

User Manual

DA14683 USB Kit

UM-B-094

Abstract

This document outlines the system design, configuration options and supported features of DA14683 USB Kit, rev-C (224-46-C).

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1 Terms and Definitions

USB	Universal Serial Bus
JTAG	Join Test Action Group
UART	Universal Asynchronous Receiver-Transmitter
SDK	Software Development Kit
SW	Software
PC	Personal Computer
SOC	System on Chip
GPIO	General Purpose Input Output
LDO	Low Dropout
QSPI	Quad Serial Peripheral Interface
SMA	Sub-Miniature version A
OVP	Over Voltage Protection
SOIC	Small Outline Integrated Circuit
DMIPS	Dhrystone Million Instructions per Second
OTP	One Time Programmable
PLL	Phase-Locked Loop
SIMO	Single-Inductor Multiple-Output
DCR	Direct Current Resistor
RF	Radio Frequency
SPI	Serial Peripheral Interface
MISO	Master In Slave Out
MOSI	Master Out Slave In
I ² C	Inter-Integrated Circuit
RFIO	Radio Frequency Input Output
SMD	Surface-Mount Device

2 References

- [1] DA14683 Datasheet, Datasheet, Dialog Semiconductor.
- [2] AN-B-052, DA1458x/68x Development kit J-Link Interface, Application Note, Dialog Semiconductor

3 Introduction

This document describes the DA14683 USB Kit. This kit offers a low cost development board with basic functionality. The development kit is implemented on a single PCB. The block diagram, the actual board, the various sections and settings as well as the connectivity are presented. The purpose of this cost-effective USB kit is to provide users with the capability for:

- Software development
- Programming DA14683 via JTAG or UART using Dialog's SDK
- Connecting MikroBUS™ module

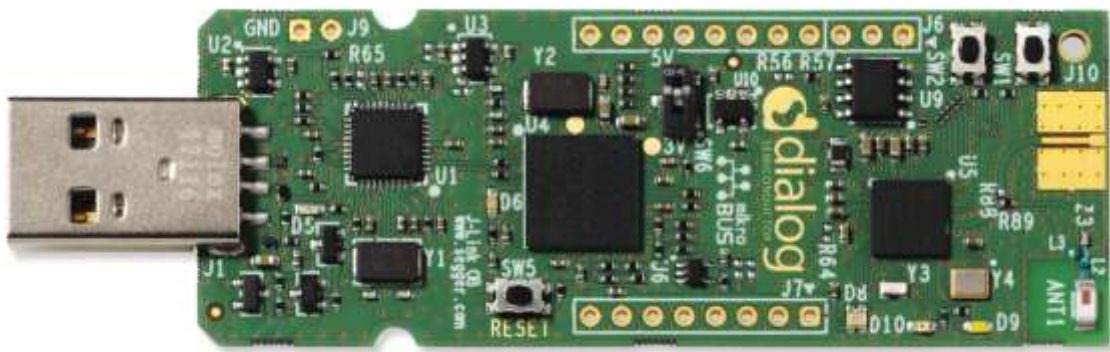


Figure 1: DA14683 USB Kit

4 System Overview

4.1 Features

The features of DA 14683 USB kit include:

- Highly integrated Dialog Semiconductor DA14683 Bluetooth® Smart SoC
- Access on GPIOs provided from the chip, when no MikroBUS™ is plugged in
- The ability to be connected directly to PC USB without extra cables
- Reset push button
- General purpose LEDs and buttons
- RGB LEDs connecting each color to dedicated PWM pins (LED1, LED2, LED3)
- Using USB (5V) or LDO (3V3) as power source
- JTAG and UART interface over USB via Segger
- QSPI flash on board
- 2.4GHz chip antenna and slot for SMA connector
- 16MHz main crystal and 32.768KHz low-power crystal
- Low cost
- Compact design
- A dimension of 89 mm × 26.7 mm × 4.5 mm

4.2 System and Components Description (Top View)

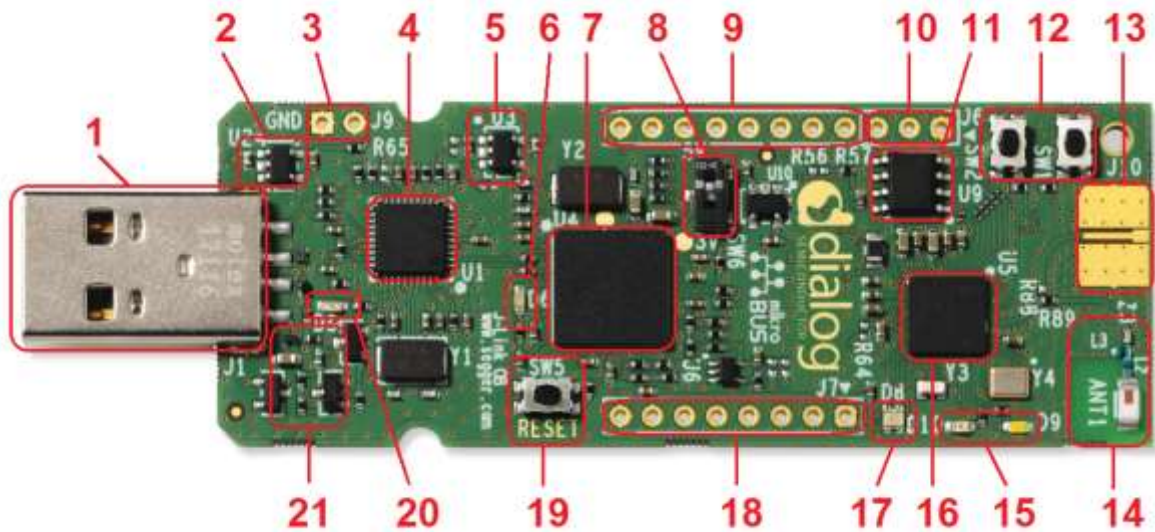


Figure 2: USB Kit - Top side

The USB kit is based on the DA14683 SoC in an aQFN60 package. The marked and numbered sections of the system are:

1. Type-A USB connector (J1)
2. LDO 3.3V (U2)
3. GND support point (J9)
4. USB HUB (U1)
5. LDO 3.3V (U3)
6. Green LED (D6)
7. UART & JTAG interface (U4)
8. DA14683 power selection (5V or 3V - SW6)
9. MikroBUS™ connection points (Left side - J6, 8 pins)
10. Extra DA14683 I/O & Power output (J6, 3pins)
11. QSPI Flash (U9)
12. General purpose push buttons (SW2, SW3)
13. SMA connector (optional - J10)
14. Chip Antenna (ANT1)
15. General purpose LEDs (D9, White & D10, Red)
16. DA14683 SoC (U5)
17. RGB LED (D8)
18. MikroBUS™ connection points (Right side - J7, 8pins)
19. Reset button (SW5)
20. Amber LED (D5)

21. OVP Circuit

4.3 System and Components Description (Bottom View)

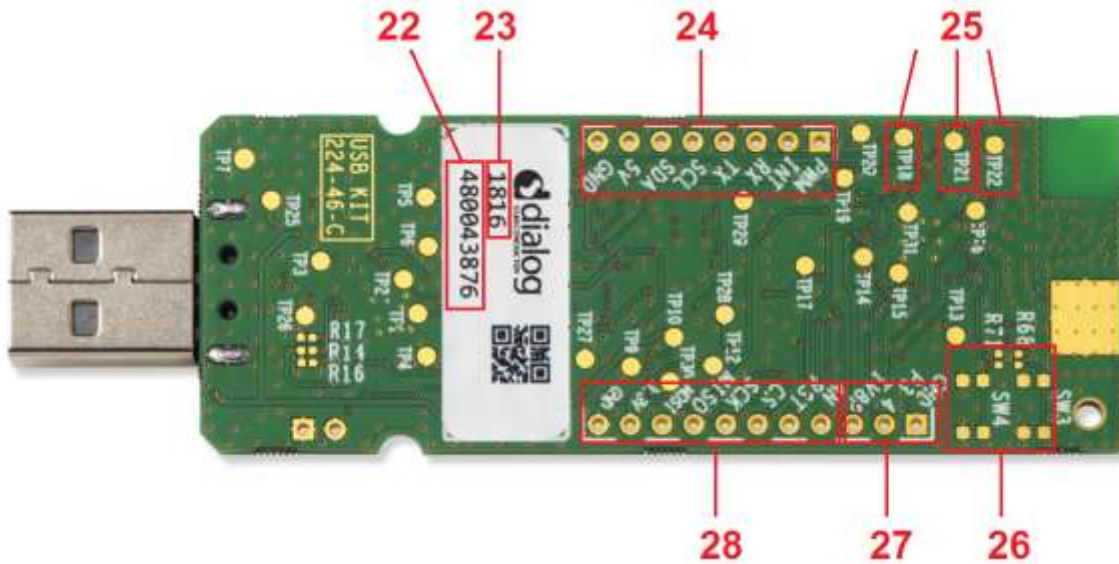


Figure 3: USB Kit - Bottom side

The bottom side of the USB kit provides information about the MikroBus™ pins assignment, the Segger ID, and the date code. 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:

- 22. ID of UART & JTAG interface (U4)
- 23. Date code
- 24. MikroBus™ pins assignment (Right side - J7, 8pins)
- 25 Test points (more details in [Table 1](#))
- 26. No populated general purpose push buttons (SW3, SW4)
- 27. Extra DA14683 I/O & Power output (J6, 3pins)
- 28. MikroBUS™ pins assignment (Left side - J6, 8 pins)

Table 1: Various test point assignments

Test point	Assigned to	Comments
TP1	USBDP_2	USB Data plus (+)
TP2	USBDM_2	USB Data minus (-)
TP3	USB_HUB_LED	Amber LED Voltage level
TP4	VDD_3V3_HUB	LDO 3.3V (U2) output voltage level
TP5	VDD_CORE	UART & JTAG interface (U4) core voltage level
TP6	Segger LED	Green LED Voltage level
TP7	GND	Ground
TP8	TDI	For programming U4 in production - Not used for development
TP9	TCK_SWCLK	For programming U4 in production - Not used for development

Test point	Assigned to	Comments
TP10	TMS_SWDIO	For programming U4 in production - Not used for development
TP11	ERASE	For programming U4 in production - Not used for development
TP12	NRST	For programming U4 in production - Not used for development
TP13	VDDIO	QSPI data flash supply voltage
TP14	VBUS_683	Voltage level for VBUS pin of DA14683
TP15	V12	Voltage level for V12 pin of DA14683
TP16	V14	Voltage level for V14 pin of DA14683
TP17	VBAT3V	Voltage level for VBAT3V pin of DA14683
TP18	GREEN	Voltage level for Green LED of RGB (D8)
TP19	RED	Voltage level for Red LED of RGB (D8)
TP20	BLUE	Voltage level for Blue LED of RGB (D8)
TP21	GP_RED	Voltage level for Red LED (D10)
TP22	GP_WHITE	Voltage level for White LED (D9)
TP23	FIDUCIAL	Not electrically connected
TP24	FIDUCIAL	Not electrically connected
TP25	5V	USB input voltage level
TP26	HUB_RST	USB HUB reset pin
TP27	VDD_3V3_SEG	LDO 3.3V (U3) output voltage level
TP28	LDO_683	Input voltage level for LDO 3.3V (U10)
TP29	V33	Voltage for V33 pin of DA14683
TP30	SWO/TDO	For programming U4 in production - Not used for development
TP31	GND	Ground

