

# KIT\_T2G-B-H\_EVK TRAVEO™ T2G Body High evaluation kit guide

## About this document

### Scope and purpose

This document serves as a guide for using the KIT\_T2G-B-H\_EVK TRAVEO™ T2G Body High evaluation kit. This document explains the kit operation, describes the out-of-the-box (OOB) example and its operation, and the hardware details of the board.

### Intended audience

This document is intended for TRAVEO™ T2G Body High evaluation kit users.

### Reference documents

This user guide should be read in conjunction with the following documents:

- AN235305 - Getting started with TRAVEO™ T2G family MCUs in ModusToolbox™
- TRAVEO™ T2G Body High datasheet

Table of contents

**Table of contents**

**About this document..... 1**

**Table of contents..... 2**

**Safety and regulatory compliance information ..... 4**

**General safety instructions ..... 4**

**1 Introduction ..... 5**

1.1 Getting started..... 5

1.2 Additional learning resources..... 6

1.3 Technical support..... 6

1.4 Documentation conventions ..... 6

1.5 Abbreviations and definitions..... 6

**2 Kit details ..... 8**

2.1 Kit contents ..... 8

2.2 Board details ..... 8

**3 Kit operation ..... 19**

3.1 Theory of operation..... 19

3.2 M.2 wireless connectivity module (Support not available) ..... 24

3.3 BSP selection ..... 24

3.4 KitProg3: Onboard programmer/debugger ..... 25

3.4.1 Programming and debugging using ModusToolbox™ software ..... 25

3.4.1.1 Using the OOB example – TRAVEO™ T2G-B-H MCU ..... 29

3.4.2 USB-UART bridge ..... 30

3.4.3 USB-I2C bridge ..... 31

**4 Hardware ..... 32**

4.1 Schematics ..... 32

4.2 Hardware functional description..... 32

4.2.1 TRAVEO™ T2G-B-H MCU (U1) ..... 32

4.2.2 M.2 interface connector (J25) ..... 34

4.2.3 PSoC™ 5LP-based KitProg3 (U2)..... 36

4.2.4 Serial interconnection between PSoC™ 5LP and TRAVEO™ T2G-B-H MCU..... 37

4.2.5 Serial interconnection between PSoC™ 5LP and M.2 interface ..... 38

4.2.6 Power supply system ..... 39

4.2.6.1 Voltage regulators..... 39

4.2.6.2 Voltage selection..... 41

4.2.6.3 Current measurement headers ..... 43

4.2.7 I/O headers ..... 43

4.2.7.1 Headers compatible with Arduino Uno R3 (J1, J2, J3, J4) ..... 43

4.2.7.2 TRAVEO™ T2G-B-H MCU I/O headers (J29, J30, J31, and J32)..... 44

4.2.8 CAN FD transceiver..... 44

4.2.9 Quad SPI NOR flash ..... 45

4.2.10 LEDs ..... 45

4.2.11 Push buttons ..... 47

4.2.12 Crystals and oscillators..... 47

4.2.13 Ethernet transceiver and RJ45 connector..... 47

4.2.14 SMIF dual header compatible with Digilent Pmod ..... 49

4.2.15 Potentiometer..... 49

4.2.16 Reverse voltage protection..... 50

4.3 Kit rework ..... 50



## Table of contents

4.3.1	SMIF dual header compatible with Digilent Pmod interface.....	50
4.3.2	VDDIO2 supply voltage selection.....	51
4.3.3	UART interface on Arduino headers .....	52
4.3.4	WLAN UART interface .....	52
4.3.5	ETM trace and debug header .....	52
4.3.6	125-MHz oscillator.....	53
4.3.7	WLAN SDIO interface .....	53
4.3.8	UART interface between PSoC™ 5LP and TRAVEO™ T2G-B-H MCU with flow control.....	53
4.4	Bill of materials.....	53
4.5	Frequently asked questions.....	54
<b>5</b>	<b>Known Limitations .....</b>	<b>56</b>
	<b>Revision history.....</b>	<b>57</b>

## Safety and regulatory compliance information

### Safety and regulatory compliance information

This kit is intended for development purposes only. Users are advised to test and evaluate this kit in an RF development environment.

Safety evaluation for this kit is done in factory default settings using default accessories shipped with the kit. All evaluations for safety are carried out using a 5-V (USB 2.0, @ 500 mA) supply. Attaching additional wiring to this product or modifying the product operation from the factory default may affect its performance and cause interference with other apparatus in the immediate vicinity. If such interference is detected, suitable mitigating measures should be taken.

This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required authorizations are first obtained. Contact [Infineon support](#) for details.



These kits contain electrostatic discharge (ESD) sensitive devices. Electrostatic charges readily accumulate on the human body and any equipment, which can cause a discharge without detection. Permanent damage may occur on devices subjected to high-energy discharges. Proper ESD precautions are recommended to avoid performance degradation or loss of functionality. Store unused kits in the protective shipping package.



#### End-of-life/product recycling

The end-of-life cycle for this kit is five years from the date of manufacture mentioned on the back of the box. Contact your nearest recycler to discard the kit.

## General safety instructions

### ESD protection

ESD can damage boards and associated components. Infineon recommends that you perform procedures only at an ESD workstation. If an ESD workstation is unavailable, use appropriate ESD protection by wearing an anti-static wrist strap attached to the chassis ground (any unpainted metal surface) on your board when handling parts.

### Handling boards

This board is sensitive to ESD. Hold the board only by its edges. After removing the board from its box, place it on a grounded, static-free surface. Use a conductive foam pad, if available. Do not slide the board over any surface.

## Introduction

# 1 Introduction

Thank you for your interest in the TRAVEO™ T2G Body High evaluation kit. The TRAVEO™ T2G Body High evaluation kit enables you to evaluate and develop your applications using the **TRAVEO™ T2G Body High MCU** (hereafter called “TRAVEO™ T2G-B-H MCU”).

TRAVEO™ T2G-B-H MCU is designed for automotive applications. TRAVEO™ T2G-B-H MCU is a true programmable embedded system-on-chip, integrating up to two 350-MHz Arm® Cortex®-M7 as the primary application processors, a 100-MHz Arm® Cortex®-M0+ that supports low-power operations, up to 8 MB flash and 1 MB SRAM, Secure Digital Host Controller (SDHC) supporting SD/SDIO/eMMC interfaces, programmable analog and digital peripherals that allow faster time-to-market.

The evaluation board carries a TRAVEO™ T2G-B-H MCU, an M.2 interface connector for interfacing radio modules based on AIROC™ Wi-Fi & Bluetooth® combos (currently not supported), a Dual-PMOD SMIF connector for interfacing HYPERBUS™ memories, and Arduino headers for interfacing Arduino Shields. In addition, the board features an on-board programmer/debugger (KitProg3), a 512-Mb QSPI NOR flash, a micro-B connector for the USB device interface, three user LEDs, one potentiometer, a Gigabit ethernet port for ethernet applications and two push buttons. The board supports operating voltages from 1.8 V to 5.0 V for TRAVEO™ T2G-B-H MCU.

You can use ModusToolbox™ software to develop and debug your TRAVEO™ T2G-B-H MCU projects. **ModusToolbox™ software** is a set of tools that enable you to integrate these devices into your existing development methodology.

If you are new to TRAVEO™ T2G-B-H MCU and ModusToolbox™ software, see the application note AN235305 - Getting started with TRAVEO™ MCUs on ModusToolbox™ software to help you familiarize with the TRAVEO™ T2G-B-H MCU and help you create your own design using the Eclipse IDE for ModusToolbox™ software.

## 1.1 Getting started

This guide will help you to get acquainted with this evaluation kit:

- The **Kit details** chapter provides the kit and package details and board details.
- The **Kit operation** chapter describes the major features of the TRAVEO™ T2G-B-H evaluation board and functionalities such as programming, debugging, the USB-UART, and USB-I2C bridges.
- The **Hardware** chapter provides a detailed hardware description, kit schematics, and the bill of materials (BOM).
- Application development using TRAVEO™ T2G-B-H evaluation kit is supported in ModusToolbox™ software. ModusToolbox™ software is a free development eco-system that includes the Eclipse IDE for ModusToolbox™ software and the TRAVEO™ T2G-B-H SDK with TRAVEO™ T2G-B-H MCU. Using ModusToolbox™ software, you can enable and configure device resources, and middleware libraries; write C/assembly source code; and program and debug the device. You can download the software from the **ModusToolbox™ home page**. See the ModusToolbox™ software installation guide for additional information.
- There is a wide range of code examples to evaluate the TRAVEO™ T2G-B-H evaluation board. These examples help you familiarize TRAVEO™ T2G-B-H MCU and create your own design. These examples can be accessed through the ModusToolbox™ Project Creator tool. Alternatively, you can also visit Infineon’s code example page to access these examples:
  - **Code examples for ModusToolbox™ software**

## Introduction

### 1.2 Additional learning resources

Infineon provides a wealth of data in the [TRAVEO™ web page](#) to help you to select the right TRAVEO™ T2G MCU device for your design and to help you quickly and effectively integrate the device into your design.

### 1.3 Technical support

For assistance, go to [www.infineon.com/support](http://www.infineon.com/support). Visit [community.infineon.com](http://community.infineon.com) to ask your questions in Infineon developer community.

You can also use the following support resources if you need quick assistance:

- [Self-help \(Technical documents\)](#)

### 1.4 Documentation conventions

**Table 1** Document conventions for guides

Convention	Usage
Courier New	Displays user-entered text and source code
<i>Italics</i>	Displays file names and reference documentation: Read about the <i>sourcefile.hex</i> file in the <i>PSoC™ Creator user guide</i> .
File > Open	Represents menu paths: File > Open > New Project
<b>Bold</b>	Displays commands, menu paths, and icon names in procedures: Click the <b>File</b> icon and then click <b>Open</b> .
Times New Roman	Displays an equation: $2 + 2 = 4$
Text in gray boxes	Describes Cautions or unique functionality of the product.

### 1.5 Abbreviations and definitions

**Table 2** Abbreviations

Abbreviation	Definition
ADC	analog-to-digital converter
BOM	bill of materials
CINT	Integration Capacitor
CMOD	Modulator Capacitor
CPU	central processing unit
CSD	capacitive sigma delta
CSX	CAPSENSE™ Crosspoint
CTANK	Shield Tank Capacitor
DC	direct current
ECO	external crystal oscillator
ESD	electrostatic discharge
FPC	flexible printed circuit
GPIO	general-purpose input/output

---

**Introduction**

<b>Abbreviation</b>	<b>Definition</b>
IC	integrated circuit
IDE	integrated development environment
IoT	Internet of Things
I2C	inter-integrated circuit
I2S	Inter-IC Sound
LED	light-emitting diode
LPO	low power oscillator
PC	personal computer
PDL	peripheral driver library
QSPI	Quad serial peripheral interface
SDHC	Secure Digital Host Controller
SDIO	Secure Digital Input Output
SDK	software development kit
SMIF	Serial Memory Interface
SPI	Serial Peripheral Interface
SRAM	static random-access memory
SWD	Serial Wire Debug
UART	universal asynchronous receiver transmitter
USB	Universal Serial Bus
WCO	watch crystal oscillator

## Kit details

## 2 Kit details

### 2.1 Kit contents

- TRAVEO™ T2G-B-H evaluation board
- USB Type-A to Micro-B cable
- 12V/3A DC power adapter with additional blades
- Quick start guide



**Figure 1** Kit contents

Inspect the contents of the kit; if you find any part missing, go to <https://www.infineon.com/cms/en/product/microcontroller/32-bit-traveo-t2g-arm-cortex-microcontroller/traveo-t2g-cyt4bf-series>.

### 2.2 Board details

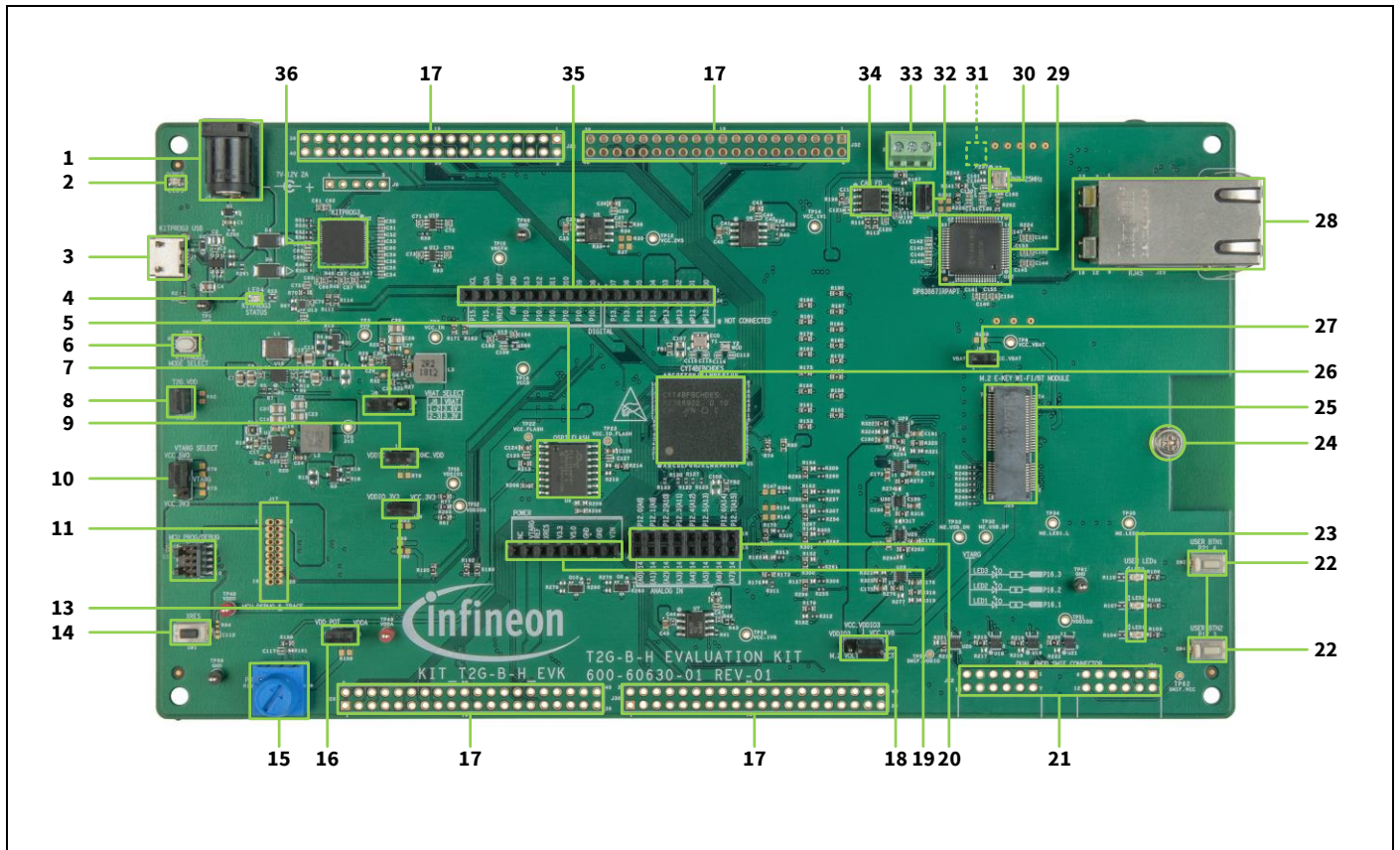
The TRAVEO™ T2G-B-H evaluation board has the following features:

- TRAVEO™ T2G-B-H MCU. See the device [datasheet](#).
- M.2 interface connector to connect radio modules based on AIROC™ Wi-Fi & Bluetooth® combos (currently not supported).
- 512-Mb external Quad SPI NOR flash that provides a fast, expandable memory for data and code.
- KitProg3 on-board SWD programmer/debugger, USB-UART, and USB-I2C bridge functionality.
- A micro-B connector for USB device interface
- Selectable input supply voltages of 3.3 V and 5.0 V for the TRAVEO™ T2G-B-H MCU.



## Kit details

- Three user LEDs, two user buttons, and a reset button for the TRAVEO™ T2G-B-H MCU
- A potentiometer which can be used to simulate analog sensor output
- A mode button and a mode LED for KitProg3



**Figure 2 TRAVEO™ T2G-B-H evaluation board – top view**

1. External power supply VIN connector (J6)
2. Power LED (LED5)
3. KitProg3 USB connector (J7)
4. KitProg3 status LED (LED4)
5. 512-Mb serial NOR flash memory (S25HL512TFAMHI010, U9)
6. KitProg3 programming mode selection button (SW3)
7. VBAT power selection jumper (J8)
8. T2G-B-H VTARG current measurement jumper (J15)
9. T2G-B-H VDDIO2 current measurement jumper (J12)
10. System power (VTARG) selection jumper (J10)
11. T2G-B-H 20-pin debug and trace header (J17)
12. T2G-B-H 10-pin SWD/JTAG program and debug header (J16)
13. T2G-B-H target I/O current measurement jumper (J14)
14. T2G-B-H reset button (SW1)
15. Potentiometer (R105)
16. Potentiometer connection jumper (J18)
17. T2G-B-H extended I/O headers (J29, J30, J31, J32)

## Kit details

18. M.2 I/O power selection jumper (J27)
19. Power header compatible with Arduino Uno R3 (J1)
20. Analog-IN header compatible with Arduino Uno R3 (J2)
21. SMIF dual header compatible with Digilent Pmod (J21, J22)
22. T2G-B-H user buttons (SW2, SW4)
23. T2G-B-H user LEDs (LED1, LED2, LED3)
24. M.2 stand-off (MT1)
25. M.2 interface connector (J25)
26. T2G-B-H microcontroller (U1)
27. VBAT current measurement jumper (J28)
28. RJ45 Gigabit Ethernet connector (J23)
29. Ethernet physical layer (PHY) transceiver (U22)
30. 25-MHz crystal for Ethernet transceiver (Y3)
31. 125-MHz crystal for Ethernet transceiver (Y4)
32. CAN FD resistor termination jumper (J20)
33. CAN FD interface connector (J19)
34. CAN FD transceiver (TLE9251VSJ – U8)
35. Digital I/O headers compatible with Arduino Uno R3 (J3, J4)
36. KitProg3 programmer and debugger based on PSoC™ 5LP (CY8C5868LTI-LP039 – U2)

Kit details

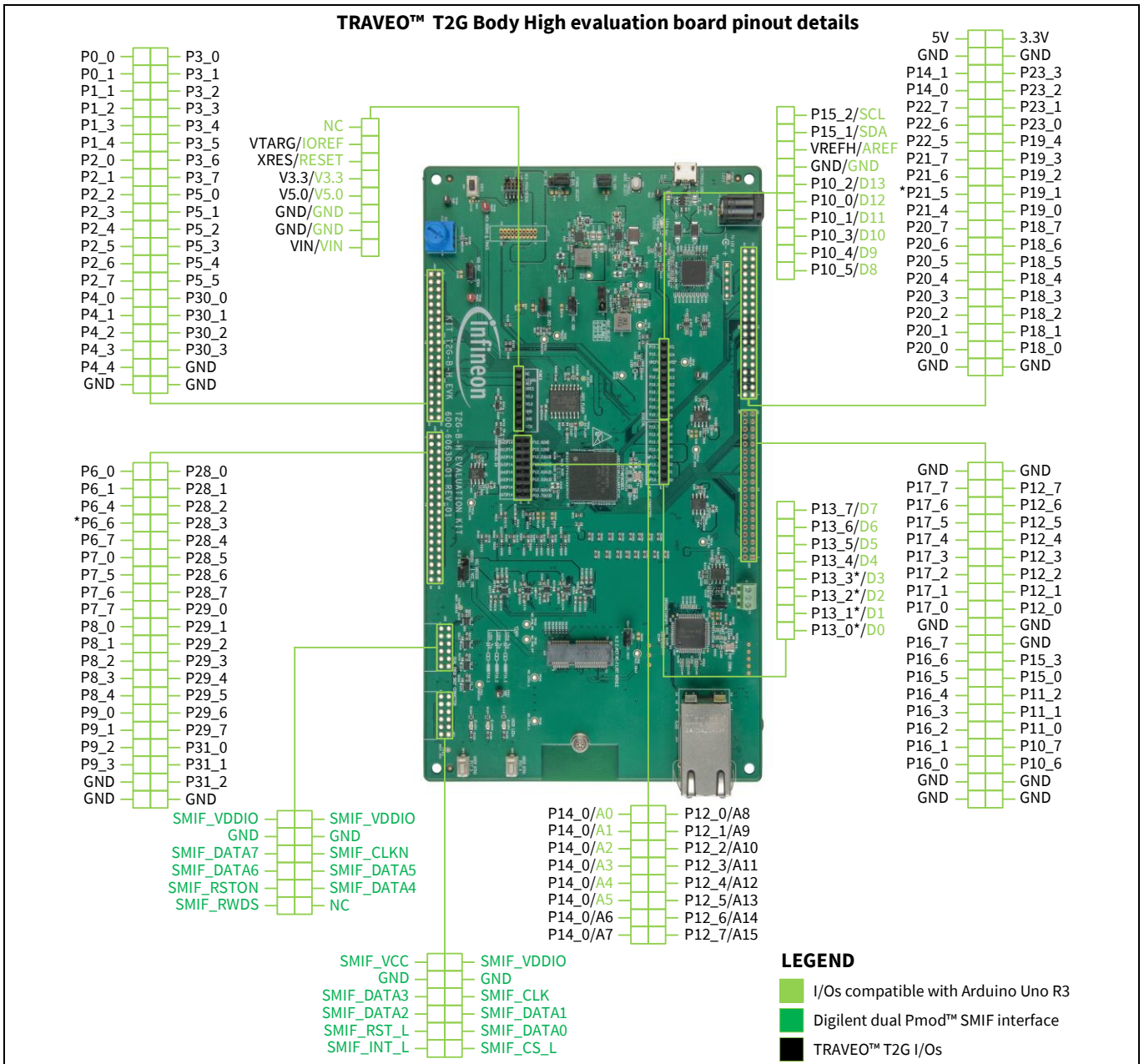


Figure 3 TRAVEO™ T2G-B-H evaluation board pinout

Table 3 TRAVEO™ T2G-B-H evaluation board pinout

Pin	Primary onboard function	Secondary onboard function	Connection details
<b>TRAVEO™ T2G-B-H MCU pins</b>			
XRES	Hardware reset	–	Remove R183 to disconnect it from KitProg3 reset.
P0[2]	CAN transmit CAN_TX	–	Connected to TxD of CAN FD transceiver TLE9251VSJ
P0[3]	CAN receive CAN_RX	–	Connected to RxD of CAN FD transceiver TLE9251VSJ

