TLE9241QU Evaluation board

Transmission IO Evaluation Board and GUI User Manual

About this document

This document details the functionality and the required steps for operating the evaluation kits for Infineon's TLE9241QU Transmission IO IC (TransIO). Included are instructions for setting up the evaluation board and for using the accompanying graphical user interface (GUI).

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1 Hardware Configuration

Figure 1 provides an overview of the component blocks of the evaluation kit of the TLE9241QU. The board provides supply connections for battery voltage (X6) and two types of load connector (X11/X12, X7/X8). The reverse polarity protection of TLE9241QU is used for the battery voltage applied at X6 is. Supply and digital signals are accessible with connector X1, and X3/X5. Analog connections are routed to X4.

The board, whilst not exactly in Arduino-form-factor (two of the SRx analog pins don't fit), will work on any Arduino-compatible Platform. The GUI supports the control of the Evaluation board with the use of XMC4700 Relax Kit.

Alternatively, you can use the included software for the XMC, standalone with a Serial-terminal of your choice. An overview of the included commands is given in the appended command list (section 3.3).

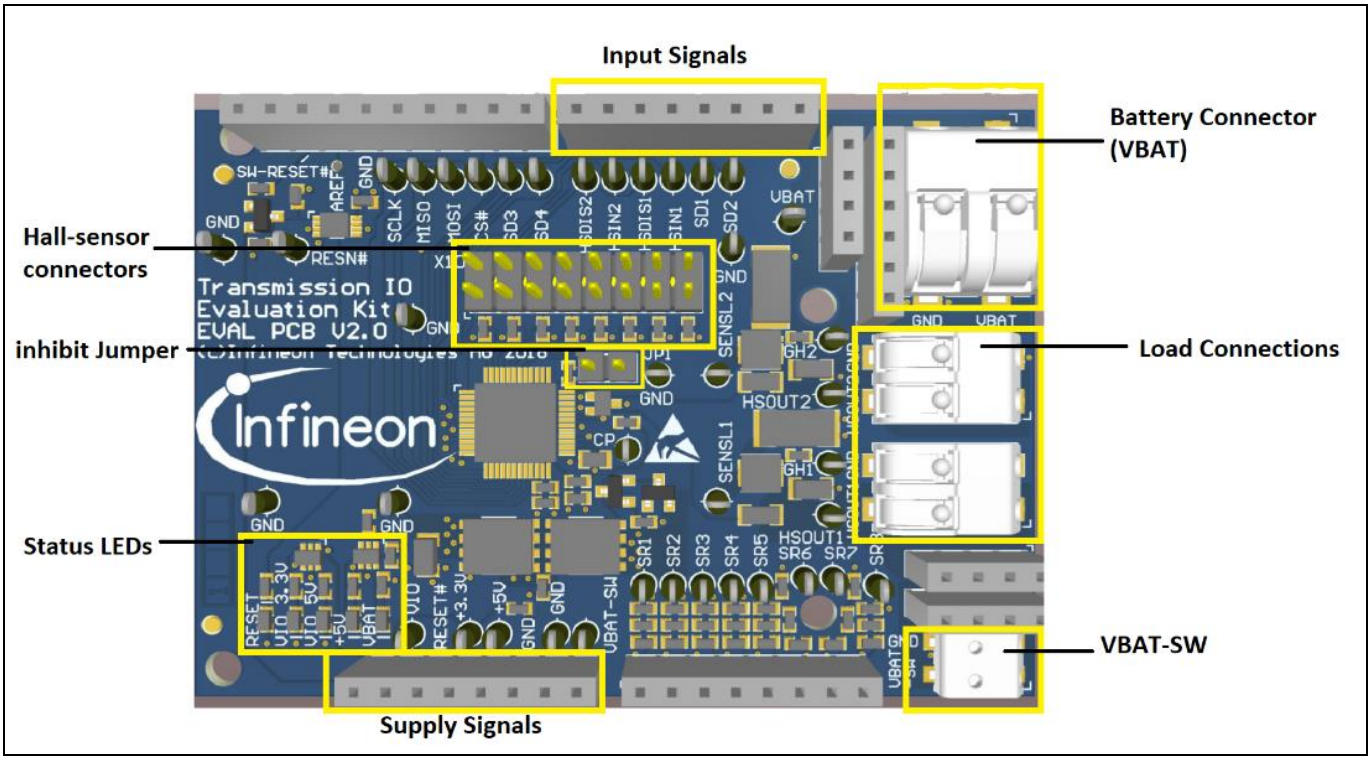

Figure 1 Functional blocks of the TLE9241QU evaluation board

1.1 Power and load connections

Power connections

The TLE9241QU evaluation board provides a reverse polarity protected voltage (VBAT-SW) from the VBAT connector (X6) if the inihibit jumper (JP1) is set.

The battery reverse protection circuit and system main switch circuit is shown in Figure 2.