4.4 Block Diagram

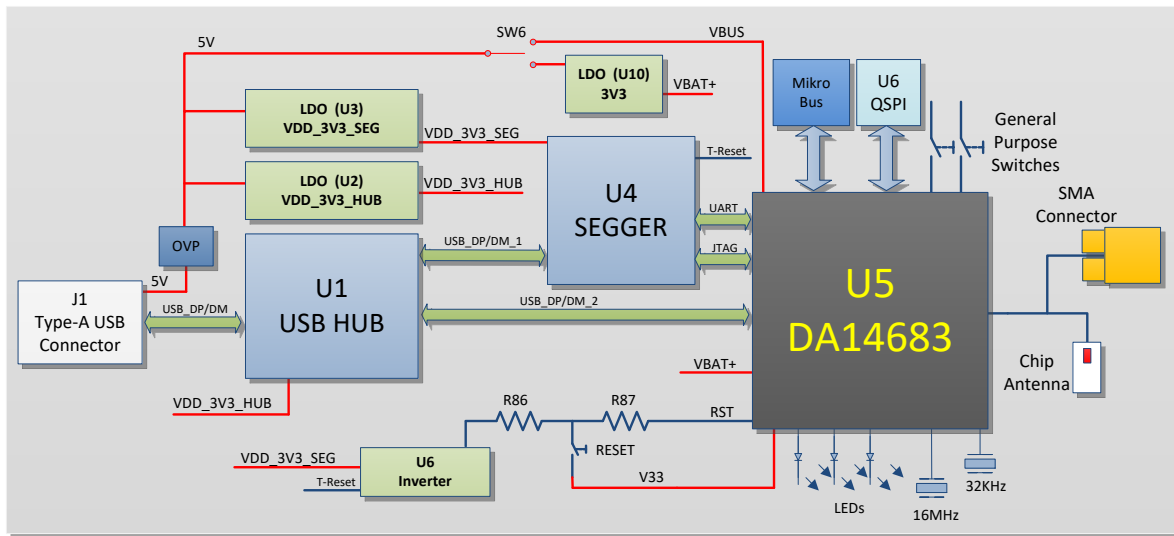


Figure 4: Block diagram of DA14683 USB kit

The power of Dialog’s DA14683 SoC on the USB kit can be supplied from two different sources (Figure 4):

- Default configuration: 5 V provided from the VBUS pin
- Alternative configuration: 3.3 V provided from the VBAT pin through LDO (U10)

The position of the SW6 connects the power supply of DA14683 and enables developers to select either of the two available power supply configurations.

The DA14683 USB Kit does not support external batteries.

5 USB Kit System

5.1 Overview

- Board name/number:
 - DA14683 USB Kit/224-46-C
- SoC:
 - DA14683 in an aQFN60 package
- Flash memory:
 - W25Q80EWSNIG (8Mbit) QSPI Flash Memory, 8-SOIC package
 - 1.8 V power supply (default)
 - 3.0 V power supply (optional, if user changes manually the existing QSPI Flash with other type)
- Clock inputs:
 - 16 MHz crystal
 - 32 KHz crystal
- Ports:
 - USB port for debugging purposes (no charging)
- Interfaces:
 - UART-JLink CDC UART Port (listed under Ports in Device Manager)
 - JTAG-JLink Driver (listed under Universal Serial Bus Controllers in Device Manager)
- Connectivity-Expansion connectors:
 - MikroBUS™ module can be plugged to J6, J7 sockets (users have to solder the sockets manually)
- Power source selection:
 - 5 V on VBUS pin (default) or 3.3 V on VBAT (optional)

5.2 DA14683 System

The DA14683 is a flexible SoC combining an application processor, memories, cryptography engine, power management unit, digital and analog peripherals, and a radio transceiver.

The DA14683 is based on an ARM® Cortex®-M0 CPU, which delivers up to 84 DMIPS, provides a flexible memory architecture, and enables code execution from embedded memory (RAM, ROM) or non-volatile memory (OTP or external Quad-SPI Flash memory). The advanced power management unit of the DA14683 enables it to provide power to external devices like sensors, MikroBUS modules, or QSPI flash.

An on-chip PLL enables on-the-fly switching of the system clock between 32 kHz and 96 MHz to meet high processing requirements.

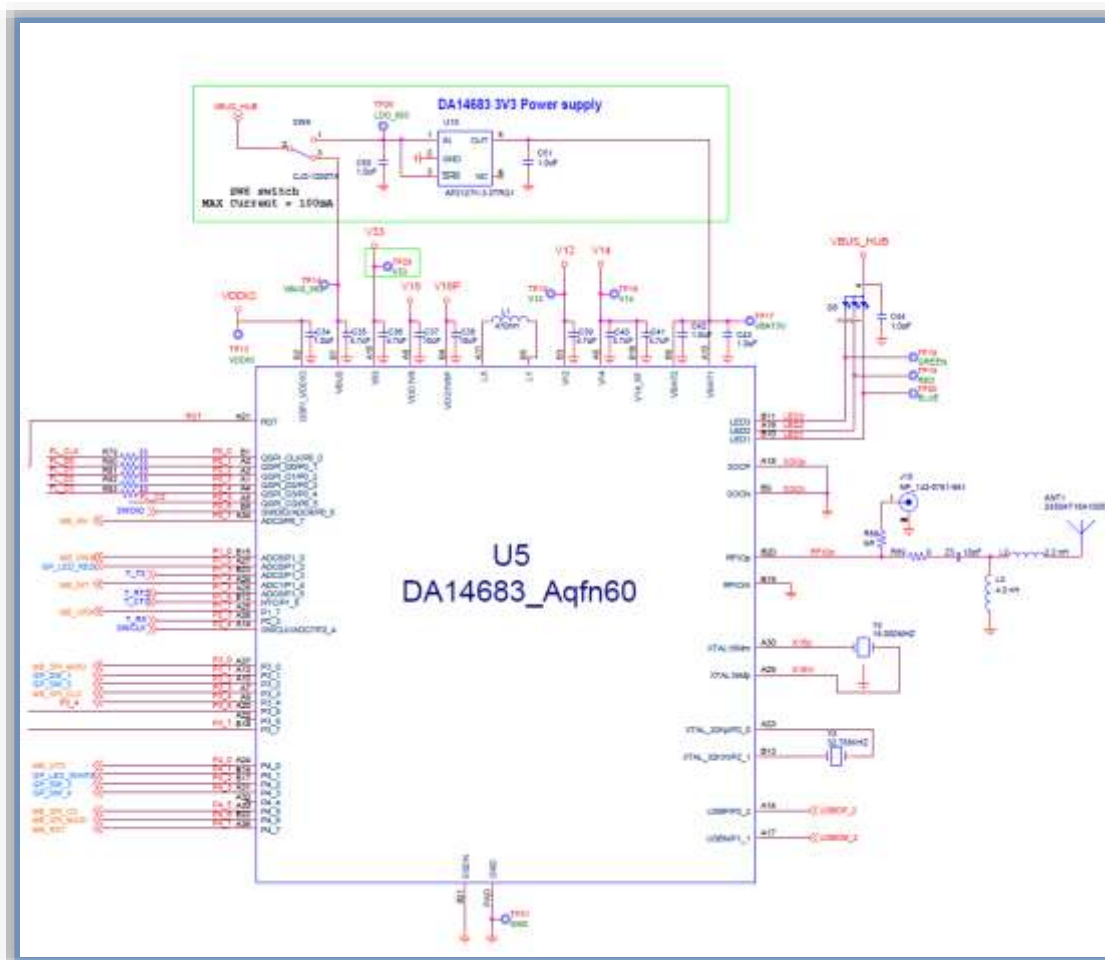


Figure 5: DA14683 schematic

The DA14683 SoC power management subsystem consists of:

- VBUS: Battery charger input as well as USB bus voltage.
 - A decoupling capacitor (C35) equal or less than 4.7 μF is placed close to VBUS pin.
- VBAT1: Battery connection.
 - A 1 μF decoupling capacitor (C43, 0402 package, 6.3 V) is required to be placed close to the pin.
 - Voltage range for VBAT1 is 1.7 V to 4.75 V.
 - On this development kit, VBAT1 and VBAT2 are connected together. No battery connection is supported.
- VBAT2: Input of the SIMO DC-DC converter.
 - It is shorted externally with VBAT1. A 1 μF decoupling capacitor (C42, 0402 package, 6.3 V) is required next to the pin.
 - On this development kit, VBAT1 and VBAT2 are connected together. No battery connection is supported.
- V33: Output voltage rail (3.3 V).
 - A ceramic decoupling capacitor of 4.7 μF (C36, 0402 package, 6.3 V) is placed close to the pin.
 - V33 cannot be turned off.

- SIMO DC-DC converter outputs: V18, V18P, V12, V14.
 - The inductor needed for DC-DC operation is placed externally. A low DCR inductor (L1) of 470 nH, (0805 package), is connected on LX/LY pins.
 - V18, V18P: Power rails (1.8 V) for supplying external devices, even when the system is in sleep mode.
 - Decoupling ceramic capacitors (C37, C38) of 4.7 μ F (0603 package, 16 V), are placed as close as possible to the V18, V18P pins.
 - V18 is assigned to the external Flash memory.
 - V18p is assigned to peripherals devices.
 - The current delivery capability of the V18 and V18P power rails is 75 mA in active mode and 2 mA in sleep mode.
 - V12: Power rail that supplies the digital core of the DA1468x and delivers up to 50 mA at 1.2 V in active mode.
 - A 4.7 μ F decoupling capacitor (C39, 0402 package, 6.3 V) is used.
 - V14: Power rail that delivers up to 20 mA at 1.4 V and should not be used for supplying external devices.
 - A 4.7 μ F decoupling capacitor (C40 0402 package, 6.3 V) is placed close to the V14 pin.
- V14_RF: Supply voltage input.
 - It is shorted to V14 on the PCB layout.
 - V14_RF powers the RF circuits via a number of dedicated internal LDOs. A 4.7 μ F decoupling capacitor (C41) is placed as close to the V14_RF pin as possible.
- VDDIO: QSPI Flash interface supply voltage.
 - It is connected to the same power rail as the Flash memory.
 - A 1 μ F decoupling capacitor (C34, 0402 package, 6.3 V) is placed close to pin.

5.3 DA14683 Pin Assignment

Most of the available signals are utilized or extracted on the breakout connectors.

Table 2 provides the pin assignment of the breakout connectors on the USB kit and the related pin name on the aQFN60 package of the DA14683.