**Kit details**

Pin	Primary onboard function	Secondary onboard function	Connection details
P1[0]	CAN transceiver standby	–	Connected to STB of CAN FD transceiver TLE9251VSJ
P6[2]	FLASH_INT_L	–	Not connected
P6[3]	QSPI_SCK	–	Connected to SCK of QSPI flash S25HL512TFAMHI010
P6[5]	FLASH_SS_L	–	Connected to CS of QSPI flash S25HL512TFAMHI010
P6[6]	Potentiometer (POT) output POT_AOUT	Generic GPIO expansion header (J30.7)	Remove R188 to disconnect from the potentiometer. Populate R191 to connect to expansion header J30.7
P6[7]	QSPI flash reset	Generic GPIO expansion header (J30.9)	Connected to RESET/RFU of QSPI flash S25HL512TFAMHI010. Remove R140 to use as GPIO.
P7[1]	QSPI_IO0	–	Connected to IO0 of QSPI flash S25HL512TFAMHI010
P7[2]	QSPI_IO1	–	Connected to IO1 of QSPI flash S25HL512TFAMHI010
P7[3]	QSPI_IO2	–	Connected to IO2 of QSPI flash S25HL512TFAMHI010
P7[4]	QSPI_IO3	–	Connected to IO3 of QSPI flash S25HL512TFAMHI010
P10[0]	D12 – header compatible with Arduino (J3.5)	–	–
P10[1]	D11 – header compatible with Arduino (J3.4)	–	–
P10[2]	D13 – header compatible with Arduino (J3.6)	–	–
P10[3]	D10 – header compatible with Arduino (J3.3)	–	–
P10[4]	D9 – header compatible with Arduino (J3.2)	–	–
P10[5]	D8 – header compatible with Arduino (J3.1)	–	–
P12[0]	A8 – header (J2.2)	–	–
P12[1]	A9 – header (J2.4)	–	–
P12[2]	A10 – header (J2.6)	–	–
P12[3]	A11 – header (J2.8)	–	–
P12[4]	A12 – header (J2.10)	–	–
P12[5]	A13 – header (J2.12)	–	–
P12[6]	A14 – header (J2.14)	–	–

**Kit details**

Pin	Primary onboard function	Secondary onboard function	Connection details
P12[7]	A15 – header (J2.16)	–	–
P13[0]	Debug UART_RX	Pin D0 of connector J4.1 compatible with Arduino	This pin is connected to the KitProg3 UART Tx pin. Remove R129 and R139, and install R134 to connect to Pin D0 of connector J4.1 compatible with Arduino.
P13[1]	Debug UART_TX	Pin D1 of connector J4.2 compatible with Arduino	This pin is connected to the KitProg3 UART Rx pin. Remove R132 and R142, and install R136 to connect to Pin D1 of connector J4.2 compatible with Arduino.
P13[2]	Debug UART_CTS	Pin D2 of connector J4.3 compatible with Arduino	This pin is connected to the KitProg3 UART CTS pin. Remove R146 and install R150 to connect to Pin D2 of connector J4.3 compatible with Arduino.
P13[3]	Debug UART_RTS	Pin D3 of connector J4.4 compatible with Arduino	This pin is connected to the KitProg3 UART RTS pin. Remove R144 and install R148 to connect to Pin D3 of connector J4.4 compatible with Arduino.
P13[4]	Pin D4 of connector J4.5 compatible with Arduino	–	–
P13[5]	Pin D5 of connector J4.6 compatible with Arduino	–	–
P13[6]	Pin D6 of connector J4.7 compatible with Arduino	–	–
P13[7]	Pin D7 of connector J4.8 compatible with Arduino	–	–
P14[0]	A0 – header compatible with Arduino (J2.1)	–	–
P14[1]	A1 – header compatible with Arduino (J2.3)	–	–
P14[2]	A2 – header compatible with Arduino (J2.5)	–	–
P14[3]	A3 – header compatible with Arduino (J2.7)	–	–
P14[4]	A4 – header compatible with Arduino (J2.9)	–	–

**Kit details**

<b>Pin</b>	<b>Primary onboard function</b>	<b>Secondary onboard function</b>	<b>Connection details</b>
P14[5]	A5 – header compatible with Arduino (J2.11)	–	–
P14[6]	A6 – header compatible with Arduino (J2.13)	–	–
P14[7]	A7 – header compatible with Arduino (J2.15)	–	–
P15[1]	I2C SDA - Common I2C SDA pin for KitProg3 USB-I2C bridge	I2C SDA pin Arduino header (J3.9)	Remove R114 to disconnect from KitProg3 I2C SDA pin.
P15[2]	I2C SCL - Common I2C SCL pin for KitProg3 USB-I2C bridge	I2C SCL pin on Arduino header (J3.10)	Remove R111 to disconnect from KitProg3 I2C SCL pin.
P16[1]	Orange user LED (LED1)	Generic GPIO header (J32.8)	Remove R104 to disconnect from the orange user LED (LED1).
P16[2]	Orange user LED (LED2)	Generic GPIO header (J32.10)	Remove R107 to disconnect from the orange user LED (LED2).
P16[3]	Orange user LED (LED3)	Generic GPIO header (J32.12)	Remove R110 to disconnect from the orange user LED (LED3).
P17[3]	User button (USER_BTN2)	Generic GPIO header (J32.30)	Remove R141 to disconnect USER_BTN2.
P21[0]	WCO IN (Y2)	–	32.768-kHz watch crystal oscillator input
P21[1]	WCO OUT (Y2)	–	32.768-kHz watch crystal oscillator output
P21[2]	ECO IN (Y1)	–	16-MHz external crystal oscillator input
P21[3]	ECO OUT (Y1)	–	16-MHz external crystal oscillator input
P21[4]	User button (USER_BTN1) (Also used for hibernate wakeup function)	–	–
P21[5]	TRACEDATA [0]	Generic GPIO header (J31.22)	TRAVEO™ T2G-B-H MCU 20-pin ETM header J17. Remove R192 and install R314 to connect to J31.22.
P22[1]	TRACEDATA [1]	–	TRAVEO™ T2G-B-H MCU 20-pin ETM header J17.
P22[2]	TRACEDATA [2]	–	TRAVEO™ T2G-B-H MCU 20-pin ETM header J17.
P22[3]	TRACEDATA [3]	–	TRAVEO™ T2G-B-H MCU 20-pin ETM header J17.

**Kit details**

Pin	Primary onboard function	Secondary onboard function	Connection details
P22[4]	TRACE_CLOCK	–	TRAVEO™ T2G-B-H MCU 20-pin ETM header J17.
P23[4]	TDO_SWO	–	TRAVEO™ T2G-B-H MCU 10-pin SWD/JTAG interface J16 / 20-pin ETM header J17
P23[5]	TCK_SWCLK	–	TRAVEO™ T2G-B-H MCU 10-pin SWD/JTAG interface at J16 / 20-pin ETM header J17
P23[6]	TMS_SWDIO	–	TRAVEO™ T2G-B-H MCU 10-pin SWD/JTAG interface at J16 / 20-pin ETM header J17
P23[7]	TDI_SWDOE	–	TRAVEO™ T2G-B-H MCU 10-pin SWD/JTAG interface at J16 / 20-pin ETM header J17
P24[0]	SMIF_INT_L_LT	–	Install R145 resistor to connect to Serial Memory Interface (SMIF) INT signal.
P24[1]	SMIF_CLK_LT	–	Install R147 resistor to connect to SMIF CLK signal.
P24[2]	SDIO_CLK_LT	Serial Memory Interface SMIF_RWDS_LT signal	Connected to M.2 WL SDIO_CLK signal via U25 level translator. Remove R301 resistor and install R149 resistor to connect to SMIF RWDS signal.
P24[3]	SDIO_CMD_LT	Serial Memory Interface SMIF_CS_L_LT signal	Connected to M.2 WL SDIO_CMD signal via U25 level translator. Remove R300 resistor and install R152 resistor to connect to SMIF CS signal.
P24[4]	SMIF_RST_L_LT	–	Install R154 resistor to connect to SMIF RST signal.
P25[0]	SDIO_DATA0_LT	Serial Memory Interface DATA0 signal SMIF_DATA0_LT	Connected to M.2 WL SDIO_DATA0 signal via U25 level translator. Remove R296 and install R157 resistor to connect to SMIF DATA0 signal.
P25[1]	SDIO_DATA1_LT	Serial Memory Interface DATA1 signal SMIF_DATA1_LT	Connected to M.2 WL SDIO_DATA1 signal via U25 level translator.

**Kit details**

Pin	Primary onboard function	Secondary onboard function	Connection details
			Remove R297 and install R160 resistor to connect to SMIF DATA1 signal.
P25[2]	SDIO_DATA2_LT	Serial Memory Interface DATA2 signal SMIF_DATA2_LT	Connected to M.2 WL SDIO_DATA2 signal via U26 level translator. Remove R298 and install R162 resistor to connect to SMIF DATA2 signal.
P25[3]	SDIO_DATA3_LT	Serial Memory Interface DATA3 signal SMIF_DATA3_LT	Connected to M.2 WL SDIO_DATA3 signal via U26 level translator. Remove R299 and install R164 resistor to connect to SMIF DATA3 signal.
P25[4]	WL_HOST_WAKE_LT	Serial Memory Interface DATA4 signal SMIF_DATA4_LT	Connected to M.2 WL_HOST_WAKE signal via U28 level translator. Remove R167 resistor and install R170 to connect to SMIF DATA4 signal.
P25[5]	WL_DEV_WAKE_LT	Serial Memory Interface DATA5 signal SMIF_DATA5_LT	Connected to M.2 WL_DEV_WAKE signal via U28 level translator. Remove R173 resistor and install R176 to connect to SMIF DATA5 signal.
P25[6]	WL_REG_ON_LT	Serial Memory Interface DATA6 signal SMIF_DATA6_LT	Connected to M.2 WL_REG_ON_3V3 signal via U29 level translator. Remove R179 resistor and install R182 to connect to SMIF DATA6 signal.
P25[7]	SMIF_DATA7_LT	–	Install R185 resistor to connect to SMIF DATA7 signal.
P26[0]	ETH_REF_CLK	–	The Ethernet signals are connected to U22A Ethernet PHY transceiver in RGMII configuration mode.
P26[1]	ETH_TX_EN_CTL	–	
P26[2]	ETH_TX_D0	–	
P26[3]	ETH_TX_D1	–	
P26[4]	ETH_TX_D2	–	
P26[5]	ETH_TX_D3	–	
P26[6]	ETH_TX_CLK	–	
P26[7]	ETH_RX_D0	–	



**Kit details**

Pin	Primary onboard function	Secondary onboard function	Connection details
P27[0]	ETH_RX_D1	–	
P27[1]	ETH_RX_D2	–	
P27[2]	ETH_RX_D3	–	
P27[3]	ETX_RX_CLK	–	
P27[4]	ETH_RX_DV_CTL	–	
P27[5]	ETH_MDC	–	
P27[6]	ETH_MDIO	–	
P27[7]	ETH_RST	–	
P32[0]	BT_UART_RXD_LT	–	Connected to M.2 radio module connector pin BT_UART_TX via level translator U30.
P32[1]	BT_UART_TXD_LT	–	Connected to M.2 radio module connector pin BT_UART_RX via level translator U30.
P32[2]	BT_UART_RTS_LT	–	Connected to M.2 radio module connector pin BT_UART_CTS via level translator U30.
P32[3]	BT_UART_CTS_LT	–	Connected to M.2 radio module connector pin BT_UART_RTS via level translator U30.
P32[4]	BT_HOST_WAKE_LT	–	Connected to M.2 radio module connector pin BT_HOST_WAKE_3V3 via level translator U28.
P32[5]	BT_DEV_WAKE_LT	–	Connected to M.2 radio module connector pin BT_DEV_WAKE via level translator U28.
P32[6]	BT_REG_ON_LT	–	Connected to M.2 radio module connector pin BT_REG_ON_3V3 via level translator U29.
P32[7]	BT_DEV_WAKE_LAI	–	Not connected. Populate R303 when using BT_DEV_WAKE signal on Laird M.2 radio module
<b>M.2 radio module pin</b>			
BT_UART_TXD	UART interface with the host MCU (TRAVEO™ T2G-B-H MCU)	UART interface with KitProg3	Remove R265 to disconnect from TRAVEO™ T2G-B-H MCU UART Rx.

**Kit details**

Pin	Primary onboard function	Secondary onboard function	Connection details
			Remove R69 to disconnect WL_UART_TX. Populate R66 to connect to KitProg3 secondary UART Rx.
BT_UART_RXD	UART interface with the host MCU (TRAVEO™ T2G-B-H MCU)	UART interface with KitProg3	Remove R266 to disconnect from TRAVEO™ T2G-B-H MCU UART Tx. Remove R65 to disconnect WL_UART_RX. Populate R64 to connect to KitProg3 secondary UART Tx.
BT_UART_CTS	UART interface with the host MCU (TRAVEO™ T2G-B-H MCU)	UART interface with KitProg3	Remove R267 to disconnect from TRAVEO™ T2G-B-H MCU UART RTS. Populate R71 to connect to KitProg3 secondary UART RTS.
BT_UART_RTS	UART interface with the host MCU (PSoC™ 6)	UART interface with KitProg3	Remove R268 to disconnect from TRAVEO™ T2G-B-H MCU UART CTS. Populate R73 to connect to KitProg3 secondary UART CTS.
BT_I2S_CLK	I2S serial clock	–	–
BT_I2S_WS	I2S serial word select	–	–
BT_I2S_DO	I2S serial data out	–	–
BT_I2S_DI	I2S serial data in	–	–
BT_GPIO_2	Bluetooth® GPIO	–	–
BT_GPIO_3	Bluetooth® GPIO	–	–
BT_GPIO_4	Bluetooth® GPIO	–	–
BT_GPIO_5	Bluetooth® GPIO	–	–
BT_GPIO_6	Bluetooth® GPIO	–	–
BT_GPIO_7	Bluetooth® GPIO	–	–
WL_UART_RX	Wi-Fi debug UART Rx pin	–	–
WL_UART_TX	Wi-Fi debug UART Tx pin	–	–
WL_GPIO11	Programmable GPIO pin	–	–
WL_REG_ON_ALT	Alternate WL Regulator ON pin	–	–
M2_SCL	I2C SCL pin	–	–
M2_SDA	I2C SDA pin	–	–

Kit operation

### 3 Kit operation

#### 3.1 Theory of operation

The TRAVEO™ T2G-B-H evaluation board is built around TRAVEO™ T2G-B-H MCU. For details of device features, see the device [datasheet](#).

