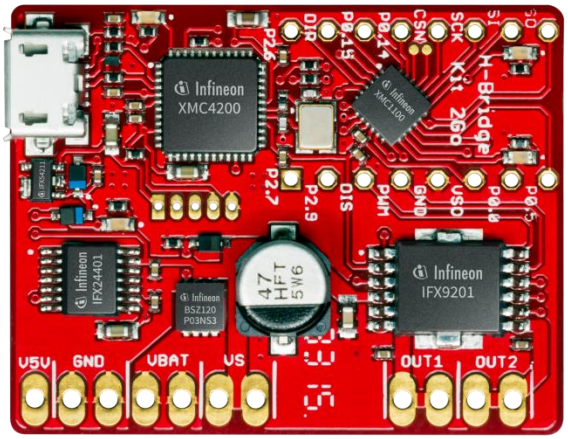
H-Bridge Kit 2Go

Evaluation Board for DC Motor Control with the IFX9201



About this document

Scope and purpose

This board user manual provides a basic introduction to the hardware of the H-Bridge Kit 2Go.

The H-Bridge Kit 2Go is a complete low cost system solution for driving small brushed DC motors. It contains a 32bit microcontroller including debug interface, an on board 5 V voltage regulator, reverse polarity protection for the power supply and an integrated H-Bridge capable of driving up to 6 A peak, the IFX9201SG.

Intended audience

This board user manual is intended for anyone interested in evaluating DC motor control with the IFX9201.

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1 Overview

The H-Bridge Kit 2Go is based on the Infineon microcontroller kit XMC 2Go. For any information on the XMC 2Go as well as for downloading the software drivers and tools please visit http://www.infineon.com/xmc2go.

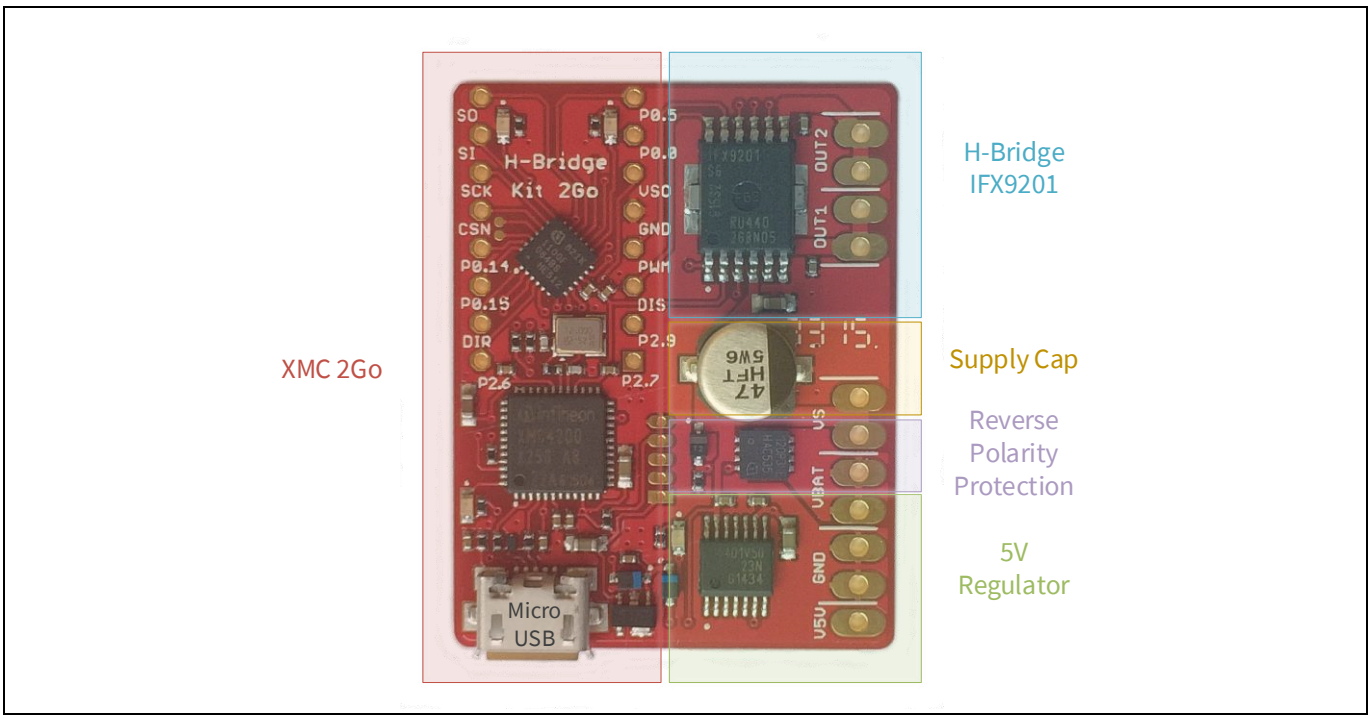


Figure 1 Top View H-Bridge Kit 2Go

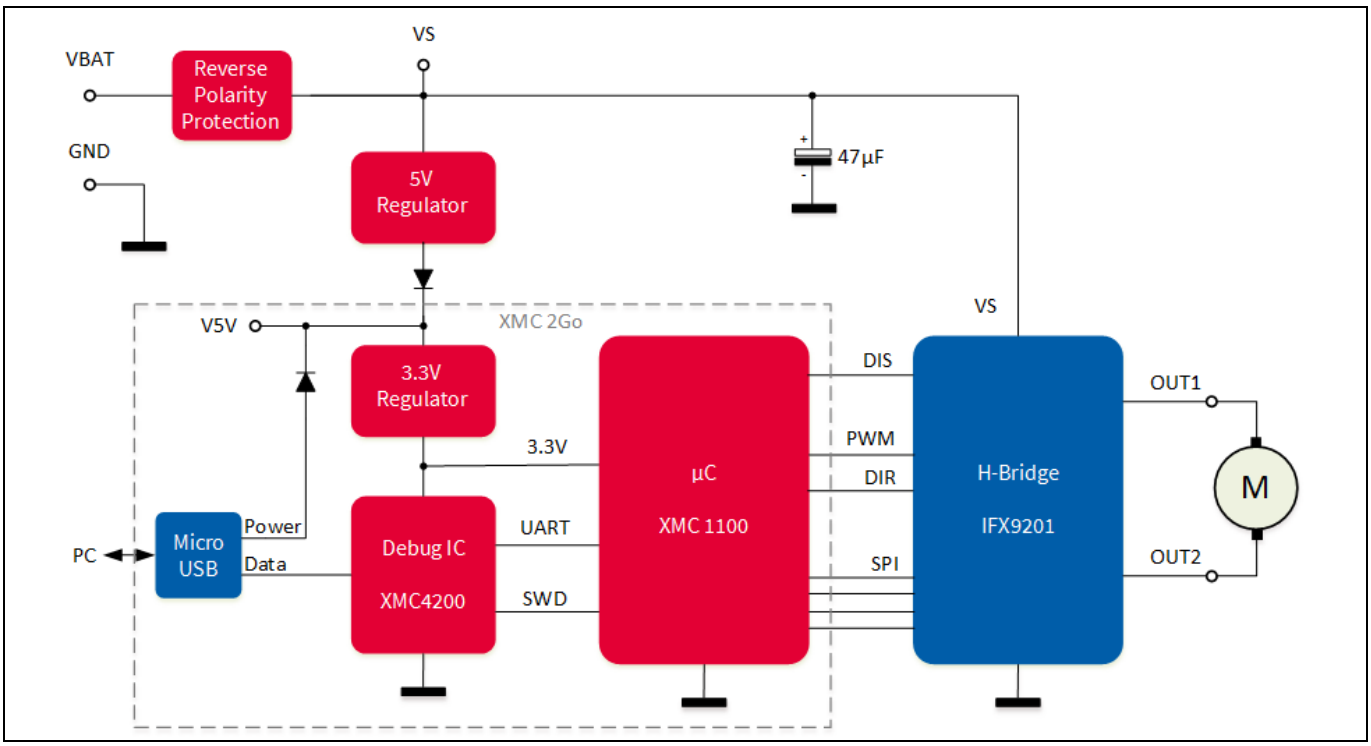


Figure 2 Block Diagram H-Bridge Kit 2Go

2 Getting Started

2.1 Power Supply

For providing the power to drive a DC motor the H-Bridge Kit 2Go needs an external power supply connected to VBAT. To protect the board from accidentialy reverted supply voltages the H-Bridge Kit 2Go is equipped with a reverse polarity protection circuit.