Table 2: USB kit pin assignment

AQFN60 pin name	Development kit signal	Header pin	Comments
P0_0	QSPI_CLK	-	Only for DA14683/DA15101 SoCs. For DA14682/DA15100 SoCs these pins are not connected.
P0_1	QSPI_D0	-	
P0_2	QSPI_D1	-	
P0_3	QSPI_D2	-	
P0_4	QSPI_D3	-	
P0_5	QSPI_CS	-	
P0_6	SWDIO	-	JTAG Data input/output
P0_7	GPIO/MB_AN	J6.4	GPIO/MikroBUS™ Analog
P1_0	GPIO/MB_PWM	J7.1	GPIO/MikroBUS™ PWM
P1_1	USBDM_2	-	USB Data minus (-)
P1_2	GP_LED_RED	-	General purpose Red LED

AQFN60 pin name	Development kit signal	Header pin	Comments
P1_3	T_TX	-	Universal Asynchronous Transmitter
P1_4	GPIO/MB_INT	J7.2	GPIO/MikroBUS™ Interrupt
P1_5	T_RTSS	-	
P1_6	T_CTS	-	
P1_7	GPIO/MB_URX	J7.3	GPIO/MikroBUS™ Universal Asynchronous Receiver
P2_0	XTAL32P	-	XTAL 32.768KHz plus (+)
P2_1	XTAL32M	-	XTAL 32.768KHz plus (-)
P2_2	USBDP_2	-	USB Data minus (+)
P2_3	T_RX	-	Universal Asynchronous Receiver
P2_4	SWCLK	-	JTAG Clock
P3_0	GPIO/MB_SPI_MISO	J6.8	GPIO/MikroBUS™ SPI MISO
P3_1	GP_SW_1	-	General purpose Switch
P3_2	GP_SW_2	-	General purpose Switch
P3_3	GPIO/MB_SPI_CLK	J6.7	GPIO/MikroBUS™ SPI Clock
P3_4	GPIO	-	General purpose GPIO
P3_5	GPIO/MB_I2C_SDA	J7.6	GPIO/MikroBUS™ I2C SDA
P3_6	-	-	Not used
P3_7	GPIO/MB_I2C_SCL	J7.5	GPIO/MikroBUS™ I2C_SCL
P4_0	GPIO/MB_UTX	J7.4	GPIO/MikroBUS™ Universal Asynchronous Transmitter
P4_1	GP_LED_WHITE	-	General purpose White LED
P4_2	GP_SW_3	-	General purpose Switch
P4_3	GP_SW_4	-	General purpose Switch
P4_4	-	-	Not used
P4_5	GPIO/MB_SPI_CS	J6.6	GPIO/MikroBUS™ SPI CS
P4_6	GPIO/MB_SPI_MOSI	J6.9	GPIO/MikroBUS™ SPI MOSI
P4_7	GPIO/MB_RST	J6.5	GPIO/MikroBUS™ Reset
LED1	LED1	-	RGB LED
LED2	LED2	-	
LED3	LED3	-	

5.4 Booting from UART

There is only one boot loader option for booting from UART using pins P1_3 (T_TX) and P2_3 (T_RX). Please note that UART-booting does not support hardware handshake signals (RTS/CTS).

The settings for UART booting are:

- Baud rate 57.6 kbps
- 8 bits

- No parity
- 1 stop bit

For more details on booting with UART, check application note *AN-B-052* (Ref [2]).

5.5 Crystals

The DA14683 SoC has two Digitally Controlled Crystal Oscillators, one at 16 MHz (XTAL16M) and the other at 32.768 kHz (XTAL32K). XTAL32K has no trimming capabilities and is used as the clock of the Extended/Deep Sleep modes, while XTAL16M can be trimmed.

The crystals used on the basic development kit are specified in [Table 3](#) and [Table 4](#).

Table 3: Y4 (16 MHz crystal) characteristics

Reference designator	Value
Part Number	7M-16.000MEEQ-T
Frequency	16 MHz
Accuracy	±10 ppm
Load Capacitance (CL)	10 pF
Shunt Capacitance (C0)	3 pF
Equivalent Series Resistance (ESR)	100 Ω
Drive Level (PD)	50 μW

Table 4: Y3 (32 kHz crystal) characteristics

Reference designator	Value
Part Number	9HT11-32.768KDZB-T
Frequency	32.768 KHz
Accuracy	±20 ppm
Load Capacitance (CL)	9 pF
Shunt Capacitance (C0)	1.3 pF
Equivalent Series Resistance (ESR)	100 Ω
Drive Level (PD)	1 μW

5.6 Antenna and RF Port

A ceramic type of chip antenna ([2450AT18A100E](#) from Johanson) is currently used as a default antenna in the DA14683 USB Kit.

Table 5: Antenna characteristics

Part Number	Frequency (MHz)	Peak Gain (dBi)	Average Gain (dBi)	Return Loss (dB)
2450AT18A100	2400 to 2500	0.5 (XZ-V)	0.5 (XZ-V)	9.5 (min)

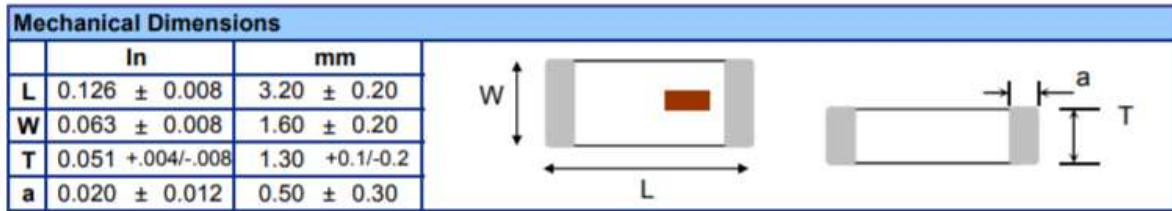


Figure 6: Chip Antenna PCB Footprint and Mechanical specifications

The DA14683 USB Kit provides a single-ended RFIO port matched to 50Ω. The RF port consists of the RFIOp and RFIOm pins, of which RFIOm is connected to ground. A copper trace with an impedance of 50Ω interconnects the RF port and the SMD chip antenna (ANT1). A T-network (Z3, L3, and L2) is added for antenna matching purposes.

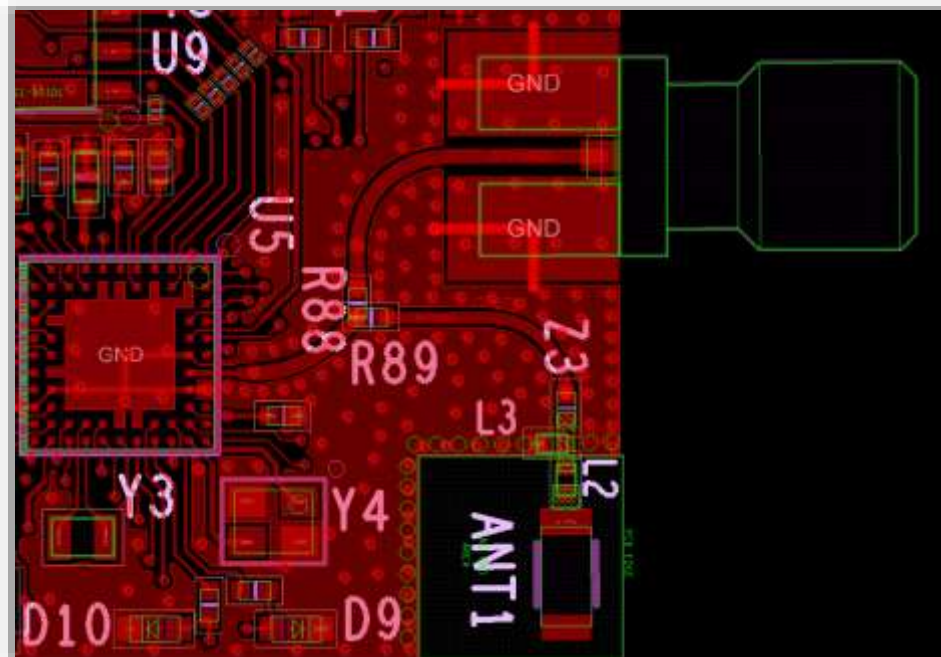


Figure 7: RF matching circuit, SMD Chip antenna and SMA connector

The DA14683 USB kit provides an RF connector (no populated) in parallel with the SMD chip antenna. The RF connector can be used for conducted RF evaluation/testing. The RF connector type is [142-0761-861](#).

In order to perform RF measurements using the RF connector J10, users have to remove the resistor R89 (0Ω) and place the resistor R88 (0Ω).

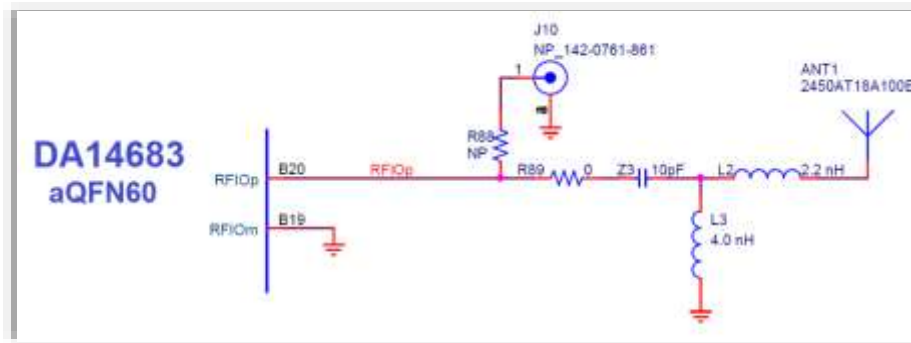


Figure 8: RF port, RF connector, RF matching and SMD Chip antenna

5.6.1 RF Measurements and Antenna Matching

RF measurements were performed to increase the efficiency of the ANT1. The values of the RF components are shown in Table 6. Radiation measurements results are shown in Figure 9 and Figure 10.

Table 6: RF Components names and values

Component name	Component value	Manufacturer part number
Z3	10pF	C0402C100J5GACTU
L3	4nH	LQW15AN4N0B80D
L2	2.2nH	LQW15AN2N2G80D
ANT1	-	2450AT18A100E

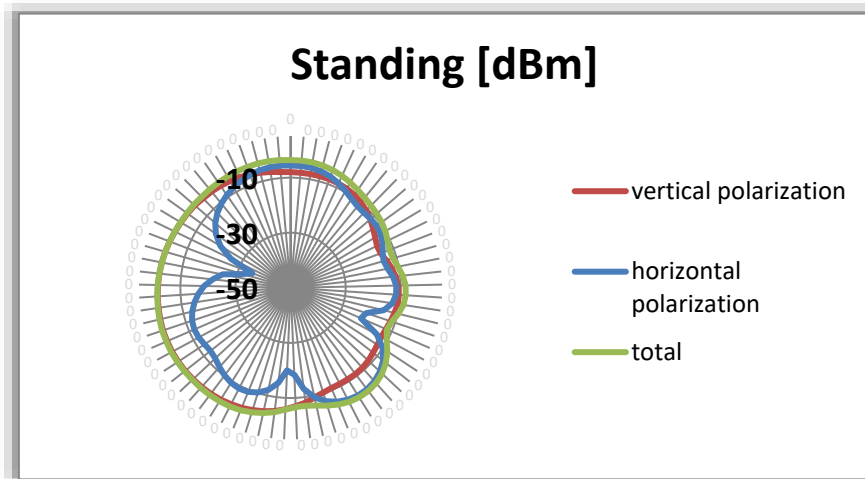


Figure 9: Radiated measurements results - Standing position

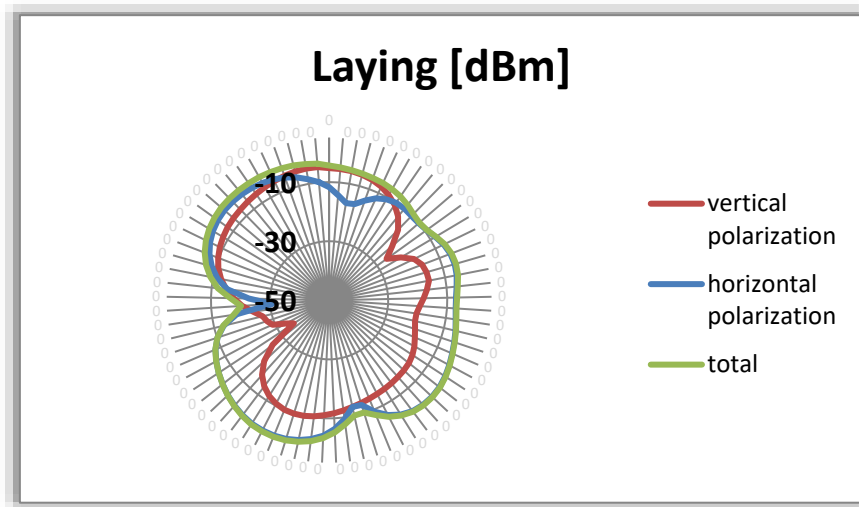


Figure 10: Radiated measurements results - Laying position

5.7 QSPI Data Flash memory (U9)

The DA14683 USB kit includes an external QSPI Data Flash memory from Winbond. The W25Q80EW Flash memory supports the standard Serial Peripheral Interface (SPI), Dual/Quad I/O SPI as well as 2-clock instruction cycle Quad Peripheral Interface (QPI), Serial Clock, Chip Select, Serial Data I/O0 (DI), I/O1 (D0), I/O2 (/WP), and I/O3(/HOLD). The power supply for QSPI can be selected from V33 or V18 with V18 being the default choice (Figure 11). The same supply voltage is also connected to the DA14683 VDDIO pin. The selected QSPI flash for the DA14683 USB kit is W25Q80EWSNIG in a SOIC package.

