

User Manual

Bluetooth® Smart Communication Interface Board

UM-B-065

Abstract

This document describes the hardware of the Communication Interface Board and the programming process of a reference design based on DA1458x and DA1468x devices.

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1 Terms and definitions

CIB	Communication Interface Board
EEPROM	Electrically Erasable Programmable Read-Only Memory
JTAG	Join Test Action Group (test interface)
LED	Light Emitting Diode
LDO	Low Drop-Out (regulator)
MCU	Micro Controller Unit
OTP	One-Time Programmable
POR	Power-On Reset
QSPI	Quad Serial Peripheral Interface
RST	reset
SOC	System On Chip
SPI	Serial Peripheral Interface
SW	software
Target Board	Any reference design based on DA1458x and DA1468x
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus

2 References

- [1] DA14580 Low Power Bluetooth® Smart SOC, Datasheet, Dialog Semiconductor.
- [2] DA14582 Low Power Bluetooth® Smart SOC with Audio Codec, Datasheet, Dialog Semiconductor.
- [3] DA14583 Low Power Bluetooth® Smart SOC with Flash memory, Datasheet, Dialog Semiconductor.
- [4] UM-B-034, DA14580 Bluetooth® Smart Development Kit – Pro, User manual, Dialog Semiconductor.
- [5] DA14680 Low Power Bluetooth® Smart SOC with QSPI Flash memory, Datasheet, Dialog Semiconductor.
- [6] DA14681 Low Power Bluetooth® Smart SOC, Datasheet, Dialog Semiconductor.
- [7] ATSAM3U2CA-CU ARM-based Flash Microcontroller, Datasheet, Atmel.

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3 Introduction

This document describes the hardware set-up of the Communication Interface Board (CIB). The block diagram, the actual board, the various sections and settings as well as the connectivity are presented. The purpose of this cost effective interface board is to allow access to the target board and provide the user with the capability to:

- Program the DA1458x and DA1468x via JTAG or UART.
- Debug the SW via JTAG, using Keil uVision 5 or Eclipse.
- Burn OTP via JTAG or UART.
- Program a SPI/QSPI Data Flash or EEPROM memory via JTAG or UART.

CIB can only be used/purchased in combination with Dialog reference boards or development kits.

4 Hardware system

The Communication Interface Board (CIB) consists of the following blocks: JTAG, UART, a reset button, an ON/OFF power switch, three jumpers, two green and two red LEDs. This system is powered from the USB connector (J1).

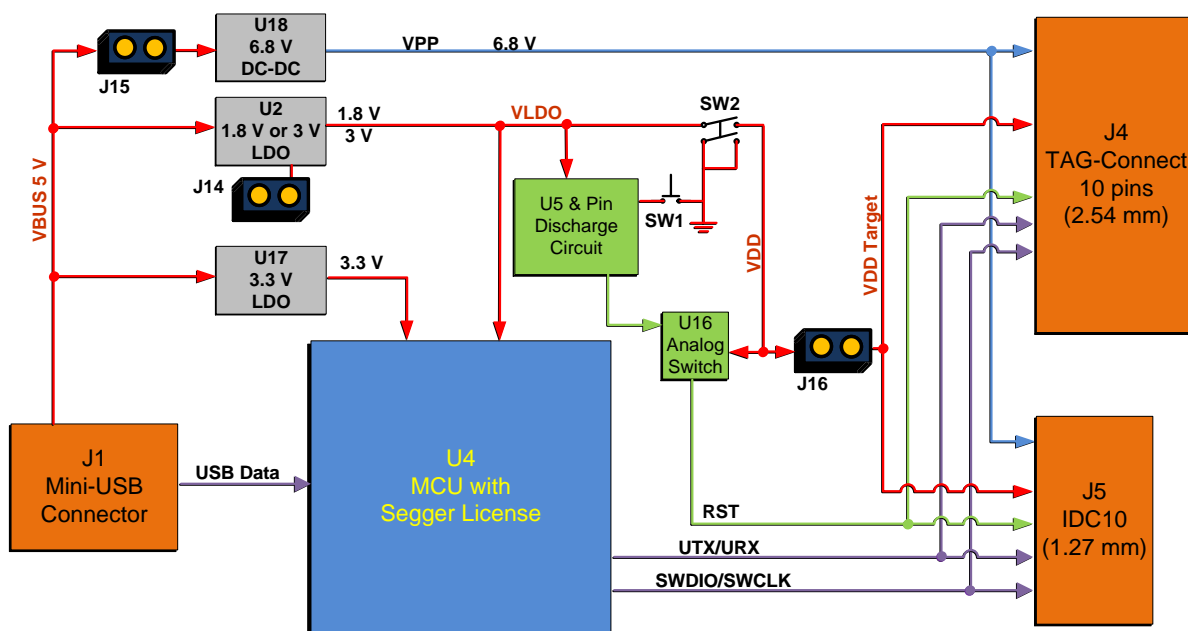


Figure 1: Block diagram of the CIB

The Communication Interface Board (CIB) has the following functions:

- Provides user access to the target board, via UART or JTAG.
- Resets the application (active HIGH) by pressing the button (**SW1**). When the reset signal is asserted, the UART and JTAG signals are driven LOW.
- Provides power to target board through ON/OFF switch (**SW2**).
- LDO (**U2**), 1.8 V or 3 V, feeds the voltage rail of VLDO. VLDO supplies the on board circuitry (Segger MCU, discharge circuit, analog switch) and the target board (VDD_Target) through SW2 and J16. The LDO can provide 50 mA @ 1.8 V and 150 mA @ 3.0 V to the target board.
- LDO output voltage (1.8 V or 3 V) is selected by jumper setting (**J14**).