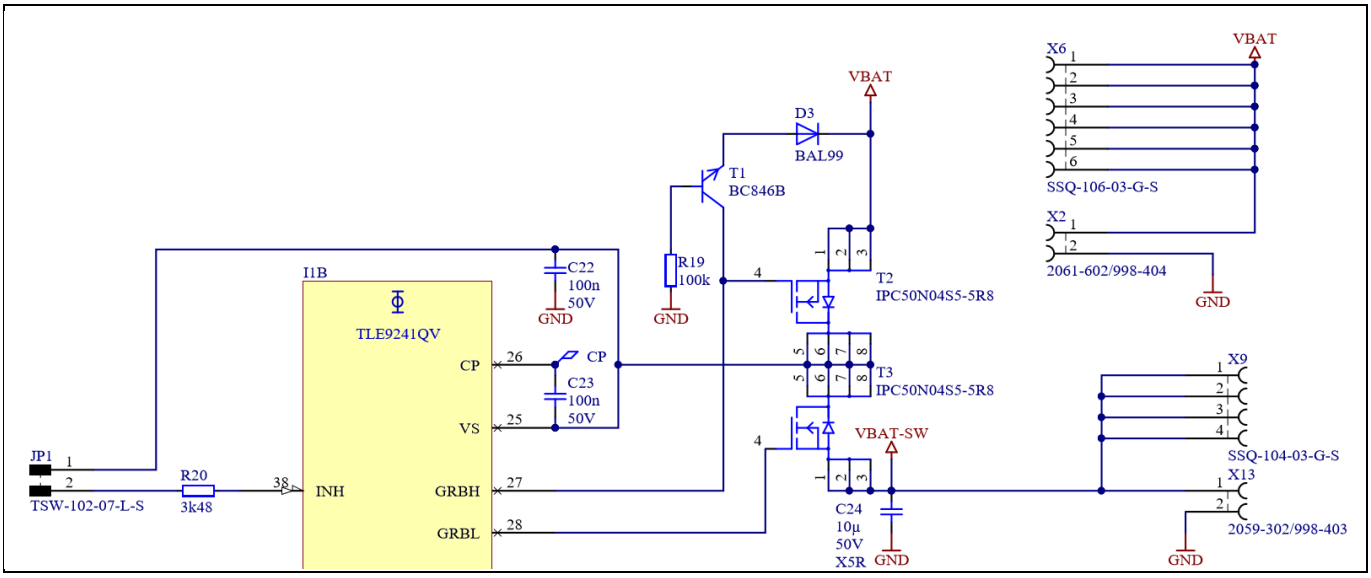

Figure 2 Supply connection and battery revese protection on the evaluation board

Load connections

The TLE9241QU evaluation board includes two high side switches (NMOS) for external loads to be connected to connectors X7/X8. Figure 3 depicts the schematics of these load connections.

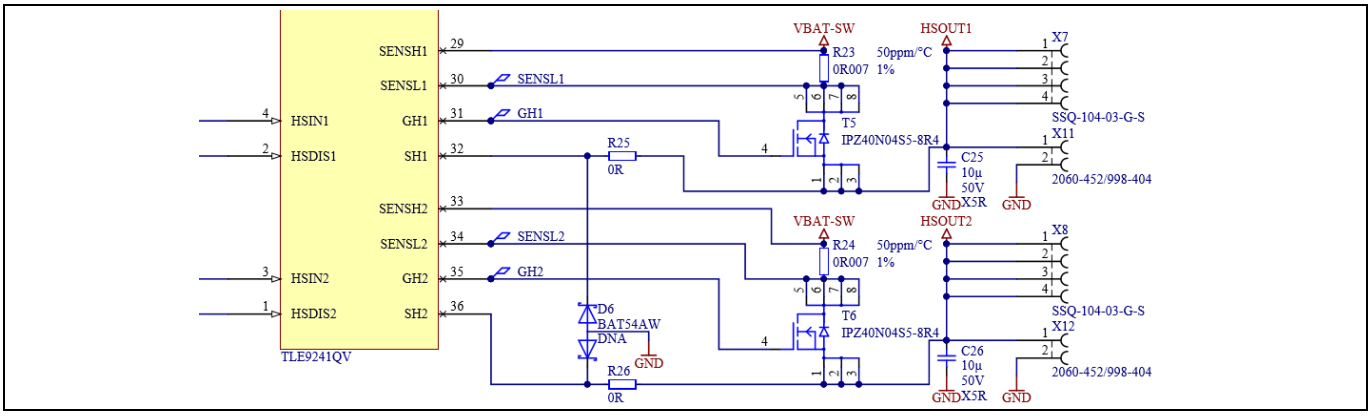

Figure 3 Load connections

1.2 Interface signals

The TLE9241QU Evalboard provides an Arduino compatible Form factor. Infineon offers a suitable microcontroller board called XMC4700 Relax Kit as shown in Figure 4. Besides the Relax Kit any other Arduino compatible microcontroller board or SPI to USB interface adapter can be used to configure the IC. The XMC4700 Relax Kit interface signals are described in the upcoming tables.

