8BPro HW instruction

V1.0

2017/11/13

OUTLINE

- Hardware design
- Application Circuit
- Layout Guidelines
- Reference Design
- Key Parts & QVL

RTL8763B HW instruction

Hardware Design

Package summary and application

QFN40 5mm X 5mm

- RTL8763BF – Stereo headset, dual mic headset
- RTL8763BFR – RWS headset
- RTL8763BM – Mono headset

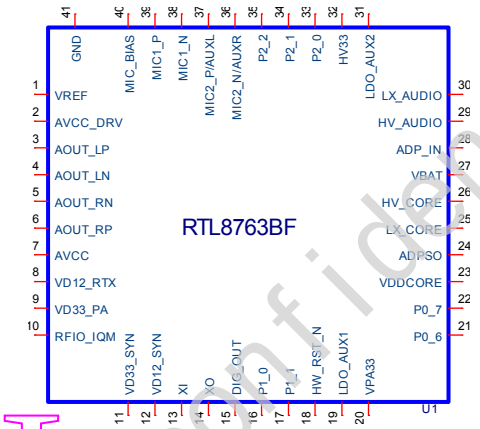
QFN48 6mm X 6mm

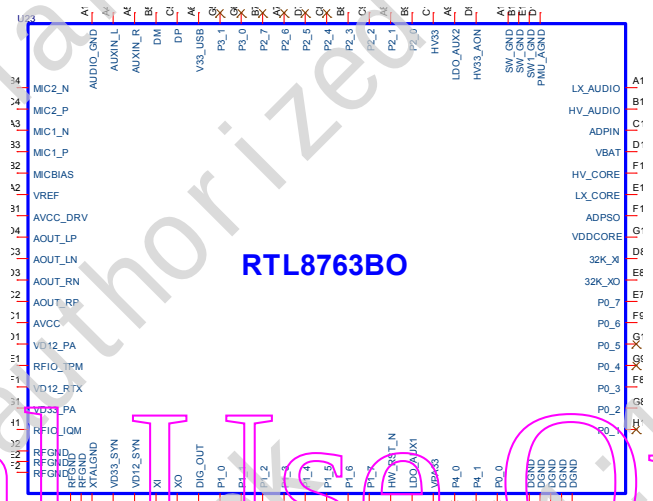
- RTL8763BS – Stereo headset, dual mic headset, 11 GPIO counts

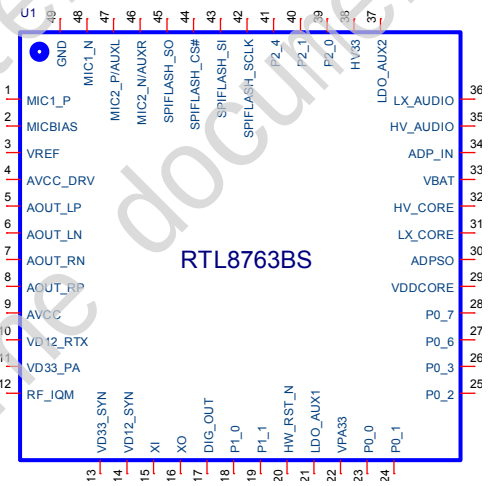
BGA 4.5mm X 6mm

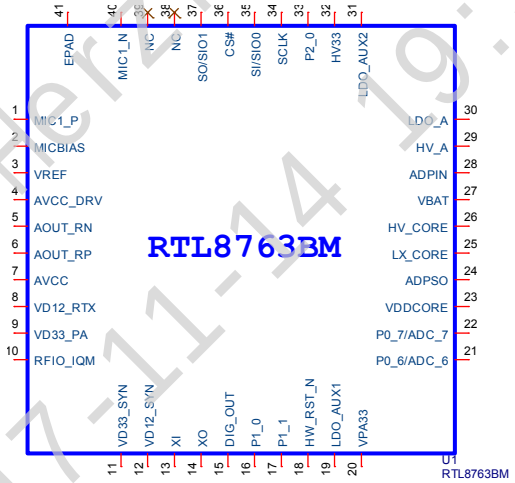
- RTL8763BO – MCU/DSP SDK with USB audio, local playback, rich peripheral interface and GPIO

Package

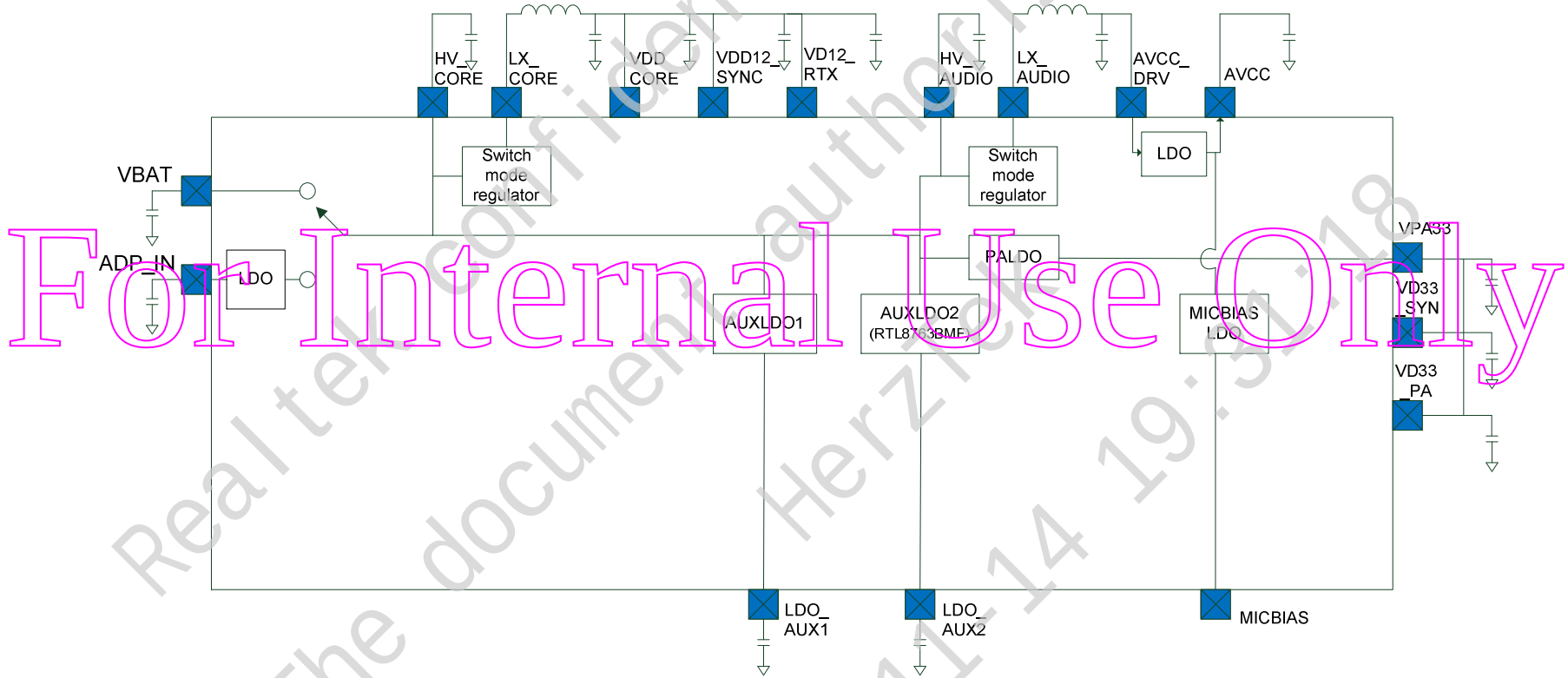








Power



Power

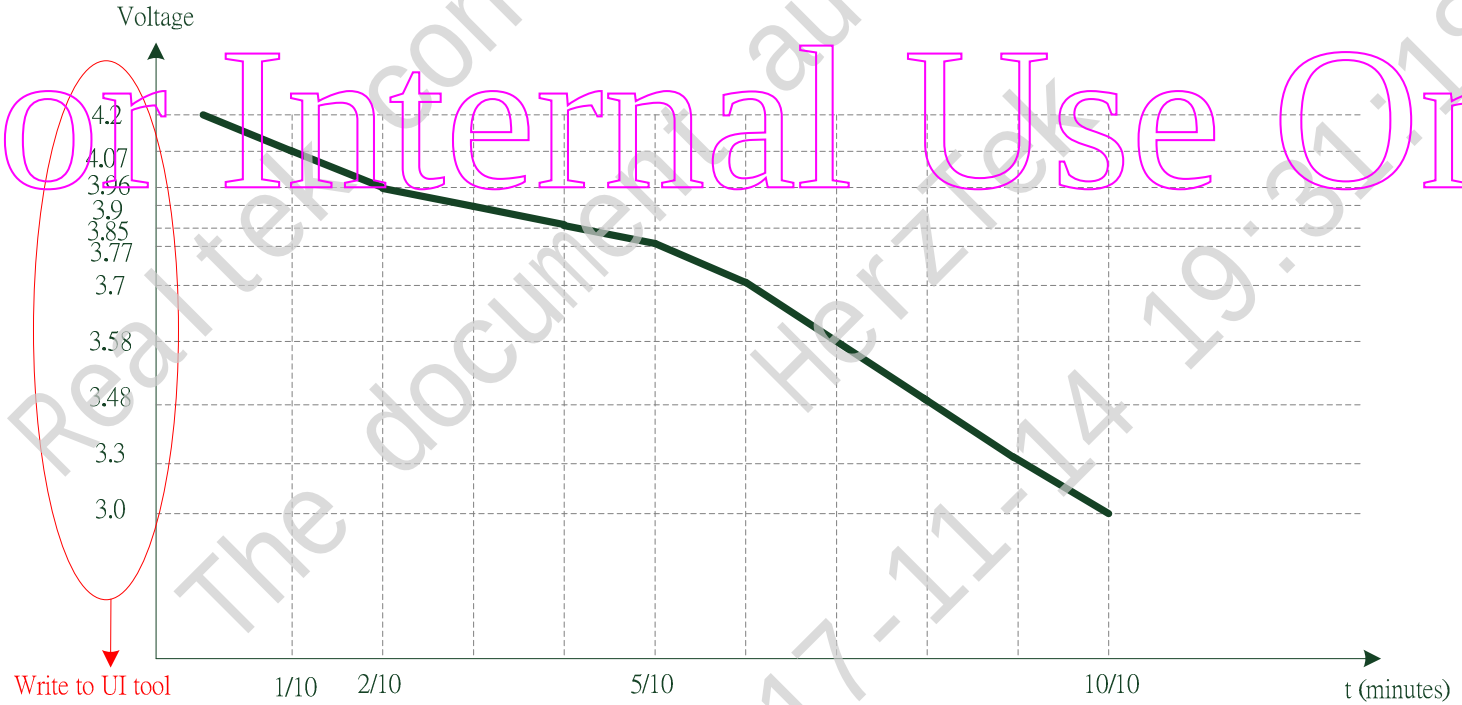
VBAT

- Chip main power supply
- Range 2.8-4.5V
- Li-Ion battery application

Power

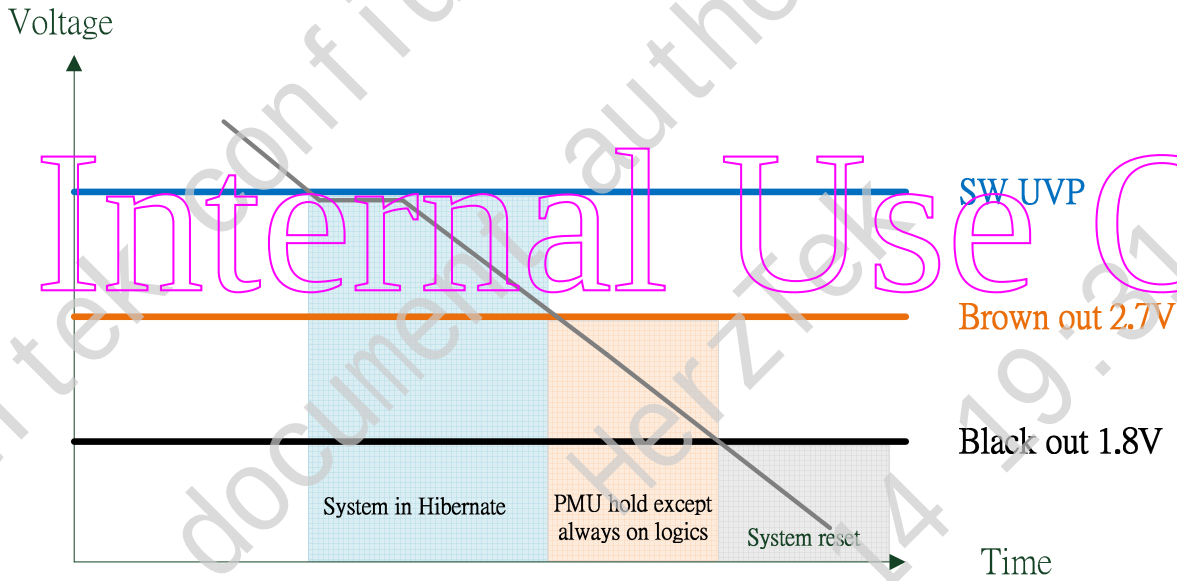
Battery Learning

- Could be used to show the battery gauge in the APP
- Customer should make the discharge curve first, and find out the 10points, fill in the voltage number to UI tool



