

DC Shield TLE9562-3QX

About this document

Scope and purpose

This user manual describes the BLDC shield with the TLE9562-3QX. This document provides detailed information on the board's content, layout and use. It should be used in conjunction with the TLE9562-3QX datasheet, which contains full technical details on the device specification and operation.

Intended audience

This document is intended for users who develop applications with the TLE956x family.

Table of contents

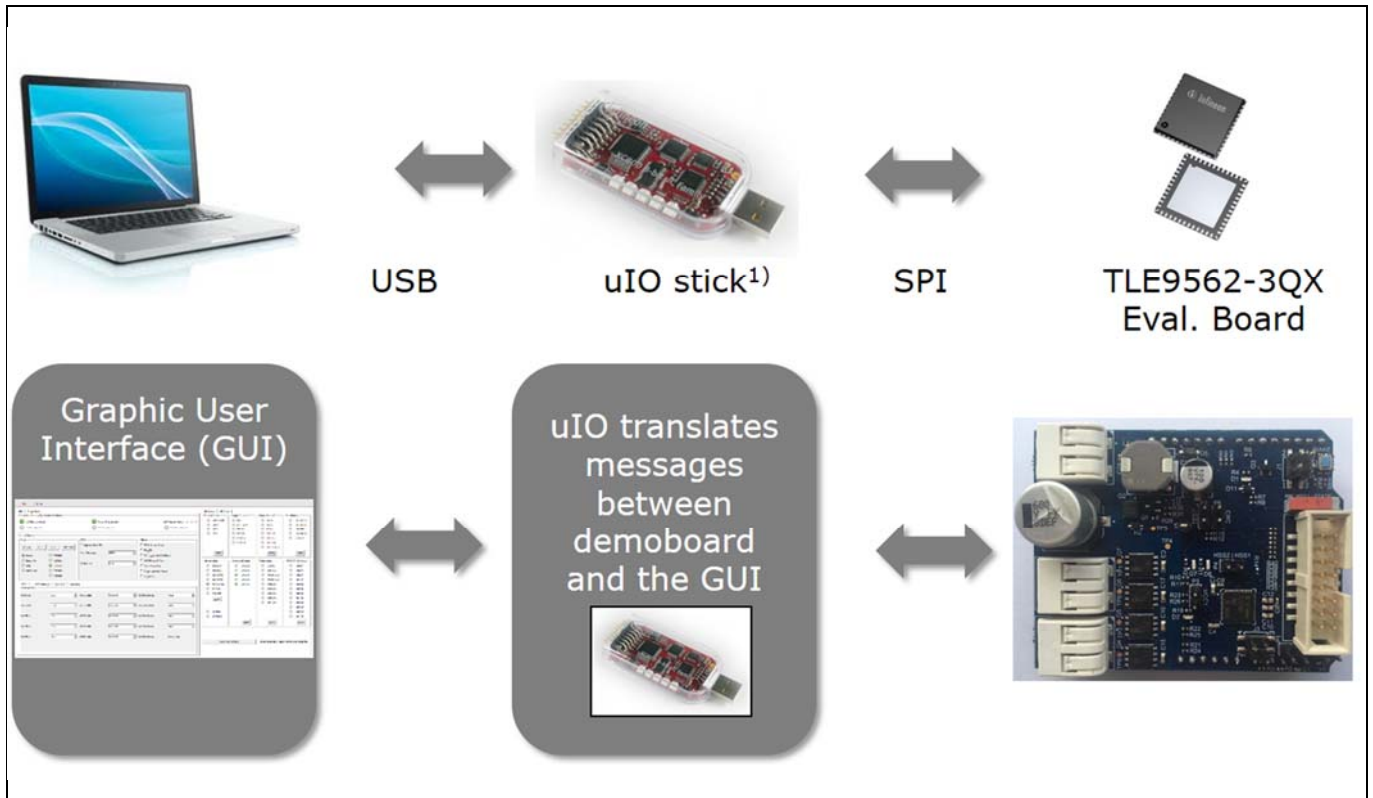
About this document	1
Table of contents	1
1 Introduction	1
2 Hardware description	3
2.1 Hardware	3
2.2 Schematic	7
2.3 Layers.....	10
2.4 Bill of Material of the TLE9562-3QX	12
3 Start and uIO stick programming	13
3.1 Download the Graphic User Interface for the uIO stick	13
3.1.1 Download from MyICP	13
3.1.2 Download from the Infineon Toolbox	13
3.2 Configuration Wizard for TLE9562-3QX	14
4 Config Wizard - Control tabs	15
4.1 SBC.....	15
4.2 Bridge Driver.....	19
5 Revision history	21

1 Introduction

- The TLE9562-3QX evaluation board is intended to provide a simple and easy-to-use tool for getting familiar with the device features and for first application tests. The evaluation board consists of a uIO-stick, a TLE9562-3QX board.
- The uIO-stick is the interface between the PC and the application board such as the TLE9562-3QX. The TLE9562-3QX SPI communication is emulated by the uIO-stick, which is controlled by the PC software.

- 4 The board of the TLE9562-3QX has a connector for the uIO-stick, connectors for the power supply, three connector for the motor output. And an active reverse battery protection with IPZ40N4S5L-2R8.

Figure 1 TLE9562-3QX evaluation Board concept



¹⁾ The uIO stick must be ordered separately – SP001215532
Details about the uIO stick can be found here: www.hitex.com/uIO

2 Hardware description

2.1 Hardware

The TLE9562-3QX evaluation board is designed to be compatible with the uIO-stick. The uIO-stick plugs into the TLE9562-3QX main board via a 16-pin header, and allows an easy interface to the microcontroller via USB for SPI communication.