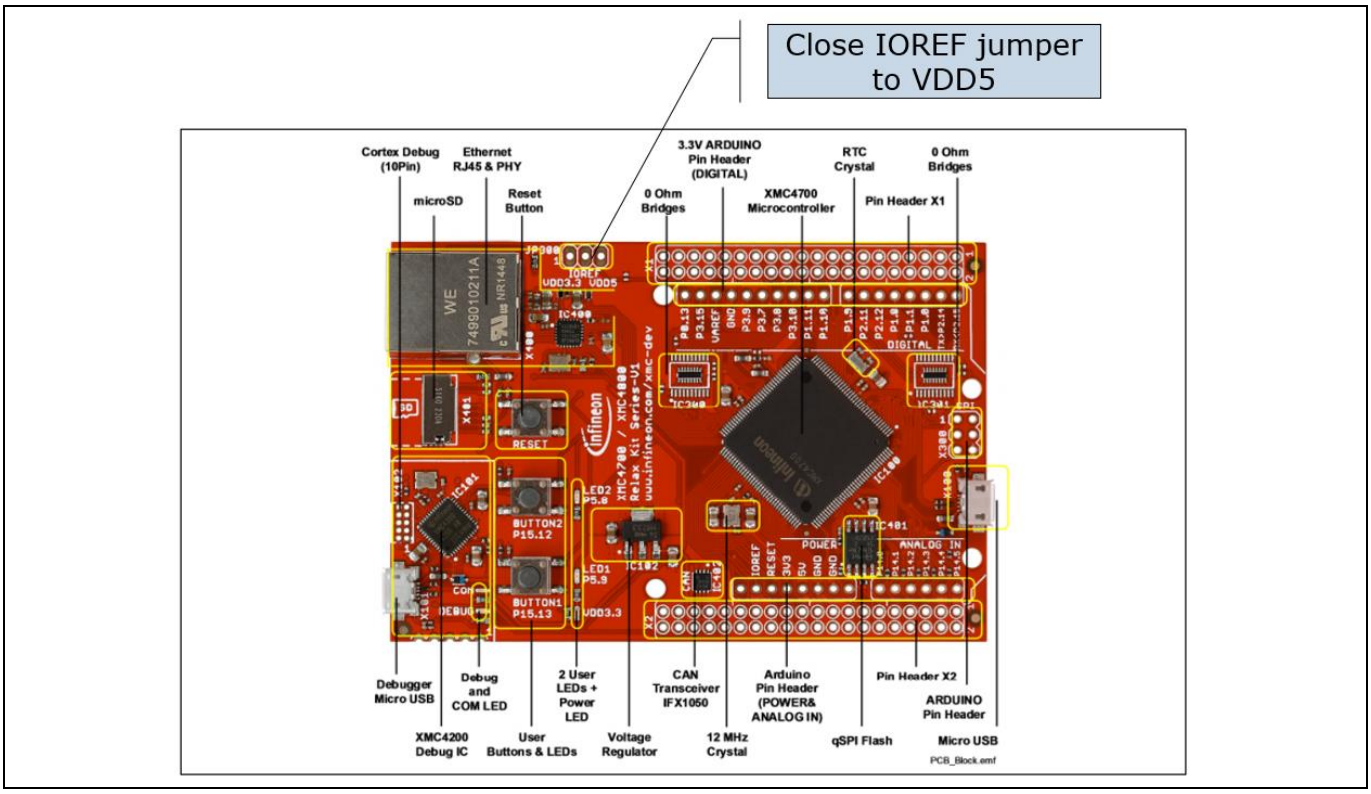

Figure 4 Considerations for use of XMC4700 Relax Kit

Error! Reference source not found. describes the name and function of each X1 pin on the IC evaluation kit and the XMC4700 Relax Kit.

Table 1 Signal description on connector X1

Pin Number	Signal name on Evaluation PCB	Signal name on XMC4700 Relax Kit	Description
1	-	-	-
2	VIO	IOREF	Signal Supply Voltage
3	Reset#	RESET	Reset (active low)
4	+3.3V	3.3V	3.3 V supply from uC board
5	+5V	5V	5 V supply from uC board
6	GND	GND	Ground
7	GND	GND	Ground
8	VBAT-SW	Vin	DC Supply voltage after reverse battery protection circuit (typ. 12V)

Table 2, Table 3 and Table 4 describe the names and functions of the X3, X4 and X5 connector pins on the IC evaluation PCB.