Battery protection scheme

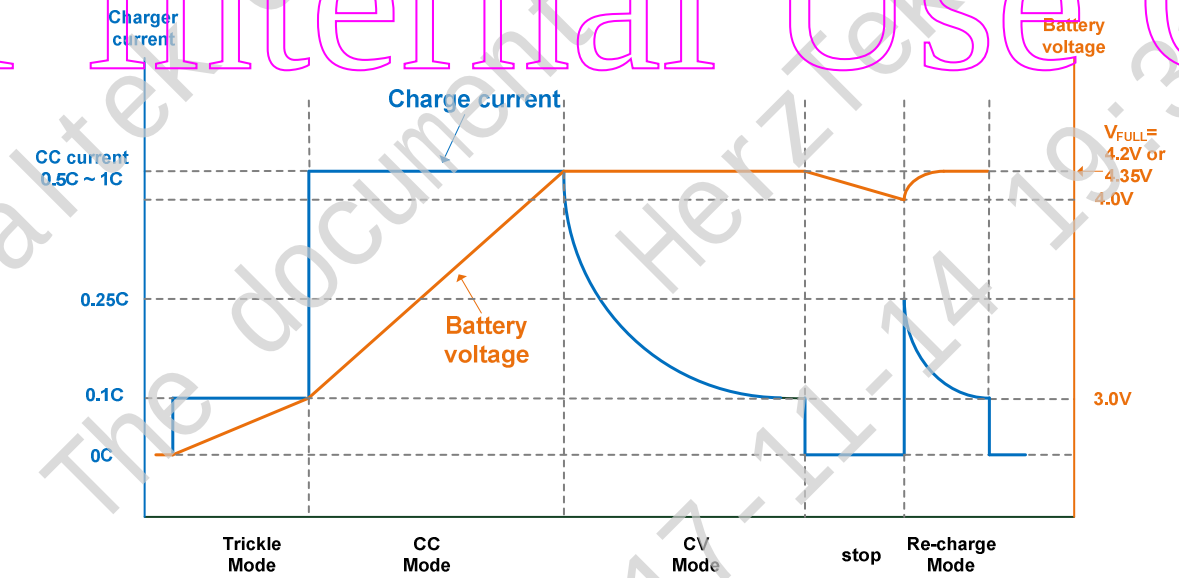
- SW UVP
- HW UVP



Power

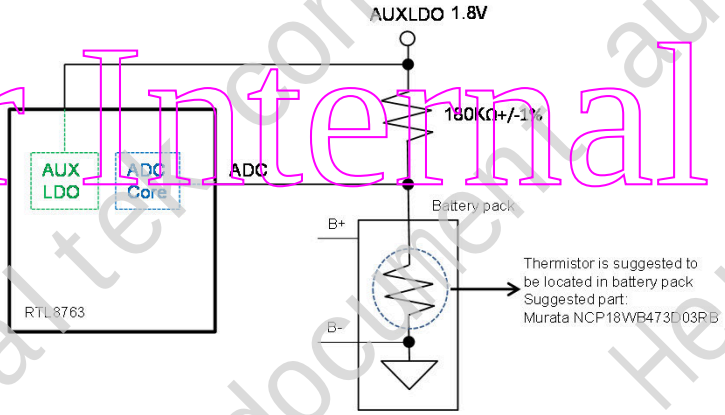
ADPIN

- adaptor in for Li-on battery charging, input range 4.5V – 6.5V
- Charging current up to 400mA
- Support AT command to show the battery gauge (percentage) on the smart phone.



Charger ambient detection

- Ambient detection
  - UI configurable forbidden temperature to stop charging!!

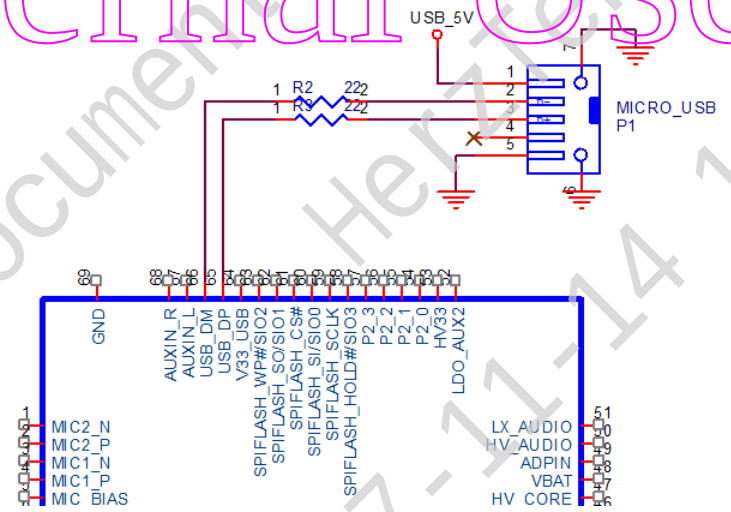


Continued from the preceding page.

Part Number	NCP□□WL333	NCP15WB473D	NCP18WB473D	NC
Resistance	33kΩ	47kΩ	47kΩ	
B Constant	4485K	4050K	4030K	
Temp. (°C)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Re
−40	1810.154	1690.586	1743.085	
−35	1330.850	1215.318	1241.814	
−30	982.609	882.908	896.201	
−25	675.385	647.911	654.460	
−20	416.464	480.069	483.172	
−15	304.219	359.009	360.367	
−10	224.193	270.868	271.363	
−5	166.623	206.113	206.304	
0	124.850	158.126	158.051	
5	94.287	122.267	122.145	
10	71.747	95.256	95.145	
15	54.996	74.754	74.676	
20	42.455	59.075	59.038	
25	33.000	47.000	47.000	
30	25.822	37.636	37.667	
35	20.335	30.326	30.381	
40	16.115	24.583	24.654	
45	12.849	20.043	20.124	
50	10.306	16.433	16.518	
55	8.317	13.545	13.631	
60	6.748	11.223	11.306	
65	5.504	9.345	9.424	
70	4.513	7.818	7.892	

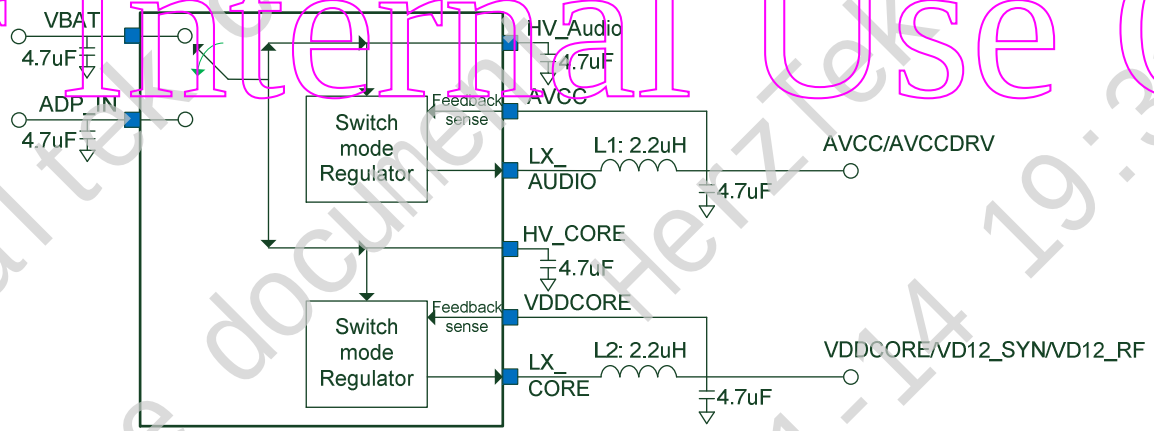
USB charger

- RTL8763BO support USB charger BC1.2
  - 2.5mA average if the USB bus is suspended
  - 100mA if the bus is not suspended and not configured
  - 500mA if the bus is not suspended and configured for 500mA
  - Support USB charger with a DCP, such as wall adapter or car power adapter



Switching power regulator

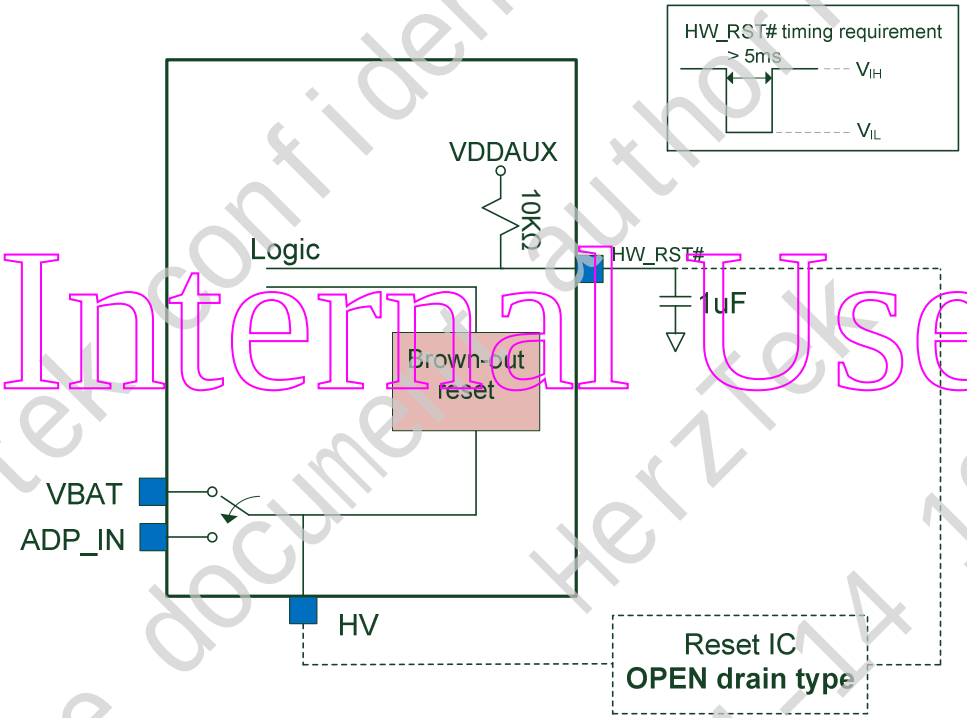
- Support dual switching power regulator (except RTL8763BM)
- 2.2uH inductor with 4.7uF capacitor
  - 2.2uH inductor is good in dimension and DCR
  - 4.7uF cap is in small dimension, 0402 is very popular