As with the XMC 2Go the microcontroller can be supplied by the PC via the Micro USB port. To enable standalone operation without a connection to the PC the H-Bridge Kit 2Go also features an on board 5 V voltage regulator which acts a pre-regulator for the 3.3 V regulator of the microcontroller.

Attention: The 5 V regulator is a linear voltage regulator and can get very hot depending on the input voltage!

VBAT can range from 5 V to a maximum of 36 V without damaging the board. However, since the power dissipation of the 5 V regulator strongly increases with the input voltage it is recommended to keep VBAT below 15 V or to provide additional cooling by attaching a heat sink to the back side of the board.

Another option when applying a higher VBAT is to provide 5 V externally at the V5V input of the board. This will relieve the on board regulator and enable operation up to 36 V, the maximum supply voltage of the IFX9201.

2.2 Selecting a DC motor

The IFX9201 can drive small DC motors with peak currents of up to 6 A. The achievable continuous drive current is lower and depends on supply voltage, switching frequency and the cooling conditions. Realistic continuous drive currents for this kit are in the range of 1 A to 2 A. Many motors for toys, RC models or robotics fall in this range.

2.3 Connecting the Kit

To get started with the Kit just connect a suitable DC Motor and the power supply as shown in Figure 3.

The power pads are spaced with a 2.54 mm pitch. Each power signal (except V5V) is occupying two pads. Therefore it is possible to use either 2.54 mm or 5.08 mm spaced connectors or screw terminals.

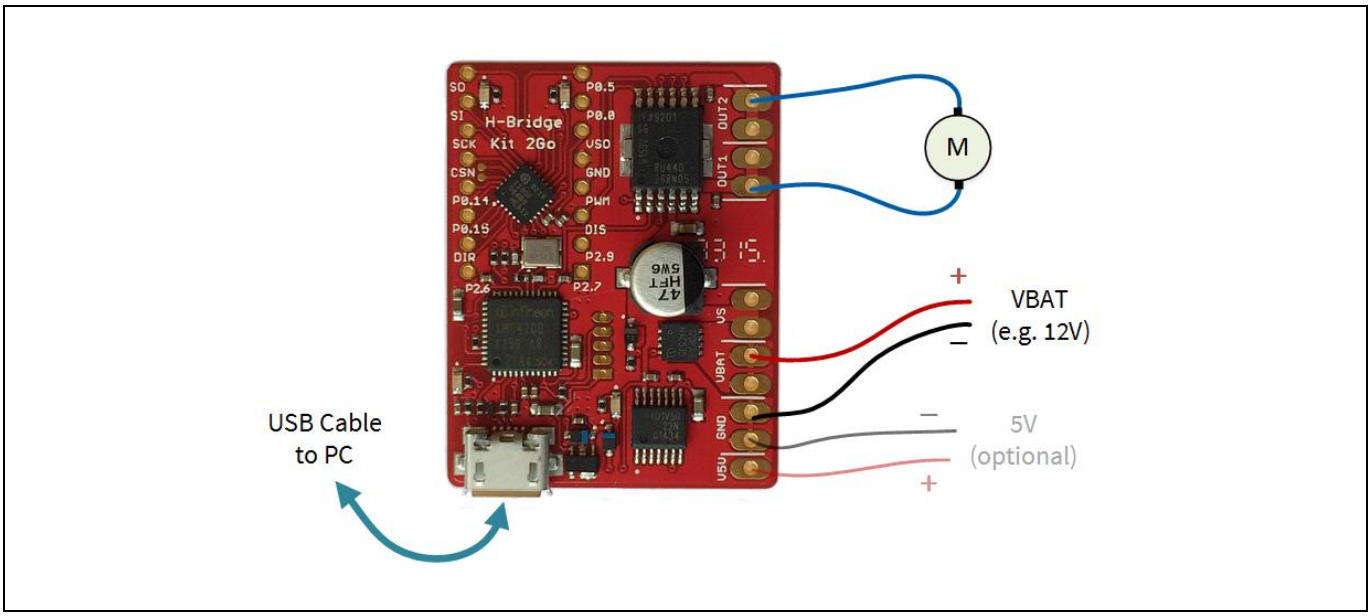


Figure 3 Connecting Motor, Supply and USB Cable

2.4 Software

The kit comes pre-programmed with a simple example routine that applies a 1 kHz PWM signal to the motor and ramps the speed of the motor up and down by increasing and decreasing the PWM duty cycle. When reaching a duty cycle of 0% it reverts the rotation direction of the motor and starts again with ramping the motor speed up and down.

There is demo code available which can be downloaded at http://www.infineon.com/h-bridge-kit-2go. See chapter 3 for more details. This program was generated using the Infineon code development platform DAVE™ (Version 4). For information on this tool, how to use it and for downloading please visit http://www.infineon.com/dave.

2.5 Port Assignment

When writing your own routines for driving the IFX9201 please refer to the IFX9201 data sheet and the following port assignment of XMC microcontroller ports (see Table 1).

Table 1 XMC1100 Port Assignment to IFX9201 signals

Port	IFX9201 signal	Comment
P0.6	SO	SPI serial output
P0.7	SI	SPI serial input
P0.8	SCK	SPI clock input
P0.9	CSN	SPI chip select (low active)
P2.0	DIR	Direction input to define direction of the motor current
P2.10	PWM	Pulse width modulation input
P2.11	DIS	Disable. Disables the outputs (all MOSFETS off)

3 Demo operation

As mentioned in section 2.4, there is software available for download at http://www.infineon.com/h-bridge-kit-2go. It has extended functionality to control the H-Bridge Kit 2Go with a PC using the Terminal interface. This chapter describes the firmware update process using DAVE™, the setup of the terminal program and the available commands.

3.1 Device discovery

Make sure the J-Link driver is installed properly. This is included in the installation of DAVE™ (see http://www.infineon.com/dave). For more details on J-Link please visit www.segger.com.
Then connect the H-Bridge Kit 2Go to the USB port of your PC. The driver for the H-Bridge Kit 2Go will now be installed (this may require administrator priviledges). Check in the "Device Manager" that the "JLink CDC UART Port" has been installed correctly; it should look like Figure 4 (the number of the COM Port may be different).

