

User Manual

DA9318 Evaluation Board

UM-PM-021

Abstract

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

DA9318 Evaluation Board

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DA9318 Evaluation Board**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.

DA9318 Evaluation Board

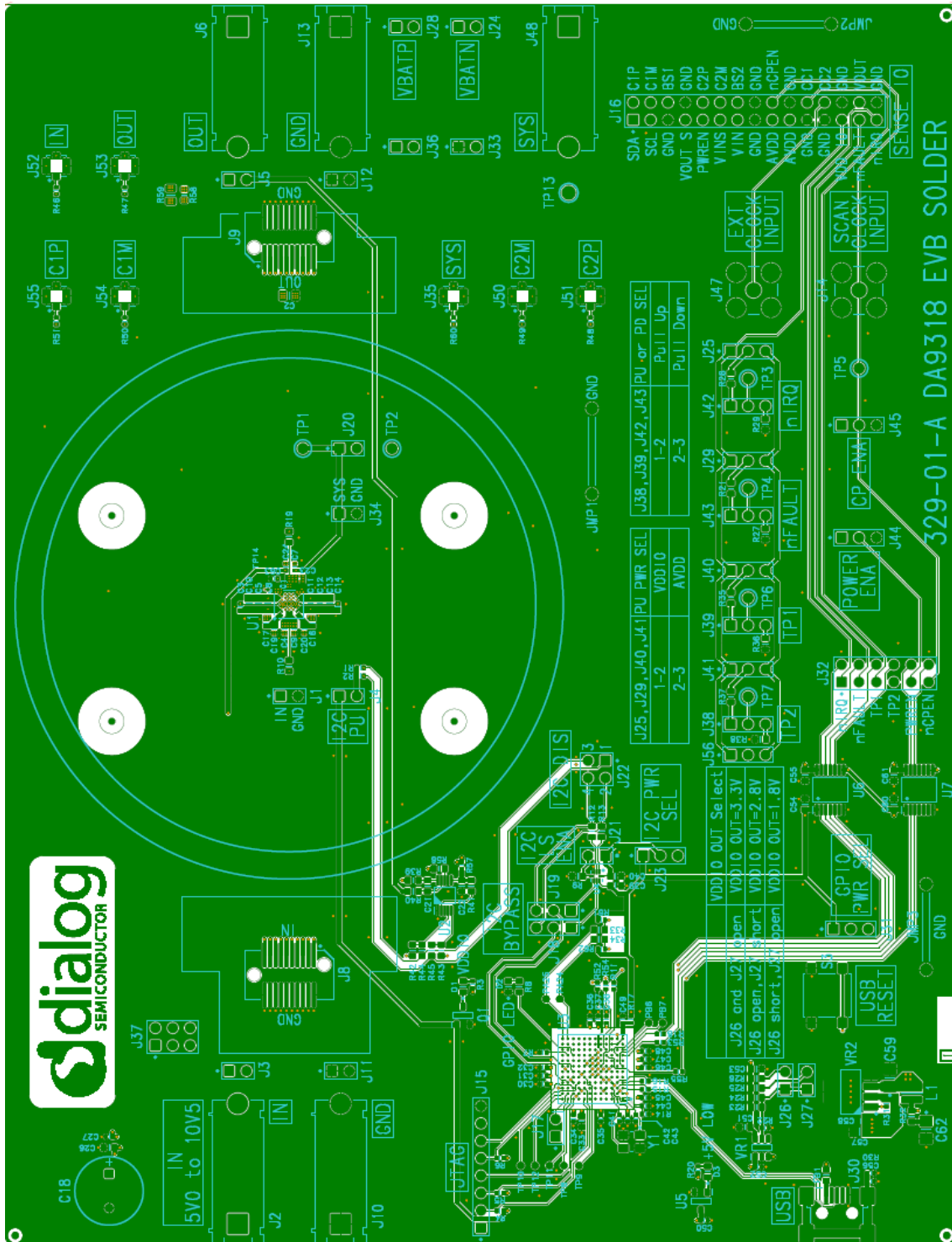


Figure 1: DA9318 Evaluation Board

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4 Evaluation Board Hardware

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

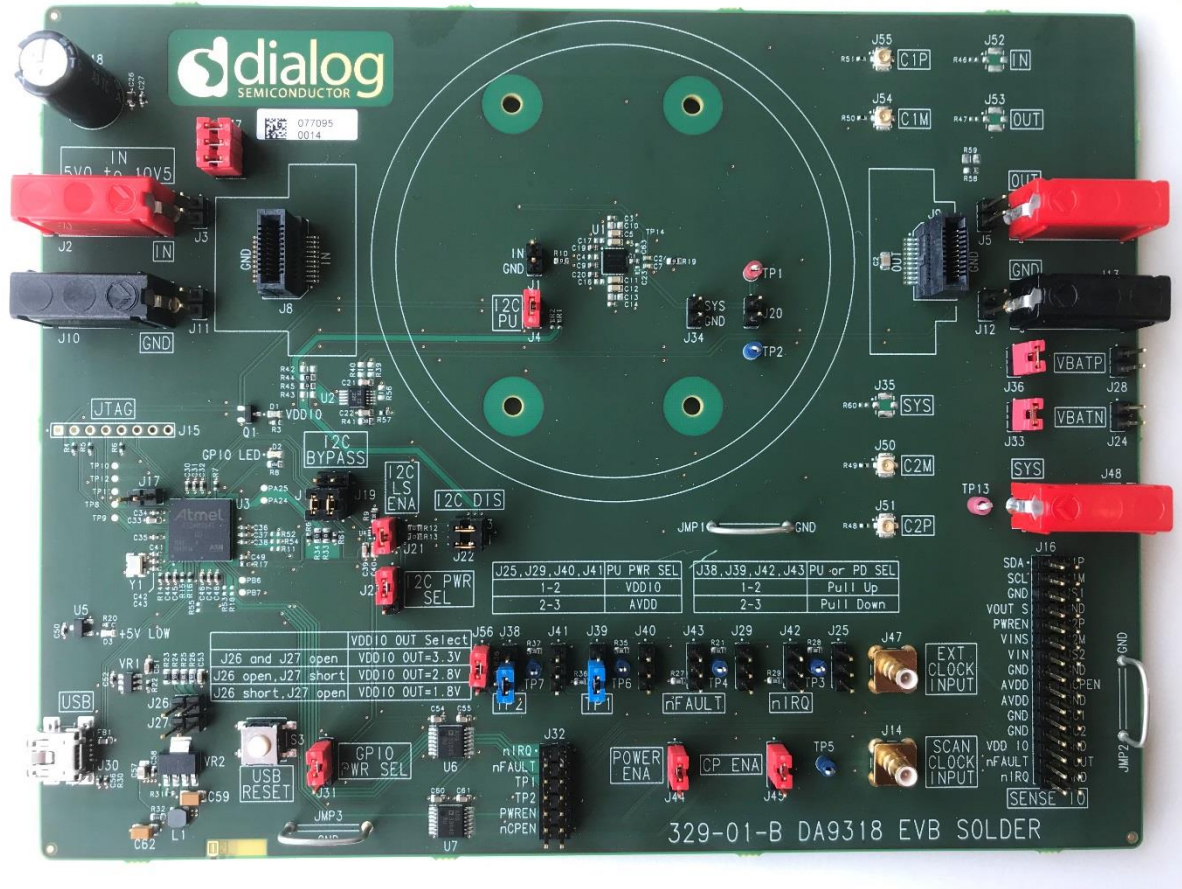


Figure 2:

