

# Customer evaluation kit description

## PROFET™+2 12V

### About this document

#### Scope and purpose

This user manual is intended to give users an overview of the PROFET™+2 12V customer evaluation kit and to enable users to integrate the Config Wizard for IPD for the PROFET™+2 12V customer evaluation kit.

The information given in this document is intended only to be an implementation guide. It is not a description or warranty of a certain functionality, condition or quality of the device.

#### Intended audience

This document is intended for anyone using the PROFET™+2 12V customer evaluation kit with or without the Config Wizard for IPD.

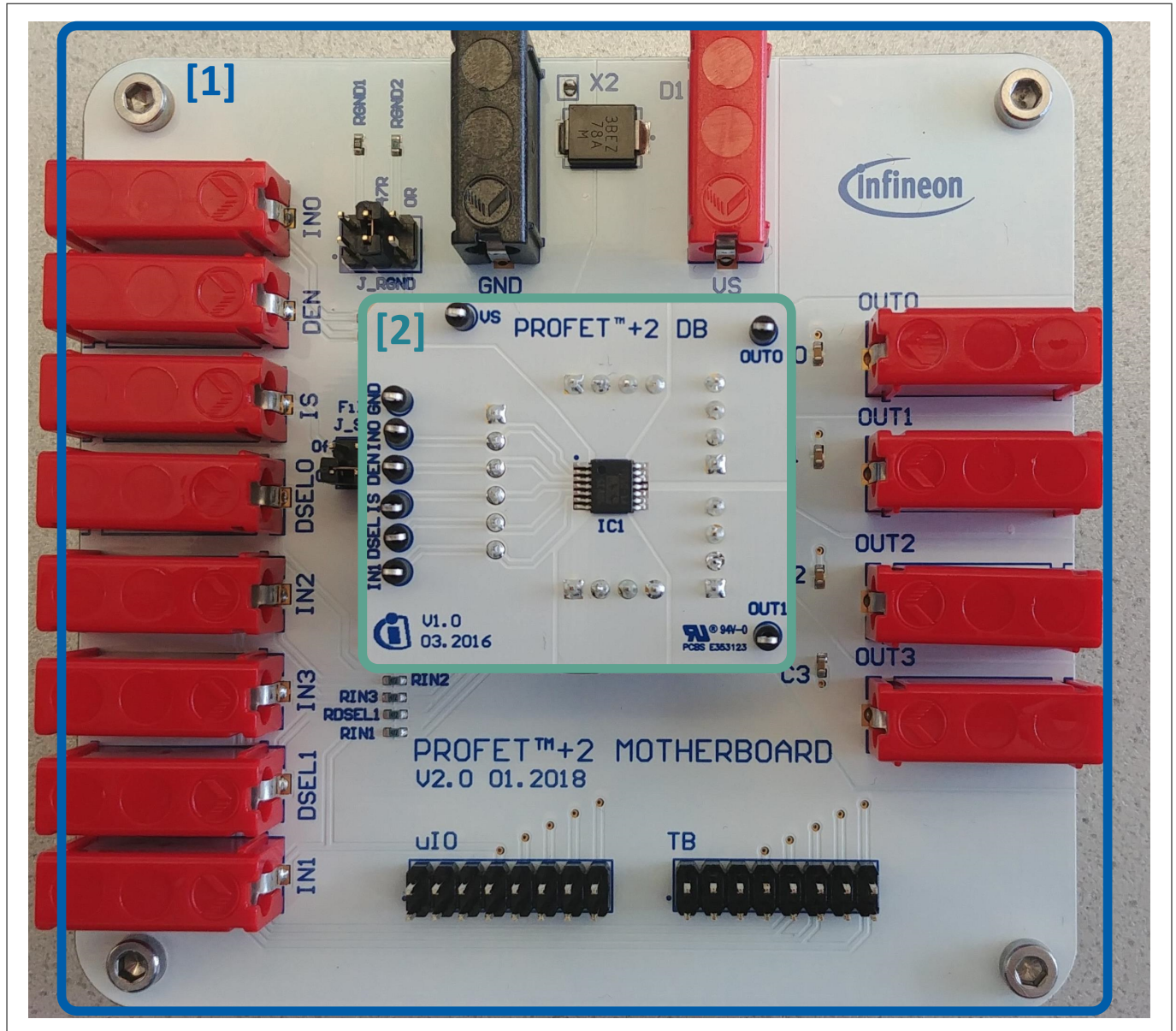
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## 1 Overview

### 1 Overview

The PROFET™+2 12V customer evaluation kit consists of a motherboard [MB] and a daughterboard [DB]. The DB is plugged onto the MB, as seen in [Figure 1](#) below.



**Figure 1** PROFET™+2 12V MB [1] and DB [2]

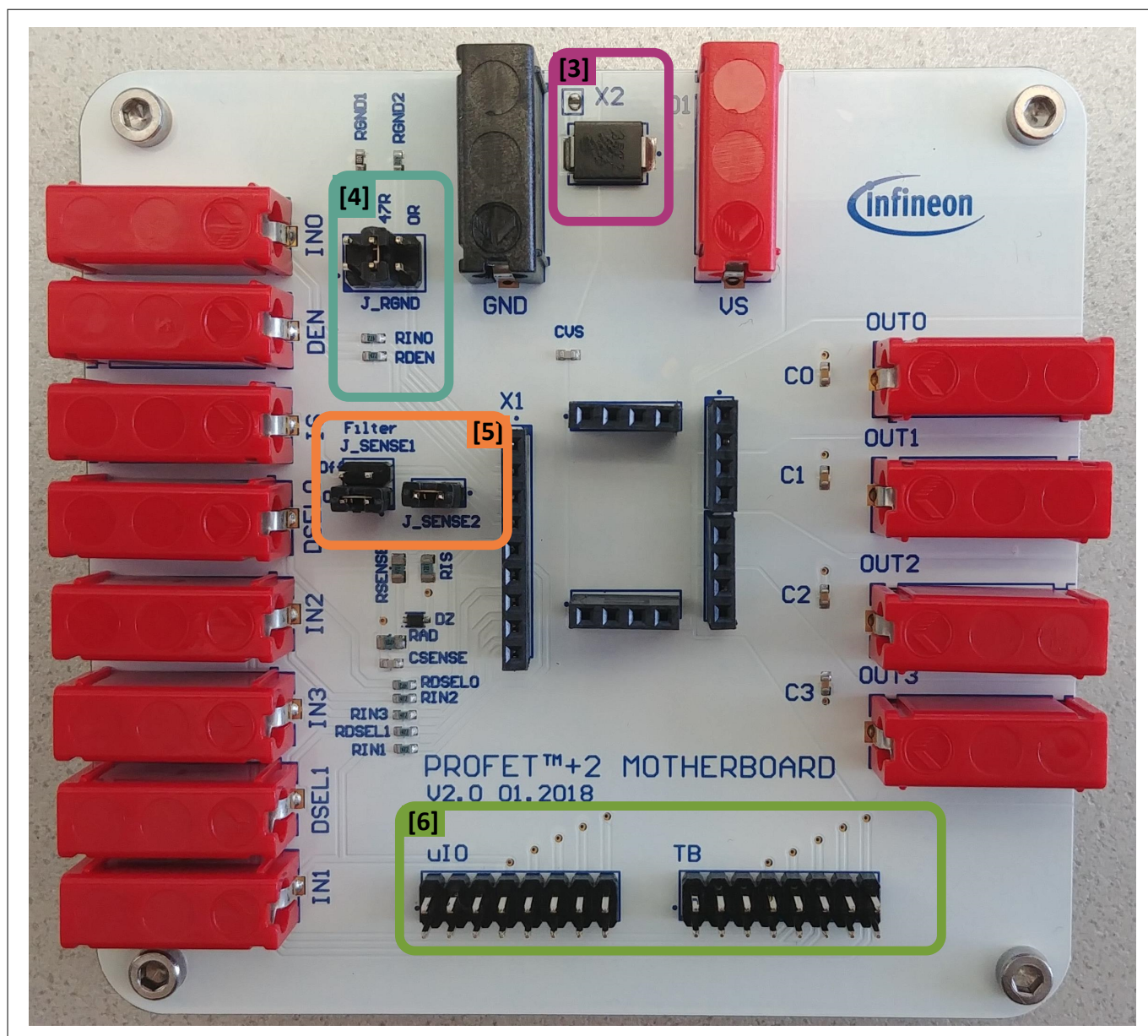
#### Application

- The MB is designed to handle all devices within the PROFET™+2 12V family
  - 1-channel, 2-channel or 4-channel PROFET™+2 12V devices (DBs) can be plugged onto the MB
- It is suitable for evaluation of resistive, capacitive and/or inductive loads
- The evaluation can either be done directly or with the Config Wizard for IPD (see [Chapter 4](#))
- The board is **not** designed for **EMC characterization**, including ISO pulses
- The board design is **not** optimized for **thermal performance characterization**

## 2 Evaluation kit description

## 2 Evaluation kit description

**Figure 2** below illustrates the location of the connectors and jumpers. The jumpers' names are printed next to them and will be explained in more detail (see [Chapter 2.1](#)).



