

DA14531 SMARTBOND TINY™ MODULE Development Kit Hardware User Manual

UM-B-141

Abstract

This document outlines the system design, configuration options and supported features of DA14531 SMARTBOND TINY™ MODULE Development Kit, PCB version 376-25-C.

Contents

| | |
|-------------------------------------------------------------------------|-----------|
| Abstract | 1 |
| 1 Terms and Definitions | 4 |
| 2 References | 4 |
| 3 Introduction | 5 |
| 4 System Overview | 6 |
| 4.1 Features | 6 |
| 4.2 System and components description | 7 |
| 4.3 Block Diagram..... | 10 |
| 5 DA14531 SmartBond TINY™ Module Daughterboard | 11 |
| 5.1 Power Section | 11 |
| 5.1.1 Default Power Supply Option Configuration | 11 |
| 5.1.2 Optional USB power section..... | 12 |
| 5.2 Reset operation..... | 12 |
| 5.3 General Purpose Buttons..... | 12 |
| 5.4 General Purpose LEDs | 13 |
| 5.5 MikroBUS™ Module..... | 14 |
| 5.6 JTAG | 16 |
| 5.7 UART..... | 17 |
| 5.8 GPIOs and pin assignment on DA14531 SMARTBOND TINY™ MODULE DB | 17 |
| 5.9 Programming and debugging interface setup | 19 |
| 5.9.1 Single wire UART, JTAG, RESET | 20 |
| 5.9.2 2-wire UART, JTAG, RESET | 21 |
| 5.9.3 4-wire UART, JTAG, RESET | 21 |
| 5.10 First Steps with DA14531 SMARTBOND TINY™ MODULE DEVKIT | 23 |
| 6 Known Issues | 24 |
| 6.1 Keil JTAG default Clock Speed..... | 24 |
| Appendix A | 26 |
| A.1 Schematic | 26 |
| A.2 Placed Components..... | 27 |
| Revision History | 28 |

Figures

| | |
|------------------------------------------------------------------------------------|----|
| Figure 1: DA14531 SMARTBOND TINY™ MODULE DB..... | 5 |
| Figure 2: DA14531 SMARTBOND TINY™ MODULE DEVKIT | 6 |
| Figure 3: Component description. Top side. | 7 |
| Figure 4: Component description. Bottom side. | 8 |
| Figure 5: DA14531 SMARTBOND TINY™ MODULE DB Block Diagram | 10 |
| Figure 6: Power option selection for DA14531 SMARTBOND TINY™ MODULE DB | 11 |
| Figure 7: Power option default configuration..... | 11 |
| Figure 8: Optional USB power supply section..... | 12 |
| Figure 9: Reset Button on DA14531 SMARTBOND TINY™ MODULE DB..... | 12 |
| Figure 10: General purpose push buttons on DA14531 SMARTBOND TINY™ MODULE DB | 13 |

| | |
|--------------------------------------------------------------------------------------------------------------------------|----|
| Figure 11: Default general purpose push button (SW2) on DA14531 SMARTBOND TINY™ MODULE DB..... | 13 |
| Figure 12: SW2 configuration on DA145xx DEVKT-P PRO-MB | 13 |
| Figure 13: General Purpose LEDs on DA14531 SMARTBOND TINY™ MODULE DB..... | 14 |
| Figure 14: Default LED on DA14531 SMARTBOND TINY™ MODULE DB | 14 |
| Figure 15: D5 LED configuration on DA145xx DEVKT-P PRO-MB | 14 |
| Figure 16: Default programming interface of MikroBUS™ module on DA14531 SMARTBOND TINY™ MODULE DB | 15 |
| Figure 17: MikroBUS™ module Socket on DA14531 SMARTBOND TINY™ MODULE DB | 15 |
| Figure 18: Example of mounting MikroBUS™ module..... | 16 |
| Figure 19: Optional debug port..... | 16 |
| Figure 20: DA145xx DEVKT-P PRO-MB jumper setup for Single wire UART, JTAG and RESET operation..... | 20 |
| Figure 21: DA145xx DEVKT-P PRO-MB jumper setup for 2-wire UART, JTAG and RESET operation | 21 |
| Figure 22: DA145xx DEVKT-P PRO-MB jumper setup for 4-wire UART, JTAG and RESET operation | 22 |
| Figure 23: DA145xx DEVKT-P PRO-MB First Steps Jumper Configuration with DA14531 SMARTBOND TINY™ MODULE DB attached | 23 |
| Figure 24: Keil reporting error when try to open debugger session | 24 |
| Figure 25: Steps to set up JTAG clock speed | 24 |
| Figure 26: Schematic of DA14531 SMARTBOND TINY™ MODULE DB [376-25-C]..... | 26 |
| Figure 27: Components on top and bottom sides for DA14531 SMARTBOND TINY™ MODULE DB [376-25-C]..... | 27 |

Tables

| | |
|------------------------------------------------------------------------------------------------------------------|----|
| Table 1: Test Points Description | 8 |
| Table 2: MikroBUS™ GPIOs multiplexing..... | 15 |
| Table 3: JTAG signals assignment..... | 16 |
| Table 4: DA14531 SMARTBOND TINY™ MODULE DB UART Signals | 17 |
| Table 5: GPIO multiplexing on DA14531 SMARTBOND TINY™ MODULE DB..... | 17 |
| Table 6: Power, SPI Flash and programming/debugging jumper setup of DA145xx DEVKT-P PRO-MB for TINY™ MODULE..... | 19 |
| Table 7: Pin assignment for DA14531 SMARTBOND TINY™ MODULE Configuration 1 | 20 |
| Table 8: Pin assignment for DA14531 SMARTBOND TINY™ MODULE configuration 2 | 21 |
| Table 9: Pin assignment for DA14531 SMARTBOND TINY™ MODULE configuration 3 | 21 |

1 Terms and Definitions

| | |
|------------------|---------------------------------------------|
| DEVKIT | Development Kit |
| DB | Daughterboard |
| USB | Universal Serial Bus |
| JTAG | Join Test Action Group |
| UART | Universal Asynchronous Receiver-Transmitter |
| SDK | Software Development Kit |
| SoC | System on Chip |
| GPIO | General Purpose Input Output |
| LDO | Low Dropout |
| QSPI | Quad Serial Peripheral Interface |
| SPI | Serial Peripheral Interface |
| I ² C | Inter-Integrated Circuit |
| SMD | Surface-Mount Device |
| PCB | Printed Circuit Board |

2 References

- [1] UM-B-114, DA14531_Devkit_Pro_Hardware_User_manual, Revision 1.1, Dialog Semiconductor.
- [2] DA14531MOD_Datasheet_v1.0, Datasheet, Revision 1.0, Dialog Semiconductor.
- [3] DA14531_datasheet_3v0, Datasheet, Revision 3.0, Dialog Semiconductor

3 Introduction

This document describes the DA14531 SMARTBOND TINY™ MODULE Development Kit. The development kit is implemented on a single Daughterboard (DB) PCB and it comes with DA145xx DEVKT-P PRO-MB for SW development, programming, debugging and measuring current but also can be used stand alone.

The block diagram, the actual board, the various sections and settings as well as the connectivity are presented. The purpose of this Daughterboard is to provide users with the capability for:

- Access to the DA14531 SMARTBOND TINY™ MODULE, via UART or JTAG
- Connecting MikroBUS™ module
- User access to general purpose LED(s)
- User access general purpose button(s)
- Reset button
- Test points for all output signals
- Stand-alone operation



Figure 1: DA14531 SMARTBOND TINY™ MODULE DB



Figure 2: DA14531 SMARTBOND TINY™ MODULE DEVKIT

4 System Overview

4.1 Features

The features of DA14531 SMARTBOND TINY™ MODULE DB include:

- Integrated Dialog Semiconductor DA14531 SMARTBOND TINY™ MODULE
- Reset push button (SW3)
- A set of general-purpose LED and button (LED1 and SW2)
- Supply from VLDO (3V) from DA145xx DEVKT-P PRO-MB or from coin cell battery
- Capability of mounting a MikroBUS™ module (J3, J4)
- JTAG and UART interface over DA145xx DEVKT-P PRO-MB
- JTAG and UART interface over on-board header (J2)
- Stand-alone operation
- A dimension of 58.43x44.46 mm
- Optional features:
 - Power supply option from USB connector (only for power not for debugging). User must solder the components.

- Location on board for a second set of LED and button (LED2 and SW1). User must solder the components.

