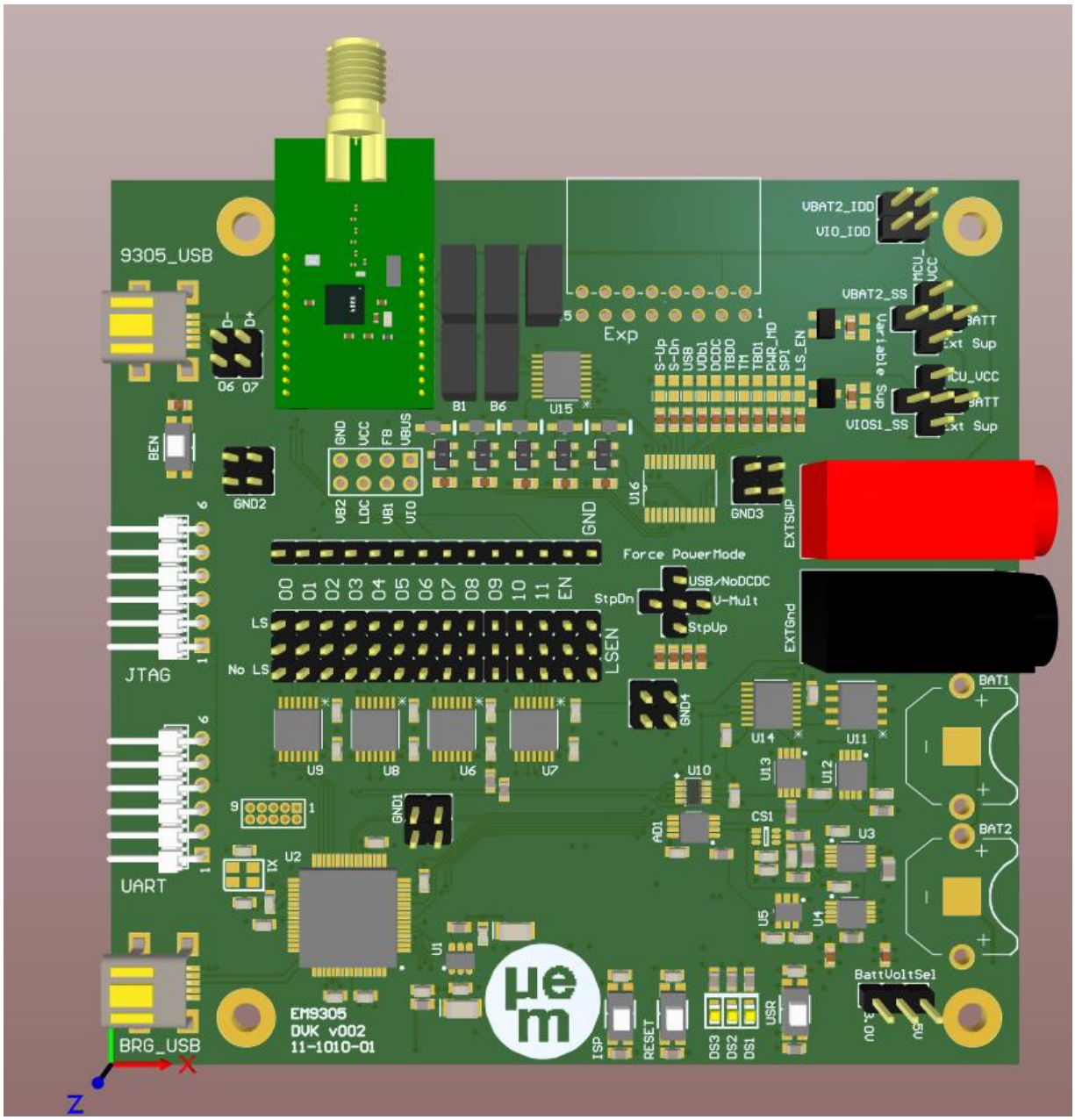
EM9305 DVK

Product Family: **EM9305**

Part Number: EM9305_DVK
Keywords: BLE, Bluetooth Low Energy, EM9305, DVK

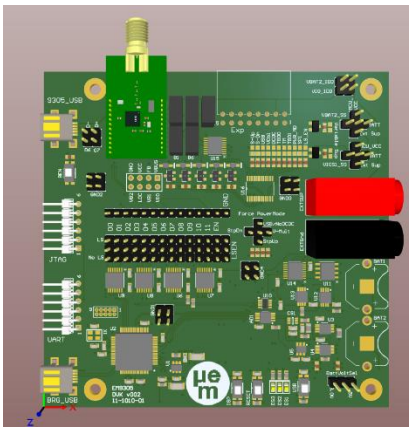


1. EM9305 DVK KEY FEATURES

The EM9305 DVK is the primary development and evaluation platform for the EM9305 BLE Radio.