**Figure 2** PROFET™+2 12V MB - connectors and jumpers

**Table 1** PROFET™+2 12V MB connectors and jumpers

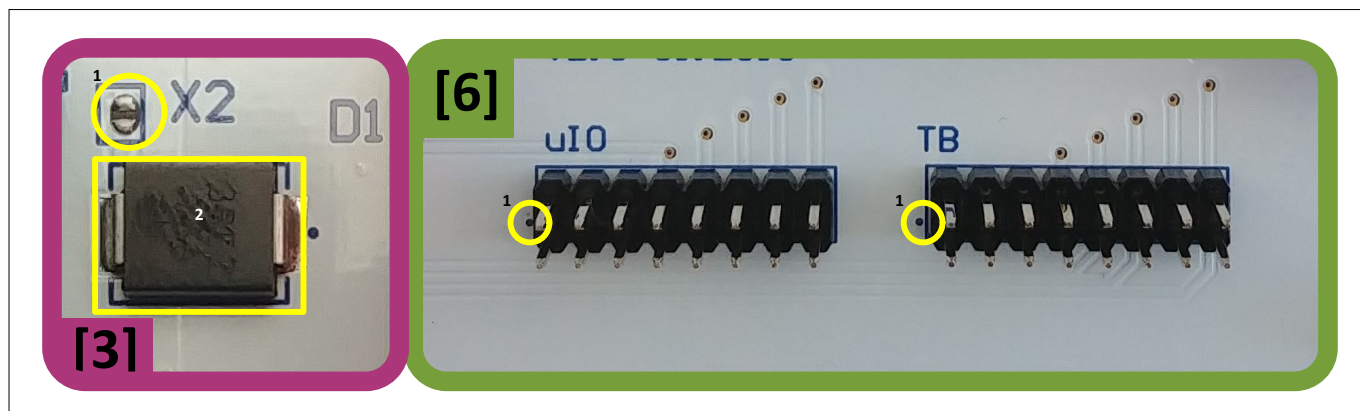
|     |                                        |
|-----|----------------------------------------|
| [1] | PROFET™+2 12V MB                       |
| [2] | PROFET™+2 12V DB                       |
| [3] | TVS Diode                              |
| [4] | J_RGND                                 |
| [5] | J_SENSE1, J_SENSE2                     |
| [6] | μIO connectors of the PROFET™+2 12V MB |



## 2 Evaluation kit description

### 2.1 Detailed information on the evaluation kit

The two  $\mu$ IO connectors of the PROFET™+2 12V MB [6] are used to connect the motherboard with the  $\mu$ IO-Stick<sup>1)</sup> (for further information see [Chapter 4](#)). The connector marked as  $\mu$ IO can only be used for 1-channel and 2-channel devices, whereas the connector marked with TB also can be used for 4-channel devices. The yellow circles on the images below mark the position of the *PIN 1* indicator. In order to avoid overvoltages on the MB it is possible to close the solder bridge X2 which connects a TVS diode between VS and GND. [Figure 3](#) and [Table 2](#) describe the solder bridge X2, the TVS diode [3] and the two  $\mu$ IO connectors of the PROFET™+2 12V MB.

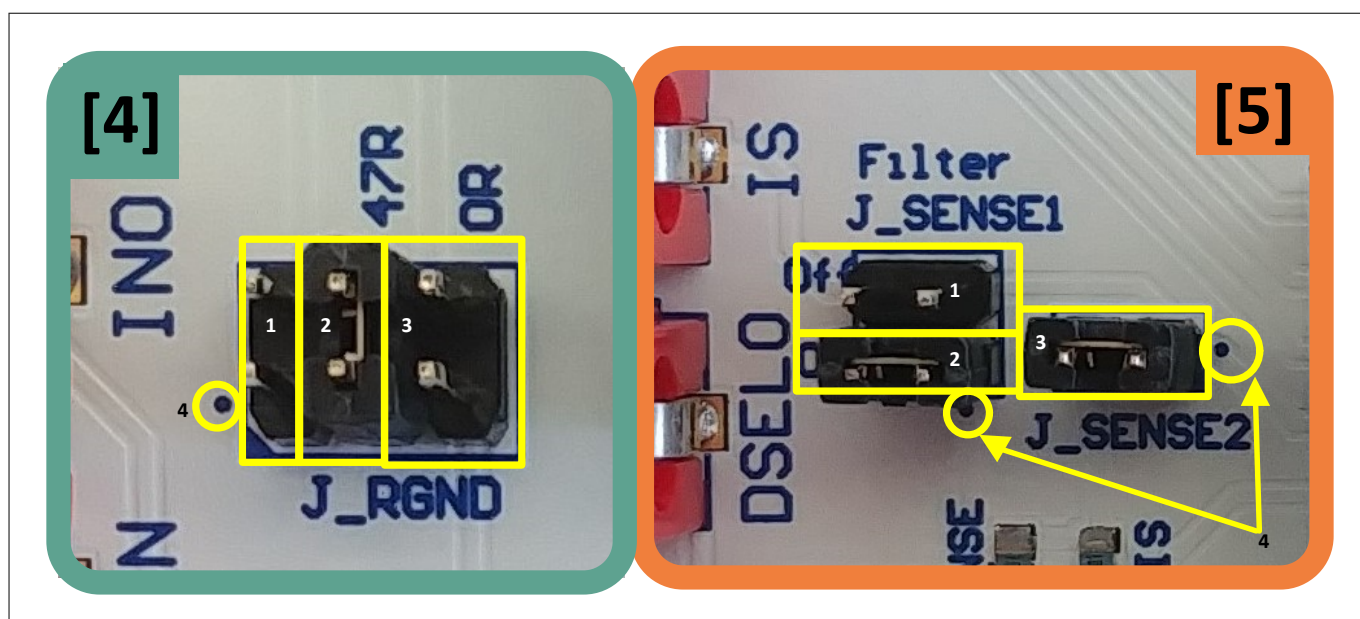


**Figure 3** TVS diode

**Table 2** TVS diode [3]

| # | Description                          |
|---|--------------------------------------|
| 1 | Solder bridge X2 (opened by default) |
| 2 | TSV diode                            |

[Figure 4](#) and the following tables illustrate the jumpers, their positions and the respective positions of *PIN 1*. The description of the positions is given in [Table 3](#) (J\_RGND [4]) and [Table 4](#) (J\_SENSE1, J\_SENSE2 [5]).



**Figure 4** Jumper positions

<sup>1)</sup> The Infineon  $\mu$ IO-Stick can be ordered at <https://www.ehitex.de/en/>



## 2 Evaluation kit description

**Table 3** below lists the description of the three jumper positions of J\_RGND [4], as well as the position of *PIN 1*.

**Table 3 J\_RGND [4] - Jumper positions**

| # | Description                                                                                |
|---|--------------------------------------------------------------------------------------------|
| 1 | The PROFET™+2 12V DB ground is connected to MB's module ground via a resistor 150 $\Omega$ |
| 2 | The PROFET™+2 12V DB ground is connected to MB's module ground via a resistor 47 $\Omega$  |
| 3 | The PROFET™+2 12V DB ground is connected to MB's module ground via a resistor 0 $\Omega$   |
| 4 | <i>PIN 1</i> indicator                                                                     |

**Table 4** below lists the description of J\_SENSE1 and J\_SENSE2 jumpers [5], as well as their positions and the position of *PIN 1*.

For converting the IS-current to a voltage J\_SENSE2 [3] has to be closed. In case a different sense resistor will be used either replace RIS or use an external resistor. Therefore remove jumper J\_SENSE2 [3] and close JSENSE [1]. This enables a direct path from *IS-PIN* of the device to the banana connector.

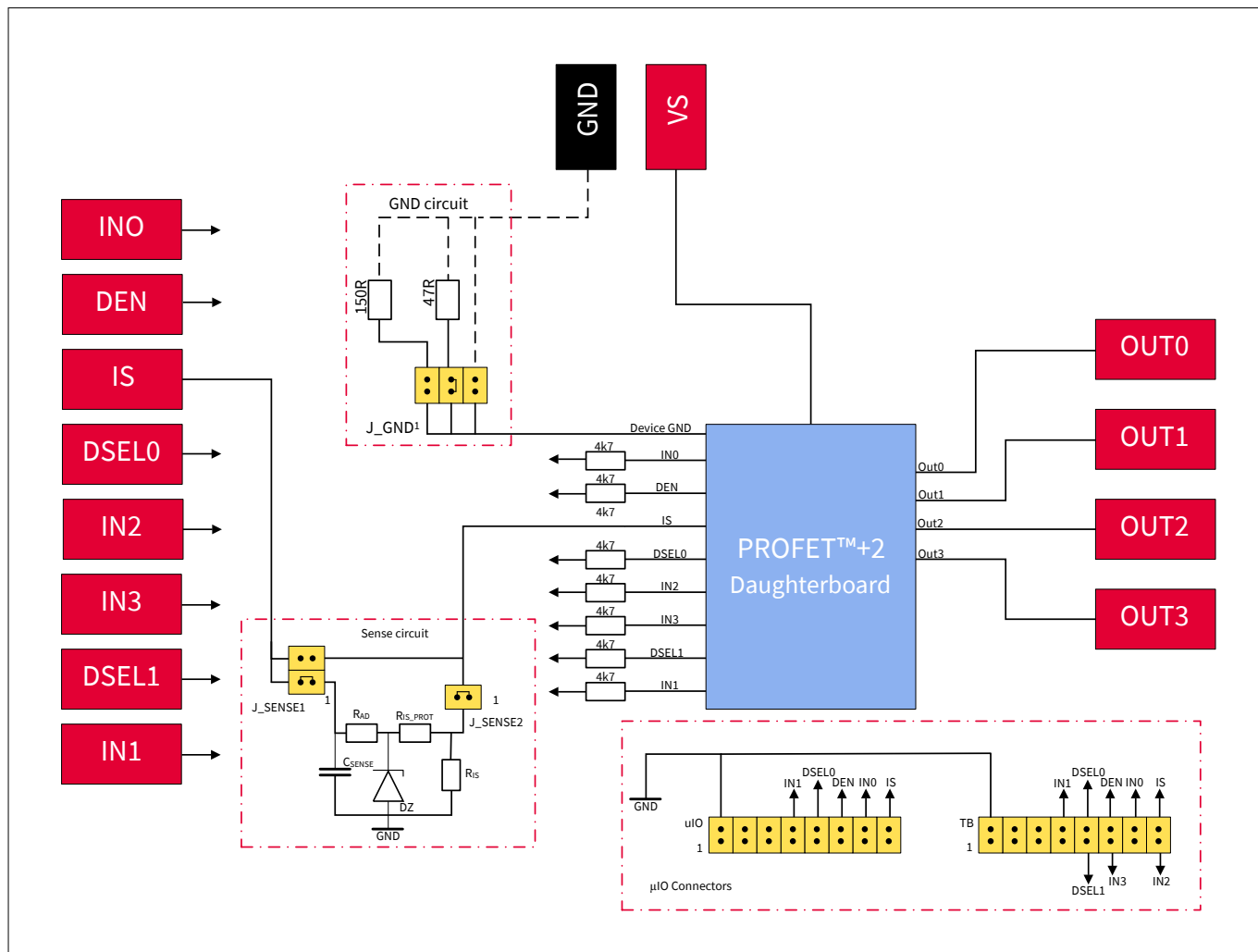
**Table 4 J\_SENSE1, J\_SENSE2 [5] - Jumper positions**