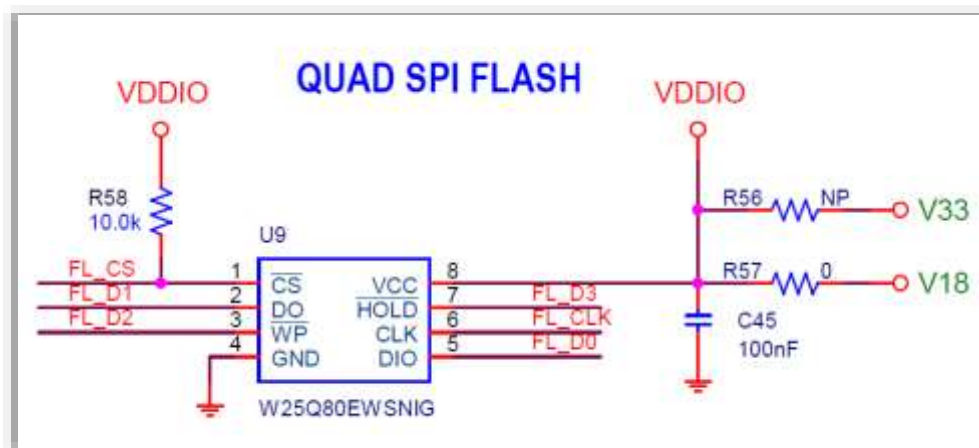


Figure 11: QSPI Flash with selectable power supply (V33 or V18)

The DA14683 uses the external Flash memory for directly executing code with some help from the internal cache, or simply for mirroring the contents in RAM during booting.

Termination resistors are placed between the processor and Flash memory. These resistors are not required, but they are placed there to mitigate any signal integrity issues.

5.8 Reset Circuit

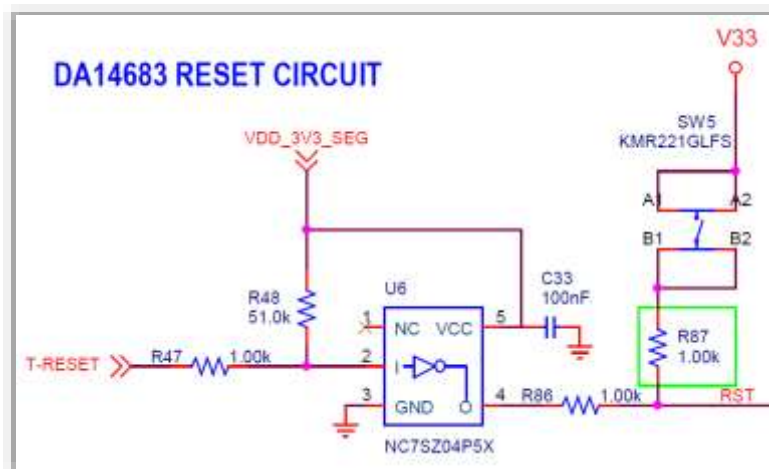


Figure 12: Reset circuit

The DA14683 USB can be reset by pressing the on board **RESET** button (Figure 13) or through software from the UART & JTAG interface processor (U4, Figure 2, #7). The Reset push button (SW5) provides a high signal to the RST line of DA14683. U4 has a reserved logic (active low) compared to DA14683 (active high) and the inverter (NC7SZ04P5X) is used.

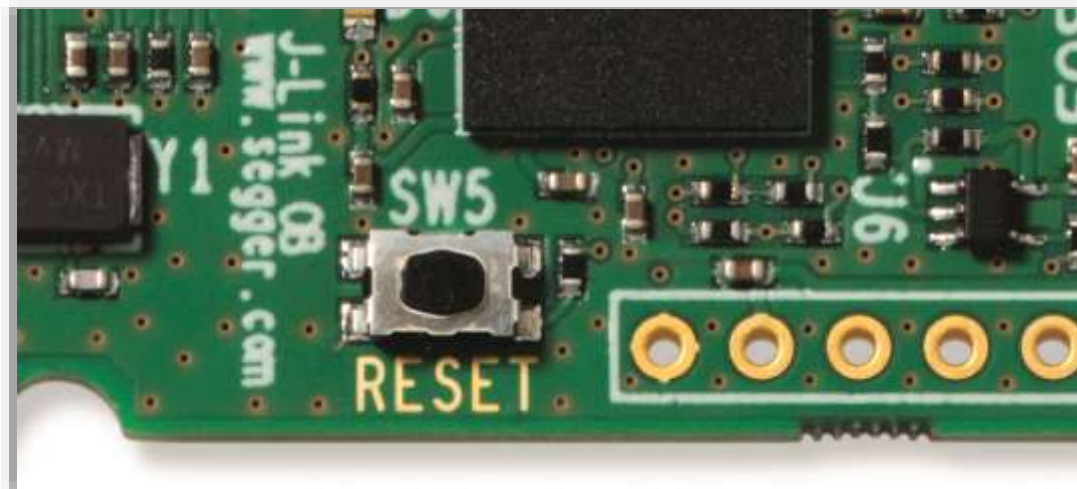


Figure 13: Reset push button

5.9 Push Buttons

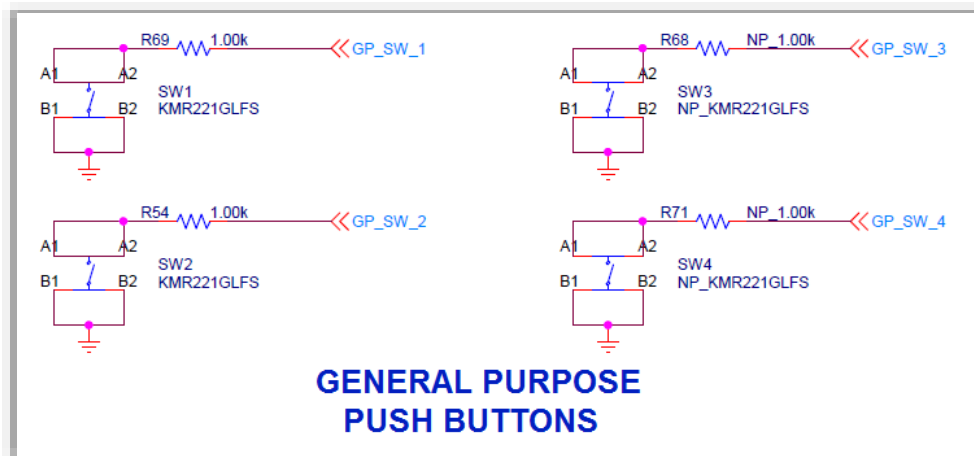


Figure 14: General purpose push buttons

Push buttons SW1 and SW2 are populated and placed on the top side of the board (Figure 15). SW1 is connected to P3_1 and SW2 is connected to P3_2 (Figure 14).

Switches SW3 and SW4 are not populated but placed in the bottom of the board (Figure 16). SW3 is connected to P4_2 and SW4 is connected to P4_3 (Figure 14).



Figure 15: General purpose push buttons SW1, SW2 (populated at TOP)

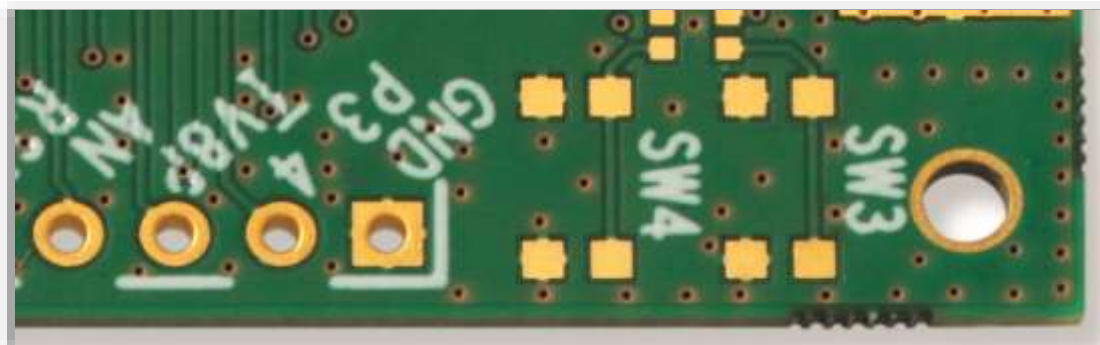


Figure 16: General purpose push buttons SW3, SW4 (no populated at BOTTOM)

5.10 User Controlled LEDs

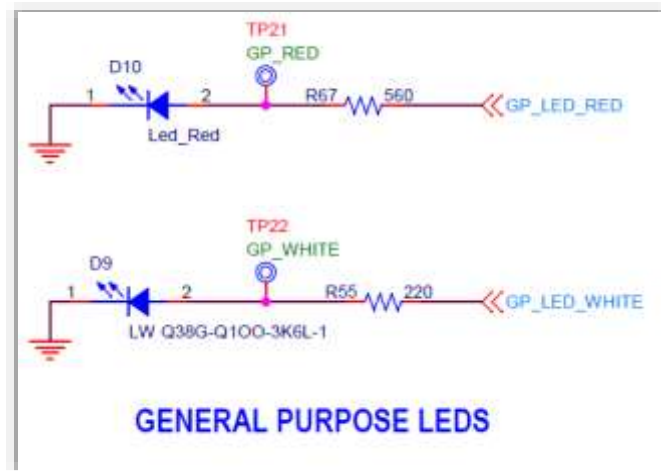


Figure 17: General purpose LEDs

The red LED D9 is driven from P1_2 and the white LED D10 is driven from P4_1 (Figure 18). Both are general purpose LEDs.

