User Manual

DA14695 USB Kit

UM-B-103

Abstract

This document outlines the system design, configuration options, and supported features of DA14695 USB Kit, rev-C (331-22-C).

Contents

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Tables

1 Terms and Definitions

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

2 References

[1] DA1469x, Datasheet, Dialog Semiconductor.

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

3 Introduction

This document describes the DA14695 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 of:

- Software development
- Programming DA14695 via JTAG or UART using Dialog's SDK
- Connecting MikroBUS™ modules

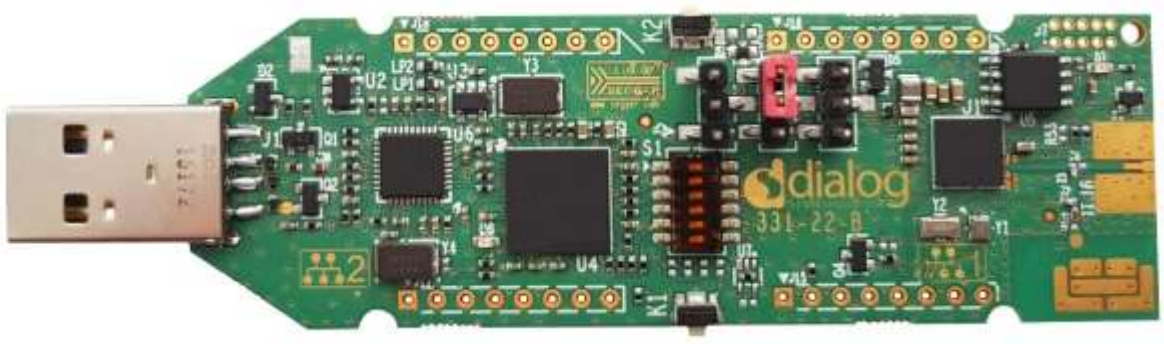

Figure 1: DA14695 USB Kit

4 System Overview

4.1 Features

The features of DA14695 USB kit include:

- Highly integrated DA14695 Bluetooth® Smart SoC from Dialog Semiconductor
- 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 LED and button
- Using USB (5 V), LDO (3.3 V), or external battery as power source
- JTAG and UART interface over USB via SEGGER
- 32 Mbit QSPI flash on board
- 2.4 GHz printed antenna and slot for SMA connector
- 32 MHz main crystal and 32.768 kHz low-power crystal
- Low cost
- Compact design
- A dimension of 100 mm × 26.5 mm × 11 mm

4.2 System and Components Description (Top View)

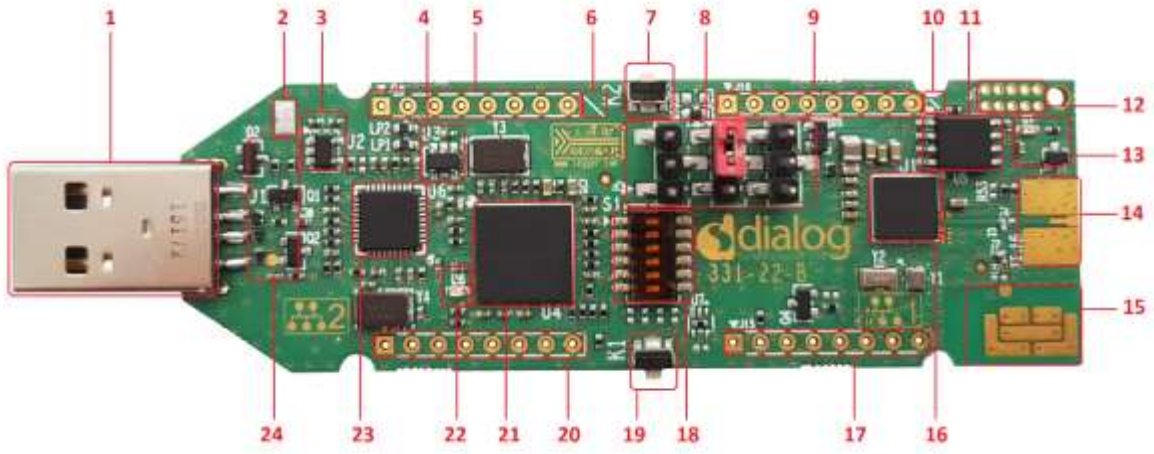

Figure 2: DA14695 USB Kit - Top Side

The USB kit is based on the DA14695 SoC in an VFBGA86 package. The marked and numbered sections of the system are:

1. Type-A USB connector (J1)
2. GND support point (not populated)
3. LDO 3.3V (U2)
4. LDO 3.3V (U3)
5. MikroBUS™ slot #2 connection points (Right side - J18, 8 pins)
6. MikroBUS™ slot #2 diagnostical notch (serves as a guideline for add-on board insertion. For more information, please check MikroBUS™ standard specifications)
7. Reset push button (K2)
8. DA14695 power selection headers (VBUS - J2, VBAT- J3) and battery connector header(J5)
9. MikroBUS™ slot #1 connection points (Right side - J16, 8 pins)
10. MikroBUS™ slot #1 diagnostical notch (serves as a guideline for add-on board insertion. For more information, please check MikroBUS™ standard specifications)
11. 32 Mbit QSPI Flash (U5)
12. Debugging Connector (J7, CIB can be connected for UART interface access)
13. Red LED (D7)
14. SMA connector (optional - J6)
15. Printed antenna (ANT1)
16. DA14695 Bluetooth® Smart SoC
17. MikroBUS™ slot #1 connection points (Left side - J15, 8 pins)
18. JTAG & UART Switch selection (S1)
19. General purpose push button (K1)
20. MikroBUS™ slot #2 connection points (Left side - J17, 8 pins)
21. UART & JTAG interface (U4)

22. Green LED (D8)
23. USB HUB (U6)
24. OVP Circuit

4.3 System and Components Description (Bottom View)

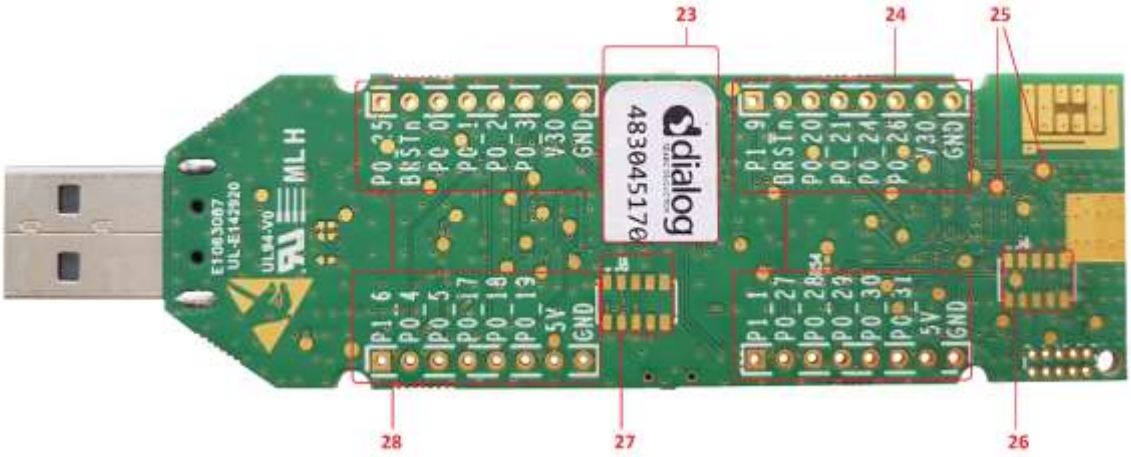

Figure 3: DA14695 USB Kit - Bottom Side

The bottom side of DA14695 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:

23. ID of UART & JTAG interface (U4)
24. MikroBUS™ slot #1 pins assignment
25. Test points (more details in Table 1)
26. GPIO connection header (not populated)
27. QSPI RAM I/O (1.8 V only, not populated)
28. MikroBUS™ slot #2 pins assignment

4.4 Test Points

Test points have been placed on the bottom side of the board and allow users to have access to signals and I/Os, or measure supplies voltage levels. Table 1 shows the assignment for each test point and Figure 4 shows the topology of the test points.