4.2 System and components description

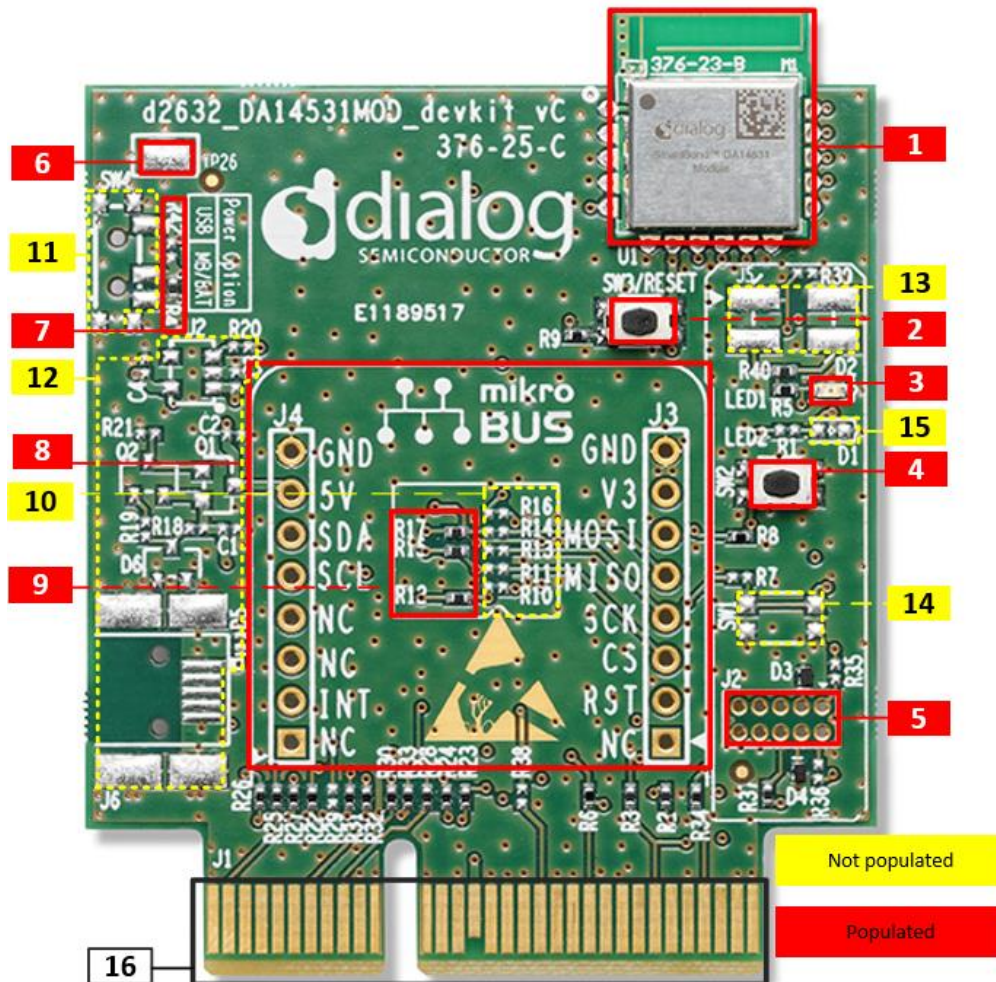


Figure 3: Component description. Top side.

The marked and numbered sections of the system are:

1. DA14531 SMARTBOND TINY™ MODULE (U1)
2. Reset button (SW3/RESET)
3. General purpose LED (D2)
4. General purpose button (SW2)
5. JTAG debugger connector (J2)
6. GND pad (TP26)
7. Power supply configuration resistor (VLDO of PRO-MB/ Coin cell battery or USB)
8. MikroBUS™ connection points (J3, J4)
9. MikroBUS™ configuration resistors for I²C interface
10. MikroBUS™ configuration resistors for SPI interface

11. Power switch (SW4). Selection between VLDO from PRO-MB/ Coin cell battery or USB power supply. **Optional.**
12. USB power supply section with OVP circuit. **Optional.**
13. Jumper header for LED isolation(J5). **Optional.**
14. General purpose button (SW1). **Optional.**
15. General purpose LED (D1). **Optional.**
16. Mating connector on the PCB (J1).

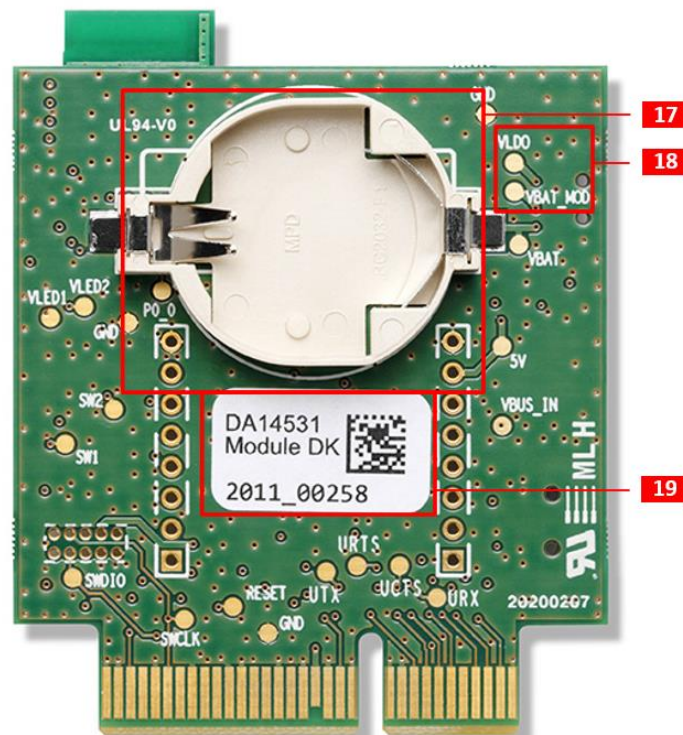


Figure 4: Component description. Bottom side.

The bottom side of the kit provides battery case for a CR2032 coin cell battery. Test points have been placed for monitoring various signal behaviors and voltage levels of the components. The marked and numbered sections of the system are:

17. Coin cell battery (BT1)
18. Test points (see Table 1 for more details)
19. Dialog label

Table 1: Test Points Description

| Test Point | Assigned to | Comments |
|------------|-------------|-------------------------------|
| TP1 | FIDUCIAL | Not electrically connected |
| TP2 | FIDUCIAL | Not electrically connected |
| TP3 | GND | Ground |
| TP7 | SWCLK | JTAG Interface- Clock Signal |
| TP8 | VLED1 | Voltage level of RED LED (D1) |
| TP9 | SWDIO | JTAG Interface DIO Signal |

| Test Point | Assigned to | Comments |
|------------|------------------|-----------------------------------------------------------------------------------|
| TP10 | VLED2 | Voltage Level of Green LED (D2) |
| TP12 | RESET | Reset |
| TP13 | SW1 | General purpose button (driven from P0_6 signal) |
| TP14 | SW2 | General purpose button (driven from P0_11 signal) |
| TP15 | SW3 | Reset button (driven from P0_0 signal) |
| TP16 | MikroBUS™ LOGO | Not electrically connected |
| TP18 | 5V | USB +5V voltage level after OVP circuit |
| TP19 | VBUS_IN | USB +5V voltage level |
| TP20 | VLDO | LDO (U2) 3.3V output voltage level |
| TP21 | VBAT_MOD | Power supply rail of DA14531 SMARTBOND TINY™ MODULE |
| TP22 | VBAT | Power supply rail of VLDO of DA145xx DEVKT-P PRO-MB or external coin cell battery |
| TP23 | ESD_WARNING SIGN | Not electrically connected |
| TP24 | GND | Ground |
| TP25 | GND | Ground |
| TP26 | GND | Ground |
| TP27 | URX | 4-wire UART RX Signal |
| TP28 | UTX | 4-wire UART TX Signal |
| TP29 | UCTS | 4-wire UART CTS Signal |
| TP30 | URTS | 4-wire UART RTS Signal |