| # | Description                                                                                                                    |
|---|--------------------------------------------------------------------------------------------------------------------------------|
| 1 | Connects the <i>IS-PIN</i> of the device directly to the banana connector of the MB and disables the on-board filter of the IS |
| 2 | Connects the <i>IS-PIN</i> of the device after the on-board filter to the banana connector of the MB                           |
| 3 | Connects the <i>IS-PIN</i> of the device to the 1.2 k $\Omega$ sense resistor ( $R_{IS}$ ) and to the $\mu$ IO connectors      |
| 4 | <i>PIN 1</i> indicator                                                                                                         |

## 2 Evaluation kit description

### 2.2 PROFET™+2 12V motherboard [MB]

The following block diagram ([Figure 5](#)) gives an overview of the locations of jumpers and connectors.



**Figure 5** Block diagram of the PROFET™+2 12V MB

The device can also be controlled via µIO-Stick (see [Chapter 2.1](#), [Chapter 4](#)) The functionalities of the jumpers as well as the purpose of the connectors in the block diagram above are listed in [Table 5](#) below.

**Table 5** PROFET™+2 12V MB connectors and jumpers

|                    |                                                                                   |
|--------------------|-----------------------------------------------------------------------------------|
| VS                 | Connection of the supply voltage                                                  |
| GND                | Connection of the GND module                                                      |
| OUT0               | OUT0 from the PROFET™+2 12V                                                       |
| OUT1               | OUT0/ <sup>2)</sup> from the PROFET™+2 12V                                        |
| OUT2               | OUT1/ <sup>2,3)</sup> from the PROFET™+2 12V                                      |
| OUT3               | OUT1/ <sup>3)</sup> from PROFET™+2 12V                                            |
| IN0, IN1, IN2, IN3 | External input control of the PROFET™+2 12V device with serial 4.7 kOhm resistors |

<sup>2</sup> If a 1- or 2-channel device is used, OUT0 and OUT1 are connected to OUT0 of the device connector

<sup>3</sup> If a 2-channel device is used, OUT3 and OUT4 are connected to OUT1 of the device connector

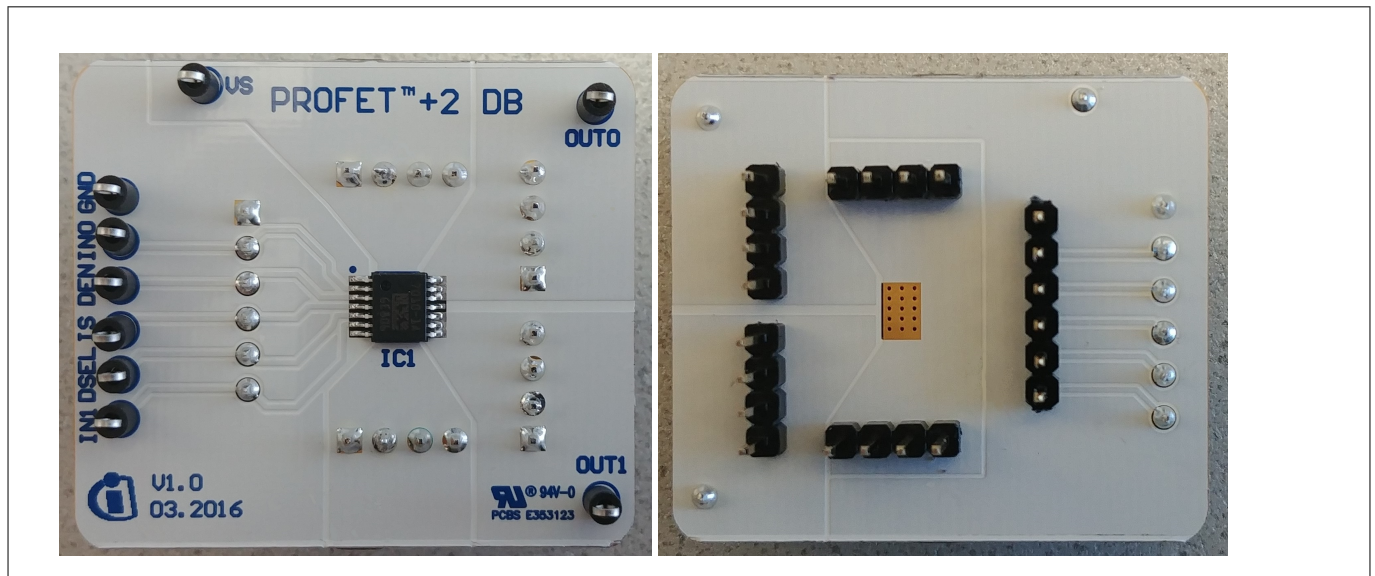
## 2 Evaluation kit description

**Table 5**                      **PROFET™+2 12V MB connectors and jumpers (continued)**

|                |                                                                                                                                                                                                                                            |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DEN            | External control of DEN pin with serial 4.7 kΩ resistor<br>This enables/disables the diagnosis functions of the device.                                                                                                                    |
| DSEL0, DSEL1   | External control of DSELx pins with serial 4.7 kΩ resistor to select a dedicated channel for diagnosis feedback                                                                                                                            |
| IS             | Sense output of the PROFET™+2 12V (see <a href="#">Chapter 2.1</a> for further information)                                                                                                                                                |
| J_GND          | J_GND is used to connect the PROFET™+2 12V to the motherboards GND network. It is also possible to choose between three ground resistances (150 Ω, 47 Ω, 0 Ω). For further information see <a href="#">Chapter 2.1</a>                     |
| J_SENSE1       | This jumper is used to enable/disable the sense filtering. For further information see <a href="#">Chapter 2.1</a>                                                                                                                         |
| J_SENSE2       | J_SENSE2 either enables the connection to a 1.2 kΩ onboard-resistor or a direct connection to the IS connector on the motherboard to add an external RSENSE with different values. For further information see <a href="#">Chapter 2.1</a> |
| μIO-Connectors | The PROFET™+2 12V demoboard can either be used with external sources or with the μIO-stick by means of the Infineon Config Wizard (see <a href="#">Chapter 4</a> ). For further information see <a href="#">Chapter 2.1</a>                |

### 2.3 PROFET™+2 12V daughterboard [DB]

The PROFET™+2 12V DB includes the device (PROFET™+2 12V). The DB is plugged onto the MB. [Figure 6](#) below displays the PROFET™+2 12V DB in top- and bottom-view.