Table 2 Signal description on connector X3

Pin Number	Signal name on Evaluation PCB	Signal name on XMC4700 Relax Kit	Description
1	SD4	P1.10	Hall Effect Sensor interface digital output 4
2	SD3	P1.11	Hall Effect Sensor interface digital output 3
3	CS#	P3.10	Serial Chip Select (active low)
4	MOSI	P3.8 / MOSI	Serial data input
5	MISO	P3.7 / MISO	Serial data output
6	SCLK	P3.9 /SCK	Serial Clock
7	GND	GND	Ground
8	AREF	AREF	Analog reference voltage
9	SW-RESET#	P3.15	Software-reset
10	-	P0.13	-

Table 3 Signal description on connector X4

Pin Number	Signal name on Evaluation PCB	Signal name on XMC4700 Relax Kit	Description
1	AD0	P14.0	Hall Effect Sensor interface analog output 1 (SR1)
2	AD1	P14.1	Hall Effect Sensor interface analog output 2 (SR2)
3	AD2	P14.2	Hall Effect Sensor interface analog output 3 (SR3)
4	AD3	P14.3	Hall Effect Sensor interface analog output 4 (SR4)
5	AD4	P14.4	Hall Effect Sensor interface analog output 5 (SR5)
6	AD5	P14.5	Hall Effect Sensor interface analog output 6 (SR6)
7	AD6	-	Hall Effect Sensor interface analog output 7 (SR7)
8	AD7	-	Hall Effect Sensor interface analog output 8 (SR8)

Table 4 Signal description on connector X5

Pin Number	Signal name on Evaluation PCB	Signal name on XMC4700 Relax Kit	Description
1	-	P2.15	-
2	-	P2.14	-
3	SD2	P1.0	Hall Effect Sensor interface digital output 2
4	SD1	P1.1	Hall Effect Sensor interface digital output 1
5	HSIN1	P1.8	High side driver 1 enable input
6	HSDIS1	P2.12	High side driver 1 disable input

7	HSIN1	P2.11	High side driver 2 enable input
8	HSDIS2	P1.9	High side driver 2 disable input

1.3 Indicator LEDs

The indicator LEDs which are mounted on theTLE9241QU evaluation board are shown in Figure 5.

- Either D4 or D5 is on, depending on whether VIO is set to 3.3 V or 5 V, respectively.
- D2 is on when the chip is in reset mode,
- D7 is on if +5V is present,
- D8 is on if +12V VBAT is present (close INH jumper)