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- VPP = 6.8 V voltage rail is available on the target board interface connectors (J2, J4).
- VPP Enable/Disable selection, based on jumper position (J15).
- Current measurement point (J16).
- Test points for all output signals (J18).
- MCU (U4) is programmed with Segger license. MCU provides the debugging and programming interface with the target board. Programming interface consists of JTAG (SWCLK and SWDIO) as well as UART signals (UTX and URX).

4.1 System description

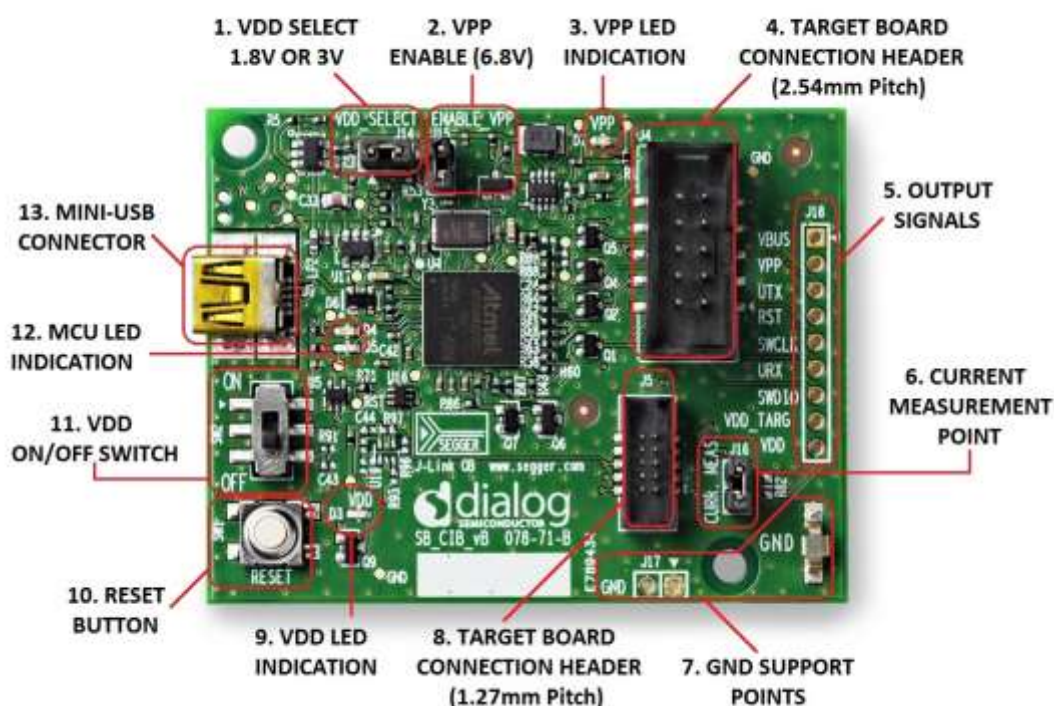


Figure 2: Community Interface Board – Components

Legend:

1. LDO (U2) output voltage selection point (1.8 V or 3 V)	J14
2. VPP Enable (6.8 V) point	J15
3. VPP LED indication	D7
4. Target board connection header (2.54 mm pitch)	J4
5. Output signals test points	J18
6. Current measurement point	J16
7. GND test points	J17, GND
8. Target board connection header (1.27 mm pitch)	J5
9. VDD LED indication	D3
10. Reset button	SW1
11. VDD ON/OFF power switch	SW2
12. MCU LED indication	D4, D5
13. Mini-USB connector	J1

Note: Only one target board must be connected to CIB at a time.

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4.2 Cables and peripheral connections

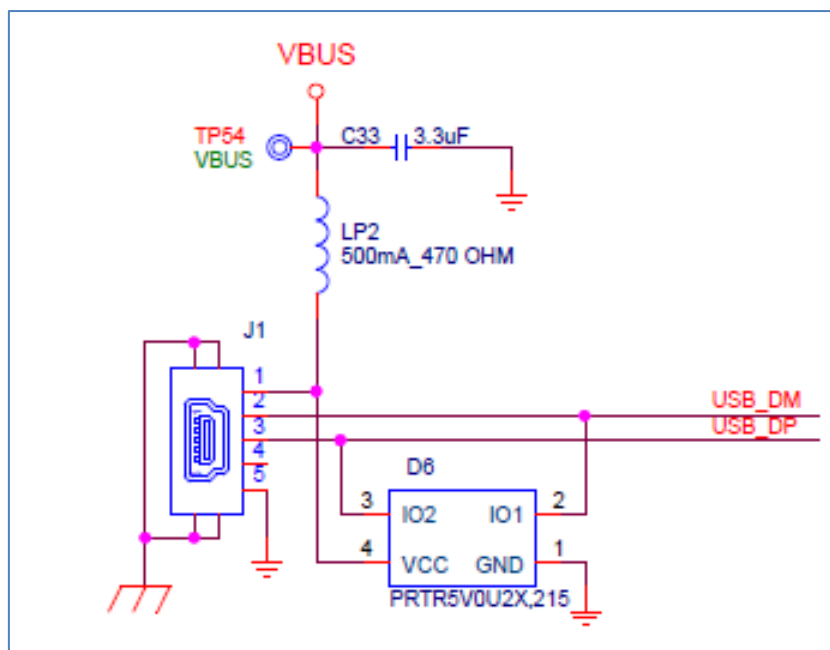


Figure 3: Schematic of the Mini-USB connector (J1)