**Figure 6**                      **Top- and bottom-view of the PROFET™+2 12V daughterboard**

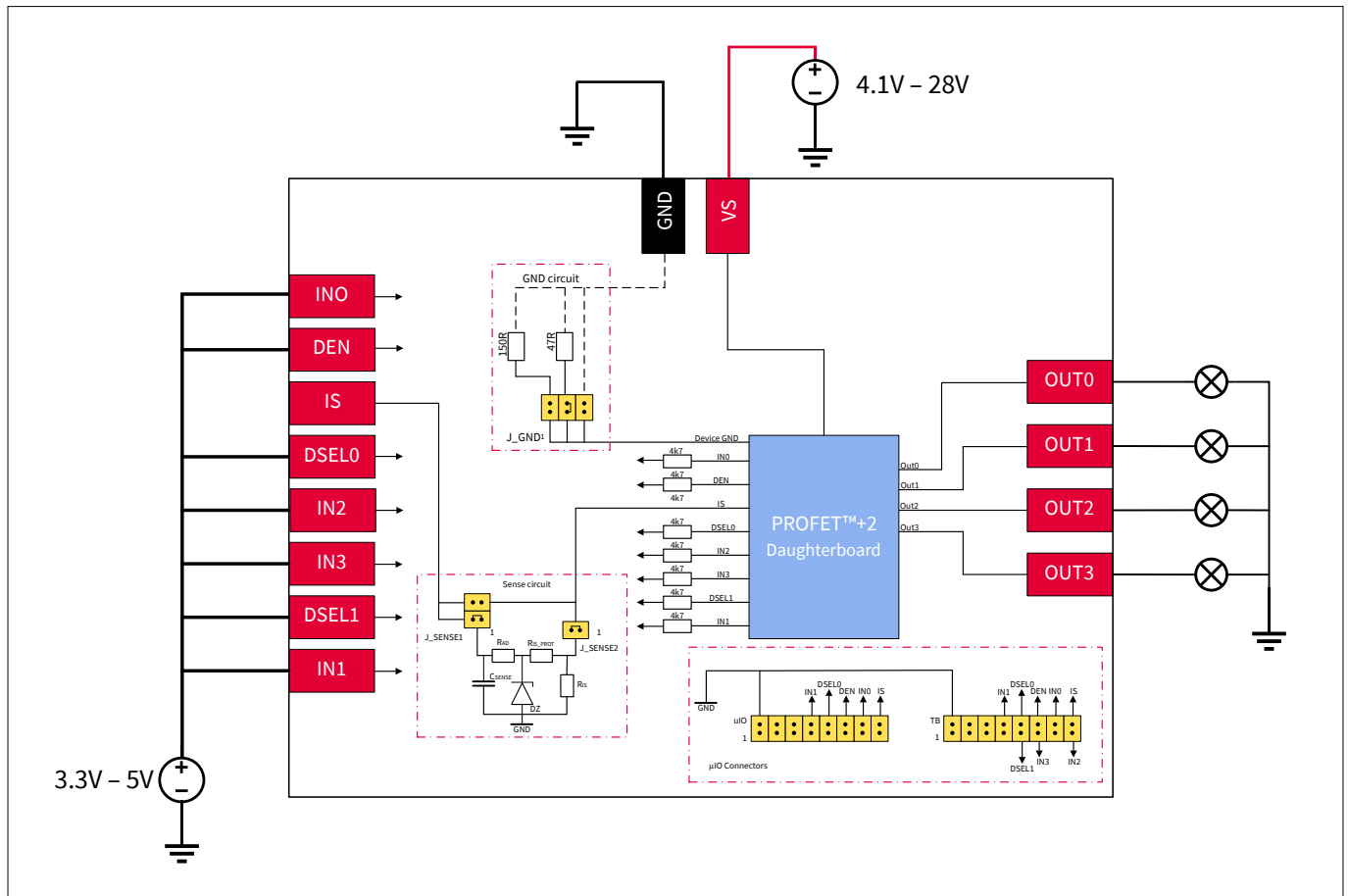


**3 Quickstart guide: PROFET™+2 12V evaluation kit**

### 3 Quickstart guide: PROFET™+2 12V evaluation kit

1. Plug the PROFET™+2 12V DB onto the MB
2. Connect a power supply to (4.1 V – 28 V)
3. Connect digital supply (LOW: 0 V, HIGH:  $3.3\text{ V} \leq V_{\text{IN}} \leq 5\text{ V}$ ) to DEN
  - a. and IN0 (1-channel devices)
  - b. DSEL0, IN0 and IN1 (2-channel devices)
  - c. DSEL0, DSEL1, IN0, IN1, IN2 and IN3 (4-channel devices)
4. Connect loads ( $I_{\text{L(NOM)}}$  according to datasheet) to:
  - a. OUT0 (1-channel devices)
  - b. OUT0 and OUT2 (2-channel devices)
  - c. OUT0, OUT1, OUT2 and OUT3 (4-channel devices)
5. Switch ON the power supply and the digital supply
6. For further details consult the datasheet

**Figure 7** below illustrates the implementation of the quickstart setup for a PROFET™+2 12V device.



**Figure 7 Quickstart setup for the PROFET™+2 12V evaluation kit**

## 4 Software (optional)

### 4 Software (optional)

The PROFET™+2 12V MB can either be used directly or with the ConfigWizard for IPD. The access to the software is the Infineon Toolbox, which can be downloaded at [infineon-toolbox](#).

#### 4.1 Infineon Toolbox and Config Wizard

By following the link in the previous [Chapter 4](#), the installation site of the Infineon Toolbox is reached. Note that *Java 8 32bit* must be installed on the system, otherwise the Toolbox will not start. Install the Toolbox by clicking the *Installer (<version>)* button, which is highlighted.

After the Installer is downloaded run the file *infineon-toolbox-launcher-setup-win-x86-<version>.exe* and follow the instructions given by the Installation Wizard as described in [Chapter 4.1.1](#).

##### 4.1.1 Installation of the Infineon Toolbox

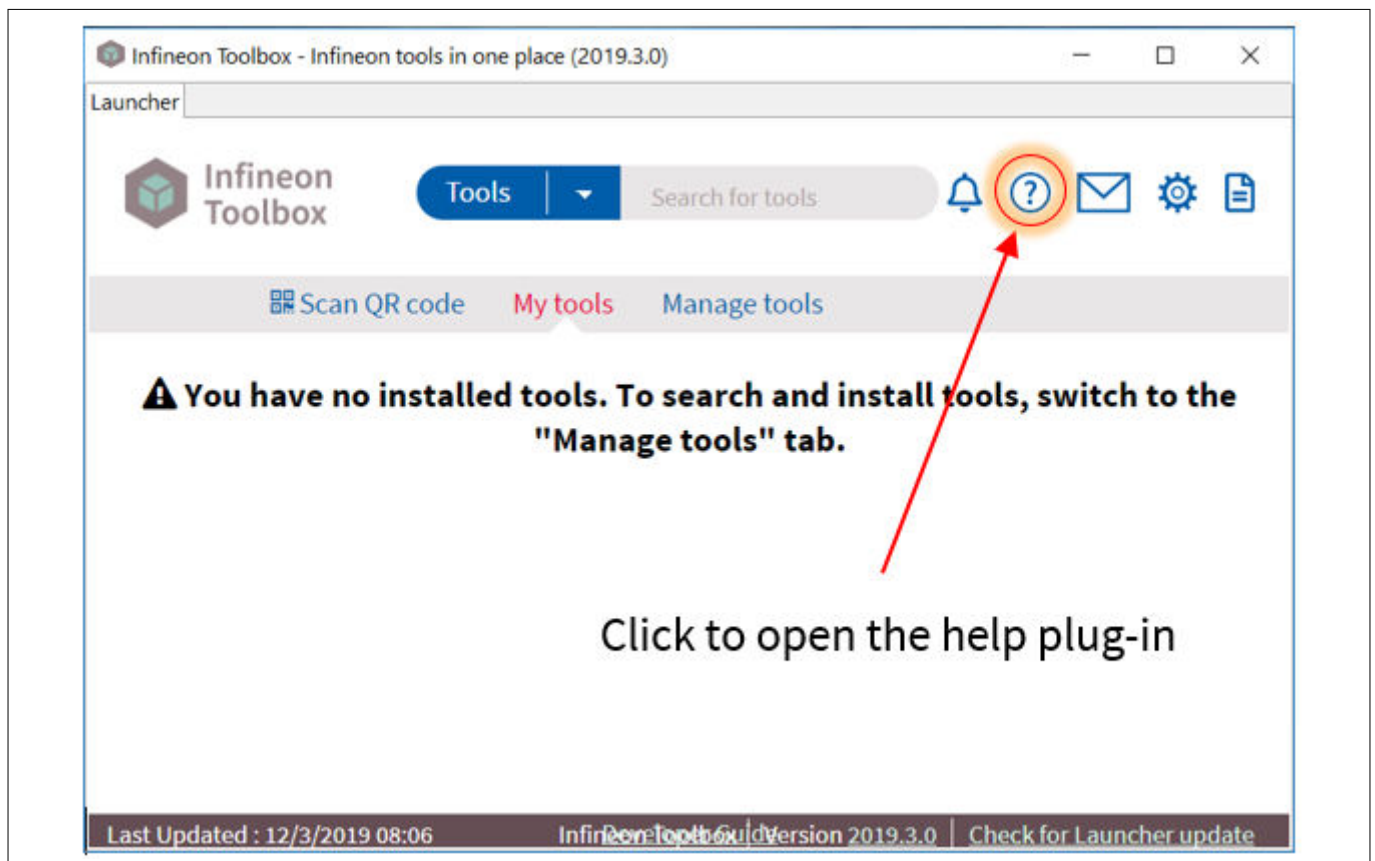
The license agreement will be the first step of the installation. Read the information carefully.

In the next step it is possible to allow the Installation Wizard to create a desktop shortcut: it is recommended to tick the checkbox.

The last step is the actual installation. Click on the button *Install* to install the Toolbox.

Once the installation process is complete, also the setup has to be finished and therefore click the *Finish* button. Note that it is possible to tick a checkbox to launch the Toolbox directly.

Launch the Toolbox and start installing the needed tools. [Figure 8](#) displays the start-up screen and the location of the help plug-in of the Toolbox.