4.3 Block Diagram

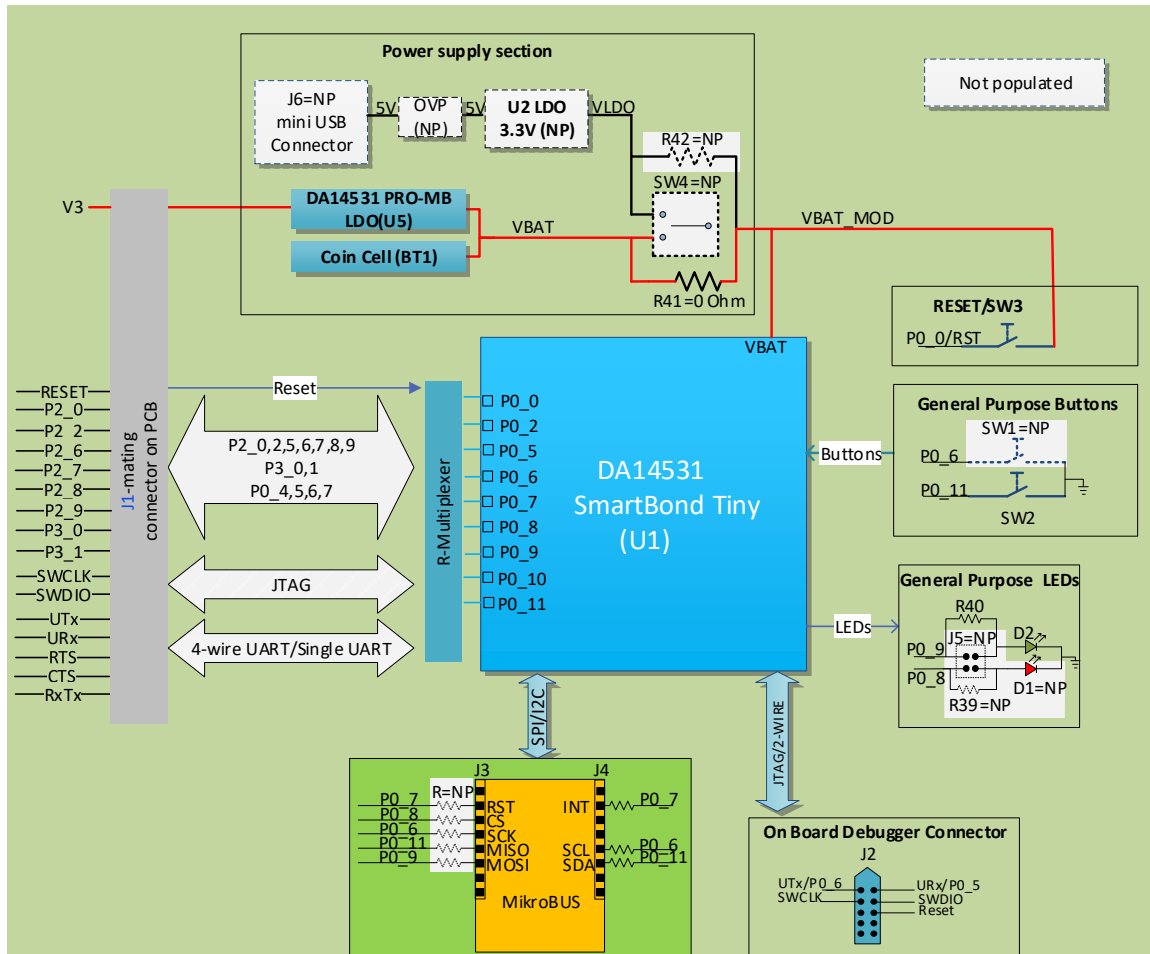


Figure 5: DA14531 SMARTBOND TINY™ MODULE DB Block Diagram

5 DA14531 SmartBond TINY™ Module Daughterboard

5.1 Power Section

The power supply on the DA14531 SMARTBOND TINY™ MODULE DB supports three options:

- Power supply from DA145xx DEVKT-P PRO-MB. The supply voltage comes from VLDO setup (U5) with output voltage range to meet recommended operating conditions of DA14531 SmartBond TINY™ Module. See [2] for recommended operating conditions and Table 6 for VLDO selection.
- Power supply from Coin cell battery (BT1). Battery case is mounted on bottom side of the daughterboard. **Notice: User must not mount coin cell battery when daughterboard is supplied from DA145xx DEVKT-P PRO-MB.**
- +5V USB Power Supply (J6 connector) with Over Voltage Protection Circuit (OVP). **Optional.**

Using power supply from VLDO of DA145xx DEVKT-P PRO-MB, allows user to measure Current drawn from the DA14531 SmartBond TINY™ Module by using the current sensing circuit and the power profiler of Dialog’s SmartSnippets Toolbox. For more information regarding current measurement refer to [1].

5.1.1 Default Power Supply Option Configuration

Power selection between DA145xx DEVKT-P PRO-MB VLDO/ Coin Cell battery and USB Power Supply is done in two ways:

- Using resistors R41, R42:
 - R41 - Power supply from DA145xx DEVKT-P PRO-MB / Coin Cell. **Default configuration.**
 - R42 - VLDO (3.3V) of USB power section. **Optional.**
- Using SW4 power switch. **Optional.**

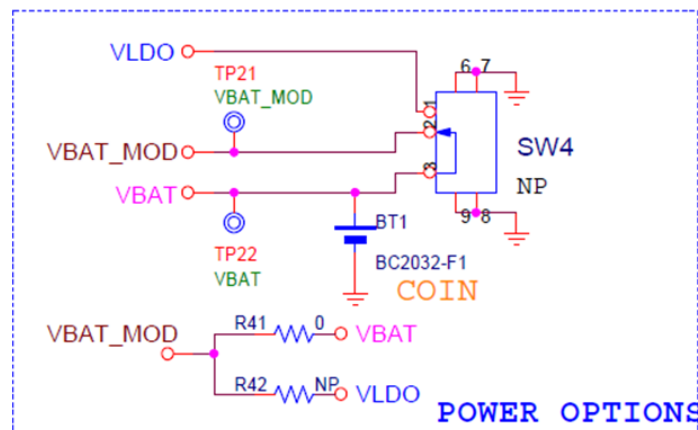


Figure 6: Power option selection for DA14531 SMARTBOND TINY™ MODULE DB

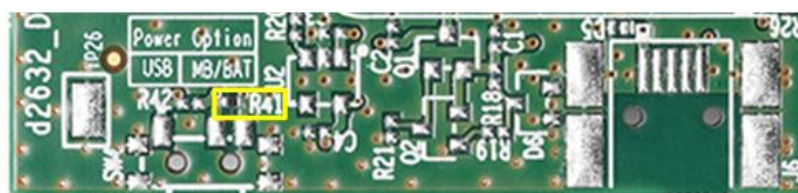


Figure 7: Power option default configuration

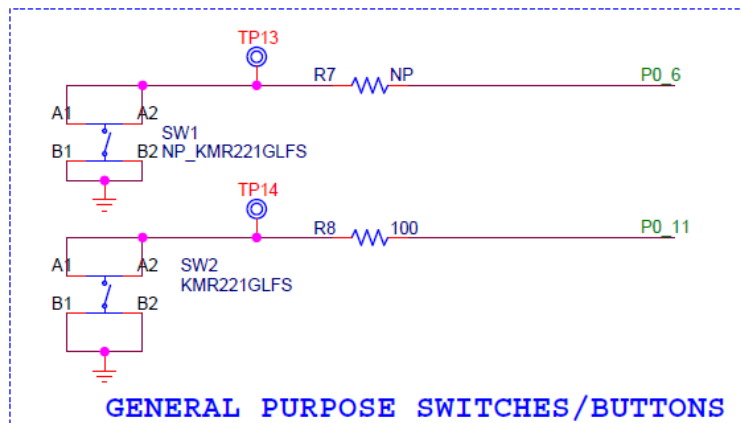


Figure 10: General purpose push buttons on DA14531 SMARTBOND TINY™ MODULE DB

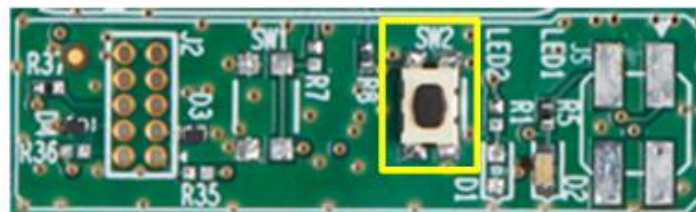


Figure 11: Default general purpose push button (SW2) on DA14531 SMARTBOND TINY™ MODULE DB

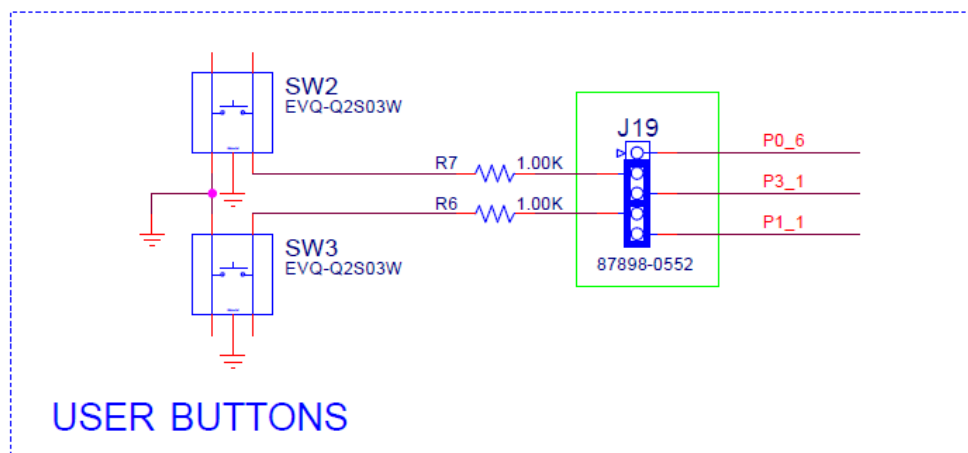


Figure 12: SW2 configuration on DA145xx DEVKT-P PRO-MB

5.4 General Purpose LEDs

LED D2 is a general-purpose LED and it is driven by P0_9. LED D2 shares same configuration as LED D5 of DA145xx DEVKT-P PRO-MB (D5 is driven by P1_0 of motherboard which is P0_9 of DA14531). See Figure 15.