Figure 2 TLE9562-3QX evaluation board

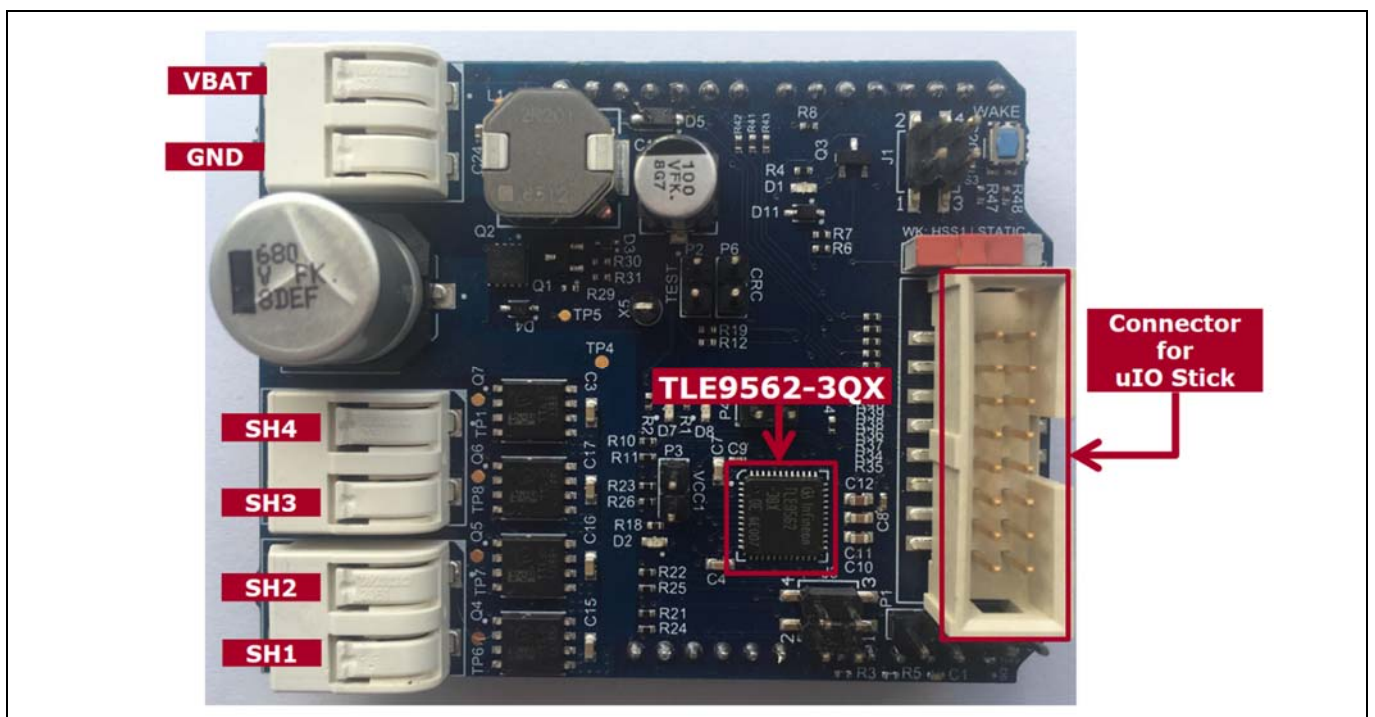


Figure 3 TLE9562-3QX evaluation board

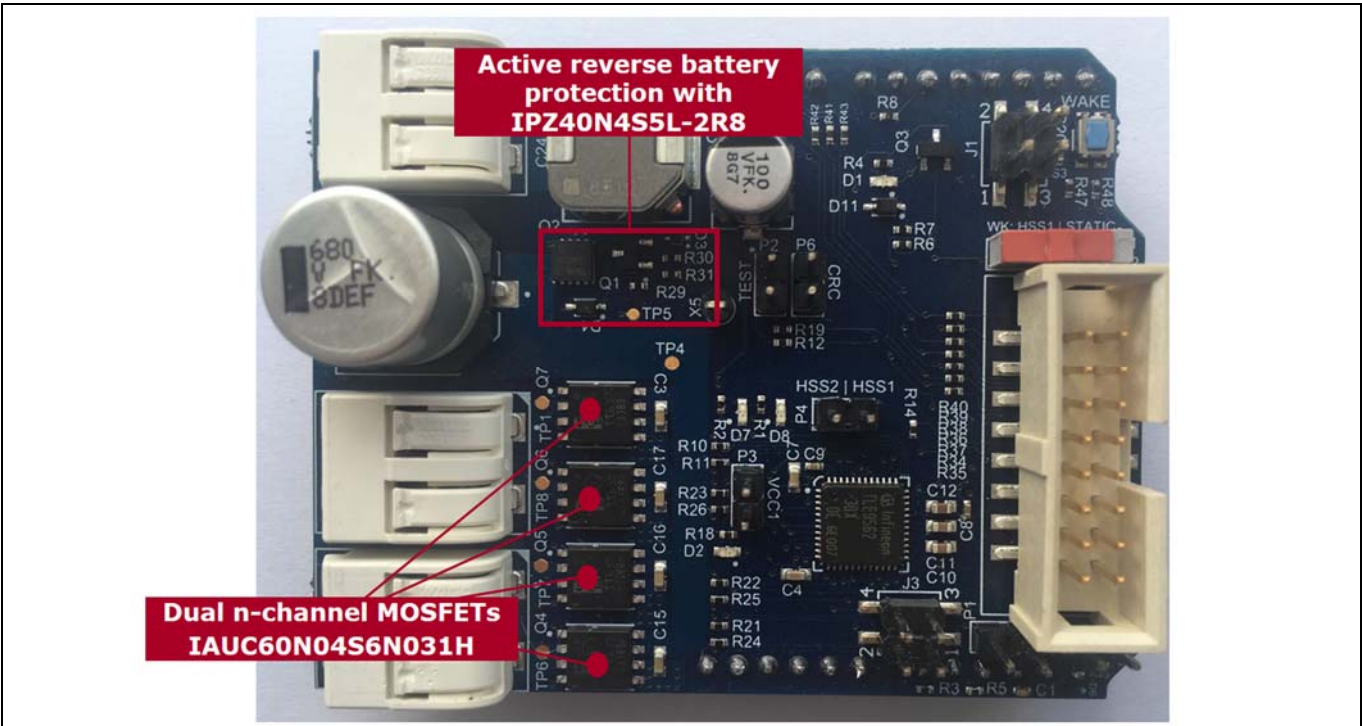


Figure 4 TLE9562-3QX evaluation board: Jumper settings

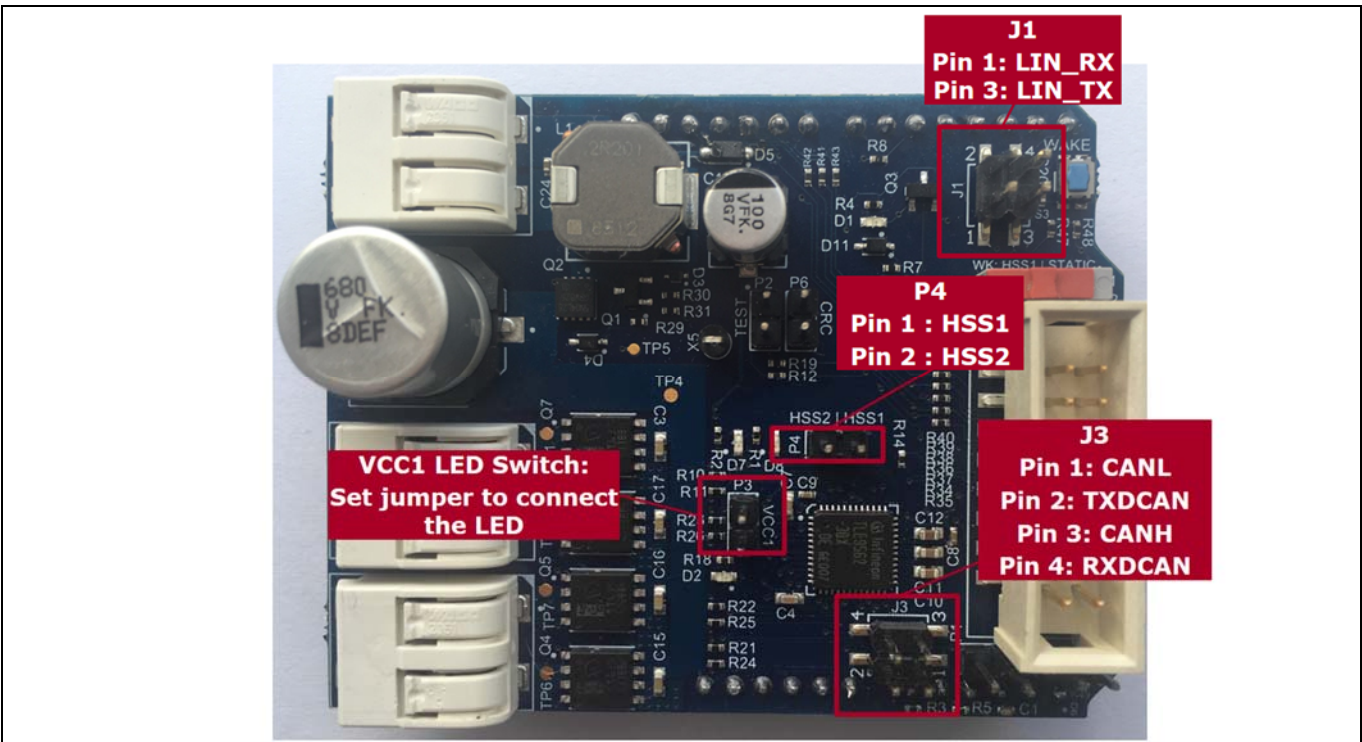
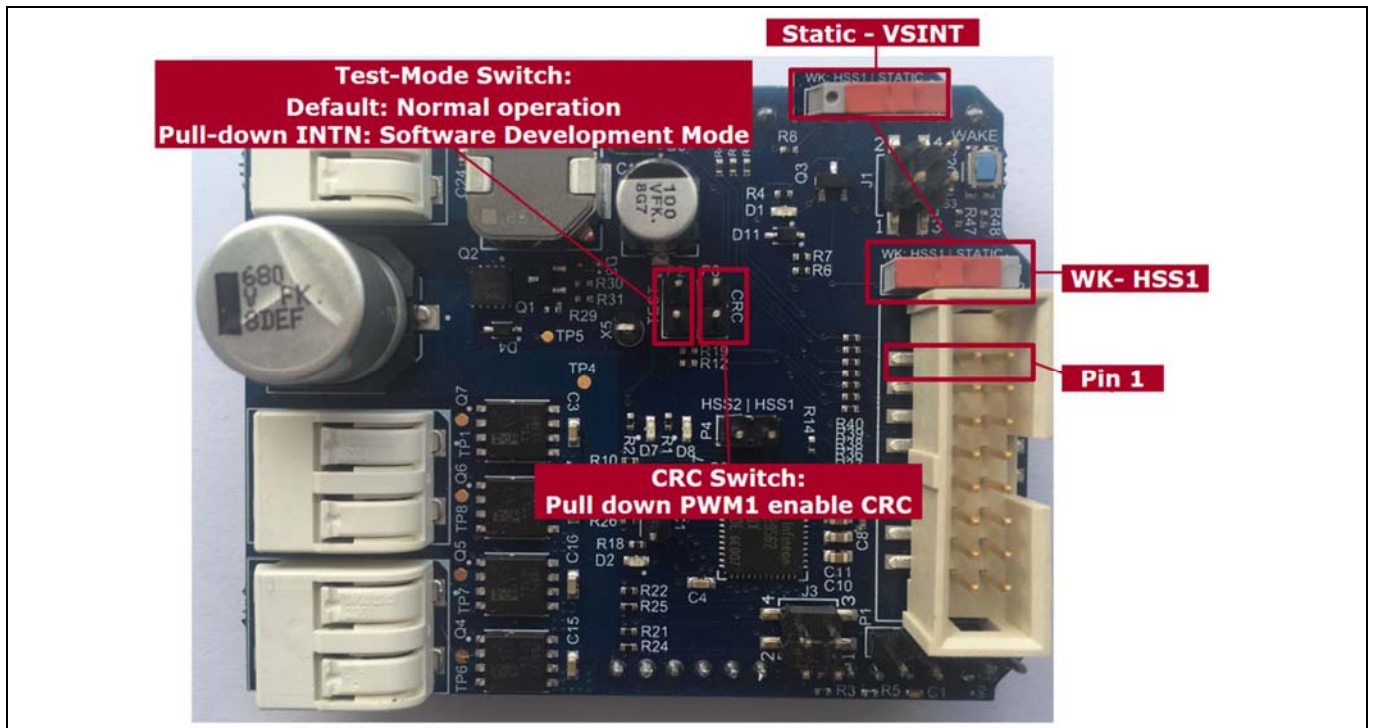


Figure 5 TLE9562-3QX evaluation board: Jumper settings and switches



- Test-Mode Switch: Software Development Mode is a dedicated SBC configuration especially useful for software development. The Watchdog is enabled in Software Development Mode as default state.
- CRC: The SPI interface includes also 8 Bits used for Cyclic Redundancy Check (CRC) to ensure data integrity on sent or received SPI command.