**Figure 8** Infineon Toolbox – start-up screen & location of help plug-in

## 4 Software (optional)

### 4.1.2 Install the Config Wizard for IPD

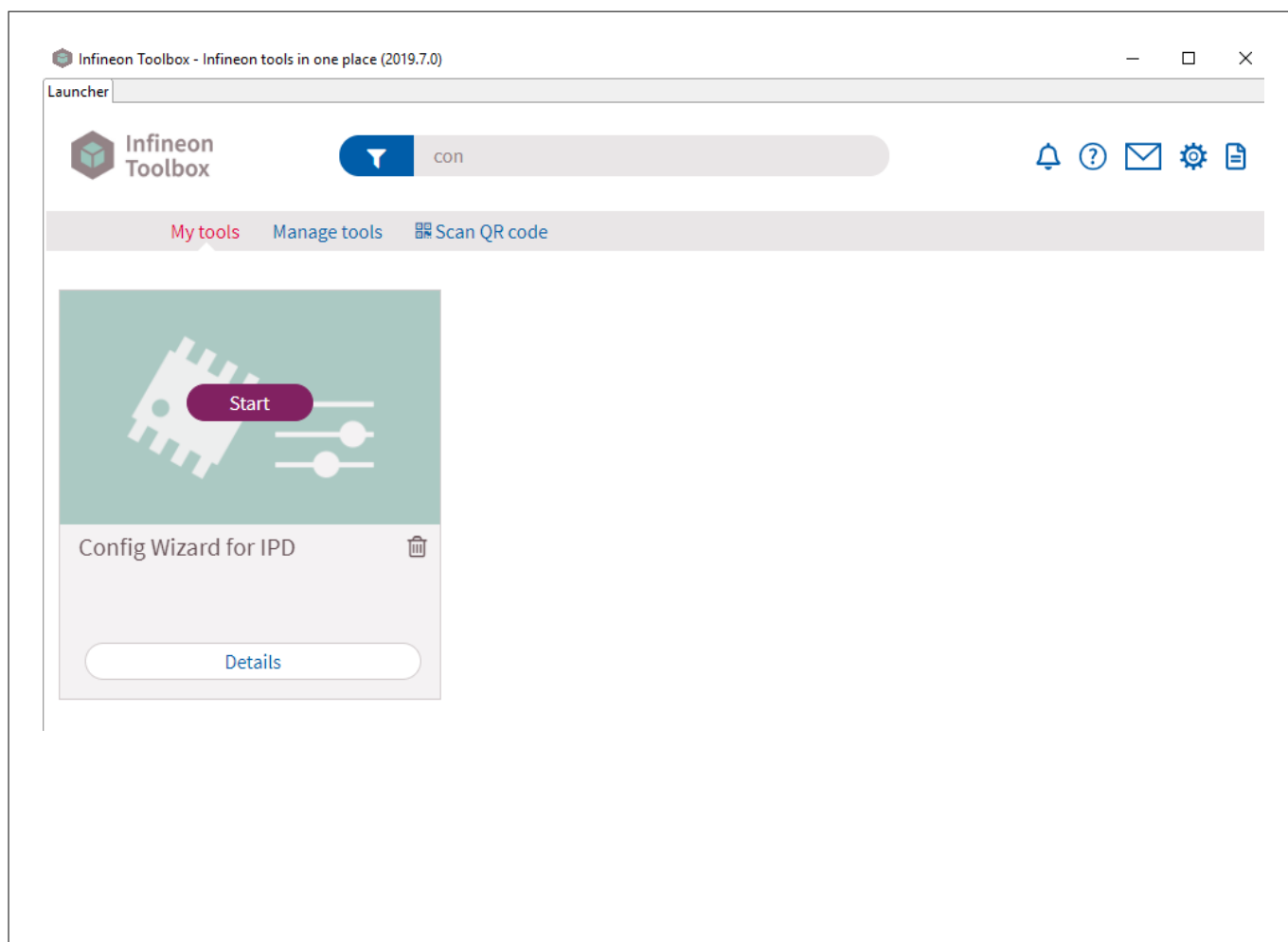
Launch the Infineon Toolbox and go to the *Manage tools* tab and type *Config Wizard for IPD* into the search bar. The Toolbox will find one application (see [Figure 9](#)).



**Figure 9** Infineon Toolbox - Config Wizard for IPD

Click the *Install* button and accept the license agreement (after reading it carefully). Once the installation is completed, the Infineon Toolbox must be restarted. After the restart, the Config Wizard installation will be placed in the *My tools* tab (see [Figure 10](#)).

Start the ConfigWizard by sliding over the icon and clicking *Start* (see [Figure 10](#)).



**Figure 10** Infineon Toolbox - start the Config Wizard for IPD in *My tools*

## 4 Software (optional)

### 4.2 GUI description

The Infineon Config Wizard is designed to configure Infineon devices easily. The GUIs are product-specific and not for detailed evaluation use.

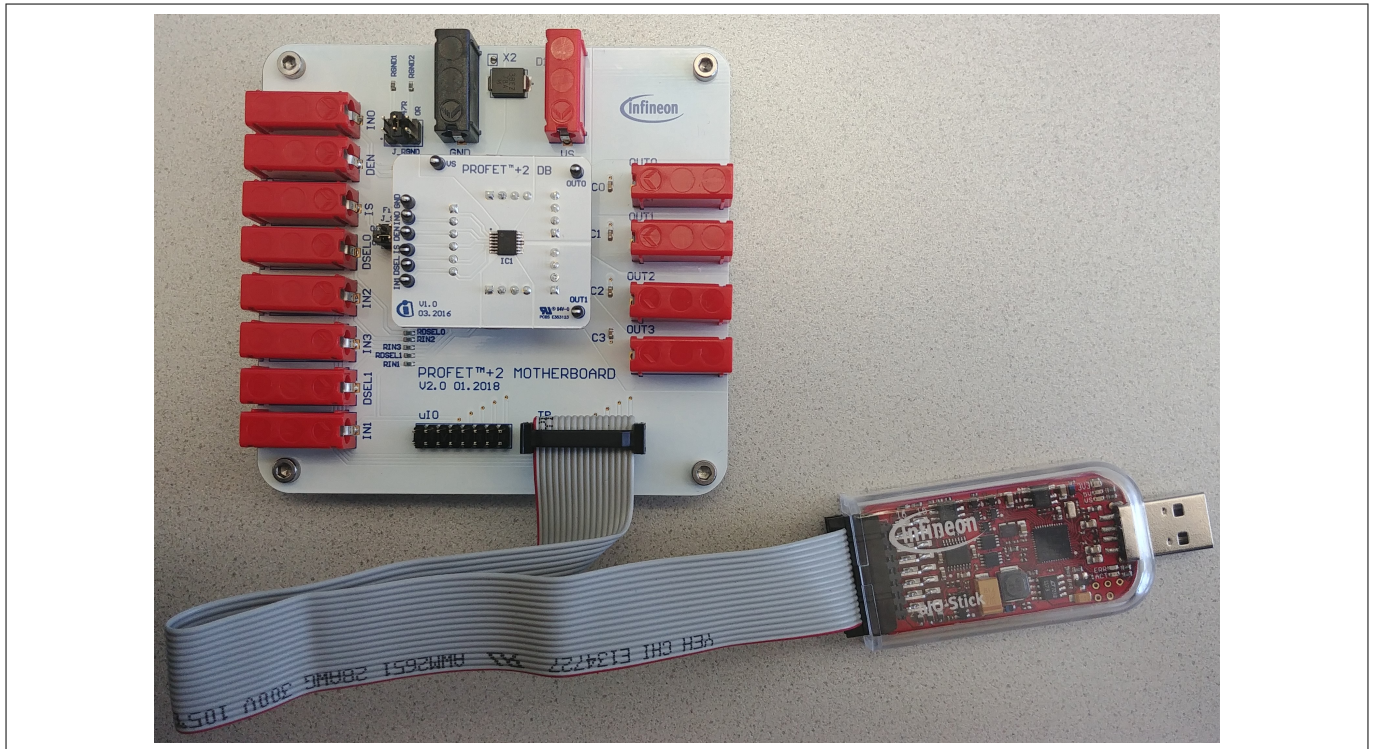
#### 4.2.1 $\mu$ IO-stick

The tool which is needed to connect the Config Wizard to the device is the Infineon  $\mu$ IO-Stick. The  $\mu$ IO-Stick is delivered with a 16-pin ribbon cable to connect the  $\mu$ IO-Stick to the MB (see [Figure 11](#)).



**Figure 11** Infineon  $\mu$ IO-Stick with ribbon cable

To connect the MB with the  $\mu$ IO-Stick please refer to  **$\mu$ IO connector uIO** and  **$\mu$ IO connector TB**. [Figure 12](#) below illustrates the  $\mu$ IO-Stick which is connected to the PROFET™+2 12V MB.



**Figure 12** Infineon  $\mu$ IO-Stick connected to the PROFET™+2 12V MB



## 4 Software (optional)

### 4.2.2 Start-up screen

The start-up screen of the Config Wizard for IPD consists of button-tiles which are named after the product families as seen in [Figure 13](#) below.



**Figure 13** Config Wizard for IPD - start-up screen

*Note: The number of tiles seen may vary due of extensions (new product families and so on).*

Clicking onto the tile with the used product family will reorganize the GUI. The next screen seen is the type selection screen for the different product types (1-channel, 2-channel, 4-channel). Also a back-button, which goes backwards one step, is included. The type selection screen for the PROFET™+2 12V-family is displayed in [Figure 14](#). The screen is organized in tiles as well.



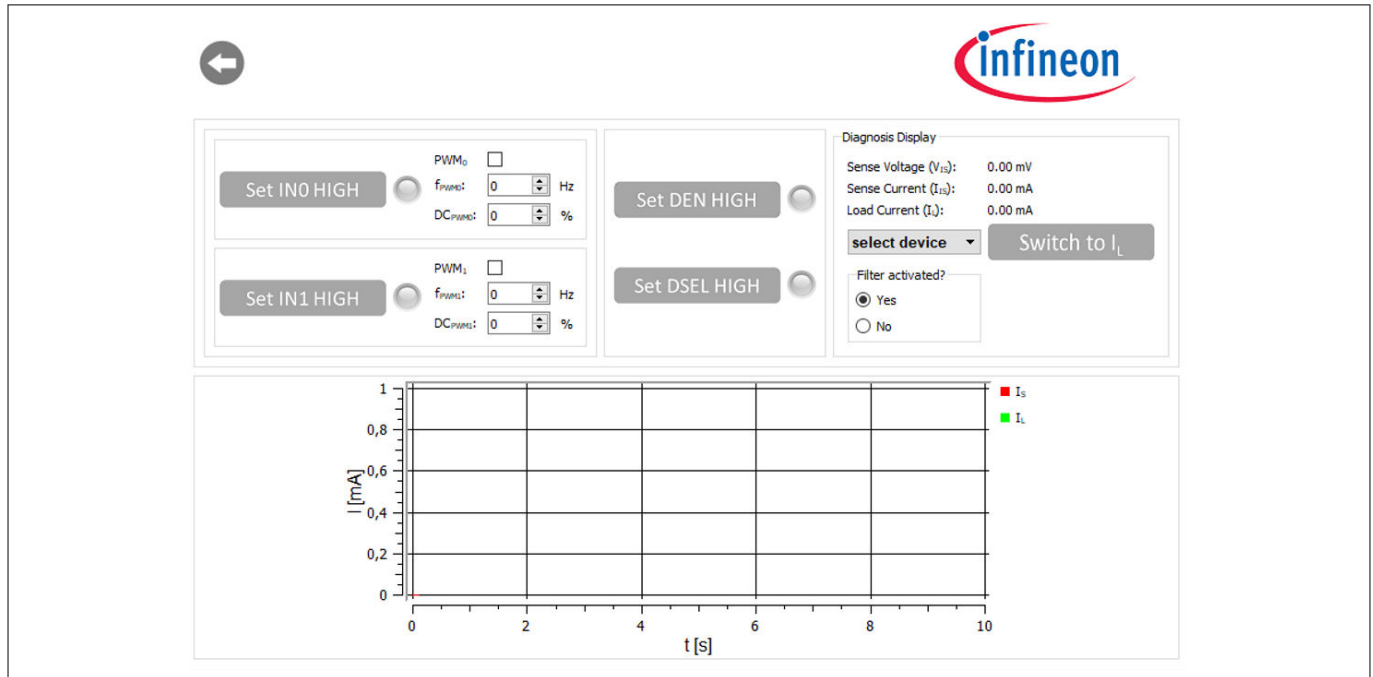
**Figure 14** Config Wizard for IPD - PROFET™+2 12V Type-Selection Screen

Clicking onto the tile with the used product will again reorganize the GUI. The next screen is the PROFET™+2 12V GUI (see [Chapter 4.2.3](#)).