Table 1: Test Points Assignment

Test Point	Assigned to	Comments
TP1	V18	QSPI data flash supply voltage
TP2	VLED	Voltage level for Red LED
TP3	VBUS	Voltage level for VBUS pin of DA14695
TP4	V30	Voltage level for V30 pin of DA14695
TP5	V18	Voltage level for V18 pin of DA14695
TP6	V18P	Voltage level for V18P pin of DA14695
TP7	V14	Voltage level for V14 pin of DA14695
TP8	V12	Voltage level for V12 pin of DA14695
TP9	VBAT3V	Voltage level for VBAT3V pin of DA14695
TP12	GND	Ground
TP13	GND	Ground
TP14	GND	Ground
TP15	VBUS_IN	USB input voltage level
TP16	ESD_WARNING_LABEL	ESD sensitive device - Not electrically connected
TP17	GND	Ground
TP18	HUB_RST	USB HUB reset pin
TP19	3V3D	LDO 3.3V (U3) output voltage level
TP20	P0_06	General Purpose push button (K1)
TP21	P0_12	MicroBus™ BRSTn
TP22	P0_13	P0_13
TP23	P0_16	P0_16
TP24	P0_22	XTAL32km/P0_22
TP25	P0_23	XTAL32kp/P0_23
TP28	VDD_CORE	Core voltage level of UART & JTAG interface (U4)
TP29	NRST	For programming U4 in production - Not used for development
TP30	ERASE	For programming U4 in production - Not used for development
TP31	TMS_SWDIO	For programming U4 in production - Not used for development
TP32	TCK_SWCLK	For programming U4 in production - Not used for development
TP33	SWO/TDO	For programming U4 in production - Not used for development

Test Point	Assigned to	Comments
TP34	DBLED	Voltage level for Green LED
TP35	SWO/TDO	For programming U4 in production - Not used for development
TP36	GND	Ground
TP37	VBUS_OUT	Voltage level for VBUS pin of DA14695, when jumper placed to header J2 (pin 2-3)
TP38	3V3	USB_HUB power supply
TP39	VLDO	Voltage level for VBAT pin of DA14695, when jumper placed to header J3 (pin 1-2)
TP40	UTX	UART
TP41	RTS	UART
TP42	CTS	UART
TP43	URX	UART
TP44	SWDIO	JTAG
TP45	SWCLK	JTAG
TP46	P0_14	USBDP_2
TP47	P0_15	USBDM_2
TP48	VBUS_IN	USB input voltage level
TP49	SWDIO	JTAG
TP50	SWCLK	JTAG

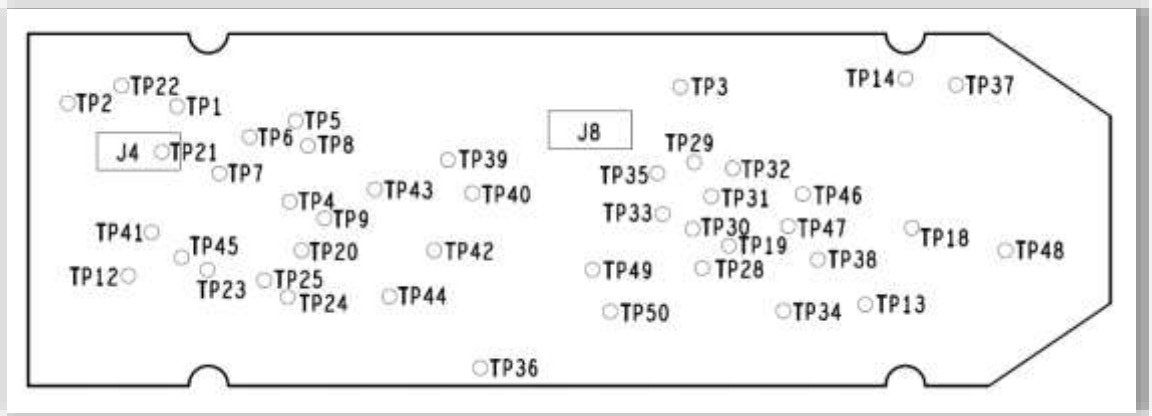

Figure 4: Test Points Topology (BOTTOM View)

4.5 Block Diagram

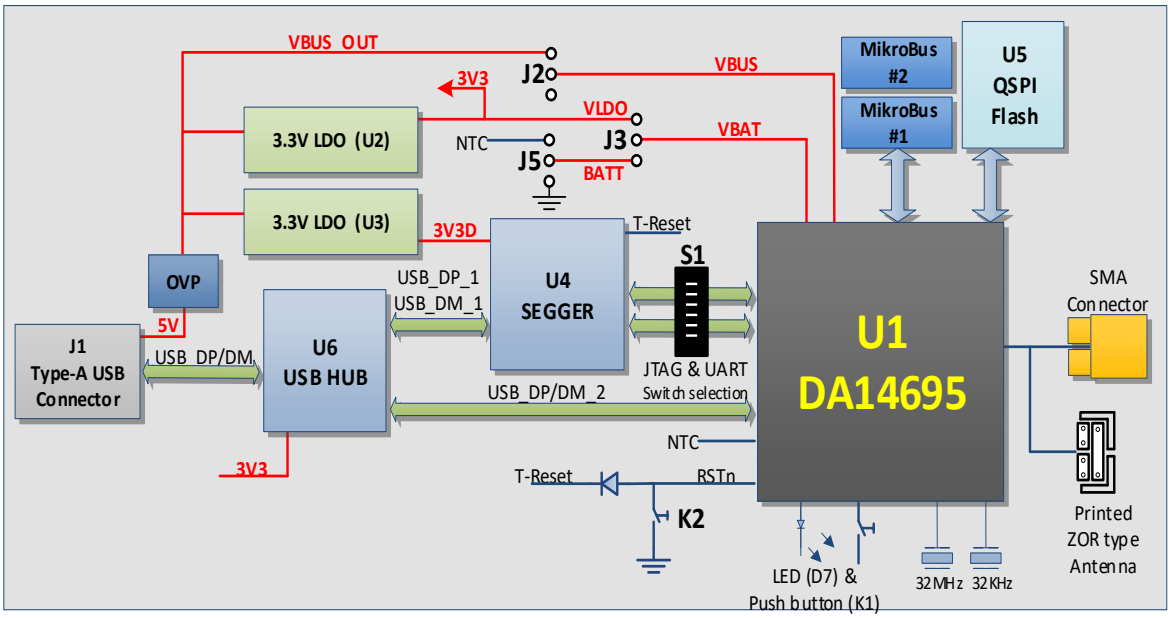

Figure 5: Block Diagram of DA14695 USB Kit

The power of Dialog's DA14695 SoC on the USB kit can be supplied from three different sources (Figure 5):

- **Default configuration**: 5 V provided to VBUS pin, when jumper placed to J2 header (pin 2-3)
- Alternative configuration: 3.3 V provided to VBAT pin, through LDO (U2), when jumper placed to J3 (pin 1-2)
- Alternative configuration: 3.6 V to 4.3 V provided to VBAT pin, from external LiPo battery (connected to J5 header), when jumper placed to J3 (pin 2-3)

5 USB Kit System

5.1 Overview

- Board name/number:
  - DA14695 USB Kit/331-22-C
- SoC:
  - DA14695 in a VFBGA86 package
- Flash memory:
  - MX25U3235F (32 Mbit) QSPI Flash Memory, 8-pin SOIC (200 mil) package
  - 1.8 V (V18P to pin V18F) power supply (default)
- Clock inputs:
  - 32 MHz crystal
  - 32.768 KHz crystal
- Ports:
  - USB port for debugging purposes and battery 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:
  - Two MikroBUS™ modules can be plugged to J15, J16 and J17, J18 sockets, respectively (users must solder the sockets manually)
- Power source selection:
  - 5 V on VBUS pin (default)
  - 3.3 V on VBAT via LDO (optional)
  - 3.6 V to 4.3 V from external LiPo battery (optional)

5.2 DA14695 SoC System

The DA14695 is a flexible System-on-Chip (SoC) combining an application processor, an advanced power management unit, memories, a flexible sensor node controller, a cryptography engine for enhanced security, digital and analog peripherals, and a new configurable Bluetooth Low Energy MAC engine with a radio transceiver capable of a 6 dBm output.

The application processor used by DA14695 SoC system is the latest ARM® Cortex® M33™ CPU which offers up to 144 DMIPS and a RAM of 512 kBytes. This application processor has an 8-region MPU and a single-precision FPU which enables code execution from embedded memory (RAM) or external QSPI FLASH via a 16 kB 4-way associative cache controller and the capability of decryption on-the-fly without extra wait states.

The advanced power management unit of the DA14695 enables it to run from primary and secondary batteries and provide power to external devices through the SIMO DCDC or integrated LDOs. The on-chip hardware charger allows the natively rechargeable batteries to be charged over USB.