Figure 6 TLE9562-3QX evaluation board: Arduino connectors 1/2

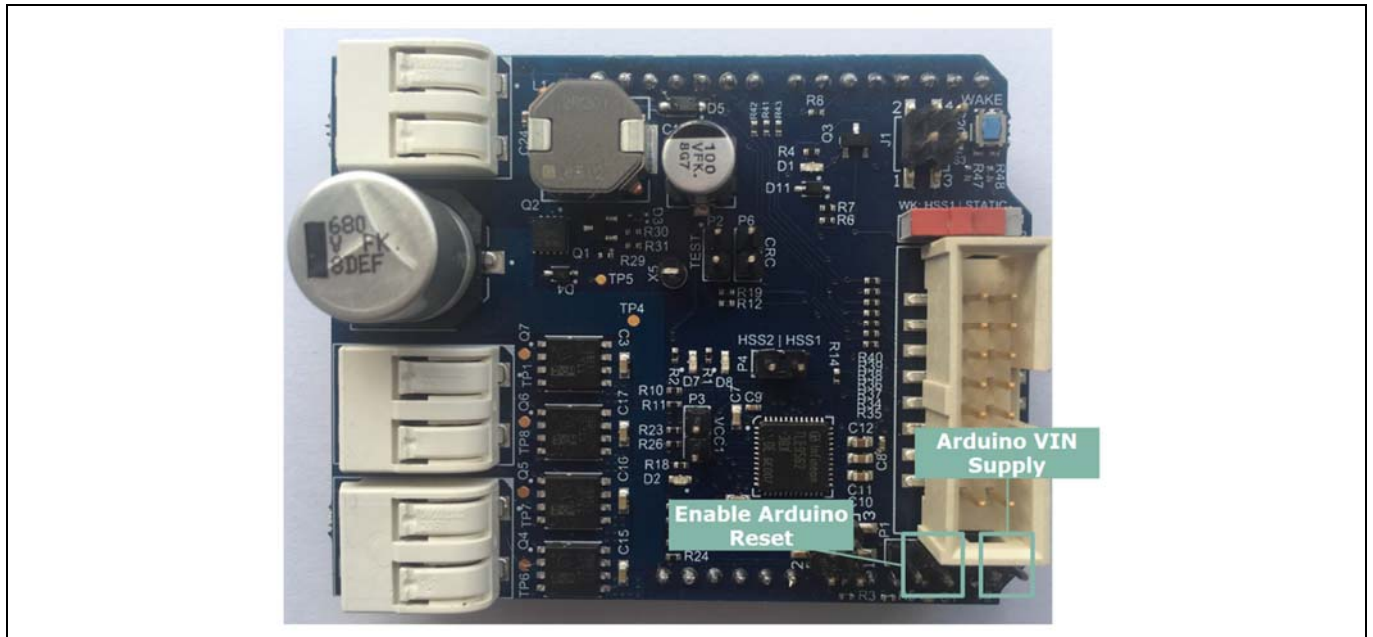
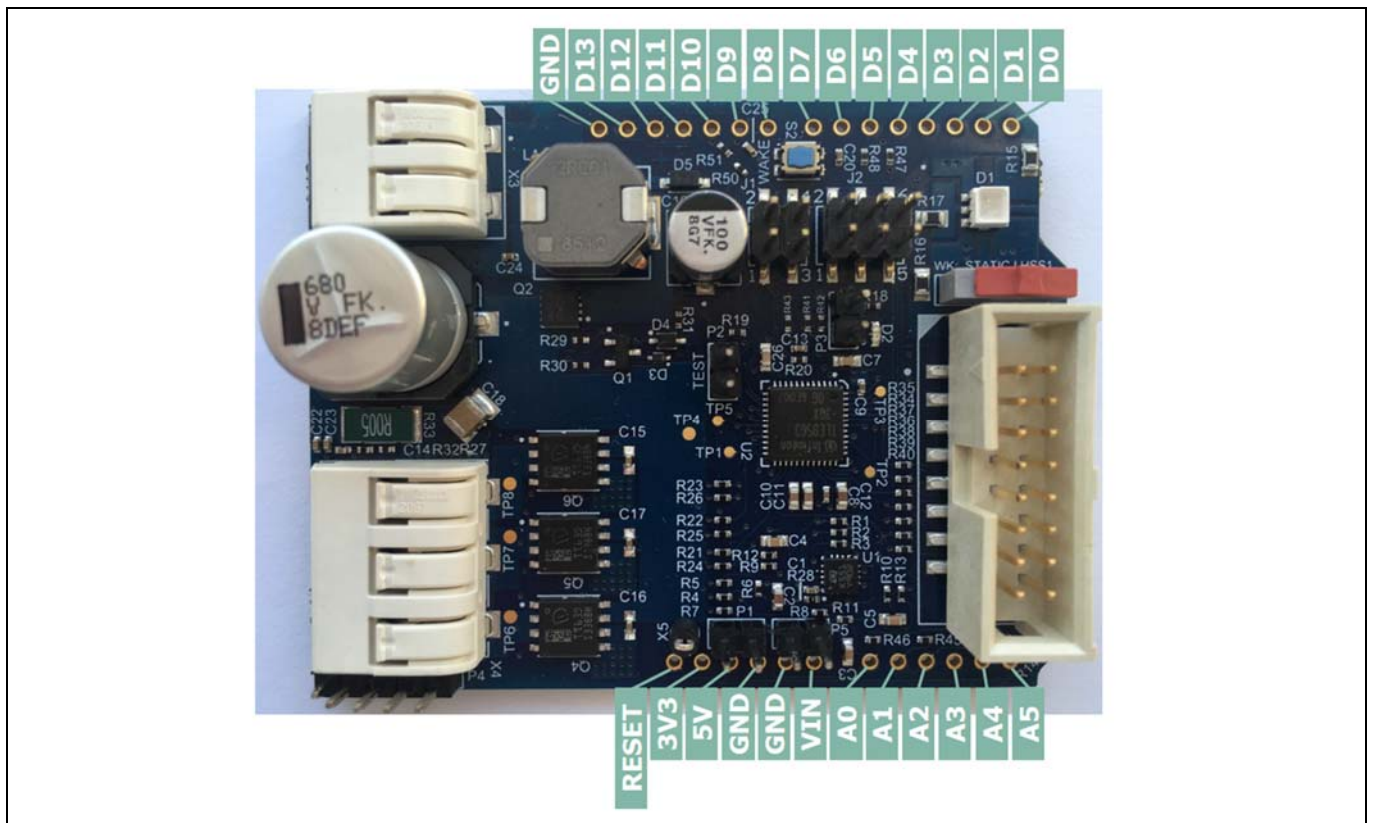


