WT32i REFERENCE DESIGN

APPLICATION NOTE

Monday, 24 February 2014

Version 0.2

VERSION HISTORY

Version	Comment
0.1	First draft
0.2	Minor improvements

TABLE OF CONTENTS

1 Introduction

This documents describes detailed the design of WT32i development kit.

2 Hardware Design of DKWT32i v1.1

2.1 Choosing the Capacitors and Resistors Used in the Audio Path

Metal film resistors have lower noise than carbon resistors which makes them more suitable for high quality audio.

Non-linearity of capacitors within the audio path will have an impact on the audio quality at the frequencies where the impedance of the capacitors become dominant. At higher frequencies the amplitude is not determined by the value of the capacitors, but at the lower frequencies the impact of the capacitors will be seen.

Ceramic capacitors should be X5R or X7R type capacitors with relative high voltage rating. The higher the capacitance value, the lower is the frequency where the non-linearity will start to have an impact. Thus it is not a bad idea to select the capacitors value bigger than necessary from the frequency response point of view.

For optimal audio quality the best selection is to use film capacitors. Film capacitors have excellent linearity and they are non-polarized which makes them perfect choice for using in audio path. The drawback of film capacitors is bigger physical size and higher cost.

Figure 1 shows a modulation distortion measurement when using different type of capacitors in the audio paths. Modulation distortion measures the amount of distortion between two closely located sine waves. The difference between the different capacitors is obvious at low frequencies where the impedance of the capacitor is dominant.