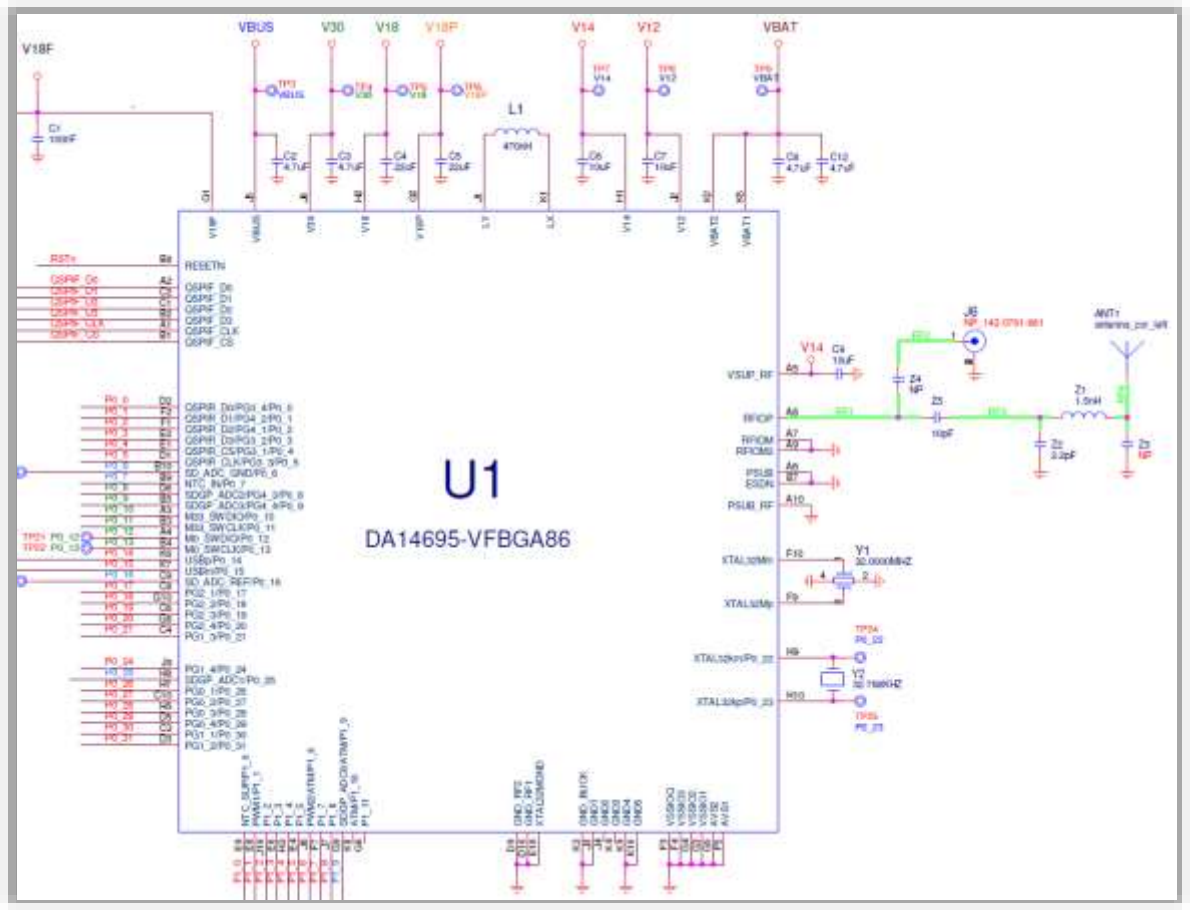

Figure 6: DA14695 Schematic

The DA14695 SoC power management subsystem consists of:

- VBUS: battery charger input as well as USB bus voltage
  - A decoupling capacitor (C2, 0402 package, 6.3 V) equal or less than 4.7 µF is placed close to VBUS pin
- VBAT1: battery connection
  - It is shorted externally with VBAT2. A 4.7 µF decoupling capacitor (C8, 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
- VBAT2: input of the SIMO DC-DC converter
  - It is shorted externally with VBAT1. A 4.7 µF decoupling capacitor (C12, 0402 package, 6.3V) is required to be placed close to the pin
  - On this development kit, VBAT1 and VBAT2 are connected
- V30: output voltage rail (3 V)
  - A ceramic decoupling capacitor of 4.7 µF (C36, 0402 package, 10 V) is required to be placed close to the pin
  - V30 cannot be turned off
  - V30 is the default option for GPIO voltage levels (expect for the QSPI-RAM I/Os which are fixed to 1.8 V)

- The current delivery capability of the V30 power rail is 150 mA
- Overcurrent protection circuit limits the current on V30 if an external device misbehaves

- SIMO DC-DC converter outputs: V18, V18P, V12, and 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 and V18P: power rails (1.8 V) for supplying external devices, even when the system is in sleep mode
    - Decoupling ceramic capacitors (C4 and C5) of 22 µF (0603 package, 6.3 V), are placed as close as possible to the V18 and V18P pins.
    - V18 is assigned to peripherals devices, QSPI-RAM, and through register setting for GPIOs
    - V18P is assigned to external QSPI Data Flash
    - The current delivery capability of the V18 and V18P power rails is 50 mA in active mode
  - V12: power rail that supplies the digital core of DA14695 and delivers up to 50 mA at 1.2 V in active mode. It should not be used to supply external devices
    - A 10 µF decoupling capacitor (C7, 0603 package, 6.3 V) is placed close to V12 pin
  - V14: power rail that delivers up to 20 mA at 1.4 V and should not be used for supplying external devices
    - A 10 µF decoupling capacitor (C6, 0603 package, 6.3 V) is placed close to the V14 pin
- VSUP_RF: radio supply voltage
  - It is connected to V14 externally. A 10 µF capacitor (C9, 0603 package, 6.3 V) is placed as close to the VSUP_RF pin as possible.

5.3 DA14695 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 VFBGA86 package of the DA14695.

Table 2: USB Kit Pin Assignment

AQFN60 Pin Name	Development Kit Signal	Header Pin	Comments
P0_00	P0_00	J8.3	GPIO
P0_01	P0_01	J8.4	GPIO
P0_02	P0_02	J8.5	GPIO
P0_03	P0_03	J8.6	GPIO
P0_04	P0_04	J8.7	GPIO
P0_05	P0_05	J8.8	GPIO
P0_06	P0_06	-	General Purpose push button (K1)
P0_07	CTS	-	UART interface
P0_08	URX	-	UART interface
P0_09	UTX	-	UART interface
P0_10	SWDIO	-	JTAG interface
P0_11	SWCLK	-	JTAG interface
P0_12	P0_12	J15.2/J17.2	MikroBUS™ BRSTn (slot 1,2)
P0_13	P0_13	-	GPIO
P0_14	USBDP_2	-	USB Data plus (+)
P0_15	USBDM_2	-	USB Data minus (-)
P0_16	P0_16	-	GPIO
P0_17	GPIO/MB2_TX	J18.4	GPIO/MikroBUS™ Universal Asynchronous Transmitter (slot 2)
P0_18	GPIO/MB2_SCL	J18.5	GPIO/MikroBUS™ I2C SCL (slot 2)
P0_19	GPIO/MB2_SDA	J18.6	GPIO/MikroBUS™ I2C SDA (slot 2)
P0_20	GPIO/MB1_CS	J15.3	GPIO/MikroBUS™ CS (slot 1)
P0_21	GPIO/MB1_SCK	J15.4	GPIO/MikroBUS™ SCK (slot 1)
P0_22	XTAL32M	-	XTAL 32.768 kHz minus (-)
P0_23	XTAL32P	-	XTAL 32.768 kHz plus (+)
P0_24	GPIO/MB1_MISO	J15.5	GPIO/MikroBUS™ MISO (slot 1)
P0_25	GPIO/MB2_AN	J17.1	GPIO/MikroBUS™ Analog (slot 2)
P0_26	GPIO/MB1_MOSI	J15.6	GPIO/MikroBUS™ MOSI (slot 1)
P0_27	GPIO/MB1_INT	J16.2	GPIO/MikroBUS™ Interrupt (slot 1)
P0_28	GPIO/MB1_RX	J16.3	GPIO/MikroBUS™ Universal Asynchronous Receiver (slot 1)
P0_29	GPIO/MB1_TX	J16.4	GPIO/MikroBUS™ Universal Asynchronous Transmitter (slot 1)

AQFN60 Pin Name	Development Kit Signal	Header Pin	Comments
P0_30	GPIO/MB1_SCL	J16.5	GPIO/MikroBUS™ I2C SCL (slot 1)
P0_31	GPIO/MB1_SDA	J16.6	GPIO/MikroBUS™ I2C SDA (slot 1)
P1_00	RTS	J4.3	UART interface
P1_01	GPIO/MB_PWM/RED_LED	J16.2/J4.4	GPIO/MikroBUS™ I2C PWM (slot 1)/Red LED
P1_02	GPIO/MB2_CS	J17.3/J4.5	GPIO/MikroBUS™ CS (slot 2)
P1_03	GPIO/MB2_SCK	J17.4/J4.6	GPIO/MikroBUS™ SCK (slot 2)
P1_04	GPIO/MB2_MISO	J17.5/J4.7	GPIO/MikroBUS™ MISO (slot 2)
P1_05	GPIO/MB2_MOSI	J17.6/J4.8	GPIO/MikroBUS™ MOSI (slot 2)
P1_06	GPIO/MB2_PWM	J18.1	GPIO/MikroBUS™ PWM (slot 2)
P1_07	GPIO/MB2_INT	J18.2	GPIO/MikroBUS™ interrupt (slot 2)
P1_08	GPIO/MB2_RX	J18.3	GPIO/MikroBUS™ Universal Asynchronous Receiver (slot 2)
P1_09	GPIO/MB1_AN	J15.1	GPIO/MikroBUS™ Analog (slot 1)
P1_10	-	-	Not connected
P1_11	-	-	Not connected

5.4 Booting from UART

There is only one boot loader option for booting from UART using pins P0_9 (T_TX) and P0_8 (T_RX). Please note that UART-booting does not support hardware handshake signals (RTS/CTS).

The settings for UART booting are:

- Baud rate 115.2 kbps
- 8 bits
- No parity
- 1 stop bit

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

5.5 Crystals

The DA14695 SoC has two Digitally Controlled Crystal Oscillators, one at 32 MHz (XTAL32M) 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 XTAL32M can be trimmed.

The crystals used on the USB kit are specified in Table 3 and Table 4.