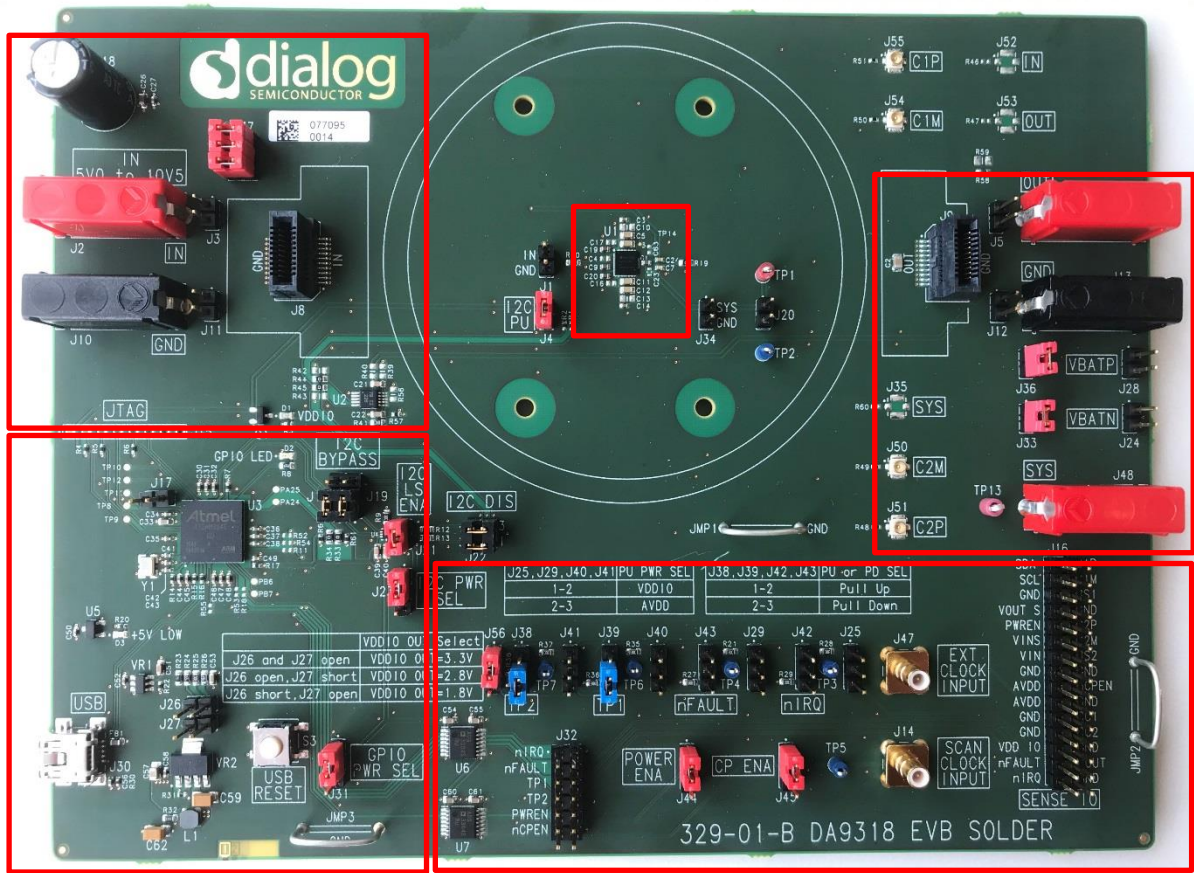


Figure 2: Functional Sections

- 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

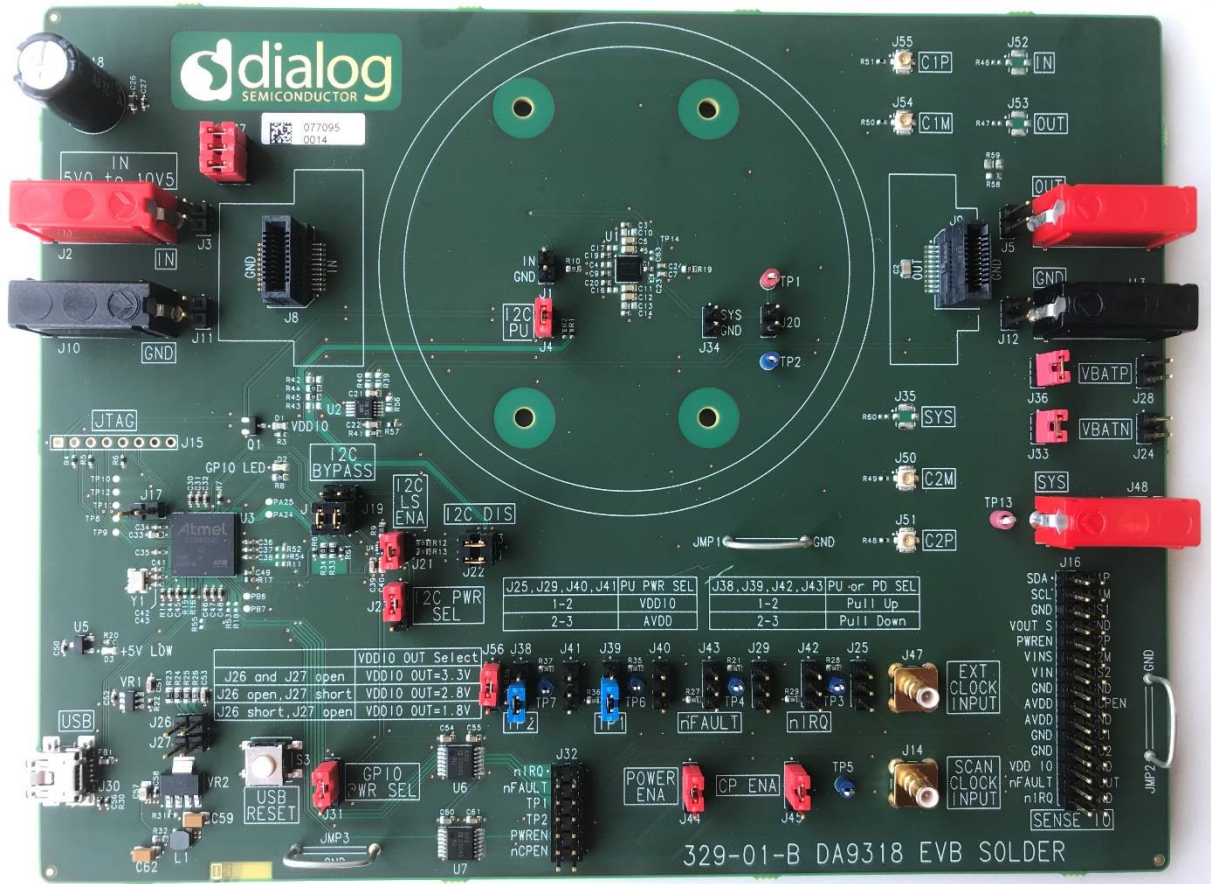


Figure 3: Default Link Positions

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) | I ² C bypass: SAMU3U SCL connected to LS input |
| | 2-3 | I ² C bypass: SAMU3U SCL connected to LS output (bypass) |
| J19 | 1-2 (Default) | I ² C bypass: SAMU3U SDA connected to LS input |
| | 2-3 | I ² C 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) | I ² C 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) | I ² C LS power selection: connected to VDD_IO |
| | 2-3 | I ² C 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:

- I²C 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 I²C interface). This resets the GUI communication with the evaluation board.