Figure 4: The actual USB cable

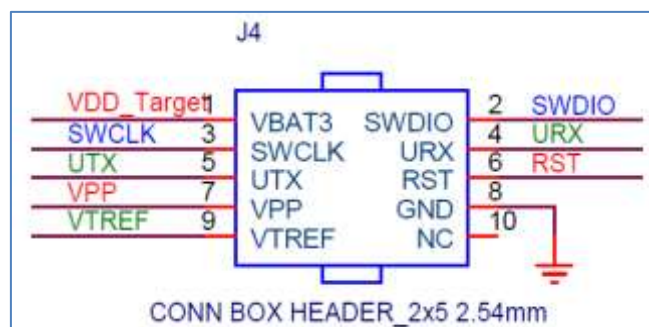
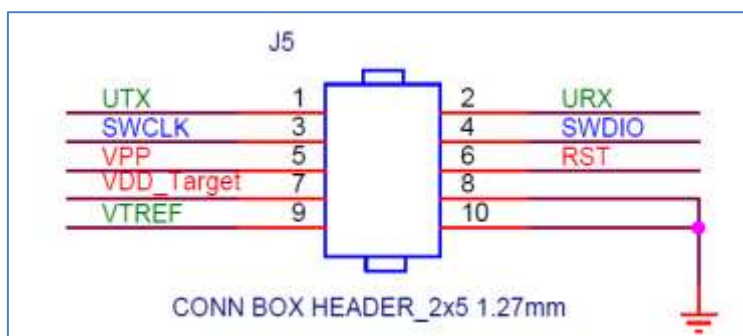


Figure 5: Schematic of the TAG-Connector (2.54 mm)

**Bluetooth® Smart Communication Interface
Board****Figure 6: The actual TAG-Connect cable (10 pins)****Figure 7: Schematic of the IDC10 Connector (1.27 mm)****Figure 8: The actual IDC10 - 1.27 mm cable**

- USB cable (Figure 4) connects to the USB connector (Figure 3).
- 10 pins TAG-Connect cable (Figure 6) is plugged in the TAG-Connector 2.54 mm, J2 (Figure 5). The cable can be purchased from Tag-Connect.com.
- IDC10-1.27 mm cable (Figure 8) is plugged in IDC header J4, (Figure 7). The cable can be purchased from various distributors, such as Farnell.

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Table 1: Signal association and description

Signal name	J4 pin number TAG-Connector 2.54 mm	J5 pin number IDC10-1.27 mm	Description
VDD_Target	1	7	Target board supply voltage
SWDIO	2	4	JTAG data
SWCLK	3	3	JTAG clock
URX	4	2	UART receive
UTX	5	1	UART transmit
RST	6	6	Reset
VPP	7	5	OTP programming voltage
GND	8	8, 10	Ground
VTREF	9	9	Not applicable / no connection
NC	10	-	No connection

4.3 Switches, buttons and LEDs

4.3.1 Reset button (SW1)

Reset to the target board is provided by pressing button SW1.



Figure 9: Reset button (SW1)

4.3.2 Reset function

4.3.2.1 Target board has reset functionality

In the case that the target board has reset functionality, the reset function is implemented by pushing button **SW1**. While the button **SW1** is pressed, the signals SWDIO, SWCLK, UTX and URX are tied to ground. These signals are available on connectors **J4**, **J5**.

4.3.2.2 Target board has no reset functionality and is powered from the CIB

In the case that the reset signal of the target board is not accessed from CIB, the reset function is implemented by switching off **SW2**. By setting **SW2** in position OFF, the VDD_Target voltage goes low, which causes power cycling of the target board. While the voltage is low, the signals SWDIO, SWCLK, UTX and URX are tied to ground. These signals are available on connectors **J4**, **J5**.

4.3.2.3 Target board has no reset functionality and it is not powered from the CIB

In the case that the target board has no reset functionality (reset signal of the target board is not accessed from CIB) and it is not powered from the CIB, the user must simultaneously:

- Power-cycle the supply of the target board, and
- Push the button **SW1**.

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While the button **SW1** is pressed, the signals SWDIO, SWCLK, UTX and URX are tied to ground. These signals are available on connectors **J4, J5**.

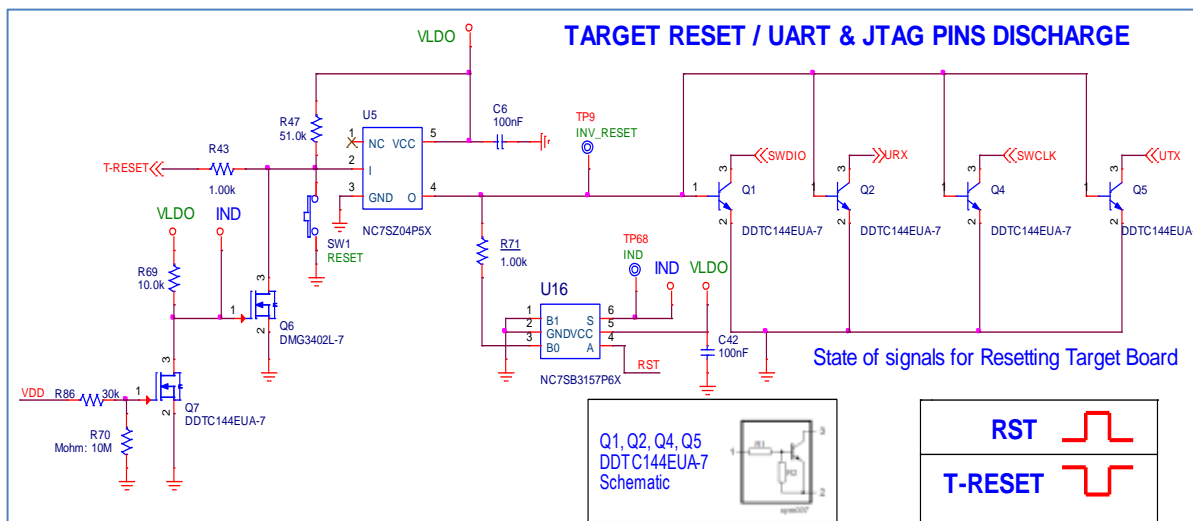


Figure 10: Schematic of the Reset and UART/JTAG discharge circuitry

4.3.3 Target board power supply – ON/OFF switch (SW2)

SW2 is a two-position switch which connects VLDO (output line of the LDO **U2**), with the connectors **J4**, **J5** and consequently the target board. In [Figure 11](#), **SW2** is set to OFF, which means that the target board is not powered from CIB. When the switch is in position ON, the target board is supplied with power from CIB. Also, by using this switch we can generate a Power on Reset signal (described in section [4.3.2.2](#)).