Reset

HW_RST_N

IC reset pin, reset active low when low pulse > 5ms

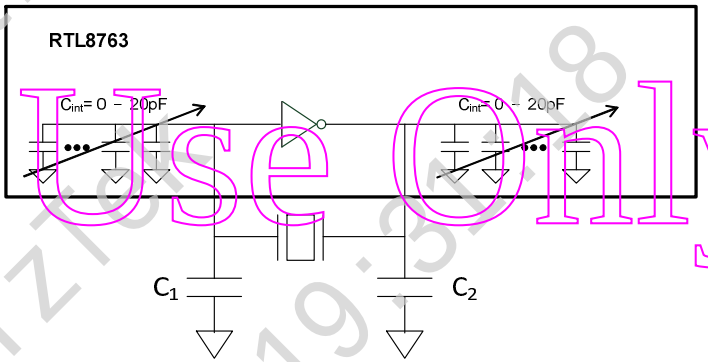


Reset IC (must be open drain type) is optional if the reset threshold defined is higher than 1.8V

Clock source

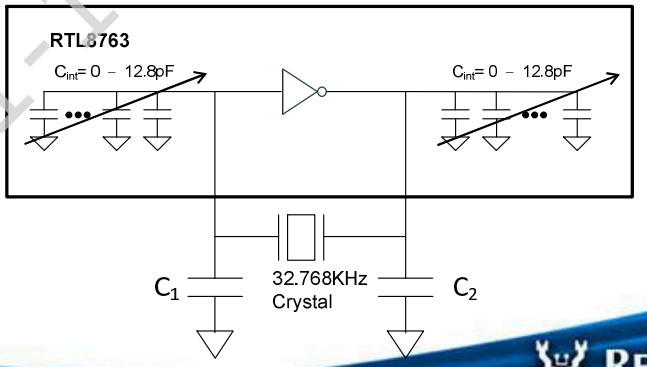
40M crystal

- Clock source for CPU / BT in normal state
- No need to add external load capacitor C1/C2 (support 7pF and 9pF crystal)
- Needs calibration during MP



32.768K crystal / Internal 32K

- Clock source in sleep mode
- External crystal only for RTL8763BO, save extra 30uA (save C1/C2 if use crystal with C_L=7pF)



Audio

Audio analog output

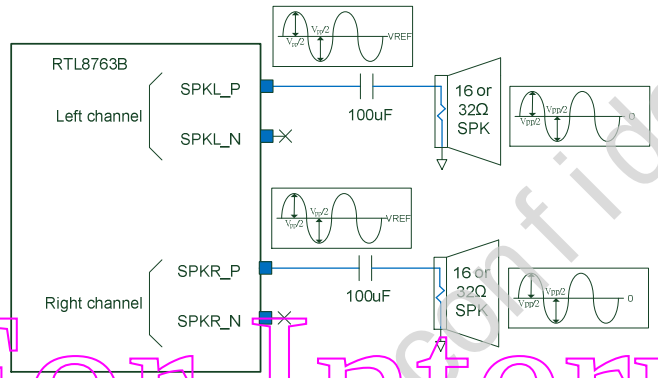
- Support output format
  - Single end mode
  - Capless mode
  - Differential mode
- SNR up to 102dBA

Audio analog output

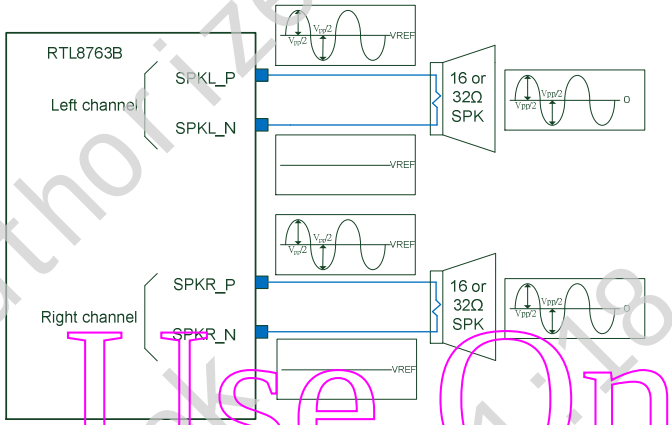
- S/PDIF

Audio

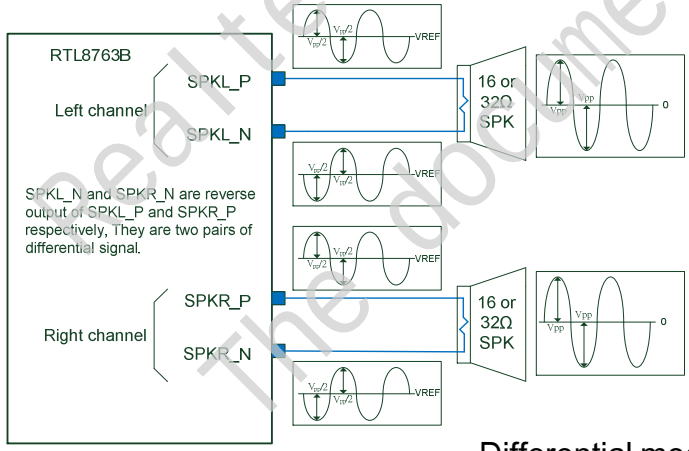
Single end



Capless mode



Capless mode, simple in layout design, save BOM.



Differential mode, high noise rejection, 2X voice swing and save BOM

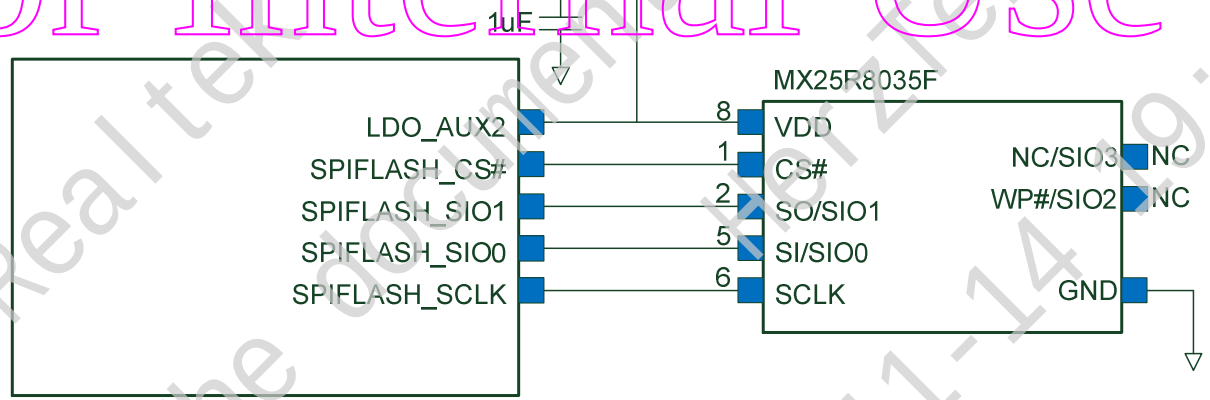
Audio

Audio input

- 24bits/96KHz
- SNR up to 97dBA
- Support:
  - AUX-IN
  - 1-MIC
  - Dual MIC
  - Digital MIC

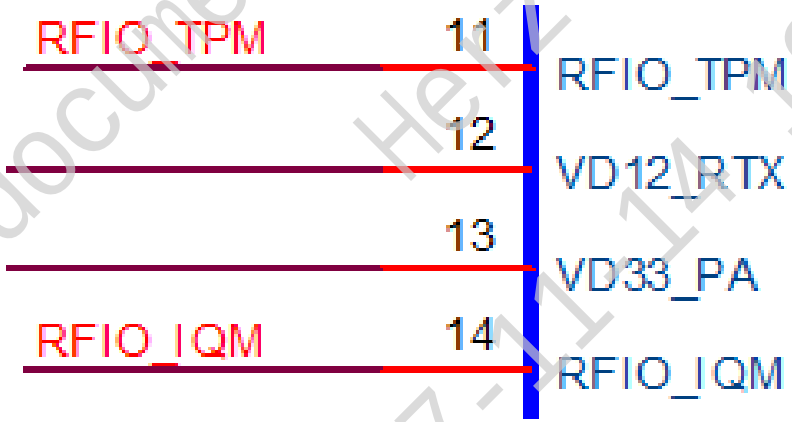
SPI Flash

- RTL8763BF/BFR supports 8M-bits on chip FLASH memory
- RTL8763BO supports 16Mbits on chip flash memory
- RTL8763BM/BMR/BS support 1-bit and 2-bit mode



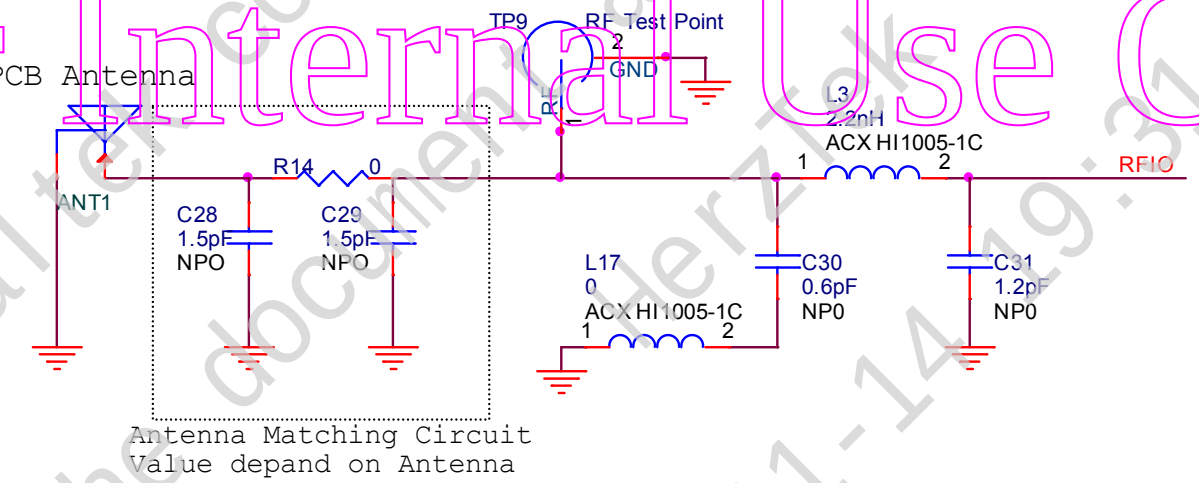
RF

- RTL8763BO support IQM and TPM
- RTL8763BM, RTL8763BF, RTL8763BS support IQM only
- RFIO_IQM support dual mode, with up to +10dBm TX power/ RX sensitivity -94dBm (2M EDR)
- RFIO_TPM is specific for BLE with lower power consumption, with up to +4dBm TX power