The key features of the DVK include:

- Reference Design Sockets with configurable power mode selection
- Optional Level Shifters to test with IO signals other than 3.3V
  - Level shifters can be bypassed or included using jumpers
- Variety of Communication Bus
  - UART Header
  - Digilent JTAG Header
  - USB-SPI Bridge
- 4 power supply options for VIO & VBAT2
  - Off Board supply
  - 3.3V from 5V BRG_USB Supply
  - On board, programmable supply
  - 1.5V of 3.0V Battery
- Expansion header to pair custom sensors to the EM9305



This app note is specific to the EM9305 DVK v002 11-1010-01 hardware. The version of the board is as noted in the silkscreen.

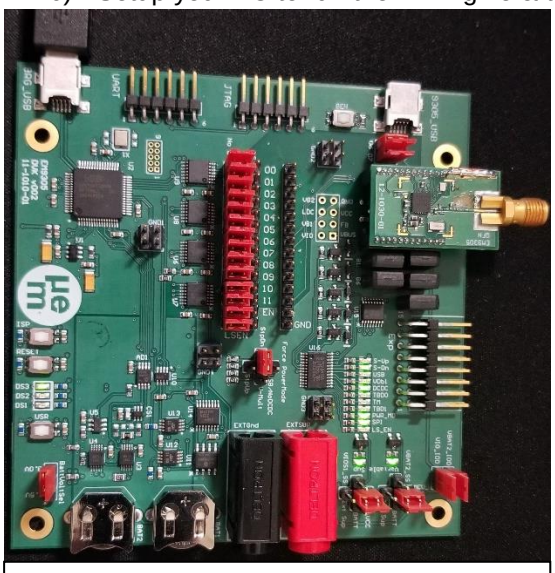
2. WHAT'S IN THE BOX

Included in the EM9305 DVK Kit are the following items:

1) EM9305 DVK v002 PCBA
2) EM9305 Reference Design Module
3) USB Mini cable for the BRG_USB
4) Diligent HS2 JTAG cable

3. QUICK START INSTRUCTIONS

1) Plug the EM9305 reference design into the P_AllMode socket.
2) Select your preferred power mode with the Force Power Mode jumper (See Section 5.1)
3) Select your preferred supply (See Section 8)
4) Configure IO LS jumpers for your IO configuration (See Section 6)
5) Plug in the BRG_USB
   a. Green DS3 LED should be flashing the heartbeat
6) Setup your PC to run the BLEngine & talk to the EM9305 (See SDK Documentation)



Example: Step Down; Onboard 3.3V Supply; Level Shifters Bypasses

Example: Step Up; Onboard 1.5V LR44 Battery Supply; Level Shifters Inline

4. BRIDGE

The bridge is the main controller of the DVK. It is continuously powered at 3.3V from the BRG_USB connector. **Any time the DVK is used, the USB_BRG must be plugged in and powering the Bridge.**

The bridge is responsible for:

- Control of Ref Design Power Mode Configuration
- SPI communication from the PC to EM9305
- Generating the clock signal to enter EM9305 Config Mode for erasing, programming and recovering modules
- Control of status LEDs
- Control of the on board variable supply
- Control of the on board current sense circuit

During operation, the Bridge maintains a heartbeat on the green LED, DS1. If at any time this heartbeat is not running, it is recommended to reboot the Bridge using the RESET button.

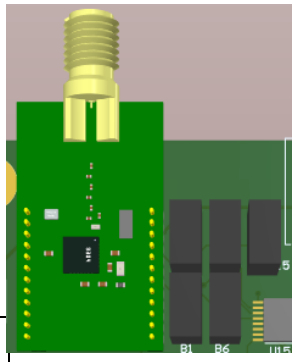
4.1 PROGRAMMING THE BRIDGE

To program the Bridge, press and hold the ISP button and press & release the RESET button. When the ISP button is pressed at start up the device will enter bootloader mode and appear like a flash drive on the PC.