Figure 7 TLE9562-3QX evaluation board: Arduino connectors 2/2



2.2 Schematic

Figure 8 Schematic 1/3

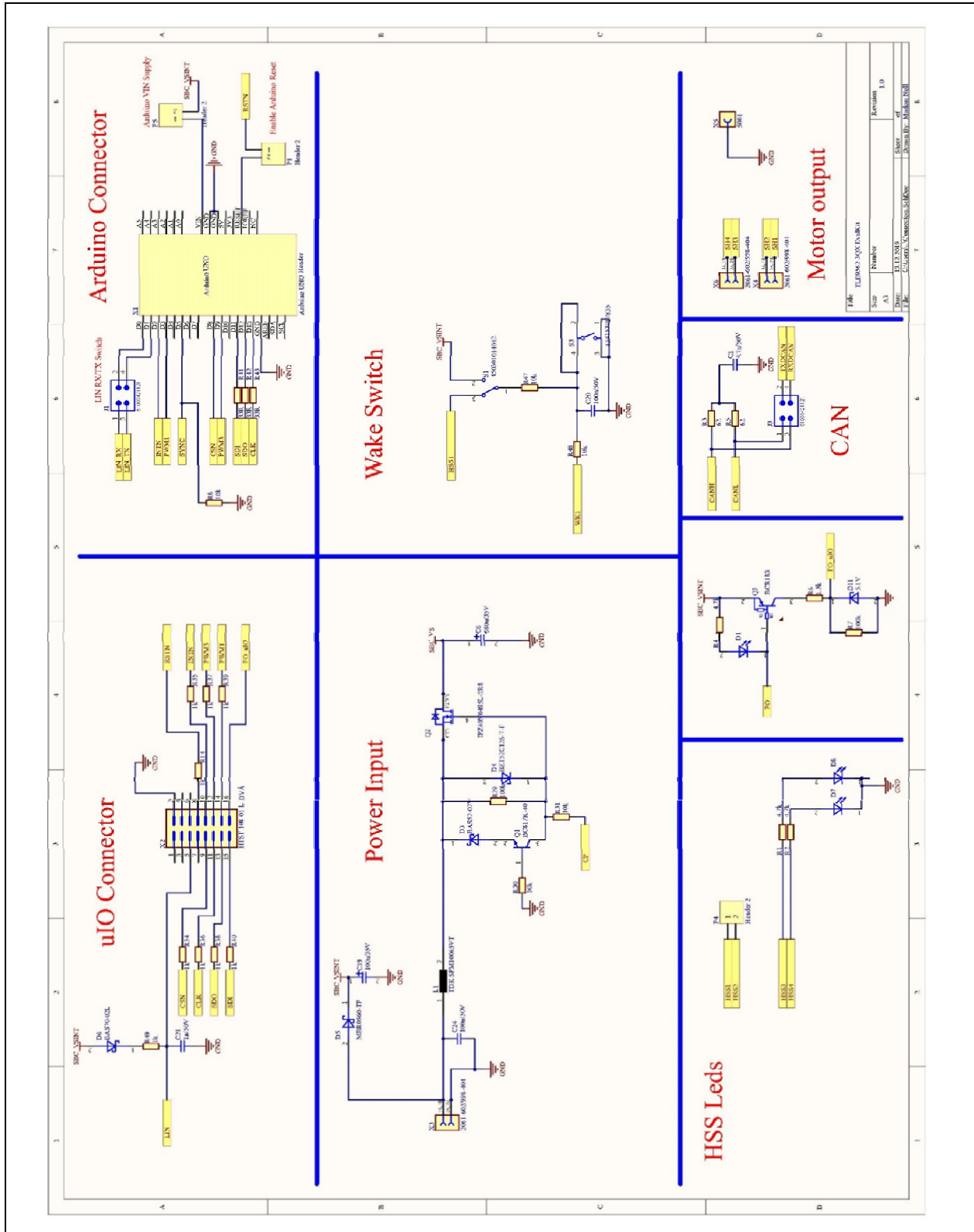


Figure 9 Schematic 2/3

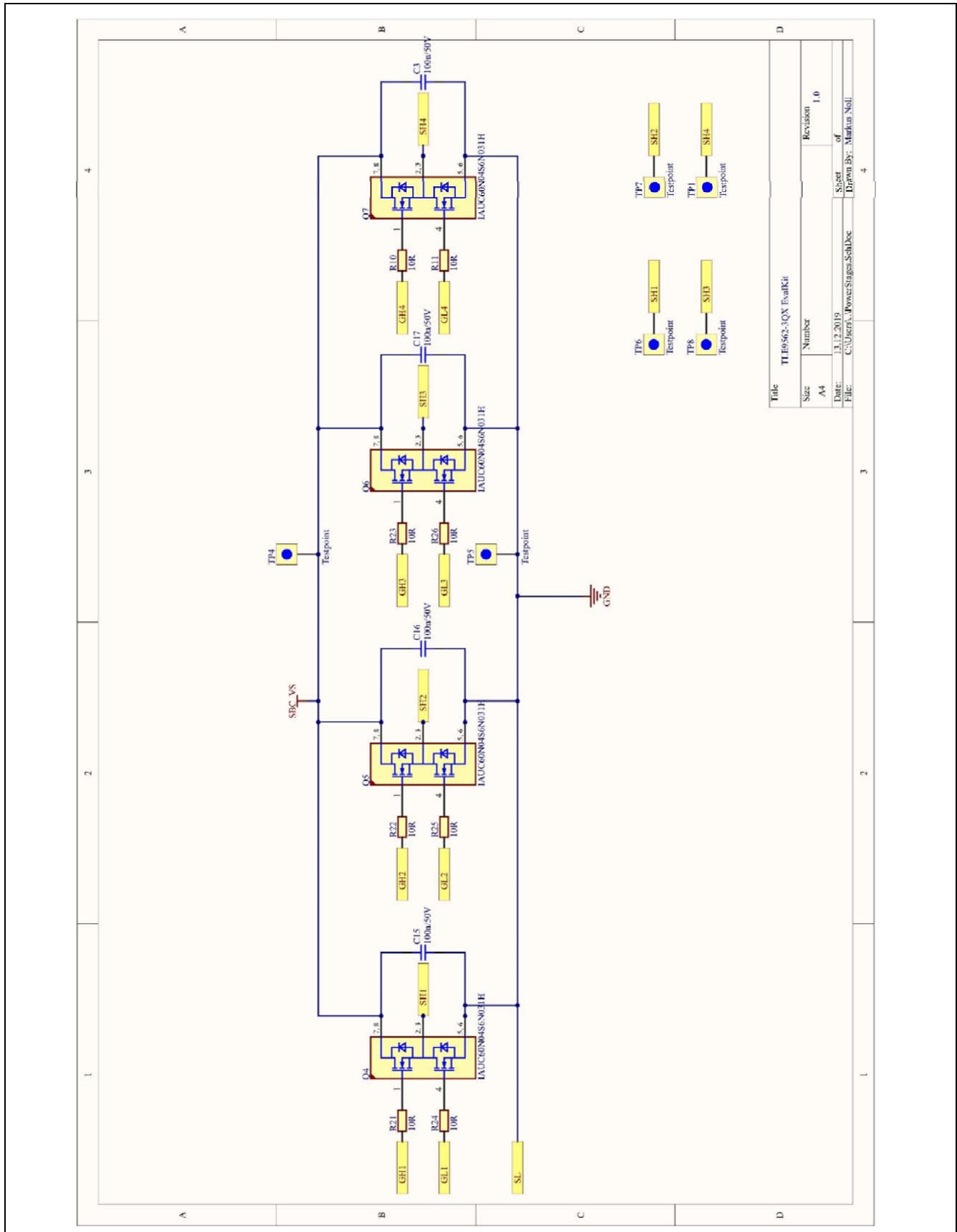


Figure 10 Schematic 3/3

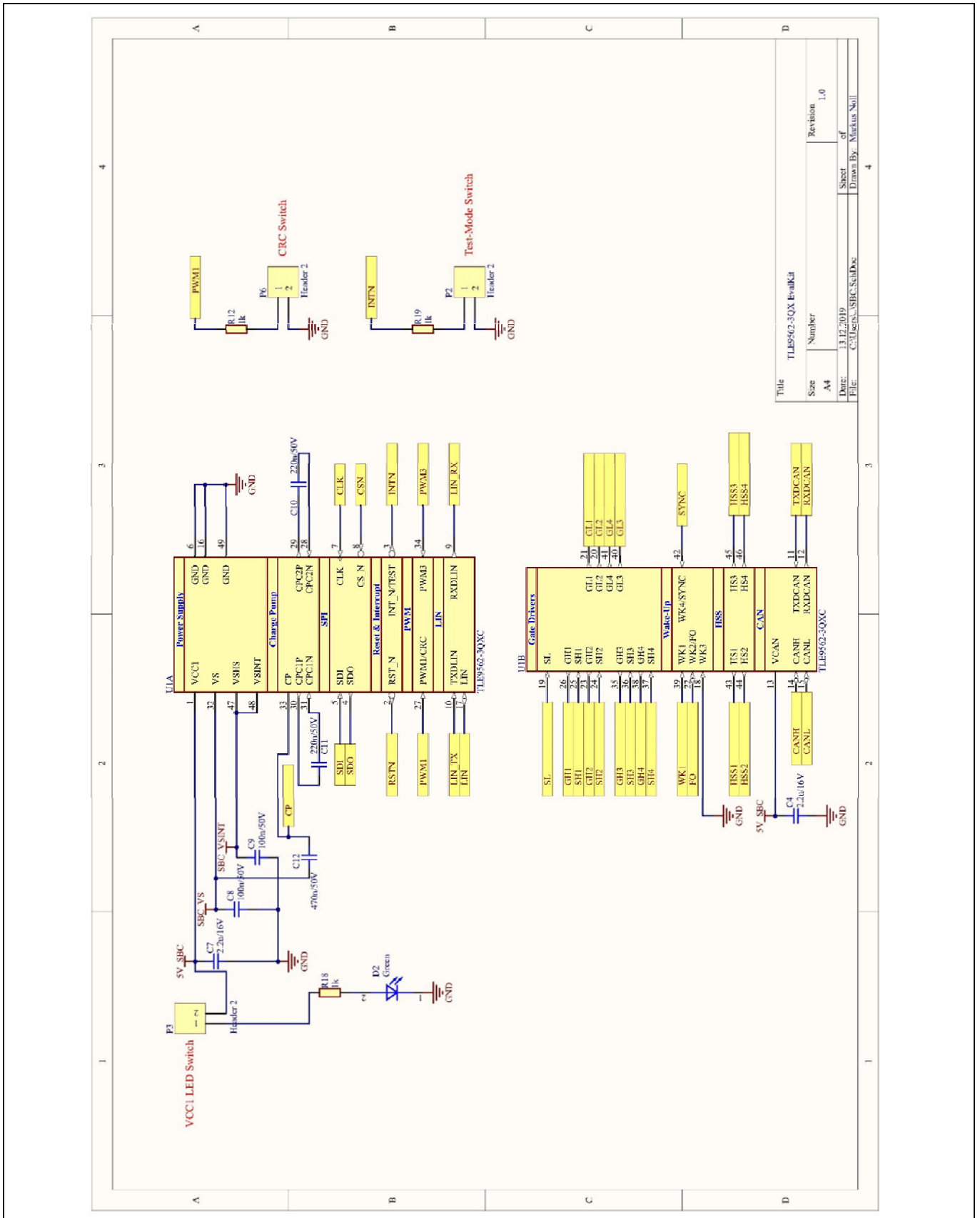


Figure 12 Bottom layer with overlay

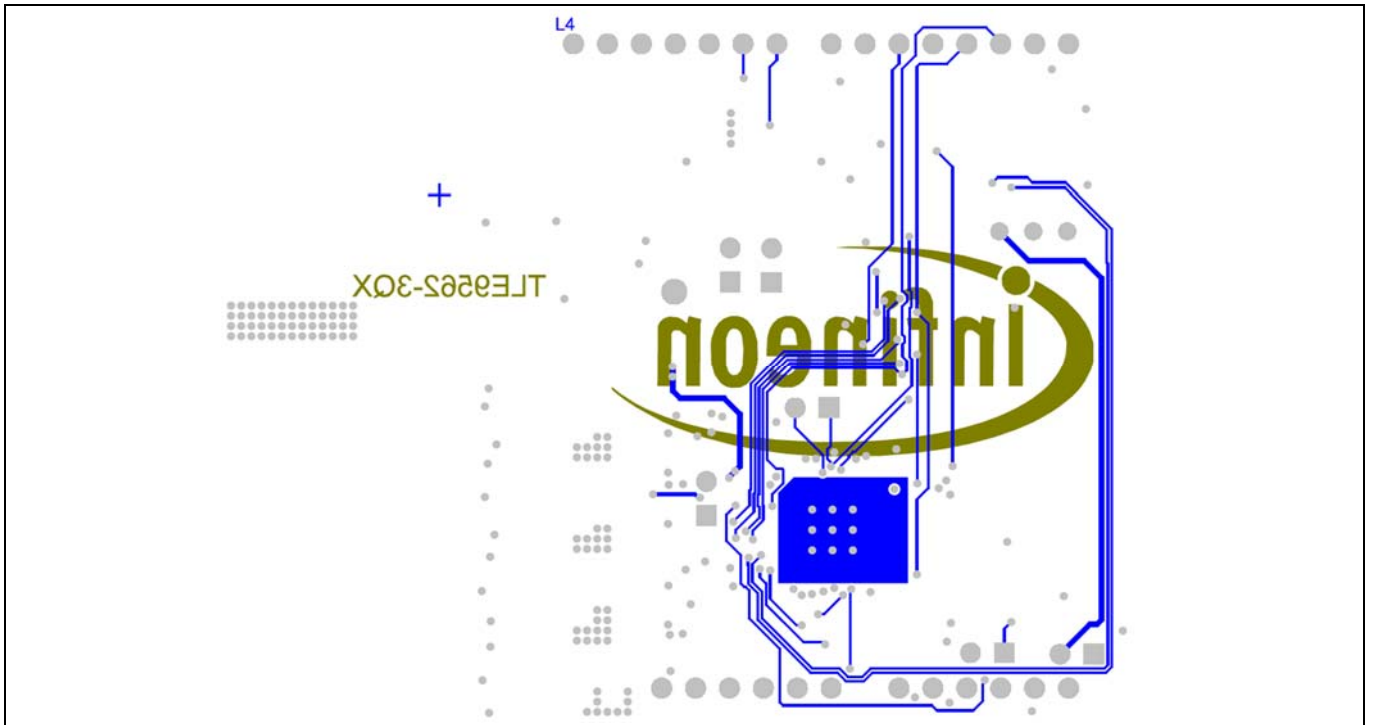
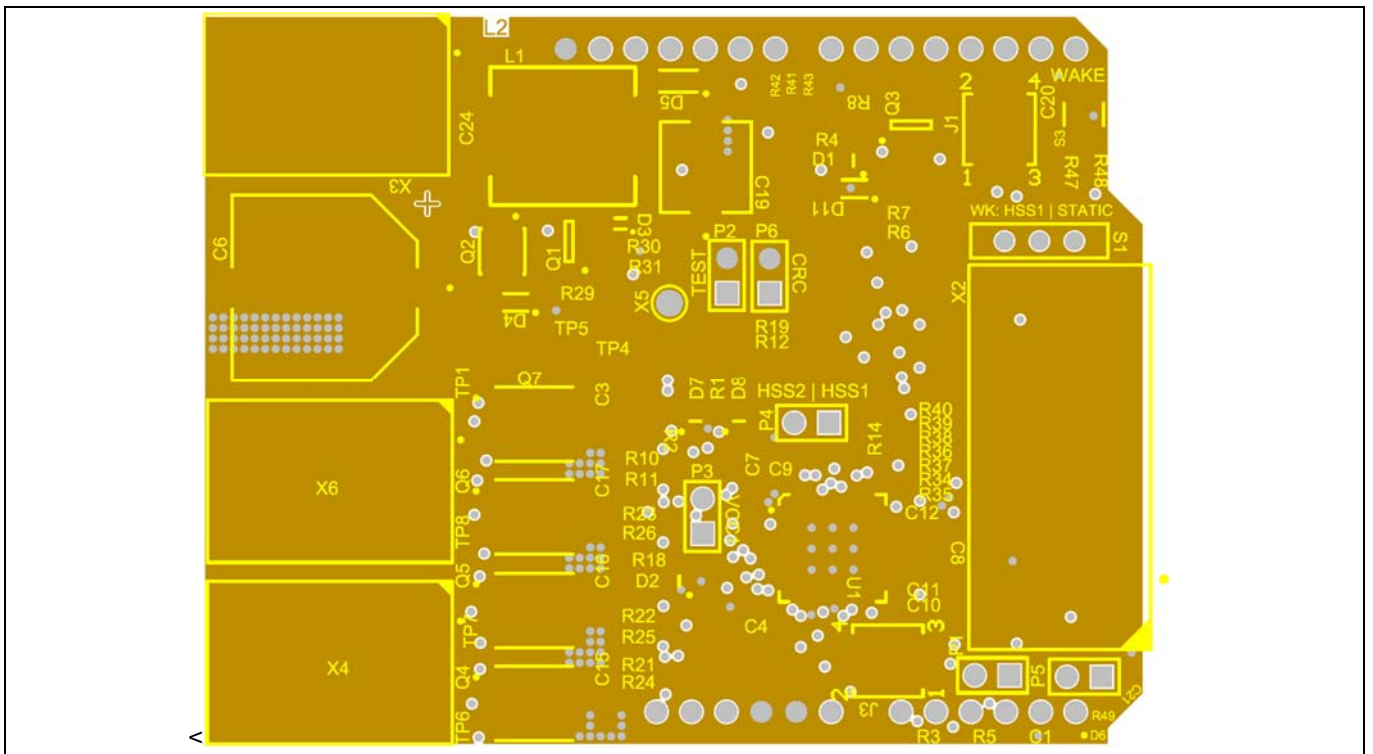