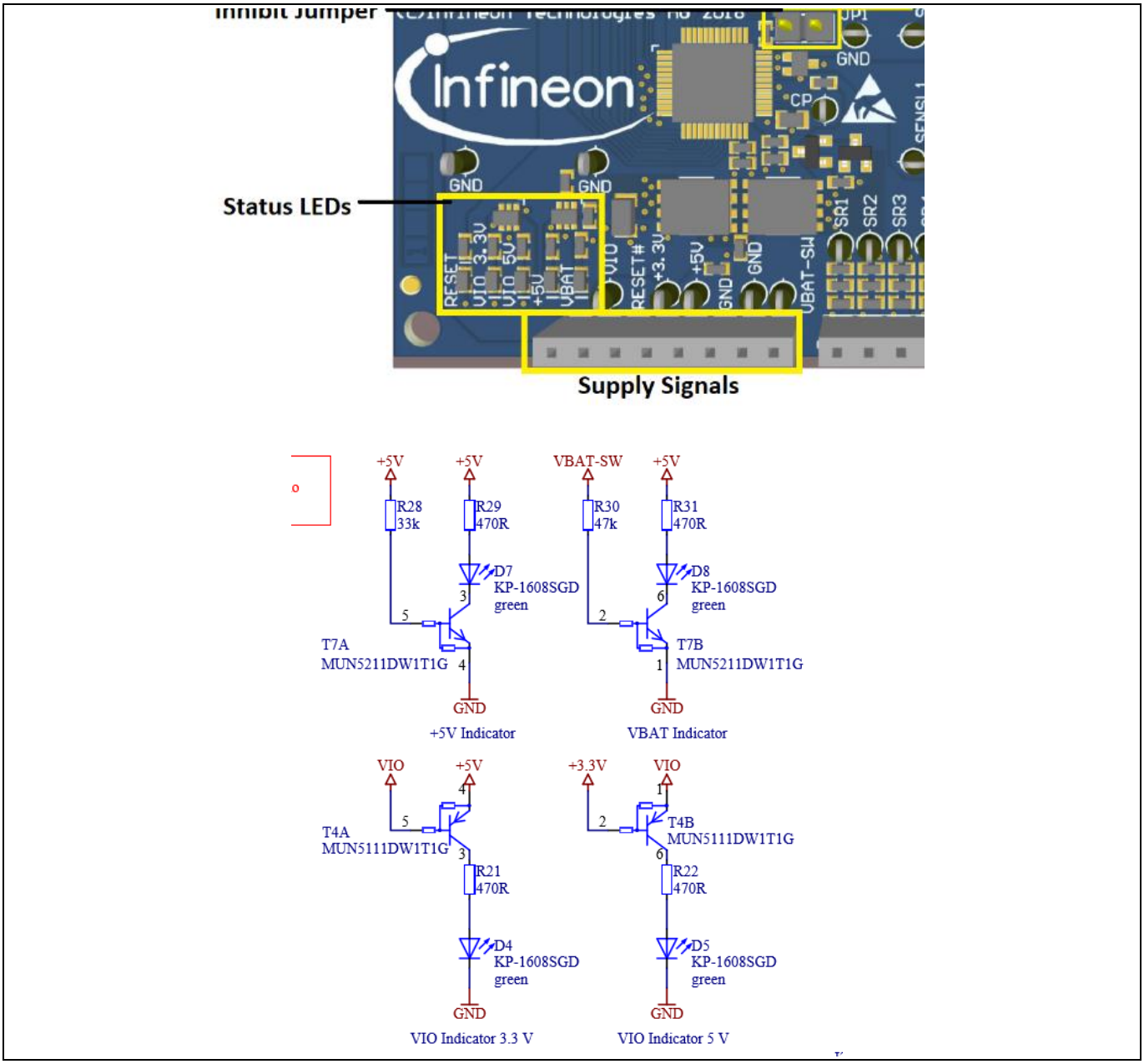

Figure 5 Status LEDs

1.4 Schematics

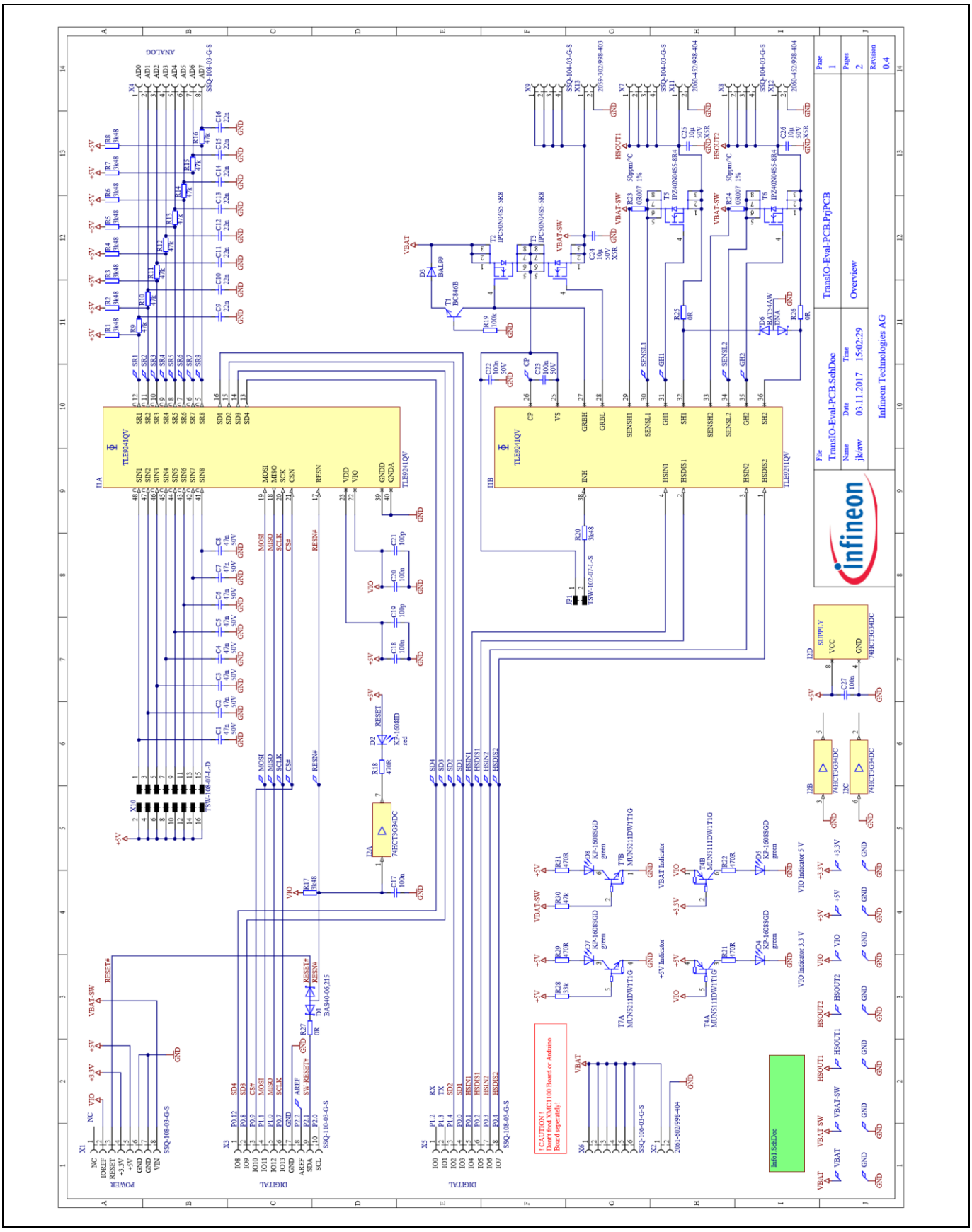

Figure 6 Schematic

2 Software

The GUI requires the use of the correct microcontroller firmware which can be flashed with the XMC flasher (aviable via Infineon Toolbox) or the SEGGER J-Flash tool (used in following sub chapters).

