figure 3, to provide access to alternative configurations and measurement test points. Most standard operating modes are evaluated with minimal link changes.
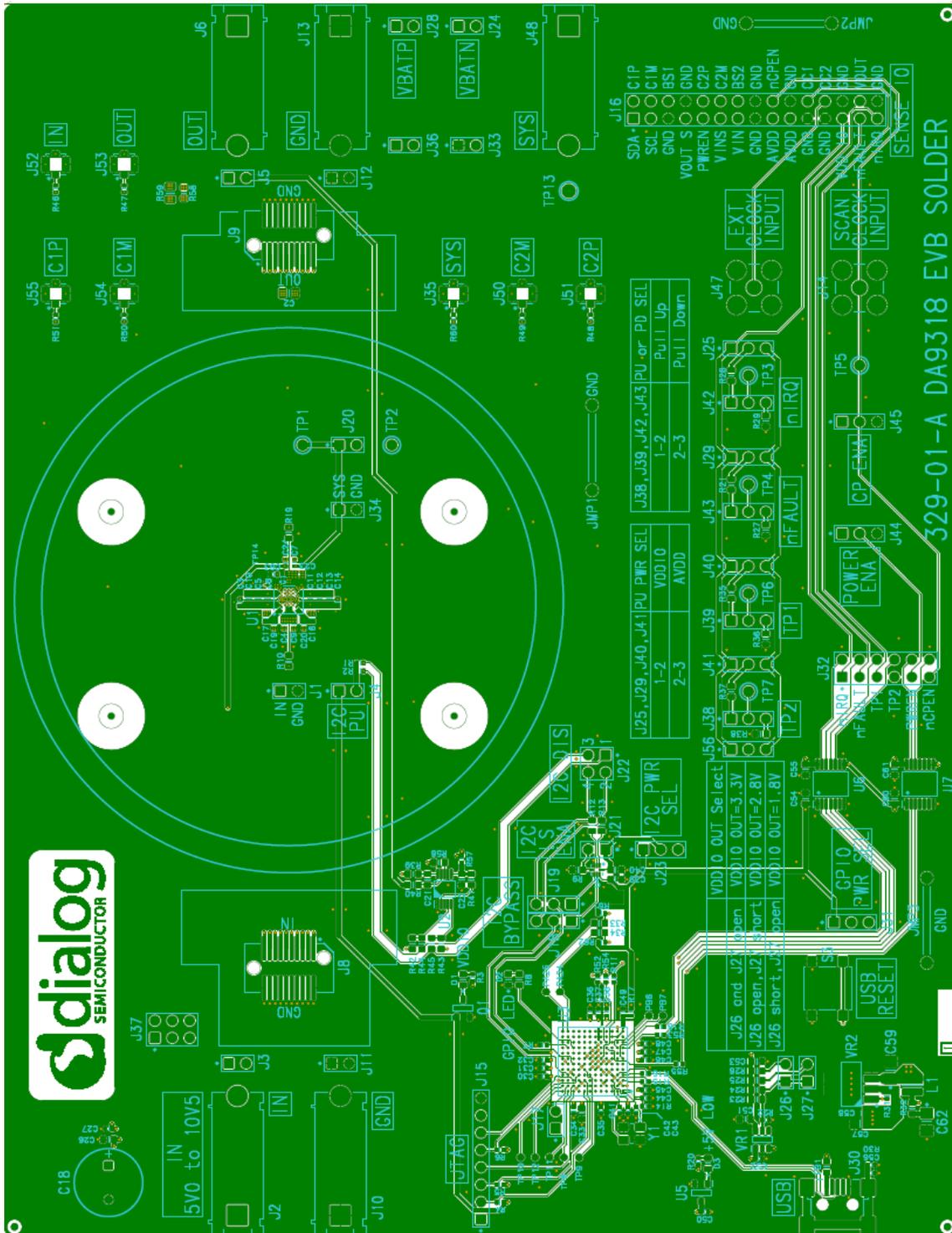
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Figure 1: DA9318 Evaluation Board

4 Evaluation Board Hardware

The DA9318 evaluation board functionality can be broken down into sections, see
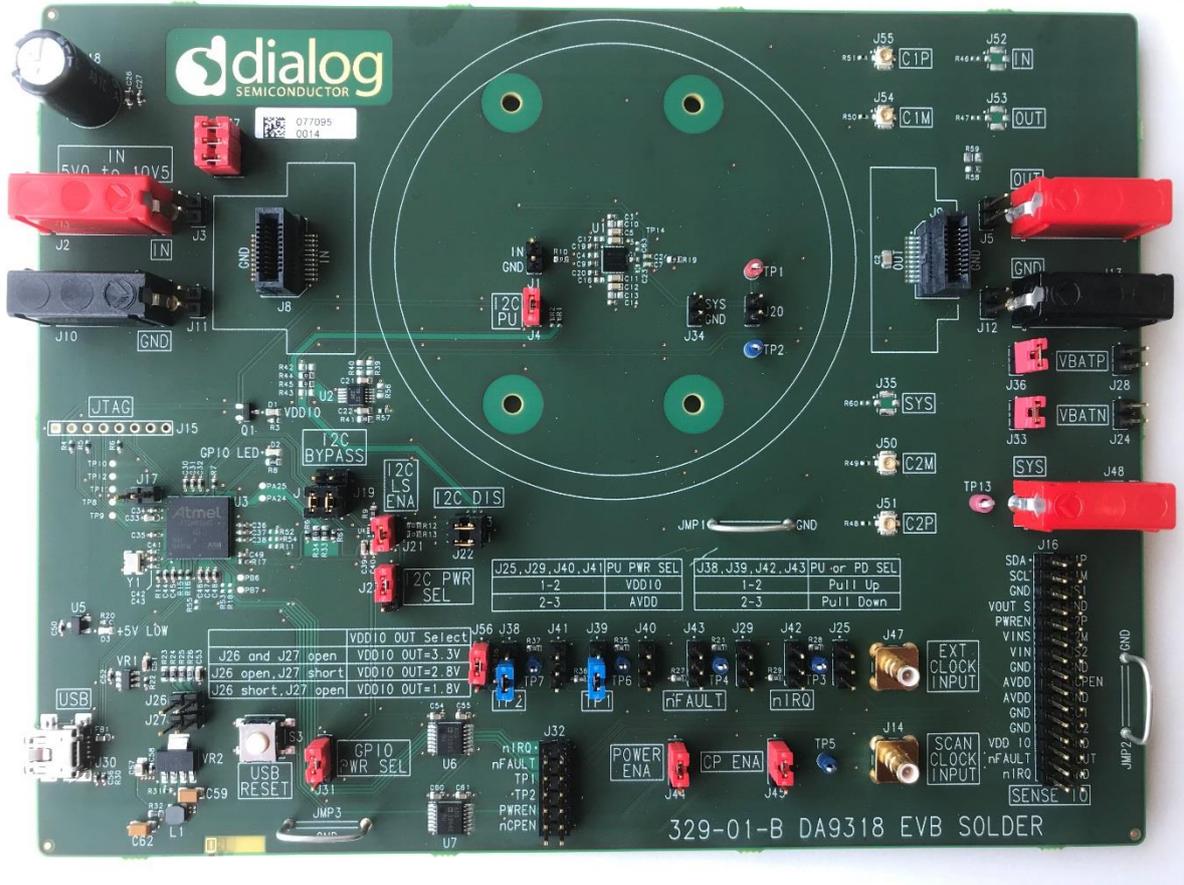