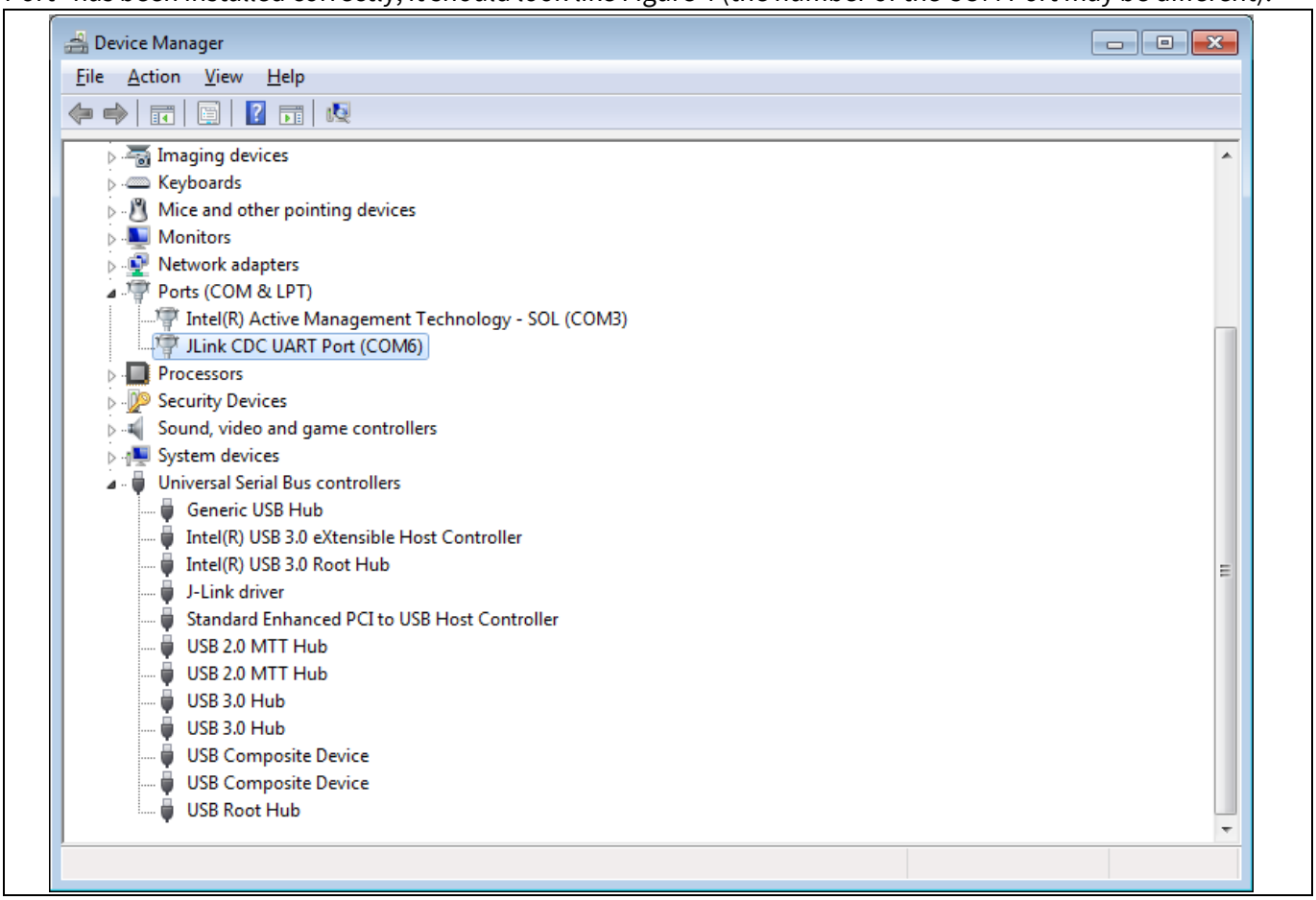


Figure 4 Correct installation of JLink UART Port

3.2 Firmware update using DAVE™

After download and extraction of the firmware example, do the following in DAVE™:

In DAVE™, go to "File" – "Import". Then select "Infineon" – "DAVE project" and click "Next". See Figure 5 for details.

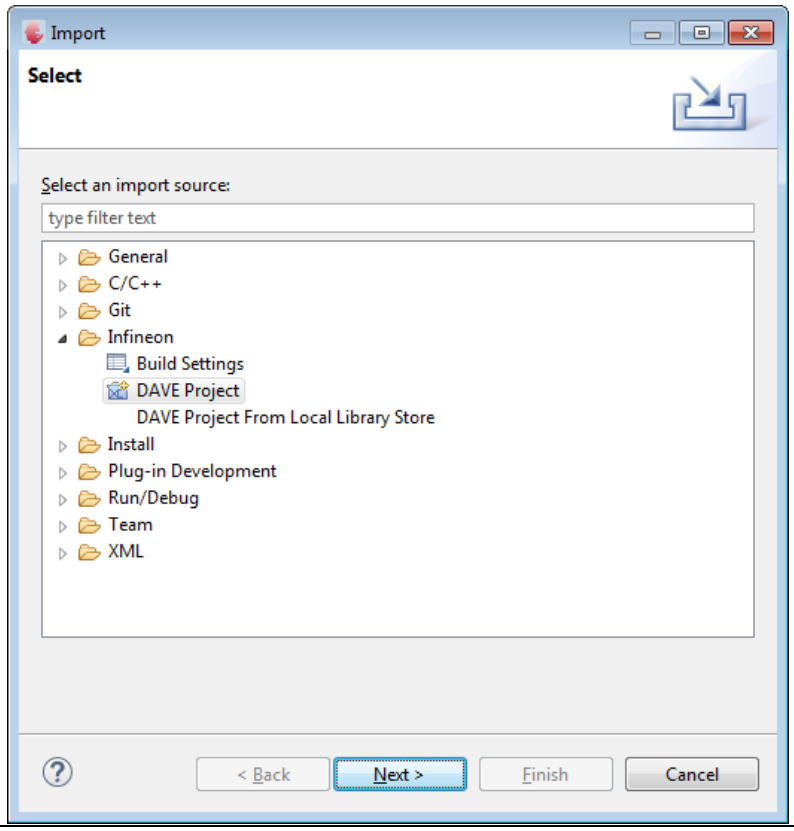


Figure 5 Import project

Select the folder with the extracted demo project and click on “Finish”. Keep “Copy Projects Into Workspace” checked (see Figure 6).

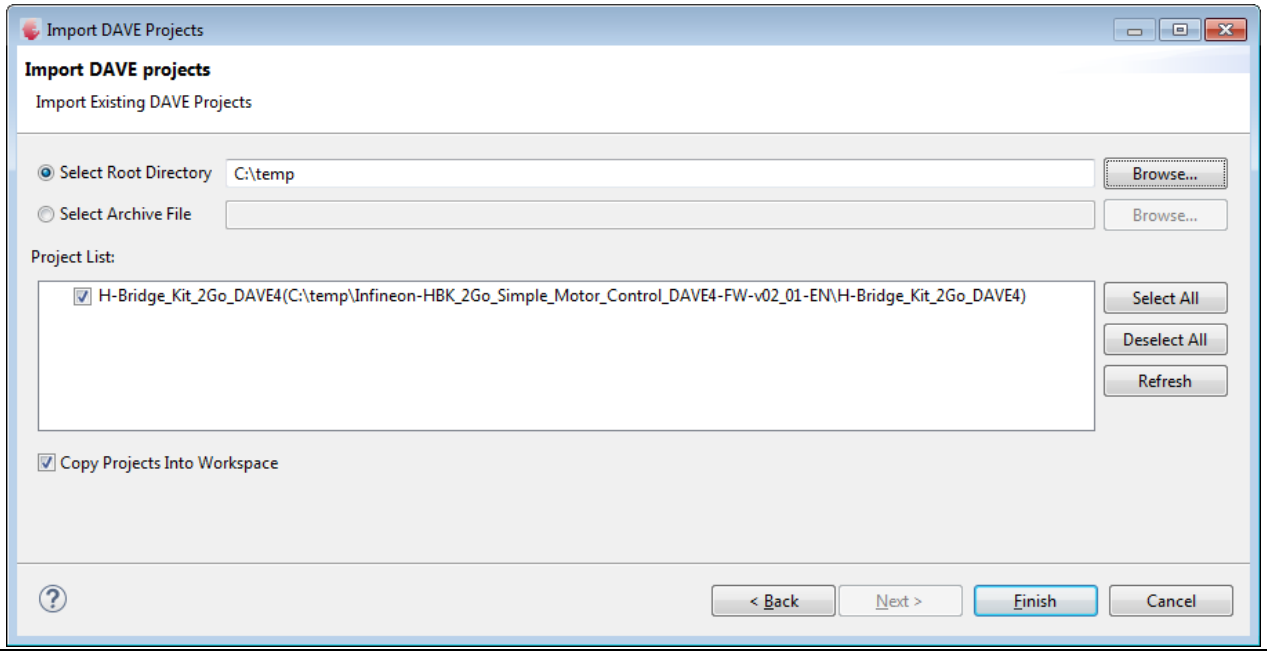


Figure 6 Import project (2)

Now the demo project will be imported. The screen should look like in Figure 7.