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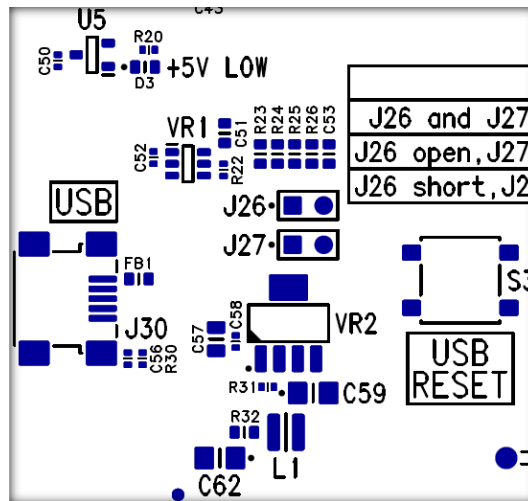


Figure 4: USB Interface Connector and Reset Switch

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.

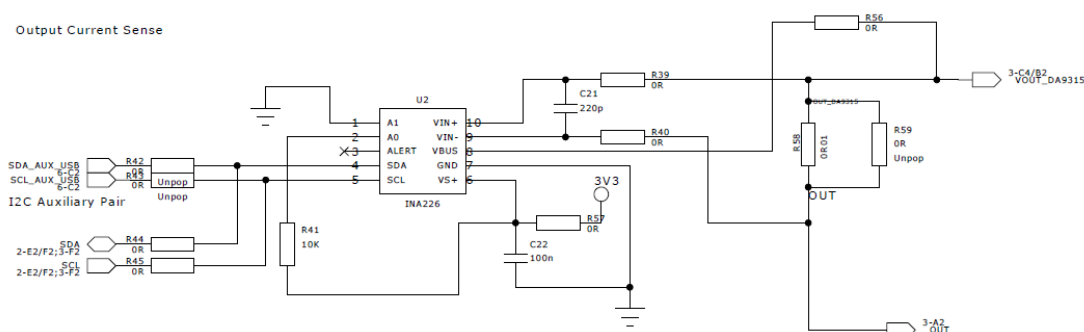


Figure 5: External Output Current Sense Circuit

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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