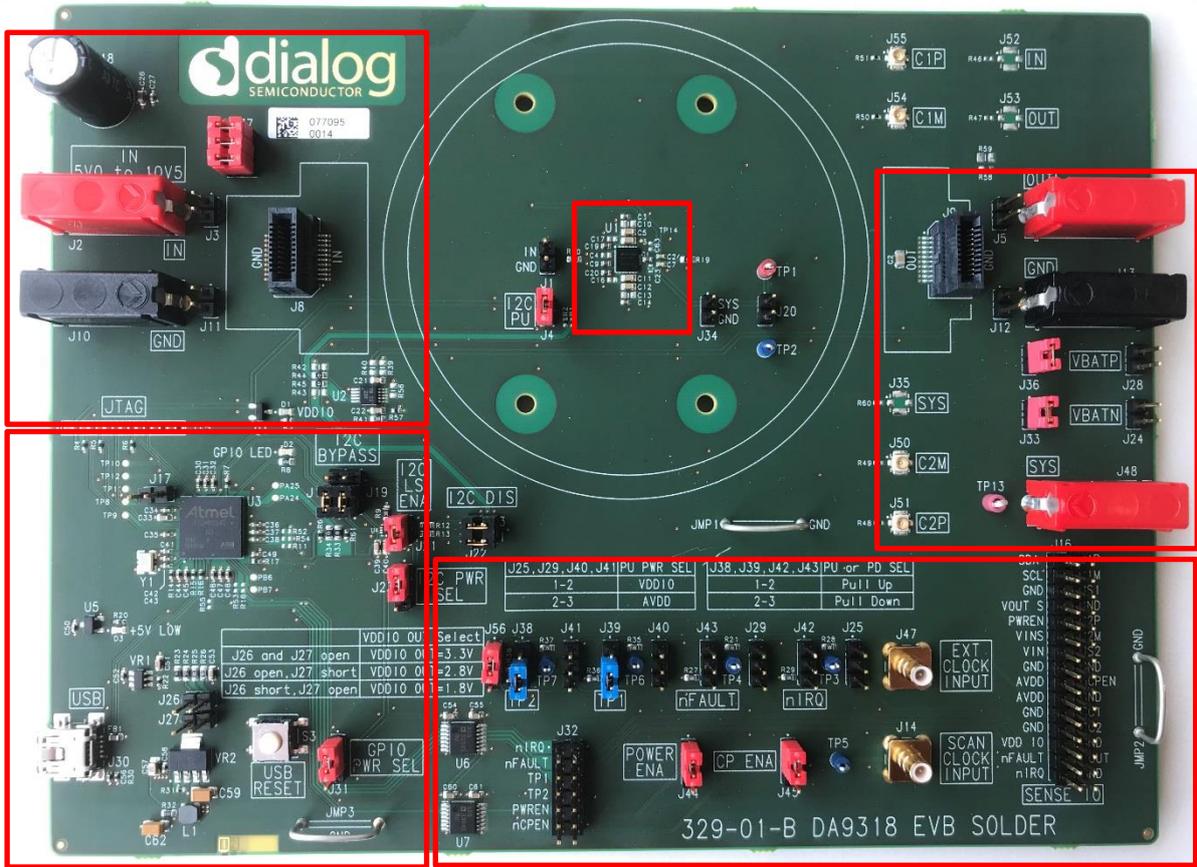Figure 2:

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Figure 2: Functional Sections

- IN input power
- DA9318 device and critical components
- Current doubler output and SYS input
- USB interface (I2C communication) and USB reset
- Digital input and output signals, and sense IOs

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4.1 Default Link Positions and Connector Definitions
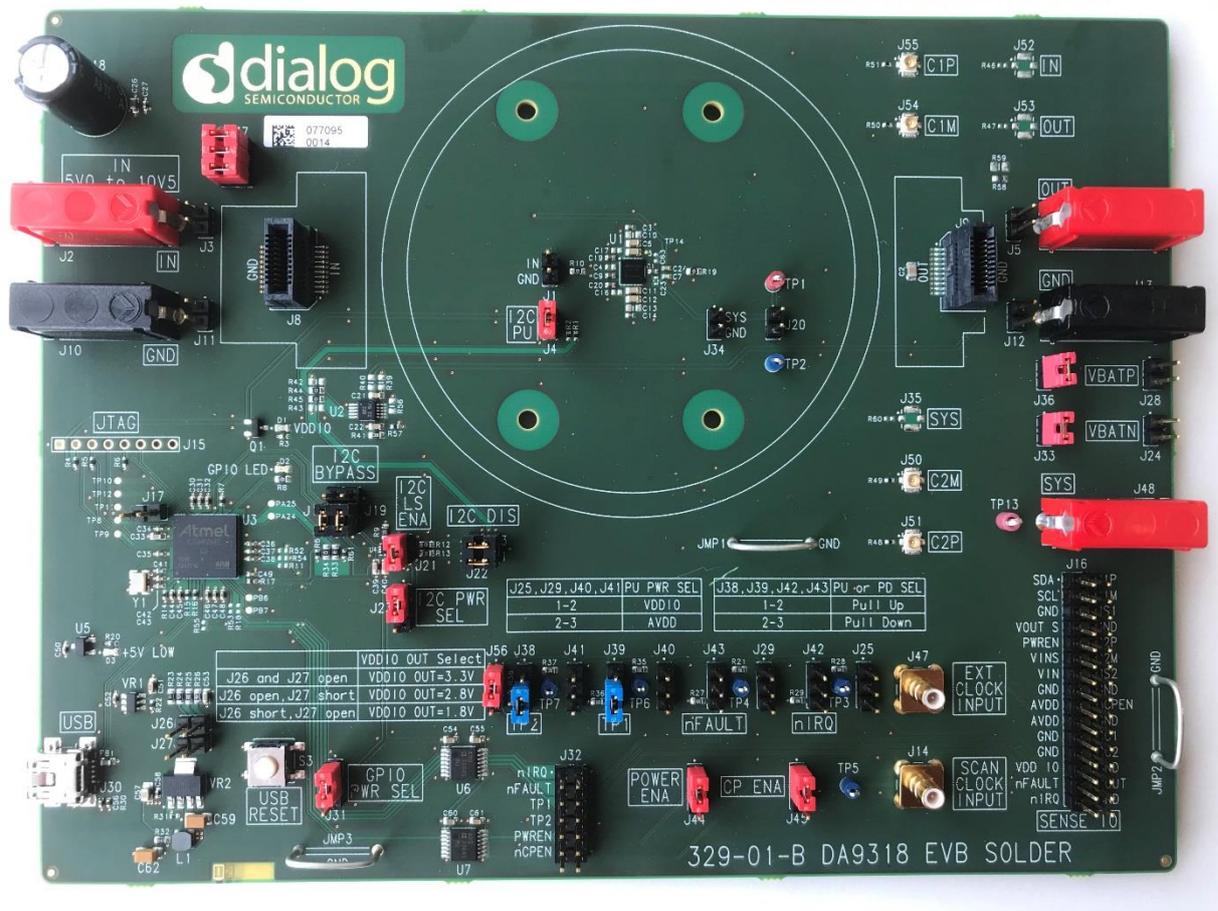
Figure 3: Default Link Positions