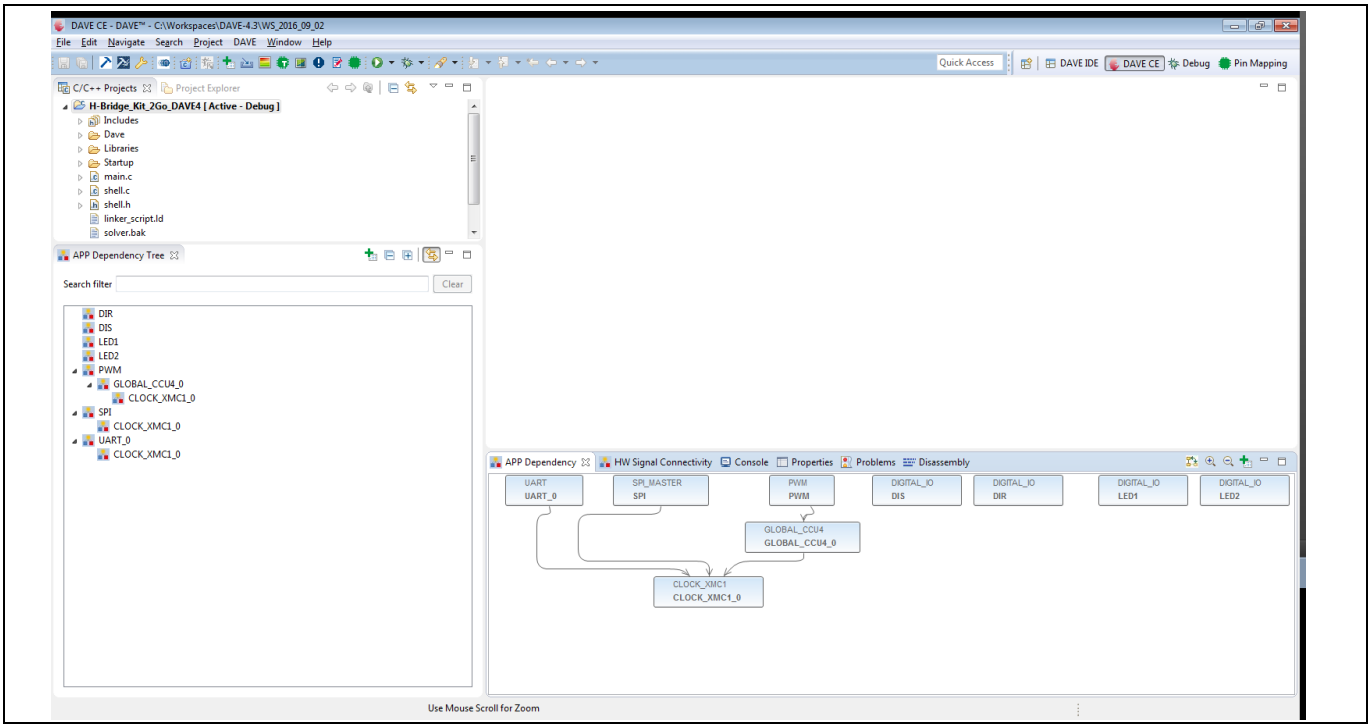


Figure 7 DAVE Screen after import of demo project

Now connect the H-Bridge Kit 2Go to a USB port (unless already done). You should see one of the red LEDs go on and off (5s on, 5s off, …). Click on “Generate Code” and “Build Active Project”. Then click on the “Debug” button. The following screen will appear (see Figure 8).

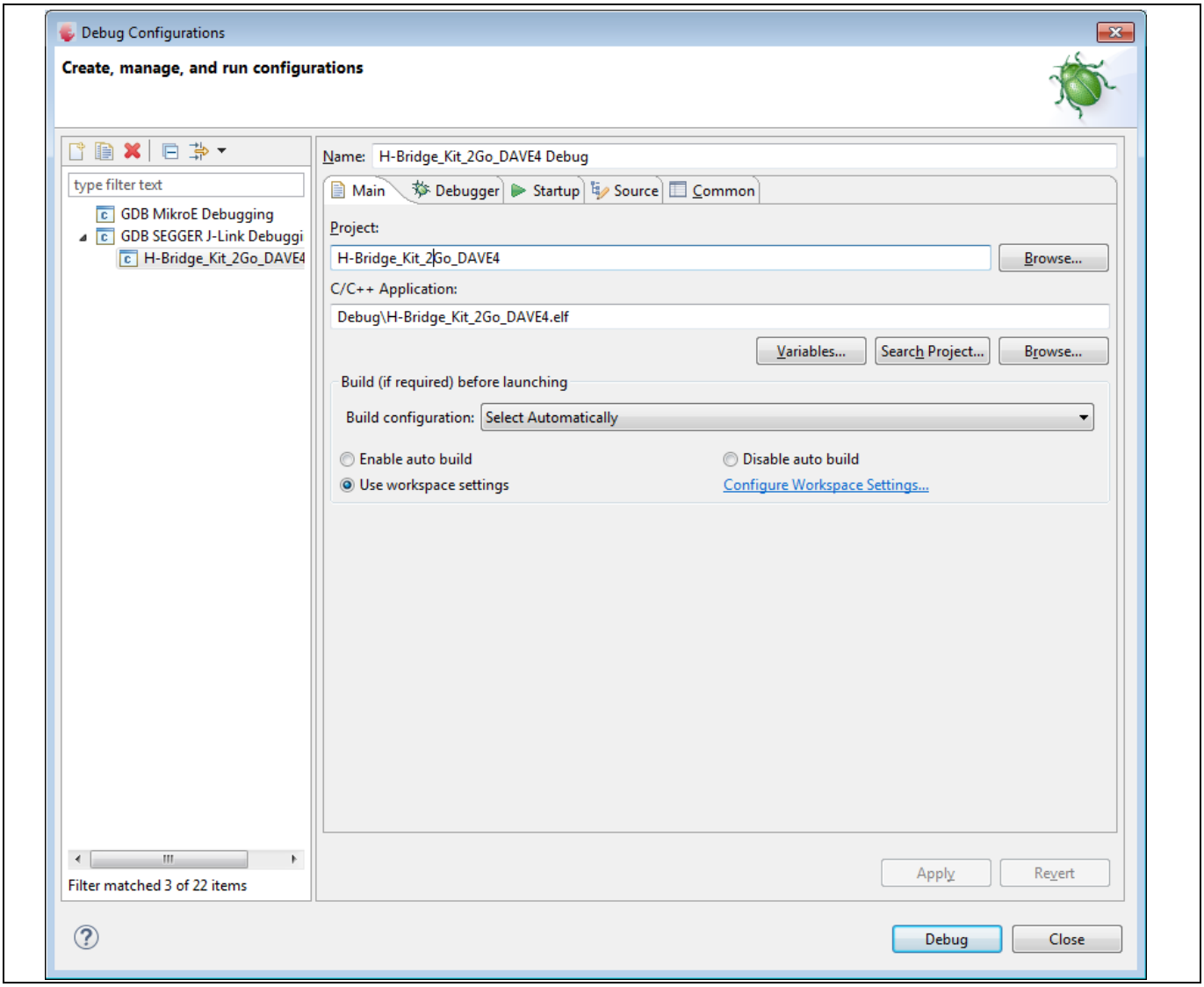


Figure 8 Debug Configuration

Again, click on “Debug”. There may be a recommendation to update the J-Link interface. If you decide to go for the update, you will need to click “Debug” again after the update is complete. Then the new demo firmware is installed on the board.