Table 3: Y1 (32 MHz crystal) characteristics

Reference Designator	Value
Part Number	XRCGB32M000F1H00R0
Frequency	32 MHz
Accuracy	±10 ppm
Load Capacitance (CL)	6 pF
Equivalent Series Resistance (ESR)	60 Ω
Drive Level (PD)	150 µW

Table 4: Y2 (32.768 kHz crystal) characteristics

Reference Designator	Value
Part Number	ABS07-32.768KHZ-7-T
Frequency	32.768 kHz
Accuracy	±20 ppm
Load Capacitance (CL)	12.5 pF
Shunt Capacitance (C0)	0.9 - 1.2 pF
Equivalent Series Resistance (ESR)	100 Ω
Drive Level (PD)	0.1 µW

5.6 Antenna and RF Port

A printed type antenna is currently used as the default antenna in the DA14695 USB Kit. The DA14695 USB Kit provides a single-ended RFIO port matched to 50 Ω. The RF port consists of the RFIOp, RFIOm, and RFIOm2 pins, of which RFIOm and RFIOm2 are connected to ground. A copper trace with an impedance of 50 Ω interconnects the RF port and the printed antenna (ANT1). A Pi-network (Z1, Z2, and Z3) is added for antenna matching purposes.

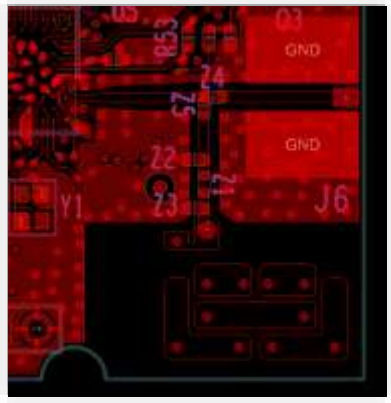

Figure 7: RF Matching Circuit, Printed Antenna, and SMA Connector

The DA14695 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. To perform RF measurements using the RF connector J6, users must remove the capacitor Z5 (10 pF) and place the capacitor Z4 (10 pF).

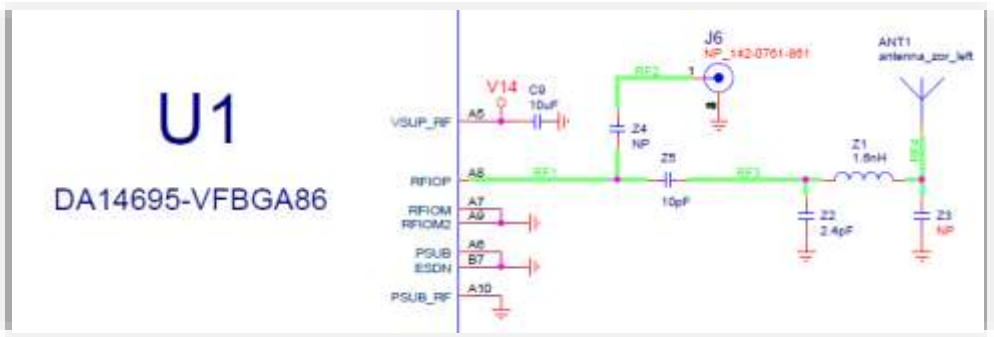

Figure 8: RF Port, RF Connector, RF Matching, and SMD Chip Antenna

5.6.1 RF Measurements and Antenna Matching

RF measurements have been performed to increase the efficiency of the ANT1. The values of the RF components are shown in Table 5.

Table 5: RF Components Names and Values

Component Name	Component Value	Manufacturer Part Number
Z1	1.6 nH	LQP15MN1N5W02D
Z2	2.4 pF	GJM1555C1H2R4BB01D
Z3	-	Not populated

5.7 QSPI Data Flash Memory (U5)

The DA14695 USB Kit includes an external QSPI Data Flash memory from Macronix. The MX25U3235F 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 selected QSPI flash for the DA14695 USB Kit is MX25U3235FM2I-10G in 8-pin SOIC 208mil package (U5). DA14695 USB Kit can support QSPI Data flash with 8-pin SOIC 150mil package (U5Y) or QSPI Data flash with 8-pin USON (2x3) package (U5X), as shown in Figure 10.

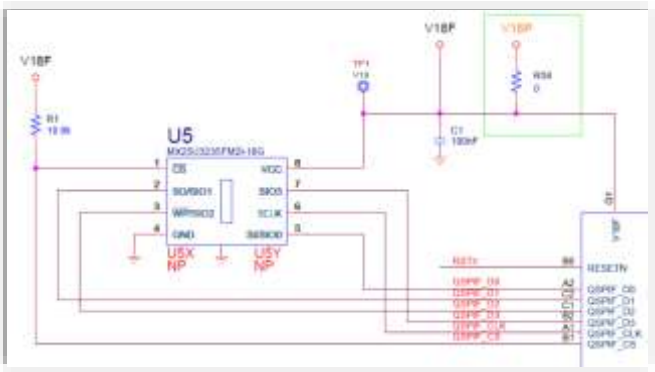

Figure 9: QSPI Data Flash

The DA14695 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.

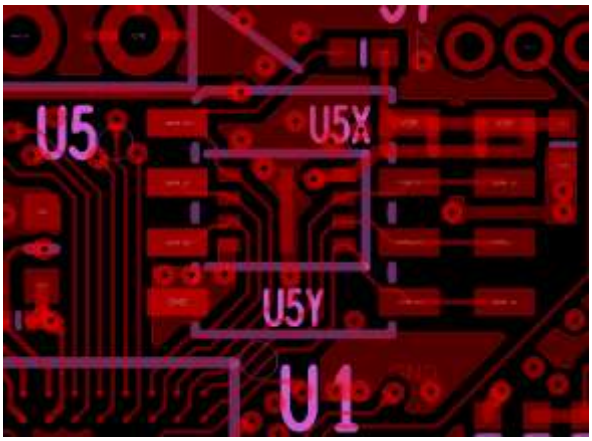

Figure 10: Available packages for QSPI Data Flash

5.8 Reset Circuit

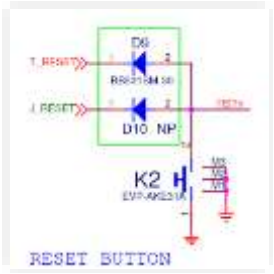

Figure 11: Reset Circuit

The DA14695 comprises an RSTn pad which is active low. The DA14695 USB Kit can be reset by pressing the on-board **RESET** push button (K2, Figure 12) or through software from the UART & JTAG interface processor (U4, Figure 2, #21). The Reset push button drives the RSTn pad to the ground.

Figure 12: RESET Push Button (K2)

5.9 General Purpose Push Button

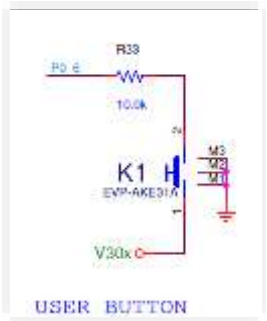

Figure 13: General Purpose Push Button

General purpose push button K1 is connected to P0_06 (Figure 13). It is populated and placed on the top side of the board (Figure 14).

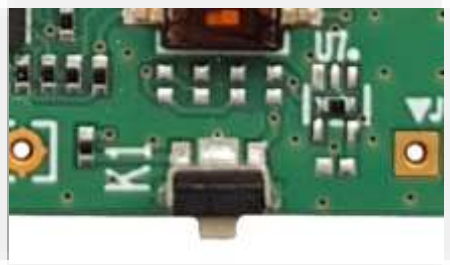

Figure 14: General Purpose Push Button K1 (Populated at TOP)

5.10 Debugging Port DIP Switch

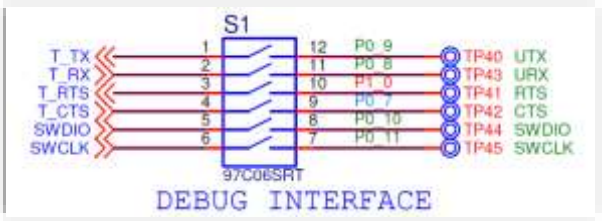

Figure 15: Debugging DIP Switch

S1 is a DIP switch which allows users to disconnect the pins used for debugging (default state is all pins connected) to allow accurate deep sleep power measurement.

Figure 16: Debugging DIP switch

5.11 User Controlled LED

The red LED D7 that can be controlled by users is driven from P1_1 (Figure 17).

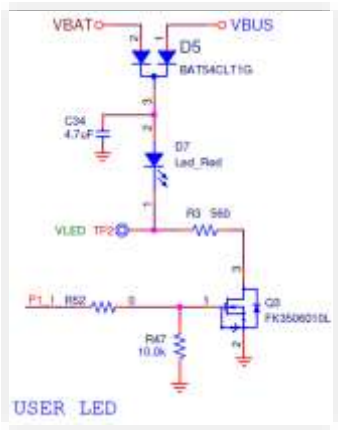

Figure 17: General Purpose Red LED

Figure 18: General Purpose Red LED D7

5.12 MikroBUS™ Modules

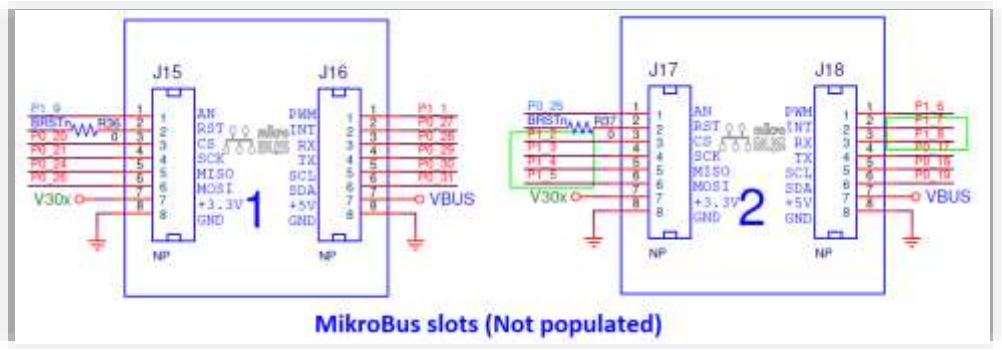

Figure 19: Mikrobus™ Pin Assignment

The DA14695 USB Kit can support MikroBUS™ modules. Users must place and solder J15, J16 sockets (for slot #1) and/or J17, J18 sockets (for slot #2) on the top side of the board as shown in Figure 20. A possible female socket type is PPTC081LFBN-RC.