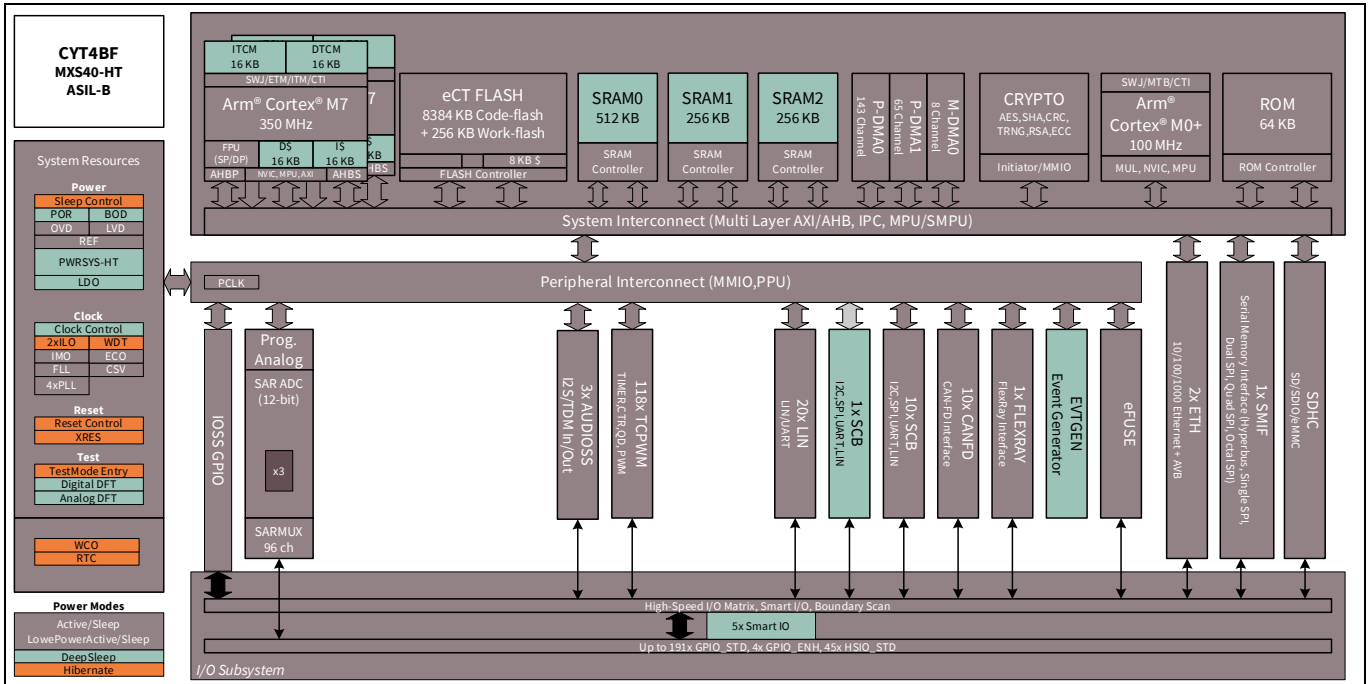


Figure 4 TRAVEO™ T2G-B-H MCU block diagram

Kit operation

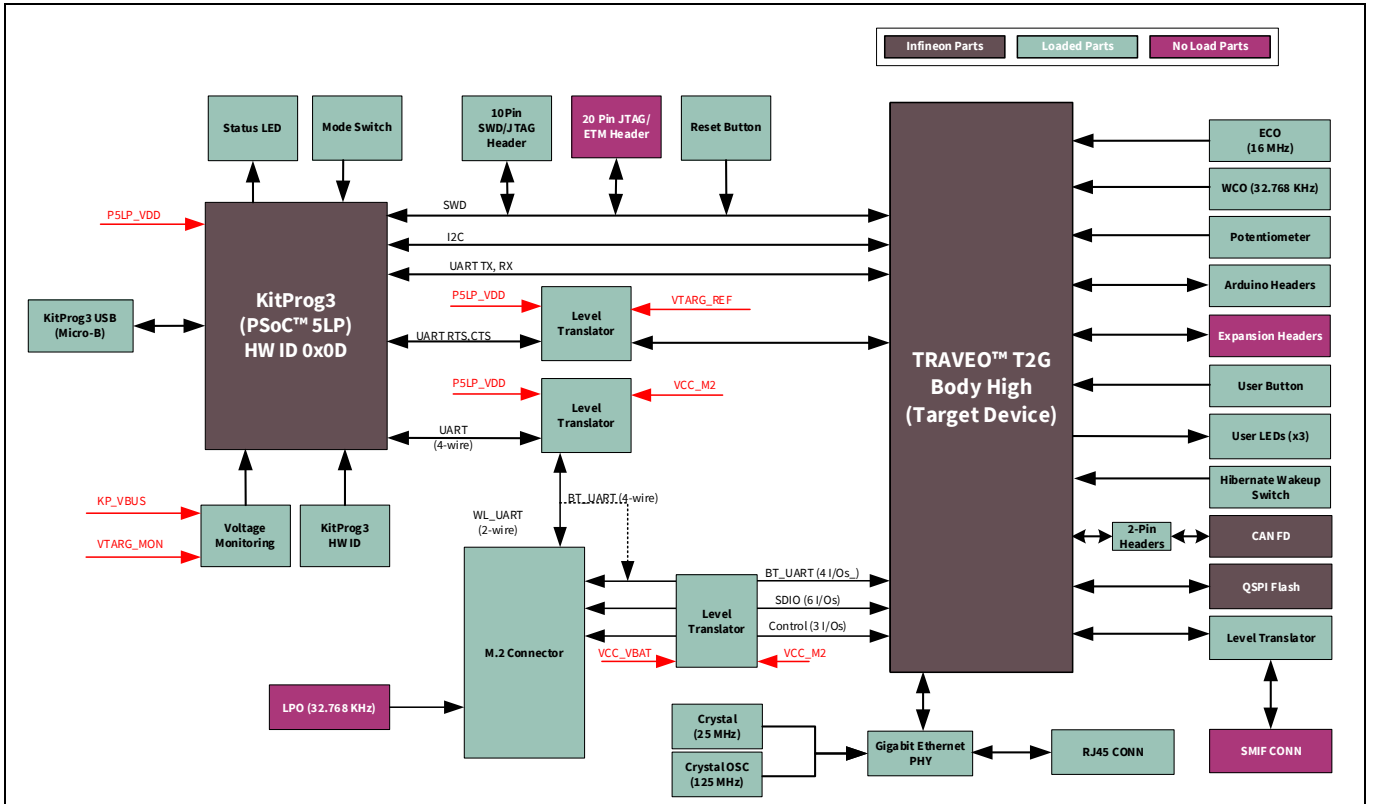


Figure 5 Block diagram of TRAVEO™ T2G-B-H evaluation board

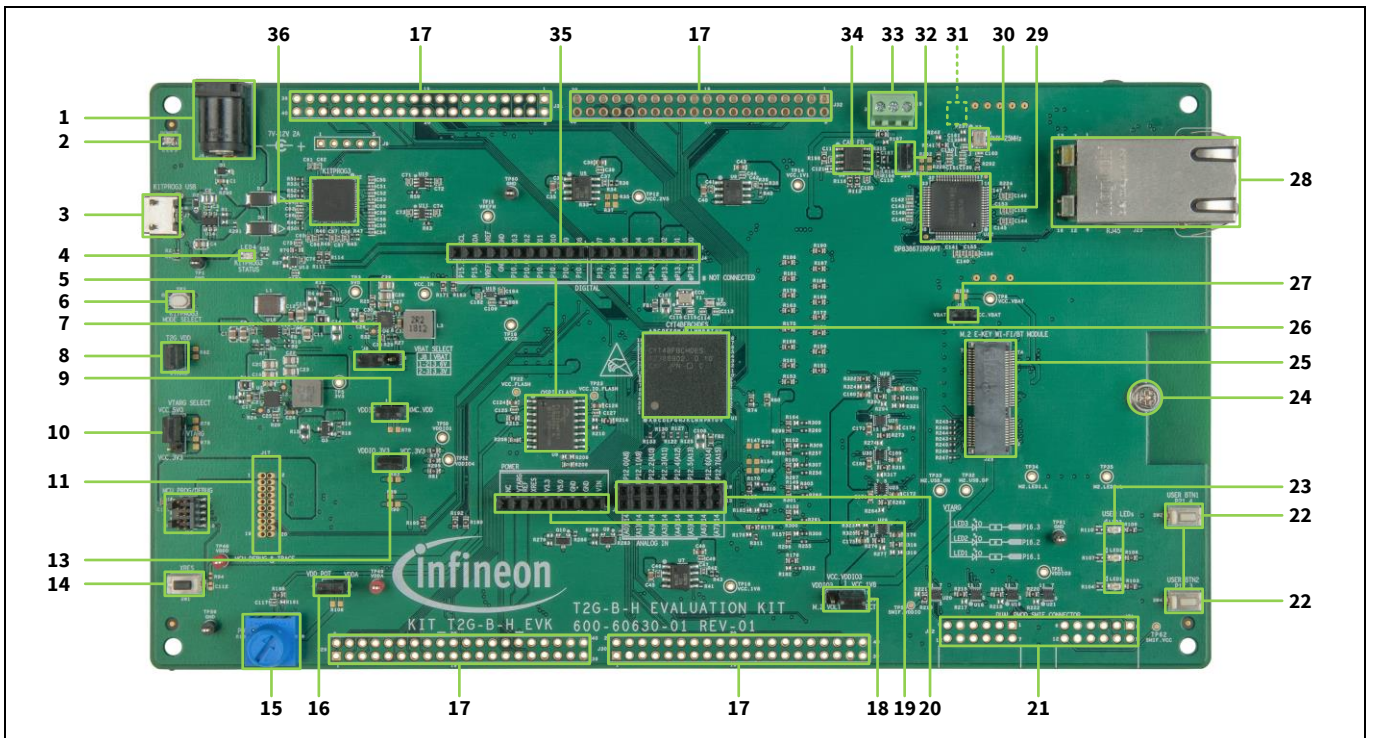


Figure 6 TRAVEO™ T2G-B-H evaluation board – top view

Kit operation

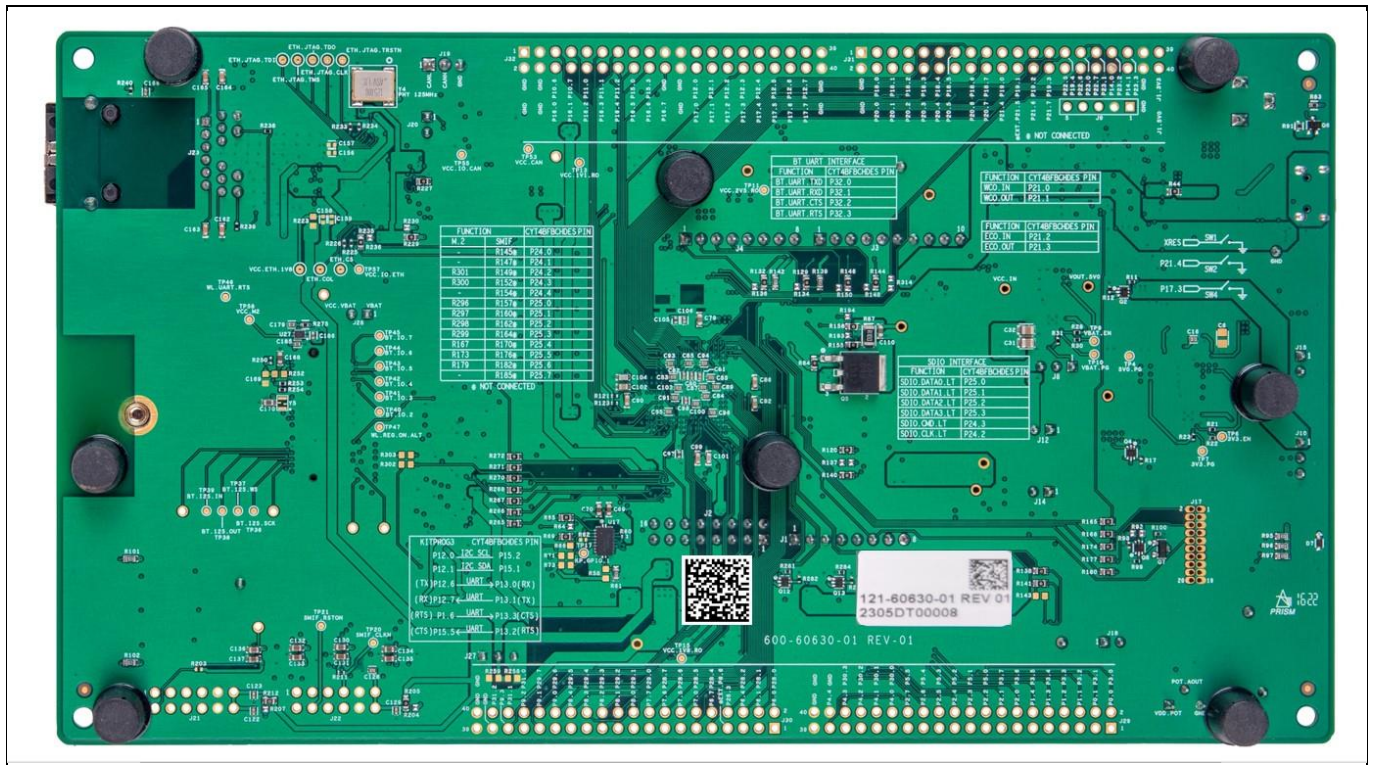


Figure 7 TRAVEO™ T2G-B-H evaluation board – bottom view

## Kit operation

The TRAVEO™ T2G-B-H evaluation board has the following peripherals:

**Table 4 Peripheral details**

Sl. No.	Peripheral	Description
1.	External power supply VIN connector (J6)	Connect to external 12 V/3 A DC power adapter.
2.	Power LED (LED5)	Power supply ON/OFF LED status indicator.
3.	KitProg3 USB connector (J7)	Connect to a PC to use the KitProg3 onboard programmer and debugger and to provide power to the board.
4.	KitProg3 status LED (LED4)	Amber LED (D4) indicates the status of KitProg3. For details on the KitProg3 status, see the <a href="#">KitProg3 user guide</a> .
5.	512-Mb serial NOR flash memory (S25HL512TFAMHI010 , U9)	Connected to the SMIF of the TRAVEO™ T2G-B-H MCU. The NOR flash device can be used for both data and code memory with eExecute-in-Place (XIP) support and encryption.
6.	KitProg3 programming mode selection button (SW3)	Use this button to switch between various modes of operation of KitProg3. Note that this board supports only CMSIS-DAP BULK mode. For more details, see the <a href="#">KitProg3 user guide</a> . This button function is reserved for future use.
7.	VBAT power selection jumper (J8)	Use this jumper to select the VBAT supply for the module that is provided from the TRAVEO™ T2G-B-H evaluation kit, which is 3.3 V/3.6 V selectable depending on the M.2 radio module being used.
8.	T2G-B-H VTARG current measurement jumper (J15)	Connect an ammeter to this jumper to measure the current consumed by the T2G-B-H_VDD power domain of the MCU.
9.	T2G-B-H VDDIO2 current measurement jumper (J12)	J12 connects MCU VDDIO2 to T2G-B-H_VDD which is the outcome of J10 (VCC_3V3 or VCC_5V0) power supply selection.
10.	System power (VTARG) selection jumper (J10)	J10 is a three-pin voltage selection header to select between VCC_3V3 or VCC_5V0 voltages.
11.	T2G-B-H 20-pin debug and trace header (J17)*	Connect to an Embedded Trace Macrocell (ETM)-compatible programmer/debugger. This is not loaded by default.
12.	T2G-B-H 10-pin SWD/JTAG program and debug header (J16)	This 10-pin header allows you to program and debug the TRAVEO™ T2G-B-H MCU using an external programmer such as MiniProg4. In addition, an external PSoC™ 4, PSoC™ 5LP, or TRAVEO™ T2G MCU devices can be connected to this header and programmed using KitProg3.
13.	T2G-B-H target I/O current measurement jumper (J14)	Connect an ammeter to this jumper to measure the current consumed by the TRAVEO™ T2G MCU I/O (VDDIO1, VDDIO3, and VDDIO4).
14.	T2G-B-H reset button (SW1)	Resets TRAVEO™ T2G-B-H MCU. It connects the TRAVEO™ T2G-B-H MCU reset (XRES) pin to the ground.

**Kit operation**

Sl. No.	Peripheral	Description
15.	Potentiometer (R105)	10-kΩ potentiometer connected to TRAVEO™ T2G-B-H MCU pin P6[6]. It can be used to simulate a sensor output to TRAVEO™ T2G-B-H MCU.
16.	Potentiometer connection jumper (J18)	Connects the TRAVEO™ T2G-B-H MCU VDDA supply to the potentiometer.
17.	T2G-B-H extended I/O headers (J29, J30, J31, J32)*	These headers provide connectivity to TRAVEO™ T2G-B-H MCU GPI/Os that are not connected to the headers compatible with Arduino. Few of these pins are multiplexed with onboard peripherals and are not connected to the TRAVEO™ T2G-B-H MCU by default. These connectors are not populated by default.
18.	M.2 I/O power selection jumper (J27)	Use this jumper to select the M.2 I/O supply for the module that is provided from the TRAVEO™ T2G-B-H evaluation kit, which is 1.8 V/3.3 V selectable.
19.	Power header compatible with Arduino Uno R3 (J1)	Powers the shields compatible with Arduino. It also has a provision to power the kit through the VIN input.
20.	Analog-IN header compatible with Arduino Uno R3 (J2)	Bring out pins from TRAVEO™ T2G-B-H MCU to interface with shields compatible with Arduino. Some of these pins are multiplexed with onboard peripherals and are not connected to TRAVEO™ T2G-B-H MCU by default. For detailed information on how to rework the kit to access these pins, see <a href="#">Table 3</a> .
21.	SMIF dual header compatible with Digilent Pmod (J21, J22)	The connectors are designed as per SMIF dual header compatible with Digilent Pmod to validate the HYPERFLASH™ memory interface. These connectors are not populated by default.
22.	T2G-B-H user buttons (SW2, SW4)	Provide input to TRAVEO™ T2G-B-H MCU. Note that by default the button connects the TRAVEO™ T2G-B-H MCU pin to the ground when pressed, so you need to configure the TRAVEO™ T2G-B-H MCU pin as a digital input with resistive pull-up for detecting the button press. SW2 buttons also provide a wake-up source from hibernate mode of the device.
23.	T2G-B-H user LEDs (LED1, LED2, LED3)	The user LEDs can operate at the entire operating voltage range of the TRAVEO™ T2G-B-H MCU. The LEDs are active LOW, so the pins must be driven to the ground to turn ON the LEDs.
24.	M.2 stand-off (MT1)	Stand-off interface to M.2 module.
25.	M.2 interface connector (J25)	M.2 E-Key socket to interface compatible AIROC™ Wi-Fi & Bluetooth® combo M.2 radio modules like the Sterling-LWB5+ M.2 module from Laird Connectivity.
26.	T2G-B-H microcontroller (U1)	TRAVEO™ T2G MCU device used on the kit.
27.	VBAT current measurement jumper (J28)	Connect an ammeter to this jumper to measure the current consumed by M.2 module.
28.	VBAT current measurement jumper (J28)	RJ45 Ethernet connector port to connect the kit to the Ethernet network.

## Kit operation

Sl. No.	Peripheral	Description
29.	Ethernet physical layer (PHY) transceiver (U22)	Ethernet PHY for connecting Ethernet network.
30.	25-MHz crystal for Ethernet transceiver (Y3)	Oscillator for the Ethernet PHY.
31.	125-MHz crystal for Ethernet transceiver (Y4)	Oscillator for the Ethernet PHY.
32.	CAN FD resistor termination jumper (J20)	Install jumper to enable terminator resistor for another CAN FD transceiver IFX1051SJ in place of U8. Along with the jumper C187 and R199 components must be installed and two resistors R196 and R315 removed. <b>(R199 is active by default, and J20 is closed by default)</b>
33.	CAN FD interface connector (J19)	Connector to connect the kit to the CAN / CAN FD network.
34.	CAN FD transceiver (U8)	CAN FD transceiver.
35.	Digital I/O headers compatible with Arduino Uno R3 (J3, J4)	Bring out pins from TRAVEO™ T2G-B-H MCU to interface with shields compatible with Arduino. Some of these pins are multiplexed with onboard peripherals and are not connected to TRAVEO™ T2G-B-H MCU by default. For detailed information on how to rework the kit to access these pins, see <a href="#">Table 3</a> .
36.	KitProg3 (PSoC™ 5LP) programmer and debugger (CY8C5868LTI-LP039, U2)	The PSoC™ 5LP device (CY8C5868LTI-LP039) serving as KitProg3, is a multi-functional system, which includes an SWD programmer, debugger, USB-I2C bridge, and USB-UART bridge. For more details, see the <a href="#">KitProg3 user guide</a> .

See [4.2 Hardware functional description](#) for details on various hardware blocks.

### 3.2 M.2 wireless connectivity module (Support not available)

The TRAVEO™ T2G-B-H evaluation kit provides the option to connect AIROC™ Wi-Fi & Bluetooth® combo radio modules to the M.2 interface connector on the board. The combination of TRAVEO™ T2G-B-H host MCU and radio module enables you to evaluate Wi-Fi/Bluetooth® IoT applications. The M.2 radio module is not required if your application does not require Wi-Fi/Bluetooth® connectivity.

For some M.2 radio modules, it is required to connect an external antenna certified by the module vendor. The Sterling-LWB5+ M.2 module from Laird Connectivity provided with this kit requires an external antenna. Connect the FlexPIFA antenna from Laird Connectivity provided with this kit.

### 3.3 BSP selection

The TRAVEO™ T2G-B-H evaluation kit comes with a KIT\_T2G-B-H\_EVK board support package (BSP) to build and run code examples on the kit by following the instructions given in the **Board Support Packages** section of the [ModusToolbox™ user guide](#).



## Kit operation

### 3.4 KitProg3: Onboard programmer/debugger

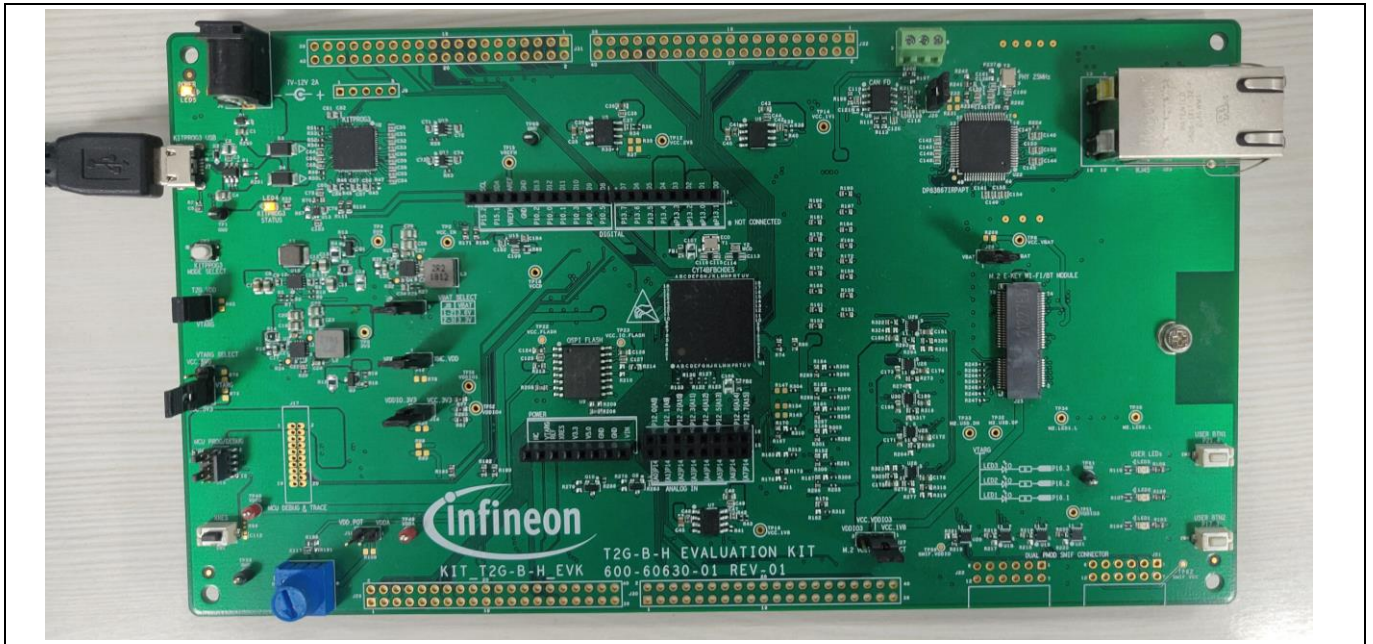
The TRAVEO™ T2G-B-H evaluation board can be programmed and debugged using the onboard KitProg3. KitProg3 is an onboard programmer/debugger with USB-UART, USB-I2C, and USB-SPI Bridge (not supported on this board) functionality. KitProg3 supports CMSIS-DAP only and does not support mass storage. A PSoC™ 5LP device is used to implement the KitProg3 functionality. For more details on the KitProg3 functionality, see the [KitProg3 user guide](#).

#### 3.4.1 Programming and debugging using ModusToolbox™ software

1. Connect the board to the PC using the provided USB cable through the KitProg3 USB connector, as shown in [Figure 8](#). It enumerates as a USB Composite Device if you are connecting it to your PC for the first time.
2. KitProg3 on this kit supports CMSIS-DAP Bulk mode (default) and CMSIS-DAP Bulk with two UARTs. The status LED (amber) is always ON in the CMSIS-DAP Bulk mode. If you do not see the desired LED status, see the [KitProg3 user guide](#) for details on the KitProg3 status and troubleshooting instructions.

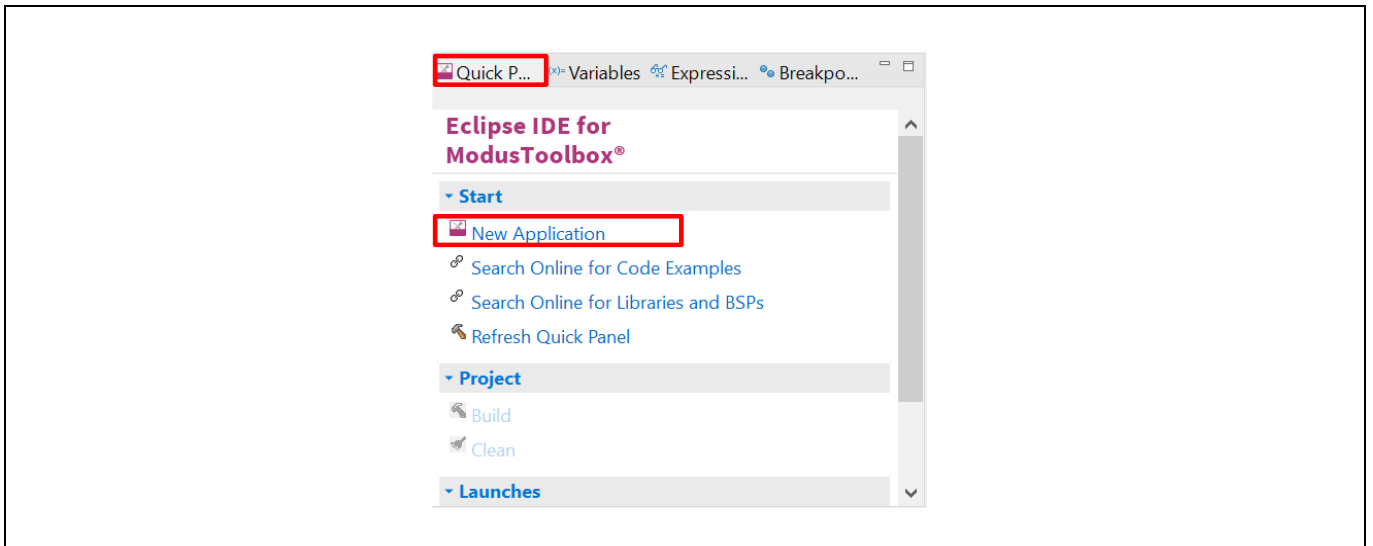
*Note: The programming can be done in either of the KitProg3 programming modes but it is recommended to program the kit in CMSIS-DAP Bulk mode.*

## Kit operation



**Figure 8** Connect USB cable to USB connector on the board

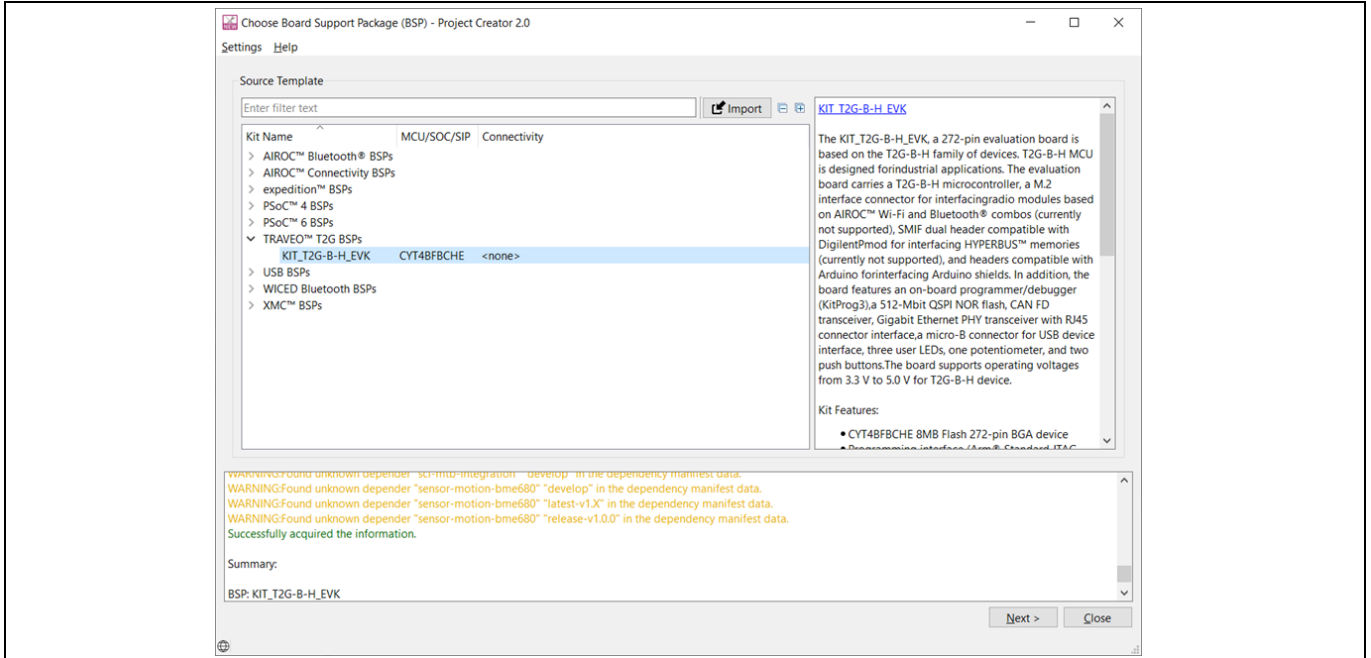
3. In the Eclipse IDE for ModusToolbox™ software, import the desired code example (application) into a new workspace.
  - a) Click on **New Application** from **Quick Panel**.



**Figure 9** Create new application

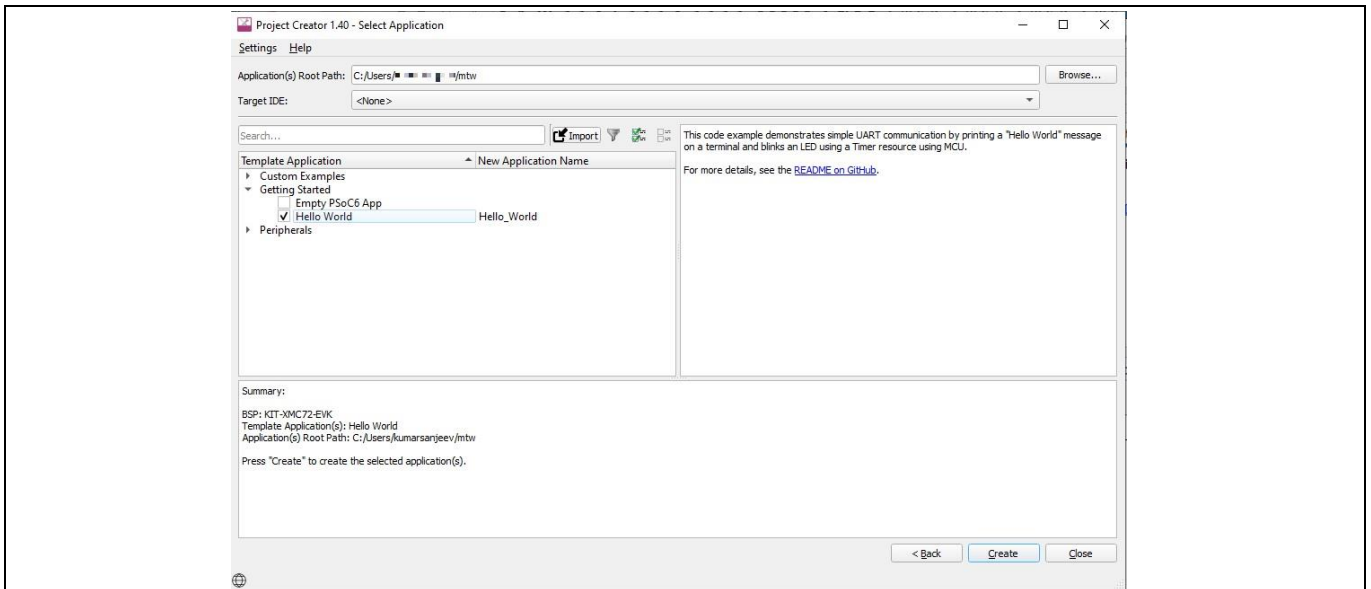
**Kit operation**

- b) Select the BSP in the “Choose Board Support Package (BSP)” window and click **Next**. As noted in section **3.3 BSP selection**, the BSP selection should be based on the combination of baseboard and radio module used. The rest of the steps assumes there is no radio module connected to the baseboard and uses the KIT\_T2G-B-H\_EVK BSP for the sake of explanation.