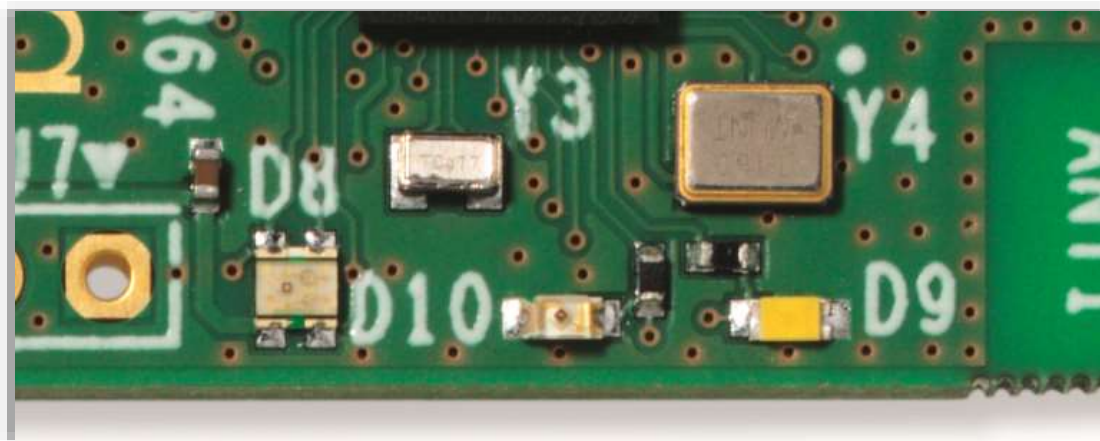


Figure 18: General Purpose LEDs D9 (red) & D10 (white)

5.11 MikroBUS™ Module

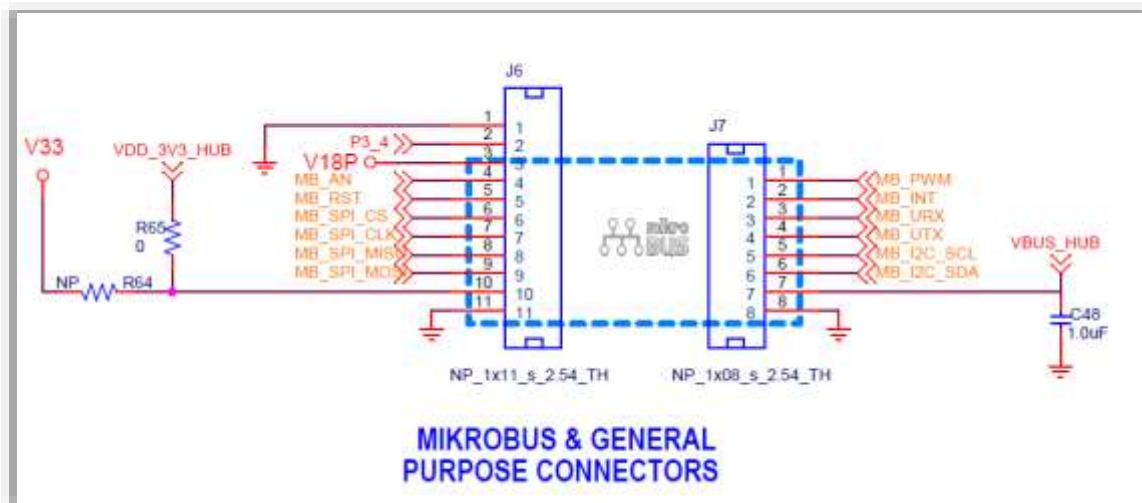


Figure 19: MikroBus™ pin assignment and extra DA14683 I/O & Power output

The DA14683 USB kit can support MikroBUS™ modules. Users have to place and solder J6 and J7 sockets on the top side of the board as shown in Figure 20. The suggested female socket is the PPTC081LFBN-RC, of which two pieces must be placed and soldered on the DA14683 USB Kit with one to J6 from pin 4 to 11 and the other to J7 from pin 1 to pin 8. Do not use the pin1, pin2, and pin3 in J6 to connect a MikroBUS™ module with the DA14683 USB kit. These pins are extra I/O and power output of DA14683 and can be used for general purposes.

The position of J7 defines the proper pin alignment between the MikroBUS™ module and DA14683 USB Kit. Figure 21 shows the proper way to connect the MikroBus™ with the DA14683 USB Kit. The pin assignment is printed at bottom side of the DA14683 USB kit (Figure 22).

A MikroBUS™ module requires a power supply of 5V, 3.3V or both, depending on the module. A voltage of 5V is powered directly from USB port. A voltage of 3.3V can be supplied either from 3.3V LDO (U2 - default configuration) or V33 output of DA14683. In order to change the default configuration and supply the MikroBus™ module from V33 of DA14683, users have to remove R65 and place a 0Ω resistor to R64. The maximum current which can be provided to a MikroBus™ module is 150 mA from LDO (U2) and 80 mA from V33.

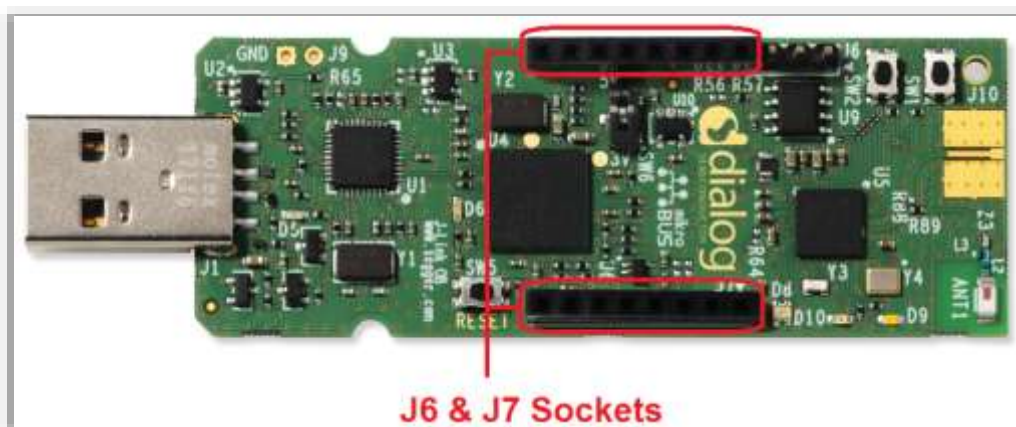


Figure 20: J6 and J7 female sockets (must be placed and soldered by users)

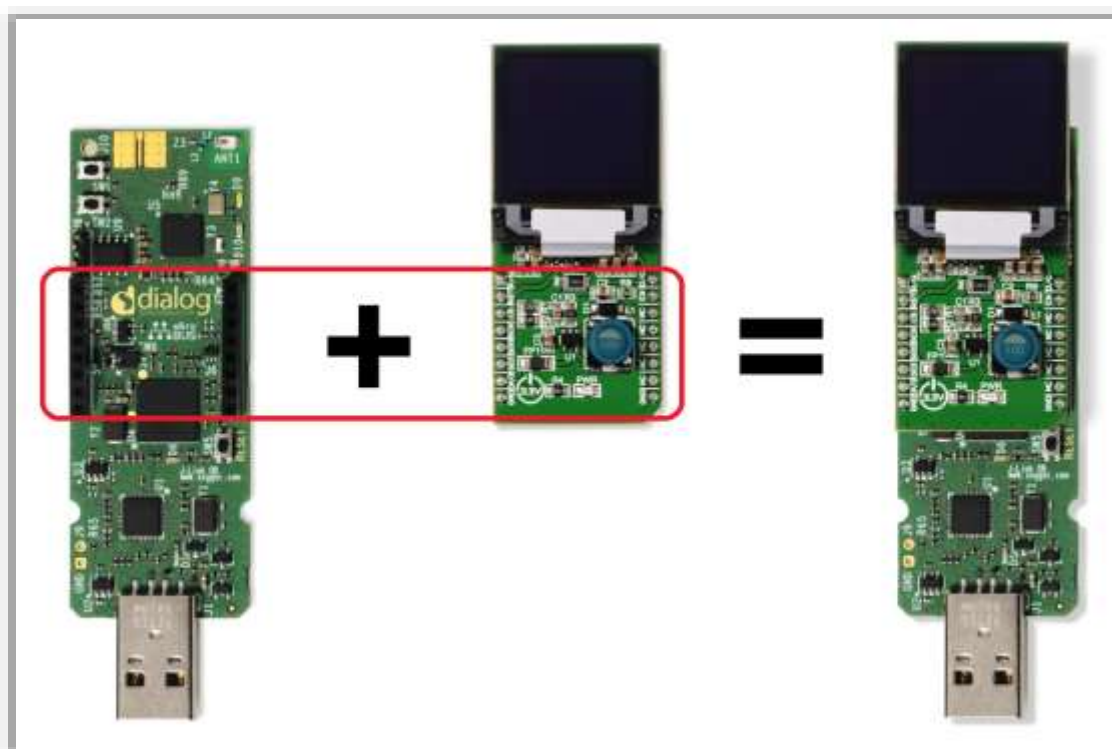


Figure 21: Proper orientation and connection between DA14683 USB Kit and a MikroBus™ click board

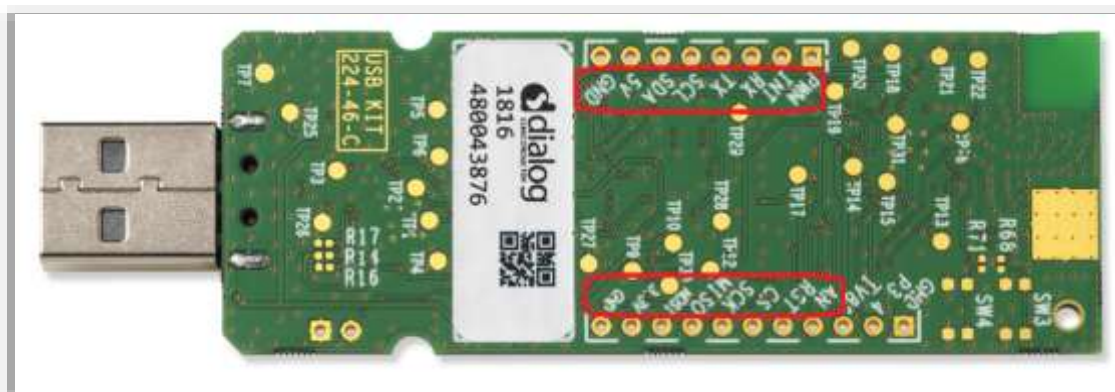


Figure 22: MikroBus™ pin assignment

5.12 GND Support Points

On the J9 (no populated, must be placed from the user) 2.54mm header, user can connect oscilloscope's probe for monitoring on-board voltages.



Figure 23: GND support point



Figure 24: GND support point (Male header must be placed from the user)

5.13 Over Voltage Protection Circuit (OVP)

The DA14683 USB kit can be used as a portable standalone device. The power supply can be a power-bank or a mobile charger. The OVP circuit can protect the device from overvoltage up to 20 V. Figure 25 shows a schematic of the OVP circuit. Overvoltage is caused not only by the connection of an unsuitable charger with different characteristics, but also from voltage surges caused by the length of the cables used to connect the charger to the device. For normal operations of the DA14683 USB Kit, the input voltage range have to be between 4.75 V and 5.25 V.