LED D1 is driven by P0_8 and it is not populated. User can mount a LED like D2.

General purpose LEDs circuitry is completed with Jumper header J5. J5 is optional and it isolates signals P0_8 and P0_9 when LEDs function is not used, so signals can be directed to other functions.

Header J5 by default is not populated. Instead resistors R39 and R40 are used in order to configure the connection of LEDs to the signals (Figure 13, Figure 14).

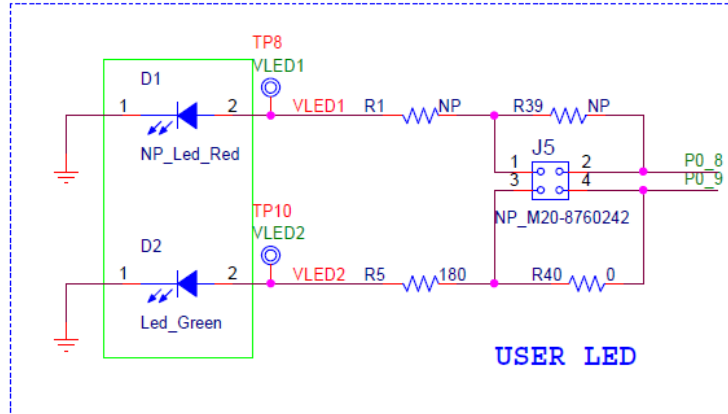


Figure 13: General Purpose LEDs on DA14531 SMARTBOND TINY™ MODULE DB

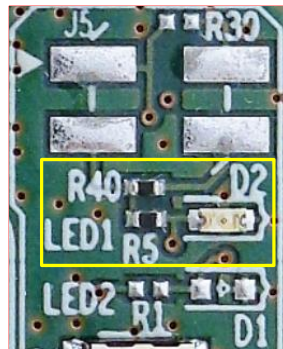


Figure 14: Default LED on DA14531 SMARTBOND TINY™ MODULE DB

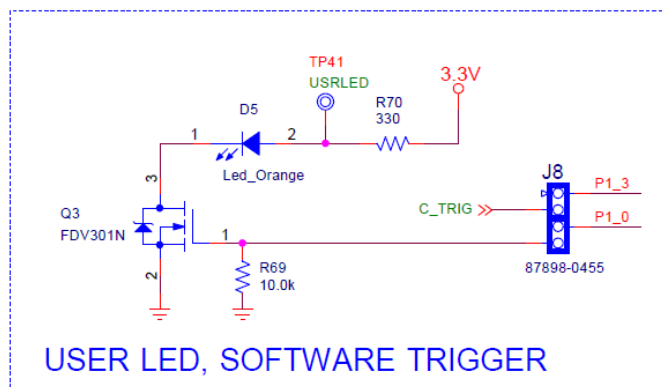


Figure 15: D5 LED configuration on DA145xx DEVKT-P PRO-MB

5.5 MikroBUS™ Module

The DA14531 SMARTBOND TINY™ MODULE DB can support MikroBUS™ modules. It requires some level of GPIOs multiplexing to avoid conflict with other functions driven by same GPIOs.

A MikroBUS™ module requires a power supply of 5V, 3.3V or both, depending on the module. The current configuration of the daughterboard supports only 3.3V. If a voltage of 5V is required, then USB power section needs to be populated.

Signals available for MikroBUS™ module can be seen in the Table 2. I²C signals and INT are the default configuration for the MikroBUS™ module. For SPI interface and RST additional resistors must be populated (Figure 16, Figure 17).

DA14531 SMARTBOND TINY™ MODULE DB MikroBUS™ doesn't share same GPIO signals as DA145xxx DEVKT-P PRO-MB MikroBUS™.



Figure 16: Default programming interface of MikroBUS™ module on DA14531 SMARTBOND TINY™ MODULE DB

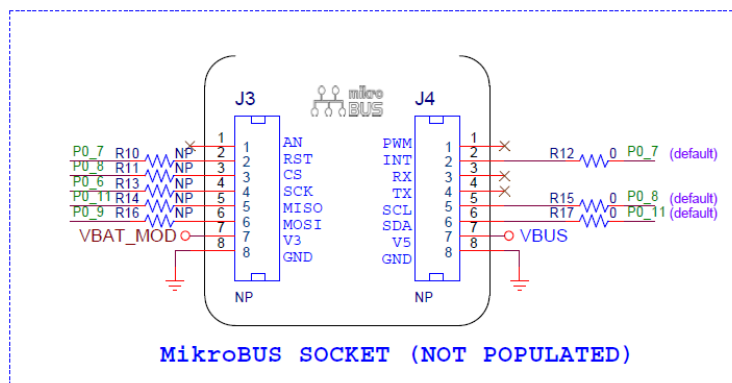


Figure 17: MikroBUS™ module Socket on DA14531 SMARTBOND TINY™ MODULE DB

Table 2: MikroBUS™ GPIOs multiplexing

| DA14531 SMARTBOND TINY™ MODULE GPIOs | Peripherals | MikroBUS™ | | |
|-----------------------------------------|-------------|------------------|------|---------------|
| | | I ² C | SPI | Other |
| P0_6 | SW1 | | SCK | |
| P0_11 | SW2 | SDA (default) | MISO | |
| P0_8 | LED D1 | SCL (default) | CS | |
| P0_9 | LED D2 | | MOSI | |
| P0_7 | | | | INT (default) |
| | | | | RST |



Figure 18: Example of mounting MikroBUS™ module

5.6 JTAG

DA14531 SMARTBOND TINY™ MODULE DB provides JTAG interface with SWDIO and SWCLK signals assigned to P0_2 and P0_10 (Table 3). JTAG signals are also available on header J2 (Figure 19).

Table 3: JTAG signals assignment

| Function | | The Signals | |
|--------------------------------|--------------------|------------------------|---------------------------------------|
| | | DA145xx DEVKt-P PRO-MB | DA14531 SMARTBOND TINY™ MODULE DEVKIT |
| Enabled by Jumpers (on PRO-MB) | | J2 | DA14531 SMARTBOND TINY™ MODULE |
| SW_CLK | J1:21-22 (Default) | SWCLK | P0_2 |
| SW_DIO | J1:23-24 (Default) | SWDIO | P0_10 |

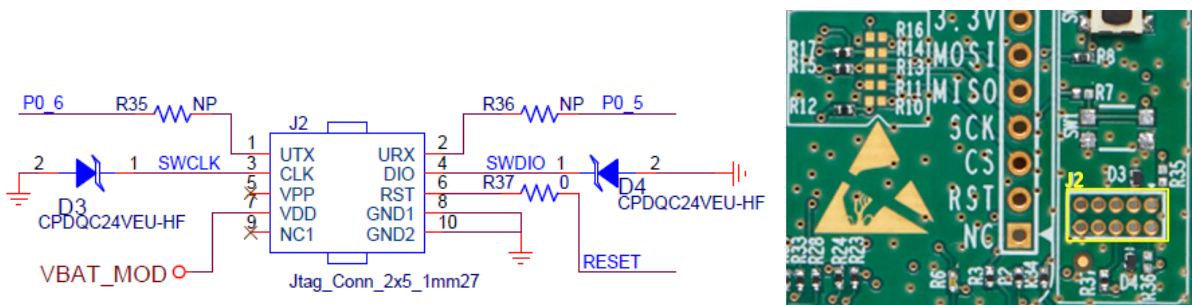


Figure 19: Optional debug port

5.7 UART

Three modes of UART can be used: single wire UART, 2 wire-UART or full UART.

Table 4: DA14531 SMARTBOND TINY™ MODULE DB UART Signals

| Function | | The signals | | |
|----------|---------------------------------------|------------------------|------|-----------------------------------|
| | | DA145xx DEVKT-P PRO-MB | | DA14531 SMARTBOND TINY™ MODULE DB |
| | | J2 | J1 | DA14531 SMARTBOND TINY™ MODULE |
| UTX | 2-wire or Full UART Transmit | P2_6 | P0_4 | P0_6 |
| URX | 2-wire or Full UART Receive | P2_5 | P0_5 | P0_5 |
| UCTS | 2-wire or Full UART Clear to Send | P2_8 | P0_6 | P0_8 |
| URTS | 2-wire or Full UART Request to Send | P2_7 | P0_7 | P0_7 |
| RxTx | Single wire UART Receive and Transmit | P2_5 | P2_5 | P0_5 |

Note 1 UART signals are directly mapped to J1 connector of DA145xx DEVKT-P PRO-MB: Rx, Tx, RTS and CTS.