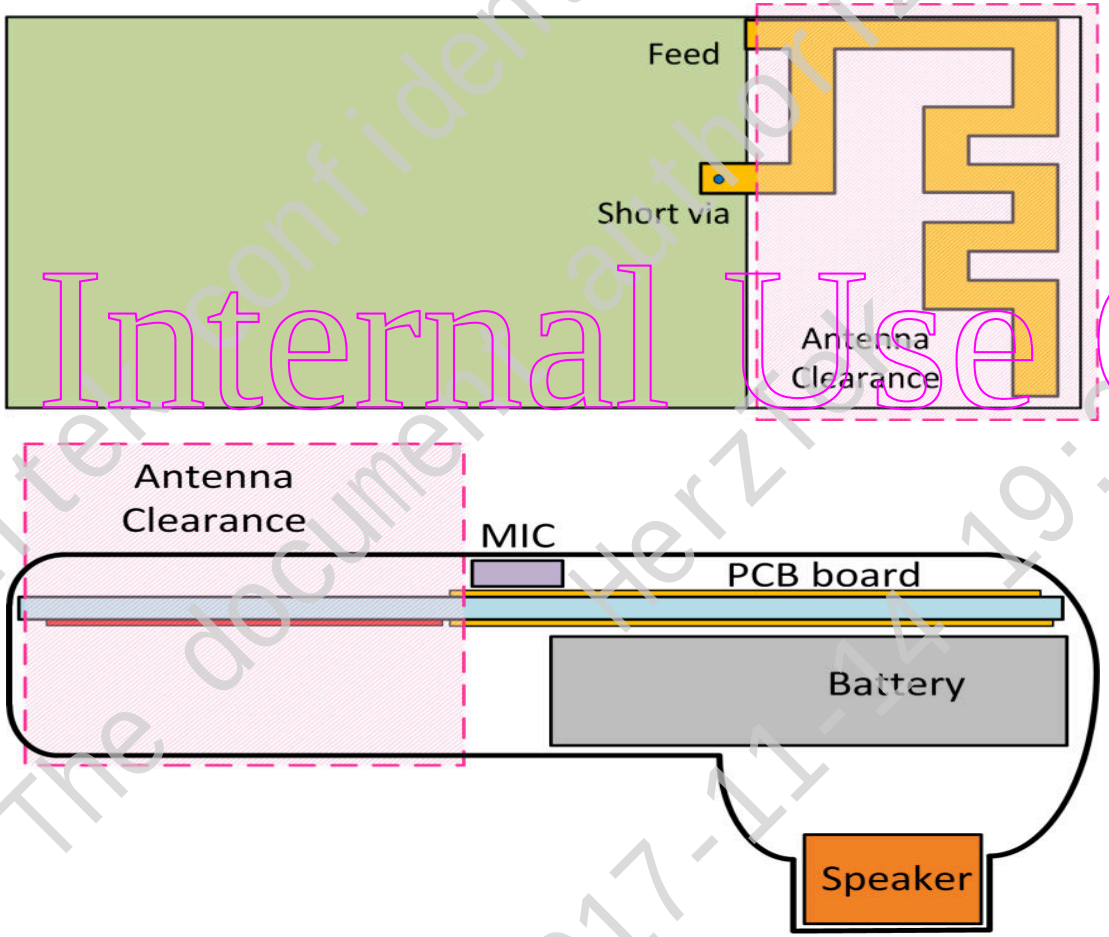
RF matching

- Follow REALTEK design guideline to get a good RF performance and harmonic performance with TX=+10dBm
  - Reference circuit, follow all the components and QVL, do not change
  - Follow layout guide

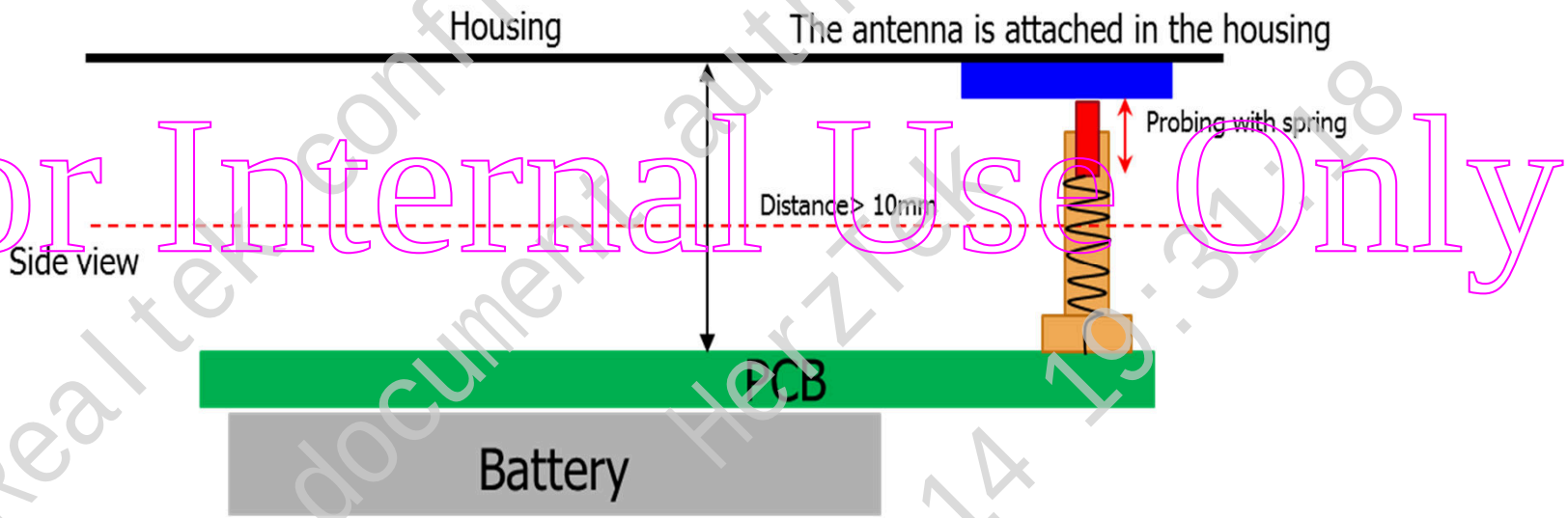


RF

- PCB antenna

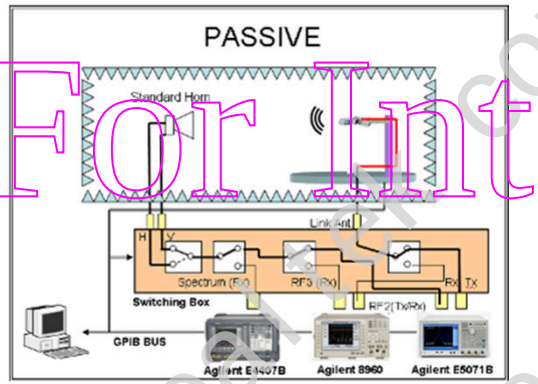


- Chip antenna
- Thimble antenna

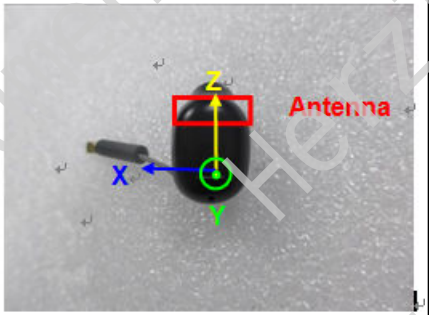


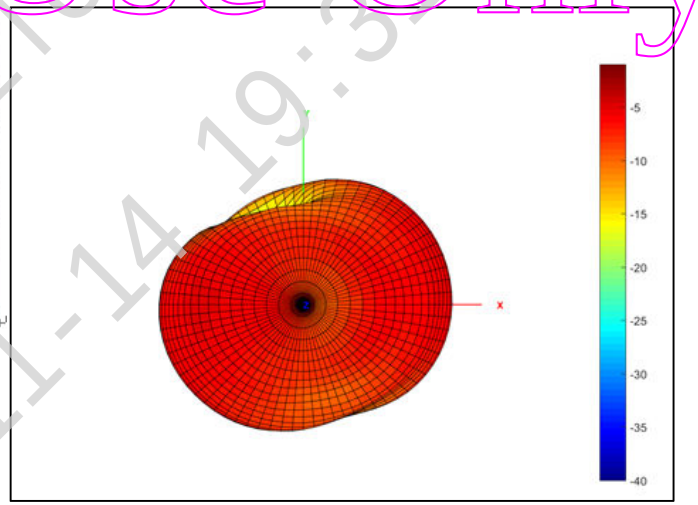
Antenna measurement

Wear on head when measure the antenna characteristics



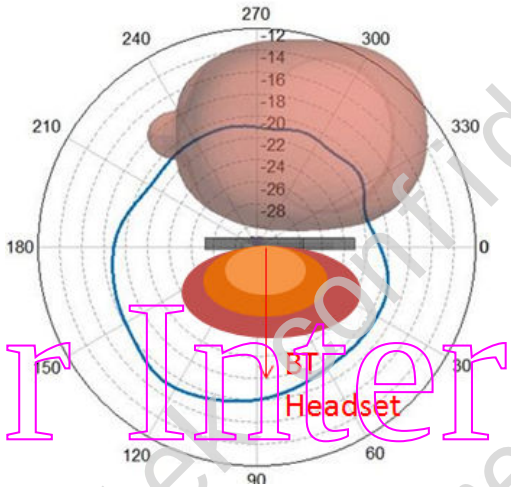
Check the antenna efficiency in antenna lab

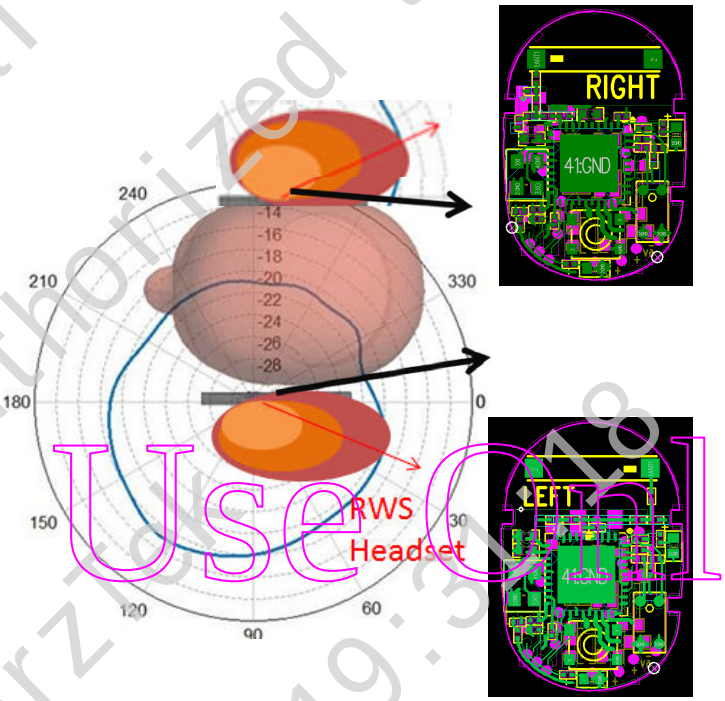




Radio antenna pattern

- Radiation pattern suggestion:





If the RWS headset is in a pair, make symmetric antenna design

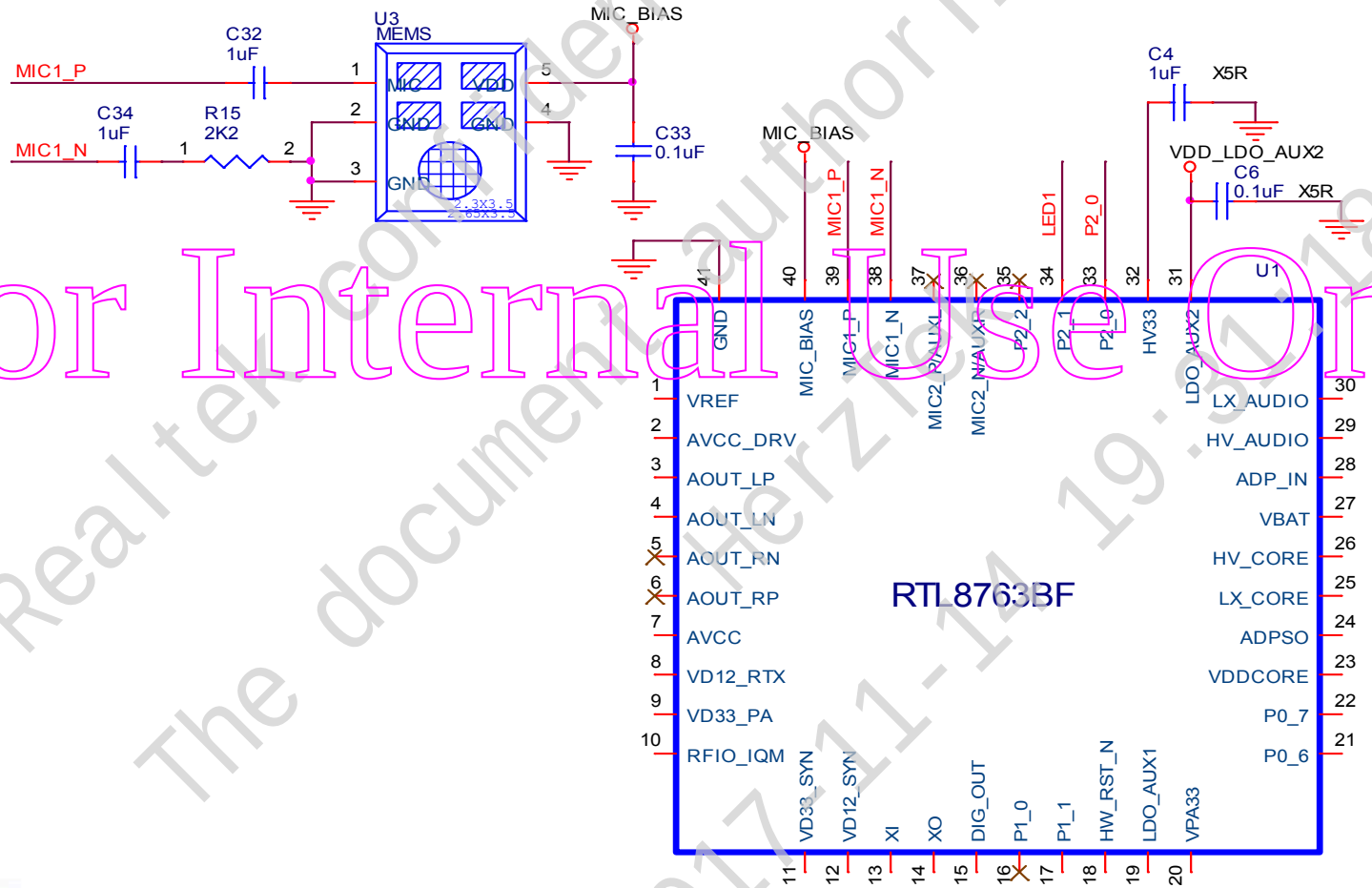
Peripherals

- GPIO
  - Up to 32 GPIOs
- Timer
  - with PWM function
- I2C
  - master/slave
- SPI
  - master / slave
- UART
  - High speed uart
  - max baudrate 4M
- GDMA
  - 8 channel
  - Single & multi block
- ADC
  - 8-channel /12-bit ADC
- Keyscan
  - Max matrix 12x20
- Q-decoder
- IR
- SD host
  - SD 2.0 compliant
- USB

Application Circuits

Audio

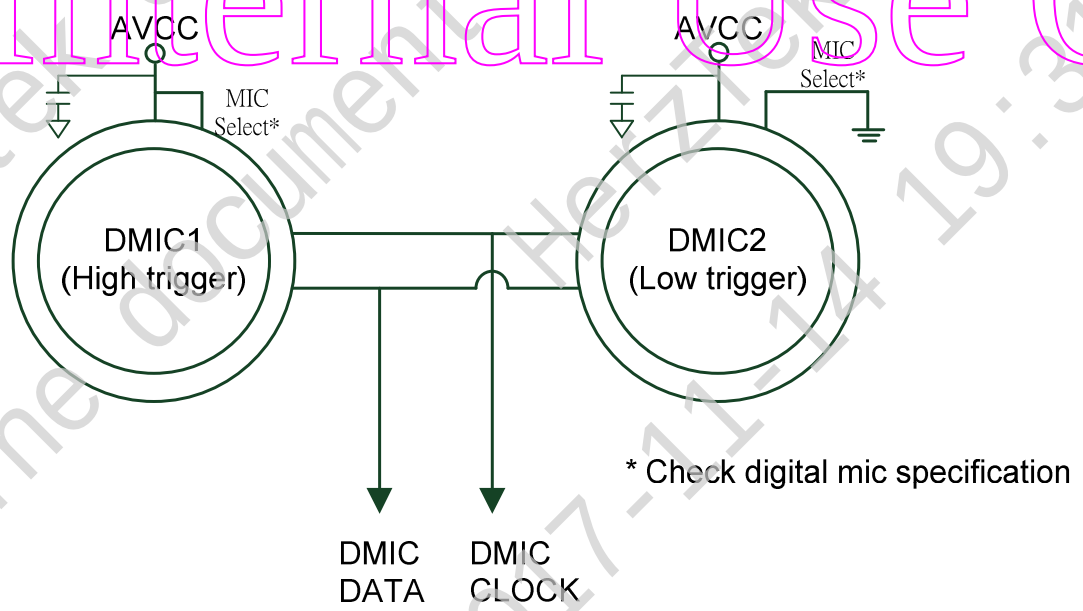
Analog MEMs Mic



Audio

DMIC

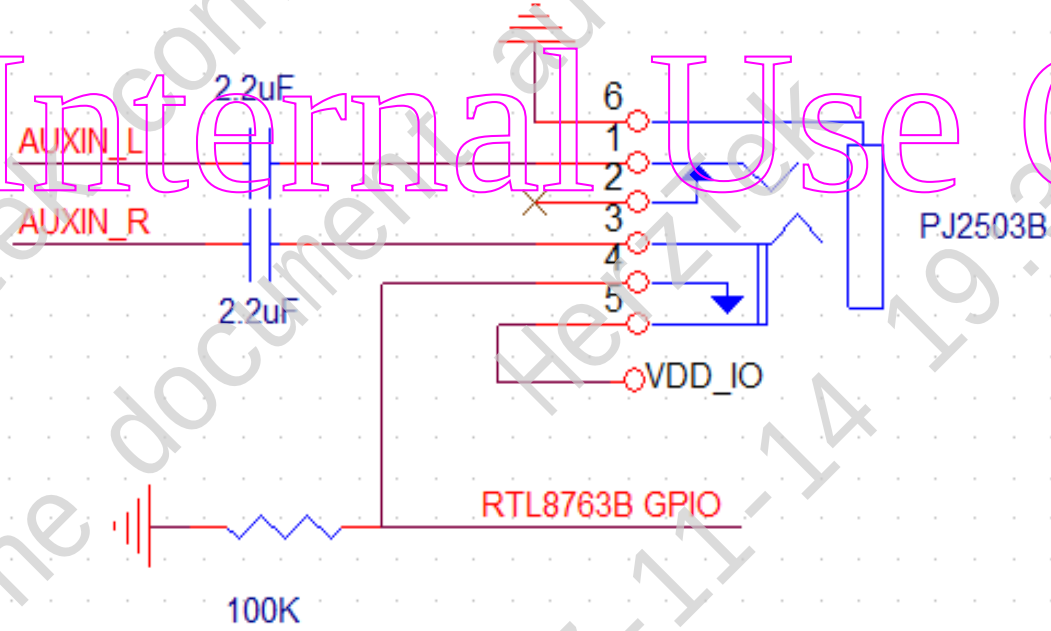
- supports most of the industrial digital microphone in PDM format
- able to latch data at both rising and falling edges
- dual digital microphone can be applied



Audio

AUX-IN

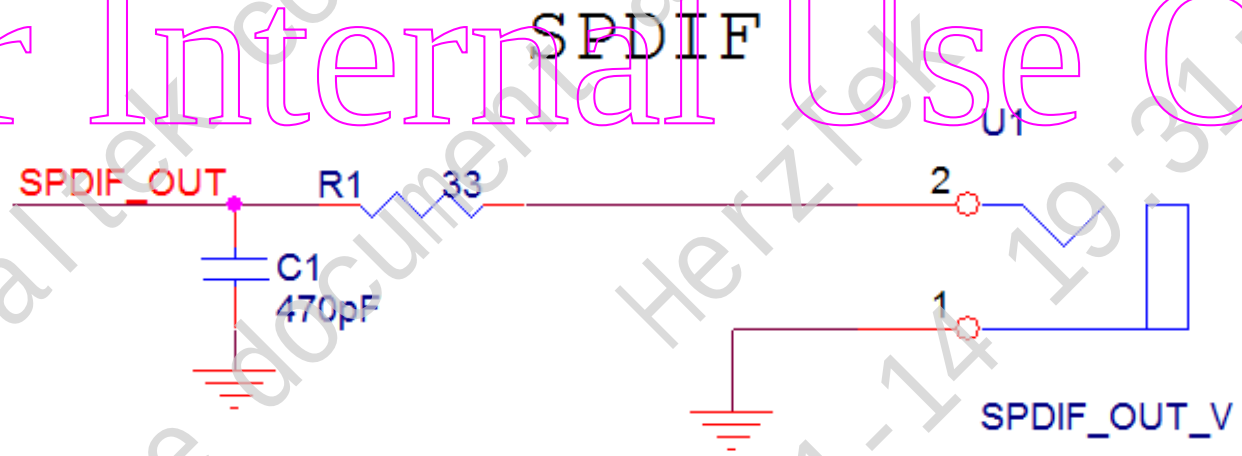
- provides an audio AUX-IN function
- An extra GPIO can be used to indicate AUX-IN plug-in



Audio

S/PDIF

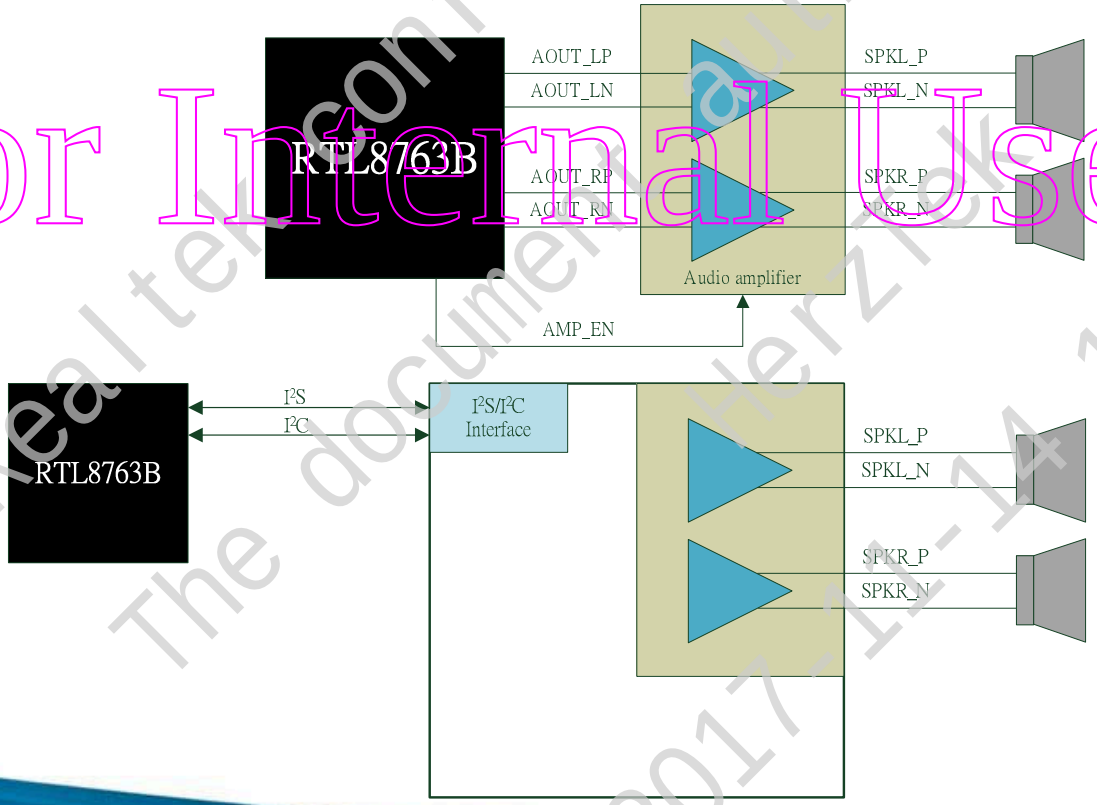
- Supports S/PDIF to transfer digital audio data between digital devices with minimum loss