3.3 Operation via Terminal interface

Open the Terminal software. Select the serial interface and “JLINK CDC UART Port”. See Figure 9.

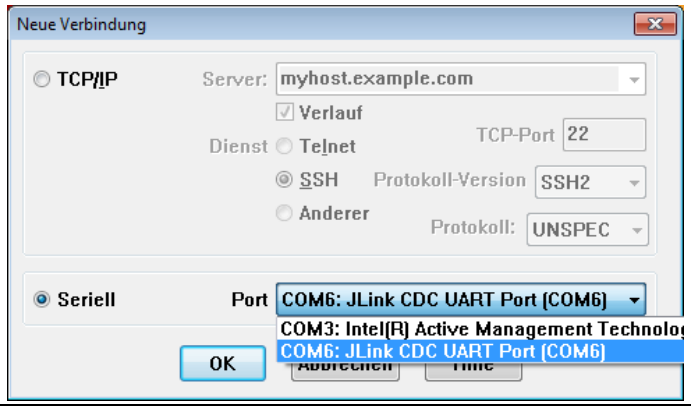


Figure 9 Select "JLINK CDC UART Port"

The port now needs to be configured according to Figure 10.

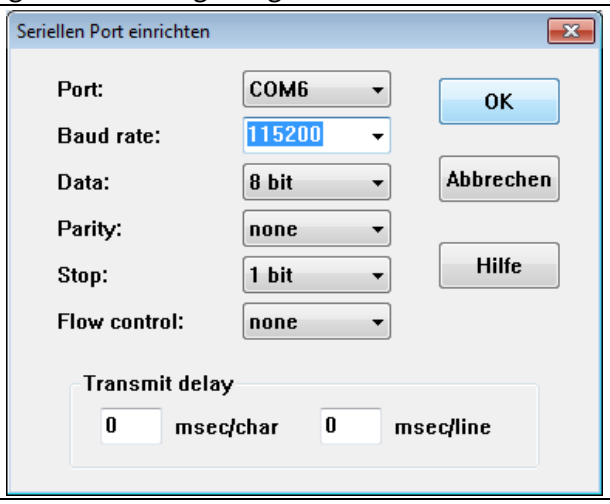


Figure 10 Set up Serial Port

After completing the above steps, type in "?" to make sure communication is working. A command overview as shown in Figure 11 or Table 2 is displayed.

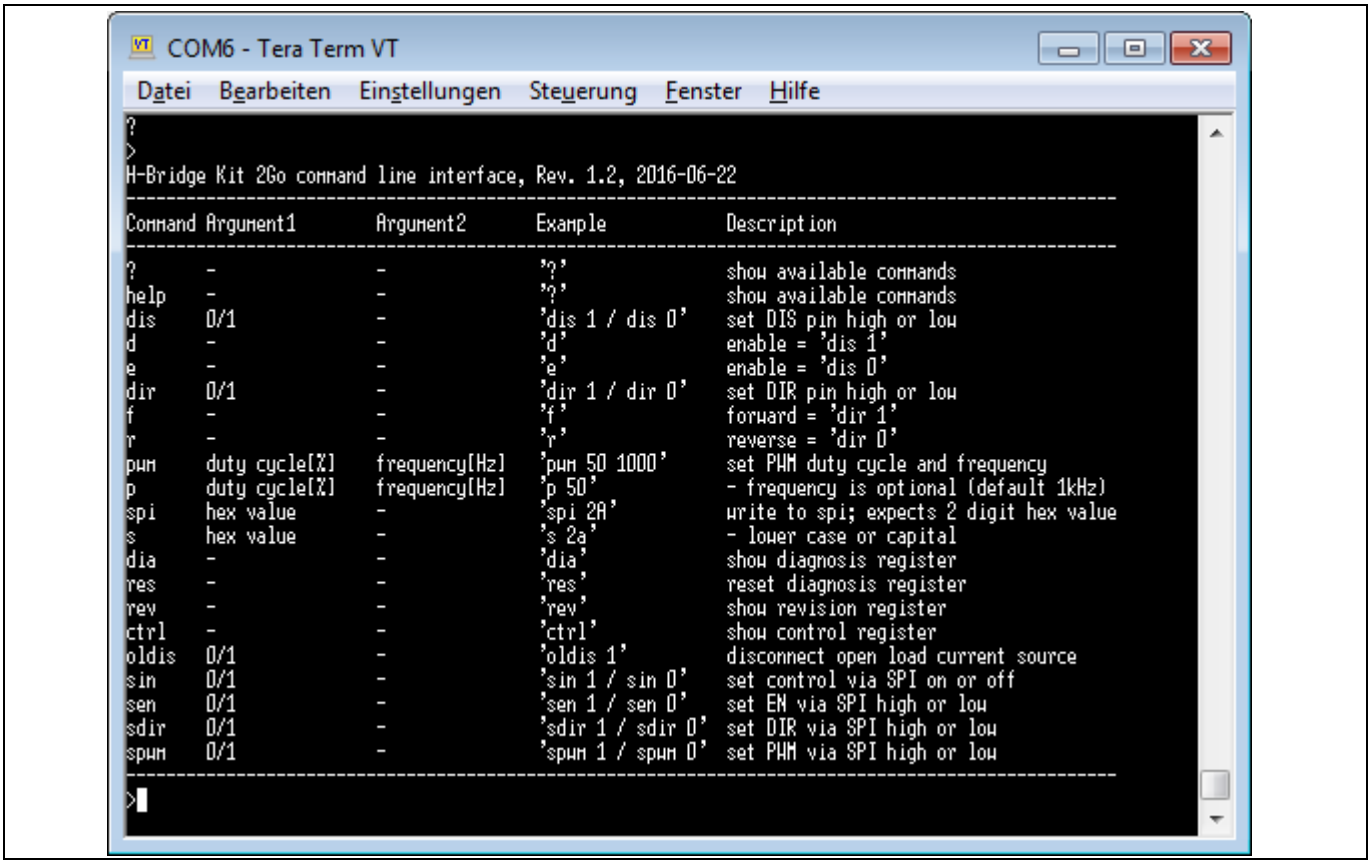


Figure 11 Command overview, displayed when “?” is entered

Table 2 H-Bridge Kit 2Go command list standard operation mode

Command	Argument 1	Argument 2	Example	Description
?	-	-	'?'	Show available commands
help	-	-	'help'	Show available commands
dis	0/1	-	'dis 1' / 'dis 0'	Set DIS pin high or low
d	-	-	'd'	Enable = 'dis 1'
e	-	-	'e'	Enable = 'dis 0'
dir	0/1	-	'dir 1' / 'dir 0'	Set DIR pin high or low
f	-	-	'f'	Forward = 'dir 1'
r	-	-	'r'	Reverse = 'dir 0'
pwm	Duty cycle [%]	Frequency [Hz]	'pwm 50 1000'	Set PWM duty cycle and frequency
p	Duty cycle [%]	Frequency [Hz]	'p 50'	Frequency is optional (default 1 kHz)
spi	Hex value	-	'spi 2A'	Write to spi; expects 2 digit hex value
s	Hex value	-	's 2a'	Lower case or capital
dia	-	-	'dia'	Show diagnosis register
res	-	-	'res'	Reset diagnosis register
rev	-	-	'rev'	Show revision register
ctrl	-	-	'ctrl'	Show control register
oldis	0/1	-	'oldis 1'	Disconnect open load current source
sin	0/1	-	'sin 1' / sin 0'	Set control via SPI on or off
sen	0/1	-	'sen 1' / 'sen 0'	Set EN via SPI high or low
sdir	0/1	-	'sdir 1' / 'sdir 0'	Set DIR via SPI high or low
spwm	0/1	-	'spwm 1' / 'spwm 0'	Set PWM via SPI high or low

This interface provides a simple method to control the H-Bridge to a PC.