To upload the firmware, simply delete the firmware.bin file on the device using the file manager on the PC and drop the new firmware image onto the device. Press RESET to restart the device into the normal application mode.

5. REFERENCE DESIGN SOCKET

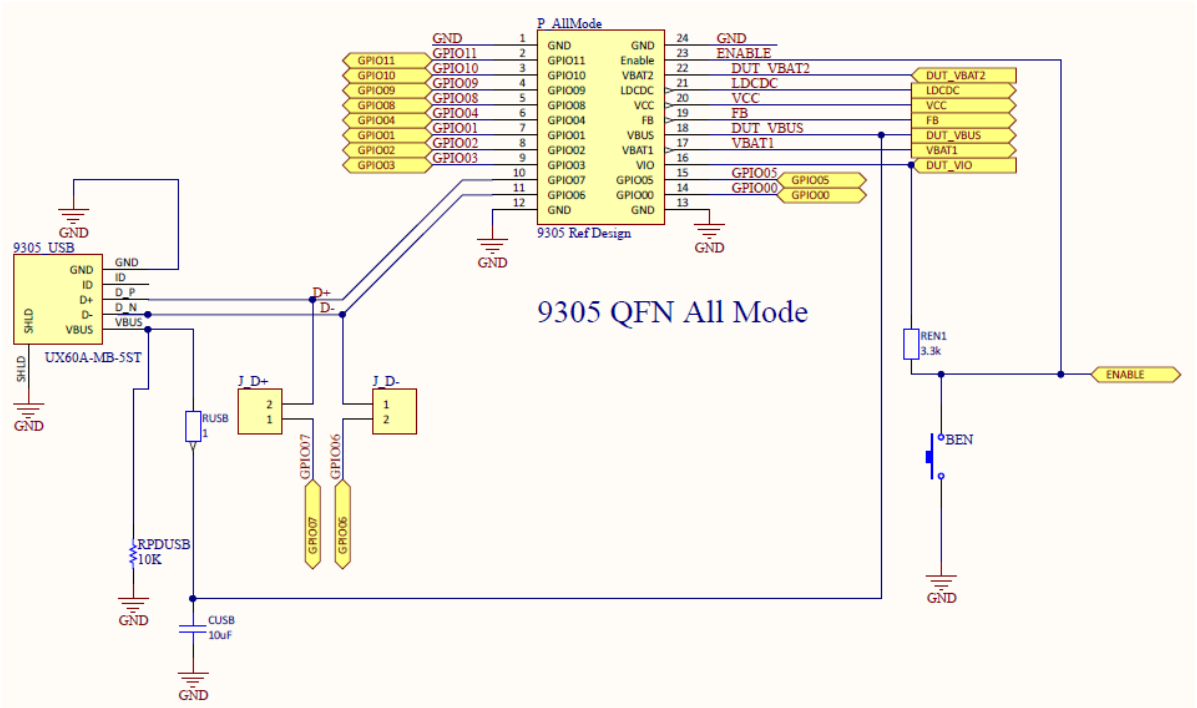
The EM9305 reference design is plugged in the P_AllMode socket. Refer to the reference design documentation for more details about the EM9305 Reference Design.



5.1 POWER MODE SELECTION

The reference design supports configuration from the headers to operate in any one of four available power modes. To set a power mode relays B1-B6 are set into the appropriate open/closed by the bridge firmware. The relays only change state on falling edges (IE button press) of the EN signal and start-up of the Bridge (IE Reset button press or BRG_USB plugged in)

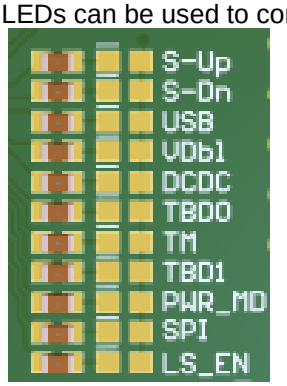
Power Mode	Supply	Closed Relay	Force Power Mode Jumper	LEDs ON
Step Down	1.9<VBAT2<3.6V	B1, B2	StpDn	S-Dn, DCDC, Pwr_Md
NoDCDC	1.9<VBAT2<3.6V	B1, B4	USB/NoDCDC	Pwr_Md
Step Up	1.1<VBAT2<1.8V	B3, B6	StpUp	S-Up, DCDC, Pwr_Md
V-Multiplier	1.1<VBAT2<1.8V	B4, B6	V-Mult	VDblr, Pwr_Md
USB	4.5<VBUS<5.5V	B1, B4	USB/NoDCDC	USB, Pwr_Md