Table 1: Default Link Positions and Connector Definitions

Reference Designator	Position	Function
J1	1	IN sense point
	2	GND sense point
J2	NA	IN connector
J3	NA	IN connector
J4	1-2	I^{2}C pull-up to VDD_IO
J5	NA	OUT connector
J6	NA	OUT connector
J8	NA	Line transient connector
J9	NA	OUT load transient connector
J10	NA	GND connector (IN side of board)
J11	NA	GND connector (IN side of board)
J12	NA	GND connector (OUT side of board)
J13	NA	GND connector (OUT side of board)
J14	NA	NA
J15	NA	JTAG: reserved

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Reference Designator	Position	Function
J16	NA	Measurement header
J17	1-2 (Open)	**Important: This erases the USB IC firmware. DO NOT SHORT**
J18	1-2 (Default)	I²C bypass: SAMU3U SCL connected to LS input
	2-3	I²C bypass: SAMU3U SCL connected to LS output (bypass)
J19	1-2 (Default)	I²C bypass: SAMU3U SDA connected to LS input
	2-3	I²C bypass: SAMU3U SDA connected to LS output (bypass)
J20	Installed	Short PWREN to SYS, DA9318 will immediately go from NO-POWER mode to SHUTDOWN mode when SYS power is supplied.
J21	1-2 (Default)	I²C level shifter IC enabled
J22	1-2	SCL from SAM3U connected to DA9318
	3-4	SDA from SAM3U connected to DA9318
J23	1-2 (Default)	I²C LS power selection: connected to VDD_IO
	2-3	I²C LS power selection: connected to AVDD
J24	NA	VBATN connector for cell sensing
J25	1-2	nIRQ PU selection: VDD_IO
	2-3	nIRQ PU selection: AVDD
J26	1-2 (Open)	Sets VDD_IO to 1.8 V (if J27 open) [Default - UNPOP]
J27	1-2 (Open)	Sets VDD_IO to 2.8 V (if J26 open) [Default - UNPOP]
J28	NA	VBATP connector for cell sensing
J29	1-2	nFAULT PU selection: VDD_IO
	2-3	nFAULT PU selection: AVDD
J30	NA	USB inlet
J31	1-2 (Default)	Both sides of level shifter set to VDD_IO
	2-3	Level shift from AVDD to VDD_IO
J32	1-2	nIRQ connected to level shifter and SAM3U
	3-4	nFAULT connected to level shifter and SAM3U
	5-6	CC1 connected to level shifter and SAM3U
	7-8	CC2 connected to level shifter and SAM3U
	9-10	PWREN connected to level shifter and SAM3U
	11-12	nCPEN connected to level shifter and SAM3U
J33	Installed	Short GND to VBATN for a local pack sensing
	Open	GND and VBATN disconnected to allow cell sensing
J34	1	SYS sense point
	2	GND sense point
J35	NA	SMA connector for measuring SYS
J36	Installed	Short VOUT_DA9318 to VBATP for a local pack sensing
	Open	VOUT_DA9318 and VBATP disconnected to allow cell sensing
J37	1-2, 3-4, 5-6 (Close)	IN connector shunt to IN of DA9318
J38	1-2	CC2 (labeled as TP2) pulled up to rail selected by J41

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Reference Designator	Position	Function
	2-3 (Default)	CC2 (labeled as TP2) pulled to ground
J39	1-2	CC1 (labeled as TP1) pulled up to rail selected by J40
	2-3 (Default)	CC1 (labeled as TP1) pulled to ground
J40	1-2	CC1 (labeled as TP1) PU selection: VDD_IO
	2-3	CC1 (labeled as TP1) PU selection: AVDD
J41	1-2	CC2 (labeled as TP2) PU selection: VDD_IO
	2-3	CC2 (labeled as TP2) PU selection: AVDD
J42	1-2	nIRQ pulled up to rail selected by J25
	2-3	nIRQ pulled to ground
J43	1-2	nFAULT pulled up to rail selected by J29
	2-3	nFAULT pulled to ground
J44	1-2 (Default)	NA, do not install
	2-3	Connect PWREN to GND to enter NO-POWER mode. Make sure J20 is open before installing a jumper in this position.
J45	1-2 (Default)	nCPEN shorted to AVDD
	2-3	nCPEN shorted to GND
J47	NA	NA
J48	NA	SYS connector
J50	NA	SMA connector for measuring C2N (labeled as C2M)
J51	NA	SMA connector for measuring C2P
J52	NA	SMA connector for measuring IN
J53	NA	SMA connector for measuring OUT
J54	NA	SMA connector for measuring C1N (labeled as C1M)
J55	NA	SMA connector for measuring C1P
J56	1-2 (Default)	Both sides of level shifter set to VDD_IO
	2-3	Level shift from AVDD to VDD_IO
S3	NA	Push button to reset the USB IC

4.2 USB Interface

The DA9318 evaluation board uses an ATMEL® SAM3U® microcontroller as the USB transceiver; programmed to deliver the following functionalities:

■ I^2C control interfaces
■ discrete digital IO control (General Purpose Input Output (GPIO) and dedicated functions)