Note: If there is no connection via USB, the device will still operate as explained in section 2.4.

4 Hardware Description

4.1 Schematics

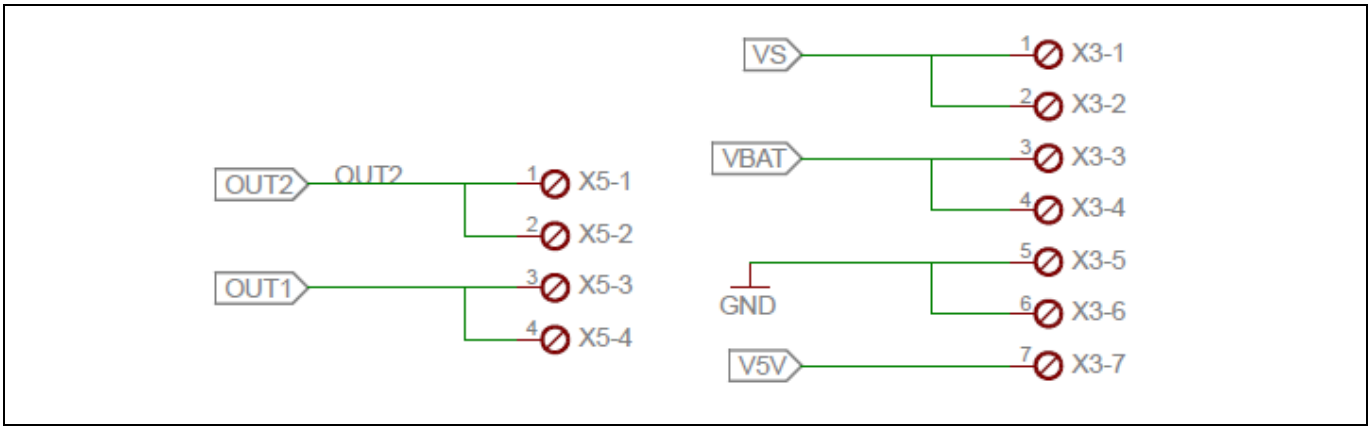


Figure 12 Power Connectors

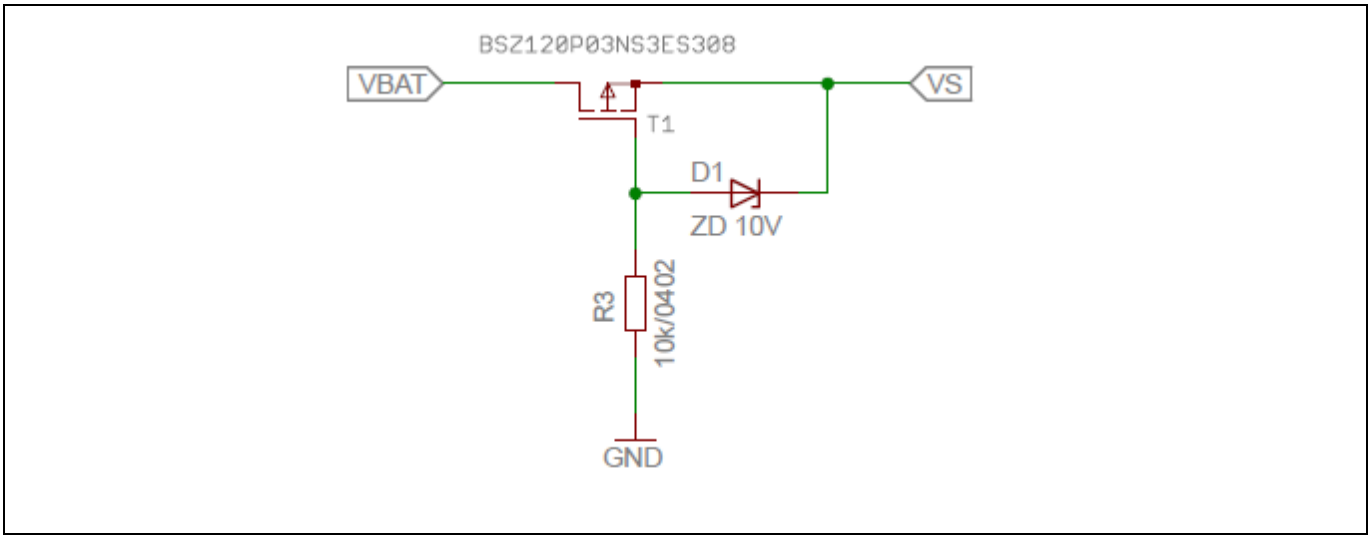


Figure 13 Reverse Polarity Protection

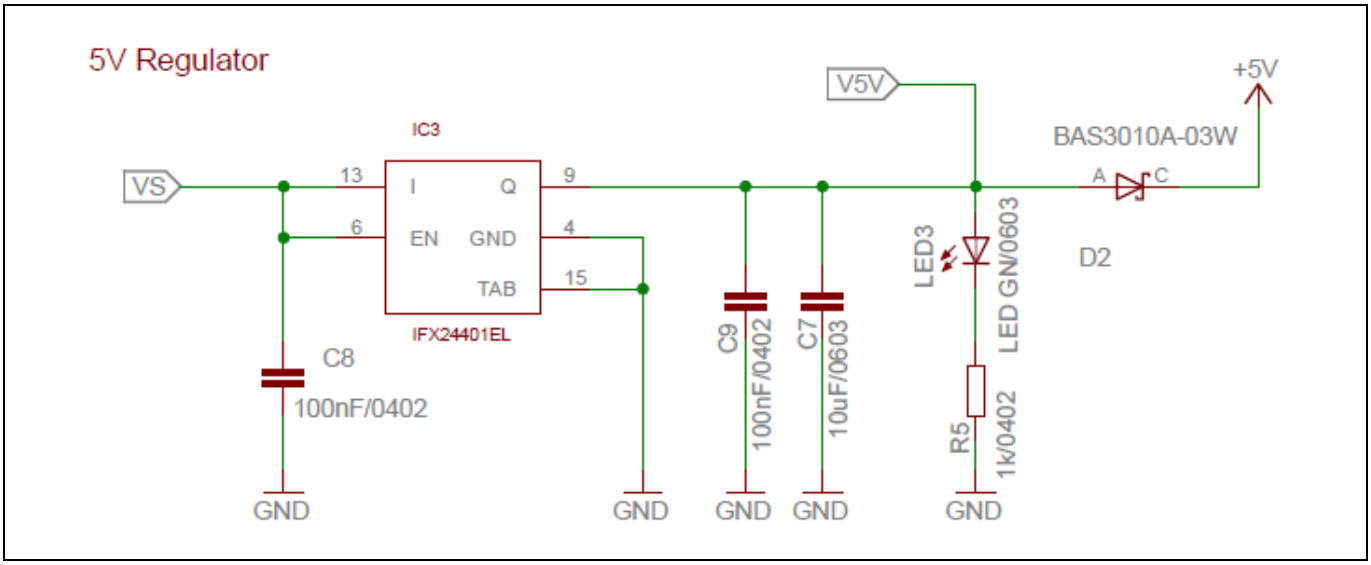