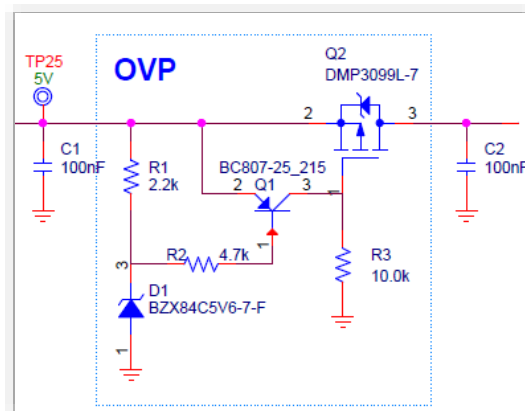


Figure 25: Over voltage protection circuit

5.14 USB HUB

USB HUB is implemented by U1, USB2512B-AEZG. This chip is supplied with a voltage of 3.3 V from U2. The signal LDO_EN is generated from U1 and it is an active high signal. It enables the LDO (U3) which supplies the Segger chip. Operation is indicated via amber LED (D5). A 24MHz crystal (Y1) is required for the chip operation. Figure 26 shows the circuit's schematic.

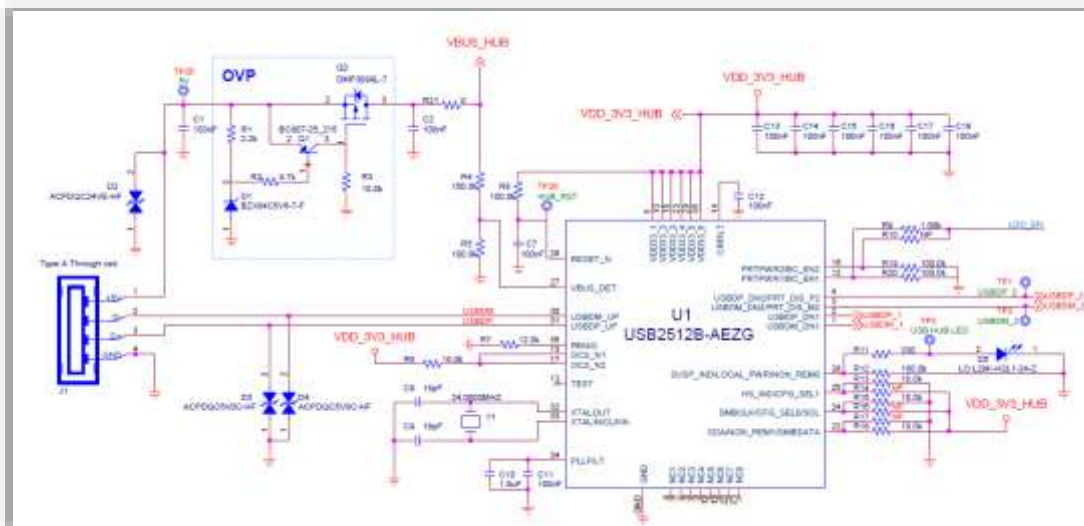


Figure 26: USB HUB circuitry

5.15 Debugging Processor (U4)

Two debugging ports (JTAG and UART) are used on the DA14683 SoC.

The USB-to-JTAG and USB-to-UART functions are implemented by the SAM3U2CA processor (U4) (Figure 27), running the Segger JLink-OB firmware. The functions served by U4 are:

- Connecting PC to DA14683 JTAG port
- Connecting PC to DA14683 UART
- Reset the hardware through the T_RESET signal.

Note 1 The signal T_RESET is active LOW and therefore is inverted by U6 before reaching the RST pin on DA14683.

The UART port supports hardware flow control (RTS/CTS). It is detected automatically by the J-Link-OB firmware, regardless of the setting on the host machine terminal. The behavior of the UART interface depends on the implementation in the J-Link-OB firmware and is subject to changes by Segger Microcontroller © with updates to the firmware. See Ref [2] for troubleshooting possible issues with the serial port.

The JTAG operating status is indicated via LED D6. The SAM3U2CA (U4) chip is supplied with a voltage of 3.3 V from U3. U3 is enabled by LDO_EN active high signal. A 12MHz crystal (Y2) is required for the chip operation. Figure 27 shows the circuit's schematic.

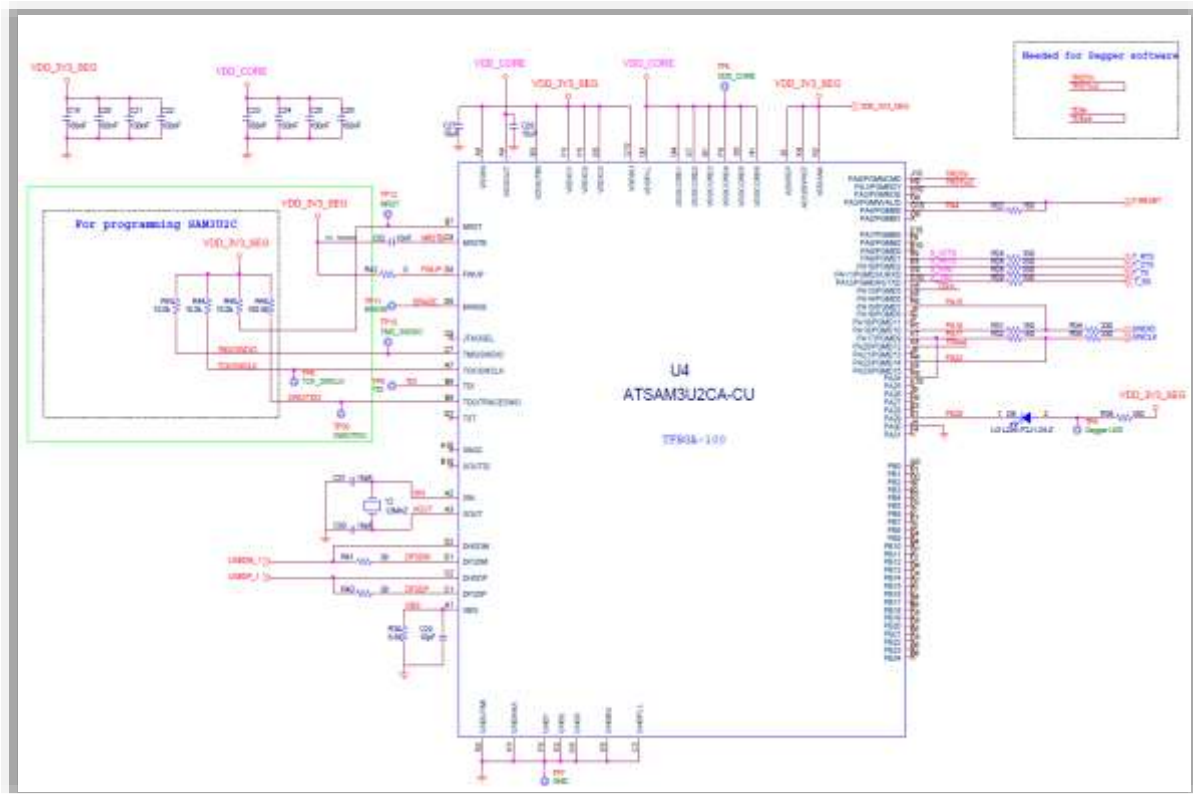


Figure 27: Debugging processor - UART and JTAG interface

5.16 Power Section

DA14683 USB Kit is supplied directly from the USB port and it does not support external batteries. Figure 28 shows the power tree.

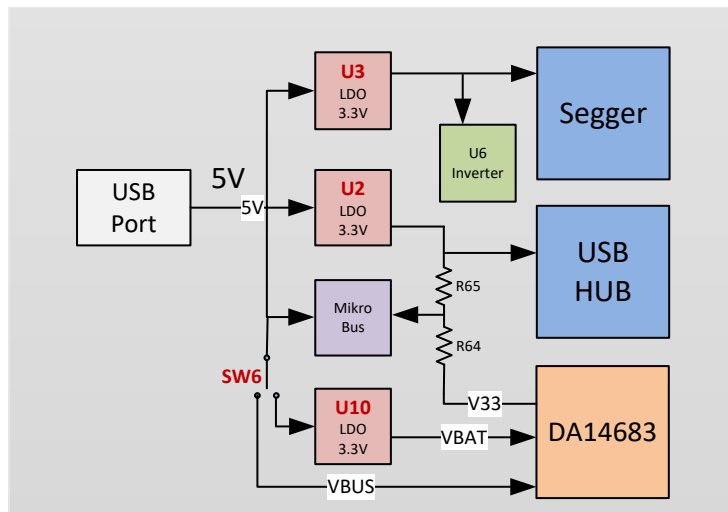


Figure 28: DA14683 USB Kit power tree

The following power components are placed on the DA14683 USB Kit:

- U3: Fixed output 3.3V LDO.

- It generates VDD_3V3_HUB voltage rail that supplies USB HUB.
- U4: Fixed output 3.3V LDO.
 - It generates VDD_3V3_SEG voltage rail that supplies the USB to JTAG/UART chip (U4, ATSAM3U2CA-CU).
 - It is enabled from USB HUB through the signal LDO_EN.
 - If the USB HUB is not enumerated with external device (PC, Laptop, and so on), then the LDO is not enabled. Consequently the debugging circuit is not functional.

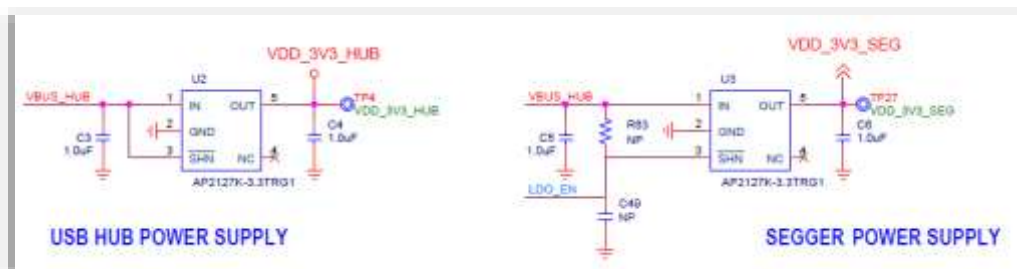


Figure 29: Linear voltage regulators (LDOs) U3 and U4

- U10: Fixed output 3.3V LDO.
 - It generates 3.3V that supplies DA14683.
 - The DA14683 SoC can be supplied either from the USB port with a voltage of 5V to the VBUS pin or through LDO (U10) with a voltage of 3.3V to the VBAT pin. The power selection is achieved through the switch SW6 (Figure 30, Figure 31). The maximum current for SW6 is 100mA. The default position of SW6 connects the VBUS pin of DA14683 with the USB port (5 V). Changes to SW configuration might be needed, depending on the SDK project and the power supply of DA14683 (VBUS or VBAT). More information about this is provided in section 6.