4.2.1 USB Power and GUI Reset

The USB is powered by an on-board regulator (VR2), see Figure 4. Pressing the USB RESET switch S3 shuts down the on-board regulator VR2, powering down the supply for the SAM3U (USB I^2C interface). This resets the GUI communication with the evaluation board.
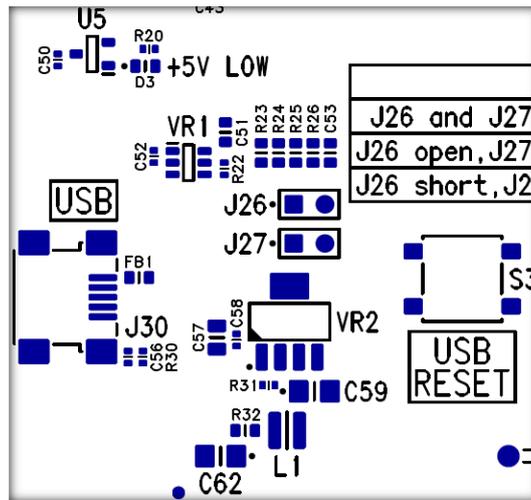
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Figure 4: USB Interface Connector and Reset Switch

4.3 Power Supplies

The DA9318 evaluation board is powered up when a power source is connected to SYS (J48) and/or IN (J2). SYS operating voltage range is +2.5 V to +5.5 V and IN operating voltage range is 5.5 V to 10.5 V.

The VDD_IO voltage is generated by an on-board regulator (VR1) supplied from the +5 V USB. By default, the on-board generated VDD_IO is +3.3 V (J26 and J27 jumpers are UNPOP):

■ to change the on-board VDD_IO to +1.8 V, J26 must be fitted while J27 is UNPOP

■ to change the on-board VDD_IO to +2.8 V, J27 must be fitted while J26 is UNPOP

NOTE
For correct operation, connect the evaluation board to a USB port capable of supplying 500 mA.

4.4 Output Current Sense

The DA9318 evaluation board comes with an external current sense circuit, see Figure 5, for measuring the current flowing from the current doubler to the battery. The current sense circuit is configured for a 7-bit slave address of 0x41. When using I_{OUT} information reported by DA9318, this circuit can be ignored and a short can be installed in place of resistor R59.
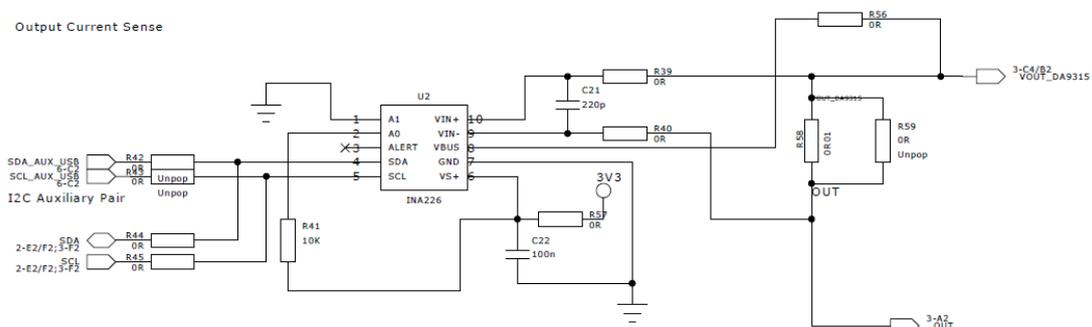

Figure 5: External Output Current Sense Circuit

5   Evaluation Board Software

The board is controlled using a graphical user interface (GUI), which requires a PC operating Windows® 2000/XP/Vista/Windows 7 with a USB1.1 or USB2 interface. The GUI allows the user to:

■   Perform raw write and read operations to all control registers on Dialog and non-Dialog ICs.

■   Poll the DA9318 registers.

■   Read ADC data from DA9318 (V_{IN}, V_{BAT}, I_{IN}, I_{OUT}, T_{JUNC}, V_{OUT}).

■   Send default settings.

■   Read all registers displayed.

5.1   GUI Installation

The files required to install the software are available on the supplied USB drive. To install the DA9318 evaluation board software:

1.   Run **Setup_DA9318_Evaluation_Board_GUI.x.x.x.xx.exe**.

2.   On completion, insert the USB cable and apply V_{SYS} and V_{IN}.

    a.   For first time users Windows should detect the attached USB device. If this is not the case, it may be necessary to install the driver by navigating to the required driver file in the USB driver directory, see section 5.2. After installing the driver, reboot the PC to ensure correct operation.

3.   Start the software by running **DA9318_Evaluation_Board.exe**.
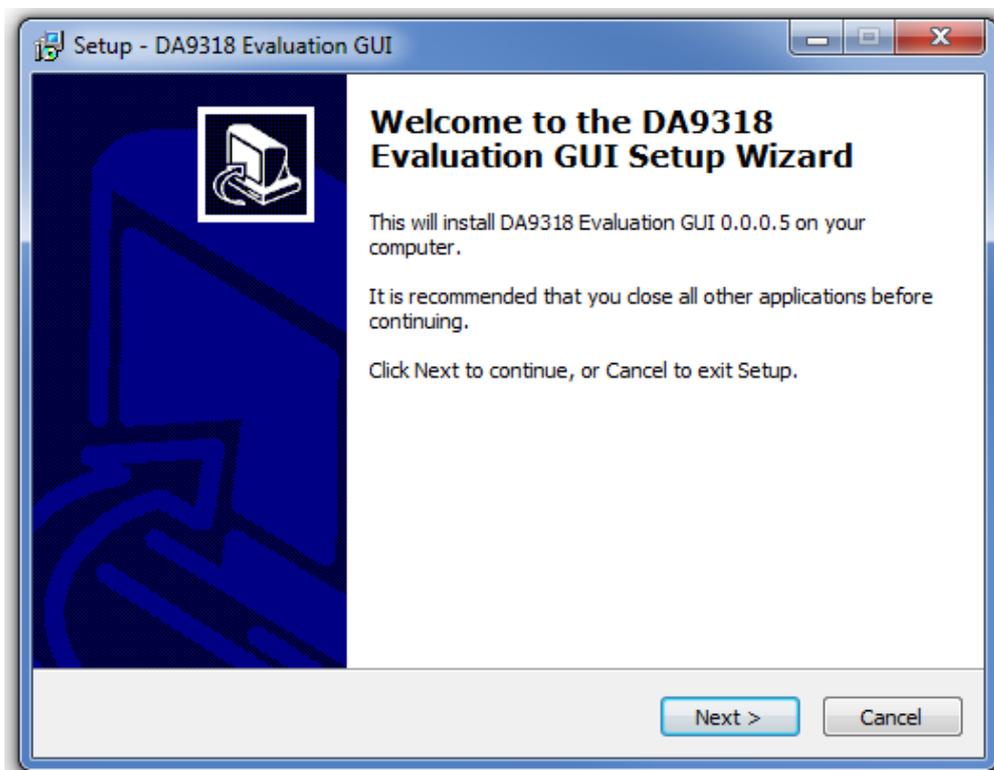
5.1.1   GUI Installation Step By Step Guide