## 4 Software (optional)

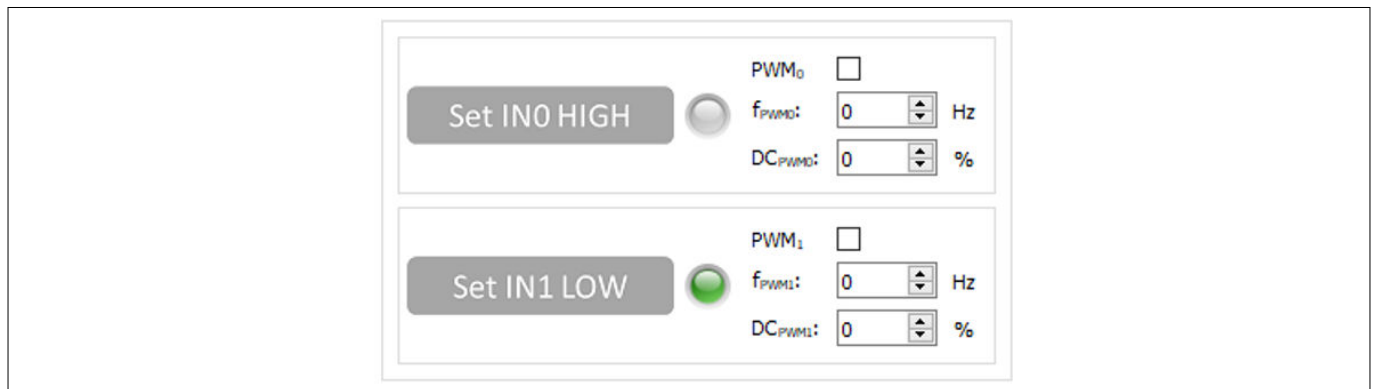
### 4.2.3 PROFET™+2 12V GUI

The GUI for the PROFET™+2 12V consists of buttons, which control the GPIOs of the  $\mu$ IO-Stick. The GPIOs are connected to the pins of the device (as  $INx$ ,  $DEN$  and  $DSELx$ ), therefore the buttons control the logic state at the pins of the device. The PROFET™+2 12V device screen is visualized in [Figure 15](#) below.



**Figure 15** PROFET™+2 12V GUI for a 2-channel device

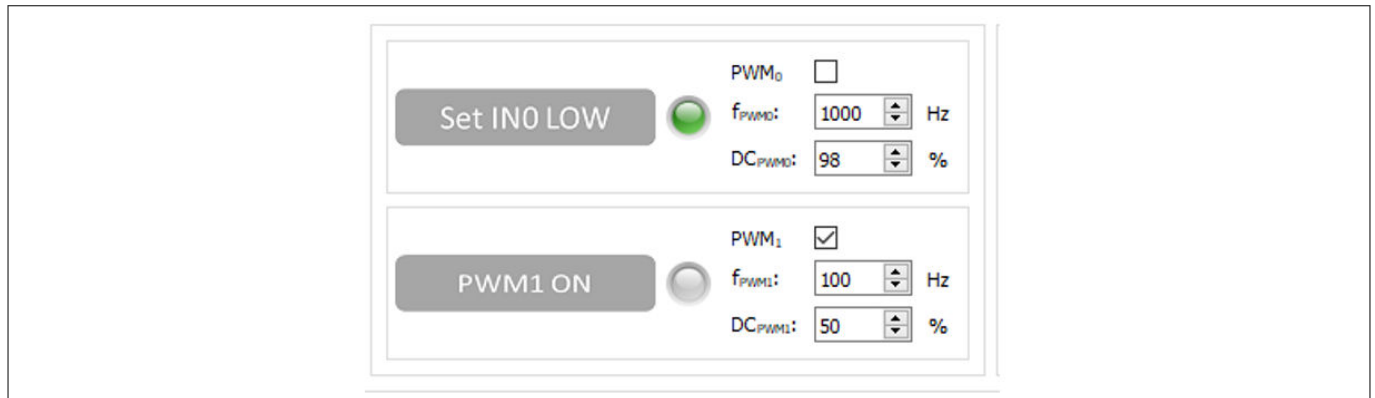
The names of buttons reflect the actions they perform, such as *Set IN0 HIGH* or, if a button was clicked, *Set IN1 LOW*. Also a lamp-element indicates if a button was clicked (see [Figure 16](#)). The state of the buttons is visualized via changing icons and lamp-elements. If the lamp-element is green, the corresponding pin is activated.



**Figure 16** PROFET™+2 12V functional view - GPIO controlling toggle-buttons

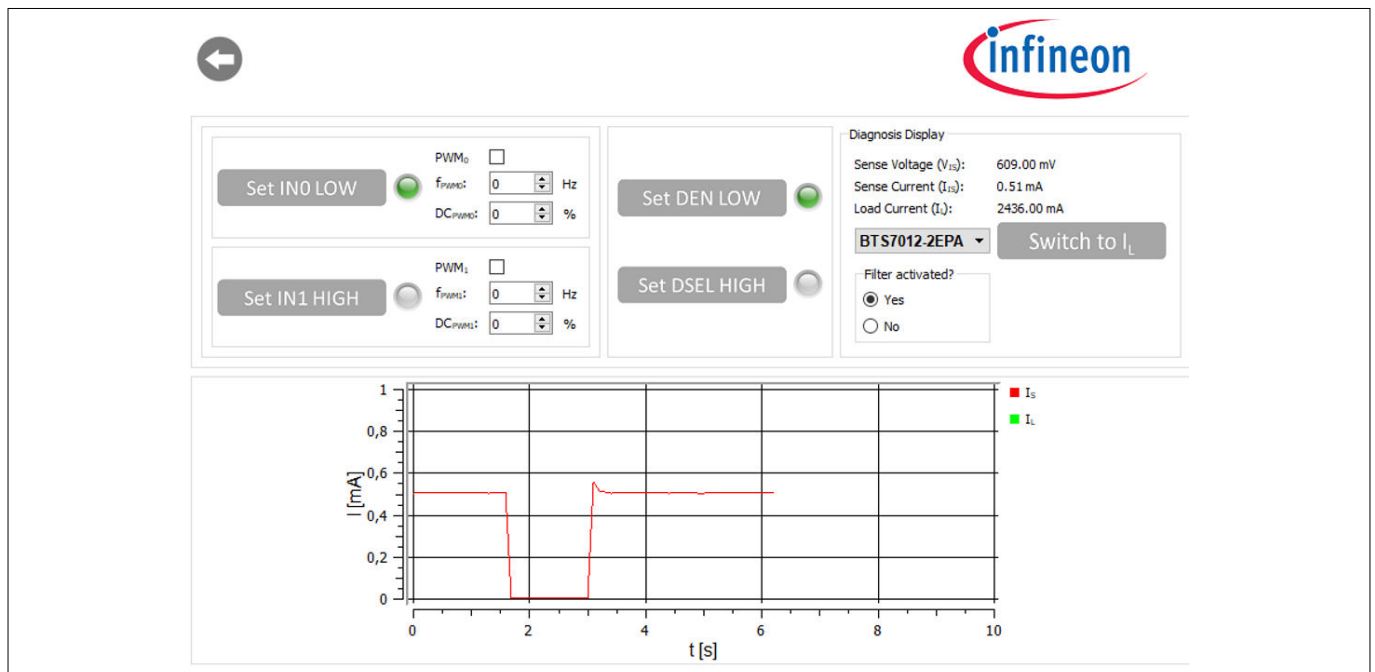
As seen in [Figure 16](#), also PWM-functionality is given for channels 0 and 1. The functionality is activated by ticking the checkbox next to the button. Frequency and duty-cycle of the PWM can be set via the two spinboxes below the checkbox. The icon of the button will also change and the lamp-element will stay gray (see [Figure 17](#)).