Figure 21 shows the diagnostic silkscreen, below the right-hand side pinout, which serves as a guideline for add-on board insertion. For more information, please check MikroBus™ standard specifications. The pin assignment is printed at the bottom side of the DA14695 USB Kit (Figure 22).

A MikroBUS™ module requires a power supply of 5 V, 3.3 V, or both, depending on the module. The voltage for the 5.0 V MikroBUS™ pins is taken directly from the main USB connector. The voltage of the 3.3 V MikroBUS™ pins is powered from V30 through the overcurrent protection circuit.

Figure 20: J15, J16, J17, and J18 Female Sockets (Must Be Soldered by Users)

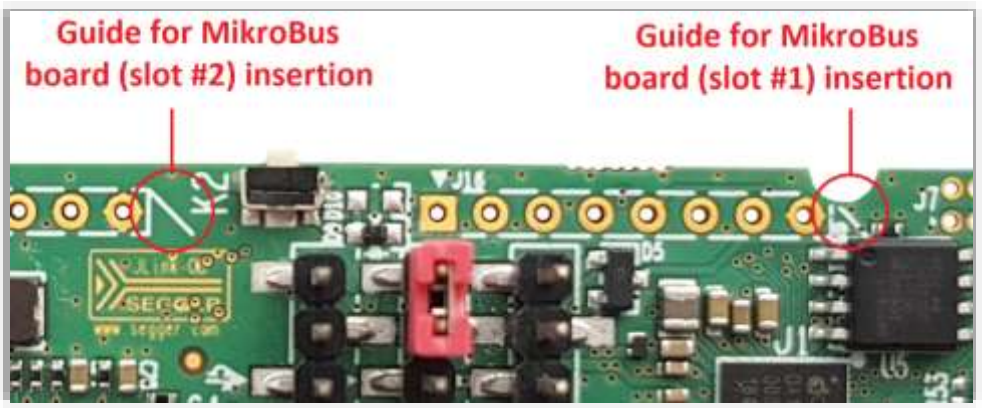

Figure 21: Guides for Proper Mikrobus™ Click Boards Insertion

Figure 22: Mikrobus™ Pin Assignment

5.13 GND Test Point

On this test point, users can connect oscilloscope's ground probe.

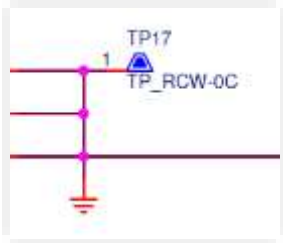

Figure 23: GND Support Point

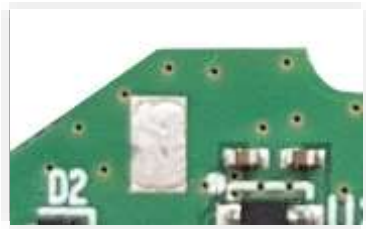

Figure 24: GND Support Point (Must Be Placed by Users)

5.14 Over Voltage Protection Circuit (OVP)

The DA14695 USB Kit can be used as a portable standalone device. The power supply can be a power-bank or a mobile charger. The overvoltage protection circuit OVP circuit can protect the device from overvoltage of 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 insertion of long length cable. For normal operation of the DA14695 USB Kit, the input voltage range should be between 4.75 V and 5.25 V, as required by the USB standard.

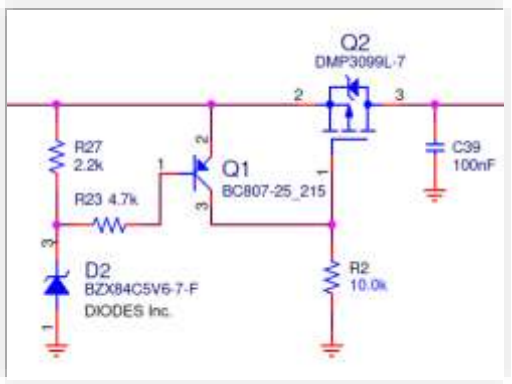

Figure 25: Over Voltage Protection Circuit

5.15 Over-Current Protection Circuit on V30 Power Rail

A P-FET is added in series with V30 power rail to prevent the voltage on the pin from dropping to very low levels if a peripheral surge sets an overcurrent condition.

The voltage on V30L (external peripherals) may reach low levels, but the voltage on V30 (the pin) always stays above 2 V.

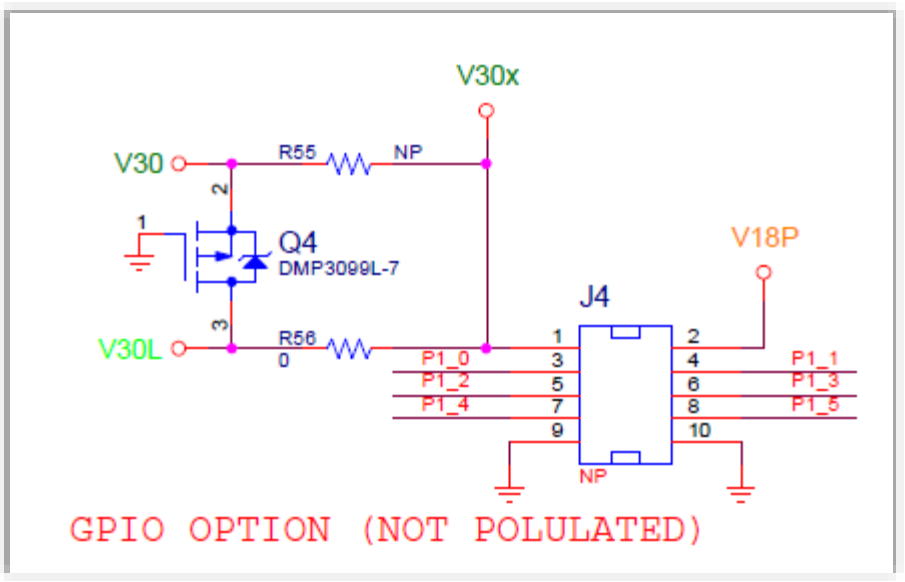

Figure 26: Over Current Protection Circuit on V30 Power Rail

5.16 USB HUB

USB HUB is implemented by U6, USB2512B-AEZG. This chip is supplied with a voltage of 3.3 V from U2. The signal LDO_EN is generated from U6 and it is an active high signal. It enables the LDO (U3) which supplies the U4 (debugging). A 24 MHz crystal (Y4) is required for the chip operation. Figure 27 shows the circuit's schematic.

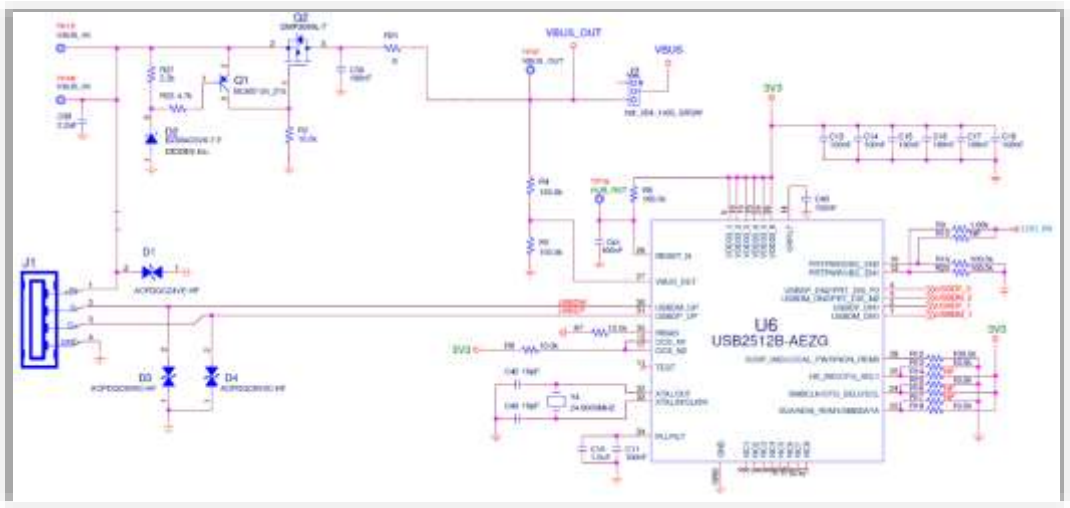

Figure 27: USB HUB Circuitry

5.17 Debugging Processor (U4)

Two debugging options (JTAG/UART) are available on the DA14695 SoC.