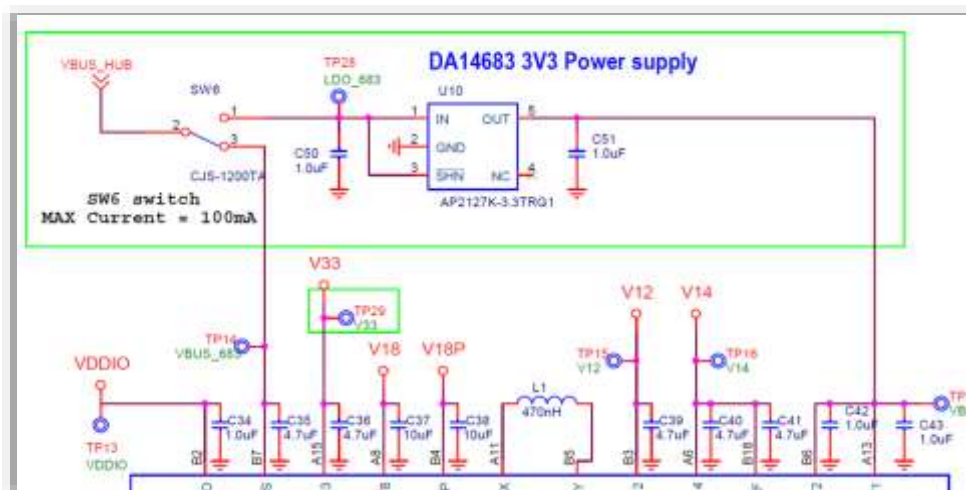


Figure 30: DA14683 power selection through SW6

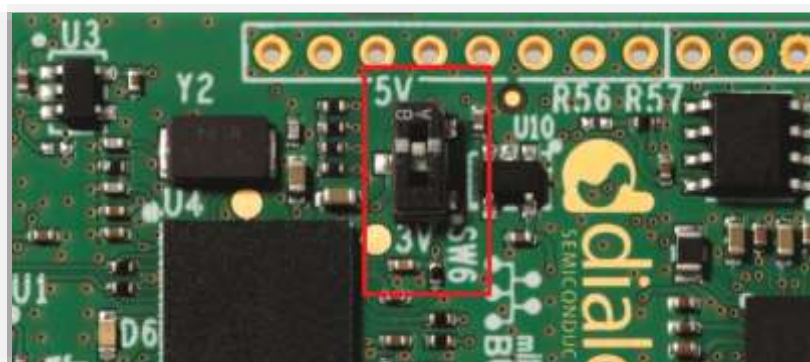


Figure 31: Power selection switch SW6 (default position to 5V)

Note 2 It is important to know that, different from DA14683 Pro MB or DA14683 Basic-DK to which an external battery can be connected directly, the DA14683 USB Kit does not support external batteries.

6 Software Configuration

As mentioned in section 5.16, switching power supply of DA14683 between 5 V and 3.3 V depends on the software configuration and project requirements.

However, since there is no battery on the system, enabling the charger functionality is not recommended.

6.1 Using the DA14683 USB kit as a USB Device

When users/developers use the DA14683 USB kit as a USB device, the SW6 is turned to the 5V side to supply the chip through VBUS. In this case, a couple of limitations need to be taken into consideration when working with the SDK projects provided from Dialog Semiconductor.

This mode should be used when a USB application is being developed, for example, a USB-CDC application. It is not a suitable configuration for battery-powered applications or when the sleep mode needs to be used. The reason for this is that when the DA14683 is powered only by VBUS, the SDK must be aware of the existence of the VBUS and its power supply is provided through the USB instead of the VBAT.

Consequently, the operation mode of the DA14683 will be switched to "*active mode*" and the DCDC will be disabled. The DCDC should not be turned on when the device is running on VBUS, since it requires the VBAT2 which is not available.

The configuration to be used in the projects when the device is powered by the VBUS is:

- SW6 must be at default position (5V).
- To be able to use the pre-programmed CDC example, install the `cdc_driver`. The `cdc_driver` is included in the mass storage which appears in your system when the USB-Kit is plugged in for the first time.
- Configure the project parameters in `custom_config_qspi.h` as follows:
 - `#define dg_configUSE_SOC` 0
 - `#define dg_configUSE_USB` 1
 - `#define dg_configUSE_USB_CHARGER` 0
 - `#define dg_configALLOW_CHARGING_NOT_ENUM` 0
 - `#define dg_configUSE_NOT_ENUM_CHARGING_TIMEOUT` 0
- Optionally, change the sleep mode in `main.c` as follows:

- `pm_set_sleep_mode(pm_mode_active)`

The limitations for this configuration are:

- The sleep mode is not available. If the extended sleep is enabled in the project, it will be deactivated automatically by the SDK code.
- The DCDC cannot be used.

6.2 Using DA14683 USB kit as Development kit

When users/developers need to have full power save and/or battery-operated applications which do not include any USB or charging functionality, then the power supply of the DA14683 USB kit must be from VBAT.

For this mode:

- SW6 must be turned to 3V position (VBAT)
- All the SDK examples can be used and no extra software configuration is needed

The limitations in this mode are:

- The USB functionality will not work as the USB/VBUS is not available to trigger the enumeration process
- The Charger functionality will not work as the USB/VBUS is not available to trigger the charging FSM

The advantage of this mode is that the sleep mode is available and the DCDC can be used allowing the development and evaluation of low power applications.

7 PCB Layout

Dimensions: 89 mm × 26.7 mm × 4.5 mm

Number of layers: 4

PCB thickness: 1.55 mm

Material: FR-4

Solder mask TOP/BOTTOM: Green

Silkscreen TOP/BOTTOM: White

Surface finish: Che Ni/Au

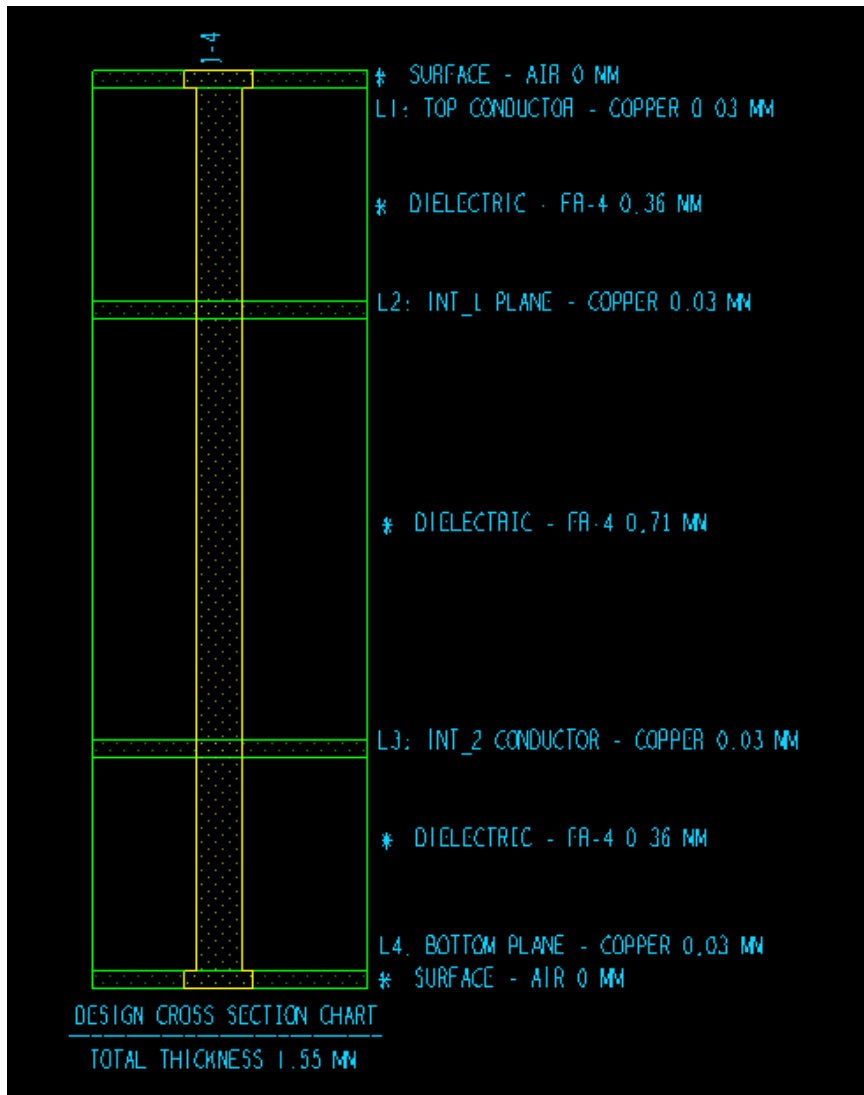


Figure 32: PCB cross section

The total thickness of the board is 1.55mm. The dielectric between each layer is shown in Figure 32.

Appendix A

A.1 Schematics

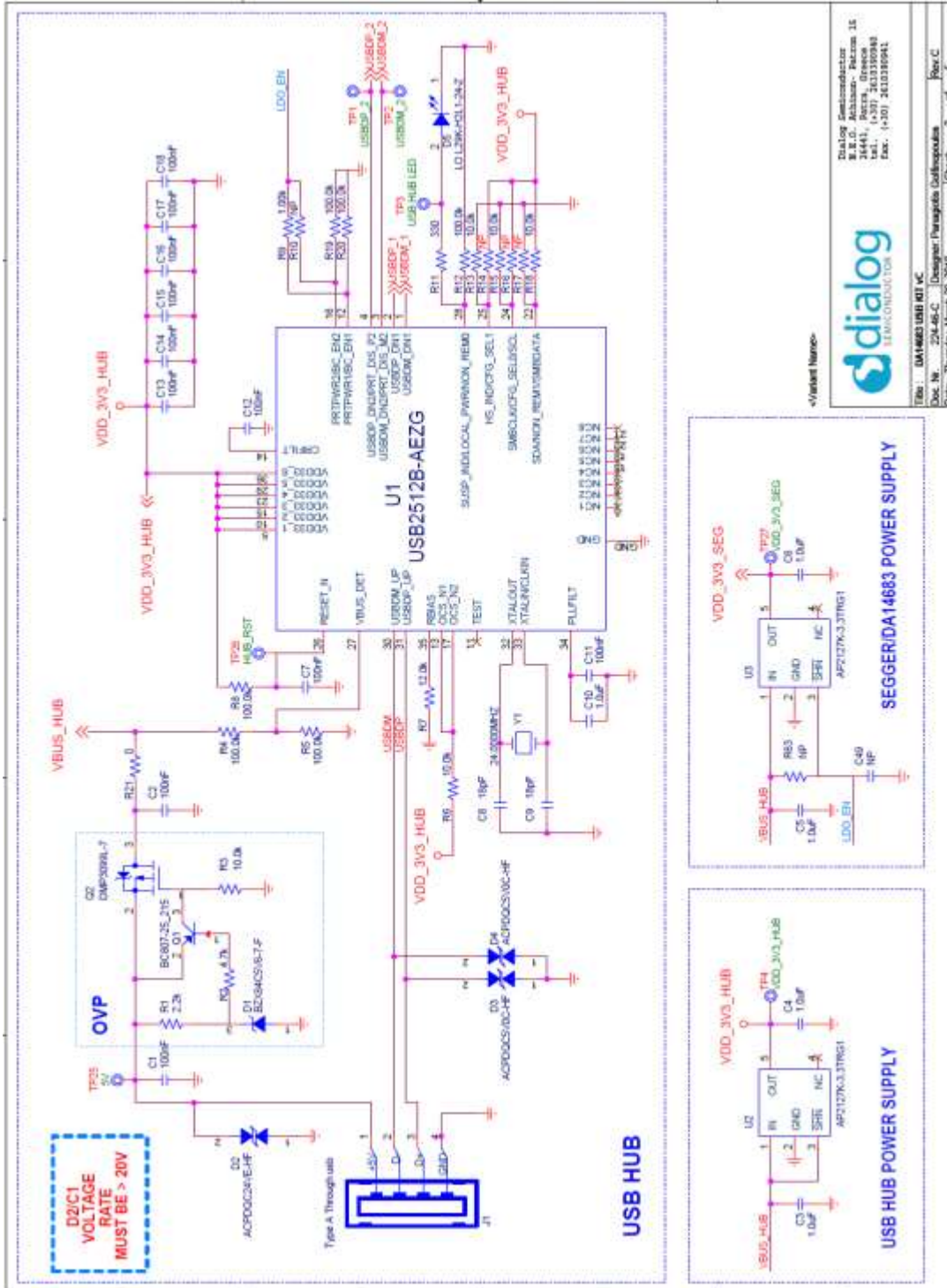


Figure 33: USB Hub section

A.2 Bill of Materials (BOM)