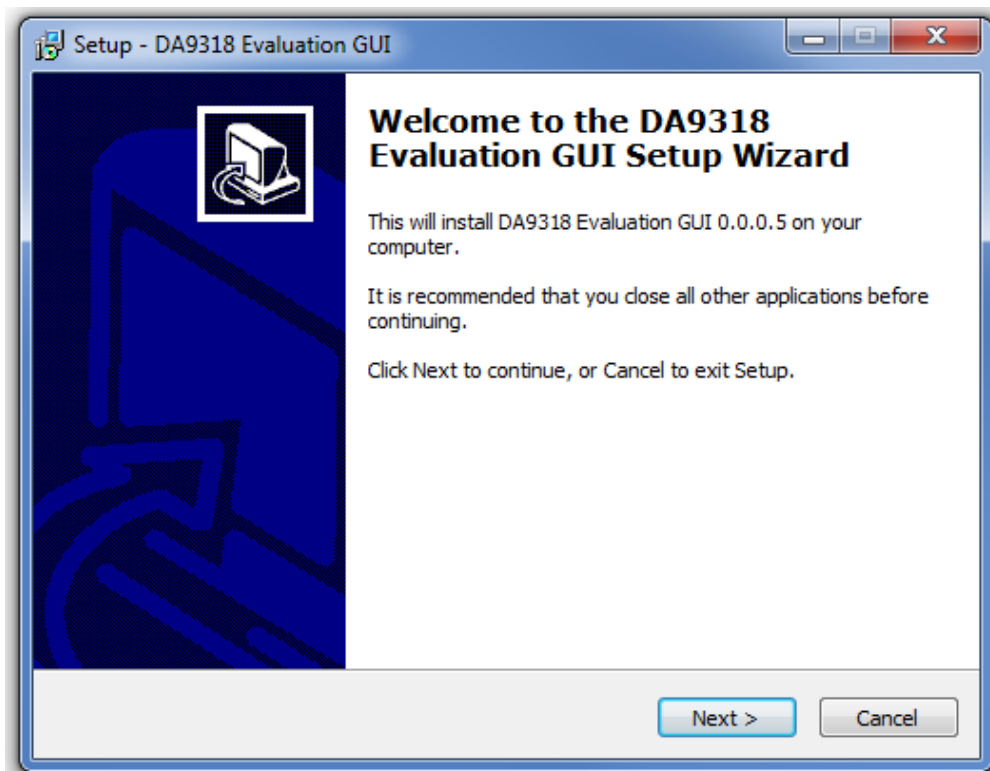


Figure 6: GUI Setup Wizard

1. Click **Next**.

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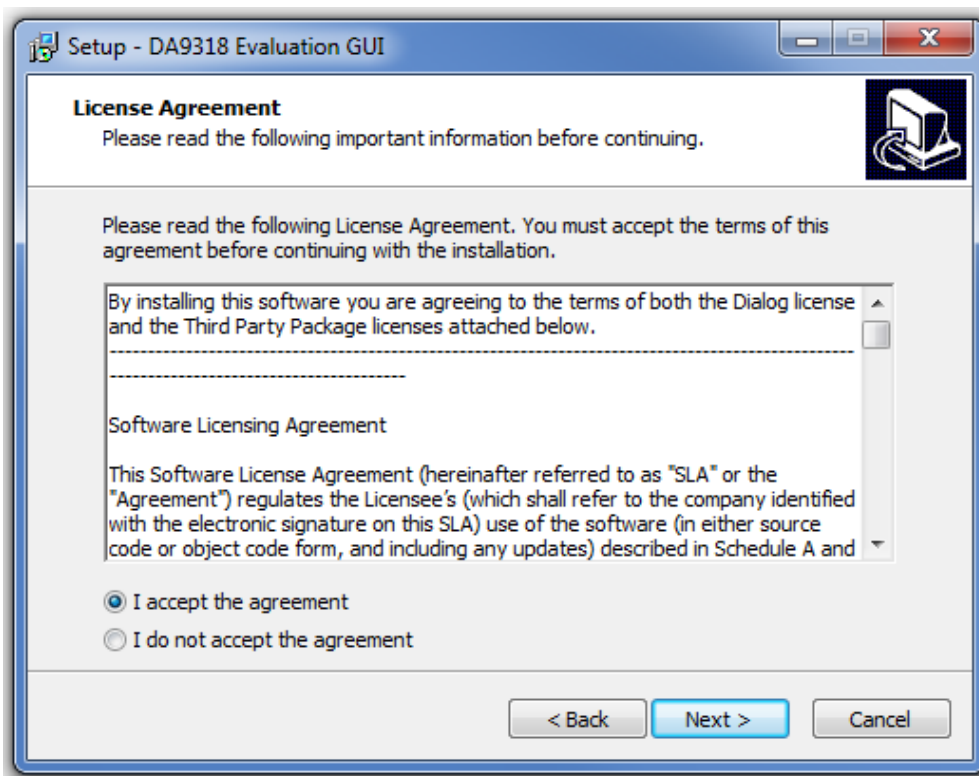