Figure 13 Inner layer - GND



2.4 Bill of Material of the TLE9562-3QX

Figure 14 TLE9562-3QX - Section of Bill of Material (BOM)

Designator	Comment	Manufacturer	Description	Quantity
J1, J3	61000421121		SMT Vertical Pin Header WR-PHD, Pitch 2.54 mm, Dual Row, 4 pins	2
L1	TDK SPM10065VT			1
P1, P2, P3, P4, P5, P6	Header 2		Header, 2-Pin	6
S1	450301014042		WS-SLTV THT Mini Slide Switch, Opposite Side Connection, SPDT	1
S3	434153017835		WS-TASV J-Bend SMT Tact Switch 3.5x2.9mm, height 1.7mm, 350gf	1
TP1, TP4, TP5, TP6, TP7, TP8	Testpoint			6
C3, C15, C16, C17	100n/50V	AVX	Surface Mount Ceramic Capacitor Automotive Grade	4
D4	BZT52C125-7-F	Diodes Incorporated	Surface Mount Zener Diode	1
D3	BAS52-02V	Infineon Technologies	Silicon Schottky Diode	1
D6	BAS70-02L	Infineon Technologies	Silicon Schottky Diode	1
Q1	BC817K-40	Infineon Technologies	NPN Silicon AF Transistor	1
Q2	IP240N0455L-2R8	Infineon Technologies	OptiMOS-5 N-Channel Enhancement Mode Power-Transistor, VDS 40V, ID 40A	1
Q3	bjt_pnp_1b2e3c_3p_10k	Infineon Technologies	PNP Silicon Digital Transistor	1
Q4, Q5, Q6, Q7	IAUC60N0456N031H	Infineon Technologies		4
U1	TLE9562-3QXC	Infineon Technologies	Bridge SBC Family, PLGM	1
X5	5001	Keystone Electronics Corp.	Test Point THT, Black	1
D5	MBR0560-TP	Micro Commercial Components	Schottky Rectifier, 0.5A/60V	1
D1, D7, D8	d_led_a	OSRAM Opto Semiconductors	Surface Mount LED, Super Red, 630nm	3
D2	Green	OSRAM Opto Semiconductors	Surface Mount LED, Green, 570nm	1
C6	680u/35V	Panasonic	Aluminum Electrolytic Capacitors	1
C19	100u/35V	Panasonic	Surface Mount Aluminium Electrolytic Capacitor	1
X2	HTST-108-01-L-DVÅ	Samtec	SMT, .025" Shrouded SQ POST IDC Headers , 2.54mm pitch, 16-pin Vertical, Double row	1
C1	4.7n/50V	TDK Corporation	Chip Multilayer Ceramic Capacitor for General Purpose	1
C4, C7	2.2u/16V	TDK Corporation	Multilayer Ceramic Chip Capacitor, Automotive Grade, Soft Termination	2
C8, C9, C20, C24	100n/50V	TDK Corporation	Chip Multilayer Ceramic Capacitor for General Purpose	4
C10, C11	220n/50V	TDK Corporation	Multilayer Ceramic Chip Capacitor, Automotive Grade, Soft Termination	2
C12	470n/50V	TDK Corporation	Multilayer Ceramic Chip Capacitor, Automotive Grade, Soft Termination	1
C21	1n/50V	TDK Corporation	Chip Multilayer Ceramic Capacitor for General Purpose	1
R1, R2, R4	4.7k	Vishay	Standard Thick Film Chip Resistor	3
R3, R5	62	Vishay	Standard Thick Film Chip Resistor	2
R6	1.3k	Vishay	Standard Thick Film Chip Resistor	1
R7, R29	100k	Vishay	Standard Thick Film Chip Resistor	2
R8, R30, R31, R47, R48	10k	Vishay	Standard Thick Film Chip Resistor	5
R10, R11, R21, R22, R23, R24, R25, R26	10R	Vishay	Standard Thick Film Chip Resistor	8
R12, R14, R18, R19, R34, R35, R36, R37,	1k	Vishay	Standard Thick Film Chip Resistor	12
R41, R42, R43	33R	Vishay	Standard Thick Film Chip Resistor	3
D11	5.1V	Vishay General Semiconductor	Small Signal Zener Diode, GDZ-G-Series / 5.1V	1
X3, X4, X6	2061-602/998-404	WAGO	SMD PCB Terminal block with Push-Buttons, with 6mm Pin Spacing, 2-pole	3

3 Start and uIO stick programming

The uIO stick requires a firmware supporting the GUI (Graphic user interface)

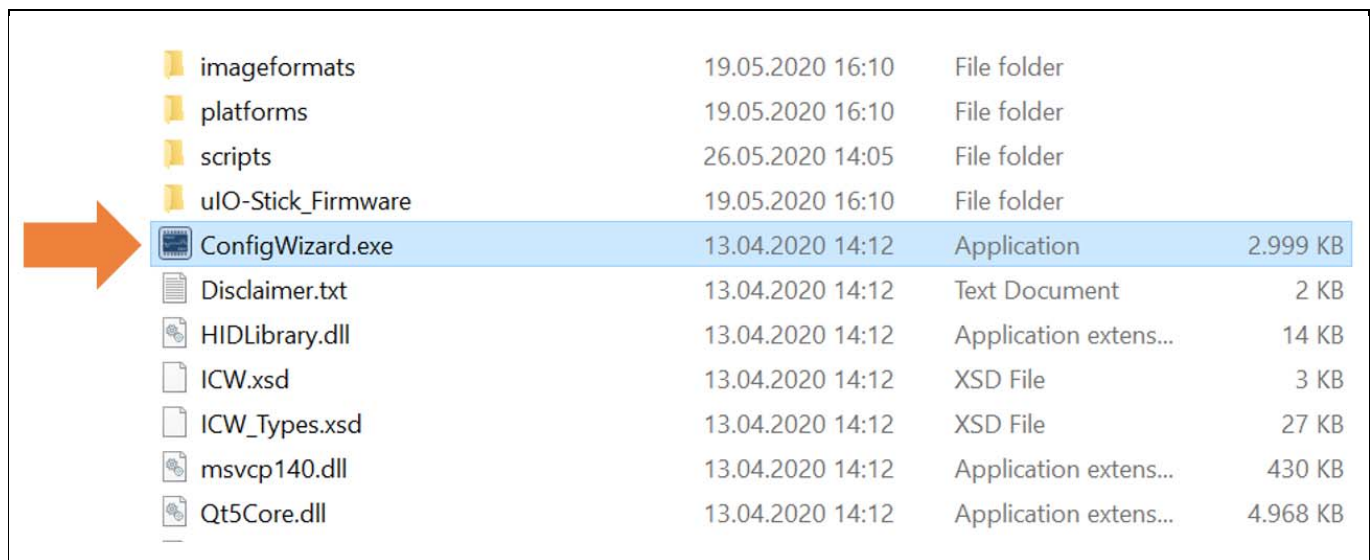
3.1 Download the Graphic User Interface for the uIO stick

The TLE9210x gate driver setting tool can be either downloaded from Infineon's MyICP upon access request or from the Infineon Tool Box (not yet possible by the generation of the user manual).

3.1.1 Download from MyICP

The GUI for the Motor System IC can be downloaded upon request to Motorcontrolsolutions@infineon.com. Once the .zip file is locally extracted, start: **ConfigWizard.exe** (in the application subfolder) and click on the icon for **TLE9562**.