2.1 Flashing XMC4700

Flashing XMC4700 Microcontroller is done via the J-Link Flash lite which can be obtained from the segger website.

Upon opening JLink Flash lite, this screen comes up. To select your device, press the button with the three dots on it. It brings up this menu. Please select the XMC4700 microcontroller as shown in the picture.

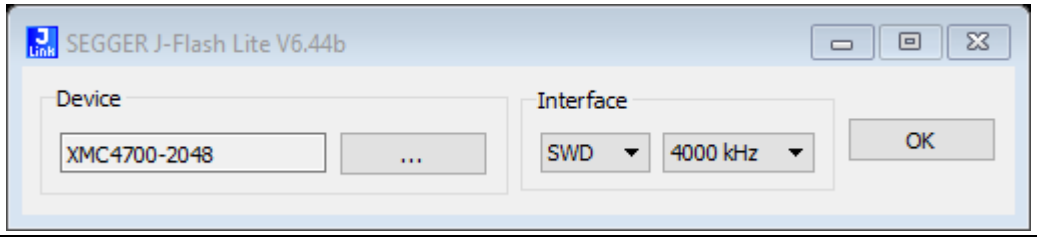

Figure 7 Select target device to be flashed

This brings you back to the first screen but now the right device is selected, which means you can proceed by pressing ok. This opens the programming-screen. Press the three dots-button to select the provided hex-file for programming. The .hex file is provided within the GUI Folder under “\XMCFirmwareFiles”. Afterwards press “Program device” to flash the microcontroller with the software.

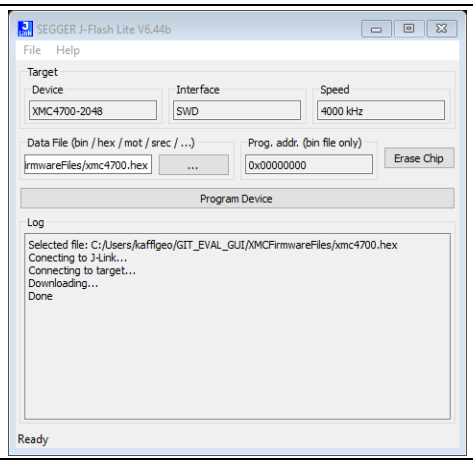

Figure 8 Successful flashing

2.2 GUI

The available GUI is used to interact with the evaluation board. The GUI allows configuring the TLE9241QU evaluation kit, specifying signal settings and reading/writing into the IC registers.

After starting the GUI a dialog window as shown in Figure 9 will pop up. From the first drop-down menu select the XMC4700 Relax Kit as interface with the evaluation kits. The UART port selection window as shown in Figure 10 pops up where the correct COM port (see Windows device manager) of the Evalboard USB connection should be selected. At “Slot A” the TransIO board should be selected. The connection is established by clicking ok.

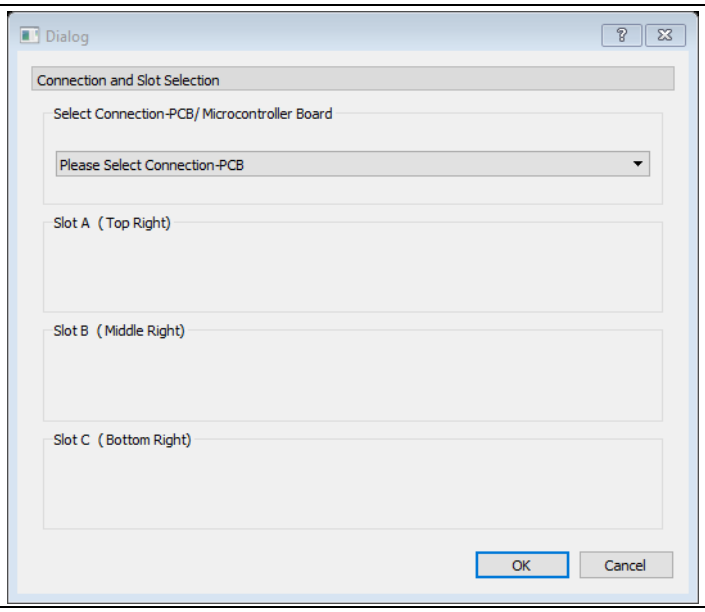

Figure 9 Slot selection for the Connection PCB

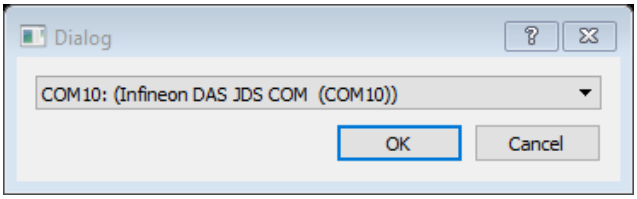

Figure 10 COM port selection

The GUI starts up in its default state as shown in Figure 11. For a successful IC communication please make sure the RESN checkbox is ticked and the RESET-light on the eval-board itself is off.