Audio

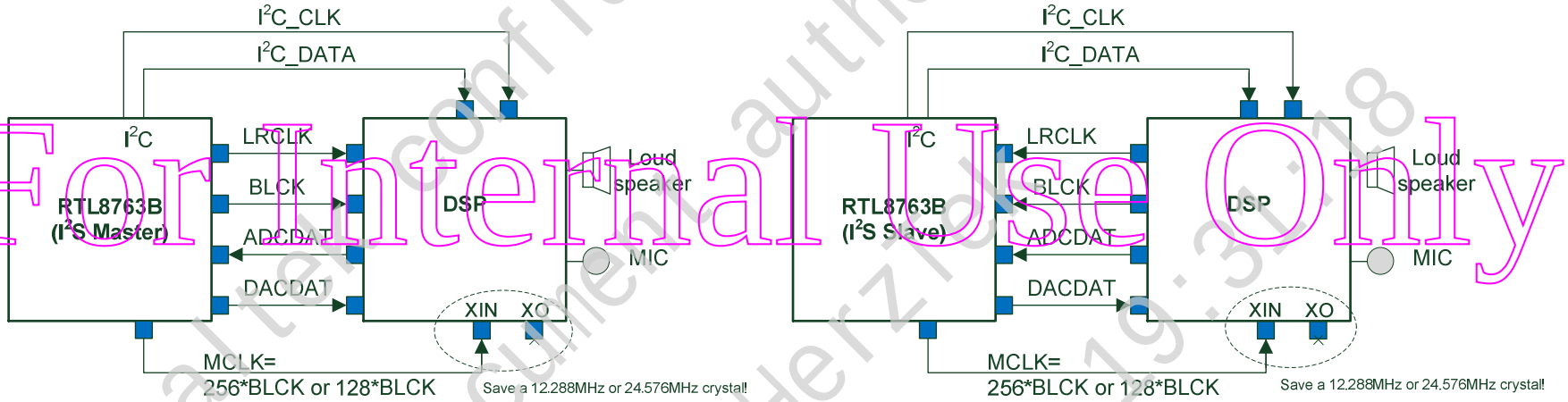
Audio amplifier

- Supports audio amplifier
- RTL8763BO also supports I²S audio amplifier and I²C control interface



I²S application

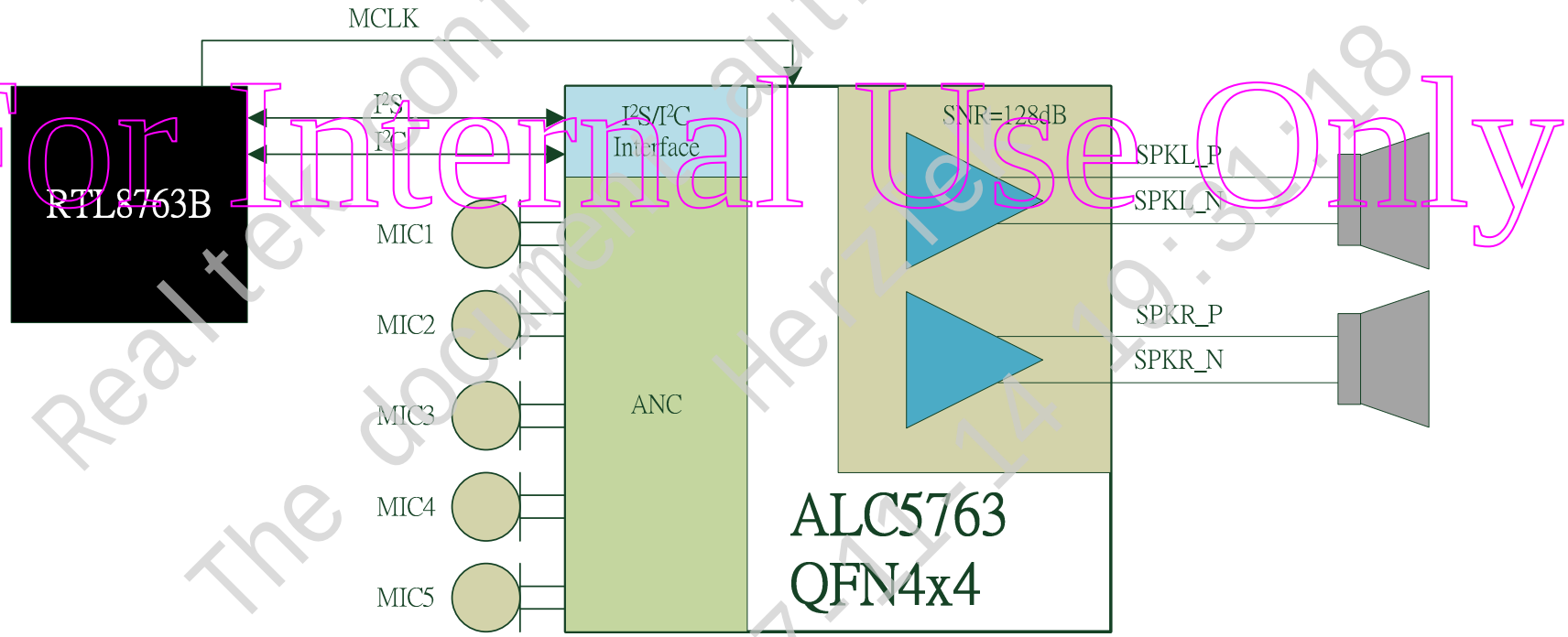
- Support both master and slave mode
- Support MCLK to save one crystal for the external DSP



Audio

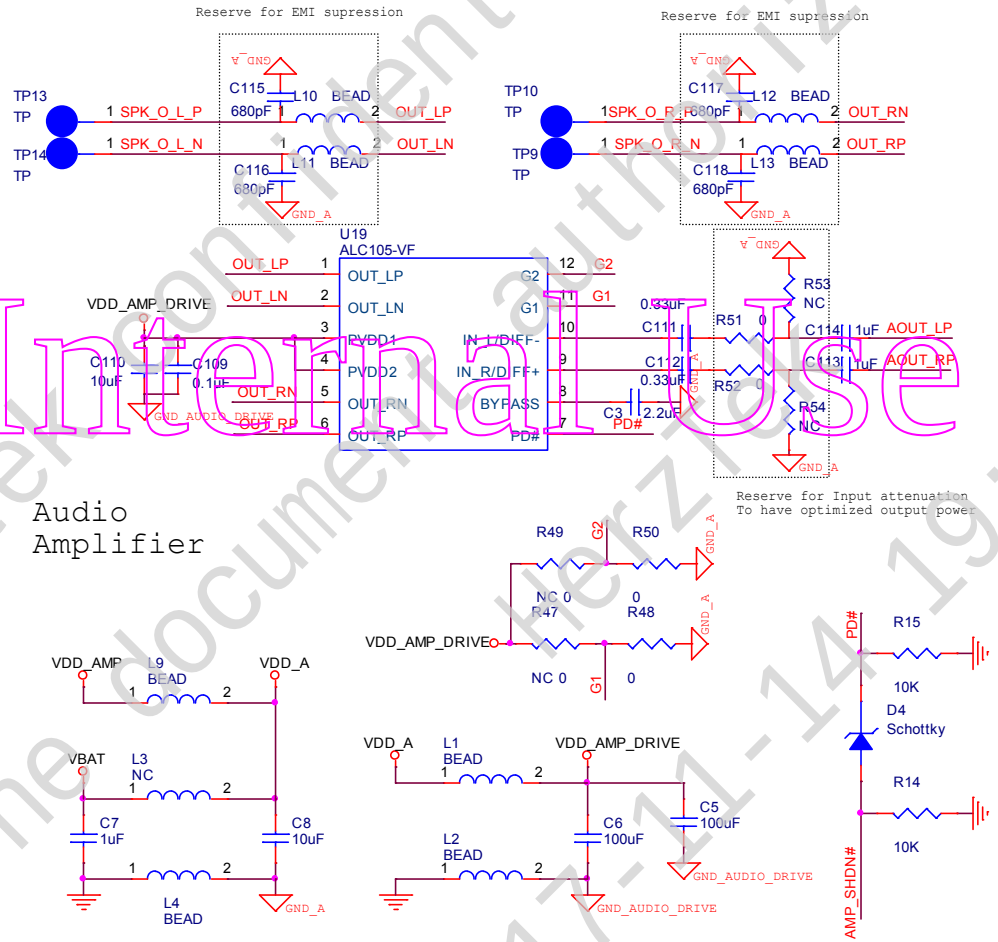
ANC

- REALTAK RTL8763B and ALC5763
- supports ANC and Hi-Fi codec with 128dB SNR



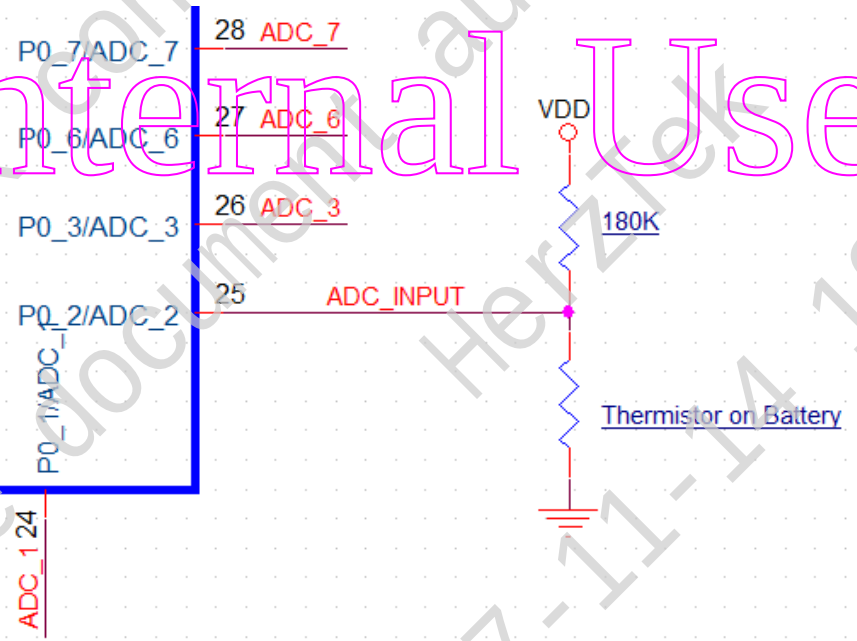
Speaker application

- RTL8763B + ALC audio amplifier series



ADC

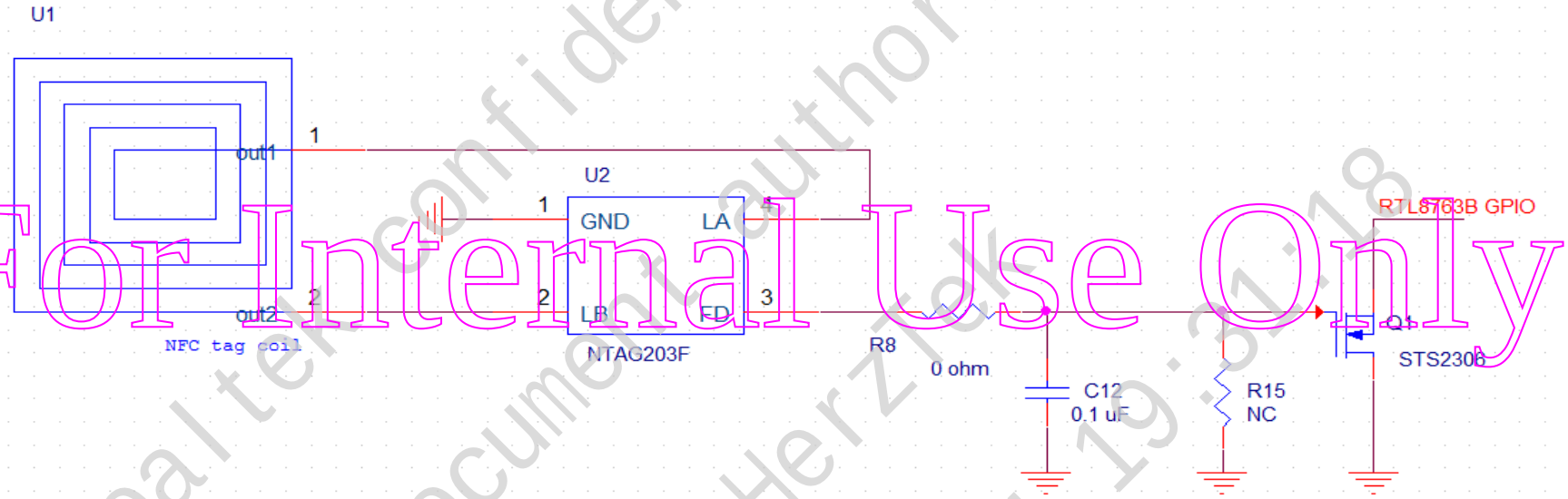
- 12-bit SAR-ADC
- 8 channels
- Support single-ended mode & differential mode
- One-shot mode / Continuous mode