Figure 11: The actual Power supply switch (SW2)

4.3.4 LEDs

For the positions of the LEDs on the CIB, see [Figure 2](#).

- The VDD LED (**D3**) indicates that target board is supplied from:
 - CIB, when switch **SW2** is set to ON.
 - An external power supply (switch **SW2** is OFF and jumper placed on **J16**).
- The VPP LED (**D7**) indicates that the VPP pin of the target board is powered with 6.8 V.
- The **D5** LED is switched off for 10 ms once per second and indicates J-Link “heart beat”. It is activated after the emulator has been in idle mode for at least 7 s.
- The **D4** LED indicates that Reset is active on the target.

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4.3.5 Headers and jumpers

Header J14:

- Place the jumper on the **J14** header for VDD Voltage = 3 V and GPIO voltage = 3 V.
- Remove the jumper from the **J14** header for VDD Voltage = 1.8 V and GPIO voltage = 1.8 V.

Header J15:

To activate the VPP, place the jumper on the **J15** header.

- The power switch (**SW2**) must be in position ON.
- If the target board is supplied from an external power supply, there are two options:
 - Remove the jumper from the **J16** header and turn the power switch (**SW2**) ON.
 - Place the jumper on the **J16** header, turn the power switch (**SW2**) OFF, and supply the target board from the external power supply.

Header J16:

There are three options to perform a power consumption measurement of the target board:

- Remove the jumper from the **J16** header and connect an ampere-meter directly.
- Mount a resistor on the footprint for **R82**. The resistor should not be larger than 10 Ω . Connect an oscilloscope with two probes on VDD and VDD_Target and measure the voltage drop. The voltage drop will be proportional with the current consumption. For example, if a 1 Ω resistor has been chosen, 1 mV equals 1 mA.
- Remove the jumper from the **J16** header, connect a Development Kit – Pro motherboard (DA14580DEVKIT-P_vB) in series and measure the current consumption using the SmartSnippets™ tool, as described in section 6.

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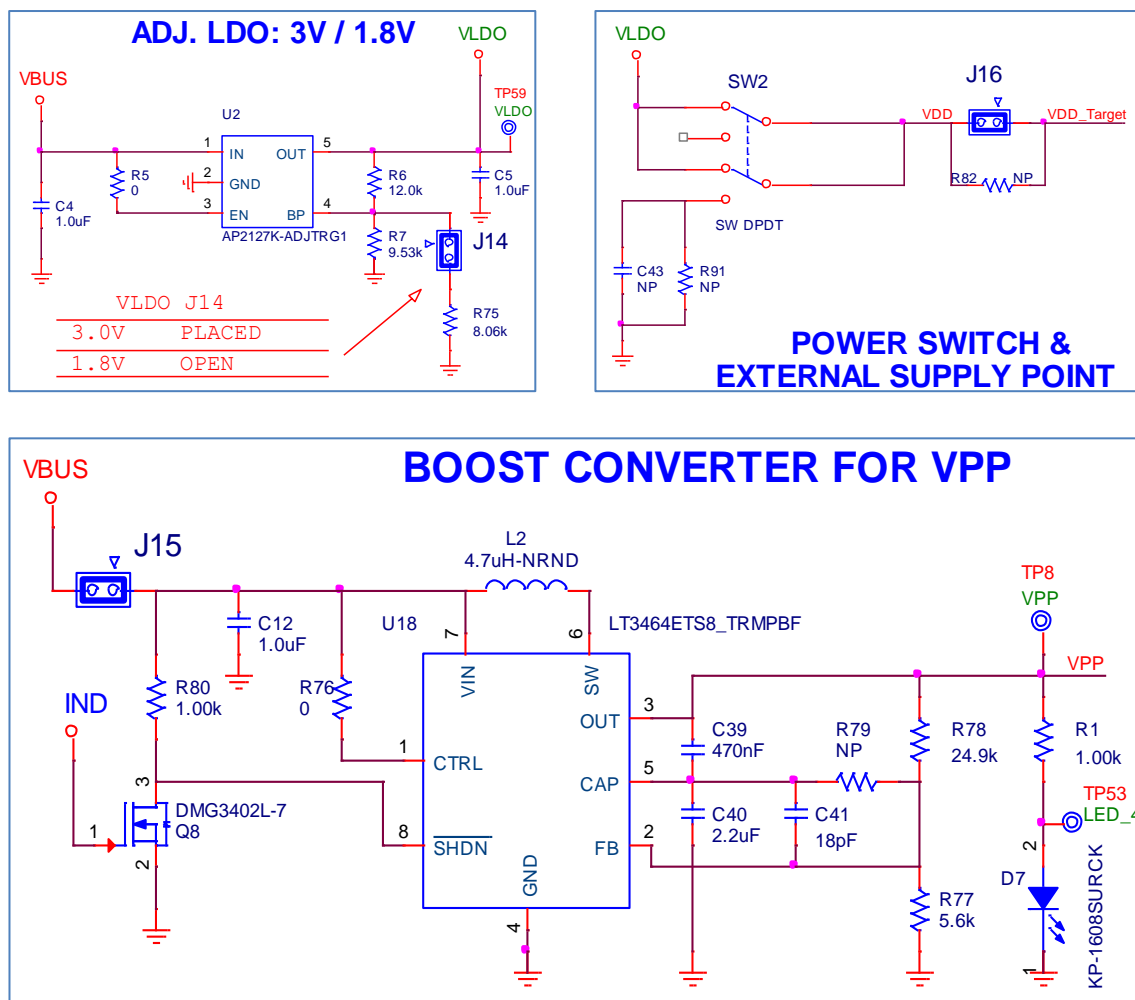


Figure 12: Headers J14, J15 and J16

5 Programming reference designs using CIB

5.1 Programming using JTAG mode or UART mode

Requirements:

- A USB cable must be plugged into the CIB.
- Please use SmartSnippets™ software (complete development environment - Dialog's proprietary tool) for programming the target board.