The USB-to-JTAG and USB-to-UART functions are implemented by the SAM3U2CA processor (U4) (Figure 28), running the Segger JLink-OB firmware. The functions served by U4 are:

- Connecting PC to DA14695 JTAG port
- Connecting PC to DA14695 UART (2-pin or 4-pin)
- Reset DA14695 through the T_RESET line

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 [2] for troubleshooting possible issues with the serial port.

The JTAG operating status is indicated via the green LED D8. The SAM3U2CA (U4) chip is supplied with a voltage of 3.3 V from U3. A 12 MHz crystal (Y3) is required for the chip operation. Figure 28 shows the circuit's schematic.

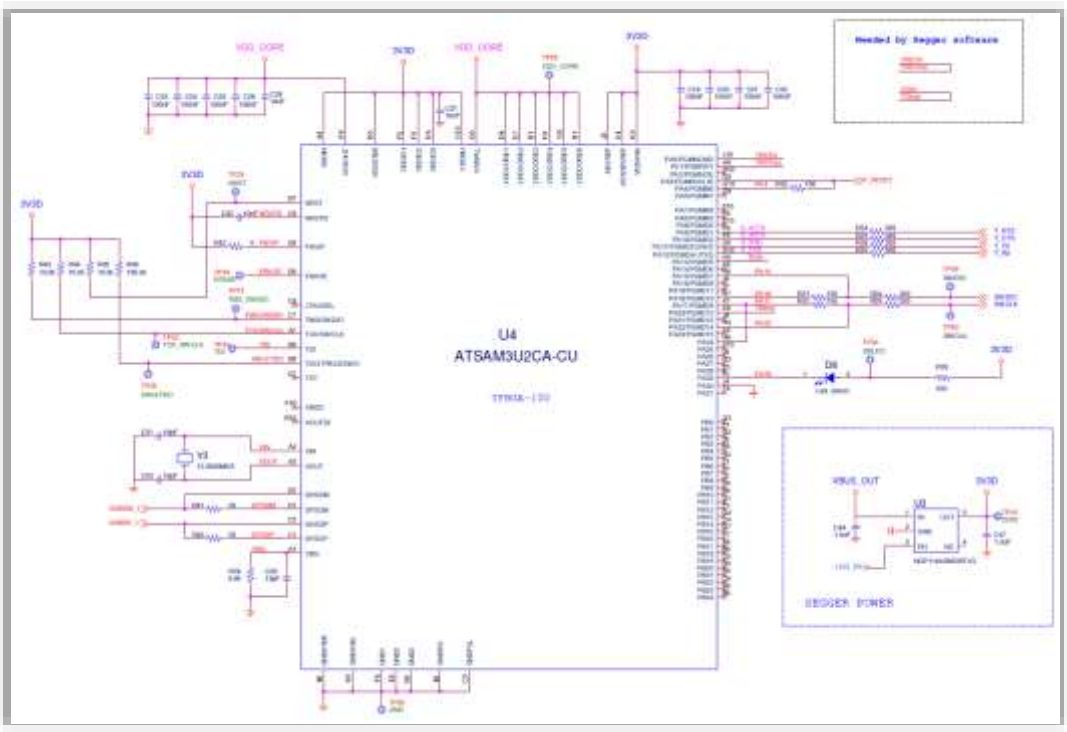

Figure 28: Debugging Processor UART And JTAG Interface (U4)

5.18 Power Section

The DA14695 USB Kit is supplied from 5 V to VBUS pin via J2 header (jumper has been placed to connect pins 2-3). Figure 29 shows the power tree.

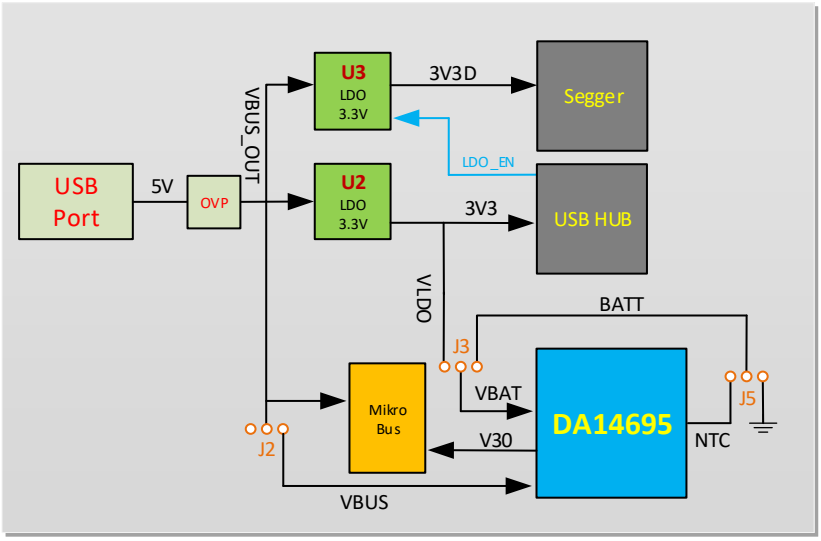

Figure 29: DA14695 USB Kit Power Tree

The following power components are placed on the DA14695 USB Kit:

- U2: fixed output 3.3 V LDO
  - It generates 3V3 voltage rail that supplies USB HUB and power section header J3
- U3: fixed output 3.3 V LDO
  - It generates 3V3D 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 an external device (PC, Laptop, and so on), the LDO is not enabled. Consequently, the debugging circuit is not functional.

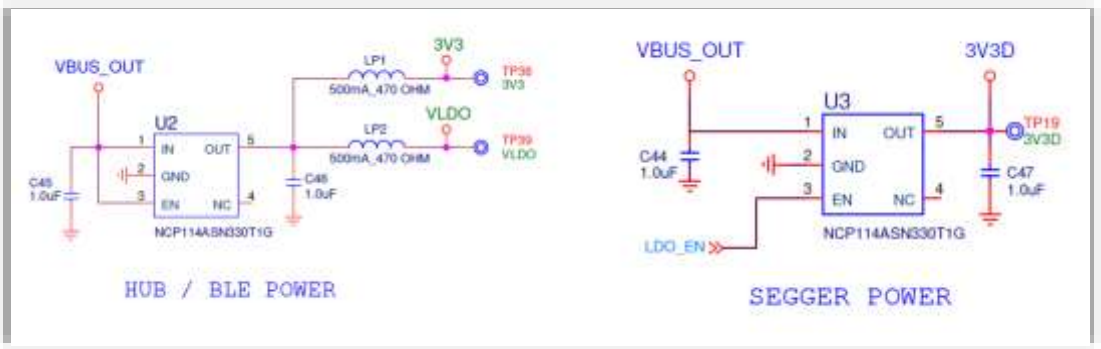

Figure 30: Linear Voltage Regulators (LDOs) U2 And U3

5.19 Power Selection Headers

The DA14695 USB Kit allows users to power supply the DA14695 from three different sources:

- 5 V to VBUS pin (default)
- 3.3 V to VBAT pin (optional)
- 3.6 V to 4.2 V from external battery to VBAT pin (optional)

The default power configuration for DA14695 is from VBUS 5 V via power selection header J2. A jumper has been placed to pins 2-3 of the J2 header. There is capability to power supply DA14695 either from LDO or external battery. Power configuration selection depends on the SDK project configuration as well. Changes to Dialog's SDK might be needed, depending on the SDK project and the power supply of DA14695 (supplied from VBUS, VBAT, or battery). There are four different power configurations (Table 6) where users must plug or remove jumpers to J2, J3, J5 headers.

Table 6: DA14695 Power Configurations

Power configuration	J2	J3	J5
LDO (3.3 V)	-	Jumper to 1-2	-
VBUS (5 V) (default)	Jumper to 2-3	-	-
External Battery (3.6 V to 4.2 V)	-	Jumper to 2-3	Battery connection
Charging external Battery	Jumper to 2-3	Jumper to 2-3	Battery connection

Note 1 If the battery has an extra pin for NTC (measuring battery's temperature), then R30 = 5.6 kΩ must be placed by the user.

Note 2 If DA14695 is supplied from an external battery but the USB Kit is not connected to USB port, there is a leakage current through UART and JTAG signals. Users must disconnect these signals by turning OFF the switches in S1 (section 5.105.10).