Figure 14 5 V Regulator

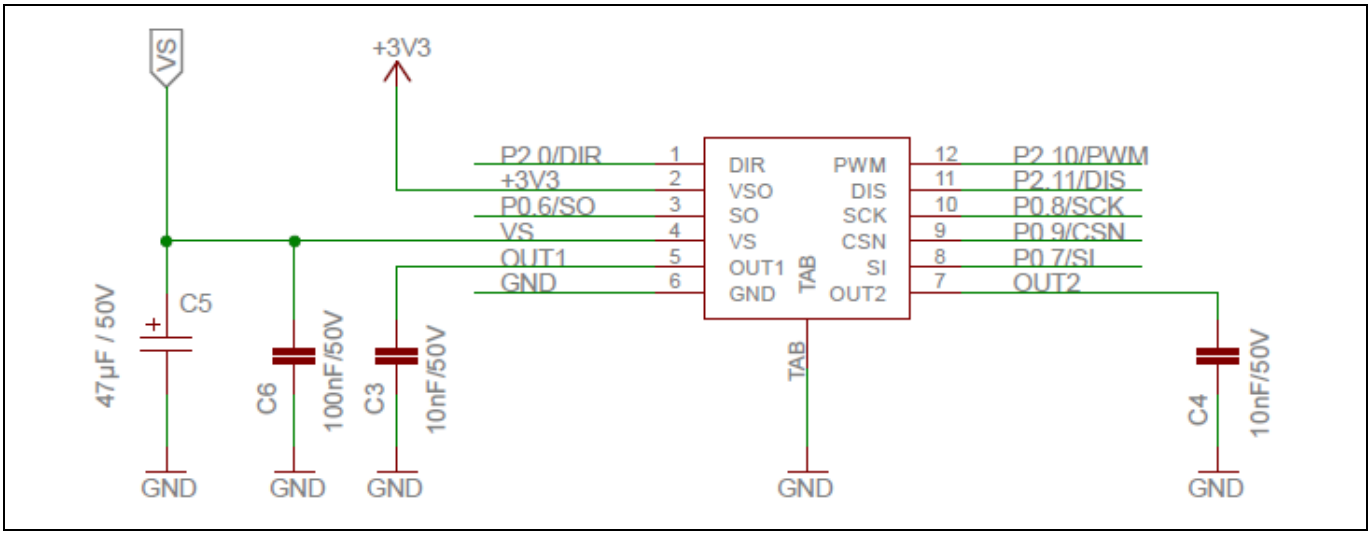


Figure 15 IFX9201 and Peripherals

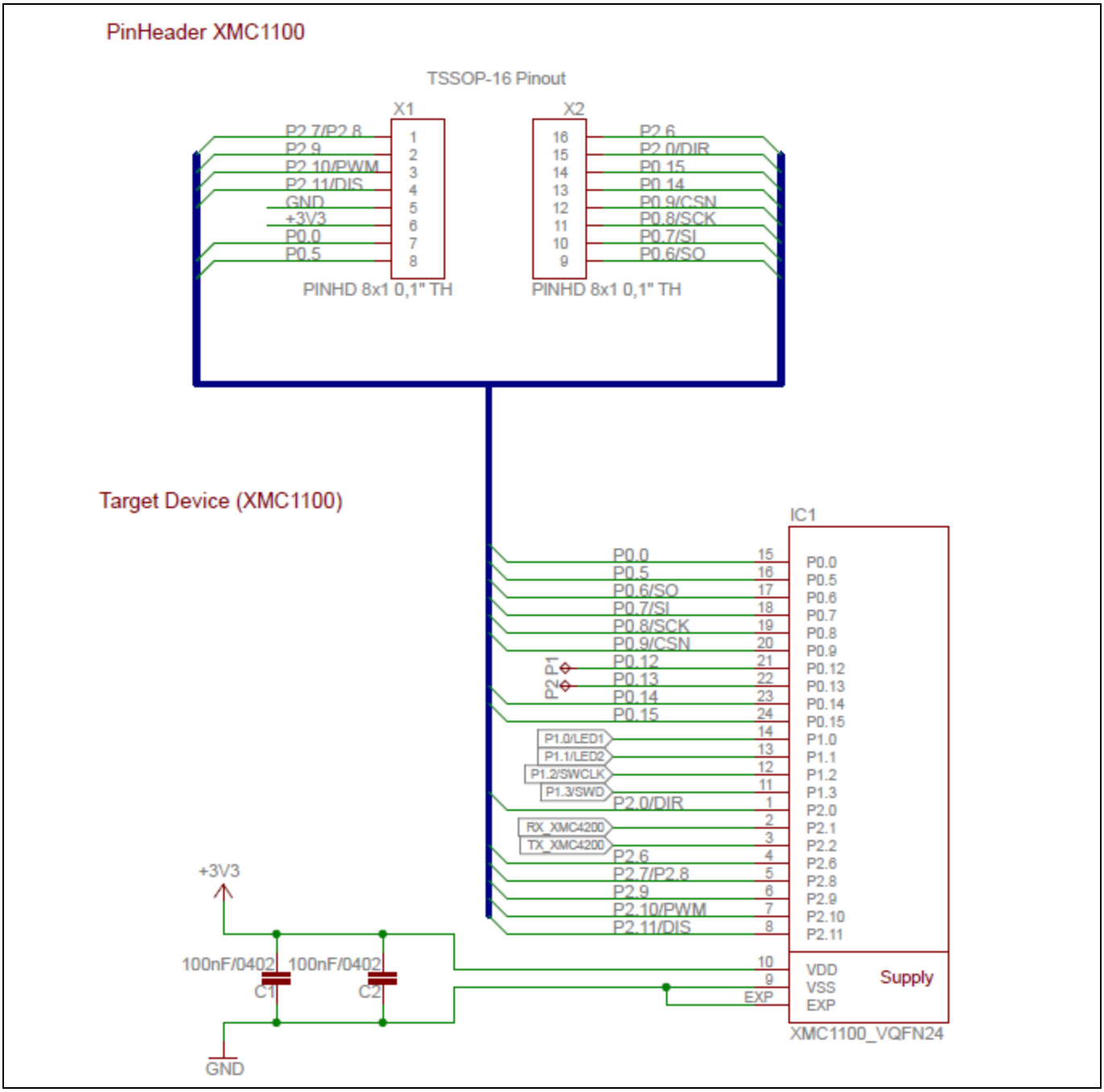


Figure 16 XMC1100 and Pin Header

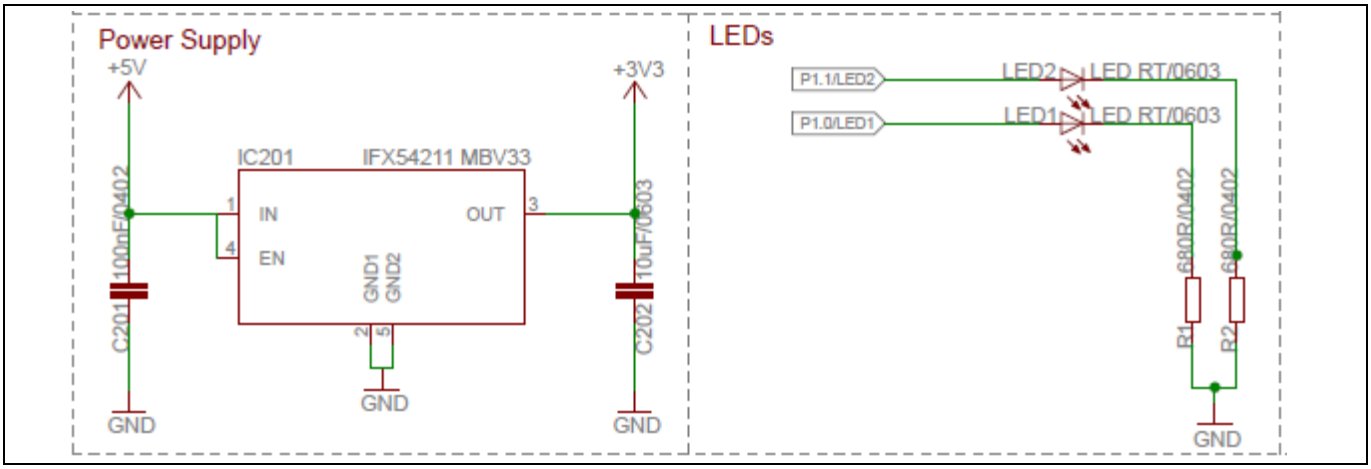


Figure 17 3.3 V Regulator and User LEDs

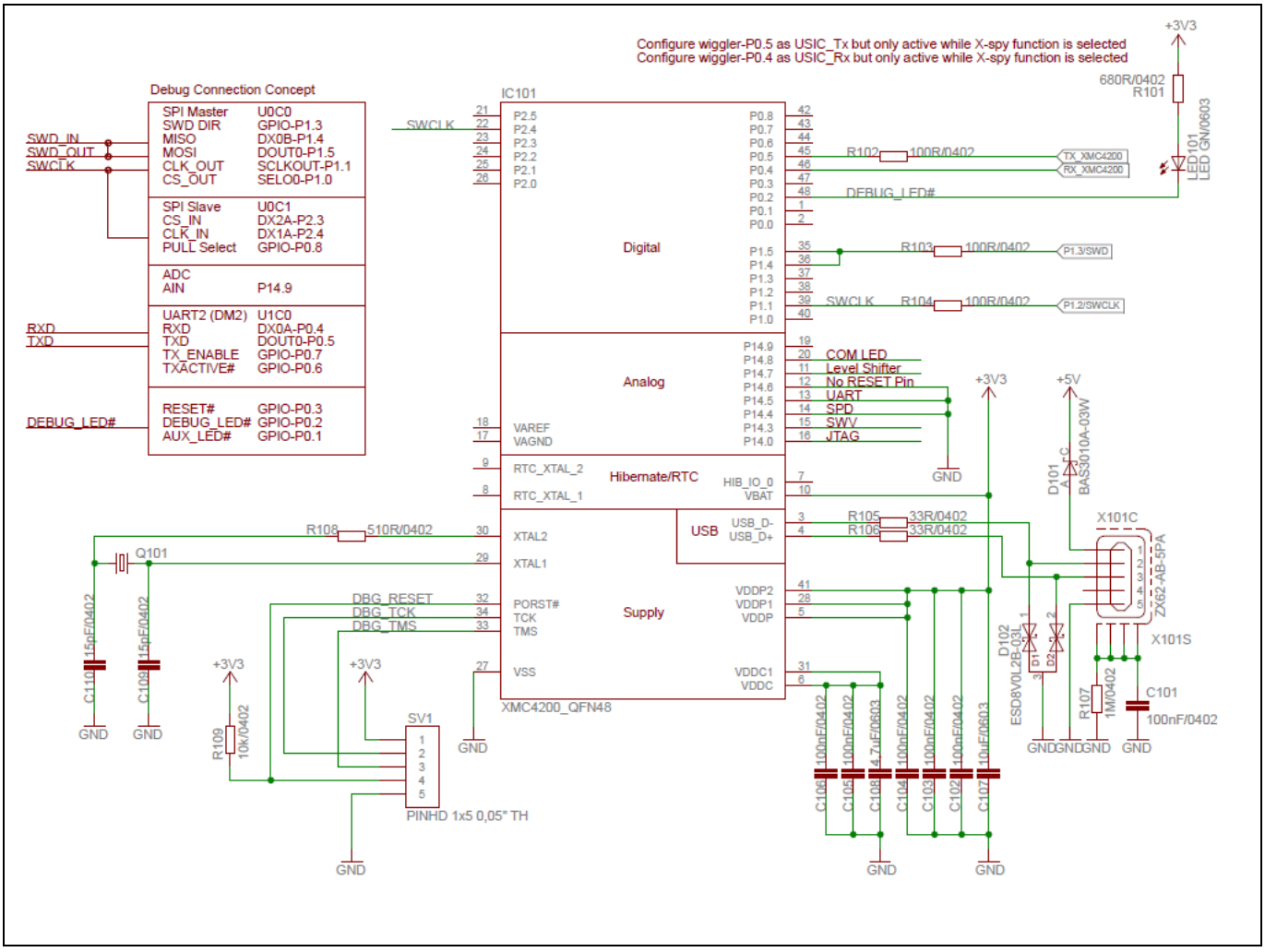