Table 2: General setup guide for programming target board

Target board powered from	Setup
CIB VDD_Target = 3 V	J14 in place J16 in place SW2 set to ON
CIB VDD_Target = 1.8 V	J14 not in place J16 in place SW2 set to ON
External power supply VDD_Target = 3 V	J14 in place J16 in place SW2 set to OFF
External power supply VDD_Target = 1.8 V	J14 not in place J16 in place SW2 set to OFF
External power supply VDD_Target = 1.5 V	J14 in place J16 not in place SW2 set to ON
External power supply 3 V < VDD_Target < 3.5 V	J14 in place J16 not in place SW2 set to ON

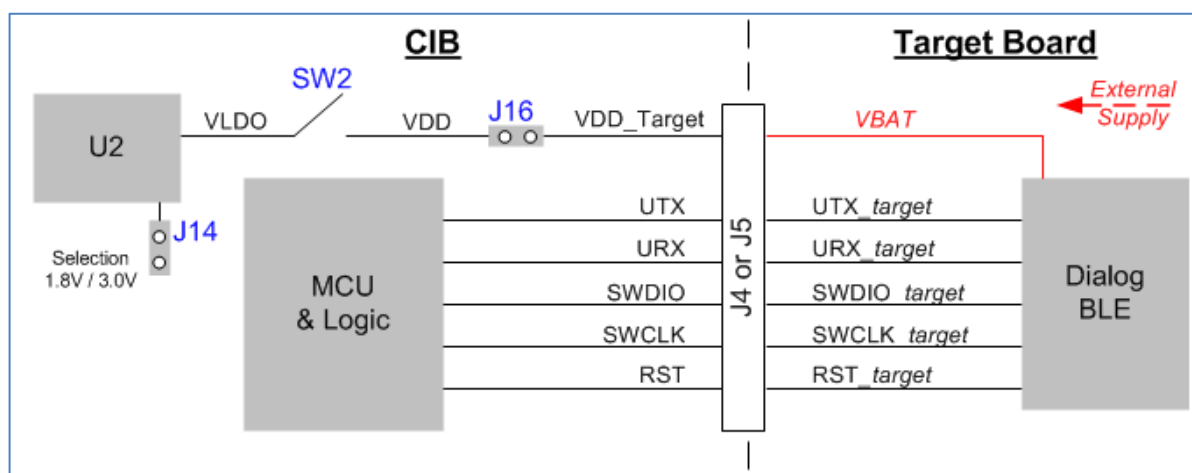


Figure 13: CIB to Target board interconnection

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5.2 Reference design configuration for programming with CIB

A wide range of configurations for CIB are possible. Examples of CIB application on a number of reference designs are presented below.

Table 3: Reference designs – UART and JTAG configuration


Reference design	Dialog device	UART or JTAG configuration
Battery Powered Beacon (078-51-D)	DA14580 (WLCSP)	Table 4
Indoor Light Powered Beacon (078-37-A1)	DA14580 (WLCSP)	Table 5
Proximity Tag (078-57-B)	DA14580 (WLCSP)	Table 6
Wireless Keyboard (078-24-B)	DA14580 (QFN48)	Table 7
Wireless Mouse (078-53-D)	DA14580 (QFN40)	Table 8
Remote control Unit (078-42-C)	DA14580 (QFN48)	Table 9
Remote Control with Voice & Motion (282-04-B1)	DA14582 (QFN56)	Table 10
IoT Sensor Board (285-01-F)	DA14583 (QFN40)	Table 11
Range Extender (078-56-C)	DA14580 (QFN40)	Table 12
Trace Antenna (078-28-D)	DA14580 (QFN48)	Table 13
Wearable (224-30-B)	DA14681 (aQFN60)	Table 14

Table 4: Battery Powered Beacon (078-51-D)

Reference design	UART	JTAG
Battery Powered Beacon (078-51-D) 	Not applicable	<ol style="list-style-type: none"> 1. Connect the target board with the Tag-Connect cable (Figure 6) to CIB. 2. Power supply: <ol style="list-style-type: none"> a. The jumper on the J16 header must be in place. b. The jumper on the J14 header must be in place. c. In order to supply the target board from CIB, turn the power switch (SW2) ON. d. In order to supply the target board from an external power supply (3 V is required), turn the power switch (SW2) OFF. e. For version D, turn ON the on-board switch. 3. Download the firmware.

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Table 5: Indoor Light Powered Beacon (078-37-A1)

Reference design	UART	JTAG
Indoor Light Powered Beacon (078-37-A1) 	<ol style="list-style-type: none"> 1. Connect the target board with the Tag-Connect cable (Figure 6) to CIB. 2. Power supply: <ol style="list-style-type: none"> a. The jumper on the J16 header must be in place. b. The jumper on the J14 header must be in place. c. In order to supply the target board from CIB, turn the power switch (SW2) ON. d. In order to supply the target board from an external power supply (3 V is required), turn the power switch (SW2) OFF. 3. Download the firmware. 4. There is no reset line to the target board. When the software requests to do a reset: <ol style="list-style-type: none"> a. In case the target board is supplied from CIB, turn the power switch (SW2) OFF, and then ON (section 4.3.2.2). b. In case the target board is supplied from an external power source, the user must simultaneously: <ol style="list-style-type: none"> i. Power cycle the external supply, and ii. Push button SW1 (section 4.3.2.3). 	<ol style="list-style-type: none"> 1. Connect the target board with the Tag-Connect cable (Figure 6) to CIB. 2. Power supply: <ol style="list-style-type: none"> a. The jumper on the J16 header must be in place. b. The jumper on the J14 header must be in place. c. In order to supply the target board from CIB, turn the power switch (SW2) ON. d. In order to supply the target board from an external power supply (3 V is required), turn the power switch (SW2) OFF. 3. Download the firmware.