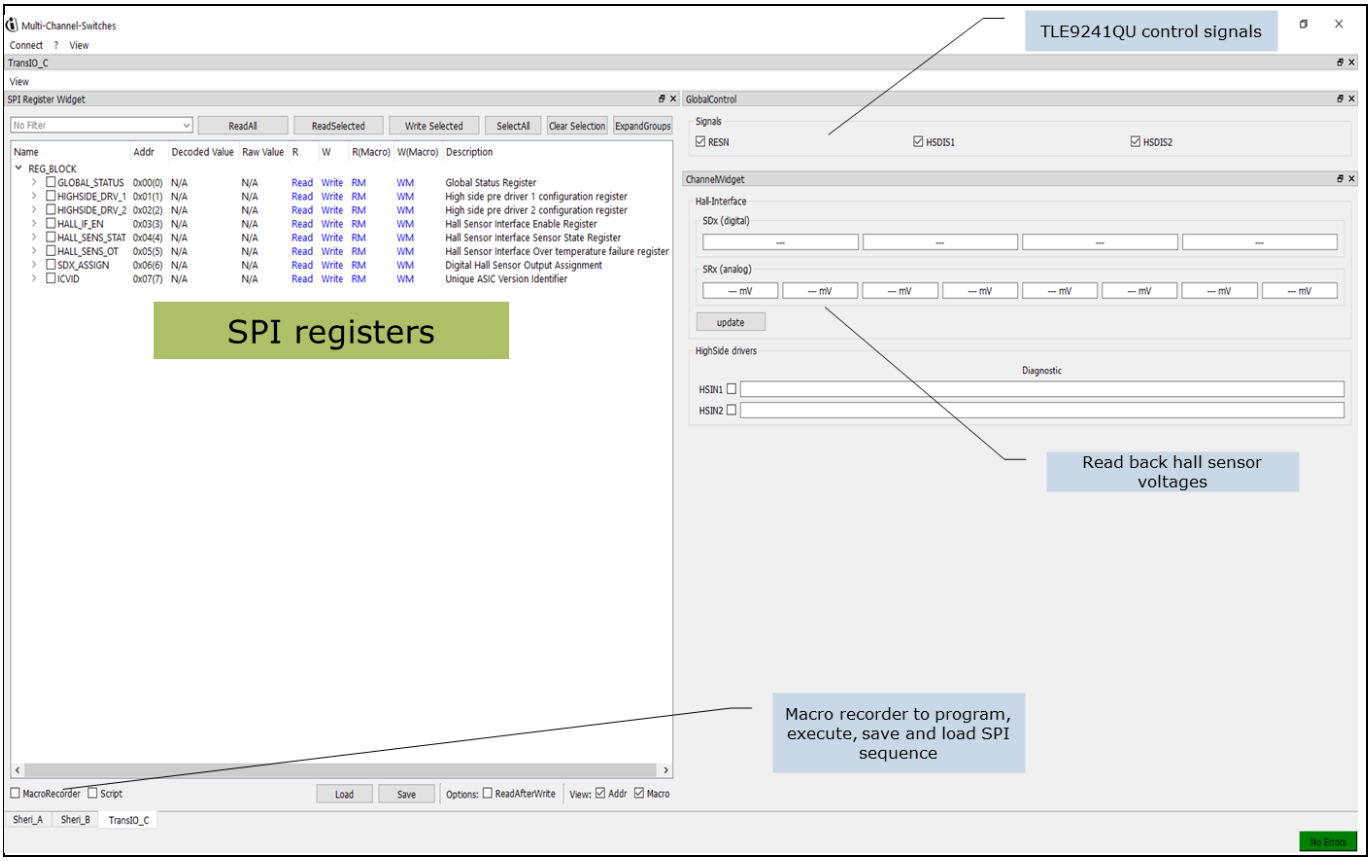

Figure 11 GUI main window

The *Connect* button in the top left corner opens the slot-selection menu. Next to it is the *View* menu which offers different layout options for the main window, such as hiding certain widgets or tabs, as well as saving the layout preferences. The bottom left corner has three buttons for switching across the three tabs corresponding to the three evaluation boards.

One useful feature of this GUI is its ability to load and run a user-written macro sequence, as an alternative to utilizing the evaluation board tabs. The user can write a command sequence to be sent to the IC and executed.

The *channel* widget permits control over HSINx signals, shows high-side diagnostics and can be used to read the hall-sensor interface-status.

The HS-FETs can be enabled by de-selecting the HSDISx signal in the *GlobalControl Widget* and selecting the HSINx signal in the *Channel Widget*.

The diagnostics of one high-side channel can be issued by selecting “HIGHSIDE_DRV_x” (x being the channel you want diagnosis on) in the *SPI register* widget. By clicking on the corresponding *Read* buttons the diagnostics will be displayed in the *Diagnostics* part of the *HighSide drivers* widget.