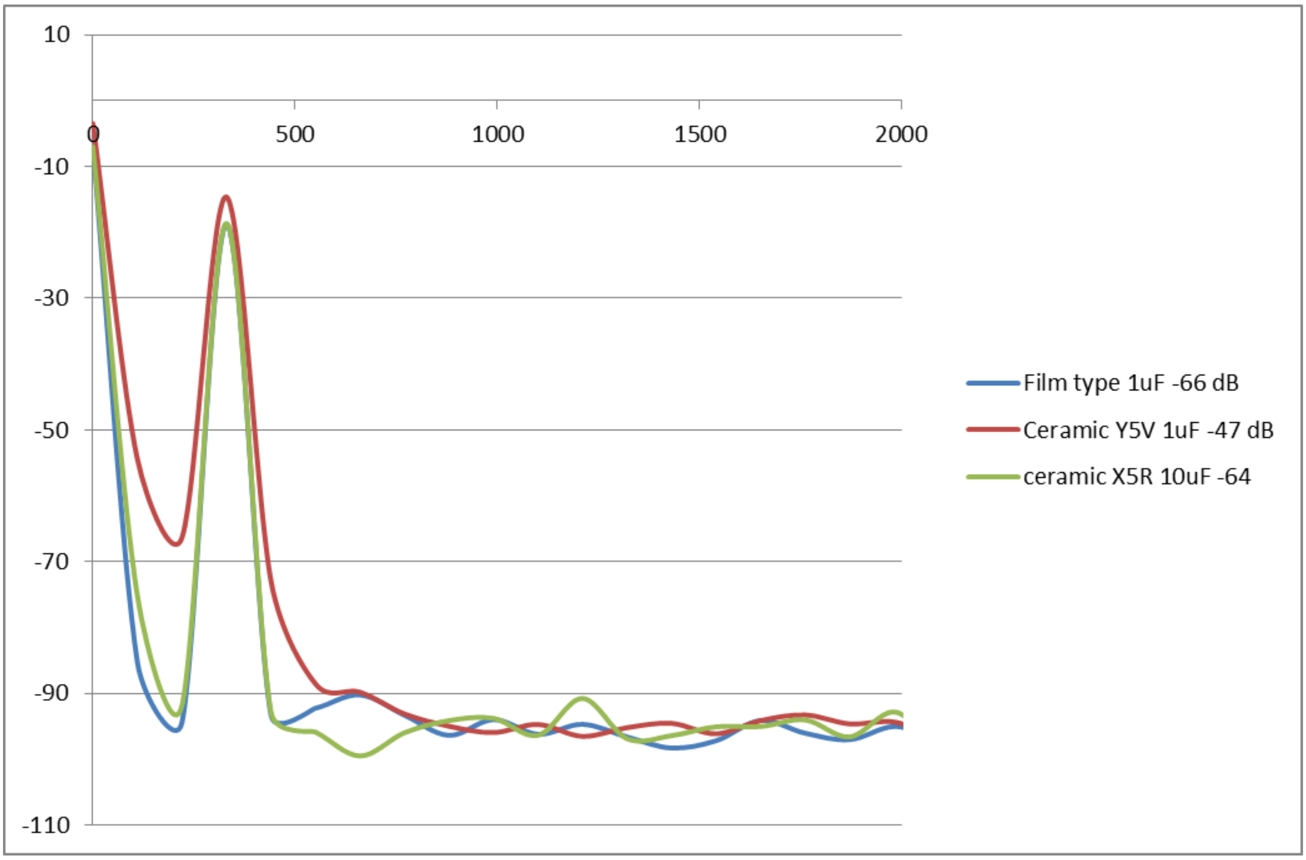


Figure 1: Intermodulation distortion with different type of capacitors

2.2 How to Avoid Pops and Cracks When Powering the Board or Establishing A2DP connection

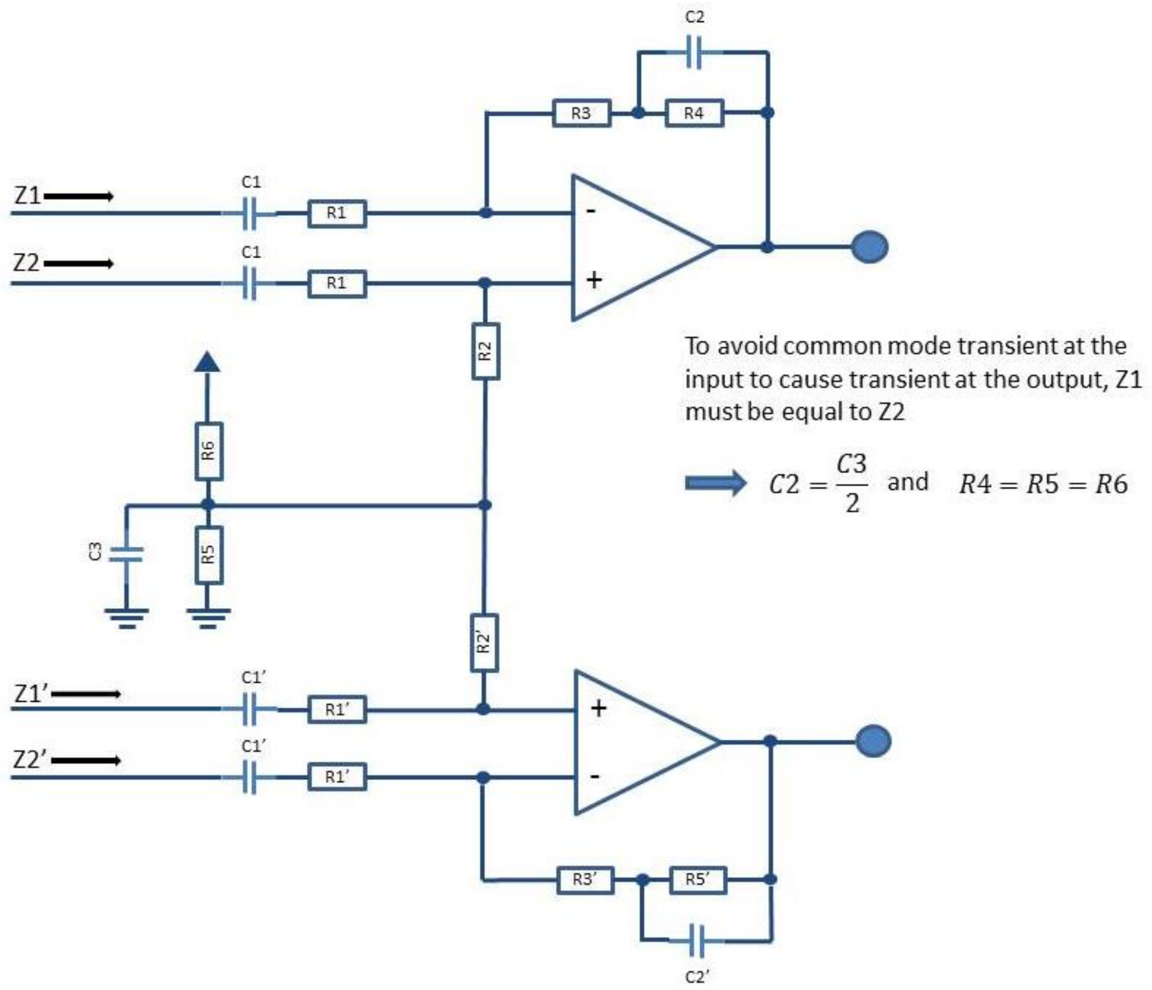


Figure 2: Extenal audio PA connection

To match the impedances Z1 and Z2 it is important that the capacitors at the input of the amplifier are well matched together. The tolerance of a ceramic chip capacitor is typically in the range of 5% - 20% and generally ceramic capacitors are more accurate than film capacitors. Thus in this case ceramic X7R capacitors with 5% tolerance were chosen for the external audio PA to minimize the pop sound when the A2DP link is established or switched off.

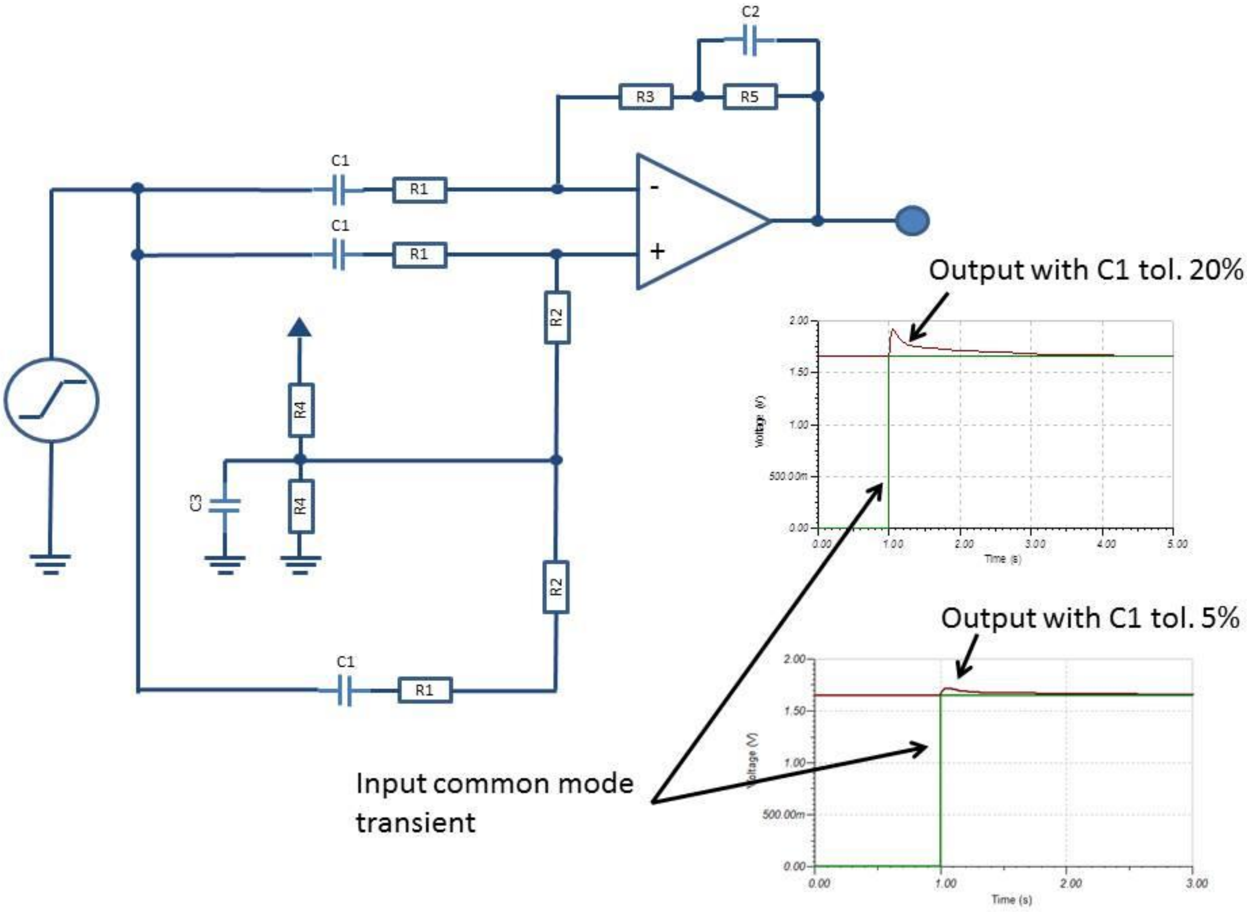


Figure 3: Equivalent circuit for simulating the transient caused by the impedance mismatch