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Table 6: Proximity Tag (078-57-B)



Reference design	UART	JTAG
Proximity Tag (078-57-B): 	<ol style="list-style-type: none"> 1. Connect the target board with the IDC-10 cable (Figure 8) to CIB. 2. Power supply: <ol style="list-style-type: none"> a. The jumper on J16 header must be in place. b. The jumper on J14 header must be in place. c. In order to supply the target board from CIB, turn the power switch (SW2) ON. d. In order to supply the target board from an external power supply or battery (3 V is required), turn the power switch (SW2) OFF. 3. Download the firmware. 4. When the software requests a reset, press the reset button SW1 on the CIB. 	<ol style="list-style-type: none"> 1. Connect the target board with the IDC-10 cable (Figure 8) to CIB. 2. Power supply: <ol style="list-style-type: none"> a. The jumper on J16 header must be in place. b. The jumper on J14 header must be in place. c. In order to supply the target board from CIB, turn the power switch (SW2) ON. d. In order to supply the target board from an external power supply or battery (3V is required), turn the power switch (SW2) OFF. 3. Download the firmware.

Table 7: Wireless Keyboard (078-24-B)

Reference design	UART	JTAG
Wireless Keyboard (078-24-B): 	Not applicable	<ol style="list-style-type: none"> 1. Connect the target board with the Tag-Connect cable (Figure 6) to CIB. 2. Power supply: <ol style="list-style-type: none"> a. Remove the jumper from the J16 header. b. The jumper on J14 header must be in place. c. Connect a battery or an external power supply (1.5 V is required). d. Turn ON the power switch (SW2) from CIB. 3. Download the firmware.

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Table 8: Wireless Mouse (078-53-D)



Reference design	UART	JTAG
Wireless Mouse (078-53-D): 	<ol style="list-style-type: none"> 1. Connect the target board with the Tag-Connect cable (Figure 6) to CIB. 2. Power supply: <ol style="list-style-type: none"> a. Remove the jumper from the J16 header. b. The jumper on J14 header must be in place. c. Connect a battery or an external power supply (1.5 V is required), to the target board turn ON the on-board switch. d. Turn ON the power switch (SW2) from CIB. 3. Download the firmware. 4. When the software requests a reset, please press the reset button (SW1) on the CIB. 	<ol style="list-style-type: none"> 1. Connect the target board with the Tag-Connect cable (Figure 6) to CIB. 2. Power supply: <ol style="list-style-type: none"> a. Remove the jumper from the J16 header. b. The jumper on J14 header must be in place. c. Connect a battery or an external power supply (1.5 V is required), to the target board turn ON the on-board switch. d. Turn ON the power switch (SW2) from CIB. 3. Download the firmware.

Table 9: Remote Control Unit (078-42-C)

Reference design	UART	JTAG
Remote Control Unit (078-42-C): 	Not applicable	<ol style="list-style-type: none"> 1. No specific connectors exist for this design. User must solder cables to corresponding test points on the target board. 2. Connect the target board with the modified connection cable to the CIB. 3. Power supply: <ol style="list-style-type: none"> a. Remove the jumper from the J16 header. b. The jumper on the J14 header must be in place. c. Connect a battery or an external power supply to the target board (1.5 V is required). d. Turn ON the power switch (SW2) from CIB. 4. Download the firmware.

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Table 10: Remote Control with Voice and Motion (282-04-B1)




Reference design	UART	JTAG
Remote Control with Voice and Motion (282-04-B1): 	Not applicable	<ol style="list-style-type: none"> 1. Replace the files <code>flash_programmer.bin</code> and <code>jtag_programmer.bin</code> with the corresponding files of DA14582 in order to use SmartSnippets for this configuration. 2. Connect the target board with the Tag-Connect cable (Figure 6) to CIB. 3. Power supply: <ol style="list-style-type: none"> a. The jumper on the J16 header must be in place. b. The jumper on the J14 header must be in place. c. Connect a battery or an external power supply (3 V is required). d. Turn ON the power switch (SW2) from CIB. 4. Download the firmware.

Table 11: IoT Sensor Board (285-01-F)

Reference design	UART	JTAG
IoT Sensor Board (285-01-F): 	<ol style="list-style-type: none"> 1. Connect the target board with the CIB. 2. Power supply: <ol style="list-style-type: none"> a. The jumper on J16 header must be in place. b. The jumper on J14 header must be in place. c. In order to supply the target board from CIB, turn the power switch (SW2) ON. d. In order to supply the target board from an external power supply or battery (3 V is required), turn the power switch (SW2) OFF. 3. Download the firmware. 4. When the software requests a reset, please press the reset button SW1 on the CIB. 	<ol style="list-style-type: none"> 1. Connect the target board with the CIB. 2. Power supply: <ol style="list-style-type: none"> a. The jumper on J16 header must be in place. b. The jumper on J14 header must be in place. c. In order to supply the target board from CIB, turn the power switch (SW2) ON. d. In order to supply the target board from an external power supply or battery (3 V is required), turn the power switch (SW2) OFF. 3. Download the firmware.