#### 4 Software (optional)



**Figure 17** PROFET™+2 12V functional view – IN0 as logic input, IN1 as PWM input

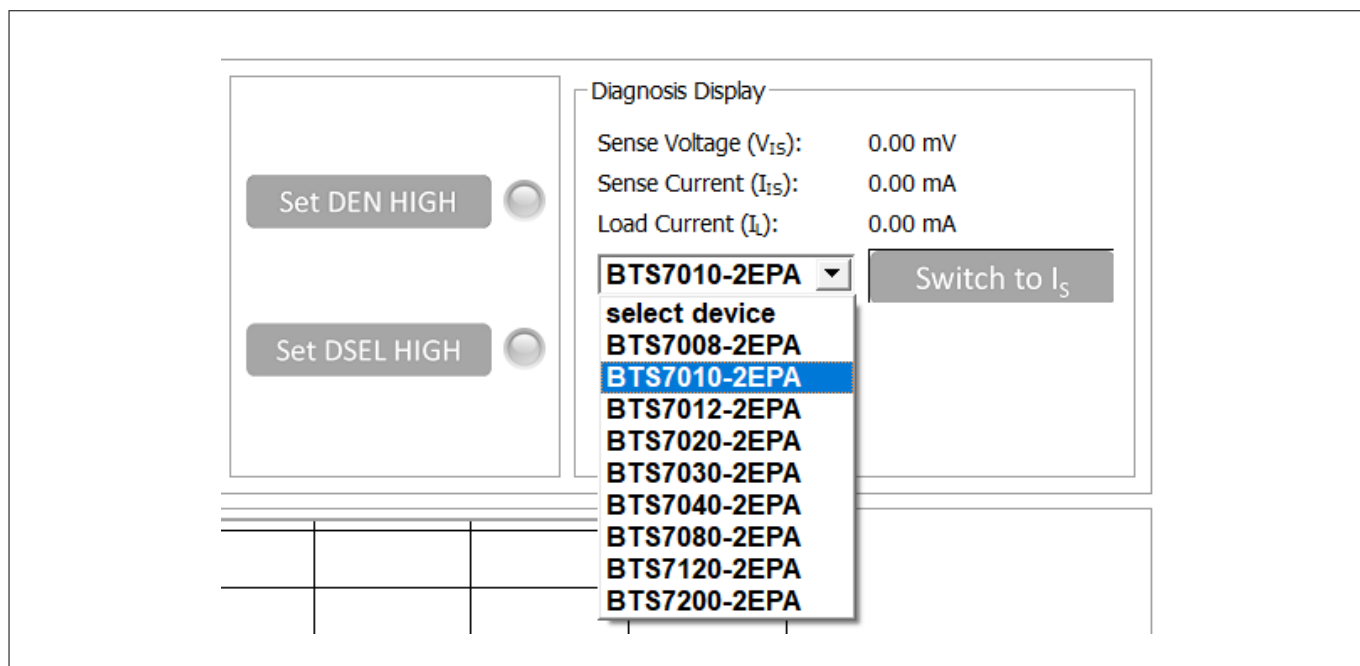
The possibility to display the sense current [ $I_S$ ] is also given. The sense current is converted to a measurable voltage over a resistor. This voltage is measured by an ADC [Analogue-Digital-Converter] on the  $\mu$ IO-stick and the digitalized data is read by the GUI and displayed in a plot, as seen in [Figure 17](#). The sense current will be displayed automatically if the button *Set DEN HIGH* was clicked (icon will change to *Set DEN LOW* and the lamp-ement will change its color to green, see [Figure 18](#)).



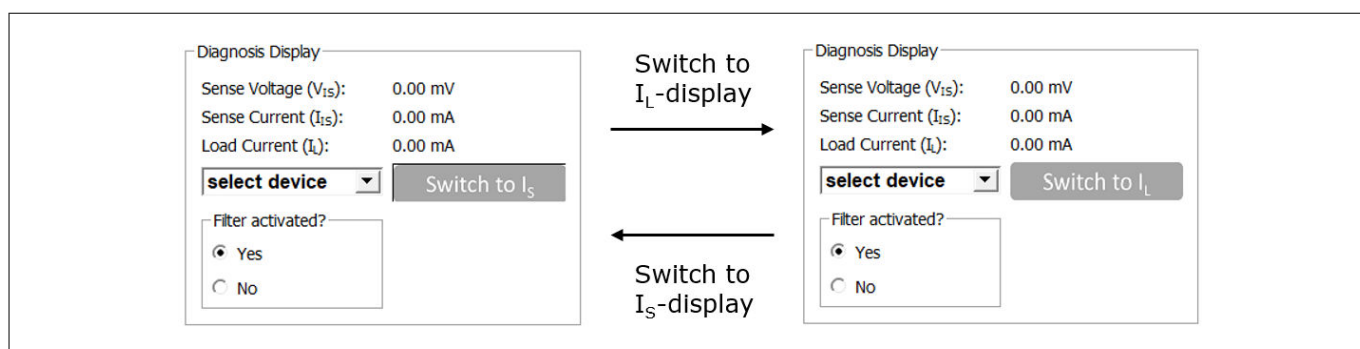
**Figure 18** PROFET™+2 12V functional view – Sense current display for OUT0

It is also possible to switch between the sense and the load current displays. If a device is selected in the display section (see [Figure 19](#)) the corresponding factor  $k_{I_{LIS}}$  is mapped to the GUI and the load current is calculated with the defaults of the PROFET™+2 12V MB. The button next to the device selection is used to switch between sense and load current and is labeled *Switch to  $I_L$*  (if clicked the label will be *Switch to  $I_S$* , see [Figure 18](#)).

#### 4 Software (optional)

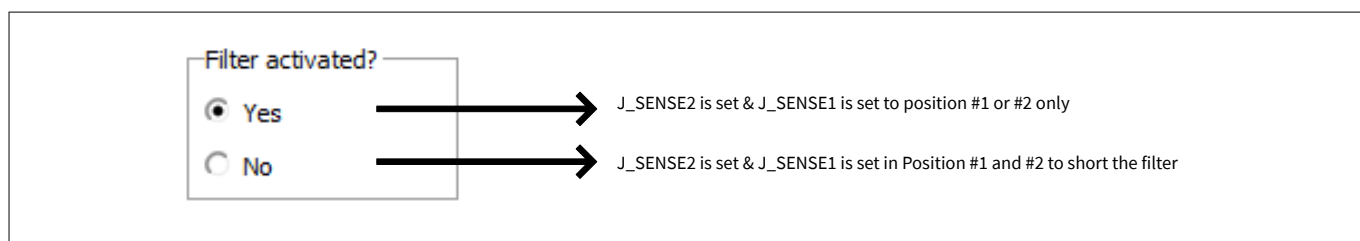


**Figure 19** PROFET™+2 12V functional view – Device selection



**Figure 20** PROFET™+2 12V functional view – Switching from  $I_S$  to  $I_L$

The small box with title *Filter activated?* (see [Figure 21](#)), which is included within the diagnosis display section is used to specify whether sense filtering is activated on the MB (see [Chapter 2.1](#) for further information). This setting is used to display the sense/load current and the sense voltage correctly.