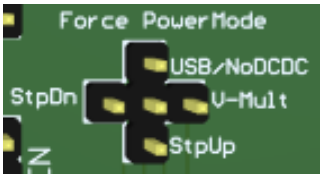
To force the power mode, place a jumper from the centre pin of the Force Power Mode jumper to the desired mode. Refer to the silk screen for the power mode being assigned. Note that when a power mode is assigned, it is the responsibility of the user to maintain a complaint supply voltage for that mode. If the USB mode is forced with the Force PowerMode jumper and no 5V supply is provided from the 9305_USB connector, the device will be configured for NoDCDC mode.

The status of the Force Power Mode jumper is only checked on start-up of the bridge and

The status LEDs can be used to confirm that the power mode has been successfully set:



If no power mode is forced the device will boot into Step Up Mode when VBAT2 is between 1.1-1.8V and Step Down if VBAT2 is 1.9-3.6V.



Power Mode	LEDs ON
Step Down	S-Dn, DCDC, Pwr_Md
NoDCDC	USB, Pwr_Md
Step Up	S-Up, DCDC, Pwr_Md
V-Multiplier	VDblr, Pwr_Md
USB	USB, Pwr_Md

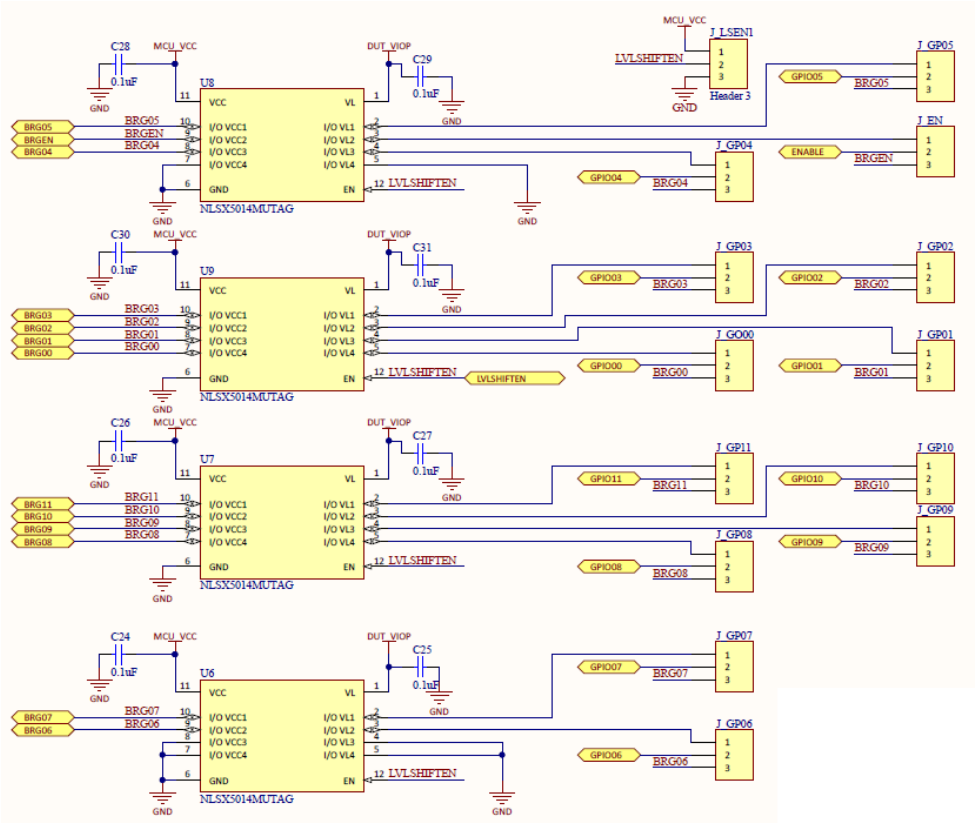
The Pwr_MD LED only illuminate on when the supply level to VBAT2, VCC, VBAT1, FB and LDCDC are within the expected range for the specified power mode.