For enabling the different configurations check section 5.8.

5.8 GPIOs and pin assignment on DA14531 SMARTBOND TINY™ MODULE DB

The DA14531 SMARTBOND TINY™ MODULE DB comes in with a pre-defined default configuration. However, due to the low GPIO pin count, several functions are multiplexed and can be enabled as needed.

On Table 5 DA14531 SMARTBOND TINY™ MODULE GPIOs use on the various functions can be found. On the last column of the table users can check which of the functions are enabled by default with the default hardware setup and which require some hardware modification by adding resistors.

Table 5: GPIO multiplexing on DA14531 SMARTBOND TINY™ MODULE DB

| DA14531 SMARTBOND TINY™ MODULE Signals | J1 connector Daughterboard | Function 1 | Function 2 | Function 3 | Comments for functions supported | | |
|----------------------------------------|----------------------------|--------------------|----------------------------|------------|----------------------------------|---------|---------|
| | | | | | | | |
| P0_0 | | SW3 (RESET Button) | | | | Default | |
| | MB2_0 | | | | | | |
| | RESET | | RESET on J2 JTAG connector | | Default | | Default |
| P0_2 | | | | | | | |
| | MB2_2 | | | | | | |
| | SWCLK | | SWCLK JTAG connector (J2) | | Default | | Default |

| DA14531 SMARTBOND TINY™ MODULE Signals | J1 connector Daughterboard | Function 1 | Function 2 | Function 3 | Comments for functions supported | | |
|----------------------------------------------------|----------------------------------|--------------------------|----------------------------------------------|----------------------------------------------|-------------------------------------|---------|---------|
| | | | | | | | |
| P0_5 | | | | URX (2-wire) on JTAG connector (J2) | | | R36 |
| | MB2_5 | | RxTx (1-wire UART) | | | Default | |
| | MB0_5 | URx (4- wire UART) | | | Default | | |
| P0_6 | | SW1 (User button) | UTx (2-wire) on JTAG connector (J2) | MikroBUS™ SCK | R7, SW1 | R35 | R13 |
| | MB2_6 | | | | | | |
| | MB0_4 | UTx (4- wire UART) | | | Default | | |
| P0_7 | | | MikroBUS™ RST | MikroBUS™ INT | | R10 | Default |
| | MB2_7 | | | | | | |
| | MB0_7 | URTS (4- pin UART) | | | Default | | |
| P0_8 | | RED LED (D1) | MikroBUS™ CS | MikroBUS™ SCL | D1, R1, R39 or J5 | R11 | Default |
| | MB2_8 | | | | | | |
| | MB0_6 | UCTS (4- pin UART) | | | Default | | |
| P0_9 | | GREEN LED (D2) | MikroBUS™ MOSI | | Default | R16 | |
| | MB2_9 | | | | | | |
| P0_10 | MB3_0 | | | | | | |
| | SWDIO | | SWDIO JTAG connector (J2) | | | Default | |
| P0_11 | | SW2 (User button) | MikroBUS™ MISO | MikroBUS™ SDA | Default | R14 | Default |
| | MB3_1 | | | | | | |

5.9 Programming and debugging interface setup

On this section the settings required for configuring the PRO-MB development kit for DA14531 SMARTBOND TINY™ MODULE are described:

- DA14531 SMARTBOND TINY™ MODULE DB
- DA145xx DEVKT-P PRO-MB

Configurations applied by adding/removing jumpers on the DA145xx DEVKT-P PRO-MB. No modification is required on the DA14531 SMARTBOND TINY™ MODULE DB.

Please notice that the SPI flash on DA145xx DEVKT-P PRO-MB will not be used as DA14531 SMARTBOND TINY™ MODULE has integrated QSPI Flash. See Table 6.

The settings of three configurations are presented:

- Configuration 1: Single wire UART, JTAG and RESET
- Configuration 2: UART (2 wires), JTAG and RESET
- Configuration 3: Full UART, JTAG and RESET

Table 6: Power, SPI Flash and programming/debugging jumper setup of DA145xx DEVKT-P PRO-MB for TINY™ MODULE

| Device | | Configuration | Setting | Comments | |
|---------------------------------------|------------------------------------|------------------------------------------------------|----------------------------------------------------------------|--------------------------------------------------------------------|----------------------------------|
| DA145xx DEVKT-P PRO-MB | SPI Data Flash | Use SPI Data Flash of DA14531 SMARTBOND TINY™ MODULE | Remove J1: 1-2 J1: 3-4 J1: 5-6 J1: 7-8 J1: 9-10 | Remove jumpers from J1 connector that enable PRO-MB SPI Data Flash | |
| | Voltage provided to DA14531 (VLDO) | | | J9:1-2 J9:3-4 | Current sense circuit of PRO-MB |
| | | 1.8V | | J5:1-3 | Default voltage for TINY™ MODULE |
| | | 3.0V | | J5:2-4 | |
| | | 3.3V | | J5:1-3 J5:2-4 | |
| | DA14531 DCDC configuration | Buck | | J4:3-4 | Power mode of TINY™ MODULE |
| | Programming/debugging interface | Single wire UART | | J1:19-20 J10:1-J1:15 J10:2-J1:17 | |
| | | 2-wire UART | | J1:15-16 J1:17-18 | |
| | | 4 wire UART | | J1:11-12 J1:13-14 J1:15-16 J1:17-18 | |

| Device | Configuration | Setting | Comments |
|--------|---------------|----------------------|----------|
| | JTAG | J1:21-22 J1:23-24 | |
| | RESET | J1:25-26 | |

5.9.1 Single wire UART, JTAG, RESET

Table 7: Pin assignment for DA14531 SMARTBOND TINY™ MODULE Configuration 1

| Configuration | P0_0 | P0_2 | P0_5 | P0_10 |
|------------------------|-------|-------|------|-------|
| 1 JTAG & single UART | Reset | SWLCK | RxTx | SWDIO |

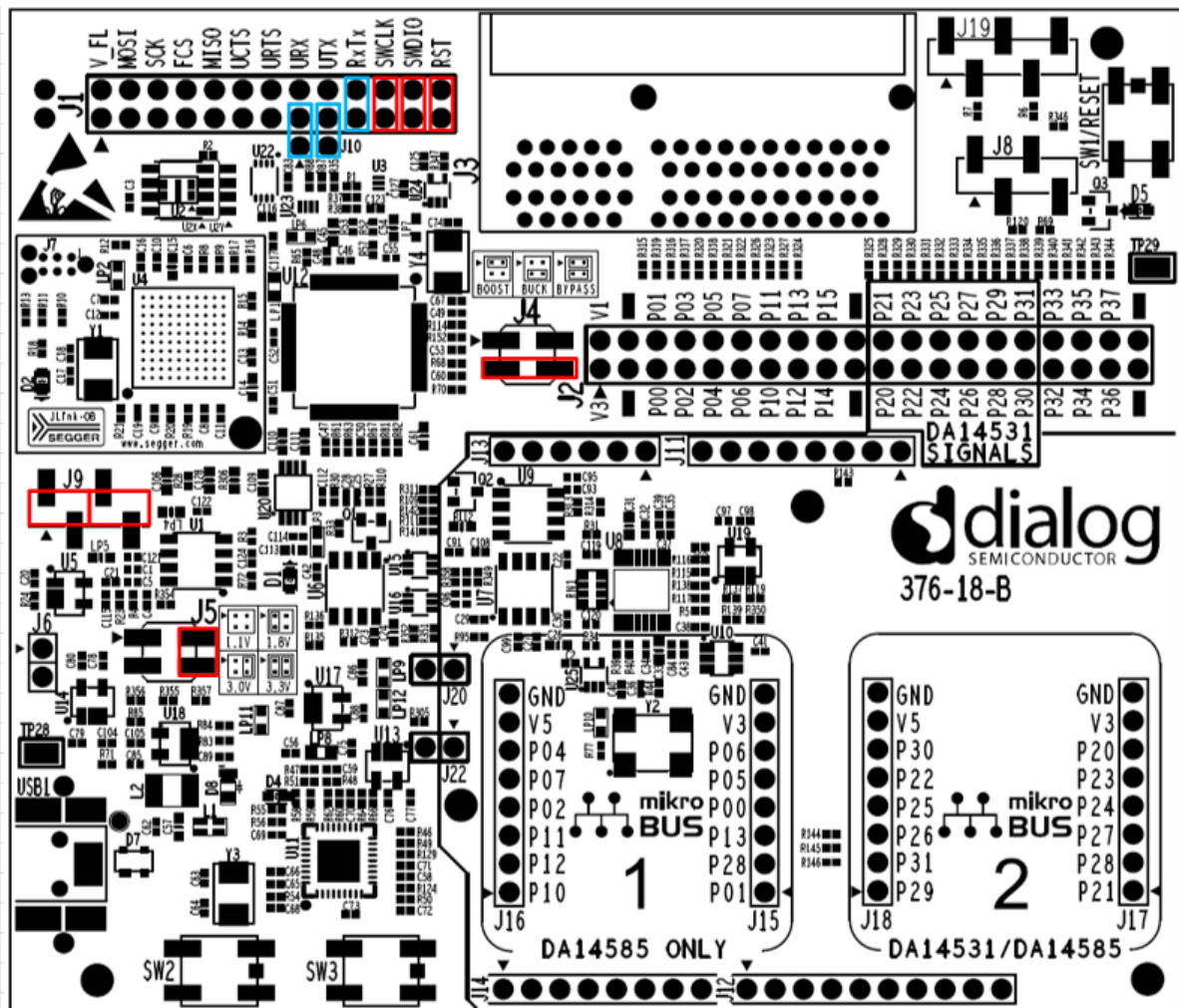


Figure 20: DA145xx DEVKT-P PRO-MB jumper setup for Single wire UART, JTAG and RESET operation