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Table 12: Range Extender (078-56-C)

Reference design	UART	JTAG
Range Extender (078-56-C): 	<ol style="list-style-type: none"> 1. An interposer board (078-67-A) is used in order to program a Range Extender v2. 2. Connect the target board with the Tag-Connect cable (Figure 6) to CIB. 3. Power supply: <ol style="list-style-type: none"> a. The jumper on the J16 header must be in place. b. The jumper on the J14 header must be in place. c. In order to supply the target board from CIB, turn the power switch (SW2) ON. d. In order to supply the target board from an external power supply (3 V is required), turn the power switch (SW2) OFF. 4. Download the firmware. 5. There is no reset line to the target board. When the software requests you to do a reset: <ol style="list-style-type: none"> a. In case the target board is supplied from CIB, turn the power switch (SW2) OFF, and then ON (section 4.3.2.2). b. In case the target board is supplied from an external power source, the user must simultaneously: <ol style="list-style-type: none"> i. Power cycle the external supply, and ii. Push button SW1 (section 4.3.2.3). 	<ol style="list-style-type: none"> 1. An interposer board (078-67-A) is used in order to program a Range Extender v2. 2. Connect the target board with the Tag-Connect cable (Figure 6) to CIB. 3. Power supply: <ol style="list-style-type: none"> a. The jumper on the J16 header must be in place. b. The jumper on the J14 header must be in place. c. In order to supply the target board from CIB, turn the power switch (SW2) ON. d. In order to supply the target board from an external power supply (3 V is required), turn the power switch (SW2) OFF. 4. Download the firmware.


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Table 13: Trace Antenna (078-28-D)

Reference design	UART	JTAG
Trace Antenna (078-28-D): 	<ol style="list-style-type: none"> 1. An interposer board (078-67-A) is used in order to program an Antenna module. 2. Connect the target board with the Tag-Connect cable (Figure 6) to CIB. 3. Power supply: <ol style="list-style-type: none"> a. The jumper on the J16 header must be in place. b. The jumper on the J14 header must be in place. c. In order to supply the target board from CIB, turn the power switch (SW2) ON. d. In order to supply the target board from an external power supply (3 V is required), turn the power switch (SW2) OFF. 4. Download the firmware. 5. There is no reset line to the target board. When the software requests to do a reset: <ol style="list-style-type: none"> a. In case the target board is supplied from CIB, turn the power switch (SW2) OFF, and then ON (section 4.3.2.2). b. In case the target board is supplied from an external power source, the user must simultaneously: <ol style="list-style-type: none"> i. Power cycle the external supply, and ii. Push button SW1 (section 4.3.2.3). 	<ol style="list-style-type: none"> 1. An interposer board (078-67-A) is used in order to program an Antenna module. 2. Connect the target board with the Tag-Connect cable (Figure 6) to CIB. 3. Power supply: <ol style="list-style-type: none"> a. The jumper on the J16 header must be in place. b. The jumper on the J14 header must be in place. c. In order to supply the target board from CIB, turn the power switch (SW2) ON. d. In order to supply the target board from an external power supply (3 V is required), turn the power switch (SW2) OFF. 4. Download the firmware.

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Table 14: Wearable (224-30-B)

Reference design	UART	JTAG
Wearable (224-30-B): 	<ol style="list-style-type: none"> Connect the target board with the IDC-10 cable (Figure 8) to CIB. Power supply: <ol style="list-style-type: none"> The jumper on J16 header must be in place. The jumper on J14 header: <ol style="list-style-type: none"> For VDD = 3 V must be in place. For VDD = 1.8 V must be removed. In order to supply the target board from CIB, turn the power switch (SW2) ON. In order to supply the target board from an external power supply or battery, turn the power switch (SW2) OFF. The external voltage supply depends on the J14 setup. Download the firmware. When the software requests a reset, please press the reset button (SW1) on the CIB. 	<ol style="list-style-type: none"> Connect the target board with the IDC-10 cable (Figure 8) to CIB. Power supply: <ol style="list-style-type: none"> The jumper on J16 header must be in place. The jumper on J14 header: <ol style="list-style-type: none"> For VDD = 3 V must be in place. For VDD = 1.8 V must be removed. In order to supply the target board from CIB, turn the power switch (SW2) ON. In order to supply the target board from an external power supply or battery, turn the power switch (SW2) OFF. The external voltage supply depends on the J14 setup. Download the firmware.

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6 Power consumption measurement using SmartSnippets

The power consumption of a reference design can be measured using the power profiler from the SmartSnippets™ tool. The reference design is supplied from the CIB, whereas a DA14580 PRO Motherboard (DA14580DEVKIT-P_vB) is used for monitoring and measuring the current drawn.

The current measurement circuit from a DA14580DEVKIT-P_vB is connected in series between the CIB and the reference design (see Figure 14, Figure 15 and Figure 16). Then proceed as follows:

1. Remove the jumper from the **J16** header (CIB).
2. Remove the jumper from the **J11** header (DA14580DEVKIT-P_vB).
3. Use a cable to connect pin **23** from the **J5** header (DA14580DEVKIT-P_vB) to pin **1** from the header **J16** (CIB).
4. Use another cable to connect pin **2** from the **J11** header (DA14580DEVKIT-P_vB) to pin **2** from the header **J16** (CIB).
5. The power switch (**SW2**) from the CIB must be in position ON.
6. Connect the Pro Motherboard (DA14580DEVKIT-P_vB) to the PC using a USB cable.
7. Connect the CIB to the PC using another USB cable.