2.3 Schematic and Assembly of DKWT32i v1.1

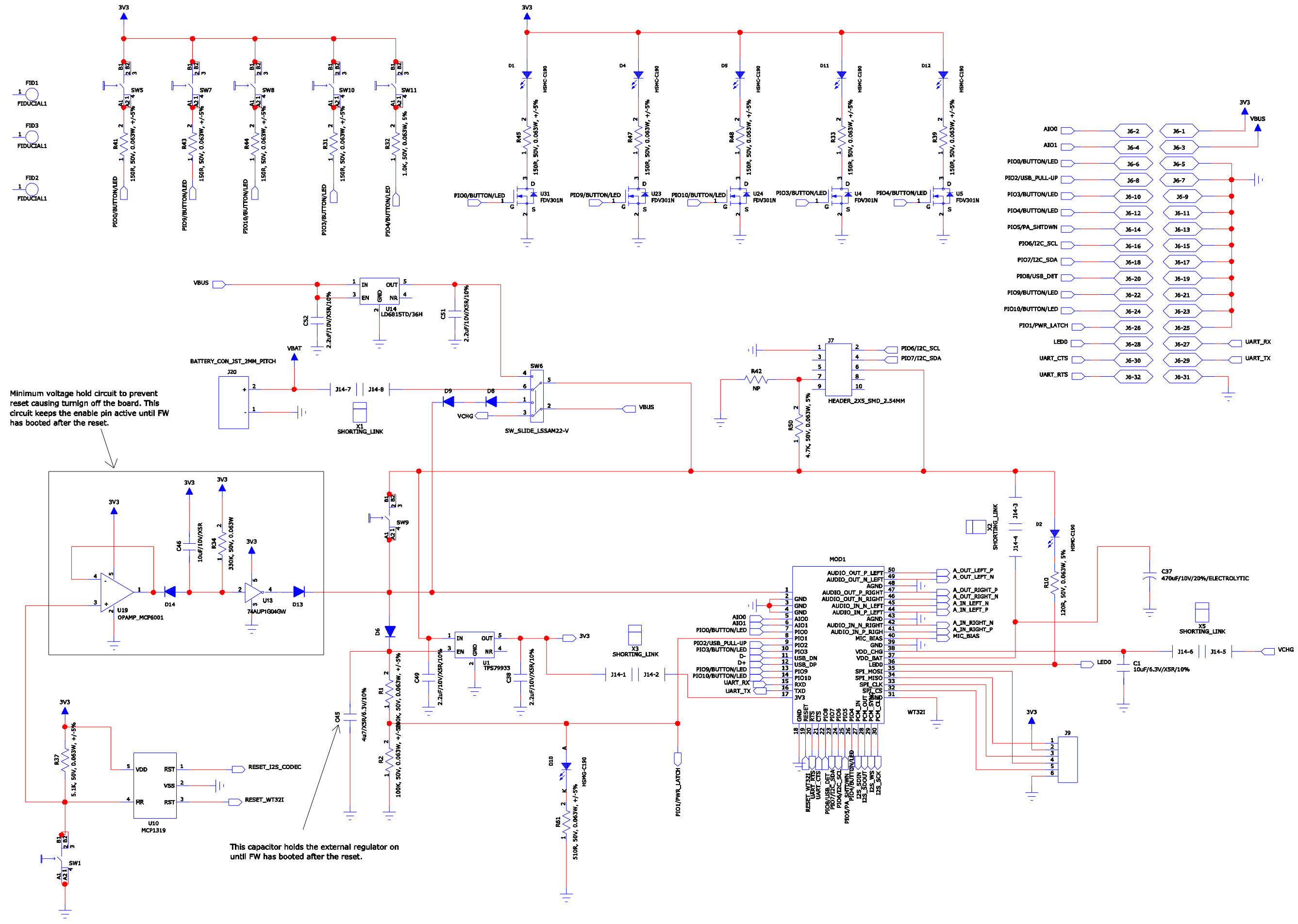


Figure 4: DKWT32i v1.1 Schematic (1/5)