Figure 15 Start of the GUI after download from MyICP



imageformats	19.05.2020 16:10	File folder	
platforms	19.05.2020 16:10	File folder	
scripts	26.05.2020 14:05	File folder	
uIO-Stick_Firmware	19.05.2020 16:10	File folder	
ConfigWizard.exe	13.04.2020 14:12	Application	2.999 KB
Disclaimer.txt	13.04.2020 14:12	Text Document	2 KB
HIDLibrary.dll	13.04.2020 14:12	Application extens...	14 KB
ICW.xsd	13.04.2020 14:12	XSD File	3 KB
ICW_Types.xsd	13.04.2020 14:12	XSD File	27 KB
msvcp140.dll	13.04.2020 14:12	Application extens...	430 KB
Qt5Core.dll	13.04.2020 14:12	Application extens...	4.968 KB

3.1.2 Download from the Infineon Toolbox

The GUI is installed the Infineon Toolbox following the steps below:

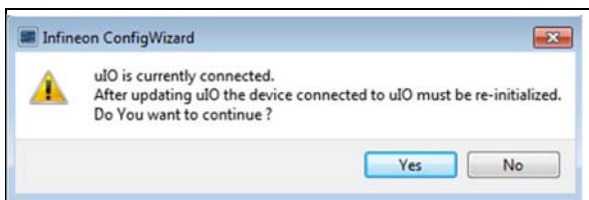
1. Go to: www.infineon.com/toolbox
2. Follow the instructions provided on the toolbox installation webpage. Also see the "Download Getting Started Infineon Toolbox Guide" link for des additional user information
3. Launch the Infineon Toolbox on your PC:
4. Select **Manage Tools**
5. Search and install the tool: **Config Wizard for Motor System IC**
6. Start the **Config Wizard for Motor System IC**
7. Click on **TLE9562**

3.2 Configuration Wizard for TLE9562-3QX

The first utilization of the uIO stick in combination of the GUI for the TLE9562 requires the programming of the uIO stick:

1. Connect the uIO stick to the USB port
2. Menu Extra
3. Update uIO
4. Click Yes (refer Figure 16)

Figure 16 Updating the uIO



5. Select uIO.V222.hex and open (the valid version at the creation time of the document)

3.2 Load TLE9562 presettings

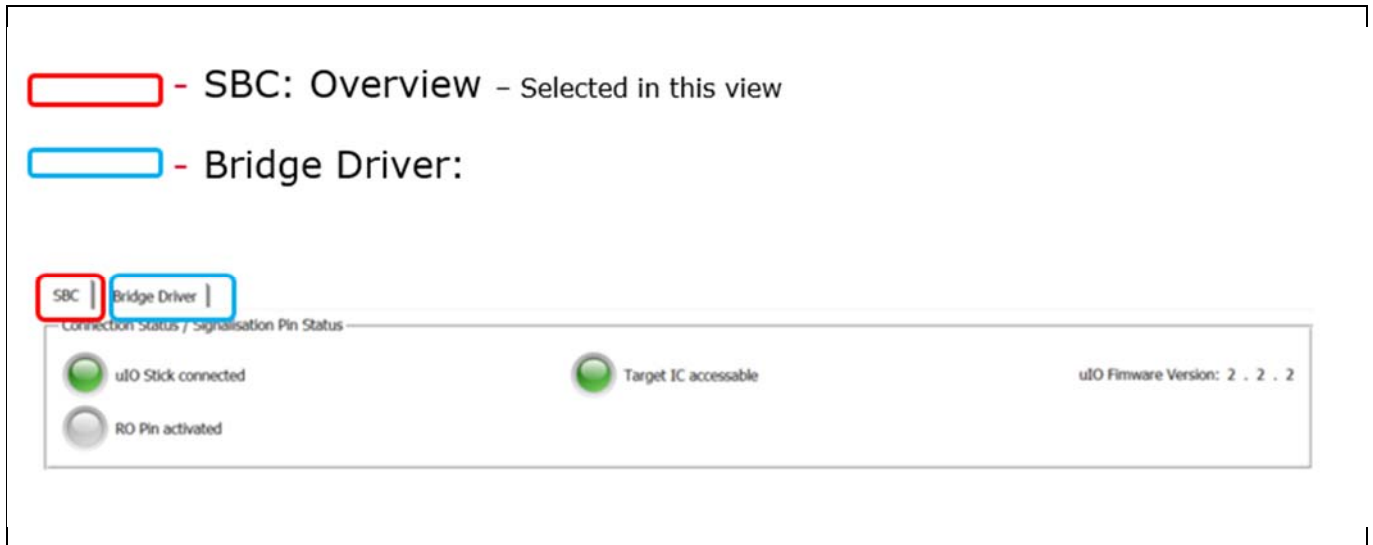
Presettings for the gate driver can be loaded:

File → Load → TLE9562_ConfigWizard_Presettings_2020_06_25_1.icwp

- The charge pump is activated
- The active gate control and the postcharge are activated
- The gate driver currents for the active and freewheeling MOSFETs are pre-configured