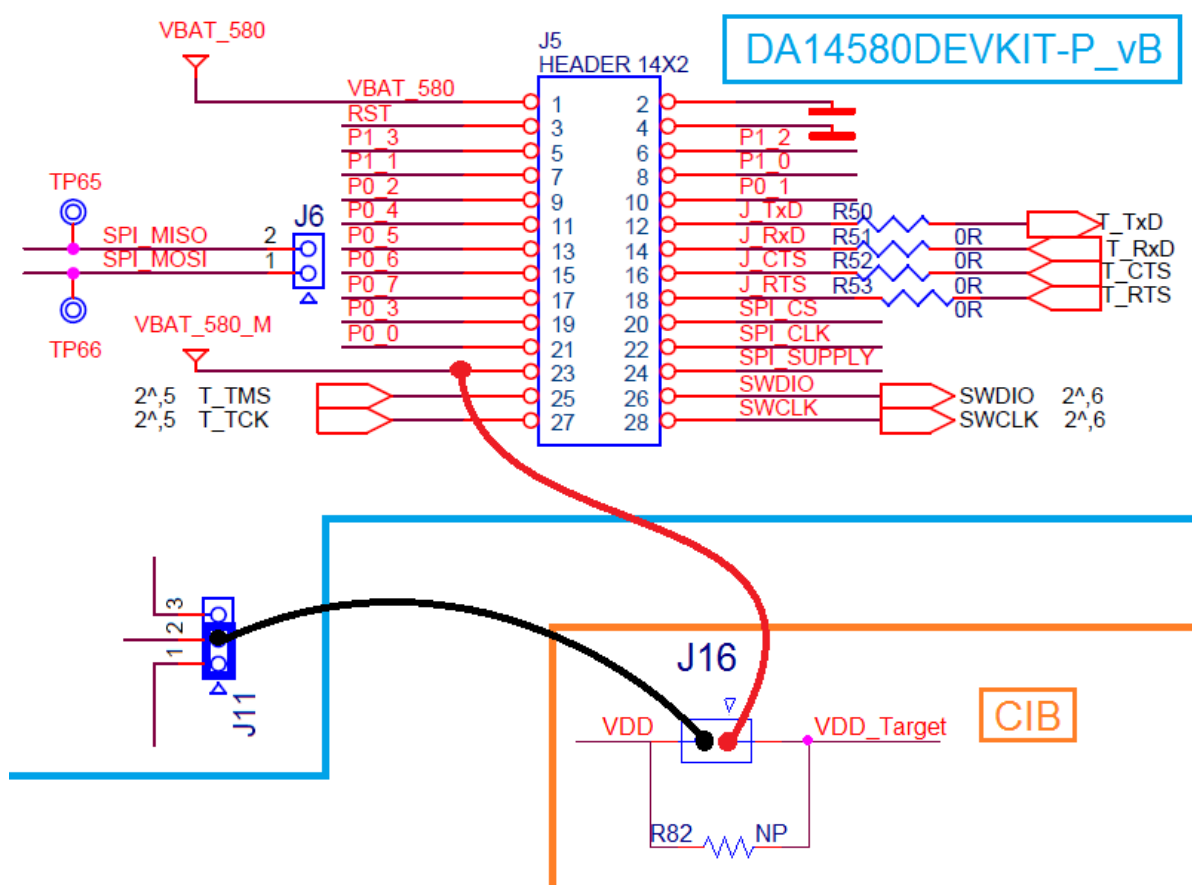


Figure 14: Connecting a DA14580 Pro Motherboard to the CIB

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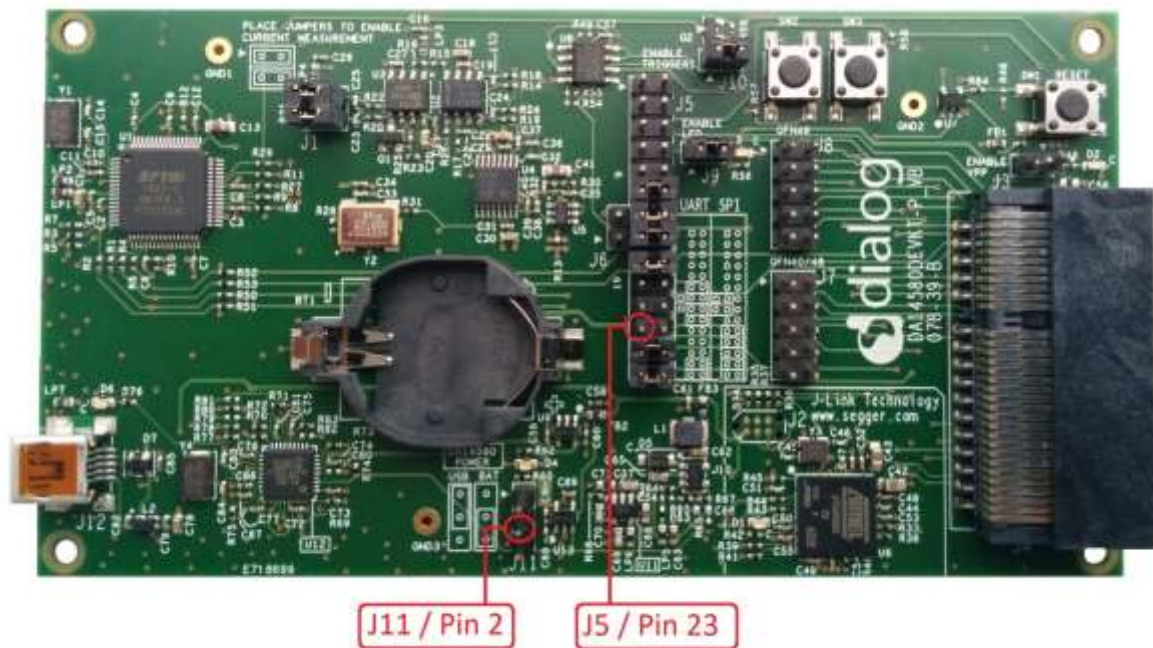


Figure 15: DA14580DEVKIT-P_vB – Header J11, pin 2 and header J5, pin 23



Figure 16: CIB – Header J16, pins 1 and 2

**Bluetooth® Smart Communication Interface
Board****Revision history**

Revision	Date	Description
1.1	24-Dec-2021	Updated logo, disclaimer, copyright.
1.0	11-May-2016	Initial version.

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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.
APPROVED or unmarked	The content of this document has been approved for publication.

RoHS Compliance

Dialog Semiconductor complies to European Directive 2001/95/EC and from 2 January 2013 onwards to European Directive 2011/65/EU concerning Restriction of Hazardous Substances (RoHS/RoHS2).
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