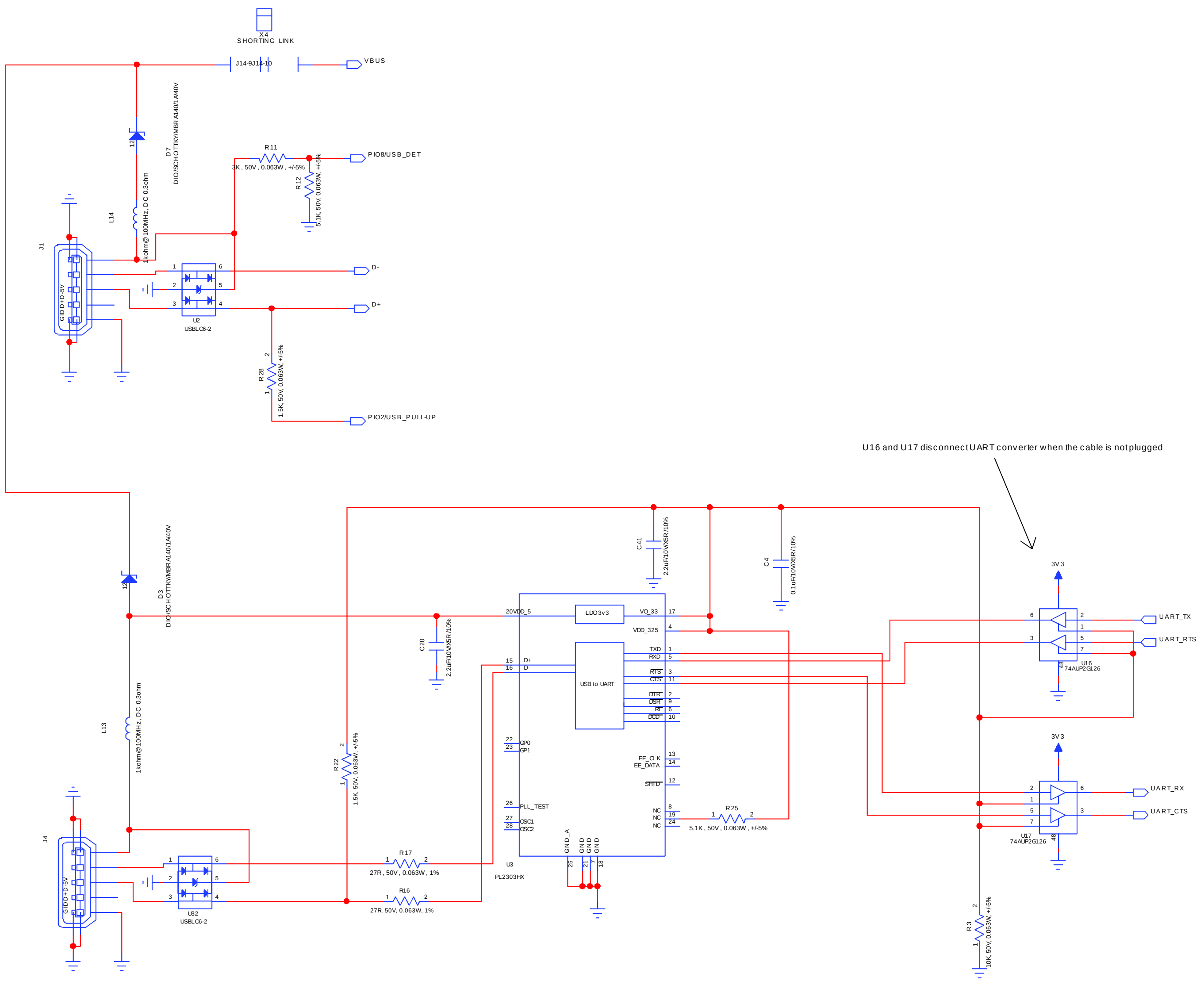


Figure 5: DKWT32i v1.1 Schematic (2/5)

Bluegiga Technologies Oy

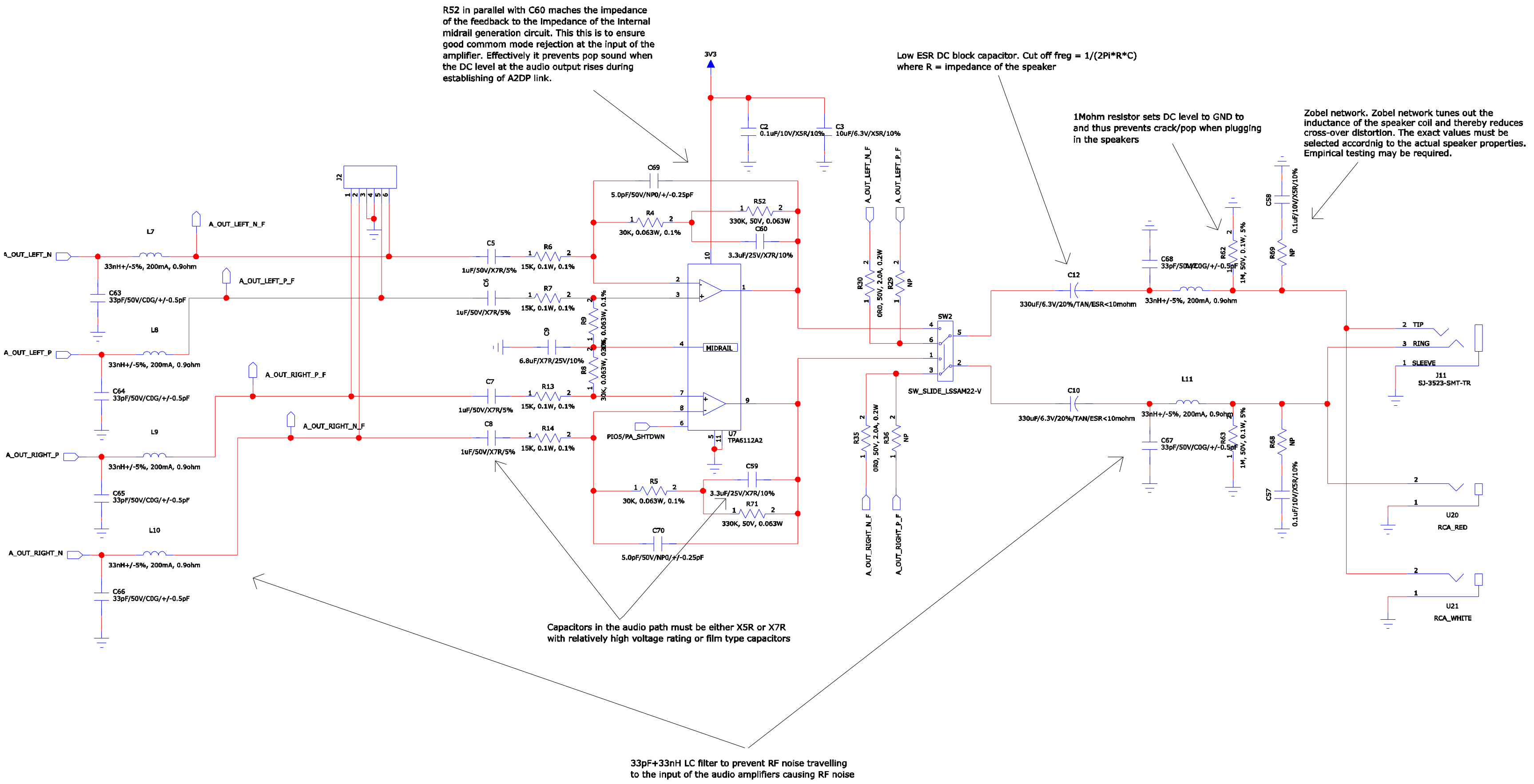


Figure 6: DKWT32i v1.1 Schematic (3/5)