Figure 6: GUI Setup Wizard

1.   Click **Next.**

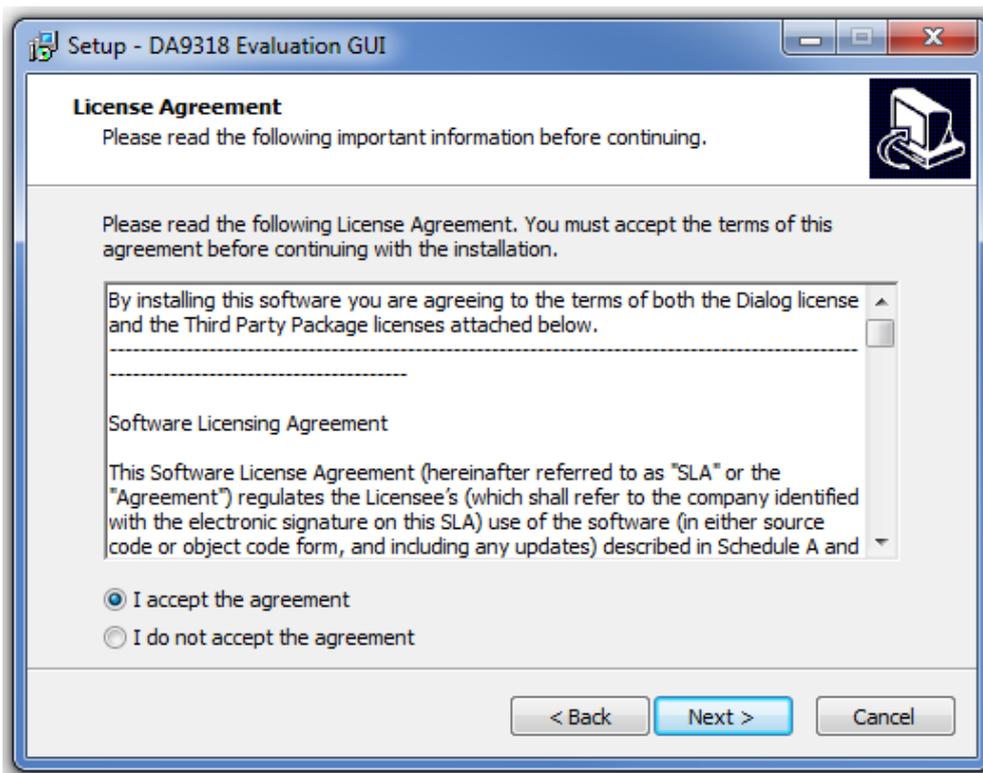## DA9318 Evaluation Board

Figure 7: GUI Setup License Agreement
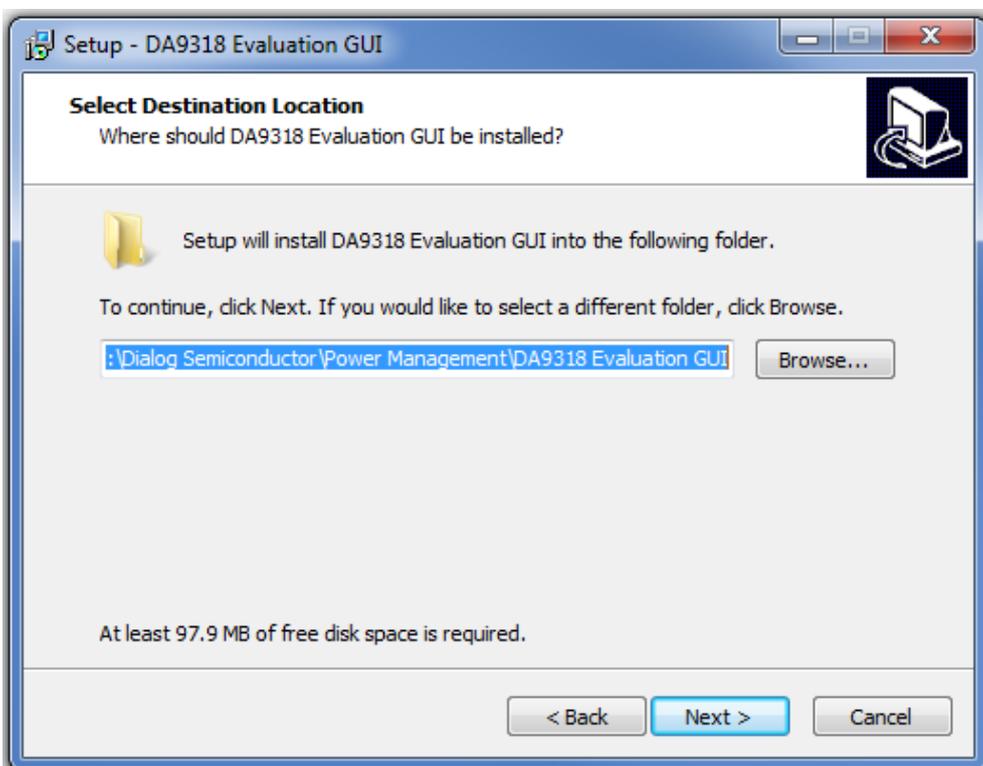
2. Select **I accept the agreement** then click **Next**.