5.2 ENTER CONFIG MODE

To enter Config Mode, press & release the USR button. This button press will trigger the Bridge to send a train of 30kHz pulses to the 9305 and toggle the EN signal and thereby put the EM9305 into Config Mode. When the EM9305 is in Confgi Mode the TM LED will be illuminated. To disable Config Mode, press the EN button to reset the EM9305.

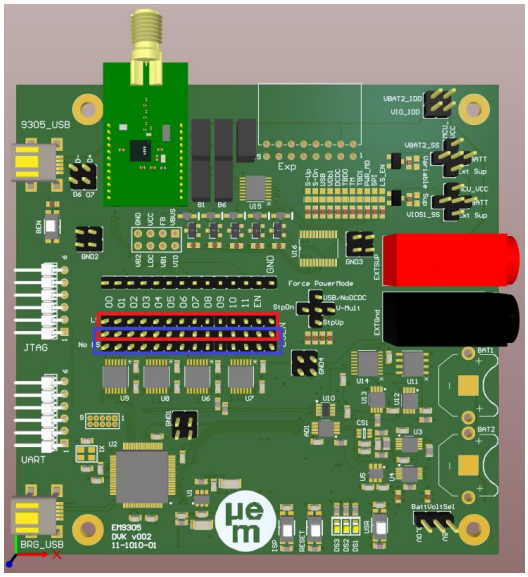
6. IO SOURCE SELECTION

IO signals sourced through the Bridge or the UART or JTAG headers may optionally be level shifted up or down from the 3.3V the bride operates on to the selected VIO supply level through the NLSX5014 level shifters.



To enable the level shifter on a particular IO, place the jumper for the J_GPxx IO between pins 1 and 2, as indicated in red in the image below. To bypass the level shifters on a particular IO, place the jumper for the J_GPxx IO between pins 2 & 3, as indicated in blue below. Note that the drive strength through the level shifters is more limited than direct drive from the Bridge/UART/JTAG. Any custom cabling that connects the DVK to an external board is recommended to use the direct drive and bypass the on board level shifters.

Any individual IO can be left floating and fully disconnected from the Bridge, UART, JTAG by removing the jumper on the associated J_GPxx pins.

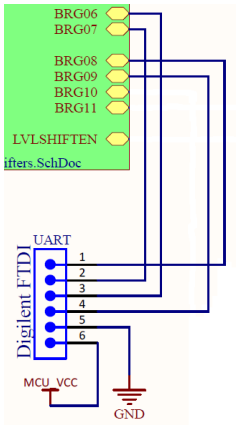


It is not recommended to combine level shifted and non-level shifted IO when communicating with the EM9305. There is no issue to combine IO driven level shifted (or non-level shifted IO) with floating IO.

7. EM9305 COMMUNICATION BUS

7.1 UART HEADER

The UART header is connected to GPIO 06-09 of the reference design. Refer to the software user guides to enable the UART bus on the EM9305. Note that GPIO8 and GPIO09 are used for 4-wire JTAG. User must use 2-wire JTAG is they wish to use 4-wire UART.

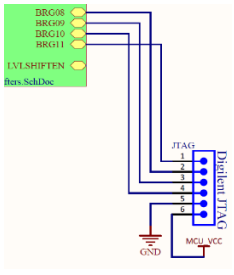


Be sure to connect the J_D+ (GPIO7) and J_D- (GPIO06) jumpers, near the 9305_USB plug when using the UART bus and remove them during USB communication directly to the EM9305.

Refer to the EM9305 datasheet for GPIO function mapping for the UART bus.

7.2 JTAG HEADER

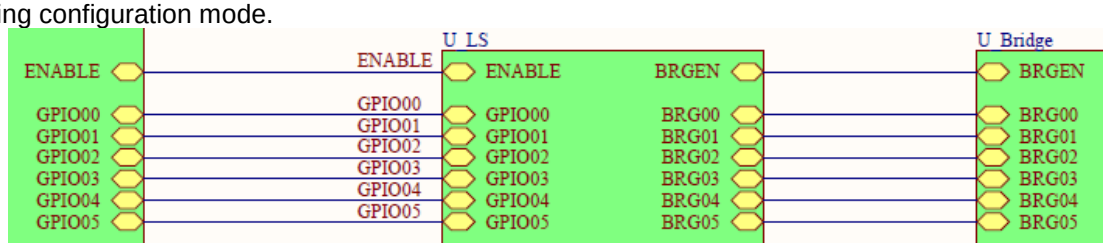
The JTAG header is connected to GPIO 08-11 of the reference design. Refer to the software user guides to enable the JTAG bus on the EM9305. Note that GPIO8 and GPIO09 are used for 4-wire UART. User must use 2-wire JTAG is they wish to use 4-wire UART.