5.9.2 2-wire UART, JTAG, RESET

Table 8: Pin assignment for DA14531 SMARTBOND TINY™ MODULE configuration 2

| Configuration | P0_0 | P0_2 | P0_6 | P0_5 | P0_10 |
|------------------------|-------|-------|------|------|-------|
| 2 JTAG & 2 wire UART | Reset | SWLCK | Tx | Rx | SWDIO |

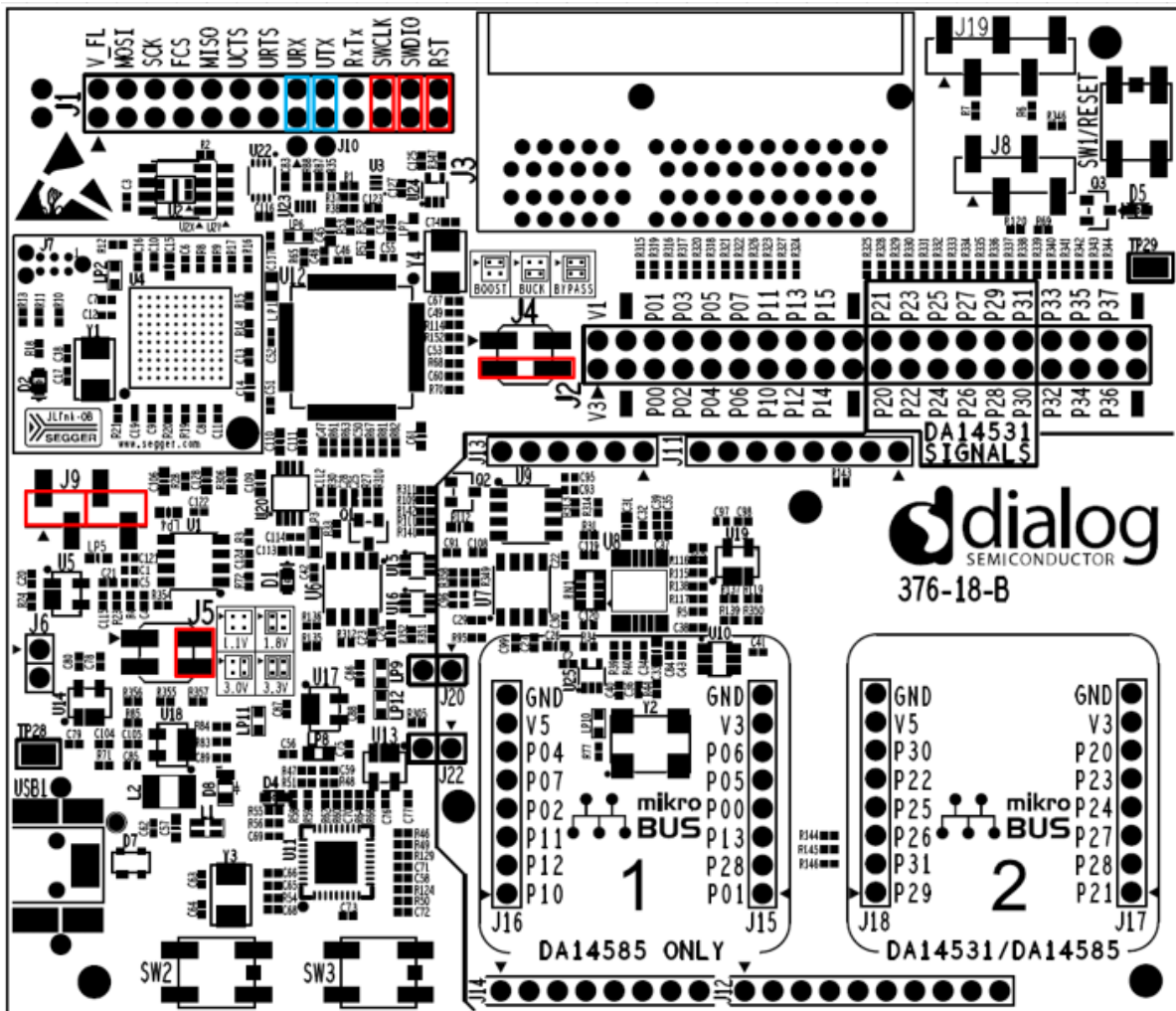


Figure 21: DA145xx DEVKT-P PRO-MB jumper setup for 2-wire UART, JTAG and RESET operation

5.9.3 4-wire UART, JTAG, RESET

Table 9: Pin assignment for DA14531 SMARTBOND TINY™ MODULE configuration 3

| Configuration | P0_0 | P0_2 | P0_6 | P0_5 | P0_7 | P0_8 | P0_10 |
|------------------------|-------|-------|------|------|------|------|-------|
| 3 JTAG & 2 wire UART | Reset | SWLCK | Tx | Rx | RTS | CTS | SWDIO |

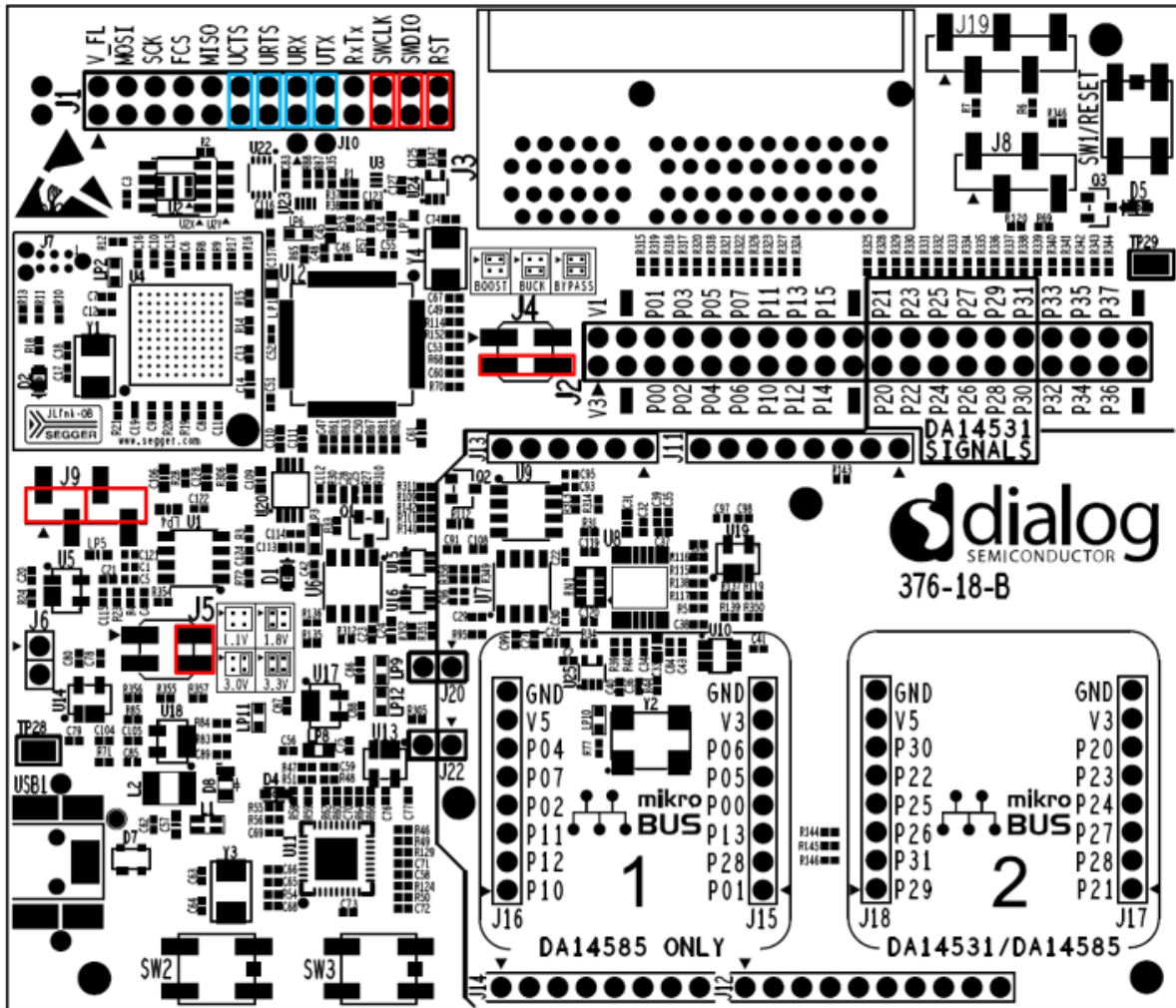


Figure 22: DA145xx DEVKT-P PRO-MB jumper setup for 4-wire UART, JTAG and RESET operation