3 Appendix

This appendix section provides a list of commands which can be used for writing a macro sequence to be loaded for execution using the GUI as explained in section **Error! Reference source not found.**, or for standalone Terminal usage.

3.1 General Information

- All values have to be typed in as hexadecimal numbers. If the first digit is alphabetic, a zero has to be typed in front of the value.
- The Connection-PCB is initialized on startup. Make sure that you are using the correct Hex File. The type of Connection-PCB is displayed on startup or when entering the *help()* command.
- For most commands a slot number (slot) has to be entered. Slot 0 selects the connection PCB. The Eval-PCBs are enumerated from top (1) to bottom (3) on the common-connection PCB. The XMC1100 has a single slot (1) only.
- Not all Eval-PCBs can be mounted on every slot. The user can initialize Eval-PCBs by the initialization commands and the slot number. The type of initialized Eval-PCBs is displayed when entering the *help()* command.
- CRCs, Parity Bits or similar have to be calculatet by the user.
- Bus speeds are depending on the maximum value spedified in the datasheet of the particular slave device.

3.2 Initialization Commands

- InitEvalTransIO(slot) – Engine-Management-Connection-PCB (slot 1 or 2), Microcontroller board slot 1.

3.3 List of Commands

- help() – help
  Displays board info, names and command list.
  Returns 0 always.

- delay(ticks) - delay
  Waits for ticks time in milliseconds.
  Returns ticks.
  Expected values:
  - ticks: [0x1] to [FFFFFFFF]

- ior(slot, ioDev) - io read
  Returns state of input or output ioDev, if successful.
  Expected values:
  - slot: [0] to [3], depending on the initialized boards
  - ioDev: Names displayed in help command or XMC1100 Bootkit IO numbers depending on the initialized boards

- iow(slot, ioDev, outState) - io write
  Writes outState to output ioDev.
  Returns outState, if successful.
  Expected values:
  - slot: [0] to [3], depending on the initialized boards
  - ioDev: Names displayed in help command or XMC1100 Bootkit IO numbers depending on the initialized boards
  - outState: [0] or [1]

- iop(slot, ioDev, outState, ticks) - io pulse
  Sets ioDev to outState for the time of ticks ms, then sets ioDev to inverse outstate.
  Returns ioDev, if successful.
  Expected values:
  - Slot: [0] to [3], depending on the initialized boards
  - IoDev: Names displayed in help command or XMC1100 Bootkit IO numbers depending on the initialized boards
  - OutState: [0] or [1]
  - Ticks: [1] to [FFFFFFFF]

- iowt(slot, ioDev, inState) - io wait
  Waits until ioDev has the value of instate.
  Returns inState, if successful.
  Expected values:
  - slot: [0] to [3], depending on the initialized boards
  - ioDev: Names displayed in help command or XMC1100 Bootkit IO numbers depending on the initialized boards
  - inState: [0] or [1]

- spi(slot, spiDev, out) - spi write
  Sends an spi command with content out to device spiDev (normaly 0).
  Returns the return value of the previous command, if successful (previous command can be the watchdog command, if activated).
  Expected values:
  - slot: [0] to [3], depending on the initialized boards, msc is only available for slot [3] on Engine-Management-Connection-PCB yet
  - spiDev: [0]
  - out: [0] to [FFFF] or [0] to [FFFFFFFF], depending on the datawith of the particular Eval-PCB

- spis(slot, spiDev, out1, out2, ticks) - spi sequence
  Sends two spi commands with with a delay of ticks ms to device spiDev (normaly 0).
  Returns the return value of the command before the second command, if successful (watchdog command can be sent between both commands, if activated).
  Expected values:
  - slot: [0] to [3], depending on the initialized boards, msc is only available for slot [3] on Engine-Management-Connection-PCB yet
  - spiDev: [0]
  - outx: [0] to [FFFF] or [0] to [FFFFFFFF], depending on the datawith of the particular Eval-PCB
  - ticks: [1] to [FFFFFFFF]

- spir(slot, spiDev, out, nop) - spi read
  Sends two spi commands in quick succession to device spiDev (normaly 0).
  In contrast to other spi functions not interrupted by watchdog.
  Returns the return value of first command (which is received while sending the second command).
  Second command can either be a "no operation" value or another command whose answer is not needed.
  Expected values:
  - slot: [0] to [3], depending on the initialized boards, msc is only available for slot [3] on Engine-Management-Connection-PCB yet
  - spiDev: [0]
  - out: [0] to [FFFF] or [0] to [FFFFFFFF], depending on the datawith of the particular Eval-PCB
  - nop: [0] to [FFFF] or [0] to [FFFFFFFF], depending on the datawith of the particular Eval-PCB

4 Ordering information

- TLE9241QU_DEV_BOARD: SP003558930
- XMC4700 Relax Kit: SP001427974

Revision history

Major changes since the last revision

Page or Reference	Description of change
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