Refer to the EM9305 datasheet for GPIO function mapping for the 2 and 4 wire JTAG bus.

7.3 SPI MASTER FROM BRIDGE

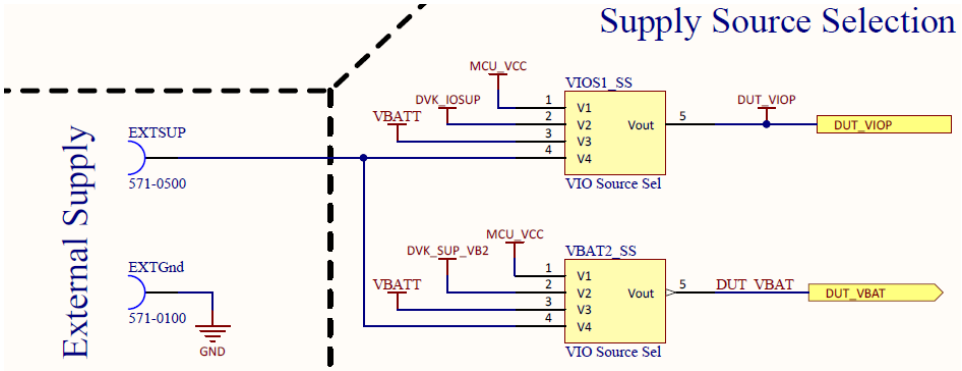
The Bridge supplies a SPI Master bus on GPIO0-4 and the configuration mode signal on GPIO5. The Bridge is used for common functions such as erasing the device, uploading firmware and entering configuration mode.



Refer to the EM9305 datasheet for GPIO function mapping for the SPI bus

8. SUPPLY OPTIONS FOR VIO & VBAT2 OF THE EM9305

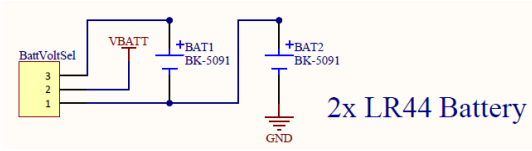
The EM9305 Reference Design VIO and VBAT2 supplied can be supplied independently from any one of four supply options:

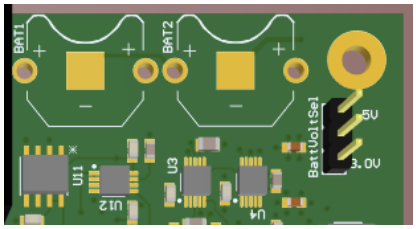


1. **MCU_VCC**: This supply is sourced from the 3.3V supply provided to the Bridge from the BRG_USB

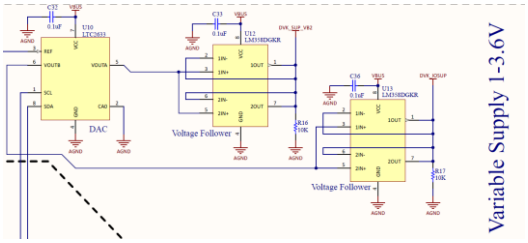
2. **Ext Sup:** This supply is sourced from the red and black banana jacks EXTSup and EXTGnd.

3. **VBatt:** This supply is sourced from BAT2 for a 1.5V supply and BAT1 and BAT2 in series for a 3.0V supply. To select the 1.5V option, a jumper should be placed between pin 1-2 of the BattVoltSel jumper. To select the 3.0V option, a jumper should be placed between pin 2-3 of the BattVoltSel jumper.





4. **Variable Supply (DVK_SUP_VB2 or DVK_IOSUP):** This supply is generated on board and configurable from the BLEngine PC tools. The supply can be set to any voltage from 0.9V to 3.6V. Refer to the software documentation for configuration details. Note that VIO and VBAT2 can be individually configured, but VIO should always be set such that it is greater than or equal to VBAT2.