Figure 7: GUI Setup License Agreement

2. Select **I accept the agreement** then click **Next**.

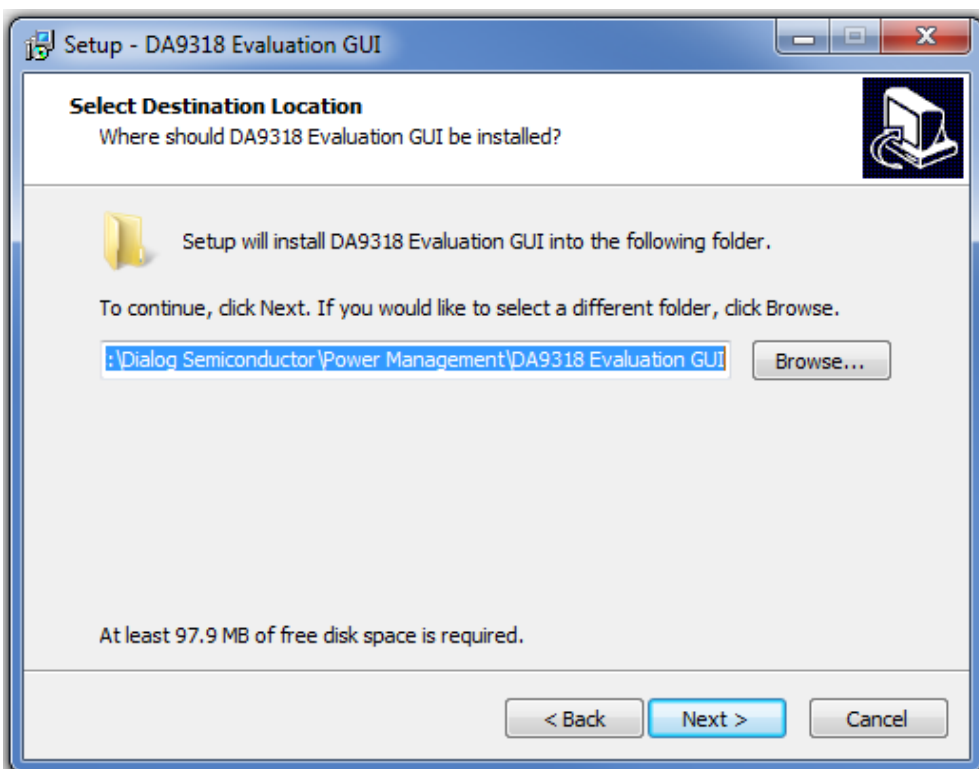


Figure 8: GUI Setup Destination Location

3. Click **Next**.

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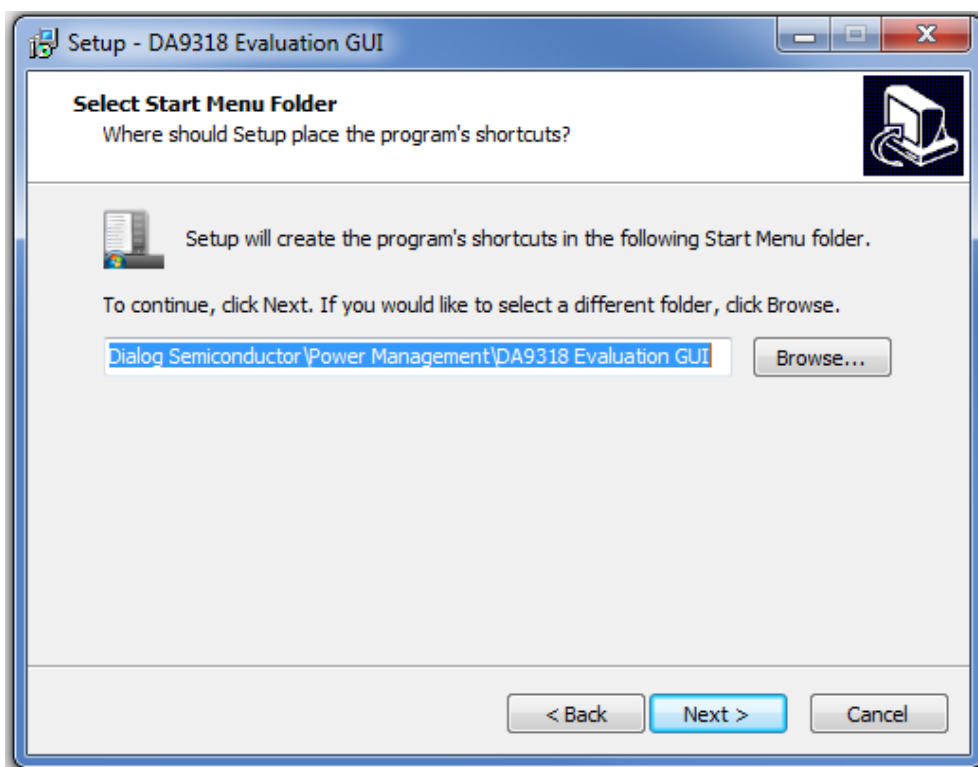