Figure 8: GUI Setup Destination Location
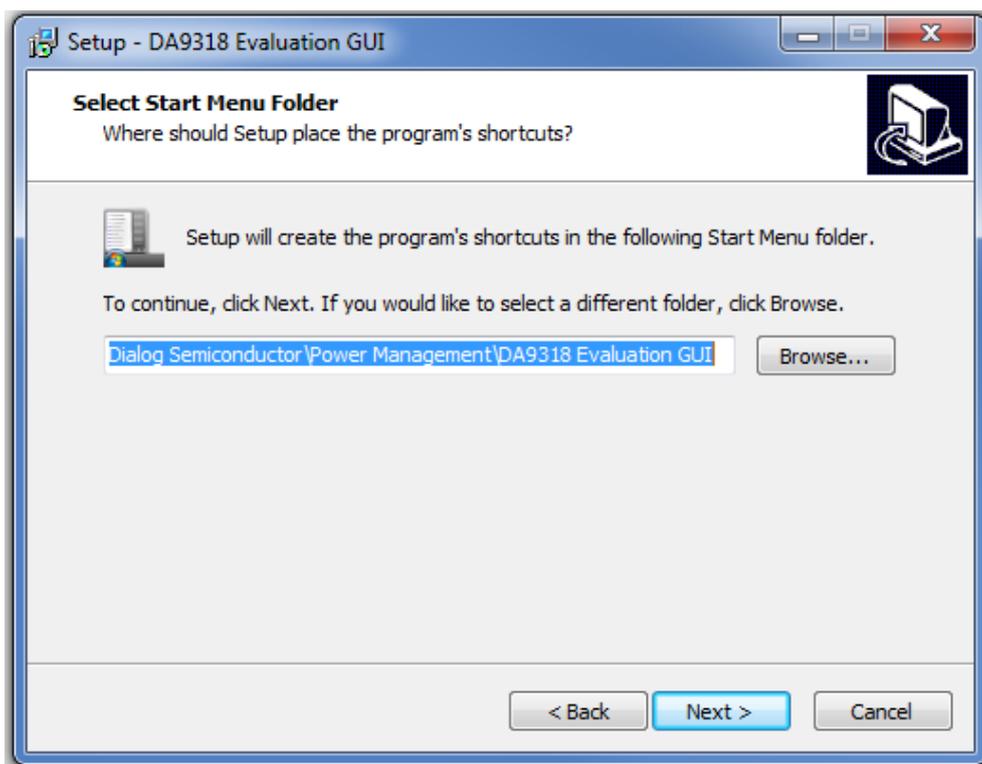
3. Click **Next**.

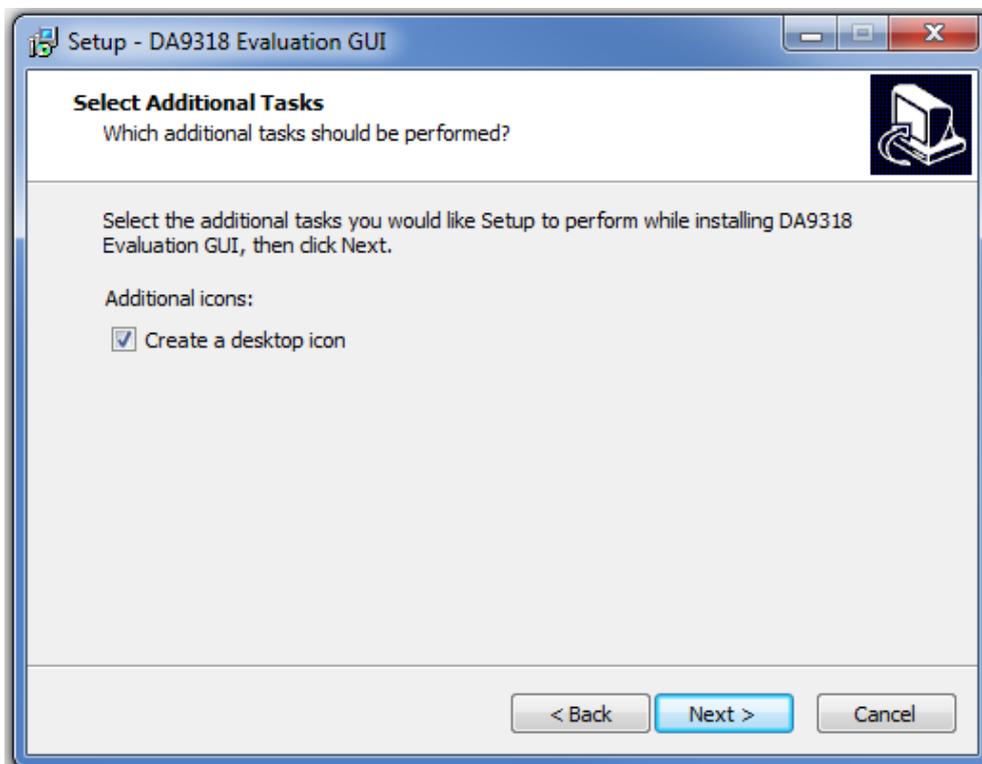**Figure 9: GUI Setup Start Menu Location**