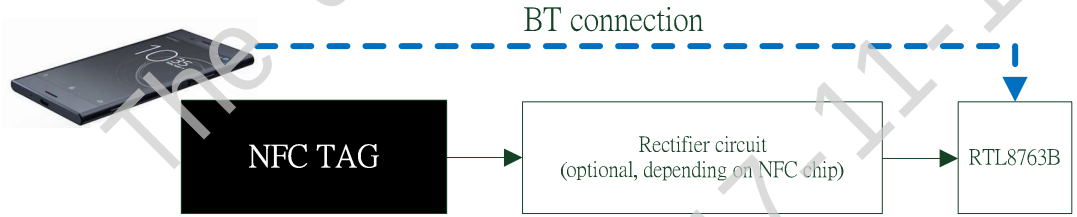


Ambient detection with ADC

NFC

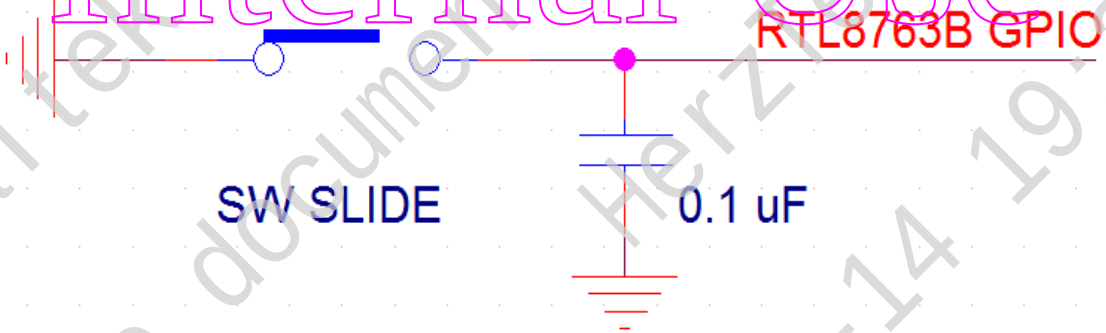
- Supports NFC to interface with external NFC devices
- FD output can be used as interrupt & trigger further actions





Slide switch

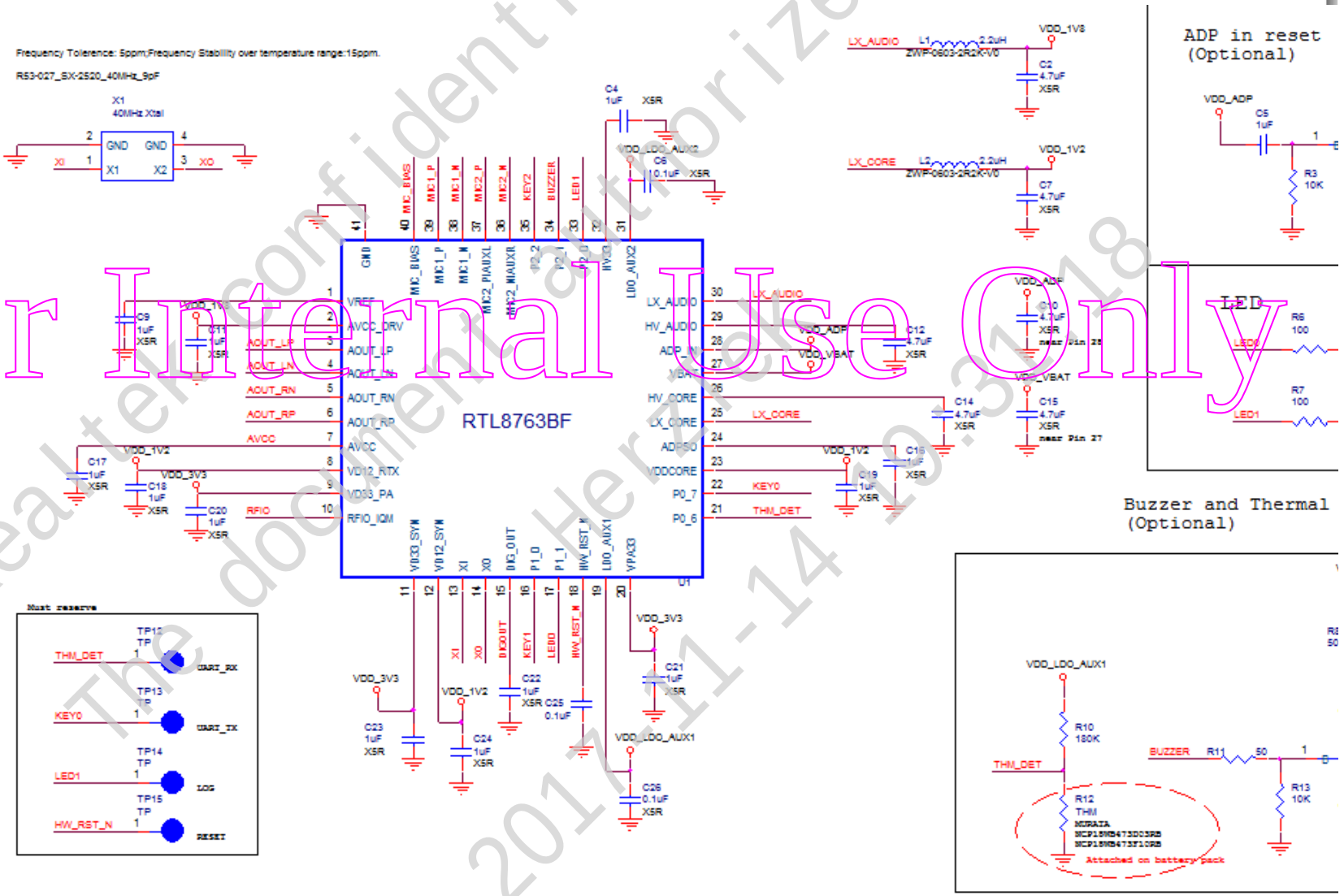
- to facilitate main power turn-on and turn-off



Layout Guidelines

Placement priority

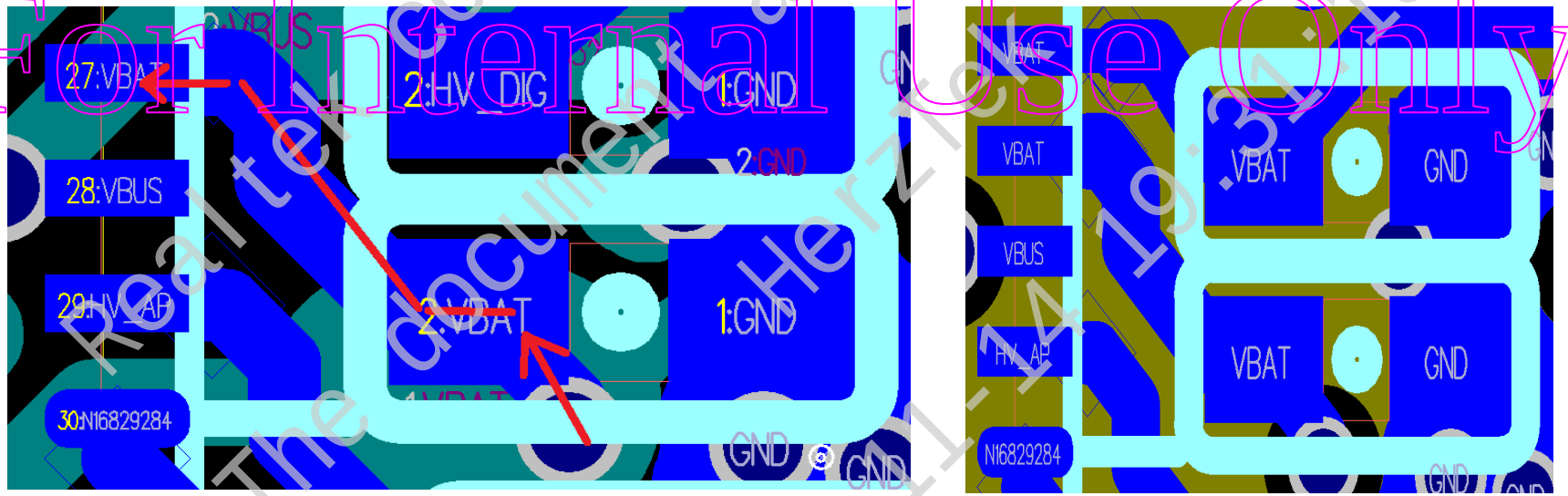
- Place C12 and C14 at HV pin
- Place L1/C2 and L2/C7 at BUCK LX pin
- Place C10 at ADP_IN pin
- Place C15 at VBAT pin
- Place Crystal, RF matching
- Place C18, C20, C23, C24, RF power pin
- Place C9, C11, C17 codec power pin



Layout Guidelines

Power

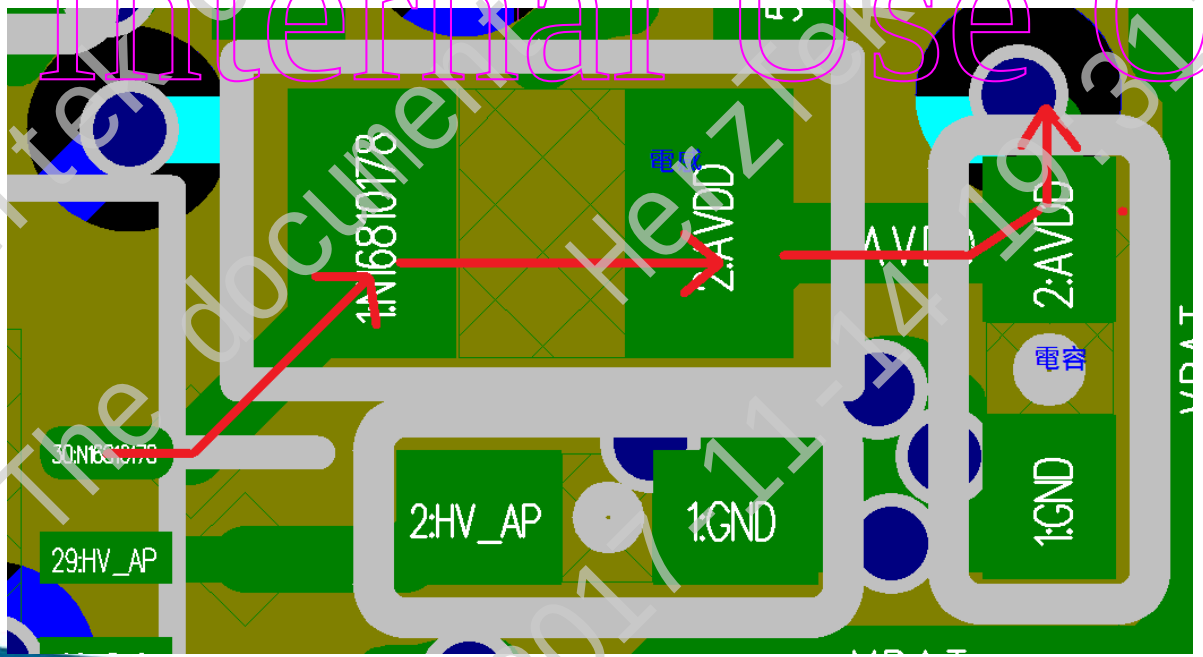
- Cap should be close to IC
- Trace should go through cap pad first, then chip pin