**Figure 10** Creating a new application: Choose Board Support Package (BSP)

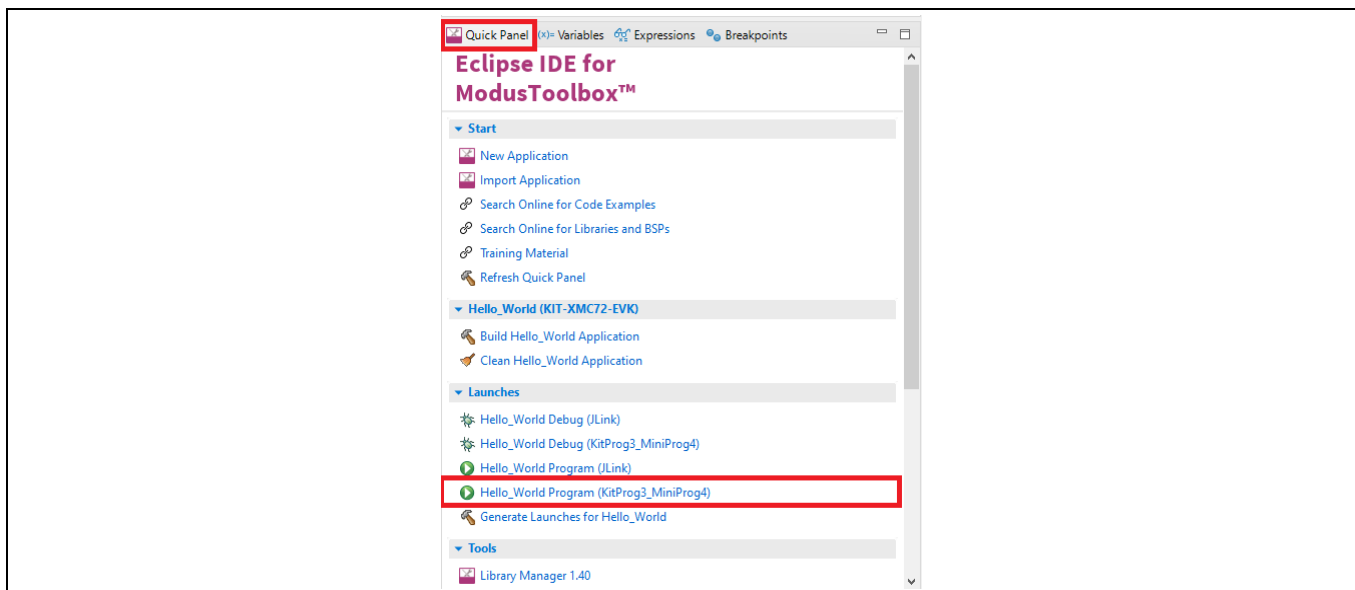
- c) Select the application in the “Select Application” window and click **Create**.



**Figure 11** Creating a new application: select application

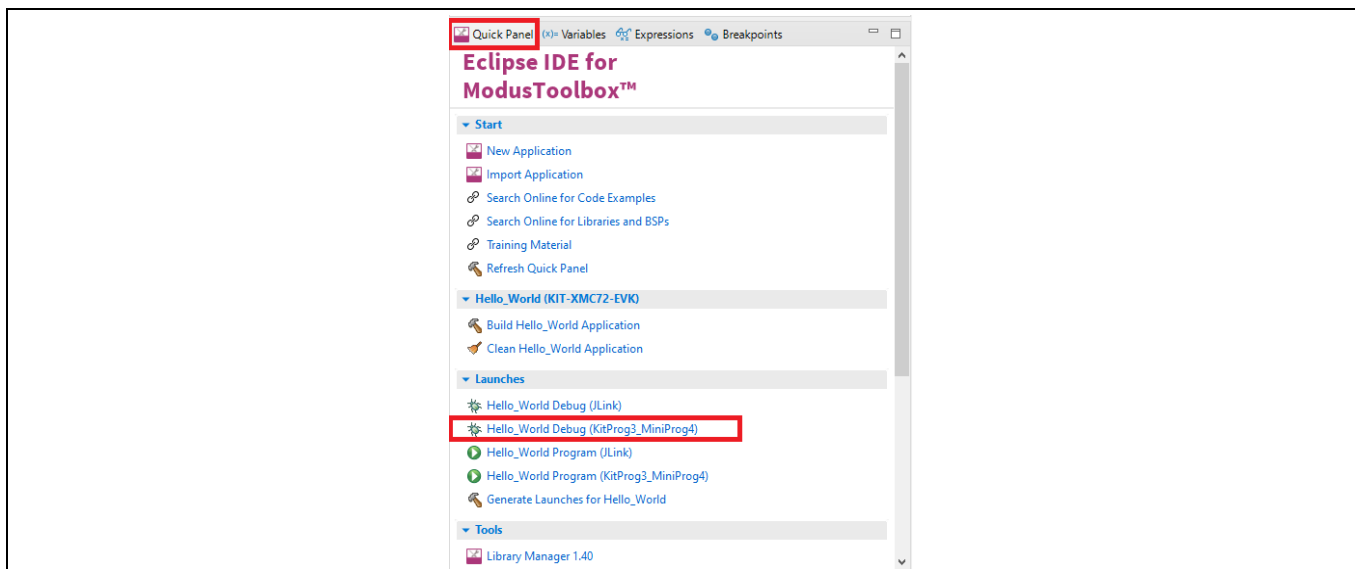
**Kit operation**

- To build and program a TRAVEO™ T2G-B-H MCU application, in the Project Explorer, select **<App\_Name>** project. In the Quick Panel, scroll to the Launches section and click the **<App\_Name> Program (KitProg3\_MiniProg4)** configuration as shown in **Figure 12**.



**Figure 12 Programming in ModusToolbox™ software**

- ModusToolbox™ software has an integrated debugger. To debug a TRAVEO™ T2G-B-H MCU application, in the Project Explorer, select **<App\_Name>** project. In the Quick Panel, scroll to the **Launches** section and click the **<App\_Name> Debug (KitProg3\_MiniProg4)** configuration as shown in **Figure 13**. For more details, see the “Program and debug” section in the **Eclipse IDE for ModusToolbox™ user guide**.



**Figure 13 Debugging in ModusToolbox™ software**

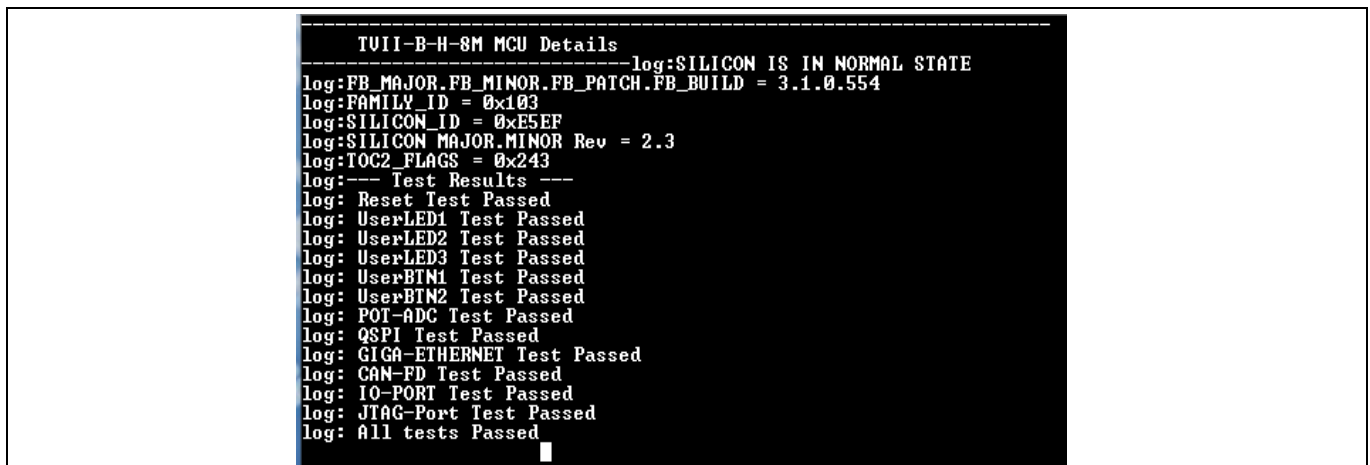
Kit operation

3.4.1.1 Using the OOB example – TRAVEO™ T2G-B-H MCU

The TRAVEO™ T2G-B-H evaluation board is by default programmed with the code example: *TRAVEO™ T2G-B-H MCU: OOB demo*. The following steps describe how to use the example. For a detailed description of the project refer to the example’s README.md file in the GitHub repository. The README.md file is also in the application directory once the application is created.

*Note: At any point in time, if you overwrite the OOB demo example, you can restore it by programming the TRAVEO™ T2G-B-H MCU: OOB demo.*

1. Connect the board to your PC using the provided USB cable through the KitProg3 USB connector.
2. Open a terminal program and select the KitProg3 COM port. Set the serial port parameters to 8N1 and 115200 baud. **Figure 14** shows COM16 but your port will likely be different.
3. Press the reset button (SW1) on the board and confirm that the terminal application displays the code example title and other text as **Figure 14** shows.



**Figure 14** OOB demo project message in the terminal

4. Confirm that the User LEDs blink one after the other.
5. This example shows the silicon details and test summary of all the on-board interfaces.

Kit operation

3.4.2 USB-UART bridge

KitProg3 on the TRAVEO™ T2G-B-H evaluation board can act as a USB-UART bridge.

The UART Rx and Tx pins of KitProg3 are connected to the TRAVEO™ T2G-B-H MCU UART pins as follows:

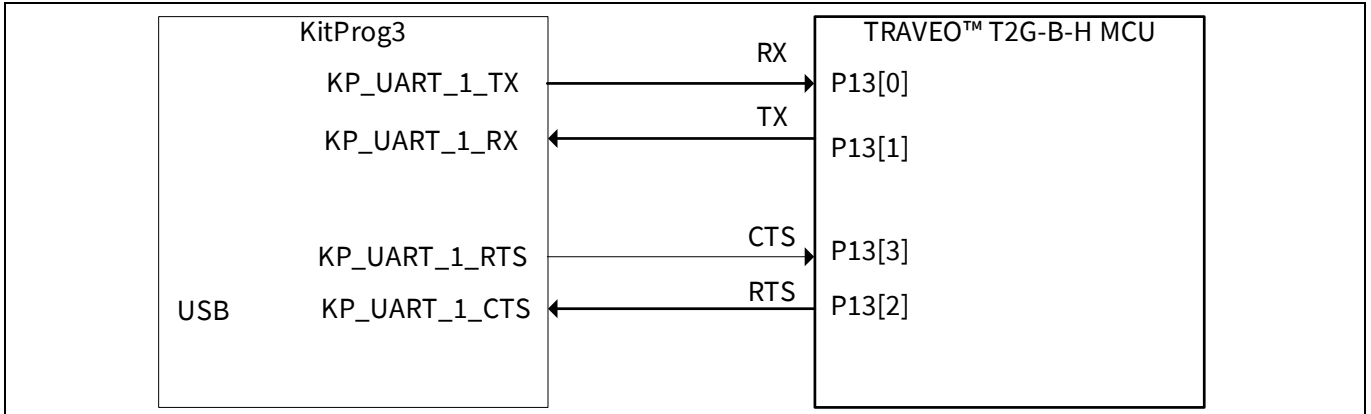


Figure 15 UART connection between KitProg3 and TRAVEO™ T2G-B-H MCU

Figure 16 shows the secondary UART connection between the AIROC™ Wi-Fi & Bluetooth® combo-based M.2 module and KitProg3. These wires are not connected to the board by default. See the [Serial interconnection between PSoC™ 5LP and M.2 interface](#) section to see how to re-work the board to connect KitProg3 USB-UART bridge with AIROC™ Wi-Fi & Bluetooth® combo-based M.2 module.

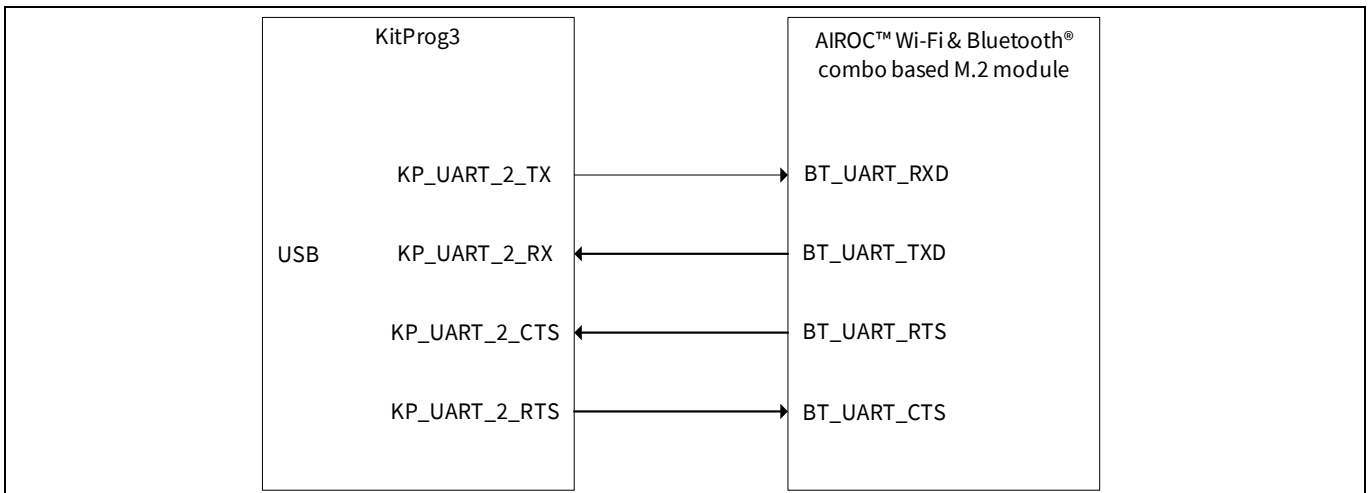


Figure 16 UART connection between KitProg3 and AIROC™ Wi-Fi & Bluetooth® combo-based M.2 module

For more details on the KitProg3 USB-UART functionality, see the [KitProg3 user guide](#).

Kit operation

3.4.3 USB-I2C bridge

The KitProg3 can function as a USB-I2C bridge and communicate with an I2C master such as a Bridge Control Panel (BCP). The I2C lines on the TRAVEO™ T2G-B-H MCU are hard-wired on the board to the I2C lines of the KitProg3, with onboard pull-up resistors. The USB-I2C supports I2C speeds of 50 kHz, 100 kHz, 400 kHz, and 1 MHz. For more details on the KitProg3 USB-I2C functionality, see the [KitProg3 user guide](#).

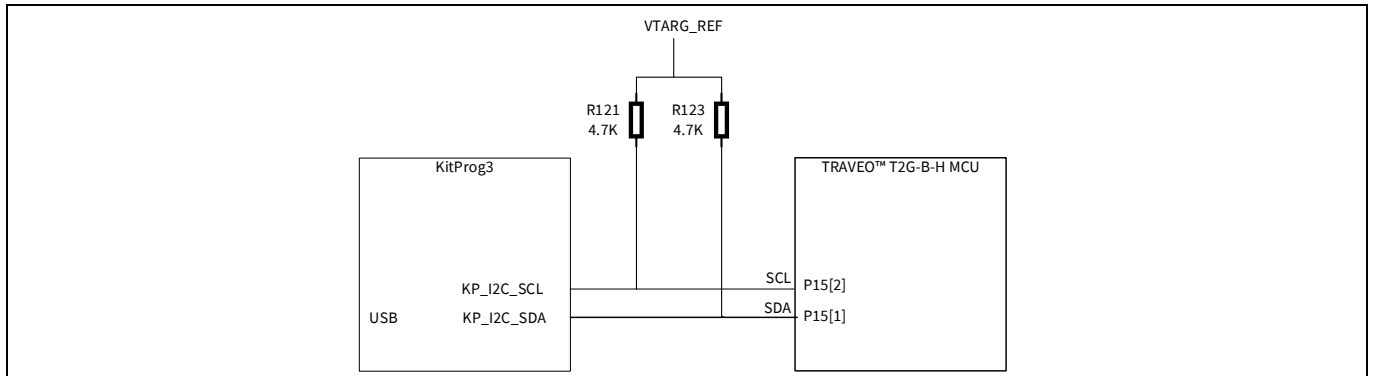


Figure 17 I2C connection between KitProg3 and TRAVEO™ T2G-B-H MCU

Hardware

# 4 Hardware

## 4.1 Schematics

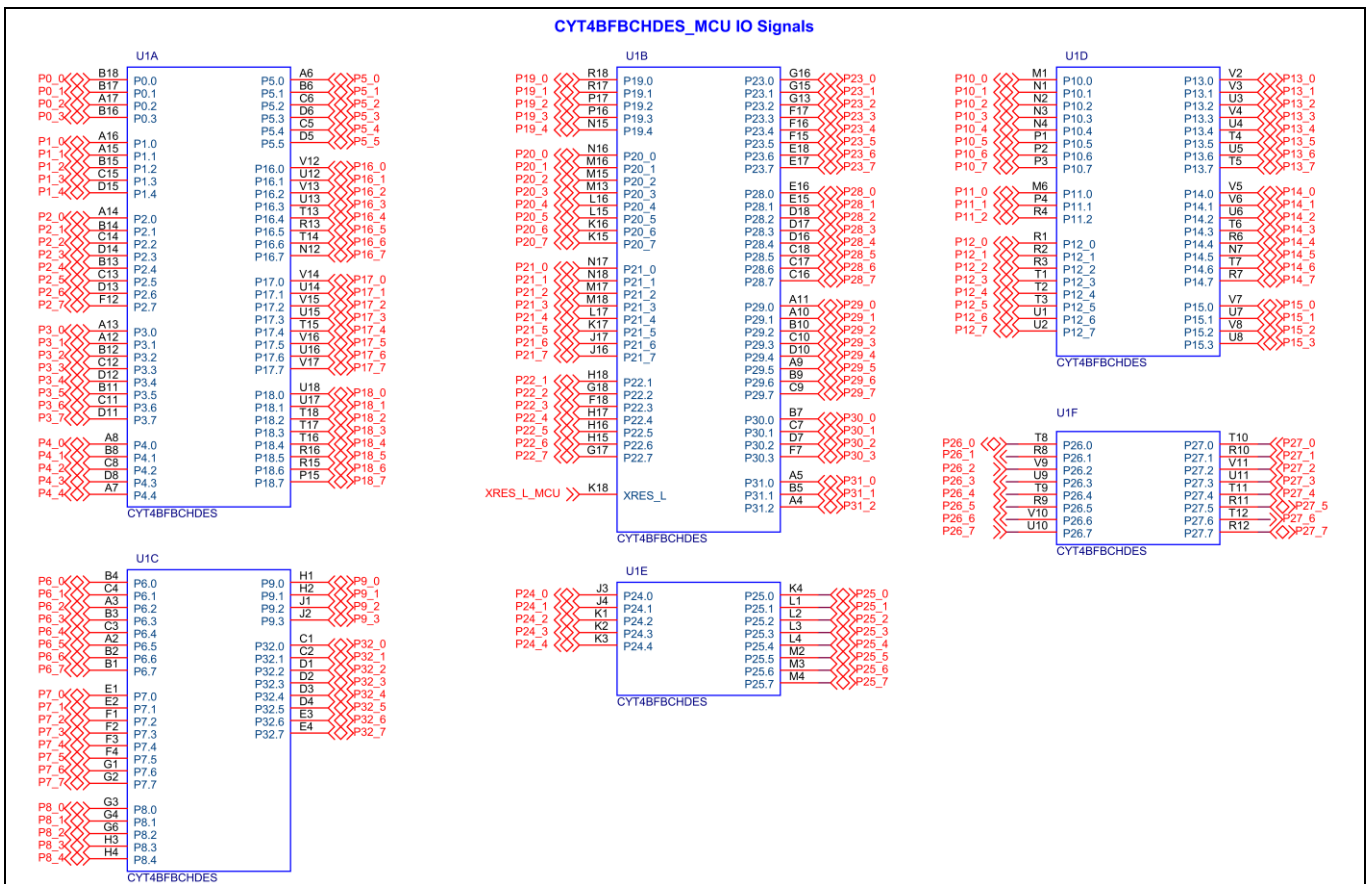
See the schematic files available on the [kit webpage](#).

## 4.2 Hardware functional description

### 4.2.1 TRAVEO™ T2G-B-H MCU (U1)

TRAVEO™ T2G-B-H is a family of TRAVEO™ T2G-B-H microcontrollers targeted at industrial applications. TRAVEO™ T2G-B-H has two Arm® Cortex®-M7 CPUs for primary processing, and an Arm® Cortex®-M0+ CPU for peripheral and security processing. These devices contain embedded peripherals supporting Controller Area Network with Flexible Data rate (CAN FD) and Gigabit Ethernet. TRAVEO™ T2G-B-H devices are manufactured on an advanced 40-nm process. TRAVEO™ T2G-B-H incorporates Infineon’s low-power flash memory, multiple high-performance analog and digital peripherals, and enables the creation of a secure computing platform.

For more information, see the [TRAVEO™ T2G-B-H MCU datasheet](#).