Figure 9: GUI Setup Start Menu Location

4. Click **Next**.

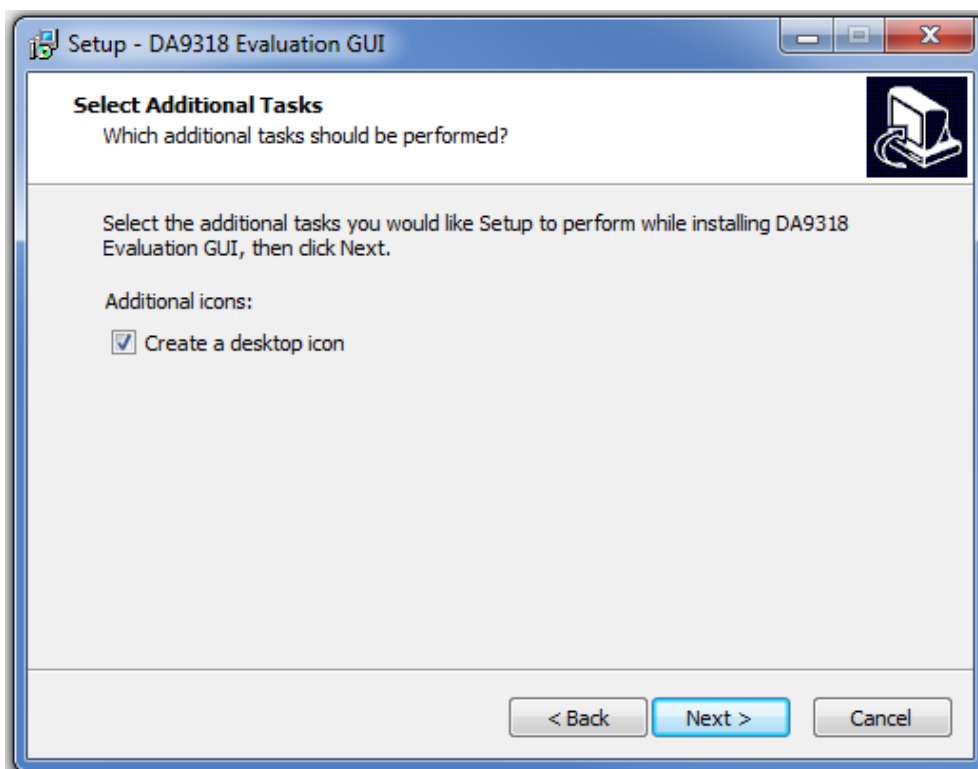


Figure 10: GUI Setup Additional Tasks

5. Select the **Create a desktop icon** check box and click **Next**.

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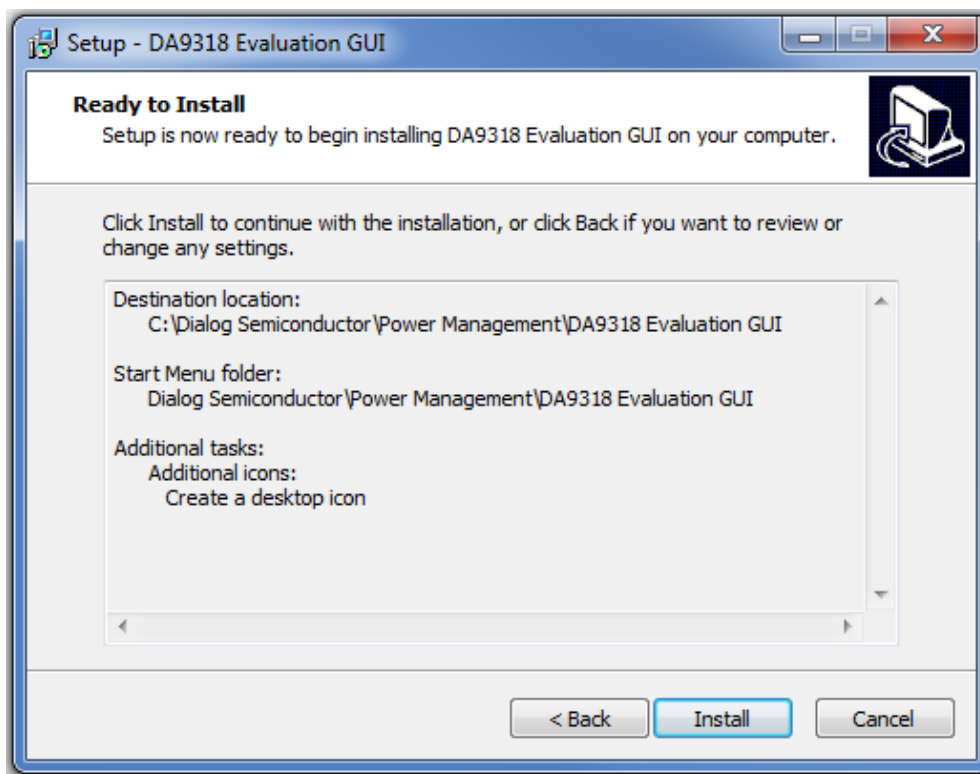