dialog SEMICONDUCTOR		DA14683 Development Kit		DA14683 USB KIT vC		224-46-C		
		vC (29-Mar-2017)		MANDATORY				
		EXAMPLE, FREE OF CHOICE, USE IDENTICAL OR SUPERIOR SPECIFICATION PART NUMBER						
Part No.	Part Type	Quantity	Description	Part Reference	Value	Layout PCB	Manufacturer	Manufacturer Part No.
Resistors								
1	Resistor	5	RES 0.0 OHM 1/16W 0402 -RoHS	R21 R42 R57 R65 R89	0	0402	Vishay	CRW0402000020E0
2	Resistor	5	RES 33 OHM 50 mW 5% 35V 0201 -RoHS	R79 R80 R81 R82 R83	33	0201	Ferrosonic	ERU-30E130C
3	Resistor	2	RES 89 ohms 1/16watt 1% 0402 -RoHS	R40 R41	89	0402	Vishay/Dale	CRW0402028R0P43D
4	Resistor	3	RES 150 OHM 1/16W 5% 0402	R22 R31 R32	150	0402	Yageo	RC0402J8-07150L
5	Resistor	1	RES 220 OHM 100 mW 5% 50V 0402 - RoHS	R35	220	0402	Ferrosonic	ERU-30E1221A
6	Resistor	8	RES 330 OHM 1/16W 5% 0402 -RoHS	R11 R24 R25 R28 R29 R34	330	0402	Vishay/Dale	CRW04021300R1ED
7	Resistor	1	RES 560 OHM 1/10W 5% 0402 - RoHS	R67	560	0402	Ferrosonic	ERU-30E156X
8	Resistor	6	RES 1.0 Kohm 1/16W 5% 0402 - RoHS	R9 R47 R54 R89 R85 R87	1.00k	0402	Ferrosonic	ERA1AE0102X
9	Resistor	1	RES 2.2 Kohm 5% 1/16W 0402	R1	2.2k	0402	Yageo	RC0402J8-072K2L
10	Resistor	1	RES 4.7 Kohm 1/16W 5% 0402	R2	4.7k	0402	Yageo	RC0402J8-074K7L
11	Resistor	1	RES 8.8 Kohm 1/16W ±5% 0402	R39	8.8k	0402	Rohm	MCR03MRT882
12	Resistor	1	RES 10.0 Kohm 1/20Watt 1% 100ppm 0201 -RoHS	R58	10.0k	0201	Vishay/Dale	CRW02011000P9ED
13	Resistor	8	RES 10.0 Kohm 5% 1/16W 0402	R3 R6 R13 R15 R18 R43 R44	10.0k	0402	Yageo	RC0402J8-0710KL
14	Resistor	1	RES 12 Kohm 1/16W 5% 0402	R7	12.0k	0402	Yageo	RC0402J8-0712KL
15	Resistor	1	RES 51 Kohm 1/16W 5% 50V 0402 -RoHS	R48	51.0k	0402	Vishay/Dale	CRW040251K01NE0
16	Resistor	7	RES 100 Kohm 1/16W 1% 0402 -RoHS	R4 R5 R8 R12 R19 R20 R46	100.0k	0402	Vishay/Dale	CRW04021000P9ED
Capacitors								
17	Ceramic	1	CAP CER 10pF 50V 0402 COG 5%	C29	10pF	0402	Murata Electronics	GRM1555C1H100A16D
18	Ceramic	1	CAP CERAMIC 10PF 50V NPO 0402 -RoHS	Z5	10pF	0402	Kemet	0D402C1005GACTU
19	Ceramic	4	CAP CERAMIC 18PF 50V 5% COG 0402	C8 C9 C30 C31	18pF	0402	Murata	GRM1555C1H180A01D
20	Ceramic	1	CAP CER 10005PF 25V 10% X7R 0402 -RoHS	C32	10nF	0402	Murata	GRM15571E103K01D
21	Ceramic	1	CAP CERAMIC 0.1UF 25V X7R 0603 -RoHS	C1	100nF	0603	Kemet	0603C104K3ACTU
22	Ceramic	20	CAP CER .1UF 16V X7R 0402	C2 C7 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21 C22 C23 C24 C25 C26 C33	100nF	0402	Murata	GRM15571C100K88D
23	Ceramic	12	CAP CER 1UF 10V X5R 20% 0402 -RoHS	C3 C4 C5 C6 C10 C34 C42 C43 C44 C46 C50 C51	1.0uF	0402	Murata	GRM155R61A105ME15D
24	Ceramic	5	CAP CER 4.7uF 10volts X5R +/-20% Soft Term	C35 C36 C39 C40 C41	4.7uF	0402	Murata	Z0815AR61A475ME01D
25	Ceramic	4	CAP CERAMIC 10uF 6.3V X5R 0603 SMD	C27 C28 C37 C38	10uF	0603	Murata	GRM188R60108ME47D
Inductors								
26	Inductor	1	INDUCTOR HQ 2.2 nH Wirewound 2.55 A, 2 % 22 mOhm (0402) -RoHS	L2	2.2 nH	0402	Murata Electronics	LQW15AN72080D
27	Inductor	1	INDUCTOR HQ 4.0 nH Wirewound 1.95 A, 2 % 30 mOhm (0402) -RoHS	L5	4.0 nH	0402	Murata Electronics	LQW15AN40880D
28	Inductor	1	FIXED IND 470nH 1.2A, DCr: 0.06 Ohm 20% (0805)	L1	470nH	0805	Taiyo Yuden	DKP2012N470M-T
Crystal Oscillators								
29	Crystal Oscillator	1	CRYSTAL 32.7680KHZ 6PF SMD ±20ppm (2PIN 2.05mm x 1.20mm)	Y3	32.768KHZ	IN 2.05mm x 1.20m	TXC	9HT11-32.768K028-T
30	Crystal Oscillator	1	CRYSTAL 12.000 MHz 18PF SMD	Y2	12MHz	8 x 3.2mmCaltienor	TXC	TA-12.000MAA-T
31	Crystal Oscillator	1	CRYSTAL 16.000MHz 10PF SMT	Y4	16.000MHz	ataiS200x2500x70	TXC	TA-16.000MEG-T
32	Crystal Oscillator	1	CRYSTAL 24.000MHz ±30ppm 18PF 50 Ohms 2-SMD	Y1	24.000MHz	8 x 3.2mmCaltienor	TXC	TA-24.000MAA-T
Integrated Circuits								
33	Special Functions	1	IC USB interface IC USB2.0 HIGH SPEED HUB CONTROLLER QFN-36-RoHS	U1	USB2512B-AE20	QFN-36	Microchip Technology	USB2512B-AE20
34	Regulator	3	IC REG LDO 300mA CMOS LDO 2.5V to 6V(IN) SOT-23-5 -RoHS	U2 U3 U10	AP2127R-3.3TRG1	SOT-23-5	Diodes Inc	AP2127R-3.3TRG1
35	Special Functions	1	IC ARM Microcontrollers - MCU 128K Flash, 36K SRAM 32-bit ARM Cortex M3 -RoHS	U4	ATSAM3U2CA-CU	TQFPGA-100	Microchip/Atmel	ATSAM3U2CA-CU
36	Special Functions	1	Bluetooth	U5	DA14683_Aqtr60	48mm xQFN 80pin	Dialog Semiconductor	DA14683_Aqtr60
37	Logic IC	1	IC Inverters LHS, 5C-70-5 -RoHS	U6	NC75204FSK	SC-70-5	Fairchild Semiconductor	NC75204FSK
38	Memory	1	IC FLASH EMBIT 104MHz 850nC 150 mil -RoHS	U9	W25Q80EWSHG	SOIC8 150 mil	Winbond	W25Q80EWSHG
Semiconductors								
39	Diode	1	DIODE ZENER 5.5V 305mW ±7% Surface Mount SOT-23-3	D1	BZX84C5V6-7-F	SOT-23-3	Diodes inc.	BZX84C5V6-7-F
40	Protection	1	TVS DIODE 6kVc 2.5A 0402C -RoHS	D2	ACPOQC24VE-HF	0402	Comchip Technology	ACPOQC24VE-HF
41	Protection	2	TVS DIODE Bidirectional 5VWV 24.5V (0402C/SOD-823F)	D3 D4	ACPOQC3V0C-HF	0402	Comchip Technology	ACPOQC3V0C-HF
42	LED	1	LED ORANGE DIFFUSED (0603)	D5	LD L29K-HZL1-24-Z	0603	Osram	LD L29K-HZL1-24-Z
43	LED	1	LED GREEN SMD (0603)	D6	LG L29K-F2J1-24-Z	0603	Osram	LG L29K-F2J1-24-Z
44	LED	1	LED RGB DIFFUSED 0605 SMD -RoHS	D8	L737-C18H1W7	1.0x2.0mm	LITE-ON INC	L737-C18H1W7
45	LED	1	LED WHITE-SMD CHIPLED, (0603)	D9	W Q38G-Q3D0-3K8c	0603	RAM Opto Semiconduct	LW Q38G-Q3D0-3K8L 1
46	LED	1	LED RED SMD 20mA (0603)	D10	Lead_Red	0603	Würth Electronics	15060R575000
47	Transistor	1	TRANSISTOR PNP 43V 0.5A SOT23 -RoHS	Q1	BC807-25_215	SOT23-3	NIJ	BC807_25_215
48	Mosfet	1	MOSFET P-Ch 30V 5.8A 1.08W (Twi)SOT-23)	Q2	DMP8099L-7	036-3, SC-59, SOT-23	Diodes inc.	DMP8099L-7
Connectors								
49	USB Connector	1	USB conn B - A USB 2.0 Plug Connector II Position Surface Mount, Right Angle; Through Hole -RoHS	J1	Type A Through usb_A_MOLEX480372		Molex inc	48037-2200
Electromechanical								
50	Switch	3	SWITCH TACTILE SPST Rnd Bttn Gull. JSA 32VDC 1W SMD -RoHS	SW1 SW2 SW5	KMR221GLFS	USH BUTTON 4 PIN	C&K	KMR221G LFS
51	Switch	1	SWITCH SLIDE SPDT 100MA 6V	SW6	CIS-1200TA	4x2.8x2.5mm J-ho	Hipec Copal Electronics	CIS-1200TA
52	Other	1	ANTENNA CHIP 2.4GHz 0.5dB 50 Ohm SMT 3216 -RoHS	ANT1	2450AT18A100E	3.2x1.6mmx3.3mm	Johanson Technology	2450AT18A100E

Figure 37: Bill of materials (BOM)

Revision History

Revision	Date	Description
1.1	28-Dec-2021	Updated logo, disclaimer, copyright.
1.0	28-May-2018	Initial version

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.