8.1 SUPPLY LED INDICATORS

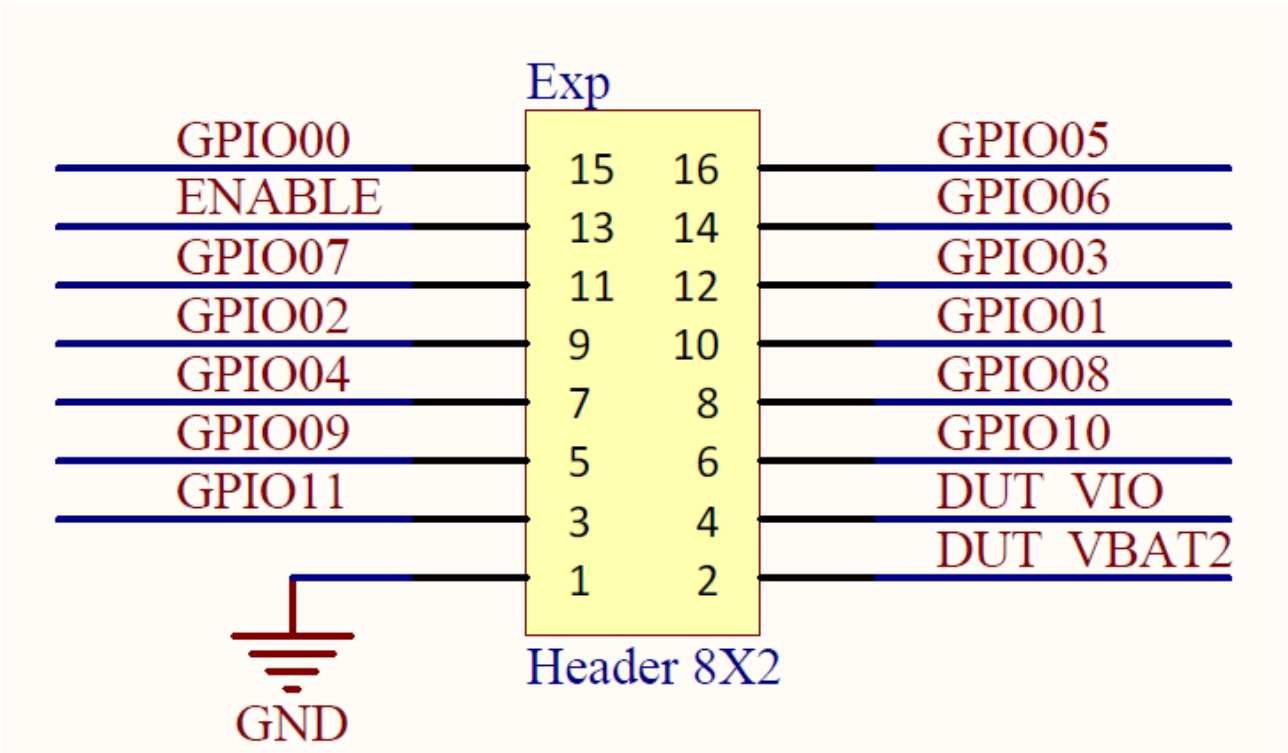
When VBAT2_SS and VIO_SS are set to a valid voltage, the LED next to jumper is be illuminated. Residual charge on the can lead to the LED being temporarily lit without the jumper being connected to the DUT_VBAT and DUT_VIOP signals, but if either LED is off, the associated supply is invalid.

8.2 CURRENT MEASUREMENT JUMPER

After selecting the desired supply in the VBAT2_SS and VIO_SS jumpers, the VIO_IDD and VBAT2_IDD jumpers should also be installed to supply the 9305 reference design. These jumpers are included to allow for current measurement on the associated supply with an external instrument.

9. EXPANSION HEADER

The dual row Exp header is intended to be a connection interface for customers developing on platforms with external sensors, actuators, etc that are specific to their end application. The pin out for this header is shown below:



10. CURRENT MEASUREMENT

Current through the VBAT2 supply can be measured with the on board current measurement circuit. This circuit is designed for measurement of steady state conditions. Measurements are averaged in hardware across a 20ms window. Short current pulses are not recommended to be measured with this circuit.

Refer the SDK documentation for the PC commands used to enable and read measurements from this circuit.