Hardware

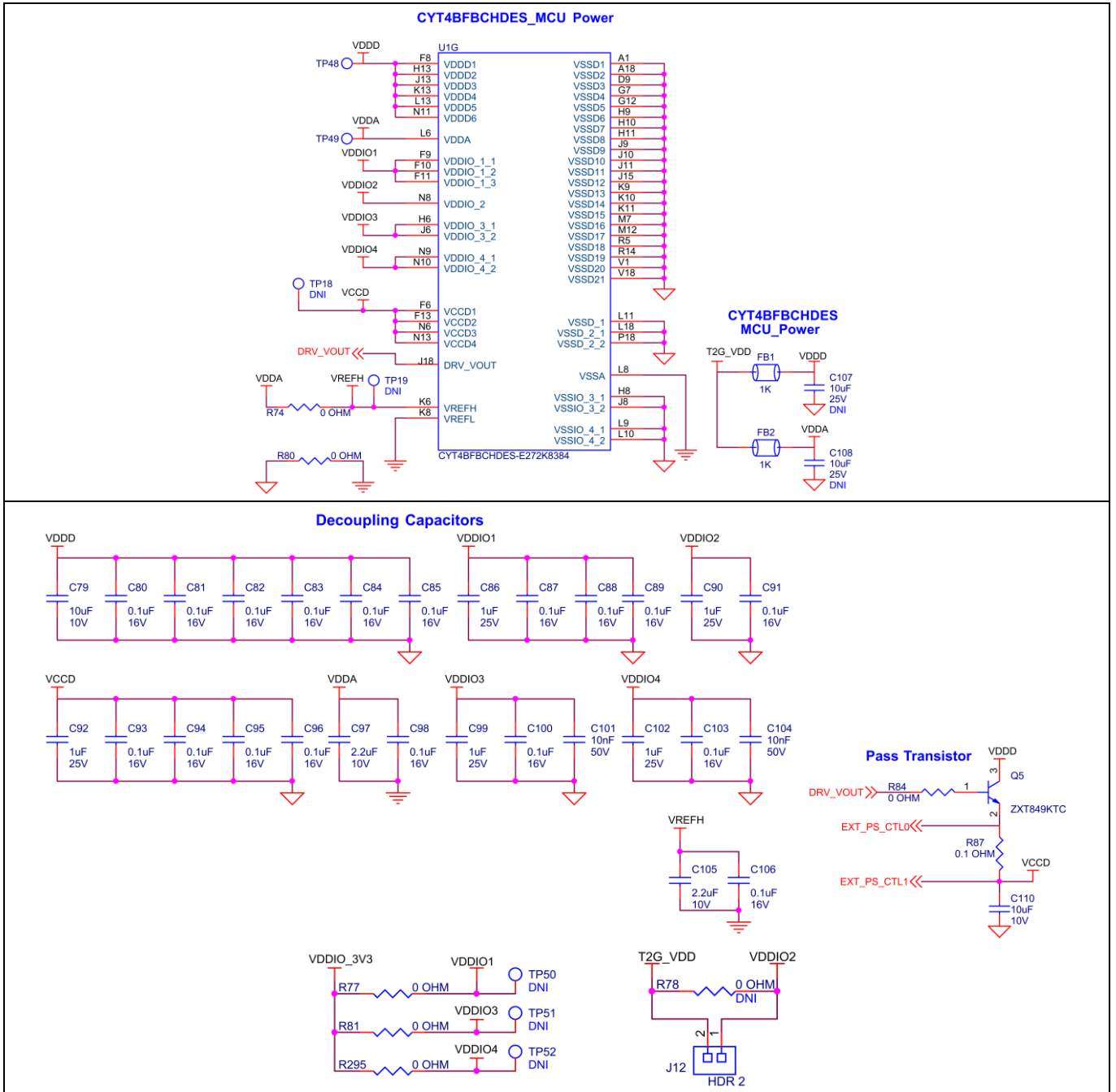


Figure 18 TRAVEO™ T2G-B-H MCU

Hardware

4.2.2 M.2 interface connector (J25)

The M.2 E-key connector adds radio connectivity to TRAVEO™ T2G-B-H MCU as required. The M.2 E-key radio module, compatible with Infineon M.2 connector pin mapping, can be interfaced with the TRAVEO™ T2G-B-H evaluation kit using SDIO for WLAN and UART for Bluetooth®. The VBAT supply for the module is provided from the TRAVEO™ T2G-B-H evaluation kit, which is 3.3 V/3.6 V selectable depending on the M.2 radio module being used. Refer to the appropriate M.2 radio module datasheet for valid operating voltage.

**Table 5 Infineon M.2 connector pin mapping**

Group	Signal name	M.2 connector pin
WLAN interface	SDIO_CLK	9
	SDIO_CMD	11
	SDIO_DATA0	13
	SDIO_DATA1	15
	SDIO_DATA2	17
	SDIO_DATA3	19
	WL_HOST_WAKE	21
	WL_REG_ON	56
	WL_DEV_WAKE	66
Bluetooth® interface	BT_UART_TXD	22
	BT_UART_RXD	32
	BT_UART_RTS	34
	BT_UART_CTS	36
	BT_HOST_WAKE	20
	BT_DEV_WAKE	42
	BT_REG_ON	54
Clock	LPO_IN	50
	*Not connected by default	
Power	VBAT	2, 4, 72, 74
	WL_VDDIO	64
	*Not connected by default	

Note: Some modules from Laird Connectivity like Sterling-LWB5+ do not follow the Infineon M.2 interface standard. For such modules, use the resistor settings mentioned in [Table 6](#).

**Table 6 Pin mapping for Sterling LWB5+ M.2 module from Laird Connectivity**

Signal name	Infineon M.2 connector pin (populate R302)	Laird M.2 connector pin (populate R303)
WL_DEV_WAKE	66	42
BT_DEV_WAKE	42	40

Hardware

There are additional optional signals which may not be present in all modules. See schematics for more details.

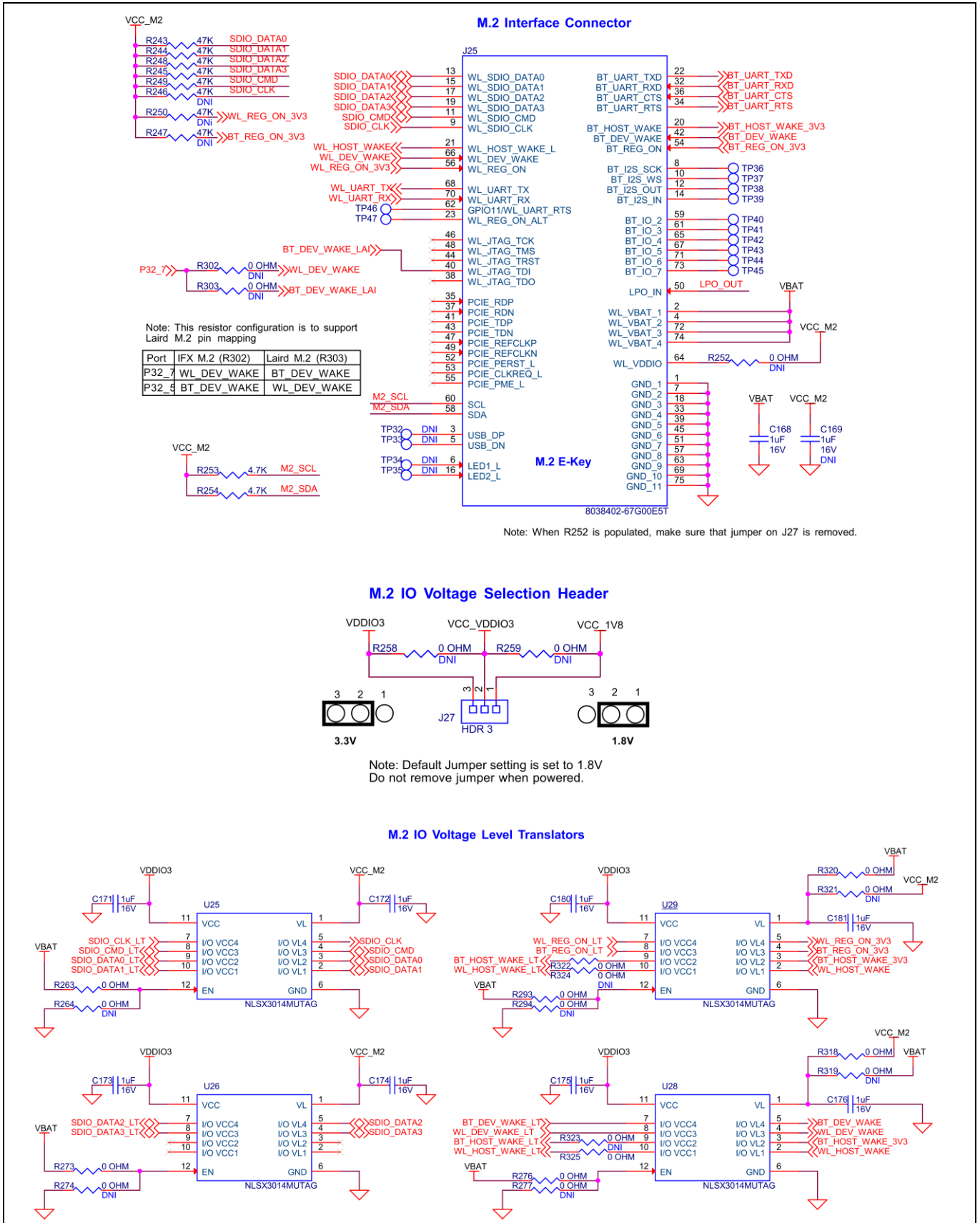


Figure 19 M.2 interface connector

Hardware

4.2.3 PSoC™ 5LP-based KitProg3 (U2)

An onboard PSoC™ 5LP (CY8C5868LTI-LP039) is used as KitProg3 to program and debug TRAVEO™ T2G-B-H MCU. The PSoC™ 5LP device connects to the USB port of a PC through a USB connector and to the SWD and other communication interfaces of TRAVEO™ T2G-B-H MCU.

Visit the [PSoC™ 5LP web page](#) and see the [CY8C58LPxx family datasheet](#) for more information.

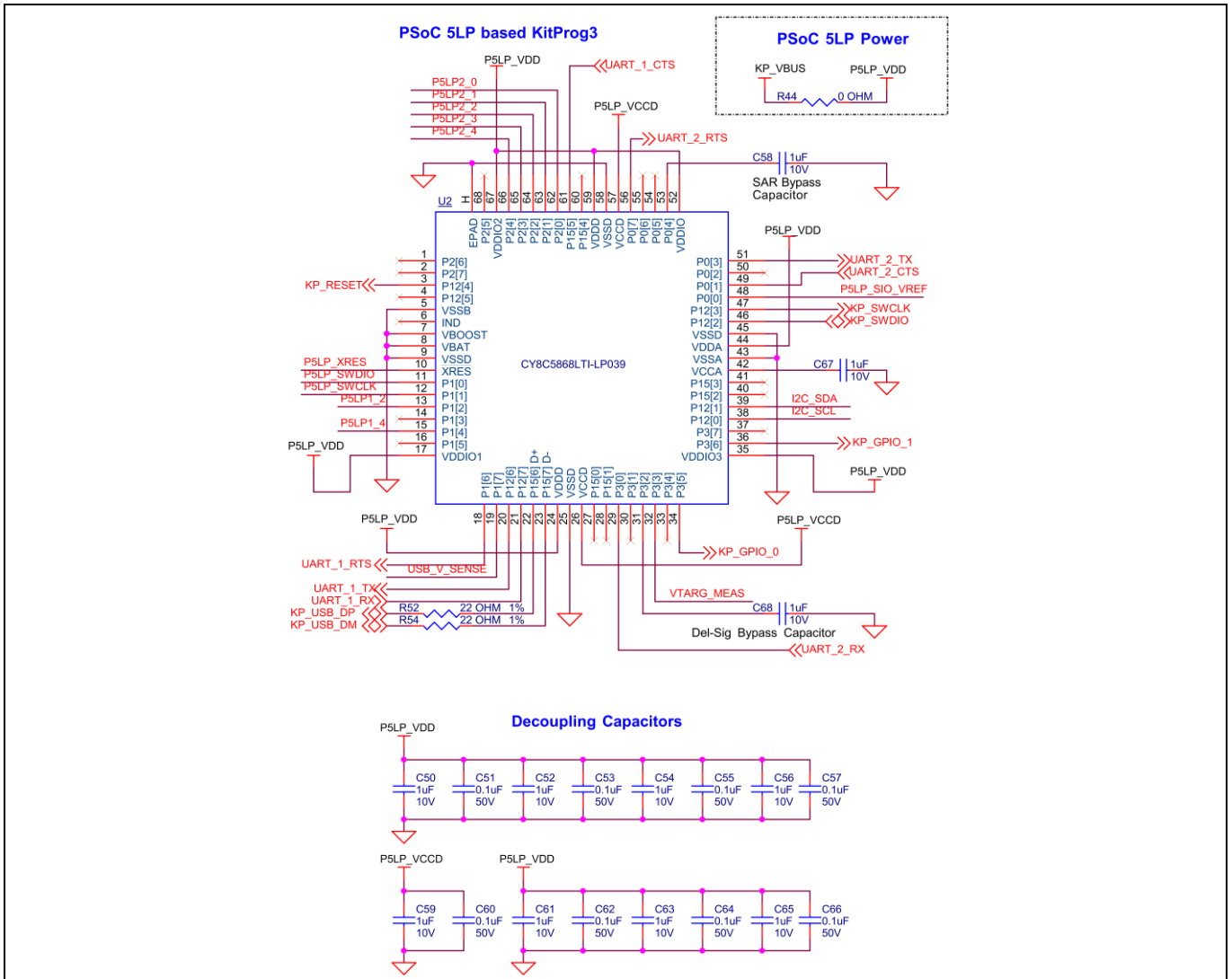


Figure 20 PSoC™ 5LP-based KitProg3 (U2)

Hardware

4.2.4 Serial interconnection between PSoC™ 5LP and TRAVEO™ T2G-B-H MCU

In addition, to use as an onboard programmer, the PSoC™ 5LP device functions as an interface for USB-UART and USB-I2C bridges, as shown in **Figure 21**. The USB-Serial pins of the PSoC™ 5LP device are hard-wired to the I2C/UART pins of the TRAVEO™ T2G-B-H MCU device. These pins are also available on the I/O headers compatible with Arduino Uno R3.

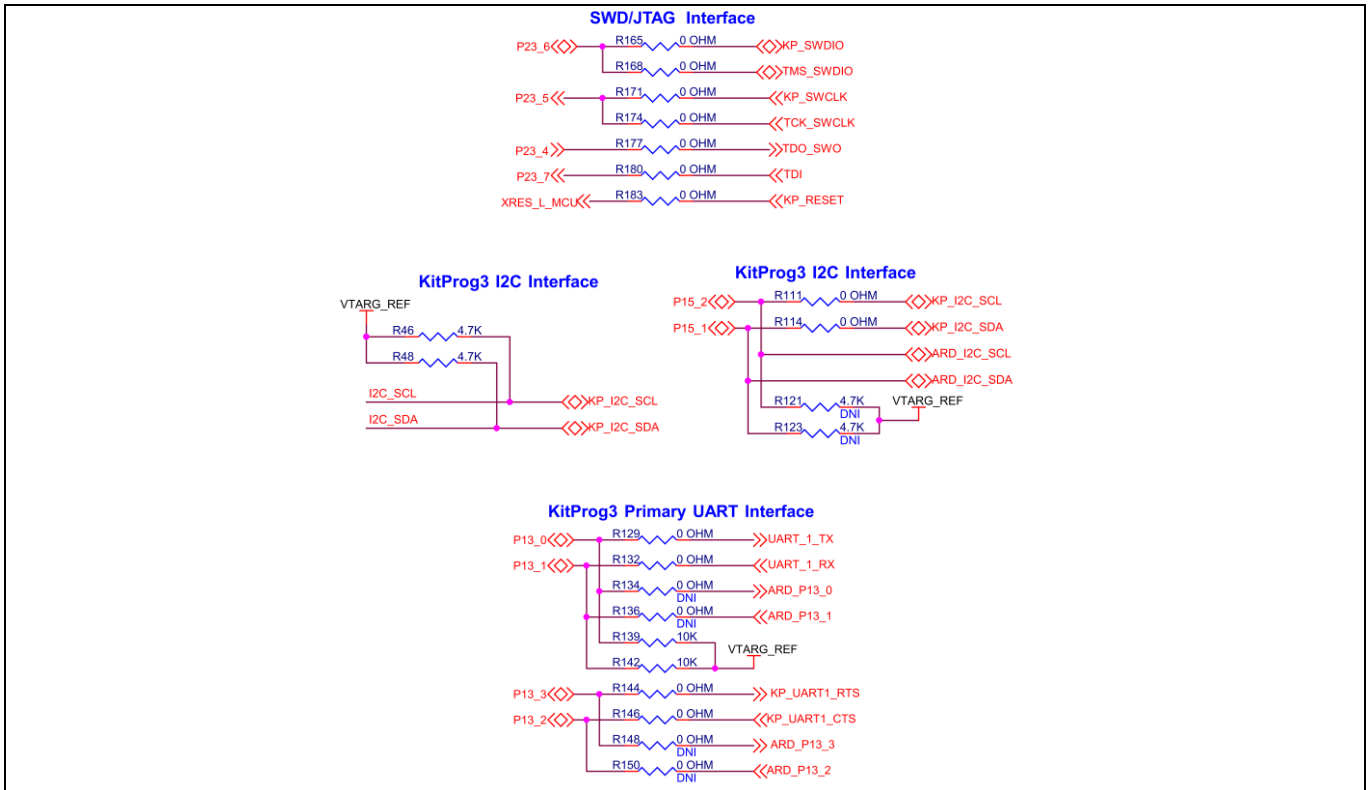


Figure 21 Programming and serial interface connections

Hardware

4.2.5 Serial interconnection between PSoC™ 5LP and M.2 interface

The PSoC™ 5LP device also has a secondary UART that is connected to BT\_UART of M.2 interface.

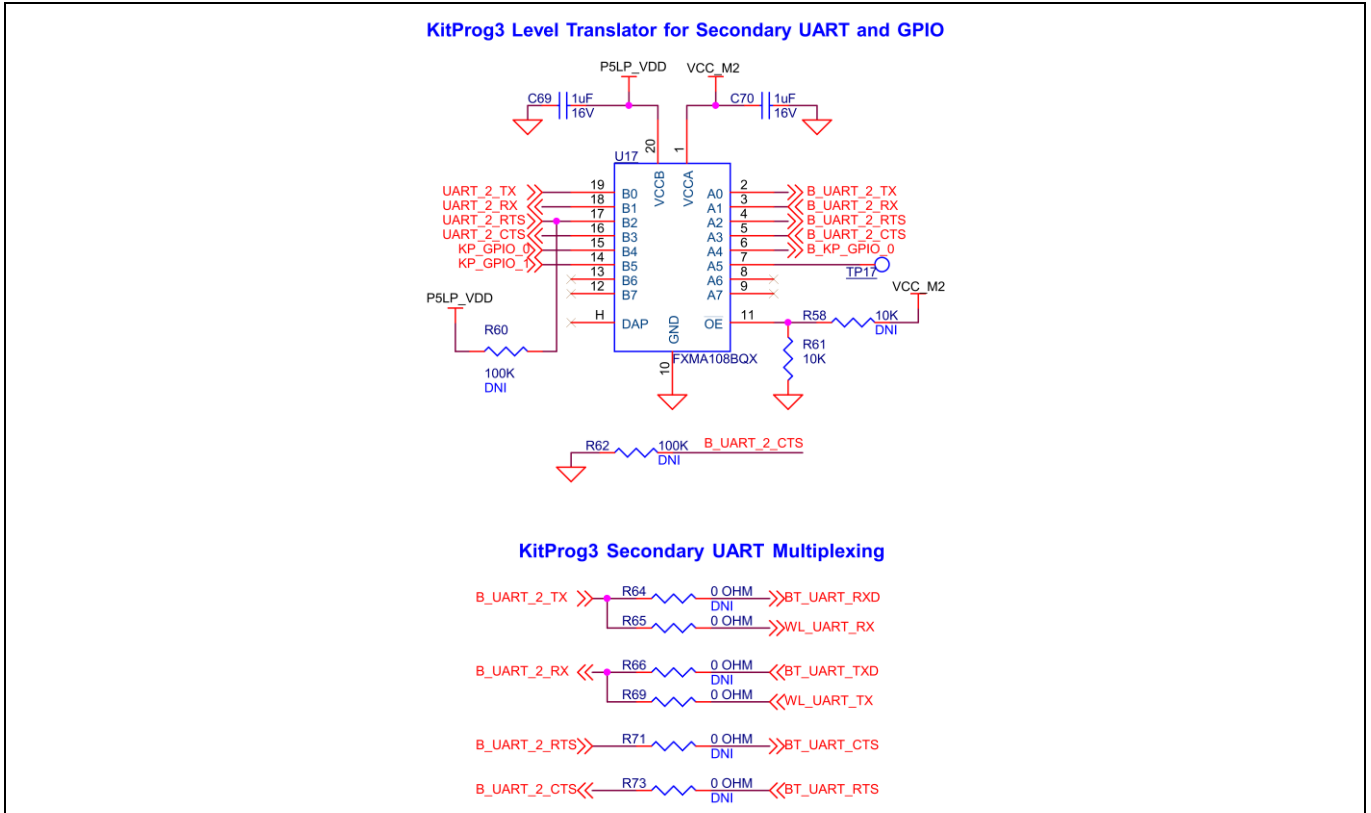


Figure 22 Serial interconnection between PSoC™ 5LP and M.2 interface

Hardware

4.2.6 Power supply system

The power supply system on this board is versatile, allowing the input supply to come from the following sources:

- 5 V from the onboard USB Micro-B connectors (**J7**)
- 7 V–12 V from an external power supply through the VIN barrel jack (**J6**) or from a shield compatible with Arduino

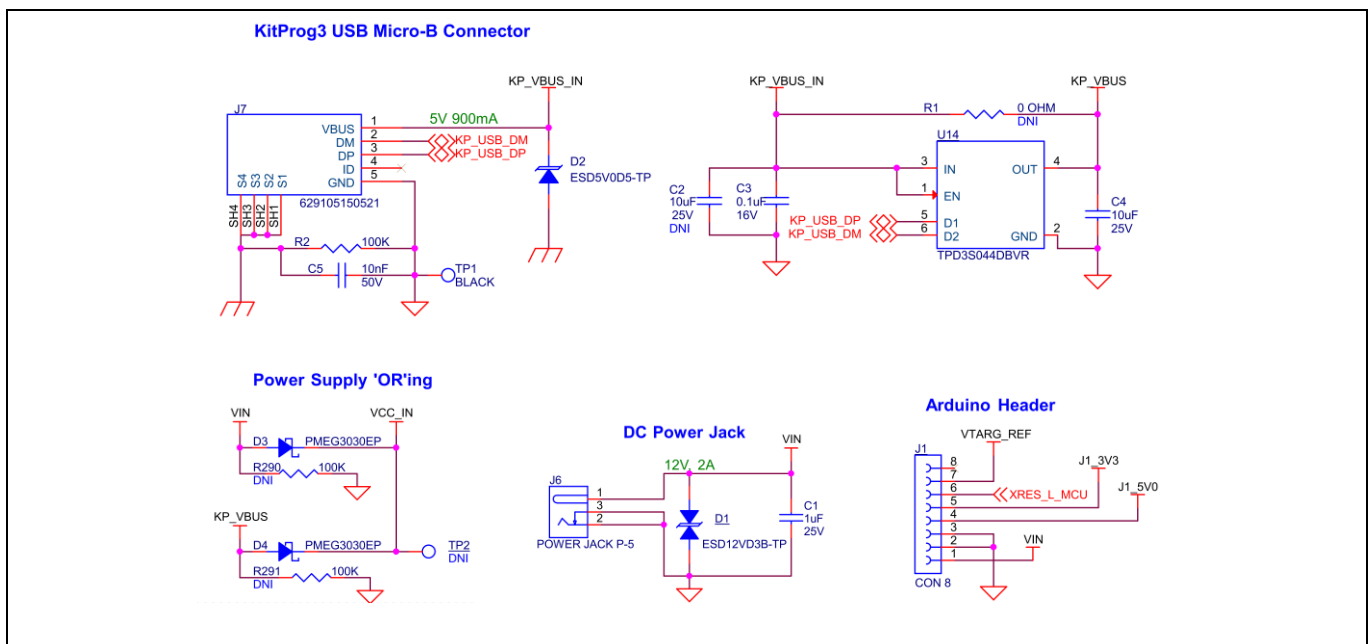


Figure 23 Power supply input and ORing

4.2.6.1 Voltage regulators

The power supply system is designed for the following voltage configurations:

**VBAT , VCC\_M2 (M.2 Interface)** – 3.6 V, 3.3 V, and 1.8 V

**VDDIO1, VDDIO3, and VDDIO4 (TRAVEO™ T2G-B-H MCU)** – 3.3 V

**VDDD, VDDA, VDDIO2, VREFH (TRAVEO™ T2G-B-H MCU)** – 3.3 V and 5 V

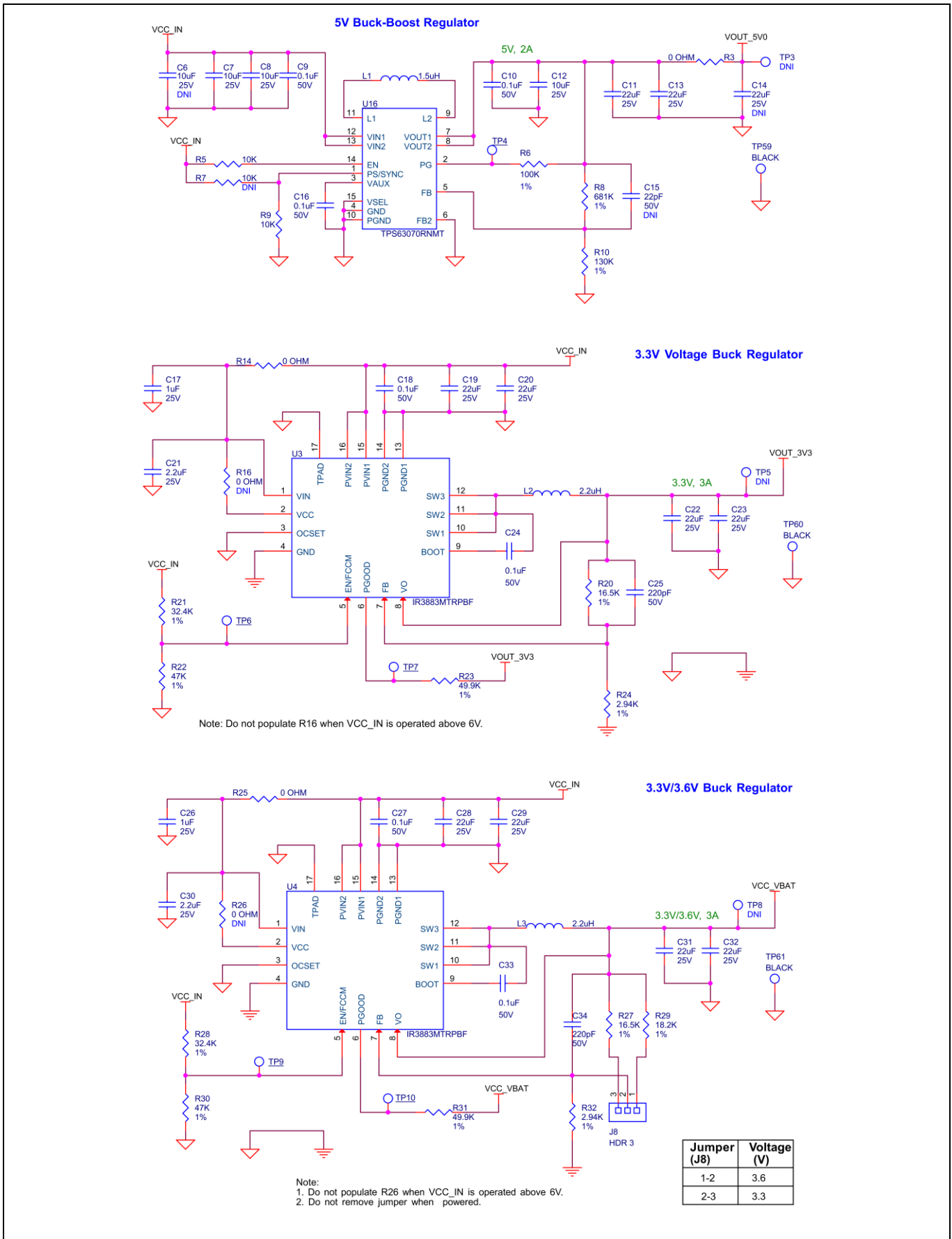
**VCC\_1V1, VCC\_2V5, VCC\_1V8 (Ethernet PHY)** – 1.1 V, 1.8 V, and 2.5 V

Some configurations may not be possible by changing jumper positions but rather requires rework of the respective 0-ohm resistors.

VCC\_M2 must be at the same voltage as the M.2 radio module I/O voltage because it powers the SDIO and UART interfaces between TRAVEO™ T2G-B-H MCU and the radio. If the VCC\_M2 voltage is not the same as the M.2 radio I/O voltage, it can cause an improper function or may even damage the radio module.

A buck-boost regulator **U16** is used on the kit to generate stable 5 V output. There are two buck regulators **U3** and **U4** that are used to generate 3.3 V and 3.6 V. Three LDOs (**U5, U6, and U7**) are designed to generate 2.5 V, 1.1 V, and 1.8 V outputs respectively.

Hardware





Hardware

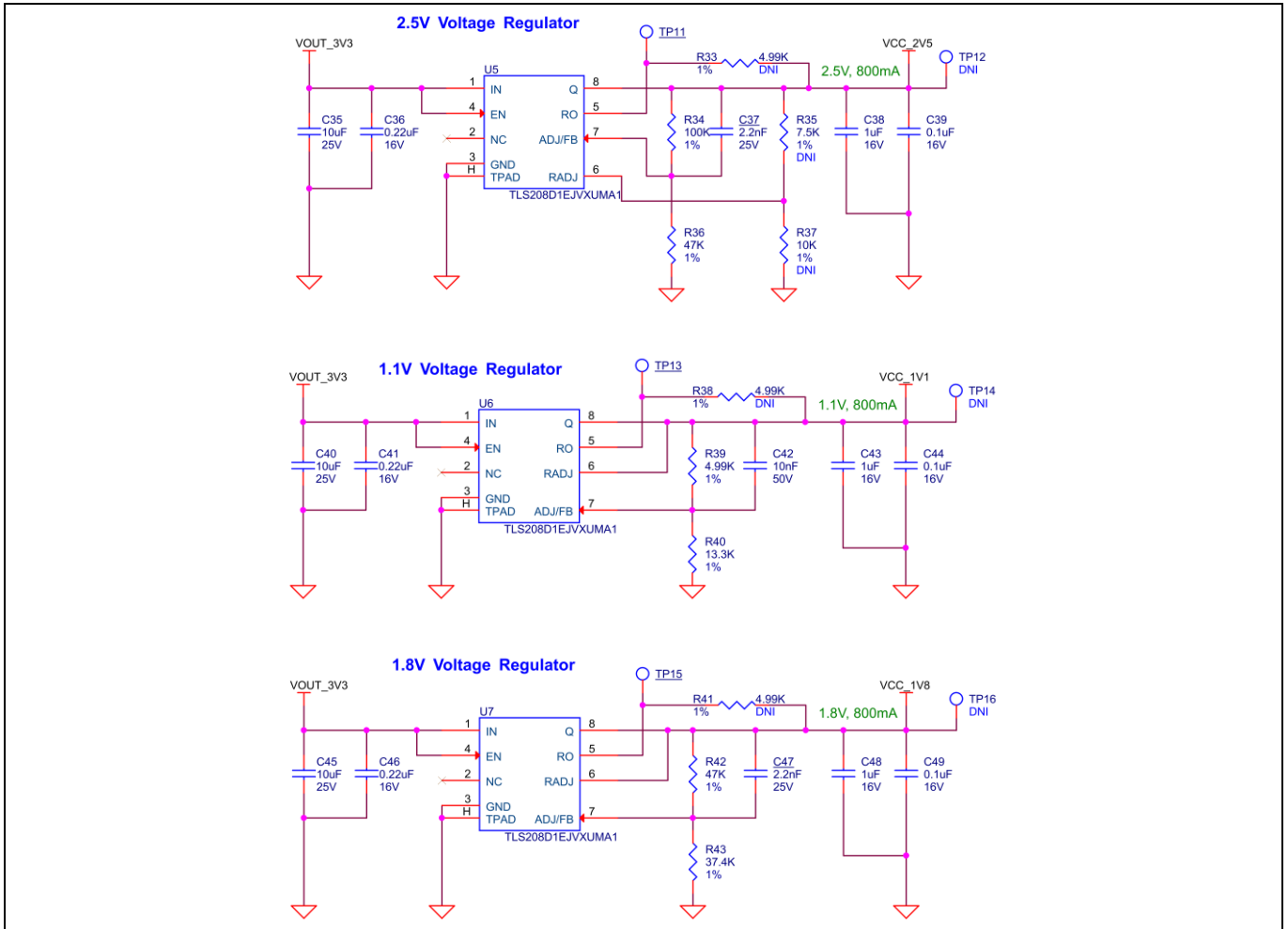
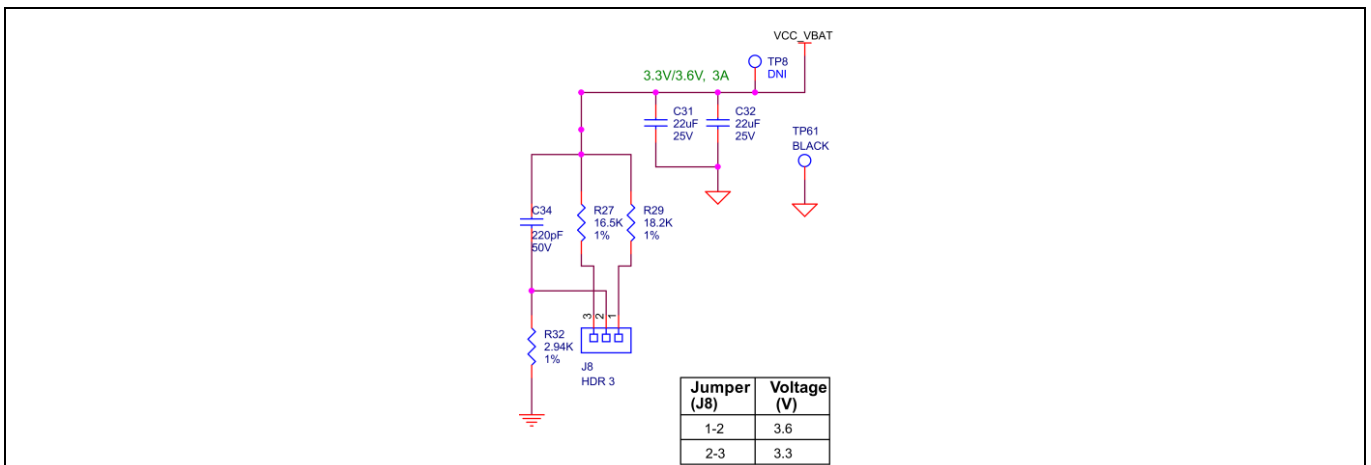


Figure 24 Voltage regulators

4.2.6.2 Voltage selection

VBAT has a dedicated regulator that changes voltage by varying the feedback voltage through the resistor network at **J8**. VTARG has a 3-pin voltage selection header **J10** to select between VCC\_3V3 or VCC\_5V0 voltages. VDDIO2 has a dedicated 2-pin voltage selection header **J12** that connects to T2G\_VDD which is the outcome from J10 (VCC\_3V3 or VCC\_5V0).



Hardware

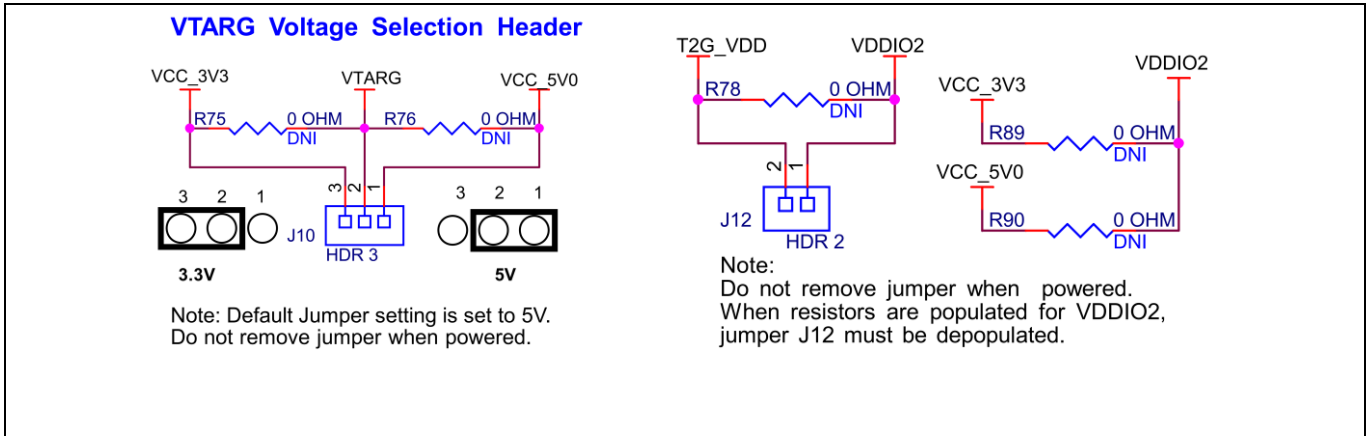


Figure 25 Voltage selection

PSoC™ 5LP uses its programmable special I/O (SIO) pins which can set the logic levels as per the reference voltage for the interface with the target device. The P5LP\_SIO\_VREF input is used to sense the target voltage and set the logic levels accordingly. The internal ADC is used to monitor the target device voltage and USB supply voltage.

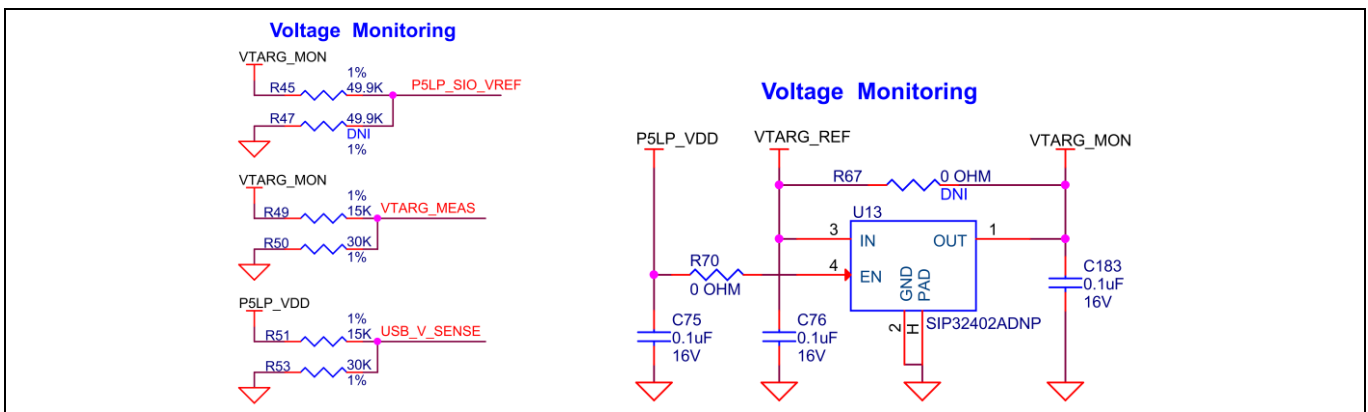


Figure 26 Voltage monitoring

The I/O voltages for TRAVEO™ T2G-B-H can be selected for VDDD, VDDA, and VDDIO2 I/O domains; this can be switched between VCC\_3v3 or VCC\_5V0 voltage levels. Voltage levels for VDDIO1, VDDIO3, and VDDIO4 are dedicated to work on 3.3 V supply voltage. To disable each individual I/O supply voltage, rework is required by removing the 0-ohm resistor connected to the respective I/O supply voltage.

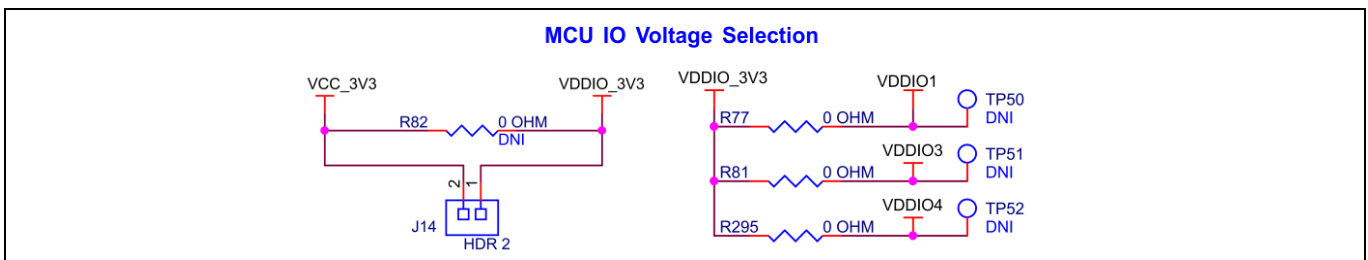


Figure 27 Voltage selection

Hardware

4.2.6.3 Current measurement headers

The current of the following domains has dedicated 2-pin headers to facilitate easy current measurement using an ammeter across the pins.

Table 7 Current measurement headers

Domain name	Header reference designator	Loaded by default
VBAT	J28	Y
T2G_VDD	J15	Y
VDDIO2	J12	Y
VDDIO1, VDDIO3, and VDDIO4	J14	Y

Resistor configuration to measure current on respective I/O domains

Domain name	Resistor reference designator	Loaded by default
VDDIO1	R77	Y
VDDIO3	R81	Y
VDDIO4	R295	Y

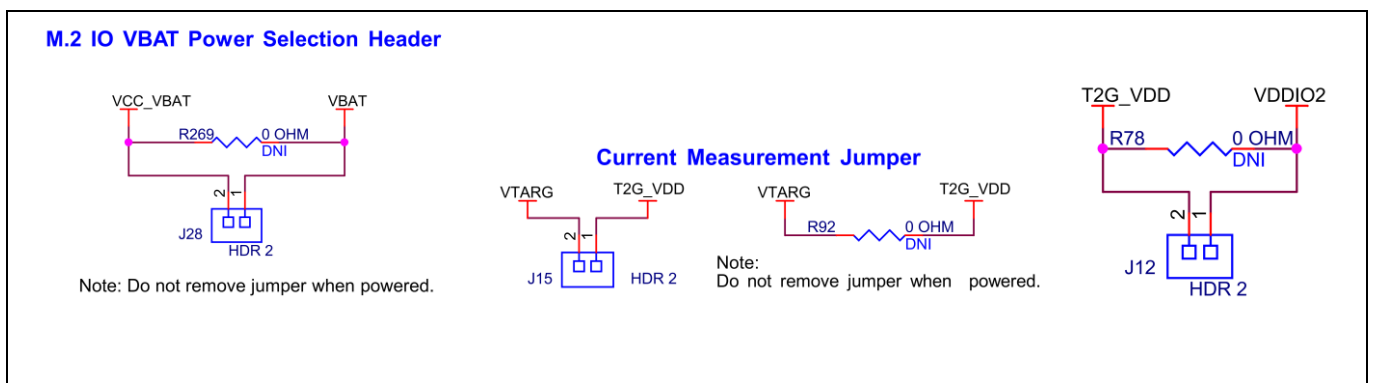


Figure 28 Current measurement headers

Note: When measuring the T2G\_VDD current, make sure that jumper J18 is removed. This will disconnect the potentiometer from VDDA and remove the leakage caused by it.

4.2.7 I/O headers

4.2.7.1 Headers compatible with Arduino Uno R3 (J1, J2, J3, J4)

The board has four headers compatible with Arduino Uno R3: J1, J2, J3, and J4. You can connect 3.3 V or 5 V shields compatible with Arduino Uno R3 to develop applications based on the shield’s hardware. Note that 1.8 V shields are not supported by the kit and TRAVEO™ T2G-B-H operating voltage is between 2.7 V and 5 V.

Hardware

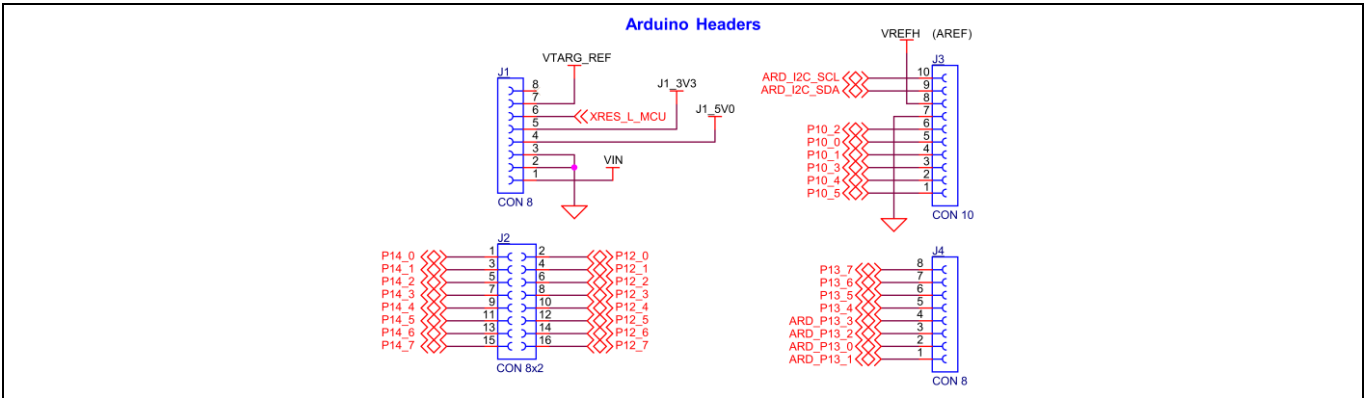


Figure 29 Headers compatible with Arduino Uno R3

4.2.7.2 TRAVEO™ T2G-B-H MCU I/O headers (J29, J30, J31, and J32)

These headers provide connectivity to TRAVEO™ T2G-B-H MCU GPIOs that are not connected to the headers compatible with Arduino. A few of these pins are multiplexed with onboard peripherals and are not connected to the TRAVEO™ T2G-B-H MCU by default. These connectors are not populated by default.