Figure 11: GUI Setup Start Installation

6. Click **Install**.

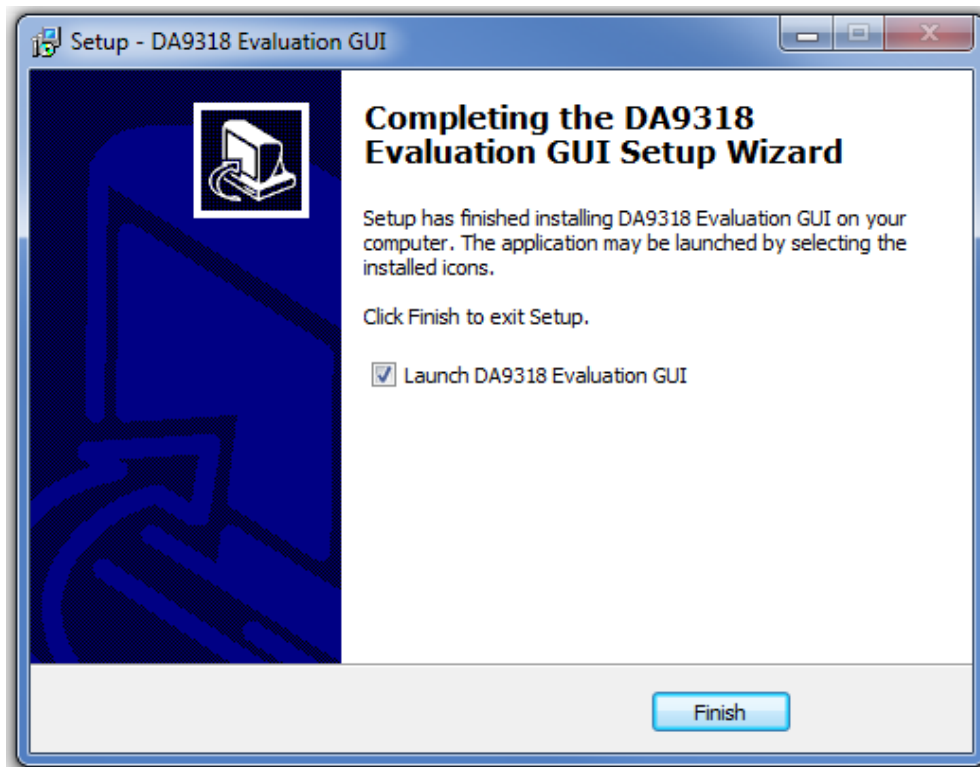


Figure 12: GUI Setup Finish and Launch

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

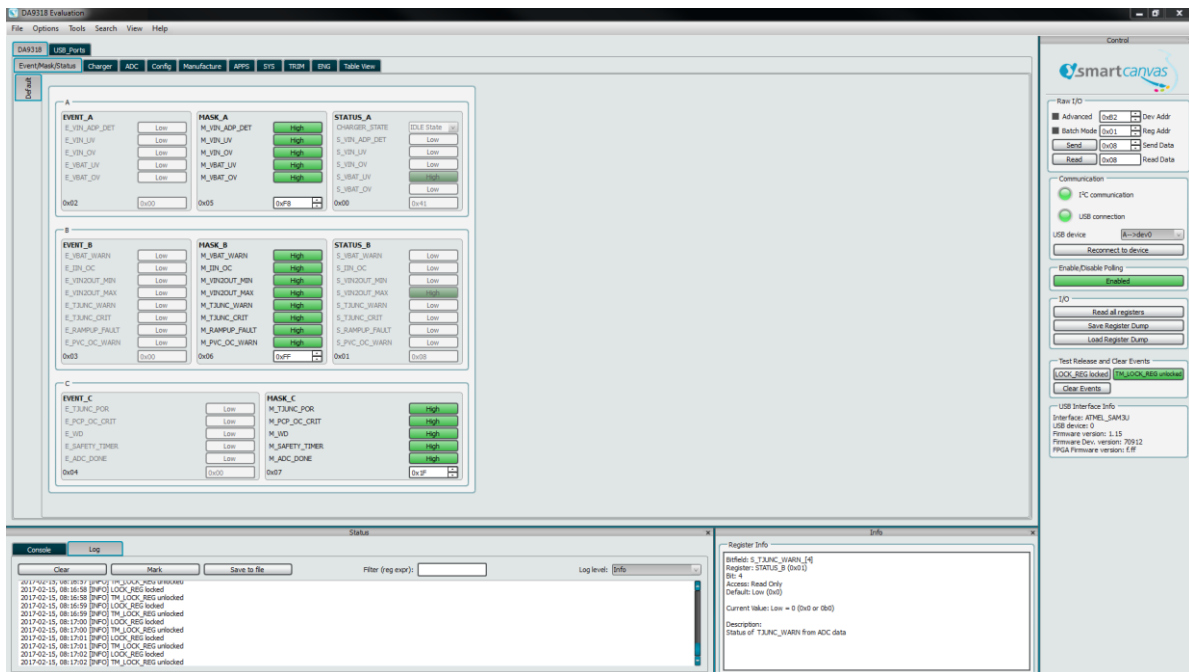


Figure 13: Main GUI Interface

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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.

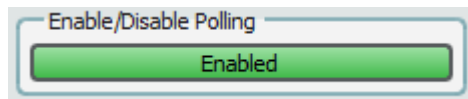


Figure 14: Polling

6.2.2 Raw I/O

The **Raw I/O** control sends the entered device address, register address, and data on the I²C communications interface. If the information sent is not valid then the I²C message will return NACK and an error message will be displayed in the **Status** window.

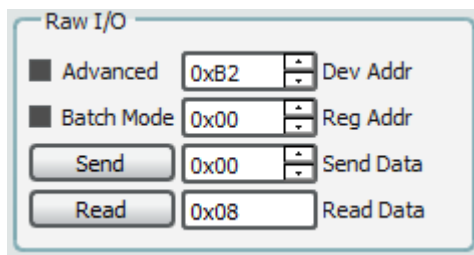


Figure 15: Raw I/O

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.