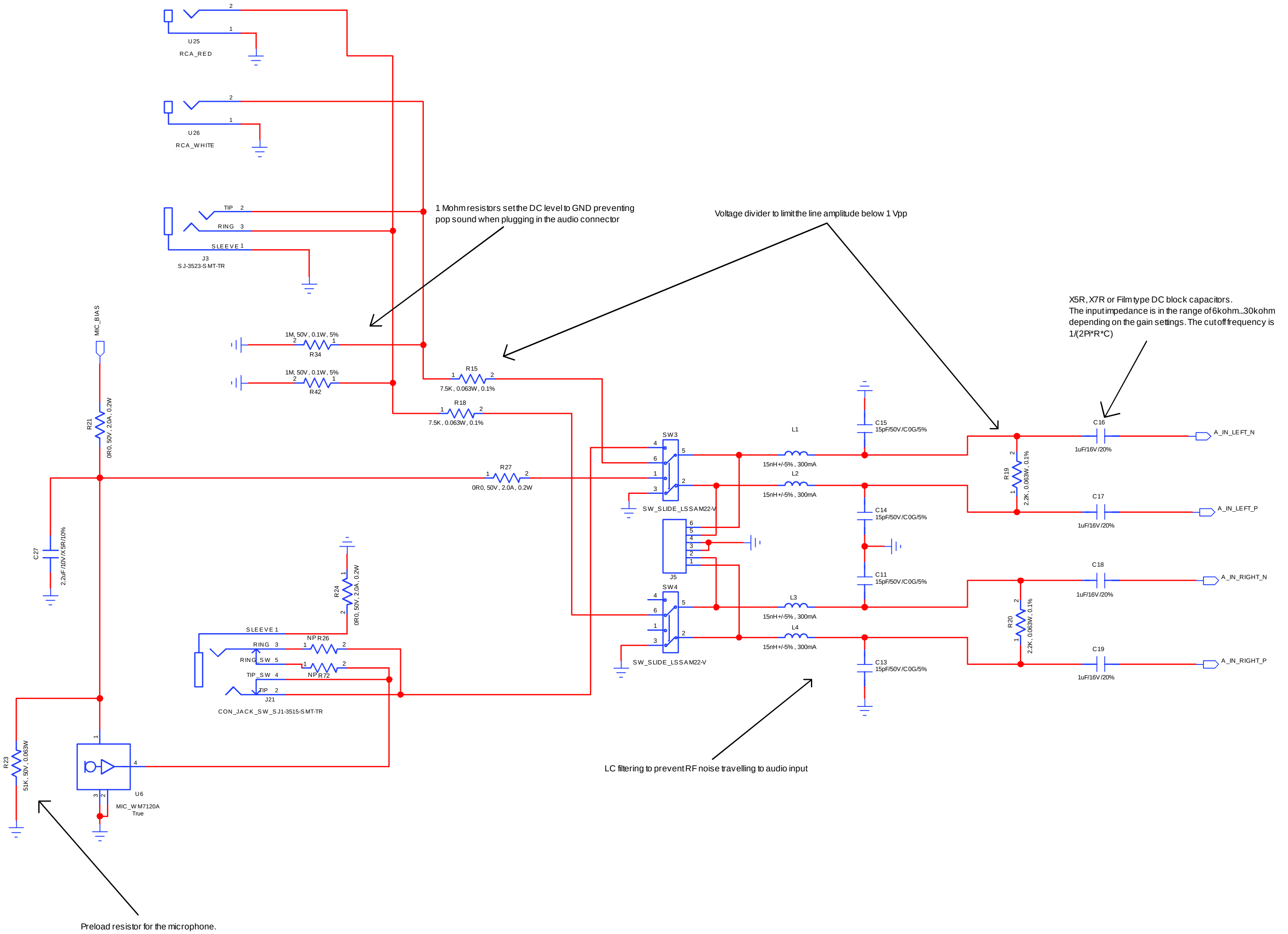


Figure 7: DKWT32i v1.1 Schematic (4/5)

Bluegiga Technologies Oy

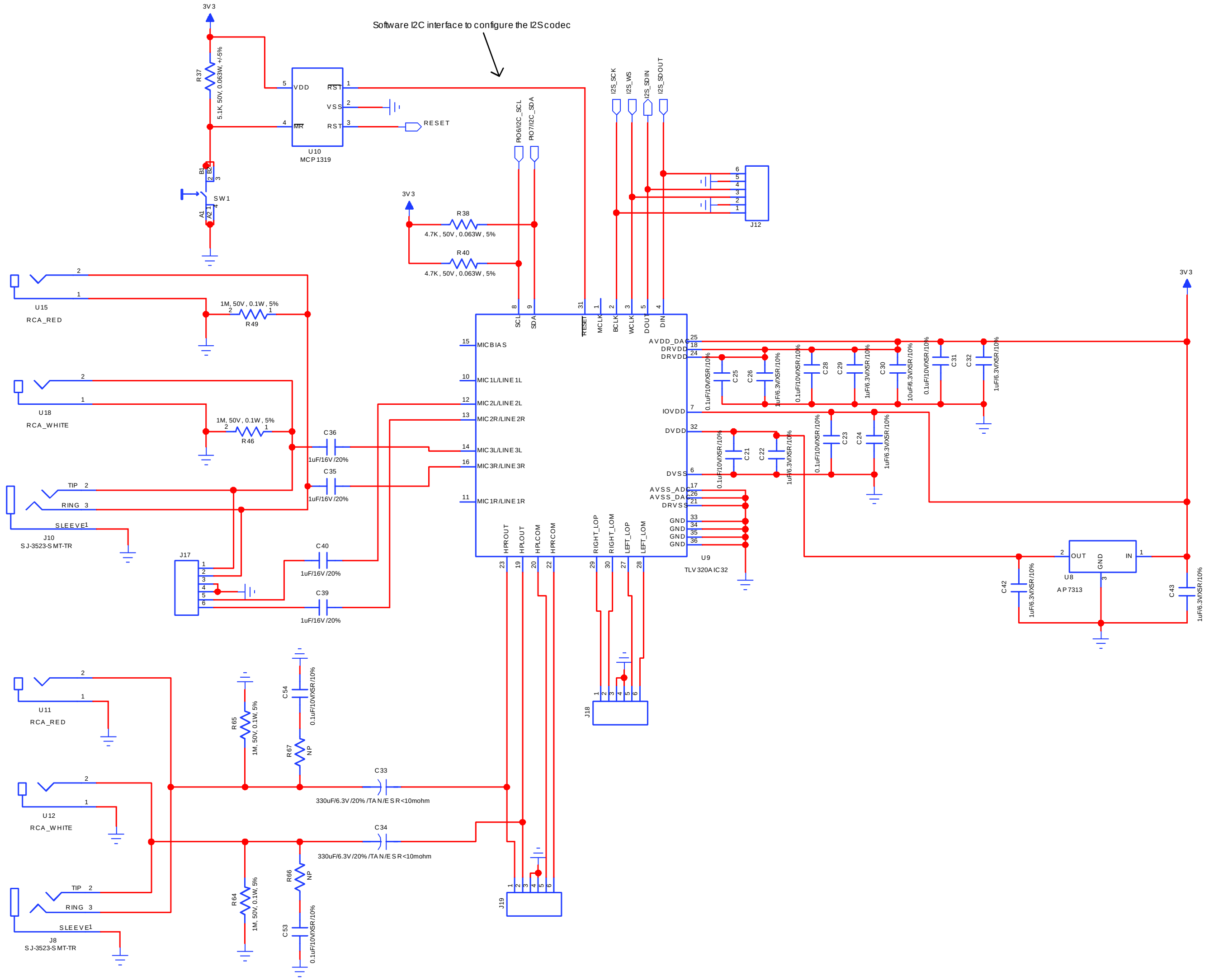


Figure 8: DKWT32i v1.1 Schematic (5/5)