6 PCB Layout

Dimensions: 100 mm × 26.5 mm × 11 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

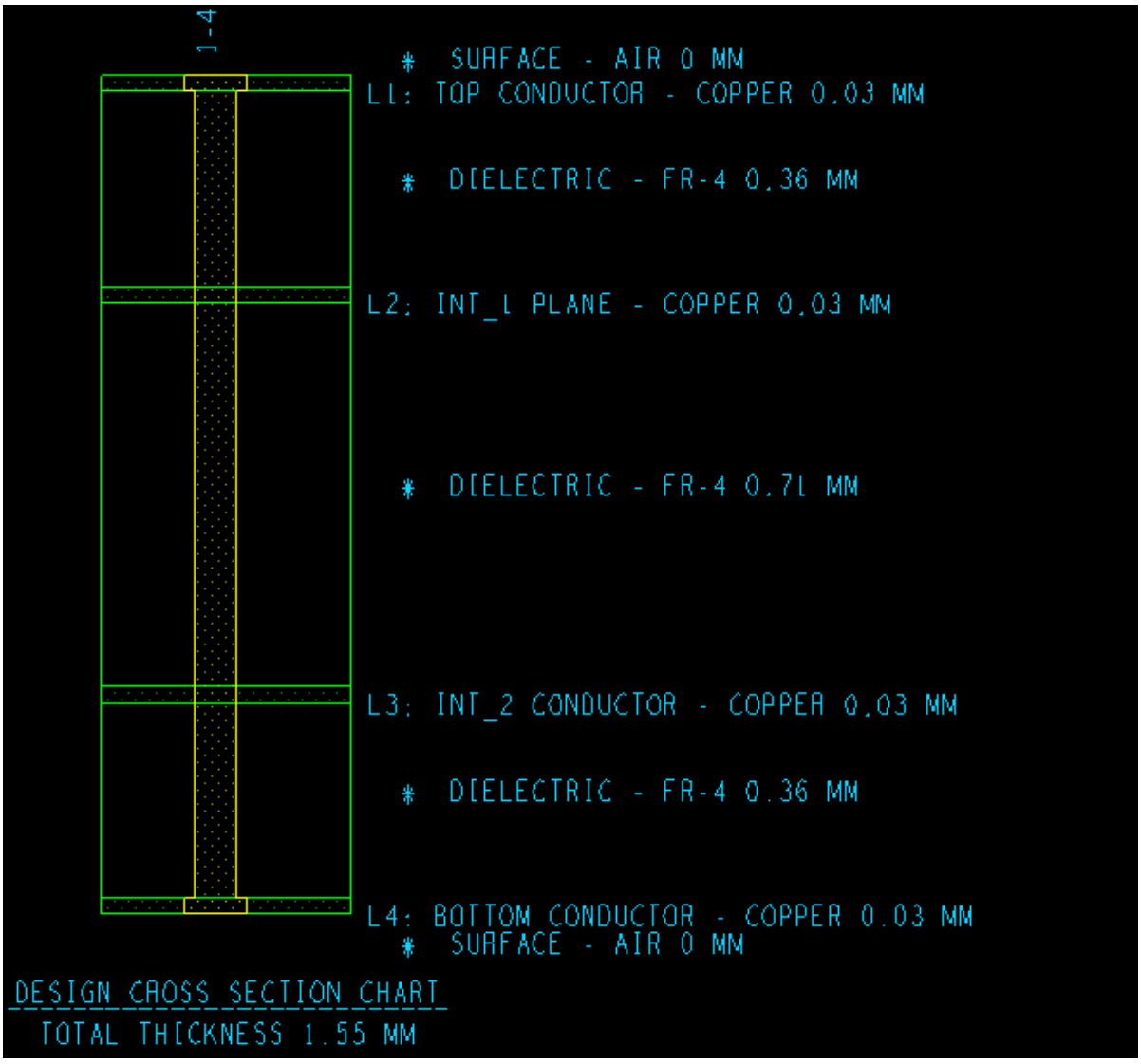

Figure 31: PCB Cross Section

The total thickness of the board is 1.55 mm. The dielectric between each layer is shown in Figure 31.