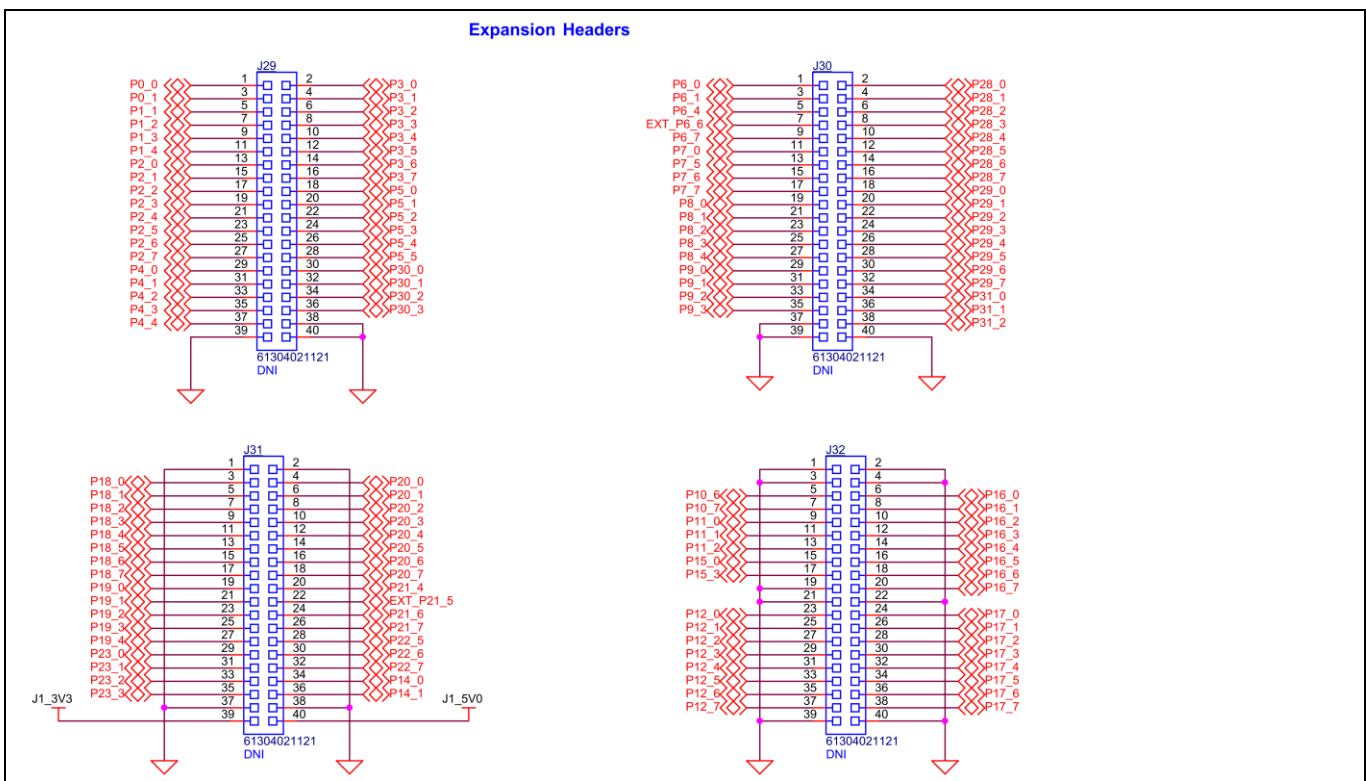


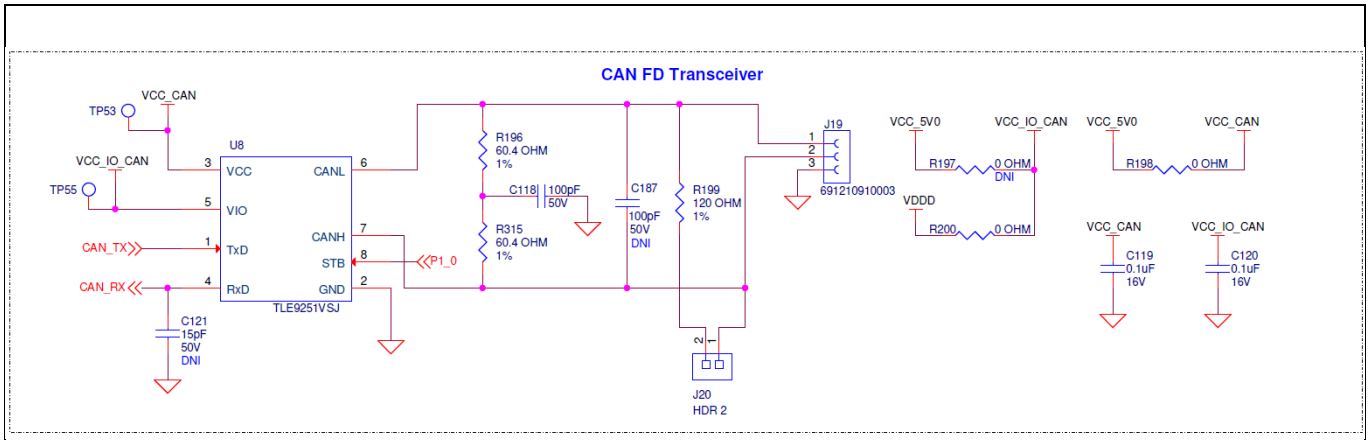
Figure 30 TRAVEO™ T2G-B-H MCU GPIO headers

4.2.8 CAN FD transceiver

The TLE9251V is a high-speed CAN transceiver, operating as an interface between the CAN controller and the physical bus medium. A high-speed CAN network is a two-wire, differential network which allows data transmission rates up to 5 Mbit/s. The CANH and CANL pins are the interfaces to the CAN bus; both pins operate as input and output. The RxD and TxD pins are the interfaces to the microcontroller. The pin TxD is the serial data input from the CAN controller, the RxD pin is the serial data output to the CAN controller. The voltage level on the digital input TxD and the digital output RxD is determined by the power supply level at the VIO pin. The signal levels on the logic pins (STB, TxD, and RxD) are compatible with microcontrollers having a 5 V or 3.3 V I/O

**Hardware**

supply. Usually, the digital power supply VIO of the transceiver is connected to the I/O power supply of the microcontroller.

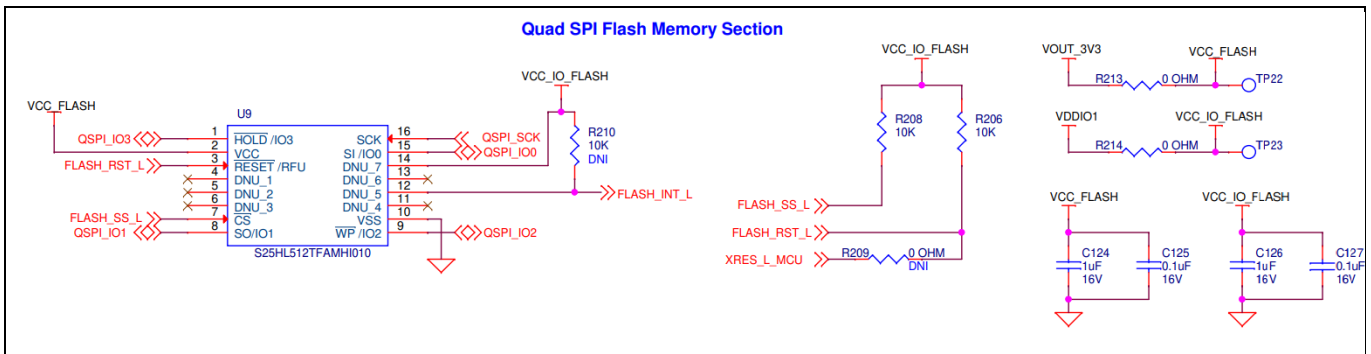


**Figure 31** CAN FD transceiver

**4.2.9 Quad SPI NOR flash**

The TRAVEO™ T2G-B-H evaluation board has a 512-Mb Quad SPI NOR flash memory (S25FL512SAGMFM10). The NOR flash is connected to the Quad SPI interface of the TRAVEO™ T2G-B-H MCU.

The NOR flash device can be used for both data and code with execute-in-place (XIP) support and encryption.



**Figure 32** Quad SPI flash memory section

**4.2.10 LEDs**

The **LED4** (amber) LED indicates the status of the KitProg3 (See the KitProg3 user guide for details). **LED5** (amber) power LED indicates the status of power supplied to the board.

The board also has three user-controllable LEDs (**LED1**, **LED2**, and **LED3**) connected to TRAVEO™ T2G-B-H MCU pins for user applications.

Hardware

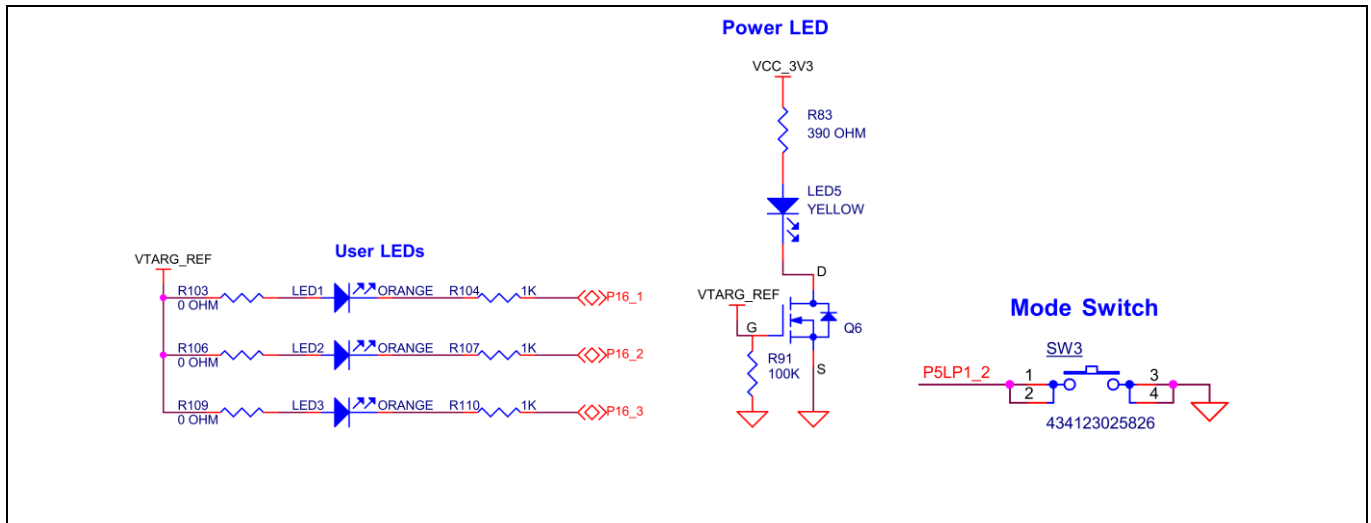


Figure 33 LEDs

Hardware

4.2.11 Push buttons

The board has a reset button, two user-controllable buttons, and a KitProg3 mode selection button. The reset button (SW1) is connected to the XRES pin of the TRAVEO™ T2G-B-H MCU device and is used to reset the device. Two user buttons (SW2 and SW4) are connected to pin P21[4] and P17[3] of the TRAVEO™ T2G-B-H MCU device respectively. In addition, the mode selection button (SW3) is connected to the PSoC™ 5LP device for programming mode selection. This button function is reserved for future use (see the [KitProg3 user guide](#) for details). All buttons are active LOW configuration and short to GND when pressed.

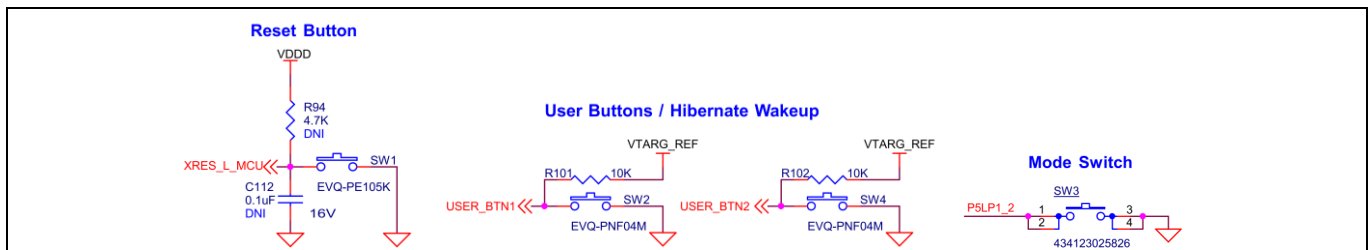


Figure 34 Push buttons

4.2.12 Crystals and oscillators

The board has three crystals:

- A 32.768-kHz crystal connected to P21[0] and P21[1] as a watch crystal oscillator.
- A 16-MHz crystal connected to P21[2] and P21[3] of the TRAVEO™ T2G-B-H MCU as an external crystal oscillator.
- A 25-MHz crystal and 125-MHz oscillator are used for the Ethernet application.

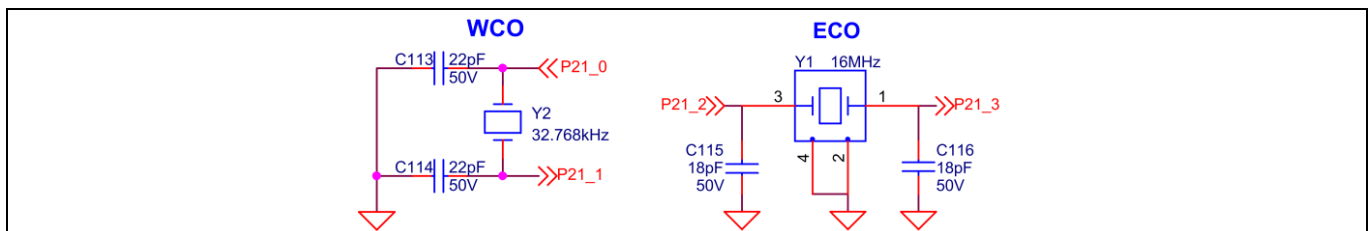


Figure 35 Crystal oscillators

4.2.13 Ethernet transceiver and RJ45 connector

Ethernet interface is provided on the board for RGMII mode operation. A physical layer controller must be used to operate at 10/100/1000 Mbps speeds. The ETH1 port from TRAVEO™ T2G-B-H is interfaced with the Ethernet transceiver with signals necessary to operate in RGMII mode. An RJ45 connector must be used which supports 10/100/1000 Mbps communication speeds. The RJ45 connector must be included with the necessary magnetics inbuilt to protect it from the external world. There must be two clock references provided on the board for the Ethernet transceiver.

By default, a 25 MHz clock is connected; the 125 MHz crystal is not populated. PHY must be capable of working with a 1.1 V core voltage supply and 2.5 or 3.3 I/O supply. The device is intended to operate at 3.3 V I/O operation as TRAVEO™ T2G-B-H supports from 2.7 V to 5.5 V applications.

Hardware

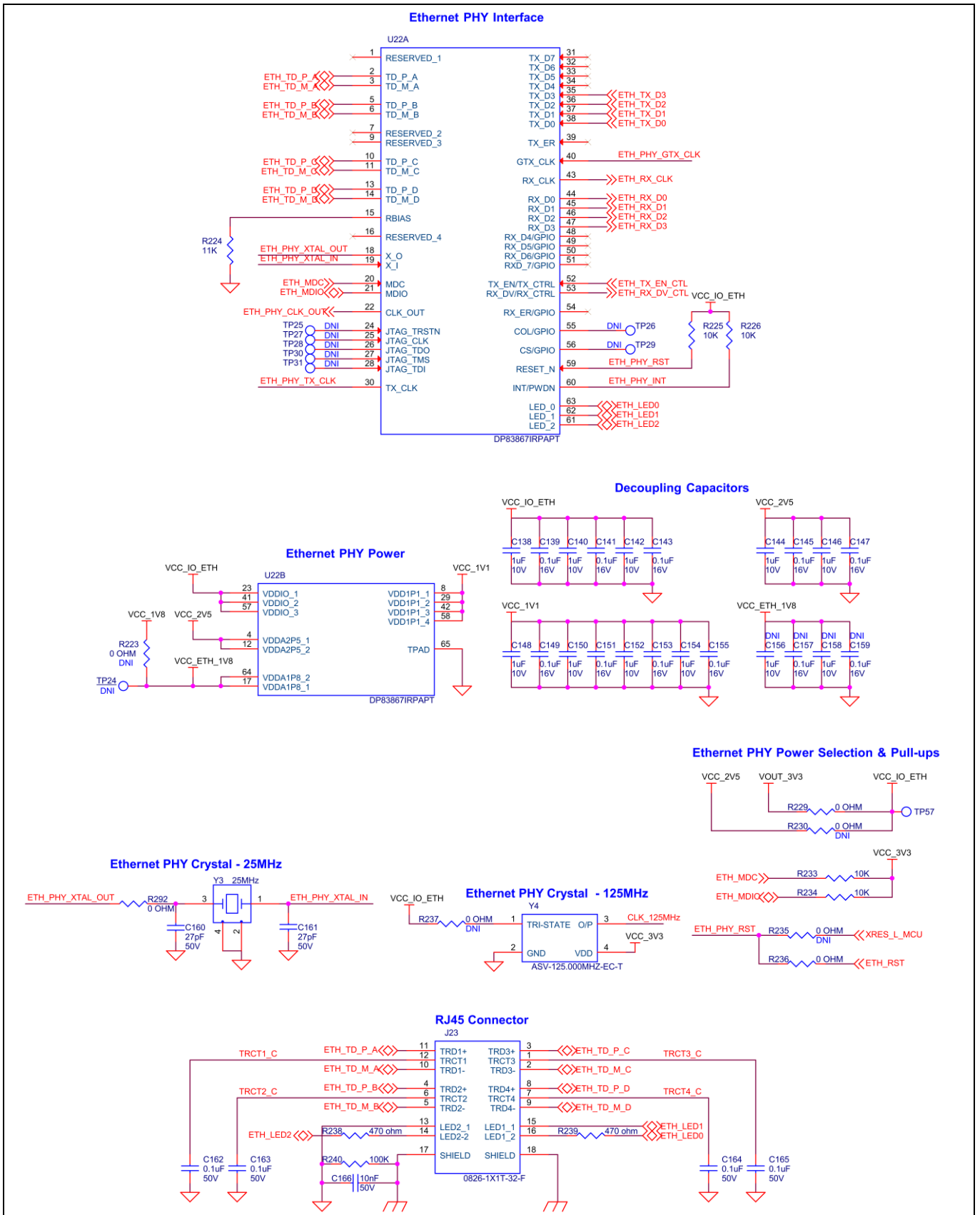


Figure 36 Ethernet transceiver and RJ45 connector



Hardware

4.2.14 SMIF dual header compatible with Digilent Pmod

The kit is designed with SMIF dual header compatible Digilent Pmod (J21 and J22) to validate the HYPERFLASH™ memory interface. Infineon-made S26KS series devices with 128-Mb, 256-Mb, and 512-Mb density are expected to be supported with the kit. External memory modules must be interfaced for validating the HYPERFLASH™. The connectors are not populated on the board by default.

Level translators are used on the board to match the voltage levels of memory modules. Module supply and I/O voltages can be selected with resistor option to switch between 1.8 V and 3.3 V operation. By default, the voltage levels are set to 1.8 V

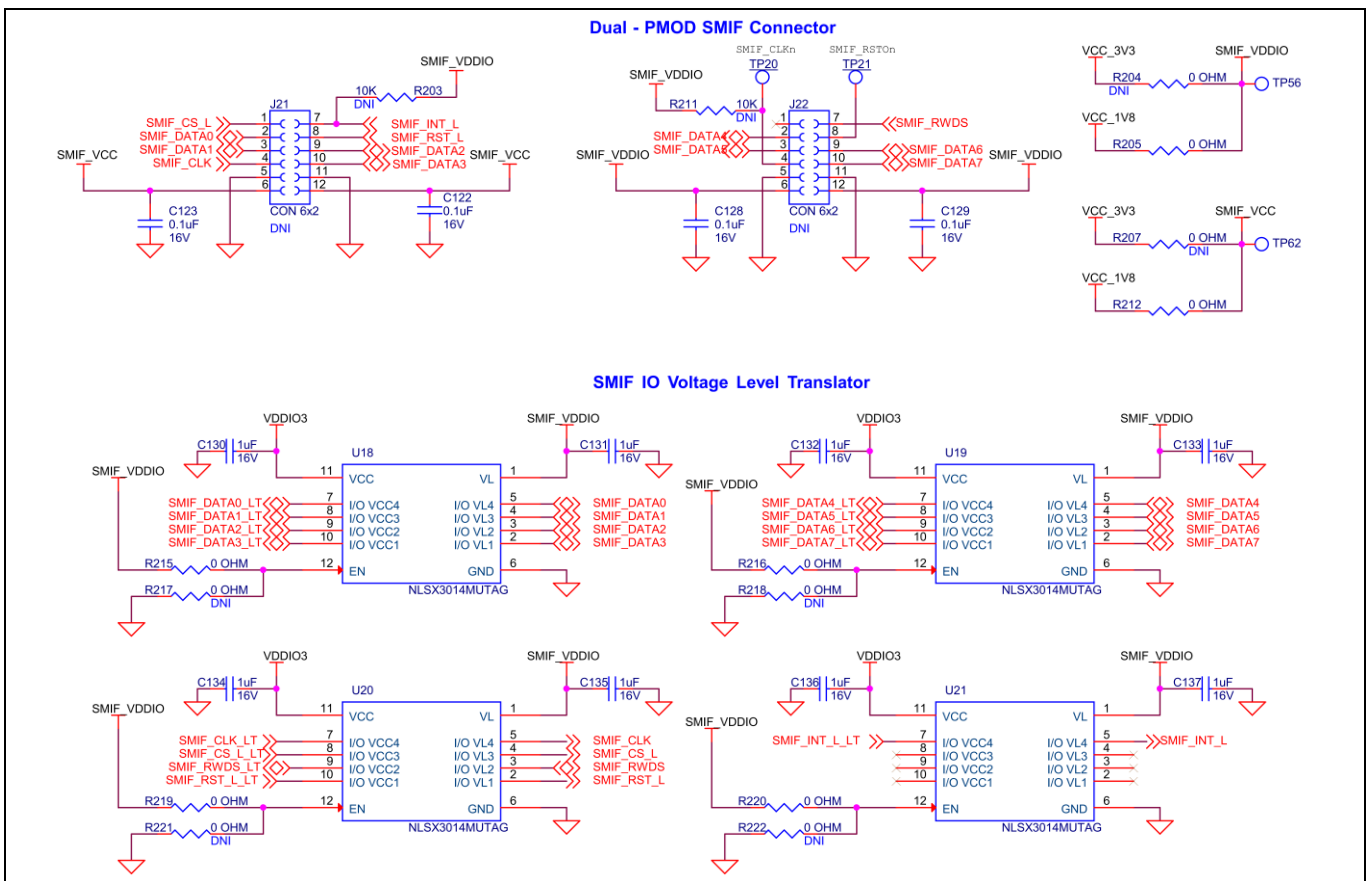


Figure 37 SMIF dual header compatible with Digilent Pmod with voltage level translators

4.2.15 Potentiometer

The board contains a 10k potentiometer connected to P6[6] of the GPIO header J30[7], which is not connected by default. The fixed ends are connected to VDDA (VDD\_POT through J21) and GND and therefore may contribute to leakage current on the P6\_VDD supply. Remove jumper J21 to disconnect power from the potentiometer when measuring the P6\_VDD current.

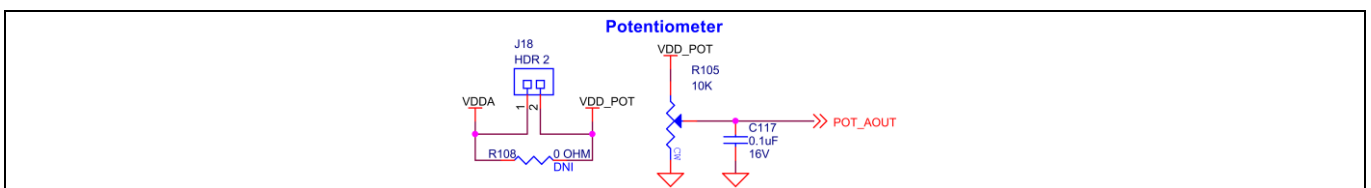


Figure 38 Potentiometer

Hardware

4.2.16 Reverse voltage protection

A necessary reverse voltage protection circuit has been provided on the kit to avoid the damage due to reverse supply to the board. Any accidental supply coming as input to the board will be prohibited by the circuit protecting the specific regulators and TRAVEO™ T2G-B-H MCU. A FET-based diode circuit is used as a reverse voltage protection on the board.