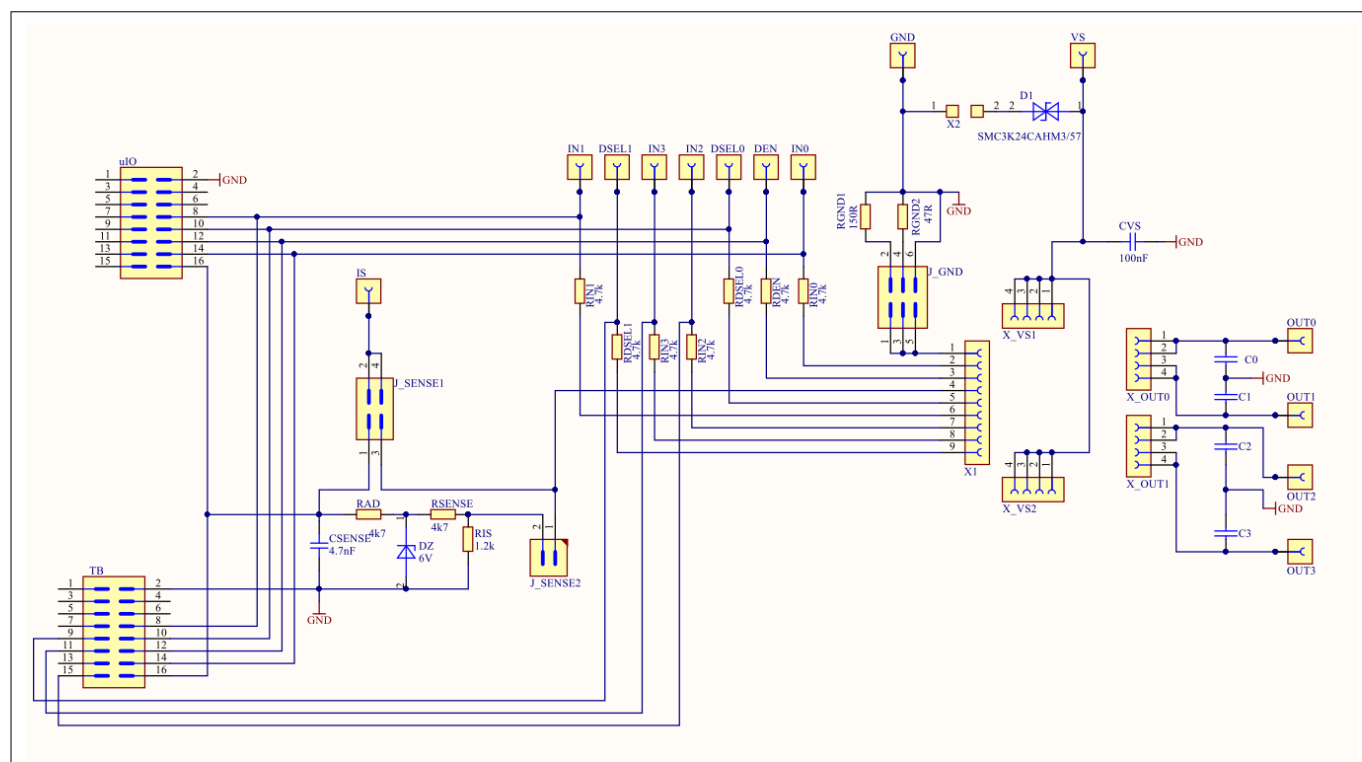


**Figure 21** “Filter activated?”- Box in diagnosis display section – meaning of “Yes”/”No”

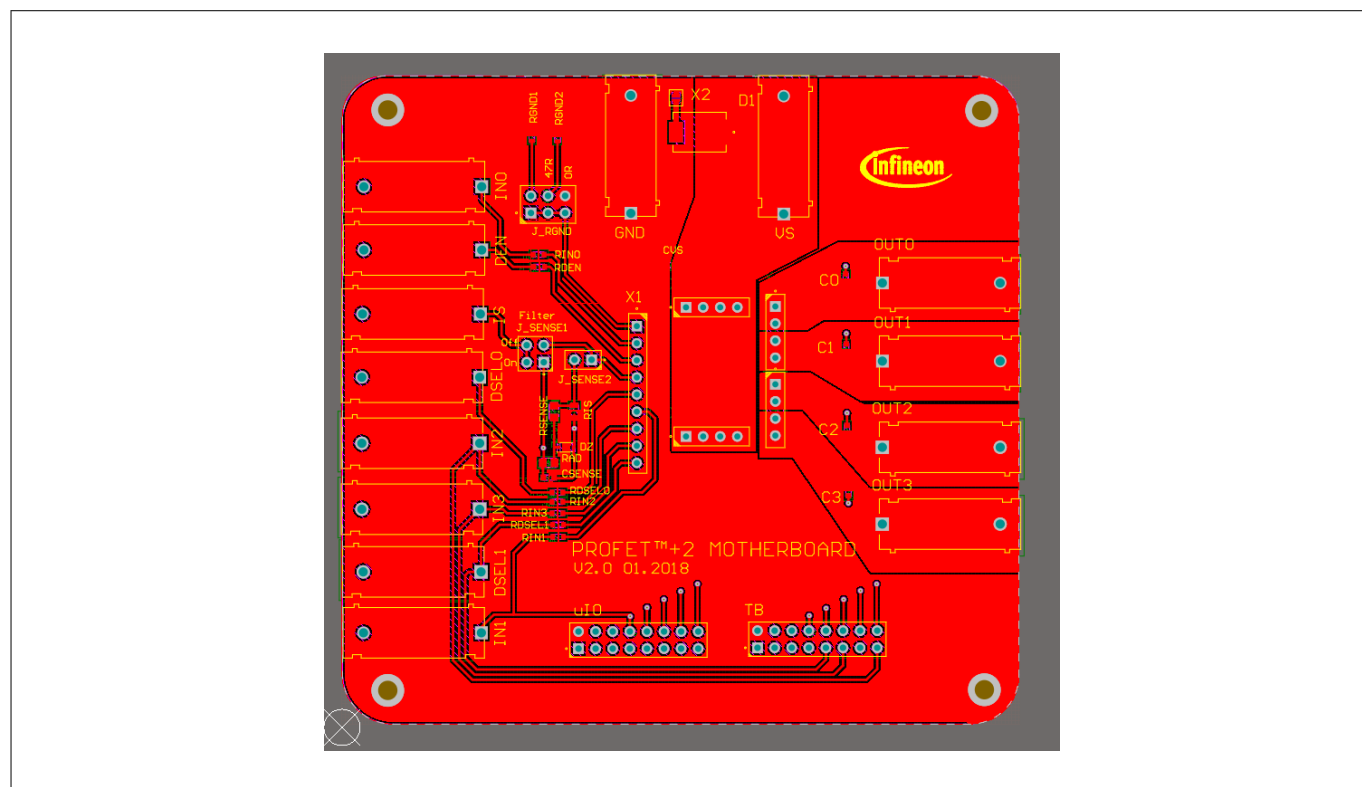


## 5 Appendix

### 5 Appendix

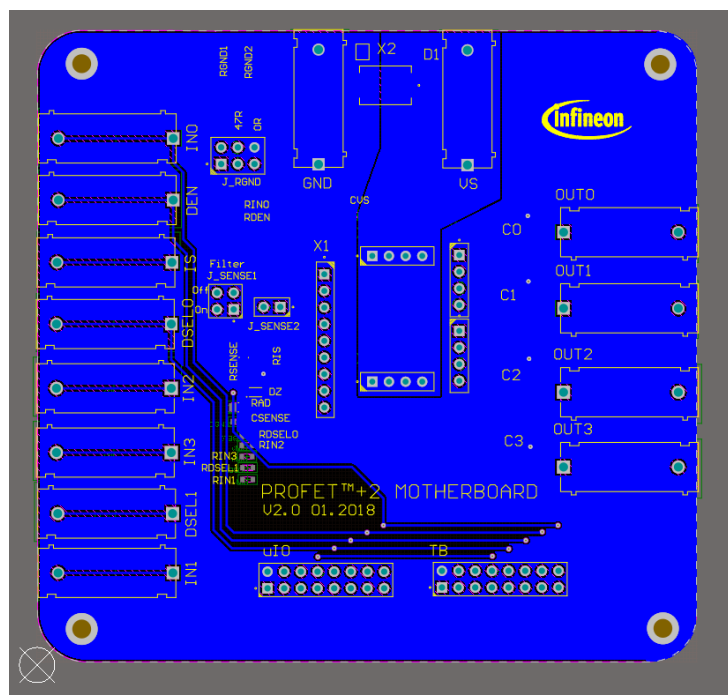


**Figure 22** Motherboard schematic



**Figure 23** PCB top view

## 5 Appendix



**Figure 24** PCB bottom view

**Table 6** Available Demoboards

| Product                   | ISaR name                 | Internet link                                                                                                 |
|---------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------|
| PROFET™+2 12V motherboard | PROFET PLUS2 MOTH BRD 4Ch | <a href="https://www.infineon.com/profet-plus2-moth-brd">https://www.infineon.com/profet-plus2-moth-brd</a>   |
| BTS7008-1EPA              | BTS7008-1EPA DAUGH BRD    | <a href="https://www.infineon.com/bts7008-1epa-daugh-brd">https://www.infineon.com/bts7008-1epa-daugh-brd</a> |
| BTS7010-1EPA              | BTS7010-1EPA DAUGH BRD    | <a href="https://www.infineon.com/bts7010-1epa-daugh-brd">https://www.infineon.com/bts7010-1epa-daugh-brd</a> |
| BTS7012-1EPA              | BTS7012-1EPA DAUGH BRD    | <a href="https://www.infineon.com/bts7012-1epa-daugh-brd">https://www.infineon.com/bts7012-1epa-daugh-brd</a> |
| BTS7040-1EPA              | BTS7040-1EPA DAUGH BRD    | <a href="https://www.infineon.com/bts7040-1epa-daugh-brd">https://www.infineon.com/bts7040-1epa-daugh-brd</a> |
| BTS7008-2EPA              | BTS7008-2EPA DAUGH BRD    | <a href="https://www.infineon.com/bts7008-2epa-daugh-brd">https://www.infineon.com/bts7008-2epa-daugh-brd</a> |
| BTS7010-2EPA              | BTS7010-2EPA DAUGH BRD    | <a href="https://www.infineon.com/bts7010-2epa-daugh-brd">https://www.infineon.com/bts7010-2epa-daugh-brd</a> |
| BTS7012-2EPA              | BTS7012-2EPA DAUGH BRD    | <a href="https://www.infineon.com/bts7012-2epa-daugh-brd">https://www.infineon.com/bts7012-2epa-daugh-brd</a> |
| BTS7020-2EPA              | BTS7020-2EPA DAUGH BRD    | <a href="https://www.infineon.com/bts7020-2epa-daugh-brd">https://www.infineon.com/bts7020-2epa-daugh-brd</a> |
| BTS7030-2EPA              | BTS7030-2EPA DAUGH BRD    | <a href="https://www.infineon.com/bts7030-2epa-daugh-brd">https://www.infineon.com/bts7030-2epa-daugh-brd</a> |
| BTS7040-2EPA              | BTS7040-2EPA DAUGH BRD    | <a href="https://www.infineon.com/bts7040-2epa-daugh-brd">https://www.infineon.com/bts7040-2epa-daugh-brd</a> |
| BTS7080-2EPA              | BTS7080-2EPA DAUGH BRD    | <a href="https://www.infineon.com/bts7080-2epa-daugh-brd">https://www.infineon.com/bts7080-2epa-daugh-brd</a> |
| BTS7120-2EPA              | BTS7120-2EPA DAUGH BRD    | <a href="https://www.infineon.com/bts7120-2epa-daugh-brd">https://www.infineon.com/bts7120-2epa-daugh-brd</a> |
| BTS7200-2EPA              | BTS7200-2EPA DAUGH BRD    | <a href="https://www.infineon.com/bts7200-2epa-daugh-brd">https://www.infineon.com/bts7200-2epa-daugh-brd</a> |
| BTS7200-4EPA              | BTS7200-4EPA DAUGH BRD    | <a href="https://www.infineon.com/bts7200-4epa-daugh-brd">https://www.infineon.com/bts7200-4epa-daugh-brd</a> |
| BTS7200-2EPC              | BTS7200-2EPC DAUGH BRD    | <a href="https://www.infineon.com/bts7200-2epc-daugh-brd">https://www.infineon.com/bts7200-2epc-daugh-brd</a> |

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**6 Revision history**

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| <b>Document version</b> | <b>Date of release</b> | <b>Description of changes</b>                           |
|-------------------------|------------------------|---------------------------------------------------------|
| 1.01                    | 2019-06-27             | updated family name (PROFET™+2 → PROFET™+2 12V)         |
| 1.00                    | 2019-06-11             | PROFET™+2 customer evaluation kit description available |

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