5.10 First Steps with DA14531 SMARTBOND TINY™ MODULE DEVKIT

The DA145xx DEVKT-P PRO-MB as well as DA14531 SMARTBOND TINY™ MODULE DB come in with a pre-defined default configuration. The initial steps that must be taken when the Daughterboard is mounted on the PRO-MB are depicted in Figure 23.

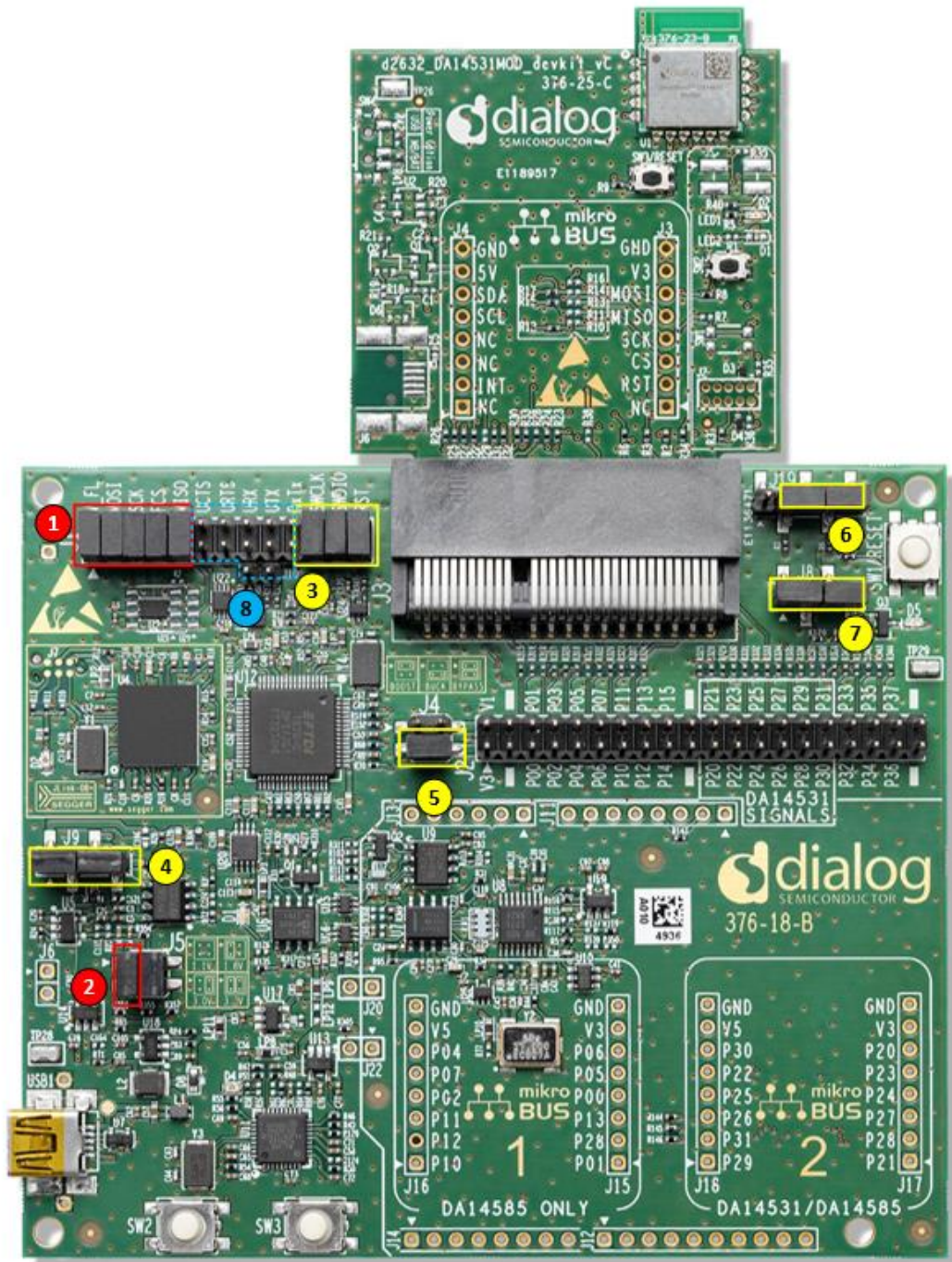


Figure 23: DA145xx DEVKT-P PRO-MB First Steps Jumper Configuration with DA14531 SMARTBOND TINY™ MODULE DB attached

Steps to be followed:

1. Remove SPI Data Flash Jumpers J1 1:2, 3:4, 5:6, 7:8, 9:10
2. Remove J5 1:3 header (LDO(U5) output at 3.0V)

3. Leave J1 21:22, 23:24, 25:26 for RESET, JTAG
4. Leave J9 1:2,3:4 (current measurement circuit)
5. Leave J4 3:4 (Buck mode)
6. Leave J8 as is (in case a MikroBUS™ module is used J8 is advised to be removed)
7. Leave J19 as is (in case a MikroBUS™ module is used J19 2:3 is advised to be removed)
8. Configure UART operation as per configuration 1, 2 or 3

6 Known Issues

6.1 Keil JTAG default Clock Speed

When trying to program DA14531 SMARTBOND TINY™ MODULE using Keil the following error may occur when the user tries to open the debugger session (Figure 24).

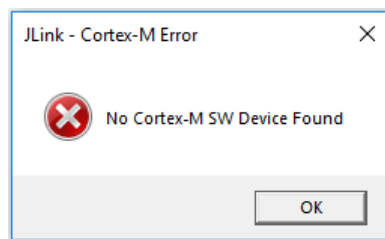


Figure 24: Keil reporting error when try to open debugger session

User must lower the JTAG clock speed to 2MHz following the steps depicted in Figure 25.

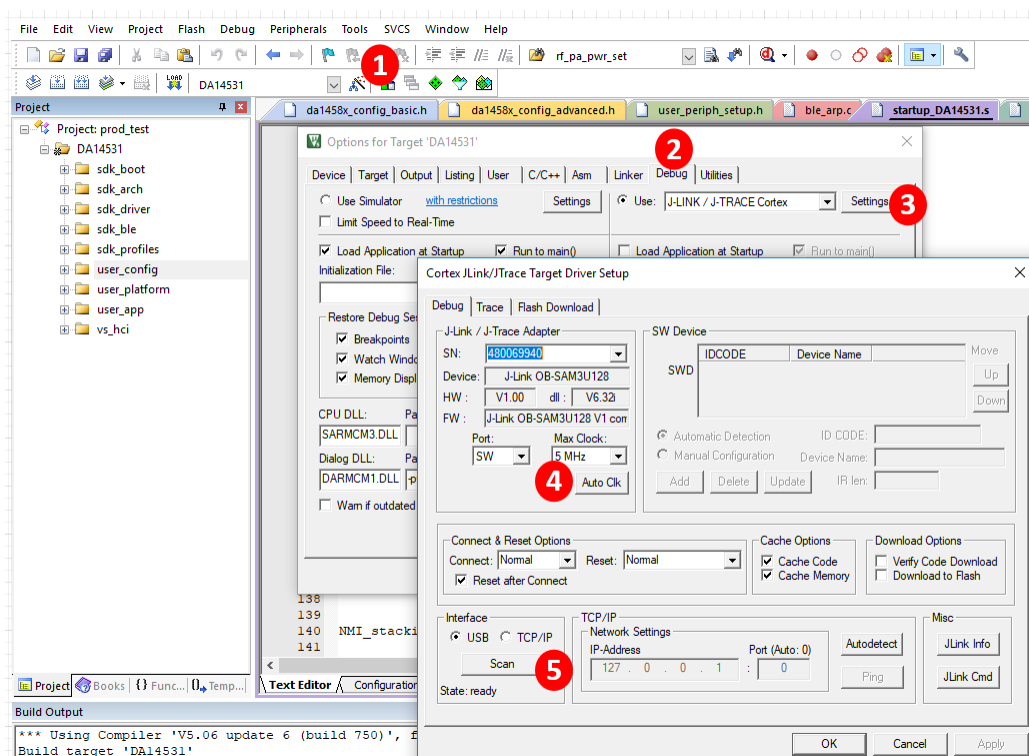


Figure 25: Steps to set up JTAG clock speed

Steps to be followed:

1. Open options for Target device

2. Choose Debug Tab
3. Press settings for J-Link/ J-TRACE Cortex
4. Change default max clock speed from 5MHz to 2MHz
5. Press Scan to detect the ARM Core

DA14531 SMARTBOND TINY™ MODULE Development Kit Hardware User Manual

Target

Appendix A

A.1 Schematic

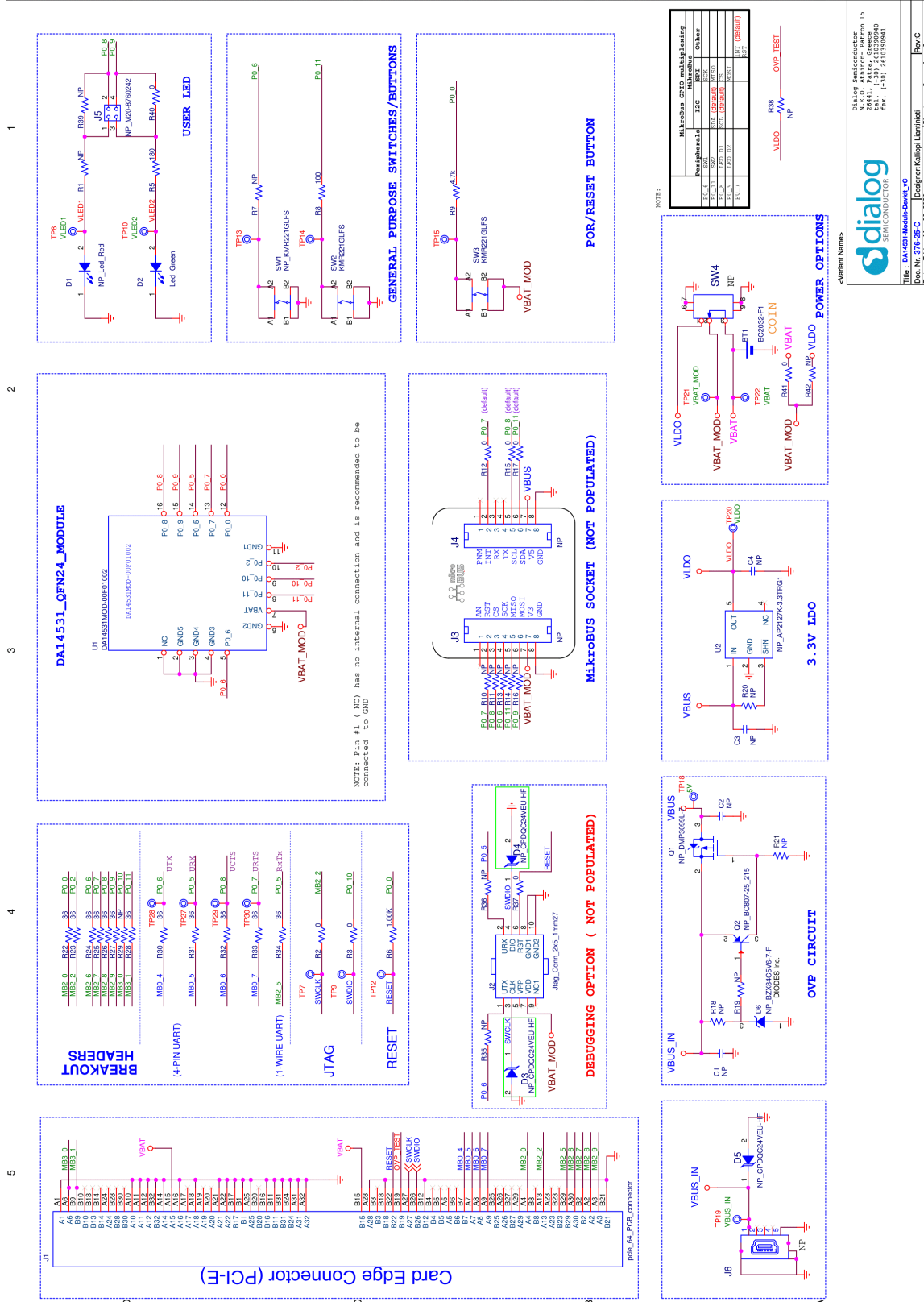


Figure 26: Schematic of DA14531 SMARTBOND TINY™ MODULE DB [376-25-C]

A.2 Placed Components

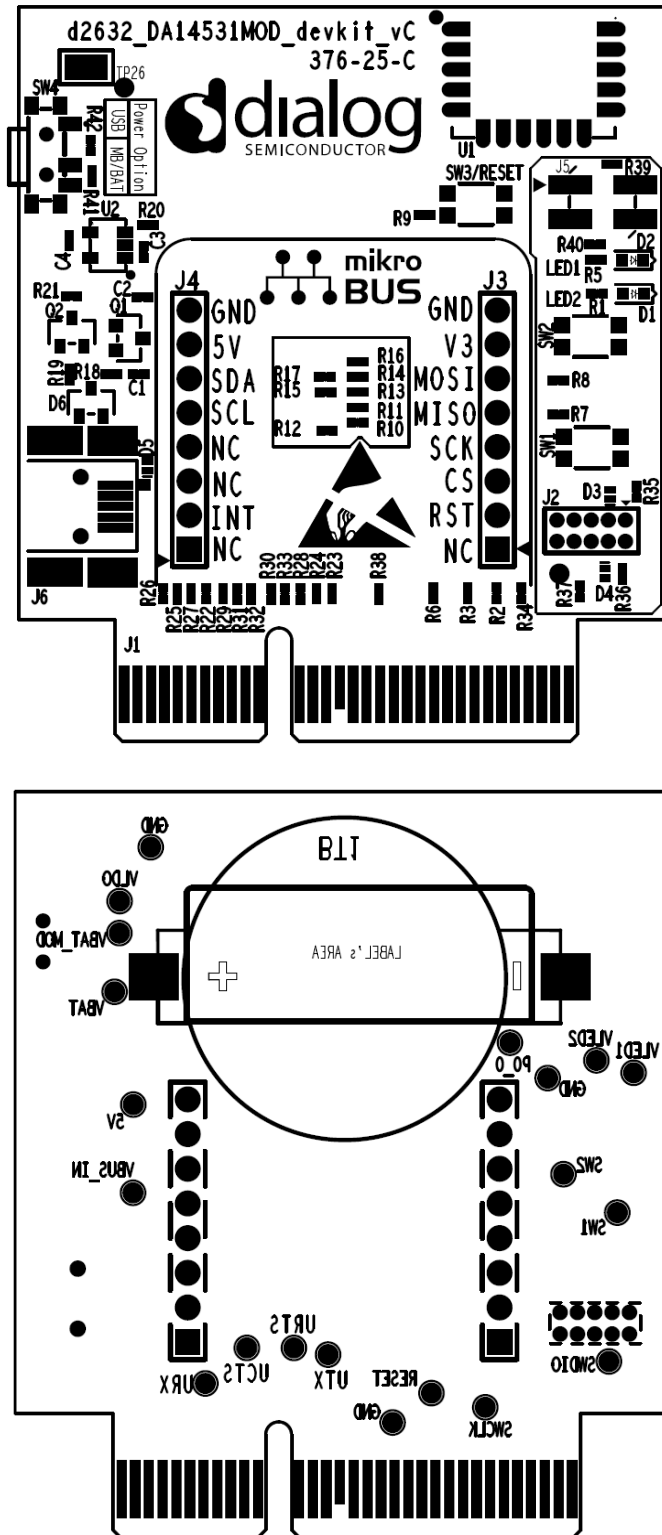


Figure 27: Components on top and bottom sides for DA14531 SMARTBOND TINY™ MODULE DB [376-25-C]

Revision History

| Revision | Date | Description |
|-----------------|---------------|--------------------------------------------------|
| <> | <DD-Mmm-YYYY> | <Latest revision. Summary of important changes.> |
| Change details: | | |
| 1.0 | 10-04-2020 | Initial version. |
| 1.1 | 11-05-2020 | Chapter 6 with Known Issues added. |

DA14531 SMARTBOND TINY™ MODULE Development Kit Hardware User Manual

Target

Status Definitions

| Status | Definition |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------|
| DRAFT | The content of this document is under review and subject to formal approval, which may result in modifications or additions. |
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