Any reverse supply voltage coming at 3.3-V regulator U3 and 5-V regulator U16 are terminated before being injected to the regulator output. 3.3 V and 5 V voltage output at Arduino power header J1 and programming header supply are protected by the corresponding reverse voltage protection circuit.

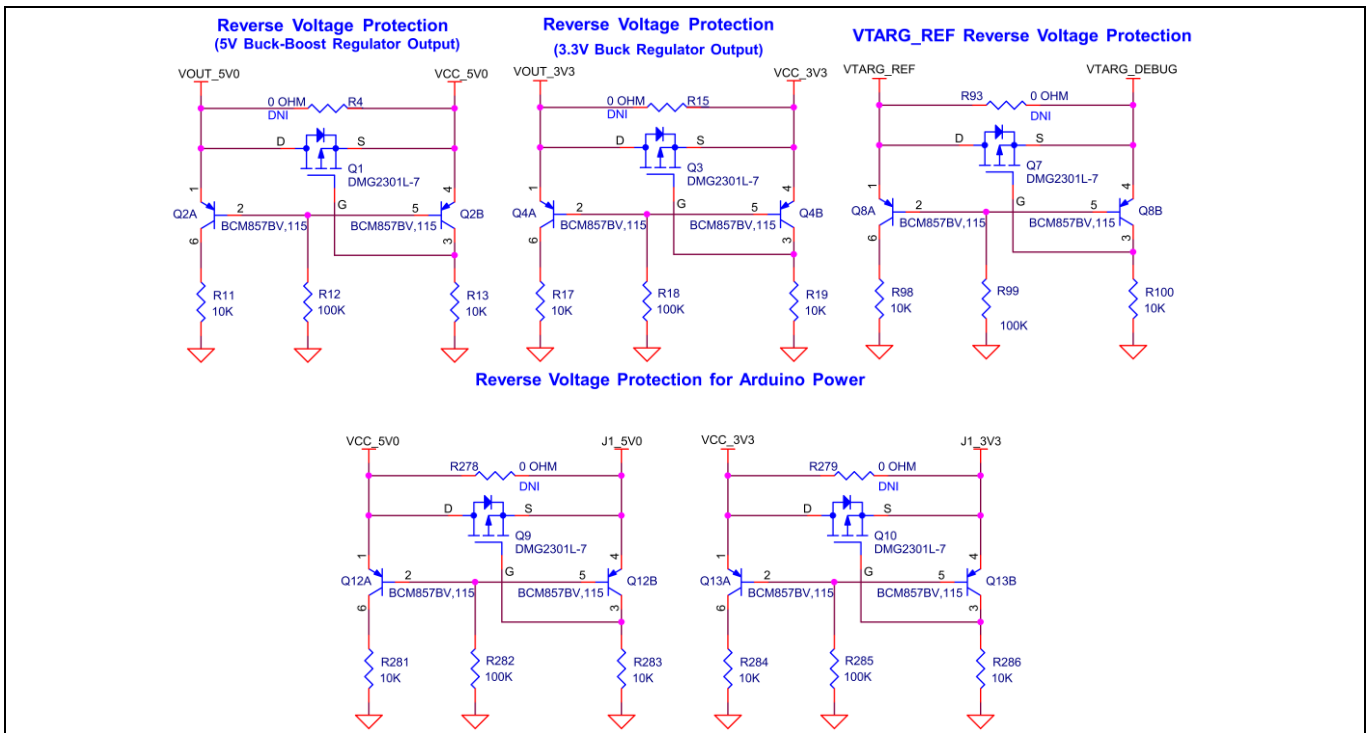


Figure 39 Reverse voltage protection circuit

4.3 Kit rework

4.3.1 SMIF dual header compatible with Digilent Pmod interface

The kit is provisioned with dual Pmod SMIF header (J21, J22) which are by default not loaded on the kit. SMIF memory interface I/Os are shared between SMIF and M.2 (WLAN/Bluetooth®) connector interface.

You should perform necessary rework done on the board by removing or adding corresponding connectors and 0-ohm resistors to work with external SMIF memory modules. Refer Table 8 for resistor rework for SMIF.

Table 8 Dual Pmod header and M.2 connector interface multiplexing

Kit function		T2G-B-H pin
M.2 connector	SMIF (PMOD) module	---
---	R145*	P24[0]
---	R147*	P24[1]

Hardware

Kit function		T2G-B-H pin
M.2 connector	SMIF (PMOD) module	---
R301	R149*	P24[2]
R300	R152*	P24[3]
---	R154*	P24[4]
R296	R157*	P25[0]
R297	R160*	P25[1]
R298	R162*	P25[2]
R299	R164*	P25[3]
R167	R170*	P25[4]
R173	R176*	P25[5]
R179	R182*	P25[6]
---	R185*	P25[7]

\*Not connected by default

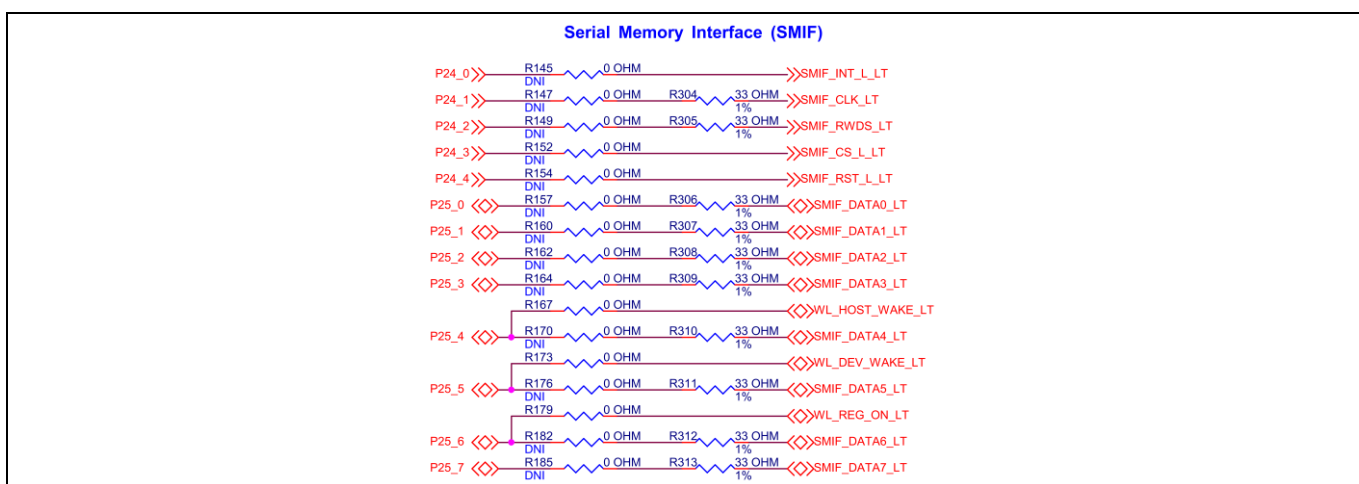


Figure 40 SMIF (PMOD) memory interface

### 4.3.2 VDDIO2 supply voltage selection

VDDIO2 is default connected to the T2G\_VDD (VTARG) interface; voltage selection depends on VTARG selection between 3.3 V and 5 V voltage output. To select separate voltage domains for VDDIO2, use the resistor rework option provisioned on the board. Populate resistors R89 and R90 for 3.3 V and 5 V respectively. Ensure that you remove jumper J12 whenever using the resistor configuration for VDDIO2.

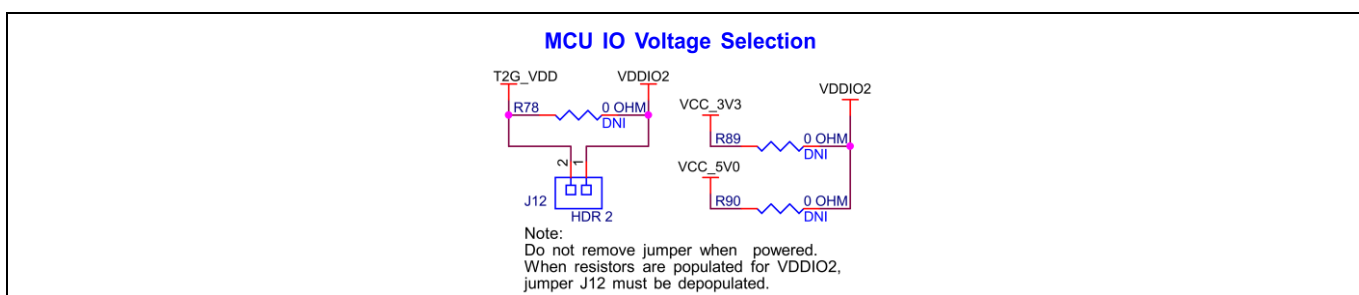


Figure 41 TRAVEO™ T2G-B-H VDDIO2 voltage selection

Hardware

### 4.3.3 UART interface on Arduino headers

UART interface signals are connected between the PSoC™ 5LP device and TRAVEO™ T2G MCU. The same signals have been shared across digital interface connector compatible with Arduino J4[1]–J4[4]. For using UART lines on connector compatible with Arduino, perform the board rework done with a specific resistor assembly.

R134, R136, R148, and R150 all four 0-ohm resistors to be populated to work with UART on a connector compatible with Arduino. You can use either of the interface for PSoC™ 5LP and TRAVEO™ T2G-B-H or TRAVEO™ T2G-B-H and the interface specific Arduino.

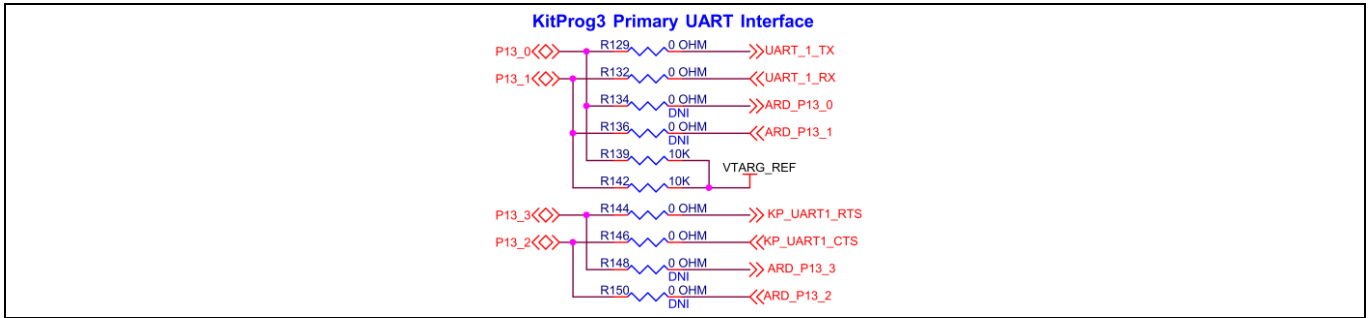


Figure 42 Primary UART interface

### 4.3.4 WLAN UART interface

The secondary UART from the PSoC™ 5LP device is connected to Bluetooth® UART lines of the M.2 connector. You need to perform board rework to use these lines for UART WLAN.

Remove 0-ohm resistors R65, R69, and populate R64, R66, R71, and R73 for the WLAN UART interface to be active.

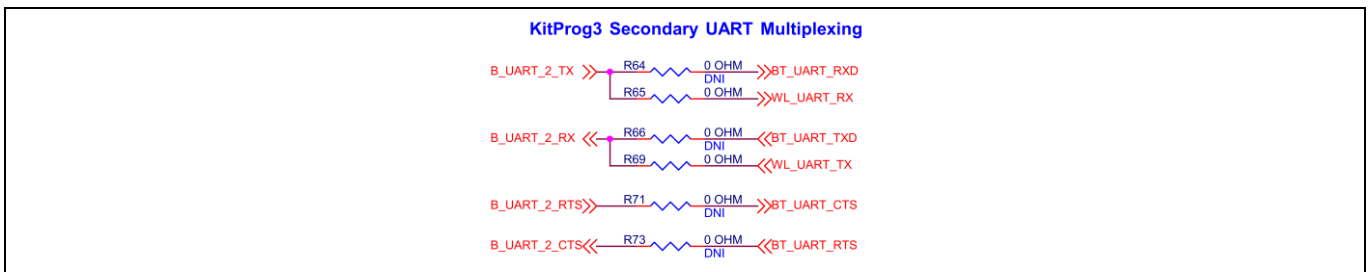


Figure 43 Secondary UART interface

### 4.3.5 ETM trace and debug header

By default, the ETM trace and debug header are not populated on the kit. Populate the 20-pin ETM standard connector before using a 3<sup>rd</sup> party programmer for trace programming. Remove resistors R155 and R158, and populate R193 and R194 to connect the TRAVEO™ T2G-B-H to the trace header.

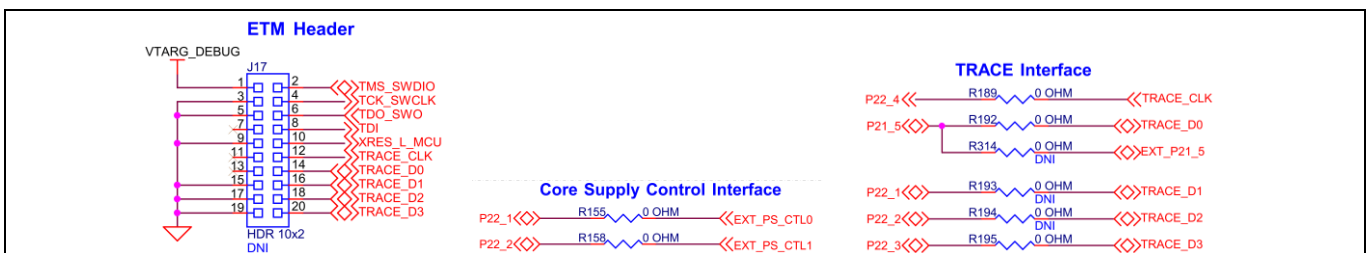


Figure 44 ETM trace and debug header

Hardware

4.3.6 125-MHz oscillator

By default, the kit is set to work with 10/100 Mbps Ethernet operation on RGMII mode. You need to perform board rework to operate at 1000 Mbps (Gigabit). Remove R241 and populate R242 to remove the 25-MHz crystal interface (R292) and connect to the 125-MHz oscillator output.

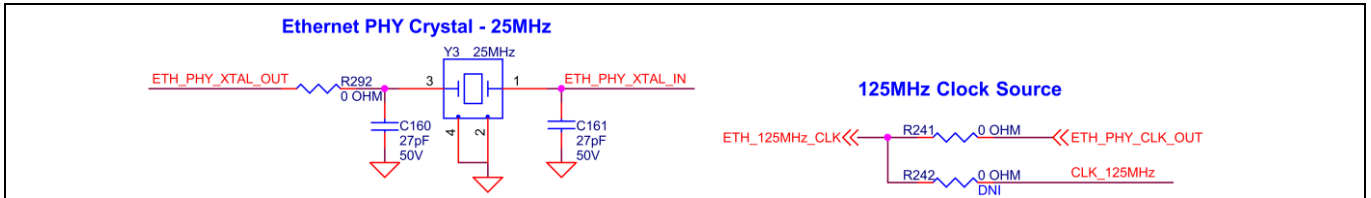


Figure 45 125-MHz oscillator

4.3.7 WLAN SDIO interface

On the kit, default connection is made for WLAN SDIO interface which is connected to M.2 connector. Whenever SMIF (PMOD) memory module is functionally enabled by specific rework, the series resistors connected to M.2 connector must be removed. (See Table 8).

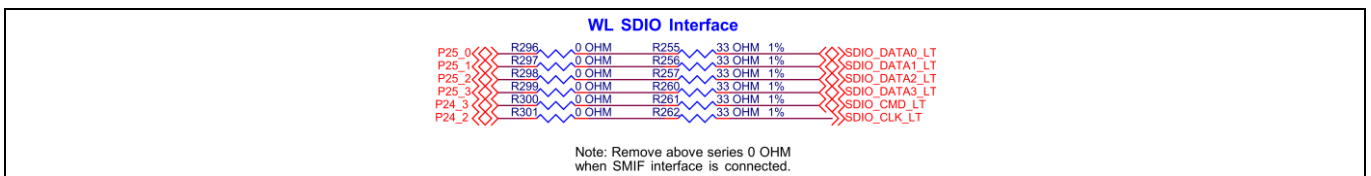


Figure 46 WLAN SDIO interface

4.3.8 UART interface between PSoC™ 5LP and TRAVEO™ T2G-B-H MCU with flow control

If any application requires the UART interface between the PSoC™ 5LP and TRAVEO™ T2G-B-H MCU with flow control, populate R10, R12, R85, and R91 and remove R8 and R14.

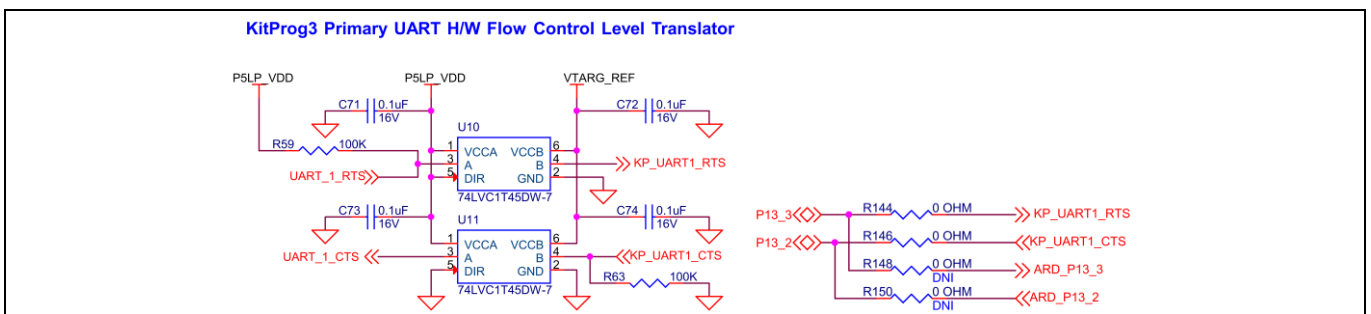


Figure 47 UART interface between PSoC™ 5LP and TRAVEO™ T2G-B-H MCU with flow control

4.4 Bill of materials

Refer to the BOM file available on the [kit webpage](#).

## Hardware

### 4.5 Frequently asked questions

1. How does the TRAVEO™ T2G-B-H evaluation kit handle voltage connection when multiple power sources are plugged in?

There are two different options to power the kit:

- KitProg3 Micro-B USB connector (**J7**)
- External DC supply via VIN connector (**J6**)

The voltage from each of the sources is passed through ORing diodes that supply VCC\_IN.

2. What are the input voltage tolerances? Is there any overvoltage protection on this kit?

Input voltage levels are shown in [Table 9](#):

There is no overvoltage protection on this kit.

**Table 9** Input voltage levels

Supply	Typical input voltage	Absolute max
USB Micro-B connector ( <b>J7</b> )	4.5 V to 5.5 V	5.5 V
VIN connector ( <b>J6</b> )	5 V to 12 V	18 V

3. Why is the voltage of the kit restricted to 3.3 V? Can't it drive external 1.8 V interfaces?

TRAVEO™ T2G-B-H MCU is not meant to be operated at voltages less than 2.7 V. Powering the TRAVEO™ T2G-B-H MCU to lower than 2.7 V will stop the chip being powered. It is recommended to power the TRAVEO™ T2G-B-H MCU at 3.3 V or 5 V.

4. I am unable to program the target device.

- Check **J10** to ensure that the jumper shunt is placed.
- Make sure that no external devices are connected to the external programming header J16 or J17.
- Update your KitProg3 version to the latest one using the steps mentioned in the [KitProg3 user guide](#).

5. Can I power the kit using external program/debug headers J16 and J17?

No, this is not possible in this board by default. The target MCU is powered by on-board regulators only and therefore, one of the two main sources (J7 and J6) must be present. There is a protection circuit that prevents reverse voltage from VTARG\_Debug to VTARG. Therefore, the board cannot be powered through J16 and J17.

Hardware

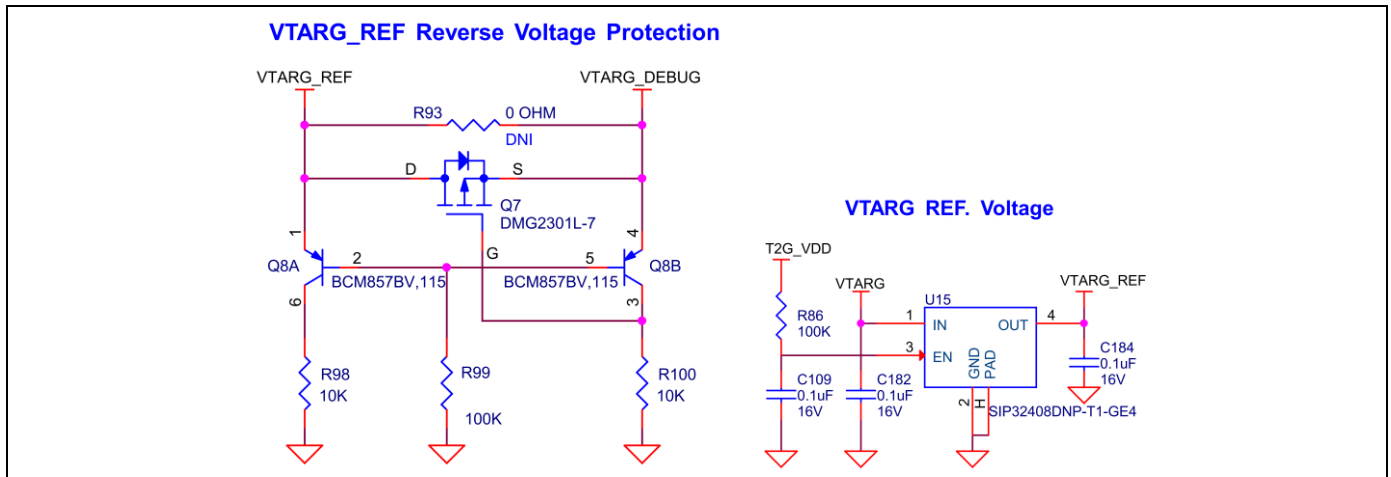


Figure 48 VTARG reverse voltage protection

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**General safety instructions**

## 5 Known Limitations

This section lists the known limitations of the TRAVEO™ T2G Body High evaluation kit.

**Table 10**    **Limitation Information**

<b>No.</b>	<b>Description</b>	<b>Workaround</b>
1	VCCD external power supply mode does not work.	Do not use VCCD external power supply mode.



---

**Revision history****Revision history**

<b>Date</b>	<b>Version</b>	<b>Description</b>
2022-08-17	**	Initial release
2023-05-26	*A	Added <b>Theory of operation</b> section. Added a sentence in Sl. No. 32 of <b>Table 4</b> . Added <b>CAN FD transceiver</b> section. Added <b>Known Limitations</b> .

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**002-35688 Rev. \*A**

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