Appendix A Schematics

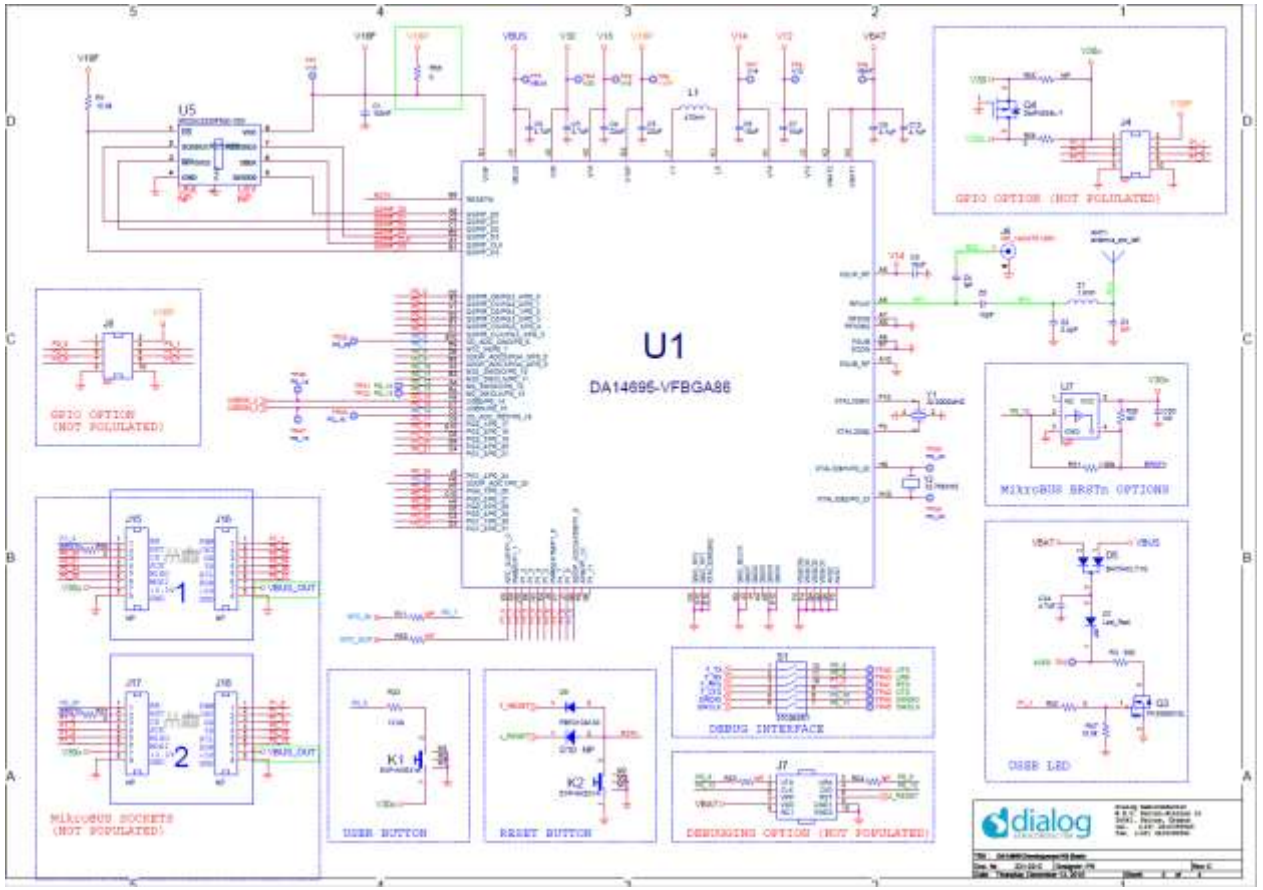

Figure 32: DA14695 SoC Section

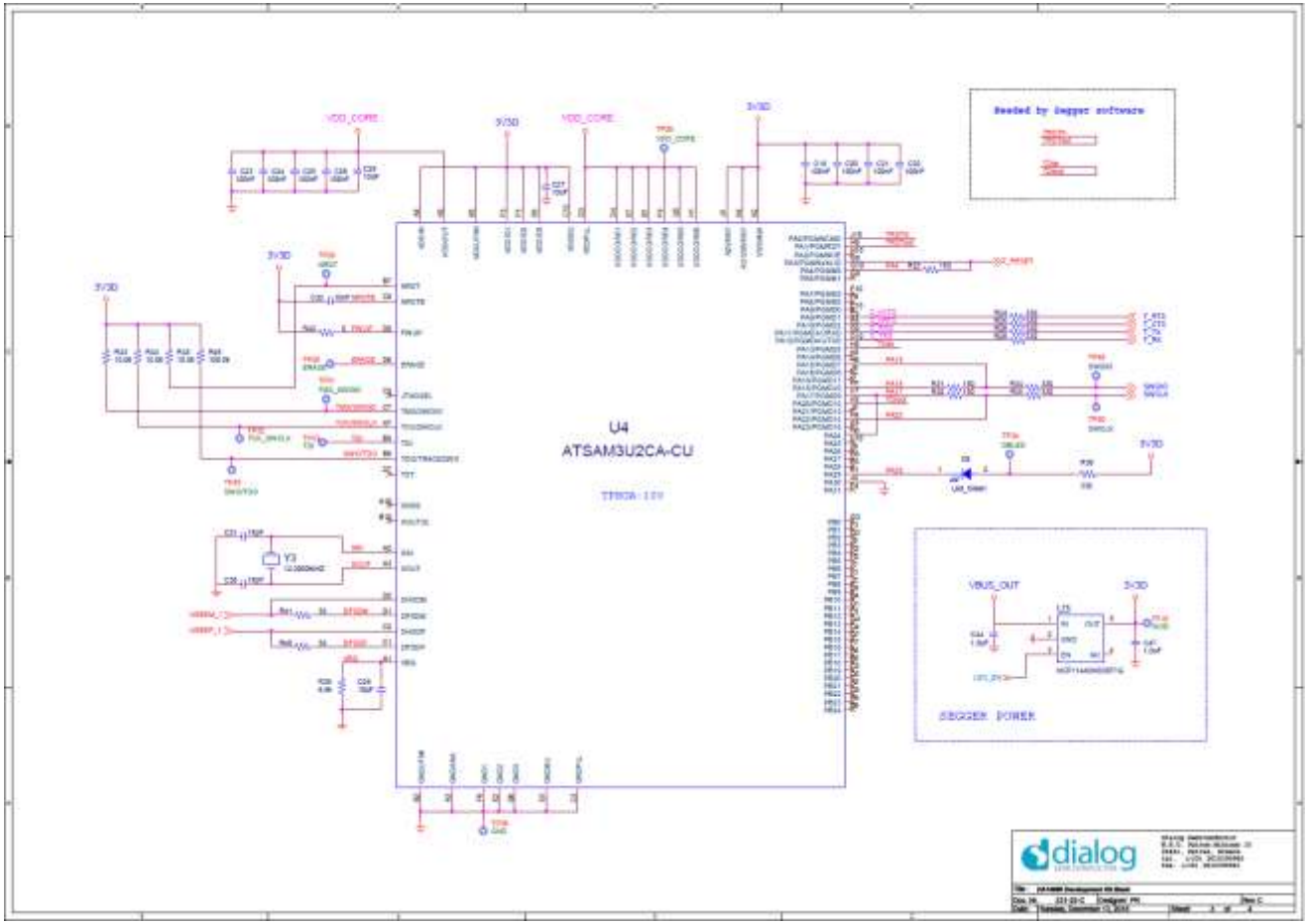

Figure 33: UART & JTAG Interface Chip Section

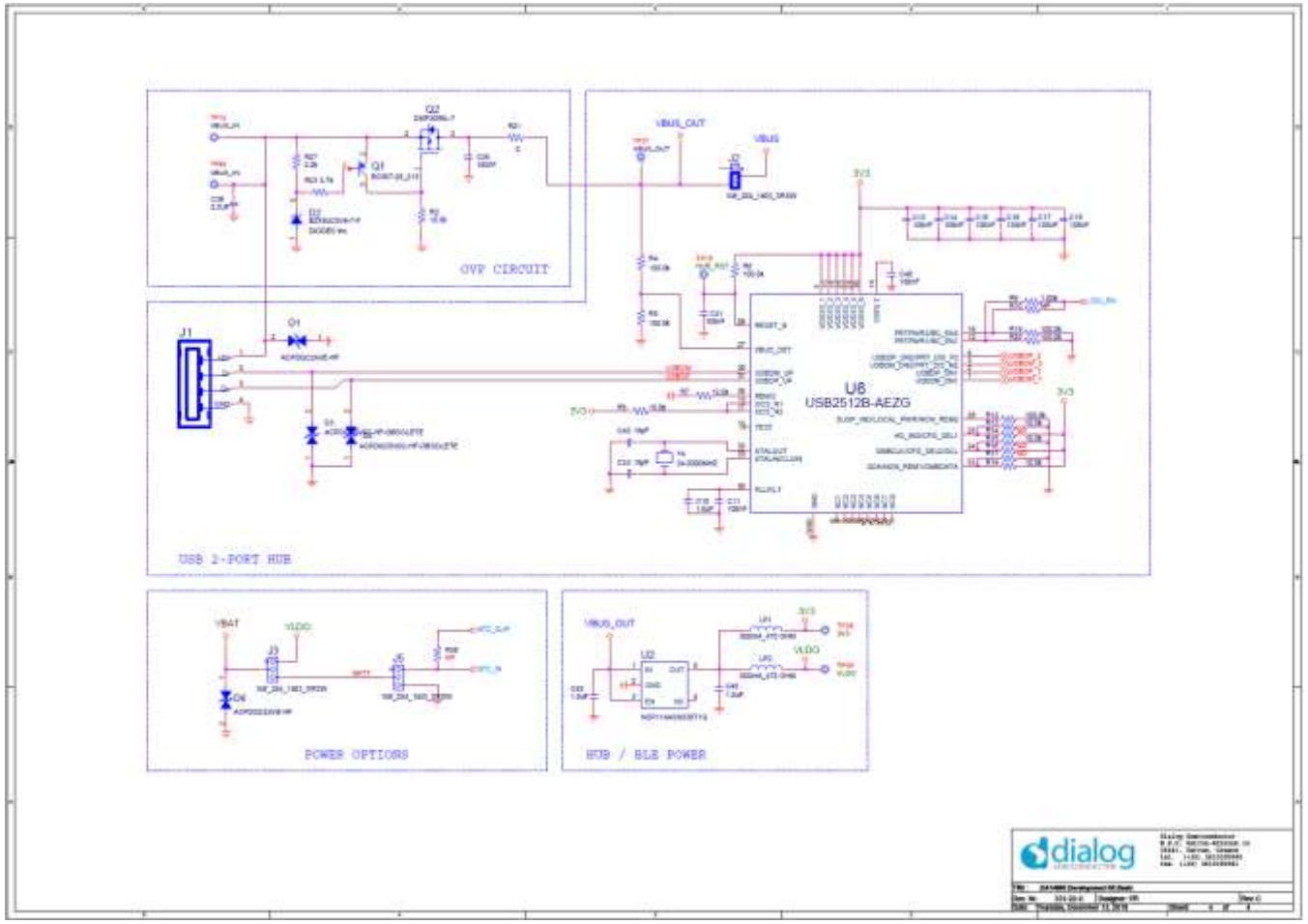

Figure 34: USB Hub Section

Appendix B Bill of Materials

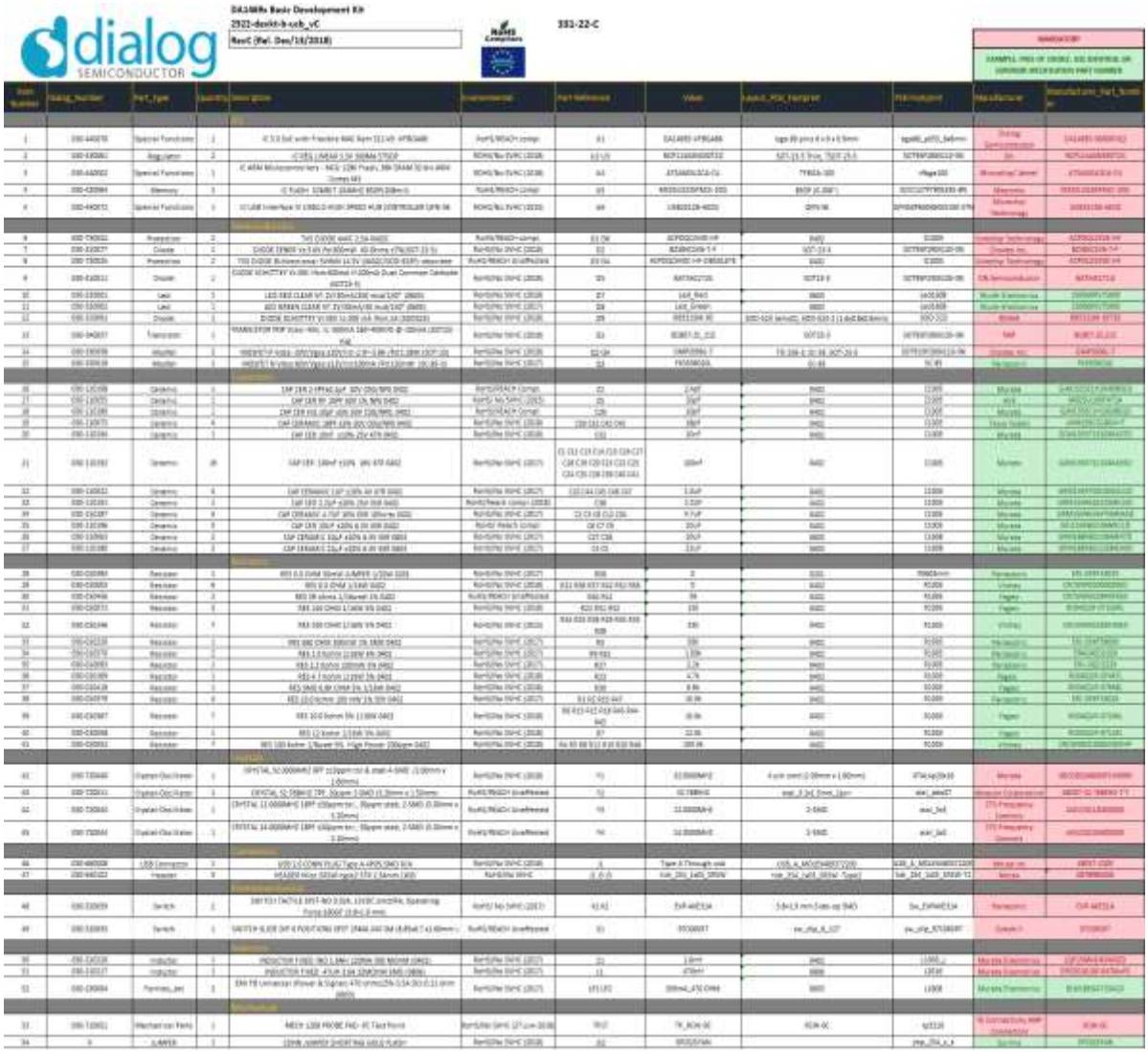

Figure 35: Bill of Materials (BOM)

Revision History

Revision	Date	Description
1.1	18-Jan-2022	Updated logo, disclaimer, copyright.
1.0	14-Feb-2019	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.