4 Config Wizard - Control tabs

Figure 17 The two main tabs SBC, Bridge Driver



4.1 SBC

Figure 18 Connection Status/ Signaling Pin Status

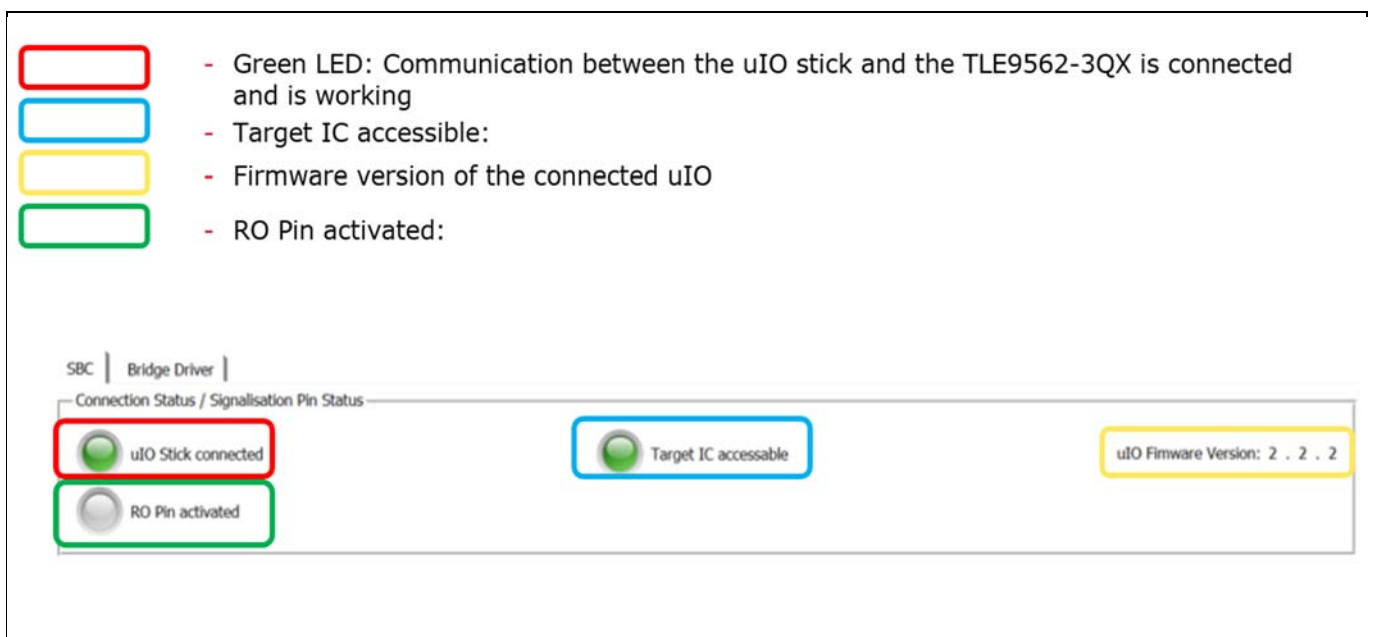


Figure 19 Overview of the SBC tab

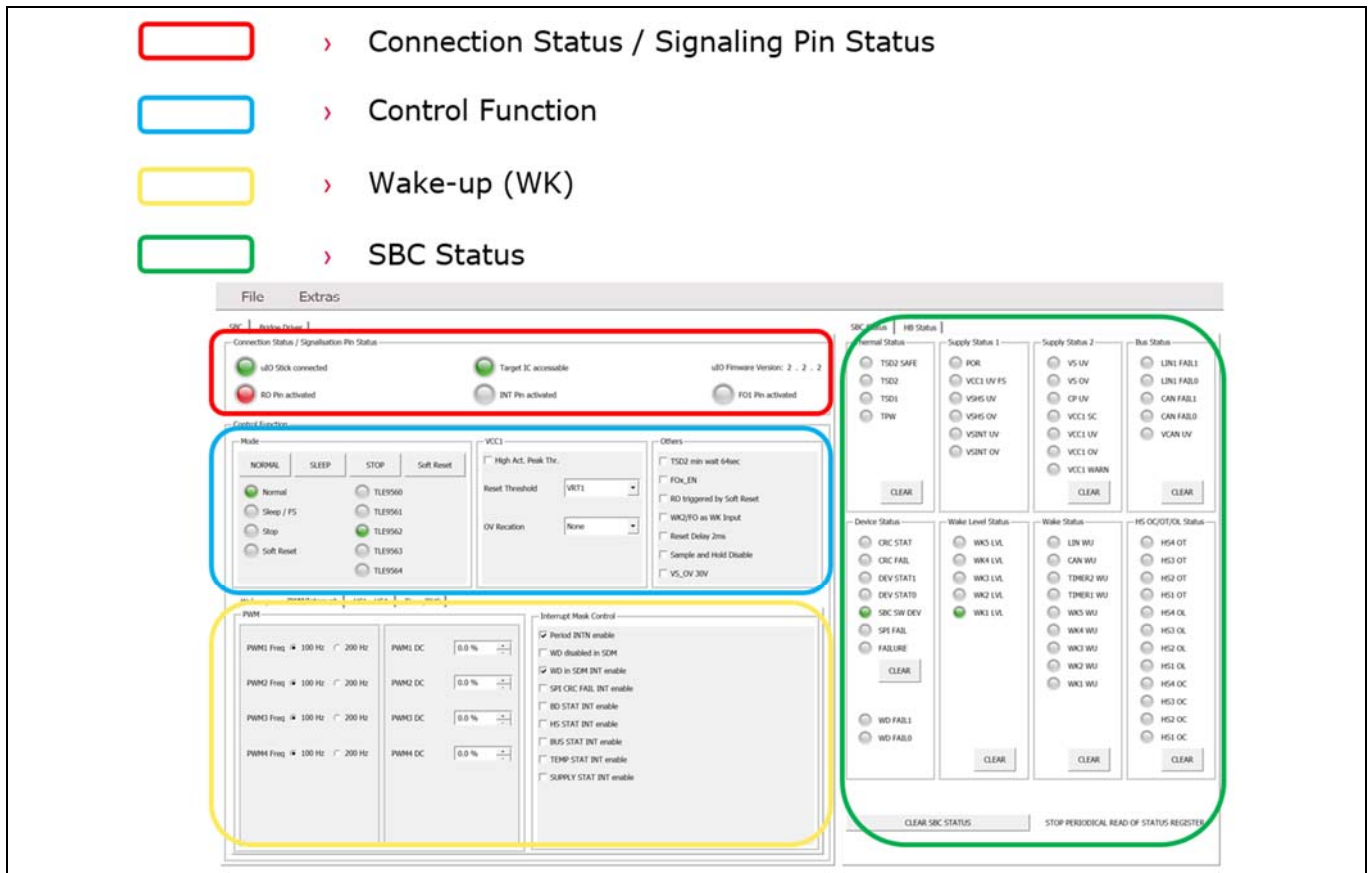


Figure 20 SBC: Control functions

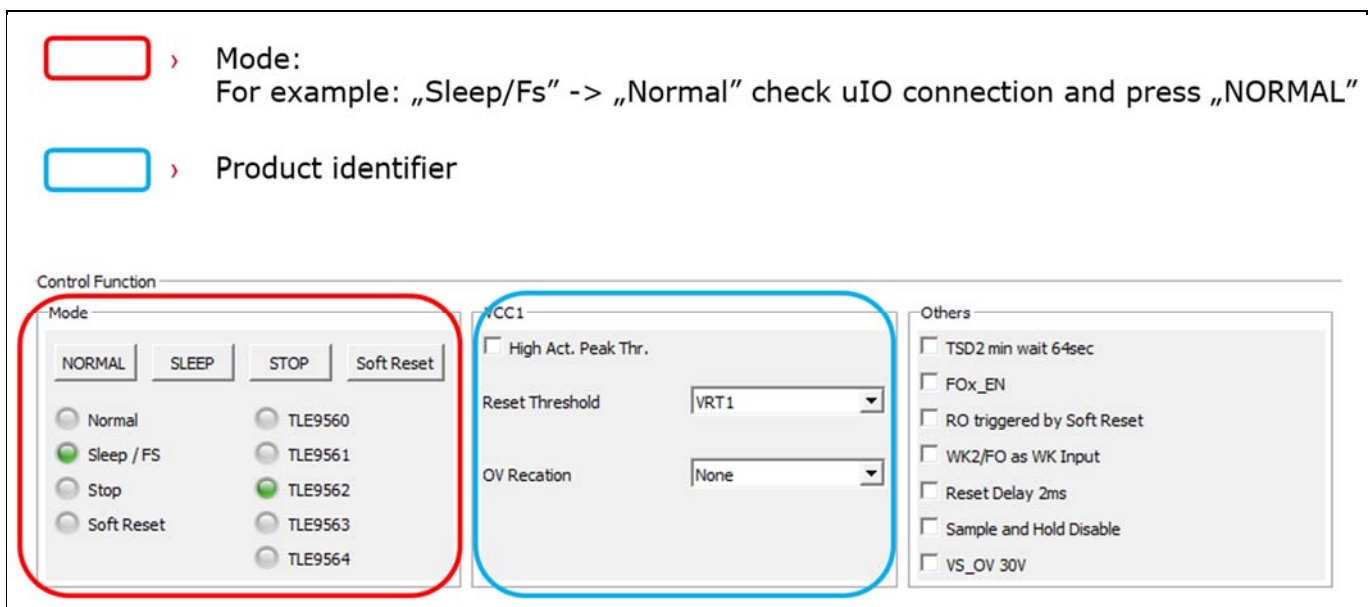


Figure 21 SBC: Wake-up, PWM/Interrupt, HS1 – HS4, Timer /BUS

The screenshot displays the SBC configuration tool interface with four panels highlighted by colored boxes and arrows:

- Wake-up:** A red box highlights the top section containing five rows of wake-up filter settings (WK1 to WK5). Each row includes a filter value (15us), an enable checkbox, an ON mode dropdown, and a pull device dropdown (None or Pull-up fixed).
- PWM/Interrupt:** A blue box highlights the middle section. It includes PWM frequency and DC settings for four channels (100 Hz, 200 Hz, 0.0%) and an Interrupt Mask Control panel with checkboxes for various interrupt sources like Period DNTN, WD, SPI CRC FAIL, etc.
- HS1 – HS4:** A yellow box highlights the bottom-left section, showing recovery and shutdown options for High-Speed (HS) modes 1 through 4, with dropdown menus for each mode (all set to 'off').
- Time/BUS:** A green box highlights the bottom-right section, showing timer periods (10 ms), on-time (OFF), and cyclic wake (Disabled) settings, along with a BUS Configuration panel for CAN and LIN1.

Figure 22 SBC Status

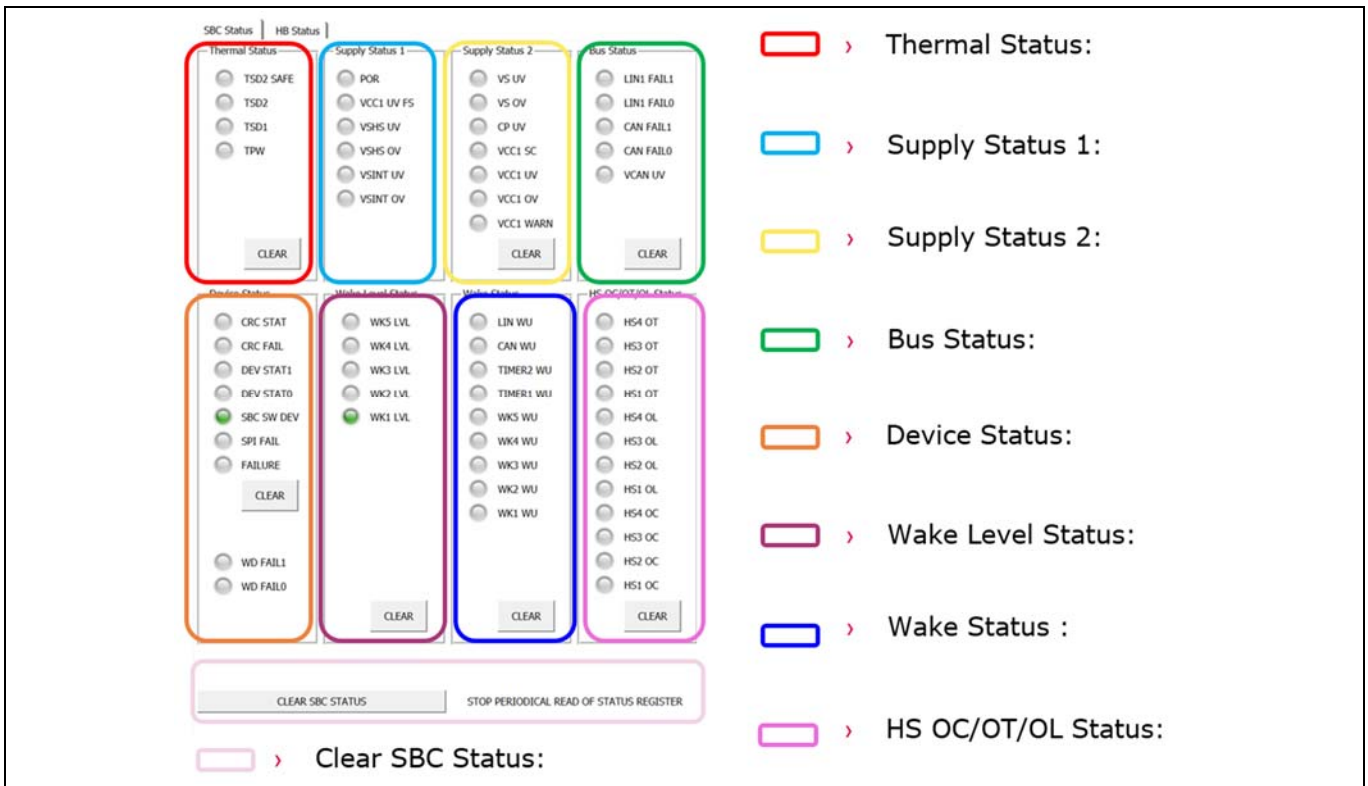
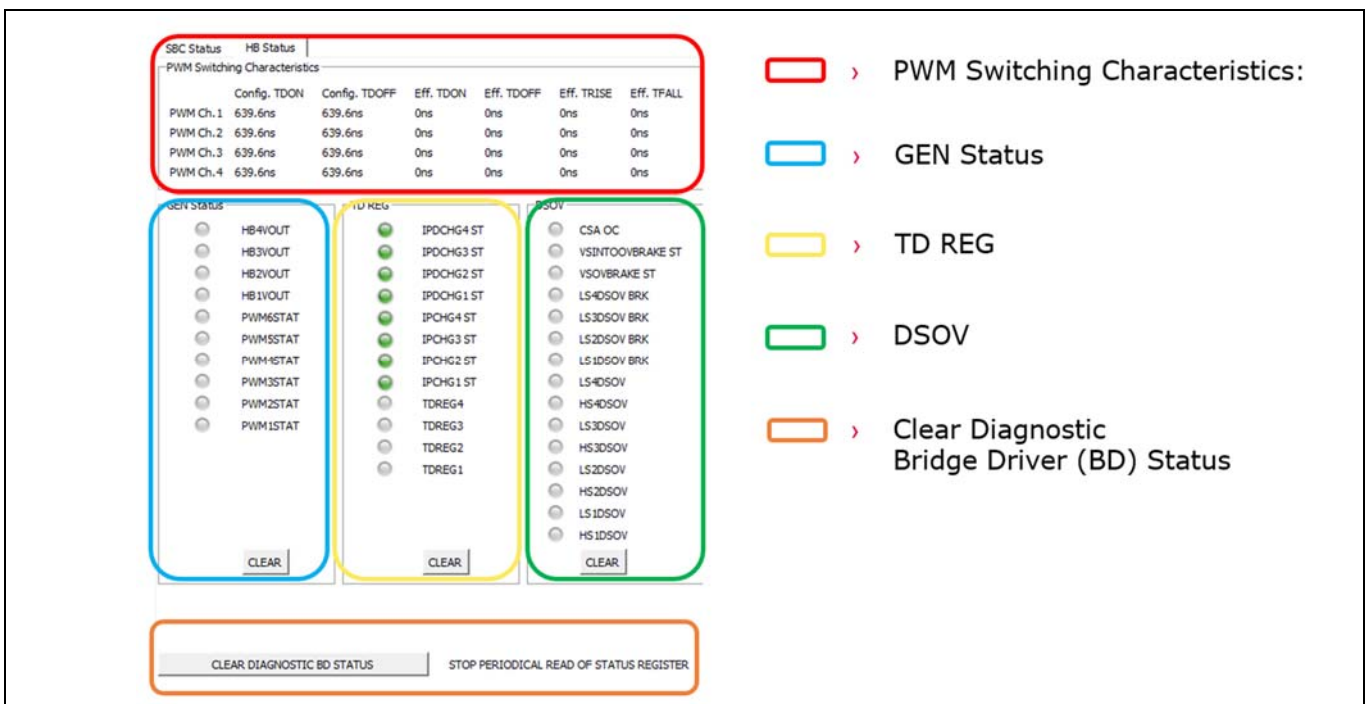


Figure 23 Half-Bridge (HB) Status



4.2 Bridge Driver

Figure 24 Bridge Driver: 1st Tab – General control , VDS Monitoring (Mon.)