Layout Guidelines

SWR

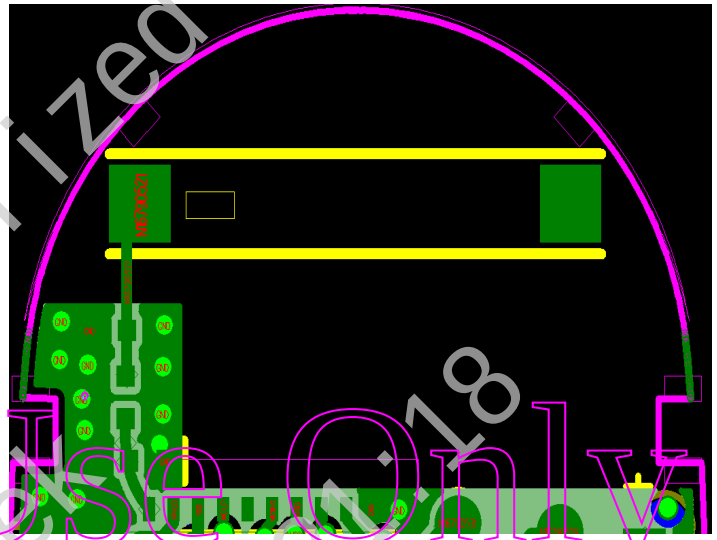
- Power inductor and cap should be close to IC
- Trace width 20mil
- Small loop area
- Clear area beneath inductor

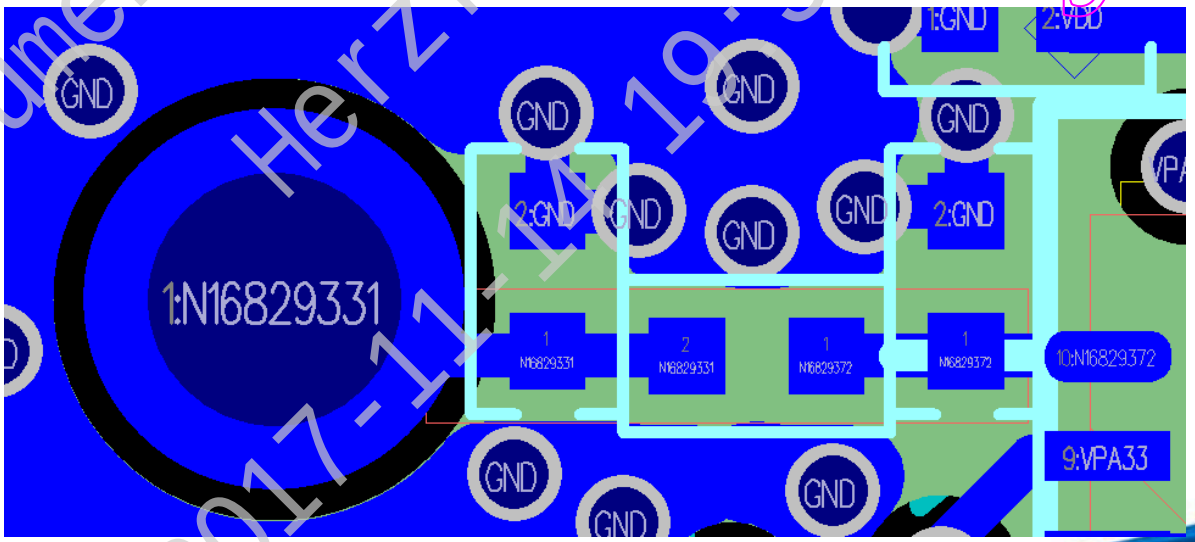


Layout Guidelines

RF trace

- 50ohm matching
- No extra trace
- Whole ground plane beneath
- Ground shielding

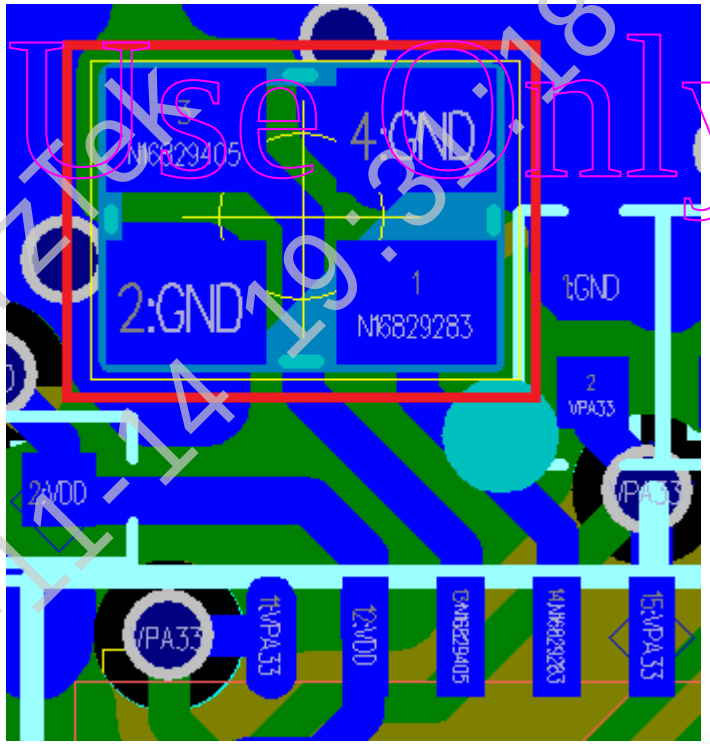




Layout Guidelines

Crystal

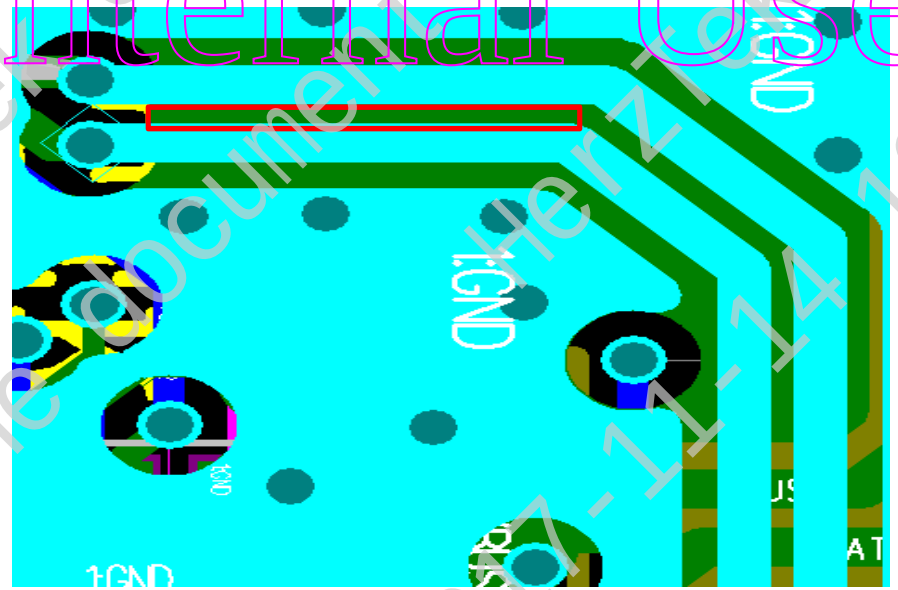
- Keep close to chip
- Trace width more than 6mil
- For 2-layer PCB, bottom GND should be complete



Layout Guidelines

Audio layout rule

- SPK_P/SPIK_N, MIC_P/MIC_N→ differential pair
- Trace width > 8 mil
- AUXIN_R & AUXIN_L→ not differential



Reference design

- Refer to schematic document

Key parts & QVL

- 40M crystal spec

	Min.	Typ.	Max
Frequency (MHz)	-	40	-
Frequency tolerance (ppm)	-	-	±10
Frequency stability (ppm)	-	-	±10
Load capacitance (pF)	-	9 or 7	-
Drive Level (uW)	-	-	300
Equivalant Series Resitance (Ohm), C_L=7pF	-	-	50Ω
Equivalant Series Resitance (Ohm), C_L=9pF	-	-	40Ω
Insulation Resistance (MOhm)	500	-	-

- 32K crystal
  - Frequency Tolerance ±20ppm

Key parts & QVL

40M & 32.768K QVL

XTAL_40M	3225 type	40MHz/CL=7pF crystal, +/-5ppm, -40 °C ~85°C , +/- 15ppm	TZ0882D	TST
	2520 type		TZ1181B	
	1612 type		TZ3220A (-30~85)	
	3225 type	40MHz/CL=9pF crystal, +/-5ppm, -40°C ~85°C , +/- 15ppm	XTL571150-R53-026	Siward
			TZ0308D (-30~85)	TST
	2520 type		XTL581150-R53-027	Siward
			TZ0733E	TST
	2016 type		XTL501150-R53-028	Siward
			TZ1269D	TST
	1612 type		XTL901150-R53-029	Siward
XTAL 32768Hz	3215 type	32768Hz/CL=7pF crystal, +/-20ppm -40°C ~ 85°C	XTL721-S349-005	Siward
	2012 type		XTL741-S999-426	
	3215 type	32768Hz/CL=7pF crystal, +/-20ppm -40°C ~ 85°C	TZ1166B	TST

Key parts & QVL

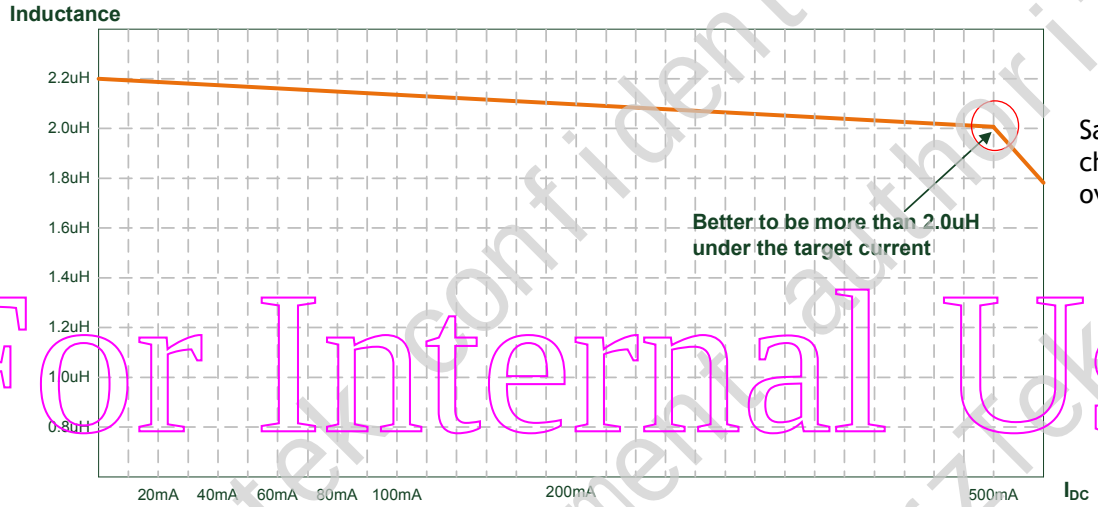
Power inductor for SWR

- Inductor Type: Power inductor
- L=2.2uH ±20%
- Self-resonant frequency > 40MHz
- DCR<1ohm (better if 0.5ohm is available)
- Saturation current > 0.5A

	Footprint	Tolerance	Part Number	Vendor
2.2uH	L2520	±20%,Rdc 0.093Ω	ZADK-252012SB-2R2M	ZenithTek
	L0603	±10%,Rdc 0.56Ω	ZWP-0603-2R2K	ZenithTek
	L-L3W3	±20%,Rdc 0.17Ω	NRH3010T2R2MN	TAIYO YUDEN

Buck inductor selection

- Check saturation current instead of rated current



Saturation current is not equal to rated current, check saturation current always, I_{SAT} should be over 500mA

- PART NUMBER AND CHARACTERISTICS TABLE

Part No.	Inductance±20% (μH)	Test Freq (MHz)	SRF (MHz)	DCR±25% (Ω)	Rated Current (mA)
MIP2012W Series					
MIP2012W 2R2MBE	2.2	1	85	0.34	700
MIP2012W 4R7MBE	4.7	1	50	0.46	500
MIP2520W Series					
MIP2520W 1R0MBE	1.0	1	70	0.11	1400
MIP2520W 2R2MBE	2.2	1	50	0.16	1100
MIP2520W 3R3MBE	3.3	1	40	0.20	1000
MIP2520W 4R7MBE	4.7	1	30	0.22	900

If the spec only mention rated current, drop it!!

Thank you