Bluegiga Technologies Oy

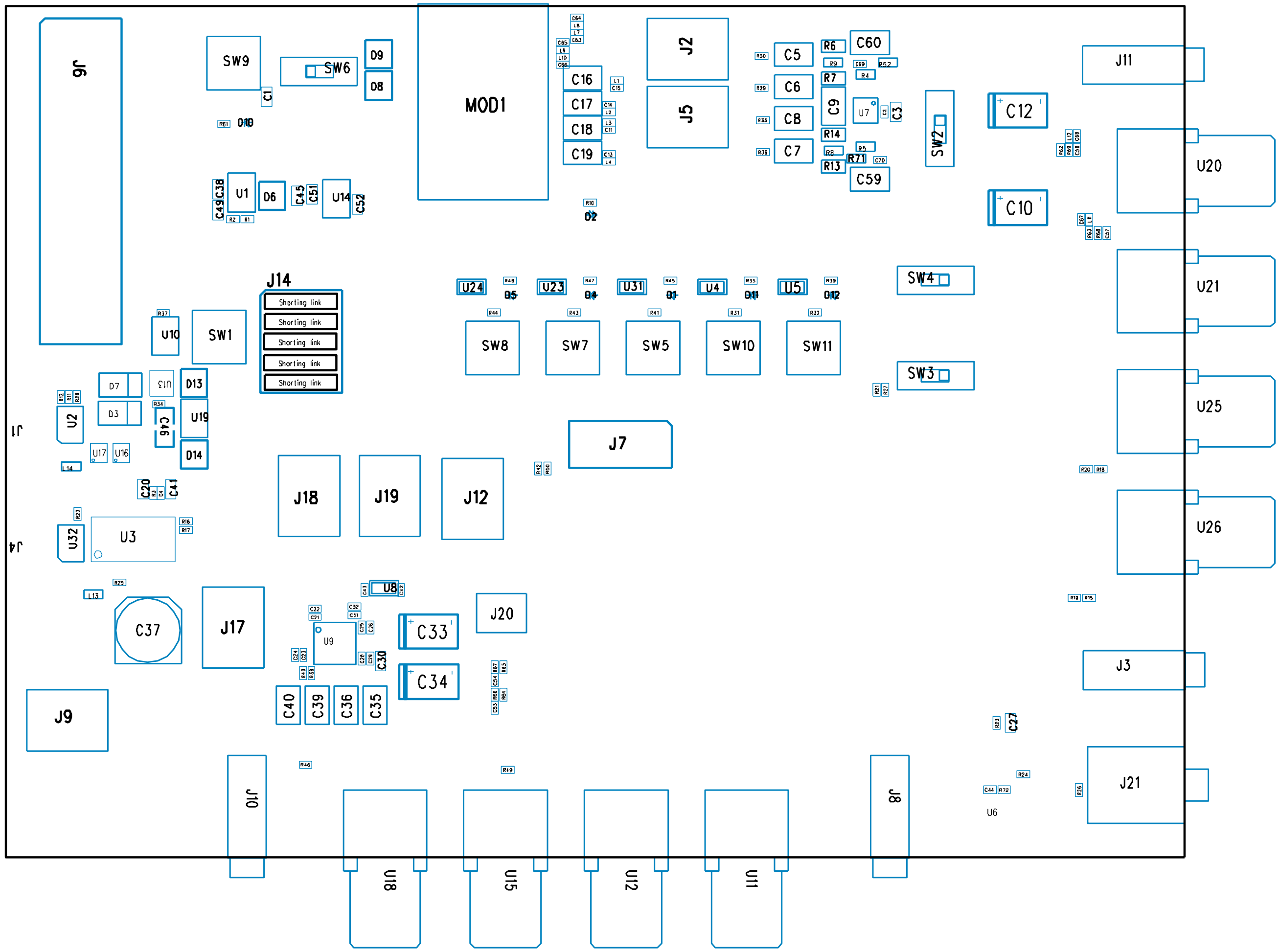


Figure 9: WT32i Development Board Assembly Drawing

2.4 Layout of DKWT32i

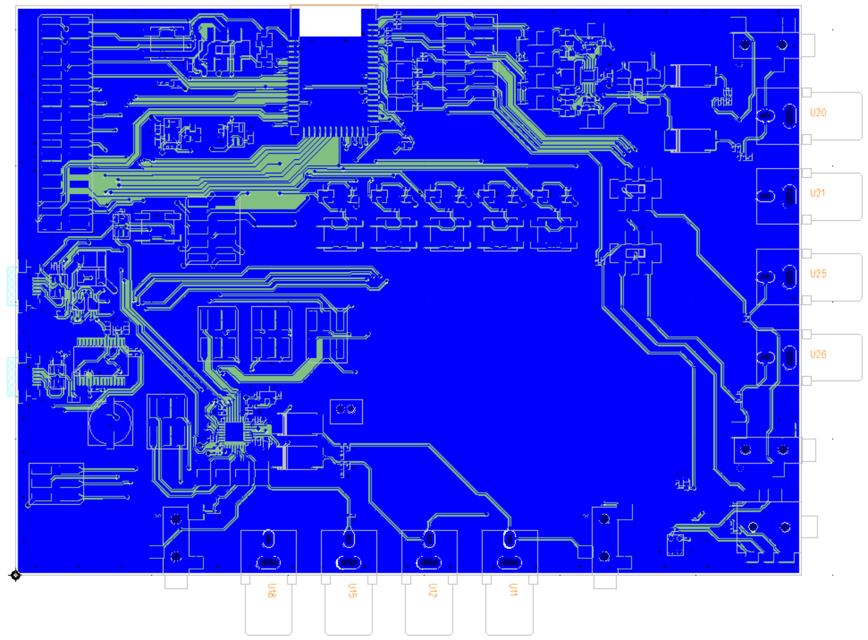


Figure 10: Top layer layout of DKWT32i contains signal and audio tracing

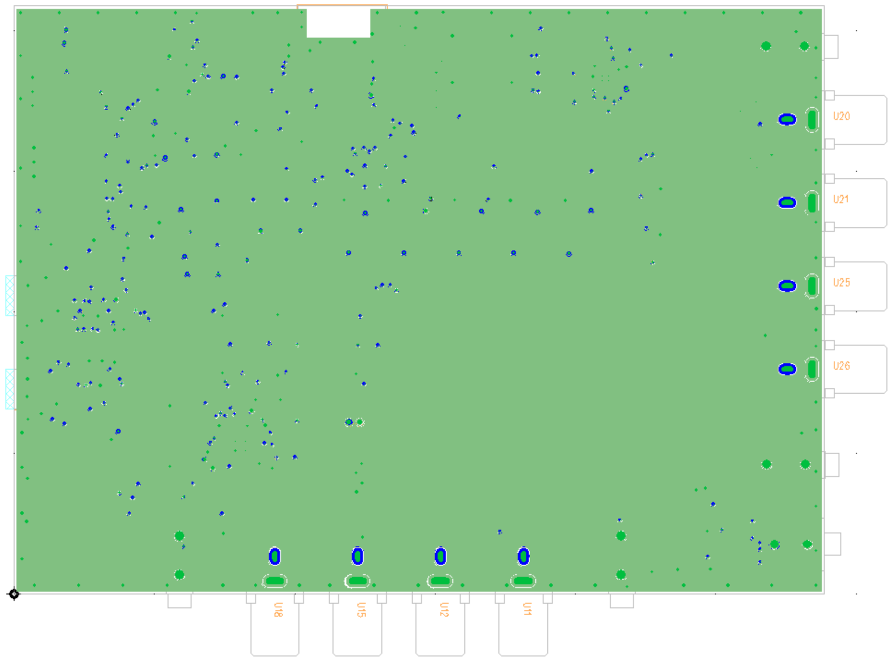


Figure 11: 2nd layer layout of DKWT32i contains a solid GND plane

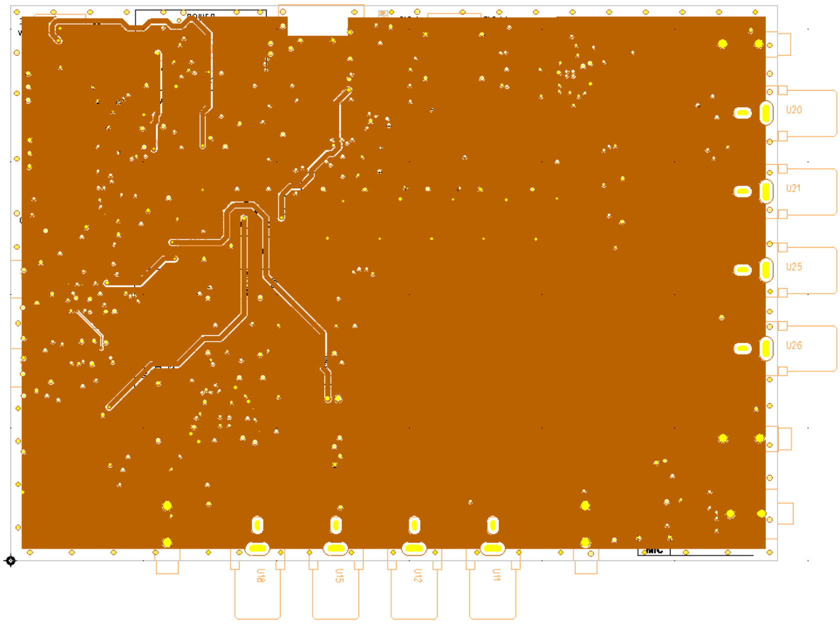


Figure 12: 3rd layer layout of DKWT32i contains supply voltages

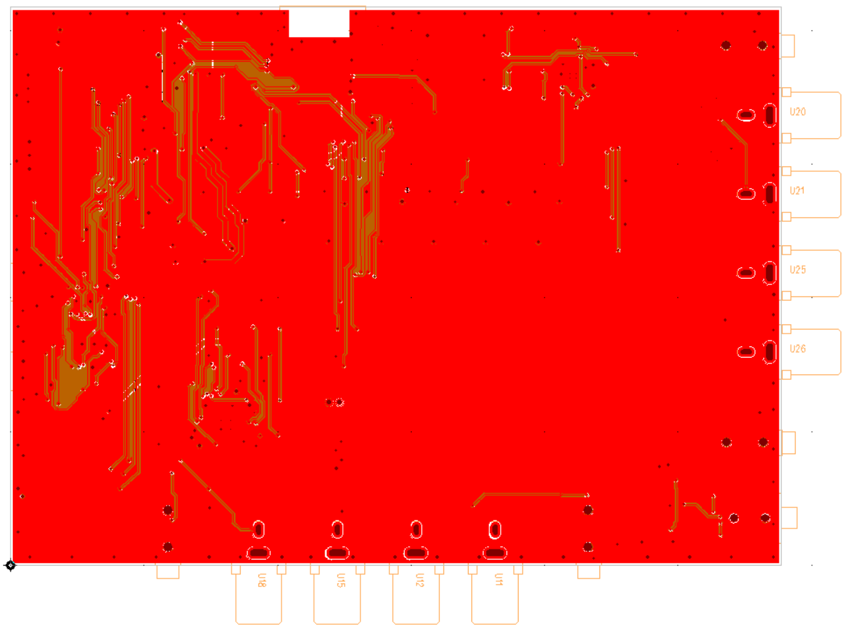


Figure 13: Bottom layer layout of DKWT32i contains GND and signal tracing

2.5 RF, EMC and Audio Layout Considerations

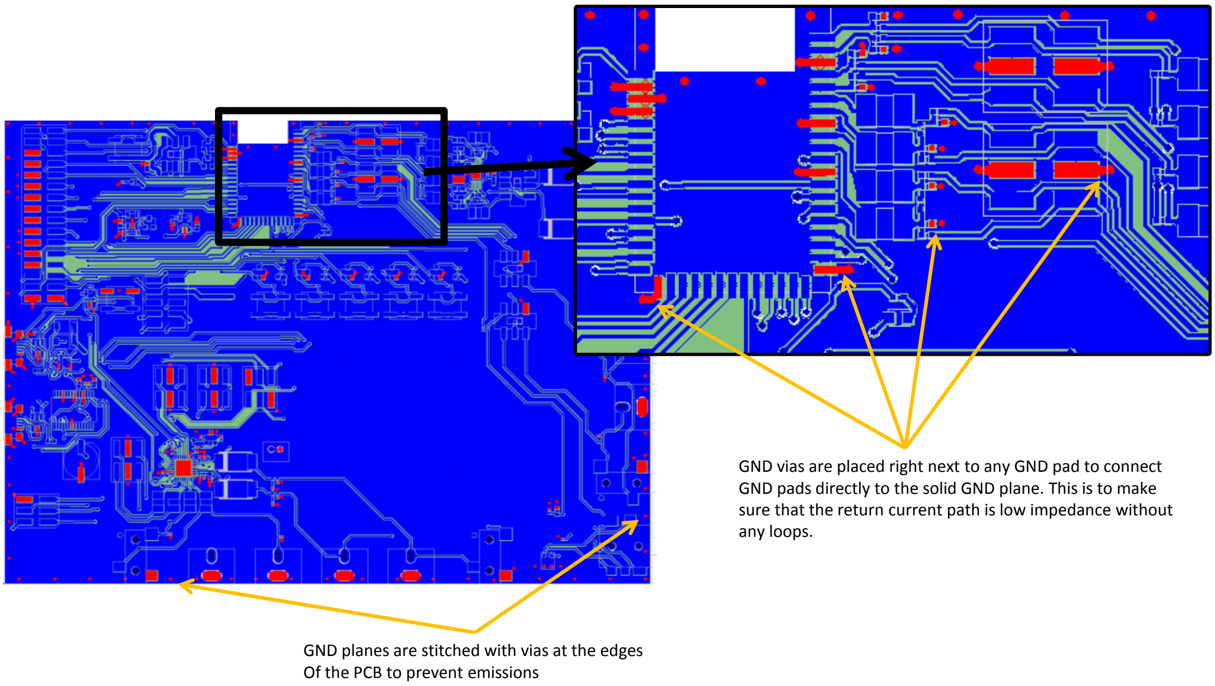


Figure 14: GND vias in DKWT32i

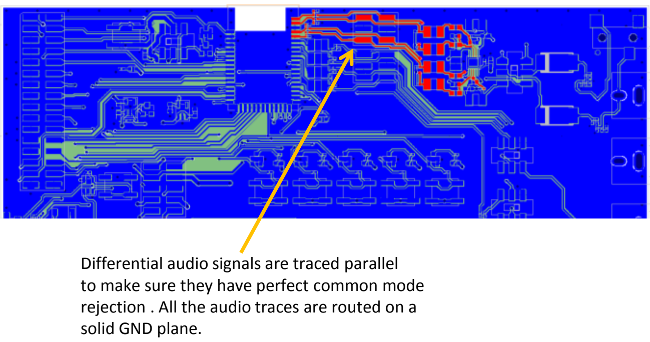
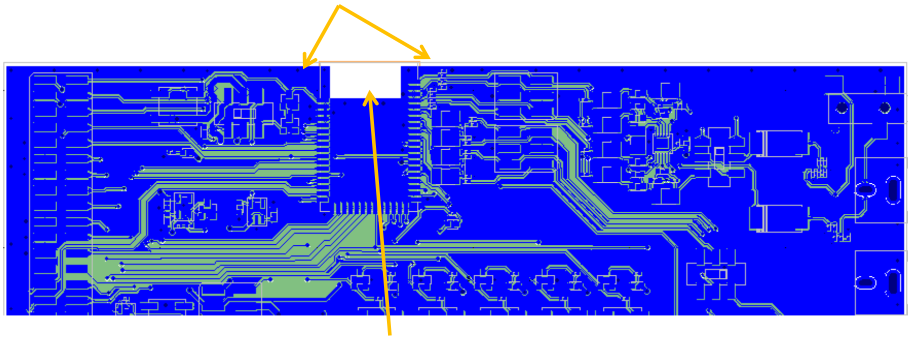


Figure 15: Routing of differential audio signals

GND plane is required on both sides of the Antenna. The antenna uses the GND plane as a part of radiator and the lack of GND plane will signifficantly reduce the performance.



Metal clearance area under the antenna. Antenna placed at the edge of the PCB.

Figure 16: Clearance area under the antenna

3 Example iWRAP Configuration

3.1 Setting iWRAP for Headset Use

Plug USB cable to the USB connector labeled “UART”, set the power switch to the USB position and connect to DKWT32i with a terminal program such as Putty. Type “SET” to see the default configuration of WT32i.

Following steps demonstrate an example iWRAP configuration for a headset use (refer to the iWRAP user manual for details):

1. Set the friendly name for the device so it is easily discoverable

   Type: SET BT NAME DKWT32i