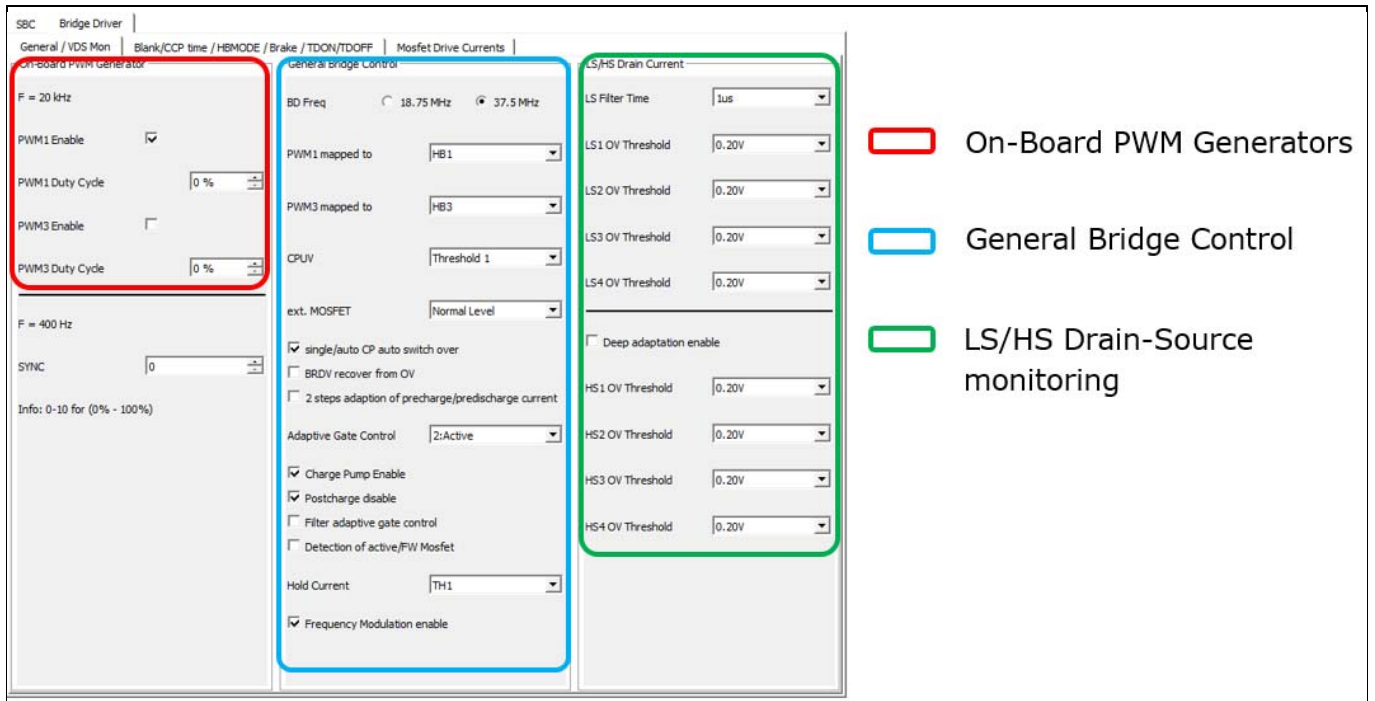


Figure 25 Bridge Driver: 2nd Tab – Blank/ CCP time, HBMODE, Brake, TDON/ TDOFF Timing

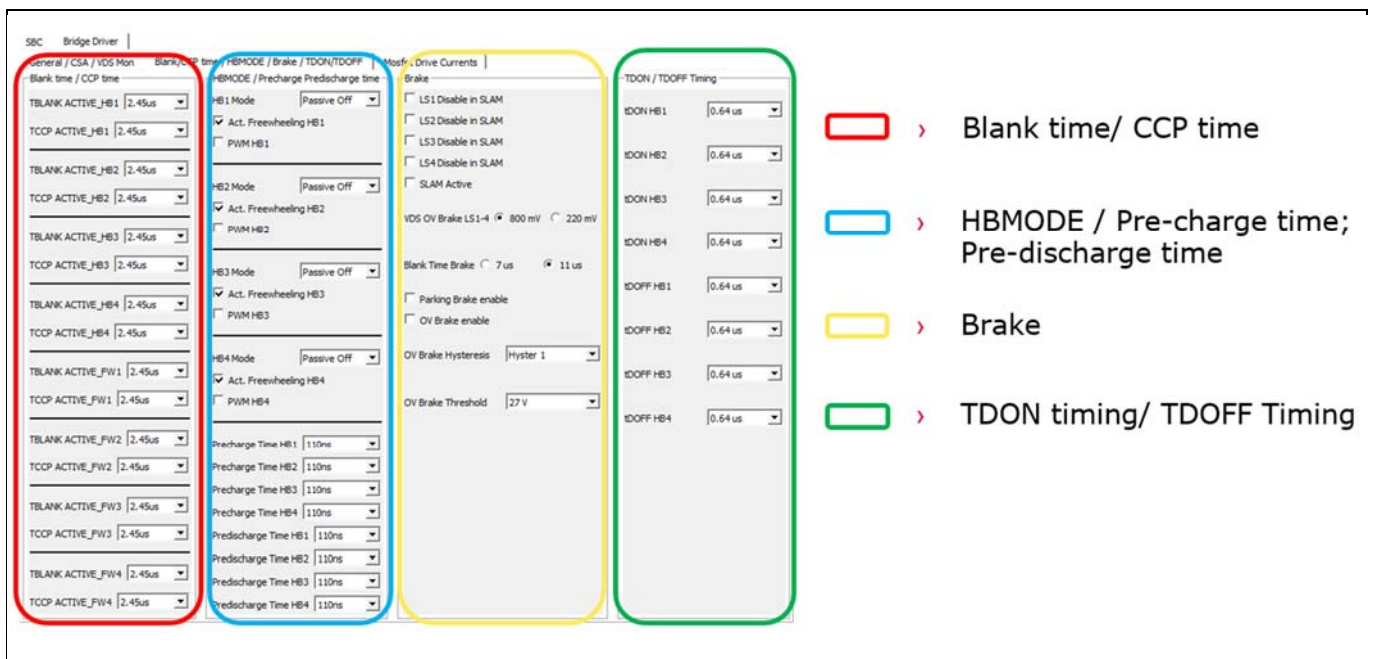


Figure 26 Bridge Driver: 3rd Tab – MOSFET Drive Currents

The screenshot shows the 'MOSfet Drive Currents' tab in the configuration tool. It contains several sections with various parameters for four half-bridges (HB1-HB4):

- Static charge/discharge current:** Four dropdown menus for HB1-HB4, each showing '40.1 mA / 39.4 mA'.
- Precharge / Predischarge INIT:** Eight dropdown menus for Precharge and Predischarge initial values for HB1-HB4, with values like 10.2 mA and 31.2 mA.
- PWM charge/discharge current:** Two sections. 'PWM charge Active MOSFET' has four dropdowns for Charge HB1-HB4 Active, all set to 6.5 mA. 'PWM discharge Active MOSFET' has four dropdowns for Discharge HB1-HB4 Active, all set to 8.2 mA.
- PWM max precharge/predischarge:** Four dropdown menus for HB1-HB4, each showing '100 mA / 100 mA'. Below are checkboxes for 'off-state pull-down' for each half-bridge.
- FW MOSFET:** Four dropdown menus for Charge/Discharge HB1-FW, HB2-FW, HB3-FW, and HB4-FW, with values like '40.1 mA / 39.4 mA'.

Color-coded boxes on the right side of the image identify the highlighted settings:

- Red box:** Static charge current/ static discharge current
- Blue box:** Pre-charge initial/ pre-discharge initial
- Yellow box:** PWM charge current/ PWM discharge current
- Green box:** PWM max. Pre-charge/ PWM max. Pre-discharge
- Orange box:** Maximum precharge and pre-discharge currents

5 Revision history

Document version	Date of release	Description of changes
V 1.0	2020-07-16	Initial version

Trademarks

All referenced product or service names and trademarks are the property of their respective owners.

Edition 2020-07-16

Published by

Infineon Technologies AG

81726 Munich, Germany

© 2020 Infineon Technologies AG.

All Rights Reserved.

Do you have a question about this document?

Email: erratum@infineon.com

Document reference

AppNote Number

IMPORTANT NOTICE

The information contained in this application note is given as a hint for the implementation of the product only and shall in no event be regarded as a description or warranty of a certain functionality, condition or quality of the product. Before implementation of the product, the recipient of this application note must verify any function and other technical information given herein in the real application. Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind (including without limitation warranties of non-infringement of intellectual property rights of any third party) with respect to any and all information given in this application note.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

For further information on the product, technology delivery terms and conditions and prices please contact your nearest Infineon Technologies office (www.infineon.com).

WARNINGS

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.