4. Click **Next**.

Figure 10: GUI Setup Additional Tasks

5. Select the **Create a desktop icon** check box and click **Next**.
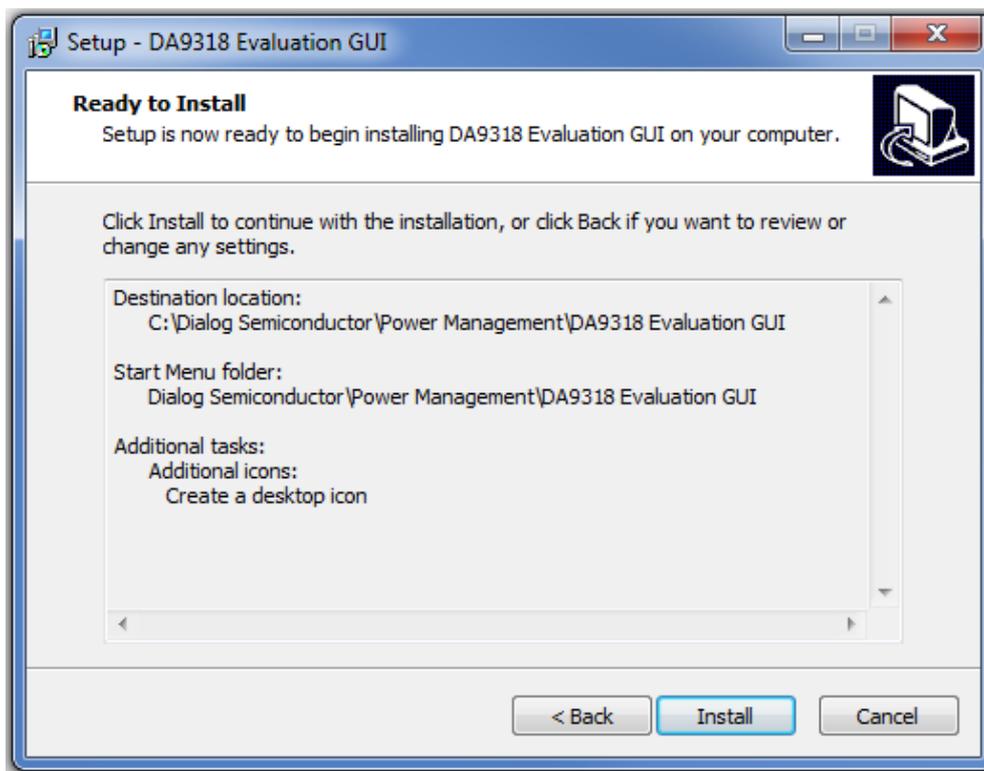
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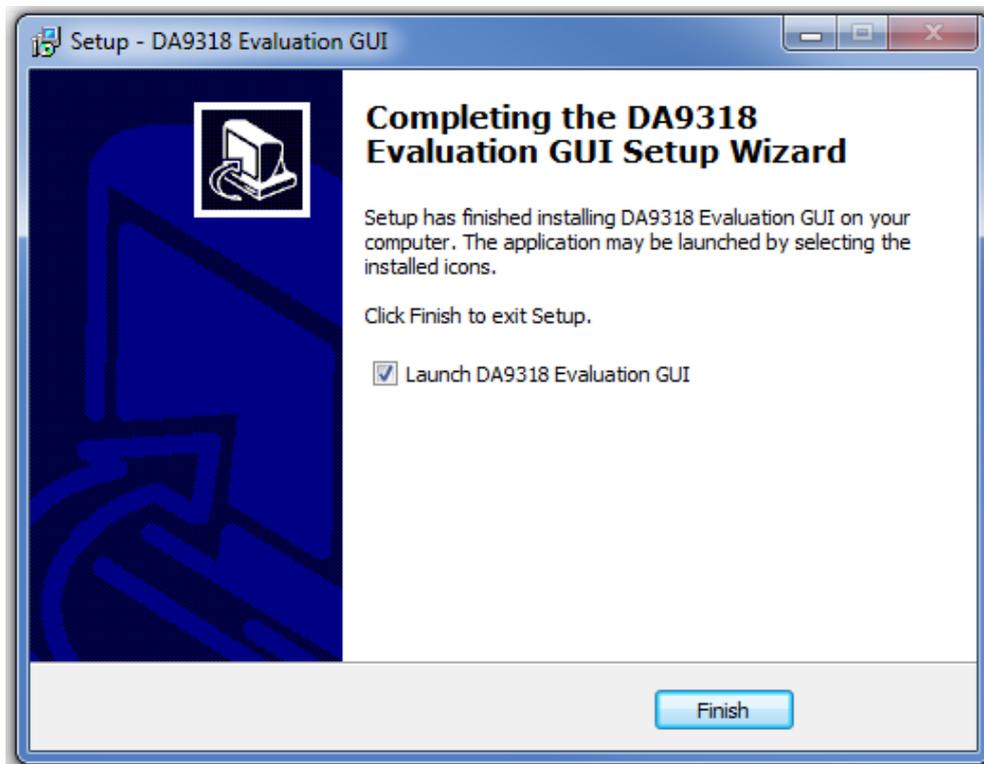**Figure 11: GUI Setup Start Installation**

6. Click **Install**.

Figure 12: GUI Setup Finish and Launch

7. Click **Finish**.

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Once the installation is completed, you may need to restart your computer.

When the software is installed, insert the USB cable before applying V_{SYS} and V_{IN}. The DA9318 SmartCanvas software can be started after power up.

5.2   Initial USB Connection

On connecting the USB to the PC for the first time, the SAM3U USB driver will request driver updating/installation from the Windows operating system. On Windows 7 (32-bit) operating systems (OS) the driver usually installs automatically. On Windows 7 (64-bit) machines it is common for the complete driver installation to fail. If this happens, install the driver manually by following these steps:

1. **Control Panel → Devices and Printers** (double-click device with yellow exclamation sign).
2. **Update Driver**.
3. **Browse my computer for driver software**.
4. Select the **Driver** folder location: **C:\Dialog Semiconductor\Power Management\DA9318 Evaluation Board GUI\Driver**.
5. If Windows warns about the driver, select **Install anyway**.
6. Remove the USB cable and then re-insert it into the evaluation board.

6 GUI Software

Run the DA9318 evaluation board GUI software by clicking the shortcut on the appropriate item in the Windows Start menu (**All Programs → Dialog Semiconductor → Power Management → DA9318Evaluation Board GUI**). The main GUI interface is displayed, see Figure 13.

The minimum recommended setting for the PC display size is 1024x768 pixels. Font size on the PC display should be Normal (95 dpi).

NOTE
A display size other than the recommended setting will affect the way in which the panels appear.

6.1 Controls

Groups of registers are grouped together on tabs to assist with identification of device function or registers of the same type. The GUI has five different tabs for accessing registers within DA9318:

- **Events/Mask/Status:** contains registers related to fault protection indicators
- **Charger:** contains selected registers that control the voltage and current protection limits, as well as the current doubler enable button
- **ADC:** contains the ADC control register and the data reported by the ADC (V_{IN}, I_{IN}, V_{OUT}, V_{BAT}, I_{OUT}, T_{JUNC})
- **Config:** contains miscellaneous configuration registers
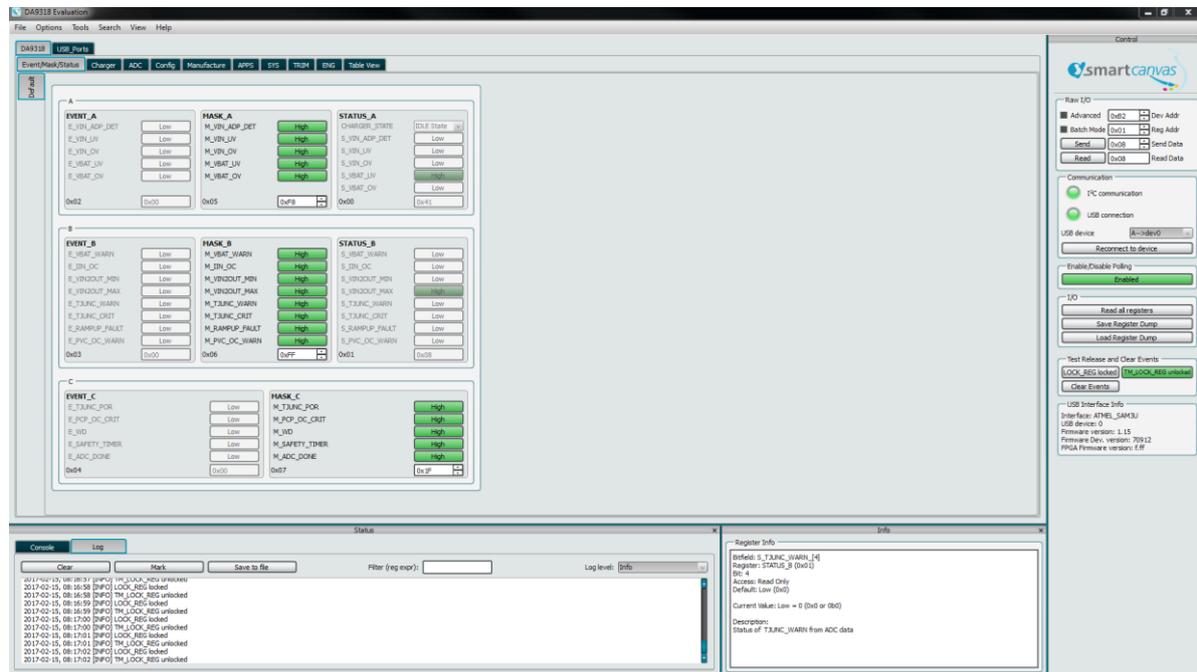- **APPS:** contains the enable bits for IDLE_LP mode and the safety/watchdog timers