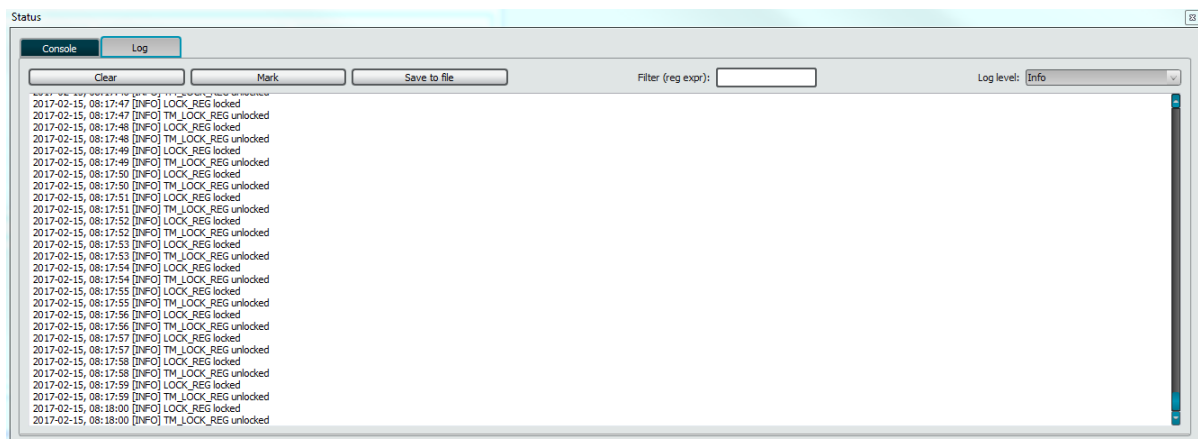


Figure 16: Interface Control Information

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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 $2 \cdot V_{BAT} + 300$ 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.

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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. |
| <ul style="list-style-type: none">■ Section 6.4: Quick Start Guide<ul style="list-style-type: none">○ Added step 11. | | |
| 1.0 | 15-Feb-2017 | Initial version. |

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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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Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu

Koto-ku, Tokyo 135-0061, Japan

www.renesas.com

Contact Information

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