Figure 18 On Board Debugger including UART to USB Bridge

4.2 Layout

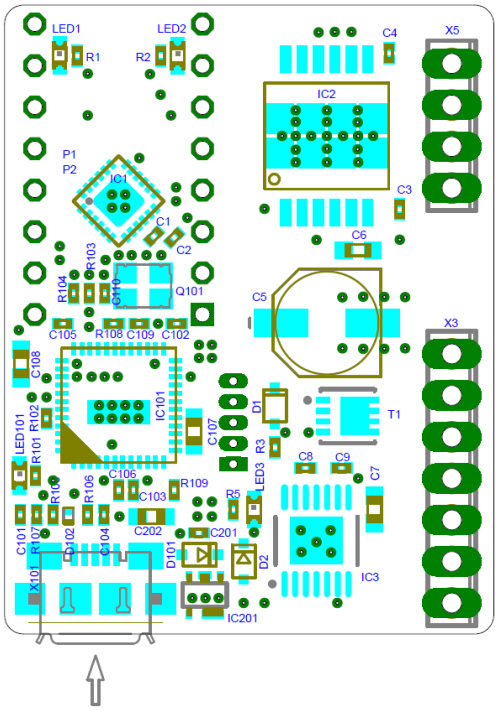


Figure 19 Component Placement

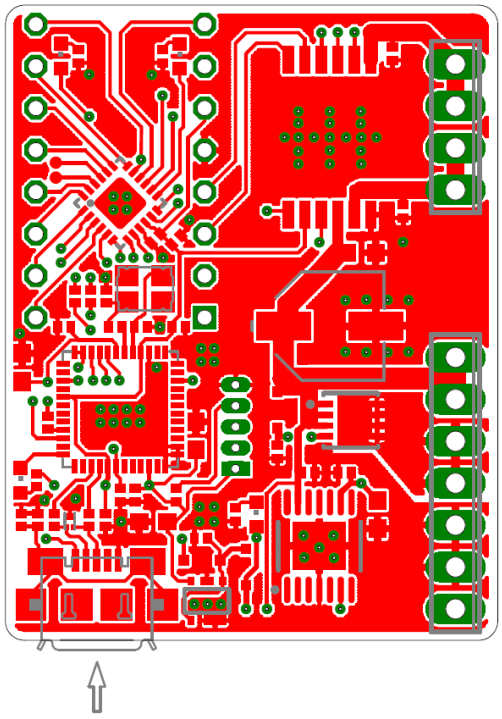


Figure 20 Top Layer

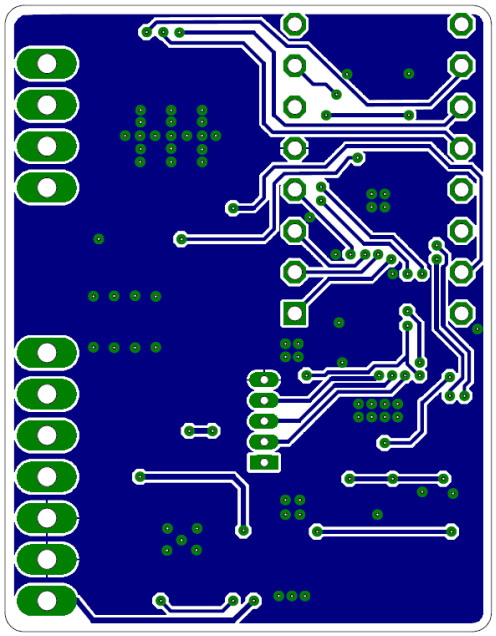


Figure 21 Bottom Layer

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