Figure 13: Main GUI Interface

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6.2 Control Windows

All dockable control windows, either on the right or bottom of the main window add additional functionality or monitoring to the GUI. The windows can be undocked, by clicking on and dragging the title bar of that window, and can be placed anywhere on the screen. If desired the **Search** and **Info** windows can be docked on the left hand side of the main window for greater convenience.

6.2.1 Enable/Disable Polling

The polling switch enables or disables polling of the device registers and the refreshing of the registers controls on the GUI interface.
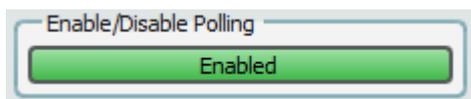
Figure 14: Polling

6.2.2 Raw I/O

The **Raw I/O** control sends the entered device address, register address, and data on the I^{2}C communications interface. If the information sent is not valid then the I^{2}C message will return NACK and an error message will be displayed in the **Status** window.

Figure 15: Raw I/O

6.2.3 Interface Control Information

In the **View** menu, click on **Status**, the **Status** window is displayed.

In the **Status** window, select the **Log** tab and **Log Level: Info**. This will display interface control information including: name, parent register and the bits to which this control corresponds, current value, whether it is read-only or R/W access, and finally a description of each possible setting.
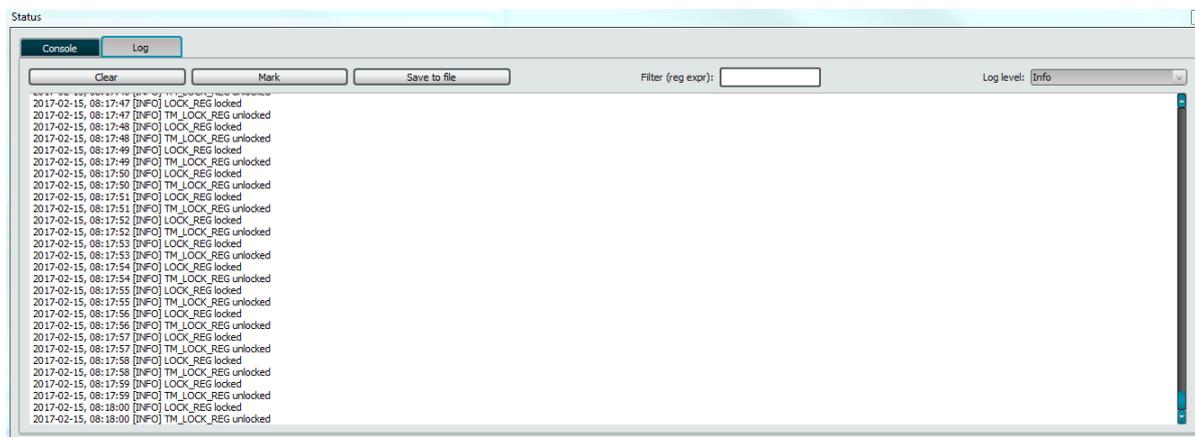

Figure 16: Interface Control Information

6.3   ADC Plotter

The DA9318 features an ADC plotting window which can plot ADC data over time. The ADC plotting tool can plot raw ADC data as well as the equivalent voltage/current/temperature. Access the ADC plotting tool from the **Tools** menu.

6.4   Quick Start Guide

To get the current doubler operational and switching:

1. Connect a power supply between IN and GND.
2. Connect a source meter, battery emulator, or battery between OUT and GND.
3. Connect the SYS connector to the OUT connector.
4. Set V_{IN} to 7.5 V.
5. Set V_{OUT} and V_{SYS} to 3.6 V (when using a real battery, set V_{IN} to 2*V_{BAT} + 300 mV).
6. Check the **EVENT** and **STATUS** registers in the **EVENT/STATUS/MASK** tab of the GUI. If any event has been flagged it is cleared by pressing the **Clear Events** button on the right side of the GUI.
7. When starting the current doubler, all the **EVENT** and **STATUS** register bits should be set to 0, except **S_VIN_ADP_DET** which should be 1.
8. On the **Charger** tab, set **CP_EN** to high. After doing this, the **CP_SWITCHING** bit should transition from 0 to 1 to indicate that the current doubler is operational. If **CP_SWITCHING** is still low after setting **CP_EN** to 1, continue with the following steps:

    a. Verify the **STATUS** and **EVENT** registers, there should be no event flag generated. The **STATUS_A** charger state should have switched from **IDLE** to **ACTIVE** after clicking the **CP_EN** button.

    b. Increase the VIN2VOUT minimum threshold before setting **CP_EN** to high:

    WRITE DA9315 0x1C 0x4A

    WRITE DA9315 0x21 0xD0

    c. If a current meter is connected between the IN power supply and the IN plug on the evaluation board, temporarily short the current meter until the current doubler is switching, then remove the short.

9. A real battery or high bandwidth battery emulator is recommended for testing. If using a source meter on the output, the source meter should be configured for high bandwidth operation. In addition, the current measurement range of the source meter should be changed from **auto** to a fixed value that is appropriate for the test.

Revision History

Revision	Date	Description
1.3	16-Feb-2022	Document rebranded to Renesas.
1.2	27-Mar-2019	Latest revision. Default link position updated
1.1	24-Jul-2017	Additional recommended setup conditions for using a source meter in place of a real battery.
■ Section 6.4: Quick Start Guide ○ Added step 11.		
1.0	15-Feb-2017	Initial version.

Status Definitions

Status	Definition
DRAFT	The content of this document is under review and subject to formal approval, which may result in modifications or additions.
APPROVED or unmarked	The content of this document has been approved for publication.

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(Rev.1.0 Mar 2020)

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