2. Set the Bluetooth Class-of-Device (CoD). Class of device is a parameter, which is received during the device discovery procedure, indicating the type of device and which services are supported. The hexa number describing the class of device can be generated with a class of device generator which can be found here:

   http://bluetooth-pentest.narod.ru/software/bluetooth_class_of_device-service_generator.html

   Type: SET BT CLASS 240428

3. Set the page mode. Page mode controls whether iWRAP can be seen in the inquiry and whether it can be connected. The default is visible when not connected and not visible when connected.

   Type: SET BT PAGEMODE 4 2000 1

4. Set the audio routing to either through the internal or external codec. The default is internal.

   Type: SET CONTROL AUDIO INTERNAL INTERNAL

5. Set the A2DP codec priorities (SBC, aptX or AAC)

   Type: SET CONTROL CODEC SBC JOINT_STEREO 44100 1

   (These command set SBC first in the priority list. Apt-X license is not delivered by default in WT32i. To enable Apt-X codec, type SET CONTROL APT-X JOINT_STEREO 44100 X, where X is the priority. Note that the caller end of the BT link will decide which codec is to be used. Thus if Apt-X is enabled and phone with Apt-X calls to WT32i, Apt-X codec will be used despite of if it is lower in priority than SBC)

6. Enable the desired BT profiles. For headset the relevant profiles are HFP, A2DP and AVRCP.

   Type: SET PROFILE A2DP SINK

   SET PROFILE HFP ON

   SET PROFILE AVRCP CONTOLLER

7. Set the pairing code

   *Type: SET BT AUTH * 0000*

8. Configure the volume up and volume down buttons

   Type: SET CONTROL BIND 0 400 R VOLUME DOWN

   Type: SET CONTROL BIND 1 200 R VOLUME UP

   Type: SET CONTROL BIND 2 8 R AVRCP PLAY

   Type: SET CONTROL BIND 3 1 R AVRCP PAUSE

   These command set PIO9 as volume down button, PIO10 as volume up button, PIO3 as play button and PIO0 as pause button.

9. Configure carrier detect signal to indicate active connection

   Type: SET CONTROL CD 10 0

   This command will drive PIO4 high when there is an active connection. In the DKWT32i the LED connected to PIO4 will lit.

10. Configure the on/off button. to turn the power on at the rising edge and turn off at the following rising edge

    Type: SET CONTROL VREGEN 2 2

    This configures the VREG_EN pin to latch the power on at the rising edge and turn off at the following rising edge. PIO1 is used to control the external regulator on.

11. Configure the module to indicate low battery voltage by driving PIO8 high when the battery voltage falls below 3.3V and to turn off the power when the battery voltage falls below 3.0V. PIO8 is driven low when the battery voltage exceeds 4.0V.

    Type: SET CONTROL BATTERY 3300 3000 4000 100

4 Contact Information

Sales: sales@bluegiga.com

Technical support: www.bluegiga.com/support

Orders: orders@bluegiga.com

Web site: www.bluegiga.com

Head Office / Finland:

Phone: +358-9-4355 060

Fax: +358-9-4355 0660

Sinikalliontie 5A

02630 ESPOO

FINLAND

Postal address / Finland:

P.O. BOX 120

02631 ESPOO

FINLAND

Sales Office / USA:

Phone: +1 770 291 2181

Fax: +1 770 291 2183

Bluegiga Technologies, Inc.

3235 Satellite Boulevard, Building 400, Suite 300

Duluth, GA, 30096, USA

Sales Office / Hong-Kong:

Elite Business Center

15/F, Millenium City 3

370 Kwun Tong Road

Kwun Tong

Kowloon

Hong Kong